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Improving drought preparedness through water transfers
The agreement between Basilicata and Puglia regions

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MEDROPLAN project workshop
Drought Preparedness and Mitigation in the
Mediterranean

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Fig. 1 Region Administrative Boundaries

Why water transfer to Puglia ?

- ✍ Puglia is a very populated region of southern Italy (four million inhabitants) with large cultivated areas
- ✍ The necessity of supplying Puglia by transfer of water resources from Basilicata and other bordering regions arises from the scarcity of water resources inside Puglia, where precipitation is low (400 - 450 mm/year), rivers are few and with limited watersheds and coastal aquifers are overexploited with salt intrusion

Puglia Water Gross Demands

- ✍ Civil uses (2002) 540,0 Mm³/year with high losses
- ✍ “ (2032) 500.8 Mm³/year with loss reduction to 30-35% (250 lpcd)
- ✍ Agricultural uses in Mm³/year
 - (potential) 1242.0
 - (2002) private 362.0 public 199.0
 - (2032) private 362.0 public 301.0
- ✍ Industrial uses
(2002 and 2032) 142.0 Mm³/year

Ionico-Sinni water system /1

- ✍ The sources of the Ionico-Sinni water system (Fig. 2) are located in Basilicata and it supplies civil, agricultural and industrial users of Basilicata and Puglia, and to a less extent also of Calabria.
- ✍ The system is supplied by the flows of the rivers Sinni, Agri, Basento and Bradano, regulated in four reservoirs, with total regulation capacity $K = 688.9 \text{ Mm}^3$ and mean inflow $I_M = 859.9 \text{ Mm}^3/\text{year}$
- ✍ The comparison among I_M , $I_{0.20} = 550.0 \text{ Mm}^3$ and $I_{0.05} = 338.0 \text{ Mm}^3$ shows the strong variability of inflows and the possibility of severe droughts.

