Module 7

Water Management

Circular Economy in Construction

24 partners 12 countries

Date of Event

*Author/ **Institute***

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Water management | Summary

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To provide the basic relevant knowledge required to minimise and reuse water using a water management on the construction site.

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Water management | Objectives

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1. Outline the **national regulations** for water management in construction
2. Identify and outline the **risks** associated with Water Management.
3. Outline the principles and steps involved in implementing a **Water Management Plan** using case studies.
4. Understand the **importance** of Water Management on a construction site.

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Topic 1 – Water management plan

Topic 2 – Water management on site

Why should we protect water resources?

Europe's water is under pressure.

Economic activities, population growth and urbanisation are increasing pressures on freshwater throughout Europe.

Water is a finite resource

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- **Construction companies can reduce their contribution to environmental degradation through their own water practices.**

- **Water is a finite resource, meaning it is non-renewable.**

Oceans, rivers, and lakes may seem large enough to support life on Earth, but much of this water is unusable.

Image source: Thehill.com

Why should we protect water resources?

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➢ **Preserve water and limit the impacts of runoff.**

Stormwater runoff carries synthetic fertilizers and pesticides to the ocean from agricultural regions.
It may also take oil, paint, glue, cement, and more from construction sites to the sea.

Stormwater runoff increases the nitrogen and phosphorous in the ocean, contributing to algal blooms. Algae depletes oxygen in particular regions, causing dead zones.
These uninhabitable regions endanger fish and other marine species.

Image source: Baltic Eye

Why should we protect water resources?

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- **Resource conservation may also limit the polluting of drinking water**.

A major construction company in Texas spilled drilling fluid into drinking wells in 2021. The pollution went unnoticed for days, posing serious risks to the community’s health and well-being.

Consider how to control water run off and pollution on your site

Image source: akvosphere.com

Water Pollution

- Water pollution happens when toxic substances end up in water systems such as rivers, lakes and oceans.
- This pollution may be visible, either on the surface or deposited on the bed, or invisible to the human eye, such as clear chemicals that dissolve in water.
- Construction activities often involve the use of toxic chemicals and pollutants that can end up in the water table if not managed correctly.

Water Pollution

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Common construction sources that contribute to water pollution include:

- **Diesel and oil.**
- **Cement.**
- **Glues.**
- **Paints.**
- **Other toxic chemicals.**

All of these contaminants have the potential to end up in water as a result of runoff from construction work. Pollutants can enter the water system in a number of ways, such as through drains, seeping into soil, or runoff directly into the watercourse, rivers or lakes.

Consequences of water pollution

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People

- Pollutants from construction sites can soak into the groundwater.
- It is much harder to treat groundwater than surface water. Groundwater is usually the source of human drinking water, there is a risk that some chemicals may end up being consumed.
- Chemical pollutants such as arsenic and mercury can cause serious health issues, including cancer, if ingested through contaminated water supplies.

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Consequences of water pollution

Environmental

- Water contaminated by pollutants produced by the construction industry poses a serious danger to the environment.
- Once pollution has entered the water system, it can harm or kill fish and animals living in it or drinking from it. This can disrupt the entire ecosystem of animals, plants, bacteria and fungi, causing many species to suffer as a result.

Limiting the impact

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- Fortunately, there are ways for construction sites to limit their impact on water pollution.
- Before evaluating the ways this industry can minimize its aquatic footprint, we must first examine the use of water on construction sites.

Image source: waterfootprint.org

Minimising Pollution

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- Most critically, construction companies can minimise their water pollution and maximise their sustainability by following environmental guidelines set at EU and national level — and by adopting more environmentally best practices.

EU Legislation

The main aim of EU water policy is to ensure that a sufficient quantity of good quality water is available for people's needs and for the environment.

Water Framework Directive (WFD)

The Water Framework Directive (Directive 2000/60/EC) is the most important piece of legislation in this area. It covers lakes, rivers, groundwaters and coastal waters.

Its main objective is to **protect and enhance freshwater resources, with the aim of achieving 'good status' of all waters within the EU**.

Achieving good status involves meeting certain standards for the ecology, chemistry and quantity of waters.

In general**, 'good status' means that water shows only a slight change from what would normally be expected under undisturbed conditions.**

EU Legislation

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This Directive is complemented by two other directives which specify further quality standards which must be met:

1. the **Groundwater Directive** (Directive 2006/118/EC) and
2. the **Environmental Quality Standards Directive** (Directive 2008/105/EC).

The WFD is also linked to a number of other EU directives. These include:

- Directives relating to the **protection of biodiversity** (Birds and Habitats directives)
- Directives related to **specific uses of waters** (drinking water, bathing waters and urban wastewater)
- Directives concerned with **activities undertaken in the environment** (Industrial Emissions and Environmental **Impact Assessment directives**)

National Legislation

- Over the last 30 years, the use and protection of water resources has increasingly come to the attention of legislators both in Ireland and in Europe.

- As a result, there is now a large body of legislation **aimed at protecting and maintaining the quality of water in Ireland.**

- There is also a large number of organisations with responsibility for ensuring that: **clean water supplies are delivered efficiently and effectively; wastewater is carried away and appropriately treated; and our rivers, lakes and coastal waters meet high environmental standards.**

https://www.gov.ie/en/policy-information/ace5b-water/?referrer=http://www.housing.gov.ie/water/water-quality/water

1. Water Management Plan

Water use on site

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- Builders use water for a variety of functions on the job, for example
  - worker hydration,
  - concrete batching,
  - grouting,
  - dust suppression,
  - soakaway testing,
  - pond filling,
  - hydro-demolition,
  - drilling and piling.

Image source: the constructor.org

- If companies mismanage this water use, they can increase their environmental impact drastically.
- Also, when leaks, poor sanitary and hydraulic installations, and unsatisfactory project designs occur on a construction site, its runoff may pollute the ocean.

- Water is a precious, undervalued resource, with many and varied demands on site for its use.

- Technology is available, but this alone will not result in a sustainable, water efficient construction site – **it is staff on-site who operate machinery and control water outlets that have the power to reduce water consumption on site.**

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Ethical waste handling

- How can Construction company operators take action to reduce their water footprint.
- They can set up the use of **erosion control blankets, sedimentation ponds, and silt fences** on project sites to limit pollution.
- Operators can also train employees to **pick up debris and trash, control erosion and sedimentation, maintain equipment, and sweep streets around the construction site.**

A sediment pond is a temporary pond built on a construction site to capture eroded or disturbed soil that is washed off during rain storms, and protect the water quality of a nearby stream, river, lake, or bay.

Image source: sustainabletechnlogies.ca

Ethical waste handling

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- Practicing ethical and legal waste disposal is essential for green construction.

- **Builders should manage their disposal of waste, limiting the pollution of nearby rivers and streams**. These companies must keep sand and cement secure so they don't wash into drains or local water sources. They can further reduce this risk by covering drains on and around their project site.

- **Builders must keep streets and sidewalks near their project clean to reduce harmful runoff discharge**. They should also collect and treat water waste produced while working. Construction companies can even treat and repurpose their water waste to minimise pollution.

Ethical waste handling

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- **It is important that the efficiency of water use on construction sites is improved through better planning** and management of water and that we encourage consideration of environmental risks associated with construction activities.

- Water management can be planned under the topics on the following slides.

Image source: Prochoicesafetygear.com

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1. Identify activities on site

- Most construction activities demand water in one form or another.
- However, few need to use potable water, unless hygiene, health or product quality is compromised.

