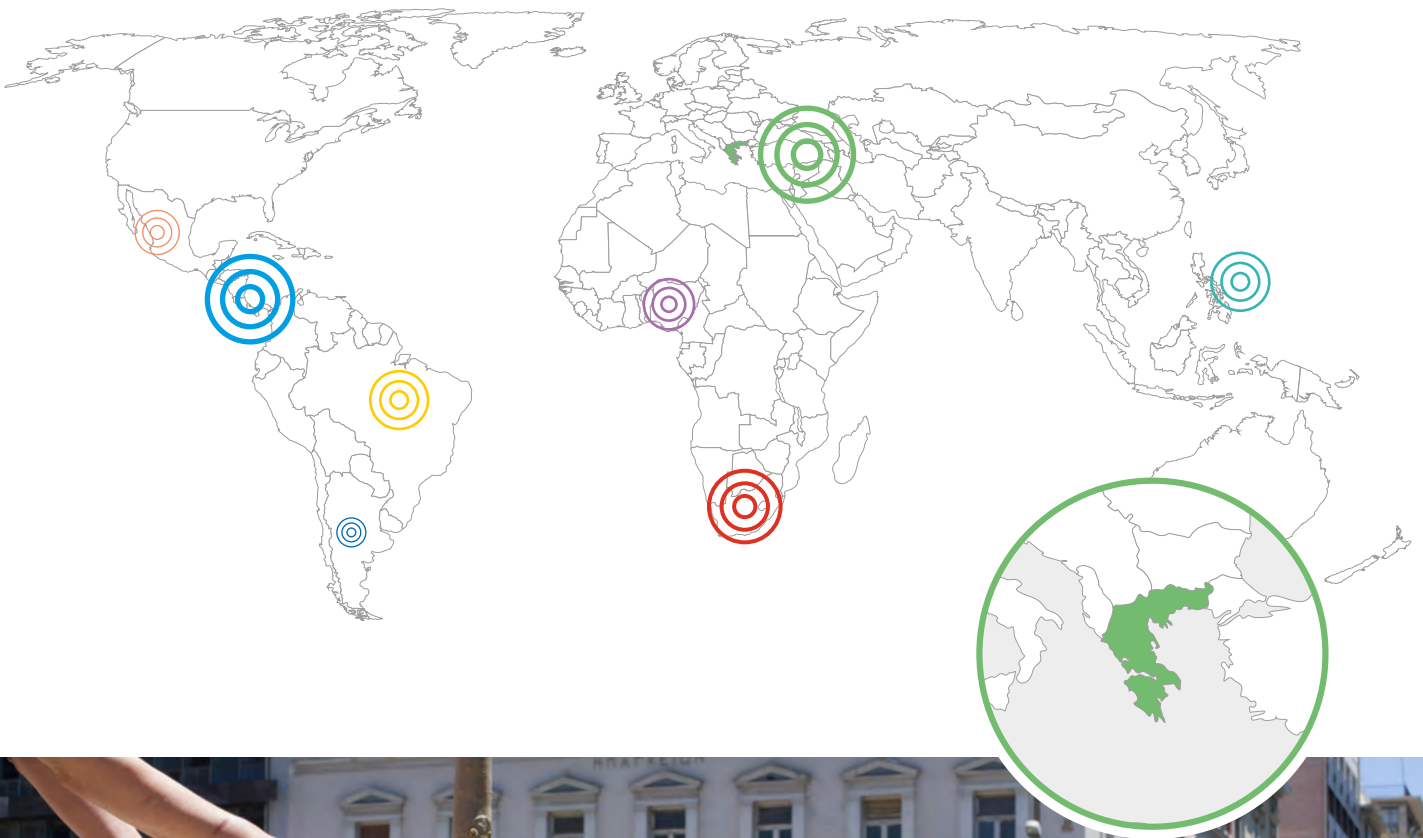


BRIEF

# National Water Operators' Partnerships

Short term exchanges between Greek Operators



**BEWOP**



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## Introduction

Water Operators' Partnerships (WOPs) serve as increasingly popular mechanisms for improving the capacity and performance of water and sanitation utilities internationally. However, National WOPs, or domestic WOPs, which refers to partnerships between utilities operating in the same country, remain far less common than international WOPs<sup>1</sup>. While national WOPs are currently taking place in several countries, the scope and duration of the partnerships often remain limited, due primarily to their often self-funded nature.

National WOPs possess distinct advantages over international partnerships derived from commonalities in participants' culture, language, legal frameworks and national policies, all of which can facilitate knowledge sharing.<sup>2</sup>

National WOPs, like all WOPs, can address a diversity of issues. In most national WOPs, larger utilities with significant in-house capacities and expertise partner with smaller utilities in efforts to address specific technical challenges. However, national WOPs also provide opportunities for utilities operating in similar geographic areas, those with overlapping jurisdictions or service areas, or for utilities operating in very different contexts hoping to be exposed to new ideas, methods or systems.

