Natural Water Retention Measures

# Afforestation

Afforestation is the process of planting trees, either to replace those removed during forest harvesting or as a means of land use conversion. Afforestation is part of several natural water retention measures as it can contribute to a more natural and sustainable hydrologic cycle.

# Agricultural practice

Agronomic practices which have the primary purpose of improvements to agriculture can, in some cases, contribute to the functioning of natural water retention measures. As such, they integrate sustainable and natural water management into current practices.

# Appropriate design of roads and stream crossings

Appropriately designed roads and stream crossings can minimize the likelihood of erosion and sediment production that can be associated with forestry activities including final harvest. Poorly designed or built roads and stream crossings can cause some of the most negative effects of forestry on the landscape. Well-designed roads follow the contours of the landscape. Roads which run up and down (instead of across) hills can act as channels which focus runoff and can lead to increased erosion. Properly designed stream crossings permit the free movement of fish and aquatic invertebrates and will not restrict peak flows. Ensuring that stream crossings do not restrict peak flows will help to reduce localized flooding and can ultimately be more cost effective as they will not need to be rebuilt following high flow events - Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Artificial groundwater recharge (AGR)

AGR stores large quantities of water in underground aquifers to increase the quantity of groundwater in times of shortage.ﾠ It results in a lowering of run-off from surrounding land, and in an enhanced natural condition of aquifers and water availability.ﾠ The natural cleaning process of water percolating through the soils when entering the AGR improves water quality. Mechanisms used to undertake the recharge should be highlighted. In this respect one can envisage:(i) surface structures to facilitate/augment recharge (such as soakways and infiltration basins);(ii) subsurface indirect recharge - artificial recharge is undertaken through wells drilled within the unsaturated zone;(iii) subsurface direct recharge - artificial recharge is undertaken through wells reaching the saturated zone. The regulatory approach to be adopted for each of the above three mechanisms could differ considerably, due to the fact that the level of natural protection to groundwater is vastly different for each of the mechanisms

# Bank

The sloping side of any hollow in the ground, especially when bordering a river. (Source: CED)

# Basins and ponds

Basins and ponds store surface run-off.ﾠ Detention basins are free from water in dry weather flow conditions but ponds (e.g., retention ponds, flood storage reservoirs, shallow impoundments) contain water in dry weather, and are designed to hold more when it rains.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Biophysical environment

The biophysical environment is the biotic and abiotic surrounding of an organism or population, and consequently includes the factors that have an influence in their survival, development and evolution. The biophysical environment can vary in scale from microscopic to global in extent. It can also be subdivided according to its attributes. Examples include the marine environment, the atmospheric environment and the terrestrial environment. The number of biophysical environments is countless, given that each living organism has its own environment.
The symbiosis between the physical environment and the biological life forms within the environment includes all variables that comprise the Earth’s biosphere.
The biophysical environment can be divided into two categories: the natural environment and the built environment with some overlap between the two. Following the industrial revolution the built environment has become an increasingly significant part of the Earth's environment.
The scope of the biophysical environment is all that contained in the biosphere, which is that part of the Earth in which all life occurs.
When narrowed down to the aquatic environment, and particularly in the context of the Water Framework Directive, these are often referred to as water quality, water quantity and hydromorphology.

# Biophysical parameter

A biophysical parameter is a measurable characteristic that can help in defining a particular system. It can cover individual substances, groups of substances or be defined by its measurement method like turbidity or the mesurement of oxygen consumption like BOD5 or COD. It is generally expressed by a value and its unit.

