



T.C  
GAZİ UNIVERSITY

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**MANAVGAT RIVER WATER AS A LIMITED  
BUT ALTERNATIVE WATER RESOURCE FOR  
DOMESTIC USE IN MIDDLE EAST**



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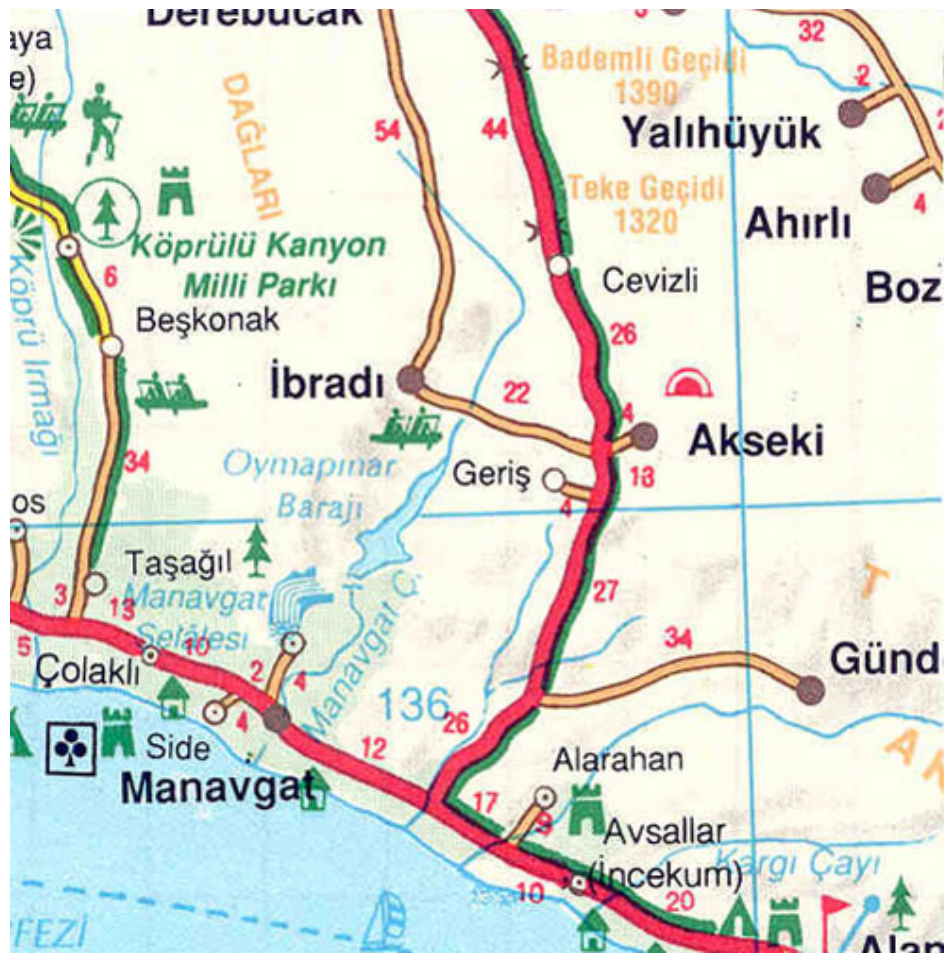
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■ MANAVGAT RIVER WATER SUPPLY PROJECT

■ WATER EXPORT FROM MANAVGAT RIVER

# MANAVGAT RIVER



- Manavgat River originates from the eastern slopes of Western Taurus Mountain (with an average flow of 156 m<sup>3</sup>/s) and flows into Mediterranean Sea after following about 90 km distance to south.

