GOVERNMENT OF MALTA
MINISTRY FOR THE ENVIRONMENT, ENERGY AND ENTERPRISE
MINISTRY FOR THE ECONOMY, EUROPEAN FUNDS AND LANDS
PARLIAMENTARY SECRETARIAT FOR EUROPEAN FUNDS

WATER BE THE CHANGE

EU funds for Malta 2014-2020

# Promoting Non-Conventional Water Resources in Malta

## Wednesday 15th March 2023

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# 1. Executive Summary

The Promotion of Non-Conventional Water Resources in Malta Conference took place on Wednesday 15th March 2023. The conference highlighted the need for community-based solutions and the promotion and education of NCWR implementation.

The conference was held at Esplora Interactive Science Centre.

Attendees were able to sign up for the conference through https://water.org.mt/join-the-drops/conference-3, where they could fill in a form, or by calling +356 2777 2777, or by sending an email to info@emcs.com.mt to register.

The ample parking spaces and Esplora's perfect location facilitated the attendance of several participants. A standing lunch was organised for all attendees. Two coffee breaks were organised during the conference which provided attendees with a short break and an opportunity to network.

In total, 67 people attended this conference. The attendees were made up of private and public individuals, NGOs, and different ministerial representatives. All attendees registered their attendance at the registration desk. The conference was open to all, and walk-ins were also accepted on the day.

The conference lasted till late in the afternoon and was hosted by Keith Demicoli, a well-known TV presenter and moderator. The conference consisted of six presentations delivered by different experts in the sector as well as three panel discussions. Throughout the report, one can find the presentations that were used by the various speakers, as well as the key points of each presentation.

Different exhibition stands were set up inside the conference halls. Various Water Be the Change campaign related merchandise items including pencils, pens, notebooks and sticky notes were displayed at the registration desk and exhibition stand and handed out to participants. The agenda, a small note pad and a pencil were also placed on the seat of each individual.

# 2. Conference Agenda

**Date**: March 15th, 2023

**Venue**: Esplora, Kalkara, Malta

| | |
|---|---|
| **08:30** | **Registration** |
| **09:00** | **Opening Session**<br><br>Chief Executive Officer, The General Soft Drinks (Marketing) Ltd. \| Ms Maria Micallef<br>Sustainability and Community Manager, The Coca-Cola Company \| Ms Sofia Kilifi<br>Regional Head of Finance and Administration, Global Water Partnership – Mediterranean \| Mr Alexis Filias<br>Chief Executive Officer, Energy and Water Agency \| Mr Manuel Sapiano<br>Chairman, Kottonera Foundation \| Hon Glenn Bedingfield<br>Minister for the Environment, Energy and Enterprise \| Hon Miriam Dalli<br><br>Keynote Speech \| The Alter Aqua Project in Malta - Achievements and Objectives \| Mr Nikos Skondras<br>Panel discussion on the achievements and objectives of the Alter Aqua Project in Malta |
| **10:30** | **Coffee Break** |
| **11:00** | **Session 1 – Non-Conventional Water Resources in Practice**<br><br>Techniques for assessing the impact of Non-Conventional Water Resources in an urban setting \| Prof Yaser Abunnasr<br>The Non-Conventional Water Resources Programme in the Mediterranean \| Mr Nikos Skondras<br>Kid-Powered Water Management: How Playgrounds Can Help Combat Flooding \| Ms Adiel Cuschieri<br>Panel discussion on Non-Conventional Water Resources in practice |
| **13:00** | **Lunch Break** |
| **14:00** | **Session 2 – Integrating Non-Conventional Water Resources in Integrated Water Resources Management Planning**<br><br>Non-Conventional Water Resources in River Basin Management Planning – A Case Study from Malta \| Mr Manuel Sapiano<br>Integrating Non-Conventional Water Resources in Water Management Planning – A Case Study from Israel \| Dr Lea Kronaveter<br>The MEDWAYCAP Project \| Prof. Konstantinos Plakas<br>Panel discussion on integrating NCWR in water management planning |
| **16:00** | **Coffee Break** |
| **16:30** | **Closing Session**<br><br>Outcomes of the Workshop \| Mr Alexandros Kandarakis |

# 3. Detailed report of conference proceedings

## 3.1 Opening Session

**MS MARIA MICALLEF, CEO, THE GENERAL SOFT DRINKS LTD.**

Ms Micallef started by introducing the Alter Aqua program, mentioning that it began in 2011 and is now launching its fourth phase. She highlighted that the value of water is more than just its price; it is vital for health, education, and the economy. For instance, water being the primary ingredient for the products that The General Soft Drinks (GSD) company produces.

The environmental challenges that are present today are quite complex and require the collaboration of all states to notice, hence, the existence of partnerships between big businesses, the Government, and civil society. A great example of this is Alter Aqua where the state, an NGO, and a private company, joined forces to contribute to helping with one of Malta's biggest challenges, i.e., water. Throughout the implementation of the Alter Aqua program more than 50 infrastructure projects have been carried out in Malta. This has resulted in the collection and using of more than 90 million litres of water annually, which is approximately equivalent to the water consumption of 1,000 families per month in Malta.

The fourth phase of the Alter Aqua program is about reminding the past and sustaining the future. Through the restoration of historical reservoirs, the aim is to raise awareness on the importance of rainwater harvesting as well as to provide an automatic resource for addressing urban water plants. The use of non-conventional water resources (NCWR) for urban purposes is in line with the objectives of the united nations' sustainable development projects.

Climate change is leading to fundamental changes and more water related risks. According to Ms Micallef, the Alter Aqua program has shown that, through combined efforts, the challenges present due to climate change can be turned into opportunities. Furthermore, water security can be put at the heart of our sustainable development.

**MS SOFIA KILIFI, SUSTAINABILITY AND COMMUNITY MANAGER, THE COCA-COLA COMPANY**

Ms Kilifi stated that water holds utmost significance as an essential resource, indispensable for both the sustenance of life and the advancement of economic activities. Recognizing its shared nature, she emphasized the collective responsibility in managing this vital resource sustainably.

According to Ms Kilifi, the Coca-Cola Company's 2030 water vision aims to achieve water security across their business operations, communities, and natural habitats worldwide. The focal points of this vision entail ensuring water quality and access, serving as fundamental pillars for economic prosperity and environmental preservation.

Highlighting the AlterAqua programme as a prime exemplar, Ms Kilifi lauded its modular and sustainable planning approach, successfully addressing water-related challenges. She commended the financial support provided by the Coca-Cola Company, enabling the programme to promote a new cultural paradigm while effectively managing water activities. Notably, Ms Kilifi expressed satisfaction with the program's outstanding results.

With today's agenda focusing on the burdens faced in Malta, Ms Kilifi eagerly anticipated discussions on strengthening the water management culture and exploring avenues for creating opportunities. She envisioned these deliberations fostering a collaborative environment for innovative solutions, paving the way towards a more resilient and water-secure future for the region.

## MR ALEXIS FILIAS, REGIONAL HEAD OF FINANCE AND ADMINISTRATION, GLOBAL WATER PARTNERSHIP – MEDITERRANEAN

Mr Filias acknowledged that the challenge of water security has been embedded in Malta's history for ages. Moreover, he indicated that the financial support from the Coca-Cola foundation committee for the past 12 years, has been the driving force of Alter Aqua's success.

NCWR are applications that involve society from day one as they require agreement and a change of mindset. Mr Filias asserts that this is a solution that the society can see, can appreciate, and participate in. He closes off his speech by stating that the aim is to support Malta, and to have water security in times of great environmental and climate change.

## MR MANUEL SAPIANO, CEO, ENERGY AND WATER AGENCY

Mr Sapiano, CEO and spokesperson for the Energy and Water Agency (EWA), emphasized that water policy is of utmost importance, particularly in the context of sustainable development goals at both the national and global levels. He underscored the need for widespread recognition of water investments and expressed concerns about supporting future development while addressing water scarcity.

Regarding the collaboration with AlterAqua, Mr Sapiano highlighted its potential impact on national policies, specifically in terms of reservoir restoration and public outreach efforts. He emphasized that AlterAqua's involvement has the capacity to influence the development and implementation of water policies, thereby promoting necessary reforms.

Mr Sapiano further stressed the importance of striking a balance between water and energy consumption. While acknowledging the energy-intensive nature of water

treatment processes, he emphasized the agency's commitment to investing in sustainable alternatives such as greywater harvesting and recycling. These approaches are considered more environmentally friendly due to their reduced energy requirements.

Under the current government programme, Mr Sapiano pointed out significant investments in the water sector, with specific attention given to greywater recycling and harvesting. He emphasized the agency's proactive approach in raising awareness about these practices among the general population and businesses. By providing accurate information and fostering informed decision-making, the agency aims to drive positive change and garner support for improving water resources.

Mr Sapiano highlighted that water scarcity is a global concern and emphasized the importance of cross-border cooperation. He emphasized the mutual learning opportunities that arise through collaboration with other nations, allowing for the exchange of best practices and innovative solutions to address water scarcity collectively.

In conclusion, Mr Sapiano reiterated EWA's commitment to developing and implementing water policies that align with sustainable development goals. Through partnerships, awareness campaigns, energy-efficient practices, the agency aims to ensure the sustainable management of water resources in Malta. Mr Sapiano emphasized the agency's role in driving positive change and securing a prosperous and environmentally friendly future for water and energy in Malta and beyond.

## HON GLENN BEDINGFIELD, CHAIRMAN, KOTTONERA FOUNDATION

Hon Bedingfield began his speech by stating that the survival of the cities is dependent on historical reservoirs. Several reservoirs were lost during the second world war, and subsequently most of them were practically forgotten or misused. He goes on to assert that the Government's intention of focusing on the rehabilitation and management of early reservoirs in order to support early green initiatives to improve our surroundings. This will also be used as an awareness campaign since it will include the school children of the Kottonera area, and hence future generations.

## HON MIRIAM DALLI, MINISTER FOR THE ENVIRONMENT, ENERGY AND ENTERPRISE (RECORDED MESSAGE)

Hon Dalli affirms that the coming together of the private sector and civil society has proven to be powerful in promoting sustainability and in creating water management interventions. Through the Alter Aqua program, the gap between water demand and supply is being bridged. Furthermore, this work is also supported through the rehabilitation of existing reservoirs, in addition to building new ones.

Rainwater harvesting reservoirs provide a sustainable and renewable source of water as well as a source of water for other secondary uses such as road cleaning. Thus, it presents a truly sustainable solution that can help address the issue of flooding.

Hon Dalli ended her statement by stating that Alter Aqua is a starting point, proving that the community can contribute to the national water conservation narrative and thus providing a more sustainable future for all.

## MR NIKOS SKONDRAS, SENIOR PROGRAMME OFFICER, GLOBAL WATER PARTNERSHIP – MEDITERRANEAN

### KEYNOTE SPEECH: THE ALTER AQUA PROJECT IN MALTA – ACHIEVEMENTS AND OBJECTIVES

Mr Nikos started his presentation by discussing the water challenges found in the Mediterranean. Water quality depletion impacts of climate change, population increase and migration, seasonality of water demand, and the energy cost for water production were all highlighted.

Water scarcity in the Mediterranean can be addressed by improving water management, as well as through the implementation of NCWR. These are:

- Rainwater harvesting
- Greywater reuse
- Treated wastewater reuse
- Aquifer recharge
- Desalination

Mr Nikos stated that Malta is the 7$^{th}$ most dense country in the world and with very little naturally occurring freshwater.

The Alter Aqua project is primarily funded by The Coca-Cola's Foundation and co-financed by the Ministry of Gozo and the EWA. The current partners for this project are the Global Water Partnership-Mediterranean, The Coca-Cola Foundation, the EWA, and GSD Marketing Ltd. He explained that the project has been divided into phases. Phase 1 occurred from 2011 till 2013 with the aim to secure water availability and facilitate sustainable development. Phase 2 began in 2014 and concluded in 2017 with the goals to extend activities, promote the use of NCWR, and to expand the NCWR agenda in the Mediterranean. Phase 3, lasting from 2019 up to 2021, aimed to promote NCWR as a solution to water scarcity and to adapt to climate change. The four components comprising this phase are:

- Technical interventions (NCWR applications)
- Capacity Building & Youth Engagement
- Awareness Raising and Communication
- Education

The 4th and current phase started in 2022 with the same aims as phase 3, comprising of:

- Technical interventions (NCWR applications)
- Capacity Building & Youth Engagement
- Awareness Raising and Communication

Technical interventions include the reinstatement or improvement of abandoned underground rainwater harvesting reservoirs as well as selecting reservoirs in accordance with their specific technical and cultural features. These interventions will also promote the agenda of the Ministry for Public Works and Planning on the mainstreaming of the Green Stormwater Infrastructure.

Workshops for young participants will be organized so that they can learn about technically sound and socially acceptable applications of NCWR, as well as promoting NCWR and the revival of Malta's water conservation culture, through featuring the country's rich water heritage. The already existing applications in Malta serve as an example of feasibility as well as an inspiration for replication.

The Water Conservation Awareness Center and the University of Malta will host activities to raise awareness. These activities include:

- The development of a reservoir trail which provides information about the structures and the project to visitors.
- Designing and printing promotional leaflets which will promote both the project objectives as well as the Malta's policy priorities.
- Promotion through media.
- A social media campaign which will focus on general public awareness on water scarcity and wise daily water use.

## PANEL DISCUSSION 1: ACHIEVEMENTS AND OBJECTIVES OF THE ALTER AQUA PROJECT IN MALTA

**Mr Kandarakis**

Mr Kandarakis states that water scarcity is not a problem that can be solved. The situation is always changing, and with climate change there is a lot of uncertainty. Water can never be enough; if there is no awareness, the more water you give to people, the more they will waste.

Malta is a country where water used to be very important. Mr Kandarakis even signifies that the older generation may still remember the lack of water. Now, water is available at the

turn of a tap. On the other hand, people are more conscious of energy because the energy process is so high.

The challenge of NCWR is that they have to go through a lot of discussions as there needs to be an agreement when it comes to choosing which reservoirs to rehabilitate. However, this can also be a positive as a lot of engagement is garnered.

**Mr Sapiano**

Mr Sapiano proposes that the most important thing to come out of the Alter Aqua project is the wave of interest in water harvesting.

He goes on to state that Alter Aqua works with whoever shows interest in water harvesting, this includes civil society and the local councils. Their biggest value is to reach out to people and indirectly raise awareness.

**Ms Kilifi**

Ms Kilifi assures that the Alter Aqua program is the solution to water scarcity and climate change adaptation. The Coco-Cola Foundation invested 1.4 million dollars in this program and in Malta, over 21 locations have been restored. This project first started with Greece and now Malta and Cyprus are also part of it. However, it is important to note that in order to be able to address the issues, this program needs to be adapted for that specific country. For example, in the case of Malta, with the use of historical reservoirs. He concluded by stating that it is important to educate both the public and stakeholders in order to help in the water scarcity that the Mediterranean is facing.

**Ms Micallef**

Ms Micallef starts off by stating that water scarcity is not only an issue in Malta. Through the sharing of best practices around the Mediterranean, a lot of added value has been brought into this Alter Aqua program.

**Mr Kandarakis**

According to Mr Kandarakis, part of the challenge is an engineering one, and how to convey the sense of this challenge to the general population.

The Alter Aqua program is also about bringing in the new generation, who are studying and starting to work on these issues. People can see and follow the challenge of it. Moreover, people are often unaware that this topic is also linked to employment.

**Mr Sapiano**

Mr Sapiano asserts that, at the time of implementation, greywater recycling was quite an innovation in Malta. In government programs there is a specific mention to promoting rainwater in the domestic sector and the commercial sector. Mr Sapiano emphasized its importance as it shows that even at a political level there is this vision to move forward. Alter Aqua was one of the main motivations for this change. He closes off by declaring that the most important thing is to ensure that when people open their tap, they find water.

**Ms Kilifi**

Ms Kilifi asserts that changing the views of stakeholders is not easy and requires a lot of effort. She goes on to thank Ms Micallef, indicating that she did her best to convince local stakeholders.

**Ms Micallef**

Ms Micallef articulates that although the culture of water conservation was here, the evolution of the economy and way of life made us forget its importance. She concludes her speech by expressing that the hard work put into this project these past years however, were well compensated for.

## 3.2 Session 1

**PROF YASER ABUNNASR, AMERICAN UNIVERSITY OF BEIRUT**

**TITLE: TECHNIQUES FOR ASSESSING THE IMPACT OF NCWR IN AN URBAN SETTING**

Prof. Abunnasr started off his presentation by discussing the complementarity between nature-based solutions (NBS) and non-conventional water (NCW). In order to implant matters, work needs to start being done at a visionary level.

NBS can do the following with respect to water:

- Percolation/recharge
- Filtration
- Recycling
- Retention/detention
- Interception
- Storage

In Malta, all these systems listed above come together. People had the vision a long time ago. According to Prof. Abunnasr, the most important thing that we are beginning to understand again is our limitation of how much it can actually be done.

NBS are living solutions that depend on nature. They use functioning ecosystems to address societal challenges in an efficient and flexible way.

NBS also have many applications:

- Resource efficiency and reduction in energy usage
- Climate control and mitigation of climate change
- Disaster risk reduction
- Conservation of natural water resources
- Habitat restoration and ecosystem support
- Positive impacts on public health and wellbeing, and Food security
- Promotion of sustainable economic growth

Singular projects and practices of NBS tend to be prototypes which generate important local benefits in social, environmental, and economic ways. They are important yet insufficient in impacting the challenges, however, they are more significant within the Mediterranean region, especially when considering climate change.

Alternatively, when incorporating NBS at city and metropolitan scales, maximum possible ecosystem co-benefits are generated. The risks associated with climate change, the impacts of flooding, and "urban heat island" are all reduced. Additionally, NBS provides an increase in liveable places, support for public health and food security, as well as easing pressure on existing infrastructure. Nonetheless, developing a city-wide NBS system has its own challenges, such as the need to rapidly identify available and suitable locations, competition for space and the simplification of complex variables. It is important to note that different types of NBS entail different spatial requirements and variables to address. On the other hand, a city-wide NBS system provides plenty of benefits, namely through phasing of investment, overall financial budgeting and planning, and prioritization based on specific city needs.

The implementation of NBS at the city scale requires the assessment of opportunities along with identifying and addressing the risks. Furthermore, expanding NBS in existing previous surfaces while also transforming impervious surfaces to NBS, along with reducing their impact.

NBS provide opportunities for water capture and storage. A predictive model can be developed by way of determining water availability, physical features, watersheds, and historical data.

The limitations encountered by NBS are as follows:

- Data Resolution compatibility
- Field Verification needs
- Verification against local policy
- Land tenure should be considered
- Account for adjacent land uses to avoid
- Socio-economic data to be incorporated

Prof. Abunnasr concludes his presentation by maintaining that this is still a work-in-progress.

**MR NIKOS SKONDRAS**

**TITLE: THE NCWR PROGRAMME IN THE MEDITERRANEAN**

Mr Skondras started his presentation by highlighting the main water challenges in the Mediterranean, including seasonality, water quality depletion, climate change impacts, increase in population and energy cost.

The geography of the partners and the programme itself encompasses the four countries of Italy, Greece, Malta and Cyprus, 123 site specific applications, and 41 water scarce insular and coastal communities. The programme's methodology is an integrated approach which includes demo non-conventional water resources applications, education, awareness raising, capacity building and training, and multi-stakeholder partnership.

Mr Skondras discussed the project's components, challenges with each, and lessons learned from these approaches.

Reviving traditional water management practices was the first component that was discussed.

The challenges with this component include:

- Increasing water demand
- Decreasing precipitation due to climate change
- Abandoning remarkable local craftmanship to harvest rainwater

The lessons learned from this approach were that Malta's heritage points to cost-efficient and sustainable water solutions for the future, and also that the traditional water management practices can be revived by modern means.

The second component made reference to promoting innovative non-conventional water resources management technologies. The challenges with this component include:

- Greywater and treated wastewater remain untapped
- Desalination is the main source of water in most islands
- Agriculture ranks at the top of water consumption

The lessons learned from this approach were that ICT-based solutions can optimise irrigation with water, and also showcasing innovative water technologies promotes use, replication and scaling up of solutions.

Another approach was optimising existing infrastructure and achieving water efficiency. The challenges with this component include:

- Aged water infrastructure causes extensive water and energy losses

- Old system design and existing capacities cannot cater for extended needs and increasing demand

The lessons learned from this approach were that by combining the use of water saving devices and by optimising the existing infrastructure, significant amount of volumes of water can be saved.

The advancing integrated solutions for urban green was the fourth component mentioned in this presentation. The challenges with this component include:

- Increasing urbanisation
- Few green spaces in the cities
- Climate change intensifies urban water vulnerabilities, such as flooding, heat stress and water scarcity

The lessons learned from this approach were that green roofs and vertical gardens can improve the microclimate and living conditions in the cities and also that green–blue infrastructure prevents flooding and increases urban green.

The following approach was to foster job creation and knowledge sharing. The challenges with this component include:

- Increasing youth employment rates
- Skills mismatch in youth
- Technology advances and the knowledge generation must be shared among peers who face similar water challenges

The lessons learned from this approach were that Non-Conventional Water Resources can provide new employment and entrepreneurial opportunities, and also that knowledge sharing has a multiplier effect towards improved management of water resources.

The last component mentioned was nurturing a new water culture. The challenges with this component include:

- New water culture
- Required changes in our values
- Governance change
- Different production and consumption patterns

The lessons learned from this approach were that awareness raising can create the acceptance of Non-Conventional Water Resources at local level and facilitate the expansion of such cost-effective methods, and also that education for sustainable development empowers learners to transform their attitudes towards mindful water use.

Mr Skondras concluded his presentation with the following remarks for the future:

- A legacy left in 41 islands and cities, showcasing solutions that can be replicated and scaled up
- All works will continue to yield benefits in the future
- Empower youth and women
- Promote innovative applications at urban and rural environment for water security, climate change adaptation and local development

## MS ADIEL CUSCHIERI, MINISTRY FOR PUBLIC WORKS AND PLANNING

### TITLE: KID-POWERED WATER MANAGEMENT: HOW PLAYGROUNDS CAN HELP COMBAT FLOODING

In her opening speech, Ms Cuschieri addressed the attendees and explained that they are currently working on an action with the Energy and Water Agency, that involves work on sustainable urban draining system.

Ms Cuschieri provided the audience with an explanation of green stormwater infrastructure and stated that it talks about engineering solutions which significantly limit the natural hydrological process.

One type of green stormwater infrastructure is Sustainable Draining Systems which focus a little bit more specifically on the infiltration of storm water, both at surface level and then percolating down into the ground.

The speaker affirmed that a drainage system manual was published last year. The identified sustainable drainage systems which are applicable to Malta include:

- Detention basin
- Dam
- Bio Retention Systems
- Swales
- Filter drains / French drains
- Ponds and Wetlands

Ms Cuschieri went on to mention that playgrounds have been recognised as potential areas that can redirect water to them and therefore can be used as sustainable urban draining system, due to the fact that they typically accumulate a lot of water during rainy events and tend to flood frequently.

The speaker also focused on ways how playgrounds can be modified to make a bit more of a bigger influence for water percolation:

- Permeable paving
- Swales or any other engineered idea

She discussed the two playground pilot projects, one in Paola, and the other one in Għajnsielem, Gozo. The playground in Paola is currently closed for renovation. The green space and the permeable area in the playground in Paola have been increased significantly. Furthermore, the soil being used will be enlarged. In order to increase the amount of water porosity on the surfaces, special paving will be used that is actually semi-permeable. The garden is situated directly between four roads, and the designs also incorporate small culverts on the side so that the water from the roads is actually redirected, going down in the reservoir underneath, where it will be used to irrigate the plants and trees. The water that is not actually used to fill up the reservoir is then redirected to the valley, where it can be once again collected and used by the farmers, in order to make use of the water to its maximum potential.

Ms Cuschieri concluded her presentation by giving a quick overview of the playground in Għajnsielem, which has very similar plans to the one in Paola. She indicated that there would be reservoirs underneath the ground, where the water that would flow from the valley right upstream of the garden would be used to gather water. This water will be used for both the restrooms and for irrigation. Once again, the overflow will be spilled into the valley.

## PANEL DISCUSSION 2: NON-CONVENTIONAL WATER RESOURCES IN PRACTICE

The below four questions were put forward to the audience for their feedback:

### Question 1

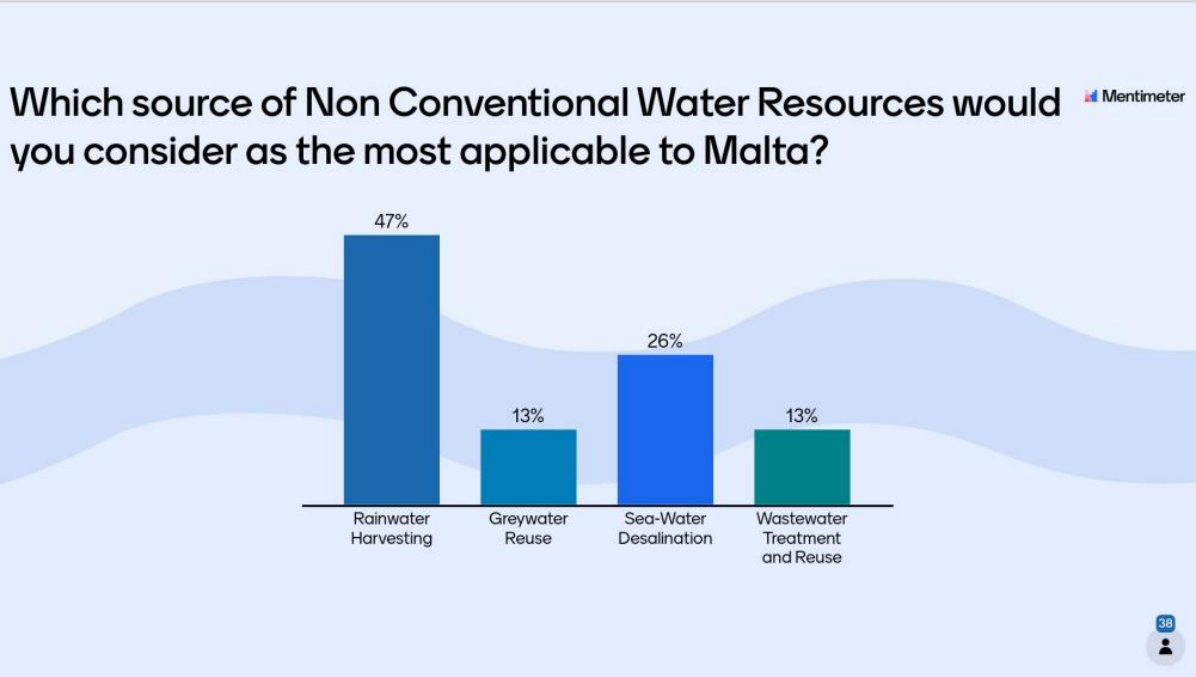
Which source of Non-Conventional Water Resources would you consider as the most applicable to Malta?

(i) Rainwater Harvesting

(ii) Greywater Reuse

(iii) Sea-Water Desalination

(iv) Wastewater Treatment and Reuse




Prof. Abunnasr stated that it would be interesting to estimate which of them produces the highest amount of water. According to him, each of them must operate simultaneously and some sort of strategy that brings them all together is crucial.

Mr Skondras agreed with Prof. Abunnasr, but he believes that sea-water desalination is the most appropriate method for Malta as it is the most secure. However, it is very expensive in terms of energy.

Ms Cuschieri concurred with the others, as she considers it extremely risky to rely solely on one source, but ideally work with all of them.

**Question 2**

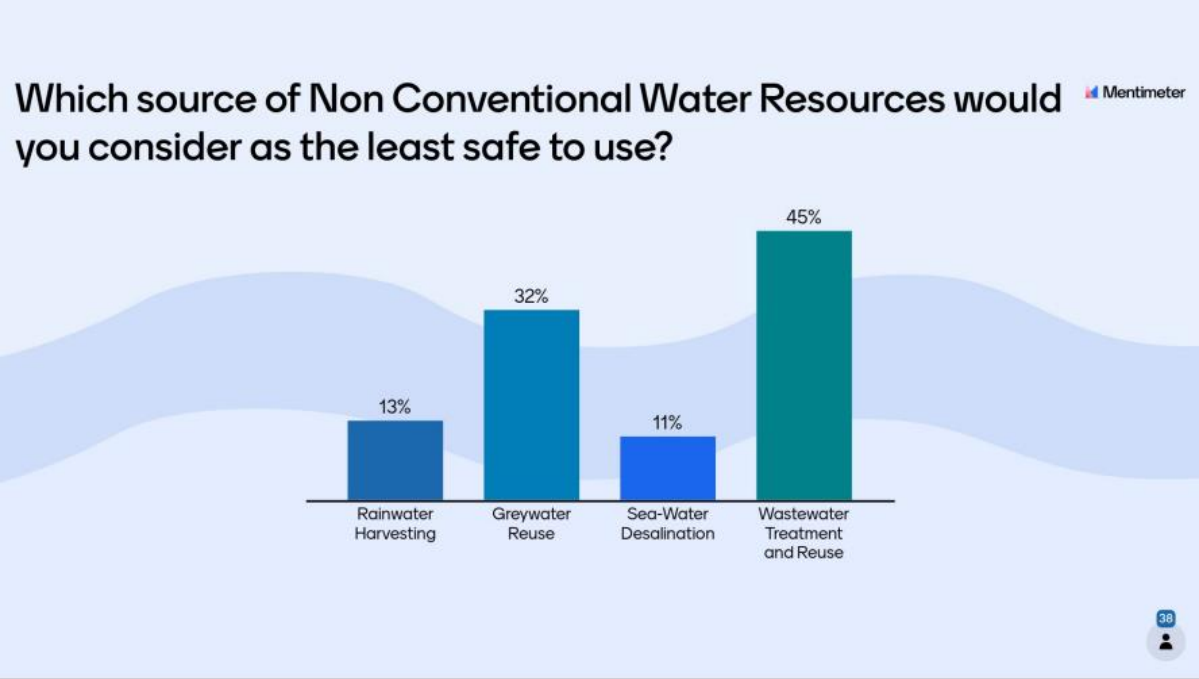
Which source of Non-Conventional Water Resources would you consider as the least safe to use?

(i) Rainwater Harvesting

(ii) Greywater Reuse

(iii) Sea-Water Desalination

(iv) Wastewater Treatment and Reuse




According to Ms Cuschieri, each one of them has a certain amount of risk, particularly when discussing greywater or wastewater because of the potential for contamination. She stated that the dangers are fairly low if the procedures are put in place in accordance with the proper requirements.

Dr Kronaveter believes that treated wastewater is the least secure Non-Conventional Water Resource.

All of these Non-Conventional Water Resources have certain usages and standards according to Prof. Abunnasr. However, he believes that how others perceive things is a more crucial matter.

**Question 3**

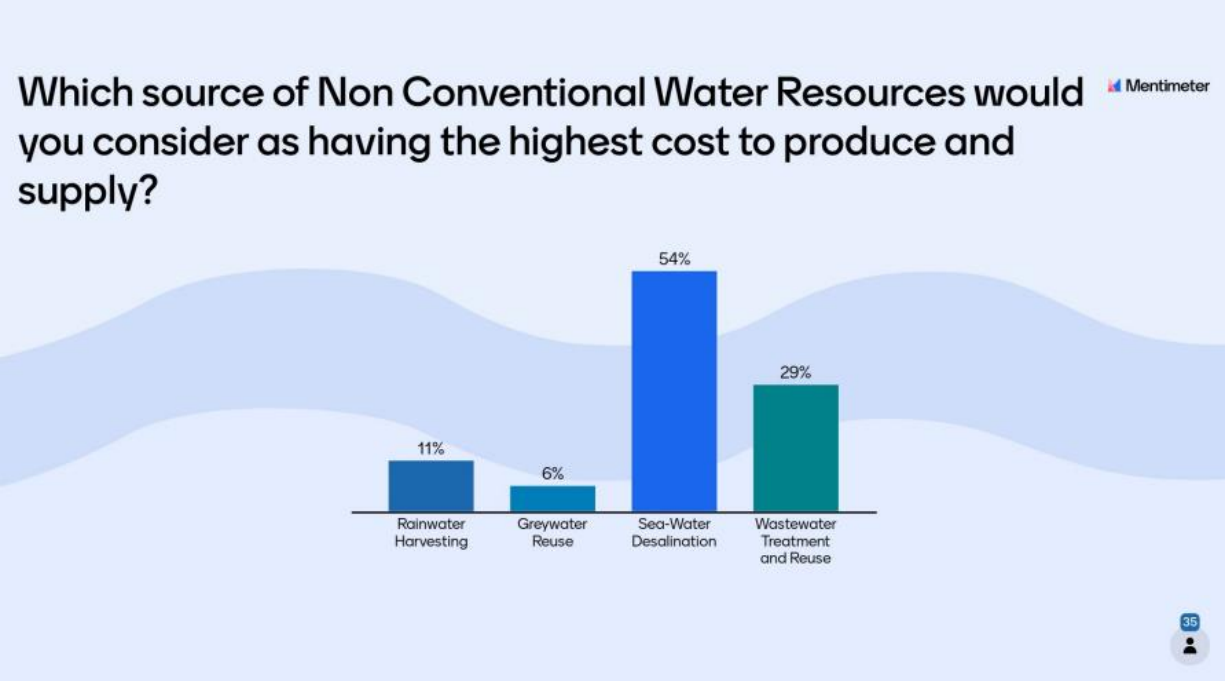
Which source of Non-Conventional Water Resources would you consider as having the highest cost to produce and supply?

(i) Rainwater Harvesting

(ii) Greywater Reuse

(iii) Sea-Water Desalination

(iv) Wastewater Treatment and Reuse




Prof. Abunnasr stated that running costs and capital investments are both significant factors in any project. However, little consideration is given to the environmental costs. He also emphasised the necessity to start thinking about long-term benefits, which politicians simply put aside.

**Question 4**

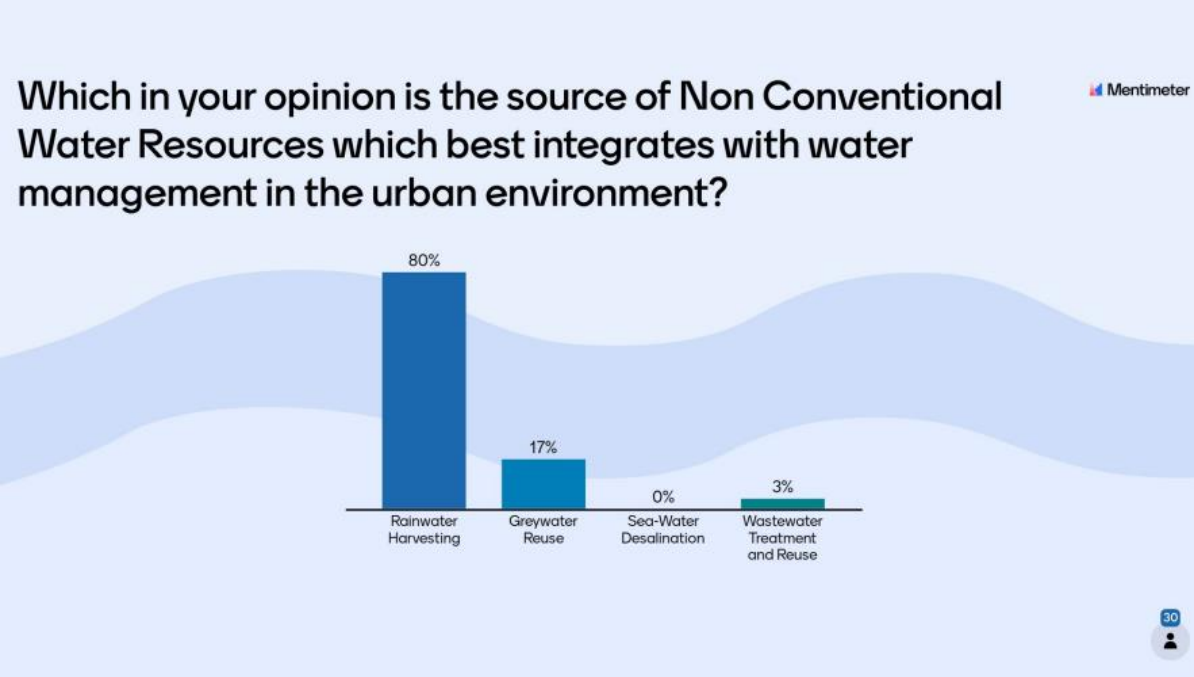
Which in your opinion is the source of Non-Conventional Water Resources which best integrates with water management in the urban environment?

(i) Rainwater Harvesting

(ii) Greywater Reuse

(iii) Sea-Water Desalination

(iv) Wastewater Treatment and Reuse




The outcome of the question did not surprise Prof Abunnasr since rainwater is simple to collect because it falls on the roof in a decentralised manner, which strengthens the system. He stated that greywater reuse is also important. In many places, infrastructure is required to separate rainwater from sewage, followed by grey and black water, in order to be able to truly upscale greywater. Overall, Prof Abunnasr agreed with the overall results, but he would have pushed grey water reuse a bit higher.