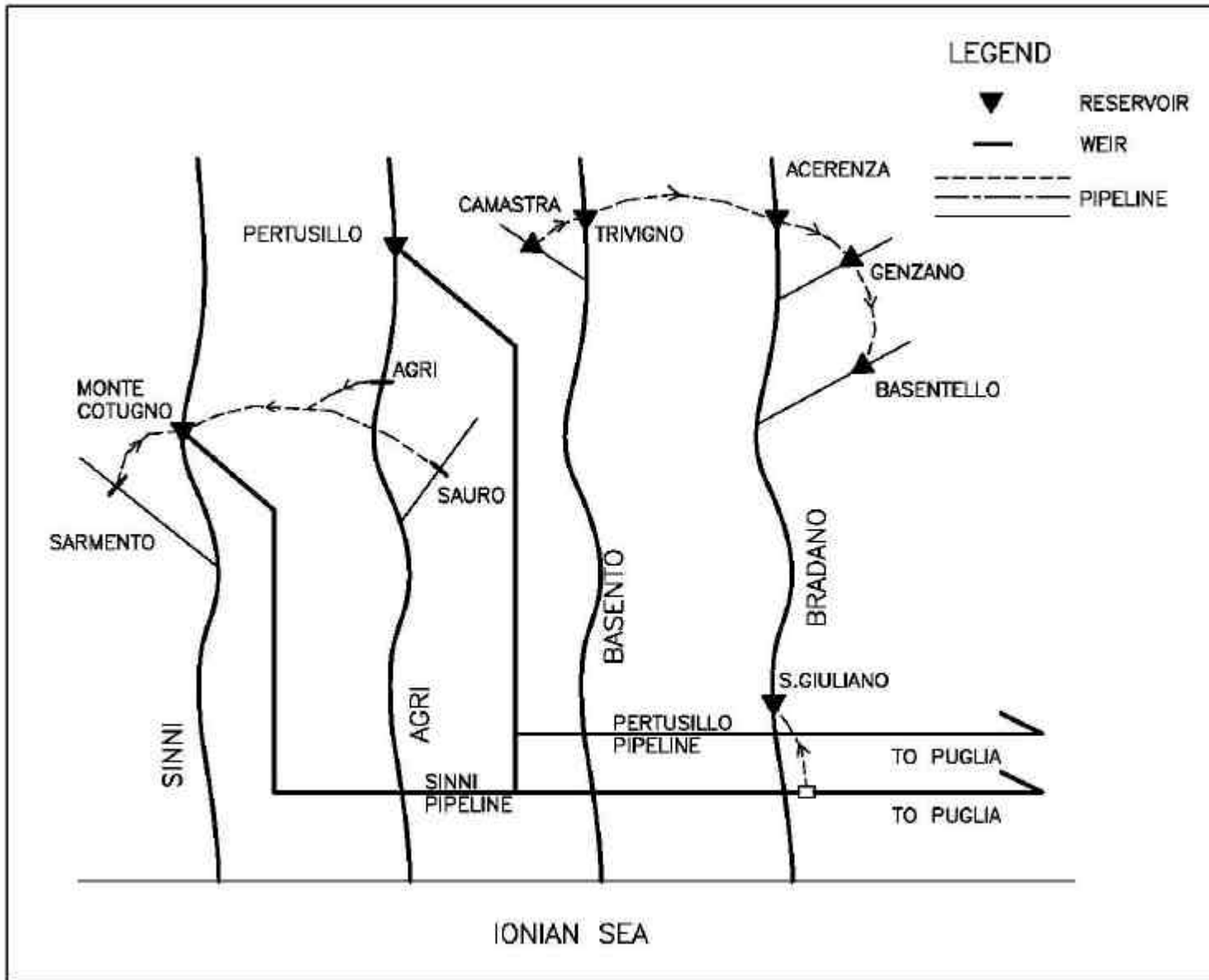


Fig. 2 - "IONICO-SINNI" WATER SYSTEM

Ionico-Sinni water system /2

- ✍ The release in a normal year (1999) has been 549.08 Mm³, shared in this way among the different users:
- ✍ Basilicata civil 28.99 Mm³, agricultural 216.36 Mm³
 industrial 0.22 Mm³
- ✍ Puglia civil 221.84 Mm³, agricultural 52.38 Mm³
 industrial 18.02 Mm³
- ✍ Calabria civil 3.48 Mm³ , agricultural 6.79 Mm³
- ✍ The system aqueducts are 551 km long with diameters in the range 3000 – 1000 mm

Ofanto-Sele-Calore system /1

- ✍ The sources of the Ionico-Sinni water system (Fig. 3) are located mainly in Campania and also in Basilicata and Puglia and it supplies civil, agricultural and industrial users of Basilicata and Puglia, and to a less extent also of Campania
- ✍ The system is supplied by springs ($I_M = 155.0 \text{ Mm}^3/\text{year}$) in the watersheds of Sele and Calore rivers and the flows of the river Ofanto, regulated in three reservoirs, with total regulation capacity $K = 175.6 \text{ Mm}^3$ and mean inflow $I_M = 300.1 \text{ Mm}^3/\text{year}$
- ✍ The comparison among I_M , $I_{0.20} = 201.6 \text{ Mm}^3$ and $I_{0.05} = 134.1 \text{ Mm}^3$ shows also in this case the strong variability of inflows and the possibility of severe droughts.

