BALTFLOODS, Baltic Flood Resilience and Digital Solutions

Deliverable 1.3
Citizen Engagement Strategy

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Interreg Baltic Sea Region

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RESPONSIVE PUBLIC SERVICES
BALTFLOODS

This project is co-funded by the European Union through the Interreg Baltic Sea Region Programme.

About the BALTFLOODS Project

BALTFLOODS aims to enhance flood preparedness and mitigate runoff pollution in cities across the Baltic Sea region by leveraging digital and technological solutions and engaging citizens as key stakeholders. The project addresses three main challenges aligned with the thematic scope of Priority 1 of the Interreg Baltic Sea Region Programme, particularly Objective 1.2. Firstly, BALTFLOODS will improve disaster preparedness and response to floods by implementing advanced monitoring systems that provide real-time data for timely interventions, benefiting local and national public authorities, infrastructure owners, and service providers. Secondly, the project will decrease the discharge of polluted stormwater, thus enhancing environmental quality and public health. This involves monitoring water quality through innovative approaches that support environmental and public health goals. Thirdly, BALTFLOODS will increase community engagement in flood and water pollution issues through participatory tools, empowering citizens and educational institutions to take an active role in environmental stewardship. By fostering a well-informed and proactive community, the project builds societal resilience to environmental threats. Transnational cooperation will be essential to facilitate knowledge exchange, policy alignment, and resource pooling to enhance the scalability and sustainability of the solutions, ultimately benefiting urban populations and the Baltic Sea Region ecosystem.

Learn more about the project:
www.interreg-baltic.eu/project/baltfloods

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Executive Summary

The BALTFLOODS Citizen Engagement Strategy provides a comprehensive, participatory framework for involving citizens in urban flood preparedness and stormwater pollution mitigation within the project and across the Baltic Sea region. As climate change accelerates flood risks, this strategy aims to foster inclusive, data-driven, and community-centred solutions by empowering citizens as active contributors and co-designers.

Grounded in citizen science and co-design methodologies, the strategy leverages the insights of diverse target groups—ranging from students, residents, and farmers to municipalities, researchers, and public service providers. Key pillars include structured co-design workshops, tailored engagement activities, and a communication and feedback framework to guide project implementation.

Three in-person workshops and seven structured interviews in Finland, Sweden, Norway, Poland and Latvia with regional stakeholders identified enablers and barriers to citizen participation. Key motivators included incentives such as certifications and gamified tools, while barriers involved trust, accessibility, and technological complexity. The aim of conducting these sessions was to gain insight into the needs and perspectives of our target groups, as well as to apply co-design methodologies as an effective approach to citizen engagement. The feedback collected from the workshops and interviews across aforementioned countries helped the incorporation of regional perspectives into developing a comprehensive citizen engagement strategy that can be applicable in not only the project countries but in the wider Baltic Sea region.

A core feature of the Citizen Engagement Strategy is the *BALTFLOODS Communication & Feedback Framework*, structured around five interrelated components: Information Provision, Data Contribution, Motivation Design, Accessibility & Inclusion, and Feedback & Trust. Complementing this is the AIDA model (Awareness, Interest, Desire, Action), used to craft targeted, persuasive messaging for different stakeholder groups.

Additionally, the present strategy presents practical guidelines for integrating citizen science into environmental monitoring, with attention to open data policies, GDPR compliance, data validation, stakeholder training, and continuous feedback loops.

The transnational value of BALTFLOODS lies in its coordinated cross-border approach, aligning local needs with scalable solutions across the Baltic Sea region. The Citizen Engagement Strategy is designed as a living document—continuously refined through iterative input from citizens, authorities, and experts—ensuring sustained impact and community resilience throughout the project lifecycle and beyond.

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Table of Acronyms

Acronym	Full Term	Description
AIDA	Awaress, Interest, Desire, Action	Communication model used for stakeholder outreach
CC0	Creative Commons Zero	Public domain dedication for data
D1.3/ D3.1/ D3.5	Deliverable Numbers	Internal project numbering for deliverables
ELY	Centre for Economic Development, Transport and the Environment	Regional public authority in Finland
FI	Finland	Partner country
GDPR	General Data Protection Regulation	EU regulation on data protection and privacy
GU	University of Gothenburg	Project partner/university
ICT	Information Communications Technology	Technologies for digital communication, information processing and related services
KPI	Key Performance Indicators	Metrics used to evaluate progress
LUT	Lappeenranta-Lahti University of Technology	Project partner/university
LV	Latvia	Associated partner country
NGOs	Non-governmental organisations	Civil society organisations
NO	Norway	Partner country
NTNU	Norwegian University of Science and Technology	Project partner/university
O2.2/ O2.3	Output numbers	Internal project numbering for outputs
PO	Poland	Associated partner country
SMEs	Small and Medium-sized Enterprises	Business size category
SE	Sweden	Partner country
SYKE	Finnish Environmental Institute	National environmental research institute in Finland
WP1.3/WP2	Work Package	Internal project structure naming
A1.3/A2.1/A2.2	Activity numbers	Internal project numbering for activities

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Introduction

As climate change intensifies the frequency and severity of flooding across the Baltic Sea region, the need for inclusive, data-driven, and community-centred approaches to flood preparedness has never been more urgent. The BALTFLOODS project responds to this challenge by enhancing flood preparedness and mitigate runoff pollution in cities across the Baltic Sea region by leveraging digital and technological solutions and engaging citizens as key stakeholders.

Consequently, the present BALTFLOODS Citizen Engagement Strategy is a structured framework for citizen engagement that empowers and involves citizens to play an active role in monitoring, planning and responding to urban flood risks and mitigating runoff pollution. As such, it aligns directly with the project's goal of incorporating public input into the design and implementation of solutions. The present strategy is formulated to support the preparation of effective engagement activities that are essential for gathering insights and fostering a collaborative approach to addressing the project challenges, namely the enhancement of disaster preparedness and community resilience against urban flooding by involving citizens in co-designing solutions.

The Citizen Engagement Strategy builds on the principles of citizen science and co-design, enabling a varied group of citizens (students, residents, farmers, commuters, fishermen, teachers) and project stakeholders (local/regional/national public authorities and service providers, schools and universities, NGOs and community organisations) to co-create solutions that are both locally relevant and transnationally scalable.

The key element of the strategy is based in a citizen science approach and a co-design methodology for designing public services with citizens in the Baltic region (Chapter 3). This is further defined into a unique iterative BALTFLOODS Communication and Feedback Framework for engaging citizens throughout the project, supported by the AIDA model for creating awareness and crafting target-group specific messaging to make citizens aware of the project (Chapter 4). To build this strategy, this paper also presents a comprehensive literature review of citizen science approaches, co-design methods (Chapter 1) and stakeholder and citizen engagement tools (Chapter 2) that informs and guides the strategy. Finally, it provides practical guidelines for local public authorities and infrastructure providers to integrate citizen science into environmental monitoring (Chapter 5).

In keeping with the co-design approach, BALTFLOODS organized three separate in-person workshops with citizens from varied contexts in partner countries Finland, Sweden and Norway and conducted seven structured interviews with a range of stakeholders, including municipalities, environmental institutes, local and regional public authorities. These workshops and structured interviews were instrumental to shaping how BALTFLOODS involves and interacts with the communities of the partner countries, and beyond.

With the involvement of diverse perspectives from different regional and community perspectives from partner countries the Citizen Engagement Strategy enables a transnational value of BALTFLOODS. This preparatory strategy lays the groundwork for more detailed citizen engagement activities in later stages of the project, ensuring that all subsequent efforts are well-coordinated, inclusive, and effective. In effect, the BALTFLOODS Citizen Engagement Strategy is a living document that will be revised and refined continuously based on feedback from citizens and other stakeholders, new insights from engagement activities (Table 4.0) and evolving community needs, ensuring its relevance and impact through the project’s lifecycle and beyond.

1. Literature Review

1.1 Citizen Science

Citizen science denotes the direct participation of non-professional volunteers in scientific activities. It is a relative new approach to knowledge creation and public engagement with science. Citizens can contribute to data collection, analysis, and interpretation across different disciplines of science; however, the exact way citizens can participate depends on the field science.

Citizen science expands the reach, resolution, and relevance of environmental monitoring by involving the public in real-time data collection, local observation, and problem-solving. It complements traditional monitoring systems by capturing hyperlocal insights—such as minor flooding, blocked drains, or infrastructure risks—that may not be visible to municipal sensors or staff. Equally important, it fosters civic responsibility, environmental literacy, and public trust.

The foundations of citizen science trace back to the tradition of natural science and natural history, and more recently, we have observed that citizen science has expanded significantly as technology has advanced. There are basically three different primary models of engagement with citizens and science (Bonney et al., 2009): 1) contributory projects where citizens role is to collect data, 2) collaborative projects that involve citizen participation in problem definition and data interpretation, 3) co-created projects where citizens work directly with scientists on all – or most – of the scientific tasks.

This typology demonstrates the evolution from data collection toward more sophisticated partnerships among citizens and scientists.

Examples of citizen science include digital platforms that are used for citizen science participation, and these have dramatically changed the game. Well-known Apps like eBird and iNaturalist have fundamentally changed biodiversity monitoring. They enable users in millions to contribute scientific observations. These observations then inform ecological research and conservation efforts. Earlier studies show how these platforms have the potential to generate datasets of unprecedented scale and geographic coverage, even though data quality remains a persistent concern.

However, citizen science has potential to extend far beyond data collection. Research (Finger et al., 2023; Peter, 2019) has shown some evidence of educational outcomes from citizen science projects, where participants develop improved scientific literacy, environmental awareness, and research skills. Citizen science also potentially enhances scientific capacity by providing access to resources and labour that would otherwise be unattainable (prohibitively expensive). Projects like Galaxy Zoo have showed how distributed human intelligence can tackle complex problems in a way that, for example, machines cannot.

Despite these advancements, challenges persist in citizen science implementation. Data quality requires careful protocol design, potentially training programs, and more mechanisms to validate data and findings. Participant retention is low, and studies (Bonter et al., 2023) show high dropout rates in many projects. Additionally, questions about representation and accessibility highlight the need for more inclusive approaches to broaden participation.

Recent scholarship (Vercammen et al., 2020) has examined the political dimensions of citizen science. Critics argue that some projects may exploit unpaid non-professionals while others question whether citizens have a say to genuinely influence the scientific agenda. Conversely, proponents emphasize citizen science's potential for democratizing research and addressing problems identified by non-professional community.

In the context of BALTFLOODS, citizen science provides a unique opportunity to involve local communities in environmental monitoring and urban flood preparedness. These guidelines aim to support the meaningful integration of citizen science into municipal flood risk management strategies, particularly through the development and use of digital platforms such as the Citizen Engagement App (WP2 – O2.2). The development and iterative use of the Citizen Engagement web-based tool enable citizens to engage with flood-related risks not just as end-users, but as co-creators of solutions. Their involvement ensures that digital tools are aligned with community needs, accessible to diverse users, and grounded in real-world contexts. When deployed through educational settings and local partnerships, citizen science becomes a vehicle for capacity-building and collaborative governance.

BALTFLOODS envisions citizen science as a foundational element in building climate-resilient communities through digital innovation, civic engagement, and educational integration. The strategic use of citizen-generated data supports multiple project objectives: it informs the co-development of inclusive engagement strategies (A1.3), enhances the functionality of digital tools such as the Application for citizen engagement (A2.2), and enables knowledge transfer to schools, universities, and citizens (A3.5). These principles are embedded in key deliverables including the present strategy in D1.3 (Citizen Engagement Strategy) and in D3.5 (Best Practices Handbook for Engaging Youth in Climate Change Adaptation). This vision also supports the goals of the Sustainability Handbook (Deliverable D3.1), which evaluates the social, environmental, and economic sustainability of project solutions. Data collected through citizen science—and insights gained from testing engagement strategies—feed into the present strategy's (D3.1) assessment framework, informing performance metrics, risk evaluations, and lessons for transnational scalability. In this way, citizen science is not only a method for engagement but a critical input for evaluating solution sustainability across the Baltic Sea region.

Together, BALTFLOODS activities reflect an integrated rationale: citizen engagement strengthens data, governance, and resilience—while simultaneously building inclusive pathways for long-term, scalable adaptation.

1.2 Co-design

Co-design represents a collaborative approach to design that fundamentally challenges traditional designer-centred methodologies by positioning users, stakeholders, and communities as active partners in the design process rather than passive subjects of study. This approach has deep historical roots in Scandinavian participatory design traditions that emerged in the 1970s, establishing a foundation for contemporary co-design practices that emphasize democratic participation, shared ownership, and collective creativity in design processes (Ehn,1993).

The Scandinavian tradition of participatory design emerged from a unique combination of democratic values, trade union activism, and technological development during the 1970s. Pioneering projects such as the UTOPIA project in Sweden and Denmark demonstrated how workers could actively participate in designing their own technological tools and work environments (Bødker,1987). These early initiatives were grounded in principles of workplace democracy and reflected broader Scandinavian social democratic values that emphasized collective decision-making and worker empowerment. Theoretical frameworks positioned design as inherently political, arguing that those affected by design decisions should have a meaningful voice in shaping outcomes. This approach challenged prevailing top-down design methodologies and

established participatory design as both a practical methodology and a philosophical stance toward democratic engagement in technological development.

Modern co-design has evolved beyond its workplace origins to encompass diverse contexts, including healthcare, urban planning, social services, and product development. Sanders and Stappers (2008) define co-design as "any act of collective creativity experienced by two or more people," emphasizing the collaborative generation of knowledge and ideas throughout the design process. This broad definition includes various forms of participatory engagement, from co-creation workshops to different types of community-based design initiatives.