According to Ms Cuschieri, combining all of them will increase efficiency, which really completes the picture.

Mr Kandarakis, who at the moment is part of the audience, puts forth the first question; What is the most expensive technology? He went on to argue that if the calculations per unit of volume are done through rainwater harvesting or through greywater recycling, the cost will be higher than that of desalination.

Mr Skondras vocalised his agreement with Mr Kandarakis, stating that this technology remains the most expensive.

Prof. Abunnasr articulated that in the case of, for example, decentralised systems within cities collecting water upstream and then distributing, using greywater would reduce cost in the long run. He concedes that the cost is higher per unit. However, when multiple decentralised systems are employed, there is no need to build a desalination plan. Thus, there would be less burden on the government.

The Moderator asserted that in Malta, one of the top priorities is to create more green spaces in urban areas. He goes on to inquire whether NCWR are able to support the increased demand for urban green initiatives and the ways in which this increased demand can be supported.

Prof. Abunnasr underlined that key idea is multifunctionality. For instance, in city spaces where rainwater collection is possible, multiple other benefits are also present: cooling of the city, supporting health, bringing in biodiversity, so on and so forth. Thus, according to the professor, NCWR would help improve multiple other areas and holistic point of view is needed.

Directing her question to Ms Cuschieri, Ms Xuereb asked whether it would be a good idea to totally remove the paved element from playgrounds. She goes on to state that playgrounds are not used in summer due to the heat and lack of trees. Her other queries are about the possibility of making the playground more season friendly and whether this novel idea will be applied to all the playgrounds.

Ms Cuschieri disclosed that these projects have a bit of a drawback in the sense that they were not the ones who created the design and thus, only have a say in so far as the project reaches their target of water sustainability.

Playgrounds have changed a lot in the ways in which they are being implemented. She asserts that these are pilot studies and thus, their level of effectiveness will be seen in the coming years. If they are a success, they will be an inspiration to other playgrounds elsewhere.

Alter Aqua is an example of how to try and change policy makers' perspectives and mindsets.

Ms Cuschieri reiterated that a change of approach is needed. For the last couple of years Malta had a very top-down approach and there have been a lot of initiatives to try and include both stakeholders and other people together from different entities and different schools of thought.

Prof. Abunnasr affirmed that working with children is the best way to change the mentality.

Mr Skondras agreed that the engagement of young people is part of the potential of the Alter Aqua program.

## 3.3 SESSION 2

**MR MANUEL SAPIANO, CHIEF EXECUTIVE OFFICE, ENERGY AND WATER AGENCY**

**TITLE: NCWR IN RIVER BASIN MANAGEMENT PLANNING – A CASE STUDY FROM MALTA**

Mr Sapiano started his delivery with a deep recognition of reality. He explained that when it comes to water in Malta, the simple reality is that natural water resources are not sufficient to meet Malta's water demand. He went on to discuss that Malta's water scarcity conditions are such that they are able to meet around 40% to 50% of the population's needs. He argued that Malta is the country at most risk for water scarcity in the EU and hence other alternatives are a must, as otherwise water would finish between the months May and June.

Mr Sapiano explained 'water policy framework' in simple terms, that the demand needs to be managed, and the water-supply based needs to be increased. He also mentioned that Malta's water management framework is based on water demand management and water supply augmentation in order to achieve security of water supply.

More than that, the policy framework aims to meet water demand through the conjunctive use of water supply augmentation and water demand management measures, in an increasingly sustainable manner. If left uncontrolled, the water demand will increase and efforts to increase supply will be futile.

Mr Sapiano went on to discuss the water demand management measures applied in Malta, which include:

- Leakage Management Programme
- Economic Instruments
- Water Efficient Irrigation Techniques
- Consumer Engagement Programs

Water supply augmentation can be implemented in two ways; by increasing the supply from Malta's existing water resources, or by diversifying Malta's water resource-base through the introduction of different water resources.

The speaker explained why it is difficult to increase supply from Malta's existing water resources:

- Malta's perched aquifer systems have limited supply capacity, and they are extensively developed for agriculture;
- Malta's mean sea level aquifer systems are over-abstracted, and they are also suffering localised deterioration;
- The dependence on ground water aquifer cannot be increased;

- Groundwater needs to be restored as a strategic reserve.

He also emphasised the importance of the diversification of the water resource base, which entails the development of other water resources in addition to ground water resources. Furthermore, non-conventional water resources of relevance to Malta are:

- Rainwater Harvesting
- Sea-Water Desalination
- Wastewater Treatment and Reuse
- Greywater Reuse

Rainwater harvesting technique has been introduced in Malta since the Neolithic period and it represented an important element in fortified cities, increasing reliance of water supply in case of siege. Cisterns were the most obvious choice for rainwater harvesting in Malta.

Scarcity of natural water resources led Malta to introduce other non-conventional water resources at an early stage:

- Seawater distillation in the 1880s
- Small scale wastewater reuse for landscape irrigation in the 1950's
- Multi-stage flash desalination in the 1960s
- Reverse Osmosis Sea Water Desalination in 1982
- Sant' Antnin Wastewater Treatment Plan in 1983

Mr Sapiano indicated the non-conventional water resources used in Malta are rainwater harvesting, sea-water desalination and water reuse. The speaker went on to mention that historic adoption of non-conventional water resources has mainly been on a localised level, whilst a large-scale adoption started with sea-water desalination to address municipal water supply mainly to response to groundwater quality deterioration in the 1960s and large-scale water unavailability in the 1980s.

Strategic consideration centred on the diversification of supply:

- Municipal Supply: Blending of desalinated seawater for and groundwater (today, around 65% of Malta's public water supply comes from desalination water)
- Agricultural Supply: Increasing the share of reclaimed water (85% of the water is still being brought from ground water)
- Maintaining groundwater as a strategic reserve in case of failure of main NCWRs.

The speaker also highlighted that the Water-Energy-Food-Ecosystems nexus requires more attention. In the coming years, new investments in the optimization of desalination plants and the extension of the new water programme are planned, together with an increased focus on rainwater harvesting and greywater recycling.

Mr Sapiano discussed the measures planned in the 3rd River Basin Management Plan (RBMP) which relate to the promotion of Non-Conventional Water Resources.

Alter Aqua is looking at pilot projects for the rehabilitation of communal reservoirs, with a specific focus on the eventual use of the harvested rainwater runoff. The project is focusing on Kottonera and includes a strong engagement element to promote rainwater harvesting as a sustainable water management technique.

Mr Sapiano concluded his presentation with the following remarks:

- In Malta, adoption of Non-Conventional Water Resources is not an option but a must.
- In this regard, the main challenge is to progressively move to more sustainable NCWR techniques.
- Different challenges exist – hence need for adapting NCWR techniques for the characteristics of the country and supporting their adoption.

## DR LEA KRONAVETER, HEAD OF THE STRATEGIC PLANNING DEPT., ISRAEL NATIONAL WATER AUTHORITY

### TITLE: INTEGRATING NCWR IN WATER MANAGEMENT PLANNING – A CASE STUDY FROM ISRAEL

Dr Kronaveter began her presentation by giving a brief overview of the region and the climate in Israel, highlighting the fact that Israel has a Mediterranean climate and is situated at the edge of a desert. Annual rain in Israel is highly variable, and typical periods of consequent draught years occur at least once in a decade.

Dr Kronaveter went on to discuss the main water uses in Israel:

- Urban and Industry
- Agriculture
- Regional Supply
- Nature Preservation

The speaker also provided an outline of Israel's water balance for 2021, agriculture being the largest sector (51% of water supply), followed by the domestic industry (36% of water supply). It was also stated that 42% of the water quality is potable.

Dr Kronaveter discussed that long-term planning of the Israel Water Economy is based on estimation of future climatologic and hydrologic conditions, i.e. prolonged periods of dry years and decrease in natural water availability.

The Water Sector Management relies on the four pillars:

- Ownership: water resources belong to the public and are managed by the Government to the benefit of the people.
- Precise measurement: according to the law, all water that is consumed must be measured and recorded.
- Centralized management: the responsibility for water management rests with the Water Authority which makes all decisions related to water supply.
- Self-financing: Israel's water sector is a financially closed economy that provides its own funding for development, with about 40% of the water bill earmarked for new water supply projects.

The speaker described that sustainable management of natural water resources and development of artificial water resources using seawater desalination, water treatment and reuse and Brackish water desalination can close the gap between demand and natural water supply.

Large scale desalination in Israel started in 2005 (with a capacity of 120MCM). Today the country have a capacity of around 600MCM and two large plants planned to supposedly start working in 2050. Dr Kronaveter explained that it takes about 7 to 8 years from the decision to actually having the plant, and hence it is essential to plan ahead. It is assumed that in 2050 Israel will have to expand the desalination capacity to 1700MCM.

Dr Kronaveter emphasised that the main objective is to have a large water supply, but also the natural water resources need to be protected as much as possible. This could be accomplished by setting operational and planning goals. Furthermore, the speaker discussed Israel's National Water Supply System, which was originally designed to supply water from the North to the South.

Dr Kronaveter claimed that all investments in drinking water supply are to be covered by water tariffs and it was also stated that every year on average around 1 billion Euro are invested in this regard.

Isreal relies on treated wastewater due to the fact that it is relatively cheap compared to desalination and it is a reliable water resource. In 2020, Israel had about 620MCM of sewage, of which 95% was treated, and 82% of treated waste water was reused, mostly for irrigation.

The speaker went on to discuss one of the biggest water treatment facility, the Shafdan water treatment facility, which treats around 150MCM of sewage from the Israel Central Area. Dr Kronaveter also highlighted the challenge of treated wastewater sector, that there is a large physical distance between the majority of consumers and the majority of sources. In order to tackle this challenge, the reform prescribes to have establishment of large,

regional water suppliers (around 9 suppliers). The aim of this is to establish water supply to all consumers, improvement of operational efficiency and maintenance, and long-term planning based on a regional perspective. Around 1,300 million Euro are required to ensure financial support from the Government (up to year 2050).

Dr Kronaveter went on to discuss the dilemmas in treated wastewater sector planning, noting the following aspects:

- Financial responsibility for wastewater treatment: the polluter (municipalities) vs. the user (farmers)
- The right level of the treated wastewater quality
- The future needs of agriculture
- Farmers' "willingness to pay" for water
- Land-use competition issues when planning recycled water infrastructure.

Dr Kronaveter closed off by saying that in 2050, the situation would be completely reversed from today, when 42% of natural water resources and 25% of desalinated sea water are utilised.

## PROF. KONSTANTINOS PLAKAS, CENTRE FOR RESEARCH AND TECHNOLOGY, GREECE (CERTH)

### TITLE: CHALLENGING THE PARADIGM IN NON-CONVENTIONAL WATER REUSE AND MANAGEMENT IN THE MEDITERRANEAN REGION: THE MEDWAYCAP PROJECT

At the start of his presentation, Prof. Plakas gave a brief understanding of capitalization, which could be reflected as the process that allows to enable the uptake of the results of a series of different projects by identifying successful and efficient practices, ensuring the promotion and dissemination with concerned stakeholders, and fostering as much as possible the replication, reuse and mainstreaming in public policies level of the identified good practices at different levels, local, regional, national and even at Mediterranean level.

The MEDWAYCAP project is composed of 5 EU partners, 4 Mediterranean partners, 1 International Organisation, and 12 associated Partners from Greece, Italy, Malta, Spain, Egypt, Palestine, Tunisia and Jordan. It has been structured in a way that addresses the scope of the specific call which aims at rolling out project results into broader policies, strategies, and action plans at national/regional level, and especially focuses on broadening as an audience target groups and relevant stakeholders and increasing their levels of awareness. Prof. Plakas explained that this is a 2-year project, expected to end by the end of September 2023 and has a total budget of around 1.11 million Euro with an ENI contribution of 1 Million Euro.

MEDWAYCAP Partners and some associate partners participate in six ENI projects namely Aquacycle, Maia-Taqa, Mediss, Menawara, Nawamed, and Prosim. The speaker highlighted the specific objectives within this project:

- To consolidate the knowledge framework on NCWR management;
- To strengthen the impact and the value of innovative integrated NCW management solutions;
- To foster the replication and mainstreaming of best practices and highlights for decision makers.

Prof. Plakas continued by stating that MEDWAYCAP proposes a novel model that can be visualised in the pyramid with three categories of capitalisation. At the bottom of the pyramid there is a structure of knowledge related to non-conventional water treatment and also re-use, based on implemented innovative solutions at best practices in the Mediterranean region. The speaker also indicated that activities to understand how to translate existing non-conventional water resources will be implemented, which will eventually help to boost the creation of related jobs, businesses, start-ups, and social enterprises.

In addition, Prof. Plakas highlighted that one of the major outcomes of MEDWAYCAP project is a development of inventory platform of best practices which is an open and dynamic platform for collection and provision to the water community of implemented solutions for non-conventional water valorisation. It was stated that it can be used for systematisation, and clustering while highlighting context, impacts, and sustainability to make the platform transferrable and reusable.

The speaker also highlighted another innovative methodology applied within the MEDWAYCAP project, which is the implementation of innovative participatory methods tools, such as Innovation Camp. The challenges addressed in the first Innovation Camp were:

- Consolidating the knowledge framework on non-conventional water resources;
- Strengthen the impact and the value of the innovative integrated non-conventional water solutions;
- Foster a circular economy.

He closed off by conveying the message of MEDWAYCAP partnerships: ‘Actions towards climate crisis cannot wait, so let’s reuse water’!

## PANEL DISCUSSION 3: INTEGRATING NON-CONVENTIONAL WATER RESOURCES IN INTEGRATED WATER RESOURCES MANAGEMENT PLANNING

The below four questions were put forward to the audience for their feedback:

**Question 1**

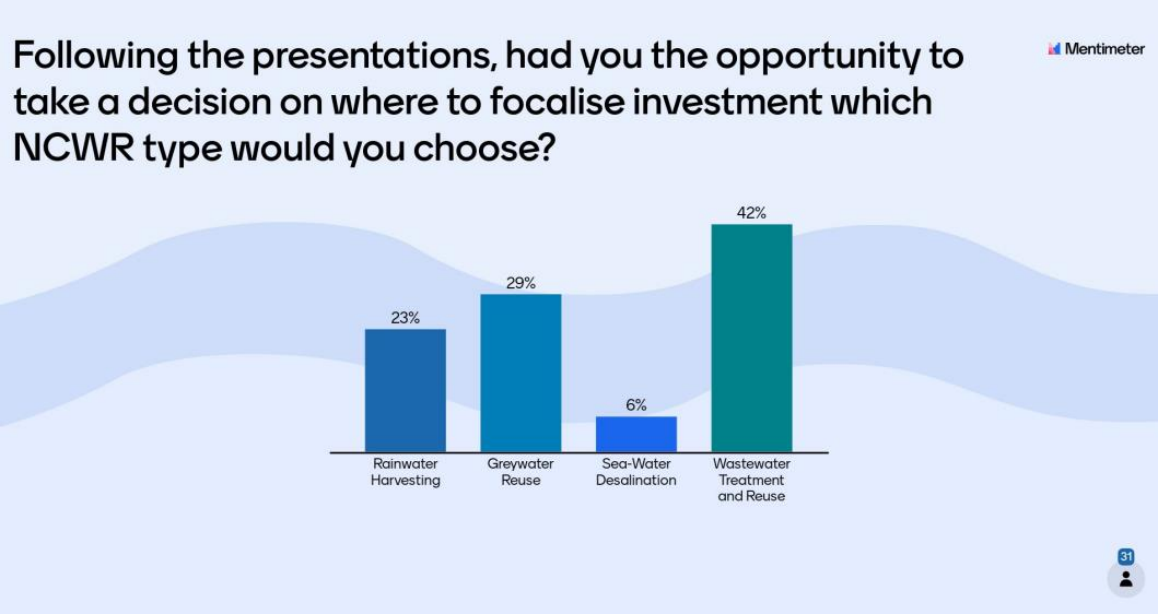
Following the presentations, had you the opportunity to take a decision on where to focalise investment - which NCWR type would you choose?

(i) Rainwater Harvesting

(ii) Greywater Reuse

(iii) Sea-Water Desalination

(iv) Wastewater Treatment and Reuse




**Question 2**

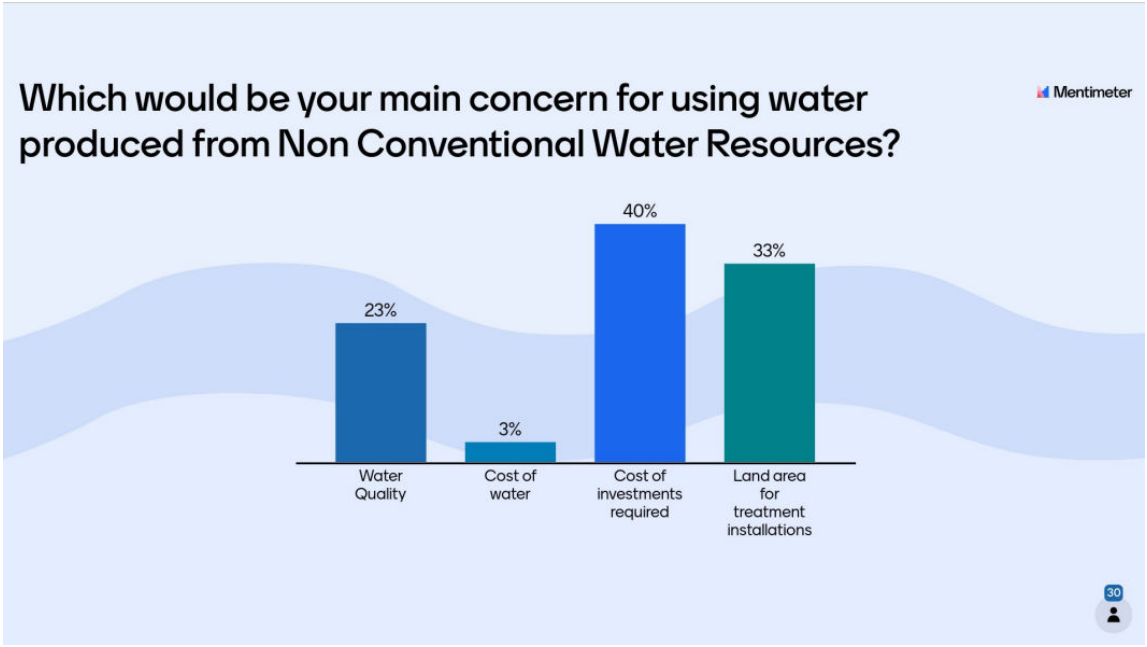
Which would be your main concern for using water produced from Non-Conventional Water resources?

(i) Water quality

(ii) Cost of water

(iii) Cost of investments required

(iv) Land area for treatment installations




Dr Kronaveter admitted that it would be difficult to select one, but she stated that she would go for water quality and cost of investments.

Mr Sapiano believes that land is a big issue in Malta, particularly also the cost of land. He added that sometimes the small, delocalised installations, coordinated between them in a green masterplan can do the trick without having the need of larger area of land.

**Question 3**

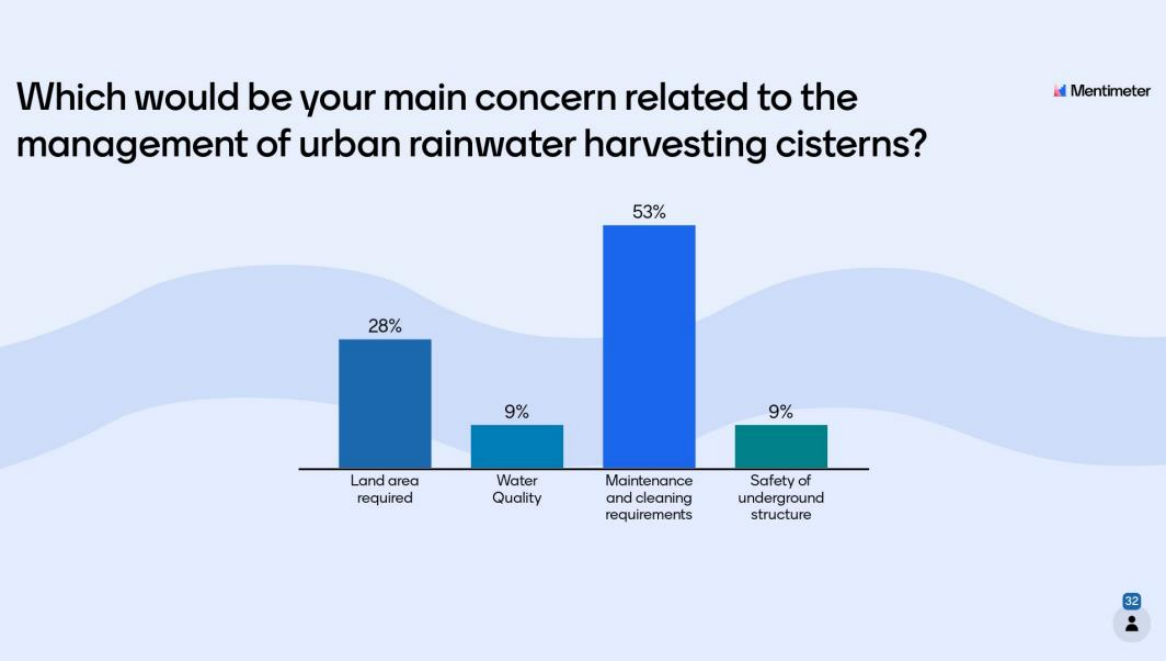
Which would be your main concern related to the management of urban rainwater harvesting cisterns?

(i) Land area required

(ii) Water quality

(iii) Maintenance and cleaning requirements

(iv) Safety of underground structure




Dr Kronaveter stated that relatively little of rain harvesting has been done in Israel, due to the need to ensure that the water is being taken from clean regions. She also highlighted that specific regulations regarding maintenance and cleaning of the facilities are required.

Mr Skondras mentioned that the main concern depends on whether the rainwater harvesting cisterns currently exist or not. If they already exist, maintenance and cleaning would be the main concern. On the other hand, if they are non-existent, land area would be the main concerned, followed by maintenance and cleaning. He went on to discuss that there is technology to address the quality of water, and safety of underground structure can also be addressed in terms of engineering.

**Question 4**

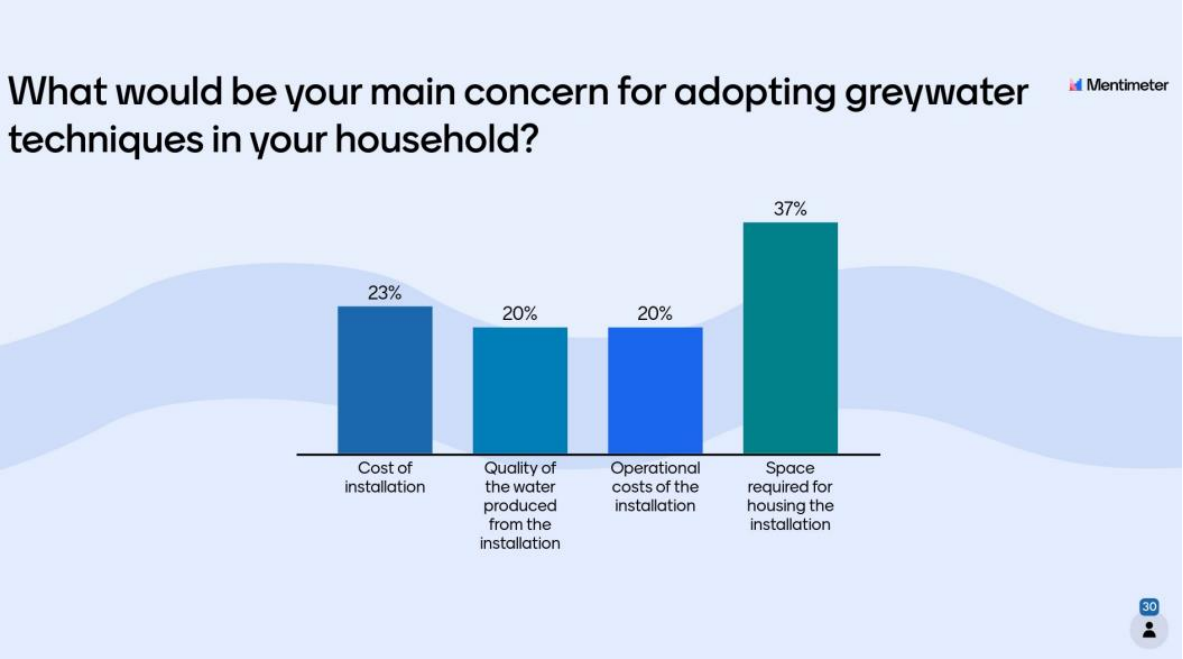
Which would be your main concern for adopting greywater techniques in your household?

(i) Cost of installation

(ii) Quality of the water produced from the installation

(iii) Operational costs of the installation

(iv) space required for housing the installation




Mr Sapiano concurred with the audience that space is a main concern for adopting greywater techniques in your household, for the simple reason that greywater requires large tanks where water needs to be stored. He continued by saying that small-scale appliances are becoming more prevalent today, but space is still necessary. He also brought up another concern regarding the cost of these appliances. In the next ten years, prices are predicted to go down, yet they are presently still high.

Dr Kronaveter discussed the disputes in Israel about water quality since the systems need to be secure because people exposed to poor water quality at home may be putting their lives at risk. She also raised another concern that was not addressed by any of the choices, namely the fact that delayed grey water is discharged to the wastewater system, where the flow velocity may occasionally be lower and may have an impact on how the wastewater is transported.

'If someone already has all the systems put in place, what would be the need of greywater?', was the first question posed by Mr Abunnasr.

Mr Sapiano asserted that things cannot be treated in isolation. For example, if all households in Malta reduce their water consumption by 25%, then there is the problem of where to place water. Greywater will be a measure to support high consumers in lowering their consumption by being more efficient.

Mr Kandarakis directed his question to Dr Kronaveter, mentioning water consumption in Israel is expected to rise by 50% in the next 3 years.

Dr Kronaveter clarified that that this rise is expected to happen by 2050.

For the sake of the foreign speakers, Mr Steven Mallia made a general observation where he indicated that a few years ago, the Government spent about 51 million Euro on a storm water management system. He argued that sewage water is being thrown into the

National Flood Relief System. The water is tested and infiltrated with sewage water. However, it cannot be utilised right away, and therefore, a significant amount is ending up in the sea. He enquired whether there was anything that could be done to reduce the sewage infiltration into our storm water management system. He also stated that the sewage system is not coping enough with the massive developments from all the apartments and blocks that are built everyday that have to cope with larger quantities of sewage.

Mr Sapiano mentioned that there are some analysis that one should take into account. The first proposal of the National Flood Relief System was to build up 12m tunnels in diameter with subsurface dense along the way to stop the water. The cost of that system would have gone up to 600 million Euro roughly. Volume is one of the main concerns when talking about water harvesting. Mr Sapiano stated that water into the streets should be avoided, but instead favour green infrastructures and cisterns. He believes that small cisterns upstream are more crucial in order to prevent a measure downstream.

## 3.4 Closing Session

**MR ALEXANDROS KANDARAKIS**

**TITLE: OUTCOMES OF THE WORKSHOP**

Mr Kandarakis provided a summary of the conference's discussions. He mentioned that non-conventional water resources are those that do not occur naturally, and must be instead collected through technical means, as Malta has been doing. The speaker claimed that it is obvious from the statistics that Mr Sapiano provided that non-conventional water resources are a must, and not an option, because natural water resources are just not enough. However, they are not the whole solution. In order to ensure that there is always a reliable source of water, Mr Kandarakis emphasised the importance of the diversification of the sources.

Mr Kandarakis discussed the fact that non-conventional water resources are flexible and can be adapted to local conditions. Furthermore, he stated that it is a low-cost solution that does not require huge infrastructure investment in an urban setting like Malta, where the structure is already present.

The speaker also highlighted the benefits of the non-conventional water resources, such as the cultural heritage aspect. Mr Kandarakis emphasised the importance of planning and developing a comprehensive vision, since such difficulties can be much better addressed through planned planning. Mr Kandarakis emphasised the significance of the golden triangle described by Ms Micallef, as well as the golden circle mentioned by Mr Skondras, and stated that in any case this has been a resilient partnership.

In addition to expressing gratitude to the project's funders (GSD Marketing Ltd and Coca-Cola Foundation), Mr Kandarakis believes that it is crucial to note that it is truly uncommon for a business to support a project for 12 years with a large amount of funds to achieve a specific goal without being influenced by what marketing trends are popular this year or the next.

As a last point, the speaker stressed how important it is for young people to be motivated and to grapple with the challenge of water scarcity. He emphasised the importance of managing the water scarcity issues year by year and day by day as it will only get worse in the future.

# 4. Presentations

A CONFERENCE BY THE ENERGY & WATER AGENCY TOGETHER WITH THE GLOBAL WATER PARTNERSHIP (MEDITERRANEAN) ON:

# PROMOTING NON-CONVENTIONAL WATER RESOURCES IN MALTA

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## The Non-Conventional Water Resources Programme in the Mediterranean:

## ALTER AQUA Project

Nikos Skondras
Global Water Partnership – Mediterranean

WED 15TH MARCH, 2023

WATER.ORG.MT

# Water Challenges in the Mediterranean (Islands)

**Seasonality and high peaks** of water demand in (extended) summer months to be addressed.

- **Water quality depletion** due to saltwater intrusion into coastal freshwater aquifers, loss of wetlands, and temperature increase with impacts on surface water.
- **Climate change impacts**: increase of droughts & flash-floods.
- **Increase in population** and **Migration flows** put extra pressure.
- **Energy cost** for water production / supply.

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# Addressing Water Scarcity in the Mediterranean

- ✓Improving Water Governance and Management
- ✓Applying Water Demand Strategy: water efficiency and water saving
- ✓Non-Conventional Water Resources:
  - Rainwater harvesting,
  - Greywater reuse
  - Treated wastewater reuse
  - Aquifer recharge
  - Desalination

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# The NCWR Programme in Malta

# Alter Aqua

Malta is the 7th most dense country in the world with approximate population density of 1.390 people/$Km^2$ and with only 40 cubic meters of naturally occurring freshwater per capita per year.

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# 11 years of impact in Malta


**22** SITE SPECIFIC APPLICATIONS
**2** ISLANDS

**19,500,000** L water saved
**71,800** Total Beneficiaries
**17,650** students
**1,380** teachers
**56** technicians trained

**Budget: $ 1.900.000,** primarily financed by The Coca-Cola Foundation, co-financed by the Ministry of Gozo and & EWA

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# The Funding & The Partners

Partners:

Global Water Partnership Mediterranean

THE Coca-Cola FOUNDATION

THE ENERGY & WATER AGENCY

GSD Marketing Ltd

Funding:

THE Coca-Cola FOUNDATION

THE ENERGY & WATER AGENCY

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# Phases I & II

**PARTNERS :**



**PHASE I : 2011 – 2013** Aims to advance the utilization of Non-Conventional Water Resources (NCWR) in the Maltese Islands in order to secure water availability and facilitate sustainable development.

**PHASE II : 2014 – 2017** Aims to extend activities in the Island of Malta, to promote the use of NCWR, to expand the NCWR agenda in the Mediterranean

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# Phase III

**PARTNERS :** Global Water Partnership Mediterranean; THE ENERGY & WATER AGENCY; GSD Marketing Ltd

**COLLABORATOR :** MCAST – Malta College of Arts, Science & Technology

**PHASE III : 2019 – 2021**

**Aims to promote NCWR as a solution to water scarcity and climate change adaptation**

**COMPONENTS :**

- **Technical interventions (NCWR applications)**
- **Capacity Building & Youth Engagement**
- **Awareness Raising and Communication**
- **Education**

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# 1. Technical interventions: NCWR applications

# RAINWATER HARVESTING & STORMWATER COLLECTION

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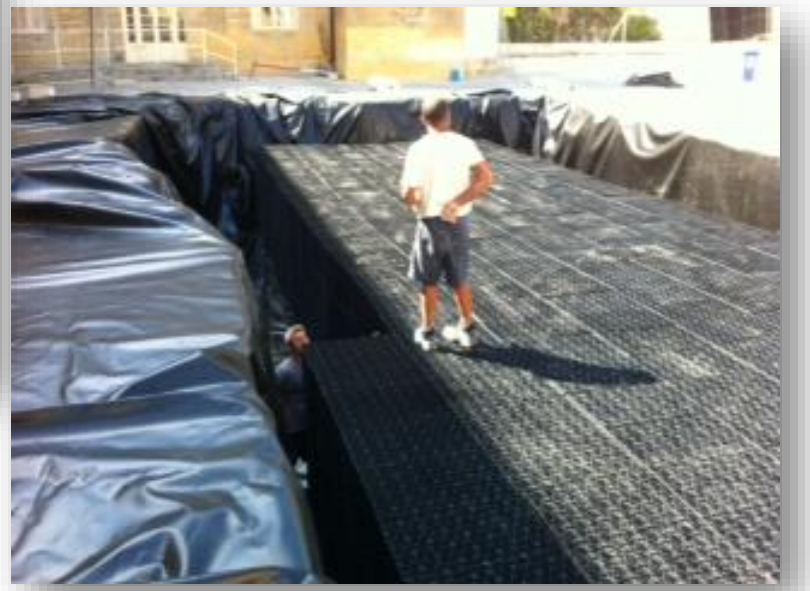
## **Innovative RWH System in public schools in Gozo:** Kercem Primary School



- ✓ 150 $m^3$ modular underground tank.
- ✓ Second-class water system to reuse rainwater for toilet flushing.

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## **Reinstatement of RWH System** at President's Garden (San Anton Palace)

- ✓ Reinstatement of 1800 $m^3$ (400 yr. old) underground reservoir.
- ✓ Irrigation of orange grove.

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## **Reinstatement of RWH System** at Kalkara Garden

- ✓ Rehabilitation of 4 underground reservoirs with a total capacity of 150 $m^3$.
- ✓ Landscape irrigation.

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## **Reinstatement of RWH System** at Victory Square, Birgu

- ✓ Reinstatement of underground reservoir of approx. 800 $m^3$ .
- ✓ Construction of stormwater culverts.

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## **Construction of Rubble Walls** along Ramla Valley for storm water retention

- ✓ Increased rainwater capacity for irrigation purposes and aquifer recharge.
- ✓ Water reuse for agriculture.

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# 1. Technical interventions: NCWR applications

## GREYWATER RECYCLING

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## **Greywater Recycling & Irrigation** at Gozo Football Club

- ✓Physicochemical treatment
- ✓Treats 5 $m^3$ greywater per day
- ✓Collects water from showers and sinks
- ✓Increases water availability
- ✓Treated greywater used for irrigation
- ✓Decreases wastewater load of sewerage systems
- ✓Low energy consumption


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## **Greywater Recycling & Green Roof** at the IAS – MCAST

- ✓Physicochemical treatment
- ✓Treats 2 $m^3$ greywater per day
- ✓Increases water availability
- ✓Treated greywater used for irrigation
- ✓Decreases wastewater load of sewerage systems
- ✓Reclamation of otherwise waste nutrients

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# 2. Capacity Building & Youth Engagement

- ✓ Capacity building workshops for institutional and other stakeholders on NCWRM
- ✓ Technical trainings for technicians, engineers and professionals in the construction industry on NCWR technology and nature-based solutions design and application
- ✓ Capacity building for farmers on sustainable water use in agriculture
- ✓ Technical guide on Non-Conventional Water Resources Technologies
- ✓ National and Regional workshops and conferences on NCWRM

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# 2. Capacity Building & Youth Engagement


https://youtu.be/mURrec0484s

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Examples (Phase III):

In collaboration with MCAST

12 – 13/11/2019 – “Communicating Water Trends & Innovation to Engage Locals and Tourists”
Targeted: Communication professionals

13 – 14/11/2019 – “Non-Conventional Water Resources Management: Local Solutions”
Targeted: Students and young Professionals with technical background

Participants also engaged in the interactive “Integrated Urban Water Management Serious Game (real-world scenarios that required water management decisions)”

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03/02/2022

• Mr. Manuel Sapiano, CEO of Malta's Energy and Water Agency, "Integration of NCWR solutions with broader policy perspectives in Malta and within a Water-Energy-Food Nexus framework".

• Dr. Nikos Skondras, Senior Programme Officer, GWP-Med, "Non-Conventional Water Resources in the context of Integrated Water Resources Management


17/02/2022

• Dr. Nikos Skondras, Senior Programme Officer, GWP-Med, the "Lessons learned for the Mediterranean from applying the Non-Conventional Water Resources Programme in four (4) countries."

• Mr. Alexandros Kandarakis, Head of Communications, GWP-Med, "Communications for water security: how to achieve public awareness and emotional connection with water issues."