In Greece, national WOPs have been used to address a diversity of challenges. The most common model employed in the Greek context involves the largest association of water and sewerage companies in the country (the Hellenic Union of Municipal Enterprises for Water Supply and Sewage or EDEYA) and smaller utilities with less technical capacity. This brief describes two WOP cases, both mentored by the Athens Water Supply and Sewerage Company (EYDAP), EYDAP NISON S.A. In both WOP cases, the partnerships helped the local utility to provide an opportunity to address challenges that are common among the Greek water supply and sanitation sector.

This brief is organized into two sections. The first section provides a short overview of the water and sanitation sector in Greece, to better understand the challenges facing Greek utilities and some of the opportunities for addressing those challenges through WOPs. The second section of the brief presents the WOPs between EYDAP and municipalities in the Aegean Islands.

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1. Approx. 12% of the WOPs registered on the Global WOPs database (356 WOPs - Nov 2019) are listed as National WOPs.
  2. Dawes, S. S., & Préfontaine, L. (2003). Understanding new models of collaboration for delivering government services. *Communications of the ACM*, 46(1). doi: 10.1145/602421.602444

## The Drinking Water Supply and Sanitation Sector in Greece

The provisioning of water supply and sanitation services occurs under context-specific social, legal, economic, cultural and political conditions, which influence and shape the operational approaches of utilities. In the particular case of national WOPs, the context within which the partnership takes place is of great importance as the entities comprising the partnership must both operate within certain shared contextual realities.

In this section, water and non-water specific contextual details, pertinent to the case studies presented, are provided to support the reader in understanding the local context.

In Greece, the provision of clean water remains one of the primary responsibilities of the State. Nationally, drinking water resources in Greece are both diverse and plentiful, as water is sourced from numerous underground and surface sources. However, there exist significant fluctuations in drinking water supply between years, as well as variability between regions. Of particular relevance to the two cases presented in this brief are the persistent water-related challenges for many of the Aegean Islands. While many islands rely on groundwater sources, a number of islands rely entirely or partly on water imported via tanker or desalination.<sup>3,4</sup> However, even for those islands with groundwater sources, the limited rainfall in the summer season and corresponding spike in demand driven by tourism puts significant pressure on the islands' capacity to meet drinking water demand.

Water and sanitation services and the development of domestic water pricing policies in Greece are structured in three different ways. In Athens and Thessaloniki, along with their surrounding metro areas, two state utilities – EYDAP, which serves the Greater Athens Area and the Thessaloniki Water Supply and Sewerage Co. (EYATH), which serves the greater Thessaloniki Urban Area – oversee all water and sanitation services. Combined, these two companies provide water services to an estimated 5.6 million inhabitants (an estimated 44 percent of the Greek population)<sup>5</sup> and sanitation services to an estimated 4.7 million inhabitants.<sup>6,7</sup> Both EYDAP and EYATH comprise two entities: a public company, which owns the major hydraulic infrastructure (dams, conveyance networks) and a semi-private utility, which owns the treatment plants and distribution network. The semi-private shares of each company are traded on the Athens Stock Exchange.

Outside of the service areas of EYDAP and EYATH, water and sanitation services are predominately provided by municipal enterprises called DEYA that operate as autonomous public agencies. Prior to 2011, there were 227 DEYA in Greece. However, following the implementation of a country-wide reformation plan intended to merge municipalities, the total number of municipalities was reduced from 1,034 to 325. This consolidation resulted in a reduction in the number of DEYA from 227 to 142. DEYA serves approximately 47 percent of the Greek population. The remaining approximately

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3. Kanakoudis, V., Papadopoulou, A., & Tsitsifli, S. (2014). Domestic water pricing in Greece: a spatial differentiation. *Desalination and Water Treatment*, 54(8), 2204–2211. doi: 10.1080/19443994.2014.933616

4. United Nations Freshwater Profile Greece (2004). Available at: <http://www.un.org/esa/agenda21/natlinfo/countr/greece/watergreece04f.pdf>

5. Kanakoudis, V., Papadopoulou, A., & Tsitsifli, S. (2014). Domestic water pricing in Greece: a spatial differentiation. *Desalination and Water Treatment*, 54(8), 2204–2211. doi: 10.1080/19443994.2014.933616

6. EYDAP corporate profile (n.d.). Can be accessed at: <https://www.eydap.gr/en/TheCompany/CompanyProfile/>

7. EYATH corporate profile (n.d.). Can be accessed at: <https://www.eyath.gr/about/?lang=en>

9 percent of the Greek population is served directly by local municipal water departments.<sup>8, 9, 10</sup>

### Challenges in the Greek Water Supply and Sanitation Sector

The Greek water supply and sanitation sector face a number of challenges. Certain challenges, such as the uneven distribution of water supply, are largely tied to Greece's geomorphology in combination with its geographical position in the eastern part of the Mediterranean Sea<sup>11</sup>. Similarly, variability in water pricing for consumers in different regions is derived from these same geographic factors, but also economies of scale, uneven infrastructure investment, among other factors. Other challenges, like those related to utility privatization pressures and inequities between utility capacities, largely stem from structural imbalances and wider political and economic forces.

