The Strategic approach in planning water cities. National and international best practices

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TECNOLOGIA DELL'ARCHITETTURA

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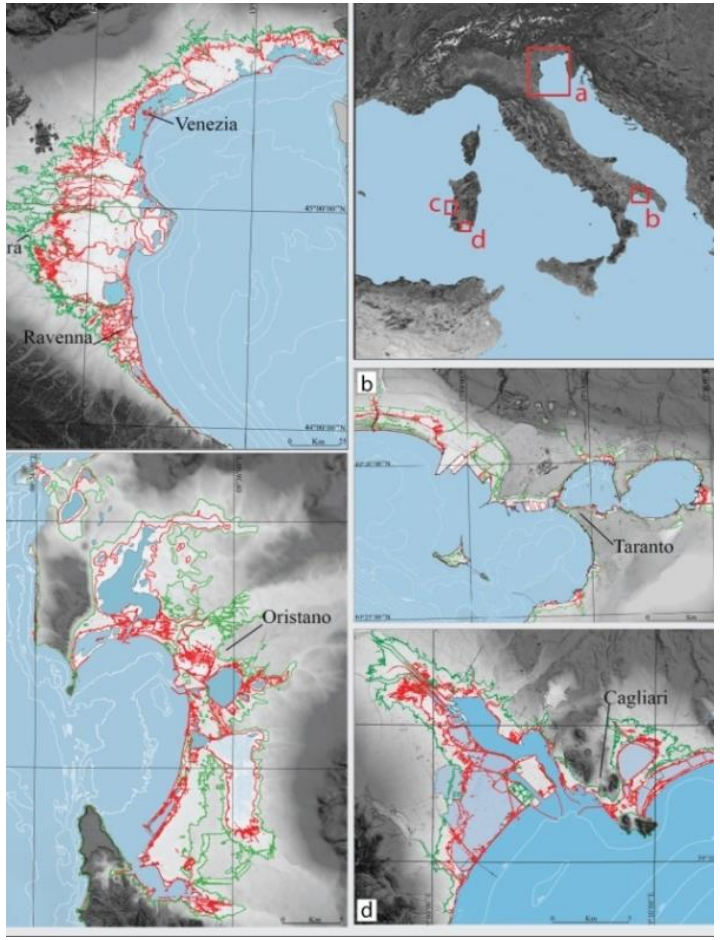
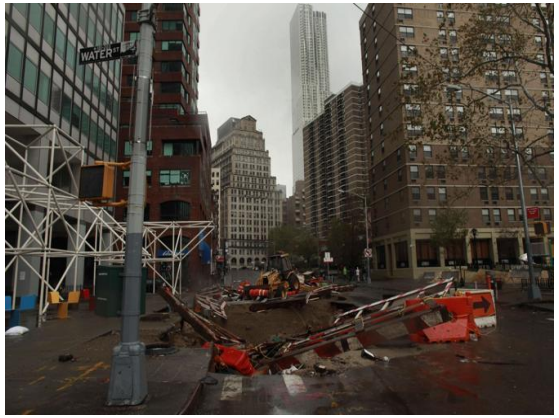
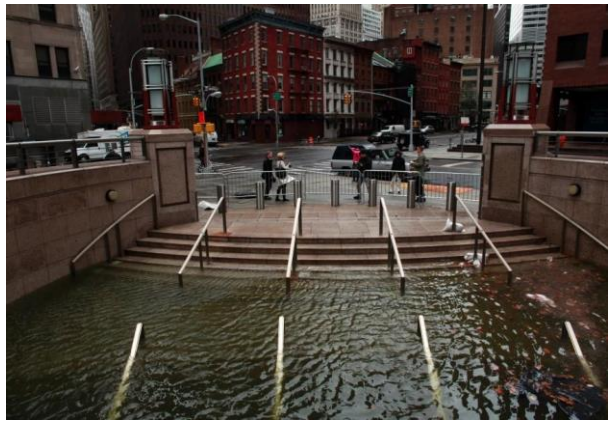
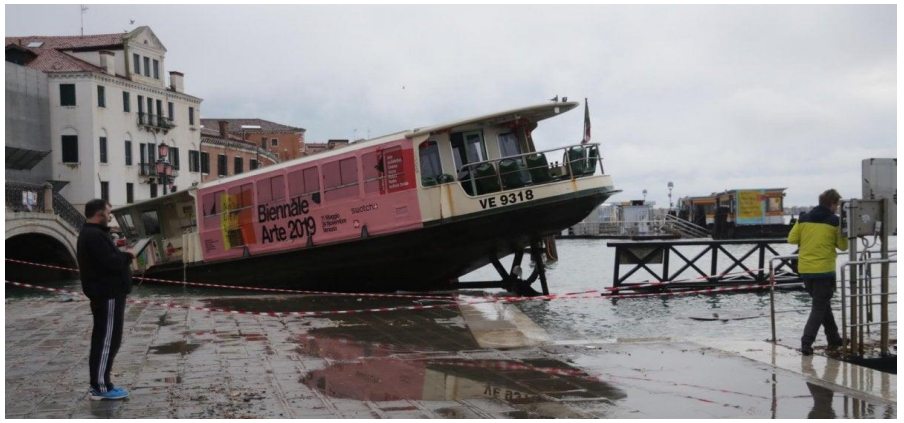
Department of Planning, Design, and Technology of Architecture (PDTA), Sapienza University of Rome with **Climate Modeling and Impacts Laboratory**, ENEA—Casaccia Research Center, Rome

Research "***Urban regeneration strategies for climate-proof territories. Instruments and methods for assessing vulnerability and identifying tactics of coastal urban environments subject to sea-level rise***" (Principal investigator: Prof. Carmen Mariano)