# Channels and Rills

'Hard-edged' conveyance channels to move water between components in a SuDS 'train'.ﾠ Typically narrower than swales, but may also include vegetated aspects.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Coarse woody debris

Coarse woody debris is a key stream habitat feature used by fish and other organisms. Coarse woody debris can also help to lower flow velocity in streams.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Continuous Cover forestry

Continuous cover forestry (CCF) is a broad term encompassing a wide variety of forest management practices. One key feature of is that biomass removal is based either on small clearcuts or selective harvesting. Smaller clearcuts may create less hydrological disturbance but some of the filtration benefits associated with forest soils may be lost as a result of the greater driving and road maintenance needed for continuous harvesting.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Early sowing

Early sowing refers to sowing up to six weeks before the normal sowing season.ﾠ This allows for an earlier and quicker development of crops and of a root network that leads to soil protection.ﾠ The period in which the soil lies bare is shorter and, therefore, erosion and run-off are less significant and water infiltration is improved.ﾠ Early sowing can also help to mitigate the extreme ETP rates typical of Mediterranean summers.ﾠ However, early sown plants are frost sensitive; therefore farmers run the risk of losing the crops because of the low temperatures.ﾠ In northern countries, temperature in spring (March) can be adequate but the risk of frost is still serious until May.ﾠ Therefore, early sowing requires specific tools (plastic tunnel covers, onsite green house, etc.) and cannot be applied by any farmers for any crops.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Economic cost

Sacrifice associated to the use of available resources to one means instead of another (so that any economic cost is indeed an opportunity cost) or of following one course of action instead of the best available alternative. As applied to NWRM, it refers to those negative impacts in terms of welfare, either direct or indirect, that may be linked to the implementation of any measure.
The difference between explicit and implicit costs depends on whether there is an unequivocal monetary payment (or at least one which is straightforward to infer) or not. The term ﾓdirect (economic) costﾔ does actually refer to those costs that fall directly on the promoter of the NWRM. Hence, as opposed to direct costs, indirect costs are those incurred by others (those who are not under the direct scope of the NWRM implementation).

# Elimination of riverbank protection

The suppression of lateral constraints consists in removing some bank protection in order to enhance lateral connection of the river, diversifying flows (depth, substrate, speed), diversify habitats but also capping floods in the mainstream.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Environmental cost

Negative impacts connected with the actual or potential degradation of natural assets or environmental quality due to economic activities.

# Equivalent Annual Cost

The cost per year of implementing a NWRM over its entire lifespan. EAC is used when comparing NWRMs of unequal lifespans. It is estimated through listing all capital expenditures and when they are incurred; calculating the net present value of expenditures, once discounted; and converting this net present value into an annuity

# Externality

(either positive or negative). Third-party effect or welfare impact, which is both unilateral (i.e. one cannot decide neither whether to suffer it or not nor how much impact to bear), and non-compensated. In other words, an externality stemming from the implementation of a NWRM is a cost (if negative) or a benefit (if positive), which is not directly reflected in the direct costs or benefits of the NWRM but are one of its outcomes. It is a welfare variation expressed in monetary units.

# Filter Strips

Gently sloping vegetated strips of land that provide opportunities for slow conveyance and infiltration. Designed to accept runoff as overland flow from upstream and to slow the progress of this runoff.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Financial cost

The (monetary) value of resources deployed for the implementation of any NWRM, which includes upfront capital expenditures, either from new investments or the replacement of assets in past investments; depreciation allowances (annualised cost or replacing the accounting value of existing assets in the future); operating expenditures (those incurred to keep the NWRM running in an efficient manner); maintenance expenditures (for preserving existing or new assets in good functioning order throughout their useful life); and decommissioning costs (those incurred at the end of the lifecycle of the NWRM).

# Forest Harvesting

Forest harvesting can cause severe disruptions to the hydrologic cycle. Clearcut areas are often subject to localized flooding due to reductions in evapotranspiration caused by removal of trees. Roads and other infrastructure needed to support forest harvesting can also be significant sources of sediment to surface waters. However, negative effects can be minimized when forest harvesting is performed in a water-sensitive manner and measures are taken to maintain the natural hydrological functioning of the landscape.

# Forests as large-scale water pumps

Much of the evapotranspiration from forests falls elsewhere as rain, Ellison et al. (2012), amongst others, have shown that this large scale water pump can be a significant component of the annual precipitation in many continental areas. That is to say, many continental areas would receive a lot less rain if it were not for the mositure returned to the atmosphere by actively growing forests.

# Gabion

A gabion (from Italian gabbione meaning "big cage"; from Italian gabbia and Latin cavea meaning "cage") is a cage, cylinder, or box filled with rocks, concrete, or sometimes sand and soil for use in civil engineering, road building, and military applications.

