



# **ARTIFICIAL AND HEAVILY MODIFIED WATER BODIES IN PORTUGAL**

**- WATER FRAMEWORK DIRECTIVE -**

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## GENERAL ISSUES

**Artificial and Heavily Modified Water Bodies** provisional identification and designation process, was done according to the iterative process of the **HMWB Guidance document – WG 2.2.**

This **process** can be redone and altered every 6 years cycles, this means that a water body that has been identified can be unidentified later and a water body that has not been identified can be identified later.

This also means that additional information can change the provisional identification and designation process.



## WFD IMPLEMENTATION IN PORTUGAL

The identification of a **heavily modified water body** considered:

- ✓ The existence of significant hydromorphological changes (**steps 3 and 4** of the artificial and heavily modified water bodies **iterative designation process**);
- ✓ If these changes do not allow water bodies to reach Good Ecological Status (**step 5 of the iterative designation process**);
- ✓ The substantial change of character due to physical alterations introduced by human activities (**step 6**).





## WFD IMPLEMENTATION IN PORTUGAL



The identification of a **artificial water body** considered water bodies created by human activity where no significant water body existed before.

Ex: Irrigation channels, navigation channels and large lagoons where no water body existed before or where there were only small and insignificant ponds.

**OBS:** The realignment of a river lead to the identification of a heavily modified and not a artificial water body.



HMWB AND AWB IN PORTUGAL

## WFD IMPLEMENTATION IN PORTUGAL

**Hydromorphological changes includes the description of:**

- ✓ Water Uses – navigation and recreation including port facilities; water supply, irrigation and hydroelectricity; flood protection;
- ✓ Significant human pressures [Annex II n° 1.4] – physical alterations such as dams that disrupt river *continuum*, change hydrological and hydraulic regimes; channelization or straightening of the river for navigation or other uses;
- ✓ Significant impact of pressures on hydromorphology [Annex II n° 1.5] – qualitative or quantitative approaches can be used to analyse elements like river *continuum*, hydrological regime and morphological conditions.





## HMWB AND AWB IN PORTUGAL

# WFD IMPLEMENTATION IN PORTUGAL

Based on the HMWB iterative process (2.2. Guidance Document) and on these criteria, **the identification of HMWB considered:**

- ✓ Reservoirs (artº 4 specified uses) with a flooded area greater than 0,5 km<sup>2</sup> (limit enlarged for 0,4 km<sup>2</sup> – Ecological Potential);
- ✓ Reservoirs with abstractions for Water Supply were analysed case by case;
- ✓ River stretches downstream of dams with significant hydromorphological changes;
- ✓ Urban River stretches, transitional and coastal waters;
- ✓ Navigation channels and port facilities.



## *HMWB AND AWB IN PORTUGAL*

### **I. RESERVOIRS IDENTIFICATION**

- **Portuguese digital geographic information 1:25.000 scale.**
- **Aerial and SPT05 satellite images.**
- **Geographic Information Systems (GIS) Tools.**
- **Reservoir and river basin characterization for selected water bodies: geographic, physical and hydrological.**





## II. RIVERS DOWNSTREAM OF DAMS IDENTIFICATION

- **Significant reduction or alteration of flow regime** based on hydrological data from Portuguese Water Resources Data Base (SNIRH) – **Flow Duration Curves**.
- When no data were available, **additional criteria** were used.
- **Expert judgment and field work** were also used, whenever necessary.





## II. RIVERS DOWNSTREAM OF DAMS IDENTIFICATION

Additional criteria:

- **water body length with more than 2 km;**
- water body with a **unique base typology;**
- **confluence with a medium river basin river;**
- water body of **complex hydraulic systems;**
- **inexistence of mitigation measures upstream dam**  
(ecological flow and fish leader).





### III. IDENTIFICATION OF OTHERS HMWB



- **Inland waters** - identification of urban river stretches was done based on aerial images and expert knowledge;
- **Transitional and coastal waters** - morphological alterations for each water body was identified, based on digital geographic information - aerial images SPOT5 satellite images, according to:
  - Physical alterations > than 50% of total length -> HMWB
  - Physical alterations between 30 and 50% where analysed case by case.