# MANAVGAT RIVER WATER SUPPLY PROJECT



Starting Date

April 1992

Completed

22.January 2000

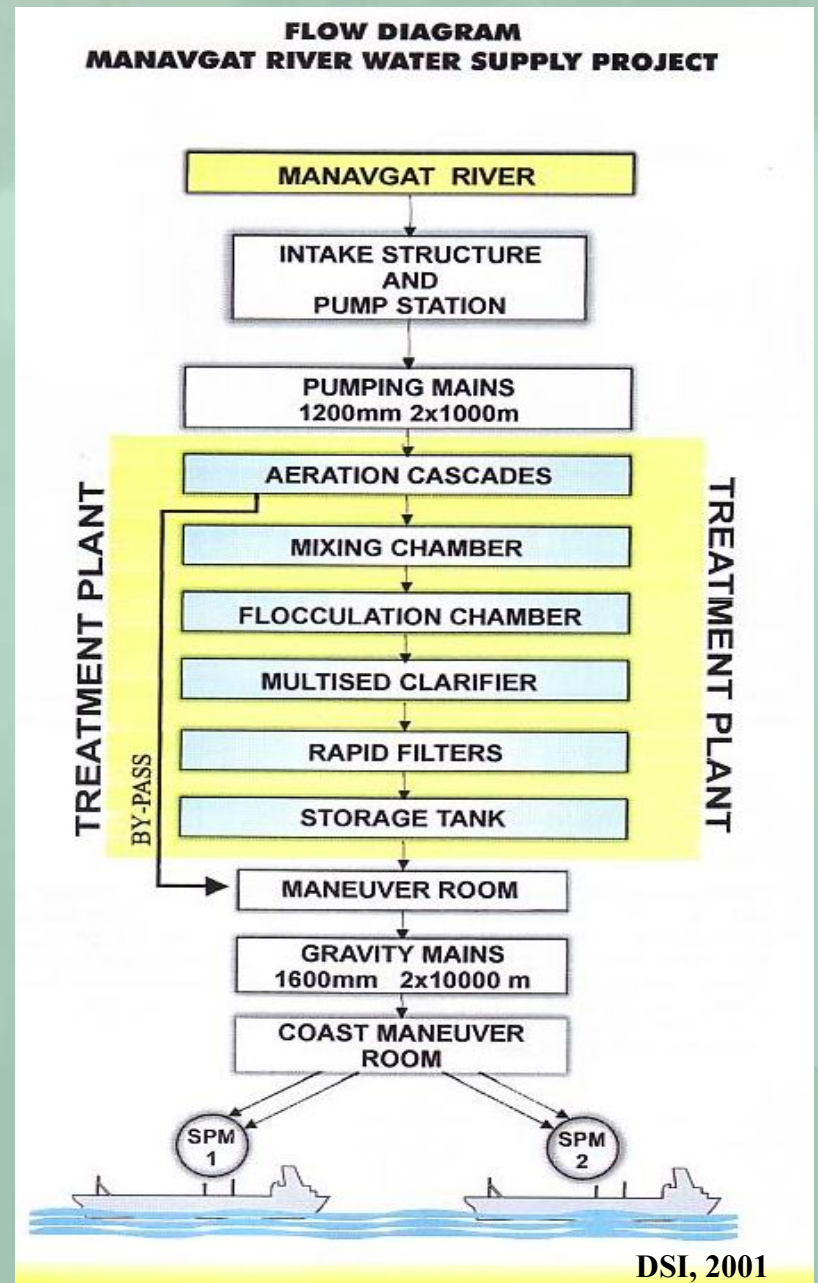
Aim of The Project

Supply water both to Turkey and other countries.