Of particular relevance for the two national WOP cases presented in this brief are challenges stemming from capacity inequities and water supply in the Greek islands. Both topics are briefly addressed below:

#### **Variability in Water Supply**

Many regions in Greece are subject to periodic droughts, the severity of which varies by area. However, due to the impacts of climate change, Greece has experienced an increasing frequency of droughts and torrential rains in recent years, posing new challenges for water

supply and sanitation services. Such variability in precipitation exacerbates pre-existing structural challenges such as persistent water shortages in the Aegean Islands, where the most serious shortages in the country occur.<sup>12</sup> While drought conditions can be far more disruptive, many Aegean Islands face challenges every year during the summer tourist season when demand is at its highest and water resources at their lowest. In some areas, rainwater retention infrastructure is being built; however, as mentioned previously, a number of islands remain dependent upon water from tankers.

#### **A Capacity Differential between Utilities**

The challenge perhaps of most pertinence to the two cases presented below is the imbalance of utility capacities between EYDAP and EYATH and other DEYA and/or municipal water departments. Given the sheer size and service areas of EYDAP and EYATH, it is to be expected that they possess far greater in-house expertise and capacity – be it technical, operational, technological, administrative, or otherwise – than the average DEYA in Greece. However, this capacity gap is particularly notable in comparison to small DEYA or municipal water departments, such as the DEYA Kefalonia and the Municipality of Milos. The continued implementation of national WOPs may offer a mechanism through which to progressively readdress this imbalance, though structural inequities within the water and sanitation sector will likely persist.

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8. Kanakoudis, V., Papadopoulou, A., & Tsitsifli, S. (2014). Domestic water pricing in Greece: a spatial differentiation. *Desalination and Water Treatment*, 54(8), 2204–2211. doi: 10.1080/19443994.2014.933616

9. Assimacopoulos, D. (2012). *Water & Sanitation Services in Greece and the Sustainability Challenges* (unpublished master's thesis). School of Chemical Engineering National Technical University of Athens, Greece.

10. Note that percentages may have changed since sources were published.

11. Kourtis, I. M., Kotsifakis, K. G., Feloni, E. G., & Baltas, E. A. (2019). Sustainable Water Resources Management in Small Greek Islands under Changing Climate. *Water*, 11(8), 1694. doi: 10.3390/w11081694

12. United Nations Freshwater Profile Greece (2004). Available at: <http://www.un.org/esa/agenda21/natinfo/countr/greece/watergreece04f.pdf>



## Two Models of National WOPs in Greece

This brief documents and analyzes two Water Operators' Partnerships (WOPs) developed in Greece. The cases in this brief include the WOP between EYDAP and the Water Supply and Sewerage Company of the Municipality of Kefalonia (DEYA Kefalonia), and the WOP between EYDAP and the Municipality of Milos. In these WOPs, EYDAP acted as mentor, and DEYA Kefalonia and the Municipality of Milos, both Greek islands in the Ionian and Aegean Seas respectively, as mentees in the partnership. In both cases, the aim of the partnership was to leverage the expertise of EYDAP (in these cases its subsidiary, EYDAP S.A.) in order to improve water and sanitation services to selected Greek islands.

The documentation and analysis of these two WOPs were made possible through primary data collected during field visits, as well as a review of relevant documentation developed during the partnership. The field visits took place in the month of July 2017 in one-day sessions per location (Kefalonia and Milos). The researcher carried out multiple interviews with employees of the utilities at top and mid-levels of management and local authorities.

This brief is part of a series of WOP analyses using an analytical framework specifically developed for this purpose under the BEWOP project<sup>13</sup>. The study of national WOPs has been motivated by the increasing existence of national cooperation that has, so far, remained largely undocumented. However, it has become increasingly clear that National WOPs can provide tremendous value to both WOP participants as well as for the populations partnering utilities serve.<sup>14</sup>

### Case Study 1: National WOP Between the Municipality of Milos and EYDAP

The first case study features a very short WOP between EYDAP and the Municipality of Milos over an approximately three-month period in 2013. The main aim was to take advantage of EYDAP's wider scope of expertise to strengthen Milo Municipality's response to its recurrent water scarcity and quality challenges. The results of the WOP were understood as mutually beneficial for the two operators. An ongoing collaboration between the utilities could lead to much more, and serve as an example to be extended in Milos and further replication across the Greek Islands. **Table 1** below provides greater detail about the partnership, including its objectives and results. **Table 2** presents a brief overview of the collaboration history of the WOP.

