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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

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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 adaptation
  - 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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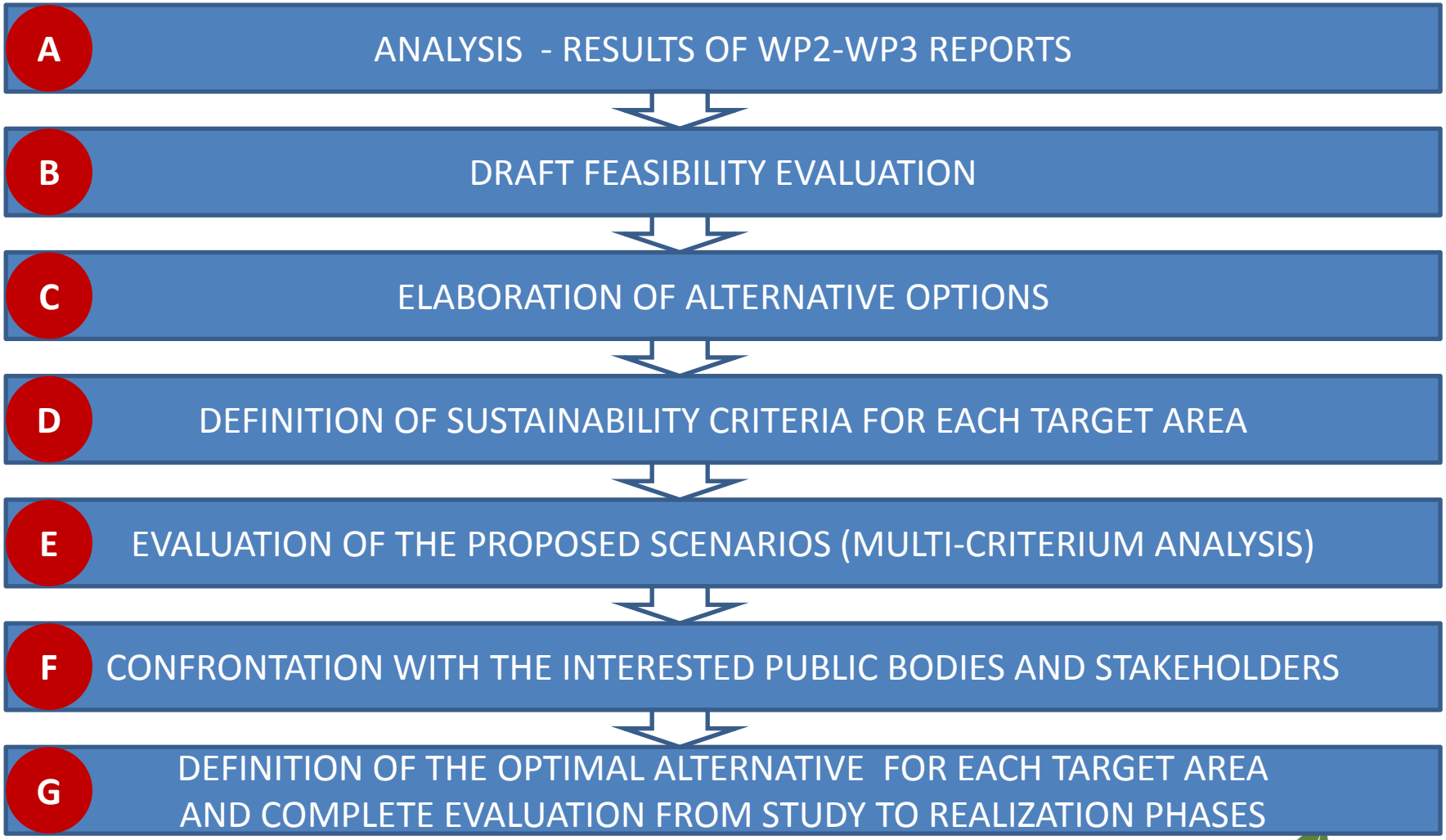

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A ANALYSIS - RESULTS OF WP3 REPORTS