# Green cover

Green cover (including cover crops or catch crops) refers to crops planted in late summer or autumn, usually on arable land, to protect the soil, which would otherwise lie bare during the winter, against wind and water erosion.ﾠ Green cover crops also improve the structure of the soil, diversify the cropping system, and mitigate the loss of soluble nutrients.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Green infrastructure

EU definition:
Green Infrastructure is addressing the spatial structure of natural and semi-natural areas but also other environmental features which enable citizens to benefit from its multiple services. The underlying principle of Green Infrastructure is that the same area of land can frequently offer multiple benefits if its ecosystems are in a healthy state. Green Infrastructure investments are generally characterized by a high level of return over time, provide job opportunities, and can be a cost-effective alternative or be complementary to 'grey' infrastructure and intensive land use change. It serves the interests of both people and nature.
Clarification points:
From the perspective of Natural Water Retention Measures (NWRM), green infrastructure refers to new methods of managing water, favouring as much as possible the restoration of natural ecosystems or at least of their key functionalities in terms of water management. It consists of land management or engineering measures which use vegetation, soils, and other natural materials to restore the natural water retention capacity of the landscape. Green infrastructure measures use natural and man-made materials to enhance or improve longitudinal and lateral hydrological connectivity and natural hydrologic processes, including infiltration and runoff control but also purification processes. Green infrastructure can exist at a range of spatial scales, ranging from the very local, to the scale of a neighbourhood, a city or a whole region.
Local scale green infrastructure includes green roofs, permeable pavements and downspout disconnections, all of which can contribute to greater natural infiltration, reduced load on wastewater management systems, and limitations of peak runoff.
At the scale of a city or neighbourhood, green infrastructure can support sustainable urban drainage systems that mimic nature by soaking up and storing water or biodiversity promotion with fish ladders.
At a regional scale, green infrastructure can include the mosaic of managed semi-natural and natural areas that provides habitat, flood protection, cleaner air, and cleaner water. Thus land management strategies such as afforestation and retention of natural water retaining features in agricultural areas such as riparian buffers, ponds and wetlands can be considered as Green infrastructures designed to manage flood risks in downstream urban areas.
One key feature of Green infrastructure is its multi-functionality. The underlying principle of green infrastructure is that the same area of land can offer multiple benefits if the natural or man-made ecosystem is in a socio-ecologically sustainable state. Benefits of green infrastructure include a more natural hydrological cycle and ecosystem services related to biodiversity and human amenity. Green Infrastructure investments are generally characterized by a high level of return over time, provide job opportunities, and can be a cost-effective alternative or be complementary to 'grey' infrastructure and intensive land use change. Green infrastructure serves the interests of both people and nature.

# Headwater areas

Targeted planting of forests in headwater areas (e.g. with a slope) can help to stabilize hillslopes, thereby reducing erosion and potentially leading to greater water retention in montane areas. Afforestation may have beneficial effects on the hydrograph by reducing peak flows and helping to maintain base flows. The potential for water retention must be balanced against the increased ET and pollutant trapping that may be associated with forests.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Hydraulic annexes

To ease the overall functioning of the river, some hydrographical network elements could be reconnected, including the so-called hydraulic annexes. This will allow for improvement of lateral connectivity, diversifying flows and habitats, but also cleaning the secondary arms that play a key role for retention in high water periods.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Infiltration Trenches

Shallow excavations filled with gravel or other material to create temporary storage and to enhance the natural capacity of the ground to infiltrate. Infiltration trenches would typically be used to intercept surface runoff drainage (e.g. drainage from roof or other impervious areas) or to convey water towards a detention pond.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Interception

Rainfall that is stored on a vegetation canopy and later evaporated back to the atmosphere.