Co-design methodology typically involves multiple phases of engagement, including problem identification, ideation, prototyping, and evaluation, with stakeholders participating as co-designers rather than users. The approach recognizes and celebrates the fact that the users possess experiential knowledge that professional designers may lack, creating opportunities for more contextually appropriate and user-centred solutions.

Contemporary co-design employs diverse methodological approaches adapted from the Scandinavian tradition while incorporating new techniques suited to different contexts (Simonsen and Robertson, 2012). Common methods include design workshops, cultural probes, storytelling sessions, and rapid prototyping activities that enable non-designers to express ideas and preferences. Digital tools have expanded possibilities for remote and asynchronous collaboration, though face-to-face engagement remains central to building trust and shared understanding.

The methodology emphasizes iterative cycles of reflection and action, drawing from action research traditions that similarly value practitioner knowledge and democratic participation in knowledge creation. Co-design sessions often employ boundary objects—tangible artifacts that facilitate communication across different knowledge domains—enabling participants with varying expertise to contribute meaningfully to design outcomes.

Co-design has found application across numerous domains, from healthcare system redesign to smart city development, demonstrating its versatility while raising questions about appropriate contexts and methods. The approach is especially valuable for addressing complex social challenges that require input from multiple stakeholders and that would benefit from locally situated knowledge.

Future developments in co-design are likely to grapple with questions of scale, sustainability, and redistribution of asymmetric power. As digital technologies enable new forms of participation, researchers and practitioners continue exploring how to maintain the democratic commitments of Scandinavian participatory design while adapting to contemporary contexts and technological possibilities.

In BALTFLOODS, co-design plays a key role in enhancing disaster preparedness by involving citizens in co-designing solutions to build community resilience against extreme weather events such as floods. Furthermore, co-design is the foundational approach to engaging citizens to design and improve public services that meet their needs. Our work in A2.2 informed by the present strategy based in the co-design approach will ensure inclusivity and transparency in decision-making processes to identify community needs and design application that addresses these needs. This approach ensures that solutions align with the needs and visions of citizen in pilot cities, and furthermore to the wider Baltic region.

1.3 Engagement of stakeholders and citizens

The aim of integrating citizen science and co-design approaches is to create a comprehensive framework for stakeholder and citizen engagement that extends traditional consultation models toward genuine partnership and shared responsibility. Building on the tradition of Scandinavian participatory design and contemporary citizen science practices, integrated stakeholder engagement recognizes that environmental challenges require diverse forms of knowledge and expertise that cannot be adequately addressed through expert-driven approaches alone (Reed, 2008). This perspective acknowledges that citizens and local stakeholders possess situated knowledge about their environments, lived experiences of risk and vulnerability, and contextual understanding that complements scientific and technical expertise.

The integration of citizen science and co-design creates an opportunity where participants would have a chance to engage not only in data collection but also in problem definition, methodology design, and solution development. This approach moves beyond the extractive model of traditional research toward reciprocal knowledge exchange and collaborative problem-solving. The combination would enable participants to transition between roles as data contributors, co-designers, and knowledge users, creating more sustained and meaningful engagement.

In the context of flood risk management, stakeholder engagement must accommodate various participant groups including residents with direct flood experience, municipal officials responsible for infrastructure and emergency response, school communities interested in educational outcomes, and technical experts managing monitoring systems and data analysis. Each group brings distinct knowledge, priorities, and constraints that must be recognized and integrated into co-design. The specific target groups in BALTFLOODS are explored and identified in the following section (Section 2.2).

2. Tools and Methods for Stakeholder Engagement

Combining co-design and citizen science requires a combination of different methods that consider the specific participant group, the design objective, and contextual constraints. The project uses tools and approaches that enable engagement of selected stakeholders. It draws on design thinking, participatory design research, and digital innovation research. Design thinking aligns closely with the democratic commitments of participatory design and offers a structured approach to the process of collaborative innovation. When design thinking, citizen science, and co-design are brought together, participants could engage in the different activities of problem identification, solution development, and implementation. Specific co-design methods such as the Business Model Canvas and Crazy8 were applied in the three in person workshops to support structured group ideation and planning. Detailed applications of these methods are discussed in Chapter 3.

2.1 Educational institutions as environments of engagement

The integration of stakeholder engagement with educational settings creates opportunities for sustained participation and knowledge transfer that extend beyond project timelines. School-based citizen science initiatives develop environmental literacy while generating valuable monitoring data, creating mutually beneficial relationships between research objectives and educational outcomes (Bonney et al., 2016). The BALTFLOODS integration with schools, universities, and NGOs/community organizations (A2.1 & A3.5) exemplifies how educational partnerships can create sustainable engagement models that persist beyond project funding periods. These partnerships develop local capacity for continued monitoring and adaptation while building broader environmental awareness and climate literacy. Involving schools and citizens in collecting data on stormwater quality, such as water pH, temperature, or pollutant levels can help raise awareness about environmental issues.

Co-design approaches in educational contexts enable students to participate as partners in problem-solving rather than as recipients of predetermined curricula. This approach aligns with contemporary pedagogical approaches that emphasise active learning, place-based education, and civic engagement. The combination of citizen science data collection with co-design problem-solving creates authentic learning experiences that develop both technical skills and civic capacity.

Stakeholder engagement in climate adaptation represents a form of environmental governance that complements formal policy processes through bottom-up knowledge generation and community mobilisation. The integration of citizen-generated data with municipal decision-making processes requires development of institutional mechanisms that can accommodate diverse forms of knowledge and evidence. This integration challenges traditional boundaries between expert and lay knowledge while requiring quality assurance and validation processes that maintain scientific credibility.

2.2 Citizen Segmentation, Stakeholder Analysis & Planned Engagement Activities

To carry out an appropriate stakeholder engagement, segmentation of our citizen user groups is necessary. Citizen segmentation is used to classify users based on how intensively they are affected by floods, whether directly or indirectly for designing level of citizen engagement in various forms. This segmentation ensures that engagement strategies are meaningful, targeted and proportional to the users' exposure and capacity to act. It also helps build relevance as people are more likely to participate when they see that the approach reflects their specific context and needs. Moreover, the segmentation is particularly helpful when the target group is diverse and 'one size fits all' approaches are not likely to work. This classification helps to better understand user diversity as a basis for more effective end user engagement as listed below in table 2.0.

Table 2.0: BALTFLOODS Citizen Segmentation

Classification	Definition	Target group
Primary user (end users/direct user/direct beneficiary)	An individual or groups who experience the physical, social and financial impacts of a flood and the consequences led by the hazards. Their capacity to prepare for, respond to and recover from the flood risk is limited.	Students Residents Farmers Commuters Fishermen
Secondary user (indirect user/indirect beneficiary)	An individual and institutions who interact and support primary users when an emergency occurs. They may influence or facilitate the experience of the primary users.	Teachers/Educational institutions NGOs Environmentalist Engineers
Tertiary users	An individual or institutions who operate at a strategic or systematic level.	Infrastructure and public service provider Researchers Policy makers

While Table 2.0 outlines the key citizen segments identified across BALTFLOODS project, understanding who these citizens are is only the first step. Effective engagement requires tailored strategy and associated activities for each group, considering their unique needs, motivations, and channels of access. The table below (2.1) expands on this by mapping the planned engagement activities to specific stakeholder types, offering a more detailed view of how these segmented audiences will be approached through targeted actions and partnerships.

Table 2.1: Stakeholder Analysis & Planned Engagement Activities

Stakeholder group	Role in the project	Planned engagement activities
Local Public Authorities/Municipalities **municipalities** *of Lappeenranta (FI), and Gjøvik (NO), in their capacity as policy makers and public authority on a local level & public service provider*	• Pilot sites for technical solutions • Provide local expertise on the conditions, challenges, and practical implementation • Distribute information (about climate change, results of real-time monitoring etc.) to the citizens and other users • Receive tailored solutions • Develop interactive tool for the citizens to report issues and identify environmental changes and give out alerts about sudden climate related changes. • Co-design public services in close collaboration citizens, stakeholders and other experts to tailor the public services aligned with the specific needs of the community.	Best Practice Handbook (A.3.2/D.3.2) Local training sessions (A.3.2) Webinars (A.3.2) Short explanatory videos (A.3.2) Attending fairs to network with other municipalities (A3.2) Citizen application with CC0 licence (O2.2) Citizen Engaging (A2.2)
Local public authority/ Municipalities and cities from all over the EU, as both public service providers & local authorities *Environmental health protection IKS (NO), Augšaugava Municipality Government (LV), Örebro municipality (SE), Lubuskie Voivodeship (PL), Municipality of Kępice (PL), Tallinn city (EE)*	• Co-create solutions through active participation in providing feedback about current situation of their municipalities • Learn from project the solutions that can be implemented at their municipalities • Aid networking with other municipalities	
Educational training centre/schools, *Elementary and secondary schools in Finland, i.e. Sammonlahti School (FI) Savitaipale Upper Secondary School (FI), Lappee School (FI)*	• Co-creators of solutions by collecting data on stormwater quality, such as water pH, temperature, or pollutant levels • Implement educational elements from project work	Citizen science campaign (A.3.5) Awareness campaigns (A.3.5) Open days (A.3.5), School events (A.3.5) Best Practices Handbook (A.3.5/D.3.5)

Higher education or universities, i.e. technical experts (in monitoring and data analysis) *Norwegian University of Science and Technology (NO), University of Gothenburg (SE), GFZ Helmholtz Centre for* *Geosciences (DE), Lappeenranta-Lahti University of* *Technology LUT (FI), Mjøslab IKS (NO)*	• Apply the data platform • leverage advanced algorithms and remote sensing technologies • Provide data-driven insights • Disseminate project knowledge to scientific community • Knowledge transfer via webinars and expert panels to create awareness regarding flooding risks and contamination issues	Peer-reviewed articles (A.3.3) Blog posts (A.3.3) Open Access data (A.3.3) Workshop for researchers/students (A.3.3/D.3.3) Preparing citizen engagement (A1.3)
National public authorities and policy makers *Hansestadt Demmin (DE), Swedish Environmental Protection Agency (SE), Polish Ministry of Climate and Environment (PL), Norwegian Environment Agency (NO)*	• To be mobilised to exploit project results at a policy level • Aid the implementation of solutions at a national level	Policy Briefs (2) (A.3.4)/D.3.4) Policy Labs (A.3.4) Webinars (A.3.4) Implementation Guides (A.3.4)
NGOs / community organisations *Saimaa Water Protection Association (FI), Finnish Association for Nature Conservation (FI), ASSOCIATION OF ATC ALL-UKRAINIAN ASSOCIATION OF L.S.G.) (UA) Volunteer Fire Department in*	• Aid implementation of project activities at a local level • Transfer results to local emergency structures • Facilitating cooperation between structures and communities • Disseminating project results	Targeted awareness campaigns (A.3.5) Local training sessions (A3.2) Citizen science campaign (A.3.5).

3. Methodologies for co-designing public services with citizens

BALTFLOODS builds upon existing citizen engagement structures that have already been in use for the past three years in the City of Lappeenranta. Previously, the city implemented a citizen science project involving primary school students' participation in water quality monitoring using testing kits. Additionally, a web-based tool was deployed to enhance public awareness, providing citizens with access to real time data on various environmental parameters such as air quality, stormwater conditions and weather-related information that includes humidity and temperature. BALTFLOODS focuses on further development of the application (O2.2) to enhance the usability and functionality of the existing tool. Furthermore, the tool will be further developed to include interactive elements so that it not only informs citizens about key environmental parameters but also enables them to provide feedback (e.g. on overflowing manholes or rising water levels. This two-way communication will support more responsive and participatory services.

Co-design methodology, which respects this two-way communication and feedback, was chosen as the approach for citizen engagement in BALTFLOODS. In preparation towards creating a comprehensive citizen engagement strategy based on co-design methodology, we carried out three in-person workshops using co-design methods – two with university students at GU and LUT and one with researchers/scientists at NTNU. In tandem with co-design methodology and to gain expert input and understand the current state of the art, BALTFLOODS used qualitative research methodology to carry out structured interviews with a varied range of stakeholders, such as local public authorities/municipalities, regional public authorities, research institutes, and local public service providers. The topics of these structured interviews included Water Quality Monitoring, V-Overflow, Data Protocol and Integration Framework, and Citizen Engagement and Co-design whereas workshops focused only Citizen Engagement and Co-design questions (see Annex for summaries). Both interviews and workshops were carried out between May and June 2025.