**Table 1: EYDAP-Milos Municipality WOP Information**

<b>Partners</b>	
Mentee Name	Municipality of Milos
Brief background about mentee	The municipality of Milos includes the uninhabited offshore islands of Antimilos and Akradies. The combined land area is 160,147 square kilometres and the 2011 census population was 4,977 inhabitants. The municipality arranges for the provision of water supply and sanitation services and subcontracted a private desalination company for water production.
Mentor Name	EYDAP
Brief background about mentor	The Athens Water Supply and Sewerage Company (EYDAP) is the largest Greek enterprise in its sector. Based in Athens, it serves 4.4 million customers in the Greater Metropolitan area of Athens with freshwater and 3.5 million customers with sewers.
<b>Duration of Partnership</b>	
Start - end date	October 2013 to December 2013
<b>Cost of Partnership</b>	
Donor	EYDAP
Total	10,000 Euros
<b>Main Objectives</b>	
	<ol style="list-style-type: none"> <li><b>1.</b> Solving the problem of increasing water needs in Milos during the summer season</li> <li><b>2.</b> Solving the problem of extended physical losses; increased NRW</li> <li><b>3.</b> Extension of the water network in the city of Pollonia and connection with the desalination plant</li> <li><b>4.</b> Improving water quality and energy efficiency (reducing turbidity and water losses)</li> </ol>
<b>Aim</b>	
Utility 1: Milos Municipality	Milos Municipality achieves measurable improvements in specific technical areas: extend the network, increase productivity, reduce non-revenue water; strengthen capacity of the technicians, adopt good practices, and implement new technology
Utility 2: EYDAP	EYDAP gains experience, insight and understanding of water provision in small islands; improves own performance by teaching new skills and providing technical assistance to the partner utility



**Table 2: History of Collaboration: EYDAP-Milos Municipality WOP**

<b>History of Collaboration</b>	
First contact and exploration	December 2011 - EYDAP made an initial audit based on public feedback and the requests of the local authorities for support.
Enabling factors	Both parties showed commitment to the collaboration. It was the first project of EYDAP Nison S.A, an EYDAP subsidiary focusing on the support of the Greek islands.
Pre-formation features	Milos community is directly responsible for the water and waste-water services.
<b>Formalization</b>	
Involved parties	EYDAP Nison S.A. and Milos Municipality
Financing	EYDAP S.A.
Diagnosis of needs	Two audits were performed by EYDAP: the first in December 2011 and another in October 2013 when the contract was signed.
Governance	There was a legal agreement between EYDAP Nison S.A. and the Municipality. EYDAP Nison S.A. was in charge of the governance of the project.

### **Approach**

Most of the WOP activities were carried out during three technical visits by experts from EYDAP to the Municipality of Milos. After an initial analysis of the water system and of the challenges faced by the Municipality of Milos, objectives were identified and a set of technical and strategic recommendations were developed and delivered to the municipal authorities. The activities in this WOP were a mixture of documentation and information sharing, on-the-job operational guidance, review of existing practices, technical assistance and on-site technical works. EYDAP continues to explore options for a longer term arrangement that would provide further support to the Municipality of Milos.

### **Implementation: Improvement Working Areas**

Four areas of improvement were identified through this WOP:

- Adapting water production to seasonal demand
- Extension of Water Supply Services
- Commercial & Physical Losses - NRW
- Service Quality & Water Safety (Drinking Water)

#### ***Adapting water production to seasonal demand***

The first improvement area aimed at solving the problem of increasing demand for water in Milos during the summer season due to tourism, in particular in the old city of Plaka in Pollonia. Demand in Milos reaches 4,000 m<sup>3</sup>/day of water during the summer season. A private desalination company can produce

up to 3,000 m<sup>3</sup> over a 24-hour period and an additional 20 percent of the total water demand (i.e., approximately 1000 m<sup>3</sup>) is stored in tanks, bringing total daily available supply barely in line with peak demand. In situations of water crisis, the Mayor of Plaka will ask people in the villages to contribute with water from their private wells. Although some citizens believe that the shortage of water is due to water leakage, the reality is that there is not enough water production to meet demand.

Drops in system pressure are also a problem (while water pressure should ideally be maintained at 2 atmospheres, in Milos, it drops to 1.5 during summer seasonal demand) due to poor operation of the existing network.

Thanks to EYDAP's assessment and recommendation, Milos Municipality recognized the need to build more tanks, increase water production, and extend the existing network to further supply critical locations on the island such as the old city of Plaka.

#### ***Extension of Water Supply Services***

In 2016, a study was undertaken by a private contractor to lay a new pipe in response to the suggestion made by EYDAP following their initial audit. The project cost was estimated at 1.3 million euros. Considering the lack of funding available in the Municipality, the project was split into two phases: Phase A (500,000 euros) and Phase B (800,000 euros). Phase A included extending the network and connecting a new pumping station and water reservoir. Phase A was intended to address the water needs in the old city of Plaka (Scala Castle). Phase B was tendered in mid-2018 though it has not yet been completed. The ultimate objective of this project is to connect the entire system with the tanks of the desalination plant.

