

D6.1 – Social Engagement Guidelines

WP6 – Social Interaction and Communication with the Citizens



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CONTRIBUTIONS FROM	Stefania Gianniko (RCM)	u (ICCS), Nikolaos	s Papadopoulos (I	RCM), Eleni Mouxiou
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ABBREVIATIONS/ACRONYMS

A2A	Authorities to Authorities
A2C	Authorities to Citizens
AIM	Actionable Intelligence Matrix
C2A	Citizens to Authorities
C2C	Authorities to Authorities
CDC	Centers for Disease Control and Prevention
CERC	Crisis Emergency and Risk Communication
CSO	Civil Society Organisation
DWSD	Detroit Water and Sewerage Department
Freemium	Free and Premium Business Model
FSO	Floating Storage and Offloading Facility
GDPR	General Data Protection Regula
MEEI	Ministry of Energy and Energy Industries
Met Office	Meteorological Office
PDVSA	Petróleos de Venezuela, S.A.
PiS	Law and Justice Party
РО	Civic Platform
PSO	Private Sector Organisation
SNS	Social Networking Service





1. Executive summary

D6.1 Social Engagement Guidelines presents the completion of Key Result (KR) 14 of the aqua3S project. The aim of this deliverable is to provide specialised guidelines to water suppliers and public authorities on how to utilise social networking services (SNS) to engage with the public before, during and after a water crisis. Based on empirical research of five water crises cases, this report provides recommendations and best practices for social media crisis communications.

The structure of this report is as follows.

First, the aims, objectives and research questions of the deliverable are outlined as well as the positioning of this deliverable within the aqua3S project.

Second, key concepts that underpin the social guidelines are explained. Previous research from the fields of crisis informatics and crisis communications are discussed with reference to the use of social media in crisis management.

Third, the guidelines for using social media during water crises are presented. Based on the synthesized findings of the case studies, this section provides advice for effectively using social media to engage with the public. In line with the crisis management cycle, recommendations are provided for the pre-crisis, crisis and post-crisis phases of a water emergency in order to build resilience.

Fourth, the viability of using social media as a means of extracting soft intelligence to provide early warning and situational awareness of issues pertaining to water quality and quantity is assessed. Furthermore, this section provides the Actionable Intelligence Matrix (AIM), a novel tool developed based on the analysis of Facebook and Twitter data collected in the aqua3S project, and the method for assessing the validity, reliability and actionability of soft intelligence gathered from social media is explained.

Fifth, the research findings of five water crisis case studies conducted through a thematic analysis of 2,575 Facebook posts from public pages and groups are presented. The research methodology, its limitations and measures to improve confidence in results are described. Following, Facebook communications by authorities and citizens during the 2019-2020 UK winter floods, 2014-2019 US Flint Water crisis, 2017-2018 South Africa Cape Town drought, 2019-2020 Poland Czajka wastewater treatment plant failures and 2020 Trinidad and Tobago FSO Nabarima oil spill prevention are analysed and the key findings and resulting recommendations are presented.

Finally, the main contributions of this deliverable for enhancing public engagement through social media during water emergencies are summarised with reference to its contribution to future work within the aqua3S project.



2. Introduction

Social media is defined as 'a group of internet-based applications that build on the ideological and technological foundations of Web 2.0 and that allow the creation and exchange of User Generated Content' (Kaplan & Haenlein, 2010, p. 61). As a multi-directional medium of communication, users are active participants in crisis discourse and action by consuming, sharing and generating information (Thackeray & Neiger, 2009). This entails the relationship between authorities and the public has dynamically shifted in times of crisis (Boin & Hart, 2003). Whilst social media provides a direct channel of communication as well as enables information diffusion across vast and complex networks during a crisis (Park et al. 2012), it may also heighten vulnerabilities as organisations possess less power over the ebb and flow of information (Ngai et al. 2014). Moreover, social media offers opportunities for authorities to obtain information from the public to better manage threats and emergencies while simultaneously generating dilemmas in how to assess and action this data (Palen & Liu, 2007).

D6.1 Social Engagement Guidelines presents the completion of Key Result (KR) 14 of the aqua3S project. KR14 is a business object within the aqua3S archititecture as an accompaniment to Standardised Set of Warning Messages (KR15), Emergency Response Plans for the Water Sector (KR16) and the aqua3S platform (KR17). The objective of KR14 is to provide water suppliers, public authorities and first responders with guidance on how to effectively disseminate information to citizens in times of an emergent or ongoing emergency utilising social networking services (SNS).

To achieve this objective, KR14 is the product of a highly specified analysis of the use and impacts of social media communications during water quality and quantity crisis situations to identify best practices as well as lessons learnt. To do so, this deliverable aims to answer three research questions (RQ).

- RQ1: In what ways do water and public authorities use social media to communicate with the public during water crises?
- RQ2: How do citizens use social media to communicate with authorities and with each other during water crises?
- RQ3: To what extent can citizen-generated content on social media be utilised by authorities as soft intelligence for early warning and situational awareness of water emergencies.

In the following section, concepts that underpin the social engagement guidelines are defined and contextualized. In this section, research from the fields of crisis management, crisis communications and crisis informatics as well as concepts from the fields of communications, public relations and marketing are presented. By synthesising communications theories, models and previous studies, this section provides general principles for effective social media communications.

The social engagement guidelines for the pre-crisis, crisis and post-crisis phases of the crisis cycle are provided in the next section. In the pre-crisis phase, the guidelines offer practical advice for using social media for crisis preparedness and public warning. The crisis phase focuses on how practitioners can manage crises through their communications with the public, articulate the response and mitigation measures being undertaken, engage citizen participation and community action as well as manage their organisations' reputation and counter misinformation and disinformation online. Finally, advice for utilizing social media as a tool for public engagement to enhance post-crisis recovery and future resilience is provided.

Next, this report assesses the viability of utilising social media data for early warning and situational awareness of water emergencies. This section is divided into two parts. The first provides a general overview of viability of methods to collect and analyse data for the purposes of early warning of potential



water related emergencies based on findings in the case studies as well as previous research in this field. The second provides a novel tool for assessing the quality and actionability of crowdsourced information from social media users. The Actionable Intelligence Matrix (AIM) draws on established intelligence assessment methods to fill a crucial gap in determining the content validity, source reliability and ultimate actionability of information gathered from social media. AIM has been developed based on the analysis Facebook data collected as part of this task as well as a sample of Tweets collected by T3.3 Crowdsourcing and Social Media Monitoring.

Finally, the empirical work on which the social engagement guidelines are based is presented. Five case studies have been conducted based on the qualitative thematic analysis of 2,575 public Facebook posts. This applied communications research examines the 2019-2020 floods in the United Kingdom (UK), 2014-2019 Flint water crisis in the United States (US), the 2017-2018 Cape Town water crisis in South Africa, the 2019-2020 Czakja wastewater treatment plant failures in Poland and the 2020 FSO Nabarima oil spill prevention in the Gulf of Paria with a focus on Trinidad and Tobago. By examining the Facebook activities of both authorities and citizens during a diverse range of water crises, best practices and lessons learnt are identified as a result.



3. Key Concepts for Social Media Crisis Communications

3.1 Crisis Types, Phases and their Management

In his seminal definition, Hermann (1963) identifies three key criteria that constitute a crisis. First, a threat is posed to the goals or values of an actor. Second, there is limited time for decision-making with increasing costs to inaction. Third, the situation is unpredictable, leading to uncertainty of the outcomes of countermeasures.

In the context of water crises, *threats* to water quality or quantity can be physical or cyber, natural or manmade whether accidental or intentional as well as isolated incidents or reoccurring events (Sawalha, 2018). Each threat not only poses a challenge on how to mitigate, prepare, respond and recover from their impacts, but also how to communicate effectively with the public to offset their potential for harm (Coombs, 2006). As social media allows instantaneous access to a wide variety of stakeholders at once, it is an invaluable tool for rapid crisis communication. However, single crisis communication strategy cannot be universally applied to every kind of crisis. For example, a communications strategy for a flood will vary greatly from the strategy developed for communication during a drought as the countermeasures deployed and corresponding objectives for engaging with the public will differ. Likewise, accidental contaminations of the water supply will differ from a crisis that occurs as a result of a malicious attack. For organisations responsible for water quality, quantity and control, it is essential to consider the type of crisis and strategic objectives for using social media in order to achieve the desired result.



Figure 1. Dimensions of Crisis Communication Typology (Olsson, 2014)

Figure 1 is based on a typology developed by Olsson (2014), illustrating the dimensions of crisis communications. The first two dimensions on the Y-axis are Operational Crisis Communication and Strategic Crisis Communication. Operational Crisis Communication focuses on dealing with the immediate impacts of an emergency, such as distributing relevant guidance about a crisis and allowing others to make informed decisions (Morgan, 2003). On the other hand, strategic Crisis Communication by cultivating a culture of positive perceptions (Grunig, 2002). The second dimension of crisis communications on the X-axis includes the two aims of reputation management and reinforcing



resilience. These orientations drive how an organisation will prepare and react in the times of a crisis. For example, water authorities that face natural risks such as floods and droughts may seek to implement resilience-orientated operational and strategic communications. On the other hand, accidental or malicious manmade disasters may gravitate towards reputational-orientated pole on the spectrum.

Another attribute of a crisis that effects corresponding communications are that it is *time-bound* in terms of its escalation, duration and termination. Boin et al. (2008) distinguish between four types of crises based on their development and termination time-horizons:

- > Fast-burning crises develop and terminate rapidly;
- > Long-shadow crises develop rapidly and terminate gradually;
- > Cathartic crises develop gradually and terminate rapidly;
- Slow-burning crises develop and terminate gradually.

Time-horizons have significant bearing on crisis communication strategies deployed. For example, fastburning and long-shadow crises decrease the window for public warning, while slow-burning and cathartic crises may require sustained campaigns to raise awareness of the crisis and mobilise action. Likewise, slow-burning and long-shadow crises will require more sustained crisis and post-crisis communication to facilitate effective responses and community recovery from the crisis than fastburning and cathartic crises.

The main ways in which social media communication during a crisis differs to more traditional communication practices includes rapid reaction time. Rapid response that facilitates logging and tracking of user-generated events which occur in real time can provide authorities with more information to use to mitigate further damage and escalation of the crisis. This can also be used to also potentially identify key areas of damage, log current victims and the potential victims who may still be impacted in the resulting causal sequence of events that can occur before, during or after a crisis (Simon, Goldberg, & Adini, 2015). Moreover, in cases where crises are longer in duration, strategic use of social media campaigns can facilitate sustained messaging targeted at public audiences.

The crisis management cycle is the most widely used framework for conceptualising a crisis over time in relation to countermeasures. This model for crisis management provides a cyclical rather than linear understanding of the emergence, duration and dissipation of a crisis, disaster or emergency (Carter, 1991). The cyclical depiction of crisis over time emphasises the need to continuously monitor, evaluate and adapt the countermeasures deployed. Therefore, it offers a highly adaptable and heterogeneous framework for determining appropriate actions for mitigating, preparing, detecting, responding and recovering from a wide range of crises with diverse time-horizons.





Figure 2. Crisis Management Cycle

According to the crisis management cycle, the temporal dimensions of a crisis are classified according to the *pre-crisis* (before a crisis), *crisis* (during a crisis) and *post-crisis* (after a crisis) phases. In crisis management theory and practice, actions are undertaken across the pre-crisis, crisis and post-crisis phases of an event seek to achieve the overarching objective of enhancing resilience (Seeger, et al., 2009). Communication is a vital aspect of effective crisis management by coordinating intra-organisational and inter-organisational countermeasures as well as engaging with the public (Ulmer et al., 2007; Coombs, 2007). As social media plays an ever more key role in how organisations interact with their stakeholders, it is an indispensable channel for communicating with the public over the course of the crisis cycle.

In line with this crisis management model, Reynolds & Seeger (2005) developed the Crisis Emergency and Risk Communication (CERC) process model comprised of five stages. The first stage is *pre-crisis risk messages, warnings and preparation*. The objective of these communications is targeted at improving monitoring of emerging risks, raising public awareness, providing guidance on what to do in the event of a crisis and facilitating self-sufficiency (Hale, Hale, & Dulek, 2006). Moreover, this stage entails the development of standardised warning messages and crisis communications planning for specific crises as well as establishing channels through which to communicate them (Reynolds & Seeger, 2005). Overall, these actions should be coordinated through multi-stakeholder alliances involving public authorities, first responders, private sector organisations (PSOs) and civil society organisations (CSOs), to name a few (Reynolds & Seeger, 2005).

During the crisis, the second stage of the CERC model (Reynolds & Seeger, 2005) is the *initial event* at the outset of the crisis. At this point, communications should aim to reduce uncertainty, provide reassurance and promote self-efficacy. This stage requires rapid and empathetic communication with target audiences and the broader public through designated spokesperson and pre-established channels. These messages should provide widely comprehensible understanding of the crisis circumstances, consequences and anticipated outcomes based on accurate and available information (Palen & Liu, 2007). The third stage seeks to *maintain* the objectives of the second stage and advance them as the crisis progresses and deepens (see Soden & Palen, 2018). These communications should provide updates and further information as it becomes available with specific reference to ongoing risks as well as causes and contextual factors. These communications should also seek to correct of



misinformation and false rumours with accurate information. Response efforts play a central role in the content of messages at this stage to reassure the public while individual and collective self-help should continue to be encouraged and facilitated (Mirsky, 2011).

In the post-crisis phase, the fourth stage is *resolution*. The prime objectives of these messages are to inform the public of recovery and rebuilding efforts as well as to reinforce or restore a positive image of relevant organisations and agencies. Importantly, communications should warn of post-crisis hazards and risks to public health and safety and recommend actions to avoid harm (Quinn, 2018). Moreover, engagement with the public should facilitate discussion on the causes and consequences of the crisis as well as the effectiveness of countermeasures (Benoit, 1997). Finally, responsible authorities and organisations should *evaluate* crisis management and crisis communication performance in terms of effectiveness (Cottle, 2014). This step should document and formalise best practices and lessons learnt in order to determine means of improving future action and implementing them. Thus, Reynolds & Seeger (2005) CERC model returns to the first stage, cycling back to the pre-crisis phase for future crisis mitigation and preparation.

Overall, the use of social media as a crisis communication tool for public engagement should be directed at managing the *uncertainty* that is synonymous with crises. The potential for nonlinear cascading effects may escalate and intensify the severity of the crisis far beyond its initial conditions. Reducing and managing uncertainty in the public can be achieved through implementing a crisis communication plan that provides warning, accessible information, advice and reassurance (Mirbabaie, Bunker, Stieglitz, Marx, & Ehnis, 2020).

Due to the advances in communication technology in the last few decades, the public has become acclimated to instant information access (Sakai, Kato, & Song, 2011). Often social media is one of the first sources of information that many members of the public look to as well as communicate their opinions and concerns (Dearnell, 2021). On social media, citizens can engage in dialogue directly with people of authority, such as public officials, emergency responders and service providers (Haro-de-Rosario, 2018).

Although social media is now a well-established communication medium, some organisations choose to focus on channels and strategies that follow more traditional and slower unidirectional communication to provide updates, news, guidance and information to the general public (Jin, 2014). This can cause the public to feel disillusioned by the lack of interactive or two-way communication with relevant organisations and authorities or simply indifferent to static messaging and content (Das & Ahmed, 2021). Previous research (Rush, 2015) has demonstrated that, when used effectively, social media holds the potential and capacity to manage uncertainty by informing and reassuring public stakeholders by providing real-time and interactive updates, advice and support.

However, reaching and engaging social media users in real-time is not a given. Often, the freemium business models of social networking services (SNS) (Kumar, 2021) push 'pay-to-play' options for page owners to encourage the purchase of promoted or sponsored posts for campaigns to reach their target audience. SNS users may require evidence of credibility and authority on a matter and the social proof required to demonstrate that partially comes from previous press or established social proofing (Naeem, 2020). Verification (Edgerly & Vraga, 2019) is often the means that most organisations go down in order to legitimise content that is published on the organisation channels, though this action will not provide the desired audience in isolation.

Additionally, social media should be part of a broader online presence and infrastructure, sign posting members of the public to digital resources and toolkits. Often this can be done by the development of



a standalone website that acts as a knowledge hub, leading visitors to the relevant resources required. Moreover, resources and toolkits for safety guidance and self-efficacy should be made accessible to disadvantaged and vulnerable communities as well as in multiple languages to ensure equality of access for minority ethnic groups (Andrulis, Siddiqui, & Gantner, 2007).

However, effective communication strategies need to be implemented to disseminate information in a responsible and appropriate manner. In addition to the potential perils of not communicating through social media, information fatigue from an overload of messaging from diverse sources can lead to panic responses by the public (Abunyewah, Gajendran, & Maund, 2018). For example, recent research by Naeem (2020) on consumer behaviour at the outset of the COVID19 found multiple lines of communication coming from various experts and individuals of authority may have induced a public panic response leading to stockpiling behaviour. Due to the implementation of national lockdowns in response to COVID-19, social media served as a primary means of socialisation, sources of information and entertainment (Shoaei & Dastani, 2020). Lack of appropriate preparation for crisis communication led to a loss in reputation and trust due to confusing and problematic advice provided by public spokespersons.

3.2 Crisis Communication and Informatics Principles for Practitioners

The aqua3S Social Engagement Guidelines are rooted primarily in the fields of crisis communications and crisis informatics. From an organisational perspective, crisis communication involves a communicative feedback loop of sending and receiving of messages 'to prevent or lessen the negative outcomes of a crisis and thereby protect the organization, stakeholders, and / or industry from damage' (Coombs, 1999, p. 4). For directly and indirectly affected citizens and communities, effective crisis communication entails whether 'response organisations are able to provide information services that meet their expectations regarding the problem in question' (Palttala & Vos, 2012).

On the other hand, crisis informatics is the study of socio-technical systems of behaviour during crises generated by flows of information between individuals and group through digital mediums such as social media (Hagar, 2007). With large numbers of people interacting in real-time online, a culture of content production and sharing has been created and public participation and collaboration in the communication of crisis information can generate results above what a single person, team or organization can accomplish in isolation (Vivacqua, 2010).

Crisis Communication Classification Matrix		Sender		
		Authority	Citizens	
Receiver	Authority	Authorities to Authorities (A2A)	Citizens to Authorities (C2A)	
	Citizens	Authorities to Citizens (A2C)	Citizens to Citizens (C2C)	

Table 1. Crisis Communication Classification Matrix (Source: Rueter et al. 2012)

Reuter et al. (2012) developed a crisis communication classification matrix to capture the flow of digital information between 'senders' and 'receivers' (see **Figure 4**). Authorities responsible for crisis management communicate with each other (A2A) to coordinate crisis preparation, prevention, responses and recovery. The public communicate with each other face-to-face or virtually via social media (C2C). Crisis response organizations may crowdsource information either by analysing digital content or encouraging reporting and providing the means for citizens communicate directly to them



(C2A). Additionally, authorities will send information to citizens to mitigate, prepare, warn, respond and recover from crises (A2C).

This deliverable adapts Reuter et al. (2012) crisis communication matrix to examine the communications on social media during a crisis, focusing on A2C, C2A and C2C. This classification matrix serves both as an analytical framework for the empirical work (see Section 6) as well as conceptualising complex communication and information flows between the creators of messages ('senders') and their target audiences ('receivers') on social media for the intended crisis management outcome.

Before, during and after water crises, social media can provide connection opportunities between authorities and the public. Social media communication across these pathways can provide enormous benefits to both authorities and the public (Yeomans, 2021). Authorities can use social media to directly engage with the public in mitigation, preparation, response and recovery efforts directly while taking advantage of the ability of users to spread and amplify their messages across social networks. Social media provides means to crowdsource intelligence and gather soft intelligence of potential and actualised threats to the water network and public (see Section 5). Additionally, citizens can utilise social media as a means of directly communicating with authorities and with each other. However, social media communications may hamper water crisis management or prove ineffective in achieving the desired response when best practices are not observed (Moors, 2018).

In the contemporary communications ecosystem, regardless of whether an organisation chooses to use social media a lack of response is still seen as a response by the public (Jalonen & Juddila, 2016). Online discourse will occur in the social arena despite an organisations choice or ability to communicate through social media. Lack of communication from an organisation on social media allows for the major narrative and conversations to occur potentially without input from those seen as responsible for the management of the crisis (Pasadeos, Berger, & Renfro, 2010). However, due to the nature of social media being synchronous and updates being provided in real-time, no such limitation is afforded to the response of the public to those updates, as a lot of platforms base their user dashboard, newsfeed and updates on the success of the engagement with the content on their platform, this can result in the content later being pushed to more users (Weber & Grauer, 2019).

As a first step to communicating effectively on social media, authorities should identify the target audience ('receivers') as part of their Crisis Communications Plan to ensure that relevant messages are disseminated to achieve the desired crisis communication outcome. Audience groups will require targeted messaging based on their specific interests and concerns related to a crisis. The Centers for Disease Control and Prevention's (CDC) implementation of Reynolds & Seeger's (2005) CERC model provides the following categorisation of key stakeholders during a crisis and their primary interests that crisis communications should aim to address in their messaging (CDC, 2018).

Audience Groups	Interests and Concerns
Directly affected	Personal safety
community	Family safety
	Property damage
	Loss of livelihood
	\succ Disruption to normal activities (e.g., water supply
	disruption, business and infrastructure closures, travel
	hazards, etc.)



Audience Groups	Interests and Concerns
Community immediately	How they can avoid the emergency affecting them
outside of the affected	How they can assist
area	Risks to self and social networks
	Disruption to normal activities
Emergency responders and	Professional responsibilities
water management	Availability of resources
authorities	Personal safety
	Family
	If they are directly affected by the emergency: family
	safety and property damage
Public authorities	Responsibilities
	Liability and reputation management
	Resource allocations
	Opportunities to express concern
Partners	Understanding their role in the response
	Coordinating with other response organizations
	Involvement in decision-making process
	Access to information, reputation management
Community leaders	Safety of communities
	Representing community needs
	 Listening to community members
	Taking part in decision-making
Media	Getting access to information right away
	Meeting rapid deadlines
	Keeping the public informed
PSOs	Employee safety
	Interruptions in business
	Loss of revenue
	Liabilities and reputation
International community	Their level of readiness for a similar emergency
	Any restrictions on trade and travel to protect their
	citizens.
	Their role in response partnership

Table 2. Messages and Audiences (Source: CERC, 2018)

Due to many audience groups relying on notifications and information from online sources, failure to address the messaging on social media by members of authority regarding these crises may lead to reputational or communicational breakdowns (Parris, 2021). Utilisation of social media platforms for crisis communication can be an efficient way to interact with many different audiences and stakeholders at once (Bennett et al, 2008). Organisations should take pro-active measures for understanding how to promote messaging that is clear, concise, accessible and informative to members of the public (World Health Organization, 2021). This requires an existing social media presence and process to be in existence prior to the need to utilise the platform for crisis communications.

Messages are the vehicles for achieving crisis communications objectives insofar as they transmit information from the sender to the receiver. Effective messaging requires the adoption of an



appropriate style, content and tone that is in line with the strategic objectives of the communication. Sutton et al. (2014) advises that crisis communication style should be clear, concise and consistent as well as providing enough information for the public to make informed decisions about their next actions in the time of a crisis.

Category	Characteristics of effective message style
Clear	Messages should be simply worded, free of jargon and targeted to the average reading comprehension level.
Specific	Provide messages that are precise and non-ambiguous about the area of risk: what people should do, the nature of the water hazard, how much time people have to engage in protective action before impact, and the source of the message.
Accurate	Messages should provide timely, accurate, and complete information that is free from errors to the extent possible.
Certain	Messages should be stated authoritatively, confidently, and with certainty even in circumstances in which there is ambiguity about the causes, scale and scope of the crisis.
Consistent	Messages should be externally consistent by explaining changes from past messages and internally coherent, for example, by never saying things that conflict with each other such as 'chemical waste is in the water, but do not worry'.

Table 3. Characteristics of effective message style (Sutton et al., 2014, p.783)

As **Table 3** illustrates, provide information in a concise manner, keep the first messages simple and only include immediately relevant information. Avoid jargon and any technical or specialist terms. Give action steps that are easy to follow and will not be easily confused (Vihalemm et all, 2012). It is theorised that on average people can only retain a small amount of information in their short-term memory, but this retention is shortened further while in a state of panic or crisis (Miller, 1956). As a rule of thumb, messages that are repeatable are usually more memorable and messaging that expects receivers to commit to an action are best broken down into three or four steps.

Category	Characteristics of effective message content
Guidance	Tell people exactly what to do to maximise their health and safety and tell them how to do it.
Time	Tell people when they should take protective actions.
Location	Explicitly state the geographical boundaries where people who need to take action are located.
Hazard and Consequence	Tell about the impending hazard by describing the event, the consequences of the hazards impact, the threat posed and how what they are being asked to do reduce consequences
Source	Say who is giving the message based on what constitutes the most credible / believable source for the population as a whole

Table 4. Characteristics of effective crisis message content (Sutton et al., 2014, p.783)



One of the most essential parts of crisis communication is the tone of the messaging. Strong and accurate information can be supported through tone that expresses competency and experience. This helps authorities to provide a sense of credibility, trustworthiness and empathy (Ioannidou & Konstantikaki, 2008). Tone is not just essential in verbal communication such as visual or audio content posted on social media (Avery, 2010) this kind of communication is usually part of crisis response strategies or post crisis and other elements contribute to tonality such as body language (Coombs, 2009), location, questions, pre-recording and more (Spence, 2009). Social media has the benefit of mitigating issues of unconscious bias against a spokesperson's features, race, gestures, image, style or voice (Claeys, 2014).

Adopting the right tone can also aid in mitigating a panic response by the public to a crisis. Leventhal (1970) argues that there are two distinct public responses that occur as a result of health risk message: a 'fear control process' and a 'danger control process'. Members of the public who engage in danger control processes have a 'rational' response danger and ways to control it, often following recommended advice from authorities and making the desired behavioural changes. Segments of the population who have fear control processes have an 'emotional' response to risks that are more difficult to temper and often result in people engaging in maladaptive processes to control their fear or ignore the danger. This is why it is essential to avoid messaging around fear, uncertainty and doubt and to provide actionable communications to mitigate citizens anxieties and fears by carefully considering tonality in the crisis communications, such as projecting an image of effective leadership and communicating reassuringly.

In times of crisis, authority communication using personal pronouns such as "We" or "Our" when publicly providing information personify the organisation, projecting a message of community and a connection with the public allowing citizens to see the individuals within an authorities organisation rather than a large unapproachable corporation (Li & Zhang, 2019). This sense of solidarity and the authority experiencing a crisis together with the populace can mitigate public reactions of the denial of the crisis or dismissiveness regarding A2C messaging. Using urgency and fear-as-acquired drive to force a citizen response only works in the cases where fear messaging motivates the desired action from the public (Janis, 1967). Therefore, the messaging from authorities need to consider tone to convey clear, memorable steps for public action, to inspire a danger control process response from the public.

Prior to developing a crisis communications strategy, it is advisable to assess current situation and vulnerabilities. To do so, a vulnerability audit can be conducted to identify issues and solutions. **Table 5** provides an example based on common issues encountered by organisations in using social media.

Social Media Vulnerability	Issue	Potential Solutions
Organisation SM not monitored overnight/weekends	Might miss important reports and updates from individuals regarding time-sensitive water crisis newly occurring.	Set up instant response chatbot who forwards resource information on how to report water crisis, recommended first actions, what to expect, who will be in contact, how long can they expect to wait for contact from your organisation.
Organisation has SM pages but engagement is low it does not have a lot of followers	This may be an issue when you are wanting to use SM channels to communicate issues.	Promoted post regarding update, alternatively up activities and campaigns on SM



Social Media Vulnerability	Issue	Potential Solutions
		to give target audience a reason to follow and engage with the page.
No crisis communication strategy – Previously known issue escalates into large crisis.	Lack of preparation can lead to reputational damage. Not having SM pages set up can lead to user-generated/third party generated updates and advice that your organisation does not control.	Develop a crisis communication plan. Consider following the Crisis Management Process - Alert, Assess, Action, Analyse (Covered in Section 3.1) to develop more transparent and, clear and open communication with the general public (A2C).
Website content not accessible	Accessibility leads to communication issues with certain demographics of people, it curates an environment of information that is not openly inclusive of those who require alternative font sizes, alt text, text to speech usability	Survey the needs of the public that will be utilizing the resources, consider consulting with organisations who specialize in adaptive digital accessibility. Ensure future content is more accessible.
Lack of translation options for non-native language speakers	Not considering the international non-native speakers can lead to tensions within a community when authorities provide guidelines and advice to the public.	Consider the population of the area that you will be covering, there are areas that attract certain international demographics due to places of worship, family, community groups and workplaces. Make website content translatable and consider how to adapt visual imagery and print materials to communicate with those who are non-native speakers.

Table 5. Example of a Vulnerability Audit

In developing a crisis communication strategy, it is important to consider the influence you have over the communications landscape to internal and external audiences. There will always be instances or messaging around a crisis that are beyond the scope of authorities control, ultimately there are three different spheres of influence that sit with internal and external communications. Messages within the authorities control using the outgoing messages and communications (A2C), the messaging with limited control often third-party communications, neighbourhood groups and communities, and no control other external third-party communications, for example individuals posting in private groups or private social media profiles with no means for authorities to correct or provide more accurate messaging surrounding a crisis.



Ultimately, social media crisis communications should follow a co-ordinated and consistent approach clear and accessible crisis communication from authorities is essential to avoid curating a panic response from citizens (Abunyewah, Gajendran, & Maund, 2018), it also allows citizens to make informed decisions about the actions they take as a result. Authorities should follow the Crisis Management Process – Alert, Assess, Action and Analyse. This approach keeps A2C communications in a place of credibility and authority on crisis updates and information.

Crisis Communications Process - Alert, Assess, Action, Analyse		
Alert	Outline the actions necessary to ensure that appropriate lines of communication are appropriately managed and accessible to those responsible for providing information to the public on social media. Information about the different kinds of alert should be accessible to the public.	
Assess	Classify the crisis in a way that can provide enough information to work with for communication and media, this should follow the crisis communications plan.	
Action	Action your plan, communicate with various authorities to co-ordinate communications in a consistent way. Delegate tasks and provide advice for those who will look to volunteer from the public.	
Analyse	Determine how the crisis will be continuously assessed, addressed and resolved throughout its timeline. Update with the type, scope and potential severity of the crisis throughout, consider different groups who may be affected and the long term, short term plans that can be implemented to limit the negative impacts. Maintenance and training around the crisis communications plan should remain in consistent rotation internally to those who are meant to be persons of power/ authority/ responsibility. Establish how prompt response was, how clear/ informative/ authentic/ problematic.	

Table 6. Crisis Communications Process

As social media is a multidirectional medium of communication, preparations for a crisis should also include the development of resources and guidance in response to common issues encountered during a crisis (Jin, 2014). Using data collected from social media (C2A) can help to develop a collection of frequently asked questions (FAQ), considering the response to these questions supports an opportunity for organisations to demonstrate their preparedness in the case of a crisis (Spence, 2009).

Development of a response bank is not only great for SNS communications (A2C) with citizens for social media communications but also it can provide insight and guidance for the questions the public may have for spokespersons within your organisation who are expected to provide timely advice and predefined responses to inquiries, reports, complaints and emergencies (Das & Ahmed, 2021). This soft intelligence is discussed later in Section 5 and is used historically in a number of different types of campaigns, most notably, political campaigns use this soft intelligence to make citizens feel heard and their input valued.



4. Social Engagement Guidelines

This section provides the Social Engagement Guidelines for water and public authorities to optimise their use of social media over the course of the crisis cycle for water quality and quantity emergencies. These guidelines are based on the empirical findings of the thematic analysis of five water crisis cases (see Section 6). The best practices and lessons learnt identified from the crisis communications case studies have been synthesised to provide general guidance on the use of social media as a holistic crisis communications medium for water suppliers and public authorities to directly engage with public stakeholders. In the proceeding sections, advice for effective use of social media is provided for the precrisis, crisis and post crisis stages.

4.1 Pre-crisis Communication

In this section, guidelines on best practices for using social media to engage the public during the precrisis stage of a water emergency are divided into two parts. The first offers advice on how organisations can prepare to utilise social media on an intra-organisational and inter-organisational level as well as to prepare communities prior to a water crisis to improve resilience. The second section presents the gold standard for social media public alerts and warnings identified in this research as well as the best means for dissemination through social media channels and networks.

4.1.1 Preparing for Crisis

In the pre-crisis phase, social media communications should be focused on advancing mitigation and preparation objectives (Hale, Hale, & Dulek, 2006). It is important to establish a strategic and operational modus operandi for utilising social media alongside other communication channels for engaging with multilevel target audiences and stakeholders over the entire crisis cycle. A key intra-organisational activity is to develop a crisis communication plan that runs in parallel to the crisis management plan, taking into consideration the advice provided in Section 3. This plan should establish communication objectives for potential manmade and natural risks as well as the tone, messaging and content style.

On an inter-organisational level, a key step in preparation is establishing linkages with crisis management partners (Reynolds & Seeger, 2005). Social media sites such as Twitter and Facebook are inherently designed to create and expand social networks and can facilitate the spread of messages not only before a crisis, but also during and after. In the pre-crisis phase of the UK winter floods (see Section 6.2.2), it was found that a consortium of public and water authorities as well as CSOs had established networks on social media for coordinated messaging and campaigns designed to improve flood resilience. Additionally, a central digital platform, the Flood Hub, was established to publish messages through its social media platforms, coordinate campaigns and act as a central knowledge hub. Establishing networks, partnerships and alliances to achieve shared crisis communication objectives can have significant benefits for maintaining consistency and synchronicity in social media communications as well as expanding the reach of messages.

Establishing public-private cooperation in social media communications is especially advantageous for resilience-building social media campaigns. The empirical research conducted in this study found that authorities can significantly expand the reach of their messages by establishing linkages with PSOs that have significant experience and investment in social media marketing. For example, the social media campaign conducted by public authorities during the Cape Town drought was done in collaboration with PSOs and CSOs to maximise the reach of messages to instil the need for significant changes to water consumption behaviour (see Section 6.4.2). Social media content published by the private sector, often



replicating the messages of authorities while utilising engaging social media marketing techniques, on average outperformed those published by pages belonging municipal authorities (see Section 6.4.3).

Within the empirical work conducted in this deliverable and best practices identified in the literature, public engagement in the pre-crisis phase emerged as a critical undertaking. In terms of messaging and content, communications at this phase should aim to educate the public on water risks they may be exposed to and ways in which they can mitigate or prepare for them (Seeger, 2007). In doing so, authorities may enhance self-sufficiency in eventuality of a crisis (Reynolds & Seeger, 2005). Public and water authorities should utilise social media as well as other mediums within their online infrastructure to provide accessible digital toolkits and resources for individuals and communities to enable individuals and communities to take pre-emptive actions to off-set the risks of a water crises. For example, the Food Hub initiative in the UK regularly shared guides targeted towards at-risk communities ranging from how to establish a community flood resilience group to preparing a survival kit as part of their content schedule (see Section 6.2.2). As such, social media can act as a channel to link members of the public to further information and advice.

Online networks should also be established in and within at-risk communities. Utilising features on social media platforms, such as pages and groups on Facebook, can foster community resilience by promoting decentralised grassroot networks (Kaufhold & Reuter, 2016). For example, the analysis of the UK winter floods found the presence of highly active flood resilience groups where members of at flood-risk communities could share information, advice, warnings and collaborate to implement response and recovery measures during the crisis and post crisis phases (see Section 6.2.3).

Guidelines

- Inform the public on ways in which they can protect themselves, their property and communities in advance of crisis to mitigate the consequences at the micro-level.
- Establish across multilevel, multistakeholder networks including public authorities, civil society and private sector partners or partnerships.
- Make digital self-efficacy toolkits and resources available on online platforms and share on social media.
- Facilitate the creation of social networks for citizens to communicate and coordinate at the grassroots level.

