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Guidelines for a feasibility study on SWMED solutions for the project target areas: technical, financial, socio-economic and administrative aspects for a sustainable domestic water use in the Mediterranean regions

Riccardo Bresciani & Giulio Conte

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Contents of the presentation

- WP4 tasks
- Guidelines for feasibility study
- Example of analysis of SWM alternatives from the Zer0-M project
- Presentation of the status of study area selection by different SWMED partners

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WP4 tasks

- **Identify sustainable water, wastewater and sanitation management solutions applicable in the different target areas**
  - Task 4.1 Identification of typologies of settlement for which sustainable water management solution have to be developed.
  - Task 4.2 Development of tailor-made solutions for each settlement typology

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WP4 tasks

- **Creation of ad-hoc SWMED solutions for different target areas in MED countries**
  - Identification of settlements typologies in MED countries to develop the SWMED solutions
    - Socio-economic surveys on MED settlements in urban and rural areas
    - Report on SWM adapatation
  - Development of tailor-made solutions for each settlement typology
    - Feasibility study on SWMED solutions for target areas
    - Final report on tailor-made solutions for the project target areas identified

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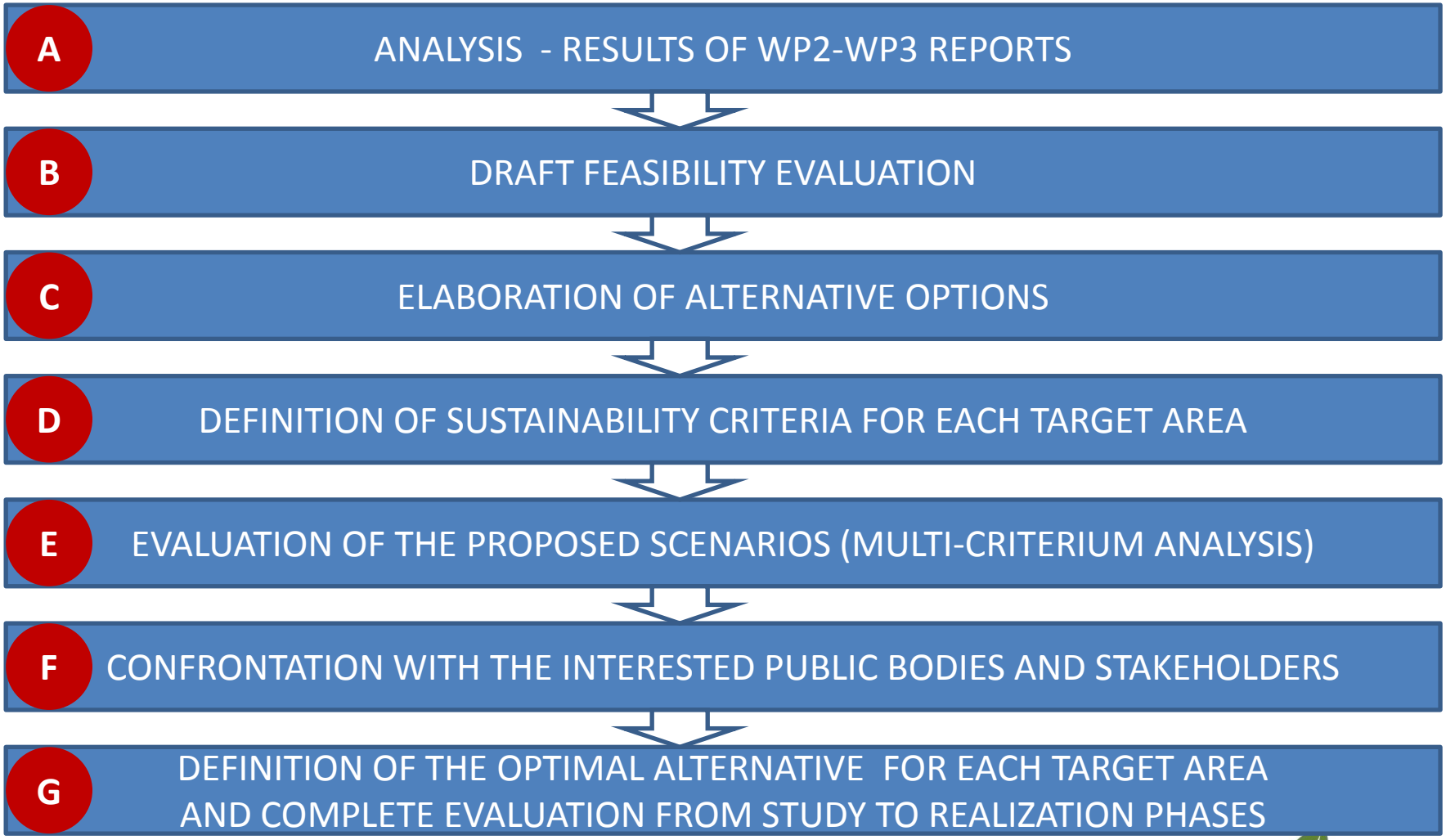