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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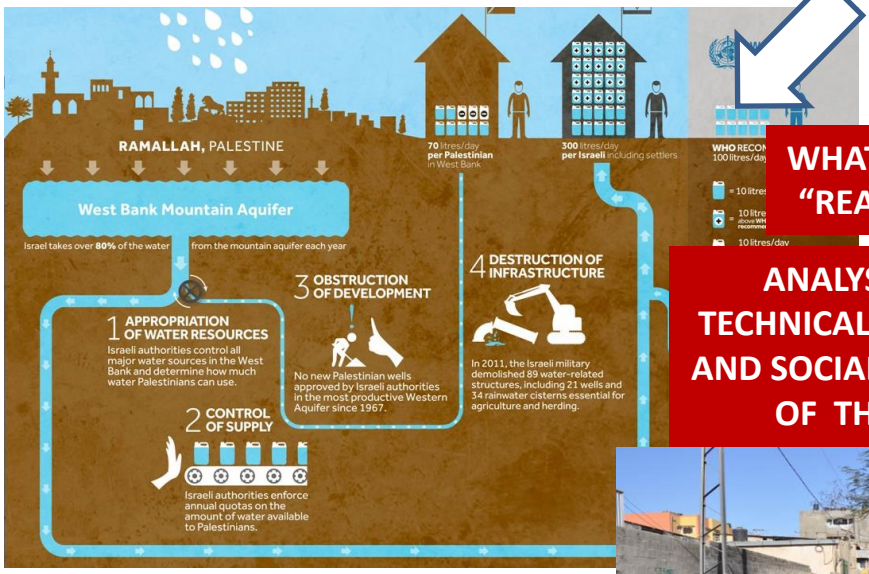
B DRAFT FEASIBILITY EVALUATION

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

Tool		Applicability in the region	Diffusion in the region	Remarks/comments
Greywater Treatment SSW				
Vertical Flow Constructed Wetland		+++	-	
Other tecquique used locally not present in SSWM toolbox				
septic gravel up-flow system				

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C ELABORATION OF ALTERNATIVE OPTIONS IN TARGET AREA

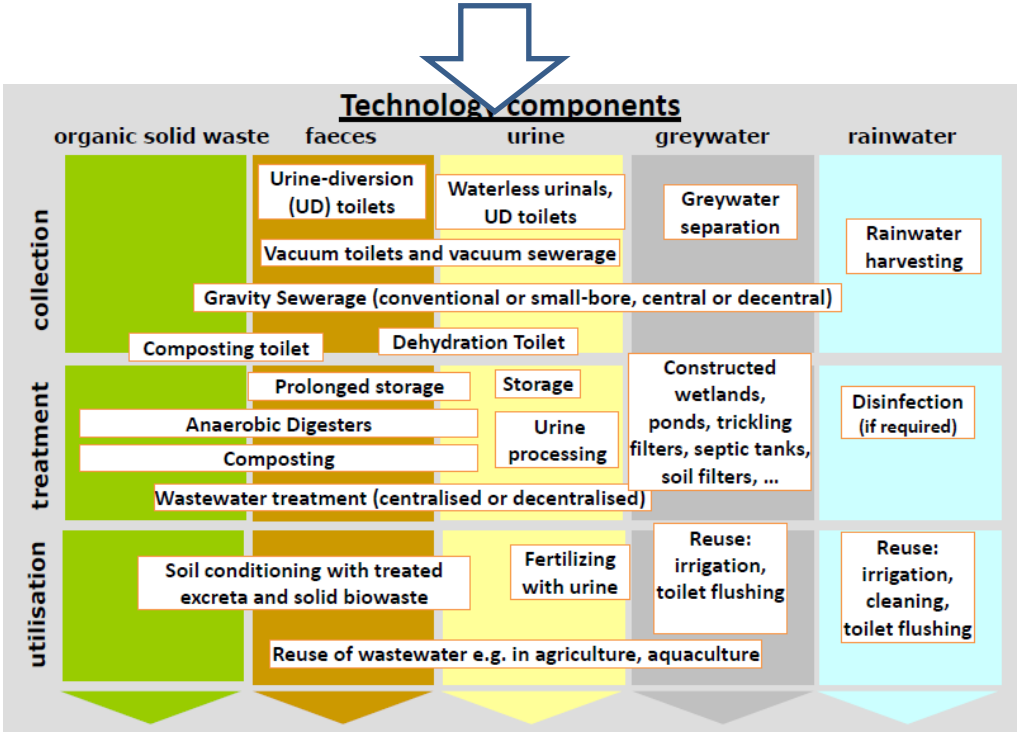
Alternative 0: no interventions

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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technical proposal for the selected sites:
Develop alternative solutions to face water and wastewater management in the selected site.
Select one or more SWM techniques to be integrated in each alternative option. EG: certalized or decentralized rainwater harvesting, greywater separation and reuse, waterless urinals, dry toilet, centralized or decentralized waste water treatment (constructed wetlands or other technologies), etc.
Every alternative shall include several technologies: please don’t develop more than 5 alternatives.