4.1.2 Public Alert and Warning Messaging

Social media provides a valuable channel for the dissemination of warnings and alerts to the public (Wendling, Radisch & Jacobzone, 2013). As soon as a crisis is known, the rapid dissemination public alerts and warnings is both critical for public safety and preventing reputational damage resulting from delayed warning (see Section 4.2.3). Public alerts and warnings lie in the intersection of the pre-crisis and crisis phase. In cases where authorities receive early warning of a water crisis from monitoring and alert systems, public warning messages can be disseminated in advance to forewarn the public and enable them to prepare and take the necessary precautions. However, as a crisis often emerges rapidly and unexpectedly, public warnings may take place after the initial event. Authorities responsible for warning the public of water emergencies must strike a balance between timeliness of warning dissemination and avoiding the creating panic or 'crying wolf' by warning based on false positives of a crisis (Choo, 2009). As uncertainty is intrinsic to crises, it is advisable to utilise an easily comprehensible



scaled alert system that can be escalated or de-escalated based on the likelihood and severity of a crisis at specific timeframes and locations.

In the empirical work conducted in this deliverable, the gold standard content for warnings and alerts disseminated on social media was identified (**Table 6**) and been divided into *essential alerts, extended warnings* and *magnet media*.

Gold Standard Social Media Public Alert and Warning Content		
Essential alert content	Crisis severity (e.g., yellow, amber, red).	
	Crisis type (e.g., flood, drought, contamination, oil spill).	
	Timeframe (e.g., hours, days, months, years).	
	Location (e.g., local, regional, national).	
Extended warning	Impacts.	
information	Recommended actions.	
	Countermeasures deployed by authorities.	
	Emergency contact details and further information.	
Magnet media	Unique hashtags	
	Infographics	
	> Emoji	
	Videos	
	Images	

Table 7. Gold Standard Social Media Public Alert and Warning Content

The standardisation of warning messages for social media is particularly important due to the nature of information diffusion across social networks. Authorities responsible for providing first warnings of a water crisis may provide standardised alerts that will enable other authorities to disseminate their own warnings to their social networks with customisable information while in keeping with a consistent framework. For example, flood warnings provided by the Environment Agency during the 2019-2020 UK winter floods (see Section 6.2.2) often took the form of essential alerts. This allowed local councils to publish warnings based on the standardised alerts but including extended information pertinent to local communities. Additionally, water authorities would share the alerts provided by the Environment Agency and give their followers guidance on the responsible authority for specific emergencies. Likewise, in the Czajka case the Chief Sanitary Inspectorate published a standardised warnings, while the Mayor of Warsaw provided a long statement with more specific information for the public (see Section 6.5.2).

Additionally, alerts and warnings launched on social media will compete with other content for reach and impressions. 'Magnet media' designed to attract the attention of users and make warnings findable and sharable can improve their potential to reach intended audiences. Authorities may choose to create a unique hashtag and include media such as emoji, images, videos and graphics. For example, hashtags may be used to denote crisis type, location and other information to increase the likelihood of messages being seen on the topic. These can also be used as part of a coordinated social media campaign to improve uptake by other social media users. The use of emoji was also frequently found within the dataset to draw the attention of social media users, particularly warning emoji (\triangle) and exclamation marks ([]). Meanwhile, infographics may be used to show recognisable warning symbols or readily comprehensible data visualisations pertaining to the crisis. Images and videos are particularly useful for providing visual evidence of the risk and reinforce messages urging caution.



When preparing warnings and advice, consideration should be taken to imply this same tone, language, terminology and approach to wording in guidance. Previous research suggests that careful consideration should be made to communicate guidance for those at the average reading comprehension level (). There will always be individuals who purposefully or accidentally misconstrue communication, but not providing information in a way that the average member of the public effected can understand can lead to accidental misunderstanding.

Standardised warning messages should be prepared in advance according to an established framework not only to expedite the speed of dissemination on social media outlets, but also to ensure consistency in messaging and public comprehension of warnings. In most cases, authorities should aim to keep this information clear and concise to assist their immediate comprehension by public audiences. While public alert and warning messages should be developed according to a standardised framework, they should allow a degree of flexibility to account for unpredictable circumstances that are intrinsic to crises. The forthcoming D6.2 Warning Message Generation provides sets of standardised warning messages for water crises in line with these guidelines.

Citizens play a critical role in the spreading of public warning messaging, particularly on social media. Social media users can significantly increase the reach of public warnings disseminated on social media through engaging with posts far beyond the following of the publishing page itself. In both the UK and South African cases, members of the public were found to frequently share the warning messages of authorities, illustrating the benefits of adopting a uniform and readily recognisable framework (see Sections 6.2 and 6.4). Once standardised alert and warning messages have been established, a critical step is to educate the public on the warning system. Education on public alerts and warnings should include what hazards exist, what certain warnings mean (e.g. colour coded warnings, levels of severity, etc.), what recommended actions to take (e.g. avoid water, boil water, etc.), which authorities to contact and where to obtain further information. Moreover, authorities should test the performance of social media warnings prior to a crisis and obtain feedback from the target groups and stakeholders to optimise them.

Guidelines

- > Disseminate warnings as soon as a water crisis is known.
- Utilise a scaled alert system that allows the escalation / de-escalation of warnings and alerts based on crisis severity and likelihood.
- Establish standardised alerts and warnings that provide essential and additional information in a unified framework that is customisable to the specific circumstances of the crisis.
- Utilise magnet media such as hashtags, emoji, infographics, video and images to attract attention on social media feeds.
- > Educate citizens on the meaning of standardised warnings and recommended actions.

4.2 Crisis Communication

This section provides guidance on the use of social media during the crisis phase of a water emergency. Firstly, the ways in which social media may be used to communicate and enhance crisis management and response efforts are discussed. Secondly, guidance on using social media as a means of fostering participatory crisis management and public engagement in the countermeasures deployed is provided. Thirdly, the effectiveness of reputational repair strategies resulting from a water crisis is evaluated and



guidance is provided on the best approaches based on the consideration of an organization's responsibility in the crisis and its outcomes. Finally, strategies for countering misinformation and disinformation resulting from issues in the water network are discussed based on the findings of the analysis conducted in this report.

4.2.1 Crisis Management and Emergency Response

Social media can be a highly effective tool for water and public authorities to communicate and coordinate with the public to improve the effectiveness of response measures (Glasgow and Fink, 2013, p. 156). Authorities should publish regular crisis updates through their social media channels (Sutton el al., 2011). These posts should provide accurate information concisely and consistently and the content of these messages can inform the public of changes to the situation as well as update the crisis severity level and latest guidance. For example, crisis updates produced by UK authorities during the 2019-2020 winter floods were typically focused on informing the public of changes to the flood alert level and providing information for public safety (see Section 6.2.2).

While the primary purpose of these messages is to keep public stakeholders informed to reduce uncertainty and improve public safety (Holmes et al., 2009), the messaging of crisis updates may perform additional functions to advance communication objectives. For example, during the Cape Town drought, public authorities regularly updated citizens on the status of the dam levels primarily to reinforce the severity of the drought to persuade citizens to reduce their water consumption (see Section 6.4.2). Thus, crisis updates not only provided public audiences with current information, but also served to reinforce the need to abide by emergency water rationing restrictions.

Alongside crisis updates published on social media, authorities should also provide advice and recommend actions. This information can streamline emergency responses by providing the public with the information they need to protect themselves, their property, livelihoods and communities. In turn, this will reduce strain on emergency communication channels and responders. Social media may also improve the efficiency of responses by being incorporated as an emergency communication channel. As a multi-directional medium of communication, authorities may utilise social media to both send guidance on how to report emergencies and to whom as well as to receive information from citizens (Bird et al., 2012; Burns & Burgess, 2012). For example, during the 2019-2020 winter floods, UK water and public authorities frequently posted advice on what actions citizens could take to reduce their exposure to flood risks as well as the responsible authority for specific types of emergency. Moreover, Facebook messenger was also used as a means for the public to communicate with authorities report emergencies.

Authorities may also provide the latest data on water quality and quantity to reinforce messages to the public during the crisis to improve public understanding of the scale and scope of the crisis. Moreover, providing data to validate public messaging can also assist in dispelling online rumours and misinformation. For example, during the Czajka wastewater treatment plant failures, water regulatory bodies published the results of their tests on the Vistula river on social media platforms to counter claims that the crisis had caused a major ecological catastrophe (see Section 6.5.2). Likewise, the latest data of reservoir levels was also published as part of crisis updates on the Facebook accounts of water and municipal authorities in Cape Town (see Section 6.4.2) However, this information must be explained for non-technical audiences and utilise engaging and easily understandable infographics to be effective.

During a water crisis, authorities should publish updates on response operations being undertaken. These posts may offer reassurance to the public that appropriate countermeasures are being deployed (Hughes et al., 2014). In addition to reducing public anxiety, these messages may also assist in increasing



public approval of water and public authorities as well as prevent or mitigate reputational damage resulting from a crisis (see Section 4.2.3). Common complaints found within the cases examined in this report were accusations of inaction by authorities in response to crises (see Section 6). By demonstrating that actions are being undertaken to respond expediently and effectively to a threat or crisis, authorities may demonstrate competence and leadership as well as defuse criticisms of failing to act.

Guidelines

- > Regularly provide updates on social media outlets on the status of the crisis.
- Provide information on the current severity level, responses being taken and latest public guidance.
- Crisis update messaging can be used to achieve broader strategic aims, such as instilling urgency, providing reassurance or de-escalating the crisis.
- Sharing data pertinent to the crisis can assist in affirming messages and dispelling rumours provided they are presented in an accessible and engaging way.
- Showing responses being taken to counter a crisis can reassure the public and improve public approval of authorities.

4.2.2 Engaging Citizen Participation and Community Action in Crisis Responses

During water crises, individual citizens and civil associations will often play a key role in responding to the crisis at the local level. Previous research has demonstrated the role that civil actors, such as emergent voluntary self-help communities (Kaufhold & Reuter, 2016) and 'digital volunteers' (Starbird & Palen, 2011), play an important role by supplementing authorities disaster relief efforts and often organise and communicate through SNS.

The role that most social media users may play in aiding response efforts during a crisis is by sharing messages published by authorities to their social networks (Starbird, 2013). This was a consistent theme across cases where authorities provided regular and clear messaging to the public during the crisis, such as updating alert levels and providing guidance for public safety. As such, citizens can broaden the reach of authorities' messages during crises far beyond the immediate following of their organisation's social media accounts.

However, previous research and the case studies conducted in this deliverable illustrated numerous ways in which citizens use social media to actively respond to a crisis. In some cases, this action may be emergent and self-organised community responses. Particularly in cases where authorities delayed acting, it was found that CSO's and local communities would act independently and utilise social media to collaborate and coordinate grassroots responses as well as raise public awareness of the issue. This was especially evident in the US Flint Water Crisis (Section 6.3.3) and FSO Nabarima oil spill prevention (Section 6.6.3) and Cape Town drought (6.4.3) In these cases, the primary use of social media for autonomous crisis responses for collecting and distributing essential goods and services to mitigate the impacts of the crisis on local communities as well as petition public authorities to act.

While citizen participation in crisis responses may be self-organised, and thereby independent of authorities, Bajek et al. (2008) notes that effective participatory crisis management can be conducted with collaboration, support and guidance from authorities. For example, flood resilience groups in the UK are often moderated by flood wardens who liaise between national and local authorities and their local communities and coordinate community action during a crisis (see Section 6.2.2 and 6.2.3).



Therefore, to maximise the effectiveness of public participation in crisis responses to water emergencies, facilitating communication between stakeholders during a crisis is vital to synergising efforts.

Social media provides a highly effective medium for establishing and maintaining communication between authorities and citizens during crisis to synchronise response efforts. Within the literature, the phenomenon of digital volunteers and emergent self-help communities using social media in their efforts to aid authorities and local communities in disaster responses is well documented (Hughes & Tapia, 2015; Stallings & El Quarantelli, 1985). This was also evident in the UK case study where requests for volunteers and donations published by local authorities were shared on flood resilience Facebook groups (see Section 6.2). Social media can also be used to coordinate participatory crisis responses by providing information about how public can help each other in times of water crisis, whether accruing resources such as potable water, shelter or how volunteers assist in local communities or from outside the affected area. This was evident in both the Cape Town drought (see Section 6.4.3) and US Flint water crisis (Section 6.3.3) whereby citizens both inside and outside the affected area utilised social media to organise water collection and distribution for vulnerable and disadvantaged segments of the population, supplementing or replacing the services of public and water authorities in some instances.

During a water crisis, authorities may have to implement far-reaching and long-term restrictions that will affect usual standards of water consumption. A key example would be cases of water scarcity due to insufficient quantity or quality where rationing regimes must be implemented. Situations such as these will require social behaviour change communications. This form of communication seeks to affect changes in knowledge, attitudes, norms, beliefs and behaviour through the coordination of messages and activities across a variety of channels to reach multiple levels of society¹. Within the cases examined, the Cape Town drought was an example of best practice in implementing a successful, large-scale social media campaign to persuade citizens to comply with 50L-per-day water rations (see Section 6.4).

Guidelines

- Design social media posts to be findable and shareable to facilitate the spread of your messages by the use of specific hashtags and engaging content.
- While CSOs and local communities may act autonomously, authorities should seek to synergise and collaborate with non-governmental entities in order to improve crisis responses both online and offline.
- Establish networks in at-risk communities, building relationships with credible voices and training agents of change to assist in collaborating and coordinating with their social networks to mobilise participatory responses during crisis.
- Utilise social media campaign strategies in collaboration with private and civic actors to instil social behavioural change during crises that require widespread behaviour modification and public participation in countermeasures.

¹ See <u>https://sbccimplementationkits.org/sbcc-in-emergencies/learn-about-sbcc-and-emergencies/what-is-social-and-behavior-change-communication/</u>



4.2.3 Reputation Management

Although social media provides advantages for managing crises, it also has the potential to increase the likelihood of reputational damage. The speed and decentralised way in which information travels across social networks facilitates the spread of unfavourable perceptions. Water suppliers and public authorities may face reputational damage because of the crisis. Reputational damage may range considerably in water emergencies due to actual or perceived impacts of a crisis and the response of authorities prior, during and after the crisis. There are numerous strategies that public relations and crisis communicators may choose to deploy. However, not all strategies are equally effective and will vary according to the crisis encountered.

Arendt, et al. (2017) identified that the effectiveness of a selected reputational repair strategy often depends on the following mitigating factors:

- Scope of the crisis: This refers to the extent of the crisis and its impact on the public. Smaller crises will be unlikely to cause major reputational damage while large-scale crises entail the implementation of more complex reputation repair strategies.
- Culpability: This refers not only to the actual responsibility an organisation has for the crisis and its outcomes, but also public perception of the culpability of the organisation. For example, while water authorities managed the Czajka wastewater treatment plant, criticism on social media was primarily targeted at municipal authorities of Warsaw who were deemed responsible for the plant failure (Section 6.5).
- Promptness of communications: Authorities should provide a prompt and clear statement to the public at the onset of a crisis. Delay in notifying stakeholders of a crisis or remaining silent may lead to failure to recover from reputational damage or cause long-term damage to the image of the organisation.
- Potential for legal action: Organisations should consider the legal ramifications of the crisis communications and reputation repair strategy that is adopted. This is particularly relevant to cases in which the individual or organisation in question is responsible for causing a crisis.

During natural and manmade disasters, the strategy of corrective action is often considered the most effective reputation repair strategy (Arendt, et al., 2017). This strategy involves the responsible authority communicating to the public the actions being taken to respond to a crisis and prevent or mitigate its recurrence in the future (Bentley, 2012, p. 223). In the cases of water crises examined in this deliverable, UK national and local authorities used social media to provide regular updates to the public of the countermeasures being deployed to mitigate flooding during the crisis as well as recovery actions after (see Section 6.2.2). Correspondingly, in the second instance of the Czajka wastewater treatment plant failure that occurred one year after the first, water authorities adopted a strategy of regularly posting updates on the progress of repairs to the faulty pipeline and highlighted safeguards being put in place to prevent future failures (see Section 6.5.2). By using this proactive approach, authorities can demonstrate leadership as well as provide reassurances to the public that the crisis is being effectively managed and mitigate reputational damage more effectively.

Denial is a frequently used strategy when individuals and organisations face a reputational crisis. Ware and Linkugel (1973) identify four types of denial: simple denial whereby authorities refute culpability; denial of responsibility for a crisis, its outcomes or the existence of a crisis itself; denial that both refutes responsibility and positions the denier on the side of the audience as a victim; finally, the denial of any interests or intention regarding the crisis.



Arendt, et al., (2017) found that while denial is the most frequently used strategy during reputational crises, it is also the least effective particularly when combined with evasion of responsibility for the crisis. According to Coombs (2014), crisis managers and communicators are advised to only use denial strategies in cases where their organisation has no culpability in the crisis and to counter misinformation and disinformation (see Section 4.2.2). He contends that even in cases where there is ambiguity in culpability, reputational damage will result from the act of denying responsibility in a so-called 'double crisis', whereby the act of denial leads to greater reputational damage than would have been otherwise incurred. For example, in the case of the Flint water crisis, the authorities' persistent denial of the possible link between the outbreak of disease and water contamination led to serious debates surrounding the accountability and transparency in the authorities' actions and behaviours. The public accusations of corruption, incompetence, and indifference to public safety were fuelled further by the denial of the crisis by authorities.

In cases where organisations share responsibility of the crisis or its outcomes, Coombs (2014) advocates adopting a victim-centred approach that addresses concerns for public safety and welfare, providing regular details of the crisis and recommended actions for stakeholders as well as build future resilience. Research suggests that in addition to addressing the damaging impacts of a crisis on the public and victims, these approaches can also mitigate reputational damage resulting from an incident (Claeys, Cauberghe & Vyncke, 2010; Cooley & Cooley, 2011).

Guidelines

- Before implementing a reputation repair strategy consider the scope of the crisis, culpability, timing of messages and potential legal ramifications.
- Corrective action is often the best strategy for reputation repair, demonstrating qualities of competence, leadership and service in the public interest.
- > Denial and avoidance of responsibility are infrequently effective when there is responsibility for the crisis and its outcomes and may lead to further reputational damage.
- In cases where organisations share responsibility for a crisis, it is advisable to adopt a victimcentred strategy that focuses on addressing the impacts of a crisis and the needs of affected citizens.

4.2.4 Countering Misinformation and Disinformation on Social Media

Misinformation and disinformation have the potential to not only damage reputations, but also pose a threat to public safety. The communications landscape in water related crises may lead to the exaggeration or minimisation of the causes, severity and impacts of a crisis or its existence altogether. It may also wrongly or inaccurately portray individuals, groups or organisations as being culpable for the crisis or misrepresent their intentions.

Misinformation and disinformation may originate from a variety of sources including public figures, influencers, fringe groups, media and prominent organisations. This Facebook post from a CSO page in South Africa illustrates the problem, whereby a Palestinian advocacy group shared a false claim made by a sitting member of parliament for political purposes:

'The Democratic Alliance (DA) created the water crisis in #CapeTown to manipulate tender processes so that they could award a R6 billion contract to the Israeli government, a National Freedom Party (NFP) MP claimed in Parliament on Thursday.'



In cases of misinformation, managers must act rapidly and proactively to counter misinformation with accurate facts (Coombs, 2014). In the cases examined in this report, the most effective strategies were to deny false rumours and provide correct information with credible evidence to counter misleading and false claims.

During the Cape Town drought, municipal authorities countered false accusations that increases to tariffs on water were profit-seeking with messages that denied profit-motives and explained the circumstances of the crisis as well as how reinvestment into the water network would improve water efficiency.

'The drought charge comment period has been extended to midnight on Monday 15 January 2018. 1. This proposed charge is absolutely vital to ensure that we can continue to deliver water services. The City makes no profit off the sale of water. All tariffs are used for maintaining our water infrastructure and for water provision. 2. The (welcome) reduction of water usage has led to an associated revenue decline and the City is under financial pressure to continue providing quality water services without assistance from our ratepayers.'

Additionally, Cape Town municipal authorities had to counter allegations that the drought crisis was fabricated. These rumours largely originated from the repeated postponement of 'Day Zero', the point at which point Cape Town's water supply would be exhausted. As maintaining public participation in the water rationing campaign was vital to response efforts, authorities had to provide an explanation and reinforce the severity of the crisis despite the postponement of Day Zero.

'We've always been very conservative with our #DayZero calculation as we'd rather be cautious and have water for longer than fall short and run out of water unexpectedly. This calculation is influenced by current dam levels, rainfall, the yield from existing water supply projects and most importantly agricultural and urban use. Because agricultural usage was limited and Team Cape Town did exceptionally well, we managed to avert #DayZero this year. A national state of disaster has just been declared as a result of the devastating drought across many parts of the country. We must therefore bring our usage down to 450 million litres per day or 50¢ per person per day to stretch our water supplies. The drought continues and it is very real. #ThinkWaterCT and keep saving'.

In the UK, water companies used more concise posts that adopted a denial strategy with an authoritative tone. For example, in response to social media rumours that water in Doncaster was causing illness, this water provider provided a brief repudiation of the claim.

'Due to recent posts about illness linked to the water supply in the Doncaster area I can confirm that we are unaware of any issues affecting the water quality. The water supply is very unlikely to be the cause of any illness problem.'

In one case, water providers appeared to adopt a strategy of countering misinformation by reassuring that water supplies have not been interrupted to address social media users who encountered misinformation without explicitly mentioning the topic of the rumour, thereby avoiding contributing to its spread.

'We're aware of Social Media reports in the Mountain Ash area giving incorrect information. Please be aware that we have no issues in the Mountain Ash area with water supplies at the moment.'

The public can also play a critical role in countering misinformation and disinformation during times of crisis. This role is not passive as 'opinion takers', but also active as 'opinion makers' and mediators of



online discourse. In the fluid and dynamic communication landscape of social and digital media, users engage in collective sensemaking of events. Research has identified that social media platforms can lead to 'self-correction' through aggregated intelligence and crowd moderation (Mendoza et al., 2010). In the dataset, several instances of content moderation for misinformation were found. In Poland, social media users identified false or misleading information and provided corrections (see Section 6.5.3). In the UK, flood resilience Facebook groups provided a forum for members to obtain credible information and validate hearsay (see Section 6.2.3).

Guidelines

- Monitor social media to identify misinformation and disinformation that misrepresents the crisis, responses and organisations that implement them.
- > Counter false claims and rumours in a timely and proactive manner.
- > Correct misleading and inaccurate information by providing correct and validated information.
- Work with credible voices on social media to counter misinformation and provide content for influential users to share with their networks and spread accurate information.

4.3 Post-crisis Communication

The aftermath of a water crisis affects different communities and authorities in multiple ways. The varying effects of a disaster imply both public and water authorities as well the public to adapt to the new conditions in a way that enables them to mitigate against the effects of future disasters more effectively. In the post-crisis phase when different actors require different assistance in terms of communication and relief coordination, social media platforms can provide useful and accessible means of communication. The social media platforms by providing a diverse set of tools such as Facebook and Twitter can supplement public and water authorities' efforts to mitigate against the adverse impacts of water crises by bridging different actors and their activities. Additionally, to ensure a swift recovery from disaster and build future resilience, it can facilitate efforts relevant stakeholders to use or adapt available resources to respond to, withstand, and recover from adverse effects of disasters. Sections 4.3.1 and 4.3.2 discuss in detail how the public and water authorities as well as the public in the cases included in this deliverable develop their post-crisis management process to recover from the adverse effects of a disaster and build future resilience to prevent or reduce the damage a crisis can inflict on an organisation and its stakeholders. The sections also provide details of the way in which the social media platforms can help public and water authorities as well as the public to design and adapt their crisis recovery and future resilience building strategies and policies.

4.3.1 Crisis Recovery

The cases included in this deliverable place great emphasis on crisis recovery in the aftermath of a disaster, mainly through the actions aimed at long-term implications of a crisis to help them return their operations and services to their pre-crisis state and to reduce the potential effects of future crises. The cases also illustrate that crisis recovery can be complex, depending on the context and the extent of the crisis. However, authorities or organisations can build their recovery strategies in a way that their disaster risk management and adaptation policies or strategies are reinforcing, adaptive, and supportive. It is also critical to understand that any recovery effort requires a comprehensive analysis and understanding of the context, correct identification of the local social and ecological conditions. This is important, as any post-crisis recovery transformation or adaptation or policy requires a careful



coordination that reaches across domains of policy and practice (O'Brien et al., 2012; Gardiner, 2010). Developing a synergy between different recovery efforts and inclusion of all interest groups in all cycles can enhance the outcome of recovery efforts.

Disaster management and recovery literature suggests that 'including disaster risk management in resilient and sustainable development pathways is facilitated through integrated, systemic approaches that enhance capacity to cope with, adapt to, and shape unfolding processes of change, while taking into consideration multiple stressors, different prioritized values, and competing policy goals' (O'Brien et al., 2012, p. 439). Social media platforms can make important contributions in collecting data, communicating with interest groups about recovery efforts, mobilising local support, or gain media attention to reach a wider audience. The excerpts below are from a post-disaster communication in the UK that illustrate the way in which crisis recovery efforts or communications can be developed that are accessible and can potentially reach a wide range of audiences. The excerpts also demonstrate that crisis recovery communications can address different issues that are relevant to communities:

'Good morning all. It's the morning after and possibly the first-time people will get a chance to really take stock of the devastation. This is what we know so far about what is going on in the village today. The Co-op will be opening and providing free cleaning materials and hot drinks from their staff canteen. The flood hub will be opened by the Council above the Library in Mytholmroyd. A check of the national Rail app suggests trains are running and are relatively on time'. The official advice for property owners can be found online at the following link. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_da_ta/file/403213/LIT_5216.pdf

'We have really been through the ringer this last week or so. If you need to talk done forget Unmasked Community Hub 7pm Thursday at the community centre. This is a confidential space for you to talk and find support from others.'

There is a risk of strategic economic sectors and infrastructure being prioritised over livelihoods and well-being in poor and marginalised communities in the development planning and post-disaster recovery (O'Brien et al., 2012; Milligan et al., 2009; Mitchel, 2001). In the case of Flint water crisis, for instance, it was demonstrated that the socio-economically marginalised communities were hit harder, and they ran the risk of being forgotten in the post-recovery efforts. Additionally, the socio-economically disadvantaged communities were reported to be less able to get their voices heard and concerns addressed, due to their limited ability to reach out to the media that would incur upon them financial costs. It was also demonstrated that access to safe drinking water was galvanised by the local media, CSOs, and influencers as a human right, and argued that the marginalised or socially disadvantaged communities had their human rights violated in the crisis. Social media platforms played an important part in portraying the Flint water crisis as a lack of social justice and denial of basic human rights.

A lack of inadequate attention to the issues surrounding crisis recovery communications such as local context and community needs in post-crisis recovery can lead to missed opportunities for building local capacity and integrating local development visions into longer-term strategies for disaster risk reduction and adaptation to climate change (O'Brien et al., 2012, p. 439). Local communities play a vital role in making risk or disaster management strategies a success by protecting ecosystems against potential degradation, adapting to changes (e.g., polices and natural), and supplementing authorities' recovery efforts (Gardiner, 2010). Post-crisis recovery efforts also require a consistent and reiterative engagement of all interest groups premised on communal learning. Learning processes are central in shaping the capacities and outcomes of resilience in disaster risk management, climate change adaptation, and sustainable development (O'Brien et al., 2012, p. 439).



Moreover, an iterative process of monitoring, research, evaluation, learning, and innovation can reduce disaster risks and promote adaptive management in the context of extremes (O'Brien et al., 2012, p. 439). Technological innovations of which the social media platforms are an important component and are accessible to different communities and actors may help achieve post-crisis recovery. Technological innovations can be adapted to local contexts and combined with capacity development embedded in communities. Crisis recovery communications by highlighting the prerequisites, at local level, and offering varying communication platforms can encourage or help the development of new patterns of response to a crisis. It is argued that successfully addressing disaster risk, climate change, and other stressors often involves embracing broad participation in strategy development, the capacity to combine multiple perspectives, and contrasting ways of organizing social relations (O'Brien et al., 2012, p. 439).

The cases included in this deliverable by highlighting certain inefficiencies in crisis communication and management displayed by the public and water authorities, highlight the necessity for good crisis recovery social engagement guidelines. The cases as well as this section illustrate that different authorities can run social media campaigns to crowd-source data about the effects of a crisis and affected actors or communities' perspectives on recovery programmes. Social media platforms can also be used to build relationships between authorities, the public, and CSOs that all play critical roles in implementing recovery activities. In a digital era, social media platforms provide accessible and cost-effective communication channels for the local communities to raise their needs, priorities, and perspectives for any future policies. However, any crisis recovery communications must provide clear guidance on how to coordinate and synergise different outlets or websites to ensure a collaborative front. The guidelines must also provide clear on how to develop content for the varied social media platforms that sensitise the crisis, meet the public requirements, and are not counterproductive.

Guidelines

- ➢ Facilitate early communications with all interest groups to avoid confusion and misunderstanding after a crisis while promoting transparency and accountability.
- Include all interest groups in crisis recovery phases and activities to ensure a diversity of needs and perspectives that not only inform policies but also play critical part in implementing policies in a more holistic and effective manner.
- Establish the socio-economic as well as technical implications of the disaster to help tailor postcrisis recovery policies and activities.
- Identify community needs and future perspectives early to empower and prepare them for future crisis and promote the ideas of self-defence that is a critical pillar of any effective recovery and sustenance strategy.
- Appreciate that the implications of a disaster are not equally distributed. Social media communications must be tailored to individual needs or extent of the damage.

4.3.2 Building Future Resilience

In the aftermath of a crisis, the communities often resort to a range of incremental steps to help them mitigate against the effects of the crisis, recover, and to adapt their facilities (e.g., property). These changes and adaptation can enable authorities or communities to be better prepared, particularly against natural water crises such as floods and droughts. Crisis management literature suggests that disaster risk, capacity to cope and adapt are unevenly distributed (O'Brien et al., 2012, p. 439). Literature



also states that vulnerability is often concentrated in poorer countries or groups, although the wealthy can also be vulnerable to extreme events (O'Brien et al., 2012, p. 439; Gardiner, 2010). This suggests that any recovery mechanisms or efforts undertaken at the authority or community levels must reflect the local conditions and the resources available to the communities, individuals, or authorities. In the case of UK flooding, for instance, there are numerous examples of how individuals or communities transform their resources or capabilities in the face of a disaster. The excerpt below provides an illustration:

"...interesting read on a first-hand account of recent flooding and how a flood warden in fishlake has adapted his community to flooding..." <u>https://www.bbc.co.uk/news/stories-51008272</u>

The resilience demonstrated by the public at the time of the flooding and the level of preparedness they put up to mitigate against the flood in the UK, was reflected in numerous posts, providing important indications of an effective effort:

'Storm Denis did not flood us but the levels of preparation we saw and the protection put out at properties was great to see. To ensure you are ready for next time please store any sandbags left over from the weekend or should you need to buy more contact MPS in the post below.'

Additionally, social media engagement could be an important source of communication across different actors as well as an important source of encouraging the public to engage with the authority and promoting good practices. The post below is from the UK flood crisis and clearly signifies that the ways in which the social media platforms as tools that are accessible and can reach to a wide range of audiences can be part of the crisis recovery efforts or initiatives:

'So glad the worst seems to be over in the valley for now ... I was very surprised though to walk through Hebden this afternoon with the river rising up the waves steps past shops that were not open but did not have their flood gates in place. Surely if you have a flood gate it would be wise to always use it at this time of year when the land is so saturated the water comes up fast when it does ... I suspect insurance companies will not pay out if you had a flood gate and neglected to use it and were flooded. Take care everyone.'

However, building future resilience is a lengthy process, requiring cooperation between all parties affected by a disaster. It also requires an effective crisis or post-crisis management from the local or regional authorities to identify the needs of those affected as well as tailor support and assistance to the local context. As illustrated in the case studies in this deliverable, public participation makes critical contribution to the efforts aimed at reducing the effects of a disaster and help develop future resilience by mobilising or adapting community dynamics or resources. To ensure this cooperation works, it is of vital significance that the authorities communicate with public consistently, in an open and transparent manner. A lack of open communication or potential inappropriate management of resource can seriously undermine authorities' credibility and reduce the possibility of public engagement in the future. The quote below is from the UK flood disaster, illustrating the significance of transparency and accountability in post-crisis recovery efforts:

'I see many reports of people who have unfortunately been flooded and who do not have insurance, because they have been unable to get insurance cover. What happened to the Flood Recovery scheme, wasn't that supposed to provide flood cover for people who couldn't get it through the usual insurers? Doesn't look like Flood Recovery has been effective?'

Whilst communities and individuals can function as important pillar in developing future resilience, the public and water authorities bear the brunt of the efforts, due to their legal/jurisdictional



responsibilities, resources, and technical capability. To ensure they are prepared for dealing with crisis, authorities must adopt a forward-looking approach as well as monitor their capability in relation to potential disaster consistently. O'Brien et al. (2012, p. 439) in their suggestion on the ways of managing the risks of extreme events and disasters to advance climate change adaptation argue that;

'Where vulnerability is high and adaptive capacity relatively low, changes in extreme climate and weather events can make it difficult for systems to adapt sustainably without transformational changes. Such transformations, where they are required, are facilitated through increased emphasis on adaptive management, learning, innovation, and leadership.'

The cases included in this deliverable show that the public and water authorities, despite some failures to act swiftly (e.g., in the case of Flint water crisis), adopted a range of incremental steps aimed at improving efficiency within existing technological, governance, and value systems. The authorities also included in their recovery and mitigation mechanisms certain adaptive facilities that could correspond to evolving risks posed by natural disasters and underlying ecological and social conditions.

RETURNING TO NORMAL: Everything is now pretty much back to normal with all road closures lifted, buses running as usual, river levels dropping sharply. There were one or two properties that got water in them although thankfully restricted to basements. There are still some pooling and running water on the hillside roads. **NEAR MISS**: Despite the rain that we had; we've been very fortunate as it could have been a lot worse. The main band of rain has sat across the country for much of the day tracking east to west. Calderdale has been just on the northern fringes, had the rain-band been 20 or 30 miles further north we would have had substantially more rain and potentially some very serious flooding. BE PREPARED: Please ensure that you have your own property protection. During flooding incidents, sandbags will likely not be available, get some now before they're needed. Also check flood gates and barriers and make sure they're working and you're familiar with how to deploy them. THANKS: The Council deployed a lot of resources today and were out unblocking drains, sweeping gullies, directing traffic etc. Thanks also to all the flood wardens who were out and about and the Town Hall at Hebden that become an impromptu flood hub for stranded school children. FAKE NEWS: During the day there have been many false messages, largely spread via social media. These caused a lot of confusion and contradicted the official/actual position. Please ensure you obtain info from reliable sources and don't always believe everything on Facebook etc. ROAD CLOSURES: The flood wardens and council had road closures in place today which some drivers chose to ignore, only to come back 10 minutes later looking rather sheepish as the Police had turned them round and sent them back through the floodwater. The road closures are only there when the road is officially closed, as soon as the road opens the barriers and signs are removed. THE GOOD NEWS: The next few days look like being mostly dry.'

This section reflected the future resilience building potential and perspectives through the use of the social media platforms that have played critical roles throughout the crisis, including awareness raising, coordinating relief, pressuring the authorities to do more or practice accountability and transparency, and promoting public participation. The section illustrates that establishing networks on social media to coordinate the dissemination of messages to the public using a common strategy at the pre-crisis, crisis and post-crisis stages helps handle the crisis more effectively and promote good practice that could lead to better preparation for similar disasters in the future. The section also highlights any crisis recovery or future resilience development efforts might benefit immensely from the inclusion of CSOs and influencers as complementary actors. The cases in this deliverable provide several examples of how the


authorities could and should include the creation of online resilience communities not only to handle a disaster in a more effective manner but to also develop a resilient and sustainable future.