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# 3. Awareness Raising & Communication

- ✓ Awareness raising for targeted and wider audiences on the use of NCWR and water efficiency options at domestic and community level
- ✓ Awareness raising for sustainable irrigation for farmers
- ✓ Water saving campaigns
- ✓ NCWR campaigns
- ✓ Exhibitions
- ✓ Publications

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## Inauguration Event – 25/11/2022


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## Project Exhibition– 25/11/2022




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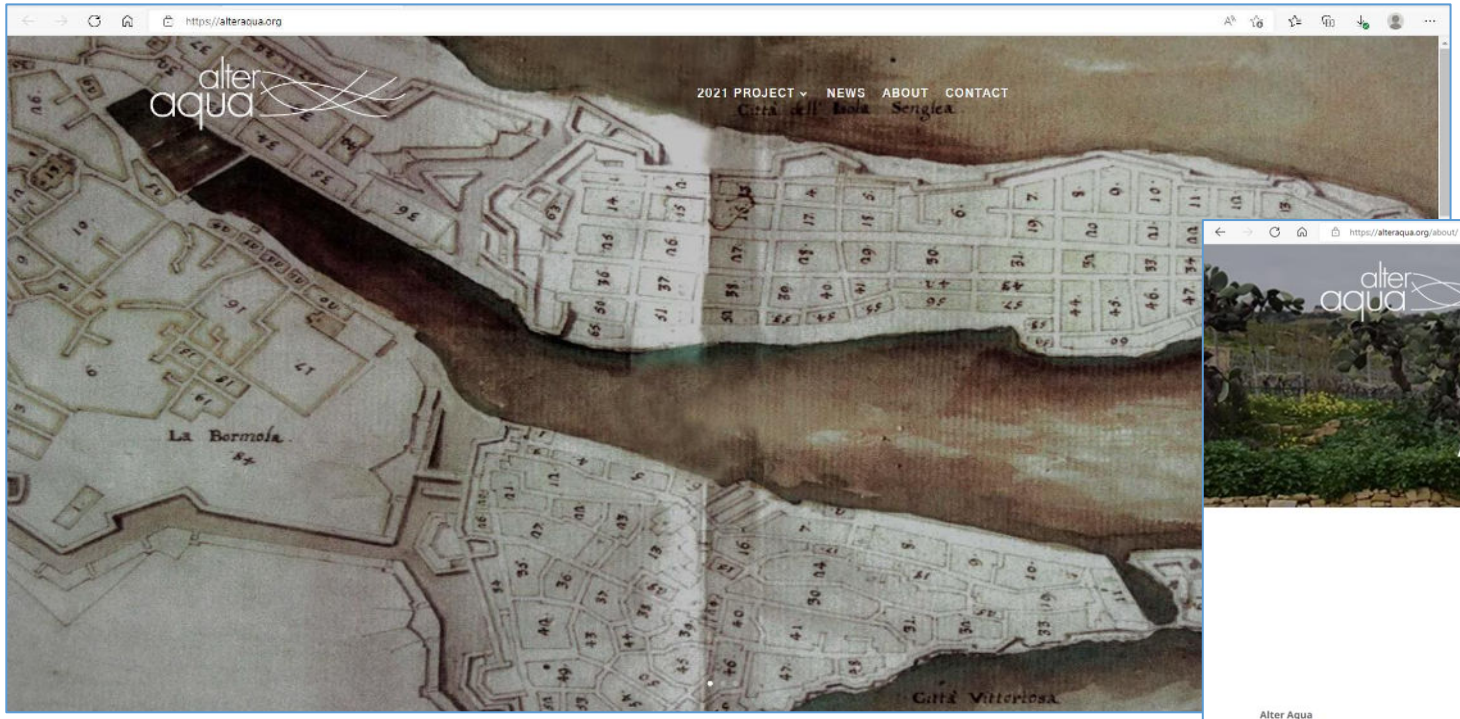
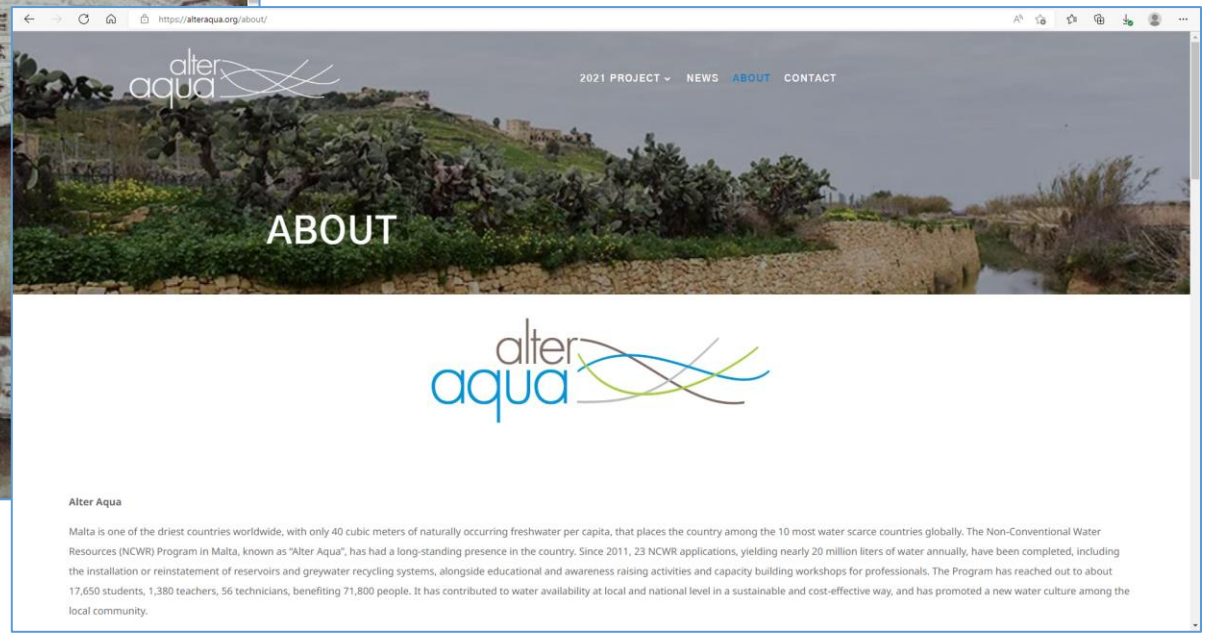
# The Alter Aqua Website was developed to describe the Programme and provide news and information




WATER
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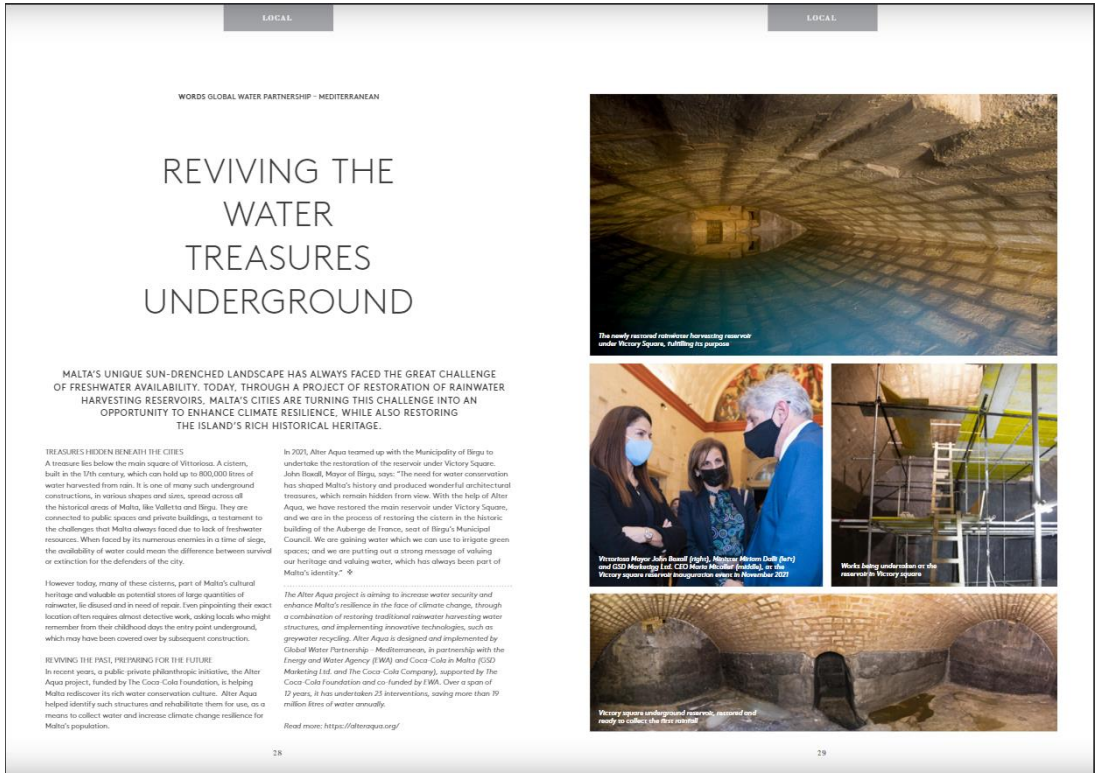
# Il Bazzilla (April and May 2022), the Air Malta in-flight magazine, with more than 2 mil. readers per year



LOCAL

LOCAL

WORDS GLOBAL WATER PARTNERSHIP – MEDITERRANEAN

## REVIVING THE WATER TREASURES UNDERGROUND

MALTA'S UNIQUE SUN-DRENCHED LANDSCAPE HAS ALWAYS FACED THE GREAT CHALLENGE OF FRESHWATER AVAILABILITY. TODAY, THROUGH A PROJECT OF RESTORATION OF RAINWATER HARVESTING RESERVOIRS, MALTA'S CITIES ARE TURNING THIS CHALLENGE INTO AN OPPORTUNITY TO ENHANCE CLIMATE RESILIENCE, WHILE ALSO RESTORING THE ISLAND'S RICH HISTORICAL HERITAGE.

TREASURES HIDDEN BENEATH THE CITIES

A treasure lies below the main square of Vittoriosa. A cistern, built in the 17th century, which can hold up to 800,000 litres of water harvested from rain. It is one of many such underground constructions, in various shapes and sizes, spread across all the historical areas of Malta, like Valletta and Birgu. They are connected to public spaces and private buildings, a testament to the challenges that Malta always faced due to lack of freshwater resources. When faced by its numerous enemies in a time of siege, the availability of water could mean the difference between survival or extinction for the defenders of the city.

However today, many of these cisterns, part of Malta's cultural heritage and valuable as potential stores of large quantities of rainwater, lie disused and in need of repair. Even pinpointing their exact location often requires almost detective work, asking locals who might remember from their childhood days the entry point underground, which may have been covered over by subsequent construction.

REVIVING THE PAST, PREPARING FOR THE FUTURE

In recent years, a public private philanthropic initiative, the Alter Aqua project, funded by The Coca-Cola Foundation, is helping Malta rediscover its rich water conservation culture. Alter Aqua helped identify such structures and rehabilitate them for use, as a means to collect water and increase climate change resilience for Malta's population.

In 2021, Alter Aqua teamed up with the Municipality of Birgu to undertake the restoration of the reservoir under Victory Square. John Boxall, Mayor of Birgu, says: "The need for water conservation has shaped Malta's history and produced wonderful architectural treasures, which remain hidden from view. With the help of Alter Aqua, we have restored the main reservoir under Victory Square, and we are in the process of restoring the cistern in the historic building of the Auberge de France, seat of Birgu's Municipal Council. We are gaining water which we can use to irrigate green spaces; and we are putting out a strong message of valuing our heritage and valuing water, which has always been part of Malta's identity." ✣

*The Alter Aqua project is aiming to increase water security and enhance Malta's resilience in the face of climate change, through a combination of restoring traditional rainwater harvesting water structures, and implementing innovative technologies, such as greywater recycling. Alter Aqua is designed and implemented by Global Water Partnership - Mediterranean, in partnership with the Energy and Water Agency (EWA) and Coca-Cola in Malta (GSI Marketing Ltd. and The Coca-Cola Company), supported by The Coca-Cola Foundation and co-funded by EWA. Over a span of 12 years, it has undertaken 23 interventions, saving more than 19 million litres of water annually.*

*Read more: https://alteraqua.org/*

*The newly restored rainwater harvesting reservoir under Victory Square, fulfilling its purpose*

*Victorious Mayor John Boxall (right), Minister Miriam Dalli (left) and GSD Marketing Ltd. CEO Mario Micallef (middle), at the Victory square reservoir inauguration event in November 2021*

*Works being undertaken at the reservoir in Victory square*

*Victory square underground reservoir, restored and ready to collect the first rainfall*

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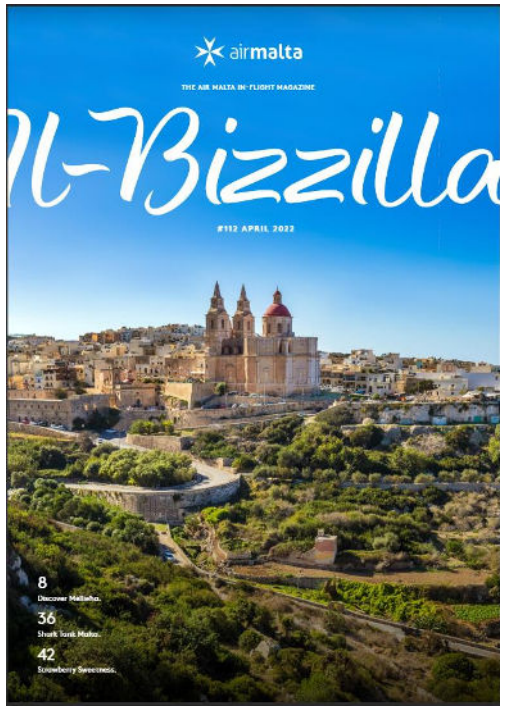



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# 4. Education

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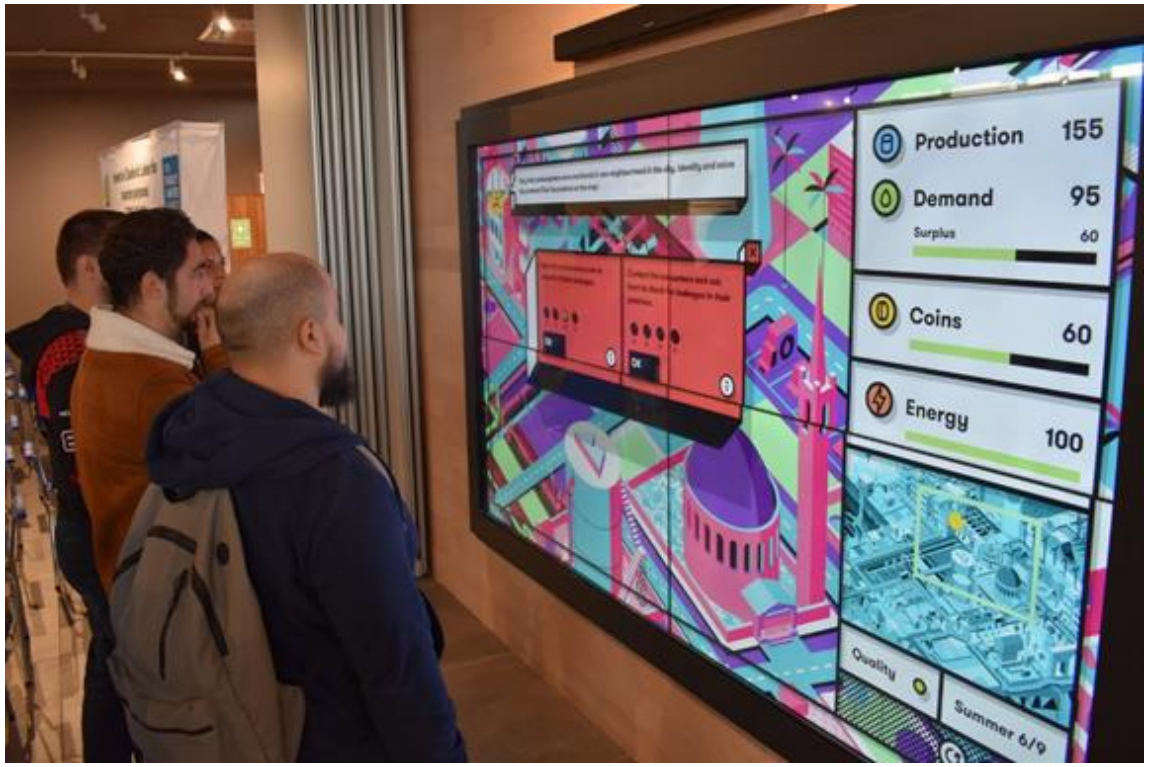
- ✓ Country-specific educational material
- ✓ Hands-on activities for students
- ✓ Special sessions for students with special needs
- ✓ Teacher training
- ✓ Digital tools (video games, etc.).

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# Phase IV

**PARTNERS :** Global Water Partnership Mediterranean; THE ENERGY & WATER AGENCY; GSD Marketing Ltd

**COLLABORATOR :** KOTTONERA FOUNDATION

**PHASE IV : 2022 – 2023**

**Aims to promote NCWR as a solution to water scarcity and climate change adaptation**

**COMPONENTS :**

- **Technical interventions (NCWR applications)**
- **Capacity Building & Youth Engagement**
- **Awareness Raising and Communication**

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# 1. Technical interventions

Reinstatement or improvement of abandoned underground rainwater harvesting reservoirs, in line with national priorities as set by the Energy and Water Agency (EWA) of Malta under the Ministry for Energy, Enterprise and Sustainable Development.

Such applications will be demonstrated in public buildings and spaces. The reservoirs will be selected according to specific technical (e.g. size, accessibility, etc.) and cultural (e.g. historical value, architectural design) features.

Options for innovation, including through a Water-Energy-Food-Ecosystem (WEFE) Nexus approach, will be encouraged within capacity and budget, aligned with the water authorities' priorities.

The technical interventions will also promote the agenda of the Ministry for Public Works and Planning on the mainstreaming of the Green Stormwater Infrastructure.

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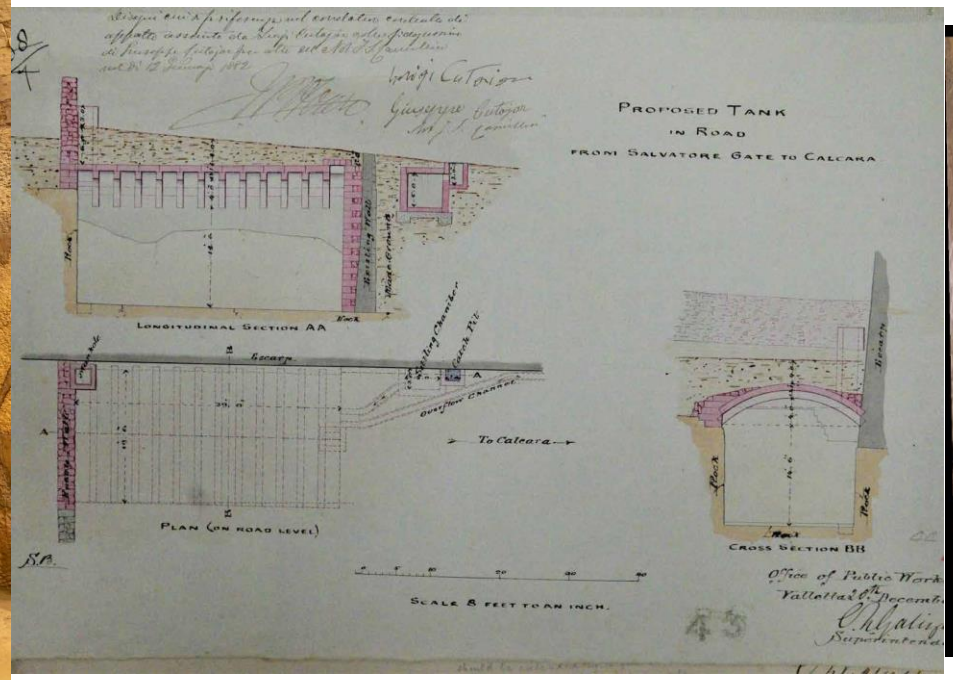
**SENGLEA SCHOOL CLOCK CISTERN**
Volume: 1,500 cubic meters

**TRIQ IX-XATT**
Volume: 400 cubic meters




**ST. JOHNS BASTION**
Volume: 2,800 cubic meters

Birgu – Auberge of England Reservoir - Volume to be identified
Birgu – Reservoir on side of Parish Church – Volume to be identified

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# 2. Capacity Building & Youth Engagement

A workshop for young participants of technical and non-technical background will be organized for the participants to learn:

- About technically sound and socially acceptable NCWR applications by a team of recognized experts, tapping into the experience of the technical portfolio of 120+ works in the 14-year course of the NCWR Programme in the Mediterranean.

- To promote NCWR and the revival of Malta's water conservation culture, through featuring the country's rich water heritage.

The existing applications in Malta will serve as an onsite example of feasibility, design and implementation, as well as an inspiration for replication.

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# 3. Awareness Raising & Communication

Building upon GWP-Med's experience in Malta, and upon the long-term collaboration with EWA, awareness raising activities will be hosted in the new **Water Conservation Awareness Center** and at the **University of Malta**, increasing visibility to young crowds and locals. Activities may include, but are not limited to:

a. The development of a "reservoir trail", with QR codes strategically placed in areas where there are reservoirs giving access to the subterranean structure, providing information about the structures and the project to visitors.

b. The design and printing of promotional leaflets. The leaflets will display a touristic component promoting both the project objectives as well as the policy priorities of Malta's Tourism Authority.

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# 3. Awareness Raising & Communication

c. Media promotion with press releases and features about the Programme's works and the reservoir's historical role in Malta's water saving culture, using original material and previously unpublished professional photographs.

d. A social media campaign which will focus on general public awareness (children and adults, locals and visitors) on water scarcity and wise daily water use/saving.

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GOVERNMENT OF MALTA

MINISTRY FOR THE ENVIRONMENT, ENERGY AND ENTERPRISE

MINISTRY FOR THE ECONOMY, EUROPEAN FUNDS AND LANDS

PARLIAMENTARY SECRETARIAT FOR EUROPEAN FUNDS

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EU funds for Malta 2014-2020

alter aqua

WATER SAVING CITIES Kottonera

Global Water Partnership Mediterranean

THE ENERGY & WATER AGENCY

THE Coca-Cola FOUNDATION

GSD Marketing Ltd

KOTTONERA FOUNDATION

Il-Kalkara

Bormla

Il-Birgu

L'Isla

L-Università ta' Malta

IL-ĠIRJUN

Operational Programme I – European Structural and Investment Funds 2014-2020
*"Fostering a competitive and sustainable economy to meet our challenges"*
Project part-financed by the Cohesion Fund
Co-financing rate: 85% European Union Funds; 15% National Funds

A CONFERENCE BY THE ENERGY & WATER AGENCY TOGETHER WITH THE GLOBAL WATER PARTNERSHIP (MEDITERRANEAN) ON:

# PROMOTING NON-CONVENTIONAL WATER RESOURCES IN MALTA

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WED 15TH MARCH, 2023

WATER.ORG.MT

# A tool to assess planning opportunities of NBS for water management at the metropolitan scale

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*Metropolitan Landscape Research Lab*

Associate Professor, Associate Dean, and Department Head

Planner, Landscape Architect and Architect

AMERICAN UNIVERSITY OF BEIRUT

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# AGENDA

- NCW + NBS - Complementarity
- Nature-based Solutions (NBS)
- NBS Singular projects
- NBS at city and metropolitan scales
- NBS opportunities at metropolitan & city scales
- NBS opportunities for water capture and storage
- Limitations & Next Steps
- Concluding Remarks

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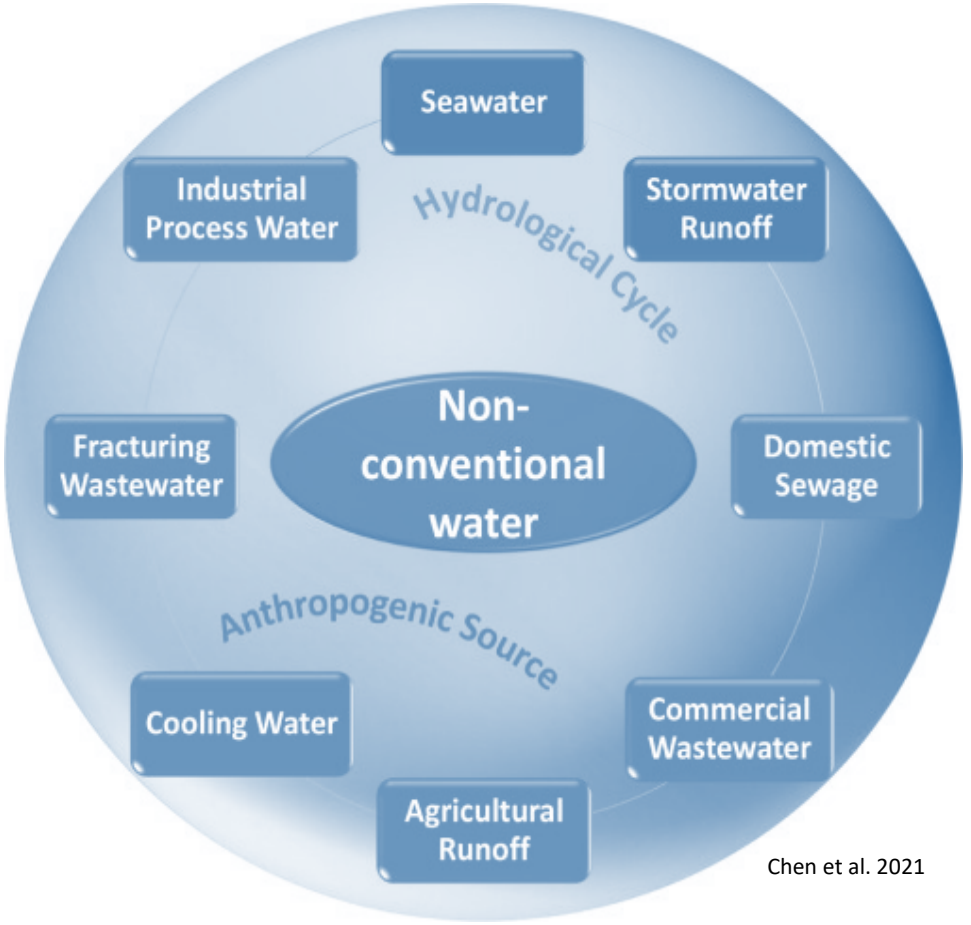
# NCW + NBS - Complementarity

**Non-Conventional water (NCW)**

- Recycled water for re-use
- desalinated water
- brackish water
- water from harvesting

**Nature-Based Solutions**

- Percolation/recharge
- Filtration
- Recycling
- Retention/detention
- Interception
- Storage




Chen et al. 2021

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# Nature-based Solutions (NBS)

**Nature-based solutions are:**

- *Living solutions* inspired by and continuously *supported by nature*, using the power of *functioning ecosystems as infrastructure*, to address various *societal challenges* in a *resource-efficient and adaptable* manner, providing simultaneously *economic, social, and environmental benefits"* (European Commission, 2015)

**Applications of NBS**

- Resource efficiency and reduction in energy usage
- Climate control and mitigation of climate change
- Disaster risk reduction
- *Conservation of natural water resources*
- Habitat restoration and ecosystem support
- Positive impacts on public health and well being , and Food security
- Promotion of sustainable economic growth

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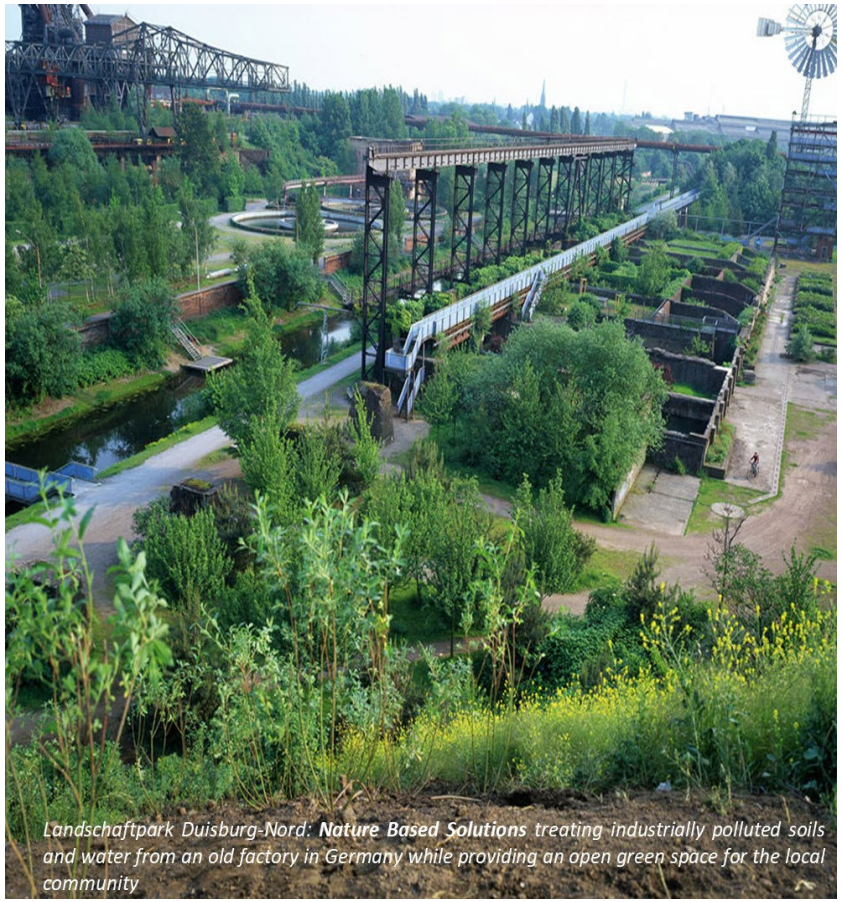
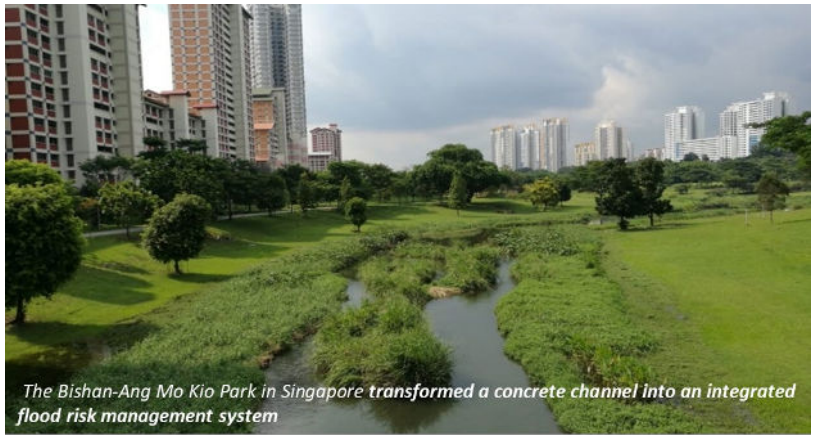
# Nature-based Solutions (NBS)



*Landschaftpark Duisburg-Nord:* ***Nature Based Solutions*** *treating industrially polluted soils and water from an old factory in Germany while providing an open green space for the local community*



*The Bishan-Ang Mo Kio Park in Singapore* ***transformed a concrete channel into an integrated flood risk management system***

*Creation of sand dunes to limit shoreline erosion*

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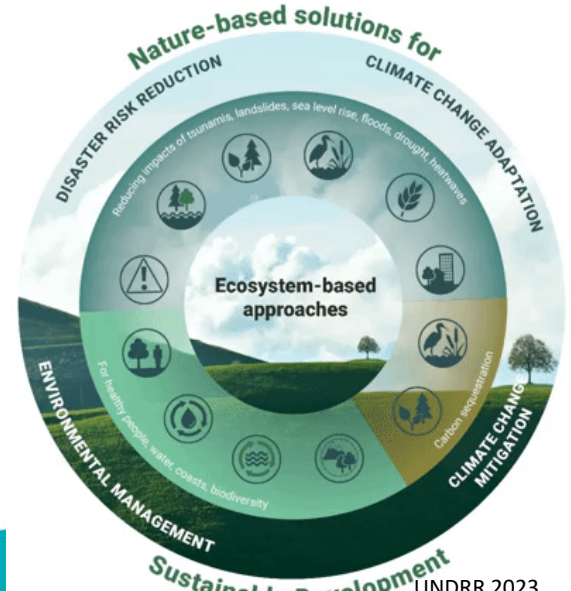
# NBS Singular projects

**Singular projects and practices**

- Tend to be *prototypes*
- Generate *important local benefits* : Social, environmental, and economic
- *Multiple applications* for water, biodiversity, social cohesion, food production etc.
- *No-regrets solutions*
- *Important yet Insufficient* to impact challenges and required changes
- More significant within the *Mediterranean Region* especially when considering *climate change*

IUCN 2016



UNDRR 2023

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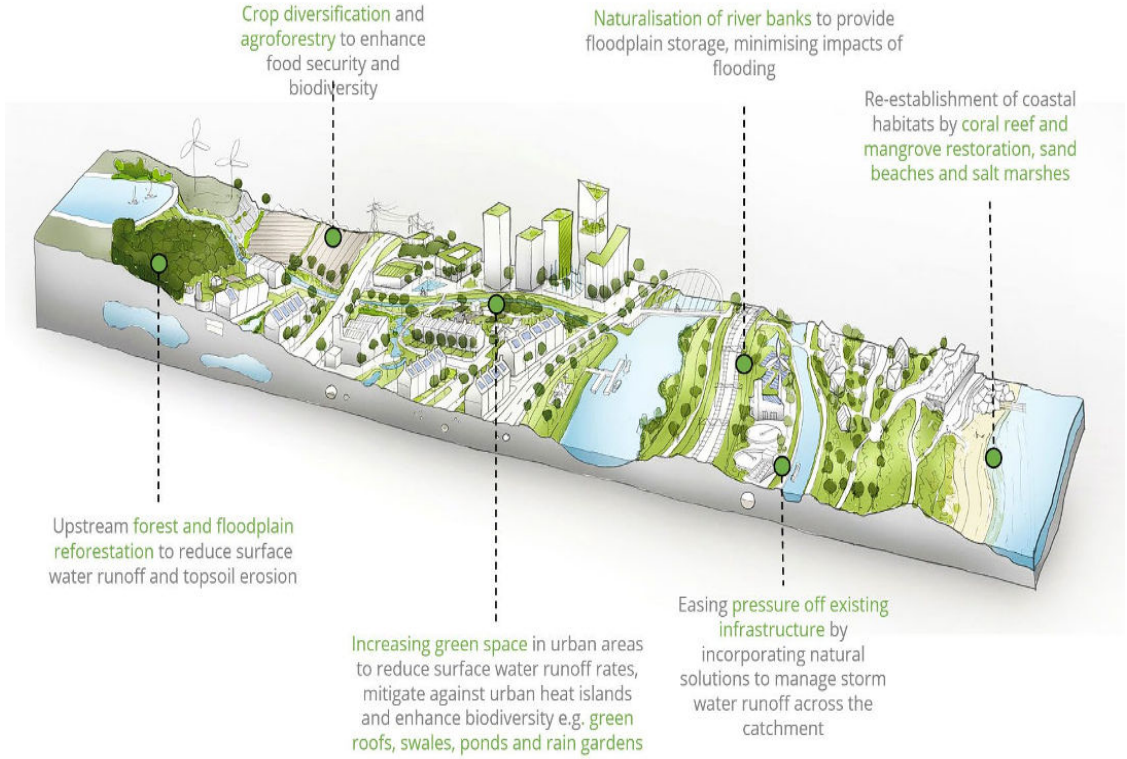
# NBS at city and metropolitan scales

**A comprehensive, integrated and holistic solutions**

- Generate *maximum possible ecosystem co-benefits*
- *Reduce vulnerability and risk* to climate change impacts
- Reduce the *Urban Heat Island*
- *Reduce impacts of flooding* when developed as an interconnected system
- Provide *livable places* through increasing *green spaces* for wellbeing
- Support *public health*
- Ease pressure on *existing infrastructure*
- Support *food security*




Infrastructure Pathways, 2023

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# NBS at city and metropolitan scales

## An Example: Theoretical scenario-NBS green walls for grey water recycling in Beirut

Assumptions

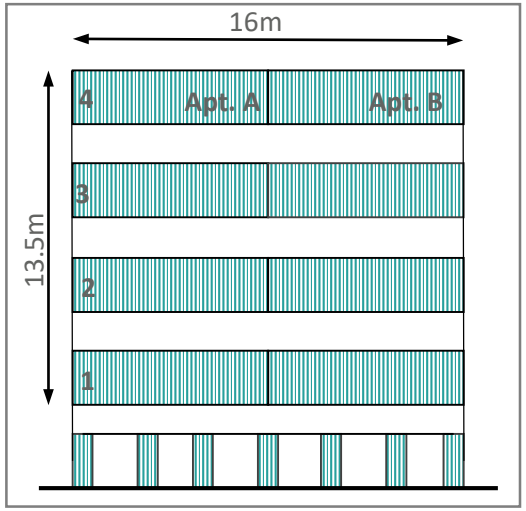
- Separated grey and black water pipes
- Adjusted building code
- Incentive for private owners to install green roofs
- One façade of a building
- Only first 4 floors of a building are used for GW

Required number green walls to recycle 18 $Mm^3$ of GW/year

- Façade area: 216$m^2$
- Percent of façade usable for green wall (50%): 108$m^2$
- Rate of treatment: 10$m^3/m^2$/year
- Total green wall area required:1,800,000 $m^2$
- Total number of facades required: 16,700 facades or buildings

**Number of buildings in Beirut: Approx. 17,400**

| | |
|---|---|
| Total waste water/year | 165 million $m^3$ |
| Portion from industries | 35 million $m^3$ |
| Portion from households | 130 million $m^3$ |
| Estimated grey water from household (2/3) | 87 million $m^3$ |
| Portion of household grey water treated by NBS (20%) | **18 million $m^3$** |

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# NBS opportunities at metropolitan & city scales

**The Challenge to develop a city wide NBS system**

- To identify *available and suitable spaces/locations* in a rapid and fast way
- *Competition for space* : real estate dynamics, land tenure, and existing infrastructure
- Reduce complex variables to simple ones to apply at this scale
- *Variable Urban Morphologies*: Different land uses provide variable opportunities
- Different types of NBS require *different spatial requirements and variables* to address

  *Example:* Green roofs requires the assessment of roof space availability, slope of roofs, utilities on the roof and structural integrity while incorporating water storage locations requires extensive surface areas, analysis of watersheds and their sub-watersheds, assess extent of impervious surfaces etc.

