Acknowledgments

The goal of the WATER CRIMES research project is to provide the first strategic analysis of crimes against water resources in Europe. While awareness of environmental crimes is gaining momentum at international level, crimes against water are an emerging issue. Such crimes have significant impacts, although intelligence is scarce and information fragmented. The WATER CRIMES project aims to advance knowledge in this field through four main activities:

1. Compiling an inventory of the various forms of crime that threaten water resources, water management, and the related supply chains and infrastructure
2. Developing a mid-term outlook of crime trends
3. Analysing the potential impacts of water crimes in Europe
4. Developing policy recommendations and mitigation strategies

The present report summarises the main strategic outcomes of the project, and represents the first European Report on Water Crimes.

Project Coordinator: Massimo Migliorini
Istituto Superiore sui Sistemi Territoriali per l’Innovazione (SiTI)
Security and Business Models for Energy Networks and Infrastructures Department
Via Pier Carlo Boggio 6, 10138 Torino, Italy
Tel: +39 011 1975 1558 • migliorini@sit.polito.it • www.siti.polito.it
Scientific Coordinator: Lorenzo Segato
Centro Ricerca e Studi su Sicurezza e Criminalità (RISSC)

PROJECT STAFF
Francesco Moresi (SiTI) • Lorenzo Segato (RISSC)
Nicola Capello (RISSC) • Walter Mattioli (RISSC)
Cecile Monnier (REC) • Danilo Aleksic (REC)
Jefferson de Andrade Lessa (REC) • Gorazd Meško (FCJS)
Katja Eman (FCJS) • Sasa Kuhar (FCJS)
Luz María Puente Aba (UDC) • Eva María Souto García (UDC)
María Ángeles Fuentes Loureiro (UDC)

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Copyediting and proofreading: Rachel Hideg


To learn more about the WATER CRIMES project, please visit the project website: watercrimes.eu
Environmental crimes are recognised worldwide as a fast-growing issue. They represent the world’s fourth largest area of criminal activity after drug smuggling, counterfeiting, and human trafficking. Since 2007, environmental crime has risen by at least 5 to 7 percent per year. Despite their seriousness, environmental crimes are still typically underestimated both nationally and internationally, and the levels of sanctions and deterrence for such crimes are still very low worldwide.

Often committed by organised criminal groups, environmental crimes are usually cross-border in nature and may result in a big impact on human health, and fauna and flora. They may also have severe consequences for the quality of air, soil and water. Different environmental media can be used by criminals, and water, in particular, is a strategic resource highly exposed to different criminal interests. Freshwater, with its limited availability, together with drinking water, are vital resources and their governance is complex, from — often transboundary — watershed management to ensuring water quality for human consumption through supply chains and infrastructure. Water management infrastructure is exposed to cyber attack and traditional terrorist threats, but intelligence and research in this field are limited.

Most crimes linked to water have not been the focus of enforcers’ attention, nor have they been widely acknowledged. They are, however, seen as emerging crimes that are difficult to assess, detect and prosecute, especially because water often crosses borders, data are recorded under various categories of offences, and legislation and policies vary among countries.

To better combat these unlawful acts, prerequisites include notably advancing the existing knowledge on water crimes and raising the awareness of the public, legislators, authorities, the judiciary, the water sector and water experts.

The WATER CRIMES project, supported by the Internal Security Fund of the European Union, carried out wide-ranging and systematic research into crimes against water and provided the first strategic analysis of offences and threats related to the freshwater sector in Europe. The work included:

- making an inventory of the various forms of crime that threaten this fundamental resource, its management, and the related supply chains and infrastructure;
- analysing the potential impact and risks of these crimes in Europe;
- developing a mid-term outlook of trends in these crimes in Europe; and
- elaborating policy recommendations for mitigation strategies.

The project was implemented by five partners — the Faculty of Criminal Justice and Security of the University of Maribor (FCSJ UM), Slovenia; the Regional Environmental Center (REC), Hungary; the Research Centre
on Security and Crime (RiSSC), Italy; the Higher Institute for Territorial Systems for Innovation (Istituto Superiore sui Sistemi Territoriali per l’Innovazione, SiTI), Italy; and the University of A Coruña (UDC), Spain. It contributed to the understanding and prevention of water crimes through work in four pilot countries (Hungary, Italy, Slovenia and Spain).

The WATER CRIMES project comprised three work packages, each with its own specific methodology:

- WP1 – Data Collection
- WP2 – Threat and Risk Assessment
- WP3 – Outlook

In the context of the research, the following working definitions were used:

- A water crime can be defined as any punishable contravention or violation of the limits on human behaviour, as imposed by national criminal legislation, against surface water and groundwater, or against water services. The definition of water crime also includes any intentional act that can potentially harm or damage the water.
- A water-related crime can be defined as any punishable contravention or violation of the limits on human behaviour, as imposed by national criminal legislation, which uses surface water, groundwater or water services as a means for committing other crimes.

The project elaborated an inventory of water crimes and water-related crimes based on seven categories:

- water corruption;
- water organised crime;
- water pollution;
- water theft;
- water fraud;
- water terrorism; and
- water cyber attack.

Each of the categories was defined and described. In addition, the project team provided an analysis and assessment of the risk index, probability index and impact index for each category, followed by an environmental, economic and social impact assessment. Based on consultations with experts, a five-year outlook based on different scenarios was developed. Finally, an illustrative case study was presented for each water-related crime category.

The results show that at EU level the most frequently reported and prosecuted crimes are water pollution and water theft, while water corruption has one of the highest risk index scores in terms of probability linked to influencing factors such as water scarcity — a rising concern in some parts of Europe — and unclear legislation; and in terms of impact, since, for example, corruption raises the price of connecting a household to the water network. It is also estimated that in the coming five years, corruption in the water sector and organised crime will increase, while other crimes will increase only slightly (cyber attack, water theft), stay at the same level, or slightly decrease (water pollution, water fraud, terrorism).

Policy implications related to water crimes refer to suitable mechanisms to reduce or eliminate the risk of these offences and to mitigate their consequences. In the context of the WATER CRIMES project, these measures are classified according to three different categories: prevention, prosecution and partnership.

Prevention can be considered the most important measure in relation to water contamination and water pollution, as in the case of these crimes the best strategy would be to prevent the damage rather than punish and remediate. Prevention also plays a key role in other types of water crime (water fraud and water theft) and is also essential in the fight against water terrorism and water-related cyber attacks.

Prosecution makes the fight against water crimes more effective. This means passing clear laws describing the offence and establishing proportionate sanctions; and guaranteeing appropriate enforcement of the legislation.

Partnership is included due to the specific characteristics of most water crimes and the fact that, in many cases, the committing of the crime and its consequences involve different national territories. It is essential that states cooperate to prosecute and punish the crime, to remediate its impacts, and to implement effective preventive controls.

The present report, as the final project deliverable, contributes to:

- advancing knowledge on water crimes;
- promoting the adoption of a national definition of water crimes;
- encouraging the systematic collection of data on water crimes, considering the convergence of environmental crime with economic crime, etc.;
- increasing the analytical capacity of police, authorities and local communities (e.g. forecasting crime evolution, evaluating risks and threats, applying scenarios);
- developing countermeasures and mitigation strategies (e.g. increasing the monitoring of water services and public contracts; and improving the interoperability of data, formats, classification and assessment processes among authorities);
- enhancing not only crime prevention but also effective law enforcement and prosecution; and
- stimulating partnership at inter-agency and transnational levels.

The report provides recommendations for different groups of actors:

- The European Commission, international and national governmental organisations — to prioritise water, create a legal framework, increase networking and activate a multi-stakeholder working group.
- International, national and local police forces — to begin with systematic data collection; extend the investigation to data referring to the water sector; disseminate/exchange data among EU countries; and develop an intelligence analysis on emerging threats in the water sector.
- Water utilities, water-related companies and municipalities — to perform a risk assessment analysis and to take proper measures to mitigate the risks of water crimes.
- Research organisations, universities and scientific institutions — to increase knowledge on water crimes; develop/ refine tools for data collection and analysis; undertake threat and risk assessments; and exchange and disseminate best practices.

The data collection approaches, logic and tools developed within the WATER CRIMES project may be used to set up a standardised approach to the collection of data to be used by different member states. This may lead to more effective actions, appropriately tailored to existing contexts and scenarios.
According to a rapid response report published by the United Nations Environment Programme (UNEP) and INTERPOL, the value of environmental crime is 26 percent higher than previous estimates, at USD 91 to 258 billion today, compared to USD 70 to 213 billion in 2014.

The report The Rise of Environmental Crime, released on the eve of World Environment Day (WED) 2016, found that weak laws and poorly funded security forces are enabling international criminal networks and armed rebels to profit from a trade that fuels conflicts, devastates ecosystems, and threatens species with extinction.

Environmental crime dwarfs the illegal trade in small arms, which is valued at about USD 3 billion. It is the world’s fourth largest criminal enterprise after drug smuggling, counterfeiting and human trafficking. The amount of money lost due to environmental crime is 10,000 times greater than the amount spent by international agencies on combating it — just USD 20 to 30 million.

The last decade has seen environmental crime rise by at least 5 to 7 percent per year. This means that environmental crime — which includes illegal trade in wildlife, corporate crime in the forestry sector, the illegal exploitation and sale of gold and other minerals, illegal fisheries, the trafficking of hazardous waste and carbon credit fraud — is growing two to three times faster than global GDP (RONA UNEP).

Environmental crimes, often committed by organised criminal groups, have an impact on society not only in terms of the health of human beings and animals, but also the quality of the air, soil and water. The EU Serious and Organised Crime Threat Assessment (SOCTA) 2013 identified environmental crime as a specific emerging threat that requires intensified monitoring. Environmental crime also often involves a cross-border dimension, and the increase in international trade and the abolition of border controls within the Schengen area are adding to the scope of the problem. Despite the potentially grave consequences of environmental crime, particularly in the areas of illegal waste trafficking and the trafficking of endangered species, its seriousness is still often underestimated at national and international level (EUROJUST 2014).

“Low risks, high profits” is the mantra of organised environmental criminals. And environmental crime is paying more and more. Estimates vary greatly, but the figures cited by experts are staggering.

According to André Viau, honorary president of the International Forum on Technology and Security (FITS), “After drugs, human and arms trafficking, this is the fourth most important source of revenue for organised crime.”

Demand for natural resources and rare species is consistently high. Tougher environmental rules, in both developed and developing countries, have led to a growing...
The problem

The UNEP/INTERPOL report mentioned above covers offences that cause damage to the natural environment — forests and timber, protected or endangered species of flora and fauna, precious metals, and air, soil and water in general, with no specific focus on freshwater.

Water, often referred to as “blue gold”, is a strategic resource for our future. Its limited availability (over 98 percent of water is saline); tensions in transboundary basins that result, in part, from human pressure on finite water resources; overconsumption and unequal distribution at state and corporate level (nine countries possess more than 60 percent of drinkable freshwater); its vital function; and its innate value make water a “hot product” (Clarke 1999), highly vulnerable to various criminal interests.

Water quality is becoming a major issue in countries affected by hydrocarbon extraction. The increasing demand for oil and gas worldwide is driving petrochemical companies to target fragile ecosystems, sometimes lobbying governments for less stringent environmental regulations and often stirring up conflicts with local populations on issues related to health and environmental impacts.

Crimes against water range from the plundering of drinkable water, to the illegal disposal of waste into watercourses by factories or hospitals, to marine pollution from oil spills. In addition, “water source grabbing” by private interests falls within an inclusive definition of water crimes, if water is intended as a public and free good.

There is growing interest among international organisations in environmental crimes: the trafficking of wild flora and fauna and illegal trade in waste (Europol 2013); illegal fishing; illegal logging and trade in timber (UNICRI 2014); surface water pollution (EUROJUST 2014); and carbon trade and illegal mining (UNEP 2014). Crimes against water are an emerging issue (INTERPOL 2014), but they remain difficult to assess, detect and prosecute, especially because water often crosses nation-state boundaries, data are recorded under various categories of offences, and legislation and policies on freshwater vary from country to country.

Although both physical and logistical water management infrastructure are exposed to cyber and traditional terrorist threat (Europol 2016; ENISA 2014), intelligence and research are still lacking in this field.

Project preparatory activities showed that analysis of water crimes is not developed in Europe, the only exception being the protection of critical infrastructure.

The project idea

The WATER CRIMES project aimed to undertake wide-ranging and systematic research into crimes against water, and to produce an inventory of crimes and an outlook for the future, in order to contribute to the understanding and prevention of this type of environmental crime.

In practice, the definition of the terms “water” and “crime” was in itself a challenging task that had to be approached pragmatically for the purposes of a new project, the scope of which was to explore and assess an emerging area of crime. Water-related crimes are often recorded as other types of offence — such as fraud, corruption, trafficking, the falsification of documents or terrorism — in the absence of a systematic analytical approach. The nature and extent of these kinds of activities are still relatively unknown.