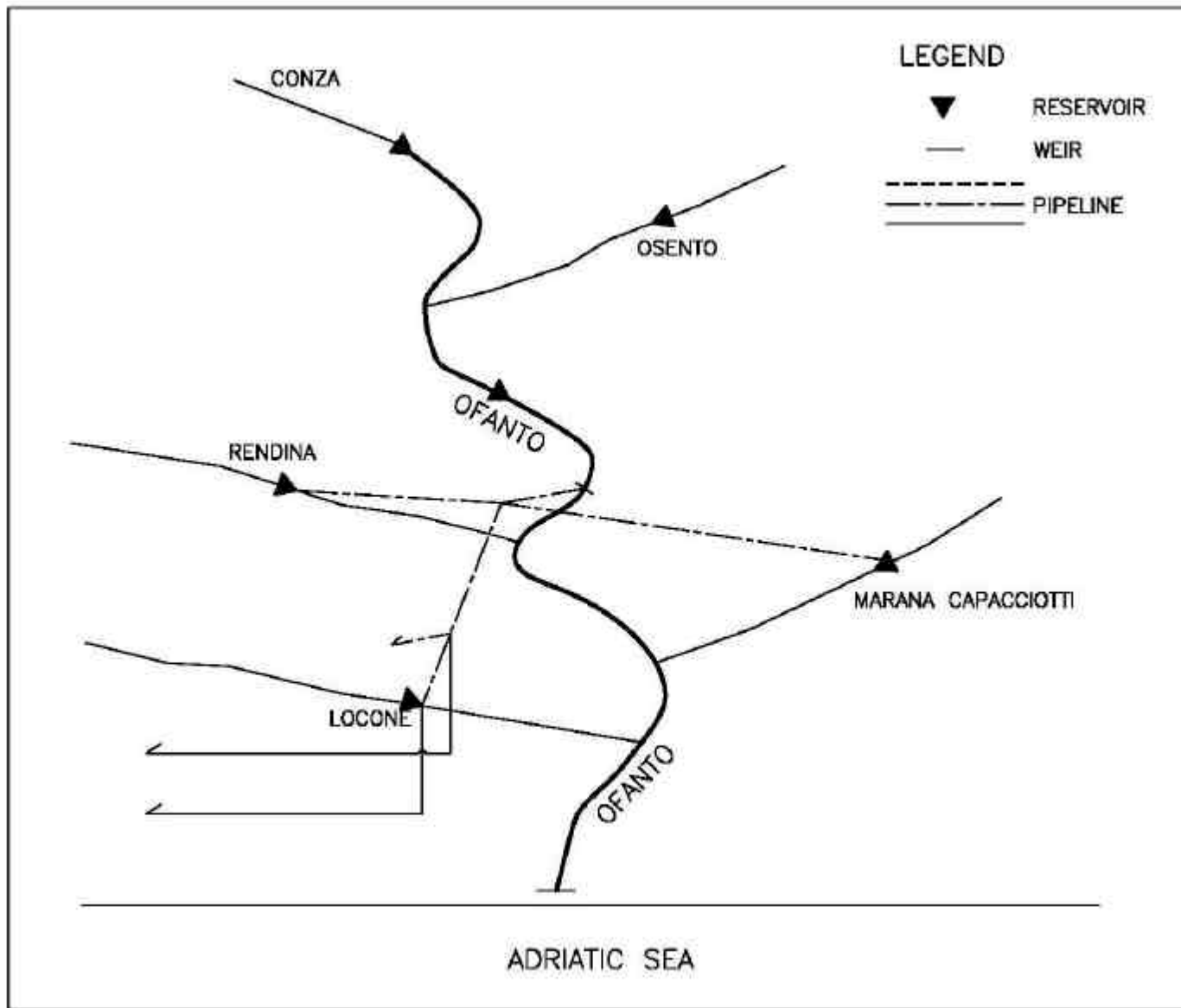


Fig. 3 – OFANTO WATER SUB-SYSTEM

Fortore water system

- ✍ The system is supplied by the flows of the Fortore river (Molise and Puglia, Fig.4), regulated in Occhito reservoir, with regulation capacity $K = 247.50 \text{ Mm}^3$ and mean inflow $I_M = 137.30 \text{ Mm}^3/\text{year}$, $I_{0.20} = 94.20 \text{ Mm}^3/\text{year}$ and $I_{0.05} = 60.50 \text{ Mm}^3/\text{year}$
- ✍ It supplies only Puglia and the release in a normal year (1999) has been 190.00 Mm^3 , shared in this way among the different users:
 - civil 51.00 Mm^3 agricultural 129.00 Mm^3
 - industrial 10.00 Mm^3
- ✍ The system aqueduct is 40 km long with diameter of 1600 mm