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A ANALYSIS - RESULTS OF WP3 REPORTS

TARGET AREA SELECTION FRAMEWORK AND CRITICAL ISSUES

Work-Package 3.5

REPORT ON WATER USES AND WASTEWATER MANAGEMENT IN THE SWMED PROJECT PARTNER COUNTRIES

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INFO ON THE PROJECT AREA

3. Information concerning water and sanitation service in the project area....

- 3.1 Typology of settlements
- 3.2 Water use and service existing in the settlements
- 3.3 Sanitation service existing in the settlements
- 3.4 Local sanitary or environmental problems
- 3.5 Local water and sanitation policy

GENERAL INFORMATION ON THE COUNTRY/REGION

- 2.1 Water availability
- 2.2 Water use per sector
- 2.3 Population served by public (collective) water distribution network
- 2.4 Water losses by public (collective) water distribution network
- 2.5 Reservoir regulation capacity of public (collective) water distribution network
- 2.6 Sources of water used by public (collective) water distribution network
- 2.7 Quality of water used by public (collective) water distribution network
- 2.8 Sanitation service and waterborne diseases
- 2.9 Wastewater treatment
- 2.10 Water and sanitation service costs
- 2.11 Water Saving and Water Reuse
- 2.12 Legal standards
- 2.13 Quality of natural water bodies

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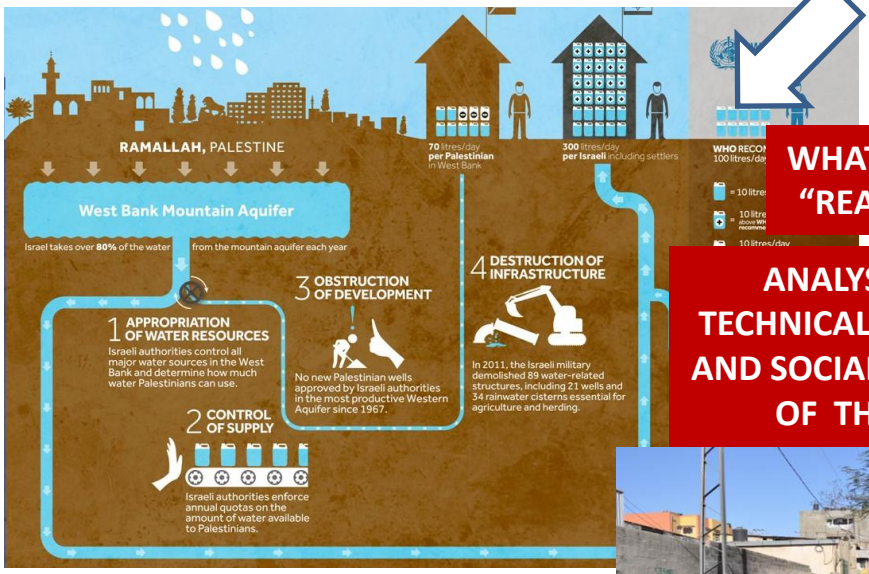
B DRAFT FEASIBILITY EVALUATION

Based on the analysis phase, verification of the acceptance and availability of a full set of SSWM tools in the various countries

Proposal: SSWM tool box http://www.sswm.info/

A

SSWM sustainable sanitation and water management



WHAT WE CAN "REALLY" DO?