**Benefits of a city wide NBS system**

- Allows prioritization of NBS systems based on city needs (i.e. water, biodiversity, UHI, etc.)
- Allows overall financial budgeting and planning
- Allows phasing of investment

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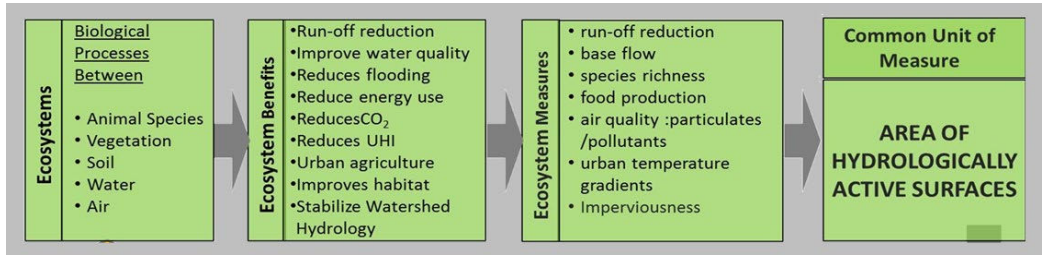
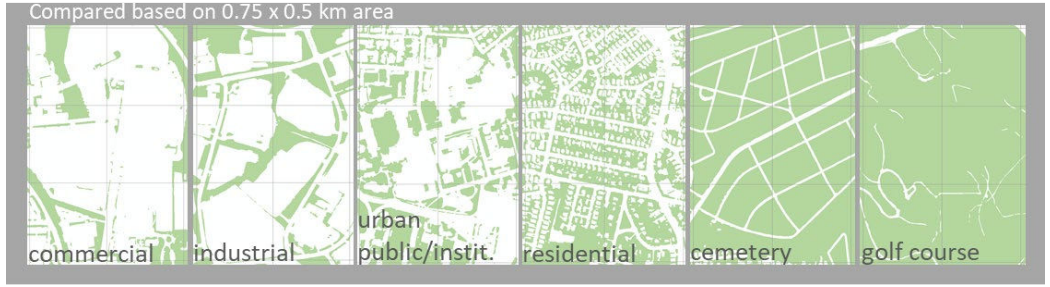
# NBS opportunities at metropolitan & city scales

**The Approach**

- Assess for opportunities to increase NBS typologies
- Assess for opportunities across different land uses
- Identify the exposure/risk to address
- Extent of pervious land surfaces (hydrologically active surfaces)
- Extent of transforming impervious surfaces to NBS
- Base the analysis on the transect approach
- Data: Simplify data to impervious and pervious variables
- Remote sensing and GIS integrated tools





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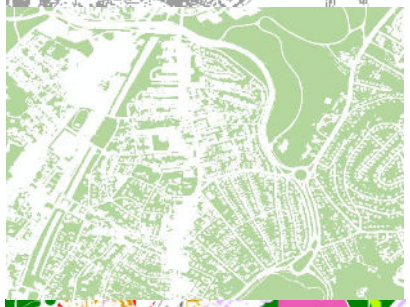
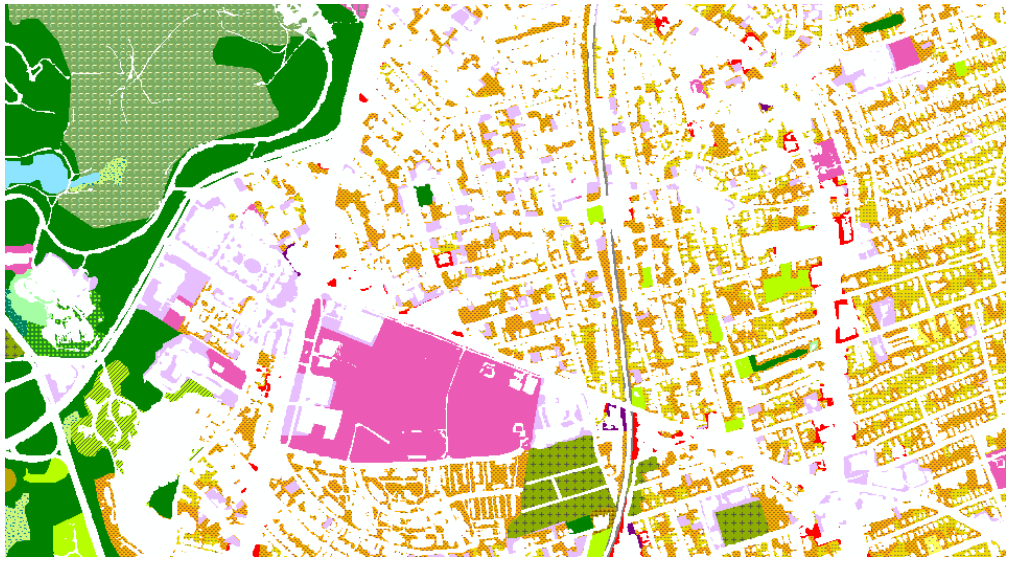
# NBS opportunities at metropolitan & city scales

**Land cover**
Impervious surfaces

**Land cover**
Pervious Surfaces



**Land Use**



**Legend ( MassGIS )**

- Forest
- Brushland/Successional
- Open Land
- Water
- Forested Wetland
- Non-Forested Wetland
- Salt Water Wetland
- Saltwater Sandy Beach
- Cranberry Bog
- Orchard
- Nursery
- Cropland
- Pasture
- Cemetery
- Golf Course
- Participation Recreation
- Spectator Recreation
- Water-Based Recreation
- Marina
- Multi-Family Residential
- High Density Residential
- Medium Density Residential
- Low Density Residential
- Very Low Density Residential
- Transitional
- Urban Public/Institutional
- Commercial
- Industrial
- Transportation
- Powerline/Utility
- Mining
- Waste Disposal
- Junkyard

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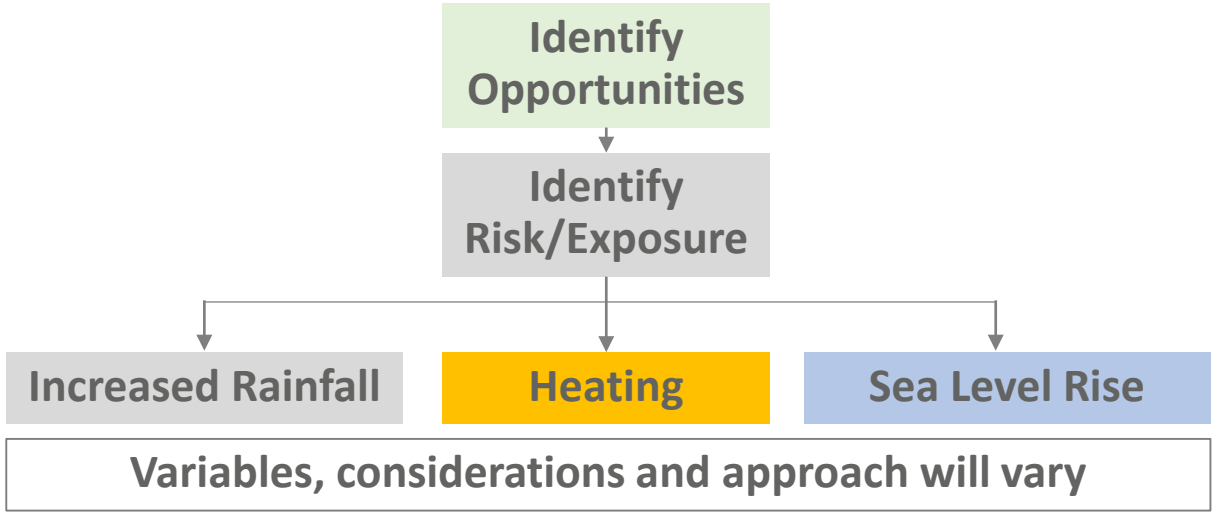
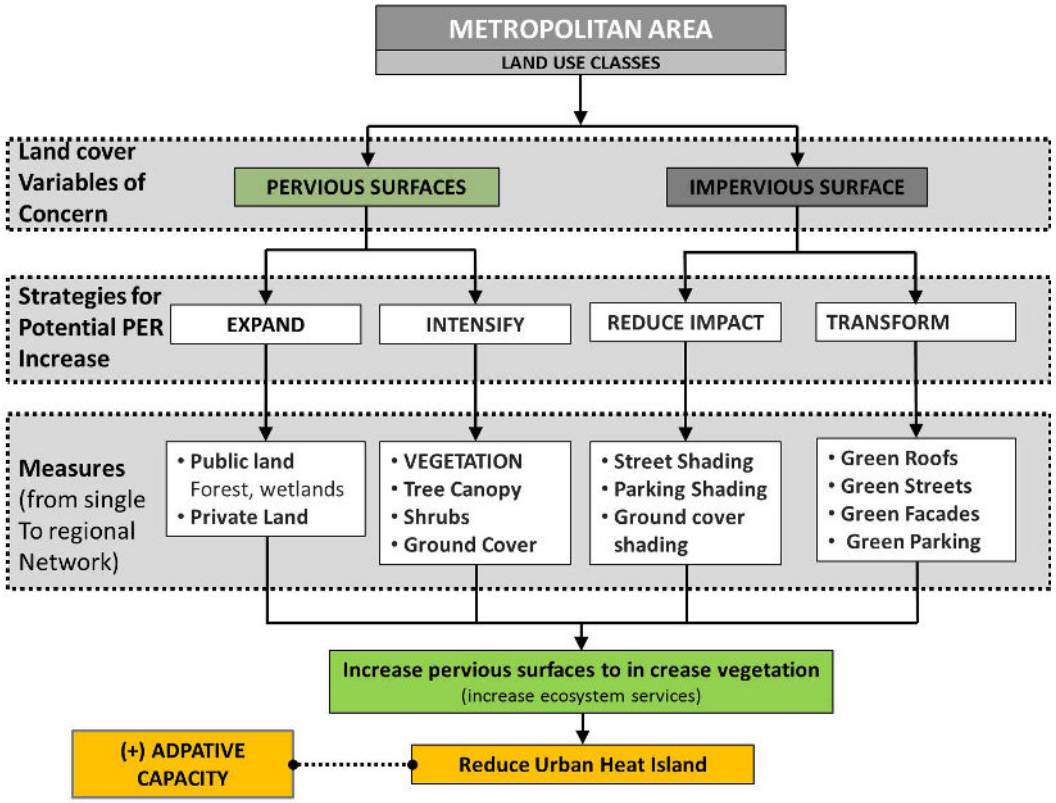
# NBS opportunities at metropolitan & city scales

**The Strategy**

- To expand and intensify NBS in existing pervious surfaces
- To reduce impact and transform impervious surfaces to NBS

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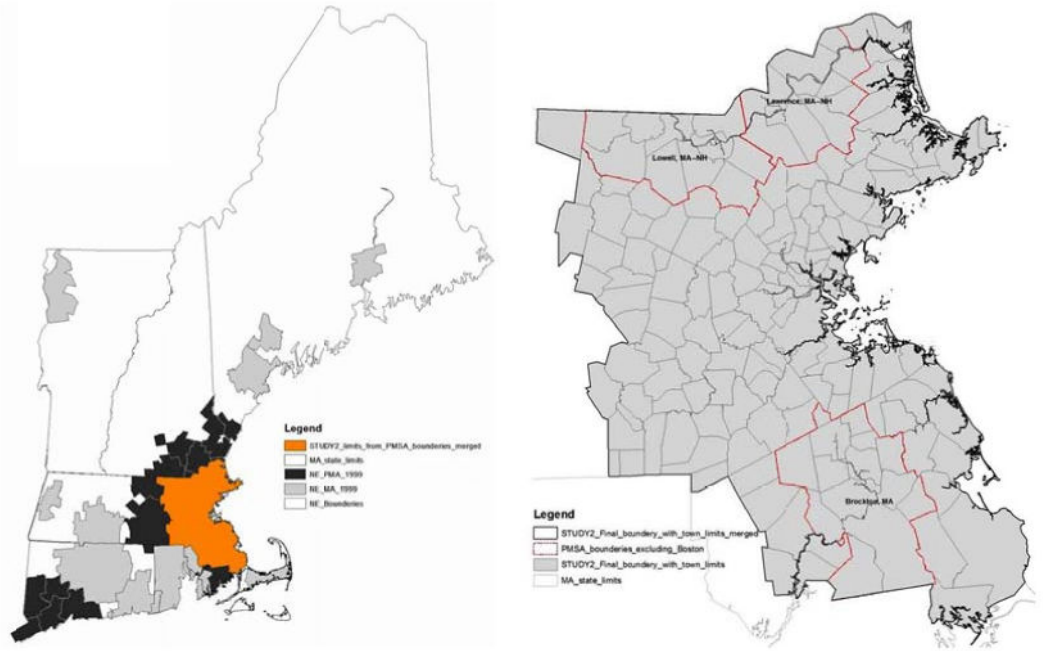
# NBS opportunities at metropolitan & city scales

**Study Area: Metropolitan area of Boston, USA**

- 161 towns/municiplaties  - Area 7,230km2
- Population: 5 million
- Pervious (72%) – impervious(16%)
- Forest(41%), Urban(33%), Agri(3%), water(18%)
- Loss of forest, 15% since 1971 (MassGIS)

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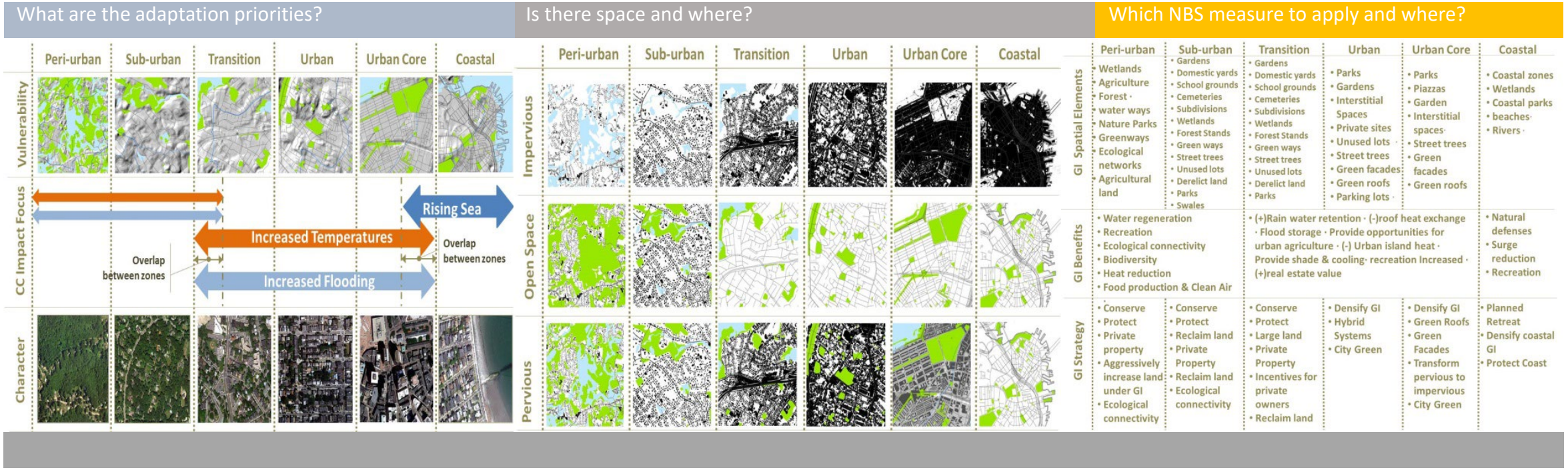
# NBS opportunities at metropolitan & city scales

## Suitability of NBS across metropolitan transect

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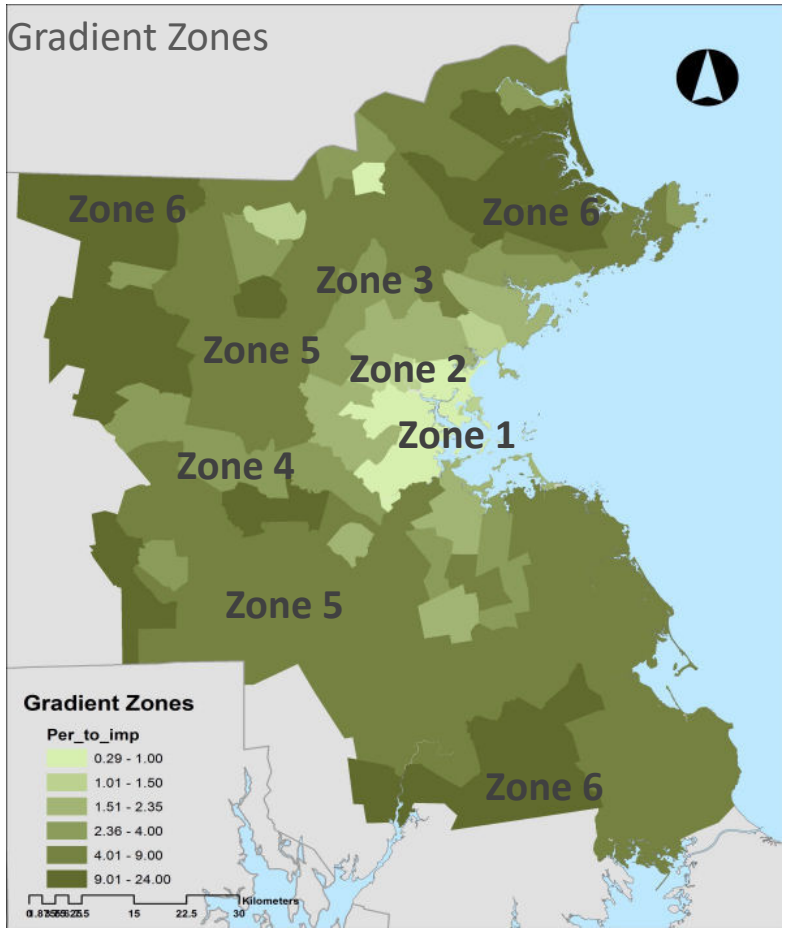
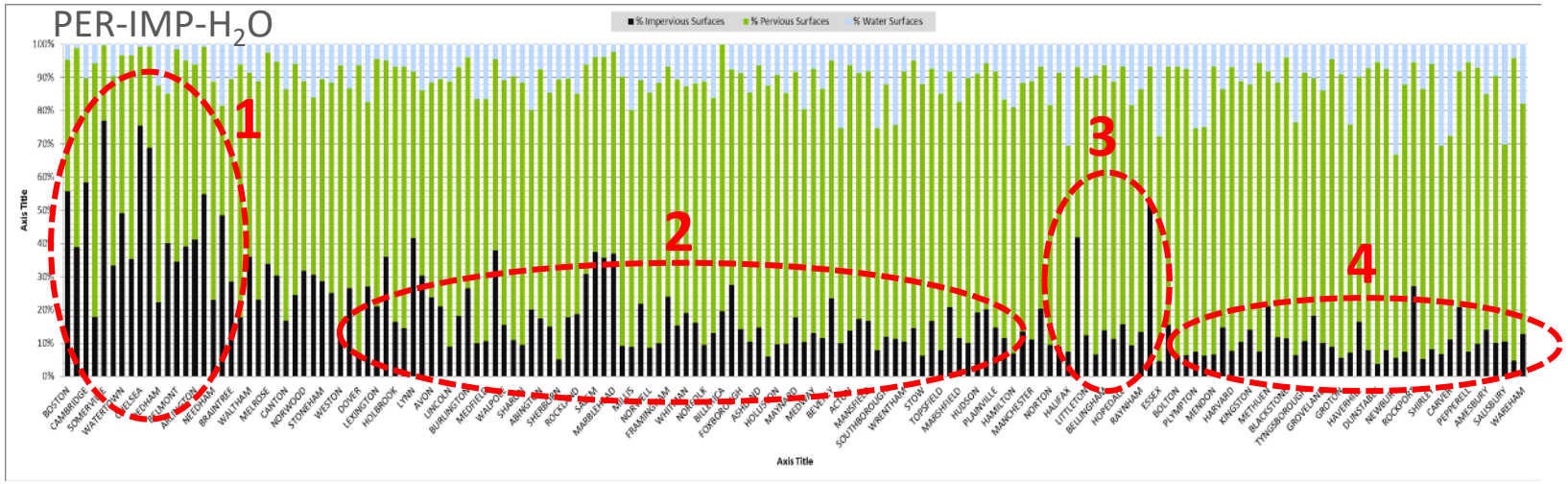
# NBS opportunities at metropolitan & city scales




**The Approach**

- To be able to develop a city or impervious surfaces etc.

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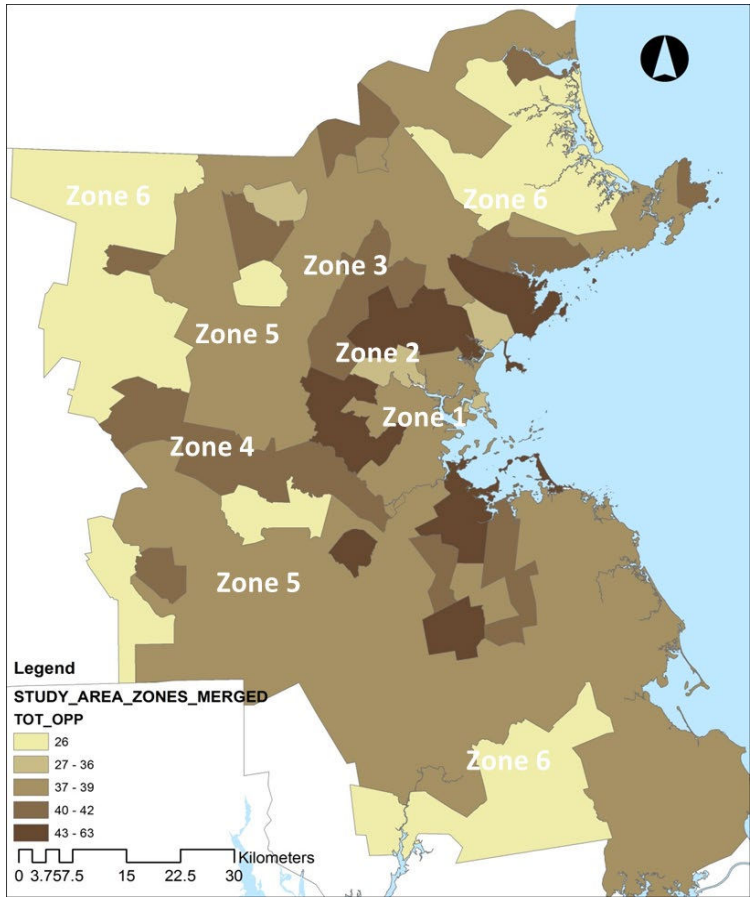
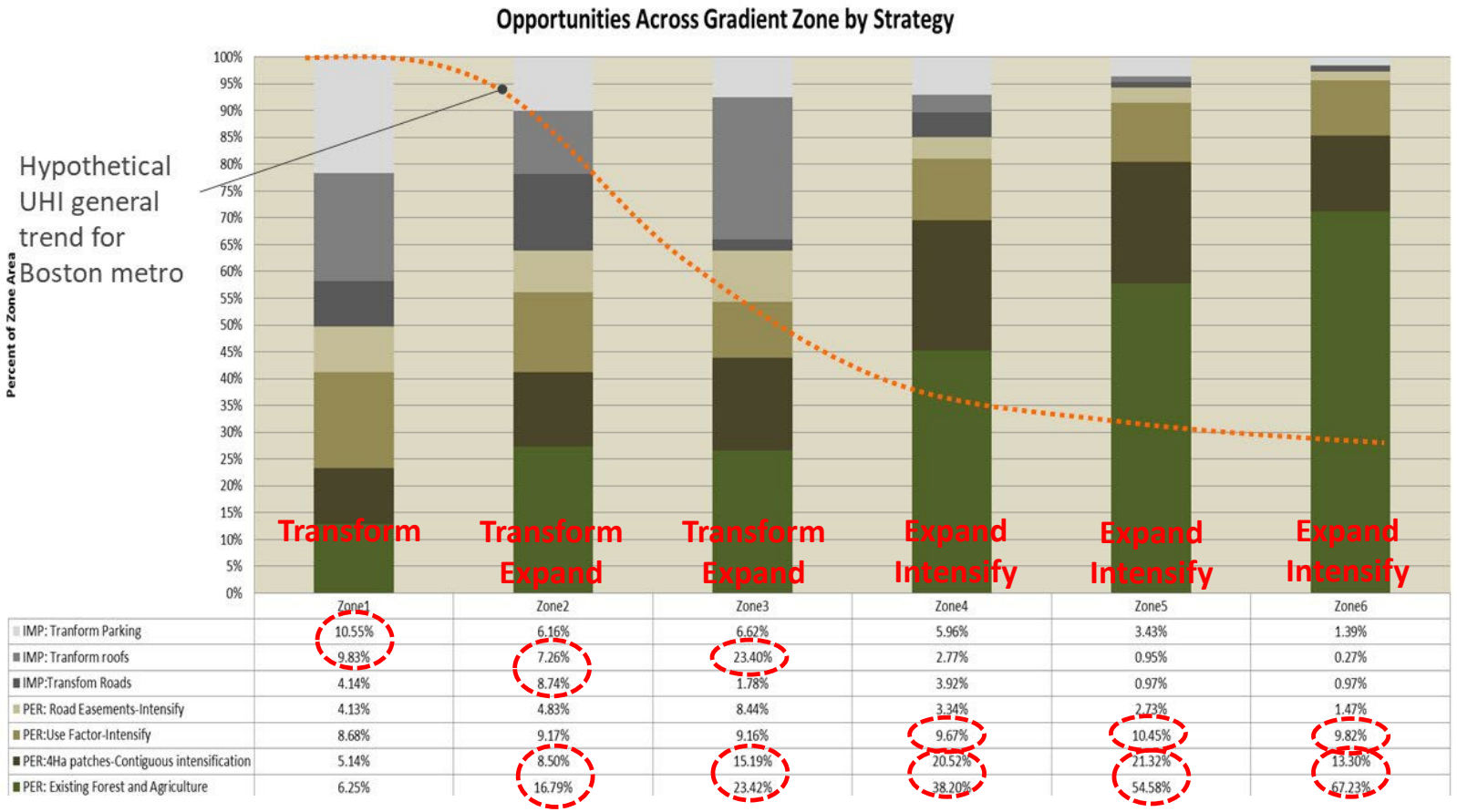
# NBS opportunities at metropolitan & city scales




| | Zone1 | Zone2 | Zone3 | Zone4 | Zone5 | Zone6 |
|---|---|---|---|---|---|---|
| IMP: Tranform Parking | 10.55% | 6.16% | 6.62% | 5.96% | 3.43% | 1.39% |
| IMP: Tranform roofs | 9.83% | 7.26% | 23.40% | 2.77% | 0.95% | 0.27% |
| IMP:Transfom Roads | 4.14% | 8.74% | 1.78% | 3.92% | 0.97% | 0.97% |
| PER: Road Easements-Intensify | 4.13% | 4.83% | 8.44% | 3.34% | 2.73% | 1.47% |
| PER:Use Factor-Intensify | 8.68% | 9.17% | 9.16% | 9.67% | 10.45% | 9.82% |
| PER:4Ha patches-Contiguous intensification | 5.14% | 8.50% | 15.19% | 20.52% | 21.32% | 13.30% |
| PER: Existing Forest and Agriculture | 6.25% | 16.79% | 23.42% | 38.20% | 54.58% | 67.23% |

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# NBS opportunities at metropolitan & city scales

## Opportunities of NBS by land use type

| | |
|---|---|
| Contiguous tree patches | All residential categories |
| Tree intensification | All residential, commercial, open land |
| Green Roofs | High density residential, commercial, industrial |
| Street shading and green streets | Class 5, local roads |
| Parking tree shading & Transform | Industrial 7 commercial |

## Policy priorities by gradient zone

| | Priority 1 | Priority 2 | Priority 3 |
|---|---|---|---|
| **Zone 1** | Parking shading/transform | Green Roofs | Tree Intensification |
| **Zone 2** | Tree Intensification | Street shade & green streets | Contiguous tree patches |
| **Zone 3** | Green Roofs | Contiguous tree patches | Tree Intensification |
| **Zone 4** | Contiguous tree patches | Tree Intensification | Parking shading/transform |
| **Zone 5** | Contiguous tree patches | Tree Intensification | Parking shading/transform |
| **Zone 6** | Contiguous tree patches | Tree Intensification | Street shading |

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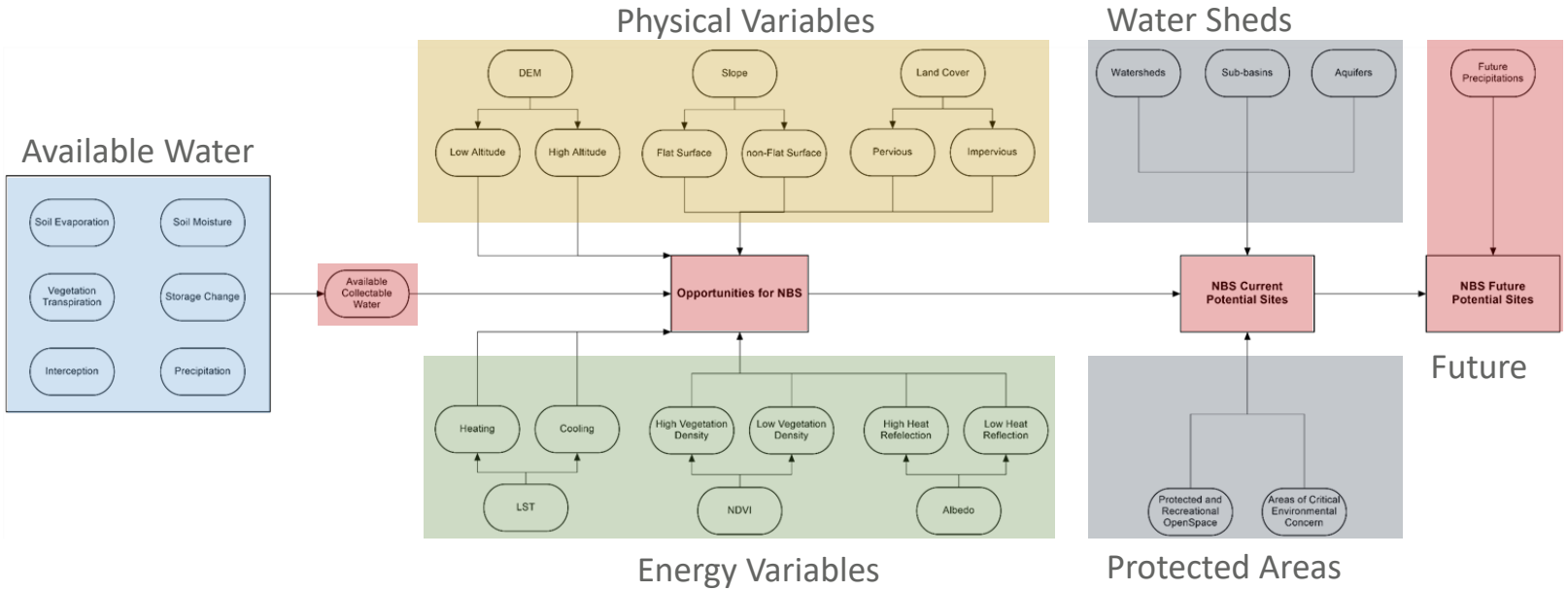
# NBS opportunities for water capture & storage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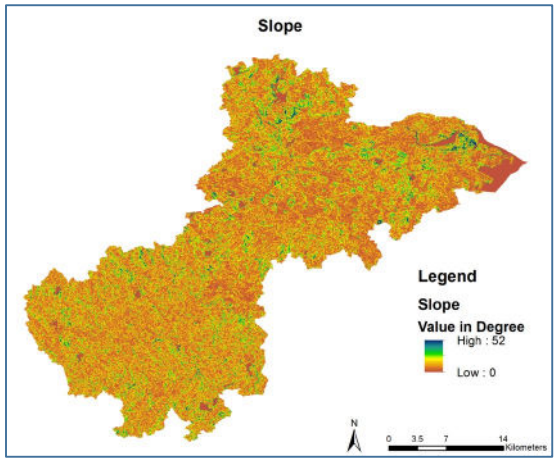
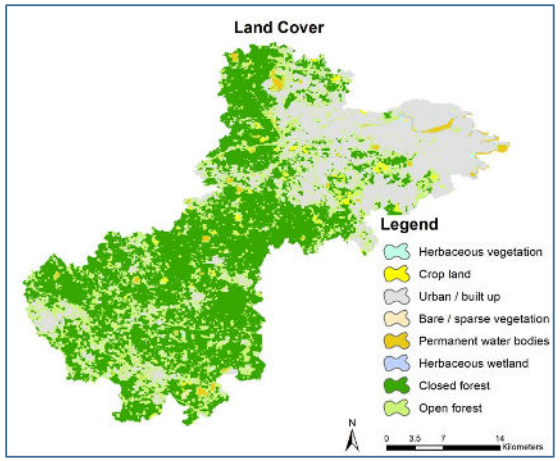
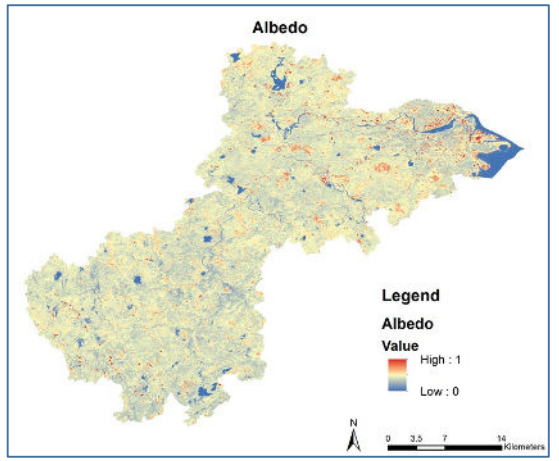
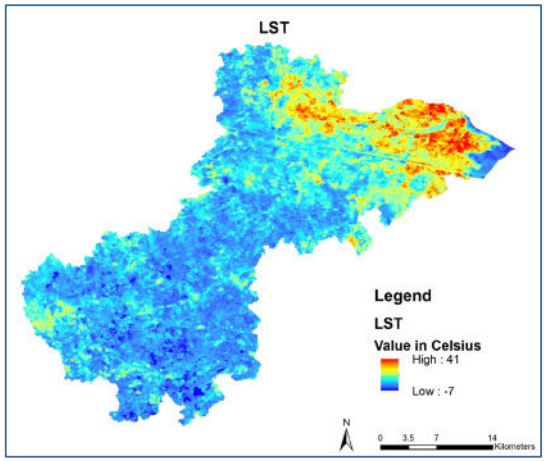
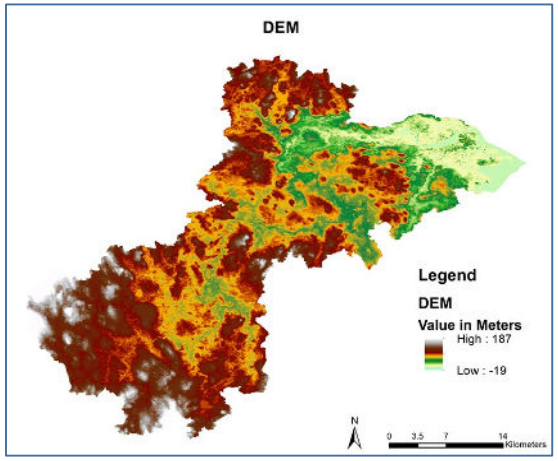
# NBS opportunities for water capture & storage