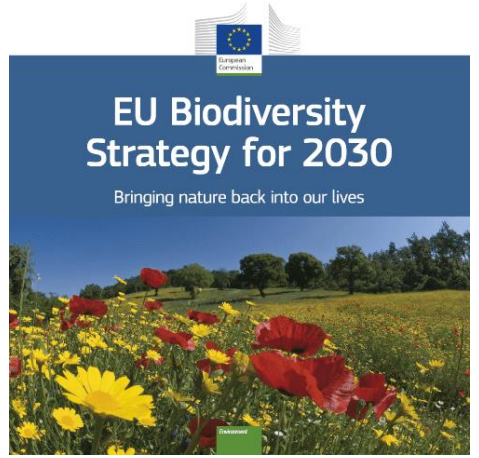




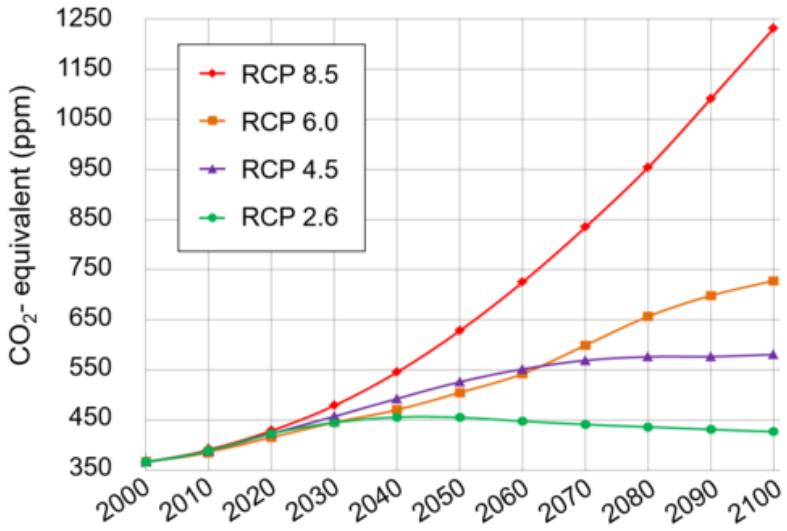




Hurricane Sandy in NY 2012 and floods in Venice 2019



Opening



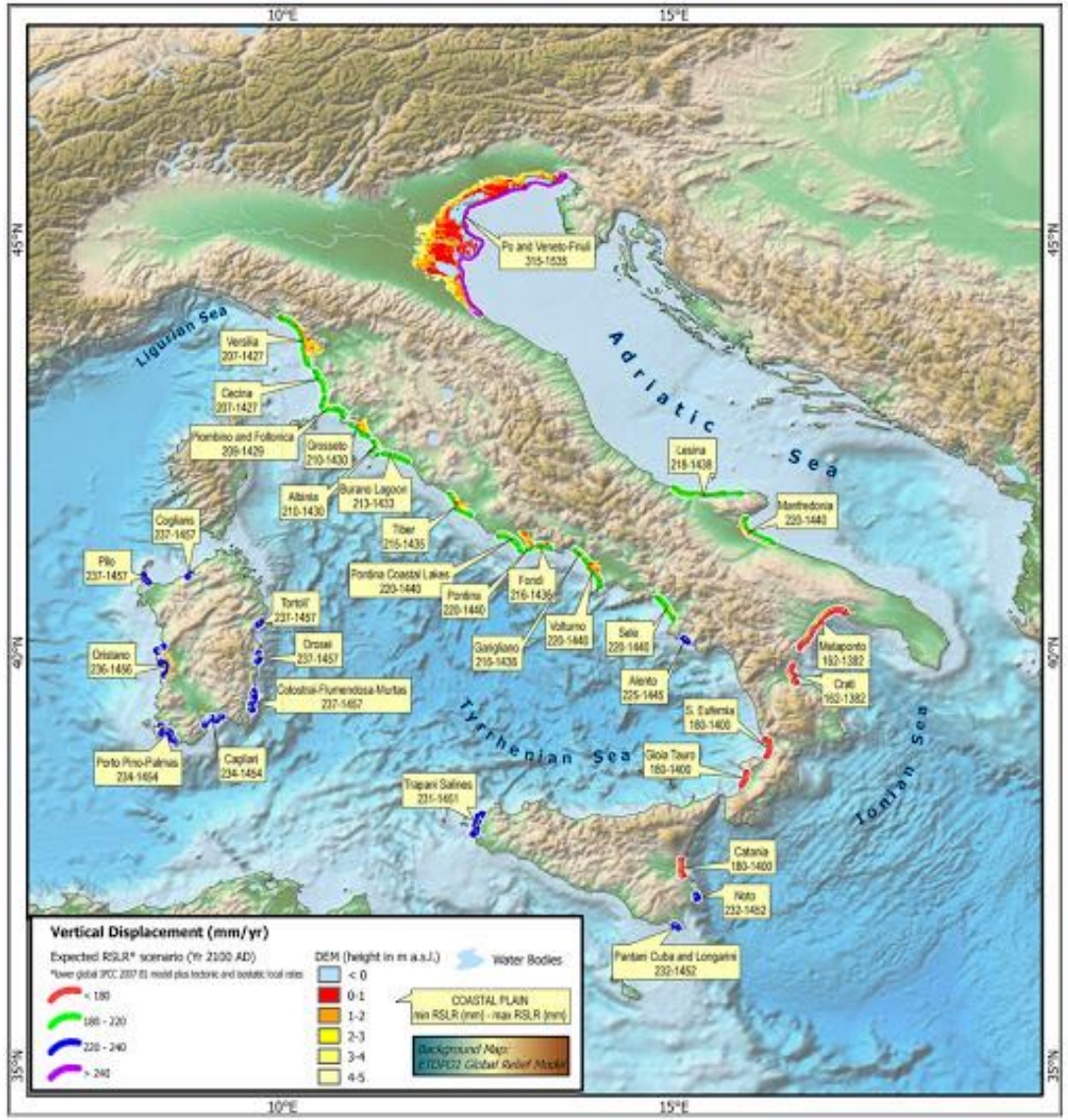
Representative Concentration Patways

RCP 2.6 scenario di mitigazione

RCP 4.5 scenario di stabilizzazione

RCP 6.0 scenario di stabilizzazione

RCP 8.5 scenario ad alte emissioni



33 aree a rischio inondazione (ENEA, 2017)

"*Sea-level rise and potential drowning of the Italian coastal plains: Flooding risk scenarios for 2100*," (Antonioli, et al, 2017), Quaternary Science Reviews

Goals

- to identify **theoretical/methodological and operative references for trialling and innovating the content of urban planning regulation**, with particular reference to the need, on the one hand, to expand the framework of knowledge of the possible impacts on the territory produced by climate change, and, on the other, to provide for adaptation strategies and site-specific actions aimed at resolving the risk.

- to overcome land governance policies' traditionally sectoral approach to the issue of climate change, in favour of climate-proof planning, through lines of deeper analysis that adopt **an experimental, integrated, multi-scalar, and iterative method**.

Methodology

two parallel approaches: a **strategic dimension** of local agendas in defining a vision for urban development, and **an experimental** one in relation to a gradual process of **integrating and innovating the content of the planning tools**, with a view to climate-proofing.