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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

350 habitants, 50 houses

Division of Cherfech 24 in two parties

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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Weight definition: number from 1 to 5, 5 is the max score, 1 is the minimum score

The "weights" will be multiplied for the specific indicator "measures" in order to obtain a final value that will contribute to the calculation of an aggregated and normalised index for each macro-indicator.

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Health issues		weight (1-5)
Don't causes any risk of	additional mosquitoes (or other insects) growth	1
	illness	4
Reduced exposure to pathogens	of users	2
	of waste workers	5
	of resource recoverers /reusers	2
	of "downstream" population	5
Impact to environment / nature		
use of natural resources	Minimize water use	5
	Low land requirements	1
	Low energy requirements	4
	Uses mostly local Construction material	5
low emissions and impact to the environment	Surface water	2
	Ground water	5
	soil/ land	1
	Air	4
	Noise and vibration	2
	aesthetic	5
	odours	2
good possibilities for nutrients recovering resources	energy	1
	Organic matter	3
	Water	3
	Landscape integration	3

Technical issues	
allows simple construction	2
low level of technical skills required for construction	5
High level of efficiency (wastewater input/depurated/timing)	4
Purification capcity (wastewater depurated/soil used by the plant)	2
has high robustness and long lifetime/high durability	2
enables simple and low operational procedures	1
Low maintenance and low skills required	3
not reliant on a continuous supply of a resource (such as water or energy	3
adaptable to unexpected future changes (adaptability)	3
Good quality of effluent (according to the receiving environment)	3
Amount and quality of generated sludge	3
reduction of the imbalance water at the basin level	3
Economical and financial issues	
Provides benefits to the local economy (business opportunities, local employment, etc.)	1
provides benefits or income generation from reuse	2
Social, cultural and gender	
Improves quality of life	2
requires low level of awareness and information to assure success of technology	1
requires low operation & maintenance and little involvement by the users	3
high level of satisfaction of the local people regarding the implemented technology	3
requires low policy reforms at local, regional or national level.	3
takes special consideration of women, children and elderly issues	4
Costs	
Investment cost (USD)	5
Maintanance cost (USD/year)	5

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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

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

F CONFRONTATION WITH THE INTERESTED PUBLIC BODIES AND STAKEHOLDERS

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Altenative 0 = no intervention

++ or 5 the criterion is very fulfilled by this alternative

+ or 4 the criterion is fulfilled by this alternative

0 or 3 the criterion is neutral to this alternative

- or 2 the criterion does not fulfilled well by this alternative

-- or 1 the criterion does not at all fulfilled by this alternative

(the + and – can be substituted by numbers in the range 1-5 as specified above)

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Health issues		alternative 1	alternative 2	Alternative 0
Causes any risk of	additional mosquitoes (or other insects) growth	+	-	-
	illness	++	++	-
Reduced exposure to pathogens	of users	++	++	-
	of waste workers	++	+	--
	of resource recoverers /reusers	++	-	-
	of "downstream" population	++	++	-
Impact to environment / nature				
use of natural resources	Low land requirements	-	-	-
	Low energy requirements	++	++	-
	Uses mostly local Construction material	++	++	-
	Low water amounts required for construction	+	+	-
low emissions and impact to the environment	Surface water	++	++	-
	Ground water	-	++	-
	soil/ land	++	++	-
	Air	++	-	-
	Noise and vibration	+	++	-
	aesthetic	-	++	-
	odours	++	+	-
good possibilities for nutrients	energy	++	-	-
	Organic matter	+	++	-
recovering resources	Water	++	++	-
	Landscape integration	++	+	-

Technical issues			
allows simple construction	-	-	-
low level of technical skills required for construction	++	+	-
has high robustness and long lifetime/high durability	++	+	-
enables simple and low operational procedures	+	++	-
Low maintenance and low skills required	-	+	-
not reliant on a continuous supply of a resource (such as water or energy)	++	+	-
adaptable to unexpected future changes (adaptability)	++	++	-
Good quality of effluent (according to the receiving environment)	+	++	-
Amount and quality of generated sludge			-
Economical and financial issues			
Provides benefits to the local economy (business opportunities, local employment, etc.)	+	+	-
provides benefits or income generation from reuse	+	+	-
Social, cultural and gender			
Improves quality of life		-	
requires low level of awareness and information to assure success of technology	++	+	-
requires low operation & maintenance and little involvement by the users	+	+	-
high level of satisfaction of the local people regarding the implemented technology	-	+	-
requires low policy reforms at local, regional or national level.	++	+	-
takes special consideration of women, children and elderly issues			-
Costs			

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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