#### ***Commercial & Physical Losses - Non-revenue Water (NRW)***

The third improvement area involved an effort to reduce the percentage of water losses (Non-Revenue Water or NRW) in the network by carrying out pressure control and repair campaigns through the old network following the guidelines developed by EYDAP in 2013. Pressure control and repair campaigns took place in 2017. It had been estimated that approximately 400 m<sup>3</sup>/day was lost through leakage during the majority of the year and as high as 1,000 m<sup>3</sup>/day during the winter. Following the repair campaign, it was evaluated that NRW had decreased by 20 percent.

#### ***Service Quality & Water Safety (Drinking Water)***

The fourth improvement area was improving the water quality on the island of Milos. As the Ministry of Health began to develop more specific regulations regarding quality for desalinated water, the Milos Municipality inquired about water suitability for consumption according to national standards. In Milos, water pH is between 8 and 9 at the exit of the desalination station and hardness is 2.7 (hardness should be 10 under standard conditions). EYDAP made suggestions and provided technical advice to the Municipality on how to correct the pH and the water hardness and advised on technical procedures to avoid stagnant water in the pipes by having a continuous flow. EYDAP recommended steel pipe post-treatment in the desalination unit to make water as hard as possible. In 2013, tests were carried out and samples of water were sent to Athens to analyze the effects of post-treatment on the network. The analysis showed that hardness had increased as a consequence of the post-treatment.

In Phase B of the project, the Municipality will have to make sure that there is no turbidity around the pumping station to avoid corrosion. Another intervention proposed by EYDAP was to add CaCO<sub>3</sub> in the pumping station to increase the hardness of the water.

## Results

The short WOP between EYDAP and the Municipality of Milos produced a number of recommendations that, once taken up by the Municipality of Milos resulted in a number of achievements both in terms of improving the performance of water services and regarding capacity improvements of the personnel of the Municipality. A more detailed explanation of these results is presented below by category.

### **Improved Operational Performance**

The strategic and operational advice provided by EYDAP helped Milos to better understand and implement actions to address its water scarcity and quality challenges. Based on EYDAPs expert advice, over the next 3 years, the Municipality of Milos:

- i.** Increased water production and water supply in key areas in the island to meet future seasonal water demands including reducing reliance on private boreholes;
- ii.** Designed and began construction of a new optimal water network infrastructure to optimize water production from the desalination plant and increased water storage while fixing the old network to decrease water losses; and
- iii.** Improved water quality by implementing effective technical solutions to control the water pH, hardness, turbidity and stagnation as well as corrosion in the pipes.

The main outputs from this partnership were the proposal of a new integrated project that

incorporates all the dimensions of the water supply chain - production, storage, leakage, and distribution - and a set of key recommendations to increase water quality and water use efficiency.

### **Stronger Capacity**

One of the principal objectives of this WOP was to strengthen the capacity of the technical staff of the water services of the mentee, the Municipality of Milos. The knowledge and working methods acquired through this WOP have contributed to significant improvements of the workers' skills. At the institutional level, the capacity of the Municipality to absorb and process the recommendations made by the mentor was also improved. As a result of this partnership, the Municipality of Milos was empowered to make informed decisions on the model of water management they want for the future and on the appropriate financial investments to be made within the context of scarce financial resources. As for the mentor, the staff of EYDAP gained practical experience and understanding of the water challenges in small islands and gained recognition and pride in providing technical assistance to a partner utility.

### **Lessons Learned**

A key lesson learned from this WOP is that the involvement and support of the local authorities, in this case the Municipality of Milos and its Mayor, was crucial to the success of the partnership. The political buy-in and the ownership of the project by the staff of the Municipality matched the commitment showed by the staff of EYDAP. The demand-driven nature of WOPs is expressed in this alignment between the improvement tracks chosen and the strategic objectives of the Municipality. Both the staff of the Municipality of Milos and EYDAP expressed their satisfaction in this partnership, a sentiment exemplified by one of the directors

of EYDAP, who stated that he had gained more respect for his team as a result of the WOP.

### Challenges

One of the challenges of this WOP was the lack of a funding mechanism for collaborations of this kind. As a mentor, EYDAP covered the direct costs of the partnership, which are estimated at 10,000 Euros. In order to continue supporting with capacity development and implementation or be able to replicate this experience in other small municipalities, another funding source must be identified or EYDAP (or whomever the mentor partner is) must consider covering direct expenses.

In terms of funding for the development of the new infrastructure proposed by EYDAP, the Municipality of Milos is facing a financing gap. Another challenge faced during the partnership was the difficulty to travel from Athens to Milos during the winter period due to severe climatic conditions and the lack of regular boat transportation. Lastly, owing to the short duration of the partnership, a notable challenge was the fact that the WOP did not support the municipality on this water-scarce island to explore other water demand approaches besides increased production. Had the partnership been longer, more innovative solutions could have been employed.

