

Deliverable B.3.1 – Report on the investigation and mapping of the existing monitoring systems at the Axios cross-border river basin

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1 CONTENTS

1 CONTENTS	2
2 Introduction	4
2.1 General information about the project.....	4
2.2 Object of the Contractor	4
2.3 Object of this report.....	6
3 The monitoring system at the Axios cross border river basin.	7
3.1 MEEN stations	7
3.2 The stations of the Region of Central Macedonia	8
3.3 AUTH stations	9
3.4 AUTH and ECO DEVELOPMENT stations.....	10
3.5 ELGO-Dimitra stations	11
3.6 Stations under the CO-PREVENT project (INTERREG BLACK SEA).	12
4 Conclusions	13
5 The way forward	15
5.1 Cost of installation and operation	15
6 Bibliography	19

Acronyms, Abbreviations and Definitions

Acronyms	Definitions
CBC	Cross-Border Cooperation
GR	Greece
IPA	Instrument for Pre-Accession Assistance
RNM	Republic of North Macedonia
DA	Designating Authority
DAMT	Decentralised Administration of Macedonia and Thrace
SWRI "ELGO-DIMITRA"	Soil & Water Resources Institute, Hellenic Agricultural Organization - DIMITRA
RB	River basin
MS	Metering station

2 Introduction

2.1 General information about the project

Project title: Joint flood risk governance and management in the Axios/Vardar cross-border area

Acronym: FLOOD SHIELD

Schedule: 21/07/2022 to 15/12/2023

Budget: € 1,474,450.00

Partnership:

Decentralised Administration of Macedonia and Thrace – GR (Head partner)

General Secretariat of Natural Environment and Water – GR

Ministry of Environment and Physical Planning – RNM

Protection and Rescue Directorate – RNM

The project is implemented under the INTERREG IPA CBC Programme "Greece – Republic of North Macedonia 2014 – 2020", Priority Axis 2 "Protection of Environment – Transportation", Thematic Priority C: "Promoting sustainable transport and improving public infrastructure", and Specific Objective 2.4: "Prevention, mitigation and management of natural disasters, risks and hazards".

2.2 Object of the Contractor

The contract dated 6/04/2023 and signed for the award of the "provision of consultancy services for the technical support of the project entitled 'Joint flood risk governance and management in the Axios/Vardar cross-border area' and with the acronym 'FLOODSHIELD' (MIS 5062181)" implemented under the Territorial Cooperation Programme "INTERREG Greece – Republic of Northern Macedonia 2014-2020" between the Decentralised Administration of Macedonia and Thrace (DAMT), being the Designating Authority (DA), and the company LEVER Development Consultants SA, being the Contractor, foresees the implementation of certain activities as these are described in the relevant contract and in the contractual documents of the project.

More specifically, the Contractor shall provide support to the DAMT in the implementation of the deliverables of Work Packages 2,3,4 and 5, while ensuring compliance with the work schedule and the quality of such deliverables. In this context, the Contractor shall support the DAMT in the following activities (A.1-5) and deliverables (two-digit numbering A.1.1. – B.5.2.):

A.1. Development, implementation, monitoring and evaluation of the Communication Plan of the project:

A.1.1 Project Communication Plan

A.1.2 Communication Activities Summary Reports (2 in total)

A.2. Creation of Promotional Material and Public Relations:

A.2.1 Two (2) Newsletters

A.2.2 Press release

A.2.3 Report on the implementation of the press conference

A.2.4 Project brochure (600 copies in total)

A.2.5 Guidelines Volume (600 copies in total)

A.2.6 Layman's Report (250 copies in total)

A.3. Development, updating and maintenance of the project's official website and social media networking:

A.3.1 Creation of website and Facebook page

A.3.2 Reports on the updating of the project's website and social media networking (as a sub-chapter of Deliverable A.2)

A.4. Organisation of the project's final event in Thessaloniki:

A.4.1 Report on the implementation of the final event and the networking dinner

A.5. Organisation of two (2) seminars on the operation and use of the monitoring and flood risk prevention system and conduct of table-top exercises and field tests:

A.5.1 Report on the implementation of seminars (e-learning and in situ) and table-top exercises and field tests

A.6. Awareness-raising and information activities:

A.6.1. Awareness-raising videos of a duration of up to (2) minutes

A.6.2. Report on the presentation of the pages to be posted on the project's official website

A.6.3. Report on the implementation of Informal Education and provision of Information for the units responsible for the disabled people and the elderly