# Lake

An enclosed body of water, usually but not necessarily fresh water, from which the sea is excluded. (Source: WHIT)

# Lake restoration

Lakes are by definition water retention facilities; they store water (for flood control) and provide water for many purposes such as water supply, irrigation, fisheries, tourism, etc.ﾠ In addition, they serve as sinks for carbon storage and provide important habitats for numerous species of plants and animals, including waders.ﾠ In the past, lakes have sometimes been drained to free the land for agriculture purposes, or have simply not been maintained and have silted up.ﾠ Restoring lakes is re-introducing them where they have been in former times or revitalising them.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Land use conversion

It is widely believed that forest soils can function as pollution filters. Afforestation is practiced in rural areas around many large cities as a means of improving the quality of the drinking water supply aquifer by filtering out pollutants. Afforestation may also reduce peak flows and help to maintain base flows. Such afforestation should reduce sediment loadings and may have other benefits including improved biodiversity and recreational value.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Levelling of dams/ longitudinal barriers

Levelling longitudinal barriers allows re-establishing fluvial dynamics and ecological continuity. The aim is to restore the slope and longitudinal profile of the river, to restore natural water flows, to allow for the solid transport (sediment) to take place, toﾠ diversify flows (depth, substrate, speed), diversify habitats and related flora and fauna.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Lifespan

Length of time for which the NWRM may fully operate.

# Low Impact Development

LID is a toolbox of site-scale practices that the site designer and developer can utilize to:
manage urban rainfall where it occurs for minimized stormwater concentration and runoff
potentially lower short-term and long-term development costs
improve water quality
enhance natural habitat and flood control
improve green space aesthetics and potentially increase property values
increase community quality of life and livability
There are many practices that are used to support these benefits, including bioretention systems, rain gardens, vegetated rooftops, bioswales, rain barrels, and permeable pavements to name a few. By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas on the environment while providing numerous additional benefits. (source: LID symposium).
This concept is very similar to NWRM in the United States context. It is very connected to Green Infrastructure. See also the link to US EPA green infrastructure website.

# Maintenance

From the perspective of Natural Water Retention Measures (NWRM), maintenance is the set of actions or processes that are performed to keep an already existing natural process functioning in the best possible manner. Maintenance can include physical activities, the planning process and communication.

# Managed Aquifer Recharge (MAR)

MAR is the purposeful recharge of water to aquifers for subsequent recovery and environmental benefit. Within the context of urban environment, MAR covers the injection and infiltration of captured stormwater ﾖ as such, it is linked to SuDS measures such as rainwater harvesting and infiltration techniques, but worth differentiating as a case where the primary purpose is to increase recharge to aquifers in addition to attenuating surface runoff,Mechanisms used to undertake the recharge should be highlighted. In this respect one can envisage:(i) surface structures to facilitate/augment recharge (such as soakways and infiltration basins);(ii) subsurface indirect recharge - artificial recharge is undertaken through wells drilled within the unsaturated zone;(iii) subsurface direct recharge - artificial recharge is undertaken through wells reaching the saturated zone.The regulatory approach to be adopted for each of the above three mechanisms could differ considerably, due to the fact that the level of natural protection to groundwater is vastly different for each of the mechanisms.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Meadows and pastures

Meadows are areas or fields whose main vegetation is grass, or other non-woody plants, used for mowing and haying.ﾠ Pastures are grassed or wooded areas, moorland or heathland, generally used for grazing. Due to their rooted soils and their permanent cover, meadows and pastures provide good conditions for the uptake and storage of water during temporary floods. They also protect water quality by trapping sediments and assimilating nutrients.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Mulching

A mulch is a layer of material applied to the surface of an area of soil. Its purpose is any or all of the following:
· to conserve moisture
· to improve the fertility and health of the soil
· to reduce weed growth
· to enhance the visual appeal of the area
Mulching as NWRM is using organic material (e.g. bark, wood chips, grape pulp, shell nuts, green waste, leftover crops, compost, manure, straw, dry grass, leaves etc.) to cover the surface of the soil. It may be applied to bare soil, or around existing plants. Mulches of manure or compost will be incorporated naturally into the soil by the activity of worms and other organisms. The process is used both in commercial crop production and in gardening, and when applied correctly can dramatically improve the capacity of soil to store water.

# Multiplier effect

Factor of proportionality that shows how much spending in a NWRM may induce direct or indirect changes in macroeconomic variables, such as income, employment, investment, etc. It is another way of referring to wider economic impacts of NWRM.