In this context, the WATER CRIMES project, supported by the Internal Security Fund of the EU, aimed to provide the first strategic analysis of offences and threats related to freshwater in Europe, and to:

- make an inventory of the various forms of crime that threaten this fundamental resource, its management, and the related supply chains and infrastructure;
- analyse the potential impact and risks of these crimes in Europe;
- develop a mid-term outlook of the trends of these crimes in Europe;
- elaborate policy recommendations for mitigation strategies.

The pilot countries were Hungary, Italy, Slovenia and Spain. The project also aimed to help law enforcement and other authorities to prevent and detect this type of crime; gather statistics and intelligence for threat and risk analysis; collect good practices; and identify links with other forms of crime (in particular, fraud and other economic crimes, terrorism and cybercrime).

Research challenges

Various challenges emerged during the development of the project. Since the boundaries of the research topic were difficult to define, it was decided to restrict the focus of the investigation to potable water. A lack of data on water theft, fraud and terrorism was also encountered.

The measurement and analysis of damage to water bodies caused by crimes are hampered by two main factors: the absence of a common definition of the terms “water crimes”, “water-related crimes”, and “water security”; and the absence of systematic data collection at the EU level. Water has no boundaries, thus the protection of this natural element from harm, and the prevention of damage to human beings and the environment, should be approached in a consistent and coordinated way at international level. Today, water security is weakened by gaps and loopholes in legislation, and by the activities of criminal groups.

According to the International Classification of Crime for Statistical Purposes (ICCS) of the United Nations Office on Drugs and Crime (UNODC), “various data sources, often within the same jurisdiction, use different definitions and concepts to organize crime data which are often based on legal rather than statistical principles. This close and intertwined relationship between legislation and statistics creates problems from an analytical perspective: statistical data are often organized and categorized according to legal provisions, such as articles in legal or penal codes, which are not always relevant from an analytical standpoint. Furthermore, comparability across time and jurisdictions can be hampered by changes in legislation and, for example, by the fact that the same act can be criminalized under very different legal provisions in different countries, or may be considered a criminal offence in one country but not in another.”

One ambition of the project was to make an inventory of water-related crimes in Europe in a form that is replicable and scalable. The research followed the ICCS approach.

In the Threat and Risk Assessment phase, the need arose to quantify social and economic impacts, which highlighted the absence of research, analyses and European reports. The principal challenge was to define the terms “water” and “crimes”. Within the project, a working definition was adopted that was as wide as possible, including forms of...
offences against water bodies based on — but not necessarily limited to — the descriptions found in the criminal law of the different countries. The definition of water crimes is provided in Chapter 3.

The working definitions have some limitations and remain open to review:

1. Although the project has a focus on Europe, the ambition of the inventory was to suggest a new classification of environmental crimes: the definition of water according to EU directives must permit a correct definition of water crimes for international classification.

2. The definition of water in EU directives has some exclusions: natural mineral waters, waters that are medical products, and other exclusions defined at country level.

Methodologies

The WATER CRIMES project comprised three work packages (WPs):

- WP1 – Data Collection
- WP2 – Threat and Risk Assessment
- WP3 – Outlook

Work Packages 1 and 3 were coordinated by RiSSC, and Work Package 2 by the FCJS UM, using three different methodologies.

Work Package 1 collected data for creating the inventory. The methodology included an expert focus group, desk review, the collection of case studies from participating countries and other European member states, and a review of existing classification systems. The methodology for WP2 was developed by FCJS UM, RiSSC and SiTI. The principle was designed in cooperation with all project partners and was divided into two parts:

- threat assessment, based on the inventory of water crimes, aimed at systematising the information needed to characterise the crime; and
- risk assessment, aimed at assessing the level of risk deriving from water crimes. The threat assessment method was derived from the knowledge collected in WP1, particularly the research methodology plan (RMP), where the information required to characterise the crime was identified:
  - seven crime categories, which were taken as the main input for crime classification; and
  - threat assessment-related parameters: offence type, perpetrator, modus operandi, and the role of water (target or means).

The risk assessment methodology started from the general concept of risk as a function of three different factors:

\[ RI = L \times I \times V \]

Where:

- \( RI \) is the Risk Assessment Index;
- \( L \) is the value of the likelihood of the threat;
- \( I \) is the value of the impact severity of the threat on the asset; and
- \( V \) is the value of the vulnerability of the asset to the threat.

Different approaches to assessing the risk of water crimes were identified via an extensive literature review, refined by project partners’ knowledge and opinions and the suggestions of external experts, which were collected during a focus group (held on June 14, 2016) and a European workshop (held on November 10 and 11, 2016, in A Coruña, Spain). The final risk assessment methodology was an integrated approach based on the systems thinking method (STM) and environmental and socioeconomic impact assessment (ESIA). Core factors related to likelihood, impact and vulnerability were identified and parametrised, leading to a relative comparison between the seven categories of water crimes.

Following the principles of this methodology, different factors capable of influencing the occurrence of water crime cases were identified. These factors are:

- **Drought**: Droughts can lead to an increase in water theft.
- **Water scarcity**: Scarcity of water can encourage water theft.
- **Forest fires**: Forest fires result in higher demand for water, and may therefore encourage water theft and corruption.
- **Water privatisation**: The privatisation of the water supply may encourage corruption.
- **Unclear legislation**: In the case of unclear legislation, the question of what should be monitored, and by whom, is not addressed, which results in an increase in water crimes such as fraud, theft and corruption.
- **Presence of alternatives**: Ensuring that people have alternative ways to achieve their objectives can result in a fall in the level of crime.
- **Poverty**: Poverty increases the likelihood of water theft.
- **Industrialisation**: The level of industrialisation affects the water sector and can influence the level of water crime.
- **Waste production**: Waste production can be a reason for committing crimes (e.g. water pollution).
- **Knowledge**: The level of water crimes is affected by how well the public and local authorities are informed about what constitutes a crime and what does not.
- **Regulatory framework**: Different EU member states have different regulations and legislation in the water sector, making the investigation of water crimes difficult.

**Interoperability**: The level of interoperability among police forces can affect the success of a water-related criminal investigation.

**Data availability**: The amount of water-related data and level of public awareness affect the level of water crimes.

**Data harmonisation**: Harmonisation among different water-related data sources enables comparisons.

**Indicator availability**: The availability of indicators describing waste/pollution related to factories/plants contributes to more successful monitoring and control.

In addition, parameters were identified to qualify the level of impact from an environmental, economic and social point of view:

- Environmental impacts: on flora, fauna, natural resources (soil, air and water etc.), and the human population.
- Economic impacts: cost of water supply service alterations/disruptions, cost of drainage, cost of damage recovery.
- Social impacts: mistrust among the population, imitation of crimes, perceptions of insecurity and loss of freedom/privacy.

The list of factors, their influence (negative/positive) and level of impact (high/low), and the parameters for impact assessment were investigated in two phases:

- the gathering of expert opinions (until May 2017); and
- on-line surveys (May and June 2017).

Based on the collected data, the risk assessment method was applied to the seven identified crime categories, resulting in the comparison of relative risks.

The methodology for WP3 was developed by the RiSSC, based on the report “Organised Crime and Energy Supply” (Europol 2010), which was considered to be the most appropriate in terms of the similarity of the topics analysed and the methodology used. It included two main activities: the collection of data via an on-line survey (May/June 2017), and the definition of possible water crime scenarios. According to the Europol report: “Scenarios are descriptions of possible worlds, which facilitate reflection on the future. Different
scenarios highlight risks and opportunities, which enable organisations, including law enforcement agencies, to prepare appropriate responses in the event of identified phenomena becoming a reality” (Europol 2010, p. 3).

The scenarios were developed according to the evolution of four main drivers in the water sector:
- water prices;
- the certainty of water supply;
- water demand; and
- investments in the water sector.

The three most likely scenarios were designed and analysed, as shown in Table 1.

Using the three proposed scenarios, it was possible to hypothesise how the seven main categories of water threats might evolve in the coming few years.

### Table 1 Three water crime scenarios

#### SCENARIO 1 (MOST LIKELY)

**CRITICAL UNCERTAINTIES IN WATER SECTOR TRENDS**

- The price of water will increase.
- The certainty of water supply will decrease.
- Water demand will increase slightly.
- The value of investments in the water sector will increase.

**KEY CHARACTERISTICS**

Demand for water on the part of consumers rises without any certainty of water supply. As demand grows, service companies invest more money in the sector, thus prices increase too. Final consumers, who require greater amounts of water, must suffer an increase in prices without the simultaneous improvement of the service. This situation might create social tensions.

**CRIME CHARACTERISTICS**

An increase in the price of water, without a parallel increase in service certainty, raises the risk that consumers may find alternative and illicit means to obtain water — that is, it may increase the risk of water theft (e.g., tampering with water meters) and the risk of criminal activities or organised crimes (e.g., the development of systems for unlawfully supplying and selling water). Price increases may also encourage consumers to devise more direct ways to dodge taxes, thus reducing the amount of the tariff. Greater investments in the water sector can stimulate illicit economic interests and the spread of corrupt agreements aimed at the splitting up of large resources. In addition, increased investments can lead to the increased digitisation of the water management system and related tools. On the one hand, this can make the system more efficient, although on the other hand it may increase its vulnerability to hacking.

#### SCENARIO 2

**CRITICAL UNCERTAINTIES IN WATER SECTOR TRENDS**

- The price of water will slightly increase.
- The certainty of water supply will remain the same.
- Water demand will increase.
- The value of investments will remain the same.

**KEY CHARACTERISTICS**

In this scenario, where the value of the investments and the certainty of water supply stay the same, demand grows significantly while prices increase slightly. This scenario corresponds exactly to situations where the increase in demand is followed by an increase in prices. Nevertheless, despite increasing demand and prices (at a different level), the value of the investments remains more or less the same. This condition, where there is no increase in the value of investments aimed at improving and adapting the service to the growth in demand, even if prices are higher, will certainly create tension.

**CRIME CHARACTERISTICS**

The rise in prices and demand for water, without a corresponding increase in the value of investments and the certainty of water supply, may increase the risk of several water threats.

#### SCENARIO 3 (LEAST LIKELY)

**CRITICAL UNCERTAINTIES IN WATER SECTOR TRENDS**

- The price of water will remain the same.
- The certainty of water supply will slightly increase.
- Water demand will remain the same.
- The value of investments will decrease.

**KEY CHARACTERISTICS**

The scenario where price and water demand remain the same, while the certainty of water supply slightly increases and the value of investments decreases, is the least likely of the three. Such a scenario may arise due to the good long-term administration of the supply system, which allows for an increase in consumers’ perceived security while maintaining unchanged prices and even reducing investments.

**CRIME CHARACTERISTICS**

In this scenario, the possibility of corruption may decrease as a result of the efficiency of the administration and the reduction in invested capital.
CHAPTER 3
Defining water crimes

The international legal framework

One of the main challenges in water crimes analysis is the absence of a legal definition of these offences. This chapter presents a review of the existing international legal instruments for the water sector, with potential relevance for the definition of criminal offences, and the working definitions adopted in the WATER CRIMES project.


This convention adopts a wide definition of the uses of international watercourses for purposes other than navigation, with the aim of protecting, preserving and managing these waters. An “international watercourse” is defined as a system of surface water and groundwater constituting a unitary whole and situated in different states.

Although the convention seeks for commitments to prevent and reduce pollution in this type of water, there is no reference to the need to include water crimes or water-related crimes in the legislation of each state.


This convention focuses on transboundary surface water and groundwater bodies that are located on the boundaries between two or more states. Its scope is to promote cooperation related to the management of such water bodies, highlighting the need to prevent pollution and to achieve sustainable development that protects ecosystems.

Like the UN Watercourses Convention, it focuses on cooperation on water management among different states, with the declared aim of preventing pollution and protecting the environment. There are no provisions regarding the need to establish any criminal offences in this field.


This directive establishes the so-called environmental quality standards (EQS) for priority substances and other pollutants, with the objective of guaranteeing good surface water chemical status. It derives from the EU Water Framework Directive (see below: Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field...
of water policy), and, though Directive 2008/105/EC, amends this last directive, adopting its concepts and definitions.

The 2008 directive has three annexes establishing EQS for priority substances and certain other pollutants. It provides a list of different substances, determining the maximum permissible amount for different kinds of surface waters in order to guarantee the safety and security of water resources. It should be noted that some of these substances are categorised as "priority hazardous substances." The purpose of the directive is to avoid the chemical pollution of water resources, taking into account the dangerous effects not only on aquatic organisms and ecosystems, but also on human health. Notably, in order to achieve this aim, the directive establishes the requirement that each member state make an inventory of emissions, discharges and losses of all priority substances and pollutants mentioned in the directive. In order to fulfill the obligations imposed by the directive, reporting activities by each member state and control exercised by the European Commission are clearly essential.