ANALYSIS OF THE TECHNICAL, ECONOMICAL AND SOCIAL CONSTRAINTS OF THE REGION

Definition of a restricted SWM tools list to be applied in the alternatives elaboration for the selected sites

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C ELABORATION OF ALTERNATIVE OPTIONS IN TARGET AREA

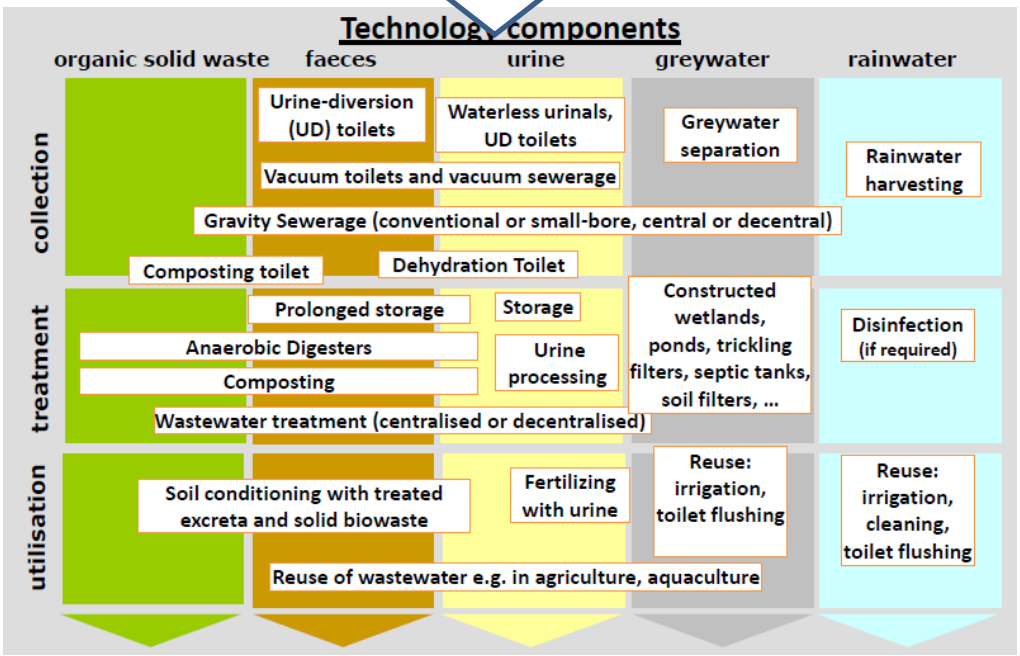
Alternative 0: no interventions

Alternative 1,2,3…: elaboration of different scenarios with the combination of the restricted SSWM tools that could be applied for each selected sites

B

LIST OF INFO NEEDED

SSWM sustainable sanitation and water management



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LIST OF INFO TO BE COLLECTED FOR EACH TARGET AREA

- Name of the site;
- Brief description of the site: type of settlements, relevant information about existing facilities for water and wastewater management (presence of sewage system, WWTP, water sources, potable network, rainwater harvesting, type of sanitation device in the settlements), main environmental information (i.e. groundwater table location, surface water, main environmental issues);
- N° inhabitants;
- N° of houses / n° of households;
- Presence of industrial and commercial activities;
- % urbanization; % water supply; % sanitation access;
- Average water pro-capita consumption for domestic purposes;
- Consumption for other sector (agriculture, industrial);
- Stakeholders and beneficiaries involved;
- Maps and satellite views with localization of the settlements and the existent water management facilities;
- If the sewer is present, network map;
- If WWTP is present, brief description and monitoring data.

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LIST OF INFO FOR EACH TARGET AREA: example

1-Rural settlement with in-house water distribution systems but no sewage system (individual sanitation): Chorfech 24 (Part 1)

Chorfech

24 Km in the NW of Tunis

Division of Cherfech 24 in two parties

350 habitants, 50 houses

WWTP: Flow 17 m3/day
Septic tank + CW (H-V-H)

Location: ARIANA (Urbanisation 90,8%, water supply 99,9%, Sanitation 90,5%) 2011
Name: Chorfech 24 (Part 1)
Hab: 180, 2020: 262
House: 39

Target groupe:
Habitants
Water and Sanitation actors in rural area

Staekholders Involved:
ONAS, SONEDE, Local authority

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D DEFINITION OF SUSTAINABILITY CRITERIA FOR EACH TARGET AREA

The proposed technologies and strategies can be classified not only according to their purification performances, which depends on the quality of the influent and the effluent quality required, but also considering other factors divided into categories:

Technical: simple implementation, use of local resources, robustness and long lifetime/high durability, simple and low O&M procedures, flexibility, amount and quality of by-products, quality performance…
Environmental: use of natural resource, impacts on environmental components, landscape integration, recovering resources…
Economical: Investment and Maintenance costs, available fund raising options
Health and social aspects

Definition of Quantitative and Qualitative criteria and the correspondent weights

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WHY MEASURING SUSTAINABILITY?