Guidelines

- > Place the local communities at the epicentre of any future resilience building policies.
- The public or water authorities must collaborate with local authorities or CSOs to help manage local outbreaks of disasters on the ground. Local authorities such as councils and CSOs are best placed to understand and respond to the needs of their citizens.
- Practice reflexivity in predicting and managing crisis to enable embrace systems and platforms which can enable public and water authorities to not only keep vital services running and the lines of communication open with citizens but build a deeper sense of engagement in the recovery process.
- Tailor post-crisis recovery assistance to local or individual needs/ requirements as disasters affect different communities or individuals differently. Also, the different socio-economic conditions of different communities are affected by a disaster and respond to disasters differently, thus, future resilience building efforts must reflect this diversity.
- > The evolving profiles of risks and the social and ecological conditions of a region/state must be reflected all community empowerment activities and must be monitored consistently.





5. Soft Intelligence on Social Media

5.1 Crowdsourced Intelligence for Early Warning and Situational Awareness

By design, social media fosters social interaction through user generated content. This content has enormous potential to provide authorities with information for early warning and situational awareness. Goodchild (2007) developed the concept of 'citizens-as-sensors', whereby members of the public use digital technologies and media to detect and report local crisis information to authorities and each other, often through social media.

Within the research conducted in this deliverable, numerous instances of user-generated content published on social media were found with high potential for early warning and situational awareness water quality and quantity issues. In the case of FSO Nabarima, civil society activists travelled by boat to the vessel and documented the conditions of the ship using a drone, providing evidence of its hazardous condition on social media to national and international authorities as well as the public prior to a potentially catastrophic oil spill (see Section 6.6.3). During the 2019-2020 UK floods, community journalism pages and flood resilience groups acted as a forum for citizens to post and share eyewitness accounts of conditions in affected areas in real-time and often accompanied multimedia content (see Section 6.2.3). In the Flint case, a significant number of citizen-generated posts referenced images of contaminated water captured by citizens and shared on social media to evidence the contamination of the water supply before it was acknowledged and acted upon by authorities (see Section 6.3.3).

These empirical findings based on the analysis of citizen-generated Facebook activity during water crises echo those of a host of previous studies and projects in what is becoming a well-established field of research and innovation. Social media data can be utilized for early warning and situational awareness through advanced data-driven technologies using methods such as natural language processing and semantic technologies to filter, detect, cluster and visualise data (Caragea et al., 2011, Castillo, 2016, Imran et al., 2015 & Yin et al., 2012; cited in Reuter et al., 2016). Additionally, as social media is a multidirectional medium of communication, the public may also directly report water quality and quantity issues to the responsible authority on their public accounts or through private messages.

While user-generated content, whether collected using big data technologies or directly reported to authorities, can provide valuable soft intelligence for early warning of crises and enhance situational awareness, there are limitations. Technical challenges include information overload, structuring unstructured data and distinguishing signals from noise (Hughes & Palen, 2012; Reuter, et al., 2016). Moreover, other studies have shown that while user-generated content produce valuable information that could aid crisis managers and emergency responders, this source of intelligence is underutilised by authorities (Carter et al., 2014) Zade et al. (2018) point out that that these challenges have opened a new research and innovation opportunities to go beyond situational awareness towards actionability, such as providing decision support tools similar to those developed by aqua3S (WP5).

5.2 Actionable Intelligence Matrix

When discussing data-driven techniques to improve crisis management, the aim is producing *actionable intelligence*. In this context, actionability refers to having quality information immediately available in order respond to a situation (Pearson & Watson, 2010). Zade et. al. (2018) conducted interviews with emergency response practitioners to elicit what constitutes actionable intelligence, finding that *location, time, crisis type* and *severity* as well as the *credibility* of the source were the most important factors in determining actionable intelligence obtained from social media.



Based on the research conducted in this deliverable, a novel method of assessing the actionability of soft intelligence obtained from digital content has been developed. This intelligence assessment matrix builds on well-established tools developed by intelligence and law enforcement communities to assess human intelligence. For example, the College of Policing's 3x5x2 method for assessing human intelligence conducts a source evaluation and intelligence evaluation to determine overall confidence in gathered intelligence². Other methods widely used by global policing and intelligence as well as the 4×4 system that enables evaluation of information and the source of human intelligence as well as the 6×6 method for rating the reliability of a source and the validity of data (UNODC, 2011). However, a survey of the state-of-the-art found there are few bespoke tools available for assessing soft intelligence gathered from social media content and determining their actionability before, during and after a crisis.

The Actionable Intelligence Matrix (AIM) is intended to assist crisis managers in assessing 1) information validity of social media content, 2) source reliability of social media users and 3) the degree to which the intelligence is actionable. This tool may be used prior to a crisis for early warning, during a crisis to build situational awareness and aid response efforts or after a crisis to facilitate recovery efforts.



Figure 3. Actionable Intelligence Matrix (AIM)

According to this method of assessment, the quality of soft intelligence from social media sources of a potential or actualised water crisis can be ascertained. To do so, AIM enables analysts to measure information validity, source reliability and actionability based on a grading system of *High*, *Medium* and

² See <u>https://www.app.college.police.uk/app-content/intelligence-management/intelligence-report/</u> aqua3S D6.1 – SOCIAL ENGAGEMENT GUIDELINES



Low for each of these parameters. The following sections detail the method for assessing soft intelligence gathered from social media that has been developed based on the qualitative analysis of a sample of 2,575 Facebook posts collected in T6.1 and a sample of 4,687 end user validated Tweets collected from the aqua3S pilot countries in T3.3: Crowdsourcing and social media monitoring.

AIM Grading Scheme	High	Medium	Low
Information Validity	Crisis, time and place are clearly stated.	Missing information requires additional verification.	Information is ambiguous, inconsistent or false.
Source Reliability	Source provides accurate and trustworthy information.	Some uncertainty of the authenticity and trustworthiness of the source.	Source provides inaccurate and untrustworthy information.
Actionability	Intelligence can be acted upon immediately.	Further investigation required before action can be taken.	Intelligence is unlikely to be actionable.

Table 8. AIM Grading Scheme

5.2.1 Information Validity Assessment

The first test for user generated content is information validity. Information validity determines whether there is sufficient information of an incident to act on it³. For crisis managers and responders, key information for a post to contain is the *type of crisis*, the *location* of the crisis and the *time* of the crisis (see Zade et al., 2018). By knowing the type of crisis, crisis managers will know the relevant authority to respond and which type of response to deploy. The location of a crisis will enable responders to direct responders to the site. Although social media posts are automatically timestamped, crisis managers and responders will not know the actual time at which the incident occurred, making this a critical consideration for high validity content. Meanwhile the X-axis is concerned with the extent to which the information provided is explicitly stated, implied or unclear.

Information Validity Assessment Y-axis

- > Explicit: All information is clearly stated without ambiguity.
- Implicit: One or more types of information is implied, but with enough contextual information for the meaning to be ascertained.
- Unclear: One or more aspects of the information provided is not internally coherent or externally consistent with known information regarding the situation.

Information Validity Assessment X-axis

- > Crisis, Time and Place: All crisis relevant information is contained within the post.
- > Crisis and / or Time and / or Place: Either crisis, time or place is not contained within the post.
- > Crisis or Time or Place: Only one type of information is contained within the post.

³ See <u>https://fas.org/irp/doddir/army/fm2-22-3.pdf</u> aqua3S D6.1 – SOCIAL ENGAGEMENT GUIDELINES



Information Validity Assessment	Unclear	Implicit	Explicit
Crisis only Time only	Low	Low	Medium
Place only			
Crisis + Time - Place	Low	Medium	High
Crisis + Place - Time			
Place + Time - Crisis			
Crisis + Time + Place	Medium	High	High

 Table 9. Information Validity Assessment Matrix

Digital content that contains all three types of information explicitly stated in the post have the highest information validity. The following posts and tweets exemplify citizen generated content with high information validity that provides sufficient information for action to be taken.

'8.50pm Bad flooding around Tesco's in Whaley Bridge'.

'Looking down on Jack Bridge and Colden School at 11:17 AM this morning. Water was over the bridge and running on the road at this point'.

'2pm Beaware of escaped livestock and flooding in Brailsford'

'09.30 Tree down by the Cockyard blocking the road near Tunstead Milton. Lots of debris on the roads.'

In some cases, information will be implicit. For example, the following posts explicitly states the crisis and the location while implying flooding occurred at the time of posting. In these posts, implied information (time) is sufficiently clear to be classified as high validity.

'Rochdale canal in Mytholmroyd spilling out onto the path **now** [emphasis added], seems to be spreading pretty quick'.

'Canal wall has **just** [emphasis added] breached near Castle Hill, Todmorden so there is an extra surge of water into the river.'

'The Culvert at the rear of Jubilee Way is overflowing onto Burnley Road at Portsmouth. Passing **still** [emphasis added] just about possible, but not advisable. Stay safe everyone!'

'Windy bridge is [emphasis added] flooded and there's a car stuck'.

'Current conditions [emphasis added] in Baslow / Calver the word is flooded! A Credit: [first name, surname]'.

'Same location: **FIVE HOURS LATER**.. Over Three feet of water covers Meadowhall Road with raw sewerage now contaminating the water. The Credit Pics – [first name, surname]'.

In cases where user generated content contains the crisis type and location, crisis and time or location and time, the information validity is rated high if key information is explicit. However, if any information is unclear, it will receive a rating of medium. This entails partial information is provided, but insufficient





to provide a complete and immediate picture of the situation on the ground without further information and investigation.

'Flooding outside laundrette on Burnley rd'. 'Rivers coming over into the park at Hebden'.

In these cases, partial information is explicitly provided. However, implied information (in this case *time*) in not sufficiently clear to be considered to have high validity. If partial information is provided, corroborating information from alternative sources should be used to validate missing intelligence.

Content with low information validity will only have crisis, location or time in isolation. The following post provides an example where location is the only information provided.

'Bridge on Stansfield Road and Patmos. Looking grim 😳'.

In this example from a CSO page in Trinidad and Tobago, no information of crisis type, location or time is provided in the post text concerning an oil spill near a popular beach. Depending on accompanying media or hyperlinks, the information provided by this post would be considered to have the least information validity.

'Sea bathers, fishermen and mariners please exercise caution.'

5.2.2 Source Reliability Assessment

The second assessment is for source reliability. This refers to the account from which the information was obtained. On the Y-axis, the source is compared with information being received by other sources on social media. As SNS platforms are an open space for users to generate and engage with content, often through commenting on or interacting with the post, this can provide a rich source of verification. Moreover, information received on social media can be cross-examined with other information being collected. If the information received from a source is contested by other sources on social media, this will impact its reliability significantly. In some cases, there will be no corroboration of the information. This will lead to a neutral effect on the rating of the source's credibility. Finally, if there is additional information corroborating the information provided by a source, this will significantly improve its reliability rating.

On the X-axis, the analyst should consider the reputation of the source and whether valid information has been previously obtained. If the information is from a credible voice, such as a reputable authority or a source that has repeatedly provided valuable information that has been proven accurate, then the source can be considered credible. If the source has not been previously encountered, the information must be validated either by other sources or current knowledge of the situation. Finally, if a source has consistently posted inaccurate information previously, then it should be treated with the utmost scepticism.

Source Reliability Assessment Y-Axis

- Credible: Information is from a reputable source that has a track-record of producing accurate content.
- Untested: Information is from a new source that has not been previously verified as producing accurate information.
- Not Credible: Information is from a source that has had a previous history of producing inaccurate or malicious content.

Source Reliability Assessment X-Axis



- > **Corroborated:** Information produced by a source is confirmed by other sources.
- > **Uncorroborated:** Information produced by a source is not discussed by other sources.
- > **Contested:** Information produced by a source is countered by other sources.

Source Reliability Assessment	Not Credible	Untested	Credible
Contested	Low	Low	Medium
Uncorroborated	Low	Medium	High
Corroborated	Medium	High	High

 Table 10. Source Reliability Assessment Matrix

The credibility of a source can be determined by its previous track-record in publishing accurate information on social media as well as the type of user. For example, reputable media outlets, subject experts and authorities are traditionally considered credible sources of information.

Additionally, social media provides scope for civil entities and members of the public with a special interest in water security to publish content relevant for detecting, responding and remedying issues related to water quality and quantity. These may take the form of CSOs, watchdogs, misinformation fact checkers, online resilience communities and citizen observatories⁴, among others. Within the dataset, numerous independent social media accounts who regularly produced reliable information were identified. For example, the following posts from a citizen observatory and environmental watchdog, respectively, illustrate non-traditional sources of information that regularly publish reliable information on water quality and quantity issues.

'#weather #latest #dennis #rivers #live #cam #flooding #uk Latest images around wales river Taff image from Cardiff plus Towy and Teifi rivers, all rising steadily. Can also see latest radar image with some heavy rain now moving into the region for a time. Keeping you updated.'

'Another oil spill Today, 21st August 2020, it was reported that our fishermen boats were being contaminated with floating globs/chunks of crude oil in Cedros. Fishermen and Friends of the Sea (FFOS) have been reliably informed by Cedros fishermen that for the past week, they have observed oil floating in the water in the vicinity of the Trinmar fields off the coast of Cedros.'

However, due to the quantity of data generated by billions of users around the globe, it is highly likely that information will be collected from untested sources that have no previous track record of producing accurate and trustworthy intelligence. Moreover, there will be certain individuals and groups that may generate misleading and false content to sensationalise and issue or maliciously mislead the public.

⁴See: <u>https://ec.europa.eu/easme/en/news/fostering-citizen-observatories-address-environmental-challenges</u> aqua3S D6.1 – SOCIAL ENGAGEMENT GUIDELINES

Therefore, determining the reliability of a source will often require triangulation with information from other social media users as well as data gathered from water monitoring and alert systems.

The corroboration of claims by other social media users is a strong indicator of reliability, particularly if the original source is credible (UNODC, 2011, p. 26). Additionally, information gathered from previously untested sources can be verified if there is strong agreement with information provided by other social media users. The following content provides an example of corroboration by multiple independent sources of a bridge being flooded producing a highly reliable account of an incident.

'The culvert at Callis has burst its banks again and one side of the road is flooded and won't be long before it's both sides. The road is still passable on one side at the moment.'

'Just FYI. Water was pooling in the road and bubbling up through the manhole at Callis Bridge when I came through about 45 mins ago.'

'I don't know how high it has to get at Callis Bridge to spill over and flood the road but the water is almost touching the top of the arch and raging down.. Drains not coping and the road is starting to puddle up. Glad I am Homeside of it and not the other. 12.00 noon Monday.'

'Callis Bridge as of about 10 mins ago. Cars having to mount the pavement to get through.'

'Video sent to me from a friend. Callis is overflowing and badly flooded.'

However, especially in the case of new or isolated incidents, posts may be uncorroborated by other social media users. When taken in isolation, consideration should be made regarding the source's reputability or previous track record in terms of generating accurate content. If the source is untested, uncorroborated information can be verified supporting evidence in the form of hyperlinks or embedded media is provided and cross-checking with available data provided by water monitoring and alert systems.

It is highly likely that accounts produced by social media users may be countered by others. This method of assessment accounts for this probability and the potential challenges it may pose for determining the reliability of the source. For example, the following tweets from two consumers who have differing accounts of water quality demonstrate how this conflict in information may arise.

'Van facto water is drinkable and locals drink it normally, just has a lot of salt and tastes of vomit.'

'As strangers who say that water has a terrible taste, from where do you get your water? I worry about the quality of water you drink!'

Contestation of the information provided by a source will negatively impact the grade assigned to its reliability may require further investigation for corroborating evidence even if the source is considered credible prima facie before there can be certainty of reliability.

5.2.3 Actionability Assessment

Having established the degree of information validity and source reliability, the final step of assessment determines the degree to which the intelligence gathered from social media may be actioned. To do so, the rating of information validity and source reliability are cross-referenced in order to provide a final actionability rating. This rating determines the degree to which the information provided is sufficient to be actioned upon and whether further investigation is needed to verify the intelligence gathered from social media.

Actionability Rating

> High: Valid information from a reliable source can be actioned without further investigation.



- > Medium: Further investigation is required on the information or source to action.
- > Low: Invalid information from an unreliable source is unlikely to be actioned.

Actionability Assessment	Low Source Reliability	Medium Source Reliability	High Source Reliability
Low Information Validity	Low	Low	Medium
Medium Information Validity	Low	Medium	High
High Information Validity	Medium	High	High

Table 11. Actionability Assessment Matrix

Based on the final actionability rating, procedures for internal and external (e.g., inter-agency) dissemination of the intelligence should follow established reporting mechanisms. Moreover, assessed intelligence should be prioritised according to standard ranking for handling reported issues and risks. This will require an assessment of the immediacy of the issue and the potential for harm. It is advisable that this prioritisation be conducted in line with a standardised risk assessment matrix to determine the degree of impact that the incident may have on operations as well as public health and safety.



6. Case Studies of Water Crises

The following section presents the findings of the case studies that form the empirical basis for the social engagement guidelines. This section is structured as follows. First, the methodology for case selection, SNS selection, data collection, sampling techniques and data analysis is described and assessed in terms of the advantages and limitations of the research design. Each case is divided into four sub-sections. The first provides background information of the case to contextualise the crisis and proceeding analysis. Secondly, Facebook posts produced by public and water authorities during the timeframe of the crisis are analysed. Third, the analysis of Facebook posts produced by the public, including civil and private organisations during the crisis cycle are presented. Finally, the findings of each case study are summarised to highlight best practices and lessons learnt in social media engagement with the public during water crises and provide practical and applicable recommendations for crisis communicators and managers.

6.1 Methodology

A case study examines a bounded system of interest that is the object of analysis and 'is not a methodological choice but a choice of what is to be studied' (Stake, 2005, p. 443). Case studies are an advantageous research strategy to answer 'how' or 'why' research questions when the subject under investigation is not under the control of researchers and when research is directed at real-life events and contemporary phenomena (Kohlbacher, 2006). In this study, thematic analysis of Facebook posts during cases of water quality and quantity crises were conducted to answer the following research questions.

- RQ1: In what ways do water and public authorities use social media to communicate with the public during water crises?
- RQ2: How do citizens use social media to communicate with authorities and with each other during water crises?
- RQ3: To what extent can citizen-generated content on social media be utilised by authorities as soft intelligence for early warning and situational awareness of water emergencies.

6.1.1 Case and SNS Selection

Desk-based research was conducted prior to data collection to identify water crisis cases for analysis. The first step sought to identify crises that were relevant to the pilot use cases of aqua3S (D2.1 & D2.3). In this way, the case studies would reflect potential crises pertaining to those that may be encountered by water authorities and produce appropriate crisis communication guidelines for engaging citizens on social media. Crises of interest pertained to water quantity (floods and droughts) and quality (pollution and contamination).

Once an initial list of potential cases was identified, a scoping study was conducted to determine whether these cases would provide sufficient social media data for analysis. Each crisis case served as the unit of analysis. To draw valid inferences from the cases, the higher the degree of social media activity that was generated by the crisis the greater the degrees of freedom resulting from the positive correlation with the quantity of units of observation. This principle derived from statistics is also a key consideration for qualitative research and case studies that may suffer from low to negative degrees of freedom (see Campbell, 1975).



The scoping study ran key word searches on Facebook and Google to identify the number of public posts, pages and groups for each case. The number of hits resulting from keyword searchers indicated the availability of data. This step led to the exclusion of four cases, while the remaining five cases were selected for the final analysis:

- ➢ UK Winter Floods (2019-2020)
- US Flint Water Crisis (2014-2019)
- South Africa Cape Town Drought (2017-2018)
- > Poland Czakja Sewage Plant Malfunctions (2019-2020)
- > Trinidad and Tobago FSO Nabarima Oil Spill Prevention (2020)

Another key consideration was from which SNS to collect data. In research, Twitter is typically the preferred site for obtaining social media data due to its availability and relative popularity amongst users. However, a number of methodological and practical considerations led to the decision to collect data from Facebook. It has been noted in the literature that the high dependency on Twitter data for crisis informatics and communications research has led to the lack of investigation of other digital and social media platforms, such as Facebook (Kaufhold and Reuter, 2016). Less studies have sought to analyse Facebook activity during crises, let alone water crises, on the most widely used SNS in the world leading to a significant research gap. Additionally, the qualitative nature of this research also informed the decision to use Facebook data. While Twitter has a 280-character limit, Facebook allows users to make posts up to 63,206 characters long. This makes it more suitable for extracting themes and latent meaning from textual data.

6.1.2 Data Collection and Sampling

Data was collected using CrowdTangle⁵, a public insights tool owned and operated by Facebook. CrowdTangle enables researchers to follow, analyse and report social media trends on Facebook, Instagram and Reddit. The platform tracks exclusively public accounts, pages and groups including date of posts, source, interactions and engagement. However, it does not allow the collection of comments, reach or impressions or personal demographic information of users. While this poses some limitations in terms of the data collected (see Section 6.1.4), it does provide advantages in addressing data protection and privacy considerations pursuant to GDPR.

In total, 35,439 Facebook posts were collected using Boolean search strings of keywords and hashtags as well as public pages and groups that were identified during the scoping study. Upon completing data collection for each case, the next step was data validation and sampling. This would ensure only the most relevant posts were selected for analysis. In order to validate the relevance of the data, a set of inclusion and exclusion criteria was established. This would ensure that each post would be evaluated against the same parameters.

⁵ Data from CrowdTangle, a Facebook-owned tool that tracks interactions on public content from Facebook pages and groups, verified profiles, Instagram accounts, and subreddits. It does not include paid ads unless those ads began as organic, non-paid posts that were subsequently "boosted" using Facebook's advertising tools. It also does not include activity on private accounts, or posts made visible only to specific groups of followers.





Inclusion (Relevant)	Exclusion (Irrelevant)	
Relevant to the crisis examined	Not relevant to the crisis examined	
Within the timeframe of the crisis	Not within the timeframe of the crisis	
Post source is from the user type examined	Post source is not from the user type examined	
Post originates from the country of the crisis	Post originates outside of country of the crisis	
Textual data is complete and clear	Textual data is missing, incomplete or unclear	
Post is from a public page or group	Post is from a private page or group	
	Duplicates	

Table 12. Data Validation Criteria



Figure 4. Post-Validation Dataset

Time and location were key considerations. In order to capture data from the pre-crisis, crisis and postcrisis phases, the sampling technique adopted a modified interrupted time series research design. An interrupted time series is a quasi-experimental research design where observations are made before, during and after an intervention or event to assess the intervention's effects (Hudson et al., 2019). Although quantitative methods were not applied in this research, sampling data for qualitative analysis in this way allowed for the observation of communications trends at each phase of the crisis cycle.

Crisis timeframes were established through background research and date ranges for data collection were set using CrowdTangle. In cases that were continuous but lasted less than one year, such as the 2017-2018 Cape Town drought and 2020 FSO Nabarima oil spill threat, data was sampled one week prior, during and one week after the crisis. In cases where multiple instances of crisis occurred, such as the 2019-2020 UK Winter Floods and 2019-2020 Czajka failures, data was sampled two weeks prior, the duration and two weeks after each instance. The only case to run continuously for multiple years was the US Flint Water Crisis. In this case, a refined list of keyword searches based on a snowball sampling technique was implemented to identify the most relevant posts over the crisis timeframe.



Case	Data Collection Date Range
United Kingdom	01/11/2019-28/02/2020
United States	11/04/2014-03/03/2019
South Africa	18/12/2017-11/07/2018
Poland	23/08/2019-13/11/2020
Trinidad and Tobago	10/08/2020-23/12/2020

Table 13. Data Collection Date Ranges per Case

Location was another key factor. As this research is primarily interested in communications between authorities and the public during water crises, only posts from the case country were collected. This was achieved by filtering the search parameters on CrowdTangle to only select public posts from the country where the group or page administrators are located.



Figure 5. Validated Dataset by Case Location

Another validation task was verification of the post publishers. To address the research questions, only direct communication between 'authorities' and 'citizens' were examined. This entailed that posts from media outlets were excluded due to their role as mediators of information rather than a direct channel of communication. The exception was the inclusion community journalism pages. Community journalism pages were included as they are often administered by independent users who typically share first-hand accounts and opinion pieces on local events through digital outlets without editorial controls (Robinson, 2014). The following table describes the classification of each user group included.



Source Type	Source Classification	Description
Authorities	Public Authorities	Organisations, institutions, agencies and persons at the national, regional and local level of government performing public service functions and duties.
	Water Authorities	State, private and semi-private water management and service providers.
Citizens	Civil Society Organisations (CSO)	Organisational structures comprised of social partners, non-governmental organisations and grassroots organisations.
	Private Sector Organisations (PSO)	Organisations owned by individuals and driven by profit- motive for the benefit of their owners, shareholders and investors.
	Online Communities	Self-organised and emergent social networks of private citizens that form and maintain ties on SNS.
	Community Journalism	Social media pages providing local information without formalised editorial controls.
	Influencers	Individual user's public Facebook accounts with more than 1,000 friends and followers.

Table 14. Source Validation Classification

The completion of the verification of user account types resulted in the total number of posts per source shown in **Figure 6**.



Figure 6. Validated Dataset by Source

6.1.3 Thematic Analysis

Thematic analysis was conducted on the final sample of 2,575 Facebook posts. Thematic analysis is a method for identifying, analysing and interpreting patterns of meaning or 'themes' within qualitative



data (Boyatzis, 1998). Unlike other qualitative methodologies, thematic analysis is a systematic approach for qualitative research that does not possess a priori theoretical commitments making it highly adaptable to different research questions, theoretical frameworks, sample sizes, data types and collection methods (Clarke and Braun, 2012).

Coding of the datasets was conducted on NVivo by two researchers. The coding schedule (Appendix I) was developed using a combination of a top-down and bottom-up approach. First order nodes were concerned with communication channels. Using Reuters et al. (2012) crisis communication matrix, posts were coded according to the 'sender-receiver' paradigm of A2C, C2A and C2C. This allowed posts to be categorized in terms of which type of user produced the message and for which target audience. Second order nodes were concerned with temporal dimensions of the data and posts were coded according to whether they were published in the pre-crisis, crisis or post-crisis phase of each case or instance. This enabled the identification of communication trends across the crisis cycle. Finally, a bottom-up approach was used for identifying common themes across cases that emerged from the data.

6.1.4 Ethical and Legal Considerations

Ethics approval for the research by CENTRIC as part of the aqua3S project was approved under application ER22016000. Pseudo-anonymisation was partially completed at the data collection stage. CrowdTangle only collects the name and account name of public Facebook pages and groups as well as verified profiles. It does not allow the collection of comments or posts from individual users except for posts on public groups, in which case CrowdTangle does not provide the name of the account holder. Moreover, all personally identifiable data contained within the posts with the exception of public figures were manually redacted and pseudonymised in line with guidance from EU Opinion 05/2014 on Anonymisation Techniques, as well as the UK Information Commission Office's (2012) anonymisation code of practice and the UK Data Archive's advice on anonymisation of qualitative data⁶ to protect the rights and privacy of the data subjects. A Data Protection Impact Assessment (DPIA) was conducted based on the Information Commissioner's Office (ICO) guidelines to ensure compliance with the data privacy and protection legislation pursuant to the General Data Protection Regulation (GDPR) and Data Protection Act 2018 (See Appendix II).

6.1.5 Limitations and Measures to Improve Confidence in Findings

The methodology adopted for this research has a number of limitations. Firstly, to address RQ2 and understand public reception to the social media activity of authorities during water crises. The most effective means of doing so qualitatively is to analyse comments to authorities' Facebook posts. However, CrowdTangle does not permit the collection of comments. Thus, there was the possibility that this data collection limitation would impact the content validity of the study. However, this limitation was addressed by collecting posts by CSOs, PSOs, community journalists and influencers as well as user generated content on public Facebook groups. These posts comprised 57% of the total sample and provided ample data to analyse interactions between authorities and citizens during the water crisis in question.

Relatedly, this study uses qualitative methods exclusively. Case study research designs will often seek to triangulate qualitative findings with quantitative analysis (Jonsen & Jehn, 2009). One example where triangulation could have potentially been applied would be analysing engagement statistics of posts to

⁶ More information can be found online at: <u>http://www.data-archive.ac.uk</u> aqua3S D6.1 – SOCIAL ENGAGEMENT GUIDELINES



measure their performance. However, as the research questions seek to understand understudied phenomena of how and in what ways social media is used during water crises, qualitative methods are most appropriate. With these exploratory questions answered, future research may seek to triangulate data with a mixed-method approach.

Finally, a limitation was the reliance on commercially available translation tools for multilingual data. Qualitative analysis requires a high degree of fidelity to the data subjects' own words to extract latent meaning. Thus, the reliance on translation software may lead to a systematic error that could result in misinterpretation of the data and invalidate findings (see Popovic, 2018). One example of this occurring was in the Polish dataset which translated 'dead fish' to 'dream fish' due to its syntax. In recognition of this possibility, a cross-verification method was used whereby multilingual data was translated using two software translators to mitigate the possibility of a systematic error.

6.2 United Kingdom: 2019-2020 Winter Floods

6.2.1 Background

Between November 2019 and February 2020, the UK experienced waves of severe winter flooding. In the first instance in November 2019, higher than average rainfall led to the saturation of soils and catchments particularly in Yorkshire and Humber, East Midlands and West Midlands in the preceding month. Over the course of November 2019, prolonged and heavy rainfall caused severe flooding in these regions as a slow-moving weather front led to rivers bursting their banks and floods in lowlands (Muchan, 2019). In the second instance, the UK was hit by Storm Ciara on the 9 February 2020 followed shortly thereafter by Storm Denis on the 15-16 February 2020, making it the wettest February on record in the UK and causing significant flooding across the country (Williams, 2020).

The winter floods of 2019-2020 led to significant disruption and damage across the UK, resulting in the evacuation of homes, damages to property, disruption of travel and economic activity and the loss of life. At least 1,758 properties had been flooded during the November floods with insurance costs estimated at £110 million with 2,250 related to flooded homes and businesses while 1,788 to damaged vehicles (ABI, 2019). As a result of Storm Ciara and Storm Denis in February 2020, estimated damages based on insurance claims place the figures at 3,350 domestic property flood damages valued at £107 million, 1,500 commercial property damages valued at £85 million and 3,600 vehicle claims valued at £21.7 million (Sky News, 2020).

Operational responses to the floods over the course of this period required highly complex multi-agency and multi-level collaboration. The UK government deployed up to 1,000 Environment Agency staff per day in flood affected areas during the peak of the crisis the assistance of 80 military personal in coordination with local authorities and emergency services (Finlay, 2020). Furthermore, CSOs and volunteers played a significant role throughout the winter floods to support impacted communities before, during and after the floods (Finlay, 2020).

Social media played a key role at all stages of the 2019-2020 winter floods. For public authorities, Facebook provided another channel to prepare and build resilience in communities and disseminate warning messages. Additionally, CSO's, community journalist pages and self-organised communities of users were highly effective at using social media to prepare, respond and recover from the floods. More than any of the other cases considered in this study, the 2019-2020 showed the potential for social media to be used as a strategic and holistic tool for crisis management and communication by directly engaging with communities across all phases of a crisis.





Figure 7. United Kingdom Dataset by Source

6.2.2 Authority Communications

According to the sampling strategy adopted, one week of data was collected and analysed the pre-crisis phase in both instances of major flooding in November 2019 and February 2020. This provided data of social media activity by public and water authorities to prepare citizens for flooding and increase resilience at the pre-crisis phase.

In the UK, the data suggests that there was significant evidence that authorities had established networks with each other on social media outlets. This allows for coordinated posting of consistent messages along parallel strategies throughout the crisis cycle. In some cases, these networks were formalised into shared Facebook accounts. For example, The Food Hub is an inter-organisational initiative developed by the Environment Agency, United Utilities, Newground, and the Cumbria, Lancashire, Greater Manchester, Merseyside and Cheshire Strategic Flood Partnerships. This digital platform provides flood information and resources to support households, businesses and communities build resilience against flooding. On social media, it provided a channel for public authorities from the national to the local levels of governance as well as water suppliers to communicate resilience building messages and resources to prepare communities at risk of flooding for crisis. The following post shows how multi-level and multi-agency stakeholders coordinated their social media activity.

'We've had great support on Twitter from agencies & authorities involved in #flooding, and on Facebook from community groups! We'd love your support by sharing our posts and linking to >> www.thefloodhub.co.uk:=:https://thefloodhub.co.uk/ Take a look at some analytics for our social media accounts.'

One of the ways in which authorities disseminated pre-crisis messages to the public on social media was by implementing social media campaigns. These campaigns were coordinated by multiple public authorities with the participation of organisations from the national level to the local level and public to private. Similar to the Cape Town drought case (see Section 6.4.2), social media campaigns involving a broad range of stakeholders using bespoke hashtags and a coordinated strategy can improve the performance of social media posts targeted at raising public awareness. Within the dataset, posts published by authorities demonstrated a high degree of coordination and collaboration between public and water authorities across campaigns aiming to raise awareness and build resilience against flooding.



'This year we have joined in with 35 campaigns and held 4 successful campaigns of our own including focus weeks on #NFM and #SuDS! We already have lots planned for the next year, including a Christmas campaign and a coastal flooding campaign! www.thefloodhub.co.uk:=:https://thefloodhub.co.uk/ #flooding Unblocktober United Utilities @theirverstrust @metoffice'

'Our partners and other organisations have provided us with some excellent messages this year through their own campaigns. We have seen #WeatherReady from the Met Office , Unblocktober, #StopFlushingWipes from United Utilities and The Rivers Trust, and #30Days30Ways.'

Messages disseminated through resilience building social media campaigns typically sought to highlight the severity of the risk posed by flooding as well as provide tips on how to mitigate them. In some cases, credible voices participated in the campaign to improve content performance. Additionally, social media users were encouraged to provide their own recommendations using specific hashtags to increase engagement and reach of the posts.

'It's #FloodActionWeek! With 1 in 6 homes at risk of flooding, take action to protect yourself, your family and your home now.'

'5.2 million homes and business are at risk of flooding. Find out what survival expert [first name, surname] would save in a flood and why What would you save? Share using #JustOneThing'

Additionally, Facebook pages of public authorities frequently provided links to online resources as part of their regular content schedule during the pre-crisis phase of the 2019-2020 winter floods. These resources are designed to be accessible to a wide-ranging public audience and inform them on actions they could take as individuals and communities to improve their flood resilience.

'Business Flood Resilience Toolkit contains all the resources you need as a basic introduction to becoming flood resilient. Check it out here and download the resources: http://bit.ly/2FPXYyQ:=:https://thefloodhub.co.uk/business-flood-resilience-toolkit/'

' ' If you are considering purchasing a property or have recently moved, there are a number of ways that you can check if the property is at risk of #flooding and increase your #resilience. Check out our resource for more info: http://bit.ly/2OoKNc5:=:https://thefloodhub.co.uk/knowledge-hub/#purchasing-propertyand-flood-risk () ' '

'Our 'Community Resilience Toolkit' outlines all the resources you need as a basic introduction to your community becoming more flood resilient. It contains information on community flood schemes, FLAGS, Community Resilience Planning and more! http://bit.ly/2UfFHTB:=:https://thefloodhub.co.uk/community-flood-resilience-toolkit/'

During the pre-crisis phase, the dataset contained several posts by local authorities advertising events for public authorities to engage with communities at risk of flooding. These 'drop-in sessions' allowed for concerned and flood affected citizens to obtain information regarding the status of flood defences, how to prepare for flooding, access to schemes and grants to improve their flood defences and recover from flooding as well as express their concerns to spokespersons from responsible authorities.

'Go along to the #Preston flood scheme drop in today from 3:30 - 7:30pm to learn more about the scheme and give your feedback to Environment Agency Lancashire County Council #flooding'



'Tomorrow, the Environment Agency are holding their monthly drop-in session for the Radcliffe and Redvales Flood Risk Management Scheme. The public can call in and have a chat about the scheme with Environment Agency staff and the contractor BMM JV. For more information: http://bit.ly/2r4WCLU:=:https://thefloodhub.co.uk/events/radclifee-and-redvales-bury-floodrisk-management-scheme-drop-in-06-12-19/'

Importantly, public authorities published posts directed at educating and sensitising the public on key issues pertaining to flood risks and resilience. These posts typically highlighted the consequences of flooding on individual households and businesses as well as wider communities to convey the importance of preparing for floods. They also provided tips and resources on how to mitigate these risks by implementing flood plans to reduce the impacts of flooding.