As one of the European framework directives, the Marine Strategy Framework Directive establishes objectives for the protection and conservation of the marine environment against harmful human activities. It seeks to prevent the deterioration of marine waters, and to restore marine ecosystems that have been adversely affected. For this, it is essential to establish control over marine inputs in order to avoid risks to marine ecosystems and human health.

The directive contains different strategies to protect marine ecosystems and to ensure that economic activities linked to the marine environment are sustainable. Cooperation between member states and neighbouring maritime regions is considered essential. The main task for member states is to identify the environmental status of their marine waters, taking into account the impact of human activities. Member states must establish what would be "good environmental status" for their marine waters, and consequently develop monitoring programmes to maintain the accepted environmental quality of such waters. The directive contains a list of qualitative "descriptors" that can be used to determine when water has good environmental status — namely, the maintenance of biodiversity; the development of sustainable fishing; the safeguarding of the seabed; and the control of marine litter and contaminants. The development of monitoring programmes is crucial for the evaluation of progress towards reaching these objectives.


The aim of this directive is to protect the environment from the adverse effects of urban wastewater discharges and discharges from some industrial sectors. The directive seeks to establish the regulation and monitoring of the collection and treatment of wastewater and to prevent water pollution.

- Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources

The goal of this directive is to protect water quality by preventing nitrates from agricultural sources polluting groundwater and surface waters, and by promoting the use of good farming practices. States should identify waters that have been polluted or that are at risk of pollution caused by nitrates, and should ensure that good agricultural practices can be implemented to prevent and control this kind of pollution. National monitoring and reporting are essential tools for achieving the objectives of the directive.


The goal of this directive is to protect human health from the adverse effects of the contamination of water intended for human consumption. All member states must implement certain measures to guarantee that water for human consumption is wholesome and clean. Regular monitoring of this kind of water is crucial in order to guarantee its safety and protect human health.


This is the basic legal instrument for implementing and developing European water policy. As a framework directive, its scope is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater, and to promote the implementation of measures and strategies to protect all these types of water and to prevent and control pollution.


This directive refers to surface waters that can be used for bathing (with the exception of swimming pools and spa pools); confined waters subject to treatment or used for therapeutic purposes; and confined waters artificially separated from surface waters and groundwater. Its aim is to guarantee water quality by establishing related management measures and parameters.


This directive sets groundwater quality standards and introduces measures to prevent or limit the pollution of this kind of waters. Member states should establish groundwater quality standards, taking into account local or regional conditions. The directive describes measures to prevent or limit the introduction of pollutants into groundwater.

- Directive 2008/99/EC on the protection of the environment through criminal law

The aim of this directive is to guarantee that the most serious offences against the environment are punished by criminal sanctions. It obliges member states to define as criminal offences different incidents, whether intentional or at least occurring due to serious negligence, that result in relevant damage or a threat to different elements of the environment. Water is considered as one of those elements that can suffer particular damage due to the different kinds of behaviour mentioned in the directive (essentially, the introduction of any material that causes or is likely to cause substantial damage to water, with specific mention of waste treatment and nuclear materials). The directive sets a minimum standard of criminal environmental law, although each member state may implement a higher level of environmental protection through its national criminal law. The reference to criminal sanctions is also very general, as the directive calls for “effective, proportionate and dissuasive criminal penalties” but establishes neither the nature nor the minimum duration of the sanction. The directive focuses on substantive criminal law — there are no references to procedural law or to partnerships and cooperation among member states in the investigation and prosecution of the crimes.

Although this directive is not specifically related to water or the environment, it is relevant due to the fact that it aims to guarantee the protection of “critical infrastructures”. These are defined as “an asset, system or part thereof located in member states, which is essential for the maintenance of vital societal functions, health, safety, security, economic or social well-being of people, and the disruption or destruction of which would have a significant impact in a member state as a result of the failure to maintain those functions.” Water infrastructure is essential for the correct distribution and availability of water for the population, thus its disruption or destruction would present a great risk or damage to water accessibility.

Annex I to the directive refers to “inland waterway transport” as critical infrastructure, although Article 3 of the directive establishes procedures to allow each member state to identify possible critical infrastructure. As will be illustrated when examining the definition of “water crimes”, some criminal behaviour (e.g. theft, fraud, cyber attacks and terrorism) could seriously affect water services and endanger water distribution. In this way, any mechanism for the preventive protection of such infrastructure would be an effective way to prevent the committing of these specific categories of water crimes.


Although not specifically on water, this directive is important as it develops a general and comprehensive framework for controlling industrial emissions and for preventing and controlling pollution coming from different sources. It replaces the previous Directive 2008/1/EC of the European Parliament and of the Council concerning integrated pollution prevention and control. According to Article 3, “pollution” is the direct or indirect introduction, because of human activity, of substances, vibrations, heat or noise into air, water or land, which may be harmful to human health, or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment.

The key instrument for implementing this control is the obligation on industries to obtain the necessary permits for their activities, guaranteeing that pollutant inputs will respect the maximum limits allowed by legislation. The directive takes as a basis an “integrated permit”. This means that the permits issued to industries take into consideration the agent’s complete environmental performance, in order to avoid pollution being shifted from one medium (air, water or land) to another.

**Working definitions**

**ENVIRONMENTAL CRIMES**

There is no precise definition of environmental crimes. The UNODC International Classification of Crime for Statistical Purposes (ICCS) defines crime as: “the punishable contravention or violation of the limits on human behaviour as imposed by national criminal legislation”, although an act against the environment can be criminalised under very different legal provisions in different countries, or may be considered a criminal offence in one country but not in another.

Directive 2008/99/EC on the protection of the environment through criminal law acknowledges the rise in environmental offences, and “obliges the Member States to provide for criminal penalties in their national legislation in respect of serious infringements of [a list of] provisions of Community law on the protection of the environment”. Member states must criminalise at least nine examples of conduct that have an impact on the environment — namely, that cause (or are likely to cause) “death or serious injury to any person or substantial damage to the quality of air, the quality of soil or the quality of water, or to animals or plants”, and only “when unlawful and committed intentionally or with at least serious negligence” (Article 3).

In general terms, “environmental crime” is understood as describing illegal activities that harm the environment and that are aimed at benefitting individuals, groups or companies as a result of the exploitation of, damage to, trade in, or theft of natural resources, including serious crimes and transnational organised crime (UNEP/INTERPOL 2016).

**WATER CRIMES**

When looking for a comprehensive definition of “water crimes”, it should be borne in mind that water may be the environmental resource damaged by a crime (e.g. surface water pollution, or fraudulent water quality reporting); the object of a crime (e.g. water theft or corruption on the part of private companies related to the economic control/exploitation of water); or the means of committing a crime (e.g. intentional flooding or the deliberate poisoning of a water supply).

Researchers have adopted the following working definitions, which can include the above-mentioned typologies of offences related to water:

**Water (surface water and fresh groundwater):** as defined in the EC Water Framework Directive and the Drinking Water Directive. The definition should also include water services.

**Crime:** criminal acts in national and international laws related to punishable contraventions or violations of the limits on human behaviour or demands, as defined by national criminal legislation. “The offences that are included within this range of events, however, are established by each country’s legal system and the codification of crimes (criminal code, penal code etc.)”, as defined in the UNODC ICCS. The working definition of “crime” for the purposes of this project can include other acts, not included in national/international legislation, that can potentially harm or damage water. In this case, acts not specified in any legislation require a specific description.

**Water crime:** can be defined as any punishable contravention or violation of the limits on human behaviour as imposed by national criminal legislation, against surface water, groundwater or water services. The definition of water crime also includes any intentional and transnational act that can potentially harm or damage water.

**Water-related crime:** can be defined as any punishable contravention or violation of the limits on human behaviour as imposed by national criminal legislation, which uses surface water, groundwater or water services as a means for committing other crimes.
Researchers collected data on 86 water crimes and water-related crimes in Hungary, Italy, Slovenia, Spain, and other EU countries. The REC collected data for Hungary; RiSSC and SiTI for Italy; UDC for Spain; and FCJS UM for Slovenia and other EU countries. These latter data were collected through a survey of the websites of national institutions, and publicly available official statistics.

As shown in Table 2, the most common water crime cases identified across EU countries were water pollution and water theft (losses in the public water supply system). These cases cover 86 percent of EU countries. Surface water was the target in 36 percent of cases; water services in 33 percent; and groundwater in 12 percent of cases. In 47 percent of cases, the water was intended for human consumption; in 7 percent it was intended for industrial use; and in 6 percent it was intended for agricultural purposes.

Water is more at risk before the supply chain (38 percent of all cases), and in the distribution phase (28 percent). In terms of location, 43 percent of offences occurred in an urban context and 42 percent in a natural or rural context. There were no cyber offences.

Offences against the environment are prevalent (76 percent of cases; of which 70 percent were against water quality, 26 percent against water services, and 4 percent against water quantity). Just 7 percent of cases were fraud, and 4 percent were offences against property.

In most cases (30 percent) the perpetrator was an enterprise; in 28 percent of cases the perpetrator was unknown; in 23 percent of cases the offender was an individual; in 11 percent of cases the perpetrator was the state or an institution; in 4 percent of cases it was another legal person; in 3 percent of cases an organised crime group; and in 1 percent of cases a criminal group.

In 70 percent of cases the offence was committed intentionally; and in 30 percent it was due to negligence. In 32 percent of all cases the damage was in the form of water pollution; in 23 percent it was water abuse; in 21 percent it was related to water accessibility; in 6 percent it was related to water availability; in 16 percent it was water fraud; and in 5 percent it was some other kind of damage.

The collected case studies were then classified in order to create the Water Crimes Inventory.

A first classification was attempted by applying the standard crime classification system—the UNODC ICCS. The ICCS is a standard international tool to classify any acts that are unlawful and committed intentionally, or with at least serious negligence, that can harm people, objects, institutions or the environment. The ICCS is structured according to 11 main categories (Level 1), each with subcategories.
<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>WATER CRIME</th>
</tr>
</thead>
</table>
| AUSTRIA            | Contamination of drinking water  
|                    | Pollution                                                                   |
| BELGIUM            | Pollution                                                                   |
| BULGARIA           | Contamination of groundwater  
|                    | Pollution                                                                   |
| CROATIA            | Losses in the public water supply system  
|                    | Wastewater (sewage, landfill leachate) discharged untreated  
|                    | into the groundwater  
|                    | Contamination of drinking water                                           |
| CYPRUS             | /                                                                           |
| CZECH REPUBLIC     | Pollution                                                                   |
| DENMARK            | Pollution                                                                   |
| ESTONIA            | Pollution                                                                   |
| FINLAND            | Pollution                                                                   |
| FRANCE             | Pollution                                                                   |
| GERMANY            | Pollution                                                                   |
| GREECE             | /                                                                           |
| HUNGARY            | Waste disposal  
|                    | Wastewater discharges  
|                    | Diffuse pollution                                                         |
| IRELAND            | Pollution                                                                    
|                    | Failure to put in place the necessary infrastructure  
|                    | Failure to notify the relevant agency about accidents                      |
| ITALY              | Corruption  
|                    | Water theft  
|                    | Pollution                                                                   |
| LATVIA             | Pollution                                                                   |
| LITHUANIA          | Pollution                                                                   |
| MALTA              | /                                                                           |
| NETHERLANDS        | Contamination  
|                    | Pollution                                                                   |
| POLAND             | Contamination  
|                    | Pollution                                                                   |
| PORTUGAL           | /                                                                           |
| ROMANIA            | Pollution                                                                   |
| SLOVAKIA           | Pollution                                                                   |
| SLOVENIA           | Contamination of drinking water  
|                    | Pollution                                                                    
|                    | Environmental destruction                                                  |
| SPAIN              | Pollution                                                                    
|                    | Fraud                                                                      |
|                    | Poisoning                                                                  |
| SWEDEN             | Pollution                                                                    
|                    | Contamination of drinking water                                           |
| UNITED KINGDOM     | Pollution                                                                   |
The case studies collected could be classified according to the following ICCS Level 1 categories (in order of relevance):

- 10 – Acts against the natural environment;
- 1 – Acts leading to death or intending to cause death;
- 2 – Acts leading to harm or intending to cause harm to the person;
- 7 – Acts involving fraud, deception or corruption;
- 9 – Acts against public safety and state security; and
- 5 – Acts against property only.

According to this tentative classification, several codes are apparently applicable to different cases: in 25 percent of cases, the same crime was classified in two or three different Level 1 categories. Only 34 percent were classified with a unique code; 39 percent were classified with two codes; 17 percent with three codes; 7 percent with four codes; and 2.5 percent with five codes.

Water crimes and water-related crimes fall mainly into category 10 (Acts against the natural environment) (51.8 percent), and less often into the following Level 1 categories:

- 5 (Acts against property only) – 26.2 percent;
- 7 (Acts involving fraud, deception or corruption) – 11.3 percent;
- 9 (Acts against public safety and state security) – 5.4 percent; and
- 2 (Acts leading to harm or intending to cause harm to the person) – 3.6 percent.