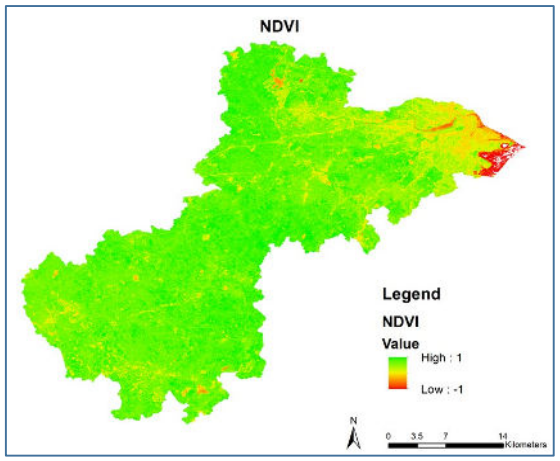



## The Approach

- Map all required variables at appropriate resolution
- Includes: water availability, physical features, watersheds, and historic data to develop predictive model

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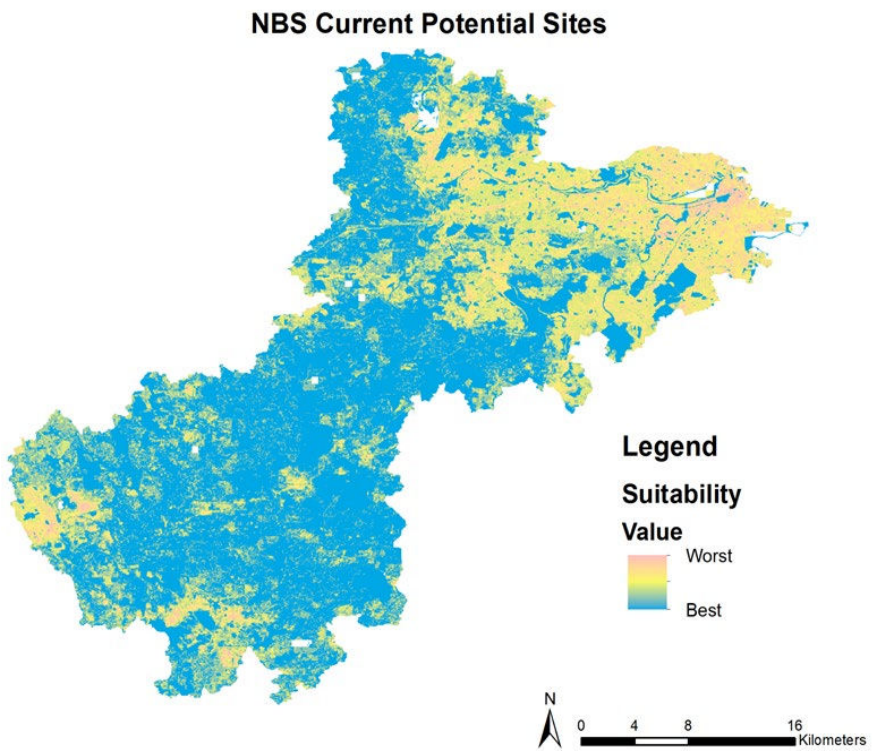
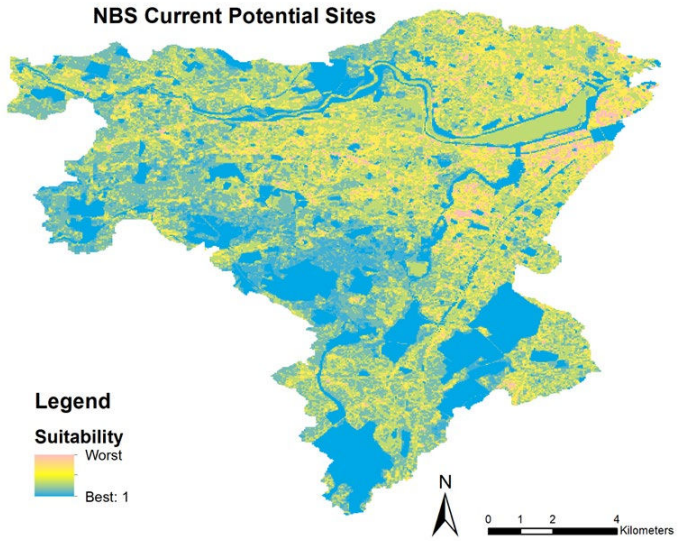
# NBS opportunities for water capture & storage

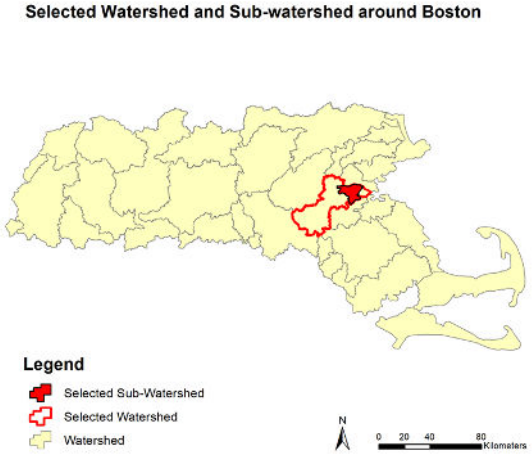
## WATERSHED




## SUB-WATERSHED




## LOCATION




| | Watershed | Sub-watershed |
|---|---|---|
| Most suitable Opportunities (m2) | 567 | 30 |
| Total Surface Area (km2) | 820 | 119 |
| Percent of Suitable Area | 69% | 25% |

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# Limitations & Next Steps

**Limitations**

- Data Resolution compatibility
- Field Verification needs
- Verification against local policy
- Land tenure should be considered
- Account for adjacent land uses to avoid
- Socio-economic data to be incorporated : Assess vulnerability and needs

**Next Steps**

- Refining the approach for different NCW applications
- Run further tests and validation
- Aim for finer resolution remote sensing and aerial data

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# Concluding Remarks

- Work is in progress
- It is necessary to plan NBS for water and considering co-benefits at metro scale to ensure sufficient impact: for example, water + cooling + public health
- The need to address climate change is crucial. A tool that allows a quick prioritization of targeted areas and investment in NBS is necessary to achieve results as soon as possible.
- To ensure implementation at the metropolitan scale development, planning tools such as the one presented need to go along with incentive-based policies so NBS becomes common practice.
- Majority of land in metropolitan areas are privately owned. Including these land tenures in policies and implementation are critical to increasing deployment and acceptance.

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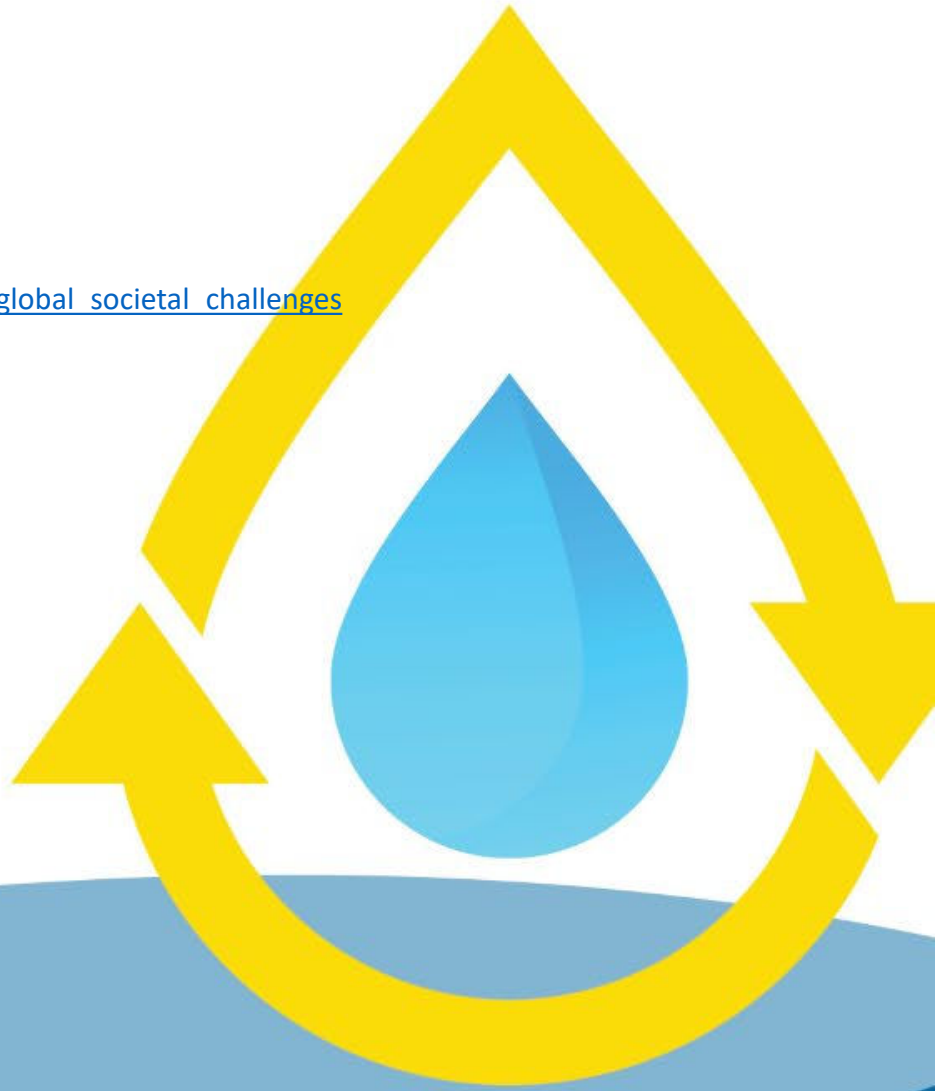

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# Thank you for your time

Yaser Abunnasr

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## The Non-Conventional Water Resources Programme in the Mediterranean:

Nikos Skondras
Global Water Partnership – Mediterranean

WED 15TH MARCH, 2023

WATER.ORG.MT

# Water Challenges in the Mediterranean (Islands)

**Seasonality and high peaks** of water demand in (extended) summer months to be addressed.

- **Water quality depletion** due to saltwater intrusion into coastal freshwater aquifers, loss of wetlands, and temperature increase with impacts on surface water.
- **Climate change impacts**: increase of droughts & flash-floods.
- **Increase in population** and **Migration flows** put extra pressure.
- **Energy cost** for water production / supply.

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# Addressing Water Scarcity in the Mediterranean

- ✓Improving Water Governance and Management
- ✓Applying Water Demand Strategy: water efficiency and water saving
- ✓Non-Conventional Water Resources:
  - Rainwater harvesting,
  - Greywater reuse
  - Treated wastewater reuse
  - Aquifer recharge
  - Desalination

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# The Geography & the Partners


Global Water Partnership Mediterranean

MEDIES

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Malta College of Arts, Science & Technology

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SICILIA

ΠΑΙΔΑΓΩΓΙΚΟ ΙΝΣΤΙΤΟΥΤΟ ΚΥΠΡΟΥ

NTM

Δήμος Λευκωσίας
Nicosia Municipality

CITY OF THESSALONIKI

EkoSkola

Lanitis BROS
Member of Coca-Cola Hellenic Group

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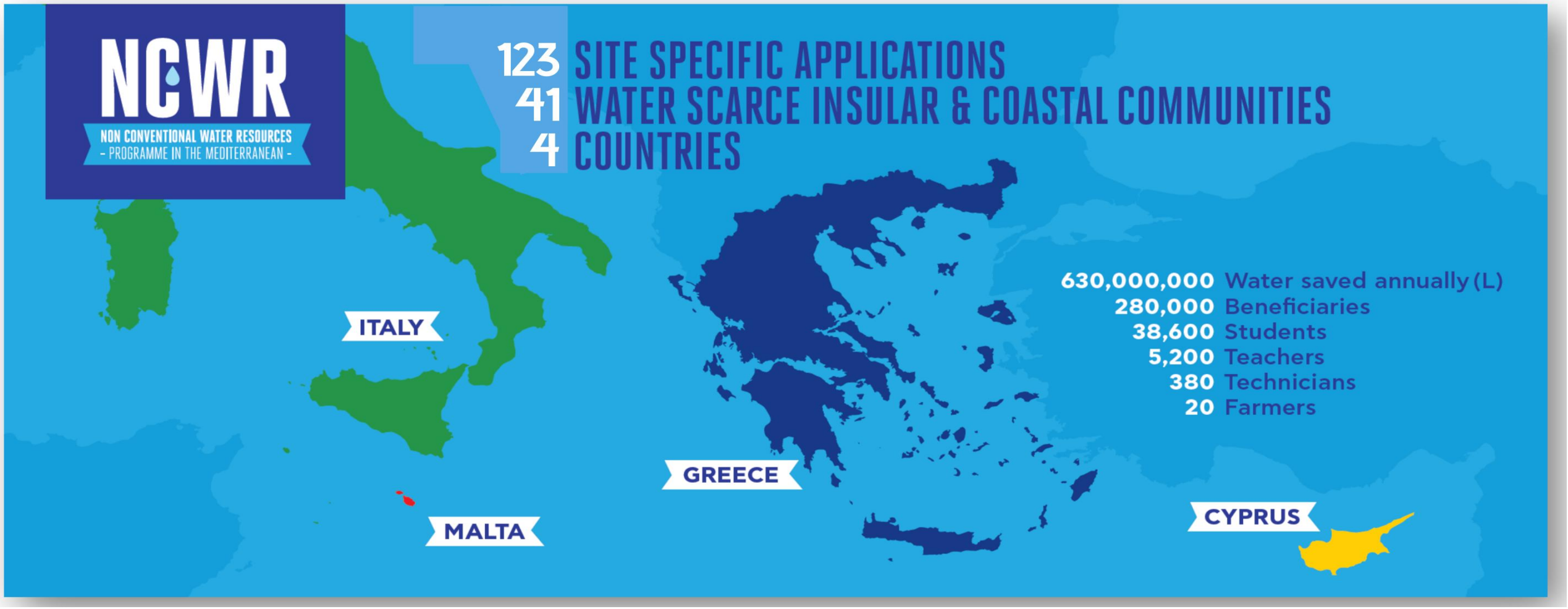
# 16+ years of impact

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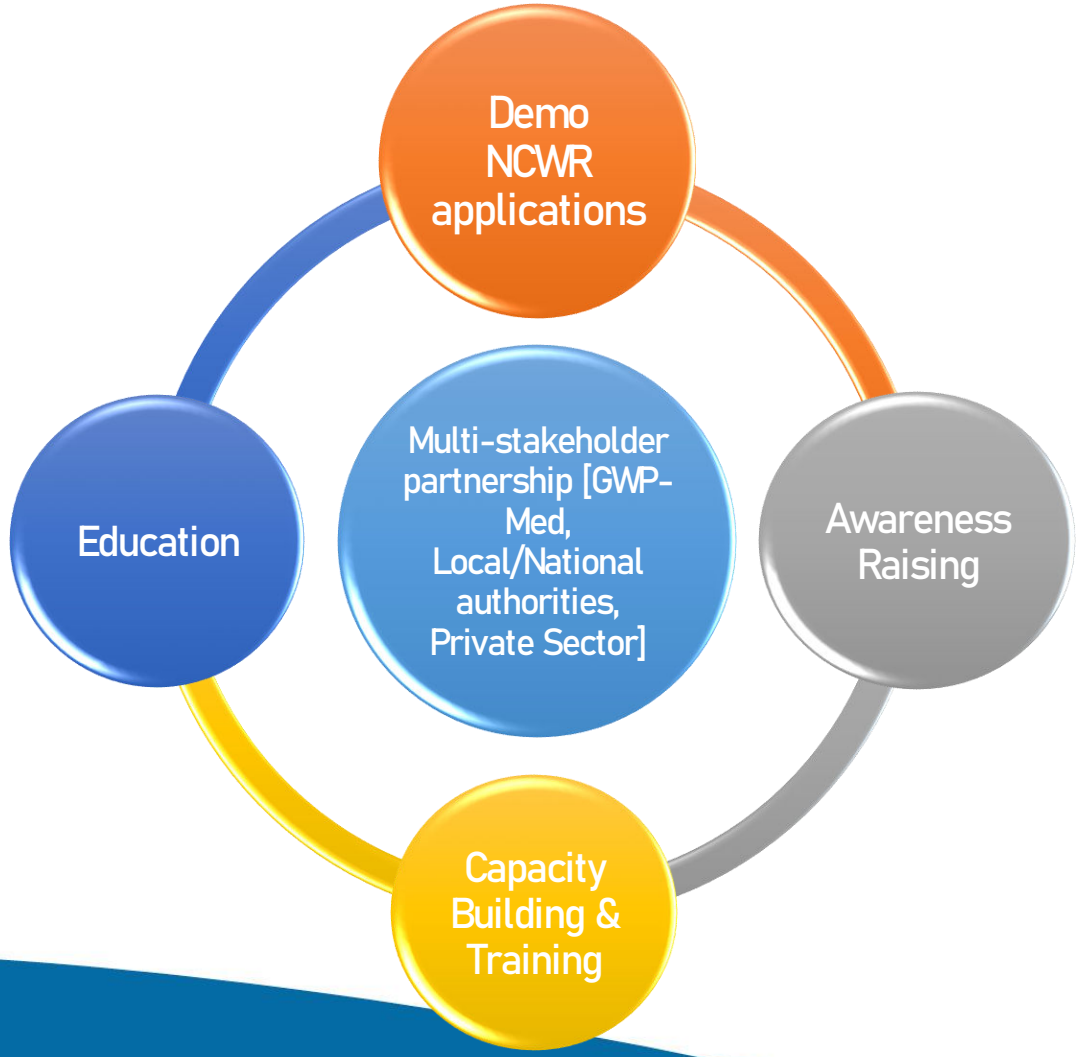
# The Methodology




Budget: > 5 million USD, primary by The Coca-Cola Foundation, co-funded by national and local authorities

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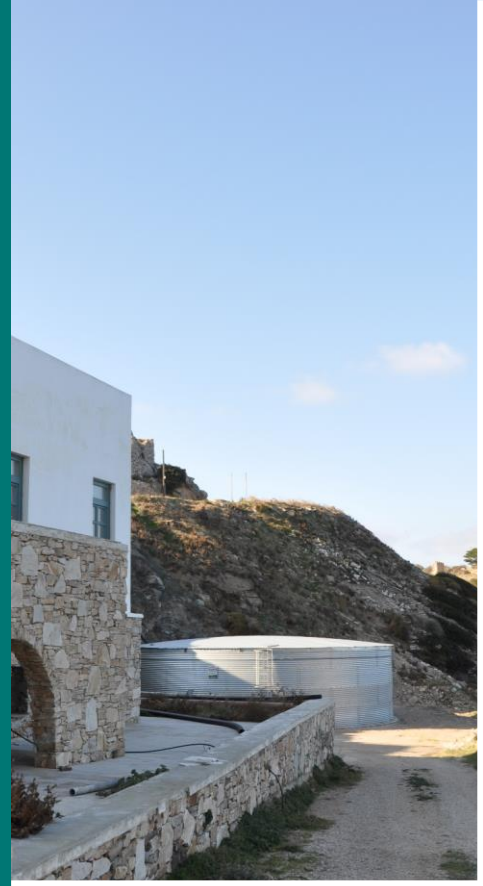
# REVIVING TRADITIONAL WATER MANAGEMENT PRACTICES

Challenges

- Increasing water demand
- Decreasing precipitation due to climate change
- Abandoning remarkable local craftmanship to harvest rainwater




# Reviving traditional water management practices

LESSONS

1 Modern means can revive traditional water management practices

2 Our heritage points to cost-efficient and sustainable water solutions for our future

# PROMOTING INNOVATIVE NON CONVENTIONAL WATER RESOURCE MANAGEMENT TECHNOLOGIES

## Challenges

- Greywater and treated wastewater remain untapped
- Desalination is the main source of water in most islands
- Agriculture ranks at the top of water consumption


# Promoting Innovative Non Conventional Water Resource Management Technologies

LESSONS

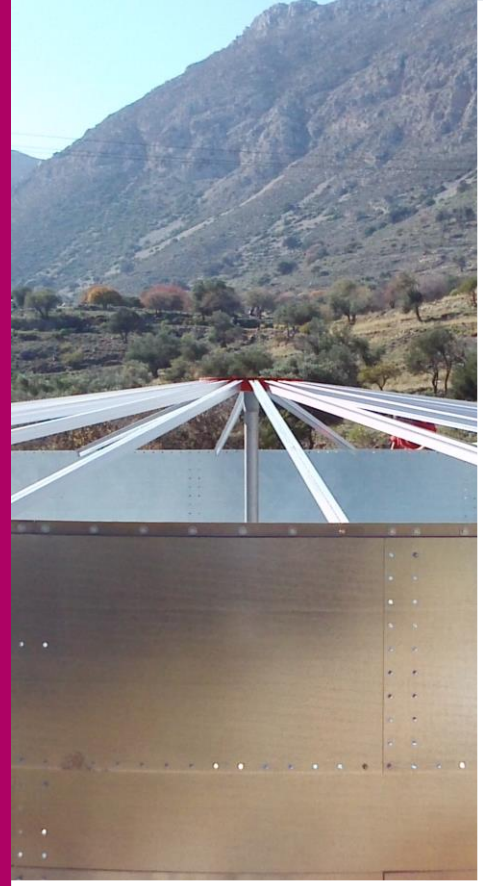
1 Showcasing innovative water technologies promotes use, replication and scaling up of solutions

2 ICT based solutions can optimise irrigation with water

# OPTIMISING EXISTING INFRASTRUCTURE AND ACHIEVING WATER EFFICIENCY

Challenges

- Aged water infrastructure causes extensive water and energy losses
- Old system design and existing capacities cannot cater for extended needs and increasing demand




# Optimising Existing Infrastructure and Achieving Water Efficiency

LESSONS

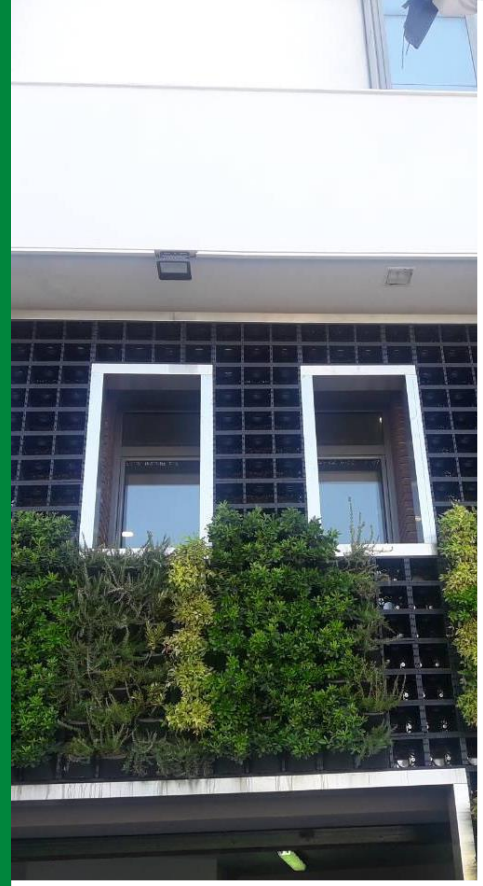
1 Optimising infrastructure requires small capital investment and yields multifold environmental and economic gains

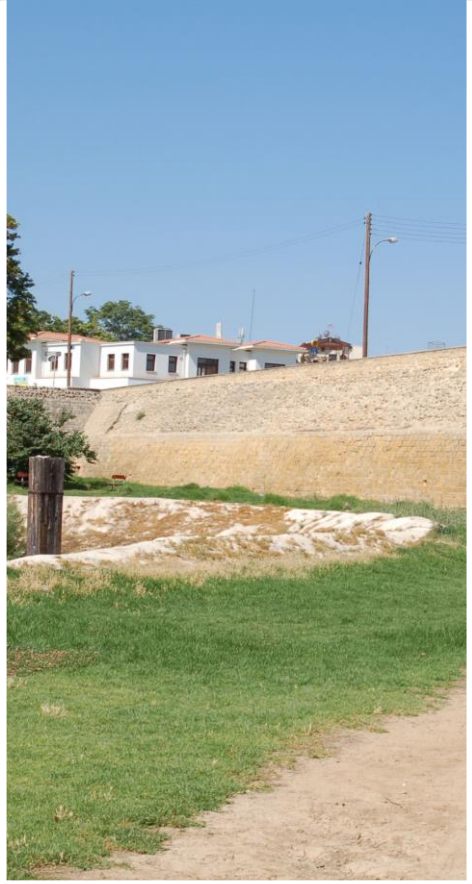
2 Combining the use of water saving devices and mindful use significantly improves efficiency of resources

# ADVANCING INTEGRATED SOLUTIONS FOR URBAN GREEN

Challenges

- Increasing urbanization
- Few green spaces in the cities
- Climate change intensifies urban water vulnerabilities, such as flooding, heat stress and water scarcity






# Advancing Integrated Solutions for Urban Green

LESSONS

**1** Green – blue infrastructure prevents flooding and increases urban green

**2** Green roofs and vertical gardens can improve the microclimate and living conditions in cities

# FOSTERING JOB CREATION AND KNOWLEDGE SHARING

Challenges

- Increasing youth unemployment rates
- Skills mismatch in youth
- Technology advances and the knowledge generated must be shared among peers who face similar water challenges.



# Fostering Job Creation and Knowledge Sharing

LESSONS

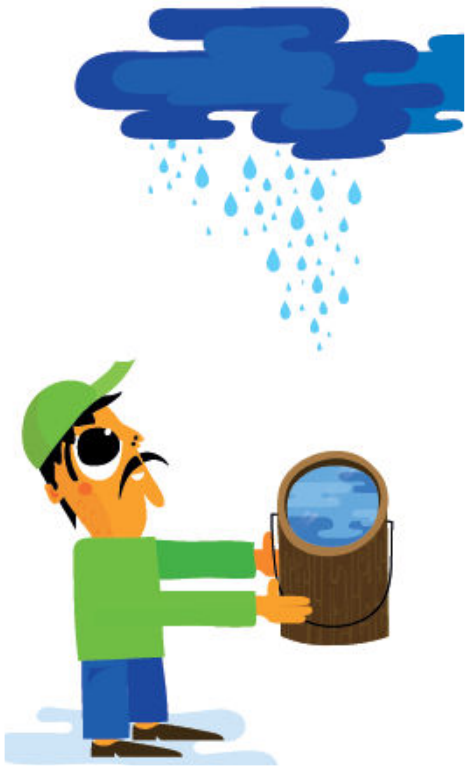
**1** Knowledge sharing has a multiplier effect towards improved management of water resources

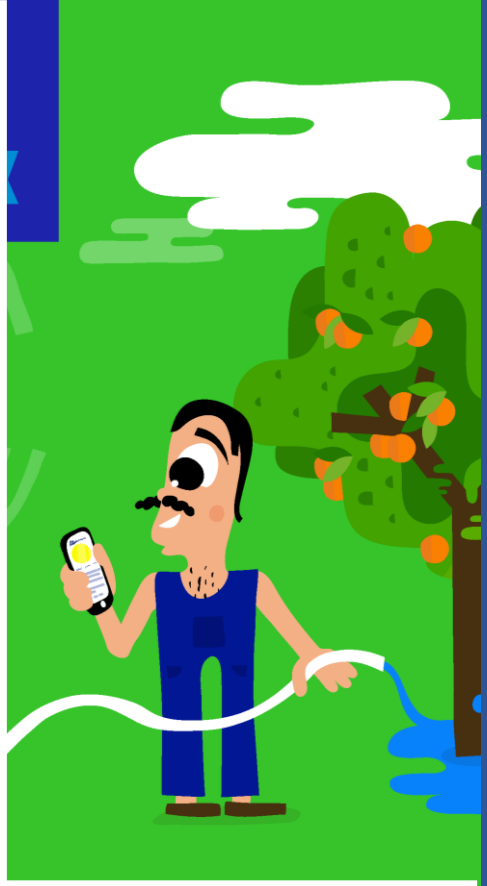
**2** NCWR can provide new employment and entrepreneurial opportunities

# NURTURING A NEW WATER CULTURE

Challenges

- New water culture
- Required changes in our values
- Governance change
- Different production and consumption patterns





# Nurturing a New Water Culture

LESSONS

1 Education for Sustainable Development empowers learners to transform their attitudes towards mindful water use

2 Awareness raising can create the acceptance of NCWR at local level and facilitate the expansion of such cost-effective

# The Value

- Holistic approach
- Multistakeholder partnership
- Builds on existing capacities and invests in the future generations
- Tangible outputs with replication and scale-up potential
- Contributes to water security and climate adaptation at local level
- Engages local communities for a sustainable future

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# The Way Forward

- A legacy left in 41 islands and cities, showcasing solutions that can be replicated and scaled up
- All works will continue to yield benefits in the future
- **Focus** on Youth & Women,
- **Focus** on innovative applications at urban & rural environment for water security, climate change adaptation and local development.

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## Kid-Powered Water Management: How Playgrounds Can Help Combat Flooding

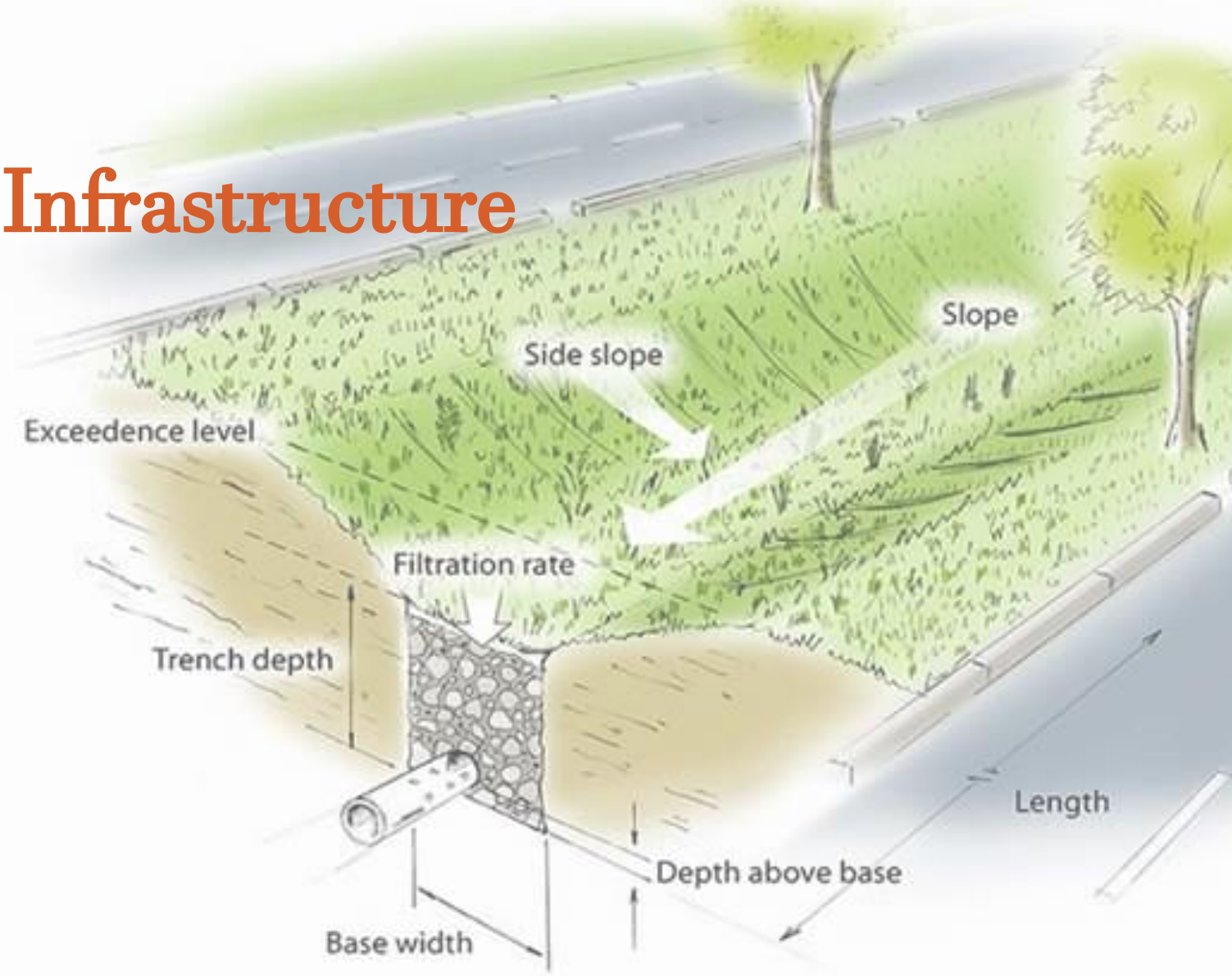
Ministry for Public Works & Planning

WED 15TH MARCH, 2023

WATER.ORG.MT

# Green Stormwater Infrastructure

Green Stormwater Infrastructure (GSI) is **a nature-based solution to water quality issues that urban stormwater runoff causes and provides greater benefits than conventional stormwater solutions.** GSI combines economic and environmental sustainability, adaptability, resiliency, and social equity.

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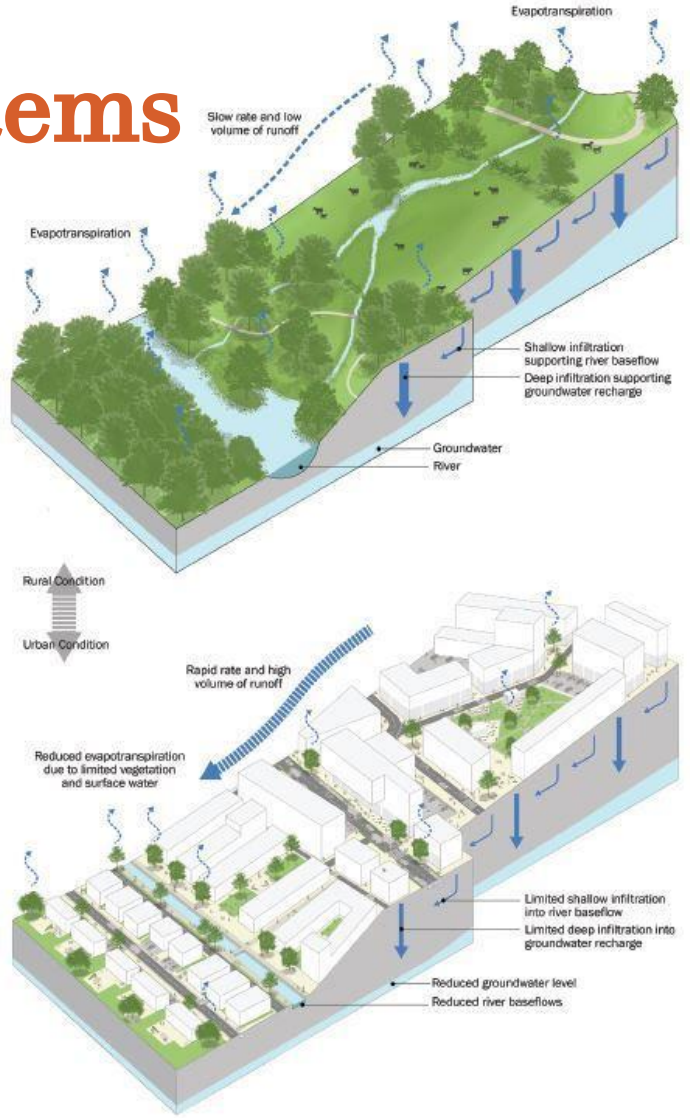
# Sustainable Drainage Systems

Are designed to manage stormwater locally, to mimic natural drainage and encourage its infiltration, attenuation and passive treatment.