<u>strategic dimension of local agendas</u>

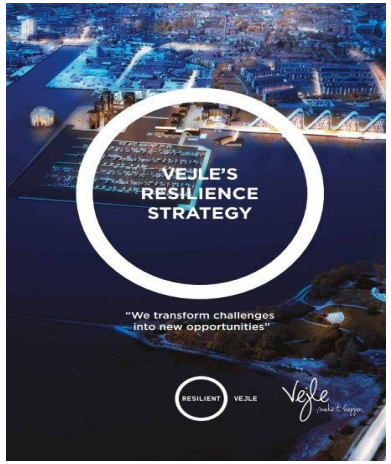
definition of short-, medium-, and long-term temporal horizons and prevalent action strategies

<u>experimental dimension of local action</u>

planning categories for site-specific intervention placed within the strategies of ecological urban regeneration

Venice (IT) 2019

Genoa (IT) 2017



Vejle (DK) 2019

Rotterdam (NL) 2019

Methodology

Three macrostrategies of urban resilience to climate change (C. MARIANO, M. Marino (2019), ***Defense, adaptation and relocation. Three strategies for urban planning of coastal areas at risk of flooding***, *INPUT aCAdemy Conference 2019*, Special issue of the TeMA journal, University of Naples "Federico II)

1. Defence **2. Adaptation** **3. Relocation**

National setting	**Strategies**
Strategic plan of the metropolitan city of Genoa	climate-proof urban policies
Strategic plan of the metropolitan city of Venice	climate-proof urban policies
International setting	
Vejle's Resilient Strategy	climate-proof urban policies and design strategies for defense, adaptation and relocation
Rotterdam Climate Change Adaptation Strategy	climate-proof urban policies and design strategies for defense, adaptation and relocation

Table 1. Comparative overview of the contents of strategic plans (by C. Mariano, 2021)

Results

DEFENCE| protection with environmental engineering works

Delta Works: Storm Surge Barrier Oosterschelde_Paesi Bassi

M.O.S.E.: Bocca di Lido_Venezia

St. Petersburg Floodprotection Barrier

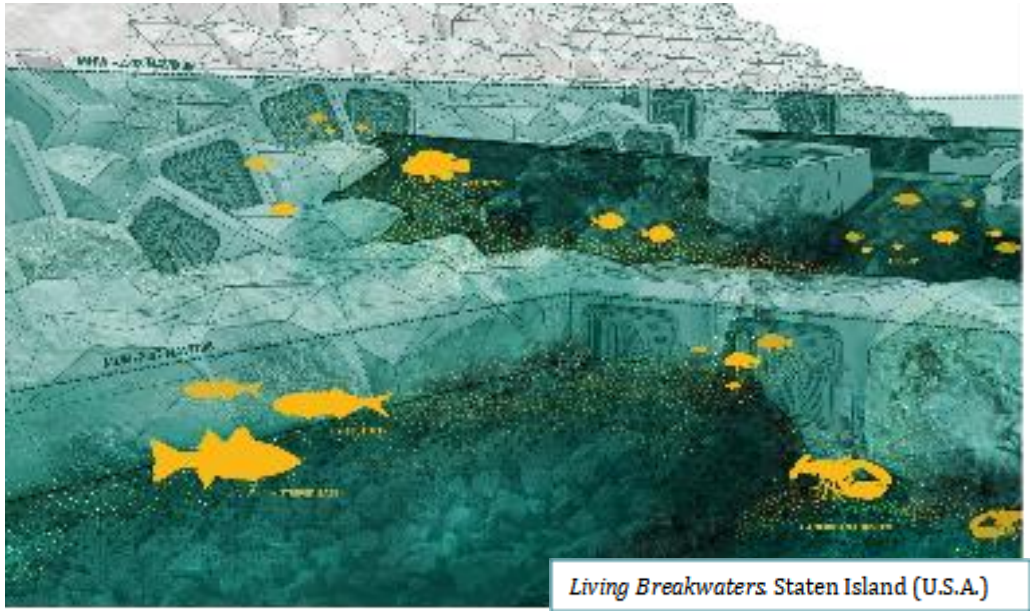
Thames Barrier_Londra

Results

ADAPTATION| ecological regeneration with nature-based solutions (NbS) as «actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits» or solutions inspired to the Ecosystem-based Approach (EbA, IUCN 2009) that involve a wide range of ecosystem management activities to increase the resilience and reduce the vulnerability of people and the environment to climate change.

The Big U. Manhattan (U.S.A.)

The Big U. Manhattan (U.S.A.)



Living Breakwaters. Staten Island (U.S.A.)

Living Breakwaters. Staten Island (U.S.A.)

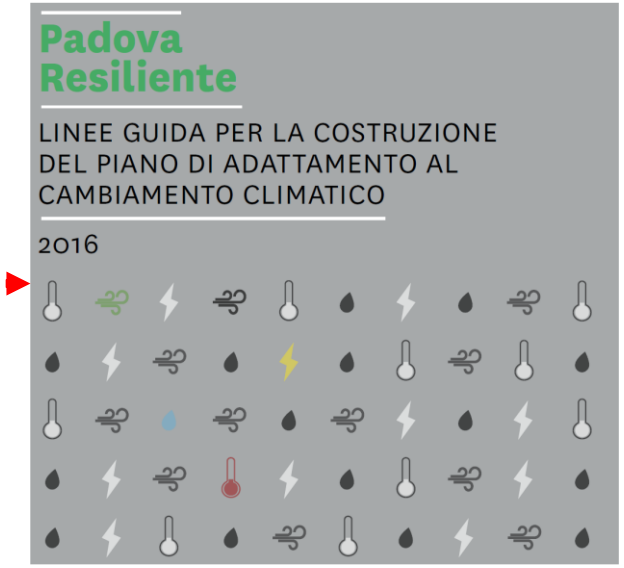
Results

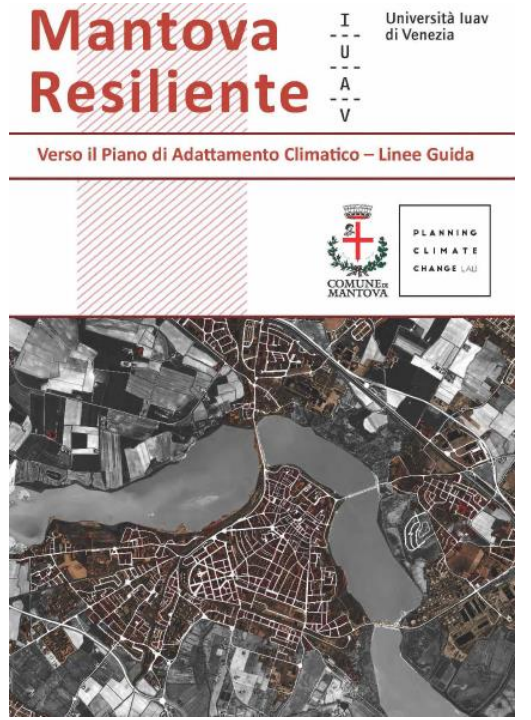
RELOCATION| “climate crisis migrants” (“*Rising tides: relocation and sea level rise in metropolitan Boston*” (Brent et al., 2015).

Results

Venice 2019

Genoa 2017





- general guidelines oriented towards implementing urban policies **with a short-term (3 years) temporal horizon** that does not meet the need to outline a structured medium- and long-term vision, in order to respond to the issues related to climate change;

- guidelines for climate adaptation plans, required by the European and national strategy adaptation to climate change, as in the case of Padua or Mantua.