One case (0.6 percent) falls respectively into categories 6 (Acts involving controlled psychoactive substances or other drugs); 8 (Acts against public order, authority and the provisions of the state); and 11 (Other criminal acts not classified elsewhere).

There is another critical issue connected to the use of this classification: information about water is lost in the data collection process, apart from subcategory 10012 (Acts that cause the pollution or degradation of water), which belongs to category 10 (Acts against the natural environment). According to subcategory 10012, “Water pollution is the direct or indirect introduction of substances or energy into a body of water, water utilities or marine environment (including estuaries), resulting in harm to living resources, hazards to human health, hindrances to marine activities including fishing, impairment of the quality of sea water and reduction of amenities.” Subcategory 10012 is wider than the definition of water crimes adopted in this project, as it also includes saline water. Information about the type of water (e.g. freshwater, marine water), the service stage involved (e.g. impoundment, treatment, abstraction), or the intended use (e.g. agricultural, human consumption, recreational) are not accounted for in the ICCS, even in the disaggregating variables for the event, the victim, the perpetrator, or other data description/inclusion, making it impossible to use the ICCS as it is for analysing water crimes.

Such issues can be addressed using one of three strategies: 1. the creation of a new category in the ICCS – (12) “Acts against freshwater”, with sub-categories classified according to policy relevance criteria; 2. the creation of an additional Level 1 within subcategory 10012 “Acts that cause the pollution or degradation of water”; or 3. the creation of a new disaggregating variable (“Freshwater” tag) within the description of the target of the offence with the following variables: a. state of water – SW (water quality, water service); b. water quantity – WQ; c. water service stage involved – WSS (abstraction, impoundment, storage, treatment, distribution, wastewater collection, wastewater treatment, other stages); and d. intended use of water – IUW (direct human consumption, industrial, agricultural, recreational, other).

Strategy 3 (the adding of a new tag) seems the most practical, although for the time being there is still no comprehensive inventory of water-related crimes in Europe, encompassing all criminal phenomena against water. For this reason, the real or potential water crime cases (threats) collected in this research have been framed according to seven main categories:

- Water corruption;
- Water organised crime;
- Water pollution;
- Water terrorism;
- Water cyber attack.

Water corruption might be in the form of so-called grand corruption, which involves political decision makers, the exploitation of natural resources, international cooperation, and large-scale investments and large procurement contracts; or petty corruption, involving the payment of sums of money to obtain access to water services or to avoid controls and fines. According to the ICCS classification, corruption involves “Unlawful acts as defined in the United Nations Convention against Corruption and other national and international legal instruments against corruption” (ICCS cod. 0703).

Water organised crime refers to the activity of criminal organisations that have taken control over the management of the water or water services within a territory. According to the ICCS classification, organised crime is defined as “Participating in the activities of an organised criminal group” (ICCS cod. 0905).

Water pollution refers to offences against the natural environment and, in particular, directly against water quality. According to the ICCS classification, environmental crimes are defined as “Acts that result in the pollution of the natural environment”. Cod. 10012 includes “Acts that result in water pollution or degradation” (ICCS cod. 1001 and cod. 10012).

Water cyber attack refers to a reduction in water quantity carried out by customers of the water supply system in order to provide an economic advantage by means of a physical alteration of the water supply system. According to the ICCS classification, theft is defined as “Unlawfully taking or obtaining property with the intent to permanently withhold it from a person or organization without consent and without the use of force, threat of force or violence, coercion or deception” (ICCS cod. 0502).

Water fraud refers to fiscal artifice aimed at altering the water consumption register and achieving illicit gains. According to the ICCS classification, fraud is defined as “Obtaining money or other benefit, or evading a liability through deceit or dishonesty” (ICCS cod. 0701).

Water terrorism includes the threat of terrorist attack against the water sector, water quality (e.g. by poisoning) or water availability (e.g. attacks on critical infrastructure). It may also include taking control over water services for the illicit financing of terrorist activities. According to the ICCS classification, the crime of terrorism is defined as “Participating in the activities of a terrorist group or other individual or group acts related to terrorist offences” (ICCS cod. 0906).

Water cyber attacks may take place via intrusions into information and technology systems; the manipulation of information or networks; or the destruction of the data of water management companies, for example. It includes ransomware and malware attacks. According to the ICCS classification, a cyber attack is defined as “Unauthorized access to, interception of, interference with, or misuse of computer data or computer systems” (ICCS cod. 0903).
World Bank estimates that between 20 and 40 percent of water sector finances are lost to criminal or corrupt activities. Petty bribes are paid to government officials and water suppliers to falsify meter readings, avoid disconnections and conceal illegal connections. The rising demand for water reinforces such practices and encourages a sense of discretionary power among officials, consequently weakening the country’s rule of law (Global Initiative 2014).

Water management is complex and requires governance at different levels and in different areas, from watersheds to local water resources management, from national policies to specific local solutions. The physical properties of water imply that these governance levels are interrelated (geographically, institutionally and politically). Choices regarding central control over water resources (big dams or many smaller dams; large-scale public irrigation or many smaller farm-managed irrigation systems; central or decentralised water quality monitoring) influence the governance structure and, by extension, transparency and accountability relations. Levels of corruption risk vary based on those relations.

Causes of corruption in the water sector include (UNDP 2011):
- the weak enabling environment (e.g. weak rule of law, political environment etc.);
- low levels of accountability and transparency;
- weak technical and management capacity;
- political capture in the context of water policies and projects;
- gaps in laws and policies; and
- the international dimension of corruption (multinational companies etc.).

Examples of corruption in the water sector can be grouped into four specific areas: the water supply and sanitation sector; the irrigation sector; water resources management; and the hydropower sector. The information and observations below are not intended to be comprehensive. The aim is rather to provide a useful examination of the scope and nature of corruption in the water sector.

Logically, corruption is often linked to other water crimes, since the aim of corruption is to obtain illicit gain from the use or consumption of water. The objective of a bribe may be to pay lower or illegal fees for water (water fraud) or to obtain illegal administrative permits that allow the installation of industries or businesses that do not meet environmental legal requirements (water pollution or water contamination).

In the public sector, bribery, the misappropriation of funds and fraud plague the tendering and procurement processes for the creation of water supply infrastructure. This also highlights disregard for health and safety regulations, which puts consumers’ lives at risk.

In parallel, corrupt practices on the part of public and private actors may take place at several stages: some consumers engage in administrative corruption to influence the design of the water supply infrastructure so as to ensure easier access to water or the benefits of preferential treatment in general (e.g. higher flow of water, repairs). This exacerbates the problem of the unequal and unfair distribution of a vital resource, based on a corrupt system that relies on bribes (INTERPOL 2016).

According to INTERPOL (2016), corruption in the water sector is also fuelled by the involvement of organised crime groups, and more specifically mafia-style groups. The monopoly over the water supply underpins the power and influence exercised by organised crime groups over vulnerable communities living in poor and/or marginalised areas. In the ICCS, water corruption could be classified as 0703 (Corruption).
RISK/THREAT ASSESSMENT
Water corruption comes highest on the risk index of all seven categories (see Table 3). The reason for the high risk can be found in the two components: as Table 4 shows, both probability and impact are very high.

Probability
As shown in Table 5, water scarcity (1.91) and unclear legislation (1.64) are the most influential factors in terms of an increase in this type of crime. Poverty (1.45) and waste production (1.36) are apparently also seen as significant catalysts, while the greatest role in deterrence is played by data availability (-0.91), followed by data harmonisation, the interoperability of police forces, and regulatory knowledge (-0.82).

In terms of growth parameters, water scarcity (2.00) will increase in the coming years, together with poverty (1.44) and waste production (1.75). The less relevant presence of the unclear legislation factor is expected, mitigating its high influence on water corruption into a more balanced scenario.

Drought also plays a relevant role, presenting a significant influence coupled with an expectedly high growth. Although data availability and data harmonisation also show a significant growth parameter, their effect is not sufficient to compensate the negative trend, which leads to a high probability of increasing corruption with respect to other forms of crime.

Impact
According to the survey results, the water corruption impact components are all very high (Table 6). From an environmental (4.00) point of view, corruption is able to contaminate both resources (soil, water, etc.) and living things (people, flora/fauna). The high economic (4.00) impact is due to the amounts of money involved in each corruption event (e.g. the MOSE [Experimental Electromechanical Module], a project designed to safeguard the city of Venice and the Venetian Lagoon from flooding), which trigger a series of social (4.00) issues, such as mistrust of people in authority and perceptions of insecurity.

This gives water corruption the highest global impact index (4.00) of all the water crime categories.

OUTLOOK
Two-thirds of experts (62 percent) think that, during the next five years, corruption in the water sector will increase (see Figure 1).

Corruption in the water sector is widespread, sometimes taking the form of so-called grand corruption, involving procurement contracts for expensive and complex projects in the fields of water management, water infrastructure, irrigation systems, and dams.

According to the World Bank, during the 1990s, private investments in water supply amounted to 15 percent of total investments, covering less than 10 percent of the world’s population (WIGO 2016). Private investments often involve powerful actors with vested interests, who are sometimes able to control the agenda in order to advance their own interests (Hepworth and Orr 2013). The growth in investments can attract illicit interests and the spreading of deals aimed at the unlawful allocation of economic resources and at ensuring control over water by multinational companies.

Corruption in the water sector could remove important resources required to ensure the interoperability of police forces, and regulatory knowledge (-0.82).
Table 7: Outline of the MOSE case

<table>
<thead>
<tr>
<th>SOURCE OF INFORMATION</th>
<th>Journalistic inquiry</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE OF WATER INVOLVED IN THE OFFENCE</td>
<td>Surface water (defined as “inland waters, except groundwater; transitional waters and coastal waters, except in respect of chemical status for which it shall also include territorial waters”)</td>
</tr>
<tr>
<td>INTENDED USE OF WATER INVOLVED</td>
<td>None</td>
</tr>
<tr>
<td>WATER SERVICE STAGE INVOLVED</td>
<td>Impoundment</td>
</tr>
<tr>
<td>DEFINITION OF CRIME</td>
<td>Water-related crime</td>
</tr>
<tr>
<td>LEGAL BASIS OF THE OFFENCE</td>
<td>Penal/Criminal law; national laws</td>
</tr>
<tr>
<td>TYPE OF OFFENCE</td>
<td>Offences involving fraud, deception or corruption</td>
</tr>
<tr>
<td>PERPETRATOR INFORMATION</td>
<td>Enterprise</td>
</tr>
<tr>
<td>MOTIVE OF CRIME</td>
<td>Intentional</td>
</tr>
<tr>
<td>MODUS OPERANDI</td>
<td>The corrupt agreement required knowledge of the laws and a capacity to establish agreements among elected officials, public employees and private entities</td>
</tr>
<tr>
<td>FORM OF EVENT</td>
<td>Completed</td>
</tr>
<tr>
<td>SPATIAL INFORMATION</td>
<td>Urban</td>
</tr>
<tr>
<td>DATE/DURATION OF THE OFFENCE</td>
<td>Not known precisely, but the crime occurred during the planning and execution of the MOSE project</td>
</tr>
<tr>
<td>CONSEQUENCES OF THE CRIME</td>
<td>Harm/damage to the public economy (water fraud)</td>
</tr>
</tbody>
</table>

Sure water quality. Water supply systems need investments so as to guarantee drinking water of sufficient quantity and quality for human livelihood. The loss of resources due to corruption can therefore have negative consequences for human health. Each year, 10 percent of investments in the water sector are lost. This means a loss of USD 75 billion due to corruption (WIGO 2016).

Access to safe drinking water is negatively correlated with the level of bribery observed in each country, since corruption raises the price of connecting a household to the water network by up to 45 percent (TI 2010).

An exponential growth in corruption could occur in the case of scenario 1. The big rise in investments in the water sector will facilitate an increase in grand corruption among political decision makers. Furthermore, an escalation in prices without an equivalent growth in the certainty of water supply could increase the number of cases of petty corruption, where customers of the water supply system bribe the public services in order to obtain some illicit gain.

### CASE STUDY

The Experimental Electromechanical Module project (Modulo Sperimentale Elettromeccanico, or MOSE), is designed to protect the city of Venice and the Venetian Lagoon from flooding. The integrated system consists of rows of mobile gates installed at the Lido, Malamocco and Chioggia inlets that can temporarily isolate the Venetian Lagoon from the Adriatic Sea during high tides. Together with other measures, such as coastal reinforcement, the raising of quaysides and the paving and improvement of the lagoon, the MOSE is designed to protect Venice and the lagoon from tides of up to 3 metres (9.8 ft.). Consorzio Venezia Nuova is the entity responsible for the work, together with the Ministry of Infrastructure and Transport – Venice Water Authority. Construction began in 2003 in the three lagoons simultaneously, and by June 2013 more than 85 percent of the project had been completed.

