Technion - Israel Institute of Technology
Grand Water Research Institute
Rabin Desalination Laboratory
Chemical Engineering Department

Water- Needs, Research and Capability
At the Technion

Prof. Raphael Semiat

STEPHEN & NANCY GRAND
WATER RESEARCH INSTITUTE

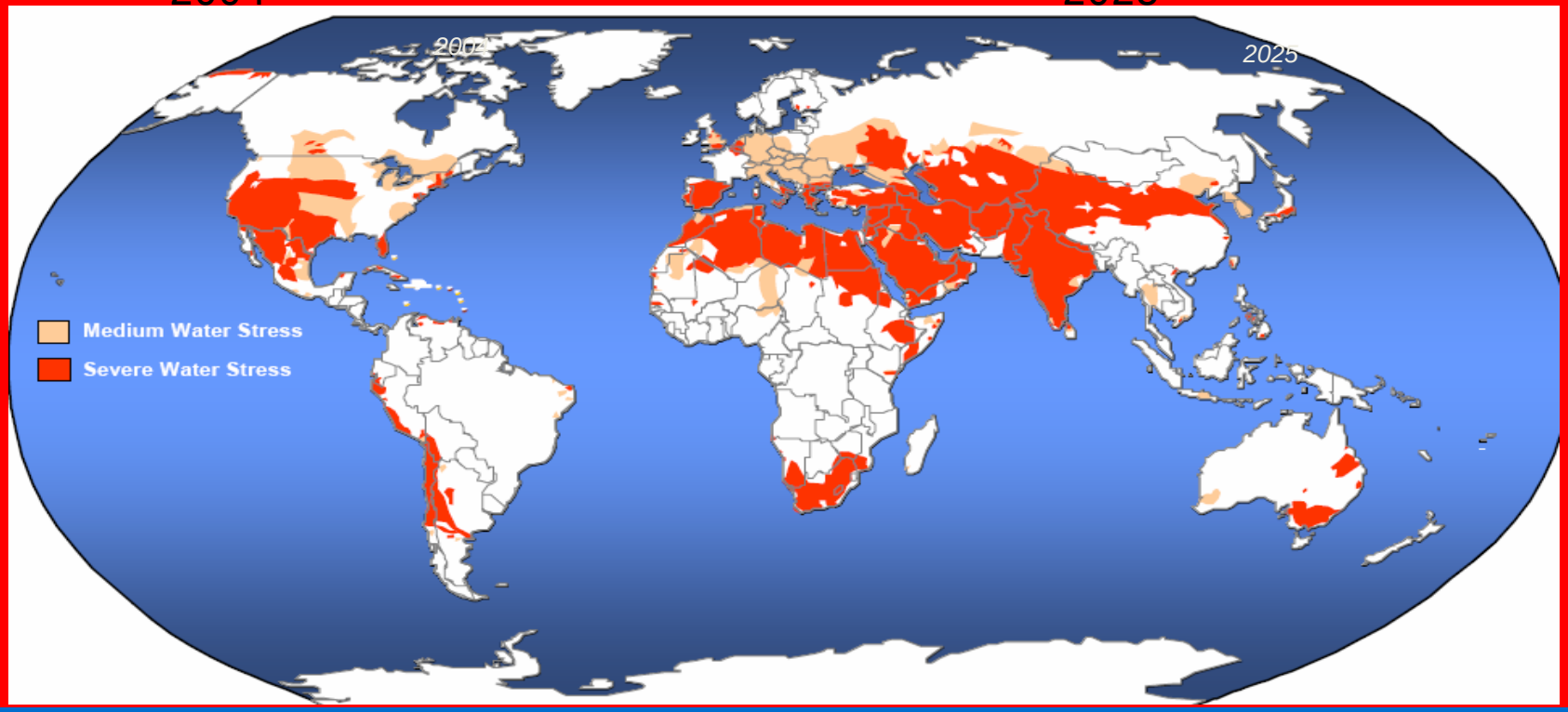
The Global Need for Water

- **Water shortage have reached crisis Proportion in many parts of the world:**
  - **Estimated 1.5 billion people do not have access to adequate supplies of safe water**
    - **Estimated 10,000 people die every day and thousands more suffer from a range of debilitating illnesses due to water related diseases**
    - **This includes estimated 2.2 million child death annually**
- **Availability of fresh water resources is fixed**
  - **Per capita availability continues to decrease as**
    - **Population increases**
    - **Developing countries improve their quality of life and level of industrialization**
    - **Salinity levels in many fresh water aquifers increases**