Sustainability is important because all the choices we pursue and all the actions that we make today will affect everything in the future. We need to make sound decisions at present in order to avoid limiting the choices of generations to come. But also because

„everyone agrees that sustainability is a good thing“
(Allen and Hoekstra, 1992)

„In the future, only companies that make sustainability a goal will achieve competitive advantage.
(Nidumolu, Prahalad and Rangaswami 2009)

Extracted from Nawatech FP7 project, www.nawatech.net

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E EVALUATION OF THE PROPOSED ALTERNATIVES (MULTI-CRITERIA ANALYSIS)

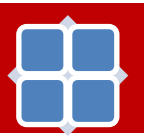
Sustainability criteria

Definition of indicators

Definition of weights

Indicators assignment to the proposed scenarios

QUALI-QUANTITATIVE MODEL



A Target area analysis

C Proposed options

F CONFRONTATION WITH THE INTERESTED PUBLIC BODIES AND STAKEHOLDERS

G DEFINITION OF THE OPTIMAL ALTERNATIVE FOR EACH TARGET AREA AND COMPLETE EVALUATION FROM STUDY TO REALIZATION PHASES

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410.7 mm; 19°C; 38°C; 6°C

110 houses mainly grouped and some scattered

Average of 6 persons per house

Example of MCA

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Development of alternatives

	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5
Sewer	Mixed	Separated	No sewer (composting toilet)	No sewer (composting toilet)	only BW
Treatment	Centralized (CW)	Centralized (CW)	Individual, only Greywater, SBR	As for ALT 3, treat by roughing filters	BW centr.CW, GW as ALT 4
Rain harvesting	No	Yes (central-ized)	Yes (indiv.)	Yes (indiv.)	Yes (indiv.)
Greywater reuse	No	No	Yes	Yes	Yes
Wastewater reuse	Yes	Yes	Yes	Yes	Yes

BW: Black water, CW: Constructed Wetlands, GW: Greywater

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Evaluation criteria

- economic criteria (investment and management costs),
- environmental criteria (amount of water used, pollution produced, impacts on landscape, level of nutrient reuse)
- socio-cultural criteria (technical feasibility, acceptability).

TO THE ANALYSED ALTERNATIVES	ALT1: mixed sewer	ALT 2: separated sewer	ALT 3: ZerO-M (SBT)	ALT 4: ZerO-M (trick-ling)	ALT 5: separated plus reuse
Total water flow extracted per person	0.20	0.26	1.00	1.00	1.00
Flow of water available for irrigation	0.28	0.70	0.21	0.21	0.18
Degree of Nutrients reuse (N. P)	0.81	0.81	0.94	0.94	0.81
Energy employed (per person)	0.03	0.03	0.99	1.00	0.51
Quality-pressure on sinks	1.00	1.00	1.00	1.00	1.00
Landscape quality (worsened or improved by the project)	0.50	0.50	0.50	0.50	0.50
Local Mastering of technologies adopted	1.00	1.00	0.50	0.50	1.00
Socio-cultural acceptabil-ity of solution adopted	1.00	1.00	0.00	0.00	1.00
Nuisance (mosquitoes. smell)	1.00	0.50	0.50	0.50	1.00
Present (discounted) value of total costs (all technical options)	1.00	0.88	0.00	0.63	0.86
Investment costs (all technical options)	1.00	0.87	0.00	0.63	0.83
Operation and maintenance (O&M) costs per year (all technical options)	1.00	0.98	0.91	0.00	0.03

