Area Innovazione Servizi al Cittadino
U.O. Innovazione e Digitalizzazione
Piazza R. Bassi, 1
40055 Castenaso (BO)

Città di Castenaso
Città Metropolitana di gna

FinEst Centre
for Smart Cities

SMART CITY CHALLENGE 2025

City Challenge

Max 3 pages
send to smartcity@taltech.ee by Sept 30, 2025

Challenge Title – Flood Management
City/county and country – Castenaso - Bologna, Italia
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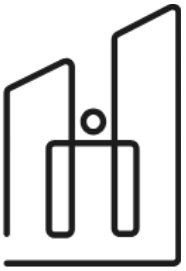
1. What is the future urban challenge that would need a solution to?

The main challenge is the **transformation of the territory from an area with high hydrogeological risk to a fully resilient and safe urban and peri-urban ecosystem**, capable of coexisting with increasingly frequent and intense extreme weather events.

Describe the challenge of your city/county bordering a city? Castenaso directly borders the metropolitan city of **Bologna** (in addition to the cities of San Lazzaro di Savena, Granarolo dell'Emilia, Ozzano dell'Emilia, and Budrio). The specific challenge, shared with the Bolognese territory, is the **mitigation of the flooding risk of the Idice torrent** and its smaller tributaries, which cross and define the territory. The collapse of the Pedagna Bridge and the numerous levee breaches demonstrate structural fragility and the need for integrated interventions along the riverbed, involving the



maintenance of in-stream vegetation and the restoration/reinforcement of riverbank defenses, in coordination with neighboring municipalities and the Basin Authority.

- **Which category does your challenge primarily fall into: safe city, happy city, and climate-resilient city?** The challenge primarily falls into the **Climate-Resilient City** category, as it focuses on the ability of the urban system to absorb and recover from the impacts of climate change (flood events) while reducing the risk to people and property. It is also closely related to the **Safe City** category, as the physical safety of citizens and infrastructure is the immediate goal.
- **Why is it important for your city to solve it? How high is the priority for you and why?** Solving this challenge is of **maximum priority (Priority 1/A)** for Castenaso for the following reasons:
- **Protection of Life and Health:** The absolute priority is to safeguard the lives and safety of citizens, who have suffered evacuations and direct damages.
- **Economic and Social Sustainability:** Events like the 2023 flood caused extensive damage to businesses, agriculture, and private homes, undermining the economic stability of the municipality and social cohesion. Resolution is crucial for long-term recovery and development.
- **Territorial Continuity:** The collapse of key infrastructure, such as the Pedagna Bridge, disrupts essential services and road access, isolating parts of the municipality.
- **Is this a specific challenge/problem for your city, why? Or, to your knowledge, is it a common challenge/problem for many cities, like other cities?** Although the hydraulic vulnerabilities linked to the **Idice Torrent** (which has local specificities such as the levee system and the surrounding urban context) are specific to Castenaso and its neighboring municipalities, the challenge of **hydrogeological resilience in the plain** in response to climate change is a **common problem for many cities**, particularly in the **Po Valley and Emilia-Romagna**. Many municipalities along the major and medium regional watercourses (such as the Reno, Samoggia, Panaro) face similar issues of flooding, overloading of drainage systems, and the need for extraordinary maintenance and redesign of hydraulic defenses.

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Castenaso's experience can therefore serve as a **laboratory** for solutions that can be replicated in similar contexts.

2. Innovation.

1) How have you solved that issue so far? Why aren't the present solutions good enough? Are there legal obstacles, and which ones?

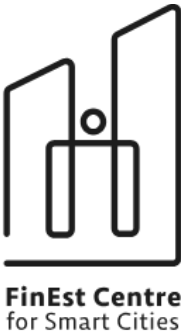
Current Solutions

So far, the Municipality of Castenaso and the higher-level bodies (Region, Land Reclamation Consortium, Extraordinary Commissioner) have implemented **emergency response and post-event restoration** solutions, such as:

- **Immediate and Urgent Interventions:** Restoration and safety reinforcement of damaged levees (e.g., Ponte della Motta/La Motta), including reconstruction and consolidation (e.g., with plastic diaphragm walls) for a total investment of tens of millions of euros.
- **Hydraulic Maintenance:** Removal of fallen or hazardous vegetation within the riverbed to improve the hydraulic capacity of the Idice torrent.
- **Support Measures:** Provision of Immediate Support Contributions (CIS) and Autonomous Accommodation Contributions (CAS) for affected citizens and businesses.
- **Planning:** Works for the reconstruction of critical infrastructure (e.g., Ponte della Pedagna).