# Natural bank stabilisation

In the past, various activities were undertaken to straighten rivers, such as the stabilisation of river banks with concrete or other types of retention walls.ﾠ Such actions limited riversﾒ natural movements, leading to degradation of the river, increased water flow, increased erosion and decreased biodiversity.ﾠ Natural bank stabilisation reverses such activities, allowing rivers to move more freely.ﾠ Where bank stabilisation is nevertheless necessary, such as in residential areas, natural materials such as roots or gravel can be used.ﾠ Natural materials are preferable as they allow water to infiltrate into the bank.ﾠ They also provide better living conditions for aquatic fauna.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Natural Water Retention Measure

Natural Water Retention Measures (NWRM) are multi-functional measures that aim to protect and manage water resources and address water-related challenges by restoring or maintaining ecosystems as well as natural features and characteristics of water bodies using natural means and processes. Their main focus is to enhance, as well as preserve, the water retention capacity of aquifers, soil, and ecosystems with a view to improving their status. NWRM have the potential to provide multiple benefits (see benefits table), including the reduction of risk of floods and droughts, water quality improvement, groundwater recharge and habitat improvement. The application of NWRM supports green infrastructure, improves or preserves the quantitative status of surface water and groundwater bodies and can positively affect the chemical and ecological status of water bodies by restoring or enhancing natural functioning of ecosystems and the services they provide (see ecosystem services). The preserved or restored ecosystems can contribute both to climate change adaptation and mitigation.

# Nature Based Solution

# Nitrate

Nitrate, NO-3, is the main nitrogen containing anion occurring in the soil. It is very soluble and moves freely in water through the soil profile. Nitrate in water is a pollutant above certain concentrations and can be a danger to human health. The main source of nitrate in water is agriculture although sewage discharges can also be an important factor.

# Opportunity cost

Value of those alternatives foregone when implementing a NWRM.

# Overland flow areas in peatland forests

Ditch blocking in managed peatland forests can be used to slow water and trap sediment after forest harvesting. The ditches can be made of wood logs or gabions, for example.
- Elaborated by NWRM project experts and validated by the European Commission

# Peak flow control structures

Engineered ponds in peatlands that have been ditched to enhance forest production have the potential to retain water in the landscape and trap sediment without adversely affecting tree growth. Such measures have the potential to limit hydrograph peaks and potentially reduce flooding associated with snowmelt.
- Elaborated by NWRM project experts and validated by the European Commission

# Phosphorus

Phosphates from agriculture are an important contributor to phosphorus loading on water bodies. Phosphorus is considered to be a limiting factor in the process of eutrophication that can generally be regarded as the enrichment of surface waters by nutrients which causes overgrowth of algae and weeds. The result is deoxygenation of waters that can kill fish and other aquatic life. Algae growth can also be a hazard to human health.

# Rain Gardens

Small-scale depressions used for storage and infiltration, typically at a property-level and close to buildings (e.g. to infiltrate roof drainage at a property level).
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Rainwater Harvesting

Collecting and storing rainwater for subsequent use ﾖ for example, using water butts or larger storage tanks.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Reconnection

From the perspective of natural water retention measures (NWRM), reconnection is the process of improving hydrological connection in the landscape, both through linking water bodies and through improving the connectivity between rivers and their adjacent floodplains. Reconnection can make use of historical and currently water channels to restore previously existing hydrological connectivity and functioning.

# Reduced stocking density

Reduced stocking density will limit soil compaction, thereby facilitating more rapid infiltration during precipitation events and potentially reducing peak flows and sediment runoff.
- Elaborated by NWRM project experts and validated by the European Commission

# Re-meandering

In the past, rivers have been straightened by cutting off meanders (historically, many rivers in northern and western Europe have been straightened and channelized to facilitate log floating and/or speed up the drainage of water and control/limit the river bed movements).ﾠ Re-meandering is bringing a river back closer to its naturally meandering state by creating a new meandering course and by reconnecting cut-off meanders.ﾠ Re-meandering slows down the flow of a river.ﾠ The new form of the river channel creates new flow conditions and very often also has an impact on sedimentation.ﾠ The newly created or reconnected meanders also provide habitats for a wide range of aquatic and land species of plants and animals.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Reservoir catchment

Afforestation of reservoir catchments can have multiple benefits. It can reduce sediment inputs from the catchment, lengthening the life of the reservoir, and may also have beneficial effects on water quality in some cases when peatlands are afforested. Afforestation can reduce peak flows and help to maintain base flows. The benefits of afforestation must be balanced against the potential for increased evapotranspiration from a rapidly growing forest.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Resource cost

The cost linked the economic or relative scarcity of water once it is used.