Water deficiency2004

1.5B ⟹ 3B

2004 2025



Source: Seckler et al, 2002

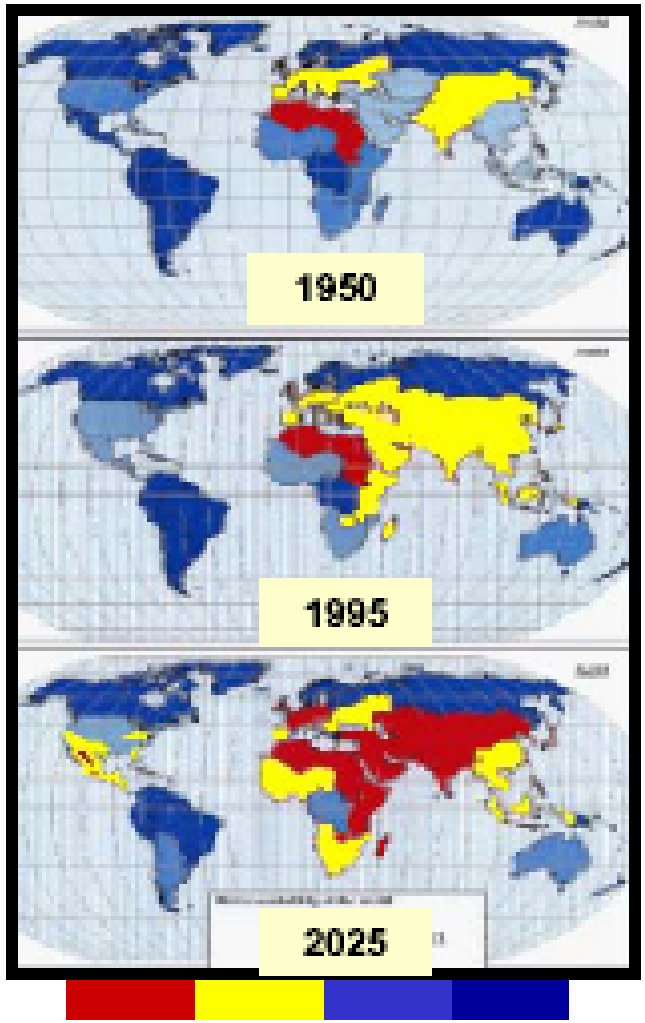
USA Bureau of Reclamation

Over half the world's population will face severe water shortage in the next 50 years.

- In 1990, poor water supply and sanitation was the 2nd leading cause of death and disability worldwide.
- Over 50% of world's major rivers are dry or heavily polluted.
- By 2025, 20% more fresh water will be needed for irrigation and 40% more for cities to maintain current per capita water levels.
- **NONTRADITIONAL** water resources will need to be used to address these shortages.

"Water promises to be to the 21st century what oil was to the 20th century: the precious commodity that determines the wealth of nations."