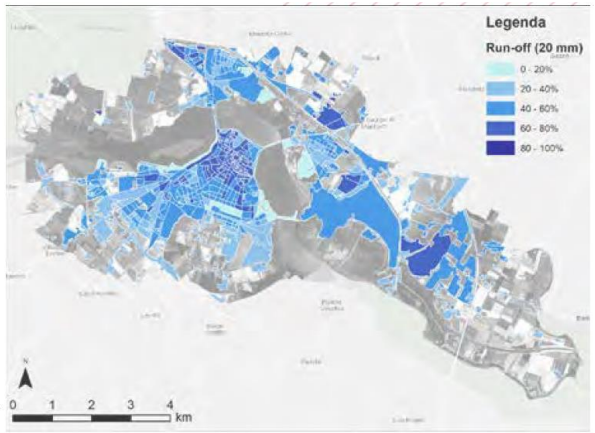


Fig. 12 - Mappa della vulnerabilità complessiva. Il valore è dato dalla somma di tutti gli indicatori morfologici, compresi quindi quelli relativi alla popolazione

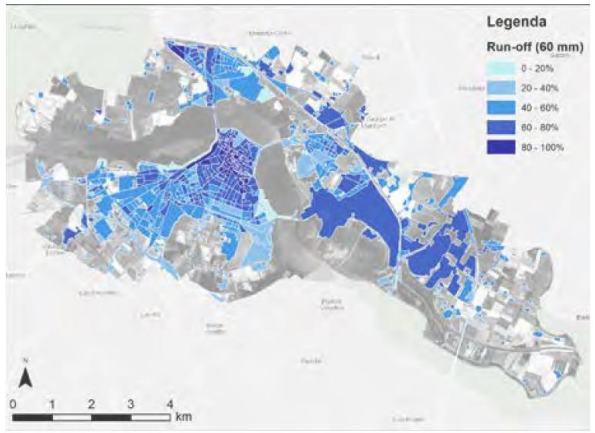


Fig. 13 - Mappa della vulnerabilità complessiva. Il valore è dato dalla somma di tutti gli indicatori morfologici, compresi quindi quelli relativi alla popolazione.

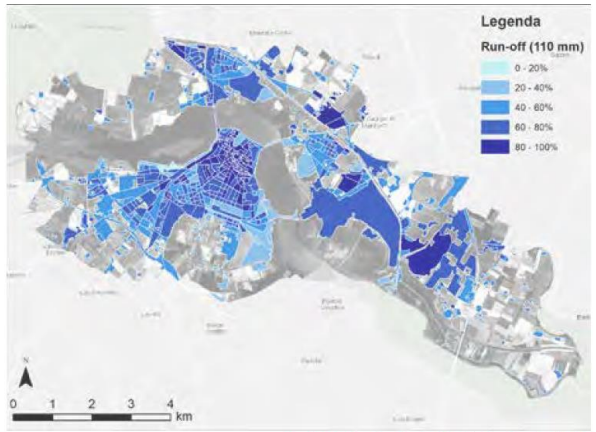
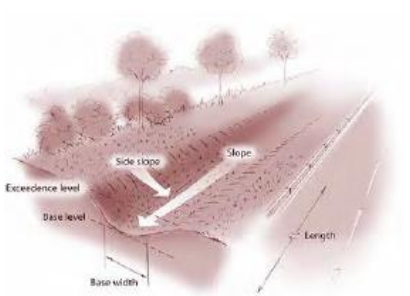
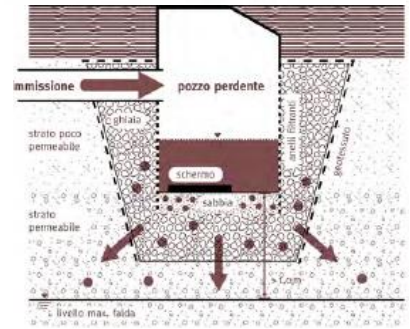


Fig. 14 - Mappa della vulnerabilità complessiva. Il valore è dato dalla somma di tutti gli indicatori morfologici, compresi quindi quelli relativi alla popolazione.





BOMA
ELENCO AZIONI

SPONDE DEI CORSI D'ACQUA
Azioni di recupero e ripristino della vegetazione ripariale ove possibili.
AZIONE B5

AIUOLE BORDO STRADA
Aiuole vegetate, con apposita stratigrafia, per filtrare ed assorbire l'acqua proveniente dai sedimi stradali.
AZIONE B4

PARCHEGGI DI AMPIE DIMENSIONI
Sostituire le pavimentazioni dei parcheggi con pavimentazioni permeabili, ove non prevista la carrabilità pesante, o così con vernici ad alto albedo.
AZIONE B6 o C5

PARCHEGGI
Introdurre vegetazione che possa ombreggiare la superfici dei parcheggi e contribuire alla gestione delle acque.
AZIONE C6

PROGETTI DIMOSTRATIVI
Dimostrazione di azioni e comportamenti innovativi con il fine di divulgare, stimolare e sviluppare iniziative più ampie.
AZIONE C8

CORSI D'ACQUA
Punto di monitoraggio della qualità delle acque
AZIONE D4

EDIFICI INDUSTRIALI
Azione rivolta alla riduzione di accumulo di calore sui tetti, rinverdendoli ove strutturalmente permesso oppure coi cosi vernici ad alto albedo.
AZIONE B1 + C3 o C4

Riduzioni dei livelli di ozono
Misure di monitoraggio o volontarie volte alla riduzione dei giorni con superamento dei livelli massimo di ozono
AZIONE D7

CENTRO STORICO
ELENCO AZIONI

EDIFICIO RELIGIOSO
Apertura straordinaria durante giorni di allarme per fornire spazi freschi per le persone più anziche.
AZIONE D2

EDIFICIO DI SETTORE
Edifici come la sede COLDIMA e della Croce Verde possono essere spazi dove fare sensibilizzazione in tempo di pace e allarme in situazione emergenziale.
AZIONE D1 + D5

VERDE PRIVATO
Censimento e divulgazione dei servizi ecosistemici del verde privato.
AZIONE C6

RIDUZIONI DEI LIVELLI DI OZONO
Misure di monitoraggio o volontarie volte alla riduzione dei giorni con superamento dei livelli massimo di ozono
AZIONE D7