A.6.4. Report on the implementation of an event in Thessaloniki

A.7. Encouraging and promoting volunteering:

A.7.1 Report on the encouragement and promotion of volunteering

B.1 Preparation of a report on the civil protection system in Greece:

B.1.1 Recognition report on the civil protection system in Greece

B.2 Preparation, organization of two (2) meetings and participation in the rest of the meetings of the Joint Flood Risk Management Group:

B.2.1. Reports on the participation in the Joint Flood Risk Management Group (four reports)

B.3. Investigation and mapping of the existing monitoring systems at the Axios cross-border river basin:

B.3.1. Report on the investigation and mapping of the existing monitoring systems at the Axios cross-border river basin

B.4 Development of the cross-border strategic response to floods:

B.4.1. Report on the cross border strategic response to floods

B.5 Preparation of a vulnerability analysis for the Axios basin:

B.5.1 Draft report on the vulnerability analysis of the sites located in the Axios river basin

B.5.2. B.5.1 Final report on the vulnerability analysis of the sites located in the Axios river basin

2.3 Object of this report

This report constitutes deliverable "B.3.1. Report on the investigation and mapping of the existing monitoring systems at the Axios cross-border river basin".

As implied by the title, the aim of this deliverable is to depict all the existing monitoring systems in the Axios river basin.

The working method approach entails the collection of all information available from several sources, such as the following:

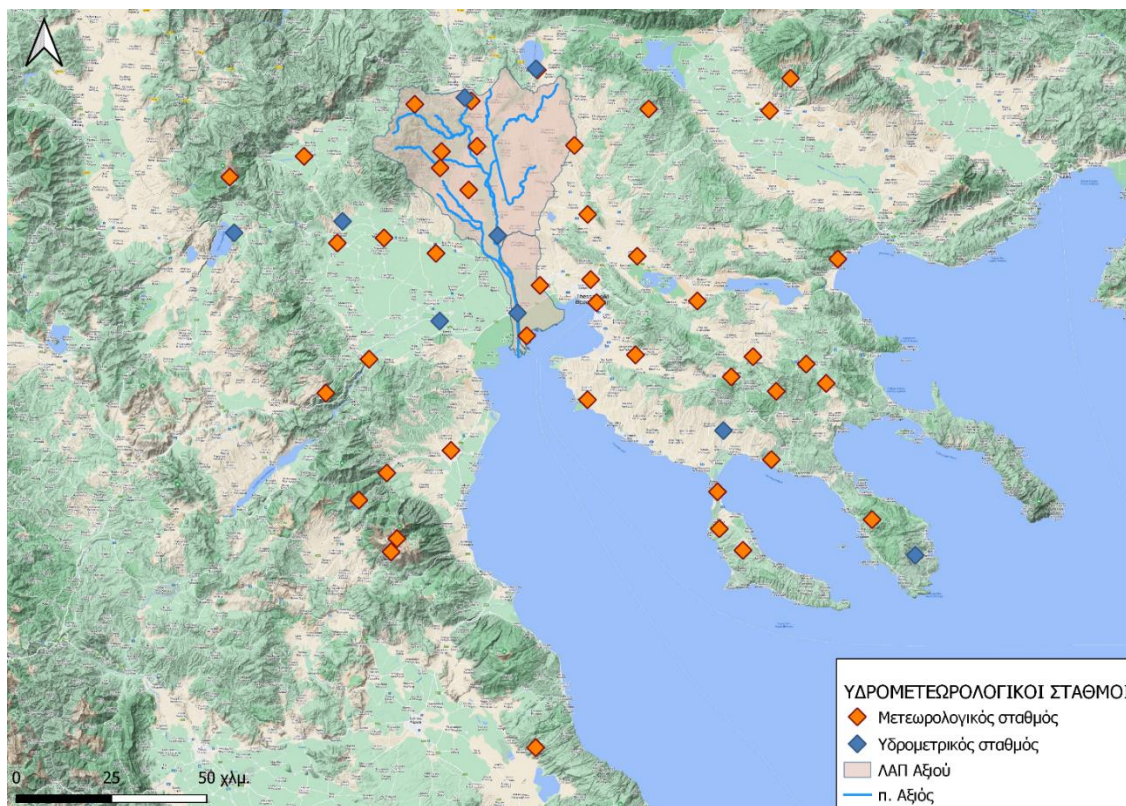
- National Water Monitoring Network, General Directorate of Water, Ministry of Environment and Energy
- Central Macedonia Water Directorate, Decentralised Administration of Macedonia and Thrace
- Soil & Water Resources Institute, ELGO-DIMITRA (conducting measurements on behalf of the National Network)
- Management Plan of the River Basins of the Central Macedonia District (EL10)
- Chemical quality of irrigation waters (superficial and underground) in the scale of the River Basins of Macedonia - Thrace and Thessaly. (Ministry of Agricultural Development and Food)
- Technical report evaluating the existing networks used for the monitoring of environmental parameters and their upgrading and extension needs (Institute of Marine Biological Resources and Inland Waters)