Potable water, also known as drinking water, **comes from surface and ground sources and is treated to levels that meet national standards for consumption**.

Planning water management

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- It is important **to identify the trades, their activities and, if water is required, whether potable or non-potable water would be appropriate**.
- The ultimate aim is to eliminate demand and use of potable water in construction. It is unlikely that water demand can be eliminated, but efforts can be made to reduce and use alternative sources, as well as reuse water for construction activities

Non-potable water is **water that is not of drinking water quality**, but which may still be used for many other purposes, depending on its level of quality.

Activity	Water Use	Potable or Non-Potable	Options to avoid Potable Water demand
Site Cabins	Drinking, kitchen, canteen, toilets and urinals, showers and hand washing.	Potable Non-Potable	Efficient showers, taps, toilets and urinal controls. Trigger control on catering taps & use of vessels for washing rather than under running taps. Rainwater for toilet flushing, floor cleaning. Waterless urinals.
General Cleaning	Tool rinsing and Boot Washing Plant and equipment washing	Non-Potable	Fill containers rather than use running taps or open hoses. Trigger-operated spray guns. Use of a closed water recycling system – like a small scale wheel washing facility.
Demolition Dust Suppression	Hydro- demolition Damping & Misting	Non-Potable Potable	Exploit existing water in the building (eg use of water tanks in building if full. Drain water from tanks to skips as temporary containment. Drain water from water tanks to basement, as a holding tank. Capture for potential use elsewhere
Site Dust Suppression	Damping – dust Wheel wash – road safety	Non Potable	Use of chemical additives. Use of control systems to allow damping activities to be altered for different applications and weather conditions. Use of water efficient road sweepers and dust suppression vehicles which recirculate water and/or have efficient spraying mechanisms such as a hydraulic spinning system. Use water collected elsewhere on site – such as from SUDS – for dust suppression activities. Use drive-on wheel wash systems that recirculate water. Use captured water, or water from elsewhere on site to fill tanks. Consider waterless wheel cleaning systems if space permits.

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2. Identify potential sources of water available

- Having identified water needs, it is important to **plan for alternative sources** within the project, whilst sustaining metered potable supply as a back-up supply.
- Phasing of activities should be considered and the use of structures could be used to store, reuse and save water during the project.
  - **Store** (covered tank, positioned in shade and optimal size), Collect (multiple sources and surfaces),
  - **Reuse** (local tubs and tanks, settlement zone with tap one third up),
  - **Save** (maintain records of metered or estimated volumes used/reused),

When considering water use on site, the **water hierarchy should always be consulted**

Use the Pre-Start meeting to discuss use and agree/share water saving ideas from and for all Trades.

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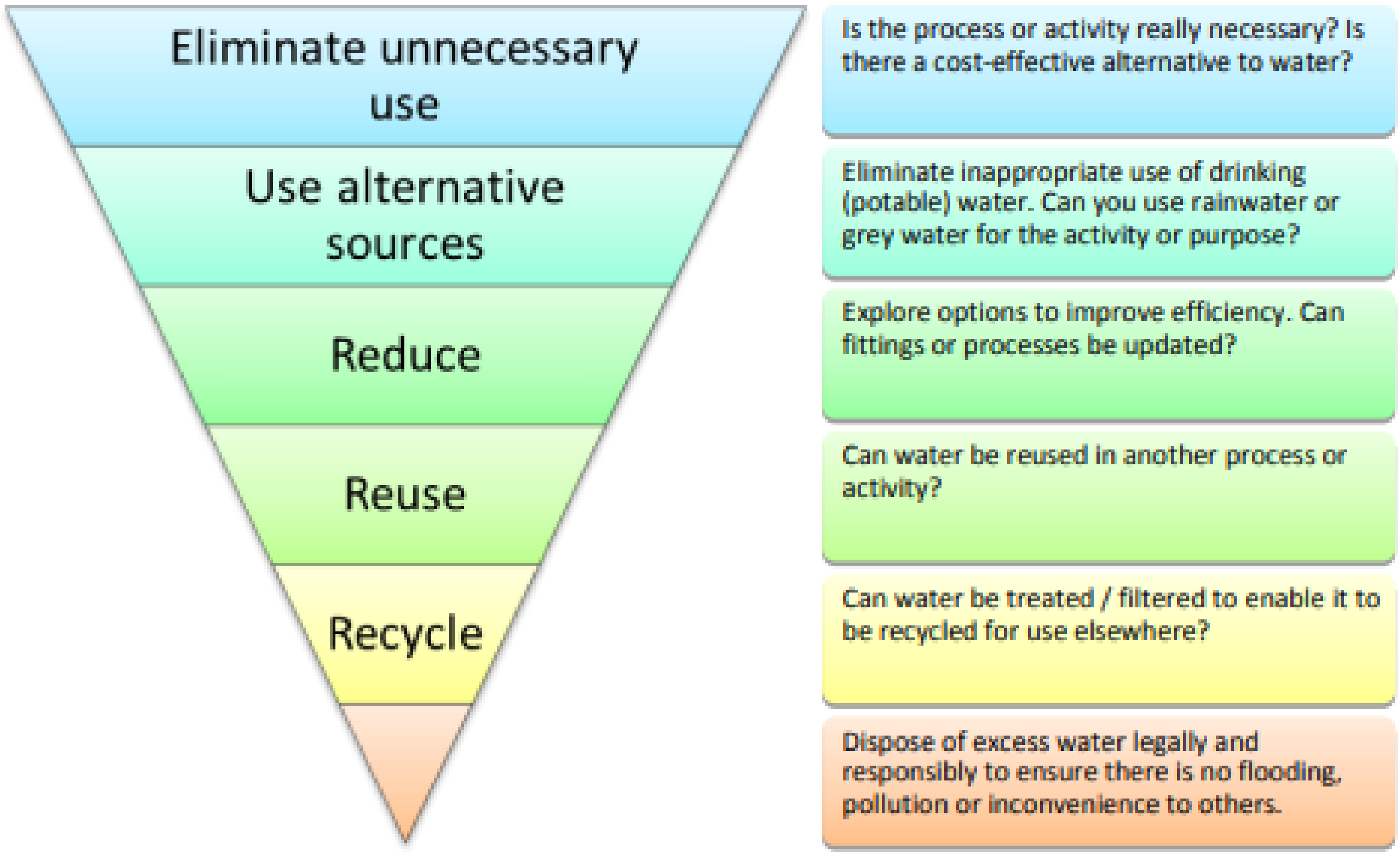
Water Hierarchy



When considering water use on site, the water hierarchy should always be consulted.

Supply	Water Source	Considerations
Non Potable	Water Harvest tanks (new or existing)	Install early for non-potable site use (install draw off pipe or for example connect to toilet flush). Use existing tanks (save from demolition) if available. Record tank volume and/or sub-meter use.
Non Potable	Runoff attenuation (tanks/storm water ponds - new or existing)	Install early for non-potable site use (Install draw off pipe). Use existing tanks (save from demolition) if available. Record volume and/or sub-meter/estimate use.
Non Potable	Land Drainage attenuation (discuss risk of increased surface or land drainage issues for the site)	Ensure potential land drainage issues resolved at outset of the project to mitigate impact for site. Reinstate or establish land drainage infrastructure or address segregated land drains in early project phase. Map likely pathways for surface water – divert or avoid flow to work area to mitigate wash-out or safety issue and programme delay risks.
Non-Potable	Dewater attenuation from excavations	Reuse (up to 20m3/day without need for abstraction licence) to avoid trade effluent charge and unnecessary surface water loading to wastewater network and treatment systems.
Non-Potable	Abstraction licence	Sources from river, groundwater, canal.
Re-Use	Storage on site for re-use	Covered tank, positioned in shade and optimal size, with back-up supply on ballcock to sustain supply if critical to operational need.
Re-Cycle	Prepare to treat on site for re-use	Set-up screening, settlement, aeration and retention tanks, with testing regime.
Potable	Mains supply or Hydrant (standpipe) supply or Bowser or Tankered supply	Potable supplies identified in activity.