Why Current Solutions Are Insufficient

Current solutions, while necessary and vital for immediate response, are not sufficient to guarantee long-term resilience:



- **Reactive vs. Preventive Nature:** Most efforts are focused on **reconstruction** (*repair*) rather than on **structural prevention** (*prevent*) and adaptive resilience. The repetition of floods (as in the case of the Casalunga Golf Club, flooded multiple times) demonstrates that the current levee system is not adequately sized for the new, exceptional water flows caused by extreme weather.
- **Linear Approach:** Interventions often concentrate on strengthening existing levees, an approach that either shifts the problem downstream or risks catastrophic failure in case of a breach (the "water bomb" effect), instead of adopting decentralized management and flood lamination solutions.
- **Slow Timelines:** Despite emergency procedures, the time required for the design and implementation of complex and definitive structural interventions (such as expansion basins or relocation) is long and cumbersome, leaving the territory vulnerable in the meantime.

Legal Obstacles

The main legal and procedural obstacles are:

- **Hydrogeological and Landscape Constraints:** Current regulations (e.g., PAI - Hydrogeological Structure Plan, landscape constraints) can slow down the approval of new structural hydraulic works, particularly the creation of new **flood expansion basins** or riverbed recalibration, which often requires the expropriation of agricultural land.
- **Administrative Complexity:** The multitude of bodies involved (Municipality, Metropolitan City, Region, Basin Authority, Civil Engineering Office, Commissioner Structure) requires long and complex procedural coordination for the approval and funding of integrated and innovative projects.
- **Hydraulic Invariance Rules:** Although regulations (e.g., Regional Hydraulic Invariance Regulations) exist for new settlements, adapting historical urbanized areas and retrofitting existing infrastructure to these standards is expensive and procedurally difficult.

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- What should be the main features, characteristics of the future solution to be potentially best for that challenge or problem?

The future innovative solution for Castenaso must evolve from a purely defensive (levees) approach to an **integrated risk management model based on the "Sponge City" concept**, combining grey, green, and digital infrastructure.

Main Features of the Future Solution:

Feature	Description
Blue-Green Infrastructure (Nature-Based Solutions - NbS)	**Maximization of natural lamination:** Creation of new **dry expansion basins** (off the main riverbed, adjacent to the Idice) and artificial wetlands upstream of the town center to absorb and slow down flood peaks. **Increase in permeable surfaces** in urban and peri-urban areas.
Predictive and Smart Monitoring	Installation of a widespread **IoT (Internet of Things) sensor system** to monitor water levels and rainfall on the Idice Torrent and secondary channels in real-time. Use of **AI-based predictive hydraulic models** for more precise, localized warning alerts (down to the street/address level).
Urban Integration (Blue-Green Planning)	Mandatory introduction of the concept of **"building with water"** into urban planning (PSC/PUG). This includes the requirement for retention/lamination basins for new developments and the assisted **relocation** of private homes and businesses located in unmitigatable high-risk flood areas (P4/R4).
Proactive and Programmed	Definition of a **multi-year, eco-compatible hydraulic maintenance program** (selective vegetation removal, hydraulic section control) managed digitally and funded stably to prevent the accumulation of

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Feature	Description
Maintenance	critical issues.
Digital Inter-Municipal Coordination	Creation of a **single, shared management platform** among Castenaso, Bologna, and other neighboring municipalities, to coordinate civil protection operations, road closures, and the management of water pumps in real-time during an event, overcoming current administrative fragmentation.

The ideal solution is one that shifts the strategy from **"defense"** to **"adaptation"**, managing water not as a threat to be contained at all costs, but as a resource to be laminated and safely diverted into designated space.