The cooperation with the Central Macedonia Water Directorate of the DA and the General Directorate of Water of the Ministry of Environment and Energy (MEEN) has been crucial for the mapping the existing monitoring systems.

This report ultimately aims at identifying the further needs of the network in order to determine, in combination with deliverable B.5.1. "Draft report on the vulnerability analysis of the sites located in the Axios river basin", the installation site and, more generally, the specifications of the additional stations foreseen in the project.

3 The monitoring system at the Axios cross border river basin.

The following stations, shown in Map 1, serve the purpose of monitoring the Axios river basin.



Map 1. Coverage of hydrometeorological stations at the Axios RB.

The problem with the existing network is that the stations constituting it belong to different entities with different objectives regarding the production of data.

The following is an analysis of the network stations by entity.

3.1 MEEN stations

The Ministry of Environment and Energy owns the following stations:

No.	NAME	COORDINATES	CHARACTERISTICS
1.1.	MS OF THE ALIAKMONAS DAM	40°29'23.21"N 22°15'16.86"E	Telemetric station, installed on 29-3-2021.

1.2.	MS OF KASTANIA	40°24'27.40"N 22° 7'22.01"E	Became telemetric in 2022.
1.3.	MS OF AG. DIMITRIOS	40° 9'23.18"N 22°13'54.05"E	Became telemetric in 2022.
1.4.	MS OF VORA (KAIMAKTSALAN SNOW RESORT)	40°24'44.89"N 21°13'31.99"E	Conventional snow and rain gauge station.
1.5.	MS OF AG. PRODROMOS	40°24'34.87"N 23°13'37.48"E	Telemetric station, installed in 2021.
1.6.	MS OF EVZONES PREF. OF KILKIS	41° 6'13.98"N 22°33'29.10"E	Telemetric station, installed in 2019.
1.7.	MS OF POLYKASTRO	40°59'49.76"N 22°34'41.33"E	Telemetric station, operational since 2010.
1.8.	MS OF PARALIMNI, GIANNITSA	40°44'34.06"N 22°27'21.50"E	Telemetric station, installed in 2019.
1.9.	MS OF SKRA	41° 5'37.79"N 22°13'53.54"E	Telemetric station, installed in 2021.
1.10.	MS OF KATERINI	40°16'40.51"N 22°30'47.16"E	Telemetric station, installed in 2019.
1.11.	MS OF KILKIS	41° 0'9.34"N 22°52'56.40"E	Telemetric station, installed in 2020.
1.12.	MS OF DOIRANI	41°10'46.12"N 22°45'47.02"E	Telemetric station, installed in 2010.
1.13.	MS OF GOUMENISSA	40°56'40.73"N 22°27'51.50"E	Telemetric station, installed in 2022.
1.14.	MS OF ORAIOKASTRO	40°41'10.42"N 22°56'17.49"E	Became telemetric and installed in 2022.
1.15.	MS OF EVROPOS	40°53'37.17"N 22°33'15.97"E	Telemetric station, installed in 2020.
1.16.	MS OF PARTHENONAS, N. MARMARAS	40° 7'26.51"N 23°48'51.52"E	Installed in 2021.

These stations, owned by the MEEN, have been conceded for use to the Region of Central Macedonia (RCM). The competent department of the RCM sends primary data from these stations to the MEEN on a regular basis. At the same time, a cooperation agreement has been signed between the RCM and the Aristotle University of Thessaloniki (AUTH) and the relevant data are conceded to the AUTH for research purposes (Tzelepis, 2023).

