



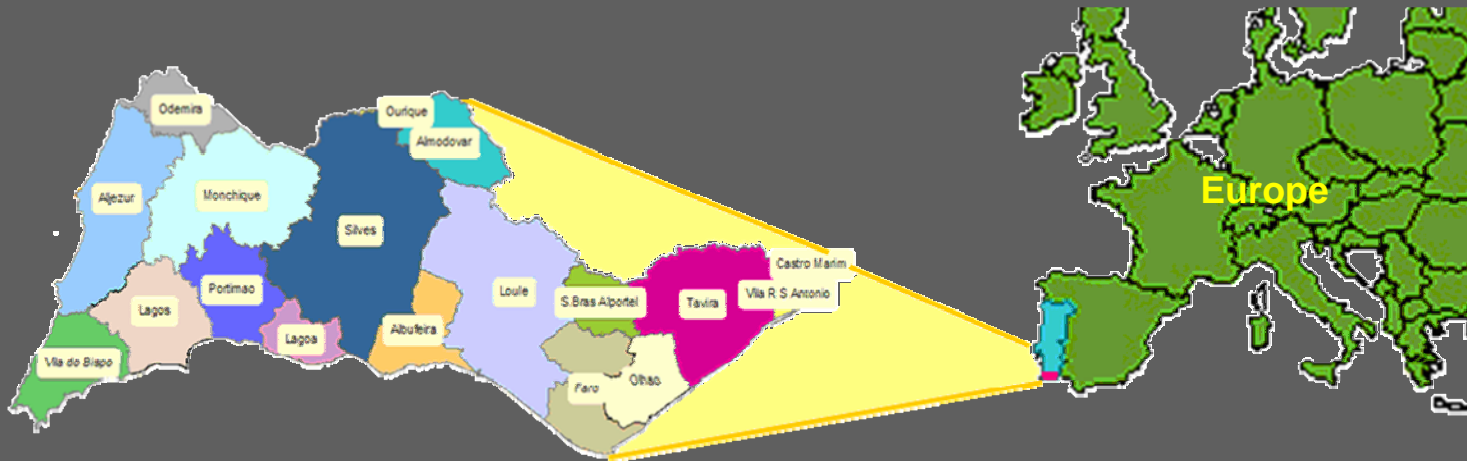
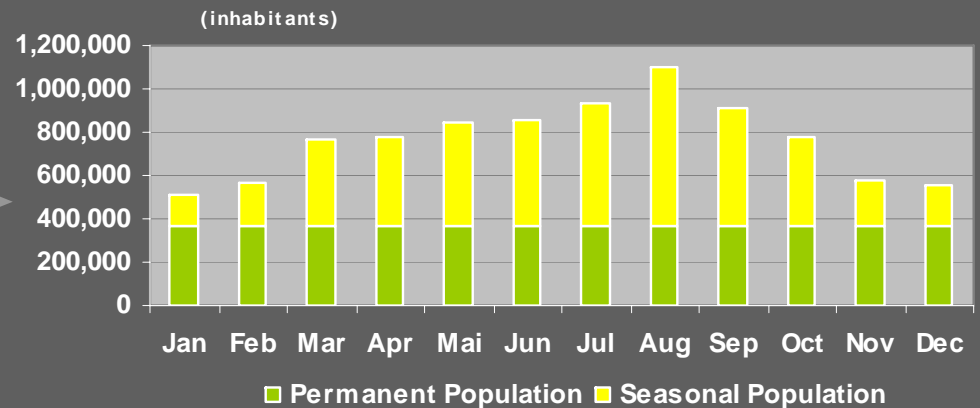
FEUP

WATER MANAGEMENT STRATEGIES FOR RIBEIRAS DO ALGARVE, PORTUGAL

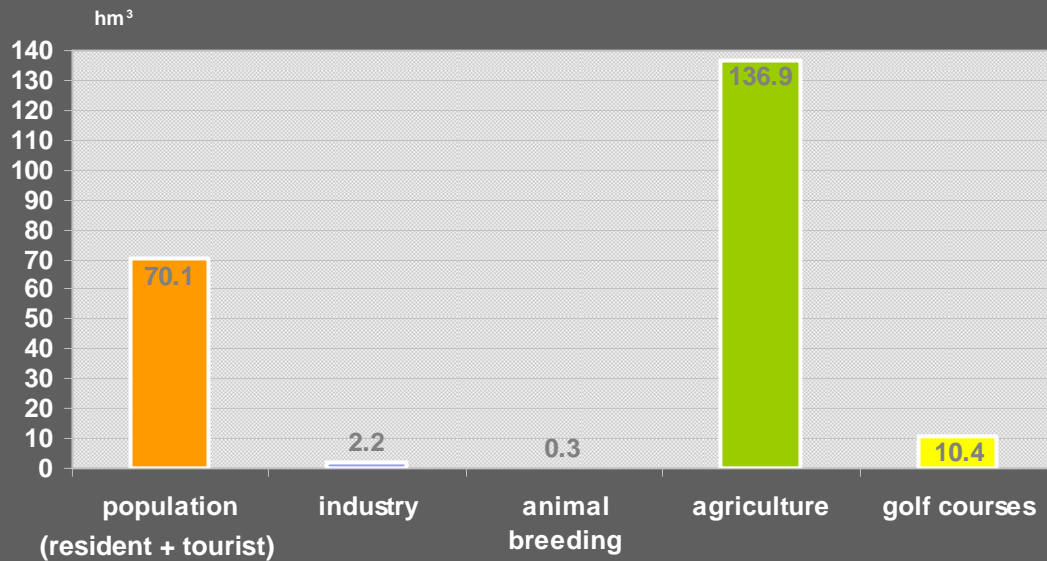
cyprus, may 2005

ribeiras do algarve river basin

- ✓ area of the basin: 3837 Km²
- ✓ 18 municipalities
- ✓ more than 350,000 inhabitants in 2001
- ✓ tourist population

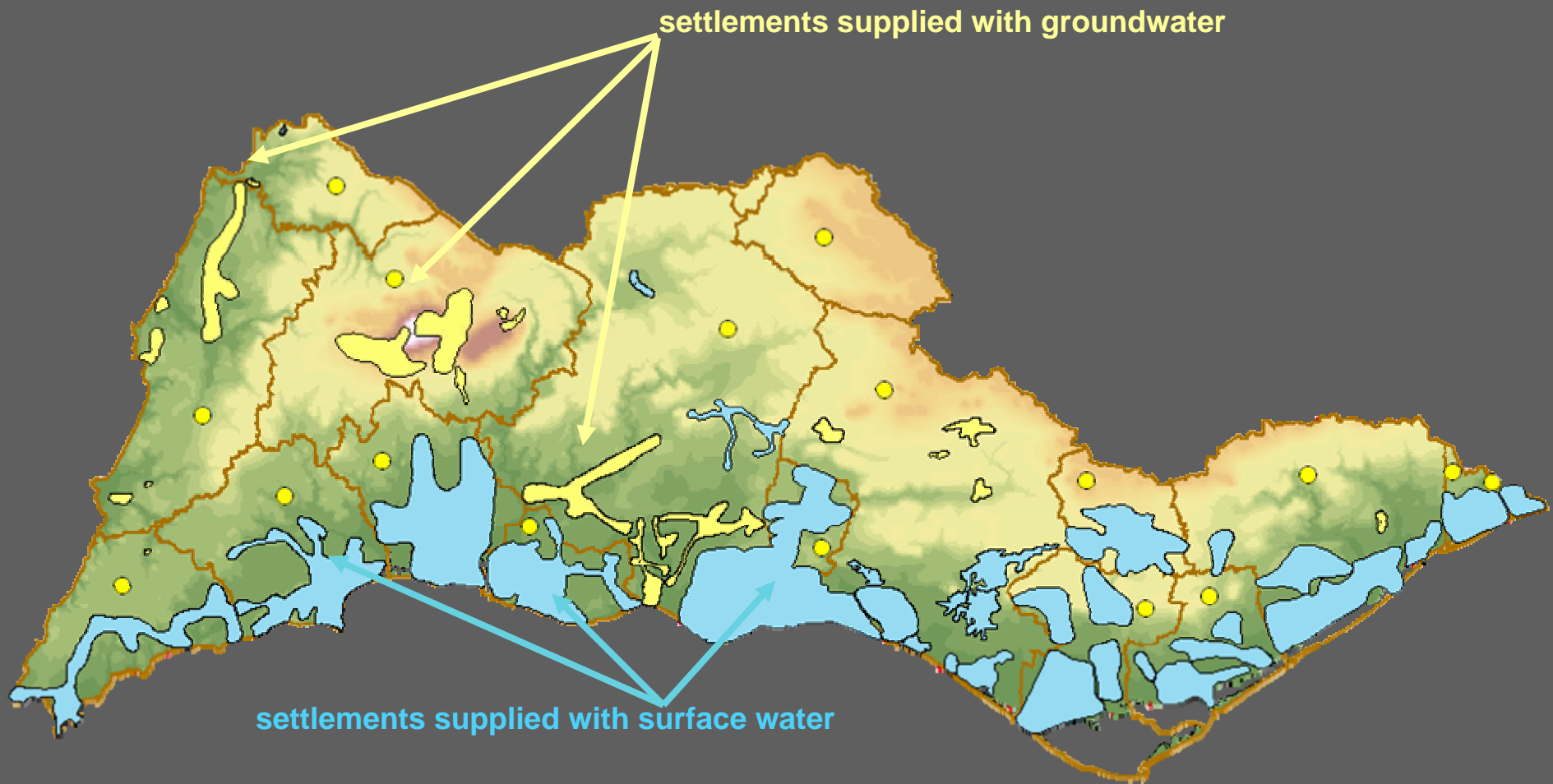


characterisation of the demand

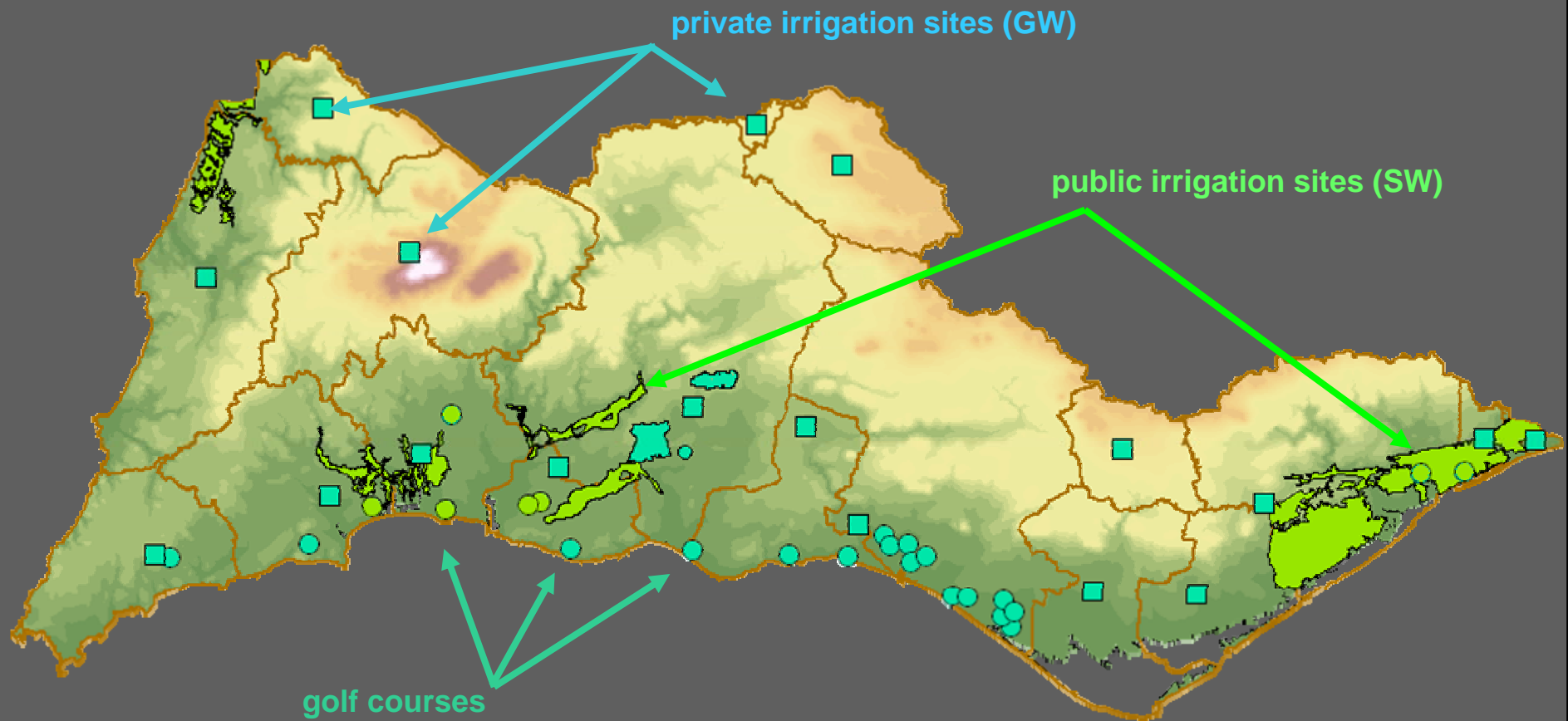


	demand (hm³/year)	%
population (resident + tourist)	70.1	31.9
industry	2.2	1.0
animal breeding	0.3	0.1
agriculture	136.9	62.3
golf courses	10.4	4.7