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3. Health and Safety considerations

- Good practice applies to **risk management** beyond bacterial/biological potential (E.coli etc.) of how water is sourced, where it comes from, how it is stored, for how long and in what conditions that could lead to contamination, plus how is the water used.

- If small droplets of water are used, the risk may be greater depending on the original water source. Consider how it has been stored, for how long etc.

- If fine droplets are needed, potable water should be used. For instance for dust suppression in densely urban areas, or use of fan-blowers to create misted air within a demolition site.

Storage of non potable water sources

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For **the storage of Non-Potable Water Sources:**
Sensible precautions should be taken to avoid bacterial growth.

- cover stored water
- keep water cool
- avoid heat and direct sunlight.

Allow waters to settle and use silt traps and filters appropriately on inflow and outflow to prevent sediment impact downstream.

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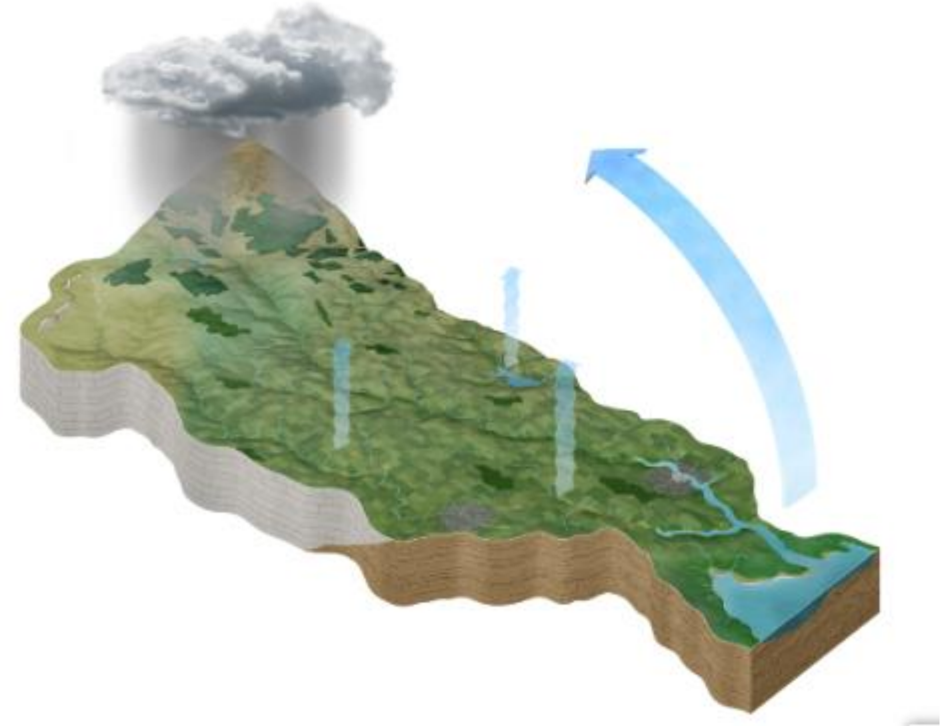
4. Local catchment situation

- For water, a catchment is simply defined as an area of land around a river, lake or other body of water.
- Living in a catchment that has healthy water can help a community to have a better quality of life.
- To identify which river basin district and catchment your site is located in, maps can be found at catchments.ie

There are 46 catchments and 583 sub-catchments across Ireland



https://www.catchments.ie/

Planning water management

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- If the site has been located in an area of **flood risk** it is likely that the construction has included flood prevention or alleviation as part of the construction methodology.

- Details of maintenance or operation of these facilities should be handed over to the site owner upon completion, and documents may be required to be sent to planning officers to discharge key conditions.

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5. Permits, consents, licences & disposal of water

- Permits, consents and licences needed for the use, transport and disposal of water on site should be identified.
- The acquisition of a permit, licence or consent may limit the way in which you handle water use and disposal on site and should therefore be considered early in the planning process
- Where a consent, licence or permit has been supplied, the site is required to operate within the relevant requirements. This may include monitoring activities such as sustaining records of discharge according to consented parameters (sampling, photo evidence, daily records in site diary etc.) and often a method of silt/sediment control (e.g. a settlement tank) prior to discharge of the water.

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Examples of types of consent that may be required.

Permission	Activity
Abstraction licence	Removal of water from a watercourse / groundwater
	Over-pumping from one watercourse to another or within the same watercourse
Impounding Licence	Damming / holding back a watercourse
Environmental Permit	Discharge of water / effluent into a watercourse*
Trade effluence discharge consent/ Groundwater permit	Discharge of water / effluent into the sewage system. Identify the relevant sewerage undertaker to liaise with. Discharge of any water other than 'clean uncontaminated rainwater'.
Development Licence	Works that may impact protected flora / fauna

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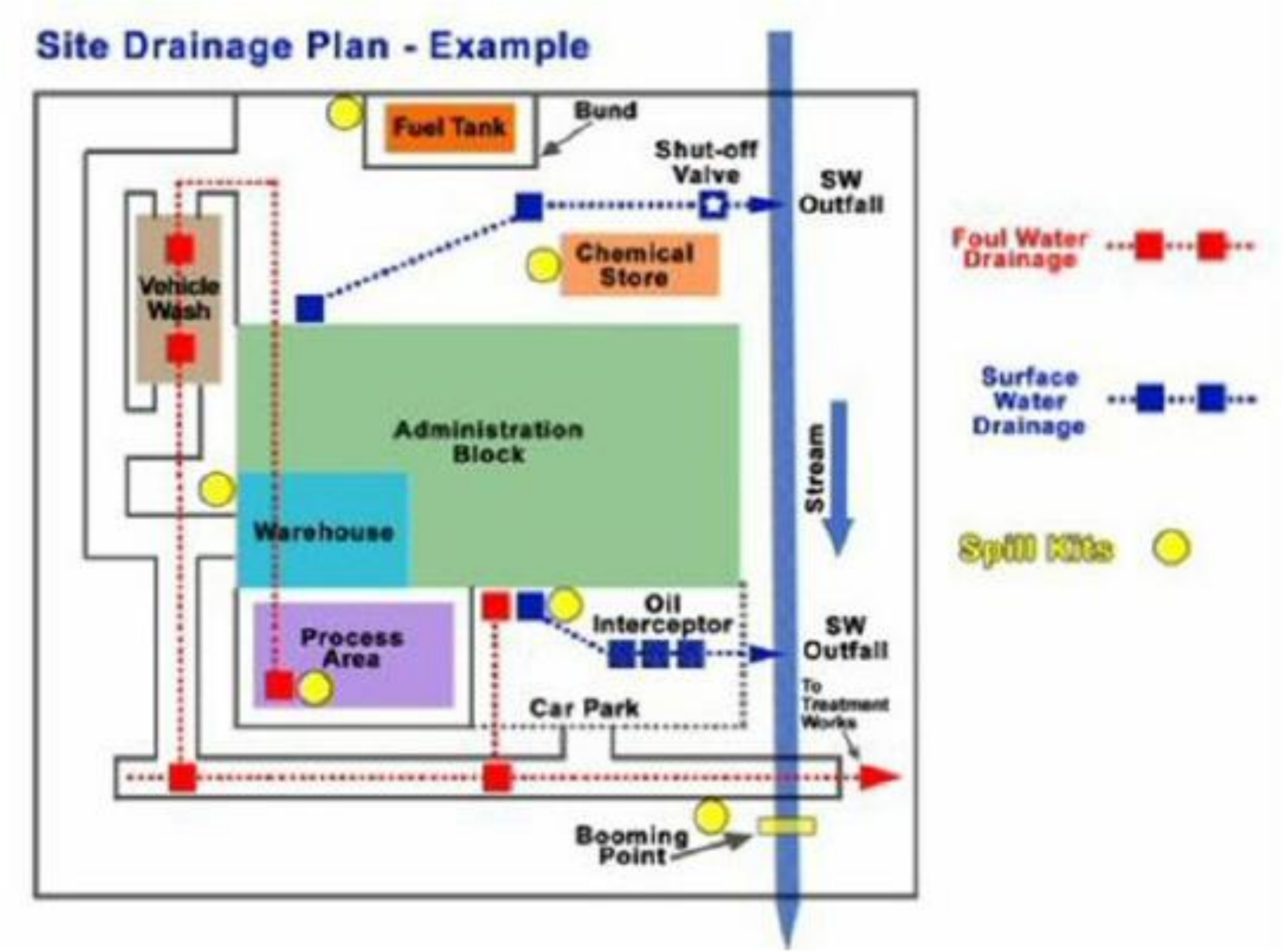
6. Solution management and site drainage