3.2 The stations of the Region of Central Macedonia

The following stations belong to the RCM:

No.	NAME	COORDINATES	CHARACTERISTICS
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2.1.	WATER-LEVEL METERING STATION of the ALMOPAIOS River	40°48'50.65"N 22° 9'48.41"E	Water-level RADAR - Profitis Ilias, Prefecture of Pella, installed in 2020.
2.2.	TELEMETRIC WATER-LEVEL METERING STATION	40°19'56.94"N 23°21'14.68"E	Water level metering station of the Olynthios River Installed on 25.1.2023
2.3.	FLOATING STATION OF DOIRANI LAKE	41°10'55.70"N 22°45'31.04"E	Installed in 2021 by the Directorate of Technical Works of the RCM.
2.4.	FLOATING STATION OF VEGORITIDA LAKE	40°46'52.06"N 21°49'37.75"E	Installed in 2021 by the Directorate of Technical Works of the RCM.
2.5.	MS OF SYKIA, CHALKIDIKI	40° 2'23.34"N 23°56'51.42"E	Installed in 2021 by the Directorate of Technical Works of the RCM.
2.6.	MS OF MEGALI PANAGIA, CHALKIDIKI	40°26'43.42"N 23°40'16.58"E	Installed in 2021 by the Directorate of Technical Works of the RCM.
2.7.	MS OF TAXIARCHIS, CHALKIDIKI	40°25'33.68"N 23°31'0.44"E	Installed in 2021 by the Directorate of Technical Works of the RCM.
2.8.	MS OF RIZA, CHALKIDIKI	40°30'27.40"N 23°26'38.57"E	Installed in 2021 by the Directorate of Technical Works of the RCM.

3.3 AUTH stations

The AUTH has installed the following stations for research purposes:

No.	NAME	COORDINATES	CHARACTERISTICS
3.1.	AUTH METEOROSCOPY OBSERVATORY	40°37'54.84"N 22°57'26.46"E	Conventional meteorological station that became telemetric in 2022. Air temperature, relative humidity, rainfall, wind direction, wind intensity, atmospheric pressure.
3.2.	AUTH VRIPOULES	40° 2'9.19"N 22°20'1.98"E	Conventional meteorological station that became telemetric in 2022.
3.3.	AUTH KASSANDREIA	40° 3'0.10"N 23°25'0.98"E	Conventional meteorological station that became telemetric in 2022.

			Air temperature, relative humidity, rainfall, wind direction, wind intensity, atmospheric pressure.
3.4.	AUTH KALYVES PSARADON	40°33'5.65"N 22°44'30.73"E	Conventional meteorological station that became telemetric in 2022. Air temperature, relative humidity, rainfall, wind direction, wind intensity, atmospheric pressure.
3.5.	AUTH OLYMPUS REFUGE	40° 4'2.64"N 22°21'4.64"E	Conventional meteorological station that became telemetric in 2022. temperature, humidity, precipitation, wind velocity and atmospheric pressure

3.4 AUTH and ECO DEVELOPMENT stations

Apart from the above listed stations owned by the AUTH, the University has developed the following network for research purposes, in collaboration with the private company ECO DEVELOPMENT:

No.	NAME	COORDINATES	CHARACTERISTICS
4.1.	AUTH-ECO DEVELOPMENT ARIDAIA	40°57'56.26"N 22° 2'20.69"E	Telemetric meteorological station (Davis vantage pro2). Installed in September 2022. Air temperature, relative humidity, rainfall, wind direction, wind intensity, atmospheric pressure.
4.2.	AUTH-ECO DEVELOPMENT SKYDRA	40°45'45.45"N 22° 8'55.08"E	Telemetric meteorological station (Davis vantage pro2). Installed in September 2022.
4.3.	AUTH-ECO DEVELOPMENT PALAIFYTO	40°46'36.70"N 22°17'36.77"E	Air temperature, relative humidity, rainfall, wind direction, wind intensity, atmospheric pressure.
4.4.	AUTH-ECO DEVELOPMENT EPANOMI	40°24'8.01"N 22°55'58.03"E	Telemetric meteorological station (Davis vantage pro2). Installed in September 2022.
4.5.	AUTH-ECO DEVELOPMENT N. POTIDAIA	40°11'16.37"N 23°20'13.68"E	Air temperature, relative humidity, rainfall, wind direction, wind intensity, atmospheric pressure.

4.6.	AUTh-ECO DEVELOPMENT PSAKOUDIA	40°15'53.45"N 23°13'11.12"E	Telemetric meteorological station (Davis vantage pro2). Installed in September 2022.
4.7.	AUTh-ECO DEVELOPMENT N. SANTA	40°50'24.11"N 22°55'33.73"E	Air temperature, relative humidity, rainfall, wind direction, wind intensity, atmospheric pressure.
4.8.	AUTh-ECO DEVELOPMENT LEFKONAS	41° 5'20.01"E 23°29'28.44"E	Telemetric meteorological station (Davis vantage pro2). Installed in September 2022.
4.9.	AUTh-ECO DEVELOPMENT ASPROVALTA	40°44'21.42"N 23°42'21.59"E	Air temperature, relative humidity, rainfall, wind direction, wind intensity, atmospheric pressure.
4.10.	AUTh-ECO DEVELOPMENT NOKOMIDINO	40°38'17.39"N 23°16'12.55"E	Telemetric meteorological station (Davis vantage pro2). Installed in September 2022.