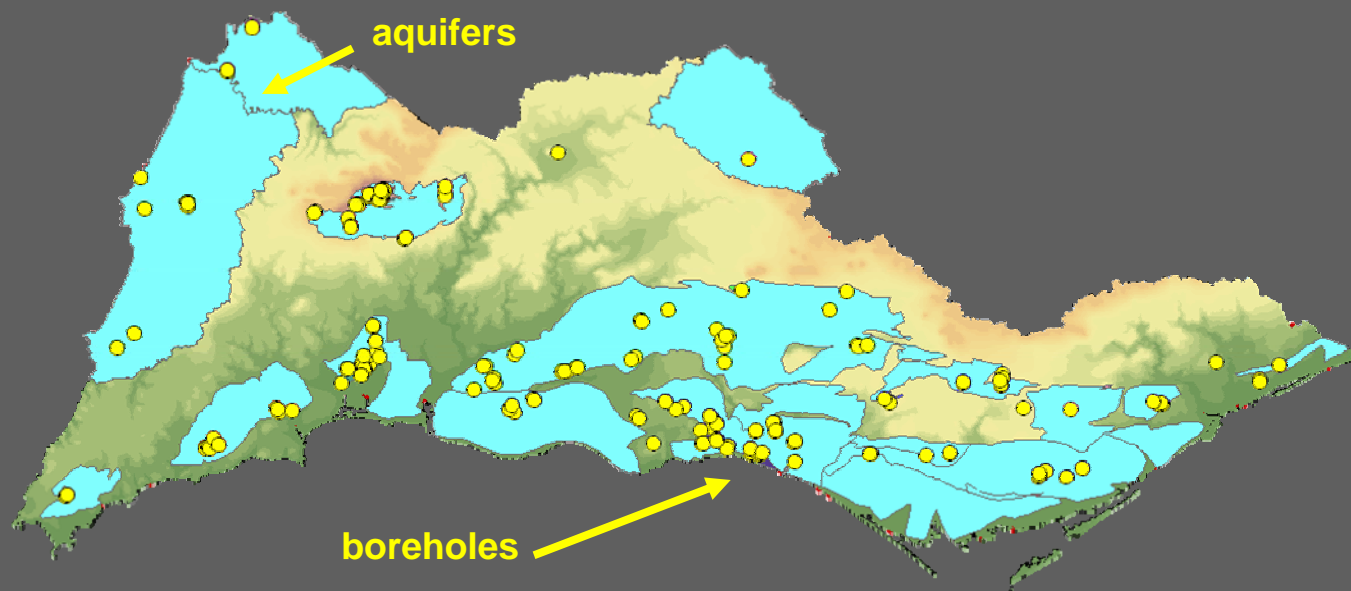
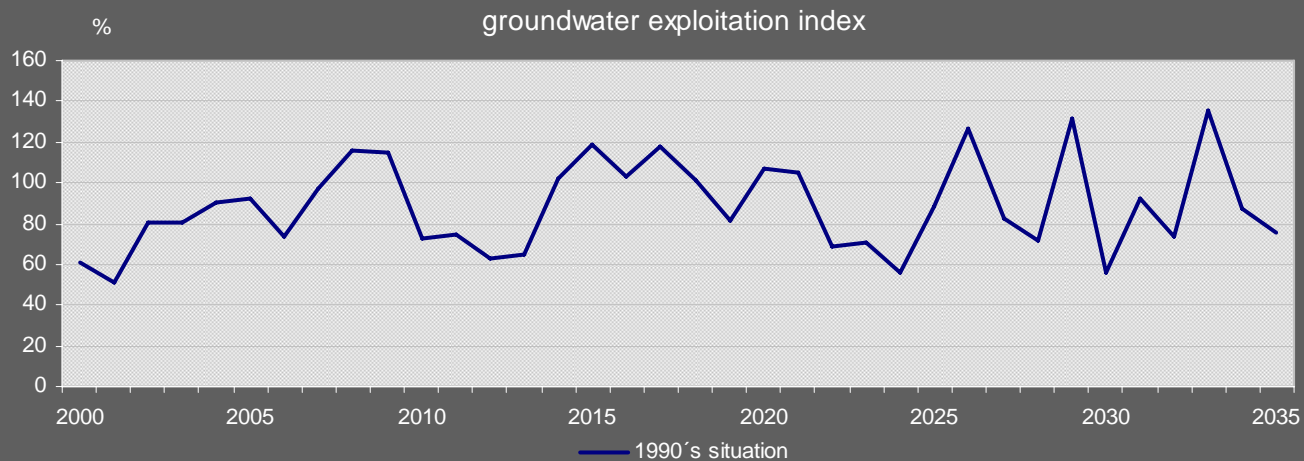
characterisation of domestic demand



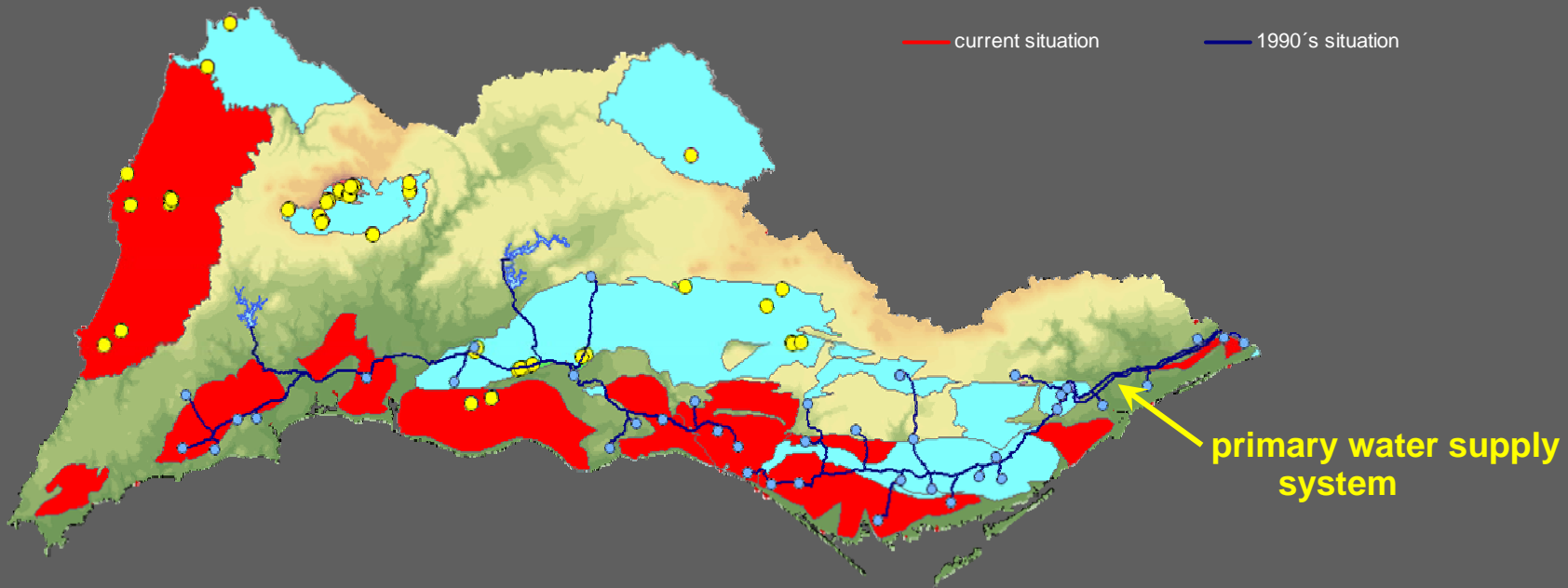
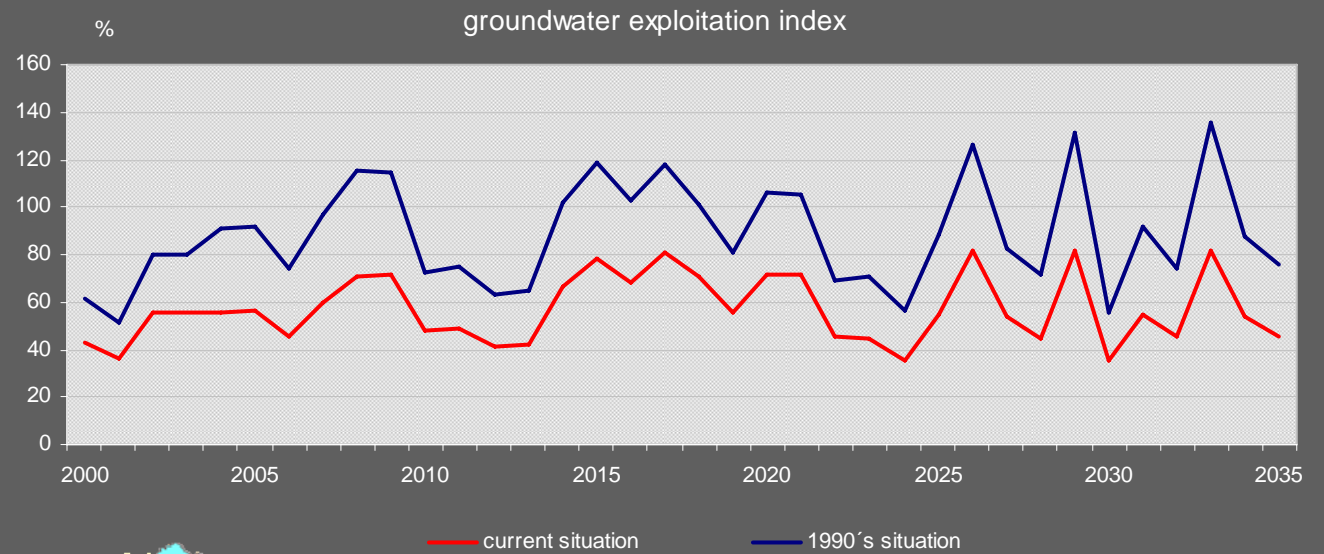
characterisation of irrigation demand



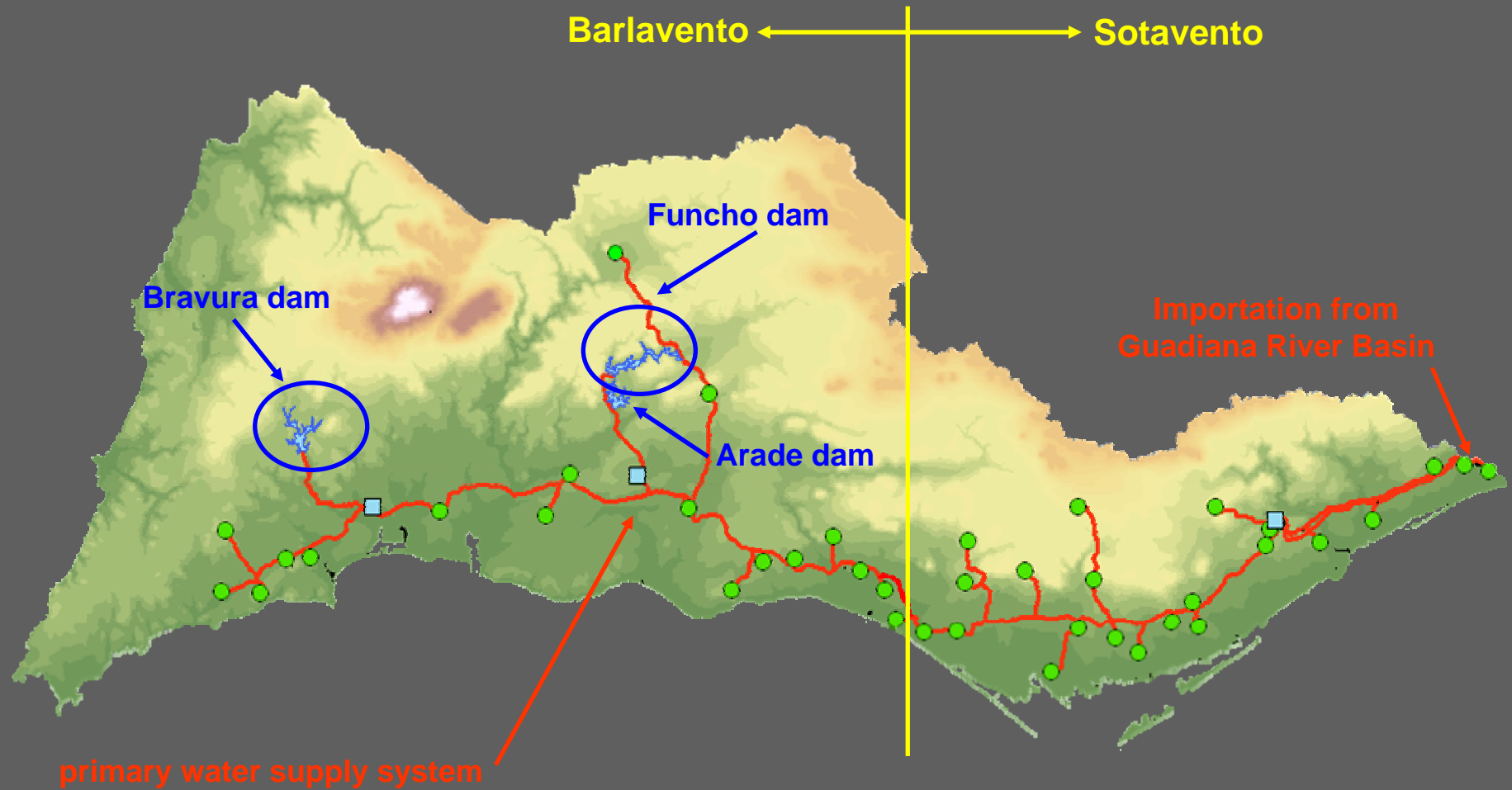
1990's situation



1990's situation vs. current situation



primary water supply system



main concerns for Águas do Algarve S.A.