MCA of alternatives

normalized values

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WEIGHTS GIVEN TO EACH CRITERION ACCORDING TO THE TWO DIFFERENT APPROACHES: ONE FAVOURING THE MINIMISATION OF COSTS, THE OTHER THE "SUSTAINABILITY", I. E. THE MINIMISATION OF THE USE OF RESOURCES

	Minimum use of resources approach	Minimum cost approach
Total water flow extracted per person	10	6
Flow of water available for irrigation	2	6
Degree of nutrients reuse (N, P)	4	4
Energy employed (per person)	4	4
Quality-pressure on sinks	4	5
Landscape quality (worsened or improved by the project)	4	5
Local mastering of technologies adopted	0	7
Socio-cultural acceptability of solution adopted	0	8
Nuisance (mosquitoes, smell)	6	4
Present (discounted) value of total costs	6	9
Investment costs (all technical options)	6	9
Operation and maintenance (O&M) costs per year	7	10

Weight of criteria

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Results of the MCA

	ALT1: mixed sewer	ALT 2: separated sewer	ALT 3: ZerO-M (SBR)	ALT 4: ZerO-M (trickling)	ALT 5: separated plus reuse
Min. use of resources approach	0.70	0.64	0.63	0.66	0.72
Minimum cost approach	0.79	0.77	0.48	0.51	0.71

▲ *Table 4:*
RESULTS OF THE MULTICRITERIA ANALYSIS ACCORDING TO THE TWO APPROACHES

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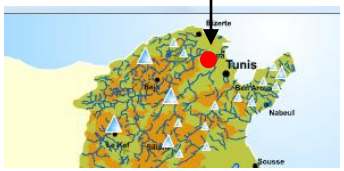
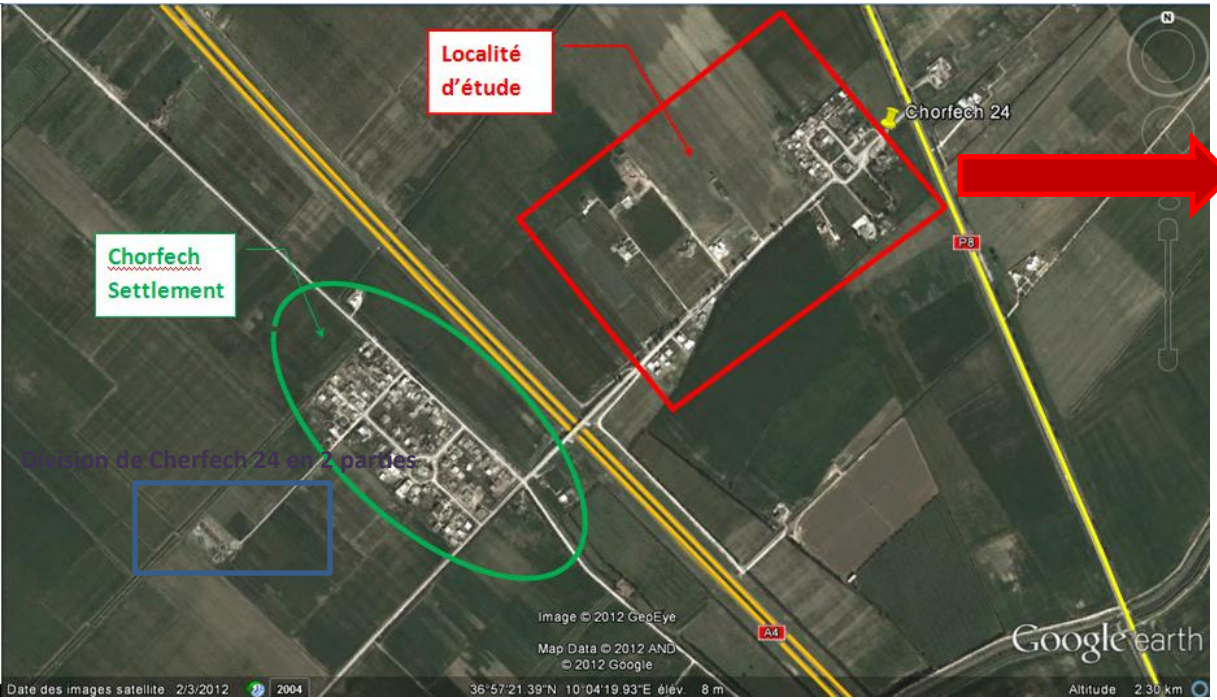
Chorfech