3.5 ELGO-Dimitra stations

The following stations are owned and operated by ELGO-Dimitra:

No.	NAME	COORDINATES	CHARACTERISTICS
5.1	AXIOS River Bridge of PROCHOMA SWRI "ELGO-DIMITRA"	40°47'14.73"N 22°38'49.33"E	Hydrometric station. Installed on 20/04/2022 Radar, (Stage, Velocity) SL-ADCP, (Stage, Velocity) Wind, (Speed, Direction)
5.2	AXIOS River VARDARIS AXIOS_IDOMENI (AXIOS_79_F) SWRI "ELGO-DIMITRA"	41° 6'42.15"N 22°32'14.83"E	Monthly measurements by an authorised metering team. [Potential installation of Radar (Stage, Velocity)]
5.3	AXIOS River AXIOS_PATHE (AXIOS_11_F) SWRI "ELGO-DIMITRA"	41°11'17"08N 22°53'74"54E	Monthly measurements by an authorised metering team.
5.4	LOUTRA THERMIS "ELGO-DIMITRA" Forest Research Institute	40°30'34.38"N 23° 4'47.42"E	Meteorological station operating since 1978.
5.5	FOTEINA PIERIAS "ELGO-DIMITRA" Forest Research Institute	40°13'19.25"N 22°18'57.73"E	Conventional meteorological station operating since 2001. Became telemetric in 2016.