3.1. Implementing Co-Design with university students at LUT

Image 3.0: Workshop conducted by City of Lappeenranta in collaboration with LUT University

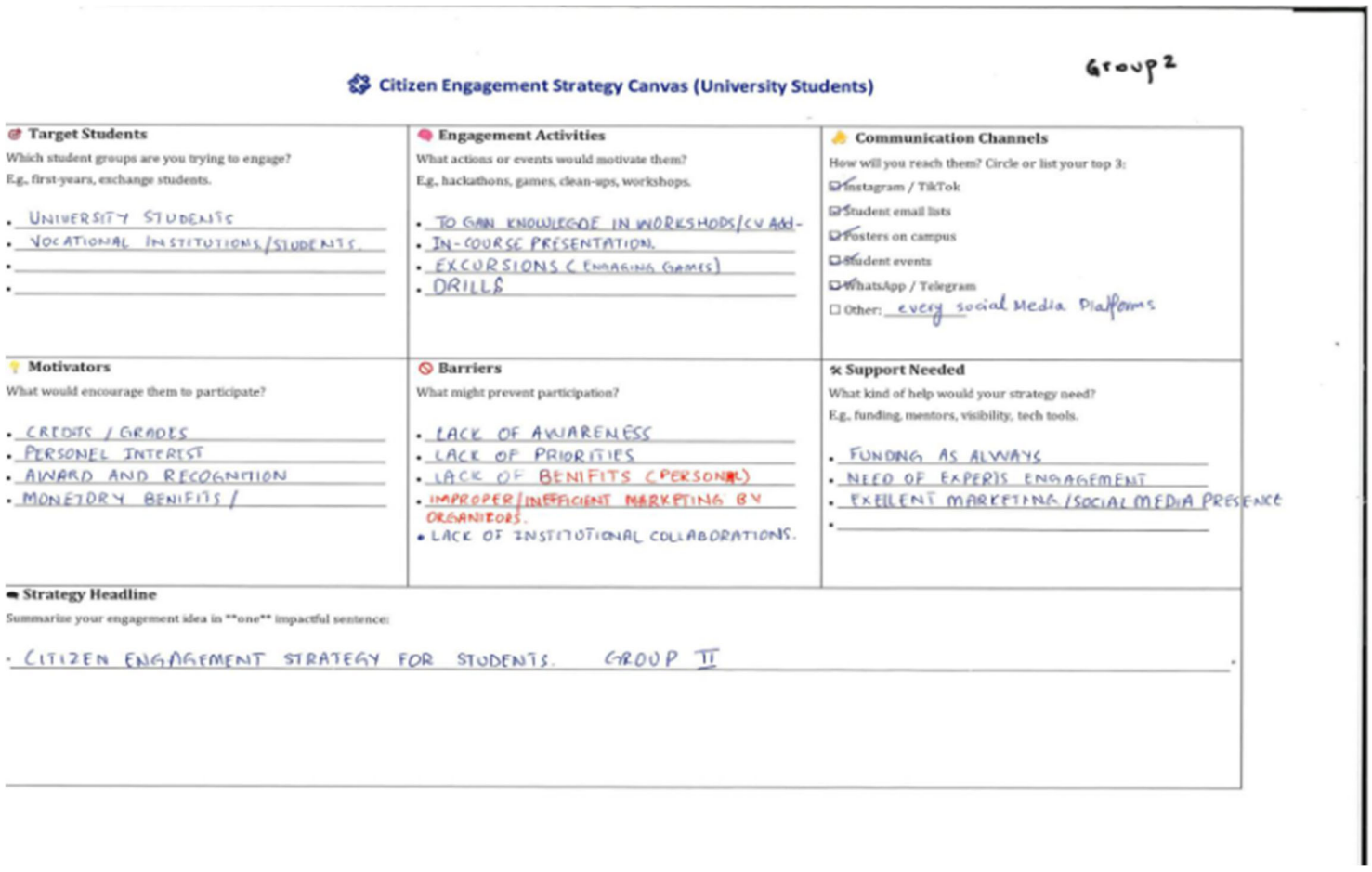
The first workshop with LUT university students was carried out by representatives of LUT project members and the City of Lappeenranta. The workshop brought together 11 participants from LUT University and one from LAB University of Applied Sciences, representing a range of academic backgrounds exploring how citizen engagement science can strengthen disaster preparedness and build community resilience against extreme weather events like floods.

It followed a structured co-design process tailored for this target group, aiming to explore how students perceive urban flooding and how they might participate in shaping local flood preparedness strategies. The methodology emphasized collaborative learning, creative ideation, and real-world applications.

The workshop began with a brief orientation on the BALTFLOODS project, highlighting the role of citizen engagement and the relevance of student perspectives in climate resilience. A participatory engagement approach was applied using Mentimeter, an interactive polling tool. Students responded to real-time word clouds, rating scales, and open-ended questions that assessed their prior knowledge of floods, their willingness to participate in flood-related monitoring, and their views on who should be involved in preparedness efforts.

During the workshop, participants were provided with a structured ***Citizen Engagement Strategy Canvas*** template (Image 3.0) inspired by **Business Canvas Model** framework (Osterwalder & Pigneur 2010) to work collaboratively in a group. The objective of the activity was to co-create strategies that encourage student involvement in preparing for, responding to, or preventing urban flooding. This canvas guided students through a seven-step co-design path—starting with identifying a target group and ending with designing a city-implementable solution. The tool was designed to support creativity, inclusiveness, and structured ideation. After collaborative group work, each team pitched their engagement concept. Peers voted on the most promising strategies based on realism, creativity, and impact.

Image 3.1: Group 2's Citizen Engagement Canvas



Group 2

Citizen Engagement Strategy Canvas (University Students)

Target Students
Which student groups are you trying to engage?
E.g., first-years, exchange students.

- UNIVERSITY STUDENTS
- VOCATIONAL INSTITUTIONS/STUDENTS.
-
-

Engagement Activities
What actions or events would motivate them?
E.g., hackathons, games, clean-ups, workshops.

- TO GAIN KNOWLEDGE IN WORKSHOPS/CV ADD-
- IN-COURSE PRESENTATION.
- EXCURSIONS (ENGAGING GAMES)
- DRILLS

Communication Channels
How will you reach them? Circle or list your top 3:
☑ Instagram / TikTok
☑ Student email lists
☑ Posters on campus
☐ Student events
☑ WhatsApp / Telegram
☐ Other: every social media Platforms

Motivators
What would encourage them to participate?

- CREDITS / GRADES
- PERSONEL INTEREST
- AWARD AND RECOGNITION
- MONETORY BENIFITS /

Barriers
What might prevent participation?

- LACK OF AWARENESS
- LACK OF PRIORITIES
- LACK OF BENIFITS (PERSONAL)
- IMPROPER/INEFFICIENT MARKETING BY ORGANIZORS.
- LACK OF INSTITUTIONAL COLLABORATIONS.

Support Needed
What kind of help would your strategy need?
E.g., funding, mentors, visibility, tech tools.

- FUNDING AS ALWAYS
- NEED OF EXPERTS ENGAGEMENT
- EXELLENT MARKETING/SOCIAL MEDIA PRESENCE
-

Strategy Headline
Summarise your engagement idea in **one** impactful sentence:

- CITIZEN ENGAGEMENT STRATEGY FOR STUDENTS. GROUP II

The session concluded with a Mentimeter feedback round to reflect on learnings and motivation. The workshop not only generated valuable ideas but also piloted a replicable format for integrating student perspectives into municipal co-design processes.

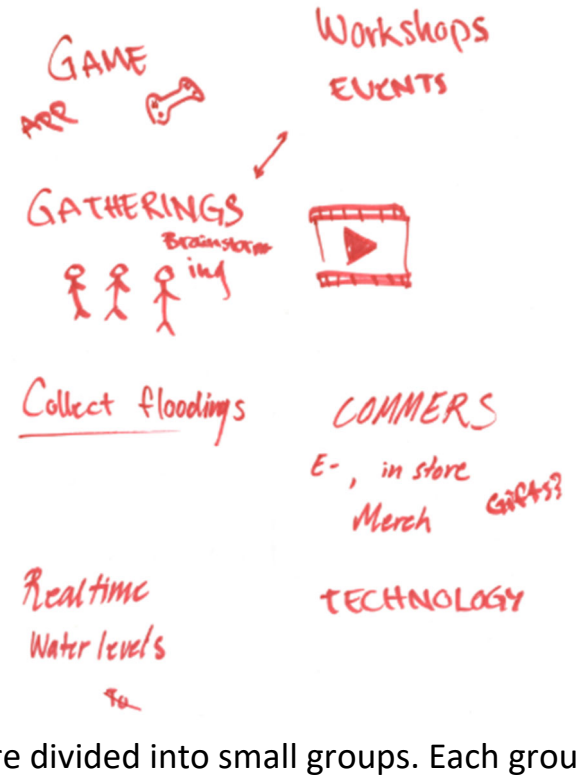
3.2. Implementing Co-Design with university students at GU

The second workshop at GU brought together 12 university students. It was designed as an engaging and structured co-ideation session with this target group. The workshop was embedded into their course in Data-Driven Organizational Development. The objective of the workshop was to understand how students perceive urban flooding, tap into their present awareness and local knowledge, and invite them to share their citizen needs in occasion of such disasters and continued citizen engagement. The methodology emphasized rapid ideation, interaction, and coming up with actionable concepts.

Image 3.2: Workshop conducted by University of Gothenburg for the students enrolled in course TIG326 Data-Driven Organizational Development

The workshop began with an introductory presentation by representatives from Lappeenranta and Gjøvik, providing context about the BALTFLOODS project and sharing real-world challenges and current flood mitigation measures in their cities. To stimulate creative thinking, a **tailored variant of the "Crazy 8s**" (Image 3.1) ideation technique was used. Crazy 8 originally means spending 8 minutes to come up with 8 ideas. We modified this approach by having the students participate in three timed sketching rounds, progressing from eight initial ideas to four refined ones, and finally down to two polished concepts. This format encouraged participants to move quickly beyond their first thoughts and tap into deeper creativity.

Image 3.3: Student's Crazy8s Drawing



Following the ideation phase, students were divided into small groups. Each group discussed their individually developed ideas and collectively selected the strongest ones to share with peers. Through informal presentations within their subgroups, students received immediate feedback, helping to refine their concepts further. The final step involved each group consolidating their insights into a single, shared concept. These group concepts were then pitched to the entire group.

This workshop format effectively combined individual creativity with collaborative refinement. It provided students with a clear path from personal insight to group consensus and showcased a replicable methodology for harnessing student-driven innovation in municipal co-design processes.

3.3 Implementing Co-Design with researchers/scientists at NTNU

The third workshop with researchers/scientists was organised as a "Colour-lunch" session at NTNU Gjøvik's Colourlab. 15 PhD candidates, post-docs and senior researchers—representing visual computing, colour science and remote-sensing—took part in a one-hour, in-person dialogue facilitated by the Gjøvik Municipality and NTNU staff. The objective was to uncover how research experts/scientists perceive stormwater problems, which visual cues and data products matter to them, and what kinds of tools could best connect scientific capabilities with citizen engagement needs. The session followed a three-phase structure modelled with a co-design logic used in workshops described in Sections 3.1. and 3.2. Municipal representatives opened with a concise problem narrative, which included recent flood incidents, regulatory drivers, and BALTFLOODS' goals as researchers were invited to note initial ideas on sticky cards.

Using a single plenary circle to preserve cross-disciplinary dialogue, facilitators posed three sequential prompts on which participants worked in groups:

- *Visibility*: "What makes water-quality or stormwater issues noticeable to you?"
- *Motivation*: "What would make citizens care enough to measure or report?"
- *Contribution*: "Where can visual-computing research add unique value?

After the brainstorming rounds, each breakout group organised its notes into thematic clusters for all three questions and then presented their consolidated insights in a plenary share-out. The plenary discussion distilled three cross-cutting opportunity spaces—real-time imaging for "visible" pollution, reward-based citizen apps —which were immediately framed as draft action statements (Who? What? By when?) to feed BALTFLOOD's pilot design in Work Package 2 and the Citizen Engagement web-based tool backlog.

This iterative group-plus-plenum approach proved effective for harnessing specialist creativity within the one-hour "Colour-lunch" format and can be replicated for other expert communities with only minor adjustment.

3.4 Implementing Qualitative Research Methodology with Varied Stakeholders

In preparation for the engagement strategy, a more traditional methodology of qualitative research was also carried out. A set of structured interviews was conducted with a range of relevant stakeholders to assess their practices, challenges, and priorities related to Water Quality Monitoring, V-Overflow, Data Protocol and Integration Framework, and Citizen Engagement and Co-design. The interviewees included the persons from the following organisations/stakeholder groups: City of Tampere (local public authority/municipality/FI), Centre for Economic Development, Transport and the Environment or Ely-keskus (regional public authority/FI), Finnish Environmental Institute (research institution/FI), Lappeenrannan Energiaverkot Oy (local public service provider/FI), Ministry of the Environment (national public

authority/FI), Kepice Municipality (municipality/PL), Augšdaugava Municipality (municipality/LV), City of Lappeenranta (Department of Streets and Environment/FI). In addition, tailored questions were created for national-level institutions to address specific insights and regulatory requirements.

A mixed methodology of co-design and qualitative research enabled a comprehensive understanding of how to engage citizens with varied needs and concerns in flood preparedness and disaster management. The students' perspectives were valuable in generating a first round of ideas on what methods work to keep citizens engaged in processes that allow the BALTFLOODS project to design appropriate solutions. The workshop with researchers/scientists on the other hand demonstrated what it takes to engage expert audiences, i.e. policymakers, professionals in data monitoring and visualisation, national public authorities, in the process of co-creating solutions. Simultaneously, the structured interviews enabled an understanding of the current situation along with highlighting the gaps that BALTFLOODS designed solutions should fill. It also aided the incorporation of diverse perspectives from regional contexts in the project as BALTFLOODS solutions are planned with an applicability in the wider Baltic region.