necessity to increase the water availability

❖ current paradigm: Odelouca dam

alternative options:

- sustainable exploitation of Querença-Silves aquifer (good quality / enough quantity)
- import water from the existent Santa Clara dam (Mira basin)

❖ new paradigm:

- desalination units to satisfy local urban demands
- demand management options, in a short period of time:
 - advertising campaigns
 - conservation measures
 - water pricing increase

stakeholders main concerns

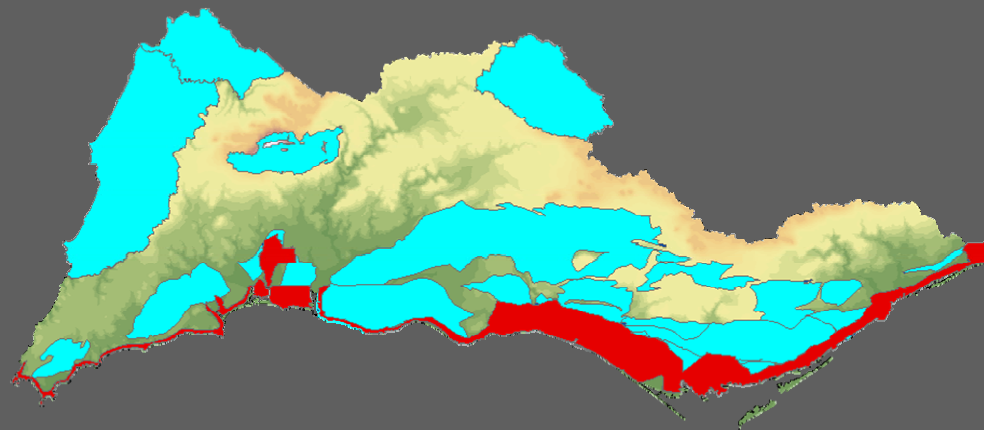
main concerns for CCCR Algarve



solve water quality and/or quantity problems (in general)

❖ current paradigm:

- irrigation methods improvement
- no new abstractions on the defined critical area located on coast



❖ new paradigm:

- small scale and localized water management measures (water re-use and desalination on golf courses)
- sustainable combination of surface and groundwater

target definition for ribeiras do algarve

drivers and pressures

- conflicting interests on water resources between tourism and agriculture (most important water sector user)
- localized water shortages, mainly during summer months
- infrastructure deficiencies
- poor groundwater quality in some areas
- high values of secondary water supply network losses
- inadequate irrigation methods

goals

- ✓ domestic use: **95%**, all year
- ✓ irrigation use:
 - public irrigation sites: **90%**, all year
 - private irrigation sites: **80%**, all year
 - golf courses: **90%** during summer months
- ✓ maximum use of the aquifer recharge: **80%**

strategies formulation

- evaluation of strategies for the period 2000–2035

- hydrological scenario: normal

(representing a 35 years period defined in accordance with the historical sequence that occurred between 1970 and 2000)

- demand scenario: annual growth rates

Business-as usual scenario – Growth rates (%)			
	2000	2020	2035
Permanent population	Differentiated for each Municipality*		
Seasonal population	2,3		
Private irrigation sites	1,3		0
Public irrigation sites	Differentiated for each public irrigation site*		0
Golf courses	0		

*according to the River Basin Plan

- demand elasticity: - 0.5 (estimated value)

strategies formulation

- **dominant paradigm strategy (strategy 1)**

- based on the implementation of structural measures and the exploitation of surface water
- most important regional measure:
 - Odelouca dam

- **shifting paradigm strategy (strategy 2)**

- although not a radical shift from structural to non-structural options, reflects the need to consider:
 - ❖ other alternatives to conventional water supply sources (e.g., desalination)
 - ❖ implementation of small-scale, localized management measures
 - ❖ sustainable exploitation of surface and groundwater water resources

domestic use

2005

new abstraction boreholes in Querença-Silves aquifer
(maximum 0.6hm³/month until the implementation of Odelouca dam)

2006

system enhancement: replacement in Loulé Municipality

2010

dam construction: Odelouca (157 hm³)

2010/2015/2020

losses reduction: a 3 stage reduction (15% maximum per settlement)

2012

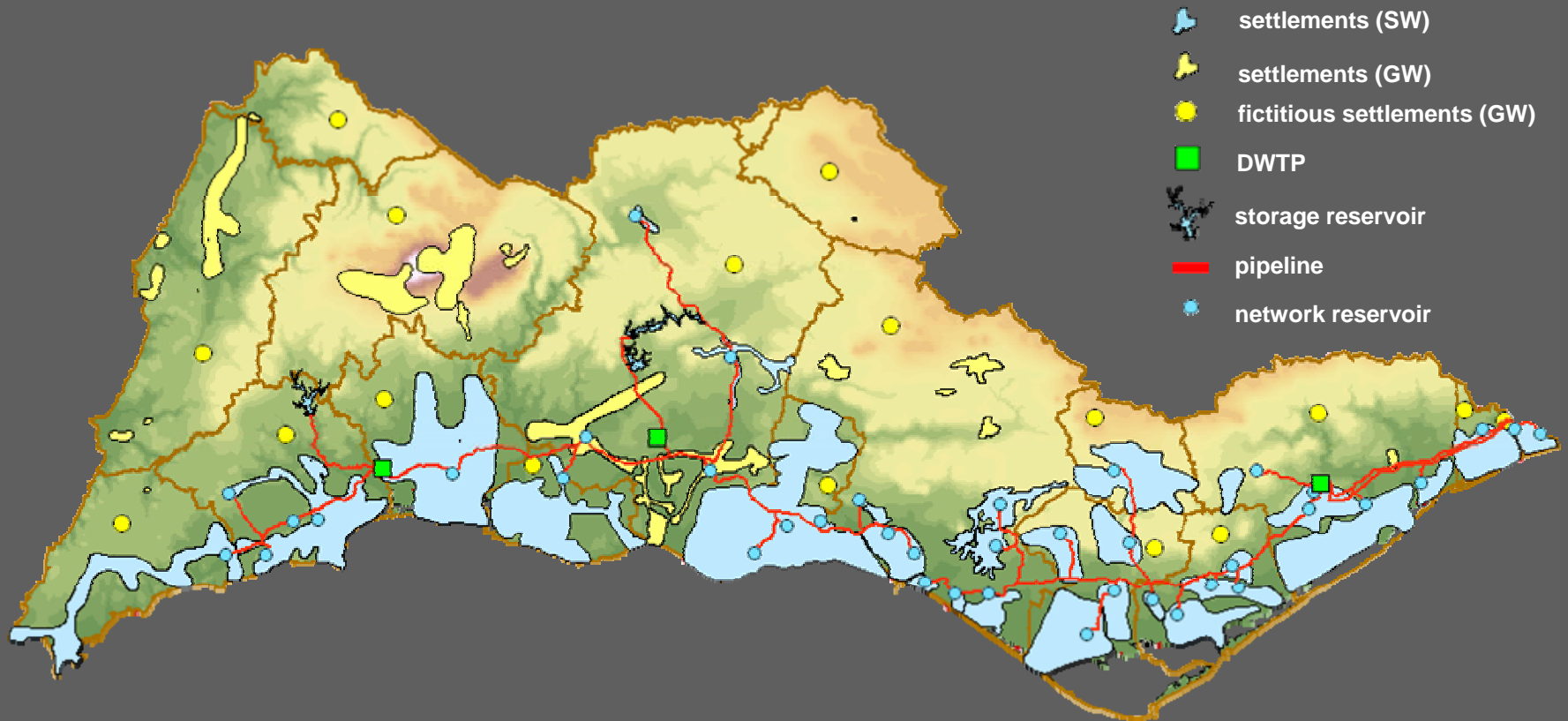
system enhancement: expansion for Aljezur and Monchique Municipalities