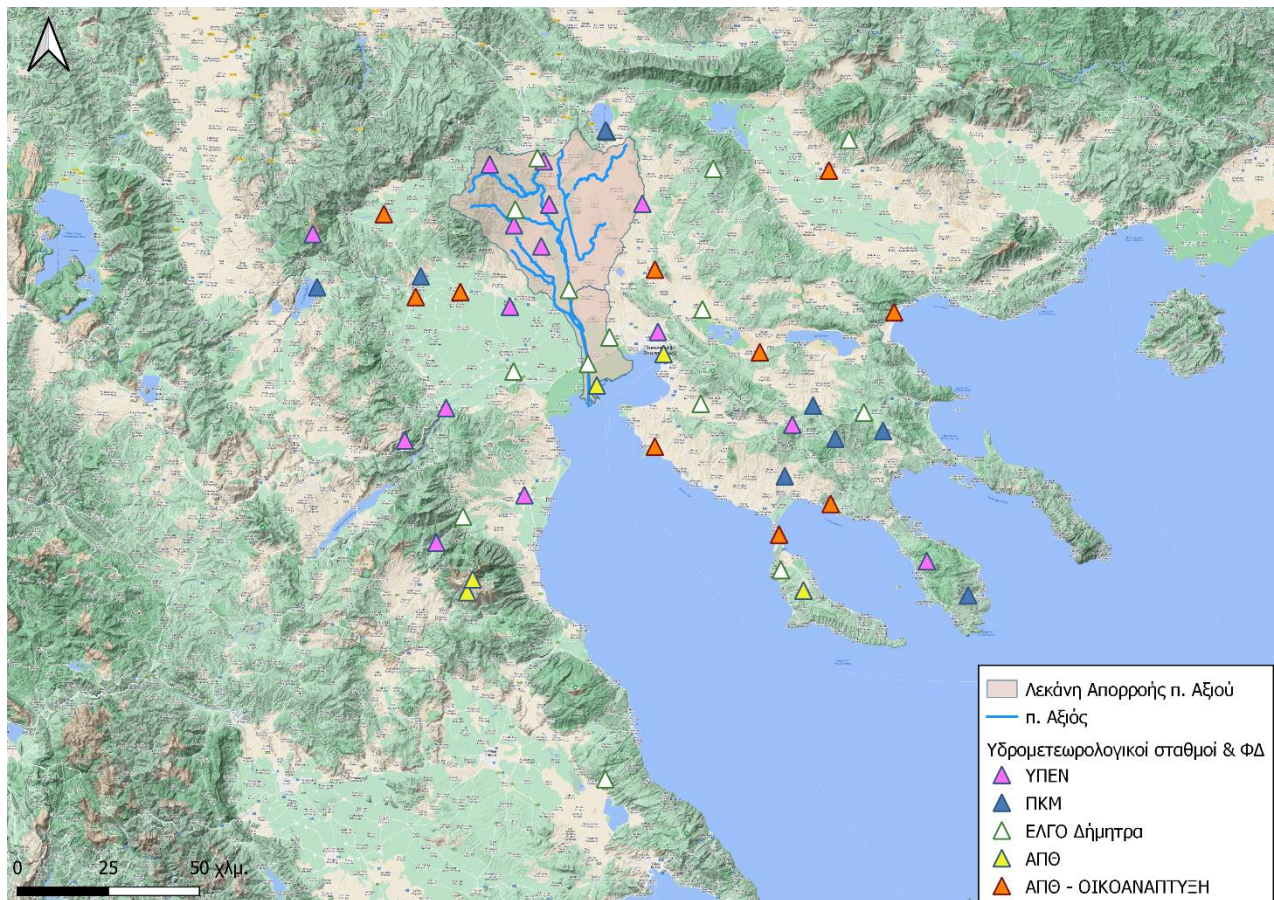


5.6	SANI CHALKIDIKI "ELGO-DIMITRA" Forest Research Institute	40° 6'1.88"N 23°20'37.30"E	Meteorological station operating since 2007.
5.7	AGIA LARISIS "ELGO-DIMITRA" Forest Research Institute	39°34'44.61"N 22°47'13.43"E	Conventional meteorological station operating since 2001. Became telemetric in 2016.
5.8	CHRYSOPIGI SERRON "ELGO-DIMITRA" Forest Research Institute	41° 9'55.87"N 23°33'21.53"E	Meteorological station operating since 2001.
5.9	ARNAIA CHALKIDIKI "ELGO-DIMITRA" Forest Research Institute	40°29'26.90"N 23°36'32.81"E	Conventional meteorological station operating since 1978. Became telemetric in 2009.
5.10	LIVADIA (GOUMENISSA) "ELGO-DIMITRA" Forest Research Institute	40°59'0.25"N 22°28'4.00"E	Conventional meteorological station operating since 2003. Became telemetric in 2016.
5.11	FYTORIO LANGADA "ELGO-DIMITRA" Forest Research Institute	40°44'33.63"N 23° 4'55.40"E	Conventional meteorological station operating since 2001. Became telemetric in 2018.
5.12	PONTOKERASIA KILKIS "ELGO-DIMITRA" Forest Research Institute	41° 5'26.60"N 23° 6'46.41"E	Conventional meteorological station operating since 2004. Became telemetric in 2016.
5.13	SINDOS SWRI "ELGO-DIMITRA" METEOROLOGICAL	40°67'09.56"N 22°78'09.26"E	Automatic meteorological station. Installed on 24/6/2008 (12/10/2012 - 24/2/2013, no recordings). Wind velocity, Wind direction, Rainfall, Solar radiation, Humidity and Air temperature
5.14	ALIAKMONAS River NISELIO Bridge SWRI "ELGO-DIMITRA"	40°34'58.87"N 22°28'15.73"E	Hydrometric station. Installed on 11/10/2017 Radar, (Stage, Velocity) SL-ADCP, (Stage, Velocity)

3.6 Stations under the CO-PREVENT project (INTERREG BLACK SEA).

Under the "Cooperation for Disaster Prevention and Environmental Monitoring in the Black Sea Basin - BSB 802" project which is co-financed, in the context of the second

call for the Black Sea Basin Joint Operational Project 2014-2020, by the European Union (through the European Neighbourhood Instrument) and the participating countries (Armenia, Bulgaria, Georgia, Greece, Republic of Moldova, Romania, Turkey and Ukraine), the installation of 3 water level metering stations at 3 locations of the Axios River (and another 2 at Gallikos River) was foreseen by the Greek partner, ANATOLIKI SA. However, their exact location, whether or not they are to be included in an already existing network and, more generally, the way they are to be used after the project's conclusion have not been communicated yet.



Map 2. Monitoring hydrometeorological stations and their operators.