Pollution prevention needs to be considered in relation to:

- Watercourses located in the vicinity of your site
- Discharges from your site
- Extreme events: surface water onto site, flooding on site and surface water flow off-site.

Site Drainage

As an example of best practice, a drainage plan specific to the site should be drafted and included within the Water Management Plan



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7. Surface water management & flooding

- Storm and rainwaters provide risk and opportunity within the built environment- **risk of surface waters creating channels within the built environment and resulting in flooding**, and **opportunity that if attenuated from roofs provide reasonable resource.**

- Planners and designers will account for the flood risk for the building, but teams planning the construction process need to consider the risk and impact for a construction site.

Planning water management

Consideration of surface water management and flooding should cover the following:

1. Are local water courses identified on the site plan?
2. Are the routes to water course identified?
3. Have areas of potential erosion and sediment transport been identified?
4. Is there a plan to mitigate potential erosion impacts?

Under the Arterial Drainage Acts, 1945 and 1995, and SI 122/2010 Regulations, construction and alteration of watercourses, bridges, weirs and embankments require the prior **consent of the OPW (Office of Public Works).** These legal requirements mainly serve to ensure that proposed construction and alteration projects do not increase the risk of flooding or have a negative impact on drainage of land.

Erosion and sediment control

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Erosion and sediment control planning will become increasingly more important for large projects with Water Framework Directive and ecological status measures in mind, and also with increasingly erratic weather patterns caused by climate change.

Projects where sediment/silt runoff could be a problem - should consider the development of an erosion and sediment control plan which can include, but not be limited to, the following information:

- Property boundaries
- General soil description
- Existing and final contours - including location of cut and fill banks
- Existing and final overland flow drainage paths
- Limits of clearing or disturbed areas where applicable e.g. on large properties
- Location of vegetated buffer strips
- Stabilised entry/exit point (rumble pad)
- Location of soil and sand stockpiles
- Location of all proposed temporary drainage control measures
- Location of all proposed erosion control measures (alternatively, use notes to describe
- locations) including installation sequence and maintenance requirements
- Permanent site stabilisation measures.

Land drainage, flood management

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Land Drainage

Contractors may operate on or adjacent to the banks of main rivers or riparian owned watercourses. In this case, a flood defence consent will be required.

Flood and Water Management

The areas of flood water management most relevant to contractors and construction sites are:

- use of Sustainable Drainage Systems (SuDS)
- process of surface water drainage approvals & adoptions
- connection to public sewer and associated provisions
- designation of third party flood management assets
- powers for water companies to control non-essential uses of water.

Sustainable Drainage Systems

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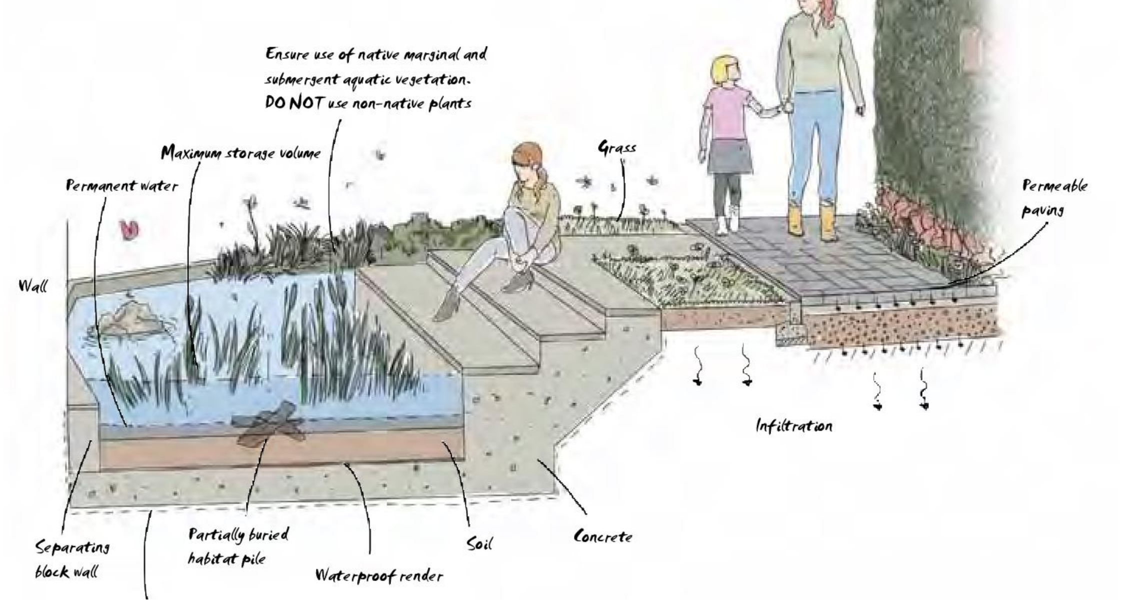
Figure 11 Urban ponds integrated into hard landscaping of SuDS can provide somewhere pleasant to sit, and when planted appropriately can also be attractive to wildlife.



Sustainable Drainage systems (SuDS)

SuDS is a technique that manages surface water and groundwater sustainably.

If planned and designed, it is an extremely effective approach. Site managers should ensure that SuDs are protected from construction activity.

SuDS use natural elements to typically manage rainfall close to where it falls. They are designed to;

- **Transport** (convey) surface water
- **Slowdown runoff (attenuate**) before it enters watercourses
- Provide areas to store water in natural contours, allowing water to soak **(infiltrate**) into the ground
- Allow water to be transpired through vegetation **(evapo-transpiration)**

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8. Site measurement and monitoring

Measurement and monitoring of water use is the most important step in being able to manage consumption on site.

