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D.6.7.1. Toolbox on River Barriers for plastic collection

ACT 6.7

WP 6

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PROJECT MARLESS

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CONTENT:

1.	Introduction	4
1.1	Brief description of the activity performed	4
1.2	Goals achieved	4
2.	Deliverable Methodology	6
2.1	WHERE: Deliverable location description	6
2.2	WHO: Experts Involved	6
2.3	HOW: Description of the activity realized	6
2.4	Outputs achieved vs Outputs expected	7
2.5	Swot Analysis	8
3.	Conclusion / Summary	9
4.	Transferability	10
5.	Media	11

1. Introduction

Within the framework of the MARLESS Project, this report describes the action realized by Veneto Region, as part of the WP6 “Pilot Actions to prevent, recover, process marine litter”, which main aim is to demonstrate the feasibility of several new technologies in the field of marine litter prevention, recovery and processing. In particular, this Toolbox is related to Activity 6.7 “Marine Litter Adriatic Toolbox on Pilot actions”, which expected results were the preparation by each partner engaged in the pilot actions of a short tool box, as a manual that interested stakeholders could follow for replicating and setting up the innovative activities, aiming at boosting the transferability of WP main outputs.

1.1 Brief description of the activity performed

The Veneto Region planned, implemented and tested a new technology as river barriers for plastic collection. The technology consists of a floating structure that, thanks to the rotation of its two floating wheels, helps the transfer of waste to two metal boxes that collect all the floating materials (waste) dragged by the channel current. Two video cameras are installed closed to the floating structures on existing irrigation adjustment structures, power supplied by photovoltaic solar panels, and are used to record and analyze images of waste, also categorizing the litter by a machine learning AI system.

1.2 Goals achieved

The experience realized by the implementation of this new technology helped to achieved the following goals:

- 1) The physical collection of riverine litter dragged by the Vela channel waters;
- 2) The collection of an images database of waste, and a statistical analysis of the main waste dragged by a river;
- 3) The development of new technology for litter collection in rivers;
- 4) The implementation and sharing of best practises in riverine litter collection;

- 5) Considering the technical difficulties, linked to the extension of waste over the entire width of the watercourse, requiring the frequent activity of litter recovery not only from land, but also with the support of a boat to drive the movement of the material toward the shore, the development of an automatic sensor for a required waste collection warning.

2. Deliverable Methodology

2.1 WHERE: Deliverable location description

The identified area for the implementation of the new device is a portion of the Vela Channel, which flows into the Sile river and ends in the Venice Lagoon transporting all the material present in its watercourse. The pilot site extends on a narrow area near the inlets towards the Venice Lagoon and is included in the municipal territory of Quarto d'Altino (VE).

The portion of the Vela Channel chosen for the installation is characterized by the accumulation of waste that takes on significant dimensions, due to the presence of a hydraulic "siphon barrel", clearly visible along the provincial road SP43.

Considering also the high touristic presence, especially during summer seasons, the selected regions can be considered at risk regarding the issue of waste disposal and the consequent accumulation of riverine and marine litter.

2.2 WHO: Experts Involved

The design and prototyping phases of the work needs to be realized by engineers, experts in electronics, control systems and mechanics, but, once the device is settled and in use, it does not need to be used by professionals. Some technics are needed to recover and disposal the collected waste from the metal boxes.

2.3 HOW: Description of the activity realized

The implementation of the new device consisted in several phases:

1. Realization of floating structure for waste interception;
2. Realization of galvanized metal box for waste accumulation;
3. Construction of anchorage structure;
4. Supply and installation of monitoring system;
5. Adjustment of the channel side profile.

More information and technical details can be found in the D.6.1.5.