'You may hear a lot about 'flood resilience', but what exactly does it mean? Here is our simple definition of what flood resilience can mean in terms of making individuals and properties more able to cope with #flooding.'

'With 5.2 million homes and businesses at risk of flooding, it's important to be aware of the small steps you can take now to be better prepared. Actions such as moving valuables upstairs to preparing a bag with insurance documents and essential medication can help avoid damage to your property, possessions - and most importantly, save a life. #PrepareActSurvive Find out more: https://flood-warning-information.service.gov.uk/what-to-do-in-a-flood?utm_campaign=envagency_floodcampaign&utm_medium=social_organic&utm_source =facebook&utm_content=pas_42'.

'Flooding is devastating. It poses a risk to life, property and vehicles and can force people out of their homes. Knowing just one action to take can reduce the impacts of flooding on your home and family. Find out more: https://flood-warning-information.service.gov.uk/what-to-do-in-a-flood?utm_campaign=envagency_floodcampaign&utm_medium=social_organic&utm_source =facebook&utm_content=prepareactsurvive'.

'#Flood plans (http://bit.ly/2utSnee:=:https://thefloodhub.co.uk/wpcontent/uploads/2019/01/Household-Flood-Plan.pdf) can save precious time in a flood and therefore help you become more prepared and resilient to possible damage. Click here for our guide on how to complete yours! >> http://bit.ly/2RfmgaU:=:https://thefloodhub.co.uk/wpcontent/uploads/2018/09/Household-flood-planning-guide.pdf #resilience #floodready #prepare Wirral Council'.

Water suppliers also contributed towards informing their customers of ways in which they could improve their flood resilience. These self-efficacy messages typically included tips for accessing alerts, protecting their property and valuables and as well as guidance on reporting incidents and emergencies.

'#FLOODFACTS "We understand that flooding can be one of the most unpleasant things you can experience in your home and with Storm Dennis on the way, we have created a little checklist to help you prepare... \checkmark Check if your home is at risk of flooding - you can view flood risk maps on the Environment Agency's website > https://bit.ly/2Hj2pCb:=:https://www.gov.uk/government/organisations/environment-agency \checkmark Get the latest flood warnings – sign up to receive free flood alerts by email or SMS from the Environment Agency. \checkmark Check your home insurance. \checkmark Prepare a go-kit of essential items – such as home insurance documents, torch & batteries, first aid kit and medication and warm, waterproof clothing and blankets. \checkmark Protect your valuables. \checkmark Have our contact details to hand



so you can get in touch as soon as possible – make sure you also have your local council's details too! Please stay safe this weekend, and if you need to contact us about sewer flooding you can call [phone number] or message us on Facebook or Twitter @YWHelp \bigotimes For more information about flooding visit > <u>https://bit.ly/31UCuKj:=:https://www.yorkshirewater.com/help-and-</u>advice/flooding/?utm_source=facebook&utm_medium=social&utm_campaign=flooding_20& utm_content=flooding_20_checklist_130220 '

Another approach adopted by authorities was to encourage local communities to establish community resilience groups in flood risk areas. As discussed in Section 6.2.3, these online communities would play an important role in self-organised mitigation, preparation, warning, response and recovery at the grassroots level. Digital toolkits were provided in these posts to inform the public of the benefits of establishing crisis resilience communities and how to set up and manage these groups, both online and offline.

'Flood action groups consist of local residents working on behalf of the community alongside agencies and authorities, who often meet up with an aim of reducing the community's flood risk and improving its resilience. For more info, click here: http://bit.ly/2CnFQcn:=:https://thefloodhub.co.uk/knowledge-hub/'

'Thinking of forming a #flood group with your neighbours? There are lots of benefits to #community flood groups, and if you need some help on where to start or advice on flood planning, visit our Community Flood Resilience Toolkit page here: http://bit.ly/2UfFHTB:=:https://thefloodhub.co.uk/community-flood-resilience-toolkit/ #flooding'

In both instances of major flooding occurring in November 2019 and February 2020, public warning messaging was highly consistent. Once public authorities became aware of the potential for floods, alerts were disseminated to the public on multiple channels, including social media. In the UK, weather warnings are standardised based on a colour-coded scheme (Yellow, Amber and Red) determined by the severity of impacts and likelihood of occurrence that are applied to flood warnings. This provided a clear and consistent framework for authorities to alert the public according to their social media crisis communication strategies.

Warning messages by national authorities were typically concise, providing essential information on the severity of the crisis, location, time and impacts. Additional advice and links to further information were also frequently found in the sample.

'Yellow and Amber #Rain warnings are in force across northern #England and north #Wales during the rest of today and early Friday. Stay #weatheraware as some flooding is possible, with delays to travel also likely.'

'▲ A yellow rain warning is in force until noon tomorrow. The ground is still very wet from the recent persistent rainfall and last Thursday's surface water flooding, so please take extra care on roads and low-lying land. ♣ For the latest picture, see: https://www.metoffice.gov.uk/weather/warnings-and-advice/uk-warnings'.

As flood warnings are regularly updated and dependent on multiple variables, the degree and likelihood of risk varies significantly across space and over time. Public authorities in the UK developed applications to provide real-time flood alerts and used social media as a means of encouraging the public to use these applications. Posts typically highlighted the impending risk of flooding in the UK accompanied with



information and hyperlinks to sign up for flood alert applications. In these cases, social media was used as a gateway to access timely and localised alerts rather than as a tool for alerting directly.

'If you do not live in a flood risk area but may still be affected by #flooding, take a look at our 7 alternative flood warning options! Download resource here > http://bit.ly/2DtEFLx:=:https://thefloodhub.co.uk/knowledge-hub/#7-alternative-floodwarnings #flooding #floodaware'

'The @EnvAgencyNW offer a free #flood warning service which enables people in flood risk areas to receive flood alerts and warnings. Our resource provides info on how to sign up, what the warnings mean and the steps you should take - http://bit.ly/2PrmHjg:=:https://thefloodhub.co.uk/knowledge-hub/ #prepare #Wirral'

' \bigcirc E It's #FloodFactFriday again! \bigcirc \bigcirc Storm Ciara brought strong winds and heavy rainfall last week, causing flooding in parts of the North West. With Storm Dennis due tomorrow, it is important to ensure you are signed up for flood warnings and have a flood plan. #FactFriday'

Another subtheme to emerge in public warning posts was an orientation towards focusing on guidance and recommended actions for citizens to minimise the risks to themselves during floods. These often focused on raising awareness common hazards and causes of emergencies such as driving through flood waters. The excerpts below illustrate the way in which authorities use the social media platforms to adapt risk awareness campaigns and convey their messages:

'Heavy rain could lead to localised surface water and river flooding in parts of England. Stay away from swollen rivers and do not drive through flood water. Keep up to date: https://floodwarning-information.service.gov.uk/warnings #Flooding #Floods #PrepareActSurvive'

'With many flood warnings and alerts still in place across England, if you are travelling today: check the flood risk on your route care on the roads don't drive through flood water Stay up to date with the latest information: https://flood-warninginformation.service.gov.uk/warnings?utm_campaign=flooding_nov19&utm_medium=social_o rganic&utm_source=twitter&utm_content=two_warnings_v1'

Facebook pages belonging to local authorities often made long-form posts containing more detailed and localised information. Not only did these posts provide standardised alerts provided by the Met Office, but they also detailed the meaning and implication of the alert as well as the countermeasures being deployed by authorities and recommended actions for citizens.

'The Met Office has upgraded today's rain warning to Amber, which means there is an increased risk of impacts from severe weather. As the ground is already very wet, there may be some surface water about so vigilance is advised. Staff have been out clearing drainage infrastructure ahead of the forecast rain. However, during heavy downpours drains can quickly become overwhelmed so please take care if you see water pooling on the roads. Slow down to avoid flooding nearby property and if you don't know how deep it is, don't try to drive through it. Temporary flood defences remain in place in Mytholmroyd as a precaution. This has meant extending the traffic management so if you are travelling through the area this morning please be prepared for possible delays. We are keeping a close eye on the situation and will post warning, updates here if required. For more information the see https://www.metoffice.gov.uk/weather/warnings-and-advice/uk-warnings'

Water companies also produced warning messages in advance of floods through their Facebook pages. These posts typically focused on informing the public on the responsible authorities for different types



of flood related emergencies. As the responsible authority for maintaining water and sewage networks, posts provided emergency contact information and guides on reporting issues such as sewage flooding while also providing contact information of first responders for other emergencies.

'Keep an eye out for any flood warnings in your area. If you need any advice, have a look at our website > http://ow.ly/ufnR50x4Mb6'

'With heavy rain falling across the region, you may encounter flooding and need help to deal with it. Who to contact depends on the type of flooding that's happening, so we've put together a handy guide to help get you in touch with the right organisation. stwater.co.uk/flooding'

'We've been tracking #StormDennis & we're ready to support you if you need us! Remember to take extra care if travelling 🔬 🖏 In periods of sustained rainfall, sewers can block or flood - should that happen, here is a useful list of who to contact: https://bit.ly/2Sha229:=:https://www.thameswater.co.uk/help/emergencies/blockages'

'Due to Storm Ciara there may be heavy rainfall and a risk of flash flooding in your area. If the flooding relates to surface water please contact your Local Authority for assistance. If sewage is present, please call [phone number] to report this.'

Information on the responsible authority to contact for specific emergencies was also provided by public authorities prior to, during and after the floods. In this way, social media was used to improve the efficiency of crisis response by streamlining communication between citizens reporting emergencies to correct first responder.

'Reporting flooding and reporting to the correct authority or agent is important so that they are aware of the issue and can respond effectively. For more information, check out our 'The importance of reporting flooding resource': http://bit.ly/2RqTZNx:=:https://thefloodhub.co.uk/wp-content/uploads/2019/05/The-Importance-of-Reporting-Flooding-graphic.pdf'

'Be safe this weekend - Storm Ciara is expected to bring strong winds and rain. If you see someone in trouble at the coast or at sea, don't hesitate to call 999 and ask for the Coastguard. #BeSafe #999Coastguard'

Social media used for directly reporting emergencies to relevant authorities alongside other communication channels such as telephones and websites. In one post, a water provider experienced issues with their telephone customer support service and redirected customers to their Facebook messenger as an alternative means of reporting issues. As such, social media presents a valuable reporting mechanism that can be used to supplement traditional channels in case of disruption to telecommunications services or to improve efficiency.

' TELEPHONY ISSUES BY We are currently experiencing issues with our telephony system which may stop customers getting through. We are working with our service provider to resolve this. In the meantime you can message us here. Thank you for your patience'

'Wondering who to report flooding to? $\stackrel{\text{def}}{\longrightarrow}$ $\stackrel{\text{def}}{\Longrightarrow}$ 1 : Solid Covers - get in touch with us via Facebook, Twitter or $\stackrel{\text{def}}{\Longrightarrow}$ [phone number] $\stackrel{\text{def}}{\Longrightarrow}$ 2 : Road gullies - get in touch with your local council if you spot a problem with these. Stay safe in #StormCiara $\stackrel{\text{def}}{\longrightarrow}$ '

Additionally, the authorities used their communication channels not only to communicate crisis themselves, but also to encourage citizens to report of flood related emergencies and damages on their social media channels as a means of building an operational picture of the crisis and gaining actionable



situational awareness. Guidance was often provided to assist citizens in knowing who to report which type of emergency to as well as what types of information to provide. In this way, authorities encouraged citizens to actively contribute to their operational responses by providing localised information that they could act upon. The post taken from a Facebook resilience group is illustrative of how social media platforms can provide during a crisis to build and operate communications that include public stakeholders. Like the following cases, citizen participation and collaboration play a critical part in mitigating against manmade as well as natural disasters.

'Please make sure you report all cases of #flooding to help risk management authorities gather as much information as possible on the situation. Take a look at this resource to see who you should report each type of flooding to - <u>http://bit.ly/2RqTZNx:=:https://thefloodhub.co.uk/wp-</u> content/uploads/2019/05/The-Importance-of-Reporting-Flooding-graphic.pdf #floodaware #stormciara'

Social media can also be used for instant crisis communication at different stages of a crisis. For instance, in both the November 2019 and February 2020 instances of flooding, public authorities provided regular updates on their Facebook pages of the status of the crisis. Status updates from public authorities provided new information for the public such as the alert level for flooding, locations where disruption was occurring as well as notifications of reduced risk when flooding subsided.

'There are still 38 flood alerts and 23 flood warnings in place across the region. Continue to be vigilant and prepare for any disruption and potential flooding. #StormCiara #TheFloodHub #NWFloodHub'

'There are many roads across Calderdale which are still blocked by flood water and it may take several hours for these to clear. Elland Bridge will be closed for at least the next 24 hours. Please plan ahead if you need to travel this evening or tomorrow morning. Check your route carefully and follow updates on https://eyeoncalderdale.com/ Stay safe #StormCiara'

'River levels in Northern England have peaked in most places and are expected to recede slowly. 7 severe flood warnings remain in place on the River Don. Today rain in central and south England may cause minor surface water flooding. Check and Sign up for flood warnings at https://flood-warning-information.service.gov.uk/warnings'

Water authorities also provided regular updates for their customers through their social media channels. In some cases, these updates were directed at providing information for specific types of emergencies, while others informed of disruptions to their operations and infrastructure caused by the flooding.

'Heavy rainfall is causing flooding across the #NorthWest. If you're experiencing sewer flooding inside your home please contact us & we can arrange help. If you're experiencing flooding in the road or footpath please visit our website: https://bit.ly/2qrA8Ei.:=:https://www.unitedutilities.com/help-and-support/current-incidents/north-west/ Thank you for your patience.'

'Due to flash flooding in area's of Scotland, some of the road side drains aren't coping with the amount of water going into them. For further advice please click on the following link : https://bit.ly/2Ve7pjt:=:https://www.scottishwater.co.uk/en/In Your Area/Service Updates/Flash flooding'

Once flooding began to subside and the situation began to enter the post-crisis phase, citizens were also informed of the change of alert level on social media. The following example shows an effective post for



communicating this information. The time of the update is clearly indicated as well as a brief sentence stating the location where flooding was no longer expected. Additionally, warning of potential hazards and disruptions lingering after the floods were provided.

'UPDATED 9am: The flood alerts for the River Calder catchment are no longer in force. The situation is improving and no further flooding is expected in this area. There is still likely to be standing water about so please avoid using low lying footpaths near local watercourses, and there appears to be some residual disruption on the rail network so please check before you travel.'

In addition to the direct threat posed by floods, they may also pose dangers to the public in the aftermath such as sewage contamination, biological and chemical hazards, electrical malfunction, standing water and others. In the post-crisis phase, authorities continued to provide warnings of potential hazards that the public may encounter after the floods. Often these posts contained hyperlinks to websites providing further information on health and safety hazards or contact numbers for citizens to obtain advice from authorities.

'The effects of #flooding unfortunately don't stop once water has left your property. The impact can last months or even years. Here's a brief summary of what you can expect in the days, weeks and months following a flood event. http://bit.ly/2Z8GkOu:=:https://thefloodhub.co.uk/wp-content/uploads/2019/11/Flood-Recovery-timeline.pdf #floodaware #floodrisk'

'When you're cleaning up after flood water please take extra care. Public Health England has provided some useful advice to help keep you and your family safe: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_da ta/file/348920/Flooding_how_to_clean_up_your_house_safely.pdf'

'Avoid contact with flood water or items that have been exposed unless you are wearing protective clothing and gloves. If you have a food business and flood water has entered your building, you can get advice by phone or by a visit from our Environmental Health Officers. Call them on [phone number] and [phone number].'

A key theme to emerge in the later stages of the crisis and early post-crisis phases was the use of social media by local authorities to coordinate and collaborate with citizens in flood recovery operations. Local authorities regularly posted information on 'Community Support Hubs' that were established in communities to provide access to a wide range of recovery support services. Posts on social media from local councils engaged local residents to take part in flood recovery efforts by volunteering and making calls for donations of supplies.

'A momentous effort over the past couple of days from across Calderdale in response to Storm Ciara. The Council has had dozen of teams out on the ground many of whom continue to work into the night. Volunteers, staff and Councillors have worked tirelessly to clean up affected areas and support flood victims. 7 Community Support Hubs were opened and a full emergency control room coordinated resource and activity. An amazing turnout from people who gave their own time to help others. Our thanks go out to everyone.'

'All our Community Hubs are likely to need more cleaning supplies through the day. Todmorden are running low and asking for donations to be taken to the Town Hall. Find your local hub at: https://eyeoncalderdale.com/household-resilience-blog-and-news/community-hubs-now-open-across-calderdale-to-help-people-affected-by-flooding'



'The Community Support Hub at Todmorden has now run out of cleaning supplies. If you can donate any to help the flood recovery effort please bring them to the Town Hall as soon as possible.'

'Two of our community hubs (Brighouse and Elland) will be closing at 2pm today. The other four hubs (Mytholmroyd, Hebden Bridge, Todmorden and Sowerby Bridge) will remain open until 4pm. All six hubs will be opening tomorrow morning. Thank you again to all the volunteers $\mathfrak{O} \mathfrak{O} \mathfrak{O}'$

Local authorities used Facebook to provide the locations of the nearest Community Support Hubs as well as publicise the services they offered. These services ranged widely from food, shelter, cleaning equipment, recovery advice as well as psychological support for vulnerable individuals.

'Community support hubs are now open across the Calder Valley, providing practical and emotional support to those who have been flooded and/or are concerned about future flooding. For details, see - https://crowd.in/MFOX9G. Please note the change of venue in Brighouse.'

'If you have been affected by the flooding, the hubs can provide assistance with clean-up equipment, general help and emotional support. Over the weekend the hubs are open 10am-4pm at the following locations: Todmorden – Sunday, Hebden Bridge – Saturday, Mytholmroyd – Saturday and Sunday, Sowerby Bridge – Sunday, Elland – Sunday, Brighouse - Saturday More information here: https://crowd.in/ite14e:=:https://eyeoncalderdale.com/household-resilience-blog-and-news/storm-dennis '

'There are Business Support Officers in every community hub in Calderdale, offering support and advice to businesses and residents who have been affected by Storm Ciara. We're still assessing the scale of the damage caused before lobbying to Government for funding. If you haven't had chance to get to a community hub today, our Business Support Officers are out and about again tomorrow, offering their support.'

In addition to Community Support Hubs, public authorities disseminated information through their Facebook pages of flood recovery assistance that the public could access. Guidance on accessing funding schemes, psychological support and other services were advertised across national and local authority accounts.

'If your household was flooded or is 'unliveable' as a result of the recent floods, you may be entitled to a Community Recovery Grant of up to £500. To make an application for the https://crowd.in/kh8t3P:=:https://www.calderdale.gov.uk/v2/residents/environment-

planning-and-building/flooding/grant-form or to enquire, send an email to floodfunding@calderdale.gov.uk'

'Distress is a common reaction for people following a flood but if symptoms persist, NHS Calderdale CCG recommends the following local services that can help: - Your GP - South West Yorkshire Partnership NHS Foundation Trust IAPT (call [phone number] or visit https://www.southwestyorkshire.nhs.uk/services/improving-access-to-psychological-

therapies-iapt:=:https://www.southwestyorkshire.nhs.uk/services/improving-access-topsychological-therapies-iapt/) - Calderdale Talking Therapies Insight Calderdale (call [phone number] or visit <u>https://www.insighthealthcare.org/our-services/talking-therapies/find-a-</u> service/calderdale:=:https://www.insighthealthcare.org/our-services/talking-therapies/find-aservice/calderdale/) - Healthy Minds (call [phone number] or visit



http://www.healthymindscalderdale.co.uk/services.html) National services include: - SANE helpline – [phone number]- The Samaritans – [phone number]'

'Calderdale residents and businesses whose properties were flooded by Storm Ciara are encouraged to apply for grants to help them recover and become more resilient. You can find out about the different types of support that are available here: https://eyeoncalderdale.com/household-resilience-blog-and-news/funding-for-flood-hitcommunities'

Water authorities used social media to expedite activities and efforts aimed at addressing the needs of their customers and provided post-crisis assistance to their customers by using SNS to publicise the services they offered. For example, the following post published by a water company after the second instance of flooding in February 2020 established a registry for 'Priority Services' whereby customers affected by flooding could access faster assistance.

'A Register now for our Priority Services A Following Storm Ciara and Storm Dennis it is important to let us know if you or someone you know needs extra support from us. It's free and could help you, your family or your friends benefit from additional support from us so we can respond quickly to those particular needs. Sign up today: https://bit.ly/37FlrgQ'

Advice, toolkits and resources were also provided on the Facebook accounts of public authorities in order to aid the recovery efforts of individuals and organisations after the floods. These varied between more comprehensive guidance to address common issues encountered in the aftermaths of floods to specific information to assist local communities in recovery. Additionally, drop-in events were advertised whereby citizens could engage directly with authorities and receive information on recovery schemes and guidance for future resilience.

'Taking the first steps to recovering from a flood can be difficult. Download our booklet to help you get started: bit.ly/2yuJKid:=:https://thefloodhub.co.uk/knowledge-hub/ #flooding #floodaware'.

'Businesses who have flood related waste can take general flood waste directly to Todmorden HWRC and Halifax Transfer Loading Station. Brick, rubble and plasterboard needs to go to Halifax Transfer Loading Station. Opening times can be found here: https://www.calderdale.gov.uk/v2/residents/environment-planning-and-building/waste-and-recycling/household-waste-recycling-centres'.

'A multi-agency flood drop-in event is being held in West Cheshire today to provide information and advice on recent flooding. Information on the event can be found here: http://bit.ly/2CyeJfr:=:https://thefloodhub.co.uk/events/west-cheshire-flood-drop-in-event/ #flood #Cheshire #TheFloodHub'.

'Flood drop-in event tomorrow 3pm - 7pm at #Nantwich Civic Hall. Go along for information and advice on recent #flooding. #Cheshire Environment Agency United Utilities Cheshire East'.

Building future resilience was a key theme in the post-crisis communications of public authorities. Messages typically made reference the recent events of flooding in order to highlight the importance of taking action to offset future crises. These posts regularly provided similar toolkits and resources to those provided in the pre-crisis phase. Moreover, these resilience building resources targeted different audiences ranging from businesses to households.

'Recent heavy rain has highlighted how areas can easily be affected by surface water #flooding. One way to manage surface water is through sustainable drainage systems #SuDS! Take a look



at our booklet for more information >> http://bit.ly/2F76BWi:=:https://thefloodhub.co.uk/knowledge-hub/#sustainable-drainage-systems-suds'.

'We have compiled some tips on preparing for future flooding after prolonged heavy rain caused surface water issues last Thursday. Do you live or work in a flood risk area? What would your advice be to others in a similar situation? Let us know in the comments. http://news.calderdale.gov.uk/stay-prepared-for-future-

flooding:=:http://news.calderdale.gov.uk/stay-prepared-for-future-flooding/'.

'Is your home flood ready? New industry-led Code of Practice launched to help prepare your home for future floods, from Business In The Community. View: https://bit.ly/2smiPpi:=:https://www.floodguidance.co.uk/ #PropertyFloodAware #WouldYouBeReady'.

The UK winter floods of 2019-2020 highlight the utility of social media as a tool for water crises management for public and water authorities. In the pre-crisis phase, authorities can incorporate resilience building messages and resources into their regular content schedule using the advantages SNS offer in terms of direct engagement with target audiences as well as spreading information through social networks. Additionally, social media can be used to provide public warning messages either directly or indirectly as a means of directing users towards alert applications. During the crisis, authorities can use social media platforms to provide updates on the crisis status as well as the countermeasures being deployed. SNS also provided a medium for authorities to provide guidance for citizens to report emergencies to the relevant authority as well as to improve situational awareness through reports of local issues on the ground. In the post-crisis phase, authorities continued to publish information pertaining to flood aftermath hazards as well as inform the public when flood alerts were no longer in effect. Authorities utilised social media as a communication tool for coordinating and collaborating with citizens in recovery operations as well as informing victims of services and support available to them.

6.2.3 Citizen Communications

Similar to public and water authorities, Facebook was used by CSOs, online communities and community journalists as a tool for emergency communication and coordination throughout the crisis cycle of the two main instances of winter flooding in November 2019 and February 2020. There was significant evidence of close coordination between authorities and citizens online. As part of the coordinated effort noted in section 6.2.2 to build resilience in the pre-crisis phase, CSO's collaborated with authorities to raise public awareness of the dangers of flooding on social media. These posts often provided information on the hazards to livelihoods and wellbeing that flooding incurs as well as provided resources for citizens to access further information. Participation in social media campaigns with authorities was also evidenced within the sample by the use of the same hashtags. In this way, CSOs worked in parallel with authorities to increase the reach of sensitisation messages.

'Knowing what to do in a flood could save your life. Flooding brings a significant risk to life as well as being a large financial burden. The mental health impacts of flooding can last for two years or more after flooding has happened and can affect up to a third of people who have been flooded. Crucially, taking steps to prepare for flooding, and knowing what to do in a flood can significantly reduce the damages to a home and possessions, reduce risk to life, and reduce the likelihood of suffering from mental health impacts in the future. #FloodActionWeek #prepareactsurvive Partners @EnvAgency @CornwallFRS'



'Flood Impacts - One of the improvements to the Flood Information Service is to add more detailed flood impact information into the service. Impacts with a known river level can be displayed on the river station pages. There is an online form to submit impact information, check out the post attached $\frac{1}{2}$ '

'1 in 6 homes are at risk of flooding in England. The average cost of flooding to a home is £30K. It takes an average of 5 months before you can return home. Some scary stats! But by knowing just 1 action to take during a flood can reduce the damage to your home and your loved ones. Check out the Environment Agency video below as FloodActionWeek continues.'

Moreover, CSOs were participated in and organised drop-in events and workshops with public authorities as part of multi-stakeholder flood resilience networks to engage with communities at risk of flooding. These posts demonstrated networks between authorities and CSOs formed a key aspect precrisis preparations for flooding.

'We have kicked off our annual conference in Penzance! Ready for an exciting day of engaging talks and workshops from a range of organisations and CCFF partners! Plenty of network opportunities throughout the day talking all things community resilience and flooding in Cornwall!'

'Today CCFF is at the CornwallCouncil Localism Summit in Wadebridge to promote communityresilience and floodriskawareness with our Cornwall Community Resilience Network

In the pre-crisis stage, CSOs published posts advertising recruitment and training of flood warden schemes. It was evident within the dataset that flood wardens acted as bridges between authorities and the public in crisis management. The flood warden scheme trains volunteers from local communities that are at risk of flooding. Their main responsibilities include preparing community flood plans bases of local vulnerabilities, monitoring flood susceptible, promoting flood warning, communicating risks, coordinating local response and recovery efforts as well as liaising with public authorities on behalf of their communities . Thus, flood wardens played a critical role not only in on-the-ground operations, but also as credible voices and agents of change on social media, building online communities using Facebook pages and groups to exercise their duties. Therefore, utilising social media to advertise the recruitment of flood wardens is an example of good practice for identifying local resources and building community readiness for future crises in the pre-crisis phase.

'FREE Flood Warden Training coming up soon, across Cornwall, please see Events. Please share this post widely. This is OPEN TO ALL. Please sign up soon, we are lucky to have funding to do this.'

'Today we are in Perranporth with our Cornwall Community Resilience Network partners to raise flood awareness and help Perranporth recruit some flood wardens!'

In both instances of the 2019-2020 winter floods, civil organisations, community journalists and private citizens widely shared alerts and warnings from public authorities on their social networks. As real time flood alerts require registry to the Environmental Agency's application or monitoring of the Met Office's communication outlets, these posts have potential to reach citizens who do not subscribe to flood alert applications or follow the social media accounts of public authorities.

'You'll have just received a flood alert. Please take any necessary precautions and stay vigilant.'

'#weather update #Dennis #southwales #flooding New Amber alert now issues to include #Cardiff and #Swansea



The whole of the Peak District and surrounding areas are now under an Amber warning for all day Sunday from Storm Ciara. Travel disruption highly likely with strong winds and heavy rain. Updates to come.'

'Those signed up to EA alerts will have just received a WARNING for Cragg Brook. This means flooding is expected. Please put your flood plan into action immediately. Move your cars and valuables to higher ground and check on neighbours who may not get warnings or who need help to respond. Λ .'

' \triangle Be prepared for further flooding \triangle I'm sure most of you have seen the forecasts already but the Met Office have upgraded their weather warning from yellow to amber (higher severity) for heavy rain for the weekend. Some areas of West Yorkshire will see a continuous, non-stop spell of heavy rain for over 24 hours.'

Importantly, CSO's and flood wardens on flood resilience Facebook groups and pages encouraged citizens to sign up to receive flood alerts directly from the Environmental Agency by registering to their application. As credible voices possessing social capital within their communities and social networks, these posts can help to encourage members of the public to opt into direct alerts from authorities.

'If you're concerned about your home or business during the floods, sign up to the national flood warning system. It's a free service and you can get the latest updates sent to your phone. Click on the link below to sign up.'

Analysis of the data also revealed how direct communication between public authorities and flood wardens enabled tailored, detailed and localised information to be disseminated to communities as the situation evolved. Flood wardens would in turn provide updates through Facebook pages and groups to notify online flood resilience communities of the latest developments. In some cases, such as the second example post, direct communication between public authorities and flood wardens enabled at risk communities to receive advance warnings prior to official alerts based on the latest forecasts.

'Having had a 'Flood Wardens alert' text, I have just spoken with EAFWDO and he has also told me that the predictions side is struggling due to snow melt but at the moment is showing a peak of 3.3 metres within the next 90 minutes, and at this time there are no planned alerts to be issued. That said Luddendenfoot has just received an alert. FW's monitoring'

'Good morning again. I have just spoken to the EA Incident Room staff for a heads up and general feeling is that an Alert will be issued sometime today and possibly a Flood Warning sometime in the afternoon. I am going out and about to check the Todmorden area for problems. Updates as and when required. Todmorden Flood Warden.'

In addition to sharing official alerts and warnings, citizens used social media to provide localised flood warnings based on eyewitness accounts. In many cases these posts were shared with additional media such as images and videos captured on smart devices. Within the dataset, these public posts were published primarily on the pages and groups of community journalists and online communities, respectively.

'RIVER LEVELS RISING FAST - There's now a flood alert for the Lower Derwent, including the village. The river has risen rapidly since about 4:30am this morning and is expected to continue to rise. The brook is flooding at Oldfield Lane and so is Warney Brook on Flatts Farm near the cycle path. The riverside footpath towards Matlock is flooded by the railway bridge. Please be careful as the river is running extremely fast and is dangerous. The photo was taken at 9:15 this morning.'



'Bloody hell, i expected rivers to respond quickly today when main rain arrives around 12, but already with the little rain in the frontal bands - rivers have already moved. Normally it takes an hour or so of moderate or heavy rain to even start a response. The ground really is saturated. I will be monitoring rainfall and river levels during the next 18 hours.'

'Good morning again. Out and about and can report lots of water on the roads and Siren about to go off for Walsden. Please prepare what you need to do as this rain is going to be with us for some time longer possibly 2pm so flooding is likely. Todmorden Flood Warden.'

'Take care on Shaw Wood and Harvelin Park. There's LOTS of water coming up through drains and running down the hill on to the road.'

'Just FYI. Water was pooling in the road and bubbling up through the manhole at Callis Bridge when I came through about 45 mins ago. '

With warnings and alerts for flooding generated by authorities and members of the public came calls on pages and groups for communities to prepare for flooding. The interconnection of pre-crisis preparation and mitigation with the crisis phase was evident, as citizens were encouraged to implement flood plans and assess their readiness and resilience.

' A flood warning now in place for central Mytholmroyd. Take action!!! Put your flood plan into place immediately and check on vulnerable neighbours'.

'In light of the predicted storm that is heading our way, it might be worth checking over your property level resilience measures to make sure you have everything where you need it. If you have street drains near your property could we ask that you keep a, safe, eye on the amount of debris that could be covering them. Hopefully, the yellow warnings for wind and rain come to nothing, but let's be prepared'.

'Good morning again. Out and about and can report lots of water on the roads and Siren about to go off for Walsden. Please prepare what you need to do as this rain is going to be with us for some time longer possibly 2pm so flooding is likely. Todmorden Flood Warden.'

The social media platforms were also used to facilitate communications between user communities and advice was shared between communities of users on flood resilience groups on how to prepare for flooding and prevent damages to their property. Additionally, communications on these groups enabled residents and volunteers to coordinate the distribution and installation of flood defences such as sandbags and household flood barriers in advance.

'An idea if you've no sandbags - use bags of compost or rock salt, or anything else to hand. Even rubbish if it's heavy enough to hold its ground in water.'

'Hi all, myself and a mate have a ton of sandbags and a van, in Leeds area currently. We were thinking of heading Hebden bridge way to help out with flood defences today. Is there anyone you guys can put me in contact with for this? Happy to head over today.'

'In the light of storm Denis due soon, if any of you have door flood barriers that leaked. (even those with a kite mark are 'allowed' up to a litre leakage per hour!) I suggest you try to find some absorbent sacs - such as flood sacs and put them behind the barrier to absorb the leakage and or use a 'puddle pump' which can pump down to a very low level. Even silicone sealant to block any visible gaps may help. If you resort to sandbags, put plastic sheeting behind them and strap that down with waterproof adhesive tape.'



Within the dataset, there was a significant number of posts generated by members of the public in flood affected areas that provided viable soft intelligence of the situation on the ground (see Section 5.2). These posts were published on public pages and groups to provide information to flood wardens and members of the community of local conditions.

'Windy bridge is flooded and there's a car stuck.'

'There is a drain blocked outside 251 Halifax road near the Shannon looks like it's been blocked for a while'.

'6.50pm Flooding issues yet again. Ashford on the water A53 on the Leek side Both badly affected Anymore you can post here'.

'Flooding at the bottom of Fairfield Road the River Wye is to the top next to the whether spoons. The content of the spoon of the top next to the whether spoons.

'#flooding latest Looking at river taff levels i can not see how the houses along the Taff at Pontypridd have not been Flooded. I would expect it to have burst its banks now. Please let us know if you are aware of any flooding , evacuations etc in your areas.'

Community journalism pages frequently shared eyewitness accounts of the floods. They also encouraged followers to provide images and videos of flooding in their areas. Thus, these pages acted as a forum for crowdsourcing information of conditions in affected areas. The frequent inclusion of images and videos also provided a means of verifying issues reported.

'The top of the Derwent Dam wall... Raging water cascading over the gritstone structure as the wind drives hard along the reservoir above \mathcal{P} Upper Derwent Valley Derbyshire Credit: [pseudonym]'.

'A6 Buxton Road Flooded between Wetherspoons and Morrison's Λ Please send in your flooded photos and videos if it's safe to do so.'

'Slightly flooded in Whaley Bridge as you go round the bend past the Whaley Sign 🕂 Got a photo or video then send it on to WhatsApp: [phone number] 🗹'

Within this theme, numerous posts showed that users were actively seeking to report incidents to authorities. In some cases, requested the information on which authority was responsible and their contact information or were sharing information with flood wardens to forward to emergency responders. In some cases, these pages and groups were used as an alternative reporting channel in cases when citizens were unable to contact the relevant authority.

'Huge tree just fallen across Savile Road in Hebden - impassable. Trying to contact council.'

'Hope ok to post here. Drains blocked on Station Rd just past Mayroyd Lane, Hebden. Looks like it could flood the electricity substation if we get more rain. Who do we let know? Thank you :)'

'Just seen large metal skip entering the river Calder from the industrial estate (Denroyd) by Holmes Rs, old Cawsey area. Worried it will cause problems further down river. Who do I contact. Tried [phone number] and just normal council line.'