irrigation use

2006/2012/2020

irrigation method improvements

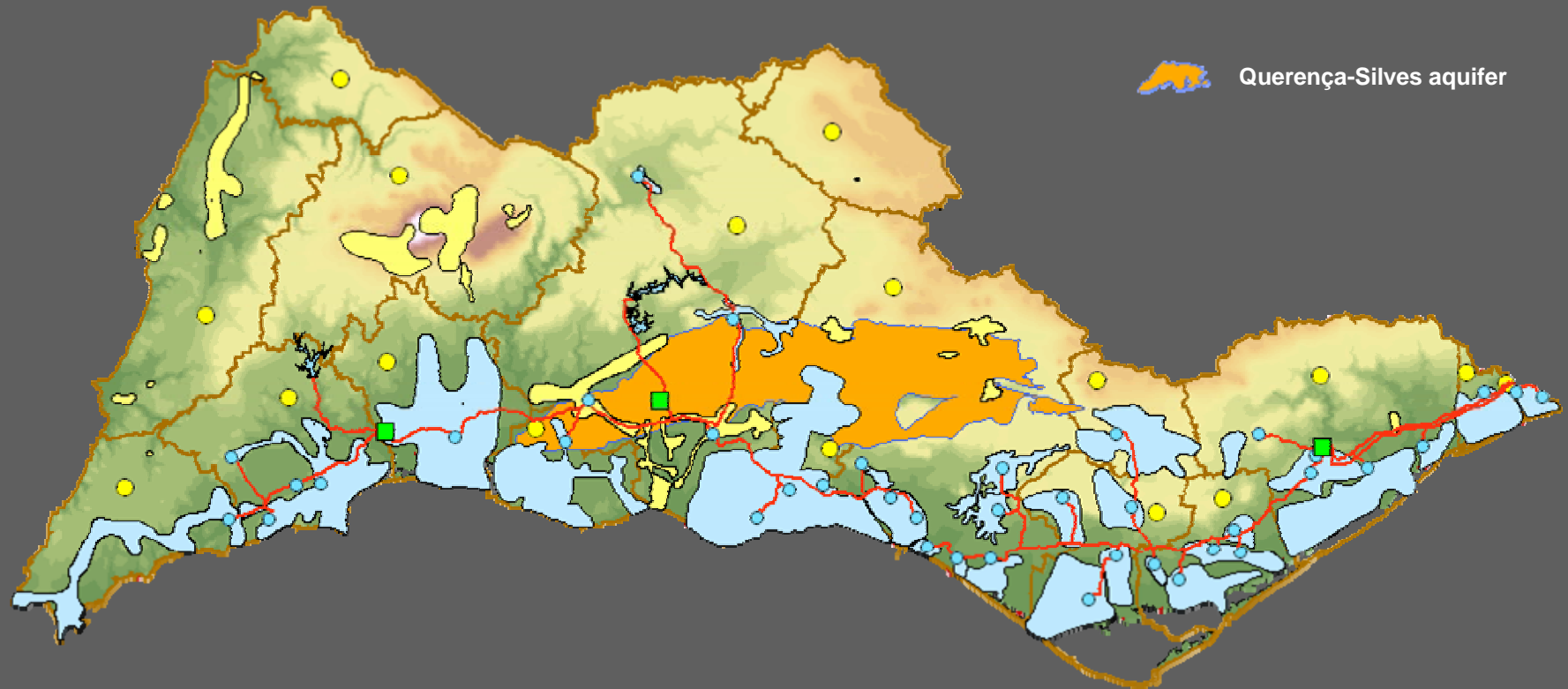
domestic use

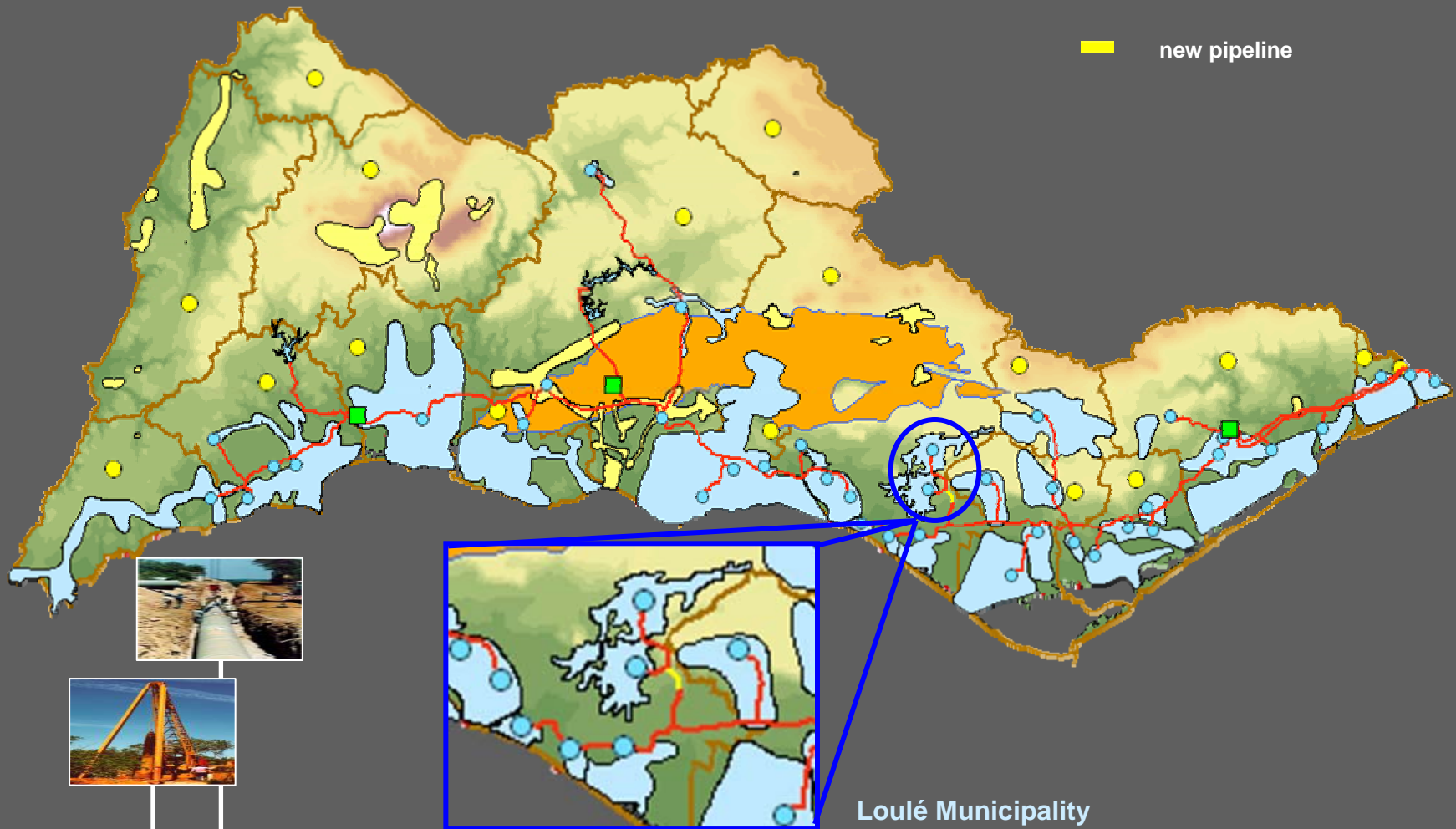


2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 ...

strategy 1: domestic use

new abstractions boreholes





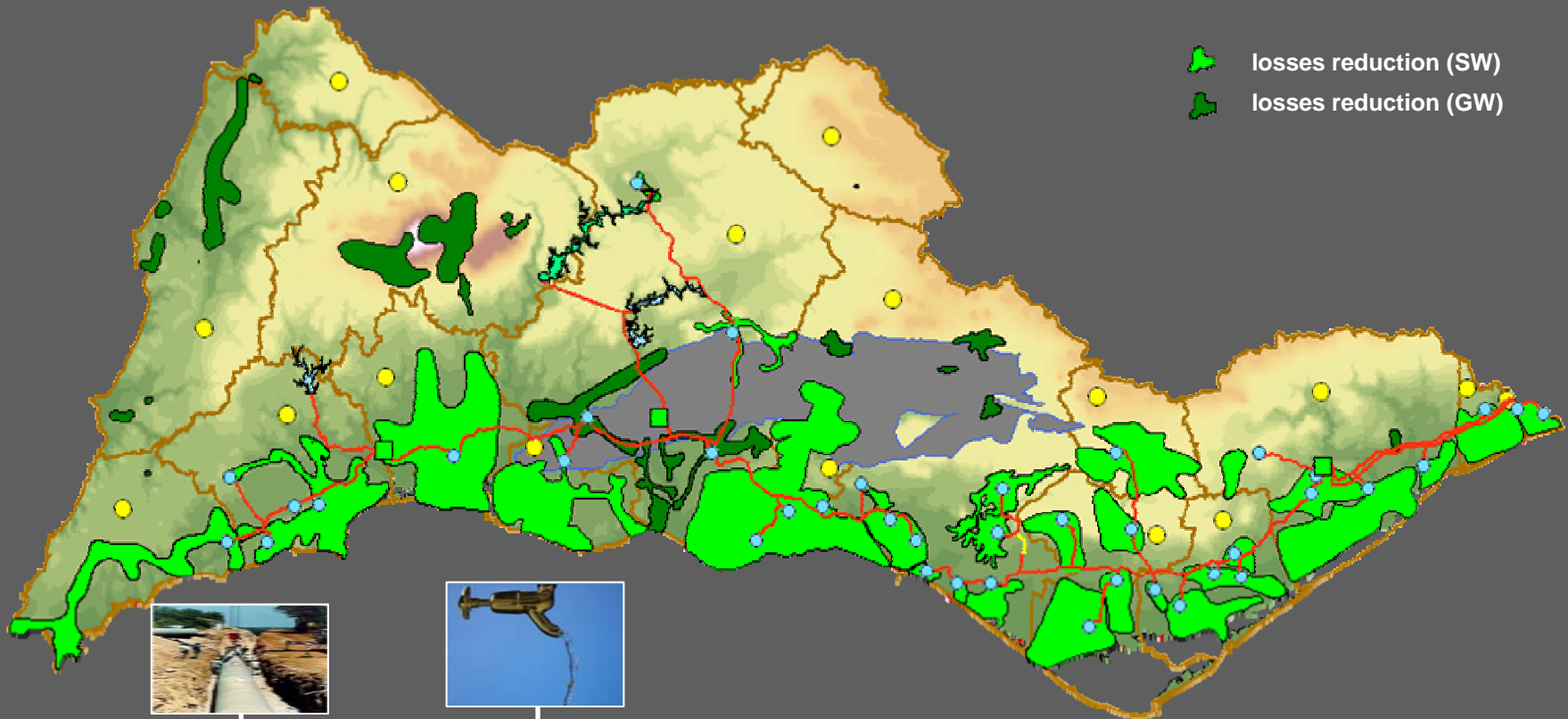
Loulé Municipality



Odelouca dam



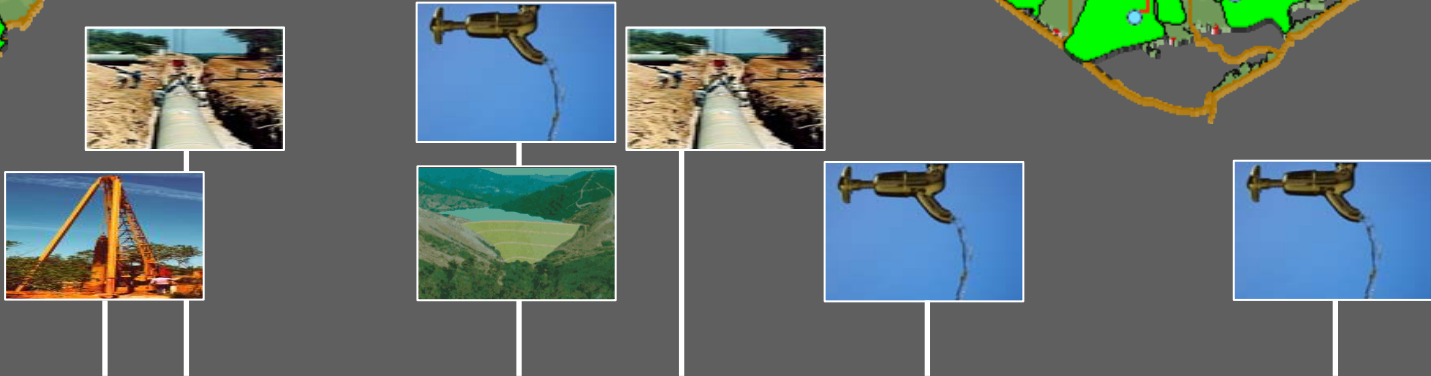
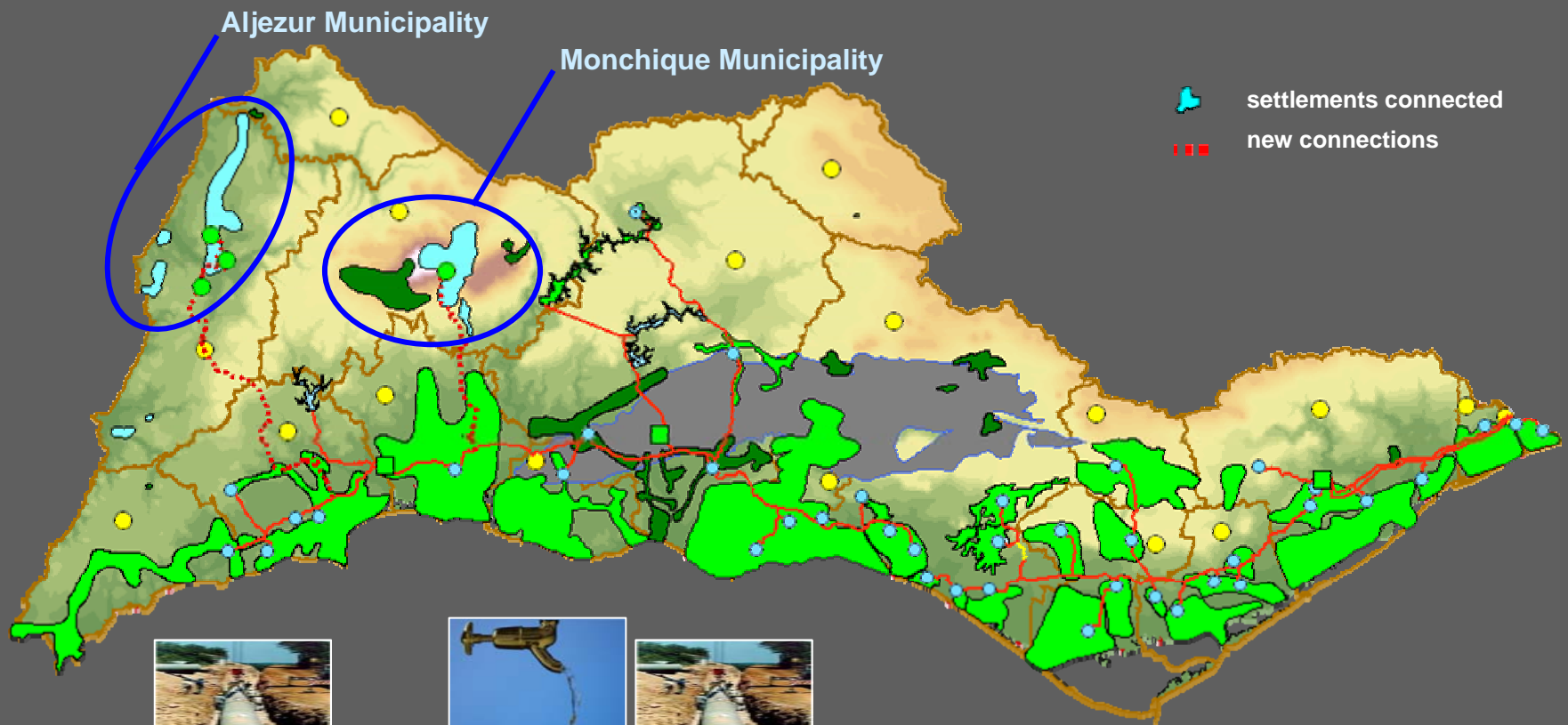
losses reduction



2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 ...