**Sustainable Drainage Systems (SuDS)** want to manage urban runoff to:

- recover the original hydrologic regime and reduce the pollutant loads, moving from post-development back again to pre-development status
- build future sponge cities in response to heavy rains;
- provide cities with as much as possible new green-blue infrastructures, exploiting the multiple ecosystem services of nature-based solutions

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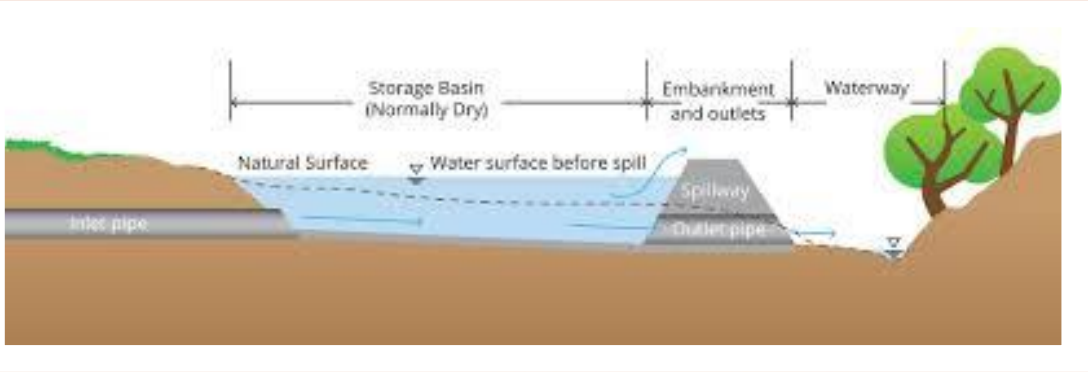
# *Sustainable Drainage Systems Examples*

## DETENTION BASINS and DAMS

*Detention basin:* A depression covered with vegetation to hold rainfall and slowly drain it

*Dam:* structures that collect water to promote water recharge

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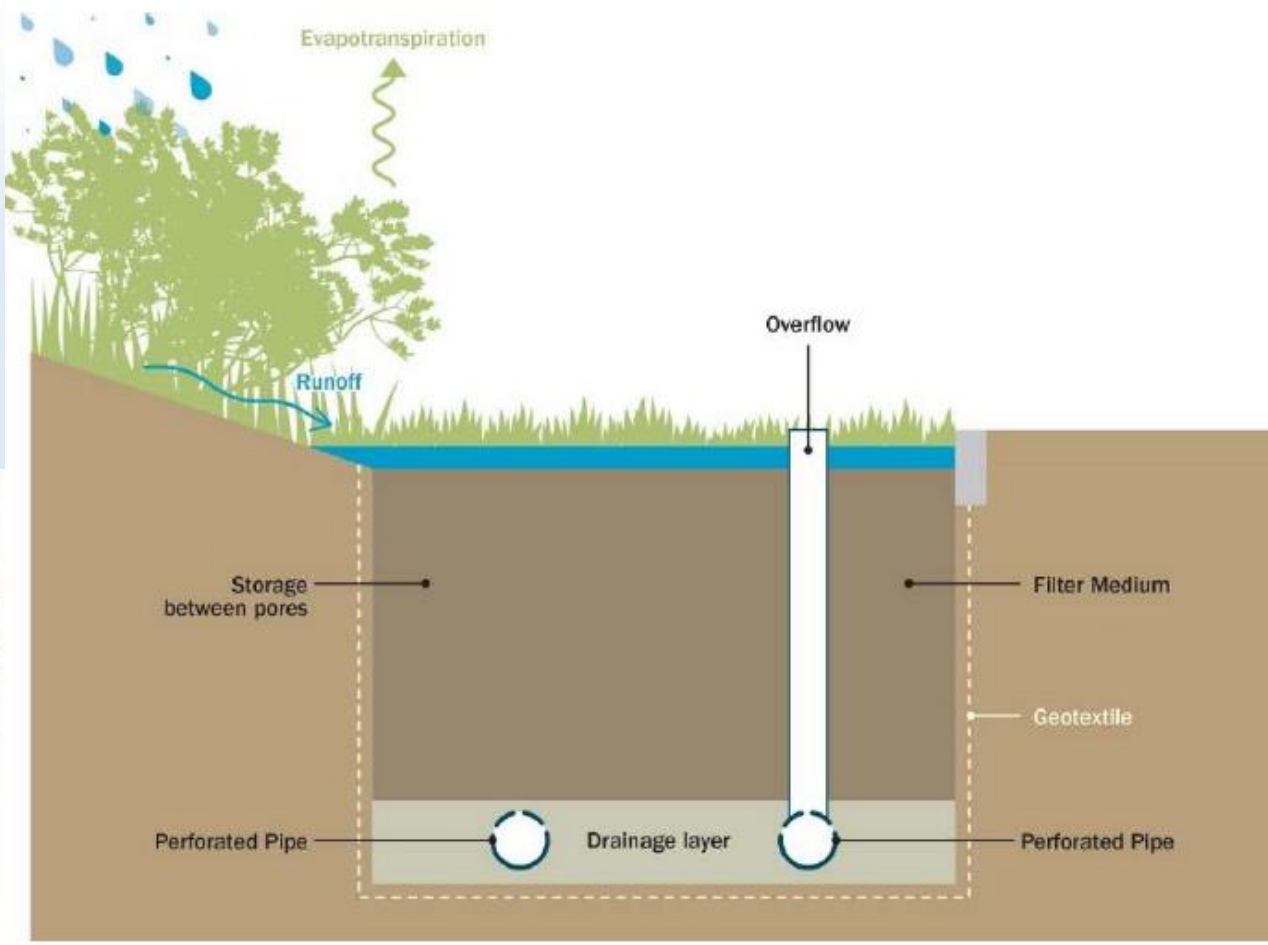
# Sustainable Drainage Systems Examples




## BIO RETENTION SYTEMS

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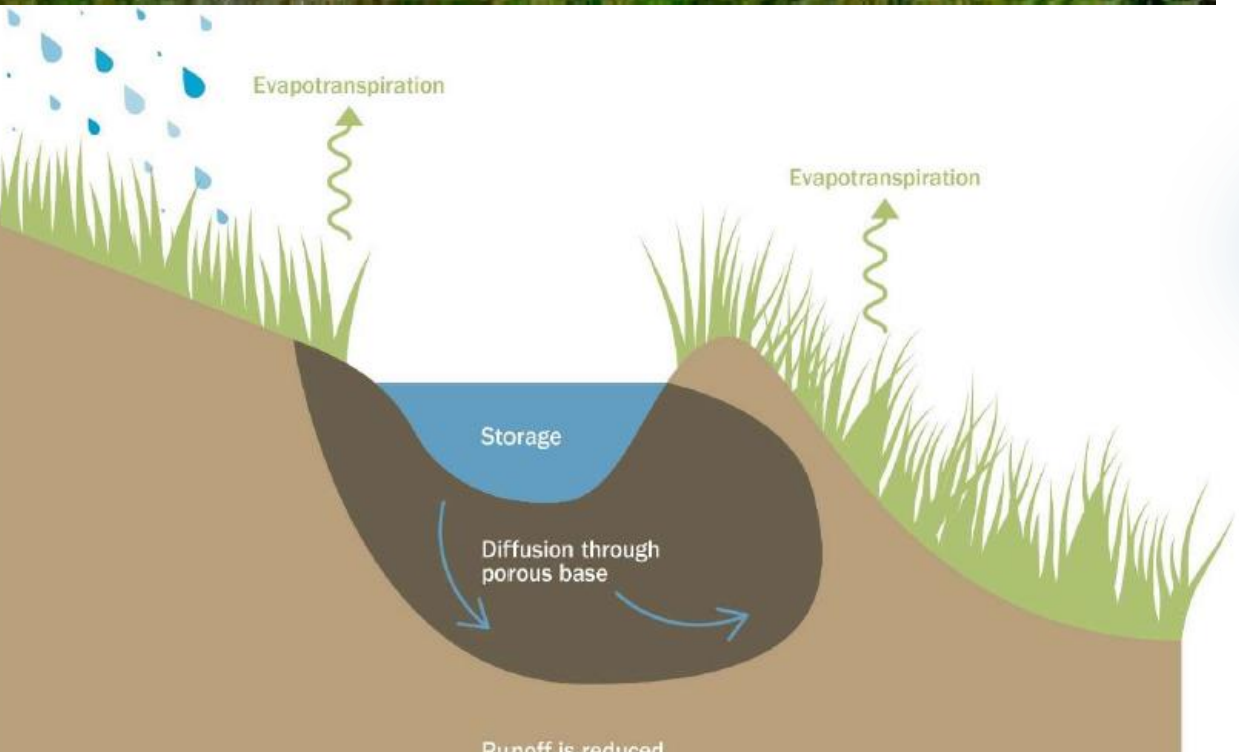
# Sustainable Drainage Systems Examples




## SWALES

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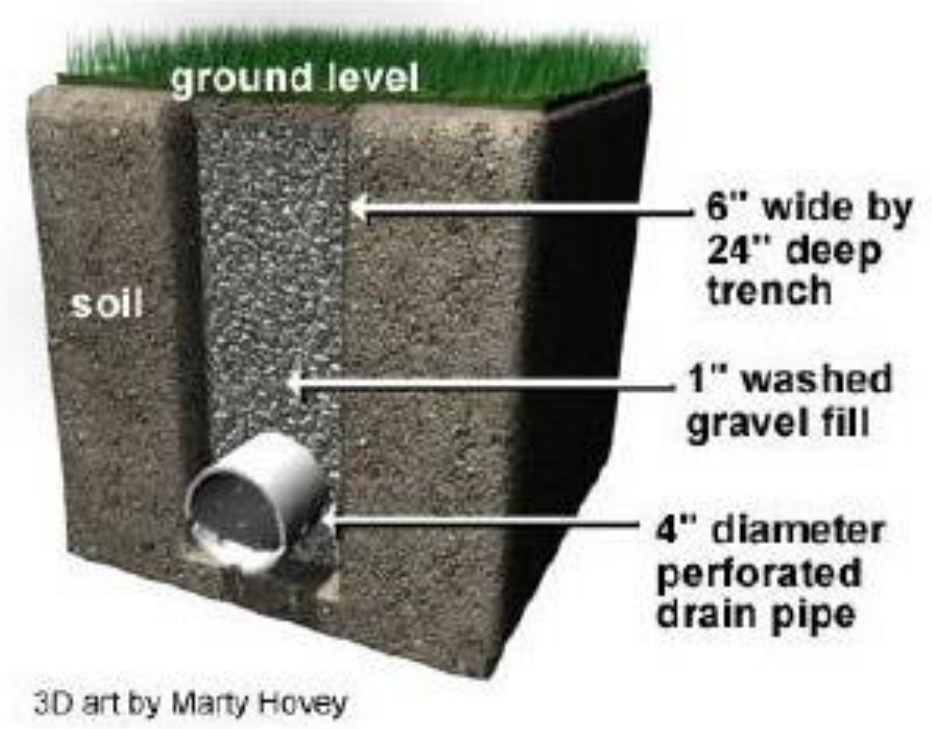
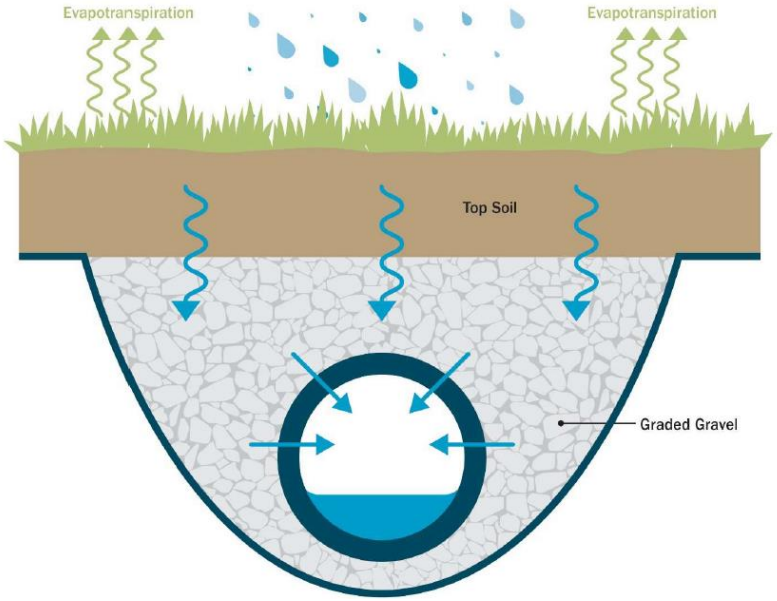
# *Sustainable Drainage Systems*

# *Examples*

## FILTER DRAINS

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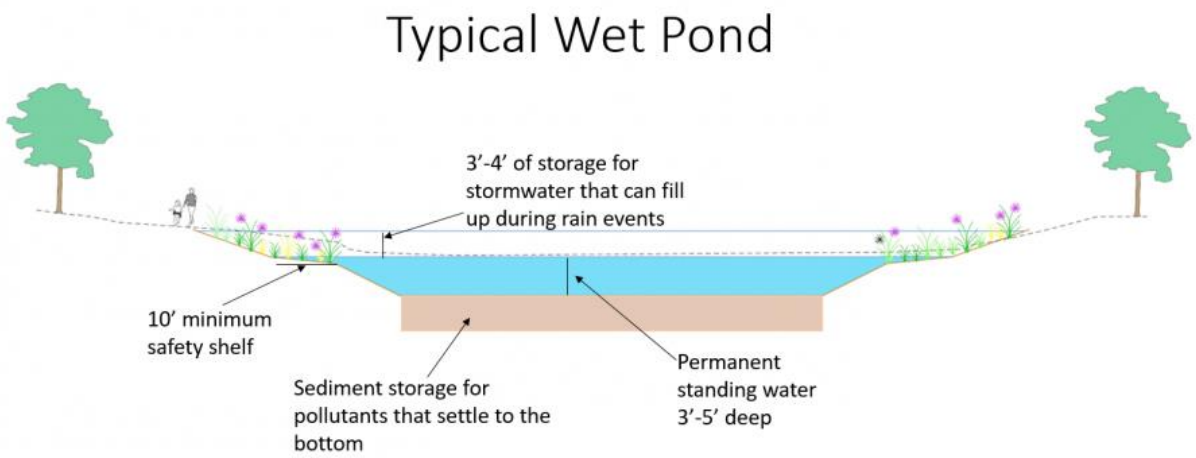
# Sustainable Drainage Systems Examples

## PONDS AND WETLANDS

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# Playgrounds as Green Stormwater Infrastructure

President's Kitchen Garden, Attard

## Why Playgrounds?

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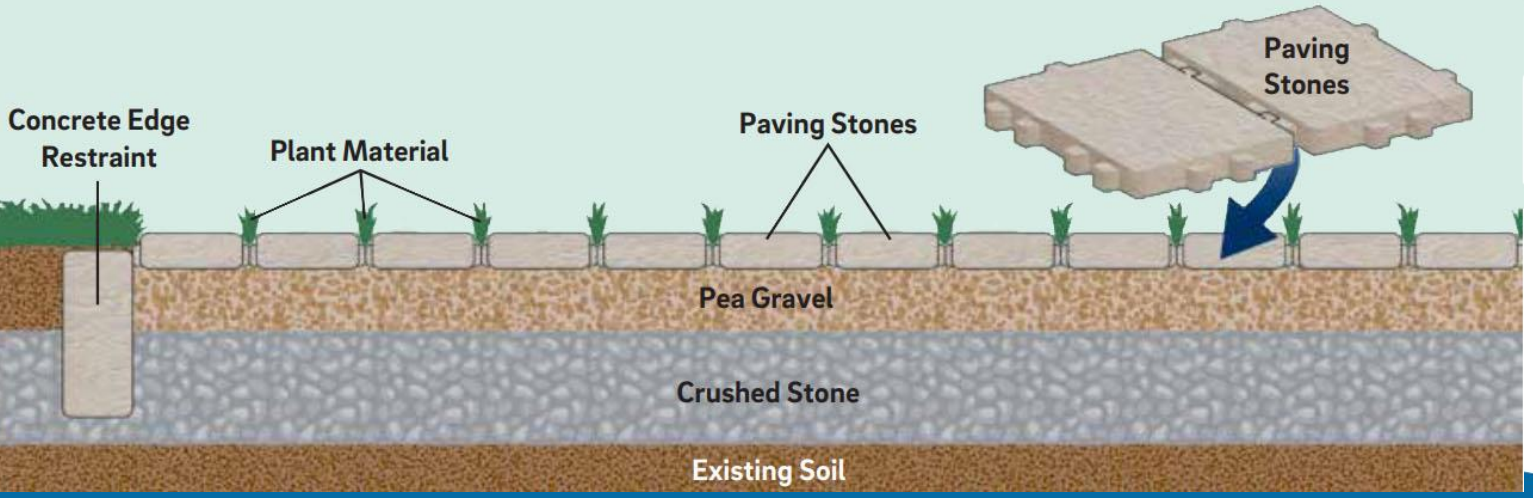
# Examples of Sustainable Drainage Systems in Playgrounds




## PERMEABLE PAVING

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# Examples of Sustainable Drainage Systems in Playgrounds

## SWALES

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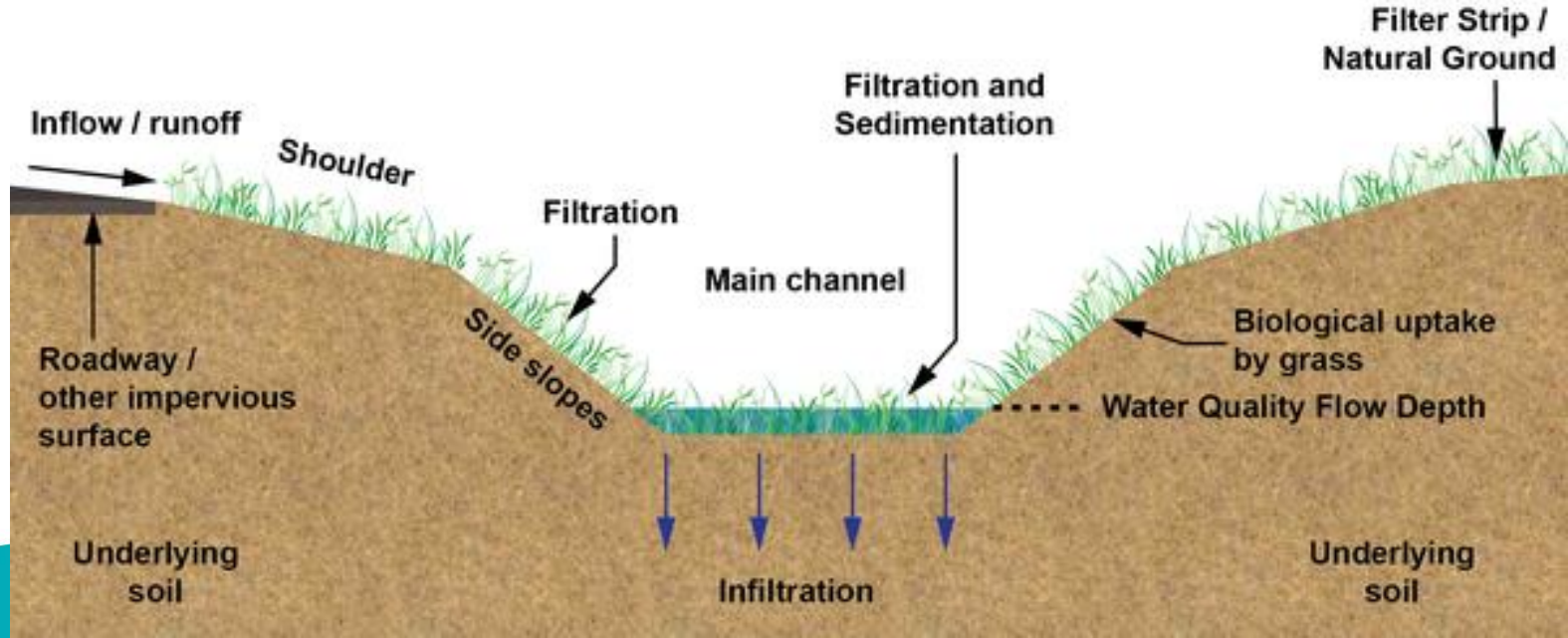


# GSI

## MALTA PLAYGROUNDS

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# Paola Public Garden & Playground

*Reconfiguration of an existing playground.*


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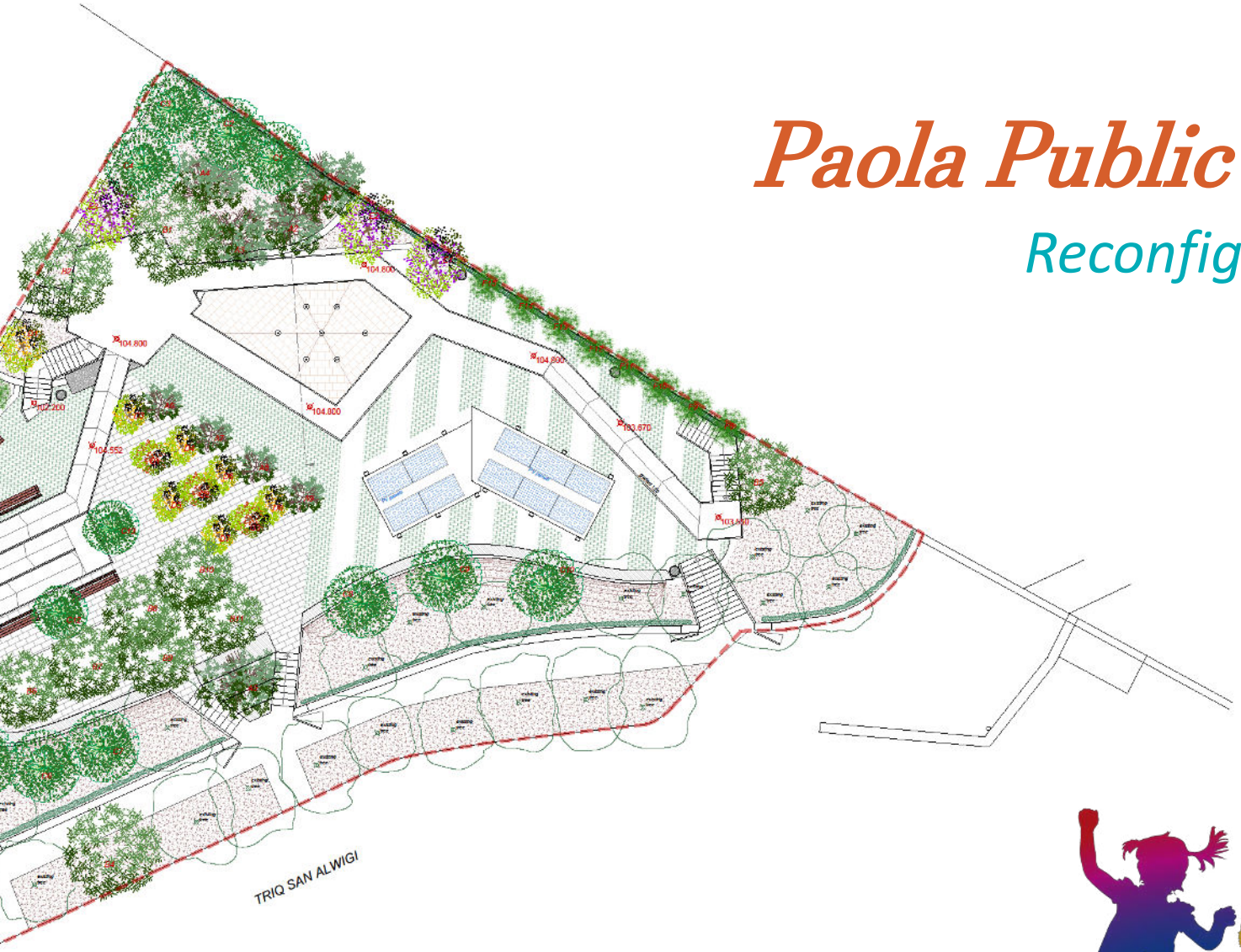


# *Paola Public Garden & Playground*

*Reconfiguration of an existing playground.*

## Project Information

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# Ghajnsielem Playground

*Reconfiguration of an existing playground.*


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# *Ghajnsielem Playground*

*Reconfiguration of an existing playground.*

## Project Information

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## NCWR in River Basin Management Planning
## A Case Study from Malta

**Manuel Sapiano**
**Chief Executive Officer**
**Energy and Water Agency - Malta**

WED 15TH MARCH, 2023

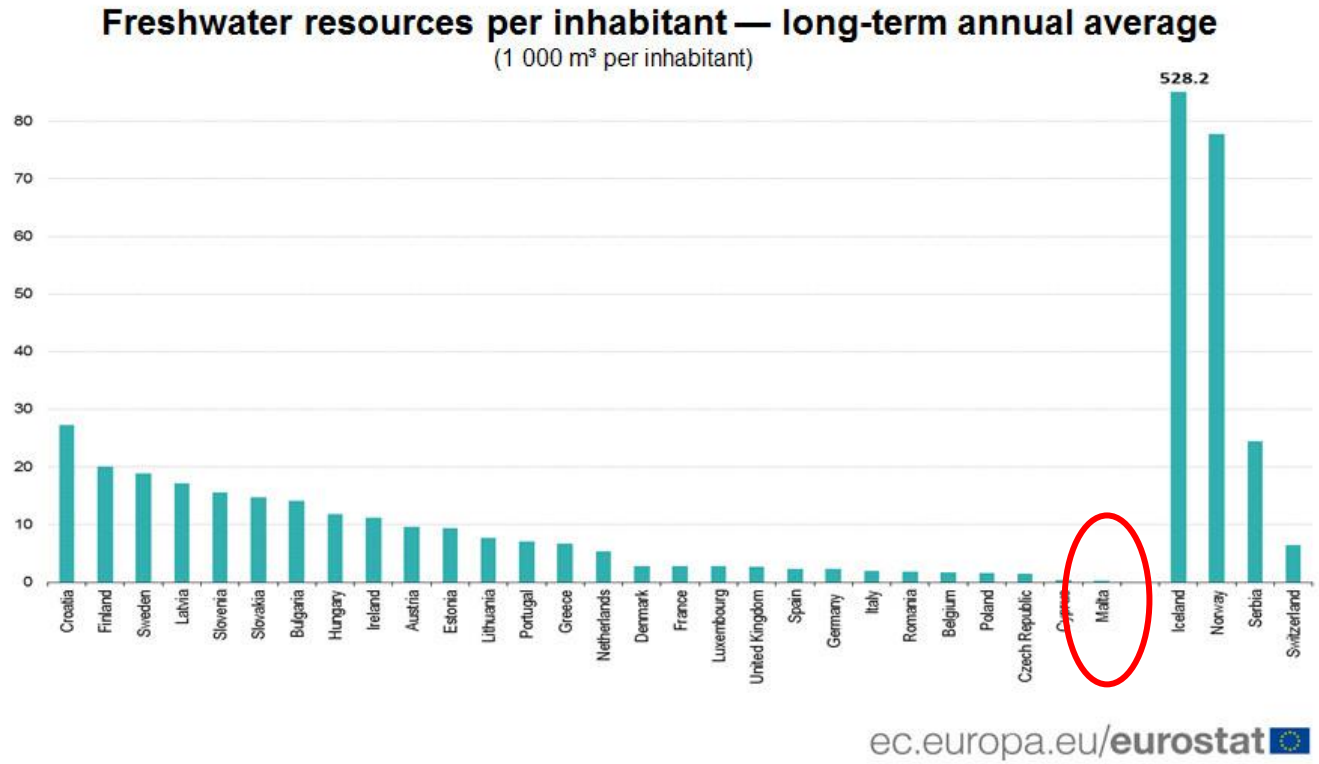
WATER.ORG.MT

# Baseline

Managing water resources in the Maltese Islands starts with a deep recognition of reality.

Natural water resources, on their own, are not sufficient to meet the national water demand.

And national water demand is increasing as a result of an increasing population, expanding economic activity and climate change impacts.

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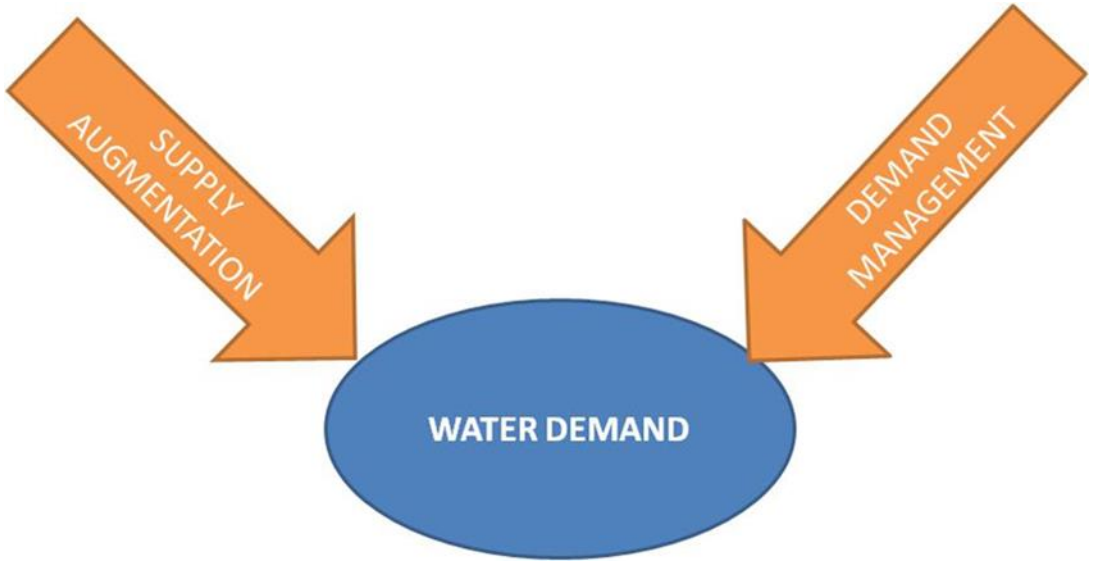
# Policy Framework

Malta's water management framework is therefore based on a two-pronged strategy to achieve security of water supply.

The framework places as specific focus on water demand.

Aims to meet water demand through the conjunctive use of water supply augmentation and water demand management measures, in an increasingly sustainable manner.

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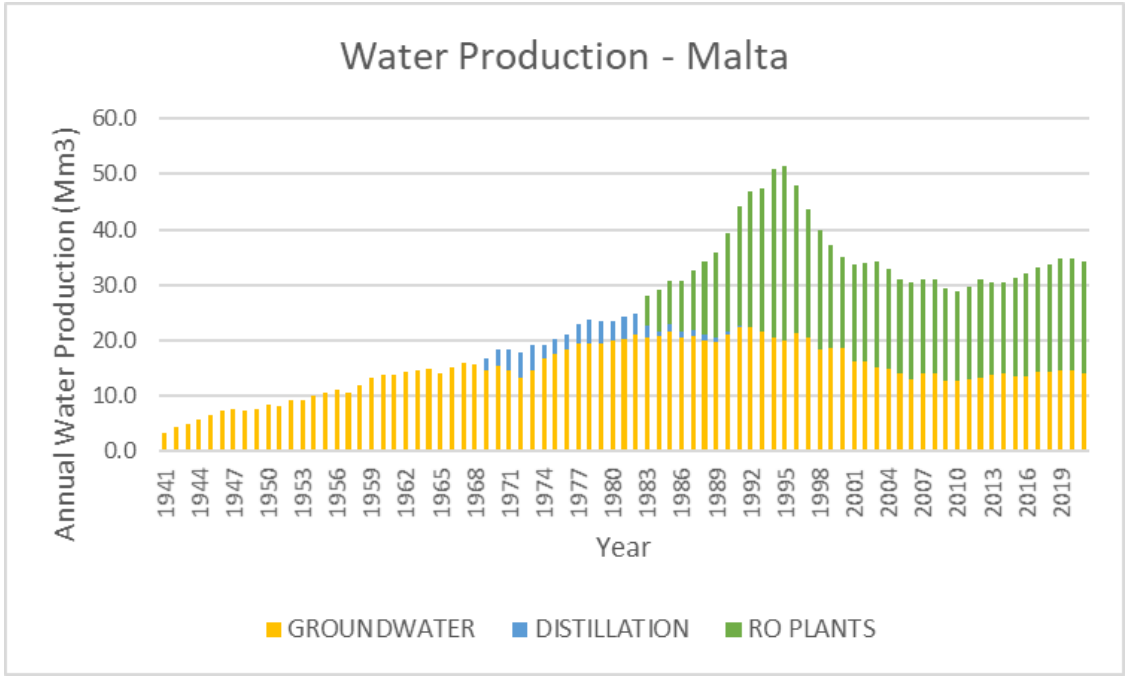
# Water Demand Management

Considered as the first level measure in the “water action hierarchy”.

If left uncontrolled, water demand will increase and efforts to increase supply will be futile.

Water demand management measures applied in Malta include:

- Leakage Management Programme
- Economic Instruments
- Water Efficient Irrigation Techniques
- Consumer Engagement Programs

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# Water Supply Augmentation

Can be implemented in two ways:

(1) Increasing the supply from existing water resources, or

(2) Diversifying the water resource-base through the introduction of different (alternative) water resources.

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# Water Supply Augmentation

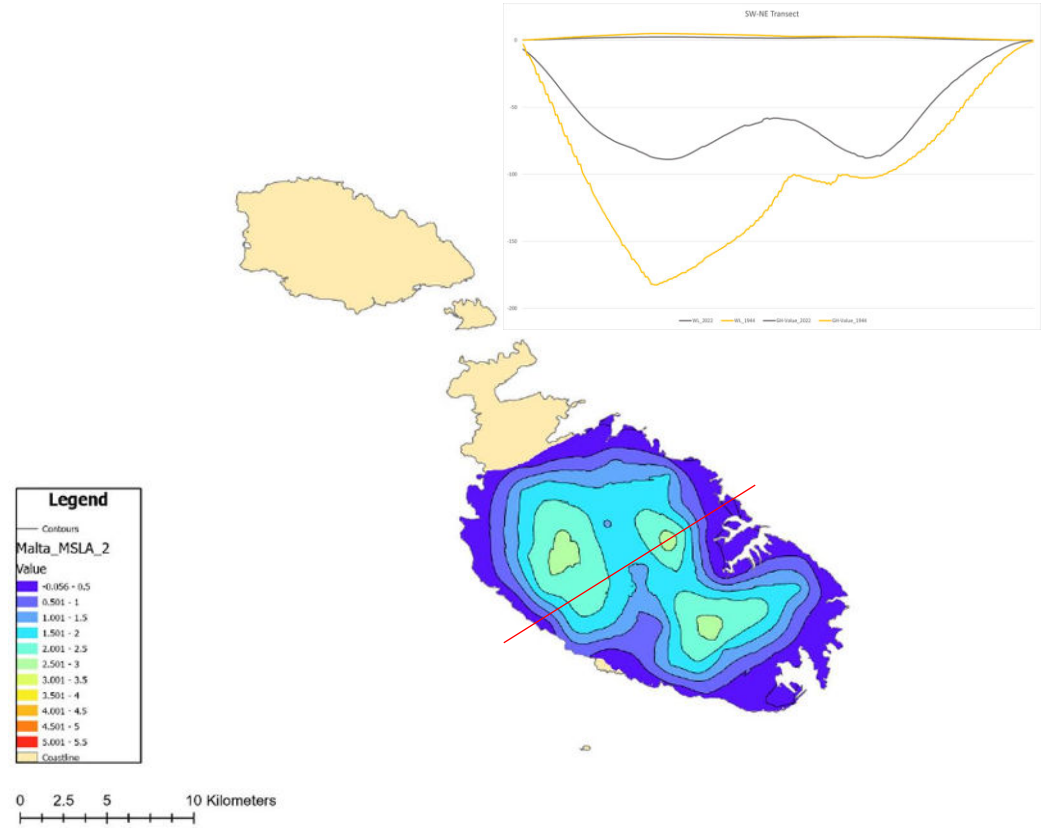
Increasing supply from existing resources:

Perched Aquifer systems – limited supply capacity, and extensively developed.

Mean Sea Level Aquifer systems – over-abstracted and suffering localized deterioration.

Increased dependence on groundwater aquifer systems is not a feasible option any longer.

Groundwater needs to be restored as a strategic reserve.

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# Water Supply Augmentation

Diversifying the Water Resource Base:

Entails the development of other water resources in addition to (to supplement) groundwater resources.

Non Conventional Water Resources of relevance to Malta are:

- Rainwater Harvesting
- Sea-Water Desalination
- Wastewater Treatment and Reuse
- Greywater Reuse

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# Historical Context

Rainwater Harvesting

Need to balance water availability from the wet to the dry season, when there was no organized water supply.

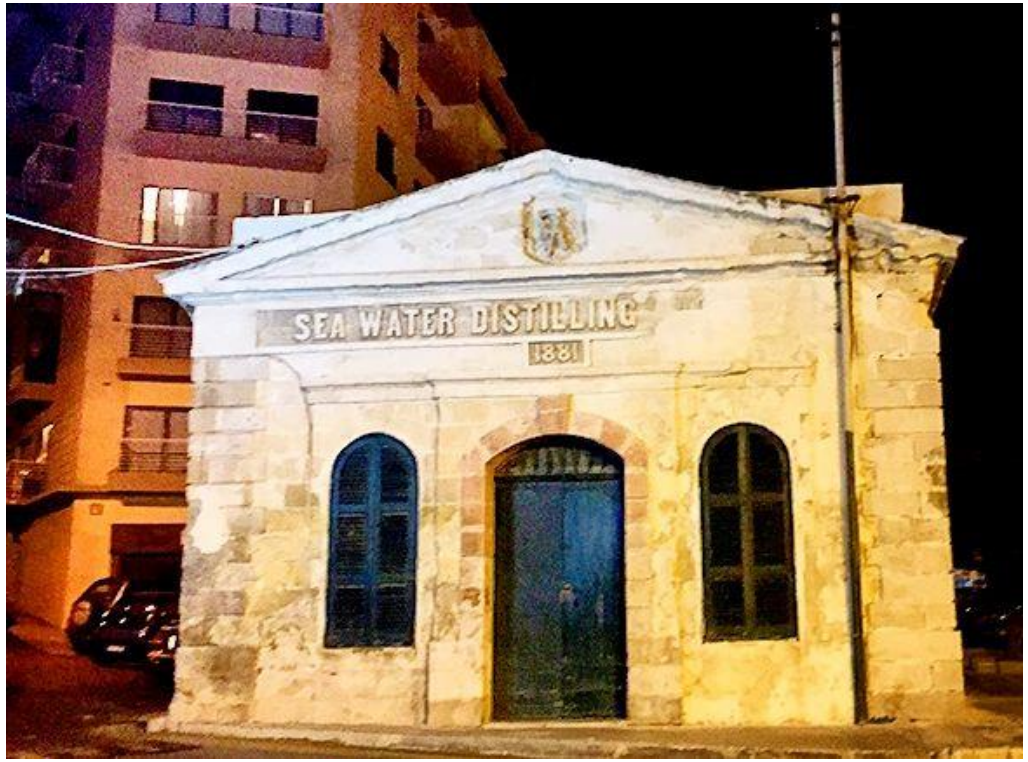
As a technique introduced (most probably) during the Neolithic Period.  Probably reinforced during the Arab period.