In 2014, the mayor of Venice and 35 other people were placed under investigation, arrested and indicted for corruption in connection with the lagoon barrier project. During his election campaign, the mayor had accepted money proceeding from illegal operations delivered by the Consorzio Venezia Nuova. The case was identified during pilot research by WP1 and is outlined in Table 7.

### Water organised crime

**DESCRIPTION**

Water organised crime can be defined as the activity of criminal organisations that have taken control over the management of the water within a territory, or even criminal organisations that carry out activities that are likely to cause, or that do in fact cause, damage to the water. According to the ICCS classification, organised crime is defined as “Participating in the activities of an organised criminal group” (ICCS cod. 0905).

According to the UN Convention against Transnational Organised Crime, agreed in 2000, the concept of “organised crime” encompasses any structured group of three or more persons, existing for a certain period with the aim of committing one or more serious crimes or offences to obtain, directly or indirectly, financial or other material benefit. Firstly, threats or damage to water can derive from the possibility that water management is controlled by criminal organisations. This can cause huge problems in relation to water availability and water fees. Organised crime is tightly linked to corruption, as the activities of such organisations can be promoted by corrupt practices. Secondly, diverse threats or damage to water may arise from different water management activities. Organised crime, even
Table 8: Risk index – Water organised crime

<table>
<thead>
<tr>
<th>CRIME</th>
<th>RISK INDEX (relative comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>2.81</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>1.43</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>2.89</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>1.18</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>1.71</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>2.05</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>2.33</td>
</tr>
</tbody>
</table>

When not strictly connected with water, can have an impact on water, particularly in the form of water pollution. The involvement of criminal groups in waste management, for example, would result in inappropriate management, leading to a real risk of inadequate waste treatment that might affect the water and cause pollution. The situation would be even more serious if the waste were toxic, leading to more dangerous water pollution.

In any such cases, the objective of the criminal activities is to obtain high economic benefits. Threats or damage to water are often caused intentionally — that is, as a result of accepting the presence of the risk or damage as a necessary means to obtain illicit gains. It is also possible to identify negligence in such cases. The modus operandi is not necessarily violent, although resorting to violence may appear as a normal way to maintain the infrastructure needed to obtain the economic benefits.

### Risk/Threat Assessment

Water organised crime has one of the highest risk indices compared to the other types of crime (Table 8).

This type of water crime is controversial, being characterised by very low probability coupled with a high impact (the so-called black swan phenomenon: see Table 9).

### Probability

Forest fires (2.80), followed by water scarcity (2.00) and unclear legislation (2.00) are without doubt the most critical factors (Table 10), although the scenario highlights many high-

Table 9: Probability and impact indices – Water organised crime

<table>
<thead>
<tr>
<th>CRIME</th>
<th>PROBABILITY INDEX (relative comparison)</th>
<th>IMPACT INDEX (relative comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>0.70</td>
<td>4.00</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>0.38</td>
<td>3.73</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>0.74</td>
<td>3.91</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>0.60</td>
<td>2.97</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>0.68</td>
<td>3.48</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>0.81</td>
<td>3.37</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>0.72</td>
<td>3.23</td>
</tr>
</tbody>
</table>

### Influence factors and effect on probability – Water organised crime

<table>
<thead>
<tr>
<th>CRIME</th>
<th>INFLUENCE</th>
<th>GROWTH PARAMETER</th>
<th>EFFECT ON PROBABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.25</td>
<td>1.75</td>
<td>2.33</td>
</tr>
<tr>
<td></td>
<td>2.00</td>
<td>1.75</td>
<td>4.00</td>
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<tr>
<td></td>
<td>2.00</td>
<td>1.75</td>
<td>1.89</td>
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<td>1.75</td>
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<tr>
<td></td>
<td>1.10</td>
<td>1.75</td>
<td>1.89</td>
</tr>
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<td></td>
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<td></td>
<td>-1.80</td>
<td>1.75</td>
<td>1.89</td>
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<td></td>
<td>-3.25</td>
<td>1.75</td>
<td>1.89</td>
</tr>
<tr>
<td></td>
<td>-3.94</td>
<td>1.75</td>
<td>1.89</td>
</tr>
</tbody>
</table>

**FINAL PROBABILITY INDEX = 0.38**
compensating deterrence effects achieved via indicator availability (-2.25), data harmonisation (-2.00), and data availability and knowledge (-1.80).

Comparing the growth parameters, the role of forest fires (1.75) and water scarcity (2.00) is reinforced, although the expected growth in indicator availability (1.75) dramatically decreases the probability of this type of water crime in the coming years (always in terms of comparison with the other crime categories).  

**IMPACT**

According to the survey results (Table 11), the biggest impact is found on the environmental (3.91) side, principally in terms of a reduction in water availability (water control is an effective tool used by organised crime groups to enforce their power). The water supply/service denial impact triggered by water organised crime cases is also reflected in the social (3.73) and economic (3.55) spheres. This results in a relatively high global impact index (3.73).

**OUTLOOK**

According to almost 80 percent of the experts, over the next five years the risk of organised crime will not decrease in the water sector (Figure 2). The reason for this forecast is the relationship between water organised crime, water theft and water corruption. Water control is a tool used by criminal organisations to manage a specific territory. This can happen in both underdeveloped countries and European countries. The main means used to gain control of water are water theft, allowing criminals to sell the water on their own terms, and corruption on the part of officials in water supply companies. The

Table 11 Environmental, economic, social and global impact indices – Water organised crime

<table>
<thead>
<tr>
<th>CRIME</th>
<th>ENVIRONMENTAL</th>
<th>ECONOMIC</th>
<th>SOCIAL</th>
<th>GLOBAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>3.91</td>
<td>3.56</td>
<td>3.73</td>
<td>3.73</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>4.38</td>
<td>3.73</td>
<td>3.64</td>
<td>3.91</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>2.73</td>
<td>2.64</td>
<td>3.55</td>
<td>2.97</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>3.91</td>
<td>3.38</td>
<td>3.91</td>
<td>3.48</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>3.08</td>
<td>2.91</td>
<td>4.10</td>
<td>3.37</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>3.08</td>
<td>2.91</td>
<td>3.70</td>
<td>3.53</td>
</tr>
</tbody>
</table>

Table 12 Outline of the Zen district case

| SOURCE OF INFORMATION     | 2015 report of Direzione Nazionale Antimafia |
| TYPE OF WATER INVOLVED IN THE OFFENCE | Water services (all services that provide, for households, public institutions or any economic activity (a) abstraction, impoundment, storage, treatment and distribution of surf ace water or groundwater; (b) wastewater collection and treatment facilities that subsequently discharge into surface water) |
| INTENDED USE OF WATER INVOLVED | Direct human consumption |
| WATER SERVICE STAGE INVOLVED | Distribution |
| DEFINITION OF CRIME | Water crime |
| LEGAL BASIS OF THE OFFENCE | Penal/criminal law |
| TYPE OF OFFENCE | Offences involving fraud, deception or corruption (Category 7) |
| PERPETRATOR INFORMATION | Organised crime group (national or transnational) |
| MOTIVE OF CRIME | Illicit gain |
| MODUS OPERANDI | High predisposition to break the law and to use violence and intimidation; high level of organisation and high degree of ability to control the territory |
| FORM OF EVENT | Completed |
| SPATIAL INFORMATION | Urban |
| DATE/DURATION OF THE OFFENCE | Unknown |
| CONSEQUENCES OF THE CRIME | Harm/damage to human beings (water accessibility); harm/damage to infrastructure (water availability); harm/damage to the public economy (water fraud) |
rise of water organised crime is linked to the growth in water theft and water corruption. Predicted water scarcity and a lack of investments in the water sector by institutions in underdeveloped countries will increase both the opportunities and the power of criminal organisations. Such criminal mechanisms will mainly affect the poor and marginalised population.

In the Kibera slum in Kenya, poor residents are forced to buy water from vendors at 10 to 25 times the price they would pay the water utility, as landlords are reluctant to invest in piped water (WIGO 2016). In Spain, many urban settlements rely on informal water vending and reselling systems that function with the blessing of the water utility but outside the regulatory framework, leaving room for corruption (WIGO 2016).

The risk of organised crime in the water sector could increase under scenarios 1 and 2, where water prices and water demand will increase and the certainty of water supply will decrease or stay the same. The lack of certainty in water supply and the growth in demand and prices could encourage the emergence of a water racket aimed at controlling the water supply illicitly. or a black market where stolen water is sold to private subjects at lower prices.

**CASE STUDY**

According to a 2015 report by Direzione Nazionale Antimafia (National Antimafia Directorate), investigation activities carried out in the Zen district of Palermo, Sicily, highlighted the existence of a criminal system for the control and management of the water supply. Citizens living in the Zen district must pay a bribe to the criminal organisations to ensure access to adequate quantities of water of acceptable quality to sustain their livelihoods and well-being.

Civil servants discovered these illegal dynamics thanks to the collaboration of two informants (see Table 12).

**Water pollution**

**DESCRIPTION**

Water pollution is one of the most serious ecological threats we face. Pollution occurs when toxic substances enter water bodies (such as lakes, rivers or oceans), are dissolved in them, are suspended in the water, or are deposited on the bed of the water body, degrading the quality of the water (WWF n.d.). Water pollution affects the entire biosphere, including the plants and organisms living in the water bodies. In almost all cases, the impacts damage not only individual species and populations, but also the natural biological communities.

Water pollution can be defined in many ways. Typically, it occurs when one or more substances have accumulated in the water to such an extent that they cause problems to animals or people. Oceans, lakes, rivers and other inland waters are naturally able to clean up a certain amount of pollution by dispersing it harmlessly. If you poured a cup of black ink into a river, for example, the ink would quickly disappear into the river’s far larger volume of clean water. The ink would still be there in the river, but in such a low concentration that you would not be able to see it. At such low levels, the chemicals in the ink would probably not present any real problem. However, if you poured gallons of ink into a river every few seconds through a pipe, the river would quickly turn black. The chemicals in the ink could rapidly affect the quality of the water, in turn affecting the health of all the plants, animals and humans whose lives depend on the river (Woodford 2016).

According to INTERPOL (2016), “Water pollution implies the intentional contamination of water, usually by companies or vessels (e.g. improper disposal of sewage, chemicals, and waste, oil spills). In cases of pollution, water is not considered as a commodity, which can be traded. In other words, water pollution is not about obtaining water as a raw product and trafficking in it: water suffers the collateral damage of negligence or criminal behaviour. Water pollution not only affects environmental quality but it also disrupts business activities. Oil spills contaminate an area which can sometimes be very large, thereby destabilizing other sectors, such as fisheries, and disrupting the supply chain of the companies in the polluted region.”

**IMPACT**

The environmental component (4.36) has the highest score in water pollution (Table 16), as expected, followed by a similar negative impact on the economic (3.73) and social (3.64) spheres, producing the second highest global impact index (3.91).
As shown in Figure 3, over the next five years, the risk of deliberate water pollution will remain stable or slightly increase (50 percent). One in four experts believe that the risk of water pollution will decrease in the future. This is in line with the Environmental Outlook to 2050 published by the Organisation for Economic Co-operation and Development (OECD 2011). The enforcement of EU Directive 2008/99 on the protection of the environment through criminal law can contribute to this trend, together with the diffusion of a culture of corporate social responsibility. Deliberate pollution is mainly a corporate crime, thus the risk depends on the evolution of the industrial and agricultural sector in Europe.

The risk of water pollution could increase in Scenario 3, where the value of investments in the water system decreases. This implies a rise in the price of wastewater management, which could push more companies to allow unauthorised discharges from agricultural and production activities. The economic crisis affecting these sectors can also be a driver of illegal and intentional pollution.

### Case Study
During the night of February 22, 2010, the Lombardia Petroli industry in Villasanta (an ex-refinery converted into a hydrocarbons storage facility) discharged more than 2,000 tons of oil into the Lambro River. The discharged oil soon reached the water purifica-
The alarm was raised at 5.00 a.m., and the incident was classified as an environmental disaster (Table 17).

Water theft

DESCRIPTION

Water theft is a serious offence that may be committed by domestic or agricultural users, or even by factories or enterprises that offer any kind of services. It includes the illegal acquisition of natural watercourses, or of piped or harnessed water. In both of these cases it is designated as “non-revenue water” — that is, water that is “lost” before reaching its intended consumer. Loss of water through theft can occur in a variety of ways, including damaging or removing water meters; physically installing connections to water distribution pipes; or stealing aid tanks (Global Initiative 2014). Stealing water by tampering with or bypassing water meters imposes costs on each paying customer. Included among this type of crime are illegal connections/tapping by homeowners or businesses, the use of standpipes without a licence, tampering with water meters and losses in the public water supply system.