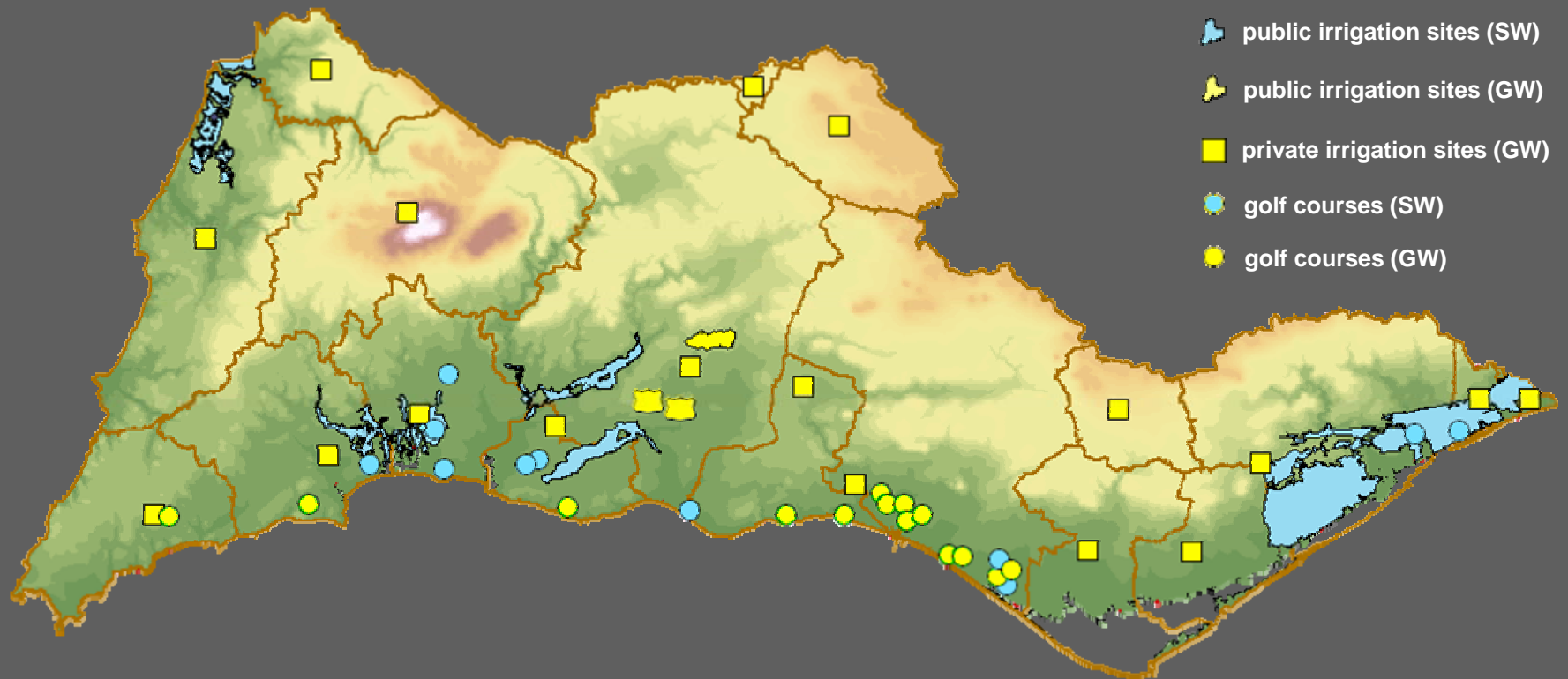
system enhancement



2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 ...

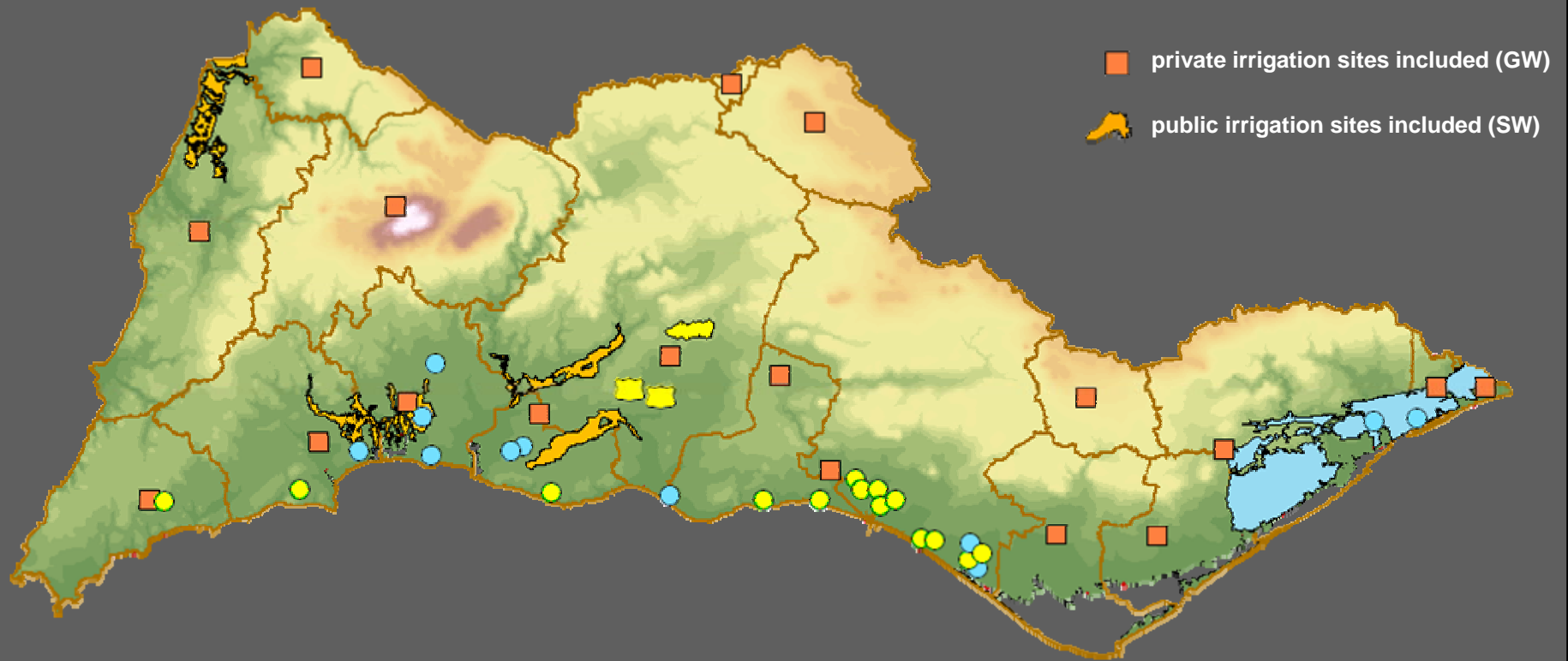


irrigation use



2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 ...

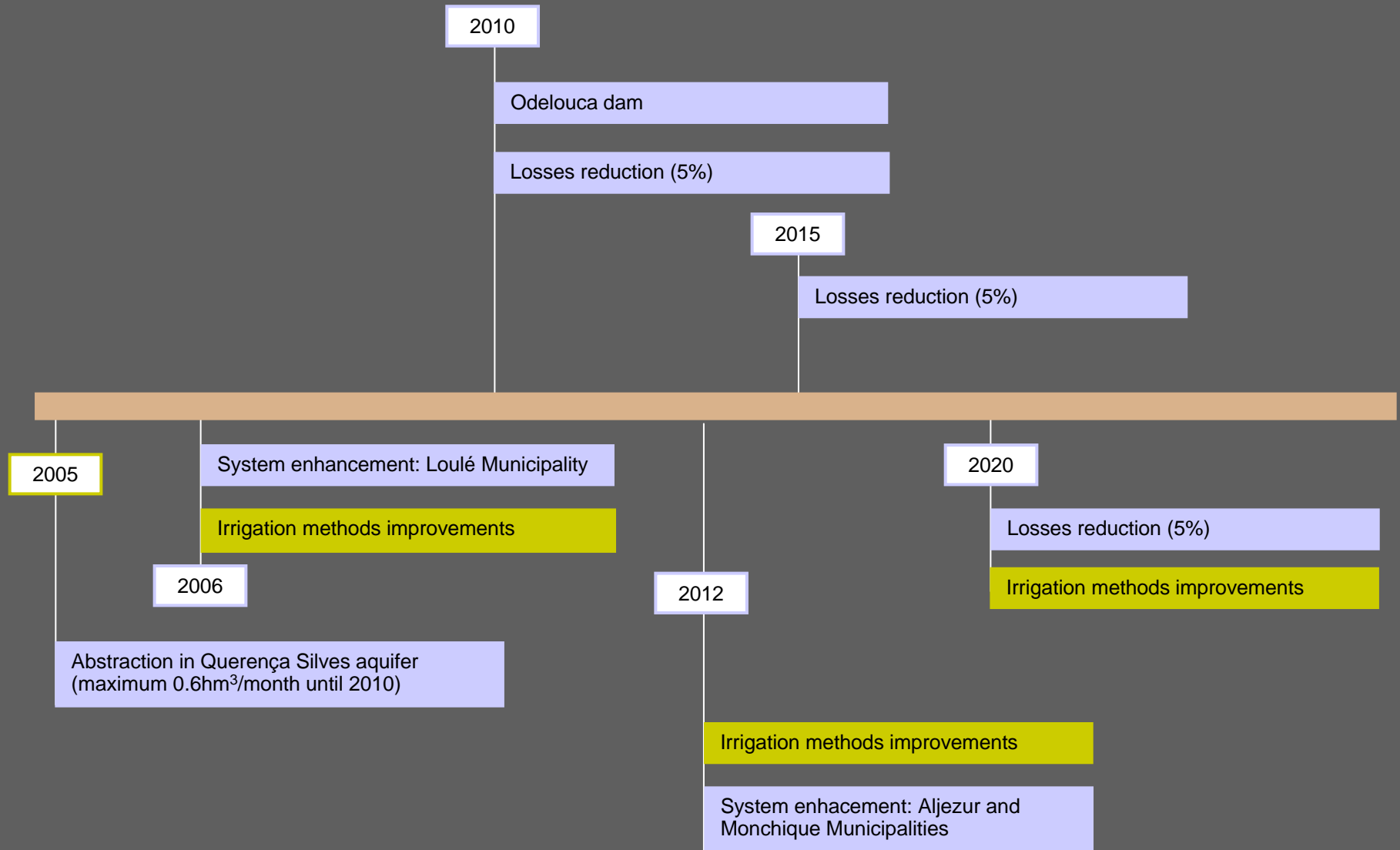
irrigation methods improvement



2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 ...



strategies formulation: dominant paradigm



domestic use

2005

new abstraction boreholes in Querença-Silves aquifer
(maximum 1hm³/month)

2006

- system enhancement: replacement in Loulé Municipality
- desalination unit in Aljezur Municipality (capacity: 5000 m³/day)
- conservation measures in domestic sector

2008

system enhancement: expansion to Monchique Municipality

2010/2015/2020

losses reduction: a 3 stage reduction (15% maximum per settlement)

