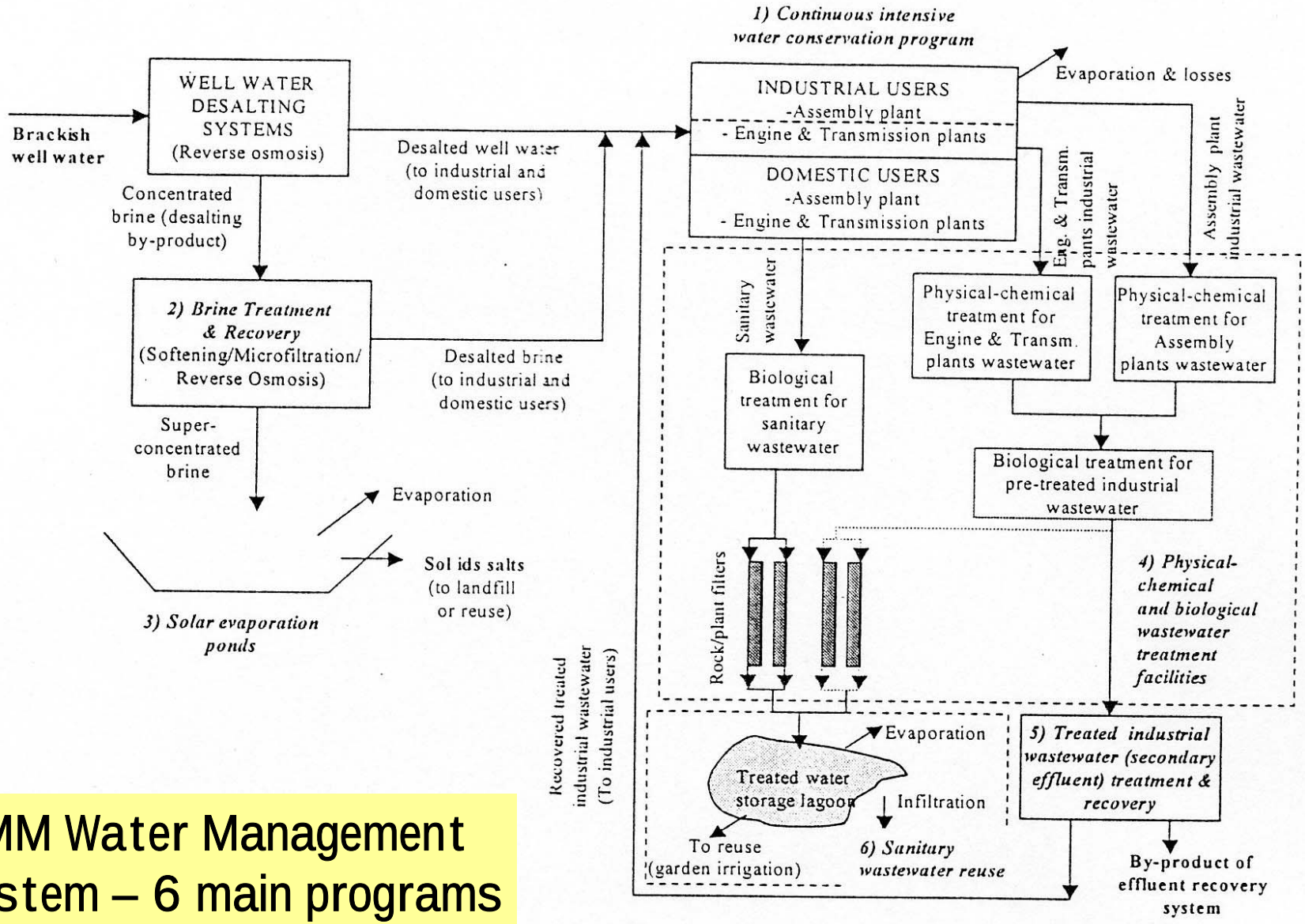
GENERAL MOTORS DE MEXICO (GMM)
RAMOS ARIZPE AUTOMOTIVE COMPLEX (RAAC)
WATER CONSERVATION AND REUSE PROGRAM