## IV. ARTIFICIAL WATER BODIES IDENTIFICATION

**Artificial Water Bodies** identification, considered:

- Irrigation artificial channels from major irrigation systems,
- Port facilities where no significant water body existed before  
(ex: Leixões Port).





## HMWB AND AWB IN PORTUGAL

# RESULTS

Table – Number of HMWB and AWB provisionally identified

River Basin District	Heavily Modified WB				Artificial WB				TOTAL
	Lake	River	Transition	Coastal	Lake	River	Transition	Coastal	
Minho/Lima	2	2	4	0	0	0	0	0	8
Cávado/Ave/Leça	7	8	1	0	0	0	1	0	17
Douro	17	6	2	0	0	2	0	0	27
Vouga/Mondego/Lis	8	7	4	0	0	3	0	0	22
Tejo/Rib. Oeste	25	26	1	0	0	8	0	0	60
Sado/Mira	19	24	2	0	0	5	0	0	50
Guadiana	19	15	0	0	0	2	0	0	33
Algarve	3	2	1	1	0	3	0	0	10
<b>TOTAL</b>	<b>97</b>	<b>90</b>	<b>15</b>	<b>1</b>	<b>0</b>	<b>23</b>	<b>1</b>	<b>0</b>	<b>227</b>

203 HMWB – 187 interiors: 97 reservoirs and 90 rivers; 15 transition and 1 coastal

24 AWB – 23 interiors and 1 transition



## HMWB AND AWB IN PORTUGAL

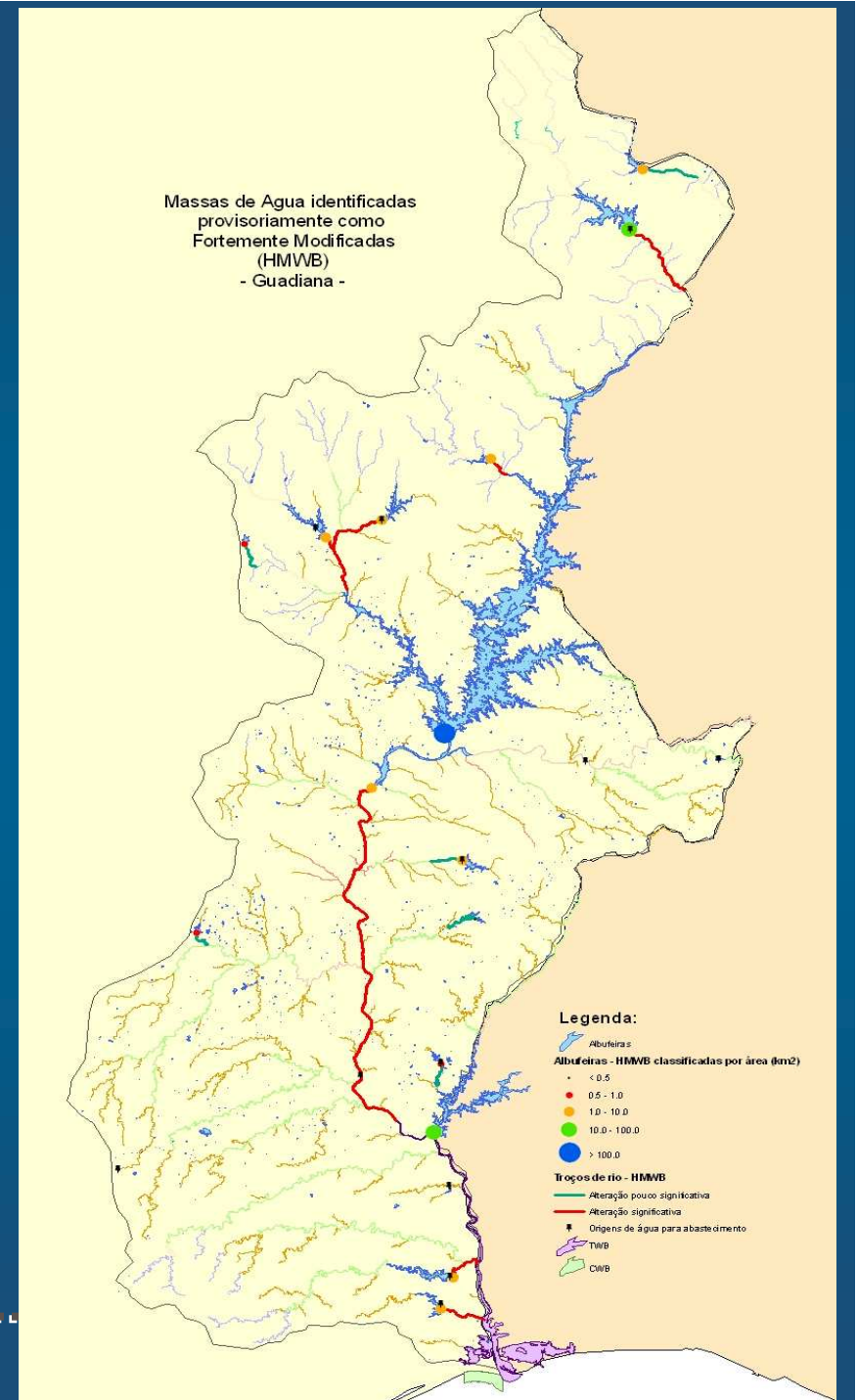
# RESULTS

## 19 Reservoirs identified as HMWB on Guadiana river basin (International)

### Uses:

- Irrigation (15)
- Water supply (12)
- Hydropower (2)

Area (km <sup>2</sup> )	Number	Total area (km <sup>2</sup> )
< 0,4	3	0,4
0,4 - 1	5	3,2
1 - 10	8	34,9
10 - 100	2	37,5
> 100	1	241,8





## HMWB AND AWB IN PORTUGAL

### RESULTS

**19 Reservoirs  
and  
25 River stretches  
downstream dams**

**identified as HMWB  
on Sado / Mira river  
basin district  
(National)**

**Uses:**

- Irrigation (18)
- Water supply (7)