4 Conclusions

There is no doubt that the specific characteristics of an area, such as the hydraulic characteristics, the supply of the river coming from North Macedonia, the geology of the area, the existence of a dam (Elli), the extensive irrigation network, the purchase and maintenance cost of the network producing hydrometric and meteorological data, play a crucial role in deciding the siting on of a new stations network. The need of conducting a relevant study and related essays may solve issues such as the

optimisation of the number and installation sites of the monitoring stations, but it may also complicate processes if it leads to different actors seeking other solutions, such as installing stations solely based on financial criteria, i.e. the purchase cost. Therefore, it would be appropriate to conduct a special purpose study, e.g. on a timely risk warning system, but this should be in line with the complete picture of the entities and the already existing network, in order to avoid overlaps and to ensure the continuance of operation beyond the duration of the project.

In this respect, for the needs of developing River Basins Management Plans in Greece, it is worth referring to the way naturalized supply and demand-supply models are extracted. Data production from hydrological models is deemed sufficient, although deficiencies are identified concerning the critical question of the way the volume of atmospheric precipitation is transformed into superficial runoff in the rivers of the country. In other words, while the network of meteorological data is becoming dense, the water-metering network is not equally dense.

Accordingly, as shown in the relevant map (Map 1), it can be concluded that the coverage of the Axios river with the meteorological stations installed is satisfying given the geographical coverage of the area. More specifically, especially in the case of the Axios basin, there is an operational network of meteorological stations which can reliably produce at least time series of data on atmospheric precipitation and the conditions of temperature and humidity. These data are necessary in order to have a complete picture of the volume of water falling into the Axios basin in Greece. However, the availability of data by and to the competent bodies should be examined and the geographical coverage in combination with the events observed should be studied via a spatio-temporal analysis. Still, the basic problem in relation to the coverage of the area is that the coverage of the main course of the Axios river with water-metering stations is deficient and, where existent, it is sporadic. In other words, there are 3 stations measuring supply (at the border, at the dam and the lower part) for the needs of the National Water Monitoring Network. These perform at least 12 instant supply measurements per year. Only the second of the 3 stations (at the bridge of Prochoma - Koufalia) has a telemetric station continually recording the river supply.

A comprehensive picture of the rainfall in the Axios basin and of what this means for the supply or the potential flooding of the river cannot be formed, because of the lack of important data on the quantity of water coming from outside the Greek river basin and of data regarding the water usage in the plain of Thessaloniki. In the first case, a telemetric water-metering station of continuous recording is also foreseen by the relevant legislation transposing Directive 2000\60\EK; in the second case (station at the Delta) it will produce data concerning the part of the supply remaining in the river, after completion of important irrigation works and the avoidance of false flood warnings, during the months when the irrigation network is operational. This way, it is possible to acquire a full picture of the water falling (rains etc.) in the Axios basin as well as of the duration and intensity of the floods these rains can transform into.

Therefore, it can be safely said that a comprehensive study dedicated to the needs of a modern timely warning station system is appropriate. However, there are necessary

steps to be taken even before such a study is conducted. These steps include the installation of two additional stations continuously recording the flow/supply on the main course of Axios.

5 The way forward

The installation of two new continuously recording stations at the Idomeni bridge downstream right after the borders, and at the bridge on the old national road Athens-Thessaloniki, at the Axios delta, is considered to be of utmost importance.

More specifically, the mapping of the existing monitoring network should be followed by an investigation in order to determine the appropriate location for the installation of the new river flow monitoring system and the telemetric stations, together with a proposal for an optional system type, for the relevant specifications and an estimation of its installation and operation cost. The life cycle and the characteristics of these stations should be studied and the eventual analysis should take into account the maintainability of the existing network, the need to maintain the existing and install new stations, as well as the areas where floods are more likely to occur. In any case, ensuring a denser network contributes to the collection of more reliable data and their cross-checking, but the installation of 2 continuously recording telemetric water-metering stations (borders and Axios Delta) is considered necessary.

The two proposed locations for the installation and operation of these automatic telemetric stations continuously recording the flow and supply are the following:

	Locations	Coordinates	CHARACTERISTICS
1.	Axios bridge on the road Idomeni - Evzoni	41° 6'42.16"N 22°32'14.87"E	Hydrometric station. Radar, (Stage, Velocity) Wind, (Speed, Direction)
2.	Axios bridge on the road connecting Malgara to Chalastra	40°37'5.88"N 22°42'37.19"E	Hydrometric station. Radar, (Stage, Velocity) Wind, (Speed, Direction)

5.1 Cost of installation and operation

Regarding the estimated operation and maintenance costs of the two stations, this is presented in the following table:

ITEM	UNIT PRICE	NUMBER OF ITEMS	TOTAL
Telemetry unit	2.500,00€	2	5.000,00€
Ultrasonic wind speed and wind direction sensor	1.000,00€	2	2.000,00€
Non-contact flow measurement system (Radar)	11.000,00€	2	22.000,00€