'Hi everyone! I live further up the watercourses which supply the Calder and thought I'd contribute if I can. I live next to Low Moor Beck which when in spate gives me a fair indication that trouble downstream is brewing. Normally I phone EA but can post here now.'



'Tried ringing Calderdale's emergency line to report a tree that has come over my parents garden wall onto the property. It is blocking the front door which is the only point of access for my disabled dad. On hold for 6 mins at a time then cut off due to "system failure" i appreciate that there are lots of people needing help but who do i contact over this? It is a concern. Thanks'.

'Many of the drains in Victoria Road Todmorden are blocked and overflowing when the rain is heavy, already today. I reported it yesterday, but nobidy managed to come and clear them. The road is badly damaged already, so I'm feeling concerned'.

Analysis of the flood resilience Facebook groups and pages showed importance as a communication channel between citizens in affected throughout the crisis. Members of these online communities were able to provide regular crisis updates amongst each other to mitigate the risks they collectively faced. These posts contained valuable information on the local impacts of flooding as well as ways in which they could take action to avert damages to their property and wellbeing.

'CURRENT STATUS OF RIVER NOT GOOD in Darley Bridge Matlock - The river is extremely high. It's flooding at Wenslees and starting to cover The Gated Road. The Square isn't flooded yet BUT it looks likely that the river will breach the defences by the bridge at the Square. Flatts Farm fields have about 4' of water. The river is close to the top of the defence wall opposite Waters. It maybe an idea to MOVE PARKED CARS AT WENSLEES as a precaution. Please also be aware that leaks in the defence wall by the Wenslees parking have not been repaired after they were reported back in November. The flooding isn't as bad as November BUT it has another 5 hours of rising until it peaks at 12 noon. So, there could be significant flooding depending on the rate of increase in levels. This will depend on rainfall across the Peak District but also if the river breaches further upstream. At the moment there doesn't appear to be significant visible breaching upstream as there was in November. Please take precautions now to be on the safe side. These photos taken 7:15 this morning Don't forget to send your information in See it!, Report it!'

During the floods, citizens also shared official information provided by authorities noted in the preceding section. These crisis updates varied from the updates on status of the crisis to the responses being undertaken by authorities. Similar to the sharing of public warnings, these updates illustrate the potential of social media to facilitate the spread of authorities messages across social networks beyond of their SNS followings.

'Environment Agency Hydrology Summary from 9-10 February. A number of gauges have seen the highest level in their period of record, with several more seeing the second highest peak. NB: Data has not yet been validated, some records may well be revised at a later date.

'Please see the latest from Mytholmroyd Flood Alleviation Scheme.'

* REMINDER FROM MYTHOLMROYD FLOOD ALLEVIATION SCHEME A Overnight working and road closures on Burnley Road are still going ahead as planned. These begin Monday 17th February, and are planned to continue until 5am on Saturday 29th February. The current plan is to work overnight on Monday, Tuesday and Wednesday this week and Monday, Tuesday, Wednesday & Thursday next week.'

'I have done a screen shot of the Environment Agency's river gauges for the who country and the orange dots are where rivers have risen into possible flooding range. As you can see storm Dennis has had a very wide impact. Todmorden Lead Flood Warden.'



'Armed Forces personnel, the 4th Infantry Brigade, will be deployed to Calderdale today (Saturday 15 February) to support the ongoing recovery from last weekend's flooding and the preparations for Storm Dennis. All available teams from Calderdale Council and partner organisations, as well as volunteers across the borough, continue to work 24/7 to support the major flood recovery efforts and to be as prepared as possible for Storm Dennis, which is forecast to bring heavy rain and strong winds later today [...]'

Another key theme to emerge during the crisis phases of the November 2019 and February 2020 instances of flooding was self-organised participatory crisis management. Volunteers would frequently post their availability to assist fellow citizens on flood resilience Facebook groups. Conversely, at risk citizens would post requests for assistance on the flood resilience groups. The self-organisation of local community responses during the floods during the crisis phase highlights the benefits of facilitating online communities as a means of building resilience.

'An early request from flood wardens would be to look after each other. If you see messages on social media and you think it relevant for neighbours, can you make sure they get the message? Tia'.

'I am lucky enough to be up the hill a bit so not at risk. Offering my services for anyone who may need. I don't have sandbags but I can lug em about and I can check on local elderly and help them stay safe. If you're concerned for a relative in the lower parts of Tod, give em a ring, let me know, I will try and help how I can. Phone number available in private message'.

'We need a pump for a flooded house 224 Burnley road, Todmorden. Can Tod flood group help? Not my house, just helping.'

'Does anyone need any help? Me and a pal are free up near Key Sike Lane in Todmorden. Going to be out from 10.30 checking on neighbours so let me know'.

'I live in Ripponden and have a spare room if anyone in need tonight.'

While posts on flood resilience Facebook groups were primarily complementary towards the efforts of authorities and first responders, complaints were also found within the dataset. These were primarily constructive criticisms of the actions taken prior to the floods. These criticisms and complaints can provide valuable feedback on local issues for learning and improving responses for future crises.

'MIdgley Road unpassable due to overflowing manholes, please do not attempt. River nearly burst its banks, unfortunately the village has already flooded due to a section of flood wall was removed for further works (great timing eh?).'

'Just come down m62 the reservoirs look more like Niagara Falls with the amount of water going over the top! Why couldn't they have lowered the water level a bit over the last few days? It's going to get filled back up again but give a valuable buffer against dennis'.

In the post-crisis phase, CSO Facebook pages and flood resilience groups utilised social media to organise recovery efforts and aid affected individuals. CSO pages publicised services they offered to affected communities to support their recovery as well as guidance. The services provided by CSOs varied from assisting with clean-up efforts to providing mental health support.

'We hope everyone has stayed safe over the weekend during Storm Dennis. If you come across any problems along our canals or rivers, such as fallen trees, please let us know, we're here to help. You can find advice for staying safe during flooding here: http://ow.ly/IXfm30qihCB:=:https://canalrivertrust.org.uk/enjoy-the-waterways/safety-on-



our-waterways/water-safety-duringflooding?utm_source=facebook&utm_medium=social_organic&utm_campaign=watersafety'.'

'We have really been through the ringer this last week or so. If you need to talk done forget Unmasked Community Hub 7pm Thursday at the community centre. This is a confidential space for you to talk and find support from others'.

Meanwhile, flood resilience Facebook groups were used by members of the public to coordinate community recovery. Users posted requests for volunteers both in their own communities as well as neighbouring towns, set up collections for both material and monetary donations as well as offered their support and availability to aid members who had been affected by flooding.

'As you know on Thursday night they have been a flooding South Yorkshire, today they have be two people from Mytholmroyd gone down to South Yorkshire to help them one of the flood warden his name is [first name, last name] he has spoken to them they would like food and bottles of water and baby stuff and blankets if you can help please contact [first name] thank you for your support much love to everyone in the cover Valley'.

'Hi guys and galls of calder valley I amongst with [first name, last name] and others are currently volunteering our help at Fishlake which has been devastated by floods... A call has come in with regard to an elderly gentleman with 3 feet of water in his bungalow who is desperate for a caravan to live in while the water is in his house... If anyone has an old caravan they are not bothered about could i please take it off your hands ? I can take it to fishlake with my landrover and can be contacted by pm or text on [phone number] Cheers All [first name]'.

'Tod Flood Hub is now open, we are looking for volunteers to help with the clean up and make refreshments.'

'I am so sorry all this has happened again. As last time, I am available 3 days a week to help out whatever the job. I am ridiculously strong, willing to do any job however menial, filthy or hands on. Give me a shout!'

'We have two spare rooms if anyone needs a bed.'

Members of online communities also used Facebook groups to ask for advice. Requests for information on accessing assistance, health and safety as well as tips for repairing flood damage were frequently found within the dataset.

'Can anyone advise what we are safe to do regarding electric. Had close to 3ft of water in. Groundfloor electric and heating boiler went off. Water now out of property. Can we touch electic/boiler in anyway to try get heat back? Do we need a gas /elec person out first? Are any gas/elec folks able to help? Thank you.'

'Is there anywhere we can get bottled water? We still have brown water coming out of taps and couldn't get out to stock up. Don't trust boiling it. Thank you'.

'Genuine question. I moved to Todmorden in september and this is my first experience of a flood. My cellar flooded. The water has subsided but the floor is disgusting and it smells like sewage. Do I call environmental health? Or do i clear it myself?'

'Sorry if this seems a silly question but is the tap water safe to drink now ? I know at times in the past it's been said to be unsafe , so we have been buying copious amounts of bottled water for ourselves and pets .'



On the other hand, post-crisis information and advice were posted by members of online communities. Facebook groups enabled the crowdsourcing of information ranging from post-flood hazards, accessing government assistance and obtaining insurance claims.

'Also please, if you are insured, make sure you check with your insurer before getting rid of anything'.

'Just nearly fell down an open man-hole the pressure 'd blown the lid off in middle of pavement by turning circle .(was watching a crane) we put it back on but please continue to be careful people.'

'If you have had any gas or electric issues due to Storm Ciara, please get in contact with your supplier or if your electric is off please call [phone number]'.

'I'd urge everyone who flooded this February (even just your basement counts!) who hasn't done so already to apply for their council tax exemption - decision/adjustment is done very quickly, and it's great to put something towards cleaning, repairs or floodproofing for next time!'

'With regards to deployed sand bags; if they are clean and you want to keep them, please do. Store them in as dry a place as possible for your future use. Any that are left on streets and visible will be removed to storage'.

The sharing of information on social media demonstrated the utility of Facebook pages and groups as a medium for collective sensemaking and learning. Within crisis management literature, this is a key step in building resilience for future crises. Indeed, the following post from one online community published after Storm Dennis highlights the importance of these communicative processes in building resilient communities that social media may facilitate.

'Storm Denis did not flood us but the levels of preparation we saw and the protection put out at properties was great to see. To ensure you are ready for next time please store any sandbags left over from the weekend or should you need to buy more contact MPS in the post below.' [emphasis added]

The emergence of online communities after flooding was also observed during the timeframe examined. The November 2019 instance of flooding had devastating impacts on the village of Fishlake in South Yorkshire with 170 households and commercial properties flooded. In the post-crisis phase after Storm Dennis, a Facebook group was formed with the aim of building an online community to coordinate recovery efforts and build community resilience against future floods.

'We are now 14 weeks in, and the recovery of the village is in full swing. A long way to go, with lots problems still to solve, but the village spirit has been fantastic. If you have a problem, please post and share, and let's our best to find a solution.'

Overall, the analysis of Facebook activity by CSOs and local communities during the 2019-2020 winter floods illustrated the utility of social media as a tool for communication and deepening social networks for building disaster resilience. In both instances of flooding, social media provided a key medium for atrisk communities to mobilise at the pre-crisis, crisis and post-crisis phases. Moreover, this case illustrates that there are significant benefits for authorities to seek out ways to engage and collaborate with local communities using social media in order to improve self-efficacy and participatory crisis management.



6.2.4 Key Findings and Recommendations

- Authorities should establish networks on social media to coordinate the dissemination of messages to the public using a common strategy at the pre-crisis, crisis and post-crisis stages. These networks should include CSOs and influencers with complementary objectives.
- Authorities should facilitate the creation of online communities. To do so, it is advisable to provide training and support to agents of change to liaise between authorities and the public and coordinate community response actions during crises.
- During the pre-crisis stage public authorities, water authorities and CSOs can implement social media campaigns and events in order to raise awareness of the severity of the risk and actions citizens should undertake to protect their individual and collective property and wellbeing.
- > The messages of sensitisation campaigns should highlight the severity of the risks related to the crisis in question and provide information on the actions citizens can take to mitigate those risks.
- Resilience building resources should be made available to the public through social media outlets and websites in order to provide guidance on how to manage the risks of crisis. These resources should provide incisive advice on actions to take before, during and after crises.
- Public warning systems should be publicised regularly on social media outlets prior to a crisis. Additionally, the meaning of alerts and warnings as well as recommended actions should be made part of a regular content schedule to educate citizens.
- Public warning messages disseminated on social media should follow a consistent, standardised framework stating the crisis, level of severity, time, location, recommended actions and emergency contact information. These will facilitate the spread of warnings through social networks as well as make them readily comprehensible.
- Social media channels offer an alternative means for the public to report emergencies. Information reported by the public can be used both for emergency responses and building situational awareness.
- Public community pages and groups can provide valuable information to authorities and the public regarding local conditions and advance warning of emergencies.
- During a crisis, authorities should provide the public regular updates on the situation. Depending on the level of severity and nature of the crisis, messages can reinforce warnings, inform of responses being undertaken, provide reassurance and recommend precautions.
- > The public should be notified when alerts are no longer in force and warned of potential health and safety hazards in the aftermath of a crisis.
- > To facilitate individual and communal recovery, material, monetary and wellbeing support provided should be publicised on social media outlets.
- In the aftermath of a crisis, public engagement should identify lessons learnt and messages should focus on building future resilience whilst the issue remains salient.


6.3 United States: Flint Water Crisis

6.3.1 Background

The 2014-2019 Flint water crisis remains one of the most severe public health crises in US contemporary history related to the water network. During a budget crisis, Flint changed its drinking water source from treated Detroit Water and Sewerage Department (DWSD) to the Flint River in April 2014. The new supply source turned out to be contaminated with lead and possibly Legionella bacteria (Kennedy, 2016). Soon after the switch, residents began complaining about the appearance, taste, and smell of the water. The contamination was attributed to the officials' failure to apply corrosion inhibitors to the water that resulted in lead from aging pipes to leach into the water (Clearfield et al., 2018, pp. 121-128). This exposed around 100,000 residents to elevated lead levels (Clearfield et al., 2018). The contamination led to wide-spread tensions across the county, with different organisations calling for independent investigations. Some research into the crisis established a lead contamination in the water supply (Hanna-Attisha et al., 2015; Flintwaterstudy.org, 2017). The crisis grew rapidly, forcing the Michigan authorities to declare a state of emergency on 5 January 2016, followed by a federal state of emergency. The contamination was viewed as a possible factor in an outbreak of Legionnaire's disease the county, which killed 12 people and affected another 87 (Kristen Jordan, 2018; Khalil, 2016).

The Flint water crisis provides an interesting case for the use of social media during a water crisis. The case illustrates the multiple roles the social media platforms play at times of crisis. The Flint water crisis case is an interesting case in terms of assessing the ways in which different actors utilise social media facilities to engage with their audience, forge communication platforms, or galvanise a particular cause. Additionally, since the crisis was a slow-burning case, the use of social media in highlighting an issue, sensitising the issue, and pressuring authorities to take action is of particular significance for the purpose of this deliverable. This case also illustrates the varying roles social media can play at different stages of a crisis. The case shows that social media is a powerful tool that can provide for a harbinger of communications and activities both at the crisis and post-crisis phases. The Flint water crisis also illustrates that if the social media platforms are utilised effectively, they can mobilise public support, raise awareness, coordinate relief, or promote accountability and transparency. Additionally, the case also demonstrates that if the public or water authorities do not respond to public demands appropriately and timely, the use of social media, by the public or CSOs, can adversely affect them such as reputational damage.







Figure 8. United States Dataset by Source

6.3.2 Authority Communications

The public and water authorities in the Flint water crisis were slow in responding to the unfolding events and public anger following the change of the water supply source. The lack of response and inaction demonstrated by the authorities to address the public concerns led to significant public outcry and seriously undermined public confidence in the authorities. The lack of public confidence would play a crucial role in the politicisation and sensitisation of the crisis. However, the public response to the authorities' inaction in the early stages of the crisis resulted in significant public engagement that provided critical support and assistance to the citizens affected by the crisis and less able to cope with the implications on their own, which is discussed in the next section.

In terms of the authorities' communications, following the confirmation of the possible link between the Legionella bacteria and the deaths, the authorities began communicating with the public and other authorities more actively, in a more robust manner. However, the authorities spent months debating the possible reconnection of the water supply source from Flint River to DWSD despite reports linking the outbreak in June 2014 of the disease to water contamination. Additionally, instead of adopting a more effective means of addressing the crisis and communicating their long-term strategies with the public, the city authorities announced a water boiling advisory for parts of the city on 14 August 2014, which would be lifted a week later 20 August 2014. Despite claims of disease caused by the contaminated water, the authorities continued defying their position and assuring the public that the Flint water consumption did not pose any health threat. For instance, on 13 July 2014, A Michigan Department of Environmental Quality (MDEQ) official said on Michigan Radio, and this was posted on Facebook:

'Anyone who is concerned about lead in the drinking water in Flint can relax.'

However, this extent of certainty faded amid increasing research that confirmed that Flint water contained elevated level of lead and that the number of children with high levels of lead in their blood after the water source switched to the Flint water was growing. Amid deepening pressures, the city authorities signed a bill for \$9.35 million to reconnect to the Detroit water system and provide relief on



15 December 2015, followed by a declaration of a state of emergency in Flint. The social media platforms were used by different authorities to communicate important news of high urgency with the public. The city authorities announced:

'DWSD and the City of Flint are pleased to announce that Flint will be reconnecting to Detroit water, effective immediately, for a period of at least nine months.'

Additionally, social media provided the public authorities with a venue to forge interactions with other stakeholders that would help them repair their relationship with their customers and voters. For instance, to de-escalate the tensions and improve public confidence in the city authorities, Governor Snyder apologised in public for the crisis on 30 December 2015. The public authorities also tried to enhance public confidence by providing the public with a platform to engage with the authorities, hear their plans, and contribute to the efforts aimed at containing the crisis:

You're Invited: Mayor Karen Weaver - Karen About Flint to Host #TownHallMeeting to discuss the latest issues surrounding #Flint and efforts underway to help the City and its residents.

The public authorities also used the social media platforms to highlight their long-term commitment to addressing the Flint residents' water concerns:

'Our team is in Flint and we're not leaving until we get the water system back on track and we're confident that the needs of the community are being met. Our Associate Administrator for Public Engagement and Environmental Education, [first name, surname], has been on the ground working with the community in Flint since January. Read about our work there.'

'We are asking all Flint residents to #FlushForFlint in 3 steps this month: 1) run your bathtub on coldest and highest flow for 5 minutes a day 2) run your kitchen sink on coldest and highest flow for 5 minutes a day and 3) repeat steps 1&2 for 14 days in May.'

Like the public authorities in Flint, the authorities in Detroit after taking over the water supply source from Flint, also made significant efforts to enhance public confidence:

'Within the next few days, you and your Detroit neighbours will receive your 2016 Water Quality Report.'

Another post confirmed:

'Detroiters began receiving their copy of the Water Quality Report in their mailbox today, including facts on how we are improving the customer service experience.'

In addition to taking a proactive approach to communicating crisis associated with Flint water, the water authorities in the Flint and Detroit areas also informed the public about potential natural water disaster too. For instance, the authorities posted on their media:

'For the 24 hours immediately following last Monday's heavy rains, over 1,727 million gallons of wastewater were pumped through the wastewater treatment plant, which is at the plant's max flow capacity. The storm on August 11 [2015] dumped nearly five inches of rain on the city, which was the most recorded since 1925. This means the wastewater treatment plant was essentially running at 100 percent capacity for the entire 24-hour period after the storm.'

'Our Field Services team is working on a water main break in the area of East Grand Blvd and Ferry St. The area has been isolated and the crew is making the repairs. We will update you when the repairs are complete. (Photo shown is a file photo.) #watermainalert.'





The water authorities also adopted a preventive approach, informing or warning the public about the potential consequences of natural water disaster:

'This week, the temperatures are expected to drop below 30 degrees. DWSD is prepared to respond, with added capacity and an improved repair process, to water main breaks.' #watermainalert

The water authorities in Flint also sought to inform the public of the magnitude of the disaster, their long-term commitment to improve their infrastructures to provide safe drinking water. Additionally, the water authorities used the social media platforms to raise awareness about the efforts required to replaced aging water pipelines, enhancing public tolerance and potential cooperation through periodic campaigns:

'Our Water Finance Center identifies financial solutions to help communities meet infrastructure needs.'

'#MayorKarenWeaver says settlement agreement will benefit the City of Flint. It ensures that the lead-tainted pipes will be replaced.'

'Lead line replacement is the long-term goal. To help now, #Flint residents are asked in the month of May to #FlushForFlint.'

'To protect you and your family from lead exposure, residents are asked to #FlushForFlint. Start the 14-day campaign today.'

The public authorities also used social media communication as one of their major transmission platforms for their messages and to inform as well as engage the public. In some instances, the authorities used social media as a key marketing tool to distribute messages and information to the broader public and interact directly with their target audience. The excerpt below is from a post that the public authorities posted on their social media page to inform and engage the wider public about their activities in relation to managing the crisis and enhancing public confidence:

'Today we awarded a \$100 million grant to Michigan Department of Environmental Quality to fund drinking water infrastructure upgrades in Flint, Michigan.'

'Testing for radon is easy and inexpensive and it's the only way to know your home's radon level. This DIY project can be done by buying a test kit from a local hardware store or online. Learn how to Test, Fix, and Save a Life.'

Coordinating relief was another major effort to mitigate against the Flint water crisis and was communicated with the public through the social media platforms. Social media platforms helped a consistent and robust interaction between the public and water authorities and the public that would lead to localised understanding, interpretations, and requirements of post-crisis mitigation measures. As such, social media was used to identify and match needs and offer services or items to the worst affected communities throughout the county. Amongst numerous posts on the Facebook pages, signposting communities to help and assistance was a prominent feature of the relief coordination:

'5 Community Water Resource Sites Now Open for Residents to get Water Supplies.'

The water authorities appear keen on using the social media platforms to response to the crisis, diffuse tensions with the public, and rebuild public confidence in the water supply source. One of the major



areas that was galvanised through the social media platforms to achieve their objectives, the water authorities marketed their improved customer service. The water authorities sought to build good relationships with their customers, appreciating their customers' contribution to the continuity of the business as well as to handling of the crisis. However, improved customer service was promoted through the social media platforms to highlight the significance of a 'mutual' relationship between water authorities and the public and the significance of public's adherence or upholding of their responsibilities and contract.

The case illustrated above indicates that the public authorities and water authorities operate under different sets of circumstances at times of crisis. These authorities whilst espousing their own interests or limitations (e.g., economic, political) are faced with a range of public interests or demands. The approach a particular authority adopts during a time of crisis plays a critical role in shaping, addressing, or complicating these interests or demands. Additionally, the public would need and demand different items or services at times of crisis that would further complicate efforts aimed at addressing a crisis. The social media platforms, thus, provide effective and accessible means of communication that can be targeted at large number of different audiences with varying needs and demands.

6.3.3 Citizen Communications

In the midst of the Flint water crisis, the social media platforms were used by the public and CSOs to put pressure on the public and water authorities. To this end, citizen communications through the social media platforms made crucial contributions to force the public and water authorities to acknowledge the contamination in the water supply source, make radical decisions (e.g., switching back to Detroit), or supply assistance or guidance on how to deal with the crisis. The social media platforms were vital instruments at the hands of the citizens to put pressure on authorities, undermine their influence, and criticise them for their inaction or lack of transparency in their handling of the crisis. The posts below illustrate the nature and diversity of the communications delivered by the citizens through social media platforms:

'Want to address Congressman Kildee and find out what he plans to do about our water struggles?? Start jotting down questions for the Congressman and let's peacefully get our questions and answers directly to and from the source.'

'#FilteredWater from #Flint is NOT SAFE TO USE FOR EVERYONE. Please use caution and thank you #MayorWeaver for pointing that out!!'

'What is the government doing about the problem of lead in household water? A: There are two major governmental actions to reduce your exposure to lead: Under the authority of the Safe Drinking Water Act, EPA set the action level for lead in drinking water at 15 ppb. This means utilities must ensure that water from the customer's tap does not exceed this level in at least 90 percent of the homes sampled. If water from the tap does exceed this limit, then the utility must take certain steps to correct the problem. Utilities must also notify citizens of all violations of the standard.'

The Flint water crisis was tainted with claims of corruption and lack of consideration for the public safety in favour of financial considerations, thus providing a fertile ground for citizens and CSOs to criticise the public and water authorities' decisions and undermine their credibility. The excerpts below highlight how different citizens and CSOs used the social media platforms to develop and disseminate a narrative targeting the public and water authorities' integrity and transparency in relation to major public policy decisions and actions:



'Answers, truth, accountability, solutions and POSITIVE CHANGE are what we're fighting for! Heroes like Erin Brockovich and Lois Gibbs were just regular people who saw that innocent people were getting hurt. They stood up and made a change! So, can you. As a unified front, we can make a difference.'

'Government officials have known for years about the toxic water supply and risks involved but continued to assure the citizens that the water was safe for consumption.'

'Some Flint residents now face permanent, irreversible brain damage due to the high levels of lead in their water supply. Residents have refused to pay their water bills and for good reason. Why would you pay to consume toxic water?'

'Being censored when trying to share an article about children and lead poisoning is fun.'

Additionally, citizen communications played important role in informing the public to make sure that everyone was aware of the crisis and also to ensure that citizens knew where to access vital support if they were vulnerable or experiencing financial difficulties. To this end, the social media platforms were used by ordinary citizens and CSOs to provide help and support to those who were at potential risk of experiencing mental wellbeing difficulties or challenges. Data collected in this research suggests that the Flint water crisis implicated large number of families in mental and emotional difficulties, due to the loss of members or fear of developing Legionnaire's disease. Research shows that at times of crisis social contact and support may help to mitigate against mental wellbeing such as depression, stress, anxiety, and isolation (Kitchingman et al., 2018)[1]. Research also suggests that a lack of social support or contact during difficult times may undermine people's normality, wellbeing, and quality of life (Kitchingman et al., 2018)[2]. In the Flint crisis, ordinary citizens, civil society activists (e.g. individuals) and CSOs placed great emphasis on social media tools to communicate with at-risk people, signpost mental wellbeing support, or encourage those affected to approach support centres:

'if you have had health issues and cost problems with the switch to the Flint River, please write a letter and bring it to the Charity United Methodist Church 4601 Clio Rd in Flint on Monday, June 8th at 6:00 pm. We would like to add them to the motion to get us off the Flint River.'

'GREAT NEWS!! [first name, last name], one of the early warriors who gathered with [first names] and the Concerned Pastors for Social Action even before the first notice of TTHM in the water, with the goal in mind to make safe water affordable for everyone in Flint. I'm honored to have been along for the ride all of this time, and grateful to everyone who has joined the movement since. Most recently, I've been blessed to be able to help in ways that match my gifts. Mayor Weaver has asked me to help identify and generate immediate solutions. I'm starting by building a project that will involve designing "adaptors" to be added to faucets in Flint that cannot accommodate the donated filters. I hope to work with the sheriff as his team goes from door to door, bringing water and filters to Flint homes. There, we'll take photos and measurements of faucets so that we better understand all of the variations in faucet design and dimension. I hope to recruit local alumni to work with students on designs, and to recruit citizens with skilled trade experience to build these adaptors.'

'Today, our group and concerned and affected citizens are going to be testifying in Lansing for new legislature for Safe and Affordable Water. If you have anything, you'd like us to share, please message me!! This is the next step to doing what is needed to protect our families and our human rights to clean, safe water we are paying top dollar for!! It's time!'



The social media platforms played a crucial role in the politicisation of the Flint water crisis, driven by a diverse set of disagreements over the origin, causes, and management of the crisis from the outset. As highlighted in the previous section, the switch of the water supply source was viewed - in the light of the crisis - to be marred with corruption and a lack of transparency in the factors that encouraged or forced the authorities to switch the supply source. Whilst a public policy might be inherently political, the Flint crisis provided numerous grounds for the ordinary people, the national/local media, and CSOs to politicise the issue more effectively. The outcome or impact of the use of social media can be seen in the big changes that were made in and after the crisis such as switching back to Detroit water or forcing the authorities to acknowledge the problem and aid those affected. The grounds also helped these actors to rally a significant public support and citizen engagement in multiple forms, including engagement with the media, galvanising the calls aimed at mobilising support. The data collected for this analysis suggests that the politicisation of the Flint water crisis helped transform the issue from a poor public decision or an issue that would be viewed as objective and often outside of politics to an issue that would result in a part of debates or contentious topics for subjective engagement and discussion. The excerpts below illustrative a set of dilemmas developed during the crisis, involving a wide range of actors:

'To add to the list of dilemmas, home-owners cannot even legally sell their homes and move out of Flint because it is against the law to list a house with known lead contamination. These people need our help. They need clean water and they need assistance in class action lawsuits against their government officials who have known all along what they were doing, and even mocked Flint residents via email.'

'Misdemeanor charges for 12 deaths? And one hundred thousand people poisoned? Much ado about nothing means another Republican cover up!'

'it would have taken up to six months to acquire and install equipment for the treatments.' 'management above me...seem to have their own agenda.'

'How long will it take for them to claim that 'they were just following orders'!!!??? I wonder if what their families were drinking while all this has been going on?? Oh right, silly me, they're white.'

'What is the status of the water crisis right now? Are people able to use the water yet? I'd like some that is real and not the media version."

The public and CSOs also used the social media platforms to criticise the politicians and at times, blame them for a lack of integrity and transparency in their approach to the crisis:

'President Obama arrived in Flint... Drinks the water and says it's safe...the question is how can he deem it's safe when Flint residents who have been affected by the contamination of this water for years? He only drank a small portion of the water which doesn't equate to the years of damage incurred by Flint residents. The filters only work for a specified period of time... THE WATER IS NOT SAFE!!!'

'Let's hope the F.B.I. will nail this sorry governor and send him to where he belongs - and I don't mean Ann Arbor. He's already taken over \$1.6 million of state monies for his attorneys fees.'

'The state has allowed it's Republican politicians and it's official to poison 100,000 people including 10,000 children with toxic water which they overpaid for, and the state is responsible for 16 deaths from Legionnaires Disease, and tried to cover it up.



The Flint water crisis illustrates that when a crisis hits a community, it implicates different actors and communities in different ways. The varied effects of a crisis require varying approaches and tools to manage the crisis or minimise the adverse effects communities might incur following a crisis. The case also illustrates that authorities come under immense pressures from varying actors and are required to act immediately and swiftly to mitigate the implications of a crisis.

6.3.4 Key Findings and Recommendations

- Authorities should commence informing the public as soon as possible when a crisis happens to avoid potential confusion, increase transparency, and build relationships with the public and CSOs.
- Authorities must foster a robust relationship with public and CSOs that can play a critical role in mobilising support for the vulnerable communities and/ or individuals, supplementing official relief or assistance.
- Authorities must understand that the effects of a crisis differ and different individuals or communities require different assistance. The social media platforms provide varying ways of tailoring and conveying messages and information to those affected.
- During a crisis, different communities or individuals consume relatively more information, increasing the demand for information or assistance. Authorities must realise this and prepare for meeting this demand by diversifying their crisis communication and crisis management tools and platforms. The social media platforms offer a pool of communication tools that the authorities can use.
- Most crises such as flood take authorities by surprise leaving them under immense pressures from public and the media, thus, using the social media platforms can accelerate communications and mitigate against any potential lack and breakdown of communications between different stakeholders that could lead to the complexion of the post-crisis context. However, it is important to note that although the Flint crisis was a slow-burning crisis, but it took longer for the public and water authorities to open effective communication channels through social media.
- Authorities can use the social media platforms to act quickly, reach wider audiences, and reduce the potential costs of crisis communications and enhance the likelihood of dealing with a crisis in more effective ways.

6.4 South Africa: Cape Town Drought

6.4.1 Background

Cape Town is the second largest city in South Africa situated in the West Cape Provence. As a major metropolis, it has a significant water demand. It is highly reliant on seasonal rainfall due to its climate and topography and water supply is primarily drawn from six reservoirs. As a slow burning crisis, the Cape Town drought of 2017-2018 was preceded by years of low rainfall. Once water reserves reached a critical level, authorities announced the so-called 'Day Zero' when the water supply of Cape Town would be exhausted (Mahr, 2018).

To avert Day Zero, public and water authorities implemented strict conservation efforts that required broad public acceptance and active participation to implement. Emergency measures included increasing water tariffs, enforced fines on heavy users, the banning of municipal water for non-essential

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use and the instalment of an improved water system that saved approximately 10% of water consumption (Alexander, 2019). In May 2018, heavy rainfall combined with reallocation of water from the agricultural sector and a drastic reduction of public consumption by an estimated 50% eased the crisis (Rodina, 2019).

The crisis necessitated the public alter their consumption behaviour and adopt significant changes to their water usage. To garner public buy-in and uptake of the new restrictions, a public outreach campaign was instituted to sensitise citizens of the severity of the crisis and affect social behaviour change to decrease private water consumption. In addition to traditional channels of communication, social media played a critical role in the campaign to raise awareness and spread public warnings and situational updates to the populace.

The following analysis pays particular attention to the strategies employed by public authorities in their social media campaigns to improve public uptake of countermeasures, the public's reception of these measures and how citizens engaged with each other over the course of the crisis. This case study examines the viability of social media as a tool for the inclusion of private individuals and groups in countering severe water crises.



Figure 9. South Africa Dataset by Source

6.4.2 Authority Communications

Prior to the announcement of Day Zero, public authorities had already commenced sensitising the public on the need to reduce private water consumption. For example, this post from the official Facebook page of the regional government is an example of early public communications on social media to raise awareness of the severe drought.

'The Western Cape Government is helping municipalities secure their water supply. Residents need to save water if we are to avoid the taps running dry. Go to http://h2ohero.co.za for water saving tips. () #SaveWater #BetterTogetherWC'.



Early public warnings were limited to providing public information regarding the status of the drought, the need to limit water consumptions and, as shown in the example below, emergency contact information for drought related emergencies for wildfires.

'The summer season coupled with the drought means we all need to do our part to conserve water. #ThinkWaterCT and be extra vigilant around open fires. Report wildfires immediately on [phone number]'.

However, as the crisis intensified and reservoir levels reached critical levels, public warning messaging adopted an urgent tone, often providing data to demonstrate the level of severity as well as appealing for public participation in water conservation efforts.

'WARNING: dam levels are at 17,2% useable water. We are currently 108 million litres over our 500 million target. Due to a drop in the dam levels of 1,4% Day Zero has moved forward to 12 April 2018. If you are not saving water, we ask you to join all of our great water-savers in Team Cape Town. It is not too late! We can still avoid #DayZero together. #ThinkWaterCT and have a look at this week's dashboard:'

Over the course of the drought, public authorities adopted a range of strategies to engage the public in water conservation and compliance with rationing restrictions. The syntax of these posts frequently emphasised a theme of collective solidarity. Public authorities referred to 'Team Cape Town' and used collective grammar such as 'together', 'we', 'us', 'all', 'everyone', etc. These words were often adjacent to the objective of 'avoiding Day Zero' or hashtags such as #savewater and #thinkwaterct. The following posts illustrate the use of pluralism to achieve a sense of collective action through individual participation in water conservation messages.

'We have the power to change this **together**! **Together we** can #ThinkWaterCT & avoid Day Zero.' [emphasis added]

'**Together** we can avoid Day Zero. **We** can prevent a further lowering of our daily water usage limits if **we all** stick to the current 87 litres per day.' [emphasis added]

'Let **us all** reduce **our** water consumption #Savewater'. [emphasis added]

Additionally, messages also focused individuals through words such as 'single', 'water users', 'your' and other singular pronouns being placed adjacent to concrete actions that citizens could take to achieve the collective objective of water conservation. In order to make messages more relatable, public authorities frequently posted the efforts of private citizens and social influencers such as sports stars, celebrities and public officials to conserve water. These posts were typically accompanied with messages to highlight the need to find alternative means of conserving water, encouraging and reinforcing conservation behaviour, providing water saving advice and publicising online toolkits and resources.