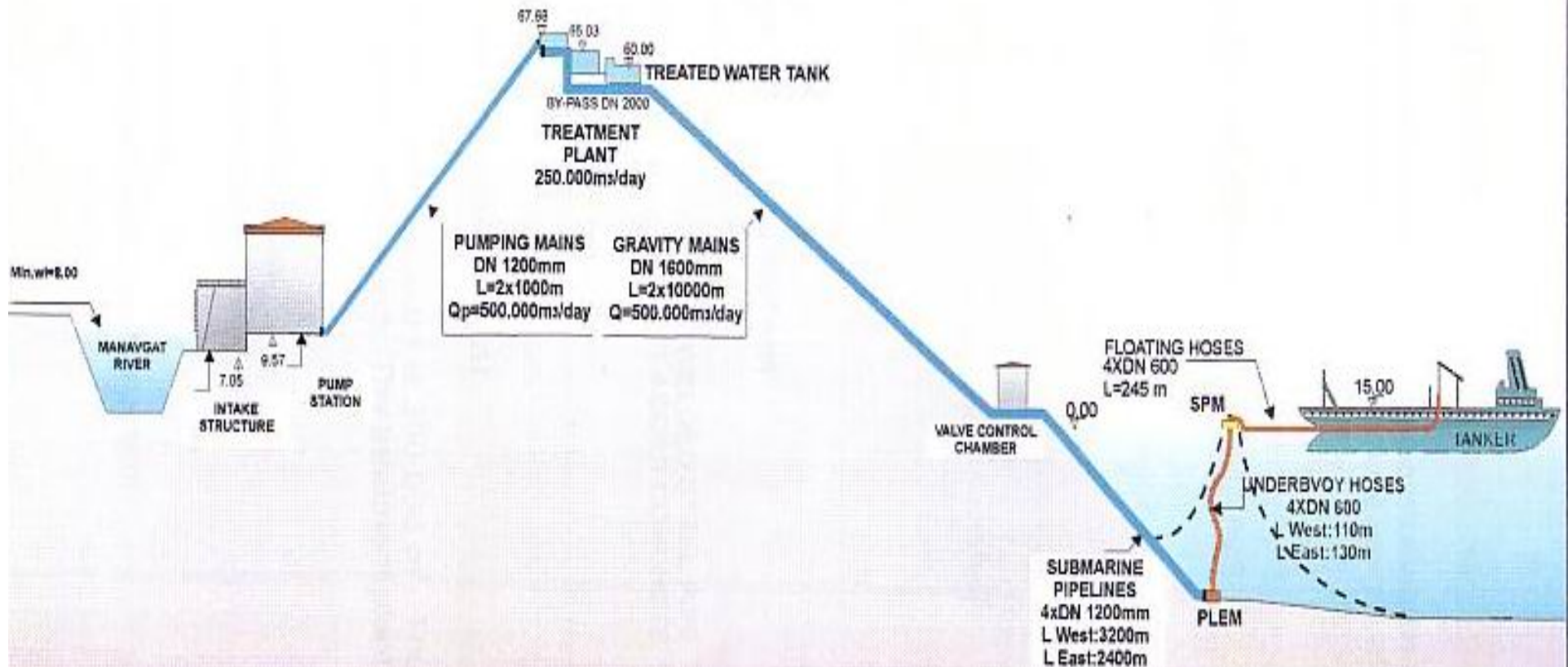
Water Amount and Expected Cost

500.000 m<sup>3</sup>/day  
147 Million US \$

# The Plan and Flow Diagram of Manavgat River Water Supply Project



# Hydraulic Flow Diagram



HYDRAULIC FLOW DIAGRAM

# Water intake Structure and Raw Water Pumping Structure



# Air Tanks



<b>Suction Head</b>	2.15 m
<b>Number Of Suction Pipes</b>	7
<b>Diameter Of Suction Pipes</b>	F 800 mm
<b>Diameter Of Pumping Pipes</b>	F 700 mm
<b>Capacity Of Air Tanks</b>	2x50:100 m <sup>3</sup>