Table 3.0: Summary of methodologies used for citizen engagement

Experience	Participants/target groups	Methodology	Method
Workshop 1 by City of Lappeenranta	University students	Co-design	Business Canvas
Workshop 2 by University of Gothenburg	University students	Co-design	Brainstorming, thematic clustering
Interviews by Several Partners	Local public authorities/ Municipalities, regional public authorities, research institution, local public service providers	Qualitative research	Structured interviews

3.5 Summary of Findings from workshops and structured interviews

Community Needs and Motivators for Citizen Engagement

During the workshops, GU students emphasised a need for easy-to-access tools and simplified platforms to be able to report local flooding issues, receive responses from authorities, and get guidance on mitigation actions. When it came to motivation for participation and continued engagement, both students and researchers/scientists highlighted a rewarding system. For students at LUT, this meant getting study credits for a course designed for citizen engagement, certification that can be showcased later in their CVs, and social gatherings, such as bonfires and hiking. As for the scientific community at NTNU, lotteries were mentioned as an incentive for participation.

Barriers to Citizen Engagement

Lack of trust in data platforms, unclear incentives, and low perceived usefulness of digital solutions and tools for community engagement in flood monitoring were outlined by GU students as potential barriers. Practical issues, such as language barriers, event location, duration, and timing, can also pose significant obstacles according to students at LUT. Insufficient collaboration between institutions and ineffective marketing strategies were also deemed to reduce visibility and outreach. Finally, a lack of awareness of issues in flood prevention combined with unclear benefits for participation resulted in limited interest.

Improving Digital Tools and Technological Solutions for Citizen Engagement

On receiving information from authorities, participants from all three in-person workshops proposed several citizen-centred improvements that could encourage community engagement. GU students suggested a simplified platform to replace the now complicated service from the Swedish Meteorological and Hydrological Institute. According to them, this simplified version would include an interactive map with local flood risks, municipal project updates, and real-time alerts.

In relation to reporting information to authorities, gamification of citizen engagement digital tools cut across both GU students and NTNU researchers. Gamified flood monitoring app, inspired by Pokémon GO's location-based gameplay, that encourages users, especially youth, to report flood-prone sites by uploading geotagged photos or videos. App features such as daily quests, point-based rewards, and digital badges (engaging local artists), were suggested. Similarly, NTNU scientists mentioned interactive elements such as Stolpejakten next to monitoring points along with a similar proposal for apps to allow users to upload photos, track water quality and thereby aid community monitoring. GU students also suggested the integration of reporting tools within existing apps to avoid app fatigue and decreasing barriers to participation, whilst boosting legitimacy. A common method for reporting flooding and monitoring water quality, preferred by participants across all workshops, was submitting reports via text messages or simple online forms, and a map to report water rise in specific locations.

Information Needs of Citizens

When it came to the workshops with students, LUT participants emphasised the need for clear, actionable flood information: emergency contacts, blocked roads and areas, evacuation guidance, localised water level updates, and short-term forecasts. At NTNU, researchers/scientists expressed a desire for direct feedback and individualised information, e.g. individualised household testing for invisible pollution or a feedback mechanism if a problem has been fixed.

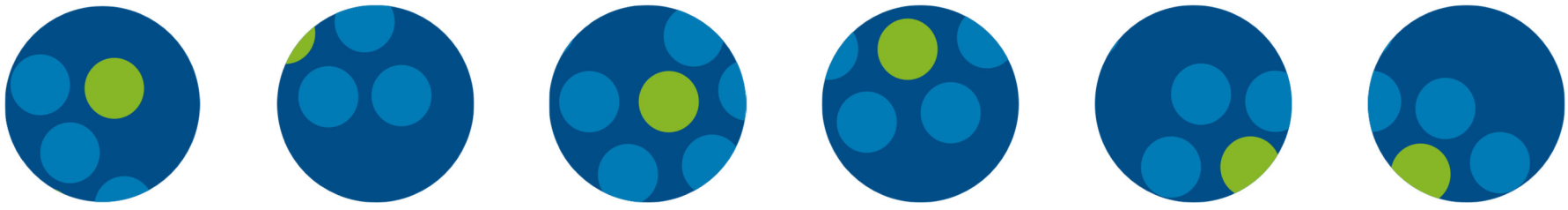
Information Needs of Authorities

Interviewees from municipalities, environmental authorities, utility services, ministries and companies across Finland, Norway, Latvia and Poland highlighted operational gaps, local needs, and emerging opportunities for more collaborative and data-informed stormwater management. Furthermore, municipalities like Kępice (PL) and Augšdaugava (SE) described frequent flooding events during spring melt or after heavy rainfall, often compounded by outdated or missing drainage infrastructure. Interviewees noted that current monitoring systems—if present—are limited in scope, rely on manual reporting, or are fragmented across multiple departments. For example, Kępice does not operate a structured monitoring system but expressed a need for real-time and predictive data to anticipate risk and coordinate response. Augšdaugava, while also lacking formal systems, emphasised the importance of data sharing across administrative units in areas with high flood risk. Institutions in Finland, such as the Finnish Environment Institute (SYKE) and ELY Centre, noted technical barriers to data interoperability and highlighted the challenge of accessing consistent hydrological information. From Norway, stakeholders including Xepto and Environmental Health Protection IKS emphasized the need for tools to identify deviations in drainage capacity and water quality in real-time—capabilities currently absent in many local systems.

Low Public Awareness

A cross-cutting insight from the structured interviews was the underutilisation of citizen engagement in environmental monitoring. Interviewees indicated that public awareness is often low, with limited mechanisms to report observations or receive timely feedback. Even where mobile apps or data dashboards exist, they are often not designed with user accessibility in mind. Interviewees widely supported co-designed solutions that allow for both community input and real-time information dissemination. This was also reflected in the workshop with researchers/scientists that emphasised the need for more public awareness workshops on issues of flooding and water monitoring, including the public's engagement.

The learnings from the workshops and structured interviews reinforce the BALTFLOODS objectives by emphasising citizen engagement, accessible and visually supported tools, real-time data contribution and strong feedback mechanisms, all of which strengthen flood and pollution prevention. For the Citizen Engagement Strategy, this means prioritising co-design approaches, developing intuitive digital interfaces, incorporating real-time citizen data into official systems, and ensuring that technological innovations support transparent, motivating, and inclusive participation.



Co-design approaches | Intuitive digital interfaces | Incorporation of real-time citizen data | Strong feedback mechanisms | Accessible and visually supported tools | Inclusive participation

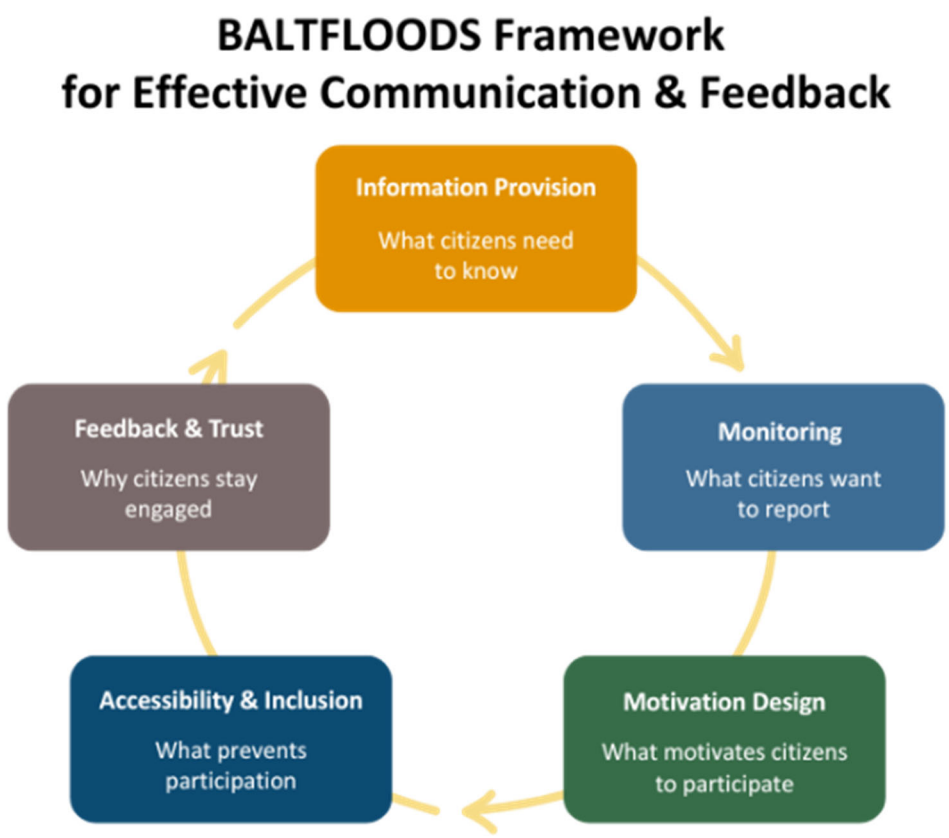
4. Frameworks for effective communication and feedback

4.1 BALTFLOODS Framework for Effective Communication and Feedback

BALTFLOODS communication and feedback framework was developed based on findings from co-design workshops with citizens and structured interviews with municipalities, ministries, and environmental agencies. These activities revealed clear needs and opportunities for improving how citizens receive, contribute, and respond to flood-related information, which forms the foundation for a structured and inclusive engagement model.

This framework, presented in Figure 4.0 comprises five interrelated components: Information Provision, Data Contribution, Motivation Design, Accessibility & Inclusion, and Feedback & Trust. Together, these components form a scalable approach that not only supports citizen engagement in flood preparedness but also strengthens institutional responsiveness and data-driven resilience planning.

Figure 4.0 BALTFLOODS Framework for Effective Communication & Feedback



Information Provision

This component ensures delivery of timely, accurate, and localised flood-related updates. It emphasises actionable alerts such as blocked roads, water level surges, emergency contacts, and evacuation routes. The strategic aim is to enhance public preparedness by providing people with the right information at the right time.

Monitoring

This element highlights the channels through which citizens can share real-time, geolocated data, such as photos, mapped locations, and checklists. The goal is to empower citizens as contributors to environmental monitoring, closing information gaps. Preferences showed tools that reduce complexity, such as maps and online forms, while municipalities expressed interest in data that complements official systems.

Motivation Design

The importance of motivation for sustained engagement was underlined. Examples of motivating factors include social recognition, providing feedback or follow-up to citizens who reported flooding areas, study credits, and co-design experiences like hackathons. Institutions echoed the value of locally relevant campaigns and partnerships. This component aims to embed incentives that resonate with each audience.

Accessibility & Inclusion

Findings revealed barriers related to language, digital literacy, and unclear event logistics. Municipal actors also stressed inclusiveness when involving youth and marginalized groups. As a result, this component promotes multilingual interfaces, visual communication, and hybrid participation options. The goal is equitable access for all user groups.

Feedback & Trust

A key insight was the need for visible outcomes. A need to know that their contributions had an impact was highlighted. Municipalities seek transparency and trust in public interaction. This component promotes feedback mechanisms, such as acknowledgements, updates on action taken, and interactive dashboards—to show how user input leads to real change.

Table 4.0: Framework, Implementation and KPIs

BALTLFOODS Communication & Feedback Framework	Implementation	KPIs
Information Provision *Partners Involved: All* *Associated Partners Involved:* *Finnish Association for Nature Conservation, Savitaipale Upper Secondary School, Sammonlahti school, Lappee school, Hansestadt Demmin*	Local demonstration 'open days' showcasing technical solutions and preparedness activities in demonstrator cities Lappeenranta (A3.5/A2.2), regional micro-campaigns on social media in local languages (A3.5) emphasising localised flood risks, mitigation actions, and engagement opportunities, using stories from schools, NGOs, and community leaders, regular updates on integrated data platform dashboards, accessible to the public (O2.3), visual storytelling via short explanatory videos and animations co-created with schools and youth published on partner school websites (A3.5).	At least 1 open day held per demonstrator city with ≥25 visitors each ≥ 1000 impressions (likes, shares, comments) across social media channels At least 2 short stories disseminated to target audiences
Monitoring *Partners Involved: All* Associated Partners Involved: Savitaipale Upper Secondary School, Sammonlahti school, Lappee school, Volunteer Fire Department in Biesowice, Saimaa Water Protection Association, Finnish Association for Nature Conservation, ALL-UKRAINIAN ASSOCIATION OF LOCAL SELF-GOVERNMENTS	Citizen science campaign to engage citizens, school pupils, teachers and students focused on data collection through accessible data platforms in demonstrator sites (A3.5), Webinars and expert panels to raise citizen awareness (A2.2), school-based citizen science labs for water quality monitoring (A2.2, A3.5), gamified data collection challenges within the citizen engagement app (O2.2, A2.2)	Number of active citizen scientists engaged: ≥100 citizens actively participating in data collection activities Diversity of participants engaged in citizen science campaign: Involvement of at least 3 schools and 4 NGOs/community groups across partner cities 1 webinar 1 expert panel towards citizen awareness
Motivation Design *Partners Involved: All* *Associated Partners Involved: All associated partner schools and Mjøslab IKS*	Interactive eLearning modules that offer certificates and/or study credits (A3.5), information stands on open days in schools in partnership with universities and SMEs (A3.5) Integrated co-design curriculum for university students	At least 100 participants complete eLearning modules, i.e. 100 certificates given out ≥50 citizens engaged via information stand ≥150 students/citizens engaged
Accessibility & Inclusion *Partners Involved: All* *Associated partners Involved: All*	Best Practice Handbook for Engaging Youth in Climate Change Adaptation (D3.5) published in local languages, Targeted awareness campaign (A3.5) via social media in country languages, including videos for simplified explanation of flood preparedness and stormwater management, Visually rich online courses with quizzes and local case studies (A3.5), Flood Risk Awareness Infographic Series in schools and social media (A3.5)	Best Practice Handbook published in 3-4 local languages and downloaded at least 50 times ≥15 reshares of the videos on partner and associated partner social media channels At least 3 online courses are created
Feedback & Trust *All associated partner public authorities*	Localized dashboards integrated into citizen application tool (O2.2) Segmented newsletters to inform citizens about actions taken and project impact (A3.5)	At least 60% if tool users report increased trust in flood management efforts (measured via in-app survey) 3 newsletters published in third year