The site should be planned to allow adequate information on water use to be regularly collected and reported on, so that decisions with regard to consumption can be made.

Water meters

Identifying sources

Ideally all water sources supplying a site should be metered. This may include mains water (which may already be metered by the supplier), standpipes, recycled water and directly abstracted water from rivers or groundwater.

Selecting meters

Selection of the correct meter for any particular site is the first step to obtaining reliable data. This means making sure the meter being fitted is the right technology and the right size.

The ability of a meter to interface with other systems may be a consideration. Meters are available that can directly interface with a number of common reporting systems and some are available with internal logging capacity.

Water meters

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Meter reading

The measurements made by a meter need to be recorded in some way and transmitted to where they are to be used.

Locating meters

As a minimum each water source should be metered.

A better granularity of information could be provided by sub-metering particular uses which allows benchmarks for consumption both within and between sites to be identified along with opportunities for reductions in water use. Sub-metering could be considered for:

Critical sections of the site.

- Points where different parts of a site are in different phases of work.
- Points prior to specific draw off points for a particular purpose e.g. welfare facilities.
- Points downstream of a specific draw off point so that consumption for a specific
- purpose can be identified.

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Frequency of monitoring

More frequent monitoring of water use will result in a better picture of how water is used on site being derived and provide earlier warning of unusually high, or low consumption.

As a minimum it is suggested that monthly meter reads are obtained. In some circumstances it may be useful to collect reads more frequently than this, for instance where there is:

- A critical period on site.
- Periods of extreme weather (wet or dry).
- A need for specific investigation of night use (to identify and quantify leaks).
- A highly variable schedule on site e.g. by number of people or activity.

Water meters

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Reporting requirements – how, when and who

- At the outset reporting requirements should be determined and agreed.
- Reporting requirements may be to site managers, to environmental managers, for corporate reporting systems, or to site staff (to encourage particular behaviours)
- Reporting will be clearest, and most clearly understood by the audience where water use values are documented in relation to factors such as:
  - Number of staff on site,
  - Value of construction work,
  - Activities carried out on site during the reporting period,
  - influencing factors during the reporting period (e.g. unusually dry, or wet weather).

Water meters

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Reporting against baseline and target

- Initially it is useful to derive baseline water use on site, against which future consumption can be assessed.
- It is good practice to set a target water use figure appropriate to the site against which progress can be measured
- Reporting should then be carried out against the target at an appropriate, regular, period.

Procedure for investigating unusual consumption

- A procedure for investigating unusual consumption should be devised. The need for this may arise from unusually high, or low meter readings that could indicate problems perhaps through leaks, or a faulty meter.
- The procedure should be clearly documented.

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Water meters

- Meters should require relatively little maintenance, although **regular review of meter reads to ensure they are within expected bounds should be undertaken.**
- **Monitoring, reporting, and investigation of unusual consumption should be carried out** in accordance with the plan.
- **If meters are to remain on site following handover to the site owner upon completion** then the location should be clearly marked on a site plan, along with details of isolation valves and other relevant pipework or ancillaries.
- It is useful also to **provide details of the make and model of meter**, and any calibration information pertinent to it.

Image source: twitter.com

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9. Efficient welfare, plant and equipment

- Welfare activities have been shown through a series of water audits on constructions sites to be one of the largest users of water as they are in place from site commencement through to the end of site operations.
- If site cabins are to be procured, **arrangements should be made for these to be water efficient**.
- Where existing facilities are to be used for the duration of a project, consideration should be given to improving the efficiency of these to reduce water use.

Planning water management

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- Welfare facilities should require relatively little on-going maintenance to ensure low water use. Basic checks can be carried out to ensure facilities are operating as designed through:
  - Checking that taps are not dripping
  - Checking that percussion taps do not run for longer than necessary
  - Ensuring the sensor driven taps and/or urinals are working correctly
  - Ensuring toilets are not leaking through the overflow or valves

- Basic awareness raising of these with site staff, and implementation of a reporting system for any problems that are identified should keep water use from welfare as low as possible

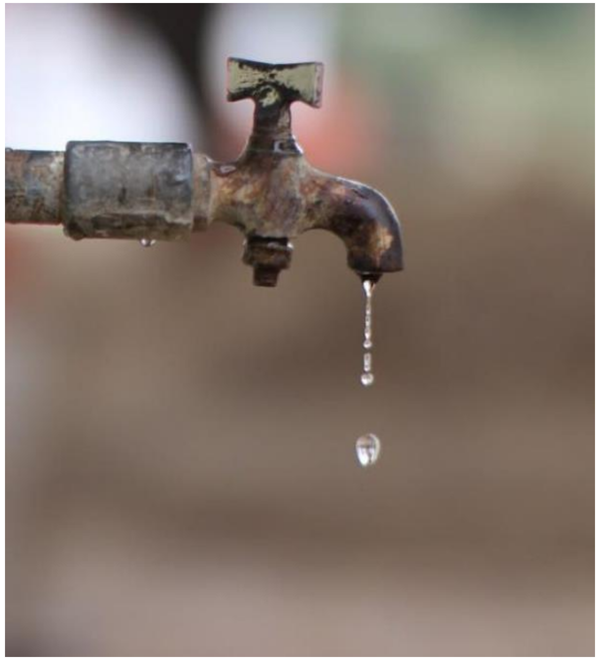

Image source: indiatvnews.com

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10. Training and awareness of water use

- Ensuring staff working on the site are aware of efficient, appropriate and safe water using practices and habits will be critical to reducing wasted water on construction sites.
- Appropriate time should be set aside during site initialisation to include water in site staff training, with tool box talks and refresher training repeated in advance of high demand periods.
- New staff joining the site should be exposed to similar training or materials on induction.
- The training should include a site behaviours plan, based upon activities which will be undertaken on site, to encourage efficient practices.
- It is useful to display top tips and reminders for staff across the site, for instance in rest areas and around welfare facilities.
- Promote water saving behaviour and celebrate innovative examples of water saving, alternative approaches or use of non-potable sources to complete activity safely.

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11. Water footprinting and embodied water

- Water foot-printing is now starting to be an emerging trend and clients are requesting that contractors consider the water footprint of the construction site – or the **embodied water of the materials used on site.**

- Traditionally embodied water refers to the cumulative quantity of water used to produce a product through the supply chain.

Image source: thewaterway.com

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12. Site handover

- It is important that the handover to the client and end-user(s) is supported with a comprehensive **Operation and Maintenance Manual(s)** that includes all aspects, including effective and efficient water use.
- This will ensure the positive legacy of optimal non-potable water use.

Image source: sutherlandsurveyors.com

Site Handover Information

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- If the site is located in an area of **flood risk** it is likely that the build has included flood prevention or alleviation assessment as part of the construction.