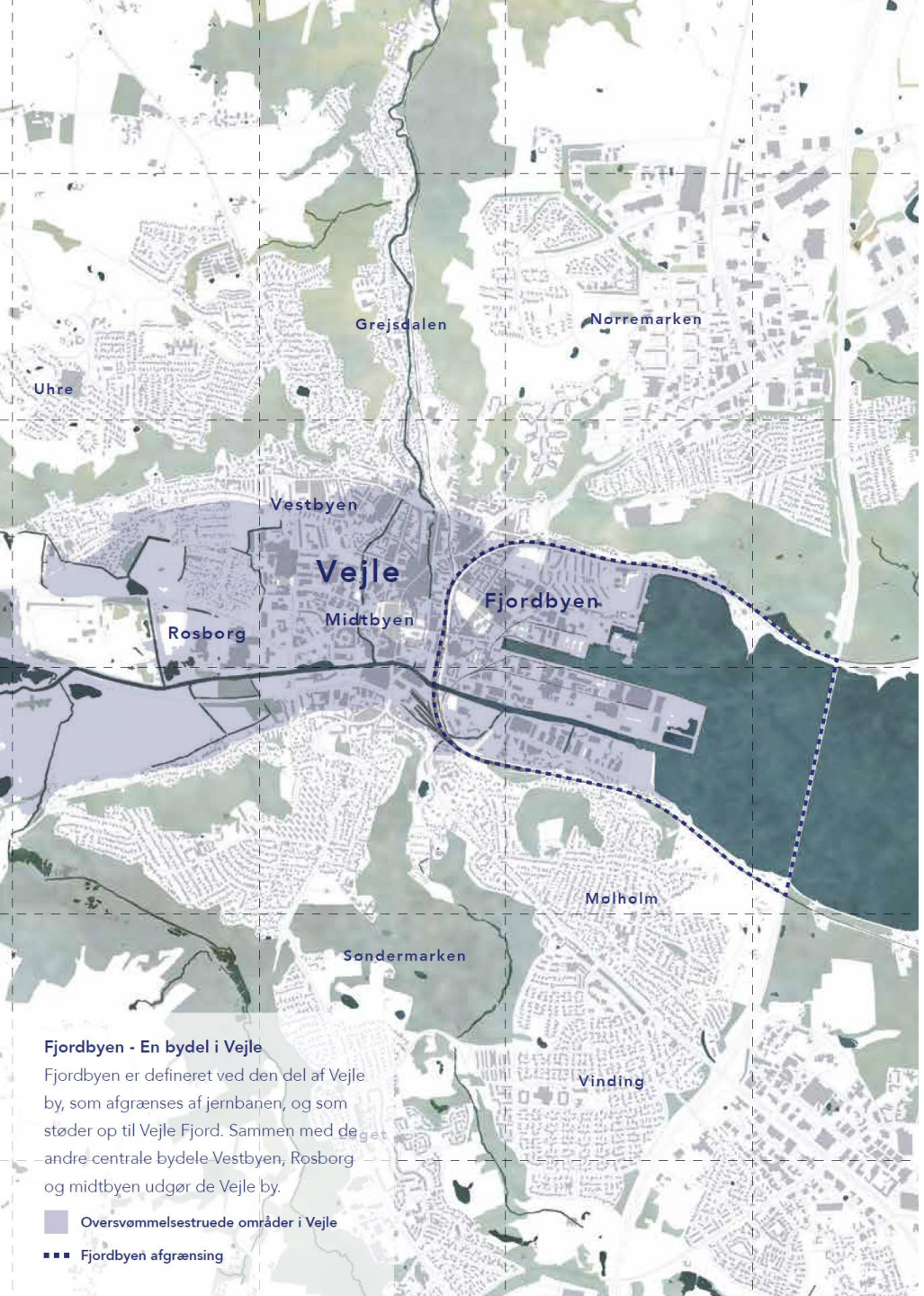
EDIFICIO RESIDENZIALI
Incentivi volti all'efficienza energetica e alla riduzione del fenomeno di isola di calore urbana, compatibilmente con i vincoli vigenti.
AZIONE C3 + C7

EDIFICIO RESIDENZIALI
Azioni di efficientamento degli sistemi che utilizzano la risorsa idrica all'interno delle abitazioni.
AZIONE A4 o A5

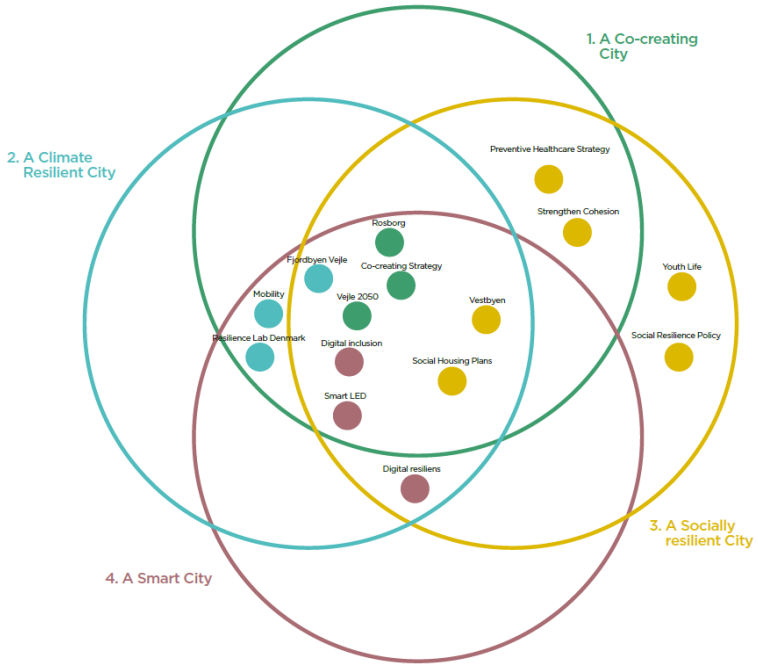
EDIFICIO RESIDENZIALI
Sistemi di raccolta delle acque piovane per utilizzi non potabili o limitazioni nell'uso dell'acqua potabile durante periodi di siccità.
AZIONE A1 o A3

EDIFICIO PUBBLICO
Azioni volte all'efficientamento energetico, progetti dimostrativi per sensibilizzare i cittadini e apertura straordinaria come luogo fresco durante giorni molto caldi.
AZIONE C1 + C8 + D2

Vejle's Resilient Strategy (approved in 2013 and updated in 2019)



Actions



Vejle’s Resilient Strategy (approved in 2013 and updated in 2019)