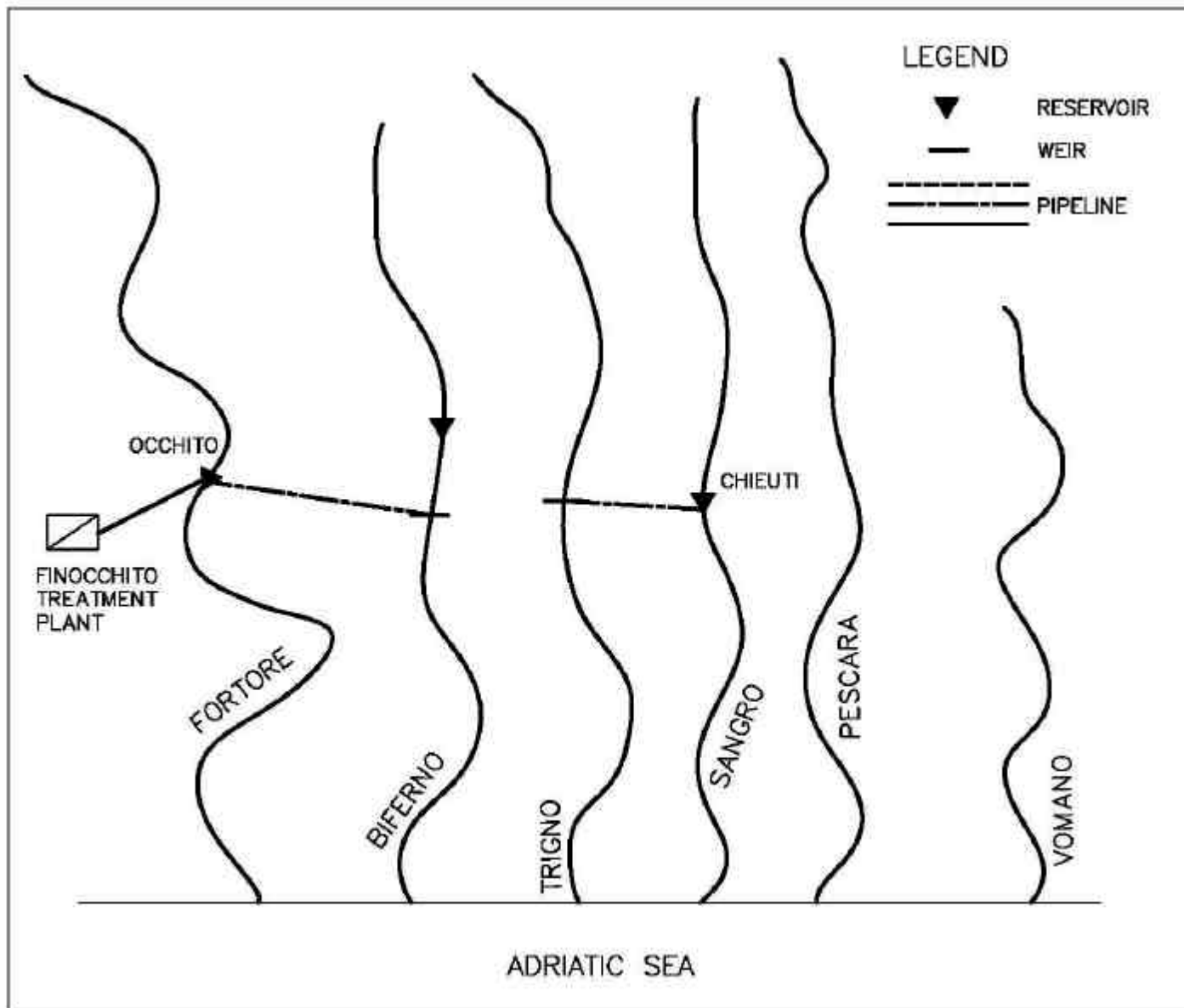


Fig. 4 – FORTORE WATER SYSTEM

Ionico-Sinni water system development/1

- ✍ Water diversion from Basento river to three existing reservoirs in the Bradano watershed (Fig.2) to increment irrigation; incremental regulation system capacity $K = 119,50 \text{ Mm}^3$ and mean inflow $I_M = 174.2 \text{ Mm}^3/\text{year}$, $I_{0.20} = 106.80 \text{ Mm}^3/\text{year}$ and $I_{0.05} = 57.40 \text{ Mm}^3/\text{year}$; project at the construction stage
- ✍ Water diversions from Sarmento, Agri and Sauro rivers to existing Monte Cotugno reservoir (Fig.2) to increment its supply capacity; incremental mean inflow $I_M = 260.30 \text{ Mm}^3/\text{year}$, $I_{0.20} = 164.90 \text{ Mm}^3$ and $I_{0.05} = 96.50 \text{ Mm}^3$; project at the construction stage

Ionico-Sinni water system development/2

- ✍ Elimination of present diversion to Noci river for hydroelectric energy production of upstream Sinni river at existing Cogliandrino reservoir with capacity $K = 10.1 \text{ Mm}^3$; incremental mean inflow $I_M = 120.10 \text{ Mm}^3/\text{year}$, $I_{0.20} = 79.00 \text{ Mm}^3/\text{year}$ and $I_{0.05} = 42.80 \text{ Mm}^3/\text{year}$; the proposal aim is to increase supply capacity of Monte Cotugno reservoir (Fig.2); project at the feasibility study stage