- **Details of maintenance or operation of these facilities should be handed over to the site owner upon completion**

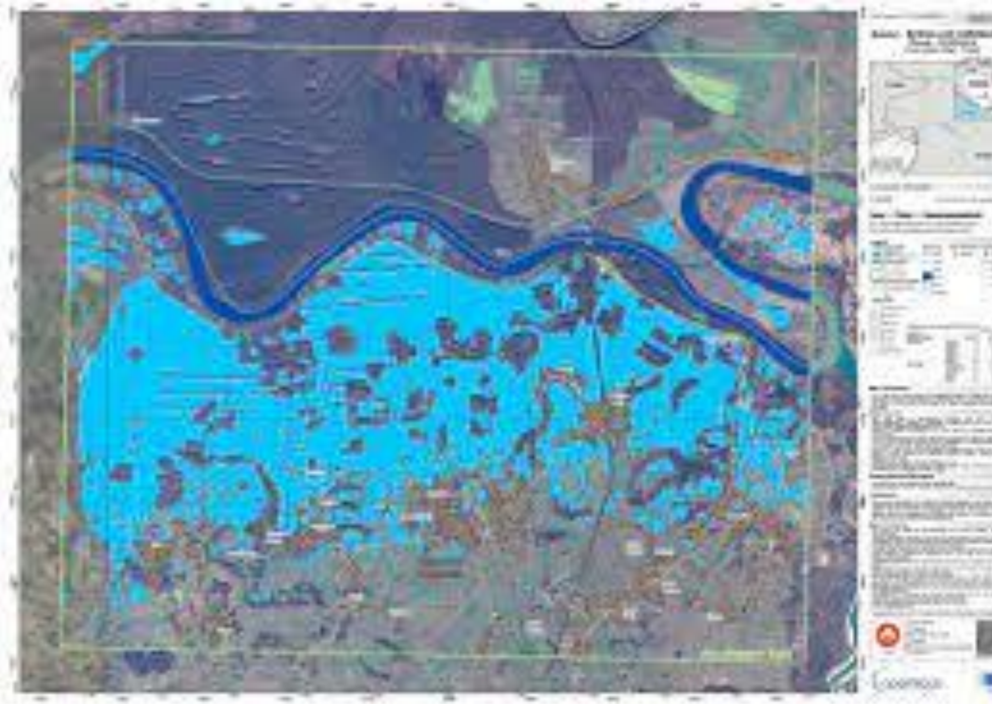

Image source: esa.int

Site Handover Information

- Where storage tanks have been used as a source of water through the construction process, these need to **be tested and prepared for site handover.**

- For instance ensuring sediment is cleared from silt traps or sumps prior to handover etc. There should be no residual liability to catchment quality.

Image source: alamy.com

2. Water management on site

Water management

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Water management is a broad term that generally refers to the control and movement of water resources in a manner designed to reduce damage to life and property, and to increase beneficial use based on efficient practices

Image source: Sustainabilitymatters.net

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Water efficient project design

Blackwater: Wastewater from toilets, dishwashers, kitchen sinks, and utility sinks

Rainwater: Precipitation collected from roofs and above-grade surfaces

Air Conditioning Condensate: Water collected from evaporator coils

Greywater: Wastewater from clothes washers, bathtubs, showers, and bathroom sinks

Stormwater: Precipitation collected at or below grade

Foundation Drainage: Nuisance groundwater from dewatering operations

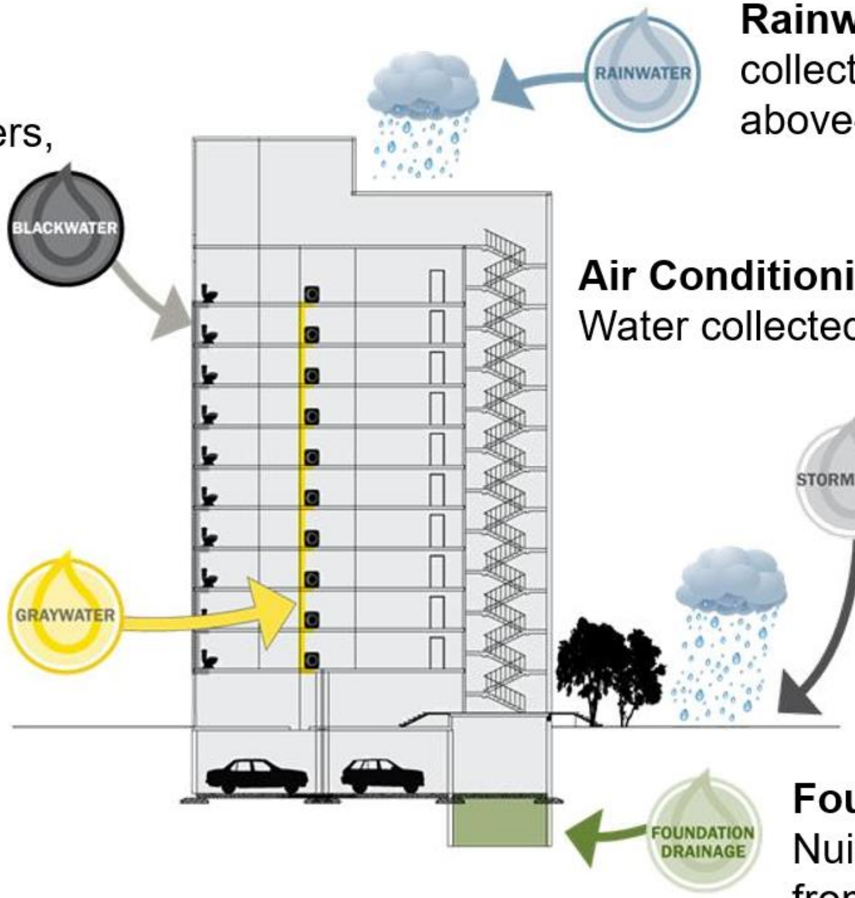

Image source: US Environmental protection agency

Water management techniques- rainwater harvesting

Rainwater harvesting

- **Rainwater harvesting (RWH) is the collection and storage of rain, rather than allowing it to run off.**

- Rainwater is collected from a roof-like surface and redirected to a tank, cistern, deep pit, aquifer, or a reservoir with percolation. Dew and fog can also be collected with nets or other tools.

- **Its uses** include watering gardens, livestock, irrigation, domestic use with proper treatment, and domestic heating. The harvested water can also be committed to longer-term storage or groundwater recharge.

Image source: constrofacilitator.com

Water management techniques- groundwater recharge

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Groundwater recharge

- Groundwater is recharged naturally by rain and snowmelt and to a smaller extent by surface water (rivers and lakes).
- Recharge may be impeded somewhat by human activities including paving, development, or logging. These activities can result in loss of topsoil resulting in reduced water infiltration, enhanced surface runoff and reduction in recharge.
- Groundwater recharge is the enhancement of natural groundwater supplies using man-made conveyances such as infiltration basins, trenches, dams, or injection wells.
- Recharge can help move excess salts that accumulate in the root zone to deeper soil layers, or into the groundwater system.