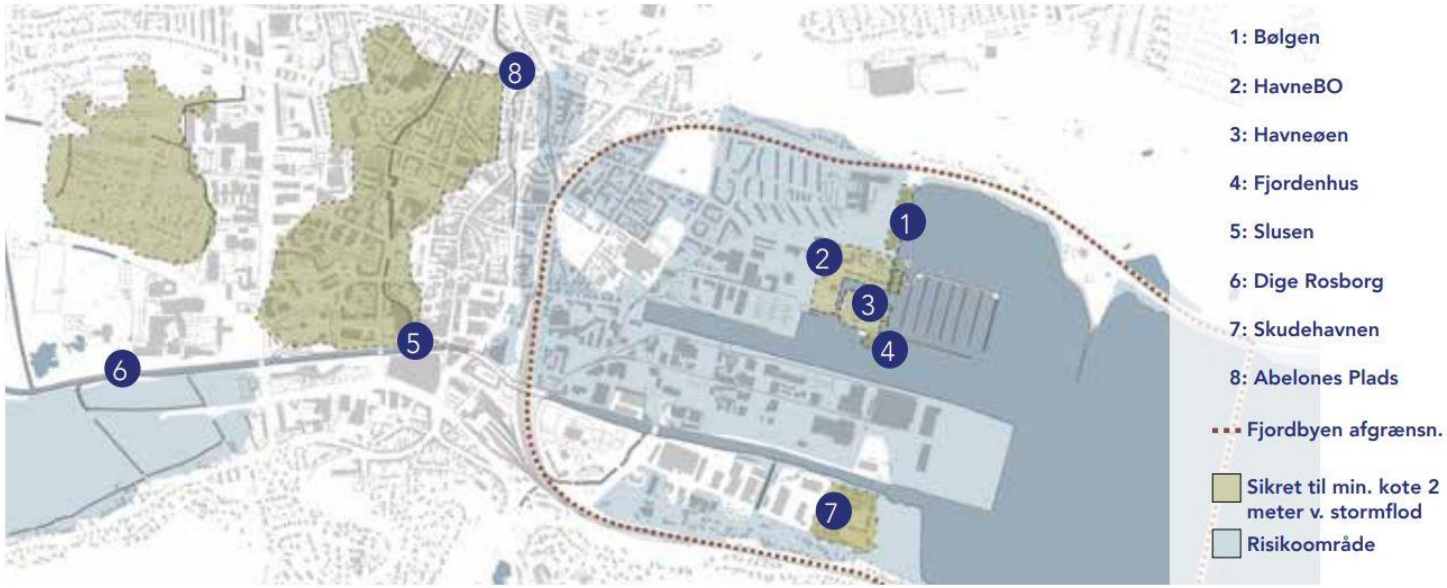


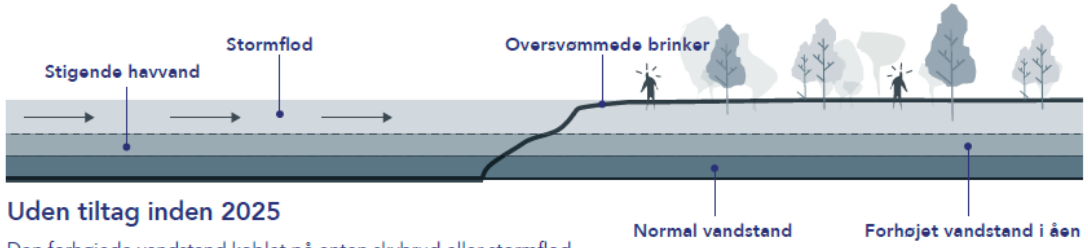
Fig. 1_Settings at flood risk starting from 2030; areas above 2 metres in elevation are in yellow. Source: Stormflodsstrategi. Stormflodsbeskyttelse der gror med byen (2019).

Et resilient byrum ved normal vandstand, illustration COBE Architects

Fase 1
Kote 2 meter i 2025

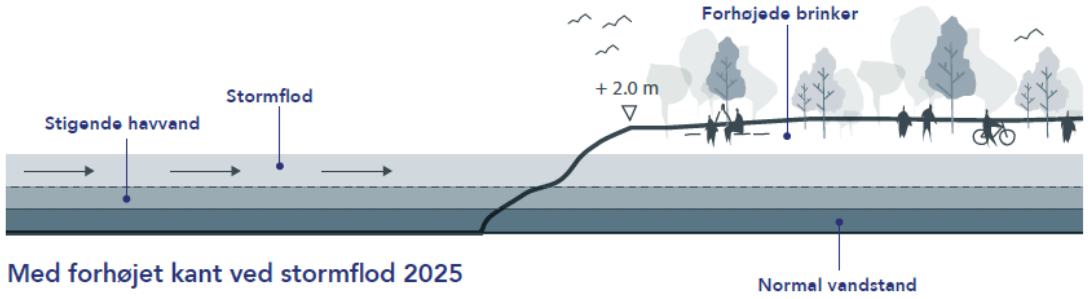
Fase 2
Kote 2,5/3 meter i 2050

Fase 3
Kote +3 meter i 2070



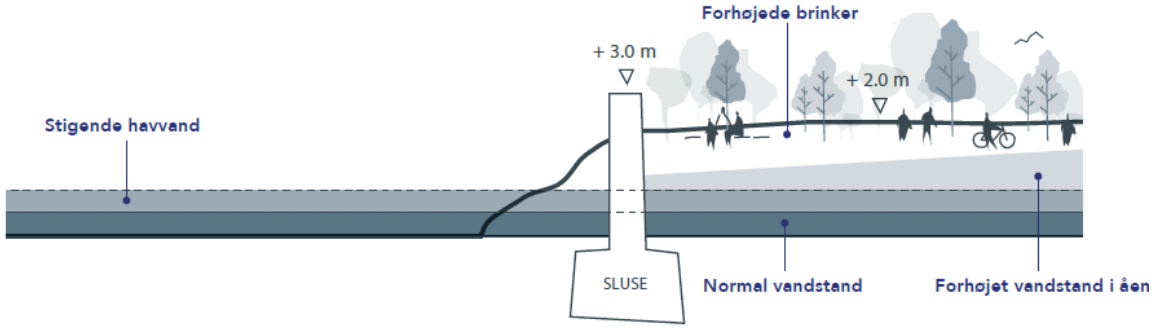
Uden tiltag inden 2025

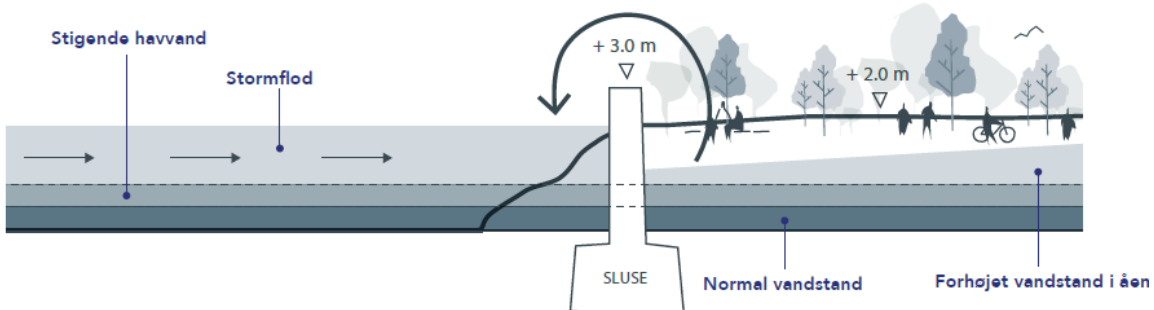
Den forhøjede vandstand koblet på enten skybrud eller stormflod løber over brinkerne og oversvømmer dele af Vejle by.



Med forhøjet kant ved stormflod 2025

Hvis brinkerne forhøjes til kote 2 meter langs Sønder Å og Vejle Å, kan oversvømmelser langs åerne undgås.