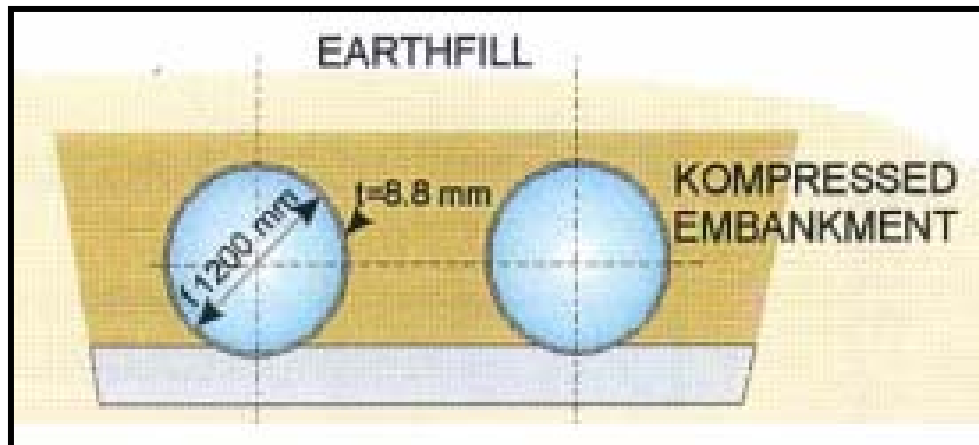
# Raw Water Pumping Structure



<b>Number Of Pumps</b>	7 + 1
<b>Capacity Of Pumps</b>	967 lt /sec
<b>Effective Power</b>	900 Kw
<b>Total Pumping Head</b>	75 m

# Pumping Mains

Water taken from raw water pumping mains is transferred to the balancing and aerating tank by means of elevation line



<b>Number Of Pipes</b>	<b>2</b>
<b>Diameter Of Pipes</b>	<b>Ø1200 mm</b>
<b>Wall Thickness</b>	<b>8,8 mm</b>
<b>Length Of Pipeline</b>	<b>1000 m</b>
<b>Type Of Pipes</b>	<b>Spiral Welded Steel Pipe</b>
<b>Inner Coating Of Pipes</b>	<b>Icoment Added Concrete</b>
<b>Outer Coating Of Pipes</b>	<b>PE</b>