ITEM	UNIT PRICE	NUMBER OF ITEMS	TOTAL
Power supply system with photovoltaic collector	600,00€	2	1.200,00€
Installation of each station	1.100,00€	2	2.200,00€
Cost of annual operation and maintenance for each station	1.000,00€	2	2.000,00€
Software, data processing and monitoring and decision-making system	2.500,00€	1	2.500,00€
TOTAL (WITHOUT VAT)			36.900,00€



Picture 1. Photo of the installation site on the Malgara bridge



Picture 2. Photo of the installation site on the Idomeni bridge

The stations to be installed should continuously provide reliable telemetric supply metering data. More specifically, the recording signal should be processed, while noise and the most intense outliers should be eliminated. Additionally, it should be possible to recover data in real time through standardised communication protocols, such as REST API. Ideally, the following should be ensured concerning the automatic telemetric supply stations:

- They should not require maintenance
- They should not require any construction in the water flow
- They should operate with a solar panel
- They should detect the direction of the flow
- They should have IP 67 protection
- They should have an operating temperature range between -25°C and 60°C
- They should be equipped with incorporated protection from electrical discharges
- The supply should be measured internally within the instrument and not by an external software
- The operator should be able to program the flow surface area (cross-section at the point of measurement)

Water level measurement using a radar:

- Measurement width of at least 0-15m
- Analysis of at least 1mm
- Accuracy equal to or better than $\pm 2\text{mm}$

Speed measurement using a radar

- Width of at least 0.3–10 m/sec
- Accuracy equal to or better than $\pm 0.01 \text{ m/s}; \pm 1 \% \text{ FS}$
- Analysis of at least 1mm/s

Operational data

- Adjustable duration for the conclusion of measurements within the range of 30–180sec
- Measurements provided: 1) Supply, 2) Level, 3) Speed

Telemetry units shall be accompanied by a solar panel supply system, battery and charger with a 10-day autonomy in case of loss of the solar panel:

- The unit must be suitable for permanent installation in ambient conditions and have IP 65 and IP 67 rating protection.
- It must be able to locally store (in an integrated memory) at least 1 million measurements.
- It must be equipped with an internal temperature sensor.
- It must be equipped with a detachable omni-directional antenna.
- It must be equipped with an integrated battery charging control system.

- It must allow the programming of the measurements rate and the measurements transmission rate from one measurement/10 seconds up to one measurement per at least 10 hours.
- It must allow connection to and supply from a solar panel.
- It must operate within a temperature rate from -20°C to 55°C

6 Bibliography

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Interreg - IPA CBC



Greece - Republic of North Macedonia

FLOOD SHIELD



Влада на Република Северна Македонија
Government of the Republic of North Macedonia
ДИРЕКЦИЈА ЗА ЗАШТИТА И СПАСУВАЊЕ
PROTECTION AND RESCUE DIRECTORATE

INTERREG IPA CBC «Greece - Republic of North Macedonia 2014-2020»

FLOODSHIELD focuses on the transboundary part of the Axios/Vardar river, which provides the area with abundant important advantages from an environmental as well as a social, financial and strategic aspect.

The implementation of the project's activities and the delivery of their anticipated outputs will contribute to the achievement of the project's specific objectives as follows:

- **Governance:** Establishment of a Joint flood risk management group, definition of the procedures needed to overcome the barriers in the cross border cooperation and elaboration of a cross border flood reaction strategy.
- **Reaction:** training of the staff of the authorities, services volunteer groups participating in the interventions during flood; mapping of flood risks and vulnerable sites; accessibility modeling of means and equipment in the neighboring territories; development of an Incident Management and Collaboration Platform for local Civil protection and other stakeholders to train, prepare and respond in case of flooding.
- **Prevention:** Development of a Flood Early Warning System; and implementation of activities aiming at raising awareness and informing citizens about their protection from the risks of flooding.
- **Mitigation:** Measures for mitigation of flood risks will be included in the flood reaction strategy

More specifically, the project combines different aspects to achieve the following sub-objectives:

1. Strengthening the flood risk governance at the cross-border area to better assess, plan, monitor, prevent and react against floods.
2. Improving the technical capacity for effective cross-border flood risk assessment, monitoring, preparedness and response.
3. Promoting the role of citizens and voluntarism groups in the civil protection actions in case of flood disasters to protect themselves and actively involved in prevention and reaction activities.



The project is co-financed by the European Union and the participating countries' national funds.

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