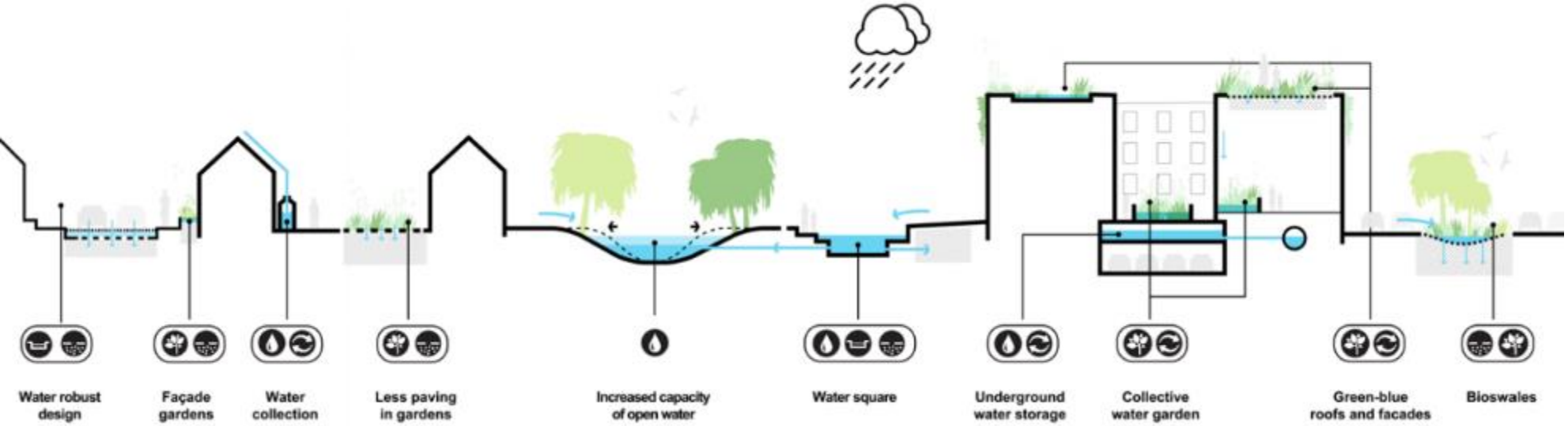


Havnegade og havnepladsen bliver et vigtigt bindeled mellem Vejles midtby og Fjordbyen

Results

Rotterdam Climate Change Adaptation Strategy (2019)

Fig. 2_Settings at flood risk, forecast at 2100, indicating the infrastructure at risk. Source: *Rotterdam Climate Change Adaptation* Strategy (2019).



The ***Climate Change Adaptation Strategy*** outlines the changing landscape of Rotterdam measured on reducing the effects of heat stress, drought, sea water rise, and increased flooding.

Multi-Use Storm Barriers

The dikes are multi-functional, integrated, attractive structures. The recognisability of the dikes in the city plays a part in making the inhabitants more aware of the risks of flooding

Rainwater Reservoirs

Conclusions

- “**strategic role of knowledge**” (Talia, 2020) in identifying – as a prerequisite for defining site-specific design actions – the territorial settings affected by the flood risk phenomenon;

- to interpret the **content of the areas affected by the risk phenomenon, differentiated by level of danger and in relation to any temporal horizons** analyzed for the medium and long term;

- to provide for a possible adoption of indications relating to the **detailed intervention categories aimed at resolving the risk** within the **planning instruments**, with particular reference to the scale of **local urban planning**;

- **construction of vulnerability and risk maps** of coastal urban settings by comprehensive databases for more in-depth knowledge of the territory, aided by **geographic information systems (GIS)** and relying on the tools and methods of **remote sensing and climate modelling**

Coastal area of Lazio. Target Area 1: Fiumicino. SLR 2100 projection in relation to RCP 8.5 scenario

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"Urban regeneration strategies for climate-proof territories. Tools and methods for the assessment of vulnerability and for the identification of resilience tactics of coastal urban areas subject to sea level rise"

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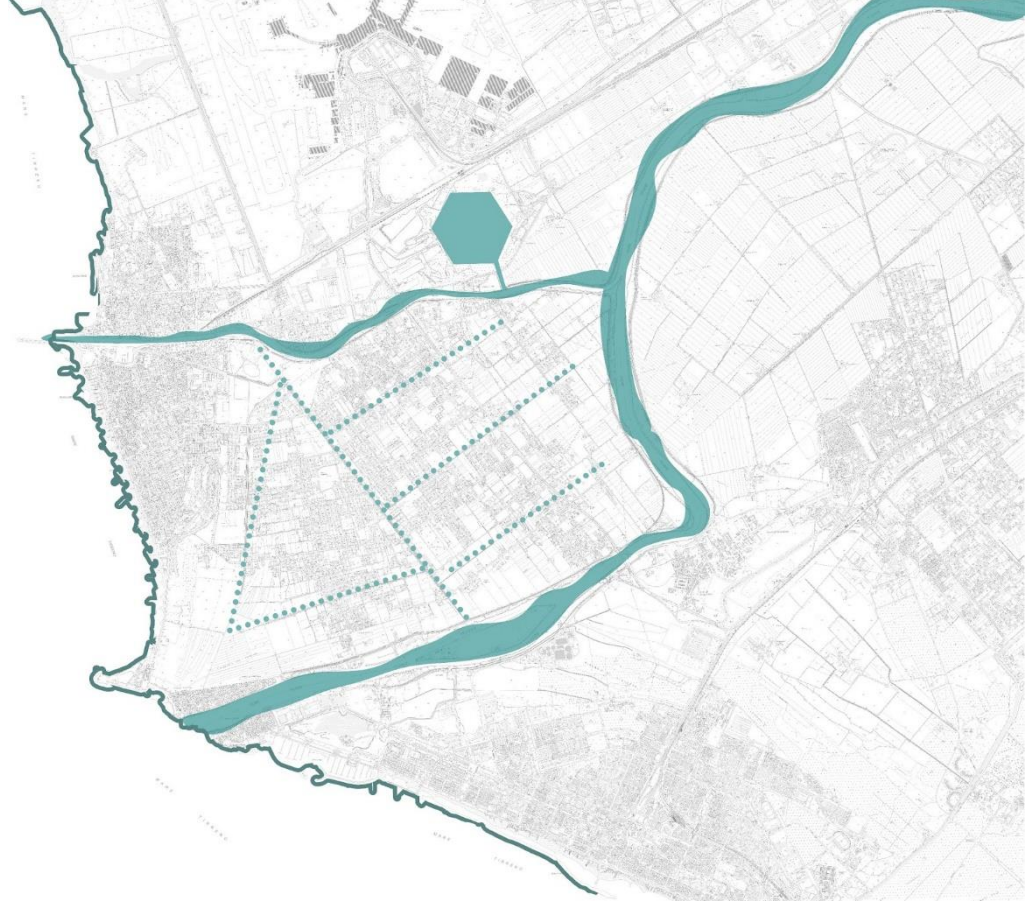
In collaboration with the Laboratory Climate Modelling of ENEA.