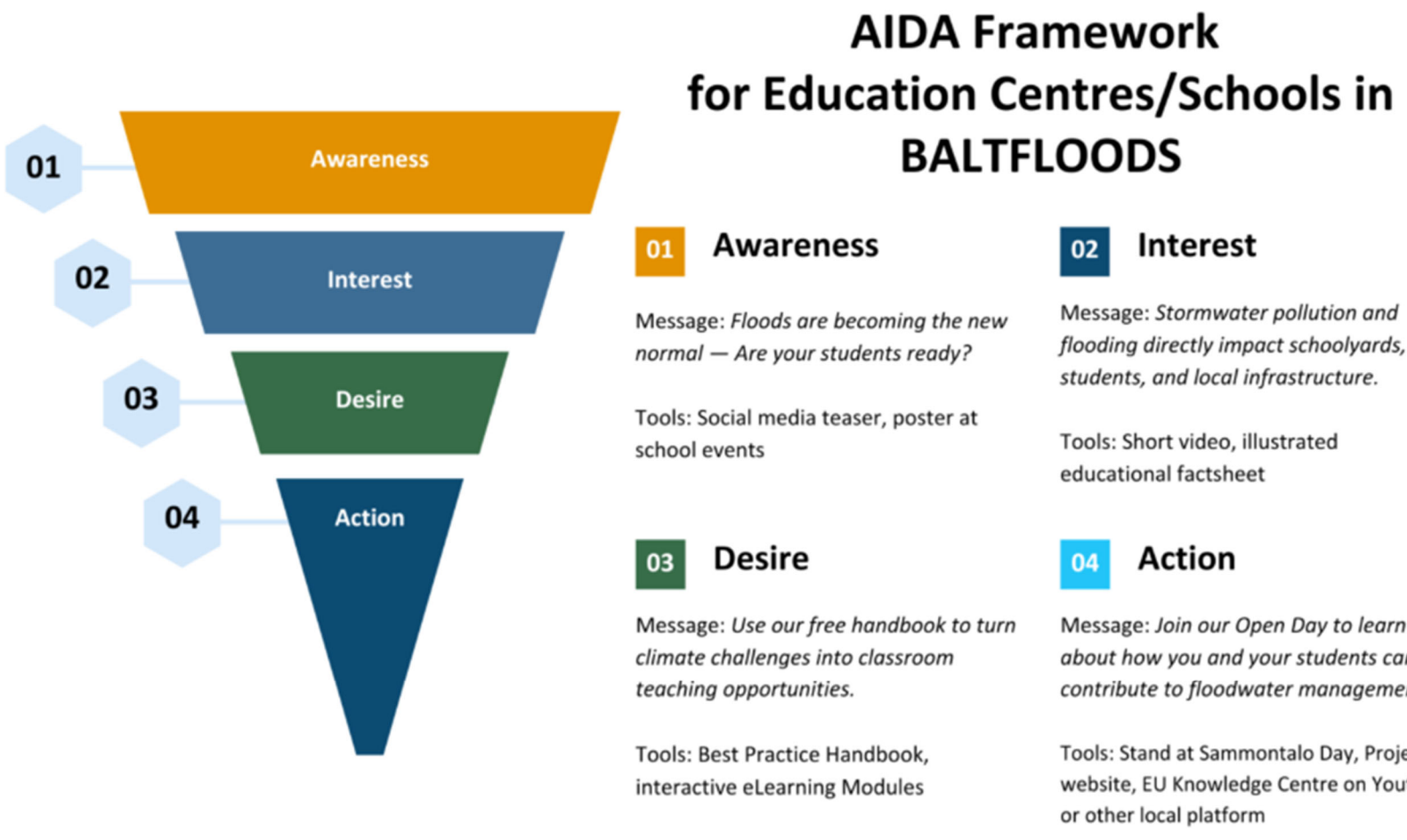
4.2 AIDA Model for Awareness and Recruitment Communication

AIDA is a marketing model used to structure persuasive communication. It outlines the stages a person goes through when engaging with a message: first noticing it (**Awareness**), becoming intrigued (**Interest**), developing an emotional or personal connection (**Desire**), and finally taking a concrete step (**Action**). Complementing the overall framework, which is based on

the citizen science approach and co-design methodology, the AIDA model serves as a linear one-way communication ideal for informing, mobilising and persuading citizen groups to act. It also helps structure how to communicate with diverse citizen groups, especially in outreach materials, school events, and targeted awareness campaigns. By aiding the sequencing of messages effectively, it aims to move people from awareness of flood risks to concrete actions, such as submitting data, attending events, or adopting prevention behaviours.

The following diagram (Image 4.1) represents the use of the AIDA model for the citizen groups, education/centres, which also include teachers as citizens. Similarly, messaging for all target groups will be prepared with the AIDA model.

Figure 4.1 AIDA Model for Education centres/schools in BALTFLOODS



The BALTFLOODS Communication and Feedback framework aims to engage citizens as active participants in co-designing BALTFLOODS solutions whereas the AIDA model aims to inform and persuade them of the project goals for them to act, such as by participating in project activities to become active members of the BALTFLOODS solutions. The integration of stakeholder and citizen feedback, as highlighted in D1.1 Framework for Piloting and Evaluating Section 4.3, ties into the present overarching framework for engaging citizens. Horizon 0, which refers to a continuous feedback mechanism, works through the entire looping cycle of the present framework by allowing citizens to provide **feedback** and thereby gaining **trust** in the project and its activities, which encourages them to provide **information** to the project that is thereby **monitored** by the NTNU team within the Citizen Engagement web-based tool. Periodic Stakeholder Reflection, Horizon 1, speaks directly to **Motivation Design** as citizens are encouraged via several incentives to provide information after major rainfall events which informs the next step of the cycle in integrating their preferences so that the Citizen engagement web-based tool as well as the project results are of equitable **access** for all user groups.

5. Practical Guidelines for integrating citizen science into environmental monitoring

For a comprehensive citizen engagement strategy to function, stakeholders and present BALTFLOODS project working with citizens need guidance on how to aptly integrate citizen science in environmental monitoring. The following provides practical guidelines for local public authorities and infrastructure providers to consider when integrating citizen science into environmental monitoring. These recommendations draw on the expertise of consortium partners as well as insights gained from preparatory work, including in-person workshops and interviews with municipalities, public service providers, citizens and researchers.

Open Data

Open data policies should be applied in various forms to share data, e.g. flood maps, water quality indicators, weather patterns, across departments within the city organisations/municipalities, as well as made freely available to the public. Open data standards make it easier for a city to access its own data and coordinate with vendors and local authorities. In citizen science, citizens often collect data themselves. In such a case, open data compliments this by offering a broader context, enabling citizens to compare their findings with official datasets, validate trends and identify gaps. This integration enhances the credibility and usefulness of citizen-generated data. Infrastructure service providers should apply their knowledge, awareness, and readiness to participate and be engaged in an informed way. This helps to integrate citizens and other stakeholders more directly into solutions through workshops, webinars, and open days to build trust and credibility among citizens.

Privacy and Personal Data

Public service providers should ensure that personal data is understood and protected. Robust privacy protections are essential for building trust in ICT-based citizen engagement. In common practice, data sharing of privacy-related data between organisations needs to be well understood and aligned with the GDPR (European General Data Protection Regulation). Wherever possible, little or anonymised personal data should be collected. When citizens register on an app, they may be asked to agree to terms that allow their data to be used for improving services, or for reporting and research. Public institutions must ensure that agreement constitutes the consent of citizens. Apart from surveys and workshops, automated data collection that requires citizens to provide their personal data can be a voluntary provision.

Monitoring and Evaluation

The performance measurement of citizen engagement can be done through KPIs, key performance indicators. Those allow benchmarking and establish monitoring indicators. They also allow measuring the progress of the project and its societal impact.

Target Group Definition and their Engagement

Local public authorities and infrastructure providers should define the target group and understand their level of awareness. Identifying who should participate – whether they are residents in flood-prone areas, students, farmers and/or community volunteers – allows public authorities to tailor their messaging, ensuring it is relevant and relatable. A qualitative analysis is important to understand the impact and usefulness of engagement activities. Additionally, determining the citizens' current understanding of water quality, flood risks, and stormwater contamination is necessary. The impact of citizen engagement as outcome of the project should be clearly communicated to develop a sense of responsibility among citizens and to show that their contributions are valued. During citizen engagement activities, it is crucial to ensure a representative selection of citizens to avoid a biased evaluation. To recruit participants and maintain engagement, a clear communication plan needs to be developed, utilising various communication channels, including social media, newsletters, and local media. It is also vital to communicate back to participants/volunteers on how their data is being used and to clarify the goal of the data collection. This feedback loop is a primary driver of sustained motivation.

Training and Safety

Safety protocols must be clearly communicated, especially when fieldwork involves potentially hazardous conditions, such as contamination or flowing water. Moreover, structured training is crucial to ensure accuracy, safety and confidence. Orientation sessions cover information on the goals of the field work, the importance of participation and how the data will be used. During such sessions, demonstrations, e.g. of a water quality testing kit, allow citizens to learn and simultaneously increase the quality of the desired data.

Data Collection and Management

Local public authorities and infrastructure providers should design data collection protocols that are simple, standardised and rigorously validated. Data management is another important part of integrating citizen science in environmental monitoring and implementing a system for data validation and verification. To ensure the accuracy of data submitted by citizens, photo documentation should be requested as supporting evidence. It is advisable to select appropriate technology for data submission and management to ensure reliability and efficiency.

6. Transnational Value

The transnational value of the BALTFLOODS project is in its ability to unite complementary expertise and shared environmental challenges across national borders. Transnational cooperation is crucial for addressing the project's challenges for several reasons. Flooding and run-off pollution exacerbated by climate change are not confined to individual countries, and the present strategy responds with coordinated, cross-border engagement. In the preparatory stage of formulating this strategy, collaborative design and cross-regional implementation brought together municipalities,

universities and several local stakeholders from Finland, Sweden, Norway, Poland and Latvia. By including perspectives of multi-regional stakeholders and co-developing engagement tools and methods, the strategy aims to facilitate the exchange of knowledge and best practices that are adaptable yet sensitive local realties. The involvement of students, public officials, researchers and citizens helped surface a wide spectrum of insights on needs and requirements of citizens in participatory work needed for co-development of solutions. In order to continue integrating a broad spectrum of experiences and insights into the project, that fosters a sense of shared responsibility and mutual learning among participating regions, the present strategy is also seen as a living document which will be further developed along the project term, via collaborative workshops and other co-design events planned with citizens to further refine it and therefore engage citizens across the pilot sites and Baltic Sea region accordingly.

Conclusion

The BALTFLOODS Citizen Engagement Strategy outlines a comprehensive, participatory approach to strengthening flood preparedness and runoff pollution mitigating in project countries, as well as across the Baltic Sea region. Grounded in co-design and citizen science methodologies, the strategy encapsulates how involving citizens as end-users and co-designers can lead to more effective, inclusive and sustainable solutions to climate change induced urban flooding.

Findings from workshops and structured interviews reveal several key insights. Citizens are motivated by incentives such as certification, lotteries, and gamified tools or, in the case of students, study credits. Trust and accessibility emerged as essential components of engagement, which underscores the need for localised communication, feedback loops, and simplified tools. Insights from municipalities, environmental authorities and public service providers further emphasised the current gaps in monitoring systems, which are often fragmented, manual or entirely lacking. This highlighted the demand for real-time data, predictive tools, and improved coordination between departments. Moreover, stakeholders stressed the importance of increasing public awareness, integrating citizen-generated data into official systems, and improving institutional capacity for two-way communication.

To address these challenges and opportunities, the BALTFLOODS project developed a core communication and feedback framework, which focuses on five pillars: Information Provision, Data Contribution, Motivation Design, Accessibility & Inclusion, and Feedback & Trust. These pillars form the backbone of a scalable citizen engagement model. To complement the framework, the AIDA (Awareness, Interest, Desire and Action) model supports outreach and communication by curating messages that guide citizens from Awareness to Action to become aware of the project tools and be activated to co-develop solutions against urban flooding as citizen scientists.

The BALTFLOODS Communication and Feedback Framework and AIDA model combined with practical guidelines for integrating citizen science into environmental monitoring create a comprehensive foundation for inclusive, transnational engagement. By embedding citizen participation throughout its lifecycle, the strategy positions BALTFLOODS as a model for climate resilience built on trust, transparency, and community-driven innovation.

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Annexes

Annex A: Report on findings from interviews

Annex B: Report on In-person workshop, City of Lappeenranta

Annex C: Report on In-person workshop, University of Gothenburg

Annex D: Report on In-person workshop, Norwegian University of Science and Technology

Towards flood resilient cities powered by data and people.

LAPPEENRANTA

GJØVIK KOMMUNE

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NTNU
Norwegian University of Science and Technology

UNIVERSITY OF GOTHENBURG

Cape Europe

GFZ Helmholtz Centre for Geosciences

Interreg
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RESPONSIVE PUBLIC SERVICES

BALTFLOODS

This project is co-funded by the European Union through the Interreg Baltic Sea Region Programme.