### Case Study 2: National WOP Between the DEYA Kefalonia and EYDAP

The second case study features a WOP between EYDAP and the DEYA Kefalonia that was in direct response to damages from two earthquakes that took place in early 2014. Similar to the Milos WOP, the purpose of the WOP was to leverage the technical expertise and institutional capacity of EYDAP. In this case, however, these expertise and capacities were deployed in order to conduct a rapid response and damage assessment as well as support in the rehabilitation and repair of damaged key infrastructure. The results of the WOP were focused on exposure to post-disaster contexts and included organizing collaborative rapid response teams under strenuous conditions. Despite the extraordinary conditions of the WOP, both operators have indicated that the partnership was beneficial. Developing structures at the national level to more easily facilitate the formation of post-disaster national WOPs models, such as the one presented in this case study, is recommended. **Table 3** below provides greater detail about the partnership, including its objectives and results. **Table 4** presents a brief overview of the collaboration history of the national WOP.

**Table 3: DEYA Kefalonia-EYDAP WOP Information**

<b>Partners</b>	
Mentee Name	DEYA Kefalonia
Brief background about mentee	The DEYA of the Municipality of Kefalonia is the result of the merging of the three existing DEYAs of the island of Kefalonia (Sami, Livathos and Argostoli) under the 2010 Kallikratis reformation. The DEYA provides water supply, irrigation, drainage, wastewater treatment, water bottling and renewable energy services and activities for the Municipality.
Mentor Name	EYDAP
Brief background about mentor	The Athens Water Supply and Sewerage Company (EYDAP) is the largest Greek enterprise in its sector. Based in Athens, it serves 4.4 million customers in the Greater Metropolitan area of Athens with freshwater and 3.5 million customers with sewers.
<b>Duration of Partnership</b>	
Start - end date	February 2014
<b>Cost of Partnership</b>	
Total	150,000 Euros
<b>Main Objectives</b>	
	<ol style="list-style-type: none"> <li><b>1.</b> Provide a rapid response to the damages in the water system caused by two earthquakes that struck in January and February of 2014</li> <li><b>2.</b> Rapid assessment and diagnostic of the water supply and wastewater networks</li> <li><b>3.</b> Rehabilitation of the damaged networks and conduction campaign of repairs to restore services</li> </ol>
<b>Aim</b>	
Utility 1: DEYA Kefalonia	DEYA Kefalonia and the Municipality of Kefalonia to receive post-disaster technical and diagnostic support, operational interventions in the field; improve staff skills to rapidly repair and rehabilitate damaged networks working under strenuous conditions
Utility 2: EYDAP	EYDAP gains experience in responding to a natural disaster affecting water infrastructure and water services in an island context; improve performance by teaching new skills and providing technical assistance to the partner utility

**Table 4: History of Collaboration: Kefalonia DEYA-EYDAP WOP**

<b>History of Collaboration</b>	
First contact and exploration	28 January 2014, 2 days after the earthquake first of two earthquakes affecting the island of Kefalonia
Enabling factors	The necessity for support after the earthquake
Pre-formation features	DEYA of Kefalonia was under the process of replacing the water distribution network when the earthquake occurred. During EYDAP's WOP with Kefalonia, EYDAP assisted in re-prioritizing the network replacement programme, taking into account the pressure reduction systems inserted in the network during rehabilitation.
<b>Formalization</b>	
Involved parties	EYDAP, DEYA Kefalonia, Ministry of Infrastructure and Transportation
Financing	EYDAP S.A.
Diagnosis of needs	Rehabilitation of water services and of the network damaged by the earthquake; network mapping; design and implementation of Distinct Metering Areas (DMAs); pressure management; priorities on the network replacement programme.
Governance	EYDAP was invited to participate in the WOP by the Ministry of Infrastructure and Transportation.

### Approach

On 26 January 2014, a  $M_w$  6.0 earthquake struck the island of Kefalonia followed by an  $M_w$  5.9 quake on 3 February 2014. As an immediate consequence of the earthquake, part of the island's potable water supply and wastewater networks collapsed, leaving the affected population with no access to these services. EYDAP, the mentor utility in this partnership, responded rapidly and deployed a Potable Water Network Team, consisting of four mobile immediate response units and one mobile coordination unit and a Wastewater Network Team with two mobile independent immediate response units. The objectives of these rapid intervention teams were to carry out a rapid assessment and diagnosis of the damaged networks and launch a campaign of repairs to fix the damages and restore the services

in the shortest possible time. This WOP included several post-disaster activities and interventions, including:

- Developing an action plan for rapid assessment and diagnosis/investigation of the network conditions
- Monitoring and chemical analyses of water samples
- Collecting network data (existing maps and digital elevation models of the ground surface from satellite data) to produce detailed GIS mapping of the potable and wastewater networks
- Network mapping
- Design and implementation of District Metered Areas (DMAs)



- Pressure management
- Organizing the repair campaigns; forming the teams and selecting the vehicles and support equipment for working uninterruptedly on 24-hour shifts
- Setting priorities for the rehabilitation programme

The rapid intervention team members from EYDAP, included experienced engineers and technicians outfitted with the most up-to-date equipment and vehicles to allow them to work efficiently and independently immediately following an emergency event. The engineers of the team were specialized and trained in emergency response assessments, crisis management, and collaboration with local agencies and communities.