# Balancing And Aerating Tank

Pumping Mains



Balancing Tank

Aerating Tank



# Treatment Plant

## Components Of The Treatment Plant

Rapid mixers and flocculation tanks

Clarifiers

Rapid sand filtration units

Chlorination contact tank and clean water tank



Clarifiers

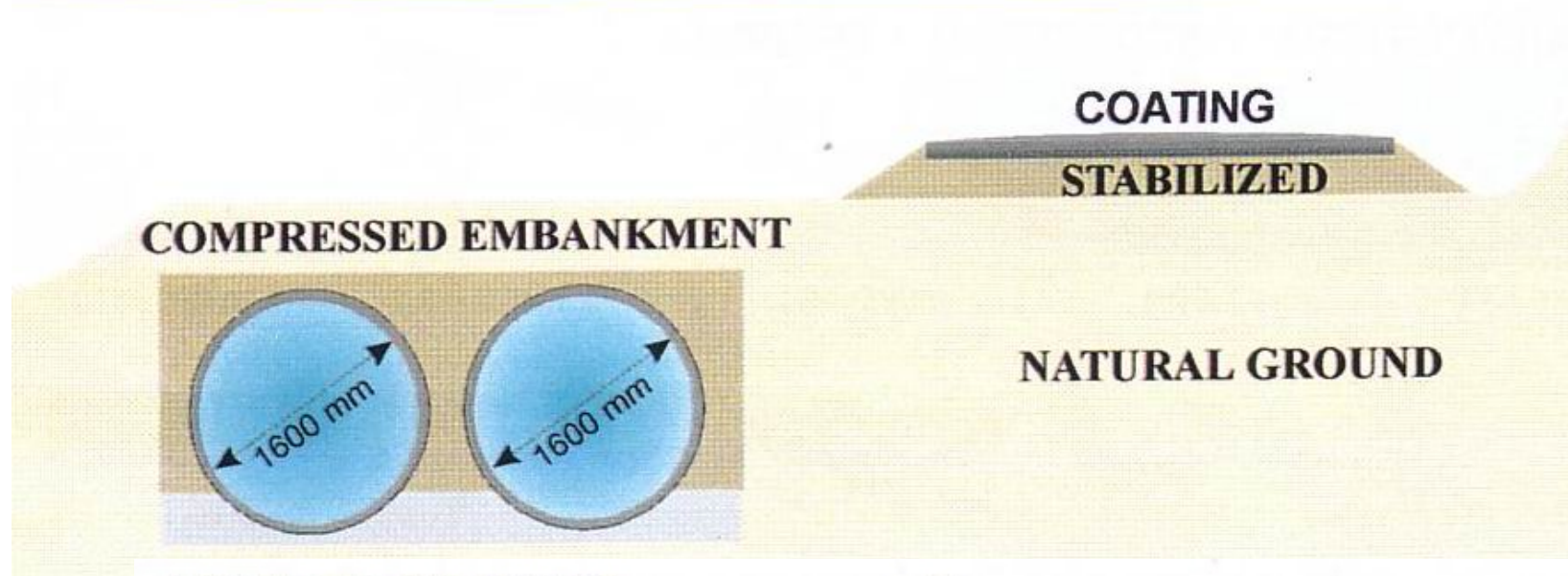


Chlorination Tubes



# Gravity Mains

## CROSS-SECTION OF GRAVITY MAINS



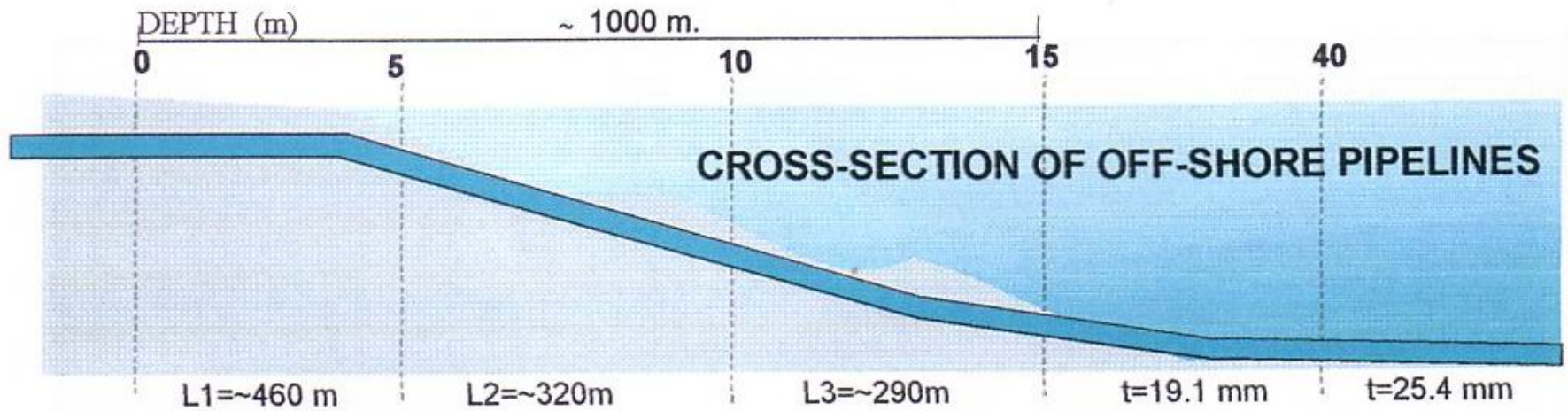
<b>NUMBER OF PIPES</b>	<b>: 2</b>
<b>DIAMETER OF PIPES</b>	<b>: F 1600 mm</b>
<b>WALL THICKNESS</b>	<b>: 8.8 mm</b>
<b>LENGTH OF PIPELINE</b>	<b>: 10000 m</b>
<b>TYPE OF PIPES</b>	<b>: SPIRAL WELDED STEEL PIPE</b>
<b>INNER COATING OF PIPES</b>	<b>: ICOMENT ADDED CONCRETE</b>
<b>OUTER COATING OF PIPES</b>	<b>: PE</b>

# Valve Control Chamber and Pumping Station



Valve Control Chamber is designed to load 250 000 m<sup>3</sup> refined water and 250 000 m<sup>3</sup> raw water or 500 000 m<sup>3</sup> raw water simultaneously to two different tanks. Also there are totally 12 pumps with the capacity of 1 m<sup>3</sup>/sec, 10 mains and 2 substitutes to pump water to the tanks

# Off-Shore Pipelines





## SPM (Single Point Mooring ) Structures

Loading from SPM terminals to the tankers can be performed according to the following options,