# Restoration

Restoration is a management action or set of actions with the aim of restoring natural hydrologic functioning ﾠin the landscape. Restoration of natural functioning can contribute to an environmental balance in water management.
NWRM implementation can either be an enhancement/improvement of the natural hydrologic functioning ﾠin the landscape or a restoration action.

# Retention Ponds

Ponds or pools with additional storage capacity to attenuate surface runoff during rainfall events.ﾠ Retention time of runoff can provide the capacity to remove pollutants through sedimentation and opportunity for biological uptake of nutrients.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Revitalisation of flowing waters

In the past, rivers flows have been modified through channelisation, embankments or modification of river beds. Those modifications were aiming at flood prevention or supporting changes of agricultural practices for example. This has led to uniformed flows in the rivers and often having effect on the water time transfers. Current practices for revitalisation of flowing waters are trying to create the conditions for diversifying the water flows, inducing more diversity in habitats for fauna but also increasing the water time transfers in order to prevent flash floods in the downstream areas for example.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Riparian buffers

Planting and maintaining tree cover in near-stream areas can have multiple benefits including erosion and nutrient leaching control. They will also slow the stream velocity during high flow flood events and may have beneficial effects on stream temperature. Maintaining treed forest buffers during clearcutting can help minimizing the adverse effects of forestry on water quality and may have additional biodiversity benefits.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Riparian zone

1) Terrestrial areas where the vegetation complex and microclimate are products of the combined pressure and influence of perennial and/or intermittent water... and soils that exhibit some wetness characteristics. 2) Zone situated on the bank of a water course such as a river or stream. (Source: DUNSTE / GILP96)

# Riverbed

The channel containing or formerly containing the water of a river. (Source: BJGEO)

# Riverbed (alluvial mattress)

The reconstitution of the alluvial mattress consists in leveling-up the river bed and/or reactivating the bank erosion in order to stop the incision of the river bed. It can allow better connection with side arms, level-up the water level at low flow periods, diversifying flows (depth, substrate, speed), diversify habitats and increase retention times.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Sediment capture ponds

Sediment capture ponds are widely used to "slow down" water being drained from boreal forests. The main function of the sediment capture ponds is to remove prevent pollution of receiving waters downstream of a forest by removing suspended sediment and associated pollutants.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Soakaways

Excavations, typically filled with gravel, designed to store water and allow it to infiltrate into underlying soils or aquifers.ﾠ Soakaways would typically receive point-source inflow (e.g. from roof drainage).ﾠﾠ
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Soil Conservation

The management of land to minimise soil erosion to maintain soil and water resources, and provide sustainable benefits in the long term.

# Sunk cost

Those expenditures that, once committed, cannot be (easily) recovered. These costs arise because some activities require specialized assets that cannot be readily diverted to other uses.

# Supplementary measure

"Supplementary" measures are those measures designed and implemented in addition to the basic measures, with the aim of achieving the objectives established pursuant to Article 4 of the WFD. Part B of Annex VI contains a non-exclusive list of such measures. Member States may also adopt further supplementary measures in order to provide for additional protection or improvement of the waters covered by this Directive, including in implementation of the relevant international agreements referred to in Article 1.