Tunisian case studies

24 Km in the NW of Tunis



Location: ARIANA (Urbanisation 90,8%, water supply 99,9%, Sanitation 90,5%) 2011
Name: Chorfech 24 (Part 1)
Hab: 180, 2020: 262
House: 39

WWTP: Flow 17 m3/day
Septic tank + CW (H-V-H)

350 habitants, 50 houses

Division of Cherfech 24 in two parties

1-Rural settlement with in-house water distribution systems but no sewage system (individual sanitation): Chorfech 24

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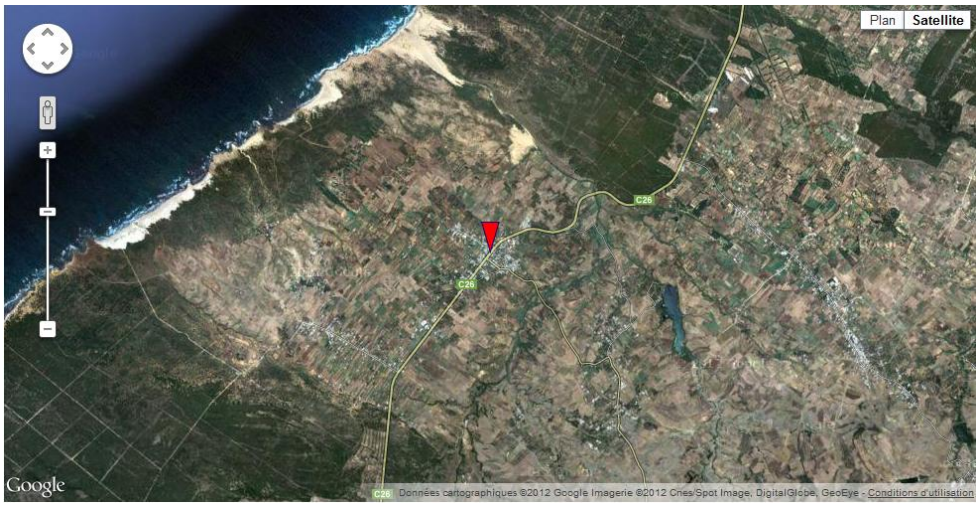
Tunisian case studies



2-Zaouiet EL Mgaeiz
Rural village with in-house water distribution systems with partially sewage system and without treatment plant

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BARDO Centre

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Tunisian case study

3-Bardo Center
Urban area

Building: M +5 floors
10 Buildings
Small stores
Supermarket
Offices (doctor, lawer,..)
Inside commercial area

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Ragusa case study: type of settlements

SMALL VILLAGES IN THE COASTAL ZONE

(e.g., Marina di Ragusa, Marina di Modica, Sampieri, Marina di Acate, Scoglitti, etc.), often far from the central urban areas.

Large fluctuation between winter and summer due to the tourism activities

>>> water supply by non conventional resources

>>> hygienic and sanitary issues

ISOLATED SETTLEMENTS

In the municipality of Ragusa there are several isolated settlements, illegally built, not connected with the municipal water systems (water supply, sewage, WWTP).
8 settlements in the “Altopiano ragusano” zone
22 settlements along the road connecting Ragusa with Marina di Ragusa

>>> water supply by non conventional resources
>>> hygienic and sanitary issues
>>> environmental pollution