3. Expected impact of your pilot solution.

Solving the hydrogeological resilience challenge through the proposed integrated solution (combining Nature-Based Solutions, Smart Monitoring, and Integrated Planning) will generate deep and systemic impacts across the city.

- What is the expected impact to your city environment you expect to see if the challenge gets solved?

  The primary environmental impact will be the shift towards a **sustainable hydrological balance** and the enhancement of **biodiversity**.

  - **Hydrological Balance Restoration:** By implementing **Blue-Green Infrastructure** (like dry expansion basins and increased permeable surfaces), the city will gain crucial capacity to **laminate flood peaks**. This reduces the velocity and volume of water reaching urban areas, protecting the existing levee system and reducing erosion along the Idice riverbanks.
  - **Ecosystem Services Enhancement:** The creation of new, managed flood areas and wetlands will function as ecological corridors, supporting local flora and fauna and offering **ecosystem services** such as natural water filtration and carbon sequestration. This turns flood-risk zones into **environmental assets**.

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- **Climate Change Adaptation:** The solution fundamentally increases the territory's **adaptive capacity** to climate change, moving from a reactive model (reconstruction after damage) to a proactive model (absorbing shock).

- What is the expected impact to your citizens you expect to see if the challenge gets solved?

  The impact on citizens will primarily center on **enhanced security, economic stability, and quality of life**.
  - **Increased Safety and Peace of Mind:** The most significant impact is the reduction of the **psychological burden** and **physical risk** associated with recurring floods. Highly accurate, localized, and timely alerts from the **Smart Monitoring** system will ensure citizens have critical minutes or hours to act and evacuate safely, saving lives and reducing panic.
  - **Economic Resilience:** The reduction in flood damage translates directly into significant **cost savings** for homeowners, businesses, and the agricultural sector (e.g., lower insurance premiums, reduced losses from business interruption, and less need for emergency public funding). This fosters long-term economic stability.
  - **Improved Quality of Life: Blue-Green Planning** can incorporate flood-control spaces into multi-functional areas (e.g., parks or recreational zones during dry periods), enhancing the quality of public spaces and promoting community well-being.

- What is the expected impact to your city governance you expect to see if the challenge gets solved?

  The solution will catalyze a modernization of governance, making it **more efficient, transparent, and collaborative**.
  - **Data-Driven Decision Making:** The **Smart Monitoring** system provides local administrators with continuous, high-quality data (real-time flows, rainfall accumulation). This shifts governance from being reactive and anecdotal to being **predictive and data-driven**, leading to better resource allocation for maintenance and faster, more confident response during emergencies.
  - **Enhanced Inter-Municipal Collaboration:** The **Shared Digital Management Platform** forces and facilitates procedural coordination with neighboring municipalities and regional bodies (Bologna, Budrio, etc.). This breaks down administrative silos, creating a **unified emergency response protocol** that increases efficiency and reduces jurisdictional conflicts during critical phases.
  - **Streamlined Processes:** By proactively addressing the risk through structural solutions and clear planning regulations, the need for repeated, costly, and resource-intensive emergency management interventions (**Somma Urgenza**) is reduced. Governance becomes more focused on **sustainable management and long-term planning**.
  - **Increased Citizen Trust:** Successfully mitigating a major recurring threat and demonstrating transparency in data-driven management will significantly boost **public trust** in local government and regional institutions.

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4. Piloting

- Why would you be interested to become a piloting partner of a proposed solution to the challenge you are describing here? Describe shortly your capability to participate.

Castenaso is highly motivated to become a piloting partner for the proposed integrated solution because the challenge is no longer theoretical, but a **recurrent existential threat**. Recent floods have demonstrated the urgent need to move beyond traditional reactive measures.

1. **Extreme Urgency and Demonstrated Need:** The municipality has been directly and repeatedly impacted by severe floods (2023, 2024), resulting in loss of infrastructure (e.g., Ponte della Pedagna), significant economic damage, and social distress. This urgency guarantees the **highest level of political commitment** and rapid deployment of the pilot.