# Sustainable Drainage Systems

"Approaches to manage surface water that take account of water quantity (flooding), water quality (pollution)ﾠ and amenity issues are collectively referred to as Sustainable Drainage Systems (SuDS).
SuDS mimic nature and typically manage rainfall close to where it falls. SuDS can be designed to slow water down (attenuate) before it enters ﾠstreams, rivers and other watercourses, they provide areas to store water in natural contours and can be used to allow water to soak (infiltrate) into the ground or evaporated from surface water and lost or transpired from vegetation (known as evapotranspiration)." (Source: susdrain)

# Sustainable Urban Drainage Systems

Sustainable Urban Drainage Systems (or SUDS) are a sequence of water management practices, green infrastructures and measures designed to drain surface water in a manner that mimics the natural hydrologic cycle and will provide a more sustainable approach to rainwater management than what has been the conventional grey infrastructure practice of routing run-off through a pipe to a receiving watercourse.

# Swales

Shallow, broad and vegetated channels designed to store and/or convey runoff.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Targeted planting for "catching" precipitation

There is some evidence that planting trees on some Mediterranean hillslopes can assist in cloud formation and precipitation. The forests assist in "trapping" rising air and condensing atmospheric water vapour. This work has been pursued by Milan Milan, amongst others.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Temporary tributaries flow

Temporary streams are of particular importance when it comes to water storage and time retention especially in flash flood prone areas. Some measures can be directly implemented in order to ensure their proper functioning.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Traditional terracing

Traditional terraces consist of nearly level platforms built along contour lines of slopes, mostly sustained by stone walls, used for farming on hilly terrain.ﾠ When properly built and well maintained, terraces can reduce erosion and surface run-off by slowing rainwater to a non-erosive velocity.ﾠ So-called traditional terracing involves less disturbance of the terrain than modern terracing, as it does not involve significant levelling or cutting using heavy machinery.ﾠ
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Transaction cost

Efforts (either monetary outlays or consumption of any other resources, such as time) of administering, monitoring, and enforcing a NWRM. Policy-making involves political costs that are absent in private exchanges.

# Trees in urban areas

Urban planning that incorporates trees can have multiple benefits. Trees in urban areas have multiple benefits including increased infiltration and other benefits including shade and amenity value.
- Elaborated by NWRM project experts, validated by th European Commission

# Urban forests parks

Urban forest parks or protected areas provide multiple benefits including increased water infiltration, pollutant filtration, reductions in peak flow and maintenance of base flows. Urban forests also have many other aesthetic, biodiversity and quality of life benefits.
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Urban Planning

Within the framework of natural water retention measures (NWRM), urban planning refers to the application of the "Grey to Green" principle within cities. The specific focus of urban planning for NWRM is to achieve sustainable water management by mimicking natural functions and processes in the urban environment.

# Water retention

Water retention covers a wide set of mechanisms (see synthesis document n°1) the effect of which are to increase the capture of water by aquifers, soil, and aquatic and water dependent ecosystems.
More precisely it refers to capabilities of catchments (including wetlands, rivers and floodplains but also other land areas) to hold or retain as much water as possible during periods of abundant or even excessive precipitation, so that water is available for use during dry periods and runoff peaks are minimized.

# Water sensitive driving

"Water sensitive driving" requires an awareness of the wet areas (mires, peatlands, etc.) in the landscape and an ability to avoid them while conducting forestry operations. Water sensitive driving is focussed primarily on minimizing water quality impacts of forestry including nutrient leakage and an increased potential for methylmercury formation.

# Wetland (measure)

Wetlands restoration and creation can involve: technical, spatially large-scale measures (including the installation of ditches for rewetting or the cutback of dykes to enable flooding); technical small-scale measures such as clearing trees; as well as changes in land-use and agricultural measures, such as adapting cultivation practices in wetland areas.ﾠ Wetland restoration can improve the hydrological regime of degraded wetlands and generally enhance habitat quality. (Creating artificial or constructed wetlands in urban areas can also contribute to flood attenuation, water quality improvement and habitat and landscape enhancement).
- Based on Stella definitions, adapted by NWRM project experts and validated by the European Commission

# Wetlands

Areas that are inundated by surface or ground water with frequency sufficient to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth or reproduction.
Wetlands provide both stormwater attenuation and treatment, comprising shallow ponds and marshy areas covered in aquatic vegetation.ﾠ Wetlands detain flows for an extended period to allow sediments to settle and to remove contaminants.ﾠ They also provide runoff attenuation and can provide significant ecological benefits.