Water theft covers not just theft from natural watercourses, but also the stealing of harnessed or piped water. The latter encompasses the offences of actual theft; breaches of extraction conditions; the construction of means to take water illegally; tampering with meters to give false readings; and contravening declared water restrictions. However, much of the literature focuses on the former type of theft, and the discussion below reflects this emphasis (Australian Institute of Criminology 2010).
In the 2016 INTERPOL report, water theft is understood as “non-revenue water, that is the unauthorised use and consumption of water before it reaches the intended end-user.” According to the report, “It is estimated that between 30 and 50 per cent of the global water supply is illegally purchased. While this reflects poor water management, this practice is also conducive to the major degradation of water resources.”

According to the Birmingham Water Works Board, water theft is the unauthorised consumption of water. Water theft may take the form of unauthorised fire hydrant usage, a jammed water meter, or unauthorised fire service usage.

According to the ICCS, water theft is classified as subcategory 0502 (theft).

**RISK/THREAT ASSESSMENT**

Water theft presents the lowest level of risk compared to the other water crimes categories (Table 18).

This is due to very low probability and impact (see Table 19).

**Probability**

Even with the significant influence of forest fires (2.00), the concurrent negative factors, the biggest of which are indicator availability (-2.67) and data harmonisation (-2.25), trigger a strong deterrent effect. One interesting observation is the low level of influence of data availability (1.20), shifting the accent to the reliability (rather than the availability) of information in the water sector to combat water theft.

**Table 18** Risk index – Water theft

<table>
<thead>
<tr>
<th>CRIME</th>
<th>RISK INDEX (relative comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>2.81</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>1.43</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>2.89</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>1.18</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>1.71</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>2.05</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>2.33</td>
</tr>
</tbody>
</table>

**Table 19** Probability and impact indices – Water theft

<table>
<thead>
<tr>
<th>CRIME</th>
<th>PROBABILITY INDEX (relative comparison)</th>
<th>IMPACT INDEX (relative comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>0.71</td>
<td>4.90</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>0.38</td>
<td>3.73</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>0.74</td>
<td>3.91</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>0.40</td>
<td>2.97</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>0.69</td>
<td>3.48</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>0.81</td>
<td>3.57</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>0.72</td>
<td>3.23</td>
</tr>
</tbody>
</table>

**Table 20** Influence factors and effect on probability – Water theft

In the 2016 INTERPOL report, water theft is understood as “non-revenue water, that is the unauthorised use and consumption of water before it reaches the intended end-user.” According to the report, “It is estimated that between 30 and 50 per cent of the global water supply is illegally purchased. While this reflects poor water management, this practice is also conducive to the major degradation of water resources.”

According to the Birmingham Water Works Board, water theft is the unauthorised consumption of water. Water theft may take the form of unauthorised fire hydrant usage, a jammed water meter, or unauthorised fire service usage.

According to the ICCS, water theft is classified as subcategory 0502 (theft).

**RISK/THREAT ASSESSMENT**

Water theft presents the lowest level of risk compared to the other water crimes categories (Table 18).

This is due to very low probability and impact (see Table 19).

**Probability**

Even with the significant influence of forest fires (2.00), the concurrent negative factors, the biggest of which are indicator availability (-2.67) and data harmonisation (-2.25), trigger a strong deterrent effect. One interesting observation is the low level of influence of data availability (1.20), shifting the accent to the reliability (rather than the availability) of information in the water sector to combat water theft.
A comparison of the growth parameters shows that the typical role played by forest fires (1.75), water scarcity (2.00), and drought (2.19) is heavily compensated by data harmonisation (1.63) and overall indicator availability (1.75), which produces the biggest negative impact on probability (-4.67) (Table 20).

IMPACT
Social impact (3.55) is the biggest component of water theft, due to the concurrence of a number of factors:

- mistrust;
- crime imitation;
- perceptions of insecurity;
- loss of freedom/privacy;
- fear; and
- reaction against governmental authorities.

There is a very low impact in the environmental (2.73) and economic (2.64) spheres in the case of water theft, critically reducing the global impact index (2.97) (Table 21).

OUTLOOK
As shown in Figure 4, according to more than half of the experts, over the next five years the risk of water theft will increase.

The different motives for the rise in water theft include illicit gain by customers in the water supply chain; and water scarcity, especially in less-developed countries.

According to estimates by the United Nations Food and Agriculture Organization (FAO), one-third of the world’s population currently lives in countries where there is not enough water to guarantee livelihoods, or where water quality is compromised. However, by 2025 the percentage is expected to rise to two-thirds.

### Table 21: Environmental, economic, social and global impact indices - Water theft

<table>
<thead>
<tr>
<th>CRIME</th>
<th>ENVIRONMENTAL</th>
<th>ECONOMIC</th>
<th>SOCIAL</th>
<th>GLOBAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>3.91</td>
<td>3.55</td>
<td>3.73</td>
<td>3.73</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>4.30</td>
<td>3.73</td>
<td>3.84</td>
<td>3.81</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>2.73</td>
<td>2.86</td>
<td>3.55</td>
<td>2.97</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>3.18</td>
<td>3.30</td>
<td>3.81</td>
<td>3.46</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>3.09</td>
<td>2.91</td>
<td>4.10</td>
<td>3.37</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>3.09</td>
<td>2.91</td>
<td>3.70</td>
<td>3.23</td>
</tr>
</tbody>
</table>

Figure 4: Predicted changes in the risk of water theft in the coming five years

Over the next five years the risk of water theft will:
- increase 25%
- increase a little 13%
- stay the same 21%
- decrease a little 20%
- decrease 9%

A comparison of the growth parameters shows that the typical role played by forest fires (1.75), water scarcity (2.00), and drought (2.19) is heavily compensated by data harmonisation (1.63) and overall indicator availability (1.75), which produces the biggest negative impact on probability (-4.67) (Table 20).

### Table 22: Outline of the Sardinia water theft case

<table>
<thead>
<tr>
<th>SOURCE OF INFORMATION</th>
<th>The research was carried out through direct contact with the public water management companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE OF WATER INVOLVED IN THE OFFENCE</td>
<td>Water services (all services that provide, for households, public institutions or any economic activity: (a) the abstraction, impoundment, storage, treatment and distribution of surface water or groundwater; and (b) wastewater collection and treatment facilities which subsequently discharge into surface water</td>
</tr>
<tr>
<td>INTENDED USE OF WATER INVOLVED</td>
<td>Direct human consumption</td>
</tr>
<tr>
<td>WATER SERVICE STAGE INVOLVED</td>
<td>Distribution</td>
</tr>
<tr>
<td>DEFINITION OF CRIME</td>
<td>Water crime</td>
</tr>
<tr>
<td>LEGAL BASIS OF THE OFFENCE</td>
<td>Penal/criminal law; national laws</td>
</tr>
<tr>
<td>TYPE OF OFFENCE</td>
<td>Offences against the natural environment (Category 10); Offences against water services (as defined in Article 2 [38] of the EU Water Framework Directive)</td>
</tr>
<tr>
<td>PERPETRATOR INFORMATION</td>
<td>Individual</td>
</tr>
<tr>
<td>MOTIVE OF CRIME</td>
<td>Illicit gain</td>
</tr>
<tr>
<td>MODUS OPERANDI</td>
<td>Using an elastic strip or large pin to falsify the calculation of water consumption. Low level of ability and preparedness required</td>
</tr>
<tr>
<td>FORM OF EVENT</td>
<td>Completed</td>
</tr>
<tr>
<td>SPATIAL INFORMATION</td>
<td>Urban</td>
</tr>
<tr>
<td>DATE/DURATION OF THE OFFENCE</td>
<td>Unknown</td>
</tr>
<tr>
<td>CONSEQUENCES OF THE CRIME</td>
<td>Harm/damage to the public economy (water fraud)</td>
</tr>
</tbody>
</table>
Future water scarcity can take a “physical” form, where the need for water exceeds the amount of water available, or “economic”, if the amount of water is sufficient to satisfy the needs of the population, but supply is limited by institutions. Both kinds of scarcity will cause an increase in water theft, and the crime of water theft will involve a significant economic and social impact.

In Kenya, where water scarcity is a widespread problem and where the climate is mainly arid, the Nairobi City Water and Sanitation Company loses 40 percent of its supply due to theft and leaks. In South Africa, where climate change has affected water resources and where there is a shortage of rain, eThekwini Metropolitan Municipality in KwaZulu-Natal has lost more than a third of its water in one year due to illegal connections and vandalism, at a cost of USD 44 million (WIGO 2016).

In EU countries, where water is generally available, the risk of water theft will grow. This is especially likely to happen in scenarios 1 and 2, where water prices and water demand will increase, but the certainty of water supply, guaranteed by the water management company, will decrease or remain the same. Price rises that are not accompanied by greater certainty in water supply or higher-value investments could result in customers adopting illegal practices to manipulate the calculation of their water consumption.

CASE STUDY (IDENTIFIED DURING PILOT RESEARCH IN WP1)

In Sardinia, water theft takes several forms, the main one being tampering with water meters, typically by inserting an elastic strip or large pin to falsify the recording or water consumption. Another form in which water theft is committed is by identifying an abandoned building that has not yet been checked by the public services and unlawfully using the water connection without payment. There are many areas in Sardinia that are affected by water shortages. The black market for water is growing, involving tampering with hydrants and collecting water in tanks to sell to private individuals. Depending on the type of crime and the area involved, the estimated total cost of theft is around EUR 100,000 (Table 22).

Water fraud

DESCRIPTION

The key element in water fraud is deception. This may be any kind of deception (fraud) used to obtain water in undue quantities or for an unreasonable price. The perpetrator obtains more water than they have paid for, or the fee they pay is not legal. There may be different ways of carrying out the fraud, such as changing water meters of issuing false invoices. The latter case typically involves cooperation between the consumer and the supplier, who agree to make a false statement and to make a payment for water for domestic use, when in reality the water is being used for industrial purposes (which would mean a higher fee). Although the victim in water fraud may be an individual or a legal person, the state is usually the damaged party, as the legally set fees are not being paid for the use of water.

Water fraud is evidently an intentional offence, aimed at reducing the costs of water use and consumption.

Water fraud may be classified among other acts of fraud (07019).

RISK/THREAT ASSESSMENT

As shown in Table 23, water fraud has a low to average risk level in comparison with the other water crime categories.

Characterised by significant impact, water fraud has a low probability, which has a compensatory impact on the final risk index (Table 24).

<table>
<thead>
<tr>
<th>CRIME</th>
<th>RISK INDEX (relative comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>2.81</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>1.43</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>2.89</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>1.19</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>1.71</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>2.05</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>2.33</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CRIME</th>
<th>PROBABILITY INDEX (relative comparison)</th>
<th>IMPACT INDEX (relative comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>0.70</td>
<td>4.00</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>0.38</td>
<td>3.73</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>0.74</td>
<td>3.81</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>0.40</td>
<td>2.97</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>0.49</td>
<td>3.48</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>0.44</td>
<td>3.37</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>0.72</td>
<td>3.23</td>
</tr>
</tbody>
</table>
Probability
Forest fires (2.20) and poverty (2.00), along with water privatisation (1.71) and unclear legislation/waste production (1.63) may be linked to this type of crime. Water scarcity (1.56) and drought (1.50) also have a role, illustrating how this type of crime can affect different domains. The most important deterrer is the availability of indicators (−2.40), which highlights the relevance of assessment indicators and methods to fight water crimes. In terms of growth parameters, the situation is similar to some other types of water crime: forest fires (1.75), water scarcity (2.00) and drought (2.19) are the most influential factors. Indicator availability (1.75) seems to be the most relevant factor in terms of compensation (Table 25).

Impact
As in the case of water theft, water fraud also has a strong influence in the social sphere (3.91) (Table 26). Economic damage (3.36) is apparently contained with respect to other categories such as water corruption or water pollution, while the environmental sphere (3.18) has a small role. This results in a global average value of 3.48.

OUTLOOK
As shown in Figure 5, according to almost half of the experts, water fraud will increase over the next five years.

Water fraud has the same purpose as water theft, but is perpetrated by fiscal artifice. According to the Water Integrity Global Outlook 2016, corruption covers all forms of extortion, fraud and embezzlement. The expression “petty corruption”, applied in the case of smaller criminal phenomena, is misleading, as a significant number of theft cases can turn into major fraud.

An audit of the national water programme (PPEA II) in Benin, which involved EUR 50 million from the Netherlands and EUR 20 million from the EU, showed up the alleged misuse of EUR 4 million by the Benin Ministry of Water.

The risk of water fraud could grow in scenarios 1 and 2, where water prices and water demand will increase, but the certainty of water supply will decrease or remain the same. Price rises will encourage the use of fiscal artifice aimed at falsifying water consumption registers for illicit gain.