2015

desalination unit in Portimão Municipality (capacity: 50700 m³/day)

irrigation use

2005

water re-use for 4 golf courses

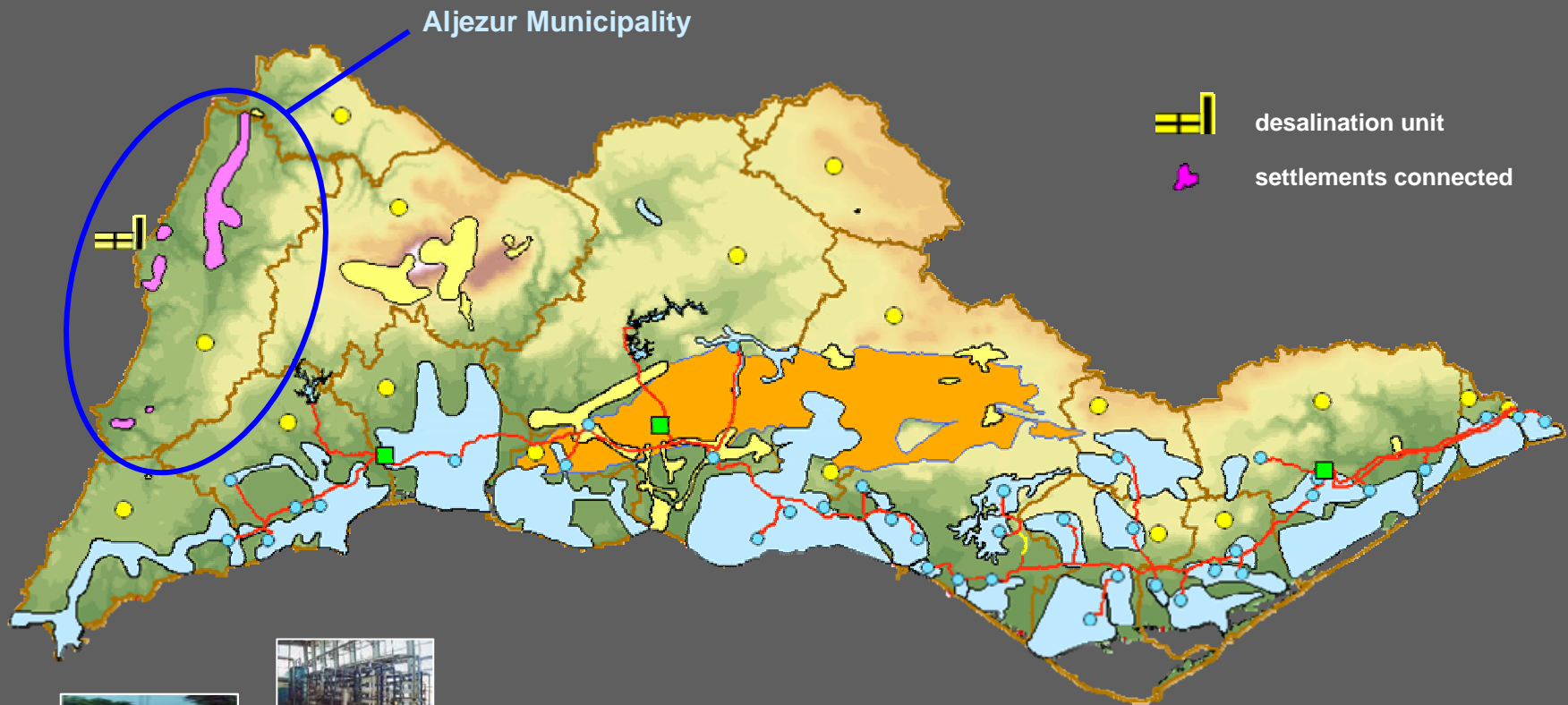
2006/2012/2020

irrigation method improvements

2007

desalination unit for golf courses in Quinta do Lago (capacity: 11500 m³/day)

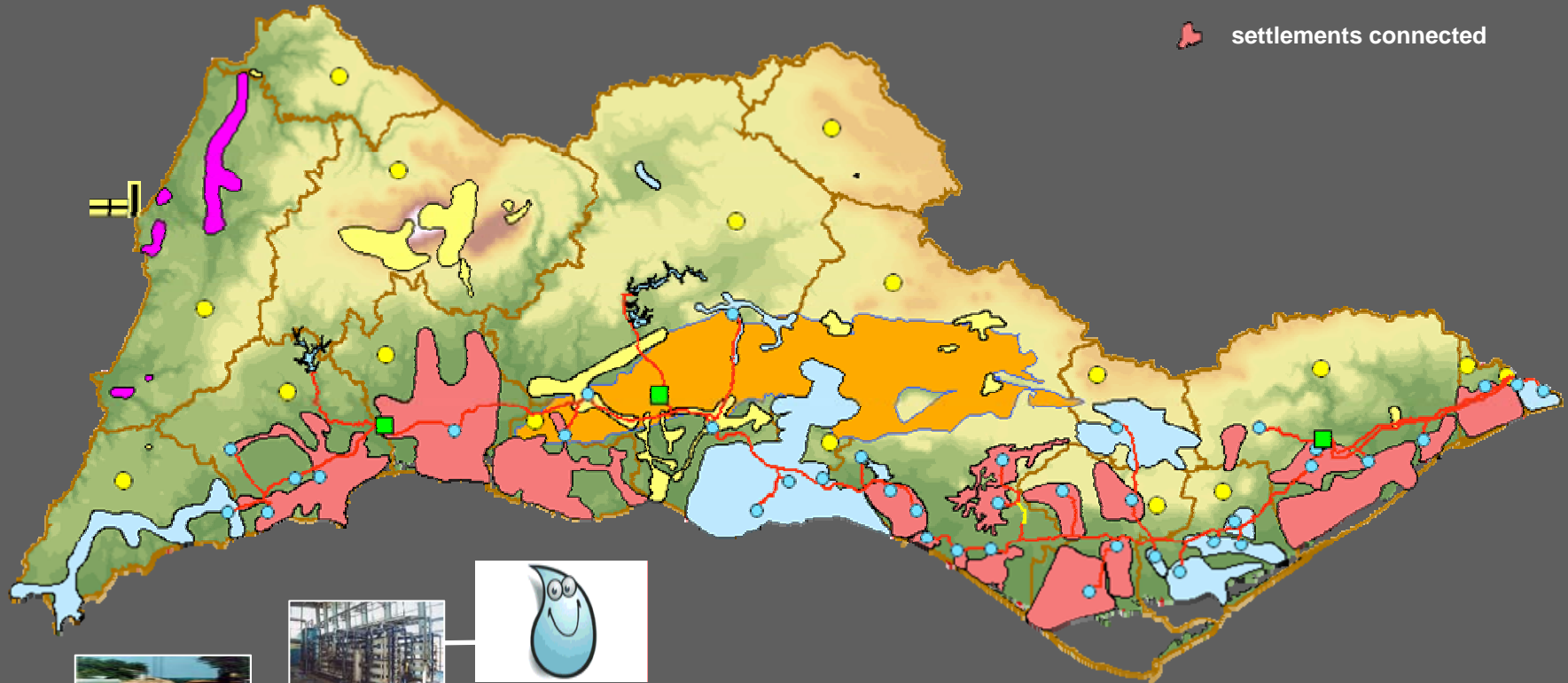
desalination in Aljezur



2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 ...

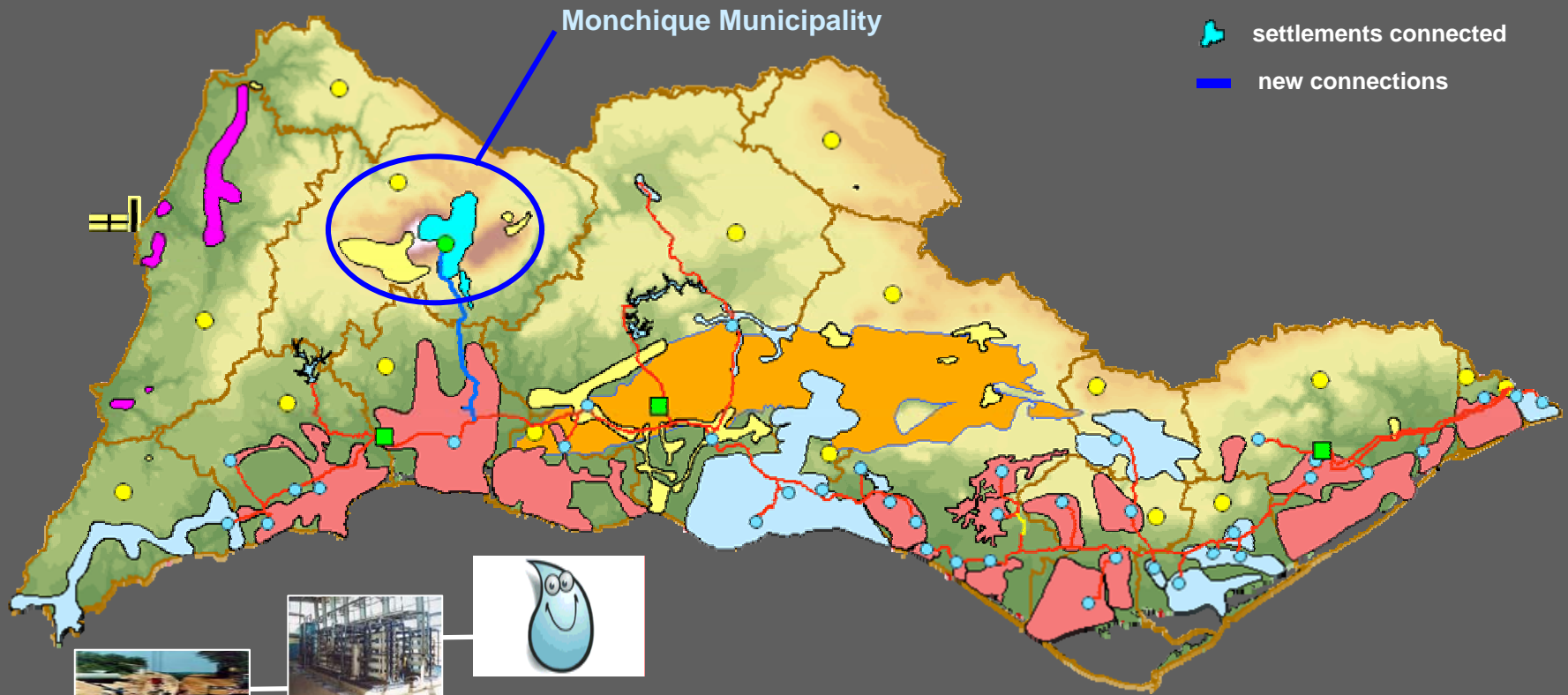


conservation measures

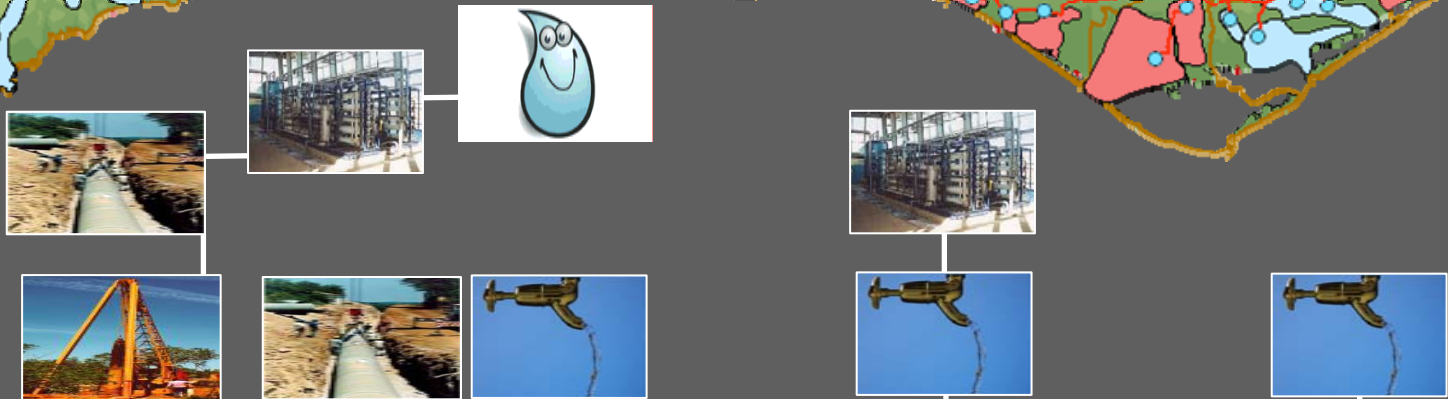
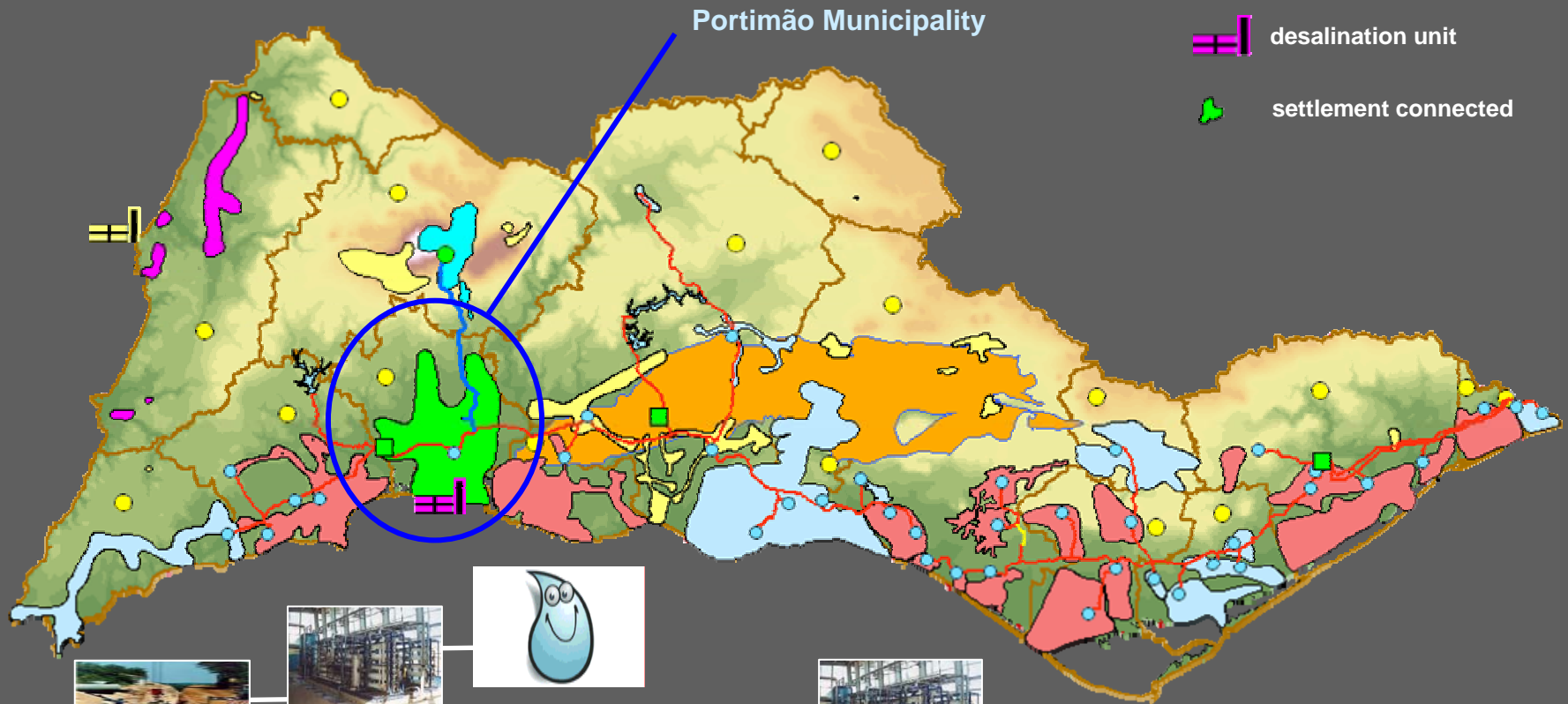