Author Prof. Carlo Valorani. Original results derived from the data of "Tarquini S., Isola I., Favalli M., Mazzarini F., Bisson M., Pareschi M. T., Boschi E. (2007). TINITALY / 01: un nuovo triangolare irregolare Rete d'Italia, Annali di Geofisica 50, 407-425".



***Isola Sacra* (Fiumicino): "amphibious area" on the outskirts of Rome**

Fig. 1. Areas at risk of flooding due to sea level rise in *Isola Sacra* – Fiumicino (blue polygon). SLR data compared to today: 63 cm; time horizon: 2100.

Drawing by Ph.D. candidate in *Planning. Design, Technology of architecture* Gabriele Pastore (2022).

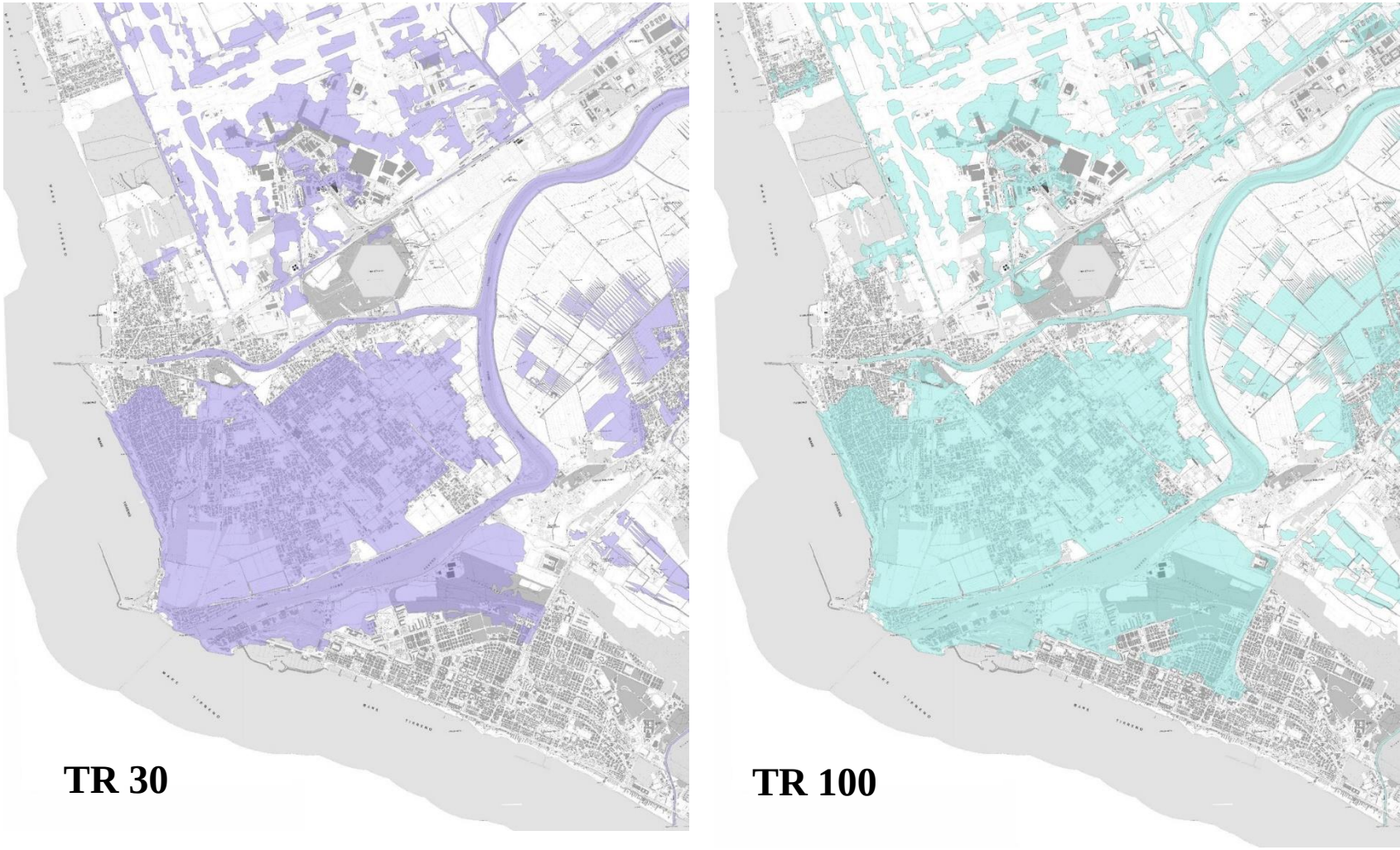


Fig. 2. Areas at risk of flooding due to overflow of Tiber River in Isola Sacra – Fiumicino. Return period: 30 and 100 years (blue and light blue polygons). Source: Piano di Gestione del Rischio Alluvione Appennino Centrale – PGRAAC (2016).

Drawing by Ph.D. candidate in *Planning. Design, Technology of architecture* Gabriele Pastore (2022).

Fig. 3. One of the embankments protecting the urban fabric of Isola Sacra. Defensive approach, substantially based on the construction of massive embankments to protect the most vulnerable areas, denying any communication between urbanized areas and the natural element (the river), to the detriment of place identity

Conclusions/Future developments

Table 2. Urban planning instrument forecasts, in relation to the physical consistency of the areas at risk of flooding by 2100.

Target Area	Nomenclature in Legend (PRG)	Total Area (mq)	Area Exposed to Potential Risk of Flooding by 2100 (mq) with a SLR of 63 cm and overflow of River
Isola Sacra	Natural space Hydrogeomorphological components and vegetation Equipped beaches with dunes	146.924	146.924 (100% of total area)
Isola Sacra	Natural space Hydrogeomorphological components and vegetation Equipped beaches without dunes	243.712	243.712 (100% of total area)
Isola Sacra	Natural space Hydrogeomorphological components and vegetation Wooded and/or shrub areas	610.158	40.289 (7% of total area)
Isola Sacra	Rural space Settlement Linear residential settlements	122.024	98.531 (81% of total area)
Isola Sacra	Environment and landscape system Emergencies in landscapes Buildings and/or architectural complexes with historical value	Point element	100%
Isola Sacra	Urban space Consolidated city or in the process of consolidation Mainly residential	751.420	279.198 (37% of total area)
Isola Sacra	Urban space Consolidated city or in the process of consolidation Mixed activities	125.029	64.784 (52% of total area)
Isola Sacra	Urban space Consolidated city or in the process of consolidation Mainly for tourist activity	16.727	16727 (100% of total area)
Isola Sacra	Mobility system Existing driveway Urban slip road and/or inter-district	20.546	20.546 (100% of total area)
Isola Sacra	Infrastructure endowments system Core of functions Port services	21.629	21.629 (100% of total area)

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Thank you!

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