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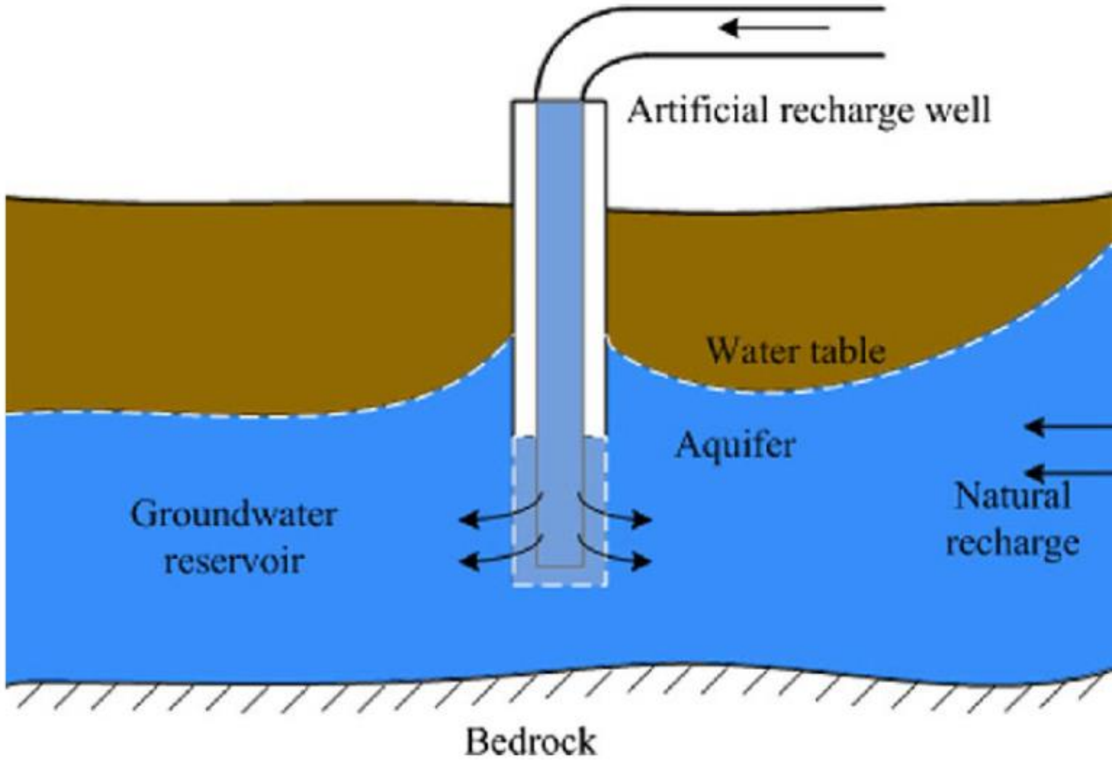
Artificial groundwater recharge

- Groundwater levels are declining across the country as our withdrawals exceed the rate of recharge. One method of controlling declining water levels is by using artificial groundwater recharge.

- **Artificial recharge is the practice of increasing the amount of water that enters an aquifer (sediment that holds groundwater) through human-controlled means.**

- For example, groundwater can be artificially recharged by redirecting water across the land surface through canals, infiltration basins, or ponds; adding irrigation furrows or sprinkler systems; or simply injecting water directly into the subsurface through injection wells.



Water management techniques- drip irrigation

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Drip irrigation

- Drip irrigation is a type of micro-irrigation system that has the potential to save water and nutrients by allowing water to drip slowly to the roots of plants, either from above the soil surface or buried below the surface. The goal is to place water directly into the root zone and minimize evaporation.

- Drip irrigation systems distribute water through a network of valves, pipes, tubing, and emitters.

- Depending on how well designed, installed, maintained, and operated it is, a drip irrigation system can be more efficient than other types of irrigation systems, such as surface irrigation or sprinkler irrigation.

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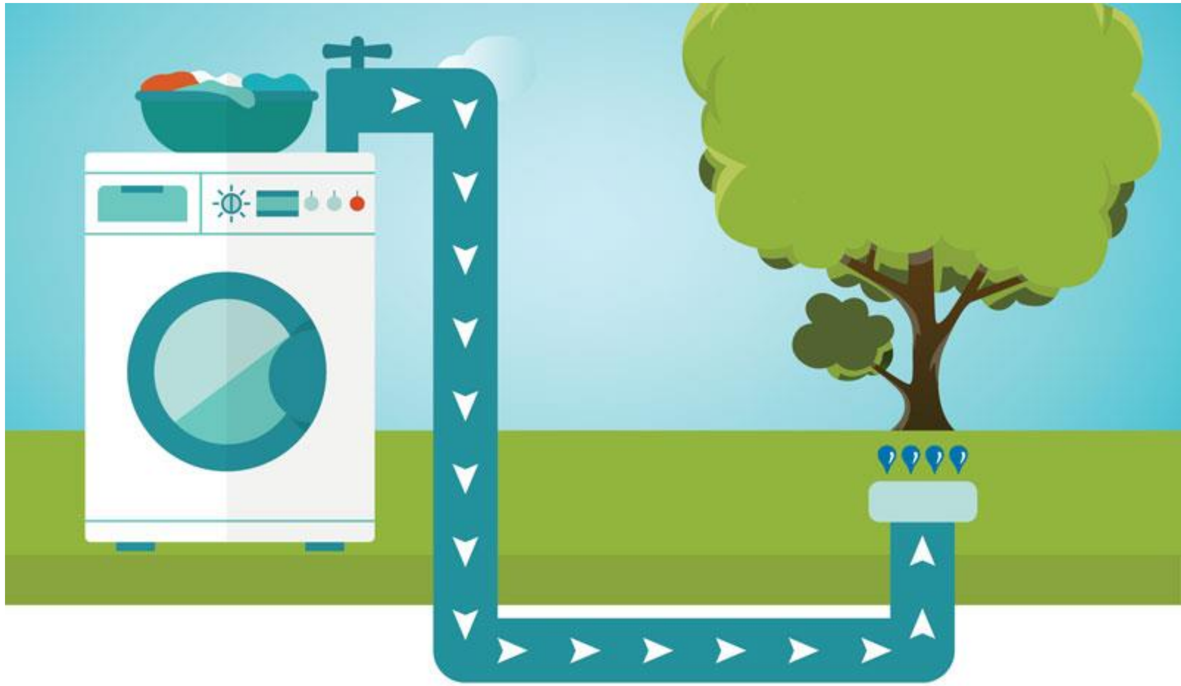
Greywater

- Greywater is gently used water from bathroom sinks, showers, tubs, and washing machines.
- While greywater may look “dirty,” it is a safe and even beneficial source of irrigation water in a yard.
- **Greywater is water from basins, baths and showers that is piped to a surge tank. The greywater is held briefly in the tank before being discharged to an irrigation or treatment system.**



Water management techniques- Green infrastructure

Green Infrastructure

- Green infrastructure reins in stormwater runoff, which the EPA describes as "one of the fastest-growing sources of pollution"
- Green infrastructure encompasses a variety of water management practices, such as green/blue roofs, absorbent rain gardens, bioswales, urban tree canopy, roadside plantings, permeable pavements and other measures that capture, filter, and reduce stormwater.
- Sewerage overflows can also be incorporated into a reed bed system acting a natural percolation area. This can be incorporated into a natural green infrastructure approach within the site and within the neighbouring areas, reducing impact of pollution in the waterways and water courses.

Green spaces, like Brooklyn Bridge Park in New York City (above), not only offer respite in a big city, but they also help capture stormwater runoff that would otherwise overwhelm storm sewers.
Kristina Blokhin/Alamy Stock Photo

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Sewage water treatment

- **Sewage treatment is the process of removing contaminants from municipal wastewater**, containing mainly household sewage plus some industrial wastewater.

- **Physical, chemical, and biological processes are used to remove contaminants and produce treated wastewater (or treated effluent) that is safe enough for release into the environment**.

- A by-product of sewage treatment is a semi-solid waste or slurry, called sewage sludge. The sludge has to undergo further treatment before being suitable for disposal or application to land.