- From one SPM 250 000 m<sup>3</sup>/day refined, from the other SPM 250 000 m<sup>3</sup>/day raw water,
- From each pontoon, 250 000m<sup>3</sup>/day raw water
- From each pontoon, 125 000 m<sup>3</sup>/day refined water and total 250 000 m<sup>3</sup> refined water

# RAW WATER ANALYSIS REPORT

RAW WATER ANALYSIS REPORT					
Period of Analysis:			February 1993 April 1999		
Dissolved Oxygen	mg/l	DO	9.63	7.00	13.0
Permanganate Value	mg/l	pV	1.14	0.32	10.72
Biological Oxygen Demand	mg/l	BOD <sub>5</sub>	1.36	0.80	2.3
Total Hardness	mg/l CaCO <sub>3</sub>	TH	158	101	192
Orto Phosphate	mg/l	o-PO <sub>4</sub>	0.12	0.00	1.1
Sulphate	mg/l	SO <sub>4</sub>	15.41	3.50	23.9
Iron	mg/l	Fe	0.06	0.00	0.2
Sodium	mg/l	Na	1.77	0.69	7.2
Potassium	mg/l	K	0.33	0.10	0.8
Calcium	mg/l	Ca	48.91	24.85	64.1
Magnesium	mg/l	Mg	8.71	2.19	19.2

**Quality of the refined water conforms to all the specified requirements of Drinking Water Quality Guide of TSE (Turkish Drinking Water Standard) and WHO (World Health Organization).**

Parameters	Manavgat River Raw Water	Treated Water	EC Drinking Water Standart	WHO Drinking Water Standarts	TS2666 Drinking Water Standart
pH	7,7-8,0	pHs-0,2	6,5-8,5	6,5-9,5	6,5-9,2
Electrical Conductivity EC (umhos/cm)	284-350		400		400-2000
Permanganate Value, mg/lit	1,14-10,72		2-5		2-5
Total Hardness, mg/lit CaCO <sub>3</sub>	158-192		min. 150	100	150
Cholorine, mg Cl/lit	11,9-19,9		25	250	25-600
Ammonium, mg NH <sub>4</sub> /lit	0,1-0,54*		0,05-0,5	0,2	0,05-0,5
Nitrite, mg NO <sub>2</sub> /lit	0,0-0,1**		0,1		0,1
Nitrate,mg NO <sub>3</sub> /lit	0,47-2,39***		25-50	50	25-50
Phosphorous, mg P <sub>2</sub> O <sub>5</sub> /lit	0,0-1,1****		0,4-5,0		0,4-5,0
Turbidity, NTU	2,3-9,3	0,4	0,4-4,0	5	5-25
Iron, mg Fe/lit	0,06-0,2	0,1	0,05-0,2	0,3	0,05-0,2
Aluminium, mg Al/lit		0,05	0,05-0,2	0,2	0,05-0,2
Manganase, mg Mn /lit		0,05	0,02-0,05	0,1	0,02-0,05
Coliform bacteria, MPN/100 ml		none	none	none	none
*NH <sub>4</sub> , Ammonium nitrogen, mg/ lit    ** NO <sub>2</sub> - N Nitrite, mg/lit    ***NO <sub>3</sub> -N, Nitrate nitrogen, mg/lit    ****PO <sub>4</sub> -P, orto phosphate mg/lit					

## CURRENT STATE OF THE PROJECT

- Project is ready to work and supply water with its every unit.
- Also it has been in the scope of privatization of Privatization High Council Decision dated 23.02.2004.
- It was decided that privatization procedures would be completed in 12 months. [www.oib.gov.tr](http://www.oib.gov.tr)