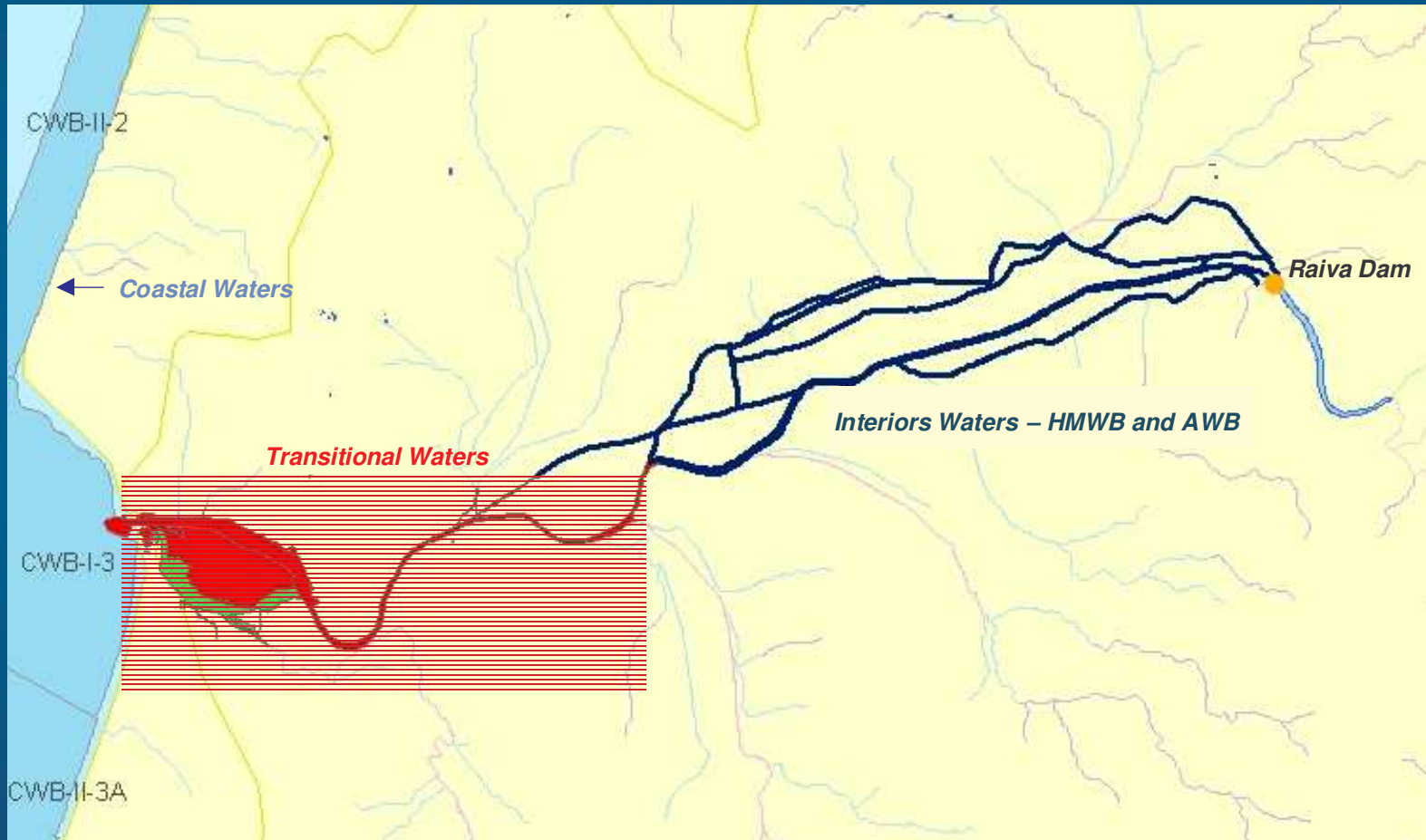




## HMWB AND AWB IN PORTUGAL

# RESULTS

### Mondego River System downstream Raiva Dam



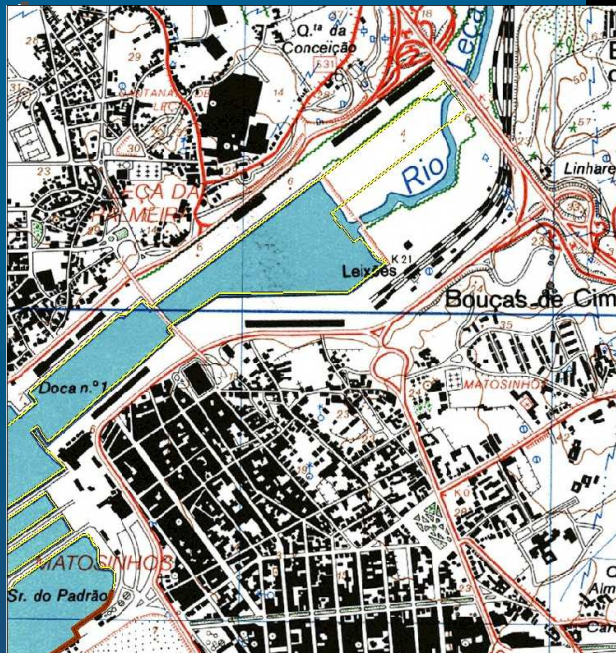


# HMWB AND AWB IN PORTUGAL

## RESULTS

*Transitional  
Waters*

*Leixões Port*



1940



TWB - AWB

2005

Legenda:  
Modificado - Descrição

	N - NÃO
	S - ESPORÃO
	S - ESTALEIRO
	S - MARINA
	S - MARGEM ARTIFICIALIZADA
	S - MOLHE
	S - PORTO
	S - PONTÃO



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