Fortune Magazine, May 15, 2000

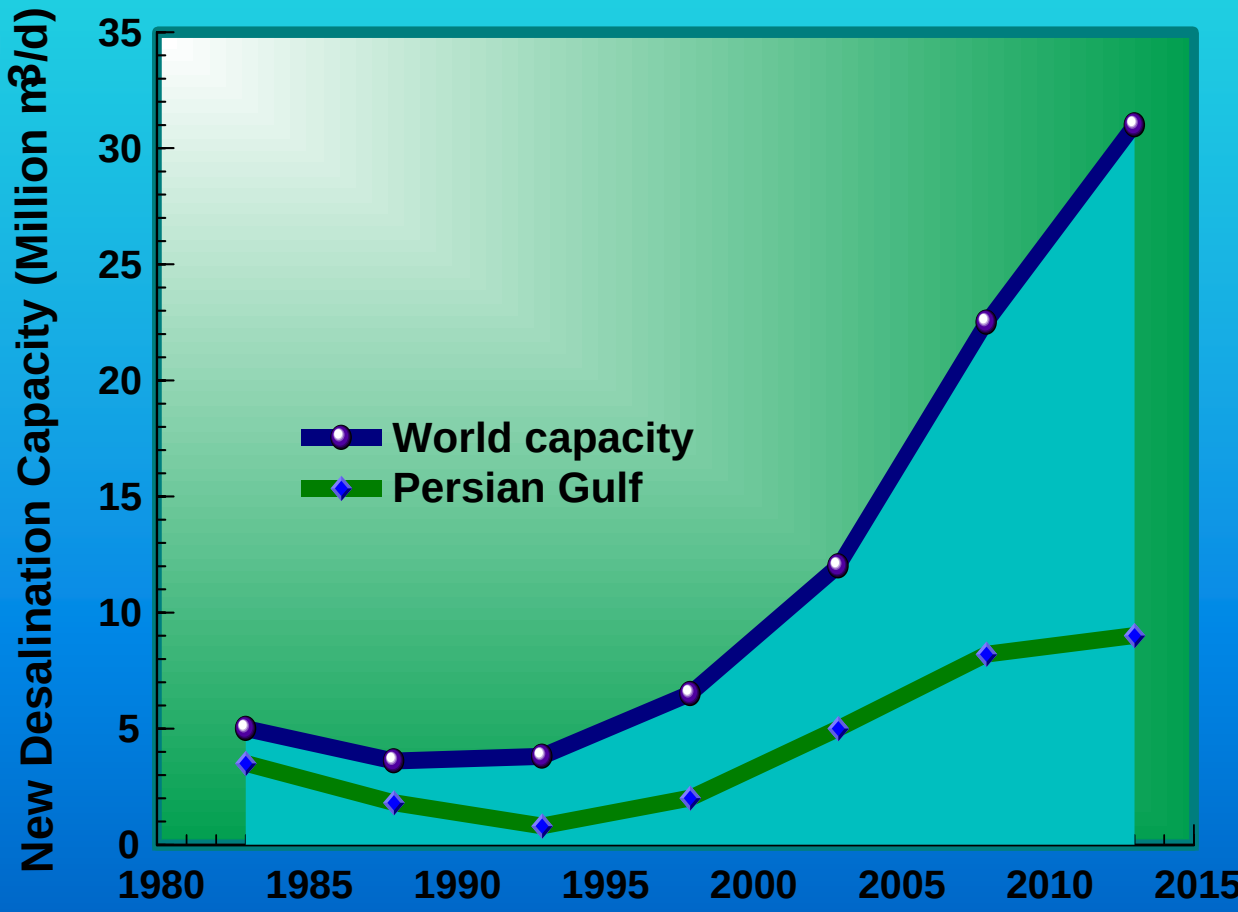


shortage

RDL GWRI Technion

Global

The desalination market is set to grow at an average annual rate of 12% until 2010 according to a forecast to be published in November new edition of the Desalination Market Report. This will take total installed desalination capacity to 63 million m3/d by 2010, compared to 40 million m3/d today. It is expected to reach 94 million m3/d by 2015.