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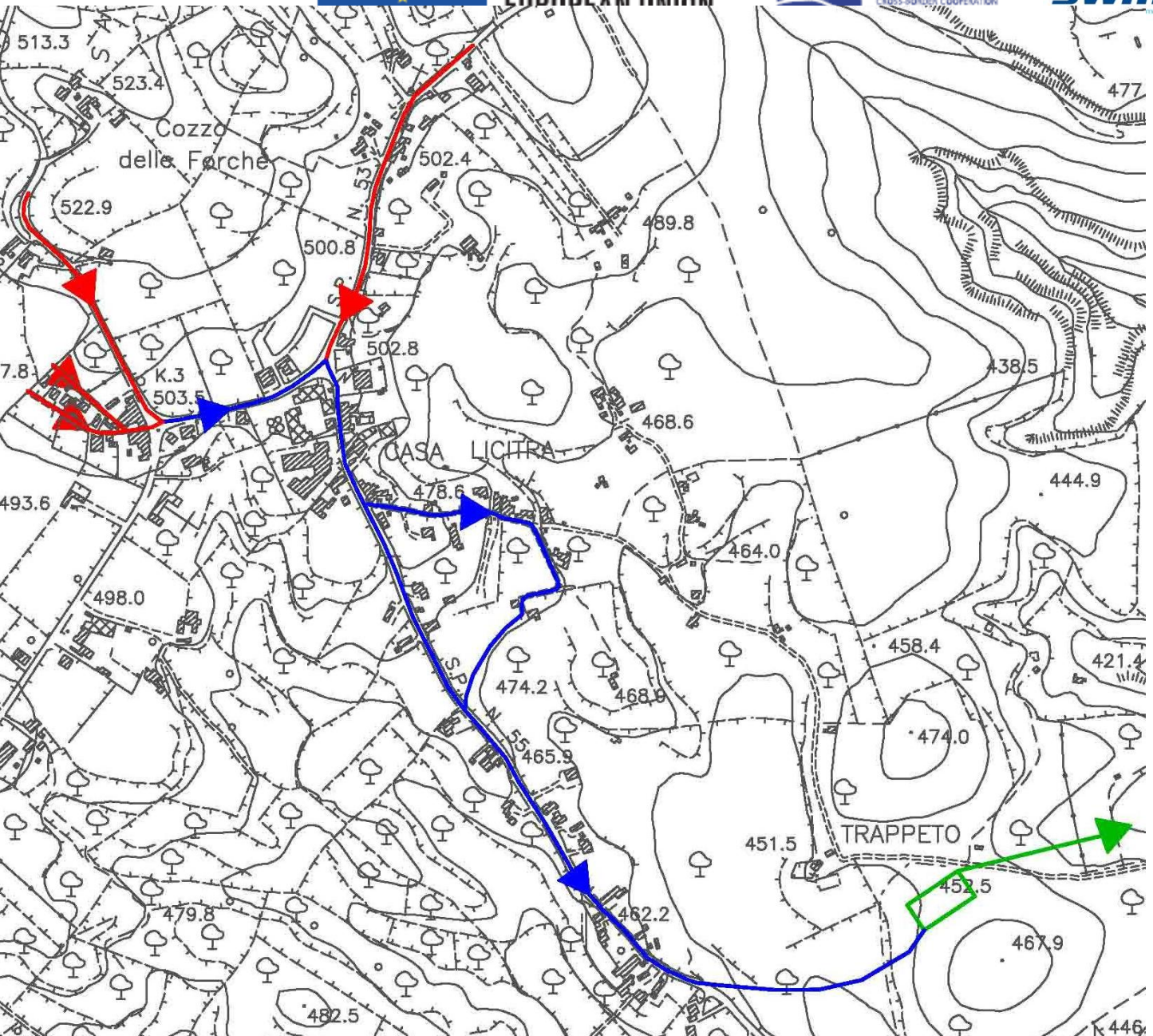

Borgo San Giacomo

Potable water Served by public network;
No sewage: housed served by private tanks