Represented an important element in fortified cities – increasing reliance of water supply in case of siege.

# Historical Context

Scarcity of natural water resources led Malta to introduce other NCWRs at an early stage:

i. Sea-water distillation in the 1880's
ii. Small scale wastewater reuse plants for landscape irrigation – 1950's
iii. Multi-stage flash desalination - 1960's
iv. Reverse Osmosis Sea Water Desalination - 1982
v. Sant Antnin Wastewater Treatment Plan – 1983

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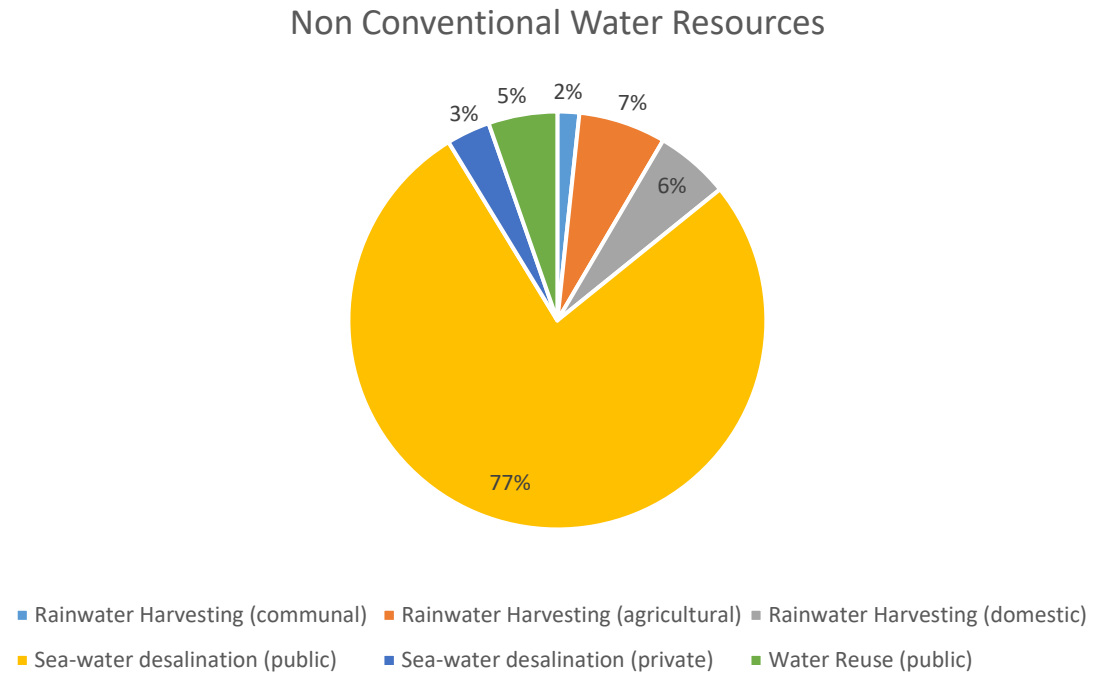
# Non Conventional Water Resources

Which are the Non Conventional Water Resources in use in Malta?
What is the production capacity of each NCWR?

| NCWR – type | Capacity 2022 (Mm3/year) |
|---|---|
| Rainwater Harvesting (communal) | 0.5 |
| Rainwater Harvesting (agricultural) | 2 |
| Rainwater Harvesting (domestic) | 1.7 |
| Sea-water desalination (public) | 22.8 |
| Sea-water desalination (private) | 1 |
| Water Reuse (public) | 1.58 |
| Water Reuse (private) | n/a |

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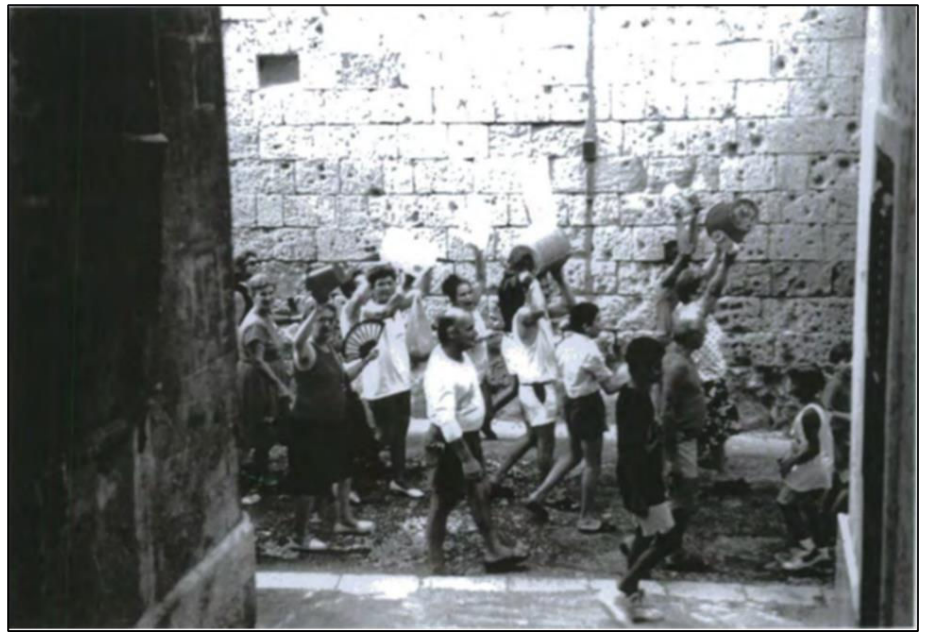
# Non Conventional Water Resources

Historic adoption of NCWR has mainly been on a localized level, close to the point of use:

- Rainwater harvesting at the household level,
- Rainwater harvesting at agricultural fields, or
- Water reuse for landscaping at the complex level.

Large-scale adoption of NCWR started with sea-water desalination to address municipal water supply. Mainly in response to groundwater quality deterioration in the 1960's and large-scale water unavailability in the 1980's.



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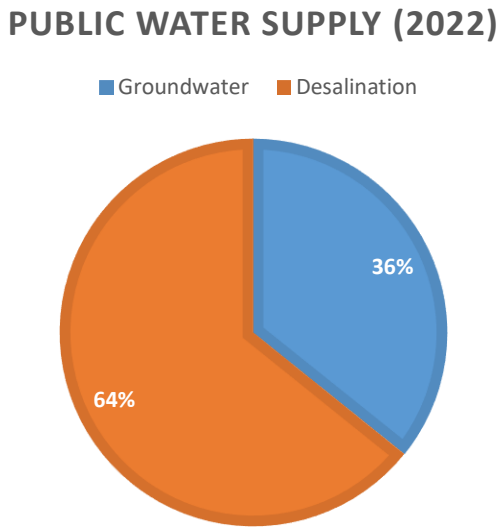
# Non Conventional Water Resources

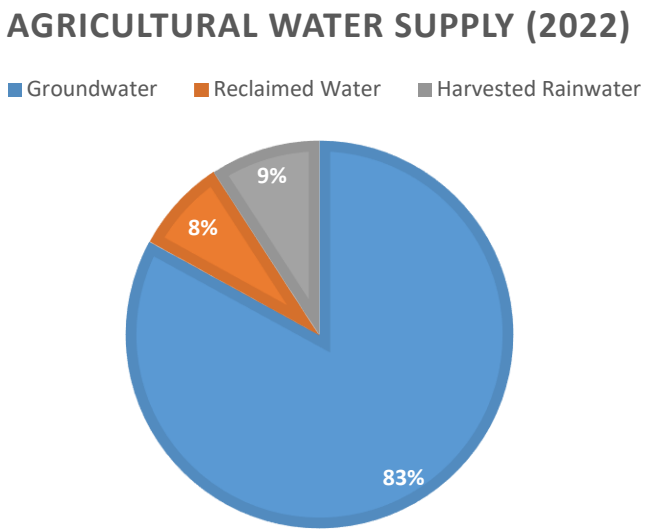
Strategic Consideration centered on the diversification of supply:

(i) Municipal Supply: Blending of desalinated Sea-water for and groundwater

(ii) Agricultural Supply: Increasing the share of reclaimed water

(iii) Maintaining groundwater as a strategic reserve in case of failure of main NCWRs.

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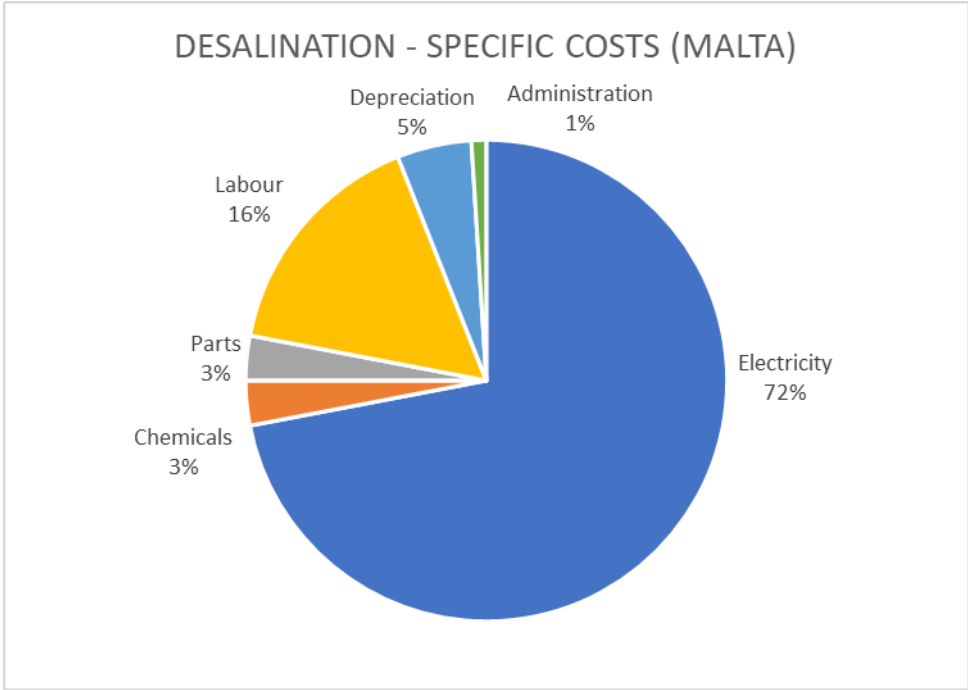
# Nexus Approach

Increased consideration to the Water-Energy-Food-Ecosystems nexus

Energy – Water: Energy requirements for water production

Water – Food: Production of water to sustain agriculture

Water – Ecosystems: Use of NCWRs in substitution of groundwater to sustain groundwater flow to ecosystems.

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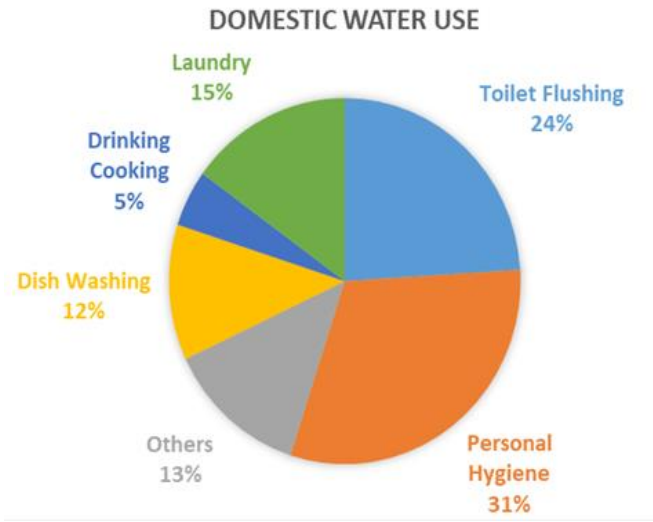
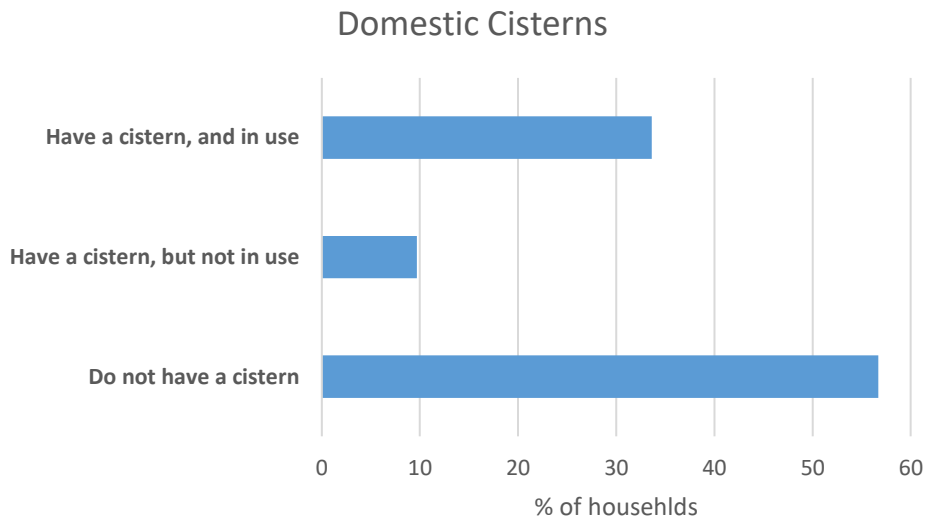
# Future Outlook

New investments in the optimization of desalination plants and the extension of the New Water programme are planned in the coming years.

Additionally increased focus on rainwater harvesting and greywater recycling is also planned.

What is the potential for these NCWRs? At household level and at municipal level?

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# Measures in 3rd RBMP

Measures planned in the 3rd RBMP related to the promotion of Non Conventional Water Resources

| Measure Typology | Measure Name | Responsible Entity |
|---|---|---|
| Infrastructural | Upgrade programme for sea-water desalination plants | Water Services Corporation |
| Infrastructural | Extension of the New Water network | Water Services Corporation |
| Infrastructural | Rehabilitation of existing and development of new communal reservoirs | Energy and Water Agency, Project Green, Public Works Department, Infrastructure Malta |
| Infrastructural | Rehabilitation of Valley Systems (Catchment Areas) | Project Green, Ministry for Gozo |
| Support | Consumption Audits for Households and Commercial Entities | Energy and Water Agency |
| Support | Scheme for the Rehabilitation of Domestic Reservoirs | Regulator for Energy and Water Services |

# Measures in 3rd RBMP

| Measure Typology | Measure Name | Responsible Entity |
|---|---|---|
| Support | Scheme for promoting domestic greywater recycling systems | Energy and Water Agency |
| Support | Scheme for promoting greywater recycling systems in hotels | Energy and Water Agency |
| Support | Financing schemes for supporting NCWR installations in commercial entities (included) | Malta Enterprise |
| Regulatory | Capacity for effective enforcement of regulations on rainwater harvesting cisterns in urban development | Buildings and Construction Authority |
| Support | Scheme for the Rehabilitation of Domestic Reservoirs | Regulator for Energy and Water Services |
| R&I | Support for Research and Innovation Projects focusing on Non Conventional Water Resources | Energy and Water Agency |

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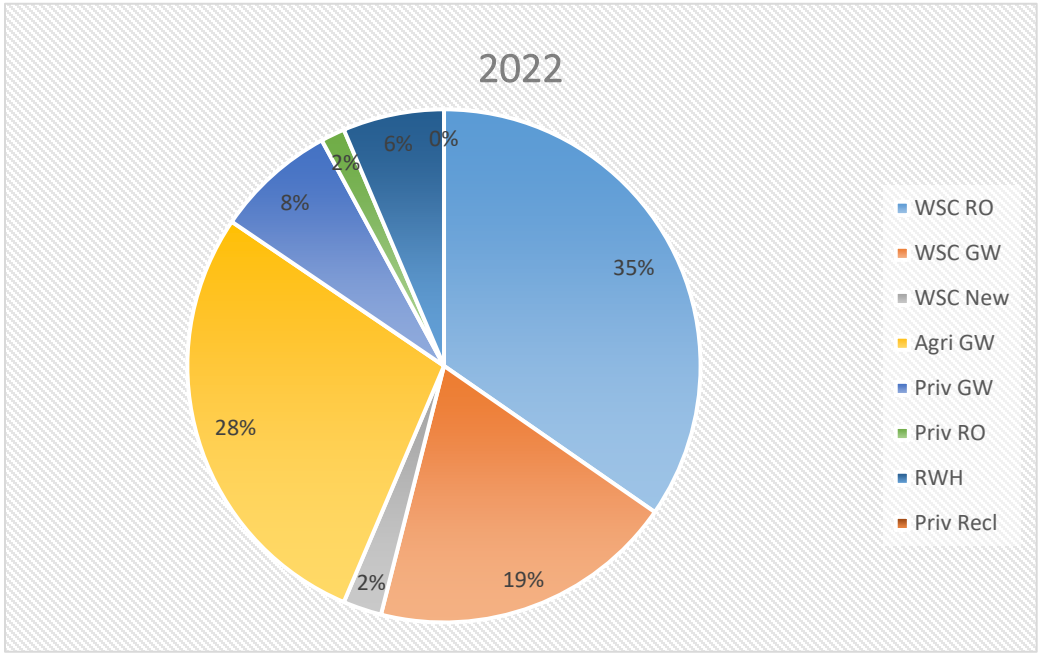
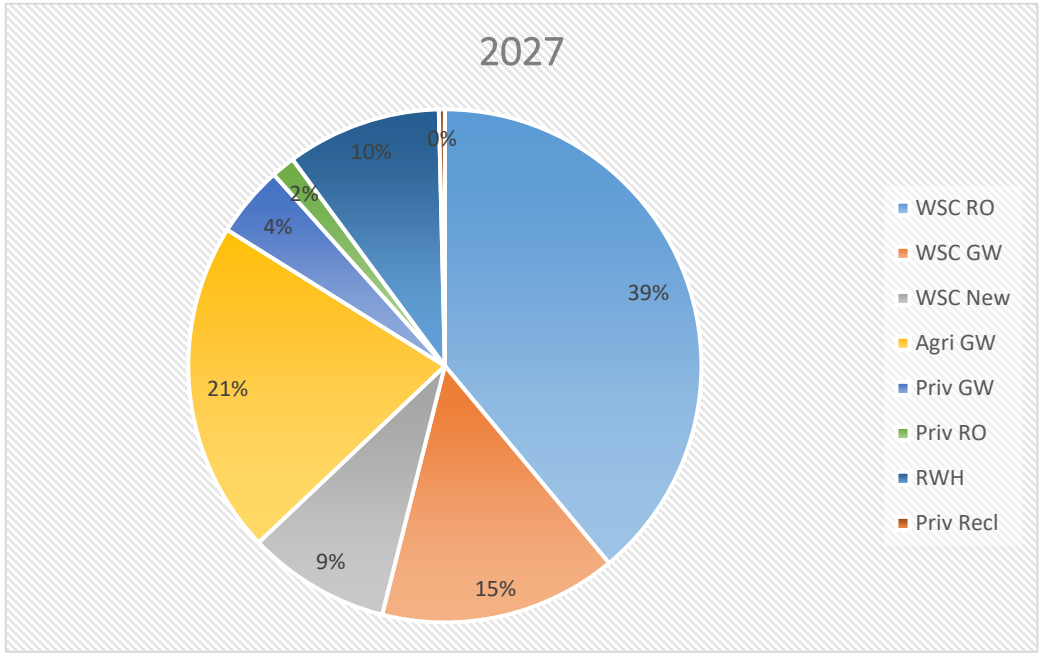
# Measures in 3rd RBMP

Projected Impact:

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# Alteraqua

Pilot Project for the rehabilitation of communal reservoirs, with a specific focus on the eventual use of the harvested rainwater runoff – such as for urban greening, and other secondary uses.

Project is focusing on Kottonera, with the rehabilitation of historic reservoirs.

Includes a strong engagement element to promote rainwater harvesting as a sustainable water management technique.

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# Conclusions

In Malta, adoption of Non Conventional Water Resources is not an option but a must.

In this regard, the main challenge is to progressively move to more sustainable NCWR techniques.

Different challenges exist – hence need for adapting NCWR techniques for the characteristics of the country, and supporting their adoption.

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MINISTRY FOR THE ENVIRONMENT, ENERGY AND ENTERPRISE

MINISTRY FOR THE ECONOMY, EUROPEAN FUNDS AND LANDS

PARLIAMENTARY SECRETARIAT FOR EUROPEAN FUNDS

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EU funds for Malta 2014-2020

**Thank-you for your attention**

**Manuel Sapiano**
**manuel.Sapiano@gov.mt**

Operational Programme I – European Structural and Investment Funds 2014-2020
*"Fostering a competitive and sustainable economy to meet our challenges"*
Project part-financed by the Cohesion Fund
Co-financing rate: 85% European Union Funds; 15% National Funds

A CONFERENCE BY THE ENERGY & WATER AGENCY TOGETHER WITH THE GLOBAL WATER PARTNERSHIP (MEDITERRANEAN) ON:

# PROMOTING NON-CONVENTIONAL WATER RESOURCES IN MALTA

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WED 15TH MARCH, 2023

WATER.ORG.MT

# Integrating NCWR in Water Management Planning – A Case Study from Israel

Israel National Water Authority

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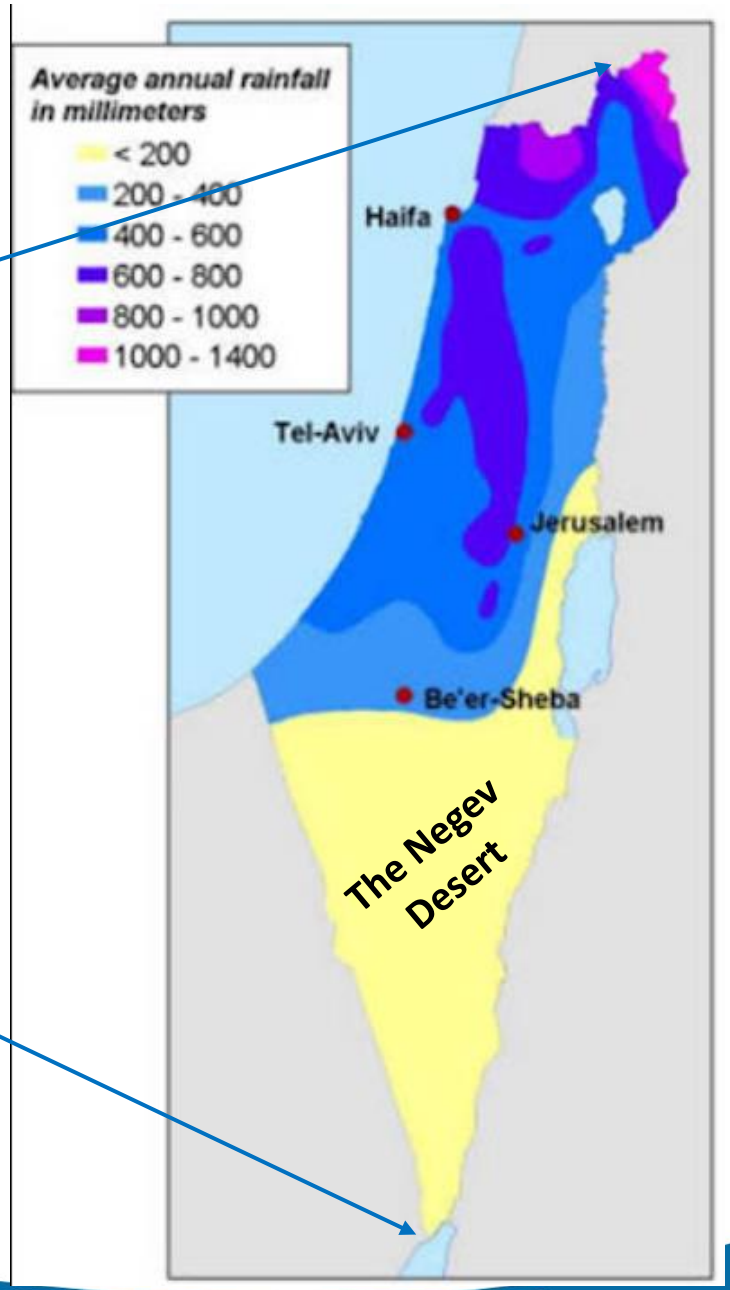
# The Region and the Climate

- Israel has a Mediterranean climate
- It is situated at the edge of a desert
- Within a length of 200 km, average annual rain drops from 700 to 150 mm
- Annual rain is highly variable
- Typically, periods of consequent draft years occur at least once in a decade.

# Water Uses in Israel

- ❑urban and industry
- ❑agriculture
- ❑regional supply
- ❑nature preservation

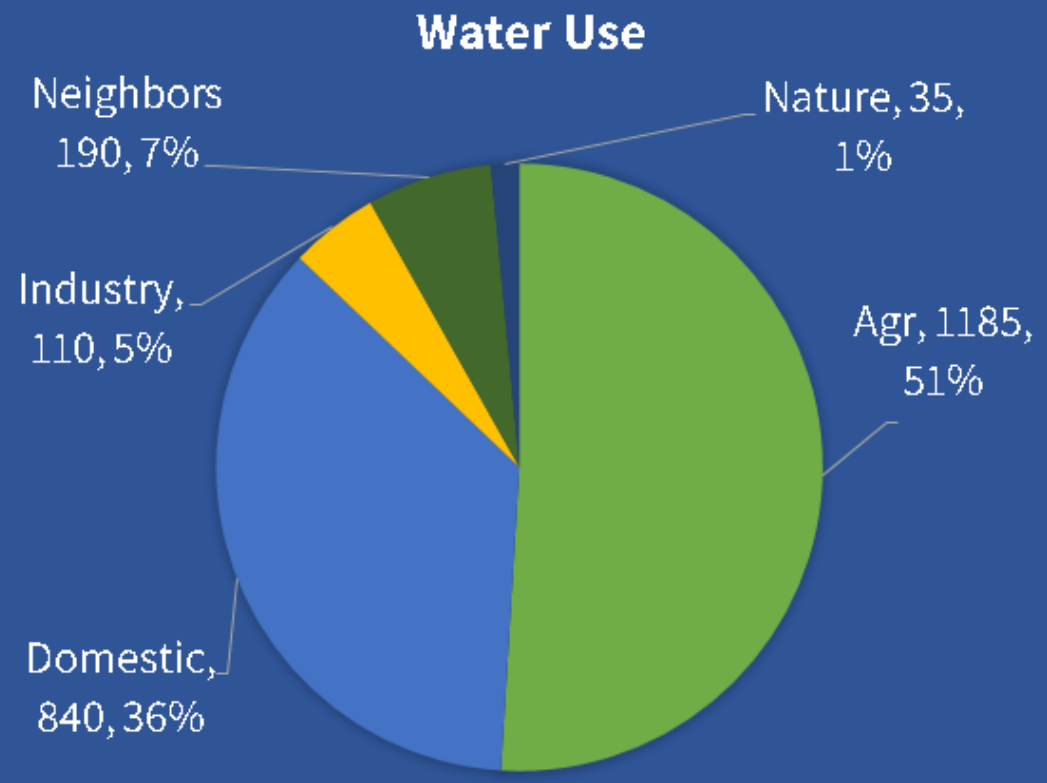
Population: 9 million
Water consumption:
**2,380 MCM**

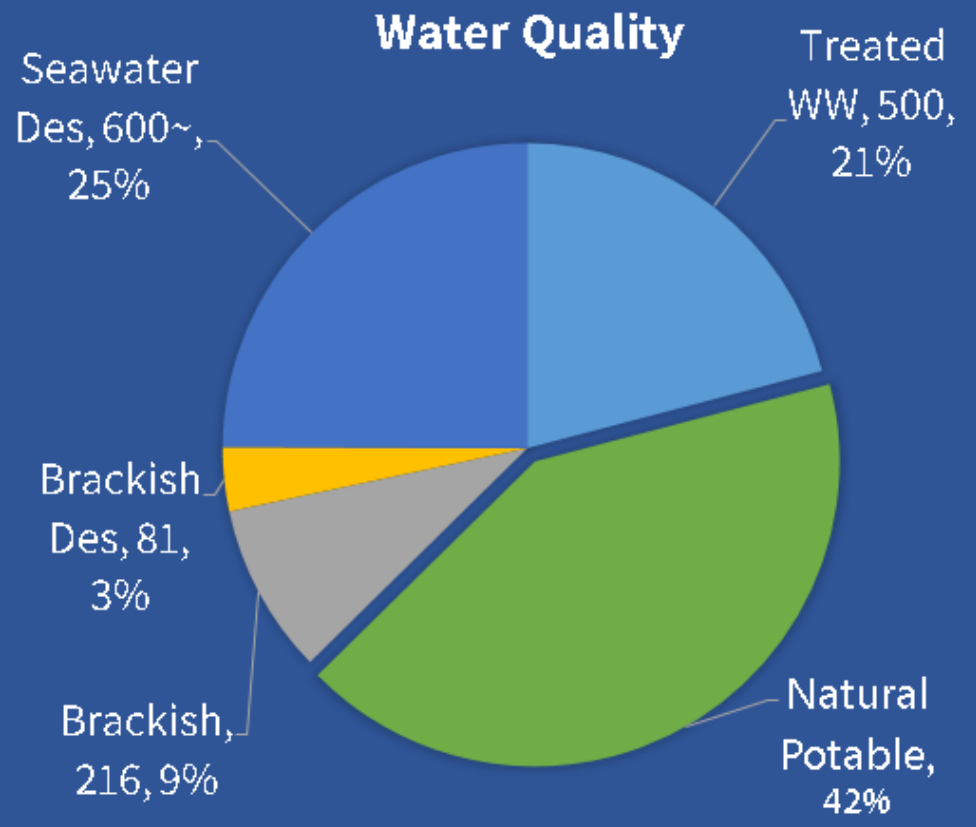
Population: 16 million
Water consumption:
**3,730 MCM**

**Year 2021**

**Year 2050**

# Water Balance 2021

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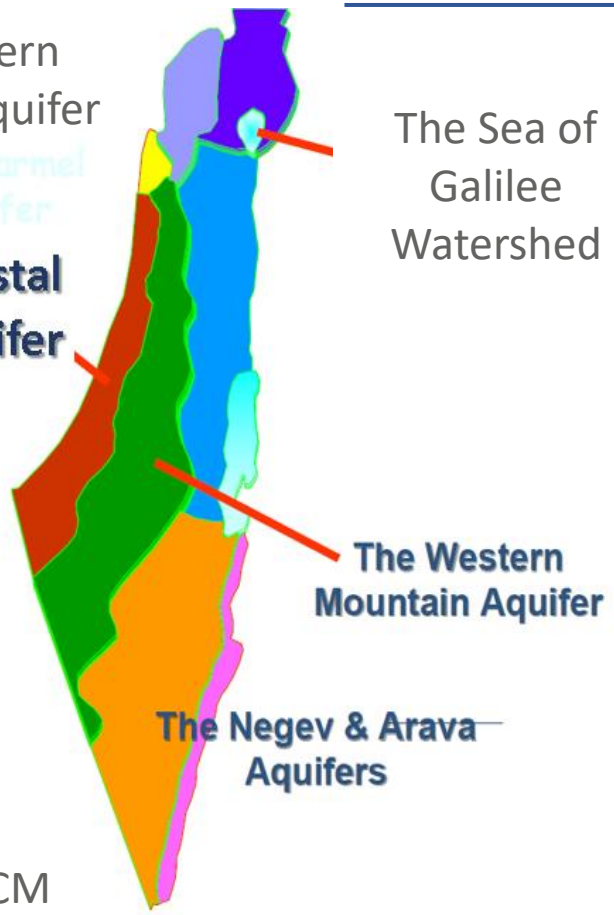
# Planning for Future Hydrological Conditions

- ❑ Strategic planning of the Israel Water Sector accounts for variability in the natural replenishment and prolonged periods of dry years
- ❑ Climate change scenarios are part of the sensitivity analysis of strategic plans to extreme conditions

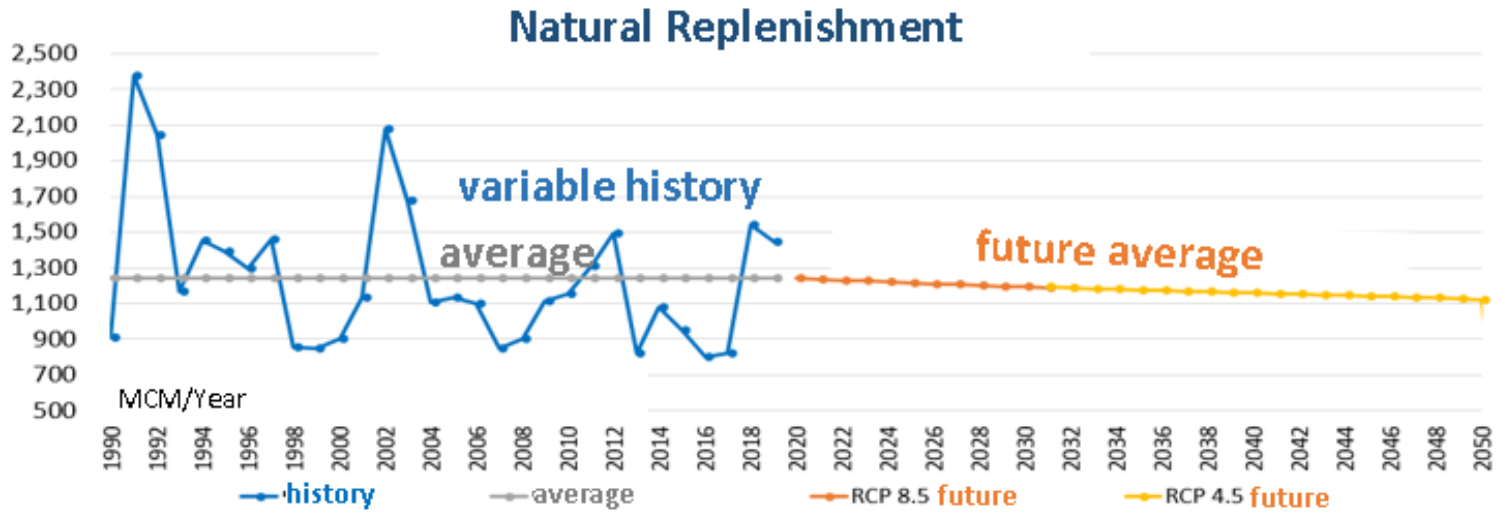
# Natural Water Resources in Israel

The Western Galilee Aquifer

The Sea of Galilee Watershed




Average:
1,250 MCM




Long-term planning of the Israel Water Economy is based on estimation of future climatologic and hydrologic conditions:

- ❑ Prolonged periods of dry years
- ❑ Decrease in natural water availability

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# The Four Pillars of Water Sector Management

- **Ownership:** water resources belong to the public and are managed by the government to the benefit of the people;
- **Precise measurement:** according to the law, all water that is consumed must be measured and recorded;
- **Centralized management:** the responsibility for water management rests with the Water Authority which makes all decisions related to water supply;
- **Self-financing:** Israel's water sector is financially closed economy that provides its own funding for development, with about 40% of the water bill earmarked for new water supply projects.