Desalination Sites

Large plants:

Hadera (100+)

Ashdod (45)

Palmahim (30)

Brackish inland (50)

Ashkelon (100)

Ktziot (3)

Tenders - BOOT projects for 25 years

PILOT PLANTS

NAHAL TANINIM (1997)
BRACKISH (SURFACE) WATER

ASHDOD (1988)
MEDITERRANEAN SEA

EILAT (1994)
RED SEA

RO DESALINATION PLANTS FOR WATER QUALITY IMPROVEMENT

KFAR DAROM (1989)
50 m³/day

NAHAL MORAG (1991)
50 m³/day

BEER ORA (1983)
50 m³/day

EILOT (1986)
50 m³/day

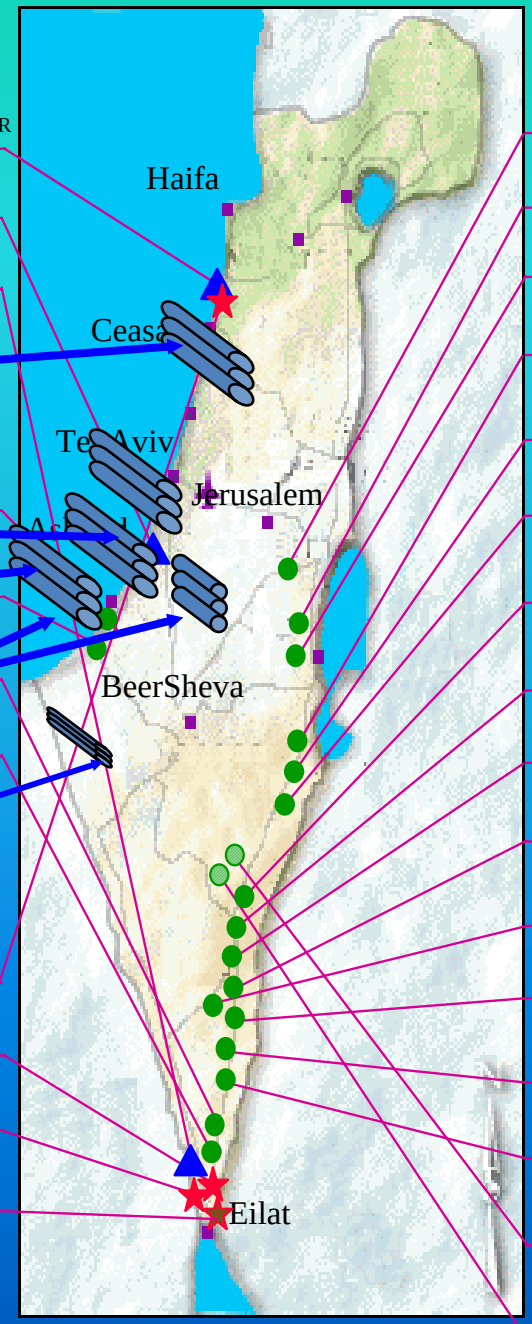
RO DESALINATION PLANTS FOR WATER SUPPLY

MAAGAN MICHAEL (1994)
1,200 m³/day

BW - SABHA "A" (1978)
25,500 m³/day

BW - SABHA "B" (1993)
10,000 m³/day

SW - SABHA "C" (1997)
10,000 m³/day



RO DESALINATION PLANTS FOR WATER QUALITY IMPROVEMENT

MIZPE SHALEM (1983)
50 m³/day

EIN BOKEK (1988)
50 m³/day

NEVE ZOHAR (1986)
50 m³/day

NEOT HAKIKAR (1982)
50 m³/day

EIDAN (1983)
50 m³/day

EIN YAHAV (1992)
50 m³/day

LOTAN (1983)
50 m³/day

YAHEL (1979)
50 m³/day

KTURA (1983)
50 m³/day

GROFIT (1974)
50 m³/day

YOTVATA (1973)
50 m³/day

MAALE SHACHARUT (1985) 50 m³/day

ELIPAZ (1983)
50 m³/day

SAMAR (1979)
50 m³/day

SDE UVDA 1 (1979)
250 m³/day (RESERV.)