Application presented to
The Stockholm Water Industry Award 2001

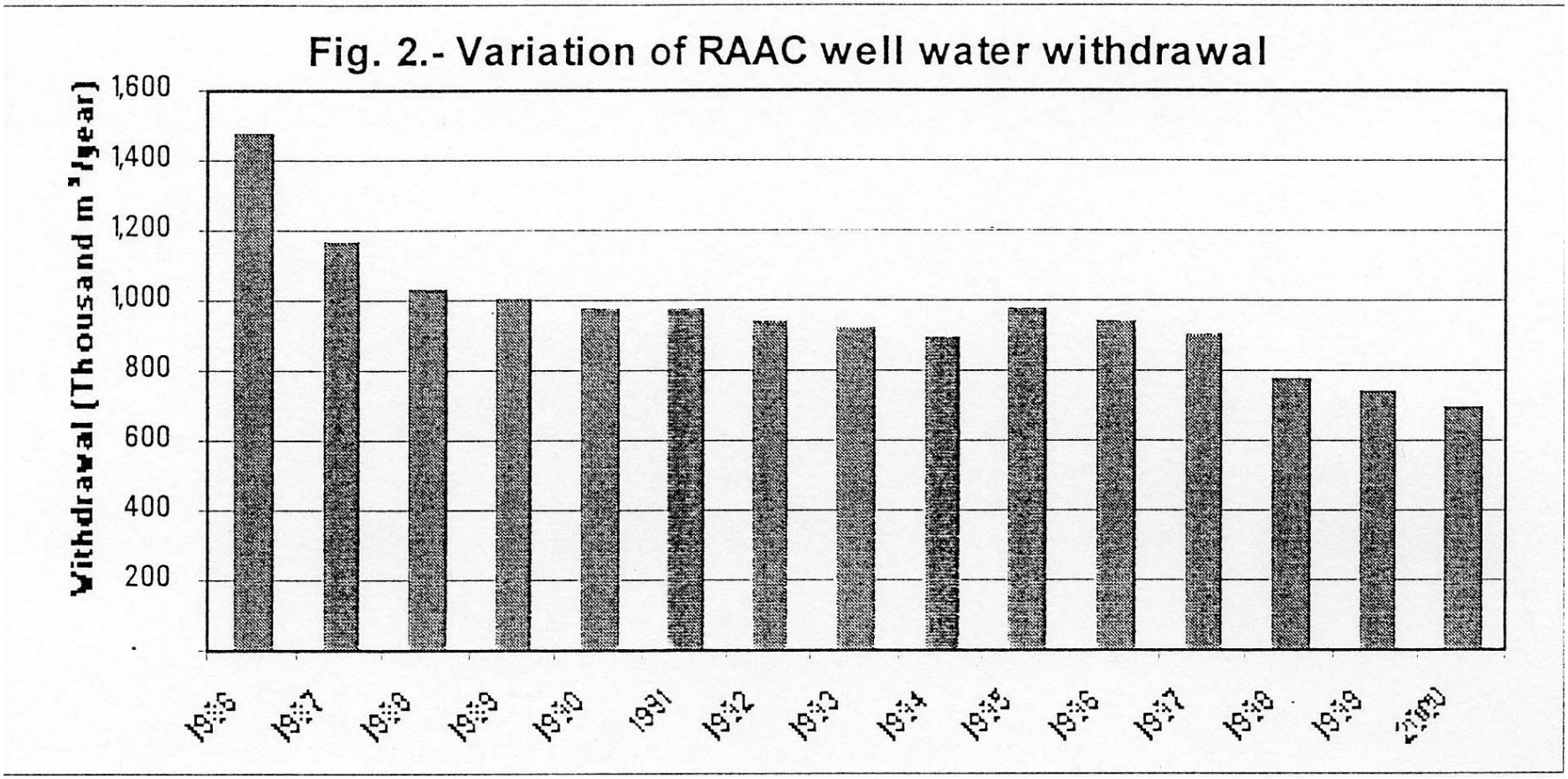
NTNU - Norwegian University of Science and Technology
Dep. Hydraulic and Environmental Engineering