Interreg Baltic Sea Region

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RESPONSIVE PUBLIC SERVICES

BALTFLOODS

REPORT ON FINDINGS FROM INTERVIEWS

Liuliu Du-Ikonen, Julia Vieira

LUT University

June 25, 2025

This project is co-funded by the European Union through the Interreg Baltic Sea Region Programme.

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EXECUTIVE SUMMARY

As part of the BALTFLOODS project, a series of structured interviews were conducted with key stakeholders across Finland, Norway, Sweden, Latvia and Poland. These stakeholders included municipal governments, national public authorities, environmental agencies, and utility service providers. The purpose was to gather insights into current practices, challenges, and future needs related to four critical domains of the project: Water Quality Monitoring, V-Overflow, Data Protocol and Integration Framework, and Citizen Engagement and Co-design. In addition, tailored questions were created for national-level institutions to address specific insights and regulatory requirements.

The findings highlight varied levels of technical capacity and institutional readiness. Municipalities expressed strong interest in improving citizen participation and local monitoring through user-friendly digital tools, while also pointing out the lack of formal systems for stormwater management. National public institutions emphasized regulatory alignment, data sharing protocols, and the integration of environmental monitoring with public awareness strategies. Utility and technology providers pointed to challenges in customer data access and predictive monitoring, underscoring the need for interoperable systems. Municipalities expressed a desire for co-designed solutions that effectively integrate technical innovation with meaningful citizen participation. Stakeholders called for real-time, geolocated environmental data, intuitive user interfaces, and actionable feedback loops to support planning and emergency response.

These insights directly support the development of Deliverables D1.1–D1.4 by informing the piloting framework, data integration plan, citizen engagement strategy, and implementation plan. By grounding project activities in the lived experiences and operational needs of diverse stakeholders, BALTFLOODS is positioned to create scalable, replicable solutions that enhance climate resilience and community engagement across the Baltic Sea Region. This report provides a synthesis of findings that will shape the next stages of project implementation, supporting more responsive and inclusive flood preparedness systems.

1. Introduction

The BALTFLOODS project is dedicated to strengthening urban and regional resilience against climate-induced flood risks. A key element of the project is the integration of citizen engagement and co-design practices into technical and institutional systems, ensuring that solutions are not only innovative but also socially relevant and grounded in local realities. Central to this effort is a deeper understanding of stakeholder needs, capacities, and expectations.

To this end, structured interviews were carried out with municipalities, national public authorities, utility providers, and companies across Finland, Norway, Sweden, Latvia and Poland. These discussions explored current practices in Water Quality Monitoring, V-Overflow, Data Protocol and Integration Framework, and Citizen Engagement and Co-design. By analyzing these insights, the project team is better positioned to develop inclusive, adaptable solutions that respond to both technical and social dimensions of resilience. The findings summarized here directly inform the development of implementation strategies, co-design practices, and digital tools in upcoming BALTFLOODS work packages.

2. Objectives

This report serves to synthesize stakeholder input gathered through structured interviews as part of the BALTFLOODS project's engagement actions. The aim is to support project design and decision-making in upcoming implementation work packages by providing grounded, stakeholder-driven insights. Based on the thematic focus areas aligned with BALTFLOODS pilot actions, the objectives of the report are to:

- Summarize the institutional, technical, and participatory needs identified across stakeholders.
- Present concrete findings that reflect different levels of readiness, capacity, and experience among municipalities, national agencies, and utility providers.
- Identify gaps and opportunities for improving data flow, system interoperability, and the effectiveness of citizen contribution.
- Provide strategic insight for the co-design of communication frameworks, data integration models, and engagement strategies tailored to local and transnational contexts.
- Support the actionable contributions to project Deliverables D1.1 to D1.4, helping align future solutions with real-world operational contexts.
- Explore opportunities for collaborative and participatory approaches across institutional and community levels, ensuring alignment with the interests of targeted audiences and stakeholders.

By capturing both operational realities and stakeholder expectations, the report supports the development of effective and scalable solutions tailored to diverse regional contexts.

3. Results

The interview questions were organized around four key thematic areas relevant to the BALTFLOODS project: Water Quality Monitoring, V-Overflow, Data Protocol and Integration Framework, and Citizen Engagement and Co-design. These areas align with the piloting practices of the project: for instance, the City of Lappeenranta is piloting activities related to Water Quality Monitoring, Data System Integration, and Citizen Engagement, while the City of Gjøvik is piloting Water Quality Monitoring and V-overflow system. Stakeholders were selectively asked questions according to their relevance to these domains. Interview responses are summarized in Table 1 below. During the process, specific insights and regulatory requirements were identified from national-level institutions, and tailored questions were added accordingly, Table 2.

Table 1. Responses from stakeholders across the thematic areas

Organization	Type	Country	Water Quality Monitoring	V-Overflow	Data Protocol and Integration Framework	Citizen Engagement and Co-Design
City of Tampere	Municipal government	FI				
Lappeenranta city	Municipal government	FI				
Lappeenranta city	Municipal government	FI				
Lappeenranta city	Municipal government	FI				
Lahti city	Municipal government	FI				
Kepice Municipality	Municipal government	PL				
Augšdaugava municipality	Municipal government	LV				
Finnish Environmental Institute	National governmental research institute	FI				
Environmental health protection IKS	Intermunicipal public-sector organization	NO				
Ministry of the Environment	National government ministry	FI				
ELY-keskus	Regional government authority	FI				
Southeast Finland ELY	Regional government authority	FI				
LAPP Water Company	Public utility company	FI				
Wioniq-Piplife	Private company	NO				
Xepto As	Private company	NO				
City of Örebro	Municipal government	SE				
Stormwater & Overflow Survey	?	NO				
Mjøsa Felles Fiskeforening	Association	NO				
Greenreality	Municipal program	FI				
NTNU	University	NO				
LUT	University	FI				
Saimaa Water Protection Association, SVSY1	Non-profit association	FI				
Saimaa water and enviromental research, SVSY2	Non-profit association	FI				

Color coding in this matrix reflects the completeness of information gathered across four thematic categories. Green indicates most questions were responded, yellow denotes that questions were partially answered, and red signifies no answer obtained for the set of questions.

Table 2. Questions to national public authorities

			Questions to National Public Authority					
Organization	Type	Country	General questions	Current Situation	Technical and legal regulation	Climate and Future Perspective	Funding and Instruments	Interdisciplinary Cooperatio and Citizen Involvement
Finnish Environmental Institute	National governmental research institute	FI						
Ministry of the Environment	National government ministry	FI						
ELY-keskus	Regional government authority	FI						

Color coding in this matrix reflects the completeness of information gathered across four thematic categories. Green indicates most questions were responded, yellow denotes that questions were

Although the number of responses was limited and not all questions were answered by every participant, the findings reveal clear themes that provide strategic insight into local needs and expectations.

Interviews with the city of Lappeenranta and Lahti, universities, and other associations conducted during the TransformAR project were also included in this analysis, as they provide answers to the water quality monitoring set of questions.

3.1. General findings

The interviews revealed shared concerns across all stakeholders regarding the growing impact of urban and seasonal flooding, particularly where drainage systems are insufficient or maintenance is lacking. Respondents from both urban and rural municipalities described issues such as infrastructure overload during intense rainfall, overgrown ditches, and runoff from agricultural areas. Spring flooding due to snowmelt and fluctuating water levels in rivers were also identified as critical challenges.

Monitoring practices and access to data varied considerably. While a few institutions collect physical indicators like turbidity, conductivity, or water flow, others reported no systematic monitoring at all. Where data is collected, it is often fragmented or outdated, limiting its usefulness for real-time response or preventive action. Stakeholders, including Norwegian partners, underscored the value of real-time, geolocated measurements to detect drainage blockages, rising water levels, and surface runoff patterns. Norwegian interviewees also highlighted the importance of predictive tools and deviations in system capacity to support risk anticipation and intervention planning.

Interviewees identified that the addition of monitoring the following parameters would be useful for their work and responsibilities:

- pH
- Nitrate and phosphate concentrations
- E. coli
- Oxygen level
- Microplastics
- Heavy metals (e.g. copper, zinc from road runoff)
- Oil compounds
- PAHs
- Pesticides
- Water level (above sea level) and levels in drainage ditches and lakes
- Precipitation intensity and frequency
- Duration of water retention after rainfall
- Electrical conductivity
- Deviation in capacity
- Load during recreational use

Some interviewees noted that current engagement practices fall short of utilizing citizens as contributors to environmental monitoring. Public awareness can be rather low, and institutional collaboration with schools, NGOs, or residents is rare. However, some community organizations are actively filling the gap. For instance, the Joint Fishing Association association at Lake Mjøsa monitors water clarity and algae blooms, using this

data to advocate for better pollution control. Such groups have expressed interest in accessing more real-time data and predictive tools from authorities, indicating an untapped opportunity for collaboration in stormwater monitoring. Answers highlighted a lack of intuitive reporting mechanisms and an absence of visible impact when citizens do provide feedback.

Interviewees from Tampere and Augšdaugava expressed interest in using mobile apps and visual dashboards, which can act as co-design digital solutions and enable better interaction across stakeholder groups. Interviewees expressed support for models that connect public data with actionable tools and community involvement.

Survey feedback from four Norwegian municipalities/utilities (collected in June 2025) reinforces these trends. All respondents affirmed facing stormwater management challenges, and most highlighted the need for better data on water quality (turbidity, E. coli, microplastics, etc.) and more systematic tracking of combined sewer overflows. This convergence of survey and interview insights strengthens confidence in the identified priority areas for BALTFLOODS.

3.2. Interest and needs

3.2.1 Municipalities

The City of Tampere, Finland, noted that while its existing stormwater systems are more advanced, challenges remain in raising awareness among citizens and activating feedback mechanisms. The city also emphasized the importance of visual tools and clear communication strategies to build public understanding of water systems and infrastructure. These needs reflect the broader demand for user-oriented co-design processes that ensure citizens are informed, motivated, and able to participate effectively in environmental monitoring and resilience-building. The cities of Lappeenranta and Lahti, also located in Finland, collect a range of information of stormwater and water quality of wetlands. While flood areas are known in Lappeenranta, interviewees listed a set of additional information they would like to have about stormwater, some of those needing more advanced equipment than sensors to be collected.

The Municipality of Kępice, Poland, reported frequent stormwater challenges, particularly due to runoff and the lack of structured drainage systems. Flooding during heavy rainfall is common, affecting homes and public spaces. They currently do not operate a formal monitoring system but would benefit from real-time water level data and flow rates. Such data would support both short-term emergency responses and long-term infrastructure planning. Kępice emphasized the need for predictive information that could be used to assess risks to specific buildings and to inform decisions on land use and system upgrades. Their feedback aligns with BALTFLOODS' objective to involve citizens in early flood detection through mobile-based tools and participatory monitoring.

Augšdaugava Municipality, Latvia, likewise does not have a functioning monitoring system in place but showed a clear willingness to participate in solution development. They are particularly vulnerable to spring flooding due to the presence of large rivers and high

groundwater levels. Their key interests include co-developing a system to visualize changes in water levels, making results publicly available, and sharing insights across administrative units. Moreover, the municipality expressed interest in engaging schools and local associations in monitoring and awareness activities, pointing to the potential for integrated educational and civic engagement efforts.

The City of Örebro, Sweden added a similar perspective from a Swedish context. Örebro officials noted that while catastrophic floods are infrequent (aside from a notable basement-flooding event in August 2023), stormwater quality is an ongoing concern under strict environmental standards. The city currently has no continuous monitoring system, relying instead on targeted flow measurements and occasional pollutant surveys. This gap points to a desire for improved data: Örebro sees value in deploying continuous flow sensors and additional rain gauges to capture runoff dynamics in real time. They cautioned that critical water-quality parameters differ by location and season, making it difficult to apply universal measures. At present, Örebro shares no stormwater data publicly, though they believe rainfall and runoff information would engage citizens if communicated via user-friendly channels. Their input underscores common municipal needs – better monitoring infrastructure and more citizen-facing information – echoing the calls for solutions that are technically robust yet community-oriented.

Municipalities vary in their technical readiness but share a common interest in participatory monitoring tools, accessible data visualization, and improved citizen engagement. Their needs reinforce the demand for modular, scalable solutions that respond to local contexts while fostering community resilience.

3.2.2 Utility services and companies

Utility services and private-sector partners play a crucial role in bridging municipal infrastructure with emerging technologies for water and data management. The Lappeenranta Water Company highlighted its ongoing efforts to upgrade stormwater systems, emphasizing the need for real-time operational visibility and digital integration across departments. The utility provider acknowledged limitations in existing SCADA systems, pointing to the value of sensor-based upgrades that can feed into citywide dashboards and risk alerts. Their interest in data-driven infrastructure supports the BALTFLOODS objective of aligning operational monitoring with public-facing communication tools.

Wioniq-Piplife, a Norwegian company specializing in smart infrastructure, focused on customer-side integration. They advocated for systems that not only monitor technical parameters but also engage end users through intuitive interfaces. For example, their vision includes modular dashboards that can deliver performance insights to both municipal engineers and residents, fostering shared responsibility for flood risk management. The company also noted the potential to integrate pipe system data with public GIS platforms, which could enhance spatial decision-making in urban planning.