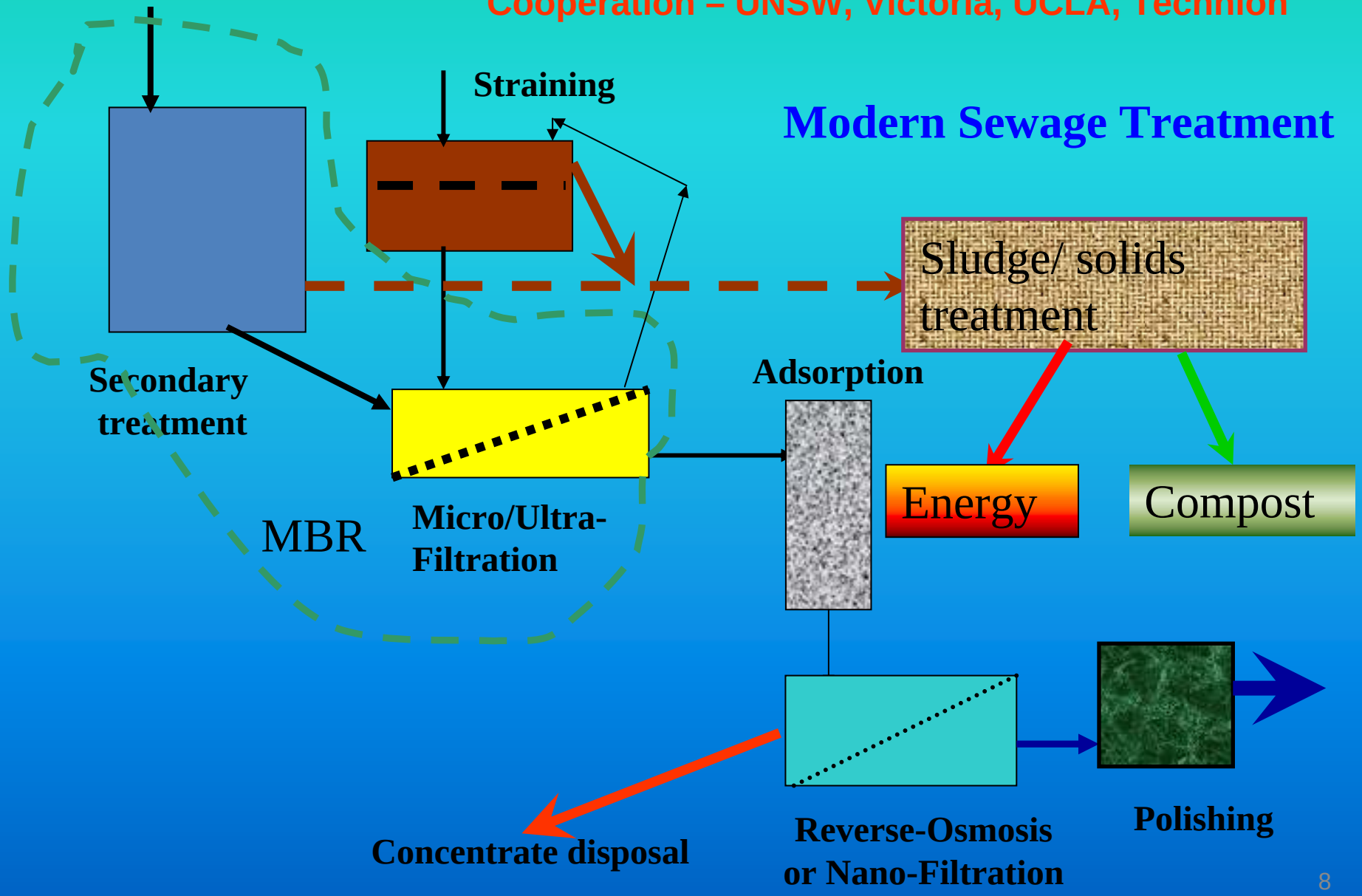
SDE UVDA 2 (1980)
500 m³/day (RESERV.)