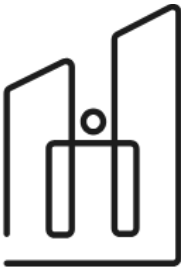
2. **Ideal Testing Ground:** The Idice river basin within the Castenaso territory presents a perfect, complex scenario for piloting. It includes critical components: a major river, a mix of urban and peri-urban areas, high-value agricultural land, and essential connecting infrastructure. The pilot success here would demonstrate the solution's viability in a **high-stress, real-world environment** common to many cities in the Po Valley.

3. **Scalability and Replication Potential:** As a municipality neighboring Bologna, the capital of the region, Castenaso's successful implementation of a "Sponge City" model and digital coordination system provides a **directly replicable blueprint** for dozens of other vulnerable municipalities along the same or similar river systems (Reno, Samoggia, Panaro).

Capability to Participate

Castenaso possesses the necessary administrative, technical, and geographical capabilities to be an effective piloting partner, specifically for the proposed solution's three pillars: NbS, Smart Monitoring, and Integrated Planning.

1. Administrative and Political Commitment



- **Decisive Leadership:** The local administration is fully committed to the reconstruction and resilience process, ensuring the necessary **political mandate** to overcome bureaucratic hurdles and fast-track permits and approvals within municipal jurisdiction.

- **Financial Leverage:** The current state of emergency and reconstruction provides access to national and regional **recovery funds** and structures (e.g., the Extraordinary Commissioner's office), which can be leveraged to co-finance the pilot components and ensure long-term sustainability.

2. Geographical and Technical Readiness

- **Geographical Vulnerability:** The presence of the Idice torrent and its flood history provides the **physical test area** for the hydraulic resilience components (NbS).

- **Digital Infrastructure Access:** As part of the Metropolitan City of Bologna, Castenaso has access to established regional and metropolitan **fiber optic networks and digital services** essential for deploying the **IoT sensors** and the **Shared Digital Management Platform**.

- **Collaboration Capacity:** The municipality already collaborates closely with the key stakeholders required for a successful pilot: the **Bonifica Renana** (Consortium for Land Reclamation), the **Regione Emilia-Romagna Civil Protection**, and the **Metropolitan City of Bologna**, ensuring a multi-level governance approach.

3. Human Resources and Local Knowledge

- **Trained Personnel:** Municipal technical offices and local Civil Protection volunteers possess direct, recent, and extensive **field experience** in flood response and damage assessment, offering invaluable local knowledge for optimizing sensor placement and alert protocols.

- **Citizen Engagement:** The high level of recent civic involvement following the floods ensures that a citizen-focused pilot—especially regarding real-time alerts and land-use changes—would be met with **active participation and feedback**.

CHECKLIST AND FAQ

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Are you a city, municipality or a campus / private real estate developer?

> Yes – you are warmly welcome to propose 1-3 challenges, one challenge per one template
>
> No – do not send us any challenges but wait until we have gathered urban challenges and you are welcome to propose solution ideas by November 30

Are you describing challenge or problem? – Yes, then great.

Does a city need to propose a solution idea as well? – No, the researchers and companies will propose their solution ideas to the challenges proposal by the cities.

Can only Estonian cities propose challenges? Can only EU cities propose challenges? – No, cities* from whatever country are warmly welcome.

*A **City** is a local administrative unit where the majority of the population lives in an urban centre of at least 50 000 inhabitants and cities from countries with less than 5 cities of more than 100 000 inhabitants if they have more than 10 000 inhabitants. Those countries are: Croatia (HR), Cyprus (CY), Estonia (EE), Ireland (IE), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Slovenia (SI) and Slovakia (SK).

Can our city participate without proposing a challenge? – Yes, that is also possible but then you need to vote for challenges proposed by other cities. This can be done between Oct 2-30.

How will the challenges be evaluated? – We will not evaluate the proposed challenges but other cities/municipalities/campuses/private real estate developers can vote for the proposed challenges. In Round 5 researchers will start to propose solution ideas only to the challenges that have minimum one Estonian city/county and one city/county from another country.

Firmato digitalmente da:
Chiara Bergamini
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