Xepto, another Norwegian firm, brought a highly technical perspective to stormwater readiness. They emphasized the importance of capacity deviation tracking—essentially detecting when systems deviate from expected flow or pressure parameters—as a predictive

maintenance tool. Their approach combines real-time telemetry with AI-based diagnostics, which could significantly enhance early warning capabilities in BALTFLOODS pilot regions. Xepto expressed interest in piloting scalable monitoring modules that can be adapted across cities with varying levels of digital maturity. Notably, a few survey respondents also identified companies like Xepto and Pipelife as current providers of sensors for stormwater and overflow monitoring, reflecting active private-sector support in this domain.

Together, these companies underscored the need for solutions that are both technically robust and socially accessible. They called for integration protocols that support legacy systems, real-time interoperability, and end-user engagement. Their insights support the BALTFLOODS goal of co-developing inclusive, future-proof tools that connect citizens, utilities, and municipal authorities in a shared resilience strategy.

3.2.3 National public authorities

National-level stakeholders offered detailed insights into the regulatory, technical, and systemic challenges that affect stormwater and flood risk management. The Finnish ELY Centre and SYKE (Finnish Environment Institute) underscored issues of fragmented data governance. They noted that water monitoring data, although collected by various actors, is often not accessible in real-time and is constrained by outdated systems and differing data standards. They emphasized the importance of establishing harmonized protocols to improve interoperability between municipal systems and national databases. SYKE also pointed to the growing need for automation and predictive modeling to manage climate-driven risks and highlighted their interest in pilot tools that can scale across municipalities.

The Finnish Ministry of the Environment emphasized the regulatory complexity involved in deploying new sensor-based systems or modifying infrastructure. They recognized the potential for pilot implementation approaches that consider permitting timelines, data privacy, and compliance with environmental directives. Their responses confirmed the necessity of coordinating legal, technical, and community dimensions in co-designing flood resilience strategies.

Norwegian Environmental Health Protection (IKS) provided insights into how national public health and environmental agencies are adapting to incorporate stormwater concerns into their mandate. They indicated readiness to collaborate with municipal actors to expand their scope beyond water quality into runoff-related indicators. IKS also expressed interest in integrating citizen-reported data, provided that validation mechanisms are in place.

The perspectives gathered from national public institutions highlight the critical importance of aligning technical innovation with regulatory standards and systemic integration. The interviews with these actors indicated the need for harmonized data protocols, legally compliant pilot designs, and scalable engagement mechanisms that bridge national oversight with local implementation. Their involvement is essential to ensure that BALTFLOODS outputs are not only effective in demonstrator cities but also transferable across national and transnational policy landscapes.

3.2.4 Non-profit associations

Non-profit organizations bring additional input on data quality monitoring. Saimaa Water Protection Association (SVSY1) focuses on evaluating the impacts of agriculture and forestry on wetlands, taking water samples from wetlands, lakes and ditches. Not all tests are performed by the organization, and some parameters such as oils in the water are not currently being tested despite the acknowledged interest for information. Saimaa Water and Enviromental Research (SVSY2) does similar measurements of ditches, bed, rivers, and wetlands, with the additional sampling of pipelines in factory areas. While important parameters are already investigated, others of importance for agricultural areas such as pesticides are not. SVSY2 also expressed interest in investigating the load during recreational use, a parameter not mentioned during other interviews.

3.2.5 Universities

The interviews with LUT and NTNU revealed important insights into current practices, challenges, and opportunities in stormwater management. LUT provided information on measurement practices, such as which parameter can be measured automatically, which should be measured in real time or through samples with more comprehensive analysis. Challenges in measuring oils visible in water were mentioned (e.g. often what looks like oil can be a bacterial population), and cameras and machine vision in oil detection were mentioned as a possible solution that could be developed by both universities. The interview with NTNU revealed technical difficulties in monitoring parameters.

4. Contributions toward deliverables

The interview findings across municipalities, ministries, research institutes, and technology providers have generated actionable knowledge that can be directly mapped to the four core deliverables of BALTFLOODS' Work Package 1 (D1.1–D1.4). Below is a summary of how these findings can potentially contribute to each deliverable's development.

4.1. D1.1 – Framework for Piloting and Evaluation

Stakeholder input revealed variability in stormwater monitoring systems, ranging from advanced infrastructure in Tampere to absent systems in Augšdaugava. This diversity enables the development of a flexible evaluation framework sensitive to different baseline capacities and system maturity. Interviewees frequently emphasized the value of real-time and predictive data, for instance, Xepto's focus on capacity deviation analysis, to detect local anomalies, offering parameters for pilot evaluation. These insights inform the performance metrics for pilot testing and evaluation outlined in D1.1, particularly concerning system responsiveness, data usability, and citizen uptake. Additionally, emphasis on co-design and localized relevance supports the development of context-specific evaluation criteria.

4.2. D1.2 – Data Systems Integration Plan

Institutions and companies across Finland, Latvia, and Norway cited challenges related to data fragmentation, outdated monitoring practices, and lack of interoperability. For example, the Finnish ELY Centre highlighted difficulties accessing up-to-date hydrological data from multiple sources, and Wioniq-Piplife emphasized the lack of customer data integration for water systems. These findings guide the development of D1.2 by emphasizing the need for integration protocols that support diverse formats, legacy systems, and real-time updates. Interviews also indicated a demand for dashboards that combine citizen-generated observations with professional data streams, reinforcing the value of flexible data routing systems and unified architecture for futureproofing.

4.3. D1.3 – Citizen Engagement Strategy

The interviews offer limited but critical input for shaping an inclusive, scalable strategy for citizen engagement. Interviewees noted that while citizens are willing to engage, there are few intuitive mechanisms to do so. The City of Tampere noted a gap in public awareness despite sophisticated systems. Augšdaugava municipality expressed a desire to involve schools in data collection and cooperate with local communities and NGOs to disseminate information on flood preparedness. Feedback from citizen associations (like those concerned with water quality in local lakes) will be incorporated to ensure the strategy empowers community monitors and volunteers.

These findings support the design of D1.3 by confirming the importance of: (1) accessible user interfaces (e.g., mobile forms, maps), (2) clear feedback loops (e.g., showing response to citizen inputs), and (3) institutional embedding of engagement processes (e.g., school partnerships). This information also informs training and outreach strategies to be embedded within the strategy document.

4.4. D1.4 – Pilot Implementation Plan

The interviews contribute to D1.4 by identifying specific operational needs, stakeholder roles, and implementation barriers that can shape pilot design. For instance, Norwegian Environmental Health Protection (IKS) showed readiness to extend existing water quality monitoring systems to cover stormwater events, suggesting how pilots could be built upon existing capacity. Meanwhile, feedback from the Finnish Ministry of the Environment emphasized regulatory considerations and the need to streamline permissions for deploying sensors. These findings point to opportunities and constraints that must be accounted for in pilot planning, particularly the importance of involving both data users and regulatory stakeholders early. Interviews also identified key timing windows for implementation, including the spring snowmelt season and summer peak rains, informing seasonal targeting in the activity timeline of D1.4.

5. Conclusion

The interview findings underscore a shared recognition among municipalities, national public institutions, and utility service providers that current stormwater and flood management systems face serious limitations in preparedness, monitoring, and citizen interaction. While technical capabilities vary significantly across stakeholders, from advanced digital tools in urban centers to the absence of any monitoring in smaller municipalities, all actors articulated a strong need for improved data integration, real-time environmental monitoring, and structured citizen engagement mechanisms. National institutions highlighted the importance of harmonized standards and inter-agency coordination, while utilities and companies called for more predictive tools and customer-linked data flows. Despite differences in institutional capacity, a unifying theme emerged: stakeholders are eager to co-develop tailored solutions that are responsive to both operational needs and public expectations.

These insights provide a valuable roadmap for refining the BALTFLOODS implementation strategy and designing the tools and frameworks outlined in Deliverables D1.1 through D1.4. By capturing diverse perspectives and revealing context-specific gaps, the interviews ensure that the upcoming piloting actions will be not only technically sound but also socially inclusive and strategically aligned. Ultimately, this report reinforces the critical role of multi-level engagement and integrated systems thinking in advancing climate resilience across the Baltic Sea Region.

Annex

1. Interview questions

General question for relevant stakeholders

Water quality monitoring

1. Does your organization have challenges with stormwater? (e.g. quality, flooding)
2. What information do you currently collect/monitor about stormwater (e.g. flow, turbidity, contaminants)?
3. For what purpose do you need information on stormwater quality (/quantity) (e.g. infrastructure planning, pollution control, public health, regulatory compliance)?
4. What additional information about stormwater would you find useful for your work or responsibilities?
5. What measurable values do you see that reveal the information you want to know?
6. Which specific parameters or indicators (e.g. pH, nitrogen, E. coli, microplastics, conductivity) do you think are most important to monitor in your area?
7. Are you aware of any laboratory analytical methods that can measure those parameters/indicators?
8. Do you know of any automatic sensors that can measure those values?
9. Can you list your suppliers of sensors and equipment for stormwater monitoring if you have any?
10. What are your expectations or requirements for data resolution, frequency, or format?
11. Are there measurable thresholds or limits (e.g. regulatory, internal guidance) that are relevant for interpreting those parameters?

V-Overflow

1. Do you have overflows in your pipeline network today?
2. How do you measure overflows today. Number of times with overflow, or number of times and quantity?
3. What are your expectations or requirements for data resolution, frequency, or format?
4. Do you have routines for following up on these measurements?
5. How do you follow up on overflows? Do you report this to the authorities or is it just for internal use?
6. How do you maintain the overflows?

7. Are there any public requirements from the government that there should be measurements on the overflows you have in your stormwater and sewage facilities?
8. Can you list your suppliers of sensors and equipment for V-overflow if you have any?

Data Protocol and Integration Framework

1. What data do you have? (e.g. data sources from cameras, satellites?)
2. What data or information are you currently sharing with the public?
3. What data or information should be shared with the public? What might be interesting?
4. How is the data shared now?
5. What data do you plan to collect and share in the project? Any challenges you foresee when sharing the data in our project?
6. How will you technically share the data. For example, is there some kind of API's that shares the data? Or something else? (Some architecture)
7. Is there any legal framework that allows you to share the data? What rules and laws apply to data sharing.
8. How do you currently reach the interested citizens?

Citizen engagement and co-desgin

Experience with flooding

1. Have you or someone you know experienced flooding in this city? What happened?
2. What's the biggest challenge you've faced during floods? (e.g., transport, power, safety)
3. Where do you think flooding is worst in our area? Why?

Awareness and local knowledge

1. What do you think are the main causes of flooding here? (e.g., blocked drains, heavy rain, river overflow)
2. Are there early warning systems in place? How do you currently receive flood alerts?
3. Which streets/areas flood first or worst? Why? (e.g., poor drainage, construction)
4. Are there recurring issues during floods? (e.g., sewage backup, power cuts, stranded residents)
5. What kinds of volunteer programs or training would help citizens feel more prepared and empowered to help during floods?
6. What communication channels (social media, community meetings, SMS alerts, etc) would be best reach a wide range of citizens during a flood emergency?
7. What barriers do you think prevent citizens from participating in flood response or pollution prevention efforts and how can we address them?

8. How can we make flood preparedness activities more accessible?

Needs

1. What infrastructure (e.g., drains, pumps, green spaces) is missing or failing in your neighborhood?
2. What info would you need in a flood alert? (e.g., water depth, safe routes, shelter locations)
3. How could technology (apps, sensors) help our community prepare? What kind of features do you need for such apps or sensors?
4. What policy changes would you suggest to local government? (e.g., zoning laws, drainage upgrades)

Citizen engagement and action

1. What would motivate you to join flood-prevention efforts? (e.g., rewards, community pride)
2. Who else needs to be involved? (e.g., schools, businesses, religious groups)
3. What support do you need from authorities/NGOs to make this happen?

Co-design

1. What apps do you use for weather alerts or emergencies? What do you like/dislike about them?
2. When flooding happens, what's the first thing you do to check for updates or report issues?
3. What information do you wish you had during floods? (e.g., real-time water levels, safe routes, emergency contact)
4. How would you like to report floods in the app? Through text, location sharing, photos, or some other ways?
5. Would you like to contribute data? Such as uploading flood photos, marking unsafe areas.
6. Who should verify reports? Such as other users, or government?
7. What successful example have you seen locally or elsewhere of citizen engagement during flood events that we could learn from?

Questions for national public authorities

General questions

1. How many incidents have there been in the last 2 years?
2. Do you have an estimate of the extent of damage and costs?
3. What are the requirements for handling stormwater and are any changes expected in the near future?
4. Do you see any changes in how this will be handled in the future?
5. Will there be any new national regulations or new EU regulations governing this?
6. How will this affect municipalities in the future?

Current situation

1. How do you assess the current stormwater management in Norwegian municipalities?
2. What requirements are currently imposed on municipalities regarding stormwater in new development projects?
3. How is it ensured that municipalities actually implement the necessary measures?
4. Is the current legislation and regulations sufficient to handle stormwater challenges?
5. How do state actors collaborate with municipalities and private actors to solve stormwater problems?

Technical and legal regulation

1. How are considerations for nature-based solutions (e.g., green roofs, rain gardens) balanced with traditional infrastructure?
2. How is the need for changes in the Planning and Building Act assessed for better stormwater management?
3. Are there plans to clarify responsibilities between the municipality, private developers, and other actors?

Climate and future perspective

1. How are you preparing for increased rainfall and extreme weather in light of climate change?
2. Are there national goals or strategies for stormwater management towards 2030 and 2050?
3. How do you assess the risk of flooding and stormwater in urban areas in future climate scenarios?
4. What kind of research and knowledge development do you support for future stormwater management?

Funding and instruments

1. How can municipalities get support to implement good stormwater measures?
2. Are economic instruments being considered to stimulate more sustainable stormwater management?
3. What is your view on introducing stormwater fees as an incentive for local measures?