6

Ashkelon Plant

Man made polluted waters: Industrial, agriculture and urban effluents

Cooperation – UNSW, Victoria, UCLA, Technion



Driving Forces for Desalination R&D

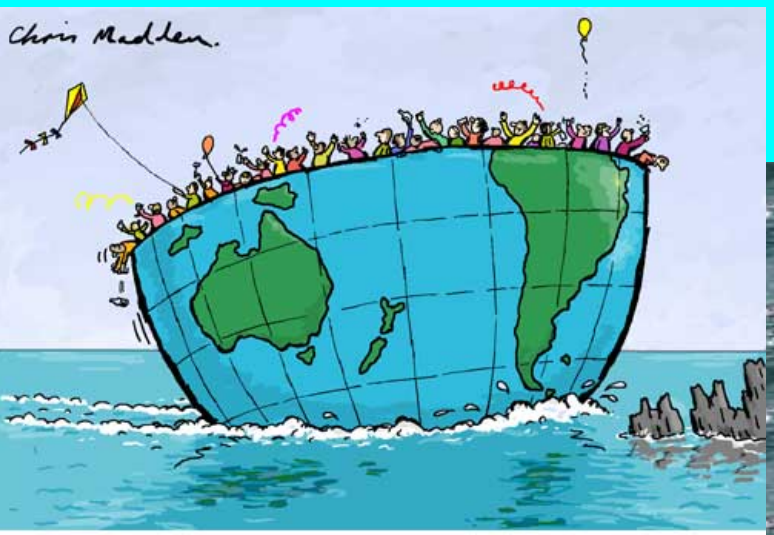
Need for Water

Global need, Industry, Agriculture, Remote Locations, Desertification, Etc.

Cost Difference - (Industry/Urban - Agriculture)

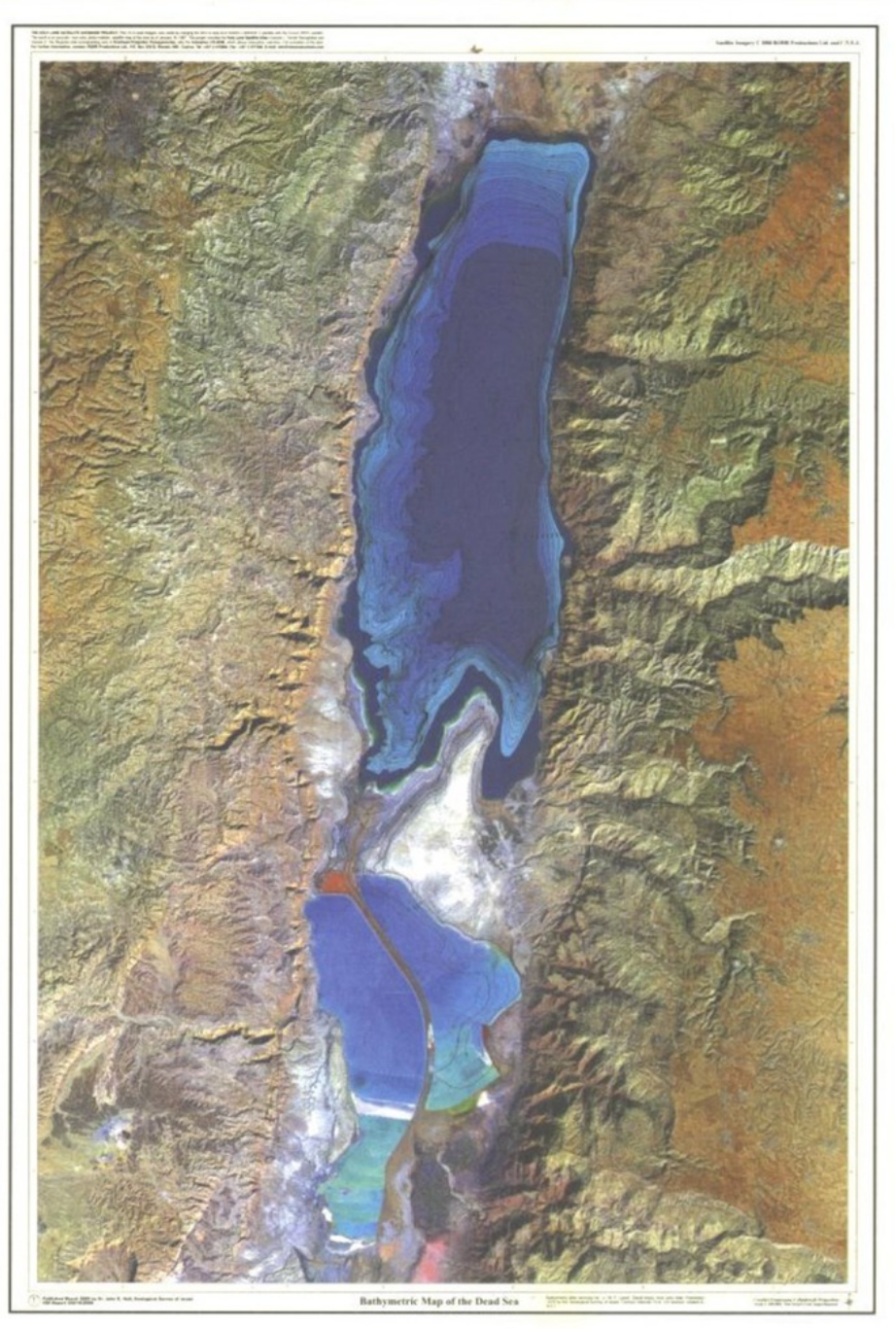
Cost Difference - (Thermal Processes - Membrane Processes)