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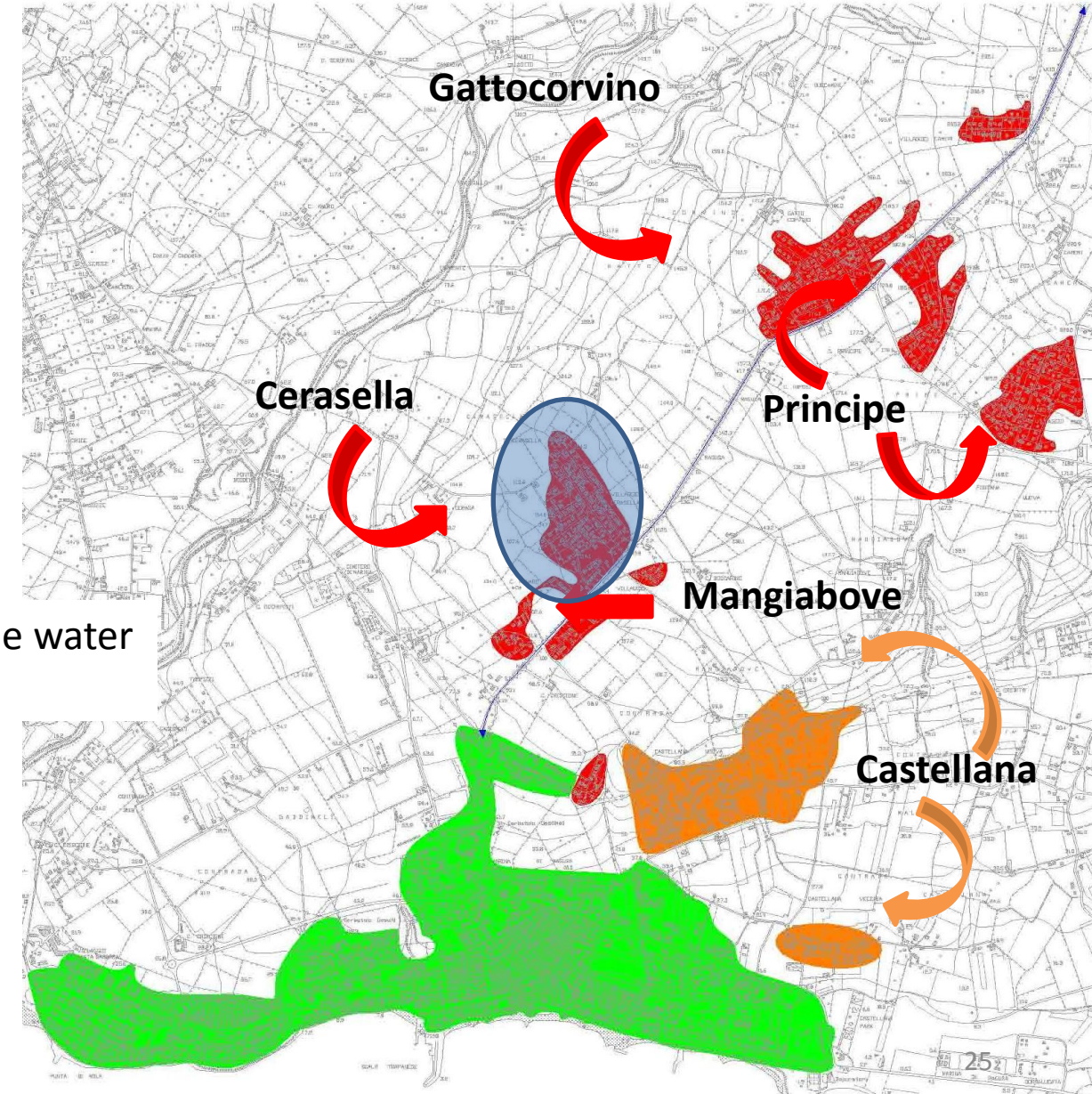
COASTAL site

1) High fluctuation 1:10

2) Water deficit in summer



Areas already linked to the water and ww network

Consolidated town

New settlement

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Lazio case study: type of settlements

Small town

>>> High water losses

>>> High water consumption

>>> Unsatisfactory ww treatment and pollution of receiving water bodies

Compact isolated settlement
(far from the existing sewage network)
>>> High water consumption
>>> Lack of ww treatment

Urban sprawl of villas or small houses with family garden
>>> very high water consumption
>>> lowering of groundwater table

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Lazio: target areas

1) Medium size city with high water consumption

>>> High water losses

>>> High water consumption

>>> Lack of ww treatment

2) Small neighborhood not served by ww treatmen plant

>>> High water consumption

>>> Lack of ww treatment

3) Urban sprawl of villas or small houses with family garden

>>> very high water consumption

>>> lowering of groundwater table

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Palestine: target areas

1) Small town?

>>> lack of ww treatment

>>> mixed sewers : problems of rainwater management

2) Rural village?

>>> water supply by truck (very high cost) : alternative source needed

>>> lack of proper sanitation facilities

>>> waste of greywater

>>> irrigation needed for food security

3) Refugee camp?

>>> need to reduce water consumption

>>> lack of proper rainwater drainage

>>> lack of ww treatment

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Malta (Gozo): target areas

1) **Rural Village?**

2) **Tourist resort?**

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