Prof. Hallvard Ødegaard



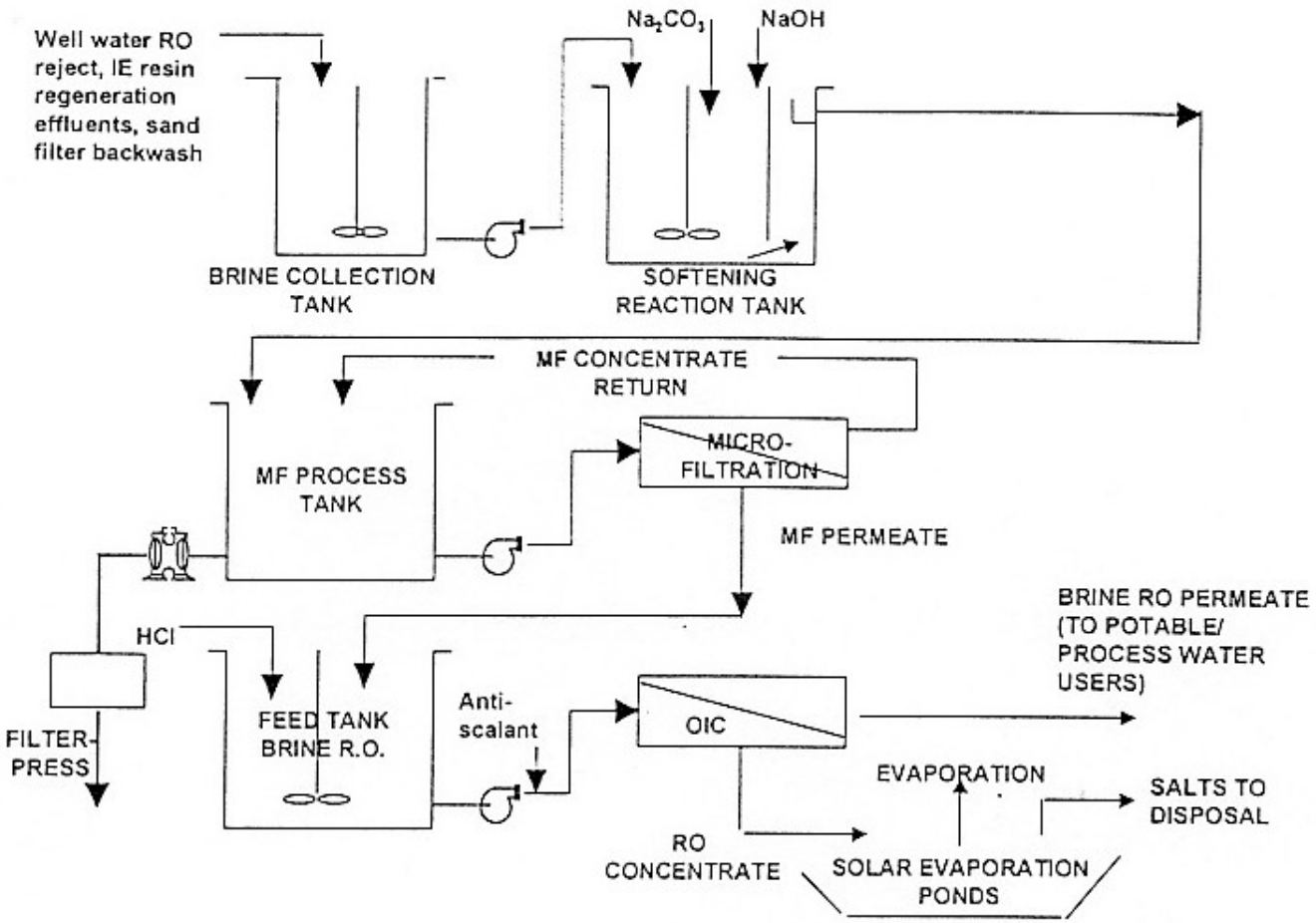
GMM Water Management System – 6 main programs