Considering the exceptional nature of this partnership, no formal agreement was signed in this WOP. A common understanding of the partnership's scope and goals was reached by the two partners prior to the arrival of EYDAP's support teams to Kefalonia.



Figure 1

## Implementation - Improvement Working Areas

Taking into account the unique context of this WOP, the two working areas were:

- Assessment/Diagnostic of the Network Conditions
- Rehabilitation of the Network and Restoration of the Water Services.



Figure 2

### Assessment/Diagnostic of the Network Conditions

Diagnostic efforts were conducted on both the water supply network and the wastewater network.

### Interventions on the Potable Water Supply Network

The first earthquake event of 26 January 2014 did not cause major damage to the water supply network. However, EYDAP engineers and technicians trained in post-emergencies immediately travelled to the island to identify and restore any problems that may have occurred. The focus areas of this investigation were the towns of Argostoli and Lixouri. Since no major problems were reported, small-scale restorations and minor repairs took place. At the end of this investigation, the



full functionality of the network was restored. The second earthquake, on 3 February 2014, caused significant problems in the water supply network. Immediately following the second natural disaster, an additional EYDAP investigation was engaged to support the restoration of the functionality of the network. Large-scale repairs and replacements took place until full functionality was achieved. The majority of the damage was in the town of Lixouri, and EYDAP's restoration activities were concentrated in that area, especially in the aged portions of the networks, consisting mainly of asbestos cement pipes. The goal of EYDAP during their mission in Lixouri was summarized laconically by the sentence: *"We will not leave the island until each home is supplied with clean water."*

The investigation and repair team in coordination with the local agencies performed a rapid assessment. Just three hours upon arrival to the island, the EYDAP teams were planning for the investigation and restoration activities. The mapping involved a total of 36,191 m of pipes. Of those, 42.3 percent consisted of PVC pipes, 30.5 percent of asbestos cement pipes, 25.8 percent of Polyethylene pipes, and only 1.4 percent of steel pipes. Electronic mapping of the potable and wastewater networks was not available by the local agencies. EYDAP decided to form a special subgroup to become responsible for digital mapping of the networks, as this was considered necessary to assess the condition and performance of the network.

### ***Interventions on the Wastewater Network***

After the second earthquake on 3 February 2014, the network fatigue and high volume of water in the wastewater network resulted in serious operational problems, leaks and risks to public health. Experienced engineers and technicians immediately visited the island in order to address these problems. Large scale inspections took place to evaluate the condition

of the network. Activities concentrated in Argostoli and Lixouri. The mission of the EYDAP wastewater team was: *"We will not leave until we have a complete picture of the damages and a recovery plan is set."*

The investigation and repair team arrived in Kefalonia on 7 February 2014 and remained there for six days. The investigation and repair team were equipped with the most recent technological equipment and vehicles to achieve its goal. EYDAP's investigation and repair team, along with the General Manager of the Preventative Maintenance Office, in coordination with the Municipality, immediately assessed the existing conditions and started in situ as well as through video inspections. More than four kilometres of wastewater pipes were inspected in the areas of Lixouri and Argostoli, 700 meters of which were video inspected.

### ***Rehabilitation of the Network and Restoration of the Water Services***

Rehabilitation and restoration efforts were focused on interventions directed at improving the potable water system. Work was conducted over twelve days of intensive labour as described below:

- **Day 1 to 3:** A team of technicians was specifically responsible for detecting and repairing the visible damages and leaks. Due to the large number of leaks, most of the system could not maintain its pressure, so nineteen additional valves were installed for the control of the water supply in the various areas. At the end of the first day, normal water supply was secured inland.
- **Day 2 to 10:** The EYDAP teams gradually connected areas to the network and performed leakage tests. Once the system achieved positive pressures, "invisible" leaks were detected using acoustic methods as well as hydraulic numerical simulations that

were employed to identify unexpected drops of the piezometric line and help in the detection of leaks.

- **Days 3 to 12:** EYDAP teams inspected the water reservoir (tanks, pipes), repaired damages, and performed continuous adjustments to ensure stable service. A bypass of the network pipes and alternative supply took place in areas where repairs would have been too difficult or where supply upgrades were significant. For the protection of the asbestos cement pipe network, a pipe rupture valve was installed since the repair of the leaks would result in increased pressures in the already distressed network, which would likely cause new leaks. At the same time, in situ chemical analyses were performed (regular and residual chlorine) to ensure water quality and also to check for leaks (which would decrease the quantity of the residual chlorine). Upon completion of these activities, the network pressures were normal.