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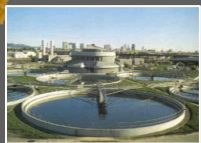
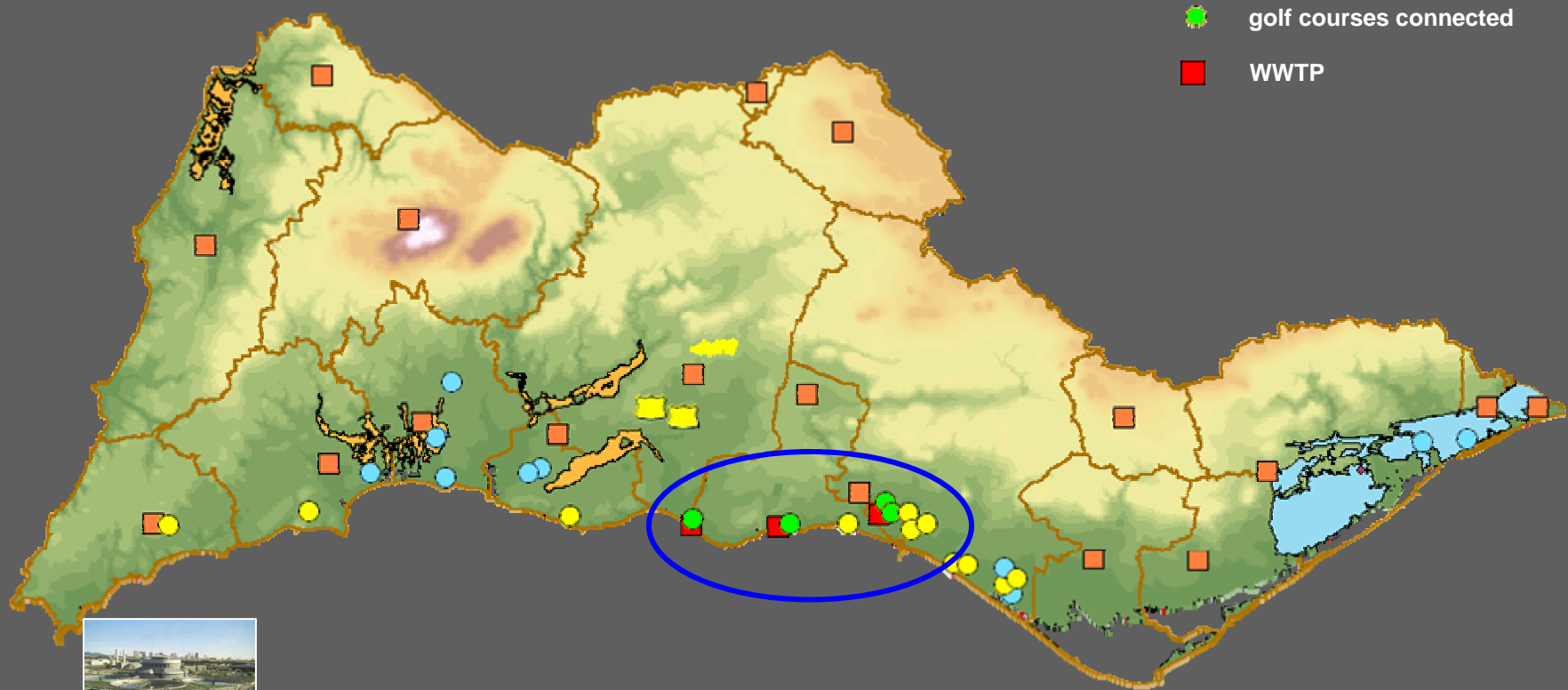


desalination in Portimão



2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 ...

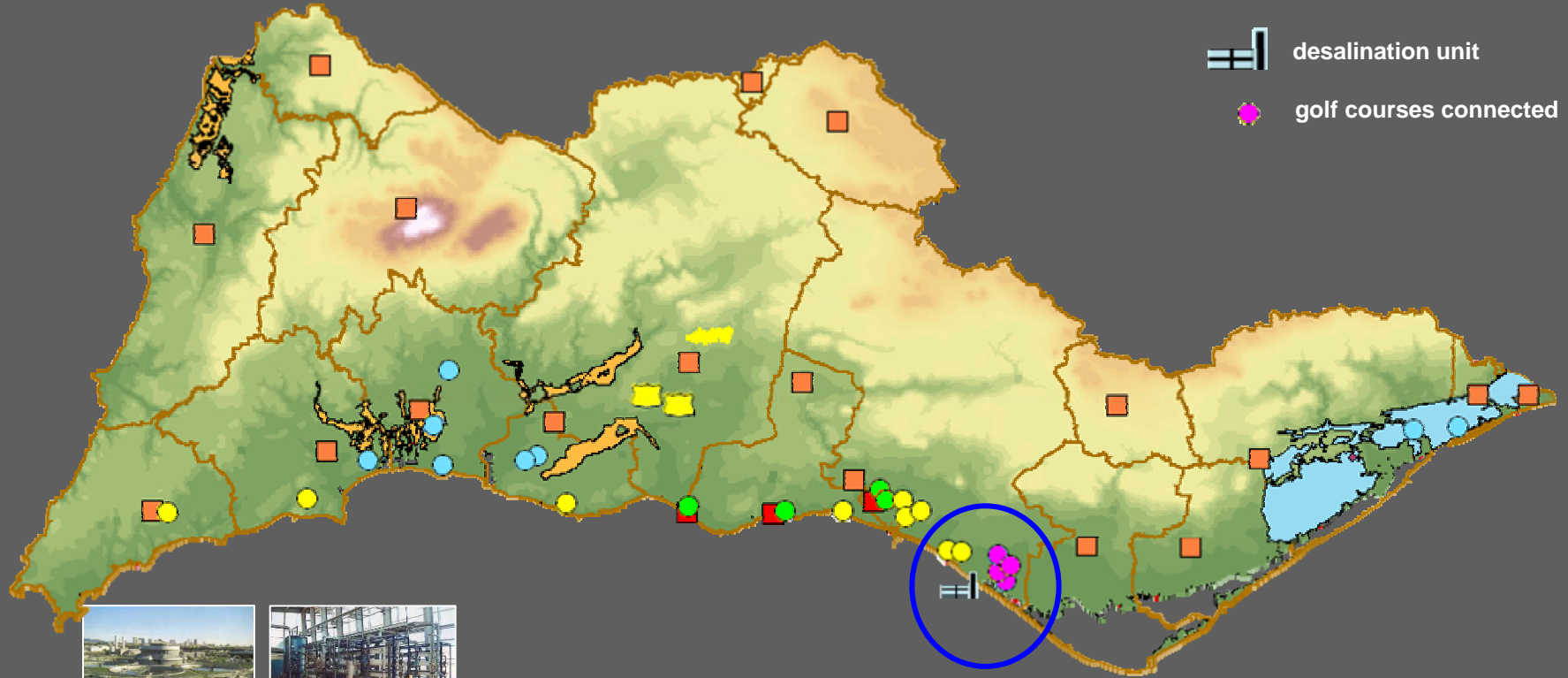




2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 ...



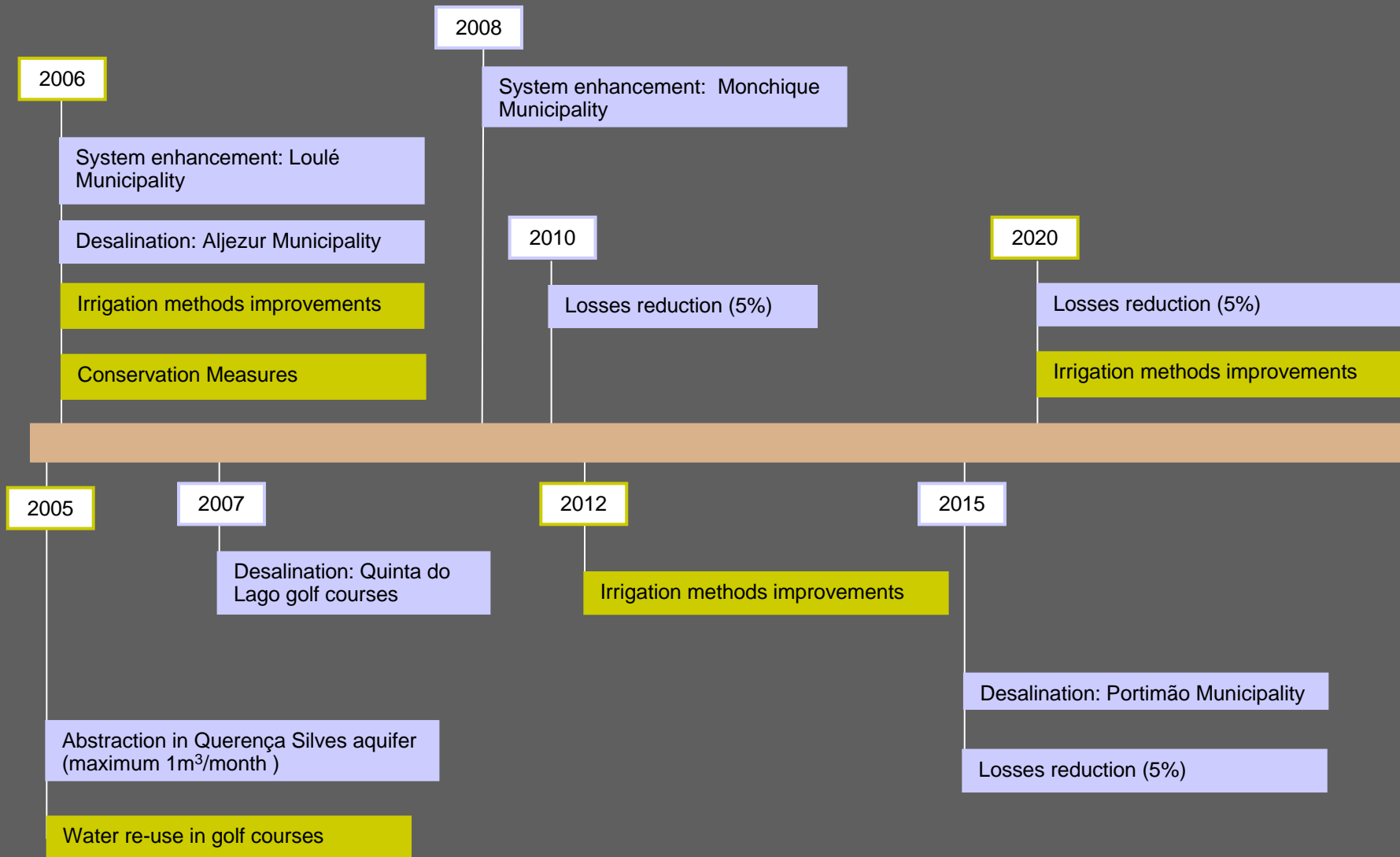
desalination in golf courses



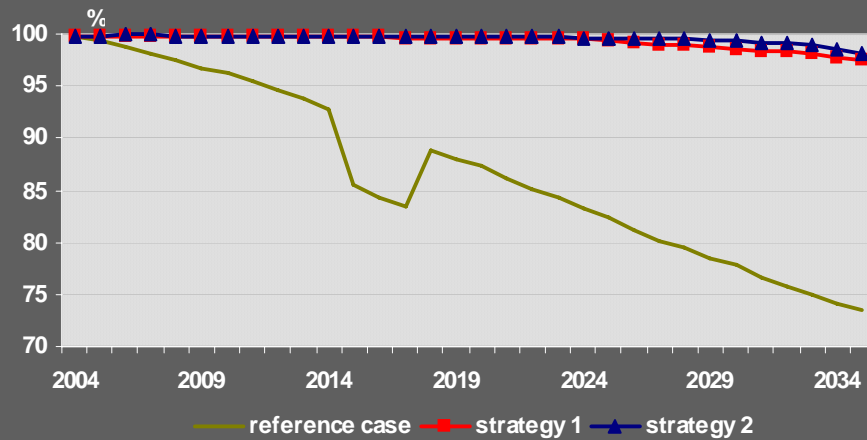
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 ...