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# Closing the Gap Between Demand and Natural Water Supply

- Sustainable management of natural water resources
- Development of artificial water resources:
  - Seawater desalination (potable uses)
  - Water treatment and reuse
  - Brackish water desalination

} agricultural uses

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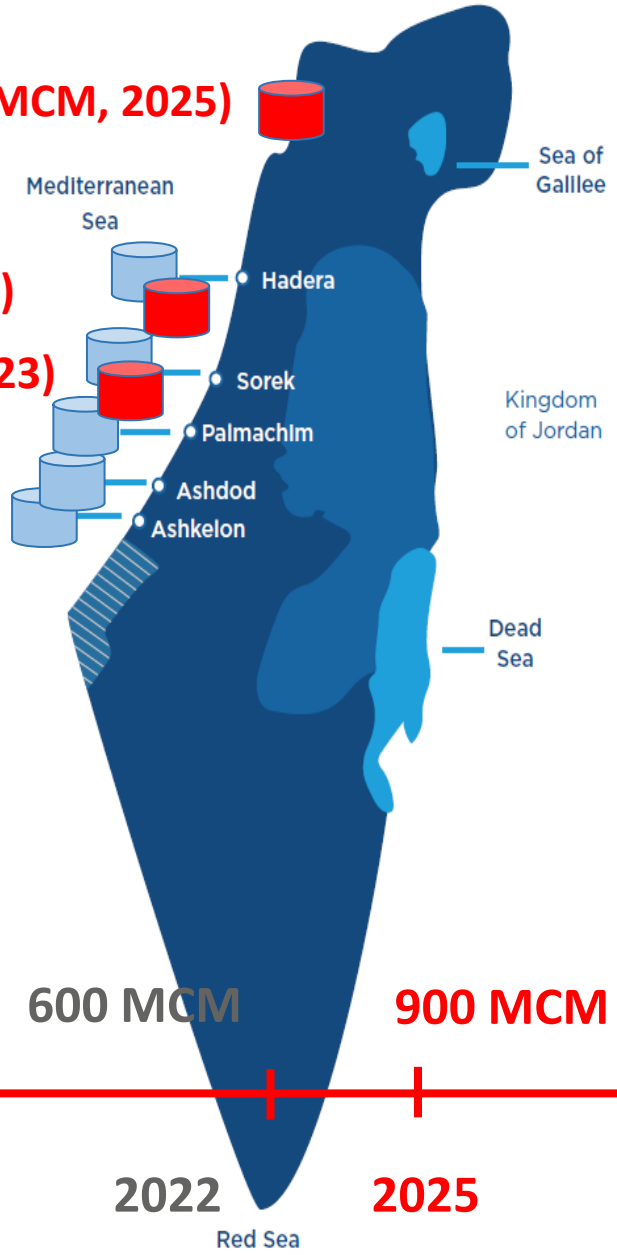
# Sea Water Desalination

## Existing Desalination Plants and Future Capacity

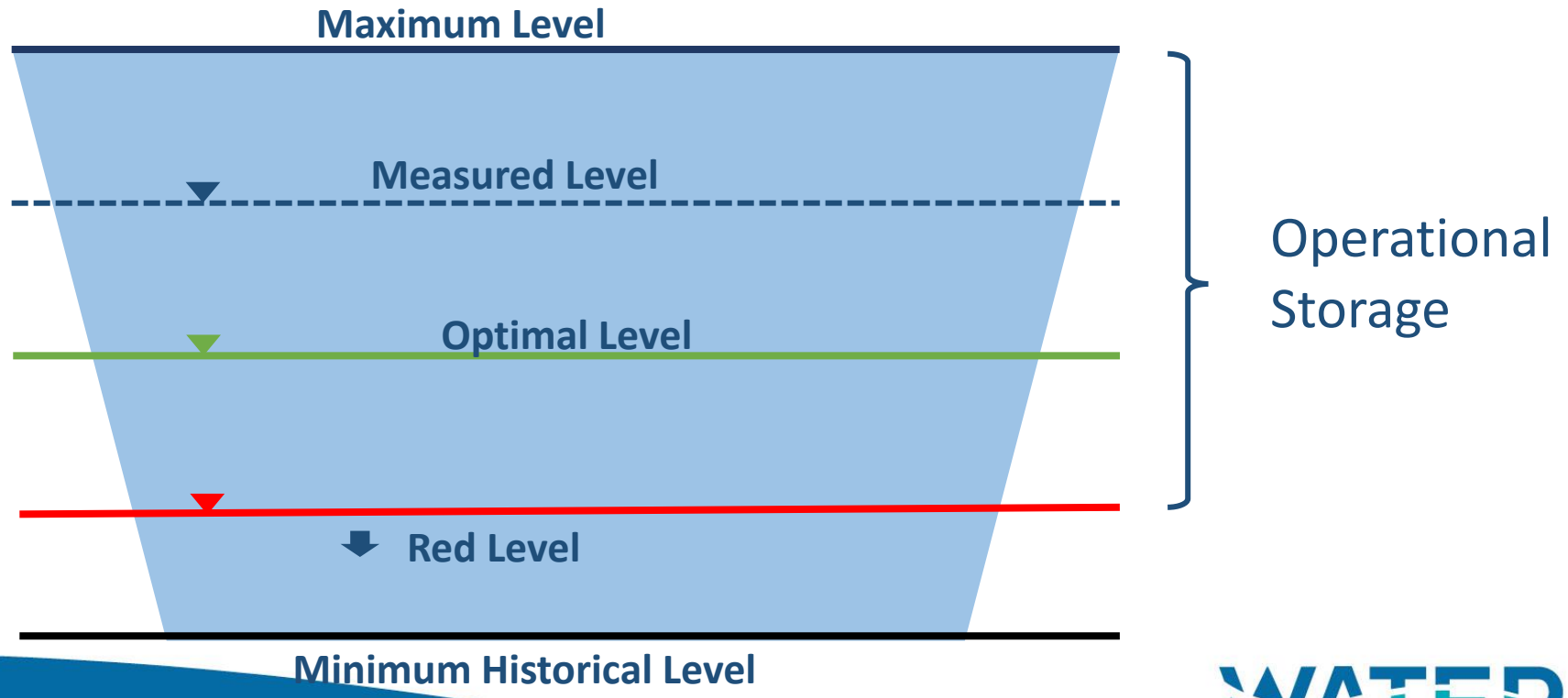



120 MCM | 600 MCM | 900 MCM | 1,100 – 1,200 MCM | 1,500 – 1,700 MCM

2005 | 2022 | 2025 | 2032 | 2050

# Sustainable Management of Natural Water Resources

Operational and Planning Objective:
Use of the natural water sources while keeping **hydrologically optimal water levels**.
For each natural water resource the operational storage is defined by:

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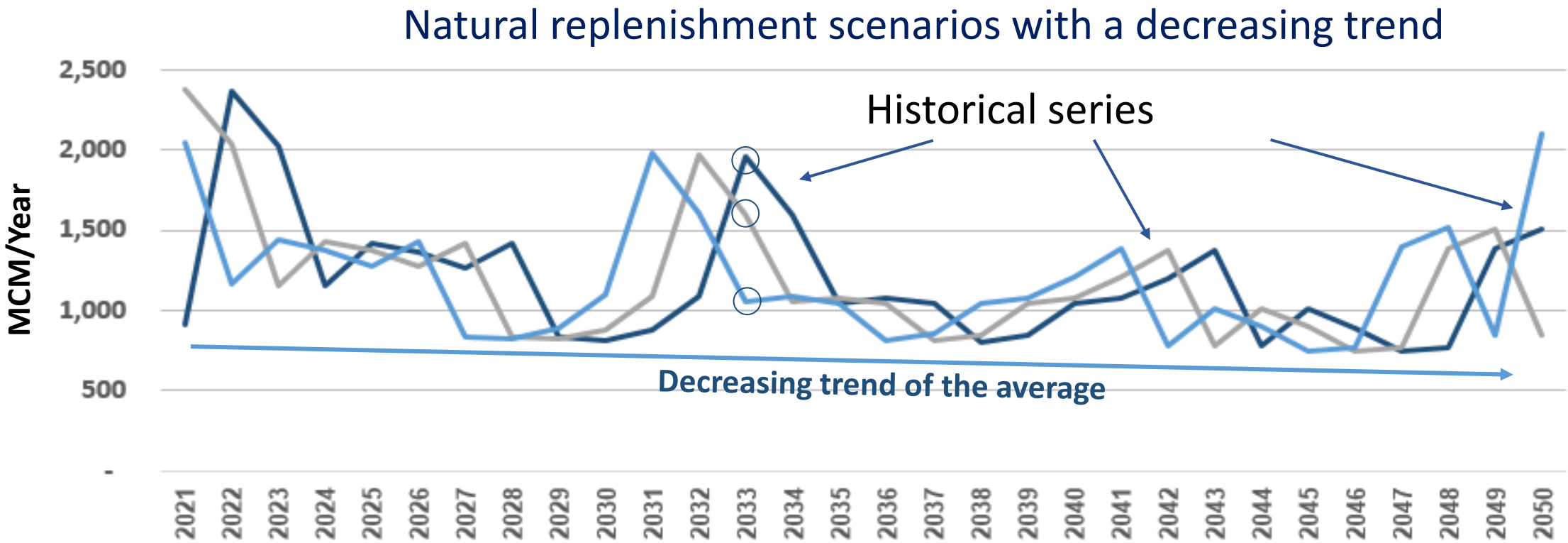
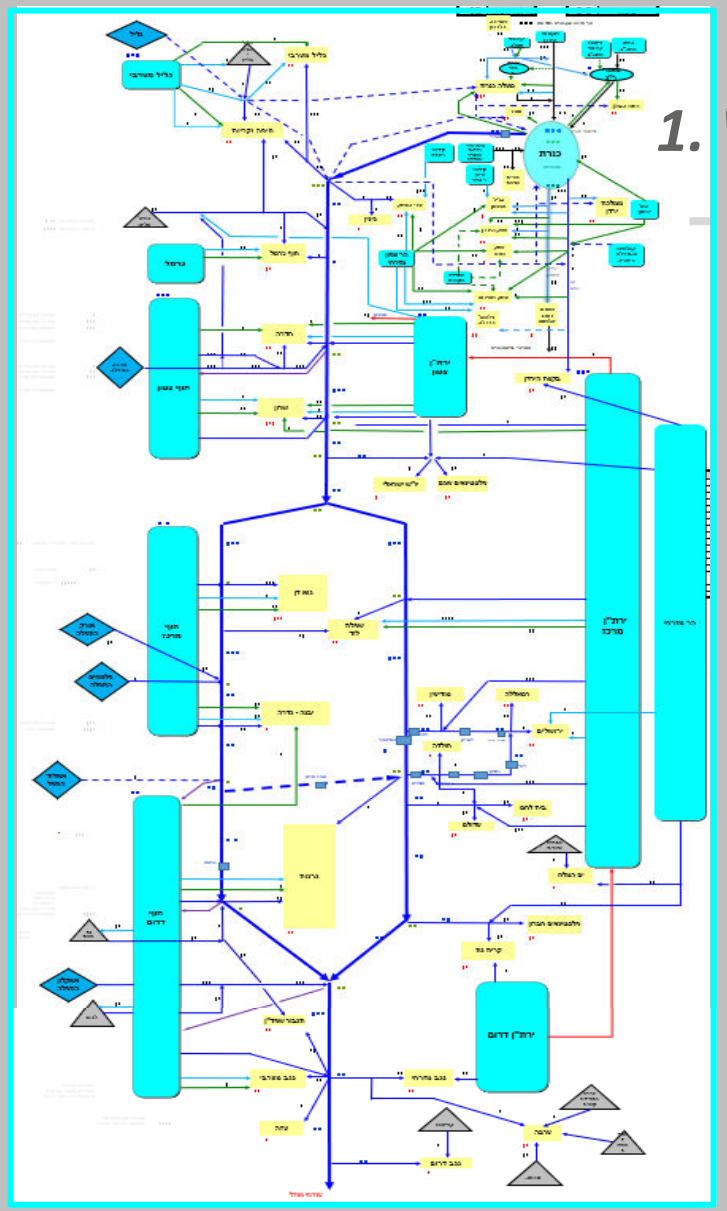
# Planning Required Desalination Capacity




- ❑ 30 years of observed data transformed into 30 scenarios of natural replenishment
- ❑ 30 hydrologic realization in each year
- ❑ Maintained hydrologic “memory”
- ❑ A 10% decrease trend applied to account for the climate change effect

# Use of analytical tools for simulation of future water balance:



## *1. Water Evaluation and Planning System*

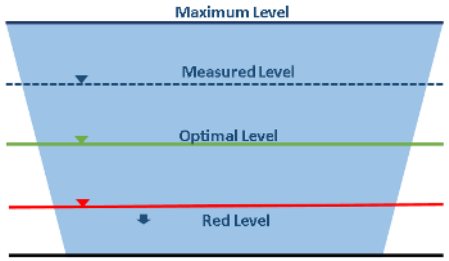
***The Stockholm Environment Institute***

- water demand scenarios
- regional water needs
- hydrologic scenarios
- climate change trends
- policy for water resources preservation.

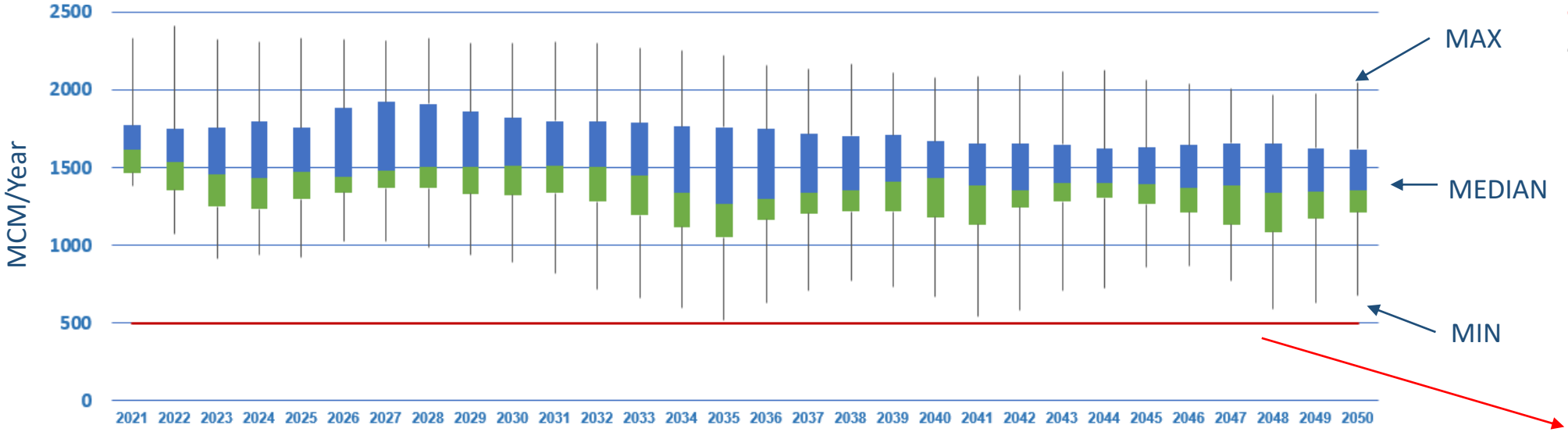

***The National Water Supply System***

# Planning Required Desalination Capacity

WEAP model: examples of simulation results

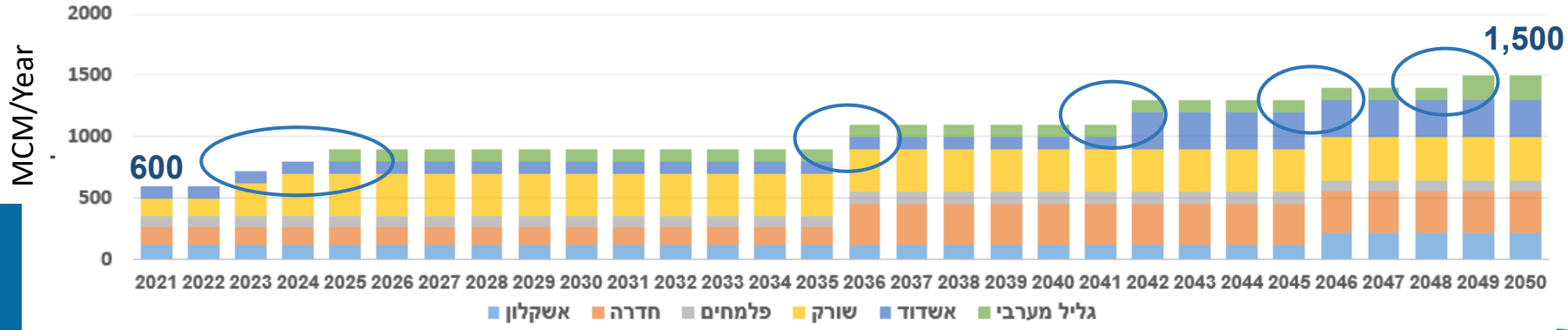



Total volumes of water in natural sources: statistical distribution of 30 hydrologic scenarios




Minimum required level (reference for expansion of seawater desalination capacity)

Required expansion of seawater desalination capacity (no climate change)

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# Planning Water Conveyance


## The National Water Supply System

- Originally designed to supply water from the North to the South; supply of desalinated sea water requires change in the direction and a more flexible conveyance system.
- Remote regions that relay only on local water sources are to be connected to the NWS.
- The Sea of Galilee is to be preserved as a water resource of strategic importance (quantity & quality); in dry conditions, the NWS will supply water to the Sea of Galilee.

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# Financially Closed Water Economy

- All investments in drinking water supply are to be covered by water tariffs

Average annual investment (approx.):

| Type of investment | Estimate (Million Shekel/Year) |
|---|---|
| Mekorot – the National Water Supply Company (The National Water Carrier & more) | 1,500 |
| Desalination Capacity | 400 |
| Municipal and Regional Water Utilities | 1,200 |
| Other projects | 400 |
| **Total** | **3,500** |

**1,000 Million Euro**

# Recycling Wastewater

Year 2020:

**850 MCM/year of domestic use**

**620 MCM/year of sewage**

**95% treated**

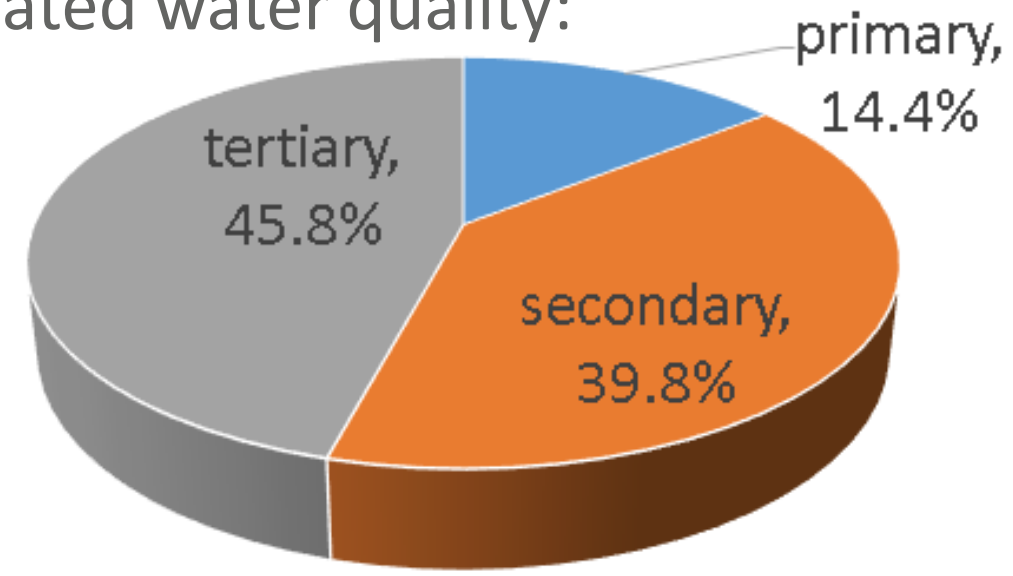
**15% discharged to nature (streams/sea)**

**82% reused, mostly for irrigation**

**484 MCM/Year used for irrigation**

- Future agriculture development will relay on treated wastewater:
  - Reliable water resource
  - Lower costs comparatively to desalination

## Treated water quality:

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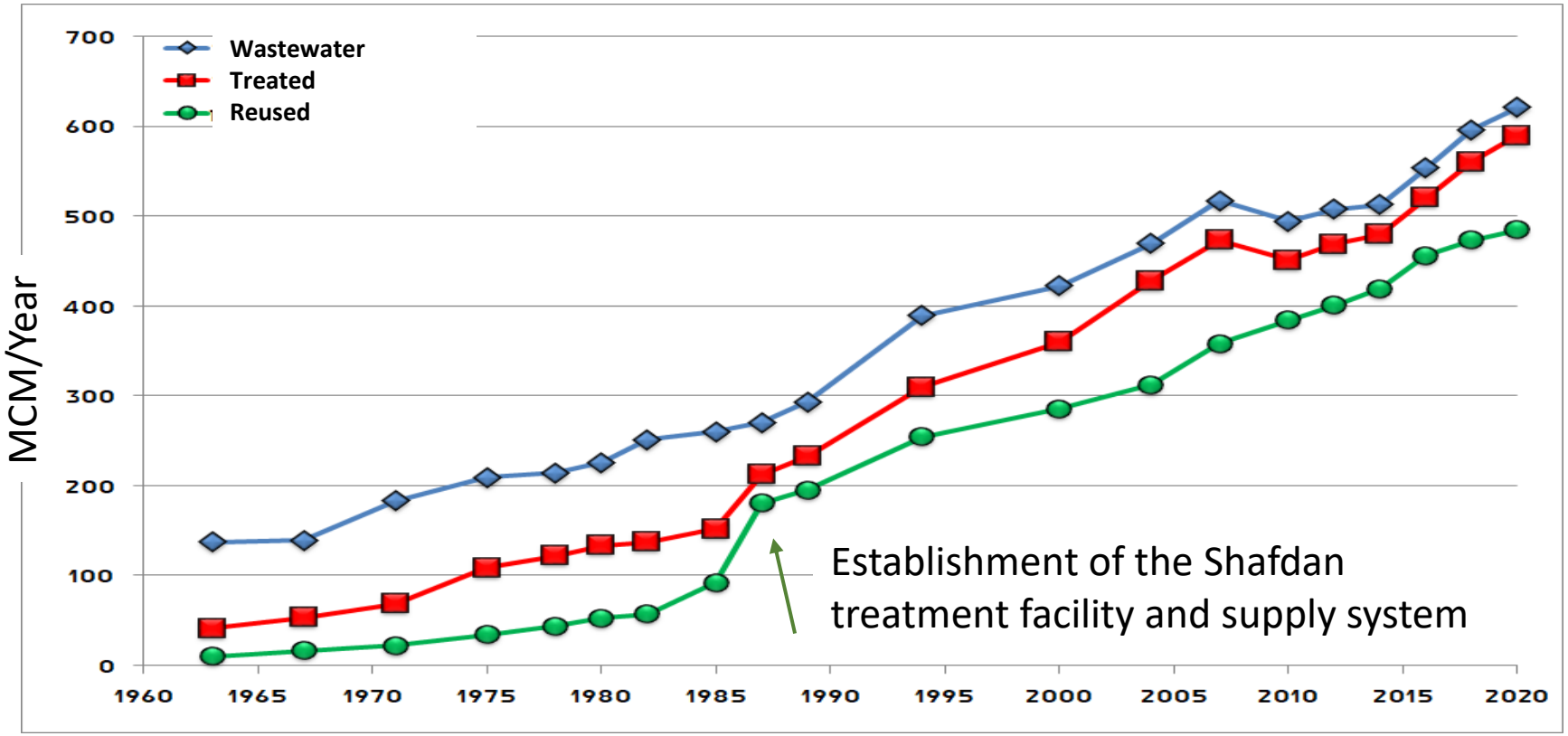
# Trends in Wastewater Treatment and Reuse

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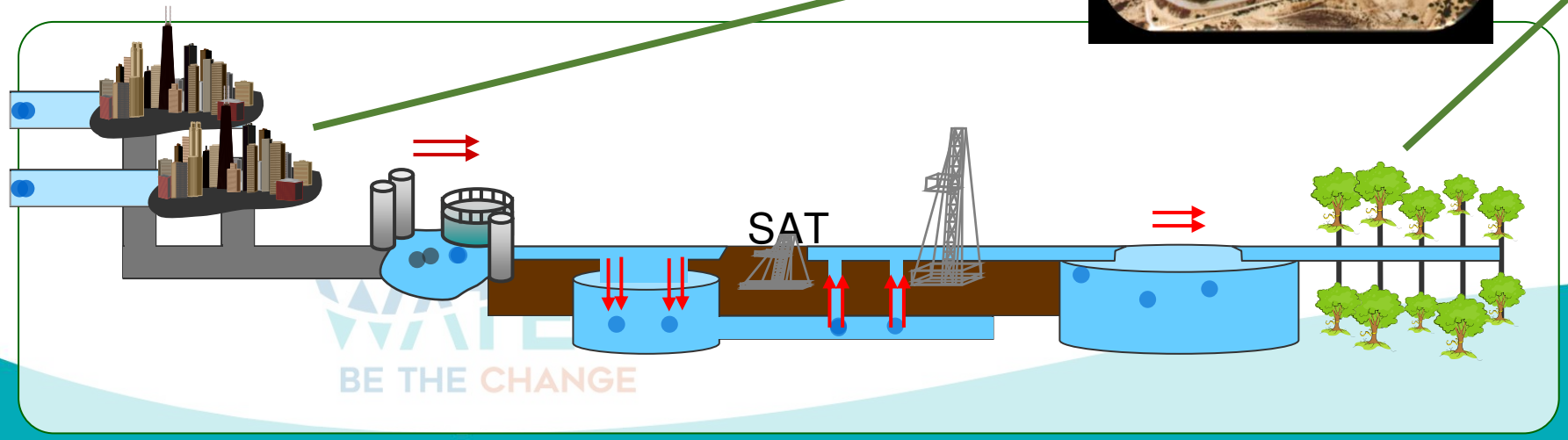
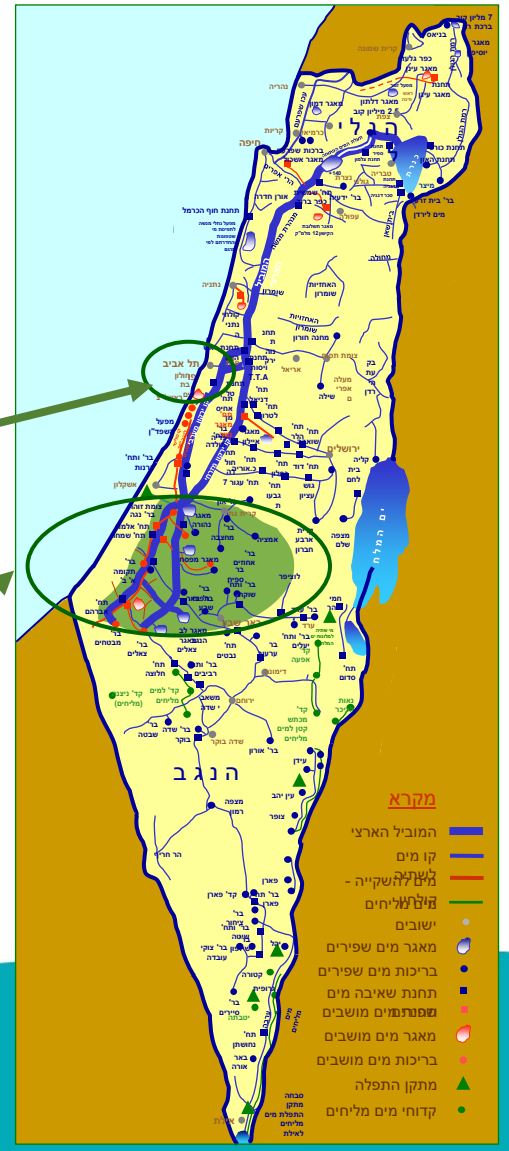
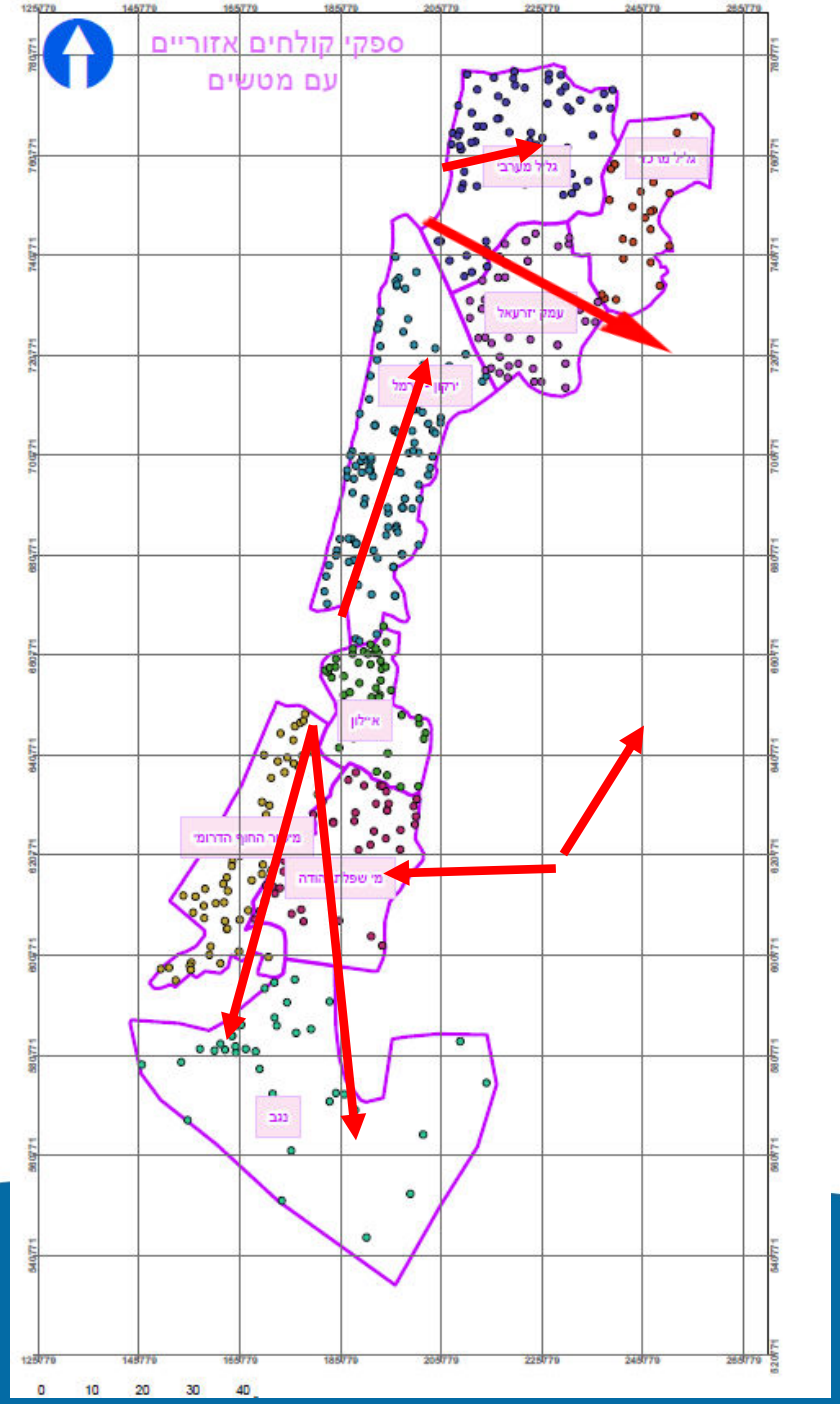
# Shafdan Water Treatment Facility

- 146 MCM of sewage from the Israel central area
- Secondary treatment & SAT (soil-aquifer treatment)
- 6 infiltration fields
- 150 recovery wells
- 90 km of water supply lines
- 32 pumping stations and reservoirs.
- Required investments ~1,200 euro (2050)






# Planning of the Treated Wastewater Sector

Challenge: large physical distance between the majority of sources and majority of consumers:

- Required investments in storage and conveyance infrastructure
- Uncertainty regarding demand for treated wastewater and tariffs

Tackling the Challenge: a reform in Treated Wastewater Sector (in progress):

- Establishment of large, regional water suppliers

Objective:

- Establishing water supply to all consumers (farmers)
- Long-term planning based on a regional perspective
- Improvement  of operational efficiency and maintenance

Necessity:

- Ensuring financial support from the Government: required investments estimated to 1,300 million Euro (up to year 2050).

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# Dilemmas in Treated Wastewater Sector Planning

- Financial responsibility for wastewater treatment: the polluter (municipalities) vs. the user (farmers)
- The right level of the treated wastewater quality (standards for irrigation purposes, standards for discharge to natural environment; risks related to micro pollutants)
- The future needs of agriculture (self sufficiency in food production vs. food import?)
- Farmers' "willingness to pay" for water
- Land-use competition issues when planning recycled water infrastructure.

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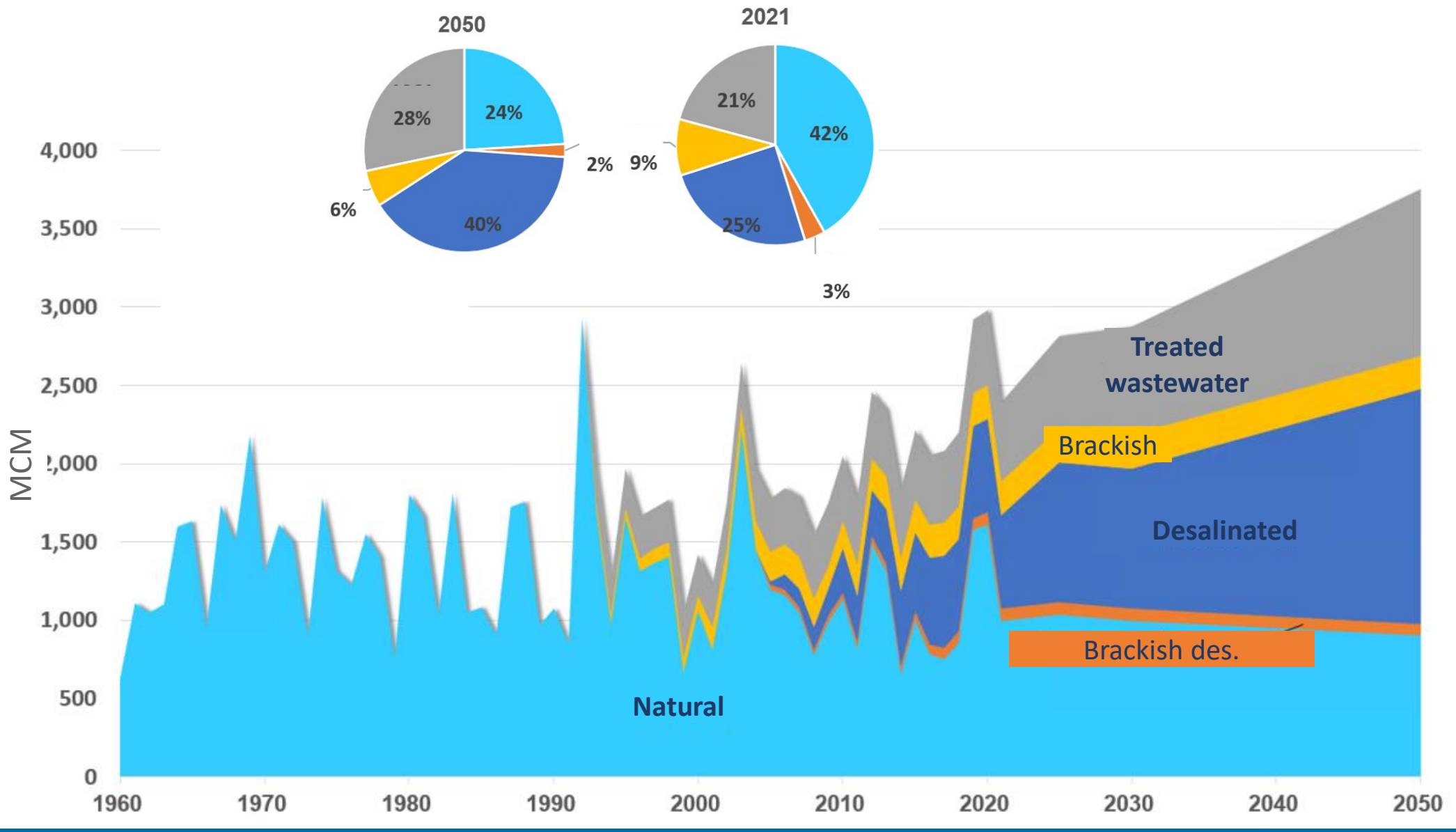
# Future Trends in Water Sources in Israel



# Thank You

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MINISTRY FOR THE ECONOMY, EUROPEAN FUNDS AND LANDS

PARLIAMENTARY SECRETARIAT FOR EUROPEAN FUNDS

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EU funds for Malta 2014-2020

alter aqua

WATER SAVING CITIES Kottonera

Global Water Partnership Mediterranean

THE ENERGY & WATER AGENCY

THE Coca-Cola FOUNDATION

GSD Marketing Ltd

KOTTONERA FOUNDATION

Il-Kalkara

Bormla

Il-Birgu

L'Isla

L-Università ta' Malta

IL-ĠIRJUN

Operational Programme I – European Structural and Investment Funds 2014-2020
*"Fostering a competitive and sustainable economy to meet our challenges"*
Project part-financed by the Cohesion Fund
Co-financing rate: 85% European Union Funds; 15% National Funds

**Prof. Konstantinos Plakas gave his presentation online. The video can be accessed here: https://youtu.be/owQ7kAfIQM4**

# 5. Images

Below one can find a number of images that were taken during the event.

## 5.1 Conference Area and Set Up

The conference was held at Esplora Interactive Science Centre offering full conference facilities and exhibition area.


PROMOTING NON-CONVENTIONAL
WATER RESOURCES IN MALTA
WATER


WATER
ALTER AQUA


WHY
WHAT

## 5.2 Registration Desk

A registration desk was provided in order to greet the participants.

## 5.3 Signage indicating direction to conference

Signage was provided by the organiser in various locations around the hotel.

## 5.4 Roll Ups

Roll ups designed for the campaign were utilised during this activity.

## 5.5 Attendees

The conference was attended by both the general public and private sectors respectively.


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## 5.6 Lunch and Networking Area

The conference offered an area for a standing lunch and two coffee breaks.


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## 5.7 Speakers and Moderator

Various speakers and a panel were present during the conference.


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N-CONVENTIONAL
CES IN MALTA


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PROMOTING NON-CONVENTIONAL
WATER RESOURCES IN MALTA
L-ILMA
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