'Thank you [first name] for saving water and helping us avoid Day Zero – the day the taps are turned off. We'll continue to #ThinkWaterCT and play our part by working tirelessly to secure alternative water sources.' [emphasis added]

'See how [first name] has been helping us avoid Day Zero - the day the taps are turned off. Thank **you** for playing your part [first name], we'll continue to #ThinkWaterCT and work around the clock to save water wherever we can'. [emphasis added]

'We'd like to thank **every single resident** who has been saving water and helping us to avoid Day Zero - the day the taps are turned off. Take a look at what [first name] has been doing to #ThinkWaterCT and save water.' [emphasis added]



'See how [first name] uses her 50ℓ allocation every day. How are you using **yours**? **You** can use our handy water calculator to find out how you can save even more every day: http://bit.ly/2GX4Qc4:=:http://herojhbdev.co.za/think/#ThinkWaterCT and let's beat #DayZero together.' [emphasis added]

Social media was used by Cape Town authorities to publicise countermeasures that would place greater restrictions and tariffs on water use. In these cases, social media was used as a tool for participatory governance and public inclusion in decision-making. For example, the post below is one in a series by the official Cape Town municipality Facebook page requesting comments from the public regarding controversial tariff increases.

'The 2018/19 water tariff structure has been proposed as a response to the drought crisis that we are all currently facing. This infographic explains where your money goes and how the new proposed tariffs are structured to help us become a more sustainable and resilient City. #ThinkWaterCT'.

The following post provided an update to the previous post presenting the final the tariff structure, highlighting the inputs that the public made as well as the revisions that occurred as a result.

'Thank you, Team Cape Town for taking the time to comment on the proposed 2018/19 water tariff structure. We have re-assessed the proposed 2018/19 Water and Sanitation budget and made several changes, such as re-phasing the New Water Programme. As a result, the proposed water and sanitation tariff increases have been reduced. This infographic explains how the new proposed tariffs are structured to help us become a more sustainable and resilient City. #ThinkWaterCT'.

Throughout the crisis, authorities provided regular updates regarding the status of the reservoirs and user consumption. The analysis strongly indicates that these messages had a consistent strategy to 1) reaffirm the severity level of the drought, 2) commend citizens efforts to reduce consumption, 3) reinforce the daily water usage limit and 4) encourage and persuade citizens to comply.

'Dam levels are at 19,7% useable water. We are currently 78 million litres over our 500 million target. We must act now to avoid Day Zero which is on 22 April 2018. We have the power to change this together! Together we can #ThinkWaterCT & avoid Day Zero'.

'Warning: Only 95 days to AVOID Day Zero! Dam levels are at 18,7% useable water and we are currently 118 million litres over our 500 million weekly target. We thank the 39% of residents who saved water this week. But it is not enough. The only way we can avoid Day Zero is by working together. #ThinkWaterCT and have a look at this week's dashboard'.

Social media was also used to transmit positive messages regarding the enforcement of water restrictions, which included extraordinary measures such as fines for heavy users. For example, this post from the regional government of the Western Cape highlights its collaboration with municipal authorities to enforce compliance with water rationing with a positive tone.

'Good morning South Africa, the Western Cape Department of Water and Sanitation together with the City of Cape Town will be conducting a water compliance blitz to ensure water users comply with the latest restrictions and regulations #SaveWater #ThinkWaterCT'.

Alternatively, an authoritative tone was typically found in public announcements of restrictions as well as in cases where citizens opted not to comply with restrictions.



'The City of Cape Town will implement level 6B water restrictions from 1 February onwards. This means daily consumption per person per household has been cut to 50 litres. Mayor Patricia de Lille says this is necessary because more than 60% of Cape Town residents are not saving water. #Savewater #SayNoToDayZero #BeWaterWise.'

'*You're ONLY allowed to water gardens between18h00- 06h00am *You're prohibited from using a hose-pipe to clean paved areas and driveways with municipal water #Savewater'.

Authorities also used social media to disseminate digital toolkits and resources for citizens. Digital tools included water usage calculators and an online dashboard showing water consumption in the city. These tools were designed to assist citizens monitor both their individual water consumption as well as community consumption.

'#ThinkWaterCT and stay on top of your 50ℓ a day target by using our handy water calculator. It's a simple and easy way for you and your family to calculate your daily usage. Level 6b restrictions require us to reduce our water usage to 450 million per day. We can only do this, together. <u>http://bit.ly/2thMR88</u>'.

'Together we can avoid Day Zero! We have developed a digital map that highlights residential properties using less than 10 500 litres per month. Consumption is indicated on the map as follows: Dark green dot: household using less than 6 000 litres per month. Light green dot: household using between 6 000 and 10 500 litres per month. Grey dot: estimated consumption due to the meter not being read or no information available. #ThinkWaterCT and see if you are below the limit: http://bit.ly/2EKA8AS.:=:http://www.capetown.gov.za/Media-and-news/Let's paint this city green'.

'28 000 new households have received a green dot for the first time! This means they've been using between 6 000 & 10 500 litres per month. In addition, 24 500 new dark green dots have appeared, so 24 500 new households are using less than 6 000 litres per month! A great example of working together to avoid #DayZero! #ThinkWaterCT'.

On the other hand, digital resources were provided to provide practical guidance to citizens on the crisis, latest water restrictions and ways to reduce consumption in order to improve compliance.

'Visit www.capetown.gov.za/thinkwater for everything you need to know about the Drought Crisis'.

'A leaking tap can use up to 90 litres per day while a household toilet could lose 360 litres per day as a result of leaks. With Level 6 water tariffs in place, leaks are particularly costly. To prevent water wastage and a high water bill, it's important to detect and fix leaks as soon as possible. Download our DIY guide: http://bit.ly/20XfCI1 #ThinkWaterCT'.

'Level 6B water restrictions come into effect on 1 February 2018. Let's beat #DayZero together by using 50 litres or less per person, per day. We've created this resource to help you #ThinkWaterCT. Save, print and share! For more on level 6B, click here: http://bit.ly/2Enw8HP:=:http://resource.capetown.gov.za/documentcentre/Documents/Proce dures, guidelines and regulations/Level 6B Water restriction guidelines- eng.pdf'.

Additionally, authorities sought to ensure all citizens could access these online resources in their native languages. As a highly multicultural society, making advice and guidance available in native languages was important to ensuring that all segments of the target population could access and comprehend the messages being disseminated.



'We have prepared a list of water saving tips in all our **eleven official languages** [emphasis added] to ensure that we can all #SaveWater. View them here and share with your family and friends: http://www.dwa.gov.za/drought/watertips.aspx.'

In addition to providing citizens with digital toolkits and resources, public authorities also incorporated water saving tips into their content schedule. These ranged significantly from advice on limiting water usage and preventing wastage to how to extend and recycle allocated water rations.

'12 litres of water is used every time you flush the toilet. Use water efficiently and flush only when necessary. Please #SaveWater #ThinkWaterCT'.

'A leaking toilet can waste up to 100 000 litres of water in one year. Visit our website for more water saving tips: https://www.dwa.gov.za/drought/default.aspx #SaveWater'.

'Leaks can waste a lot of water, especially if they are undetected or underground and left for a long time. Join the movement- FIND AND FIX LEAKS TO #SAVEWATER'.

'Are you building your drought kit? Waterless hand sanitiser, vinegar and food-grade sterilising liquid can help you to get through this severe drought. Download our water-saving checklist for more ideas on how to build a more water-resilient home: http://bit.ly/2oKfPgH #ThinkWaterCT'.

'#SaveTheLastDrop Got a blow-up pool in your garage? Pump it up and leave it in the garden to collect rain water. Once the rain stops, cover the pool so that mosquitos don't breed in the water #savewater \checkmark ^GZ'.

While posts placed emphasis on conservation, advice and guidance provided by the authorities also emphasised health and safety issues and educated citizens on ways to maintain sanitation and hygiene while undergoing water restrictions.

'Did you know that stored water quality decreases after three days? It's important to adhere to safety standards in your water-saving efforts. Follow these tips to learn how to stay safe when storing water. And remember you're only allowed to store up to 10ℓ of your daily 50ℓ. #CTInfo #ThinkWaterCT <u>http://bit.ly/2ES3P4w</u>'.

'It's important to exercise good hygiene in your home, but remember to be water-conscious when you do. Learn more about how you can use lag and grey water in your home: http://bit.ly/2GDjUKP:=:http://resource.capetown.gov.za/documentcentre/Documents/Graphi cs and educational material/Safe Use of Greywater booklet.pdf #ThinkWaterCT #CTInfo'.

'City-supplied drinking water is safe to drink and adheres to national safety standards. If you are sourcing water from alternative suppliers for drinking purposes, make sure that the water comes from a reputable water supplier. Store your drinking water in closed, sanitised, clearly marked containers and in a cool dark place. Remember to rinse and sanitise your containers and taps once a week if possible. Springs and water streams do not form part of the municipal supply and are not monitored and controlled for drinking water standards. For more tips on water safety, visit our guide: http://bit.ly/2F9nw7j #ThinkWaterCT'.

Analysis of these posts indicate that in addition to providing citizens with useful information to aid them in safely reducing their water consumption, they were also intended to increase engagement and dialogue with citizens and promote the exchange of information on social media. For example, the following posts asked Facebook users to provide their own tips for saving water.

'Are you sharing your water saving ideas? #SaveWater'.



'Are you a water-saving superhero? Tell us your secrets to avoid #DayZero'.

Another key theme that emerged during the analysis was public-private cooperation. Both in the countermeasures that were undertaken and in communicating with the public, authorities partnered with PSOs to achieve the objective of avoiding Day Zero. In terms of crisis communications on social media, this had a positive effect by broadening the reach of their messages by tapping into the expansive social media networks of private companies. Inversely, it provided private sector organisations a means to demonstrate social responsibility, particularly for heavy water users (see Section 6.4.3). Similarly to the UK winter floods case (see Section 6.2.2 and 6.2.3), establishing alliances with non-state actors can improve the effectiveness of crisis communications and management.

'Our hydration partner Coca-Cola Peninsula Beverages (CCPB) is working with the City to provide millions of litres of relief water to the Western Cape and to the City of Cape Town in a bid to help mitigate the impact of Day Zero. Read the full article here:'

'Showcasing leading companies reducing water usage in Cape Town. If we all work together, we can defeat #DayZero and emerge stronger and more resilient in the future. #CapeConfidence #WaterCommsRoom FWJK Western Cape Government'.

'The Department of Water and Sanitation is today launching the #SaveWater Ambassador Programme which will serve to increase communication between the Department and communities in and around the drought-stricken City of Cape Town. The programme is a multisectoral initiative that includes a wide array of partners including Miss Earth SA, Operation SA, Tsogo Sun to ensure that Department works collaboratively with stakeholders to find solutions to the challenge of water scarcity.'

'Premier Zille is briefing the media following a meeting with the SAB on how the company is willing to assist in the distribution of water should we reach day zero #WaterCrisis'.

With the arrival of the winter rains in May 2018, public authorities had to maintain active communication with the public to reinforce the necessity of continued water rationing. It was evident from the sample that public authorities were concerned that the public may resume usual levels of water consumption prior to it being safe to do so because of drought fatigue. Post-crisis messaging typically coupled positive updates with appeals to continue to abide by water restrictions.

'While some winter rain has finally arrived, we must urge all residents to continue saving water. Our dams still have a long way to go, and the only way to help them get there is if we all stick to 50% or less. Remember, 50% A DAY KEEPS DAY ZERO AWAY. Calculate your actual usage here: http://bit.ly/2Gr2dzh #ThinkWaterCT'.

As situation improved, authorities took a congratulatory tone with messages highlighting solidarity and emphasising the key role that the public's actions played in mitigating the crisis as they began to deescalate water restrictions into the post-crisis phase.

'Well done Cape Town! Together, we've pushed out Day Zero to beyond 2019. By uniting against the drought we've managed to do what no other city in the world has ever done before and now we're saving over half a billion liters of water every single day through innovative water management and of course, you, our residents. Thank you for playing your part, remember to #ThinkWaterCT and keep saving, even when it's raining. For more information: http://bit.ly/2ND9dMN:=:http://www.capetown.gov.za/Media-and-news/ No Day Zero for 2019 if appropriate water restrictions are maintained.'



The multifaceted campaign conducted by public authorities in South Africa illustrates the potential benefits social media for inducing social behaviour change during water crises. In cases like drought, active public involvement over a sustained period of time is vital and may require significant alterations to their way of life. By instituting a robust social media strategy, authorities can directly communicate their messages to the public and co-opt not only acceptance of restrictions, but also active participation into the solutions they deploy.

6.4.3 Citizen Communications

While the online communications of authorities highlight best practices in utilising social media as a tool for engaging citizens in crisis management efforts, citizen communications were also vital to its success. Due to the social networking paradigm of sites such as Facebook, the public act as creators and cocreators of social media campaigns rather than mere passive recipients of messages (Thackeray, et al. 2008). As such, the success of campaigns targeted at co-opting public participation in emergency management likewise depend on user uptake and participation in digital campaigns.

As was previously mentioned, one strategy employed by authorities was to collaborate with PSOs through public-private partnerships. Within the dataset, a wide range of large, medium and small enterprises spread the messaging of municipal and water authorities. Indeed, the similarities in messages were striking. For example, this post by Coca Cola closely aligns the posts produced by the City of Cape Town Facebook page, providing municipal data and drawing attention to the work of authorities while echoing themes of solidarity in their calls for water conservation.

'Dam levels are currently at 24,2% useable water. The City of Cape Town is working hard to avoid Day Zero, but they can't do it without you! According to the latest consumption levels, only 37% of residents are using less than 87 litres per person per day. Please reduce your water consumption as much as you can. #ThinkWater #WaterWednesday'.

Analysis of posts published by PSOs found that some heavy users may have been inclined to participate to demonstrate social responsibility and participation in water saving initiatives. For example, agricultural sector associations highlighted their conservation efforts and contributions to offset the drought.

'Western Cape farmers are going above and beyond the call to save water. Not have they pledged to use less and less municipal water, they will also be donating 18-20 days worth of water #SaveWater #WaterCrisis'.

Others paired messaging of the drought with promotional messages for their businesses. These posts often highlighted the actions being taken by companies to contribute to conservation efforts while promoting their brand. This indicates profit-seeking motivations were potential impetus for participation in the social media campaign.

'We LOVE saving WATER! Let's fill the bottle and save water #TheWillowbridgeWay. Willowbridge has implemented several water saving initiatives which has led to a significant saving in water consumption. Can you guess the % water saved by Willowbridge for the year 2017? http://www.willowbridge.co.za/competitions.htm Take a guess and you could win up to R 5000. Every entry equals one drop in the bottle. Share this post and see the water level of our bottle rise. T&C's apply. The winner will be announced on WORLD WATER DAY, 22 March 2018. #SaveWater #DayZero #WorldWaterDay'.





When analysing the content and performance of PSO posts during this timeframe, it was evident that private sector experience in social media marketing provided significant added value for to the public conservation campaign. Some private sector pages created sub-campaigns in parallel with those instituted by authorities. A key example was the #SaveLikeAPenguin challenge created by Two Oceans Aquarium, a popular aquarium in Cape Town. In the dataset, this challenge averaged 438 engagements per post, which was higher than the average for posts produced by public authorities. The content of posts typically encouraged citizens to conserve water by undertaking specific actions or providing water saving advice. The tone of the posts tapped into social media challenge strategies to user participation, engagement and viralisation of messages.

' SHOWER WITH A BUDDY N We challenge you to #SaveLikeAPenguin! The Share the shower with a partner to halve water use. Waddle you do to avoid #DayZero? #CapeTown | #WaterCrisis | #SaveWater | WWF South Africa | City of Cape Town.'

SHOWER WITH A BUCKET A We challenge you to #SaveLikeAPenguin! A Catch your shower greywater in a basin or bucket and use it to flush your toilet. Big savings! Waddle you do to avoid #DayZero? #CapeTown #WaterCrisis #SaveWater #CapeTown | #WaterCrisis | #SaveWater | WWF South Africa | City of Cape Town | V & A Waterfront | SANCCOB saves seabirds | Flow - For Love Of Water SA | Hotel Verde.'

Analysis of the posts produced by PSOs during the Cape Town drought number of benefits of working with the public sector in social media campaigns. One key benefit is that companies typically invest significantly into their online marketing infrastructure, often entailing a large social media following and network. As such, they can provide vectors for authorities to spread messages to citizens. In a similar vein, the proficient social media marketing experience of private sector companies can assist to increase both the reach of messages and public engagement. Taken together, collaboration with private sector partners can improve the performance and reach of crisis messages produced by authorities when interests coincide as they did during the Cape Town drought.

In addition to partnering with authorities, PSOs played an active role in community responses to the crisis. Whether by donating to CSO's leading community efforts or by creating their own initiatives, posts collected from private sector pages indicated a high degree of active participation.

'Mining Indaba handed over a cheque of R100 000 to Gift of the Givers towards Cape Town Water Crisis. #CapeTownDrought #DayZero'.

'We have had such amazing support from our customers across South Africa and it's a beautiful sight to see everyone stand together during this water crisis. Don't forget to contact us if you would like to join our next water drive for Cape Town we would like to extend a big thank you to all who lent a helping hand. #dayzero #tibbhealth'.

'Good morning, Cape Town & the Western Cape! If we all do our bit to #SaveWater, we will not only avoid #DayZero, but also emerge stronger and more resilient. And in doing so, we will become a beacon of hope for many other places around the world. The film industry is adapting to make this happen. What is your business doing? Let us know, and we will share it. #CapeConfidence #Wesgro'.

'For the past month Pam Golding has been on a massive water collection drive for Cape Town. This project was initiated by [first name, last name], who is the Principal for Pam Golding (Port Shepstone, Margate, Westville and Pinetown). This drive was a great success and approximately



20 000 litres of sealed bottled water was collected from the Port Shepstone and Margate branches by the Gift of the Givers. #DayZero #CapeTownDrought'.

Social media influencers also played a direct role in the social media campaign. Compared to the other cases examined, the validated dataset had the highest proportion of public posts by accounts classified in this category (12.8%). These credible voices within the public often called on their online followings to limit their water use and participate in communal action. Indeed, the post with the highest engagement of any posts within the South African dataset was published from the account of a popular imam.

'Don't take for granted the favours of our Creator. No matter how much water there is around you, be mindful of those who are facing severe shortage of this precious resource from the Almighty. Don't waste water. #SaveWater #EveryDropCounts'.

Influencer posts sought to raise awareness and encourage conservation in a variety of ways. Some undertook individual challenges to raise awareness or promoted the viralisation of the #EmptyBucketChallenge similarly to the #SaveLikeAPenguin campaign.

'Today, on World Water Day, I'm announcing my biggest challenge yet: Running Dry. I will run 100 marathons in 100 days to show the scale of the global water crisis, and the commitment we need to make sure #everydropcounts Δ '.

'This is the #EmptyBucketChallenge - I challenge YOU to do the same... and let's create awareness- #SaveWater because #EveryDropCounts - DO IT NOW!'

'Please take up the #EmptyBucketChallenge and let it go viral. Let's not waste water. It's time to #SaveWater because #EveryDropCounts'.

Other posts by influencers called for solidarity, emphasising the collective responsibility of individuals to abide by water restrictions in order to offset the crisis. This example from one influencer urges citizens to take an active role in remedial actions.

'THIS IS OUR LAST CHANCE CAPE TOWN COME ON CAPE TOWN - WE DON'T HAVE ANY OTHER OPTIONS - LET'S DO THIS!!! Just for once, let's stop attacking government departments, we all know by now who's fault it is... point is, we are sitting with this massive problem. Watch this video clip, Share it with everyone you know in Cape Town & Let's work together to avoid our taps running dry. Share this even with your enemies if you have any, otherwise you will have to stand next to them in the water queue... #CapeDrought #NARI #DayZero #FiftyLitres'.

Private citizens were also active on Facebook groups ranging from specific water user pages to neighbourhood groups. These online communities provided forums for citizens to exchange water saving techniques and organise community responses.

'Pour White Vinegar into your toilet to instantly neutralize any bad odours. If you are being a good neighbour and letting the yellow mellow, then you'll appreciate this tip. Keep up the water saving effort in Cape Town. #ThinkWaterCT #DroughtTip #Neighbourly'.

'Working together we can beat Day Zero - here are some safety measures with regards to grey water.'

'Cape Town's drought crisis is real! We can all get involved to save water where we can. When cleaning kitchen countertops, use disposable wipes, or even vinegar with paper towels instead of water. Share your water-saving cleaning tips... #beatdrought #savewater#'.



'Are you a water-saving superhero? Tell us your secrets to avoid #DayZero'.

Similar to other cases examined, CSOs played an active role in responses to the Cape Town drought. Social media was used as a tool for coordinating community action. CSO's were particularly active on Facebook to coordinate water donations, distribution and advertise collection points.

'Our truck has departed with water to be delivered to Beaufort West and soon Cape Town, where residents are currently experiencing a water shortage. Your fellow South Africans need your assistance. Contact us if you'd like to assist. #QuenchAfrica #QuenchSA #WaterCrisis'

'Thank you to our fellow South Africans for your generosity toward the Gift of the Givers #CapeTownDrought relief mission. Collection points all over South Africa can be found here:'

Solutions devised by civil organisations to offset the water crisis varied broadly. In some cases, events were hosted to encourage water donations. In others, water collection drives were conducted to crowdsource water for redistribution to severely impacted areas and communities. Some CSO's also implemented water solutions such as drilling borewells.

'Our efforts to alleviate the Western Cape #WaterCrisis continue with drilling in Klapmuts Stellenbosch today. Exciting to be able to provide more families with clean, safe water! To donate go to http://bit.ly/2qVUCna and help us drill more wells in the province.'

'@GiftoftheGivers successfully drills borehole at the Habibia Soofie Educational Centre in Rylands Estate, Cape Town. This borehole will pump 18 000 litres providing for at least 15 000 people per day. #DayZero #CapeTownDrought #GiftoftheGivers More boreholes planned for Cape Town, please contribute here:'

'1200 x5lt bottles of water collected from Fordsburg Football club. They hosted a soccer tournament and requested each parent bring a 5lt bottle of water. #CapeTownDrought #DayZero'

'Please join in our drive to send water to Cape Town. # GoscorCares #CapeTownDrought #MakingADifference'

The data gathered from CSO pages illustrated the important role that non-governmental entities play in assisting in response to crisis by broadening the scope for citizens to directly engage in community-led solutions. In this context, social media can be used for the publicization and self-organisation of initiatives to address the crisis. Innovative bottom-up solutions can play a key role in supplementing top-down countermeasures deployed by authorities.

Additionally, CSO posts also acted to amplify the crisis messages of authorities to their own networks. Some of these posts used the same taglines and hashtags as those used by authorities while others made direct appeals to their followers to comply with water restrictions. As was observed in the UK case study, the sharing of authorities' messages by CSOs can significantly improve not only their reach, but also their uptake.

'Every drop counts! Level 6B water restrictions in effect from 1st February in Cape Town. South Africa. Here is what you can do with 50L a day: #watercrisis #ThinkWaterCT #SaveWater'

'#DAYZERO pushed out to 11th May! Does this mean we can relax our efforts to reduce our water use? ABSOLUTELY NOT! Every drop counts. The more we save, the more we reduce our use, the better chance we have of avoiding the big tap switch-off'



'Getting on board with the water crisis is no longer an option. It's a must. Nobody wants to arrive at the prospective #DayZero and wish they had done more to avoid queuing for water. While there is still water coming out of our taps it is completely possible (and at this point essential) to live off the required 50 litres of allocated water per person per day. And believe it or not, you can do so quite comfortably. Let's do this thing and #DefeatDayZero from becoming a dire reality.'

The data also showed how CSOs broadened discourse on the crisis to raise awareness for water disparities and the root causes of the crisis. Posts that highlighted the gendered and socioeconomic dimensions of the water crisis and broader issues of water scarcity were also published by CSO accounts. These posts sought to highlight the ways in which disparities affected access to water and raise awareness for disadvantaged groups who frequently experience water scarcity in their daily lives.

'DROUGHT: More helpful tips for Capetonians on how to live within current water restrictions of 50l per person per day. The free basic water supply as prescribed under the Water Services Act is only 25l per person per day - a determination the Constitutional Court refused to set aside in the 2009 case of Mazibuko brought by Soweto residents, and many South Africans live on 25l or less water per day. Moreover, as the effects of climate change start becoming more severe, Capetonians and many urban residents across the world have to change the way we use water to ensure that there is enough for everyone. #DayZero'

'This powerful video created by Eyewitness News highlights the impact the water crisis has on women in particular. This International Women's Day, Sonke Gender Justice is calling on the City of Cape Town and other stakeholders to work with women and men to mitigate the negative impact that lack of access to water has on women and the longer term negative effects on gender equality.'

'Water is life and a fundamental human right! We cannot live without it. We must make sure that the people of South Africa's right to water is protected and comes first! #watercrisis'

Other CSOs' participating in social media discourse on the water crisis sought to highlighted environmental reasons for the drought and raise awareness of climate change.

'In SA water scarcity is an ongoing significant challenge that climate change is likely to worsen. Just imagine what it would be like to only have 50L of water to use per day? For many this is a reality #watercrisis #defendwater'

'Climate change and global warming are already beginning to transform life on Earth. Without action, climate change threatens to damage our world. #WaterCrisis #SaveWater #WaterTanks'

While the messaging of CSO posts were typically complementary to those published by authorities, others were more critical. However, these posts did not run contrary to the objective of addressing the water shortage. For example, one CSO organisation published several posts critiquing the national government's decision not to declare a national water emergency, which would entail a more direct role in crisis response efforts and wider restrictions being placed across south Africa, despite widespread water shortages across the country during this time. These messages sought to raise awareness of the crisis and used popular hashtags for the drought crisis to increase their reach, calling on the public to write to the national government to intervene.

'Water distribution points around the city could expect up to 20,000 people per day, and will need to be open 24 hrs. This will be chaos if the government doesn't act to put plans in place now. Take a stand by asking the SA president to intervene: http://bit.ly/2ncvwxg #DayZero'



'The water crisis in the Eastern Cape and Western Cape (SA) affects all of South Africa. The situation is dire and needs a quick response. Ask President Jacob Zuma to declare these provinces national disaster areas, and provide much needed assistance: http://bit.ly/2ncvwxg #WaterCrisis #DayZero'

'It could take 4 years of good rain before dam levels are restored. The SA government must do something to avoid the worst impacts of this water crisis. Ask President Zuma to declare the Eastern Cape and Western Cape national disaster areas: http://bit.ly/2ncvwxg #DayZero'

'Over 3700 of you have sent a letter to @PresidencyZA - asking him to declare the Western and Eastern Cape disaster areas. Thank you! If you haven't yet, do it now >> http://bit.ly/2ncvwxg #DayZero'

The Cape Town drought required active public participation in water conservation efforts to prevent Cape Town from becoming the first major city to exhaust its water supply. Not only did authorities need to directly engage citizens, but private and civil organisations as well as individual members of the public were needed to participate in the campaign for it to be successful. Analysis of the dataset in case study demonstrates the utility of social media as a means for private and civil actors to communicate with their audiences and broaden the reach of messages and implement initiatives. Whether by contributing to the efforts of authorities or through self-organised bottom-up solutions, social media provides an important tool for mobilising public participation and compliance with measures to manage the crisis.

6.4.4 Key Findings and Recommendations

- Social media is an indispensable tool for engaging the public during crises that require active participation from citizens as part of the solution.
- Public warnings and crisis updates targeted at altering water consumption patterns should provide regular updates on the status of water quality and quantity to reinforce the severity of the crisis and the need to follow emergency measures. These messages can adopt tones of urgency, authority and persuasion depending on the intended outcome.
- Messages to affect social behavioural change can adopt a strategy of highlighting collective solidarity and individual responsibility to persuade members of the public to adopt changes to their behaviour in times of crisis.
- In cases where restrictions are in force, clear messaging should be provided as to what those restrictions are as well as why they were implemented and the positive outcomes of compliance.
- In cases where a controlled de-escalation of a crisis is required as it transitions into the postcrisis phase, water and public authorities should utilise social media to outline the roadmap for easing restrictions and returning to normalcy. In cases where restrictions will be phased out, messaging should clearly indicate the latest rules and regulations.
- Social media can be used not only for informing of countermeasures being enforced, but also for including the public in the decision-making process by obtaining feedback on actions being taken and proposed measures.
- Digital toolkits and resources should be made available to the public to assist them in monitoring their water usage as well as guidance on how to abide by restrictions that are in force. These should be translated into the languages of the target audience in order to improve accessibility and comprehension.



- Social media campaigns should make use of bespoke hashtags to improve uptake and the spread of messages through social networks.
- Public-private cooperation in social media campaigns holds mutual benefits for stakeholders. Authorities can benefit from the online communications infrastructure and marketing experience of PSOs to spread their messages while PSOs can demonstrate social responsibility.
- > Campaigns targeted at promoting largescale social behavioural change require active participation of social media influencers, CSOs and online communities to be effective.
- CSOs and voluntary community action can play a key role in supplementing efforts by authorities to respond to crises by implementing grassroots initiatives and solutions. Social media plays a key role in coordinating these responses and authorities should seek to create synergies with grassroots efforts.

6.5 Poland: Czajka Sewage Contamination

6.5.1 Background

The Czajka wastewater treatment plant is Poland's largest sewage treatment infrastructure and services the capital city of Warsaw with a water purification capacity of 435,000 metres³ per day⁷. Before the modernisation of the Czajka plant in 2013, approximately 50% of Warsaw's wastewater flowed directly into the Vistula river that runs through Warsaw⁸. Modernisation of the plant occurred at pace and was completed within two years of commencing. Since then, the Czajka plant has been the primary wastewater treatment facility for Warsaw.

In late August 2019, a failure at the Czajka treatment plant led to the discharge of untreated sewage into the Vistula river at a rate of 3,000 cubic meters per second and a total of 1.5 billion litres of wastewater ultimately contaminated the river (The Associated Press, 2019). The sewage contamination was the result of a failure of the main collector pipe connecting the two banks of the city to the Czajka plant. The system switched to the back-up pipe which also failed, leading authorities to opt to discharge untreated wastewater into the Vistula. The primary contaminants of potential harm to the public and environment were sharp increases in phosphorous and nitrogen resulting from the malfunction. Comparative to the situation prior to the malfunction, discharge caused phosphorus levels to increase from 0.6 tons per week before to 10.8 tons per week during the incident, while nitrogen levels increased from 10.8 tons per week to 101 tons per week during the same period⁹. Although authorities were able to restore the pipeline, the Czajka treatment plant malfunctioned again one year later 30 August 2020. Once again to the discharge of untreated wastewater into the Vistula. The second discharge began at a comparable rate of 3,000 cubic litres per second but was reported to have increased to 15,000-20,000 cubic litres per second (Wilczek, 2020).

Both malfunctions and efforts to mitigate the crises took place against the backdrop of a highly politically contentious environment. The mayor of Warsaw, Mr. Rafał Trzaskowski, is a leading member of the centrist Civic Platform (PO) party and contested the 2020 Presidential election against the incumbent President Andrzej Duda supported by the Law and Justice Party (PiS). In the closely run elections that

⁷ See <u>https://www.water-technology.net/projects/bayview/</u>

⁸ See <u>https://www.avkvalves.eu/en/cases/wastewater-cases/improved-water-environment-czajka-poland</u>

⁹ See <u>https://www.apgw.gov.pl/en/news/show/96</u>



concluded in 12 July 2020, Duda retained the presidency with a slim majority of 51% to 49% of the votes (Walker and Rankin, 2020).

In both instances of the Czajka sewage malfunction, social media activity deeply reflected the polarised political environment, and the plant failure became highly politicised. While political contention is not inherently negative to crisis management and may cause authorities to adopt more effective measures than they would otherwise, it may lead to conflicting messaging from public spokespersons which may lead to confusion. Therefore, this case presents a unique study as to how to manage water crises under contentious political circumstances between public authorities.



Figure 10. Poland Dataset by Source

6.5.2 Authority Communications

After the Czajka sewage plant malfunction, public warning messages were published by both public authorities and water authorities at 21:00 on 28 August 2019. In both instances, the warnings were consistent and provided standardised notices for the public in to avoid using water from the Vistula. While these posts did not state the cause of the crisis outright, they did provide guidance for citizens as well as the location for which these alerts applied.

Attention Główny Inspektorat Sanitarny and Rządowe Centrum Bezpieczeństwa $\$ The Chief Sanitary Inspector appeals: Λ avoid baths and water sports in Wisla from Warsaw towards Gda ańsk, Λ don't drink and use water from the river to wash. #Czajka #zdrowie #bezpieczeństwo

While the warnings published on the Facebook pages of public and water authorities in Warsaw are consistent with good practices, the main flaw in the approach adopted by authorities in the first case of the Czajka plant malfunction was timeliness of warning. Authorities had delayed warning of the incident when the main collector pipe failed and only after the back-up pipe failed. Additionally, initial warnings of the sewage plant malfunction contained little information regarding the causes or scale of the incident.

This placed water and municipal authorities under considerable criticism on social media from other political actors and public authorities. In posts such as the example below, the delay in warning and



scarcity of information provided room for speculation. Typical implications were malpractice and attempts to cover up the failure of the Czajka plant.

A giant failure in Warsaw and the threat of ecological disaster! [Mayor] Trzaskowski, in agreement with the city's company, decided to drop a huge amount of sewage directly into Vistula. Locations located north of Warsaw are facing a real epidemic. In cities like Płoock, where water is taken differently than in the capital, the situation is already dramatic, although the sewage will only get there on Friday. With every minute thousands of liters of unworked sewage fall into Vistula at the height of the north bridge. All state institutions are beating the alarm. Surely this will be one of the topics of today's Council session, which will start at 10:00 in the Warsaw Hall of PKiN. Hope we have the opportunity to ask the president some key questions Why was the waste water drop information hidden for hours? Was the situation prejudiced by the local government of the cities of northern Mazovia and others? How could there be a failure of an investment given away a few years ago that consumed huge funds from the city budget? #Czajka #ZrzutTrzaskowski

As criticism mounted, municipal authorities posted reassurances on their social media pages directed at the citizens of Warsaw. The messages focused on affirming that drinking water in Warsaw was not affected and that responders were working to remedy the failure.

'Ladies and gentlemen, in connection with your questions about the possible deterioration of drinking water after the failure of the Czajka sewage treatment plant collector, I would like to reassure you that this situation does not affect Zielonka. Our city does not use Warsaw water shots. We have 3 of our own deep-sea shots in Zielonka, from which we deliver water to your taps on a regular basis. The state of water in the collection stations has not changed and is constantly controlled. We are only related to the sewage treatment plant Czajka in the field of drainage from our city to it.'

'Everything you need to know about the manifold failure at @Miasto Capital Warsaw: Warsaw tap water is still clean and safe to drink, in cooperation with services and experts, we are simultaneously implementing temporary solutions to minimize damage caused by the failure, we are constantly working to solve the problem for good and find out the causes of the failure. #Czajka #Awaria #Bemowo #Warszawa'.

Water authorities also published reassurances on their Facebook pages that the plant failure would not cause harm to the residents of Warsaw as well as provided clarifications as to the nature of the malfunction.

'Due to numerous false information, we confirm that the wastewater treatment plant "Czajka" works smoothly, and the failure concerns the submitters waste collectors under the Vistula River. #MPWiKWarszawa City of Warsaw photo. Aeromedia") #IMGW #Wisła #Czajka #awaria'

To correct information that had been misconstrued in the early stages of the crisis, institutions responsible for monitoring water quality published the results of tests conducted along the Vistula river. These posts were often accompanied by tables and maps in order to better illustrate the data and the environmental impacts of the Czajka malfunction. However, the infographics were typically presented as tables of raw data that would only be comprehensible to expert audiences. Although the media and experts could relay these findings in more comprehensible terms, this significantly limits the value of directly communicating directly with public audiences offered by social media.



IMGW-PIB informs about an update of the projected propagation of sewage from the failure of the Czajka treatment plant to individual locations along the Vistula River. Values may change due to the low flow of Vistula, difficulties in determining the real start of the crash and the work of the Dam in Włoocławek.

Although authorities sought to reassure the public, the issue had already become significantly politicised. Municipal and water authorities came under sharp criticism. On social media pages belonging to both left-wing and right-wing political entities, water authorities were typically critiqued for the technical management of the crisis, while municipal authorities were often criticised for their handling of public finances during the modernisation of the Czajka treatment plant in 2013. This is illustrated in the following two posts by public authorities directed at the responsible water company and Mayor Rafał Trzaskowski, respectively.