CASE STUDY (IDENTIFIED DURING PILOT RESEARCH IN WPI)
Several customers in Sicily have a contract with a fixed charge. It is frequently the case that in the same building there are customers with a flat rate contract and customers who pay according to actual consumption. The latter customers sometimes have an understanding with the others that they will use their water supply and thus not pay for the amount they are consuming in reality (Table 27).

Table 25: Influence factors and effect on probability – Water fraud

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>Drought</th>
<th>Water scarcity</th>
<th>Forest fires</th>
<th>Water privatisation</th>
<th>Number of Observations</th>
<th>Poverty</th>
<th>Industrialisation</th>
<th>Water need for industry</th>
<th>Waste production</th>
<th>People’s knowledge of what actions are “crimes”</th>
<th>Heterogeneity of regulatory framework on water consideration different EU member states</th>
<th>Interoperability level among police forces</th>
<th>Availability of indicators describing waste/pollution related to factories/plants</th>
<th>Presence of alternatives</th>
<th>Water-related data harmonisation among different data sources</th>
<th>Water-related data availability and quality</th>
<th>Final Probability Index = 0.49</th>
</tr>
</thead>
<tbody>
<tr>
<td>INFLUENCE</td>
<td>1.50</td>
<td>2.20</td>
<td>1.71</td>
<td>1.03</td>
<td>1.00</td>
<td>1.37</td>
<td>1.11</td>
<td>1.67</td>
<td>-0.00</td>
<td>-2.00</td>
<td>-1.67</td>
<td>-1.33</td>
<td>-1.13</td>
<td>0.00</td>
<td>-2.00</td>
<td>-1.67</td>
<td>-2.40</td>
</tr>
<tr>
<td>FACTOR GROWTH PARAMETER</td>
<td>2.19</td>
<td>2.00</td>
<td>1.75</td>
<td>1.08</td>
<td>1.00</td>
<td>0.75</td>
<td>1.66</td>
<td>1.00</td>
<td>1.56</td>
<td>1.75</td>
<td>1.64</td>
<td>0.08</td>
<td>1.83</td>
<td>1.81</td>
<td>1.83</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td>EFFECT ON PROBABILITY</td>
<td>3.28</td>
<td>3.11</td>
<td>3.05</td>
<td>1.82</td>
<td>1.83</td>
<td>0.75</td>
<td>2.88</td>
<td>1.18</td>
<td>1.74</td>
<td>2.86</td>
<td>-2.40</td>
<td>-0.77</td>
<td>-1.48</td>
<td>-3.83</td>
<td>-2.71</td>
<td>-4.20</td>
<td></td>
</tr>
</tbody>
</table>

In Table 26, the total probability index (Fig. 5) is 0.49, reflecting the significance of the factors. The case study scenario shows the potential for water fraud, especially when water prices are not regulated or monitored effectively. This highlights the need for enhanced monitoring and enforcement mechanisms to combat such crimes.
### Table 27: Overview of the Sicily case study

#### Source of Information
Girgenti Acque spa (www.girgentiacque.com)

#### Type of Water Involved in the Offence
Water services (all services that provide, for households, public institutions or any economic activity: (a) the abstraction, impoundment, storage, treatment and distribution of surface water or groundwater; and (b) wastewater collection and treatment facilities that subsequently discharge into surface water)

#### Intended Use of Water Involved
Direct human consumption

#### Water Service Stage Involved
Distribution

#### Definition of Crime
Water crime

#### Legal Basis of the Offence
Penal/criminal law

#### Type of Offence
Offences against the natural environment (Category 10); Offences against water services (as defined in Article 2 [38] of the EU Water Framework Directive)

#### Perpetrator Information
Individual

#### Motive of Crime
Illicit gain

#### Modus Operandi
The illicit act requires knowledge of the different kinds of water supply contracts.

#### Form of Event
Completed

#### Spatial Information
Urban

#### Date/Duration of the Offence
Unknown

#### Consequences of the Crime
Harm/damage to the public economy

---

### Water terrorism

#### Description
The importance of freshwater and water infrastructure for human and ecosystem health and the smooth functioning of a commercial and industrial economy makes water and water systems attractive targets for terrorism. There is a real chance that terrorists will strike at water systems. The two basic ways to inflict damage on a water supply system are either to physically destroy the system's infrastructure (by bombing pipes, dams or treatment plants), or to release a contaminant into the water itself. Damage is caused by harming people, rendering water unusable, or destroying purification and supply infrastructure.

This is a specific offence related to water, because the modus operandi differs from that in other offences. As has already been explained, characteristics common to all water crimes are that the aim is to obtain illicit gain and the modus operandi does not include threat or violence. By contrast, the motive in water terrorism is not economic, but ideological. The perpetrator’s intention is to cause terror or panic, rather than to obtain illicit gains. This means that this kind of crime is never caused by negligence, but is always intentional.

Another specific characteristic of this crime is that water will not necessarily be affected. The modus operandi could comprise the effective contamination of water, or the destruction of water infrastructure, but might also take the form of the threat of contamination or destruction. Protecting the water supply from terrorist attack must be understood as a very big task.

According to the ICCS, water terrorism can be classified as an act against public safety and state security (Section 09), specifically terrorism (0906).

#### Risk/Threat Assessment
As shown in Table 28, water terrorism presents a significant level of risk in comparison with the other water crime categories. Characterised by average impact, water terrorism presents a high probability, which is why it should be regarded as a significant threat (Table 29).

#### Probability
In the case of water terrorism, there is a wide range of influencing factors, both positive and negative. The data collection undertaken in the framework of the WATER CRIMES project highlighted only one case of water terrorism, although the recent rise in attention to the water sector among terrorists indicates a serious challenge in the future. Because of the lack of cases, no mitigation measures have been properly developed to date. This lack of information was reflected at the data collection phase, where expert opinions were largely contrasting and heterogeneous. A higher number of surveys would refine the results of the analysis and reduce the need for the approximation of values. As a consequence, many factors are rounded to approximate values. Table 30 shows five factors with an influence of over 2 (including presence of alternatives, which had a significant influence in other water crime categories), and three factors with an identical negative impact (-2.33).

In terms of growth parameters, the situation is approximately the same. A further element indicating the need to increase the amount of data collected for the analysis of this crime is the effect on probability of the interoperability of police forces (-0.36).

#### Impact
As shown in Table 31, water terrorism exerts huge pressure on the social sphere (4.10), triggering high levels of mistrust and fear capable of resulting in anarchy in local communities. Economic impact (2.91) is apparently the least...
even coming behind environment (3.09). This is mainly because the real economic impacts of terrorist attacks tend to be long term and difficult to perceive. Again, the lack of water terrorism cases creates a scenario that is quite difficult to interpret, highlighting the need for further analysis.

### Outlook

As shown in Figure 6, two-thirds of the experts surveyed believe that the terrorist threat will increase in the next five years, or will at least remain the same.

The EU faces a range of terrorist threats that differ in nature: in overall terms, the level of activity in the EU attributed to jihadist terrorism remains high, and there are indications that it will continue to rise. In 2016, a total of 718 arrests were made in relation to jihadist terrorism. The figures have increased sharply in each of the last three years, but anarchist and left-wing extremists, on the other hand, have taken advantage of peaceful demonstrations to carry out attacks on government properties (Europol 2017).

An assault on the water sector may include the use of explosives and vehicles against water infrastructure, or the introduction of hazardous materials into the water system as possible weapons.

### Table 29: Probability and impact indices – Water terrorism

<table>
<thead>
<tr>
<th>CRIME</th>
<th>PROBABILITY INDEX (relative comparison)</th>
<th>IMPACT INDEX (relative comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>0.70</td>
<td>4.00</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>0.38</td>
<td>3.73</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>0.74</td>
<td>3.91</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>0.40</td>
<td>2.97</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>0.40</td>
<td>3.48</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>0.81</td>
<td>3.37</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>0.72</td>
<td>3.23</td>
</tr>
</tbody>
</table>

### Table 30: Influence factors and effect on probability – Water terrorism

<table>
<thead>
<tr>
<th>FACTOR GROWTH PARAMETER</th>
<th>INFLUENCE</th>
<th>WATER SCARCITY</th>
<th>FOREST FIRE</th>
<th>WATER POLLUTION</th>
<th>WATER TERRORISM</th>
<th>WATER THEFT</th>
<th>WATER FRAUD</th>
<th>WATER CYBER ATTACKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.14</td>
<td>2.33</td>
<td>2.75</td>
<td>1.75</td>
<td>2.67</td>
<td>2.00</td>
<td>1.88</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>2.00</td>
<td>2.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td></td>
<td>1.75</td>
<td></td>
<td>1.00</td>
<td>0.75</td>
<td>1.44</td>
<td>1.00</td>
<td>1.56</td>
<td>1.44</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td></td>
<td>1.00</td>
<td>1.44</td>
<td>0.89</td>
<td>1.00</td>
<td>1.83</td>
<td>1.83</td>
</tr>
<tr>
<td></td>
<td>2.67</td>
<td></td>
<td>2.67</td>
<td>2.67</td>
<td>0.83</td>
<td>1.83</td>
<td>2.60</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>0.75</td>
<td></td>
<td>0.75</td>
<td>0.83</td>
<td>1.31</td>
<td>0.63</td>
<td>-2.40</td>
<td>-6.23</td>
</tr>
<tr>
<td></td>
<td>0.63</td>
<td></td>
<td>0.63</td>
<td>1.31</td>
<td>-2.40</td>
<td>-0.36</td>
<td>-6.23</td>
<td>-3.78</td>
</tr>
<tr>
<td></td>
<td>1.31</td>
<td></td>
<td>1.31</td>
<td>-2.40</td>
<td>-0.36</td>
<td>-6.23</td>
<td>-3.78</td>
<td>-6.88</td>
</tr>
</tbody>
</table>

### Table 28: Risk index – Water terrorism

<table>
<thead>
<tr>
<th>CRIME</th>
<th>RISK INDEX (relative comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>2.81</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>1.43</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>2.89</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>1.18</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>1.71</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>2.05</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>2.33</td>
</tr>
</tbody>
</table>

Final Probability Index = 0.61
devices appears limited, while attacks against the water system would require a medium to high level of preparation. The nationality and gender of the terrorists is not relevant in the case of this threat. The consequences of a terrorist attack against water infrastructure may be far higher in the world’s driest countries than in Europe, due to the high level of availability of freshwater in Europe, general accessibility to water services in Europe, and the complexity and dimensions of water infrastructure.

A chemical, biological, radiological or nuclear (CBRN) attack against water is expected to have very limited impact in terms of the availability of and access to water, but could have a multiplier effect, with guaranteed worldwide media attention, thus bringing about a dramatic fall in water consumption and widespread fear about the possible contamination of food and water resources. None of the experts foresee a decrease in this criminal phenomenon.

A rise in the risk of terrorism is not linked to the realisation of the three most plausible scenarios for the water sector.

**CASE STUDY**

The case involved a suspected jihadist who attempted to contaminate water tanks supplying hotels, campsites and households. The case ended in an acquittal (Table 32).

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**Table 31 Environmental, economic, social and global risk indices – Water terrorism**

<table>
<thead>
<tr>
<th>CRIME</th>
<th>ENVIRONMENTAL</th>
<th>ECONOMIC</th>
<th>SOCIAL</th>
<th>GLOBAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>3.81</td>
<td>3.55</td>
<td>3.73</td>
<td>3.73</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>4.36</td>
<td>3.73</td>
<td>3.84</td>
<td>3.91</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>2.73</td>
<td>2.64</td>
<td>3.55</td>
<td>2.97</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>3.18</td>
<td>3.08</td>
<td>3.91</td>
<td>3.48</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>3.08</td>
<td>2.81</td>
<td>4.10</td>
<td>3.37</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>3.08</td>
<td>2.81</td>
<td>3.70</td>
<td>3.23</td>
</tr>
</tbody>
</table>

**Table 32 Overview of the Spanish case**

- **SOURCE OF INFORMATION**: Journalistic inquiry
- **TYPE OF WATER INVOLVED IN THE OFFENCE**: Surface water (“inland waters, except groundwater; transitional waters and coastal waters, except in respect of chemical status, for which it shall also include territorial waters”)
- **INTENDED USE OF WATER INVOLVED**: Direct human consumption
- **WATER SERVICE STAGE INVOLVED**: Distribution
- **DEFINITION OF CRIME**: Water-related crime
- **LEGAL BASIS OF THE OFFENCE**: Penal/criminal law; national laws
- **TYPE OF OFFENCE**: Offences through water (or against water users, e.g. by poisoning); offences against public safety and state security (Category 9)
- **PERPETRATOR INFORMATION**: Individual
- **MOTIVE OF CRIME**: Intentional
- **MODUS OPERANDI**: Threats
- **FORM OF EVENT**: Attempted
- **SPATIAL INFORMATION**: Physical
- **DATE/DURATION OF THE OFFENCE**: 2011
- **CONSEQUENCES OF THE CRIME**: Harm/damage to water (water pollution); harm/damage to human beings (water accessibility)
**Water cyber attack**

**DESCRIPTION**

Security threats evolve as water utilities’ control systems are increasingly connected to the Internet in an effort to save money by remote monitoring. Industrial control systems that operate pumps, valves and disinfection systems in drinking water treatment plants are at increasing risk of cyber attack. Hackers are developing computer viruses capable not only of stealing data, but also of taking control of critical infrastructure. According to Daniel Groves (2016), cyber attacks are a huge and emerging public risk. Cyber security is growing more complex, and attacks are becoming more sophisticated.