## Results

During the field operations, the investigation and repair teams gathered information to generate a more detailed estimate of the hydraulic and mechanical network operations in order to submit proposals for the improvement and support of the network. EYDAP's efforts then focused on the management of the pressures and the application of modern technologies and special methodologies in network restoration. EYDAP considered their main goal to maintain a steady pressure in the network that is necessary to ensure the quality of potable water.

The main result of this WOP was to demonstrate how a quick response from a mentor utility could be provided to another water utility affected by a natural disaster or other disruptive events. The principal objective, at first, was not explicitly set out to leverage knowledge as

comprehended in classical WOPs. However, in the end, it was evident that DEYA Kefalonia were equipped with know-how and data (e.g., DMAS and GIS generated maps) to deal with future disaster relief efforts. This partnership became a precedent and an example for other utilities in Greece to put in place rapid response and emergency teams that could be deployed in different parts of the country, especially in areas prone to natural disasters such as earthquakes.

Other results of this WOP included:

- The water supply network of the island was mapped and delivered to DEYA Kefalonia.
- District Metered Areas (DMAs) were created and pressure management has continued to be performed by DEYA Kefalonia.
- Going forward, DEYA Kefalonia and the Municipality of Kefalonia have prioritized the network replacement programme, which was planned before the earthquake, ensuring efficient rehabilitation efforts

## Success Factors

As the concept of structured capacity development learning did not apply in the same form as it would in most WOPs, this partnership would be considered atypical. But, the spirit of solidarity was a catalyser for this peer-exchange. The partnership owes its success to the full commitment and predisposition of the teams that worked in the field following the earthquake events. The camaraderie and empathy from both operators were crucial in achieving the goals of this collaboration in addition to the following factors:

- Rapid reaction and mobilization of human resources and equipment to provide support by EYDAP
- Existence of an action plan to guide the activities and interventions

- Good coordination in the field between teams and with the local authorities
- Willingness to provide relief and help populations under post-disaster stress
- Complete trust from the beneficiary and mentor towards the mentee utility

### Challenges

Providing field support to a partner water utility in the aftermath of a natural disaster such as the earthquake in Kefalonia is difficult in and of itself, but the insular nature of the location and the strenuous conditions under which the teams had to work made this collaboration a challenging one. The teams from the mentor utility, EYDAP, faced serious challenges during the implementation of the field activities, in particular during the repair interventions, including the following:

- Weather conditions: rainfall not only made the efforts more difficult, but also affected the groundwater table elevation.
- Groundwater: the high level of the groundwater table, the presence of wells as well as the stormwater made it difficult to assess whether potable water was spilling in the wastewater network. This resulted in the need to perform many more chemical analyses to define the source of the water entering the wastewater network, causing delays in the repairs or in performing unnecessary checks in locations where no leaks were present. In the end, it was established that there was no potable water spill into the wastewater network.
- Social factors: most of the residents of Lixouri had evacuated their homes and as a result the network could not be tested and adjusted for usual operating conditions.

## Lessons for National WOPs in Greece and Beyond

EYDAP has visited more than 30 Greek islands, creating initial audits, out of which only five (5) have evolved into partnerships. While the demand for national WOPs is large, as noted by the former Deputy Minister of Environment at a meeting with GWOPA officials in 2019, and the benefits are many, as evident in the above cases, there is a lack of sustainable structures of financial support in place. In Greece, the current investment structure of the national government in the water and wastewater sector (e.g. the implementation of River Basin Management Plans or the completion of urban wastewater collection and treatment infrastructure, etc.) is potentially an enabling environment for sustainable programming and implementation of the WOPs in Greece but needs to be further analyzed.

Beyond the Greek context, enabling legal and financial structures in the water and sanitation sector capable of supporting the formation of national WOPs of varying models should be explored. Concerted advocacy efforts rooted in demonstrating the significant benefits that can be generated by national WOPs, and the corresponding limited financial costs required to support them, will be instrumental in promoting the replication and expansion of successful national WOP models such as those pursued by EYDAP in Greece.



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BEWOP Boosting the Effectiveness of Water Operators' Partnerships (BEWOP) is a 5-year research, operational support and outreach initiative aimed at boosting the effectiveness of Water Operators' Partnerships around the world. Launched in September 2013, BEWOP is a collaboration between leading water sector capacity development institute, UNESCO-IHE, and UN-Habitat's Global Water Operators' Partnership Alliance, the organization leading the global WOPs movement. This project has been made possible by the support of the Dutch Ministry of Foreign Affairs (DGIS). This brief is part of a series promoting different aspects, models and features of the WOPs practice.

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