My comentary for #RadioWarsaw about #Czajka 📻 🎕 🗘 What sanctions, penalties threaten #MPWiK for dropping 3,6 billion litres of sewage into #Vistula 🎖 #RadnyLasocki

(5)! Failed projects and related expenditure. Warsaw's increasingly negative public opinion -Rafaał Otoka-Frrąckiewicz workshop accompanied by Warsaw councillors: Olga Semeniuk (PiS) and Pawe ła Lech (KO).

On the left of the political spectrum, political entities took a more measured approach in their public criticism of the handling of the crisis by the authorities of Warsaw. Moreover, they also highlighted the way in which the ruling PiS national government were politicising the crisis in order to discredit centrist and left-wing political opponents. For example, the following post by an environmental party critiques both Mayor Rafał Trzaskowski for the causes and response to the plant failure as well as accuses PiS of capitalising on the crisis to attack environmentalist groups more closely aligned with the PO.

The failure of the treatment plant #Czajka in Warsaw must not be underestimated. It needs to be explained why there was such a serious failure in the freshly built treatment plant and action to ensure that such crashes do not occur in the future. At the same time, it is irresponsible to sow fear by PiS politicians. The power is starting again with the hate campaign on ecological organizations. The government is for helping people, not frightening them!

Posts analysed by official and affiliated Facebook pages of PiS confirm that from the beginning of the crisis there was significant social media activity directed at discrediting Mayor Rafał Trzaskowski and the PO party over their handling of the crisis. Analysis of these posts demonstrate that the messaging was more orientated towards politicising the crisis than its management.

'! CALENDARIUM & WASTE IN VISTULA!! & #Trzaskowski informs the government about the failure in #Czajka with a 30-hour delay. According to experts #Trzaskowski, it may take weeks to repair and clog the leak. Poland is in danger of #ecological disaster. A Prime Minister Mateusz #Morawiecki is coming into action IIIII

'Platform governments in the capital: literally over the years, water and heating networks in @warszawa. #Czajka manifold failure, failure on Powsi ńska, failure on Jagiellonian and today a failure on Grrójecka. What else? What else?'



Political entities further right on the political spectrum published even more unconstrained posts attacking Mayor Rafał Trzaskowski's handling of the crisis. A common theme to emerge in posts from right-wing political parties and politicians was the linking of multiple policy issues with the Czajka plant malfunction. Typically, these posts criticised not only the management of the crisis, but also issues pertaining to LGBTQ+ rights, public taxation and expenditure as well as other municipal infrastructural projects.

[Mayor] Rafał Trzaskowski's work in 2019 clearly shows that for the benefit of citizens, the Civic Platform should stay as far away from government as possible! \rightarrow Increases in resident fees and taxpayer money subsidies to organisations promoting LGBT ideology \rightarrow Signing the outrageous LGBT Card + and implementing vulgar sex education into schools, based on so-called WHO standards. \rightarrow Hiding the Czajka sewage treatment plant for 29 hours (the most expensive sewage treatment plant in the world was created on the initiative of Hanna Gronkiewicz-Waltz, cost 6,5 billion PLN) - there was a huge failure in the treatment plant and many thousands of liters of contaminated thousands of liters of water. Although the whole situation was dangerous and threatened ecological disaster, the Warsaw authorities kept the case from the public for 29 hours. \rightarrow Instead of the promised beautiful square with underground parking, the so-called relaxation zone, i.e. wooden benches and loungers spread on concrete, for which... million zlotys were paid. \rightarrow Attempting to block the Confederation's Sovereignty March (he lost the fight against us in a court that overturned the president's decision).

While the contesting responses to crises is not inherently counteractive to their management and is indeed good democratic practice to ensure accountability to the public interest, there was little evidence in the sample that the degree of politicisation of the Czakja failure on social media contributed a net benefit for crisis management outcomes. A key issue to emerge in the first instance of the Czajka plant malfunction was the proliferation of online rumours that distorted information regarding the severity and impacts of the crisis. While this is not uncommon during crises, the Czajka case is unique from the other cases analysed in this study insofar that many online rumours were propagated by public authorities, an issue which became more pronounced in the second instance of the Czajka plant malfunction discussed below.

In response to mounting criticism, the social media activity of public and water authorities focused on repairing the reputational damage caused by the crisis following a strategy of corrective action. These posts typically focused on the concrete actions being undertaken by relevant authorities and crisis response teams to construct the pontoon bridge and emergency pipeline in collaboration with the armed forces. These posts were typically result-orientated and quantified efforts and progress to repair the bridge while highlighting collaboration between authorities.

The action is underway to stop the sewage drop to Vistula in Warsaw [] Half the equipment needed to build the pontoon bridge has already been collected. About 150 soldiers work on site. The Vistula bottom is scanned using the inspection boat of the Polish waters to determine the path of dinghyding, which will be combined into a flexible bridge. The action is coordinated by the Deputy Chairman of Polish Waters Christopher Wooś. The meetings of the crisis staff are participated Deputy Minister Anna Moscow #Czajka #SaveTheVistula!

Additionally, posts from water authorities in the post-crisis stage of the first instance of the Czajka malfunction also sought to repair the image of the plant itself and restore public confidence in its operations. For example, the post below illustrates efforts by water authorities to inform the public about the services provided by the wastewater treatment facilities.



As every Wednesday, in a sewage treatment plant ""Czajka"" we host young people from high schools and technicians. During the course, students can see what the process is mechanical - biological wastewater treatment. They have the opportunity to compare the various stages - sense \bigcirc and O! Below is a picture of the process samples in order from left to right: raw sewage, sludge from the reactor, the digested sludge, treated wastewater and tap water? You see the differences? #MPWIKWarszawa #Czajka #zobaczsam

On 30 August 2020, the second instance of the Czajka malfunction occurred nearly a year to the day of the first. Once again, the malfunction was the result of a fault in the pipeline connecting the left bank to the Czajka plant on the right bank of the Vistula.

Comparatively, municipal and water authorities adopted a more robust social media strategy during the second instance of the Czajka plant failure. Warnings were promptly provided to the public once the crisis occurred. While standardised warning messages provided on social media provided similar guidance to the first instance, improvements were made in clarifying the nature of the crisis, time of occurrence, location and recommended actions as illustrated in the following post.

'Attention Communication from the Chief Sanitary Inspector of August 31, 2020 due to the failure of the sewage transmission system of Czajka in Warsaw. The Chief Sanitary Inspector appeals: in the Vistula from Warsaw towards Gdansk A avoid bathing and water sports, A don't use river water to wash. #Czajka #zdrowie #bezpieczeństwo' [emphasis added].

Additionally, greater emphasis was placed on assuring the public that authorities were rapidly responding to the crisis earlier than in the first instance. For example, this message from Wody Polskie, the main water authority in Poland, provided public warnings that clearly outlined the known facts of the crisis, recommended actions as well as the measures being undertaken by public authorities and crisis managers to address the crisis.

'Today, a year after the sewage collector failure, there was another damage in the Warsaw sewage treatment plant #Czajka. The impurity from the Warsaw agglomeration is flowing straight into the river again. Attention! Attention! We warn all water users in Vistula, bathing, anglers, resting by the Vistula River, kayakers, farmers taking water to drink and to irrigate crops - about the risk of water pollution! We appeal not to use water in the river from Warsaw to the mouth of Vistula. Polish Waters Service is operating in the operating system. Approximately 3 thousand liters of wastewater flow to Vistula per second. At 20:30 there will be a crisis staff meeting, in which representatives of the RZGW in Warsaw will participate.'

Mayor Rafał Trzaskowski also provided early updates on his social media accounts, taking the form of press releases on Facebook. These posts were directed at presenting updates on the crisis and responses by authorities, shaping the narrative as a collaborative effort that would implement a lasting solution while assuring citizens that the river's contamination would not cause significant harm to the citizens of Warsaw and cities downstream on the Vistula.

I have two important updates for you on the progress in repairing the transmission network failure to the treatment plant #Czajka. Firstly - we are much closer to stopping the sewage flow to Vistula. Thanks to good cooperation with the Polish Military and the Polish Watoda State Farm, a temporary pontoon bridge will be created next week on Vistula. Today, the city's water supply company came to an agreement with the company that will lay a pipeline on this bridge. Thanks to this, in a few weeks, the whole installation should be ready - and then sewage from the left-wing Warsaw will be sent to the Czajka treatment plant again. Second, extremely important information - we also end conversations with companies that will perform brand new



drills under Vistula. It takes a little more time to break under the river bottom - a few months - that's why we decided to build a pontoon bridge. However, when two new pipes are ready, the sewage shipment to Czajka will be secured regardless of the season, for a long time. And that will give us time to reflect on the future of a damaged pipeline in an already existing tunnel. The one who unfortunately failed Warsaw for the second time. Finishing the sewage drop to the Vistula as soon as possible is an absolute priority. I would also like to remind you that thanks to the ozone of sewage from the first hours of the crash, environmental damage was significantly reduced. Water tests in the Vistula, which MPWiK continues to lead at many points of the river (all the way to Płoock!) they show that the current water quality does not differ significantly from the state before the crash. I also emphasize all the time and ensure that #WarsawKran ówwka is completely safe. In the following days they will update you on our follow-up. The moment I write these words, information about the failure and the corrective steps we have taken are presented at the extraordinary session of the Council Warsaw, called on my initiative. #RzetelnieoCzajce

Once the response was agreed by the multi-agency crisis team, social media was used to provide the public a clear plan of action to repair the failed pipeline. The following post exemplifies how water authorities made this information available on social media to provide citizens with a roadmap for halting the wastewater contamination of the Vistula.

According to the decision of the government of Poland, the #MilitaryPolskie will build a bridge across the Vistula and #WodyPolskie will provide pipes, necessary equipment and technical documentation used in the construction and operation of a replacement bypass by Wisla during last year's failure of the sewage system to the treatment plant #Czajka. A team of experts of Polish waters, experienced in the implementation of last year's emergency installation, is at the disposal of the City of Warsaw, which will supervise the construction and operation of the replacement installation. We would like to remind you of the scheme of last year's emergency installation, thanks to which 14 million m 3 of sewage was pumped into OS Czajka, protecting the Vistula from contamination.

As work commenced on the temporary pipeline, water authorities involved in the construction with the support of military engineers published frequent updates on the status of the repairs. posts by municipal and water authorities adopted a unique hashtag, #RzetelnieoCzajce, to indicate that the information provided was from official and validated sources. These posts adopted an active tone of voice, highlighting concrete progress in building the second pontoon bridge as well as the magnitude of the undertaking.

'Work in the area of the Vistula gaining momentum! On construction sites, on both sides of the Vistula, they are brought in pipes and equipment for the welding. The tubes are 1. In total we arrange them over a 3.2 km (1.6 km at the each of the filaments). #RzetelnieoCzajce Water Uponor Polish

See progress on the construction of a temporary pipeline. 🛱 working continuously day and night, do not slow down the pace. 🕑 #MPWiKinformuje #RzetelnieoCzajce Uponor City of Warsaw Poland Polish waters

During the construction efforts to build the permanent pipeline, heavy rainfall and resulting rising river levels threatened the integrity of the temporary pontoon pipeline. This entailed that portions of the pipeline had to be dismantled. The responsible authorities published immediate updates to inform the citizens of Warsaw of the threat, actions being undertaken to address the situation.



'[Update] Today, h. 18 taken off both pipes with pontoon bridge over the Vistula # lasts disconnecting pipelines. Due to the constantly rising water level in the river we have to act quickly and efficiently, and the operation is complicated. Keep your fingers crossed for us! #rzetelnieoczajce'

'The water level in the Vistula # constantly falling, so we started preparing for re-laying of pipelines on the pontoon bridge. According to the plan, this week has begun to cure and prepare the terrain for welding pipes. We do everything to restart the system was temporary as soon as possible. Our works are done in consultation with the Polish Army. More on our website: www.rzetelnieoczajce.pl:=:https://rzetelnieoczajce.pl/ City of Warsaw #MPWiKinformuje #rzetelnieoCzajce'

Once work was completed on the pontoon bridge, posts from water authorities outlined the measures that would be undertaken to establish a permanent solution, the timeframes for completion and the long-term implications for the citizens of Warsaw.

'Pipeline on pontoon bridge operates efficiently and Sunday wastewater flowing into the treatment plant #Czajka. i Now go into further activities and work as soon as possible to build a new, secure transmission under the river. Preparatory work is underway and the construction site already going down equipment, including wibromłotowe sets and steel sheet piles. At the same time on the site are the surveyors who carry out the necessary measurements. i MPWiKinformuje #RzetelnieoCzajce # InżynieriaRzeszów PPI Chrobok SA TPI - measuring solutions'

'Good news - we have already started drilling a new pipeline under the Vistula River - one of the two, which will eventually build MPWiK Warsaw. They will ensure secure transmission system for wastewater #Czajka. The first drilling should be ready at the turn of November and December. #RzetelnieoCzajce'

Additionally, agencies responsible for monitoring water quality posted updates on their findings to social media similarly to the first instance of the Czajka malfunction. However, these posts saw a significant improvement from those published in 2019 in terms of explaining the data to non-expert audiences. For example, the following post illustrates how scientific data was translated into accessible messages regarding the status of the Vistula in terms that matter to the public.

'Water in the Vistula is safe and has the right amount of oxygen! The minimum oxygen level for the Vistula is 7,4 mg / I. Studies show that oxygenation does not fall below the required level (in August before the failure, water had a worse quality for natural reasons). We are doing everything to ensure that the failure has the slightest impact on the water condition - from the first hours of failure, the sewage has been intensively ozone and mechanically cleaned. Let's say #ReliantlyChriday! Woda dla Warszawy'

While the municipal and water authorities of Warsaw adopted a more robust social media strategy in the second instance of the Czajka failure, as the second failure in the space of a year it was inevitable that criticism on social media would be severe. Within the sample, a significant proportion of posts were directed against Mayor Rafał Trzaskowski's record in public office, handling of the crisis and the launch of an official investigation by the prosecutor's office.

'Oops... I did it again 🛛 Rafał go away, save shame!! 🕿 🕿 🕿 🕿 🕿 Another failure, he won't get tired of it... 🕿 🕿 🧟 🧟 & 🖇 waria #CzajkaII #Czajka'



'Editor of Mazurek: What can the president of Warsaw give to all of Poland besides what the Vistula is already giving 🖗 🖗 🕼 🚜 #Trzaskowski #Czajka'

'Third disaster of the sewage treatment plant in Warsaw. How much sewage still has to pour into Vistula to make half of Poland understand that this guy is absolutely not fit to manage anything?'

'Minister Marek Gróbarczyk filed a notification to the prosecutor's office today about the possibility of pop. crime by the president of Warsaw Rafa ała Trzaskowski. The notification concerns failure to fulfil obligations and to harm the public interest (Article) 231 § 1 KK) for water pollution (Article 1 182 § 1 KK). More: https://www.pap.pl/.../news%2C709166%2Cgrobarczyk... #Czajka'

#Czajka #Trzaskowski #Warszawa Rafa ał Trzaskowski hasn't been taking care of Warsaw's issues for six months because he has more ambitious plans. Following the example of the Civic Platform, I urge President Rafa ała Trzaskowski not to return full-time to the Town Hall, not to even return part-time. I urge him not to return to City Hall at all. If Mr. President of Warsaw has higher ambitions than Warsaw's affairs, there is no point in him dealing with something as mundane as the city's sewage. Someone else better take care of it and Mr. President can fulfil his plans and calmly build a new political movement 🖸 Do you agree? Share! Share!

The official page of PiS was particularly prolific in sharing content discrediting the municipal authorities of Warsaw and personal attacks on Mayor Rafał Trzaskowski. These posts were typically accompanied by memes containing political satire and popular tropes circulating online.

'Rafał Trzaskowski's Logic is directly proportional to the amount of sewage that fall from the plant to the Vistula #Czajka 🔊 🗗 🌍 🗗 Law and Justice - Częstochowa County #PiS'

The levels of hypocrisy and embarrassment growing faster than the level of wastewater in the Vistula River. This truth about the pseudo environmentalists 😨 😰 🕸 Law and Justice - District #Częstochowa Częstochowa County Silesian #PiS #Polska #NaszeMałeOjczyzny #ŁączyNasPolska #Czajka #AwariaCzajka #Ekolodzy #Zieloni #Greenpeace #Protesty # PrażonaCebula #Warszawa #Trzaskowski #PO #Hipokryzja

Supporters of Mayor Rafał Trzaskowski typically deflected blame for the crisis by stating that the faults in the Czajka treatment plant that led to the failure pre-existed the modernisation of the plant in 2013. This indicates the adoption of a scapegoat strategy (see Coombs, 2007) for deflecting blame for the plant failure in combination with corrective action for mitigating reputational damage.

The #Czajka failure has its sources deep in the early investment stages. We need to be aware of how many years ago the mass need for sewage treatment looked like throughout Poland and the history of building the #Czajka itself is even older. Today we need to solve these issues systematically and what's important to the target. The threats of polluting Polish rivers are not only about Vistula.

Although the discourse regarding responsibility for the crisis is an important aspect of ensuring public accountability, analysis of the posts originating from public authorities highlighted that a consequence of the divisive narratives surrounding the Czajka failure was the dissemination of inconsistent information from public figures regarding the severity and impact of the crisis. The politicisation and sensationalisation of the crisis led to social media acting as a vehicle for polarised accounts of the crisis to be published in the public domain. On the one hand, opponents of the Mayor Rafał Trzaskowski and



the PO party heightened the severity of the crisis and often referred to the impact of the Czajka failure as a major 'ecological disaster', although water regulatory bodies had found otherwise.

' C Are we facing an ecological disaster? Right now we see this possible because we see dead fish. I am a MP from Gda ańsk, so I am preparing appropriate writing also for the authorities in Pomerania, because it is not only a matter of Warsaw, but also of our district. For now, as far as we know, the services are putting up a big question mark and saying it could be a serious failure. It's hard to deny that this has an impact on the environment' [emphasis added]

' MP Krzysztof July: How did it come to the same situation in a year after the crash. For this year, the president of Warsaw has done nothing about this matter to protect Warsaw and Poland from another disaster. **This is an ecological disaster**. Only after five days he applied for government support.#Czajka' [emphasis added]

' Control of President Rafał Trzaskowski.' [emphasis added]

On the other hand, public authorities loyal to Mayor Rafał Trzaskowski accused PiS and allied parties of being responsible for spreading online rumours and misinformation regarding the severity of the crisis, effectiveness of the responses deployed and conduct of the responsible municipal and water authorities. For example, in the following post, one political actor opted to start a series of posts to counter accusations originating from political opponents.

Me are starting a series of posts to bring down fake news. Failure of the sewage treatment plant Czajka @MULTIPUNCT | #Myth1: City Hall and MPWIK did nothing for a year since the last crash in 2019 - FALSE \bigcirc \checkmark The city's priority after both crashes was to stop the waste water drop into the river as soon as possible. A number of further actions were taken after securing this goal. 🗹 After August 2019, the city and MPWIK replaced 103 meters of the damaged pipeline. Appropriate additional procedures have been implemented checks. On August 27, a very deep inspection of the B thread - the one that split first. In addition to the test, the devices were personal inspections inside the pipeline. Check results were positive. Another action implemented additionally was the purchase of ozone equipment - during the second failure it started working immediately after the sewage drop off. The state of water in Wisla is also being investigated on a regular basis in several places in Warsaw and north of the city. The city not only did not neglect the case, but on the contrary: it imposed additional procedures on itself and the services. MPWiK was preparing a plan to build an alternative transmission, which can now be quickly implemented thanks to this job. The most important issue after August 2019 was the absence of an alternative pipeline in case of further problems (hence the construction of a pontoon bridge to stop the waste water drop). The company joined this task and a number of deep pre-project analyses were done. Now they are very helpful in realizing the second stage of the city's work. These analyses revealed that an alternative pipeline will be created by drilling under the bottom of the Vistula. They cost several hundred thousand PLN, not a few million, as you speculate online. #MówPrawde



Another political actor highlighted that claims by PiS politicians that the Czajka failure had resulted in a major ecological catastrophe were inconsistent with the findings of tests conducted along the Vistula river that indicated that the impacts of the contamination were minimal. While these findings may be correct, they are not internally consistent by stating that contamination of a major waterway is not environmentally damaging. Therefore, there are reasons to doubt their persuasive effectiveness.

GIOZ - We can't talk about the ecological disaster in the Vistula after the collector's failure 🛛 As experts disprove the myths and fake news of MPs PiS and TVP about Czajka and its malfunctions, they face disbelief of the latter. And measurements don't lie. 📉 Today we held an extremely important meeting of the Committee on the Conservation of the Environment, Natural Resources and Forestry of the Polish Parliament. According to the information provided by the Deputy Director of the Department of Environmental Monitoring in the General Environmental Inspectorate, p. Ma algorzata Marciniewicz-Myketa to the great disappointment of PiS MPs, the water in the Vistula after the failure of the Warsaw collector, last year was in measurements of harmful factors already at the height of Wyszogrod, which did not differ from the results comparable from previous years. 🧟 The same situation happened in Płoock, Bydgoszcz, Kiezmark and on the mouth of Vistula to the sea. One of the indicators has improved even after the failure (phytoplankton). Interestingly, this year's malfunction had, mainly due to the higher level of the river, an even smaller impact on the state of the river. And these are facts, these are reliable, resulted in measurement lessons learned by experts. 😰 🚍 🧐 🛱 Of course, PiS MP couldn't accept such an evaluation, MP Hoc, immediately alleged that GIUJ was using bad measurements, because after all, if the facts don't agree with PiS's opinion, it's worse for facts. It is also devastating that the opinion of MP P łazynski, who seems to not notice that the bottom of the W looc lawski tank is from almost the very beginning the gathering point of a huge mass of harmful settlement. Unfortunately, that's how dams operate, the river is best when it's unregulated. #Wisła #Środowisko #Czajka

While determining the degree of the ecological impact caused by the Czajka failure is far outside the scope of this study, the analysis of political discourse showed that the high degree of politicisation of the crisis led to inconsistent information being presented to the public. In such cases, information becomes diffused and encourages speculation and the creation of online rumours that are counteractive to measures to address the crisis.

6.5.3 Citizen Communications

User generated content analysed in the context of this study were equally divisive and politicised as those generated by authorities. Public posts published by the Facebook accounts of private citizens and organisations showed a high degree of dissatisfaction with the handling of the crisis by public authorities. Across both instances, frustration was often directed at the perceived inefficiency of public authorities in managing and operating public infrastructure.

'This time we take the floor! Another failure Lapwing is proof of the incompetence of the authorities of Warsaw'

'When will those in public life responsible for managing public property be professional? (This applies to every political party) # StopPudrowanymAmatoromWSamorządachiRządach #Czajka

'#Jedziemy | #Trzaskowski guilty of another failure Czajka. Marek Gróbarczyk: ignoring expert advice #Czajka #Warszawa #NiezaleznaPL")



The cost to public finances was another point of considerable resentment. The majority of posts intertwined three main financial issues contributing to public discontentment, 1) the cost of modernising and maintaining Czajka 2), the cost of repairing the plant and 2) and alleged mishandling of public finances.

'So far, PLN 7 million has been spent to determine the cause of the failure of collectors that drained sewage to the Czajka treatment plant. On the other hand, the solution that we are proposing - will cost about PLN 12-13 million, Warsaw President Rafa ał said on Tuesday Trzaskowski. It's about repairing the collectors and building an additional sewage thread. What do you mean @#% 7 million zlotys were spent to determine the causes of the failure, but they have NOT been established yet! Thieves. What are they doing, research drilling in Antarctica?'

Posts related to the public expenditure often implicitly or explicitly denoted a corruption scandal had been the reason for the Czajka failures.

'WASTE WATER AGAIN TO AFFECT Vistula, TRZASKOWSKI THOUGHT ONLY ABOUT MONEY and looting Warsaw 💫! '

'French company 'Veolia Water Tech' which built a waste incineration plant in #Czajka not working since the end of last year, known for tampering with contracts. Corruption scandal in Romania 2015 In March, #WorldBank banned her for one year for malpractice in Brazil: chihttps :// t.co/aZJ5mOr2eJ'

'!! Another failure of the sewage treatment plant Czajka and again the septic tank flows directly into the Vistula The last repair for 40 million PLN is probably the duct tape made by Mr. Trzaskowski

Another subtheme to emerge to dissatisfaction with the management of public finances was the perceived lack of accountability of public authorities for the crisis.

Everyone wants to take the money, but once you have take responsibility for the leakage of waste water, there are no buyers! "

'A sumptuous appetite, but there is no responsibility for mistakes and deficiencies... 🚱 #czajka #mpwik #trzaskowski #warszawa #zakichajsiewwarszawie'

Analysis of user generated posts during both instances indicate that the reputation repair strategies employed by the municipal authorities did offset criticism on social media and very few posts were found that defended the local governments actions. However, few posts directly accusing water authorities for malpractice were found in this dataset. This may be mostly due to the prominence of the mayor as a prominent politician, but it may also indicate that the strategy of corrective action used on social media by water authorities was effective.

As has been noted in the preceding section, the politicised and polarised discourse surrounding the Czajka failure led to the fragmentation of information on the severity of the crisis and its human and ecological impacts. As a result, misinformation was a more significant theme to emerge from the analysis of user generated content than in other cases examined in this study.

A frequently reoccurring instance of misinformation related to the Czajka failure found in the dataset was the discovery of dead fish in the Vitsula. While the death of wildlife in the Vitsula river was verified by multiple social media users and responsible authorities, the cause of death was determined to have been the result of other pollutants unconnected to the Czajka failure. However, Facebook users

associated dead fish found in the Vistula with the plant malfunction, such as the following post from a member of a Facebook group for recreational fishing that discovered dead fish in the Vistula.

'Today, the fourth day in a row, I arrive at the seat below the bridge in Nowy Dwór Mazowiecki; the water is covered with brown foam and hundreds of small and medium fish killed! Judging by the state of decay, they were killed on the day of the [Czajka] failure.'

Within the dataset, posts containing images of dead fish side by side with satirical images of Mayor Rafał Trzaskowski appeared frequently. These posts often contained unverified information and images of dead fish that were found not to be connected to the incident in question, leading to the continued spread of misleading information regarding the ecological consequences of the Czajka plant failure on social networks.

'Local specialties ... 😐 #ekologia #czajka #trzaskowski #karp #platformaobywatelska")'

'An anglers old proverb makes sense. 'If you go fishing, take soap and a towel, because if you catch it in the Vistula, you'll have something to wash your hands with ". Thanks Rafał!" #Czajka'

'And where is this sensitivity of this celebrity to the fate of fish??? #stenchTrzaskowki #czajka #Trzaskowski'

However, the dataset also showed instances of citizen moderation of online content to correct misinformation and provide accurate facts. For example, a not-for-profit Facebook page dedicated to monitoring and correcting misinformation in Polish media identified false or misrepresented images related to the 2019-2020 Czakja failures and provided correct information. The following two posts counter false images and misrepresented facts regarding the discovery of dead fish that were attributed to the Czakja sewage plant malfunction.

'Another manipulation associated with the "Chaika". This time the image was used from 2010. #lapwing'. [this post showed a meme with an false image of dead fish]

'Dead fish were indeed found at the height of Łomianki. However, photos and videos of dead fish are also circulating on the internet, which concern neither Vistula nor Łomianki, and are falsely attributed to the failure of the sewage treatment plant "Czajka". A post with incorrectly tagged material, among others, MP Beata Mazurek shared. More in the article $\Box \Box \Box \Box$.

Another post countered misinformation regarding a popular image used in social and traditional media for the crisis that misrepresented natural discolouration of the water at the confluence of two rivers as being caused by the Czajka sewage plant failure.

'The photo shows the completely normal colour of the Vistula, nothing to do with the failure of the Czajka treatment plant. In this place, Vistula mixes with Narwia, which is an interesting phenomenon known for many years. More in the article.'.

From a birdseye view, a community journalism page alleged the use of 'troll farms' to spread misinformation regarding the Czajka plant malfunction providing social media analytics to raise public awareness of the issue.

'This is just one example of how trolling and Facebook factories work in the service of PiS. Let's not believe anonymous accounts posts, they are not a source of reliable information, they are an instrument of propaganda, manipulation and misinformation.

Theme #Vistula #Czajka on social media:



More than 35 % of the profiles that take part in the discussion have less than 100 followers and were created in the 2 mc ost.



▶ More than 70 % of mention is created outside Warsaw

The most mention is made in warlowerlask, małopolska, Silesia, Pomeranian, Lodz'

While this report cannot verify whether 'troll farms' were active in the Czajka case based on the data available, evidence was found in support of coordinated posting. In one instance, 18 right-wing affiliated pages posted the same native post criticising water suppliers and municipal authorities within 00:05:11 minutes. In another instance, 16 centrist and left-wing affiliated pages natively posted the same post praising the actions of Mayor Rafał Trzaskowski within 04:47:43 hours. These posts point towards coordinated posting either from a single page administrator or a network of page administrators. In the contentious political environment surrounding the Czajka plant failures, crowd moderation and credible voices were an important asset in countering misinformation on social media.

6.5.4 Key Findings and Recommendations

- > As soon as a crisis is known, it is critical to alert the public. Delays in public alerts lead to reputational damage. If the causes and scale of the crisis is unknown, alerts can be provided in incremental stages providing details on the crisis as they emerge.
- Post standardised warnings on social media that concisely and clearly state the type of crisis, timeframe, location and recommended actions.
- Provide clear and accurate information on social media regarding the impacts of a water crisis on public wellbeing and livelihoods. This information should also explicitly inform the public of what is not a risk.
- Non-restricted data related to the crisis should be made available to the public. This information should be clearly and concisely explained with a focus on its implications for the daily lives of citizens.
- > Inform the public of the status of infrastructure after a malfunction as well as regular updates on mitigation, recovery and resilience operations. In the early stages, a roadmap for the restoration of services should be outlined to provide reassurances.
- While it is the responsibility of authorities to hold each other accountable as part of the checks and balances that are fundamental to democratic practice, authorities also have a responsibility to do so in a manner that is not counteractive to crisis management. Unchecked politicisation of crises on social media may generate or validate online rumours, misinformation, disinformation and panic.
- > Authorities should monitor public opinion on social media to inform public relations and communication strategies. Criticism and complaints can assist crisis communicators in developing their messaging and crisis managers in addressing the concerns of the public.
- > While misinformation and disinformation can spread through social media, it may also be used to counter it. Authorities must act decisively to counter misinformation and disinformation during crises. These can take the form of fact-checking posts and should follow appropriate social media practices for effective communication as well as engaging mediums such as images, memes, videos and infographics to name a few. However, these posts must be internally consistent to be persuasive.



Provide accurate information to be accessed by credible voices and agents of change that can identify and correct false information on social media.

6.6 Trinidad and Tobago: FSO Nabarima Oil Spill Prevention

6.6.1 Background

Of the cases considered in this study, the prevention of a major oil spill off the coast of Trinidad and Tobago is unique insofar as it is the only case that remained in the pre-crisis stage. At the outset, it is important to note that accounts differ, both within the data examined as well as desk-based research, as to the severity of the threat posed by the floating storage and offloading facility (FSO) Nabarima during the period examined. Official accounts from authorities often reported little risk of an oil spill. However, citizen generated content consistently countered official accounts. For the purpose of this case study, the severity of the threat posed by the condition of the FSO Nabarima is less important than social media communications that took place during the timeframe considered.

The FSO Nabarima is partly owned by the Venezuelan state-owned oil company Petróleos de Venezuela, S.A. (PDVSA) and the Italian oil company Eni¹⁰. However, US sanctions on the government of Venezuela and PDVSA resulted in a diplomatic impasse that impeded operations of the vessel in the Gulf of Paria that separates Venezuela and Trinidad and Tobago. Although the FSO Nabarima is stationed in Venezuelan national waters, the semi-enclosed inland sea separating the two countries would have entails an oil spill in the Gulf of Paria would be a major ecological disaster for both countries.

Warning of the deterioration of the FSO Nabarima first became public on social media. On 30 August 2019, a tugboat captain for PDVSA tweeted images of disrepair and flooding occurring on the lower decks of the ship. On 16 October 2019, photographs and drone footage was captured by an environmental watchdog, Fisherman Friends of the Sea (FFOS), that documented the Venezuelan oil tanker FSO Nabarima oil tilting precariously. Holding an estimated 1.3 million barrels of crude oil, the potential ecological damage caused by an oil spill is estimated to be five times that of the Exxon Valdez oil spill in 1989¹¹.

The images captured by FFOS were published onto their Facebook page. The publication of local user generated warnings led to the uptake of the story by international media, in turn placing pressure on national governments and oil companies involved to take actions to avert a major ecological disaster. The public authorities of Trinidad and Tobago were placed in a highly challenging position. On the one hand, their ability to take direct action to prevent an ecological disaster was very limited due both to the FSO Nabarima being stationed in Venezuelan national waters and the diplomatic standoff between the Venezuelan and US government. On the other hand, an oil spill of the magnitude that was projected threatened the environment, livelihoods and wellbeing of Trinidad and Tobago. Nevertheless, perceived inaction led to significant pressure from oppositional political actors, CSOs and the public to prevent this outcome.

¹⁰ <u>https://www.forbes.com/sites/nishandegnarain/2020/10/21/caribbean-threatened-by-13-million-barrels-of-oil-from-sinking-oil-tanker/?sh=531f5e761c3b</u>

¹¹ <u>https://www.smh.com.au/world/south-america/damaged-venezuelan-oil-tanker-fso-nabarima-draws-international-concern-20200903-p55rwj.html</u>



6.6.2 Authority Communications

During the timeframe examined in the dataset, there were 28 relevant posts on public Facebook accounts of public authorities in Trinidad and Tobago that made an explicit reference to the FSO Nabarima. This represents the lowest proportion of posts published on Facebook by public authorities across the cases examined, while posts from CSOs comprised the majority of dataset. Typically, information regarding the FSO Nabarima from public authorities were formatted as press releases. Portions of these posts sought to reassure the public that there was little risk of a major oil spill. Excerpts of a single post from the Ministry of Energy and Energy Industries (MEEI) illustrates authorities attempted to reassure the public regarding the status of the ship and the policy measures being taken.

'FSO NABARIMA The Ministry of Energy and Energy Industries (MEEI) continues to closely monitor the developing situation with regards the Venezuelan FSO NABARIMA. [...]'

Initial reports from the Venezuelan authorities indicated that the vessel was upright and in a stable condition. There was no risk of an oil spill. [...]'

Recent reports from the national press has stated that the vessel has tilted 5 degrees to the right and that it has sunk 14.5 meters at the water line. An ARGUS report dated September 2nd quotes a statement from ENI, the Italian Multinational energy company who has minority interest in the field. The report indicated that the FSO is stable and that the recent water leak has been solved. The report further stated that plans are afoot to transfer the crude oil to another vessel to further stabilize the FSO and that there is no risk of an oil spill. [...]'

'The MEEI has initiated official communication to get independent verification of the status of the vessel from the Venezuelan authorities in addition, the MEEI, through the Venezuelan Embassy in Trinidad and Tobago, has offered any assistance, technical or logistical, to the Government of Venezuela that it may require in this matter. Additionally, the Minister of Energy is in contact with his Venezuelan counterpart for further updates as they become available. [...]'

'The Nation needs to be reminded that Venezuela is a sovereign state and Trinidad and Tobago cannot unilaterally enter Venezuelan territory to conduct any reconnaissance or other works without being invited to so do [...]'