According to cybersecurity experts working for government agencies and in the private sector, the threats are very real. Ransomware, the most common form of cyber attack, locks down computer networks or control systems and demands payment. Operations can be recovered by replacing the system or restoring a backed-up version.

Water cyberattacks may be related to other kinds of water crimes, as they may provide the means for committing other crimes. A cyber attack may, for example, have the objective of carrying out water fraud, water theft or water terrorism.

**RISK ASSESSMENT**

As shown in Table 33, water cyber attacks show a significant level of risk in comparison with the other water crime categories.

Characterised by average impact, like water terrorism, water cyber attacks have a high probability, close to the highest, reflecting the increase in automation expected in the near future (Table 34).

**Probability**

Although no cases of water cyber attack were identified in the data collection, the probability of this type of crime is expected to grow in the near future.

The survey indicates that data harmonisation (-2.33) and data availability (-2.33) play a significant role in deterrence (Table 35).

**Impact**

In the case of water cyber attack, a similar scenario to water terrorism can be observed, in which the social sphere is apparently the most affected (3.70) (see Table 36). A new analysis, with further surveys, is needed to obtain more precise results for this still partially unexplored water crime category.

**OUTLOOK**

As shown in Figure 7 (page 59), according to 75 percent of the experts surveyed, over the next five years the risk of cyberattacks will increase if a future scenario in which the water sector is characterised by investments in the digitisation and modernisation of management systems.

The digitisation of water supply systems (e.g., the installation of digital water meters, automated pumping stations and remote control systems) makes those systems more vulnerable to cyber attacks. The level of supervisory control and data acquisition (SCADA) security may not be sufficient in the context of the increased connectivity of devices, sensors, remote terminal units and pumps.

---

**Table 33 Risk index – Water cyber attacks**

<table>
<thead>
<tr>
<th>CRIME</th>
<th>RISK INDEX (relative comparison)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER CORRUPTION</td>
<td>2.81</td>
</tr>
<tr>
<td>WATER ORGANISED CRIME</td>
<td>1.43</td>
</tr>
<tr>
<td>WATER POLLUTION</td>
<td>2.69</td>
</tr>
<tr>
<td>WATER THEFT</td>
<td>1.19</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>1.71</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>2.05</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>2.33</td>
</tr>
</tbody>
</table>

**Table 34 Probability and impact indices – Water cyber attacks**

<table>
<thead>
<tr>
<th>CRIME</th>
<th>PROBABILITY INDEX (relative comparison)</th>
<th>IMPACT INDEX (relative comparison)</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>WATER THEFT</td>
<td>0.48</td>
<td>2.97</td>
</tr>
<tr>
<td>WATER FRAUD</td>
<td>0.48</td>
<td>3.68</td>
</tr>
<tr>
<td>WATER TERRORISM</td>
<td>0.81</td>
<td>3.37</td>
</tr>
<tr>
<td>WATER CYBER ATTACKS</td>
<td>0.72</td>
<td>3.23</td>
</tr>
</tbody>
</table>
In the recent past, viruses have randomly targeted water facilities without any specific attack, and national infrastructure has proved to be particularly vulnerable to such attacks (AWWA 2017). More malicious scenarios are achievable (US-CERT 2005). All these attacks can be conducted remotely, making it very difficult to detect the perpetrators — generally a group of hackers motivated by the prospect of economic gain — either due to their ability to conceal their identities and the origin of the attack, or due to the difficulties in tracking virtual money such as bitcoin. In the near future, cyber attacks against the water sector will target public companies or governments and could have severe consequences, especially if public services are disrupted (e.g. hospitals). It is likely that cyber attacks will target economic sectors that use water intensively, such as industries, rather than agricultural production.

One possible scenario involves BlackEnergy ransomware. BlackEnergy is a Trojan that is used to carry out distributed denial of service (DDoS) attacks, cyber espionage and information destruction attacks. In around 2014, a specific user group of BlackEnergy attackers began deploying SCADA-related plugins against victims in industrial control systems and energy markets around the world. This indicated a unique skillset, well above the average DDoS botnet master. Since mid-2015, the BlackEnergy advanced persistent threat (APT) group has been actively using spear-phishing with macros to infect computers in a targeted network. However, in January 2017, researchers discovered a new malicious document that infects systems with a BlackEnergy Trojan. Unlike the Excel documents used in previous attacks, this was a Microsoft Word document. On opening the document, the user is presented with a dialogue box recommending that macros should be enabled to view the content. Enabling the macros triggers the BlackEnergy malware infection (Lab 2017).

Although BlackEnergy ransomware targets energy infrastructure, it could easily be applied to water infrastructure. The latest version of the virus includes a dangerous automatic DoS mechanism that can automatically stop any (and potentially all) water pumping stations, with a demand for a ransom.

On February 2013, U.S. Presidential Executive Order 13636 – Improving Critical Infrastructure directed the National Institute of Standards and Technology (NIST) to lead the development of a framework to reduce cyber risks to critical infrastructure. In 2017, the American Water Works Association released the guidebook Process Control System Security Guidance for the Water Sector. The risk of cyber attack could increase in scenarios 1 and 2. The big rise in investments in the water sector will bring about the major digitalisation of the water supply system. The use of highly technological water meters and a more digitised system of water management will heighten the risk of cyber attacks.

### CASE STUDY

The research did not identify any cyber attack during the project, although our outlook suggests that there is an increasing risk of such attacks.
The policy implications of water crimes are related to suitable mechanisms to reduce or eliminate the risk of such offences and mitigate their consequences. This implies a significant commitment on the part of European, national and local authorities. In attempting to clarify the various perspectives for the adoption of diverse and effective measures, it is useful to classify them according to three different areas: prevention, prosecution and partnership. This makes use of three of the “Four P paradigm” determined by the U.S. Government and familiar throughout the world, of policies to tackle the trafficking of human beings: prevention, protection, prosecution and partnership. As “protection” is understood from a victim-centred approach, this particular “P” is not considered, given the fact that most water crimes do not affect specific victims, but rather the environment and the community. That said, as will be explained, a very important question is the need to restore the damage caused to the environment or to victims in specific typologies of water crimes such as water theft or water terrorism.

Prevention

Prevention can be considered as the most important aspect of the specific water crimes water contamination and water pollution. Such crimes usually cause severe damage to water, and consequently to human beings, which can extend over large spaces and populations, and the effects of which are difficult, or even impossible, to erase. In this context, the best strategy is to prevent damage rather than punish and remediate.

Among the effective mechanisms for the task of prevention are the following:

- The establishment of environmental inspectorates at local and national level.
- The establishment of specific and clear permitting procedures for new enterprises and/or businesses that can pose a risk of water pollution or contamination. Although the EU Services Directive (2006/123/EC) aims to simplify administrative procedures for service providers, the elimination of complex administrative permits should not result in a lack of effective control by the public administration. Two key elements are needed: information for the entrepreneur/service provider; and subsequent and regular controls regarding the environmental requirements of the specific activity.
- The effective detection and prosecution of corrupt practices and the guaranteed effectiveness of real controls and inspections. The establishment of inspectorates and monitoring processes will not help if there are no effective controls over their implementation in practice. It may be that, although the legislation foresees
such controls, they do not undertake any real activity. It is essential first to ensure that inspectorates have sufficient re-

sources, that inspections are carried out, and that effective and proportionate sanc-
tions are imposed as a result of these in-
spections. These administrative controls should also be monitored in order to de-
tect possible corrupt practices, such as failure to carry out required inspections, or the covering up of offences detected during inspections. According to some legislation, such behaviour can constitute a criminal offence. To prevent inspections from playing only a symbolic role, it is therefore essential that police forces and the judiciary are able to act to discover and punish illicit behaviour.

Prevention also plays a key role in other typologies of water crimes. In the case of water fraud and water theft, the following could be effective preventive measures:

- Designing water meters capable of pre-

venting fraud or theft.

- Establishing regular controls, especially in relation to big enterprises, to ensure that water fees and water taxes are correctly paid.

- Ensuring the effective detection and pros-

ecution of corrupt practices in order to avoid possible agreements between en-

terprises and public servants in relation to committing water fraud or water theft.

Finally, prevention is also essential in the fight against water terrorism and water cyber attacks. As in the case of water con-
tamination and water pollution, the impacts of this kind of water crime can be very seri-

ous, and the best strategy is prevention. Re-

levant measures might include:

- designing clear and safe computer sys-

tems and programmes in the field of pub-

lic administration to guarantee resistance to cyber attacks, and ensuring the ex-

change of relevant information between

the authorities of different states and

among different powers (e.g. the police, judiciary system, tax office and water au-

thority); and

- appointing public servants specifically to

ensure coordination among different

authorities and states, so as to ensure

that all relevant information is considered.

Prosecution

The fight against water crimes will not be ef-

fective without the prosecution of offences. This means the need to pass clear laws defin-
ing these offences and establishing proportionate sanctions, and the need to guarantee the appropriate enforcement of this legislation. Specific measures in this field might include:

- Passing clear laws that describe all these criminal offences, considering all areas and perspectives of risks to water: contamination, pollution, fraud, theft, corrup-
tion, cyber attacks and terrorism. Sanctions must be effective, deterrent and proportionate. Prison should not be the only or the core sanction: other kinds of sanctions might also be strong deterrents, such as prohibitions against owning a business or obtaining public subsidies. It is also important to consider the liability of legal persons, and even criminal liability.

- Ensuring the enforcement of legislation, which requires sufficient resources on the part of the judiciary and the police.

- Ensuring, besides criminal sanctions, effective damage restoration. This is very important in cases of water contamination and water pollution, where damage can be very significant and very expen-
sive. This also applies to the remediation of damage caused to victims in other typologies of water crimes, such as water terrorism, water fraud or water theft.

Partnership

Bearing in mind the specific characteristics of most water crimes, effective prevention and prosecution are not possible without real partnership among states. In many cases, the committing of the crime, or its consequences, involve different national ter-
ritories, making cooperation among states essential in terms of prosecution and punish-
ishment, the remediation of damage, and the implementation of effective preventive controls. The following mechanisms might be considered:

- Adopting transnational agreements on

the prevention and prosecution of water crimes and the restoration of damage.

- Establishing networks of public agents who work in these areas: for example po-
lice, judges and inspectors. The sharing of information, both nationally and interna-
tionally, especially through specific com-
puter networks, is essential in prosecuting offenders and ensuring the effective pro-
tection of water across state boundaries.

Recommendations

We recommend the European Commission and international and national governmen-
tal organisations to prioritise water; create a legal framework (directive or interna-
tional convention); and increase network-
ing. A further recommendation is to estab-
lish a multi-stakeholder working group, as water crimes are an increasing phenomenon and the value of water is also increasing. There is no unique, legal frame-
work on water crimes: information is dis-
persed or lacking. Knowledge about water crimes must be disseminated and ex-
changed as soon as possible.

International, national and local police forces are recommended to begin the systematic collection of data, extending their investiga-
tions to data referring to the water sector; and to disseminate and exchange data among EU countries and develop intelligence analysis on emerging threats in the water sector. Data are lacking, but they are needed in order to classify and assess water crimes. Water crimes are a cross-border issue, and threat assessment must be improved.

Water utilities, water-related companies and municipalities are recommended to carry out a risk assessment analysis and take ap-
propriate measures to mitigate the risk of water crimes. Vulnerability to water crimes must be highlighted, as the impacts of water crimes may be relevant from an economic, social and environmental point of view.

Research organisations, universities and sci-
entific institutions are recommended to build knowledge about water crimes and to develop and refine tools for data collection and analysis, threat and risk assessment, and the exchange and dissemination of best practices. Knowledge is the starting point in the fight against the increasing phenomenon of water crimes.

In the future, the reactivity of member states should be increased and new activities should be launched to build on the knowl-
edge developed in the WATER CRIMES proj-
ect and to refine knowledge-generation tools, including extended and systematic cooperation with national and international police forces. The data collection ap-
proaches, logic and tools developed within the WATER CRIMES project may be used to establish a standardised approach to collect data to be used by different member states. Research may be undertaken to gain a proper understanding of how different member states have transposed Directive 99/2008/CE, and how transposition can or-
ient European strategy towards more effec-
tive actions, appropriately tailored to ex-
tistent contexts and scenarios. However, the most important thing is to build knowl-
edge and assess the risks and threats of crimes against water in Europe.
References


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