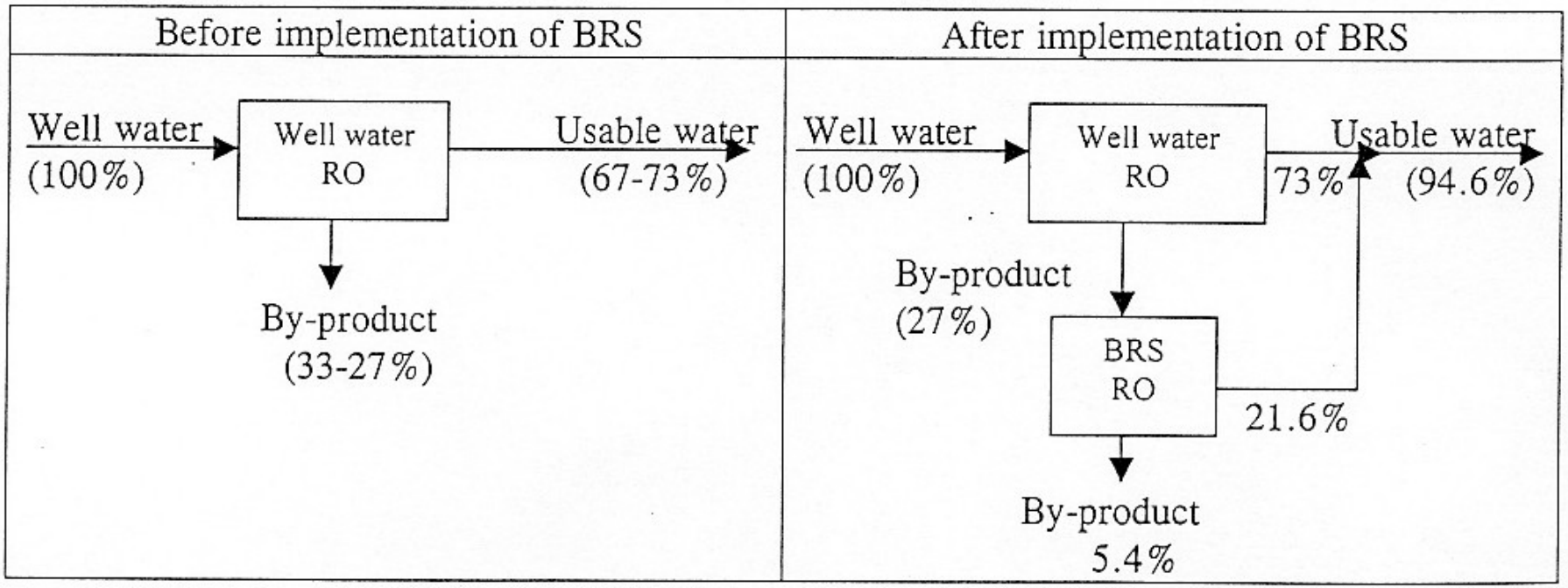
WATER CONSERVATION PROGRAMME



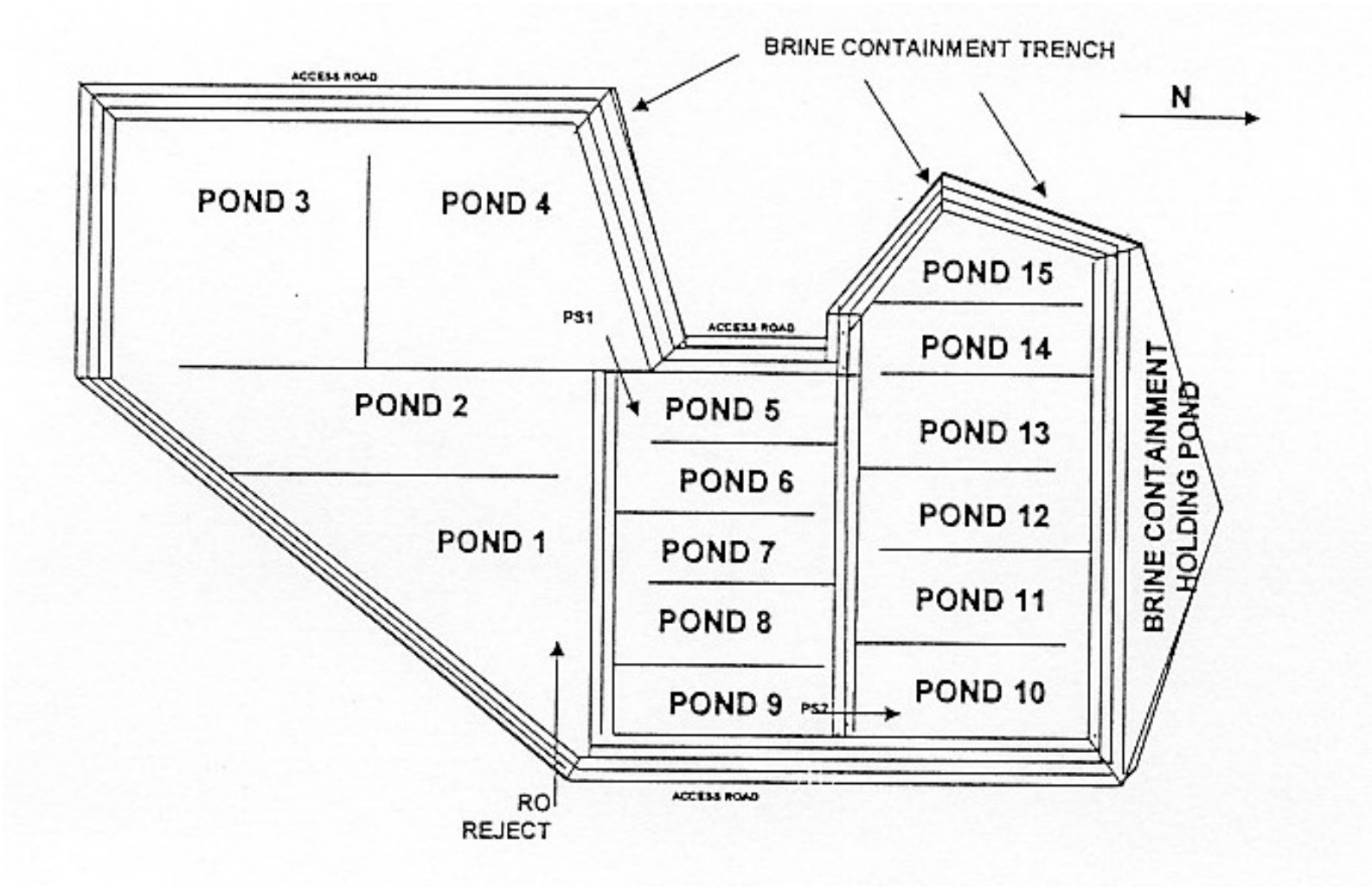
RECOVERY OF WELL WATER TREATMENT BY-PRODUCT STREAM

Fig. 3.- FLOW DIAGRAM OF THE BRINE RECOVERY SYSTEM