While this messaging is not dissimilar in strategy for public reassurance adopted by authorities examined in other cases, there are several flaws. Firstly, authorities opted to limit their engagement with the public on social media and posted updates on a matter of significant public interest infrequently. By doing so, other actors gained greater prominence in online discourse and controlled the narrative regarding the potential for crisis. When information was provided, its messaging, content and tone indicate that it was targeted primarily to the media and elite audiences rather than audiences who would be affected the most by an oil spill, such as coastal communities on the Gulf of Paria and particularly small-scale fishing enterprises. While press releases were shared by local and international media in the sample that was assessed, this approach used in isolation greatly limits the utility of social media as a direct channel of communication with the public. Finally, the reassurances provided did not outline concrete measures that the government would take beyond 'monitoring', limiting the effectiveness of the reassurance strategy. Finally, while the MEEI disclosed with candour the political situation, the shift of responsibility to Venezuelan authorities was unlikely to be positively received by the citizens of Trinidad and Tobago whose interests were threatened.

Similar to the Czajka oil spill case, authorities from opposition parties applied pressure publicly on social media to contest official reports of the potential crisis and critique government actions. Unlike the


Czajka case study, the politicisation of the FSO Nabarima had a net positive outcome in addressing the potential crisis. Particularly in cases where public authorities do not take timely or sufficient countermeasures to address a crisis, political contestation is not only good democratic practice, but also beneficial for effective crisis management. Calls from other authorities can lead to pressure for countermeasures, propose alternatives and raise public awareness of potential dangers. For example, this post from a sitting opposition parliamentarian countered the official narrative that the FSO Nabarima did not pose an environmental security risk to Trinidad and Tobago.

'Government must act now to avert possible environmental disaster. A potential major environmental crisis is currently brewing in the Gulf of Paria. For the past weeks the Venezuelan oil vessel the FSO Nabarima, which contains nearly 1 million barrels of crude oil, has been listing and leaking in the waters between Trinidad and Tobago and Venezuela. According to international news reports it is at "major risk" of sinking. If the Nabarima sinks it will trigger an ecological disaster of which Trinidad and Tobago has never seen.'

Social media posts by political opposition leaders typically accused the government of inaction, failure to implement pre-emptive crisis management plans and highlighted the potentially catastrophic implications to public wellbeing and livelihoods of the citizens of Trinidad and Tobago and their territorial waters.

'Given the imminent threat posed by this vessel, the Government ought to utilize every possible avenue to prevent a disaster. It is alarming that no emergency or contingency plans have been put in place in the event of a major oil spill. The Rowley regime, which has proven itself incompetent in dealing with serious issues, is once again failing our nation. I want to remind the government they have a duty under the bilateral treaty on oil spills to get accurate information on this situation, and secondly, it should have started to consider how it would plan for the worst case which is a spill headed towards our west coast. If the Rowley regime fails to act on the environmental threat the Nabarima presents, the entire fishing industry of Trinidad and Tobago may never recover, and our marine environment and coastlines would be destroyed.'

The government's reaction to the images posted on social media and criticism by the public and political opponents led to the adopted a strategy of denial. For example, this post made by the governing party's public relations officer, denounced the credibility of citizen generated evidence that the FSO Nabarima was in an unstable condition.

'Release from the Ministry of Foreign and Caricom Affairs on the FSO Nabarima: "On October 15th the Venezuelan Ambassador categorically described a new photograph being locally circulated on social media, which purports to represent severe tilting of the Nabarima in October, as total propaganda." #pnmonthejob #TheRightChoice'

The data analysed evidenced that Trinidad and Tobago government social media accounts altered their social media strategy with mounting pressure from political and civil entities. More frequent posting of concise and widely accessible messages with a focus on concrete actions replaced long-form press releases. Messaging and tone emphasised decisive action, strong leadership and solidarity. This is especially evident in the hashtags used by social media accounts used by authorities, such as '#wedoingthistogether', '#onwardsandupwards', '#pnmonthejob', '#GoodGovernanceInAction', '#forthepeople'. The following posts highlights this significant change in messaging and tone although preventative action had not yet been taken.

MEDIA RELEASE I The Government of the Republic of Trinidad and Tobago, through the Ministry of Foreign and CARICOM Affairs, remains **steadfast in its determination** to be granted



access to inspect the FSO Nabarima. Ensuring the Health and Safety of all citizens of this country takes priority and the Ministry will continue to utilize all channels to ensure that the required access is granted as swiftly as possible. A team of experts stands ready to make their assessments in order to determine whether any further action is needed to safeguard our country.' [emphases added]

Once the team of inspectors were granted access to the FSO Nabarima, the official Facebook accounts of the president and relevant governmental departments made this known on social media with an embedded video to provide visual evidence of the status of the oil tanker and the actions being taken by authorities. This was a rare instance in the specific case of the FSO Nabarima of authorities providing multimedia content to reinforce their messages to the public, engage their audiences and demonstrate tangible results.

As diplomatic barriers to the offloading of eased and the US granted permission for the Italian oil company ENI to begin offloading oil from the FSO Nabarima, the authorities Facebook accounts continued to provide updates to deescalate the potential crisis and reassure the public as well as repair their reputation as an effective authority.

'Minister of Foreign and Caricom Affairs Dr Amery Browne has said work on transferring crude from the FSO Nabarima to a more stable onshore site is going smoothly. The ship poses no danger to Trinidad and Tobago at this time. #GoodGovernanceInAction #forthepeople #weAREthePeoplesNationalMovement'.

The change of messaging, tone and content by the official accounts of the government of Trinidad and Tobago demonstrates the necessity for public authorities to carefully consider their social media strategy at all stages of a crisis and carefully consider the target audience and frequently engage them. Failure to do so may result in reputational damage as well as enable other actors to seize the narrative, placing themselves under increased scrutiny. The change of strategy of public authorities as discourse became increasingly negative by opposition leaders and civil society actors (see sections 7.6.3 and 7.6.4) demonstrates. Additionally, adopting a position of leadership and action rather than deflection or denial was shown to be more effective strategy for public authorities.

6.6.3 Citizen Communications

Over the course of the time period examined, CSOs played a critical role in warning authorities about the potential crisis. Facebook provided a platform for private citizens, civil organisations and online communities to directly and publicly engage authorities. In particular, FFOS, an environmental and social advocacy NGO in Trinidad and Tobago, played a key role in documenting the conditions of the FSO Nabarima. Drone images that showed the FSO Nabarima tilting perilously low in the water and were natively posted on the FFOS Facebook page.

'Nabarima Sinking Confirmed! #ffos #nabarima #oilspillthreat #urgent'

'New evidence shows that the FSO Nabarima is still a major threat to our Gulf of Paria #ffos #nabarima #URGENT'

In addition to images captured by FFOS, other social media pages posted images and videos that appeared to verify those captured by FFOS. For example, the recreational fishing page Trini Fishing Crew posted a video filmed on a smartphone from a small vessel circling the FSO Nabarima.

'Video of Venezuela-flagged Nabarima moored at the Corocoro field in the Paria Gulf showing it listing to starboard, was sent to me today and claimed to be taken today.'



These videos were widely circulated online and were taken up by national and international media, raising awareness of the situation. This had a two-pronged effect of warning authorities and the public who were unaware of the potential crisis as well as placing the issue on the policy agenda at both a national and international level.

In order to validate their account of the condition of the FSO Nabarima, the FFOS Facebook page published reports from reputable media outlets that challenged official narratives regarding the stability of the oil tanker.

'The New York Times has reported that the Nabarima, a Venezuelan Vessel anchored in the Gulf of Paria, containing approximately 1.3M barrels of oil "dangerously leans more than 5 degrees on its right side, it has also sunk 14.5 meters (47.57 feet), right at the waterline, a sign of excess weight. " Despite these international reports and appeals from FFOS Minister Franklin Khan has stated that the vessel is currently "upright and in a stable condition".'

In this case study, social media not only served as a means for civil entities to provide early warning of a potential threat to vital waterways, it also provided a platform to hold authorities responsible for ensuring that there was no potential risk of an ecological disaster in full view of global public opinion. This is what Coombs (2014) terms stakeholder activism, whereby civil associations and utilise social networks afforded by the internet to generate and spread content that challenges official narratives and raise awareness of issues in a coordinated way that may impact the reputations of the targeted organisations. The aim of stakeholder activism is to pressure organisations to change their behaviour. Thus, FFOS used social media as a platform to publicly petition authorities to take preventative action as well as criticise their inaction in public view.

'By letter dated 23rd September 2020, Fishermen and Friends of the Sea (FFOS) appealed to the Honourable Minister of Foreign and CARICOM Affairs, to hasten his efforts to ensure that Trinidad and Tobago acts with extreme urgency in preventing the greatest environmental disaster in Caribbean history [FSO Nabarima]. The Minister's assurances that this inspection was likely to take place on September 28th 2020 have proven to be less than truthful and given the Honourable Minister of Finance's failure to mention any mechanism for the improvement of our country's environmental stewardship within the recently concluded budget presentation, it seems like PM Rowley has turned a blind eye on this environmental threat.'

Due to the international dimensions of the situation, FFOS also used social media to make public appeals to the ambassadors of the US and EU.

'Today Fishermen and Friends of the Sea (FFOS) have written to the Ambassador of European Union (EU), His Excellency, Aad Briesebroek and again to the Ambassador of the United States of America, His Excellency Joseph Mondello, appealing to their good office for an immediate international response to the potential catastrophe that is looming in our Gulf of Paria. [...] We have asked Ambassador Briesbroek to encourage the EU to: 1) Place pressure on the Italian Government owned Ente Nazionale Idrucarburi, which owns a 23% share in the Nabarima to provide a blueprint of the ship and hull design to allow for an independent and scientific determination of the status of the vessel to be made so as to forecast and mitigate potential risks. 2) Take a proactive approach and mobilize its vast resources and technical expertise to contain and minimize the impacts of this spill, an undertaking we are certain that neither the Maduro regime or our reticent Government is capable of fulfilling. Further, we have asked Ambassador Mondello to advocate to the President of the USA, the Honourable Donald Trump, to temporarily ease the sanctions that the USA has placed on Venezuela thereby allowing the



international community to lend much needed assistance in averting this disaster. We hope that both of the esteemed Ambassadors can treat with the issue with the utmost urgency to prevent the greatest environmental disaster that the Caribbean has ever faced and to safeguard the Gulf of Paria for generations to come.'

The Ambassador of the United States to Trinidad and Tobago provided assurances on social media that efforts to stabilise the FSO Nabarima would not be impeded by the US.

'Statement on Nabarima October 16, 2020: The United States remains concerned by the potential risk to safety and environment posed by the Venezuelan-flagged vessel, Nabarima, in the Gulf of Paria. We strongly support immediate actions to bring the Nabarima up to international safety standards and avoid possible environmental harm, which could negatively impact not only the Venezuelan people but also those in nearby countries. PdVSA has a responsibility to take action to avoid an environmental disaster in Venezuelan waters. As a general matter, the United States' Venezuela sanctions program is not designed to target activities addressing safety, environmental, or humanitarian concerns. These activities to avert an ecological disaster are consistent with U.S. policy to support the Venezuelan people and avoid further harm to the environment. <u>https://tt.usembassy.gov/statement-on-nabarima/</u>'

Although posts appealing for US action pre-date the embassy's response by over a month, it should not be deduced based on available data that the US position was altered by civil actors' social media activity. However, the sample does indicate that CSO's, such as FFOS, as well as the media played a key role in framing the issue as an emergency and applying multi-channelled pressure on authorities, both national and international, to take action to avert a potential ecological disaster and social media provided a tool for spreading citizen generated messages to this end.

The strategy of using social media to raise public awareness and petition the government to take action was also taken up by other CSOs. For example, the IAMovement initiated a petition to the government to address the issue and encouraged its followers to share it across social media.

'All of the information you need to know about the FSO Nabarima, and the potential consequences if it sinks and there is an oil spill. Though not in T&T waters, the impact on ecosystems, fisheries and the economy in Trinidad would be massive in what is already a challenging time. Keep signing the petition and sharing it, and spreading information on this urgent issue!'

In the dataset examined, CSO's and private citizens played a key role in maintaining pressure and public interest in the situation by providing updates for fellow citizens of the actions or the lack thereof to stabilise the FSO Nabarima. FFOS continued to regularly provide updates on its Facebook page over the course of the time-frame examined, often highlighting risks and sharing links from the media and technical reports.

'FSO Nabarima Danger Continues #ffos #nabarima #oilspillthreat'.

'At this time two Venezuelan vessels are on the the [sic] way to the FSO Nabarima. The Nabarima is taking in water and listing starboard and is at risk of capsizing and spilling 1.3 milliom barrels into our Gulf of Paria marine food basket. FFOS are currently monitoring the situation.'

Other CSO's and community journalism pages frequently posted to their followers about the dangers of an oil spill of the potential magnitude posed by the unstable FSO Nabarima. The messaging of these



posts typically centred on the potential impact on the environment and resulting effects on the wellbeing and livelihoods of citizens of Trinidad and Tobago.

"The FSO Nabarima is tilting dangerously and is at risk of capsizing and spilling up to 1.3 million barrels of crude oil into the Gulf of Paria. This is 5 times the amount of the Exxon Valdez spill in 1989, one of the most environmentally damaging spills worldwide! A spill of this magnitude could have a catastrophic impact on the Caribbean region, with severe implications for wildlife, nearby habitats, human health and the economy."

'More than 50 percent of all fishing activity in Trinidad and Tobago occurs in the Gulf of Paria near to where the FSO Nabarima remains stranded. Marine conservation group SpeSeas says that any ensuing oil spill from the oil tanker has the potential to negatively impact local fisheries, ecosystems and more.'

Within the dataset, there was evidence of CSO's sharing each other's messages in order to increase their reach. Like other cases examined, cross-posting between social media accounts can act to amplify messages across follower networks and audience groups. This was illustrated in the dataset by the following posts the pages of the Institute for Small Islands and the Cropper Foundation, respectively.

'Conservation NGO Fishermen and Friends of the Sea called for urgent action, saying the spill could be one of the worst environmental disasters in the Gulf of Paria, if not addressed'.

'The Gulf of Paria is in danger!! Gary Aboud of Fishermen and Friends of the Sea - FFOS says he put his life in danger by breaching Venezuelan waters to visit the damaged and tilting FSO Nabarima oil tanker which has been stranded in the Gulf of Paria for three months carrying approximately 1.3 million barrels of crude oil. He says the trip was necessary because of the threat a potential oil spill of this magnitude would pose to marine ecosystems, fisheries and people throughout the Caribbean region. For more updates on this situation and other environmental issues, be sure to follow Cari-Bois Environmental News Network.'

Citizen pages also broadcasted the messages of public authorities from opposition parties to increase the validity of their demands for action. Drawing on the social capital of credible voices within parliament, CSOs aimed to validate their assessment of the severity of the situation.

"Venezuelan oil vessel FSO Nabarima is at risk of sinking and Government must act immediately to prevent any possible ecological fallout and threat to livelihoods. That's according to Tabaquite MP Anita Haynes who noted that the vessel contains nearly one million barrels of crude oil and has been listing and leaking in the waters between Trinidad and Tobago and Venezuela. According to international reports the 264-metre long ship is at "major risk" of sinking. Haynes, who accused Government of failing to act urgently, said should the vessel sink, much of T&T's coastline as well as its fishing industry would be devastated. She said: "If the Nabarima sinks it will trigger an ecological disaster of which Trinidad and Tobago has never seen. Our Marine coastline from Chaguramas to Icacos could be destroyed and along with it the livelihoods of thousands of people.'

As the situation progressed, CSO pages provided the public with regular updates on the actions being taken by public authorities. Analysis of these posts imply that their purpose was to keep the issue in the public eye and hold public authorities accountable by tracking their progress in addressing the situation.

'#UPDATE: Almost 1.5 months after this initial post, there is still local, regional and international appeals for action to be taken. Locally, many have criticized the government's perceived inaction and lack of alarm over the issue. A team of experts will leave Trinidad today to visit the



vessel according to the Newsday. #UPDATE: FINALLY Govt speaks with Venezuelan authorities on listing oil ship https://guardian.co.tt/news/govt-speaks-withvenezuelan-authorities-on-listing-oil-ship-6.2.1199363.a0edb08b33 #UPDATE: NYTIMES - A potential spill in the shallow inland sea that Venezuela shares with Trinidad & Tobago could damage fragile mangroves, fisheries and bird sanctuaries. The situation has raised alarm in Trinidad and the nearby Dutch Caribbean islands of Aruba, Bonaire and Curacao, said a second industry executive, who also insisted on speaking anonymously because they weren't authorized discuss the matter to publicly. https://www.nytimes.com/aponline/2020/09/02/world/americas/ap-lt-venezuela-sinking-oiltanker.html #UPDATE: Oil to be taken off damaged cargo vessel in Gulf of Paria NO TIMELINE GIVEN https://www.cnc3.co.tt/oil-to-be-taken-off-damaged-cargo-vessel-in-gulfof-paria/?amp #UPDATE: MINISTER OF ENERGY SAYS THE SITUATION IS BEING CLOSELY MONITORED. 18 NO INFORMATION ON POSSIBLE PLANNED INTERVENTIONS BY INTERNATIONAL AGENCIES AND RELATED COUNTERPARTS. MILLION BARRELS OF CRUDE OIL spills in the Gulf of Paria, it could be the end of our marine Food Basket and the livelihoods of tens of thousands of people either directly or indirectly in fishing communities from Chaguaramas to Icacos \square CALL ON THE AUTHORITIES TO INVESTIGATE THIS MATTER ASAP

Overall, the FSO Nabarima case illustrates the potential for social media to be used by civil actors provide early warning of a potential water crisis utilising smart technologies. Moreover, in cases when authorities do not act, social media also provides a medium for stakeholder activism between networks of political and civil entities that share complementary goals. By raising awareness, publicly petitioning, and monitoring the actions taken by authorities, pressure may be applied to change courses of action to avoid reputational damage. In this case, social media also enabled non-state actors to raise the issue onto the international stage and draw attention to the issue to induce international actors to make the necessary concessions to avert the crisis.

6.6.4 Key Findings and Recommendations

- With the widespread availability of smart technologies in combination with social media, citizens may provide early warning of threats and impending crises to authorities, the media and public.
- Denial and repudiation of responsibility are rarely effective crisis communication strategies when the actor in question shares responsibility for the crisis or its outcomes. Even in cases where authorities have limited culpability or control of a crisis, it is critical to demonstrate that actions are being taken to prevent or manage a crisis.
- Authorities should monitor the performance of their social media communications as well as public sentiment online and revise strategies based on the reception of their messages by the public.
- In cases where public interests and security are under threat, authorities and CSOs have a responsibility to act as checks and balances on each other during an emergency to ensure the optimal course of action is undertaken. Social media can provide a medium for stakeholder activism through collaboration between non-state actors to petition authorities in and raise public awareness of the threat.





7. Conclusion and Future Work

The aqua3S Social Engagement Guidelines aims to provide water suppliers, public authorities and first responders with guidance on how to effectively disseminate information to citizens before, during and after a water emergency. To achieve this objective, a detailed qualitative analysis of social media communications during water crises was conducted to answer three research questions:

- RQ1: In what ways do water and public authorities use social media to communicate with the public during water crises?
- RQ2: How do citizens use social media to communicate with authorities and with each other during water crises?
- RQ3: To what extent can citizen-generated content on social media be utilised by authorities as soft intelligence for early warning and situational awareness of water emergencies?

With regards to RQ1, this deliverable analysed the Facebook activity of public and water authorities in five water quality and quantity crisis cases. The findings of these case studies highlighted best practices as well as lessons learnt in crisis communications before, during and after a diverse range of natural and manmade water emergencies. Synthesising the results of the empirical research as well as previous studies in the fields of crisis communications and informatics produced a comprehensive set of social engagement guidelines. These recommendations provide guidance to optimise the use of social media as a crisis communication and management tool for engaging with the public during the pre-crisis, crisis and post-crisis phases.

As social media is a multi-directional medium of communication, this deliverable also examined the social media activity of a diverse range of public stakeholders (RQ2). This enabled issues such as public reactions to the crisis and messaging of authorities to be examined as well as communication between members of the public. Not only did the resulting findings highlight the receptivity of the public to the messaging of authorities, but it also illustrated ways in which social media can be used for participatory crisis management. Incorporation of these findings into the social engagement guidelines provides a more holistic set of strategies water and public authorities can draw upon to improve resilience against water crises through their social media activity.

Finally, this research evaluated the degree to which user-generated content can be utilised by authorities as a source of soft-intelligence for early warning and situational awareness (RQ3). Qualitative analysis of the textual content of Facebook and Twitter data highlighted significant potential for the detection of issues within the water network and their impacts to be detected at an early stage. However, limitations in determining the actionability of information obtained through social media was also identified. To enhance the ability of public and water authorities to determine the actionability of issues reported on social media, AIM provides a novel tool that builds on previous research on actionable social media information for emergency responders (see Zade et al., 2018), established intelligence evaluation methods and empirical work conducted in this deliverable.

These findings and recommendations contribute to the aqua3S project and wider research and practitioner community by delivering highly specified guidance to enhance the effectiveness of social media communications. Within the context of aqua3S, future work will deliver a set of standardised public warning messages aligned with the best practices identified in this deliverable for dissemination on social media channels (D6.2). In terms of contributions to crisis communications and crisis informatics academia, the results of the highly specified qualitative analysis of an understudied subject domain and SNS platform can inform further research, particularly through mixed-method and quantitative studies.



Ultimately, the resulting outputs of this deliverable seek to aid practitioners in utilising social media as a tool for engaging public stakeholders effectively to mitigate, prepare, detect, respond and recover from water crises.





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9. Appendix I Codebook

Node Name	Node Description
Authorities to Citizens	Communications from authorities targeted to public stakeholders.
Pre-Crisis	Posts published one week prior to the initial crisis event.
Preparedness and Prevention	Public engagement to enhance readiness for crisis at the individual and group level.
Public Warning Messages	Advance warnings of a water crisis disseminated by authorities on social media.
Raising Awareness	Sensitisation of the public to water quality and quantity risks.
Resilience Building	Fostering networks with public stakeholders and provide resilience enhancing resources to prepare and mitigate for crises.
Crisis	Posts published during the crisis timeframe.
Advice and Recommended Actions	Posts providing guidance on how to mitigate risks resulting from the crisis.
Authorities Collaboration	Evidence of coordinated social media activity between water authorities and / or public authorities.
Authorities Conflict	Posts by water authorities and / or public authorities contesting countermeasures implemented by responsible authorities.
Participatory Crisis Management	Efforts to include public stakeholders into the deployment of crisis countermeasures.
Coordinating Relief	Use of social media to direct citizens to the means of accessing relief.
Crisis Updates	Posts that inform the public on the status of the crisis and its impacts.
Guidance on reporting	Posts that direct citizens to the responsible authorities for reporting issues in the water network and receiving emergency assistance.
Response and Countermeasures	Posts that update public stakeholders on the corrective actions taken to respond to the crisis.
Toolkits and Resources	Digital tools and resources shared by authorities to improve self-efficacy during a crisis.
Post-Crisis	Posts published one week after the crisis timeframe.





Node Name	Node Description
Authorities blame each other	Posts from water or public authorities that blame the cause or outcome of the crisis on another water or public water authority.
Collaborating with Citizens	Evidence of public authorities working with civil entities in post- crisis recovery and learning.
De-escalation	Posts that state that the severity level of a crisis has been decreased and / or normal consumption and activities can resume.
Future Resilience	Posts that provide recommendations for mitigation and preparation after a crisis has occurred.
Post-Crisis Updates	Posts that inform the public on the status of recovery efforts, long-term impacts of the crisis and warn of post-crisis risks.
Assisting Community Recovery	Posts that inform citizens of how to access assistance, provide advice.
Citizens to Authorities	Communications from public stakeholders targeted at public and / or water authorities.
Pre-Crisis	Posts published one week prior to the initial crisis event
Soft Intelligence and Early Warning	Posts detailing eyewitness accounts of a potential crisis targeted at authorities.
Crisis	Posts published during the crisis timeframe.
Complaints	Posts by the public detailing discontent with the actions of authorities.
Corruption	Accusations of mishandling of public money.
Inaction	Complaints of a lack of response to remedy a crisis.
Lack of Communication and Engagement	Complaints that authorities have not been responsive to public interests or concerns.
Type of Response	Complaints that the wrong countermeasures have been implemented.
Reporting local issues	Posts that notify authorities of water quality and quantity issues.
Request for information and advice	Posts that ask authorities for information regarding the crisis and for recommendations.
Post-Crisis	Posts published one week after the crisis timeframe.





Node Name	Node Description
Criticism	Posts that critique the recovery efforts implemented by authorities.
Gratitude	Posts that express thanks for the efforts of public authorities, water suppliers and emergency responders.
Requests for Information and Assistance	Posts that ask authorities for information regarding the the aftermath of a crisis and for recovery recommendations.
Citizens to Citizens	Communications between members of the public.
Pre-Crisis	Posts published one week prior to the initial crisis event
Collaboration with Authorities	Posts published by private and civil actors that evidence coordinated social media activity with water authorities / public authorities.
Community and Local Warnings	Posts that provide localised warnings based on eyewitness evidence.
Community Preparedness and mitigation	Posts that evidence self-help mitigation and preparation for a crisis.
Raising Awareness	Posts by private and civil actors that aim to sensitise citizens of water quality and quantity risks
Resilience building	Posts that evidence local efforts to improve crisis resilience.
Sharing Authorities Warnings	Posts that explicitly share the public warning and alert messaging of authorities.
Crisis	Posts published during the crisis timeframe.
Collaboration with authorities	Posts that evidence citizen collaboration with authorities in crisis response efforts.
Criticism of Authorities	Posts targeted to other citizens that critique the responses of authorities.
Criticism of CSOs and Fellow Citizens	Posts that criticise the actions of members of the public or civil groups during a crisis.
Croudsourcing Information	Posts that pool information of a crisis from other members of the public.
Local Crisis Updates	Posts that provide eyewitness accounts of the crisis to update the public of local issues.
Political, economic and social flashpoints	Posts that highlight socioeconomic and political cleavages during a crisis that lead to contention.



Node Name	Node Description
Raising awareness	Posts that warn of risks due to the crisis.
Self-Help, Solidarity and Community Action	Evidence of self-organised participatory crisis management.
Sharing Authorities' Information	Posts that explicitly share crisis updates provided by authorities.
Post-Crisis	Posts published one week after the crisis timeframe.
Collaboration with authorities	Evidence of collaboration with authorities in post-crisis recovery efforts.
Community recovery	Evidence of self-organised crisis recovery.
Criticism of Authorities	Posts targeted at members of the public that critique the recovery efforts of authorities.
Future resilience	Posts that share information and recommendation for future mitigation and preparation after a crisis has occurred.
Post-crisis updates and advice	Posts that share information on the status of recovery efforts, long-term impacts of the crisis and warn of post-crisis risks.
Requests for information and assistance	Posts that ask other members of the public for aid in recovery efforts or further information.
Sharing authorities information	Posts that explicitly share authorities' post-crisis information and advice.
Emergent Communities	Evidence of the emergence of online resilience communities.
Misinformation	Evidence of false information and online rumours.





10. Appendix II Data Protection Impact Assessment

Research aims

The goal of aqua3S is to develop and enhance standardisation strategies for improving the safety and security in existing water networks. D6.1 analyses how social media can be used to support citizens' awareness of incidents within the water network. Data is used to create social media engagement guidelines to work with water companies and first responders to tailor their messages during water emergencies. Furthermore, analysis of social media data is conducted to understand whether information posted can be garnered as a form of soft intelligence for early detection of water issues.

Nature of data processing

A sample of Facebook posts collected from public pages and groups using CrowdTangle form the basis of this analysis. Sheffield Hallam University has a data management policy in order to ensure good research practice for research projects that concern the use of data¹². As part of this policy the university makes the following commitments that support good practice both technically and organisationally to support data management.

- All research data is stored securely on the University's networked storage system in both original and processed formats. The Research Store specifically designed for storing research data whilst research is on-going.
- Each folder on the research store is accessible only by a set of data custodians (who have responsibility for all research activities within a specific research centre, in this case CENTRIC) and specifically defined researchers who are carrying out the research. Access to all folders is monitored and audited and is only accessible through a university issued username and password.
- All files as a primary copy in one of the university's data centres and then replicated to a second data centre. Additionally, all files are backed up every evening to a remote location to provide redundancy whilst also ensuring they are secure and protected by firewalls and access permissions.
- Physical access to the data centre is restricted to the university's digital technology services operations team and is monitored by CCTV.
- > An updated copy of a metadata file must be stored alongside the research data
- If, in unlikely case, research data must be taken off-campus each researcher has access to an encrypted USB upon which they can store files or a secure VPN connection to access the Research Store from a university computer when working remotely.
- The university maintains policies on Electronic Data Encryption¹³ through their Electronic Information Security Framework¹⁴.

In terms of access of information posted to social media and utilised within this research the following technical and organisational measures will be applied:

aqua3S D6.1 – SOCIAL ENGAGEMENT GUIDELINES

¹² More information can found online at: <u>https://www.shu.ac.uk/research/quality/ethics-and-integrity/data-management-policy</u>

 ¹³ More information can be found online: <u>https://eisf.shu.ac.uk/pdf/ElectronicDataEncryptionPolicy.pdf</u>
 ¹⁴ More information can be found online: <u>https://eisf.shu.ac.uk/</u>



- Data is obtained using semi-automated methods provided by CrowdTangle to extract data from Facebook depending on the site from which the data should be extracted, and the requirements associated with collecting that specific data.
- Where personal data will be processed this will be in the form of names and usernames associated with social media accounts and posts. All data that will be directly analysed as part of the research will during the first stage of processing be pseudonymised.
- In the case of *Pseudonymised* data the identifiers- such as name and username- will be removed from the data source but the researcher will still hold the identifying information. This identifying information is a 'key' for the data, to enable the researcher to link the pseudonymised file to a particular person. The key will be kept *securely* and *separately* from the research data itself on a separate encrypted device separate. When the key is no longer needed, it will be securely destroyed.
- ➢ In this task account names and usernames will be pseudonymised by using one-way cryptographic hash function and by following the guidelines produced by ENISA.¹⁵
- Other identifiers (e.g., location, contact information) may also be present in the data, where possible this data will not be captured as it will not be necessary for analysis. In cases where the capture of such data is unavoidable this will be manually redacted from the dataset prior to further analysis.

Sheffield Hallam University maintains a research data archive to support the long-term data archiving of research data following the completion of a research project or activity¹⁶. Research data can be submitted without such data becoming public; however, the metadata description is publicly available. Data from this task would be unlikely to be made public as even with pseudonymisation the original data could be identified via searching for the post's content via Google or an alternative search engine.

Scope of data processing

Data was only collected from public Facebook pages and groups that are administrated from the case study countries of the UK, US, South Africa, Poland and Trinidad and Tobago. Data was collected one week prior, during and one week after the crisis in each case. In total, 35,439 Facebook posts were collected from pages belonging to public authorities, water authorities, CSOs, PSOs, online communities, community journalists and influencers. These posts underwent data validation using a stringent criterion to determine their relevance. This led to a final sample of 2,575 relevant posts being retained for analysis.

CrowdTangle is a Facebook-owned tool that tracks interactions on public content from Facebook pages and groups, verified profiles, Instagram accounts, and subreddits. Facebook data collected includes the username, post content, timestamp posted and engagement metrics. It does not collect activity on private accounts, or posts made visible only to specific groups of followers. Additionally, it does not collect the usernames of personal accounts that have posted onto public groups.

Context of data processing

¹⁵ ENISA (2019) Pseudonymisation techniques and best practices. *ENISA*.
 <u>https://www.enisa.europa.eu/publications/pseudonymisation-techniques-and-best-practices</u>
 ¹⁶ More information can be found online at: <u>https://shurda.shu.ac.uk/</u>

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The focus of this research is on the content and messaging of posts produced by organizations and members of the public. Traits or behavior of individuals were not analyzed. Informed consent was not sought out from the data subjects prior to data collection and processing. Therefore, robust procedures were placed to ensure that data processing safeguarded the rights and freedoms of the data subjects under Article 89(1) of the UK GDPR. These included data minimization and pseudo-anonymisation of personally identifiable information was implemented to the fullest extent possible (see Compliance and Proportionality Measures).

Purposes of the processing

The purpose for processing this data is in the public interest. This research aims to improve engagement between authorities and public stakeholders via social media by highlighting best practices and lessons learnt to optimize the ways in which public and water authorities adopt social media as a crisis management and communications tool. As such, this research aims to contribute the mitigation, preparation, detection, response and recovery of water quality and quantity emergencies, and thereby the fundamental rights of citizens.

Consultation with relevant stakeholders

Consultation with water companies engaged in the aqua3S project occurred through regular teleconferences. Through this engagement, the aims and requirements for the research were defined This guided the research aims and the types of data collected. Ethics approval for the research by CENTRIC as part of the aqua3S project was sought from the Sheffield Hallam University Ethics Review Committee and approved under application ER22016000.

Compliance and proportionality measures

The lawful basis for the processing of personal data is that it is in the public interest. The aims within this task are:

- To understand how organisations associated with the water network use social media to communicate information with citizens in the area through social media;
- To understand how members of the public communicate with authorities and eachother during water crises.

To understand whether issues of water quality within the network can be detected at an early stage through monitoring social media.

This involves two types of data processing activities:

Data processing activity 1: Collection and analysis of social media posts made by organisations involved in monitoring and reacting to incident that impairs the quality and/or safety of the water in the network.

Data processing aim: To understand how organisations associated with the water network use social media to communicate information with citizens in the area through social media.

Data processing description: Data is collected from organisational social media pages from organisations responsible for communicating with organisations involved in detecting, maintaining and communicating issues about water quality. Initial analysis indicates most organisations are only engaged through social media via Facebook.



Data collection in this phase will focus on content posted by organisations to limit the personal data collection. To the extent possible, only organizations within the countries of the water crisis cases will be examined. Data collection will make use of a mixture of semi-automated and manual collection. Data collected will include username, post content, timestamp posted, timestamp of collection, engagement metrics. Collection will focus on content that is direct communication to all followers rather than individual replies. Each piece of content will be assigned a unique identifier. In some cases, data will be collected from an organisation's page for the duration of the time period considered.

On some social media sites (e.g., Facebook) the organisation may share relevant content by posted by individuals to provide additional information to their followers. This data will be captured alongside the content list above with additional data protection steps in place. Posts collected that are made by accounts other the organisation will be detected by comparing the username with that of the page, if a mismatch is identified (and hence the post may belong to an individual rather than organisation) the username is hashed and the hash value is present in the main dataset.

A separate file will be maintained that contains the unique identifier assigned to the post, the username and a link to the post. This information will be stored separately and securely to the main dataset to be analysed and is only retained for reasons of accountability and integrity of the research data but will not be analysed further.

Data processing activity 2: Collection and analysis of social media posts made by the public about water quality issues.

Data processing aim: To understand whether issues of water quality within the network can be detected at an early stage through monitoring social media.

Data processing steps: Use of keywords that would indicate potential issues within the water network. Each of these search terms would be used in a Boolean AND search with the word 'water' (or appropriate translation to local language) to limit the results to those restricted to the water network as best as possible. Collection activity will focus on the locations of water crises considered. This will limit, to the extent that it is possible, data relevant to the project and only relating to issues of water quality / safety.

Collection in this phase will focus on individual posts in public Facebook groups and verified profiles. We assume the default position that each post collected is made by an individual and thus may contain personal data. Although CrowdTangle do not collect the account name and username of individual users that post content onto public groups, this information will be hashed upon collection of public pages and verified profiles of individual users with the exception of public figures and the original data stored separately and securely in a key table to ensure research accountability and integrity. Any post that contains the first name and / or surname of an individual is also redacted, with the exception of public figures. Any post that mentions the word house / home / apartment or similar undergo additional manual redaction to ensure that any personal addresses are not included in any further processing activities. Phone numbers and other contact information are also redacted in a similar fashion.

Each post is analysed to the extent that it could inform the water company about the quality of the water in that area or means of engaging with the public to improve crisis mitigation, preparation, detection, response and recovery. This analysis will be in the first stage mostly qualitative to identify



specific indicators that may be present in the network. The outcome of the qualitative research may form the basis of any further quantitative analysis.