- ✍ The possibility of increasing water transfer from Monte Cotugno reservoir to irrigation areas and to Puglia is limited to $50\text{-}60 \text{ Mm}^3$ by the size of existing pipeline, and to overcome this limit it is necessary another pipeline, with strong environmental and social problems.

Ofanto-Sele-Calore water system development

- ✍ The water system supply will be increased in the next years by the resources regulated in the existing Conza reservoir (regulation capacity $K = 63.0 \text{ Mm}^3$, inflows $I_M = 90.7 \text{ Mm}^3/\text{year}$, $I_{0.20} = 62.1 \text{ Mm}^3/\text{year}$ and $I_{0.05} = 40.2 \text{ Mm}^3/\text{year}$) located in Campania (Fig.3); expected yearly production is 32 Mm^3 distributed for civil uses in the central Puglia by an already existing 175 km long pipeline, with diameters in the range $2400\text{-}1600 \text{ mm}$; project at the approval stage

Fortore water system development /1

- ✍ Transfer of 20 –25 Mm³/year from Biferno river in Molise to Occhito reservoir (Fig.4) with limited environmental problems; the agreement between Puglia and Molise (art.17 of law 36/94) will be probably signed in few weeks
- ✍ Transfer from Sangro and Trigno rivers (Fig.4) whose watersheds are in Molise and Abbruzzi regions, to Occhitto and Locone reservoirs, by pipelines 163.70 km long and with diameters in the range 3000 – 1000 mm ; the preliminary feasibility study should define amount of water to divert, costs and environmental effects to verify the possibility of an agreement among Puglia, Molise and Abbruzzi.