Interdisciplinary cooperation and citizen involvement

1. How can citizens and private actors contribute more actively to stormwater management?
2. How do you work with interdisciplinary cooperation between planning, environment, and the water sector?

BALTFLOODS, Baltic Flood Resilience and Digital Solutions

Report on In-person Workshop, City of Lappeenranta

DEVELOPING A COMPREHENSIVE CITIZEN ENGAGEMENT STRATEGY

MAY 19, 2025

Interreg Baltic Sea Region

Co-funded by the European Union

RESPONSIVE PUBLIC SERVICES

BALTFLOODS

This project is co-funded by the European Union through the Interreg Baltic Sea Region Programme.

Background/Purpose of workshop

The workshop is conducted as part of A1.3 Preparing citizen engagement. As part of group activities, the partners are supposed to organize a three-day offline workshop to develop a comprehensive citizen engagement strategy. This workshop will be instrumental in shaping how the project involves and interacts with the community. City of Lappeenranta co-hosted one of the offline workshops in close collaboration with LUT University.

The workshop brought together 11 participants from LUT University and 1 from LAB University of Applied Sciences, representing a range of academic backgrounds exploring how citizen engagement science can strengthen disaster preparedness and build community resilience against extreme weather events like floods. While the majority were enrolled in Sustainability Science and Solutions and Environmental Technology, there were also students from Energy Technology and Public Health programs. The workshop was structured into three distinct sessions, incorporating both individual tasks and collaborative group discussions to encourage active engagement and diverse perspectives.

Methodologies Used

The workshop started with quick presentation of BALTFLOODS and the definition of stormwater management, including the challenges and actions currently being taken by the City of Lappeenranta.

The *first session* then took place using real time engagement through a series of structured questions using word clouds, rating scales, open ended questions and live polls using web based interactive polling and presentation tool called Mentimeter. The structured questions were related to the students' prior knowledge of floods and their willingness to participate in flood reporting, as well as their opinion on who should be involved in flood preparedness and verification of the data reported by citizens.

After a short break, the *second session* began with students divided into three groups to work on the 'Citizen Engagement Strategy Canvas' developed specifically for the workshop. Inspired by the Business Model Canvas, which transforms complex planning into clear visual blocks, this tool helps students identify their target audience, design meaningful engagement activities, and summarize their strategy in a concise format. Using structured prompts, icons, and accessible language, the canvas fosters inclusive participation, creativity, and collaborative thinking. It also allows for easy comparison across group ideas and serves as both a practical workshop tool and a replicable framework for future study materials. The objective of the activity was to co-create strategies that encourage student involvement in preparing for, responding to, or preventing urban flooding. Each group presented their strategy, followed by a peer voting session to identify the best idea. The session concluded with a Mentimeter-based wrap-up to gather feedback and reflect on the students' engagement and learning experience

Q & A

1a. How did you reach the students at LUT to participate in the workshop? Eg: over social media, personal contact, or other ways?

We reached the students through different platforms such as LinkedIn and WhatsApp (in student groups). Announcements were made by professors through student email groups and the degree's news channel. Additionally, I've invited students in person on campus.

In addition to promotion via internal communication channel in LUT, it was further promoted on the City of Lappeenranta's LinkedIn page via post which has nearly 800 followers and also shared in Facebook group for students which helped us to recruit participants from other academic backgrounds beyond just environmental science. We also shared the post in our personal LinkedIn profile.

1b. Which of these communication methods worked best to get to get the students to turn up to the workshop?

We had a total of 25 sign-ups, but only 12 participants attended the workshop. A significant number of no-shows were from those who registered through external networks. It clearly shows that the announcements through official channels such as university forums and email lists, worked the best. There was also a sort of snowball effect in which students who signed up also invited their friends.

2a. During the workshop, what kind of tools were used to gather feedback from the workshop participants?

We used Mentimeter for individual questions to access participants' understanding of flood. Paper based canvas template were used for group work.

2b. Which feedback tool worked best to gather data?

Mentimeter

3. Which communication methods worked best to engage the students in the activities during the workshop?

Presentations of real flood situations via visual aids help participants to relate to the topic. Activity guides and engagement canvas with the instructions helped them to stick within the topic and provide the expected result.

BALTFLOODS, Baltic Flood Resilience and Digital Solutions

Report on In-person Workshop, University of Gothenburg

DEVELOPING A COMPREHENSIVE CITIZEN ENGAGEMENT STRATEGY

MAY 29, 2025

Interreg Baltic Sea Region

Co-funded by the European Union

RESPONSIVE PUBLIC SERVICES

BALTFLOODS

This project is co-funded by the European Union through the Interreg Baltic Sea Region Programme.

Background/Purpose of Workshop

The workshop was conducted as part of WP1.3 Preparing citizen engagement. The workshop was organized by Yixin Zhang, Juho Lindman, and Sebastian Andreasson from the Department of Applied IT, University of Gothenburg. Sanna Varis from City of Lappeenranta, Inger Katharina Gregersenm and Trond Hulleberg from Gjøviks kommun shared real-world challenges and current flood mitigation measures in their cities and inspired participants. We also got support from Vasili Mankevich who is responsible for the course TIG326 Data-Driven Organizational Development, focusing on data-driven solutions.

The workshop involved 12 participants from University of Gothenburg. The participants are enrolled in TIG326 Data-Driven Organizational Development. The learning objectives of the course include knowledge of design thinking approach and arguing for role of individuals for sustainable development. The Baltfloods project objectives fit very well with the course objective.

Flow of Workshop and Method Adopted

1. In the workshop, we start with Lappeenranta and Gjøvik introducing the challenges they are facing about flooding in the urban areas. Their sharing is very important, as they help participants realize the relevancy of the problems, and participants thus get very engaged, as they know the tasks they work on are real.

2. We then had group discussions, with the discussion questions designed around the topics of experience with flooding, awareness and local knowledge, citizens' needs and citizen engagement. participants are allowed to submit their answers either individually or as a group through Microsoft form https://forms.office.com/e/LVaDi1Ef5s.

3. Design task

   After a short break, participants worked on a design task: How would you engage citizens in flood prevention with a crowd-sourced phone application?

   We adopted the Crazy Eight method. Participants started to work on the task individually and then group work.

   - 8 minutes to come up with 8 ideas, then refine

   - 30 minutes individual for three stages (8 > 4 > 2)

   - 30 minutes groupwork, present your individual findings and develop the best idea(s)

   Individual work: Participants were given A4 papers and put their ideas through other drawings or texts, depending on their preferences and comfort.

   On the first piece of paper, they put down 8 ideas. In this way, participants were encouraged to go beyond their first, most obvious ideas.

   On the second piece of paper, they picked 4 ideas from the initial 8 ideas, refine them. On the third piece of paper, they picked 2 ideas from the 4 ideas, further refined them.

   Group work: Participants presented their individual best ideas, and the group discussed the ideas and developed the best idea(s) together.

   The workshop was concluded with groups presenting their ideas.

   Adopting the Crazy Eight method, allows for both creativity, inclusive participation, and high engagement. The iterative progression from individual ideation to group synthesis allows for both individual creativity and collective work, which are important in addressing complex problems such as urban flooding.

   Participants were very engaged in the workshop and gave positive feedback. Some participants shared that the workshop helped them know more about the urban flooding problem, the municipality and city's efforts, and encouraged them to explore more in this area.

Data collected

Data collected consists of three parts:

1. Participants' answers about experience with flooding, awareness and local knowledge, citizens' needs and citizen engagment are in the file Workshop Discussion Questions Results.xlsx

2. Partipants' individual work and groupwork for the design task, using the Crazy Eight method, are in the folder Participants design drawings

3. Partipants' group presentations are transcribed in the file Transcript of the group presentations.

Some Highlights from Participants' Suggestions

Is Mobile App the best tool? – How about a website interface, that is easier to access, easier to browse.

How to present the data? – Regarding data presentation, it is important to keep in mind who are the users. Citizens are just one type of users. How about municipality, and potentially other users?

Reporting flood is an activity that probably occurs only during certain seasons. Citizens may be reluctant to download an app just for reporting flood. How about collaborating with some other organizations, leverage some already existing app? Such as SMHI, the Swedish Meteorological and Hydrological Institute, and their app for checking weather?

BALTFLOODS, Baltic Flood Resilience and Digital Solutions

Report on In-person Workshop, Norwegian University of Science and Technology

DEVELOPING A COMPREHENSIVE CITIZEN ENGAGEMENT STRATEGY

JUNE 3, 2025

Interreg Baltic Sea Region

Co-funded by the European Union

RESPONSIVE PUBLIC SERVICES

BALTFLOODS

This project is co-funded by the European Union through the Interreg Baltic Sea Region Programme.

Introduction to the Workshop

On June 3, 2025, a one-hour Colourlunch workshop was held at NTNU in Gjøvik, led by Steven Le Moan and Inger-Katharina Gregersen from Gjøvik Municipality. The workshop engaged approximately 15 participants, including PhD candidates, postdocs, and staff from the Colourlab at NTNU in Gjøvik. These participants represented diverse cultural backgrounds and age groups. The primary objective of this workshop was to gather insights from researchers regarding their perceptions, monitoring practices, and potential improvements for water quality and stormwater management. The feedback collected is intended to directly inform the design of technical tools, engaging public interfaces for environmental monitoring, and community-inclusive strategies for stormwater awareness and action within the broader Baltfloods project.

End-User Needs: Insights from Researchers

The workshop prompted discussions around what makes stormwater and water quality visible or relevant, what would encourage citizen participation in monitoring, and how the visual computing community can contribute.

What Makes Stormwater or Water Quality Visible or Relevant?

Participants identified several key indicators and impacts:

Sensory Observations:

- Smell of water, particularly unpleasant odors.
- Visible cues like different responses to visible/smelly conditions, as opposed to invisible pollution.
- Rainbow colors due to oil spillage.
- Trash on beaches and debris in the water.
- Color changes in rivers (e.g., Hunnselva) or general water bodies.
- Blopores.

Direct Impact on Daily Life:

- The quality of tap water, as it is consumed daily.
- Negative impacts on the human body.
- Hindrance of recreational activities due to poor water quality.
- Impacts on skin and hygiene purposes.
- Flooded roads and public spaces.

What Would Make Citizens Care or Take Part in Water Monitoring?

Engaging citizens requires addressing their concerns and providing incentives:

Direct Information and Feedback:

- Individualized household testing for invisible pollution.
- Feedback mechanisms to confirm if a problem has been fixed.
- A hotline for water quality issues, similar to emergency services (e.g., 112).

Awareness and Incentives:

- Public awareness days (e.g., Awareness day in Gjøvik).
- Rewarding systems, such as lotteries, for participation.
- Developing an app that allows users to send pictures and earn points exchangeable for rewards (e.g., cinema tickets).
- Workshops like the one held to raise awareness.

Interactive and Gamified Approaches:

- Games and interactive elements, such as "Dolpejakten" next to monitoring points.
- Crowd-sourced imagery.
- Participation (upstream & downstream).
- Couple showering.

How Can the Colourlab and Visual Computing Community Contribute?

The visual computing community, particularly the Colourlab at NTNU, can play a significant role in improving water quality monitoring:

Advanced Sensing and Imaging:

- Leveraging RGB/Hyperspectral imaging for water quality assessment.
- Utilizing remote sensing techniques to monitor water bodies for changes in quality, turbidity, and pollutant levels, particularly during and after flood events. This includes using satellite imagery like Sentinel 2 for environmental imaging and color analysis.
- Applying opportunistic sensing, such as vision-based rainfall estimation using ordinary surveillance cameras, to measure rainfall intensity.
- Using the Colourlab Observatory.

Data Management and AI Integration:

- Simplifying the use of quality sensors.
- Developing Digital Twins based on Water Smart Data Models for enhanced data management and flood risk assessment. This involves integrating data from sources like Copernicus APIs and legacy systems into a FIWARE-compatible system for real-time context management.
- Combining Artificial Intelligence (AI) in water management for flood prediction.
- Image-based measurement of tap water quality.
- Monitoring fish numbers and activity using AI/Computer Vision (CV).
- Quality monitoring.
- Temperature and quality monitoring of Mjøstranda.

Public Engagement Tools:

- Developing apps like "EyeOnWater Colour" or "CitySen" for citizen engagement in monitoring.
- Creating accessible communication materials and platforms for gathering community feedback.
- Disseminating the possibilities of existing solutions, such as Copernicus products, to the public.
- Utilizing colour science and colour imaging to increase citizen engagement in stormwater and water quality management.
- Conducting PhD or postdoc research specifically on automatic detection from street cameras and remote sensing data for water quality in public sources.

Data Integration and Real-time Monitoring:

- Enabling real-time Gjøvik water quality monitoring.
- Supporting real-time information for flooding and stormwater.

Conclusion

The workshop provided valuable insights into the multifaceted challenges of stormwater and water quality management, highlighting the crucial role of both technological innovation and active citizen engagement. The visual computing community, with its expertise in remote sensing, AI, and imaging, is uniquely positioned to contribute to the development of robust and scalable solutions for real-time monitoring and public awareness. The feedback from this workshop will directly inform the ongoing development of technical tools and public interfaces within the Baltfloods project, ensuring that the solutions are tailored to the needs of municipalities and their citizens.

Towards flood resilient cities powered by data and people.

LAPPEENRANTA

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LUT University

NTNU
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UNIVERSITY OF GOTHENBURG

Cape Europe

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