Water management techniques- conjunctive use

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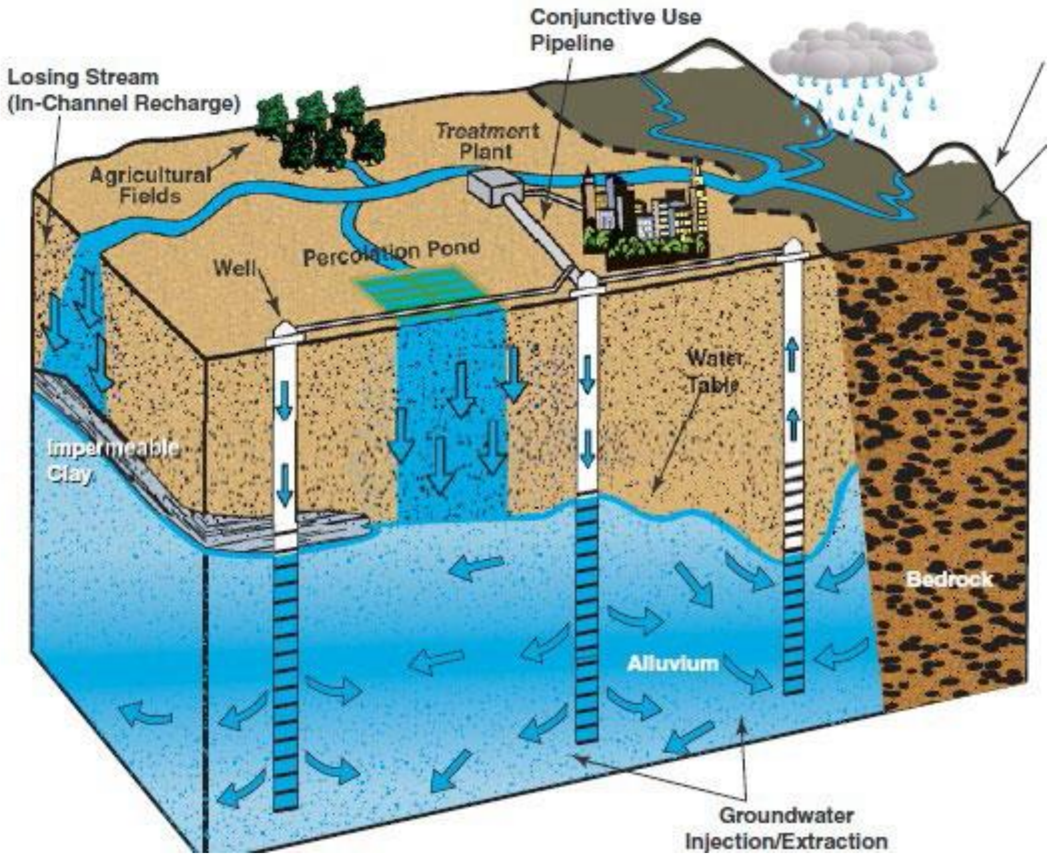
Conjunctive use

- Conjunctive use is the **coordinated use of surface water and groundwater**— literally going with the flow to maximize sufficient yield.

- At the resource level, groundwater pumping for irrigation used in conjunction with surface water provides benefits that increase the water supply or mitigate undesirable fluctuations in the supply



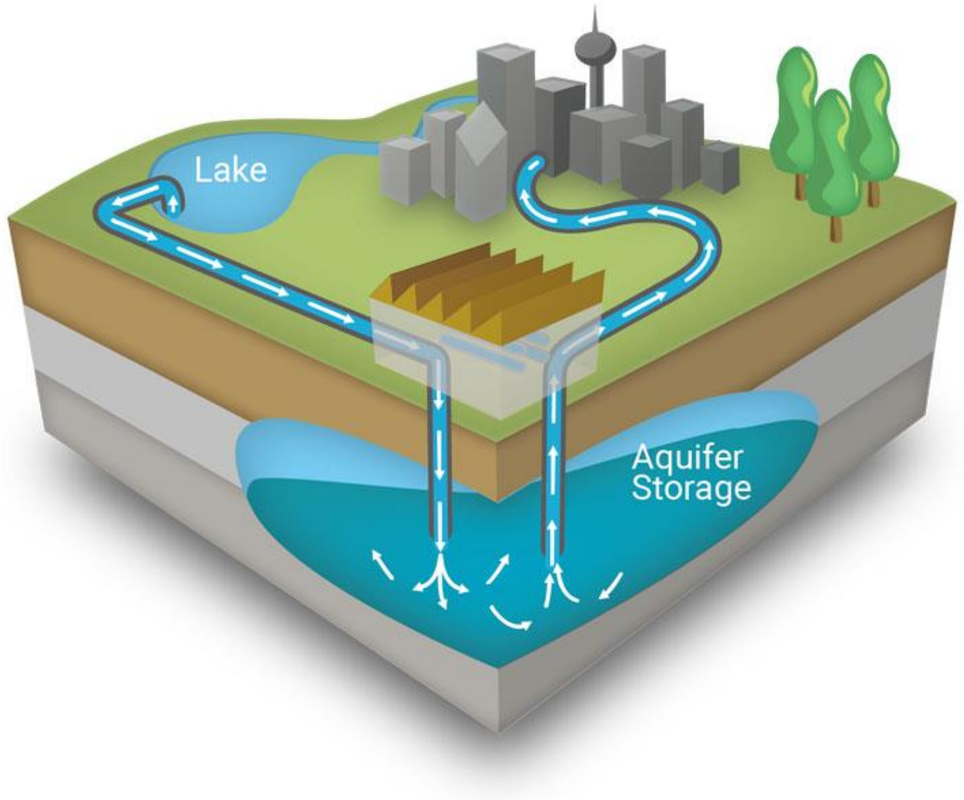
Water management techniques- conjunctive use

Aquifer storage and recovery

- **Aquifer storage and recovery (ASR)** is **the direct injection of surface water supplies such as potable water, reclaimed water (i.e. rainwater), or river water into an aquifer for later recovery and use.**

- The injection and extraction is often done by means of a **well.** In areas where the rainwater cannot percolate the soil or where it is not capable of percolating it fast enough (i.e. urban areas) and where the rainwater is thus diverted to rivers, rainwater ASR could help to keep the rainwater within an area.

- ASR wells are used to store water in the ground and recover the stored water for drinking water supplies, irrigation, industrial needs, or ecosystem restoration projects.



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Water management techniques- desalination

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Desalination

- Desalination refers to the removal of salts and minerals from a target substance. For example: saltwater is desalinated to produce water suitable for human consumption or irrigation.
- Most of the modern interest in desalination is focused on the cost-effective provision of freshwater for human use. **Along with recycled wastewater, it is one of the few rainfall-independent water sources.**
- Feedwater sources may include brackish, seawater, wells, surface (rivers and streams), wastewater, and industrial feed and process waters
- The technology is energy intensive and research is continually evolving to improve efficiency and reduce energy consumption.

Conclusion

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- Water management methods should be adopted strategically, keeping in mind the need for the work to be implemented. Planning groups must address the needs of all water users, if feasible.

- When the industry comes together to increase its sustainability, global access to clean drinking water improves.

- Water-conserving businesses may also increase their profit and customer appeal due to heightened demands for sustainable goods and services.

- Construction companies can reduce their water footprint and raise their environmental awareness.

Assessment

QUIZ!

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CONSTRUCTION BLUEPRINT

Thank You

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BZB Bildungszentren des Baugewerbes e.V.

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CENTRE IFAPME Liège-Huy-Verviers

European Federation of Building and Woodworkers EFBWW

ŠOLSKI CENTER KRANJ

CNC Confederación Nacional de la Construcción

EBC CONSTRUCTION SMEs EUROPE

FFB FEDERATION FRANÇAISE DU BATIMENT

FIEC EUROPEAN CONSTRUCTION INDUSTRY FEDERATION

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