Fortore water system development /2

- ✍ Transfer of 200 – 260 Mm³ /year from Sangro, Pescara and Vomano rivers in Abbruzzi (Fig.4) to the Fortore system by three pipelines 125.7, 165.9 and 191.5 km long in a large part submarine
- ✍ The project is expansive, also because it is necessary to increase the capacity of water treatment plant and to realize new pipelines to transport resources also to central Puglia
- ✍ The preliminary analysis of potential irrigation demand in northern Puglia and of environmental effects are key points for the evaluation of project benefits and costs and the subscription of the agreement between Puglia and Abbruzzi.

Other proposed projects

- ✍ Another proposed project for the supply of Puglia is a pipeline 212 km long (85 km submarine) transferring 150 Mm³/year from Albania to southern Puglia;a preliminary feasibility study, with cost-benefit and alternative analyses, should be carried out before going further in the project
- ✍ Since many of these projects are long term ones, Puglia has decided to build three desalination plants to reduce the negative effects of long droughts as that occurred in the 2000 – 2002 years; the preliminary projects will be ready in September and plants are expected to be completed in three years; their locations are close to the cities of Bari (20 Mm³/year of sea water), Brindisi (20 Mm³/year of sea water) and Taranto (18 Mm³/year of brackish spring water)

Institutional framework of interregional agreements/1

- ✍ Federalism reform in Italy has decentralized all the decisions about water permits to the regional level
- ✍ Regions are at the same time the institutional subjects responsible of the definition of collective water demands for the different users and of the control of exploitation of water bodies to ensure environmental and social sustainability overtime
- ✍ Furthermore regions are responsible of EC and national funds for the development of water and wastewater infrastructures

Institutional framework of interregional agreements/2

- ✍ When in the river basins planning the analysis of water demand-supply balance could imply water transfers among different regions and river basins, the concerned Regions and River Basins Authority promote Program Agreements, which are approved by the National Government (National law 36/94, art.17)
- ✍ The interregional water transfer infrastructures are defined of national interest and State can financially support investment and operation costs
- ✍ In each agreement are defined the criteria and procedures for the realization and management of proposed measures or infrastructures, which should respect in any case the principle of environmental, economic and social sustainability

Institutional framework of interregional agreements/3

The feasibility studies of measures and infrastructures proposed in the agreement should contain:

- ✍ present and forecasted demand-supply analysis for the different uses
- ✍ energetic state balance of water resources before and after the transfer
- ✍ analysis of resources quality state before and after the transfer
- ✍ environmental impact evaluation
- ✍ financial and economic benefit – cost analysis
- ✍ financial plans for the realization of proposed measures and infrastructures, with the identification of public and private funds
- ✍ subjects involved in their realization and management

Institutional framework of interregional agreements/4

Principles of EC Water Framework Directive 2000/60 :

- ✍ Integrating water resources management at the hydrographical district scale, taking into account at the same time the qualitative aspects of surface and ground waters to reach a satisfactory level of environmental protection
- ✍ Analyzing the characteristics of the hydrographical district, the impact of human activities and developing the economic analysis of water resources uses
- ✍ Hydrographical district is the main unit for water resources management, and it is defined as the area of land and sea, including one or more adjacent river basins and the respective ground and coastal waters

Institutional framework of interregional agreements/5

The economic analysis is based on the principles of “polluter pays” and “full cost recovery” of water services.

Three main components of costs are defined:

- ✍ *Financial costs* include the costs of providing technological services and the costs of administering these services; they include operation and maintenance costs, capital maintenance costs, capital cost (principal and interest payment, and return on equity where appropriate)
- ✍ *Environmental costs* represent the costs of damage that water uses impose on the environment and ecosystems and those that use the environment (e.g. recreation)
- ✍ *Resource costs* represent the costs of foregone opportunities, which other uses suffer in the present and in the future due to the depletion of the resource beyond its natural rate of recharge or recovery