# PROJECT OF WATER EXPORT FROM MANAVGAT RIVER



Annual capacity of Manavgat River



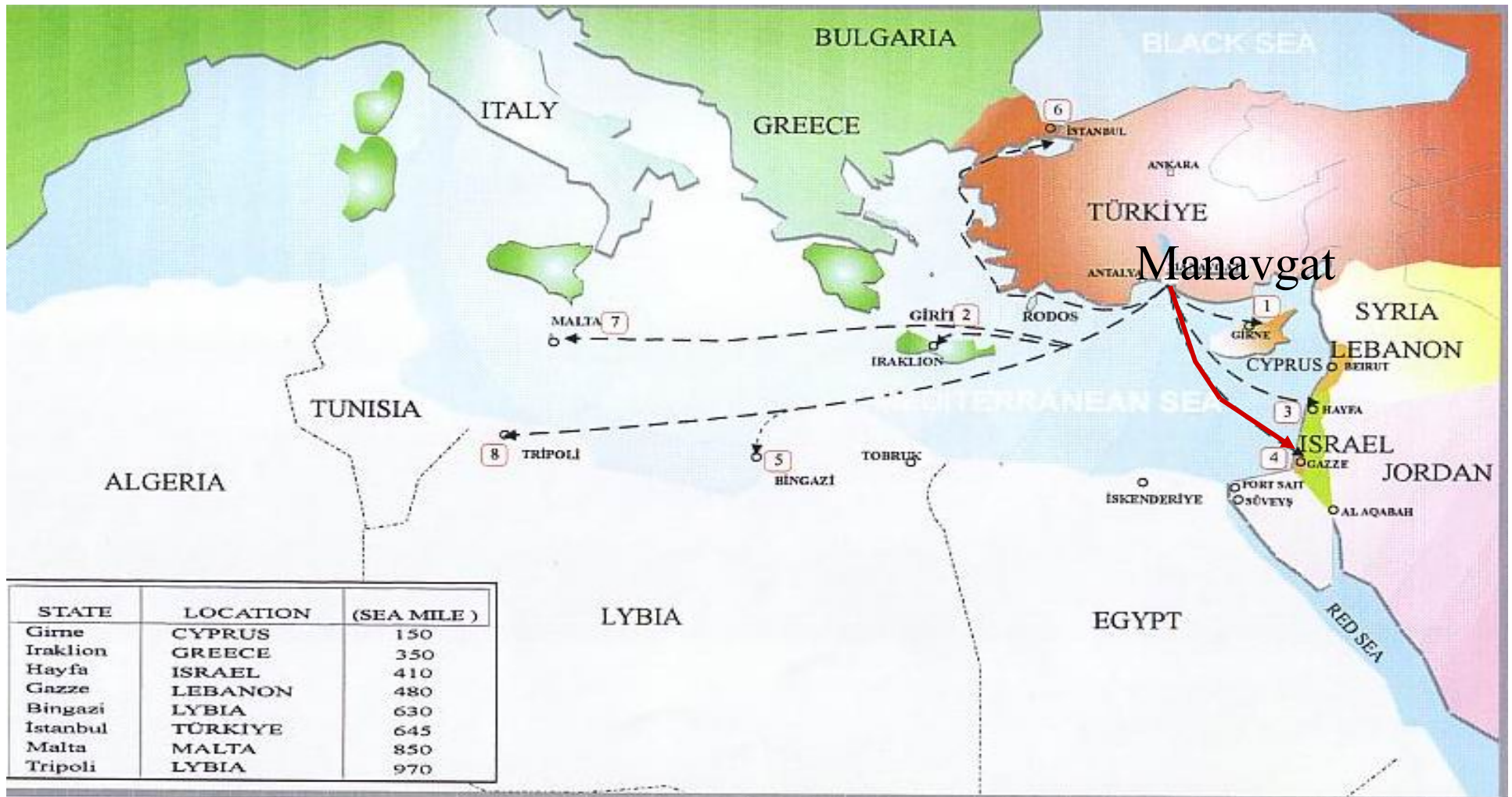
$5 \times 10^9 \text{ m}^3$

Manavgat River Water Supply  
Project

$180 \times 10^6 \text{ m}^3$



# Water Sale To Israel And Alternatives Countries For Marketing Of Water from Manavgat River Water Supply Project



# CONCLUSION

As a conclusion it can be stated that, for the water scarcity problem of Middle East countries, “Manavgat River Water Supply Project” of Turkey, can be viewed as an alternative but partial solution.

Thank You  
For  
Your Patience