Technologies for Export



THE SHIP OF FOOLS AND THE ROCKS OF SHORT-TERM ECONOMIC PLANNING

The dead sea problem



Bathymetric and Satellite Map of the Sea of Galilee.

Ben Avraham Zvi, Amit Gideon and Golan Arik

(contour interval 1 m)

Energy Canals

Med – Dead

Red - Dead

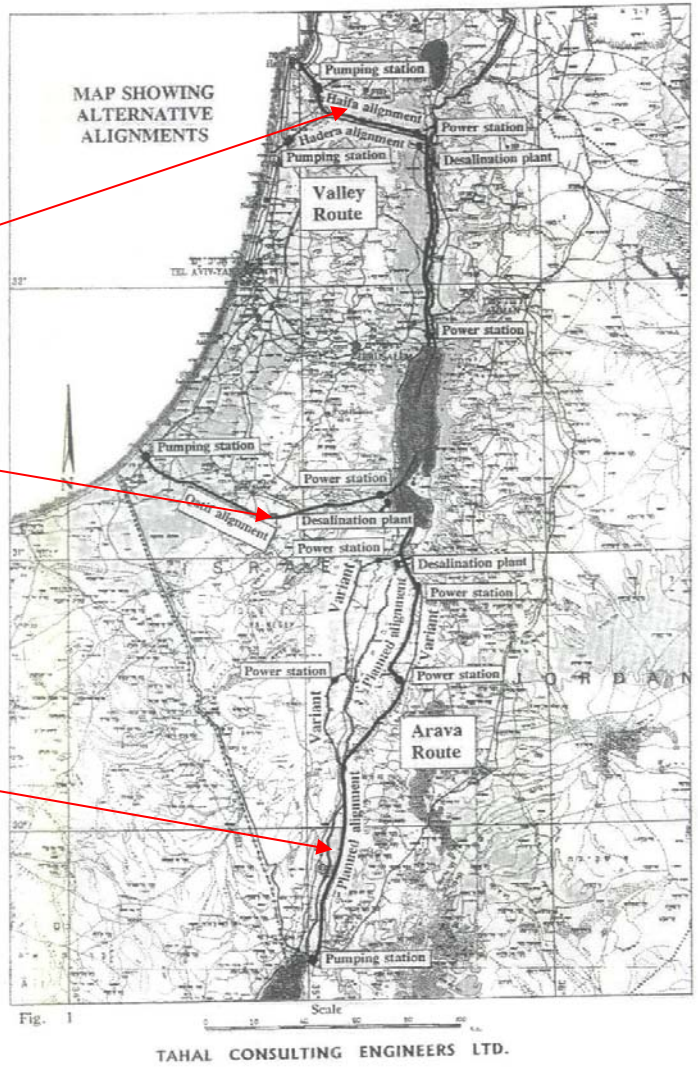
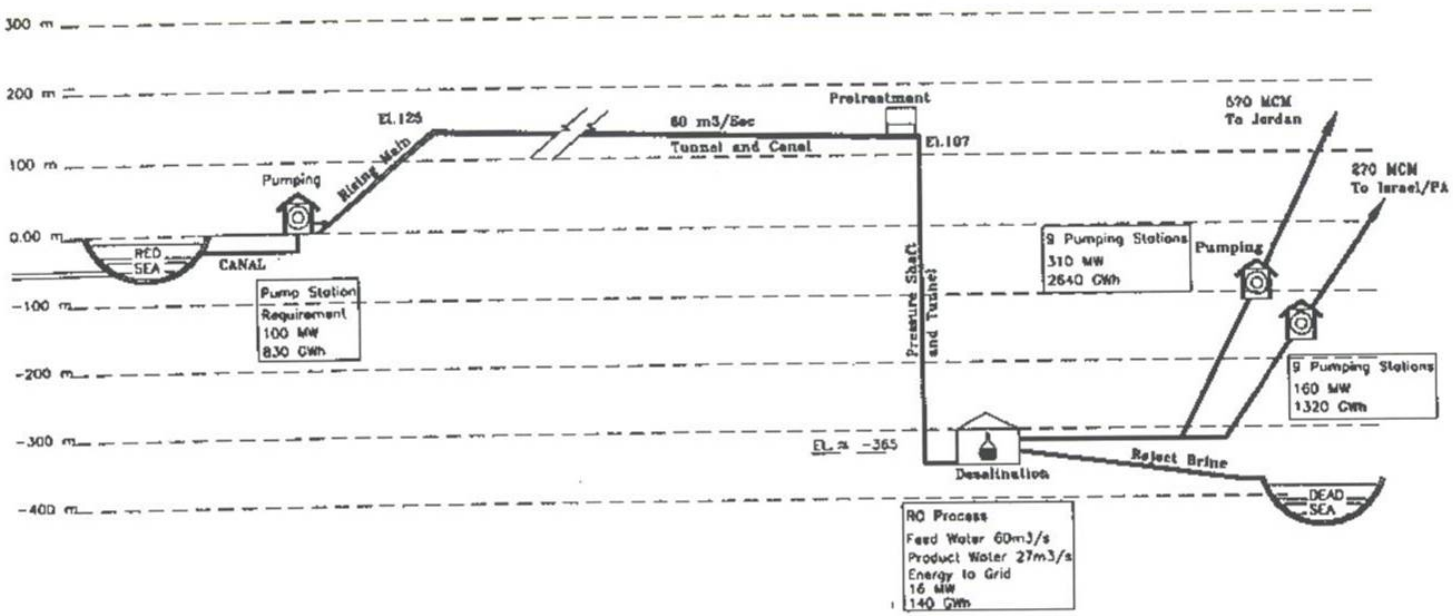


Figure 1: Alternative alignments



Jordan Rift Valley Integrated Development Study
Red Sea – Dead Sea Canal Project
RSDSC PROJECT SCHEMATIC

The HARZA JRV Group

Figure 4: HARZA JRV Group – Red Sea – Dead Sea Canal Project

The Grand Water Research Institute: Mission Statement

- The Stephen and Nancy Grand Water Research Institute at the Technion operates as the Israeli national institute for research in the science, technology, engineering and management of water resources
- The mission of the GWRI, established in 1993, is to be a center of excellence of international caliber, the leading water research institute in Israel
- The GWRI concentrates in particular on topics of relevance and importance to Israel

Membership and Collaboration

- 54 members from 7 Faculties of the Technion
- 6 professors from other universities
- Participation in projects: from universities, research institutes, agencies, government ministries, industry, private sector

Major Research Areas

- Water Treatment
- Desalination
- Treatment and reuse of wastewater
- Preservation of water quality and quantity in the sources
- Hydrology – quantity and quality
- Water and environmental microbiology
- Management in and of the urban water sector
- Water resources management and policy