Institutional framework of interregional agreements/6

- ✍ Each country has to complete the analyses of river basins characteristics, human activities and the economic analyses of uses within four years from the enforcing date of the Directive(art.5)
- ✍ Each country should define water pricing policies which stimulate users within 2010 to consume efficiently water resources contributing to the environmental objectives of the Directive
- ✍ Within 2010 civil, agricultural and industrial users have to be “fairly” charged of the full costs of water services, but the member States could be take into account the social, environmental and economic aspects of recovery, as well as geographic and climate regional conditions
- ✍ The expected effects and the results of these policies are described in the river basins management plans, which each Member State has to prepare and publish within nine years from 2000 and revised every six years

Puglia-Basilicata Program Agreement /1

The regions Puglia and Basilicata and the Ministry for Public Works signed on the fifth of August 1999 the Program Agreement concerning the management of the water resources transferred from Basilicata to Puglia by the Ionico-Sinni water system with these objectives:

- ✍ Definition of the water resources balance and planning of the system till 2015
- ✍ Identification of existing infrastructures of common interest forming the raw water system
- ✍ Establishment of permanent cooperative executive body for the planning of actions and monitoring of the Program Agreement
- ✍ Reform of the existing authorities and public water agencies
- ✍ Definition of raw water tariff, including financial, environmental and resource costs

Puglia-Basilicata Program Agreement /2

- ✍ Implementation of actions of water demand control, reducing losses and wastewater reuse in the different uses and of environmental control of coastal areas for retrogradation and aquifer salt intrusion
- ✍ Identification of measures and infrastructures to complete and to improve the existing water system
- ✍ Development of feasibility studies to increment system water supply and transfer to Puglia
- ✍ Definition of guidelines for water resources management and priority of reduction measures for the different users during droughts

Puglia-Basilicata Program Agreement /3

- ✍ The article 5 of the Agreement provides the institution of the Authority of the Government of Water Resources, made up by the Minister of Public Works and the Presidents of the Regions Puglia and Basilicata or their delegates, with the participation of the Secretary of River Basin Authorities competent for the water system
- ✍ The Authority has been constituted after the signature of the Agreement and it worked really well during the long and severe drought of years 2001-2002, smoothing the negative effects of shortages on final consumers

Puglia-Basilicata Program Agreement /4

- ✍ In the article 7 of the Agreement the two Regions undertake the engagement of reforming the organization of the existing River Basins Authorities reducing the number to only two Authorities. These reforms have been carried out
- ✍ In the article 13 of the Agreement and in the quoted Attachment 5 the two Region and the Ministry agree on the reform of existing water public corporations (Acquedotto Pugliese for civil services and EIPLI for raw water services) in three new stock companies, two for the civil water services in the regions and one for the management of common raw water system. At the present time the two companies for the civil water services have been started, that is Acquedotto Pugliese S.p.A. in Puglia and Acquedotto Lucano S.p.A. in Basilicata.
- ✍ The reform of EIPLI has not been carried out by the Ministry of Agriculture, and in the meantime the Basilicata Region has started a new stock company (Acqua S.p.A) to manage and to develop the whole regional system supplying raw waters.

Puglia-Basilicata Program Agreement /5

- ✍ The shareholding of Acqua S.p.A is open to other bordering regions, and the control will remain public
- ✍ Main functions of this society are the minimization of the financial costs of raw water system and moreover the society could cover the needs of technical assistance of River Basin Authorities and Regions for the definition and implementation of water resources policies
- ✍ To avoid the possible distortions of the natural monopoly in which this society operates market competition is introduced by contracting-out the construction, operation and maintenance services
- ✍ Nothing has been done in practice to implement the efficiency of Land Reclamation Agencies and Industrial Development Agencies
- ✍ The unsuccessful reforms of this subjects and EIPLI and the possible clash of competences of EIPLI and Acqua S.p.A are weak points in the process

Puglia-Basilicata Program Agreement /6

The article 15 of the Agreement has stated that the total production costs of raw water had to be established by the Authority of the Government of Water Resources within the end of year 2000 (art.15). This costs have to take into account:

