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Ecosystem-based approach towards the sustainable management of coastal engineering: compensation and mitigation measures applied to the Civitavecchia harbour

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The expansion of Civitavecchia Hub Port will potentially produce an impact on the adjacent coastal areas which are characterized by the presence of SCIs (Sites of Community Importance IT6000005 northern and IT6000006 southern to the port area) which extend in front of the municipalities of Tarquinia, Civitavecchia and Santa Marinella.

The two SCIs are characterized by priority habitats and species under the Habitat Directive 92/43 / EEC; in particular, they host *Posidonia oceanica* meadows (Priority habitat 1120 * - *Posidonium oceanicae*) and coralligenous bioconstructions (Habitat 1170 - Reefs), as well as individuals of *Pinna nobilis* (Annex IV - Habitat Directive Code 1028) and colonies of *Corallium rubrum* (Annex IV - Habitat Directive Code 1001).

Within VIA and VAS procedures, a series of complex activities has been implemented to reduce the potential impacts on the marine environment, leading to the presentation of an innovative ecosystem-based program of mitigation and compensation measures based on the assessment of direct and indirect impacts of construction activities as well as ecosystem services analysis. This new program is based on our project "Ecosystem-based approach applied to the evaluation of compensation and mitigation measures in marine environment: The case study of the Port Hub of Civitavecchia". The project includes for example: a detailed analysis of marine habitats and oceanographic conditions, restoration of equivalent habitats, habitats and species protection systems, actions towards an eco-sustainable use of the environment. The innovation of this approach derives from the quantification of the interventions which is based on the assessment of surfaces damage as well as on the uses affected both directly and indirectly, considering a time interval of ten years for the recovery of the damaged ecosystem functions.