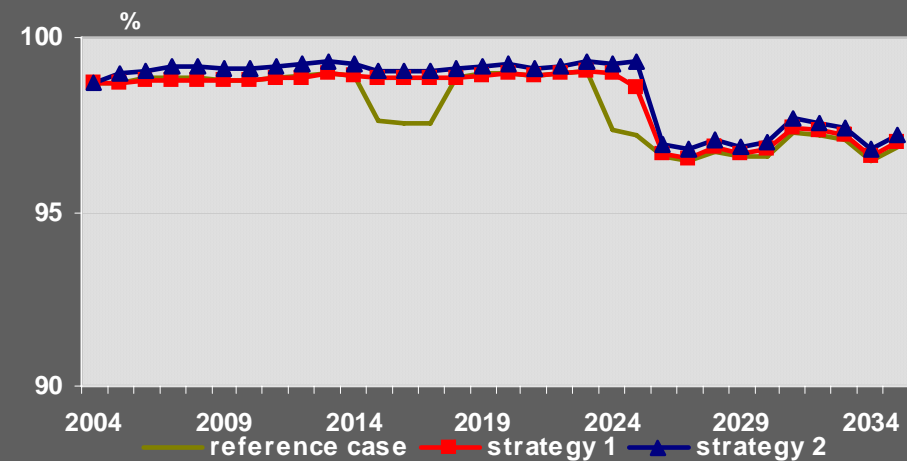
strategies formulation: shifting paradigm



- for domestic and irrigation use

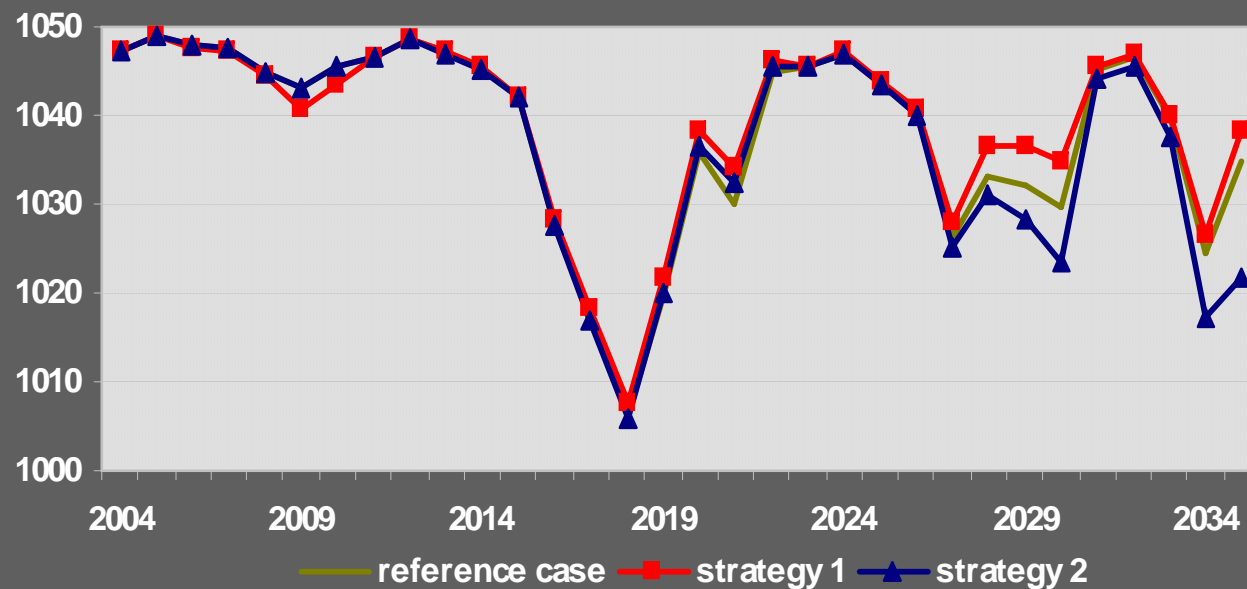


domestic demand coverage



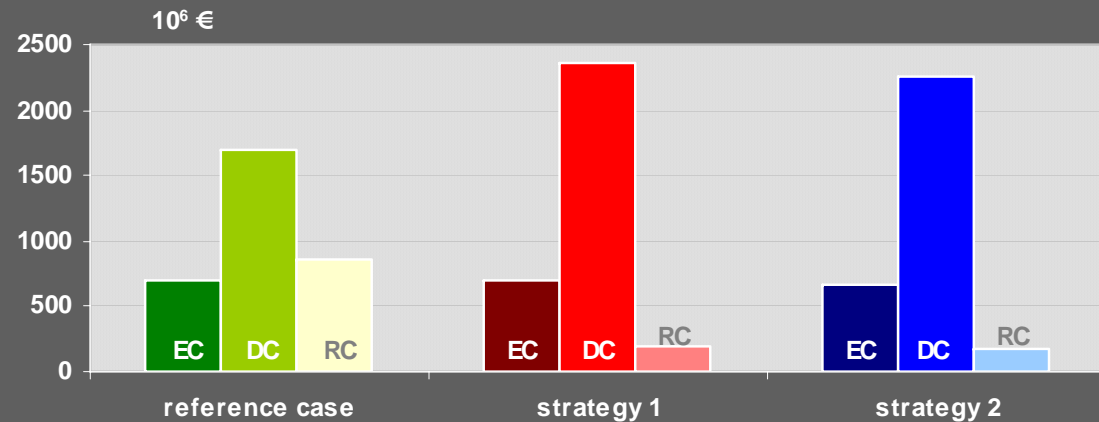
irrigation demand coverage

❖ volume stored in the Querença-Silves aquifer



economic analysis and strategy evaluation

- present value



EC - PV Environmental costs
 DC - PV Direct costs
 RC - PV Resource costs
 (PV- Present Value)

	effectiveness (relative sustainability index for demand coverage)	economic efficiency		total value to users PV, million €
		environmental cost PV, million €	direct cost PV, million €	
reference case	0,3	692	1690	9779
strategy 1	0,57	700	2361	10206
strategy 2	0,63	667	2253	10078

cost recovery strategy (domestic use)

the impact of both “domestic pricing” and “irrigation pricing” have been studied



only “**domestic pricing**” will be considered as:

- (i) agricultural sector long dependant on subsidies
- (ii) in practical, no irrigation use fees are currently charged to private irrigation sites

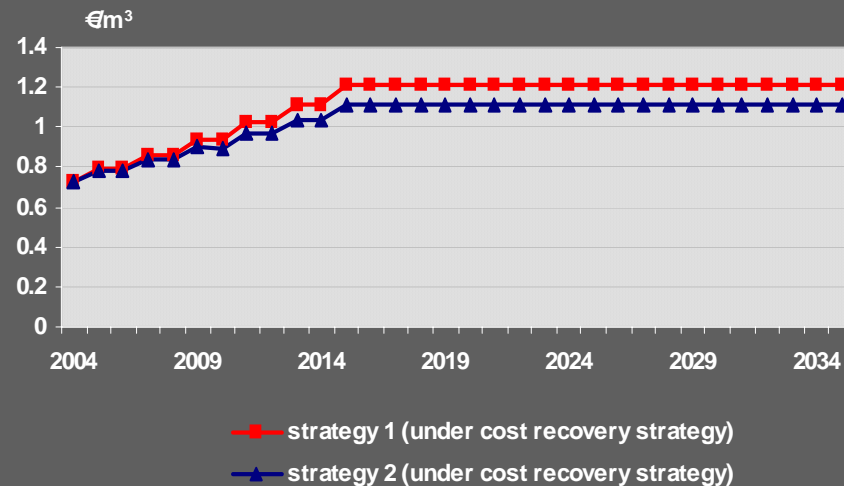
cost recovery targets

- **100%** cost recovery of direct costs from 2020 onwards
- minimum cost recovery of **70%** associated to environmental costs by 2025

iterative process

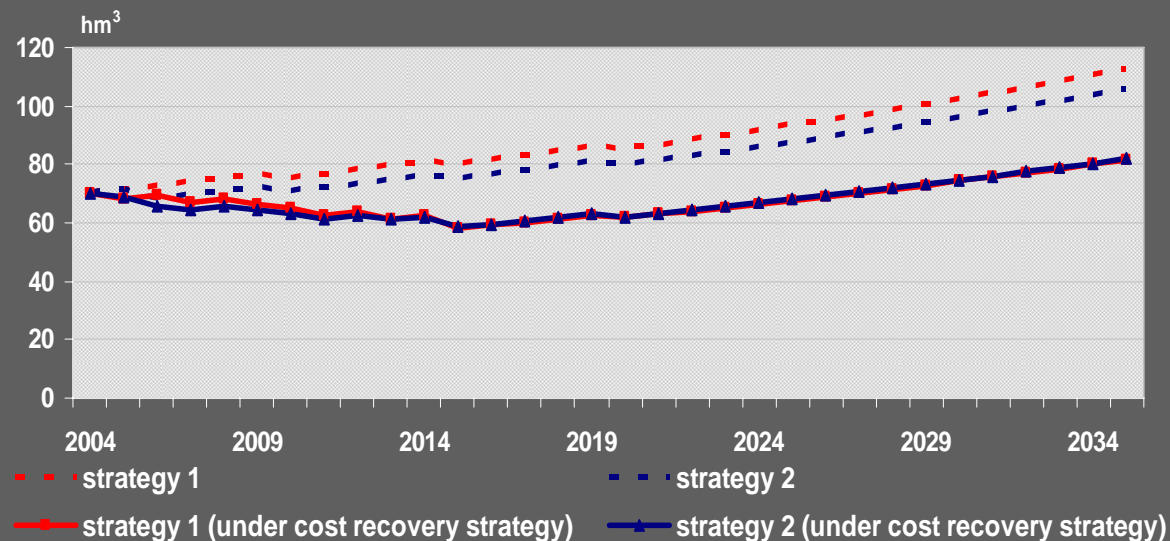
→ differentiated increase in water prices for domestic users every 2 years from 2005 to 2015

cost recovery strategy (domestic use)



€/m ³	current prices	strategy 1	strategy 2
average	0,68	1,21	1,12
minimum	0,41	0,65	0,62
maximum	1.04	1.56	1.56

✓ domestic demand



❖ strategy evaluation table

→ before cost recovery strategy

	effectiveness (relative sustainability index for demand coverage)	economic efficiency		total value to users PV, million €
		environmental cost PV, million €	direct cost PV, million €	
reference case	0,3	692	1690	9779
strategy 1	0,57	700	2361	10206
strategy 2	0,63	667	2253	10078

→ after cost recovery strategy



strategy 1	0,70	647	2137	9681
strategy 2	0,70	628	2074	9679

- Strategies 1 and 2 try to respond to the concerns of the stakeholders through two distinct approaches:
 - strategy 1: structural and global (regional) water management options
 - strategy 2: alternative options aiming at solving the water shortages issues on a local scale.
- Both strategies 1 and 2 enable the main goals defined to be achieved.
- In terms of economic performance, strategy 2 appears to be more effective after cost recovery strategy is applied.



The combination of localized, non-conventional water management options allows achieving the same domestic demand coverage levels with lower values of direct, environmental and resources costs.