- ✍ *financial costs*, including operation and maintenance costs
- ✍ *environmental costs*, including costs of anti-erosive actions to reduce reservoir silting, costs of improving the quality level of water resources stored in the reservoirs, costs of reducing the environmental impacts of existing infrastructures, costs of reducing ionian coastal erosion and costs of system monitoring
- ✍ *resources costs*, evaluated as the economic value of the loss of natural potential production of hydroelectric energy resulting by the alternative uses of the resources stored in the reservoirs

Puglia-Basilicata Program Agreement /7

- ✍ A working group has been charged to propose how to apply these concepts. It produced in July 2002 a very valuable document from the theoretical point of view, but with limited applicability for lack of information and uncertainties
- ✍ Present operation and maintenance costs are incomplete and partially unreliable, and the estimated value of 0.021 €/m³ may be significantly different from the real one; consequently the definition of these costs has been postponed.

Puglia-Basilicata Program Agreement /8

Environmental costs have been estimated as a percentage of the following costs:

- ✍ Maintenance of watersheds upstream the reservoirs (50%)
- ✍ Maintenance of hydrographical networks upstream the reservoirs (50 %)
- ✍ Tertiary level in the wastewater treatment plants upstream the reservoirs (30 % of the total treatment costs)
- ✍ Quantitative and qualitative monitoring (60 %)
- ✍ Maintenance of hydrographical networks downstream the reservoirs (20 %)
- ✍ Defence from hydrogeological risks downstream the reservoirs (50 %)
- ✍ Protection from erosion of Ionian coast (60 %)

The estimated unit environmental cost is 0.055 €/m³

Puglia-Basilicata Program Agreement /9

- ✍ The document introduces the energy recovery costs for Basilicata as a measure of resources costs. Owing to the lack of specific information, as first approximation of the actual one in the document the estimated unit electric energy recovery cost is 0.024 €/m³, that is equal to the double of yearly irrigation pumping costs in Basilicata, to take into account also the other pumping costs in Basilicata and the loss of potential production of hydroelectric energy
- ✍ In the absence of any indication, the document proposes also to estimate the other resource costs as a percentage of 10-20 % of the sum of financial, environmental and energy recovery ones
- ✍ The document tackles also the problem of cost sharing among the different users, and proposes to apply mean tariff to civil users, to increment tariff for industrial ones and to reduce it for agricultural users

Puglia-Basilicata Program Agreement /10

Only the 25th of May, 2004 the Authority of the Government of Water Resources has approved a document on water raw tariff which states:

- ✍ Provisional mean raw water tariff excluding financial costs for years 2003 and 2004 is 0.055 €/m³ and for year 2005 is 0.075 €/m³ and it is applied to the water resources assigned to each region ; for the years 2000-2002 the environmental costs of 35.0 M€ are covered by national funds
- ✍ Each region can differentiate tariffs among different users within the region, and eventually reducing them by regional funds in order to subsidize sectors, like the rural one
- ✍ Document on raw water tariff should be revised in order to reduce estimate uncertainties, and within the end of July 2004 the financial costs should be fixed

Conclusions

- ✍ The Agreement activities are one of the first application in Italy of the EC Water Framework Directive 2000/60, which introduces economic aspects in the water resources management of river basin and the need of planning at hydrographical district scale, extending the concept of integrated river basin management
- ✍ It works really well in the coordination of the Regions in the water resources management by the institution of the Authority of the Government of Water Resources, with strong benefits specially during severe shortages and more efficient planning of new infrastructures
- ✍ Positive effects have been partially the reform of the existing water public corporations for civil services, but till now it has failed in reforming the raw water supply public corporation EIPLI, and the existing public subjects charged of irrigation and industrial water services
- ✍ The possible clash of competences of EIPLI and of new society Acqua S.p.A is another weak point in this process, as the delay in the application at the rural sector of the EC Directive principle of “fairly” charging of the full costs of water services to each user