2.4 Outputs achieved vs Outputs expected

The expected outputs consisted in:

- a) Monitoring of floating waste on the Vela Canal in order to quantify its size on an annual basis;
- b) Interception and collection of plastics (and other riverine litter) without fixed works, ensuring compliance with the landscape context of high value (anytime the chosen side of the channel can be modified or the infrastructure can be moved to a different channel if needed);
- c) Collection of high volume of waste, preventing their release on the coast or in the sea;

In summary, the implementation of this project allowed to achieve also the following outputs:

- a) Determination of the prevailing type of material by cameras and AI;
- b) Using of indirect technologies (video cameras) for remote monitoring, avoiding to check periodically the reached amount of waste accumulated in the channel;
- c) Testing of the effectiveness of the combined monitoring solution - collection prepared, in order to refine and replicate the system in other sites affected by similar problems;
- d) Raising of community awareness of the problem of waste at river and sea by spreading documentation of the project within the framework of programs already in place like Project School - Consortium of Remediation and National Week of the Remediation, or with seminars and guided tours:

All the measures to collect floating material presented considerable technical difficulties, linked to the extension of waste over the entire width of the watercourse, requiring the frequent activity of litter recovery not only from land, but also with the support of a boat to drive the movement of the material toward the shore. With this new system, an automatic sensor alerts the team for the litter collection only when a certain amount of volume is reached.

2.5 Swot Analysis

In the following table, the SWOT analysis scheme, and how the performed action can be improved

	Helpful	Harmful
Internal Origin	STRENGTHS: <i>small preexisting infrastructures</i> <i>easy installation</i> <i>minimum environmental impact</i> <i>non-invasive technology</i> <i>remote control system</i>	WEAKNESSES: <i>only for riverine litter (not marine litter)</i> <i>for macro plastics only</i> <i>for non-navigable river only</i>
External Origin	OPPORTUNITIES: <i>scalability</i> <i>transferability</i> <i>best practices</i>	THREATS: <i>meteorological extreme and fast events</i>

3. Conclusion / Summary

In the MARLESS framework the Veneto Region carried out the so-called “Monitoring and interception of floating waste at the Vela Channel”, a pilot action aimed at testing new technologies to reduce the presence of riverine litter. The chosen site for the implementation of the pilot action extend on a narrow area near the inlets towards the Venice Lagoon of a high landscape value: the area can be considered heavy industrialized and present a high-presence of tourists, especially during summer seasons.

During the pilot testing phase the new river instrumentation have been able to collect big volumes of litter in the Vela Channel, as well as help in the as well as in helping the cleaning operations of the channel itself through the use of sensors that warned once passed a certain volume level. The camera-sensor, indeed, helped in have also reduced the number of interventions to be carried out for ordinary cleaning.

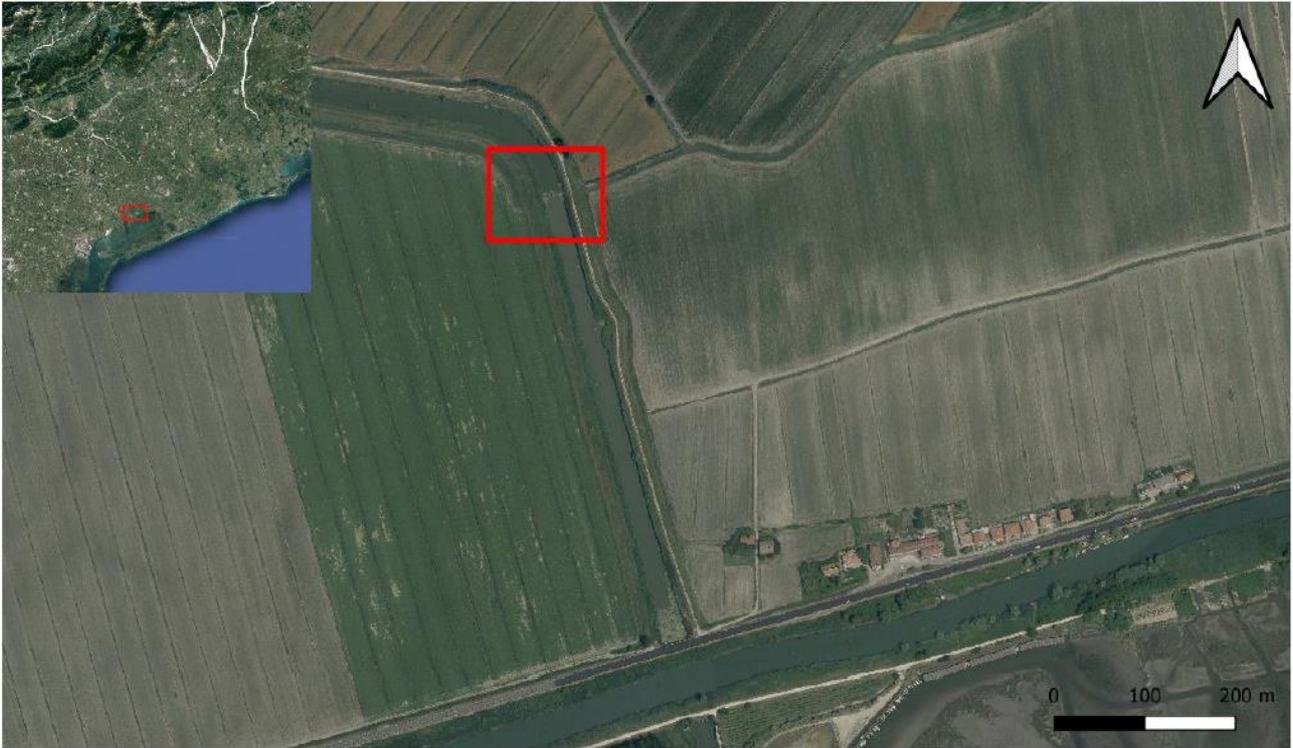
This technology will provide a double baseline for future studies and instrumentation:

- on the one hand, it will continue to provide a valid instrumentation for the collection of mechanical waste, with minimum environmental impact through non-invasive technology that is well incorporated in the surrounding environment;
- on the other hand, the indirect technology provided by the image processing software for the categorization of waste trapped by the mechanical system can gradually be enhanced by artificial intelligence and machine learning, including the input of new visual references for the recognition elements such as protected or invasive species.

4. Transferability

The experience gained in this pilot action can be considered perfectly transferable to other fluvial or lagoon environments, or confined waters. Furthermore, the innovative technologies implemented and deployed can be applied in future river agreements. “River agreements” could be considerate also for bigger contests, like the Adriatic Sea. After the project, this prototype of the river barrier for litter collection and identification will be available to the local authorities, interested public and non-governmental organizations. Specific geomorphological, geographical and fluid-dynamic condition needs to evaluate the correct location and position of similar technology in other environments.

5. Media



ORTOFOTO_2015
ORTOFOTO 20 cm [2015] CONSORZIO TeA – TUTTI I DIRITTI RISERVATI

Figure 1: Intervention area.



Figure 2: Floating litter accumulation on the Vela Channel.



Figure 3: Aerial photo of the portion of Vela Channel interested by the intervention.

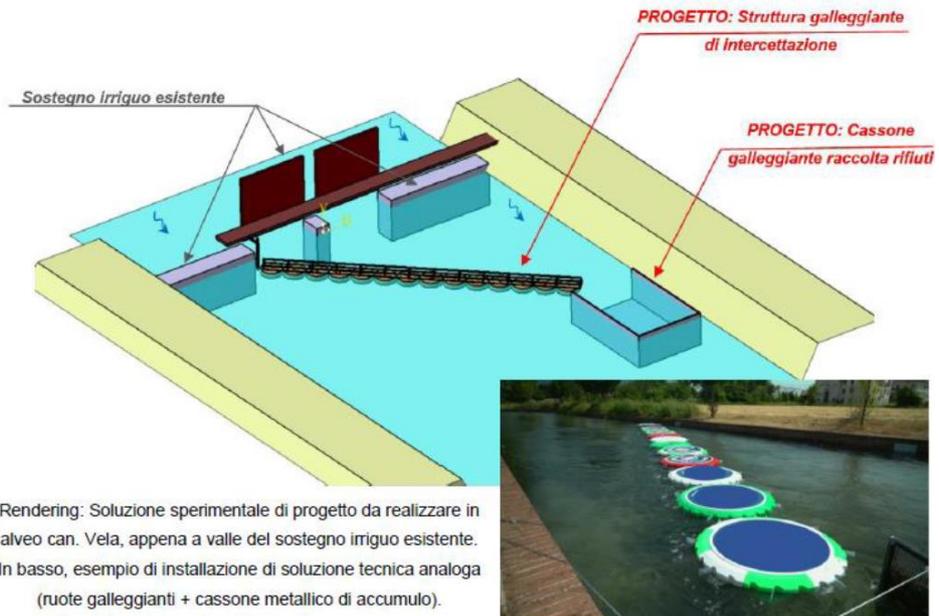


Figure 4: Example of the realization of the devices before the implementation



Figure 5: Pilot site with devices in place.