INSTALLED AT GM DE MEXICO RAMOS ARIZPE COMPLEX

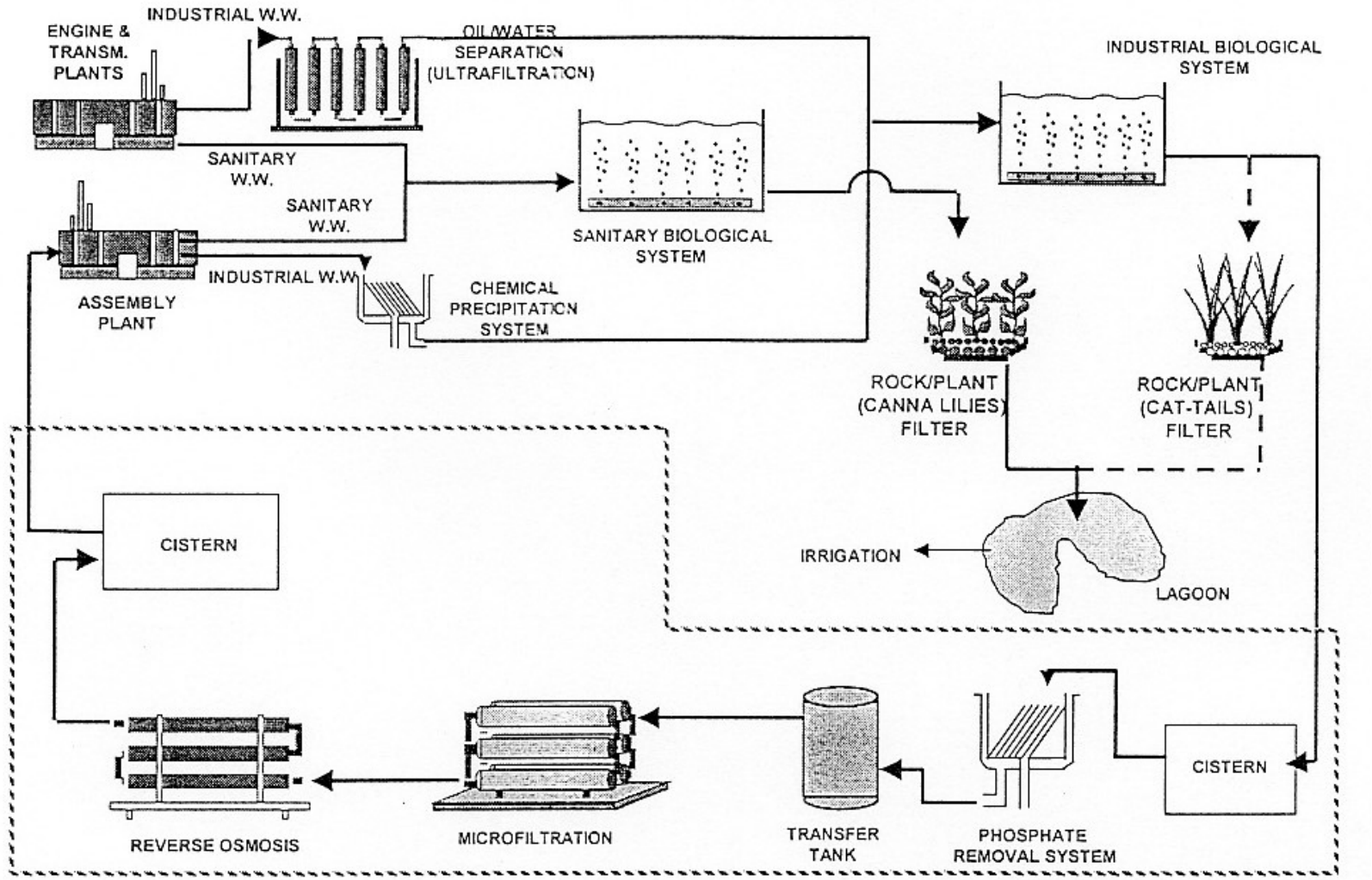



Before implementation of BRS
Well water
(100%)
Well water
RO
Usable water
(67-73%)
By-product
(33-27%)
After implementation of BRS
Well water
(100%)
Well water
RO
73%
Usable water
(94.6%)
By-product
(27%)
BRS
RO
21.6%
By-product
5.4%

SOLAR PONDS FOR FINAL BRINE EVAPORATION



TREATMENT AND RECOVERY OF INDUSTRIAL AND SANITARY WW



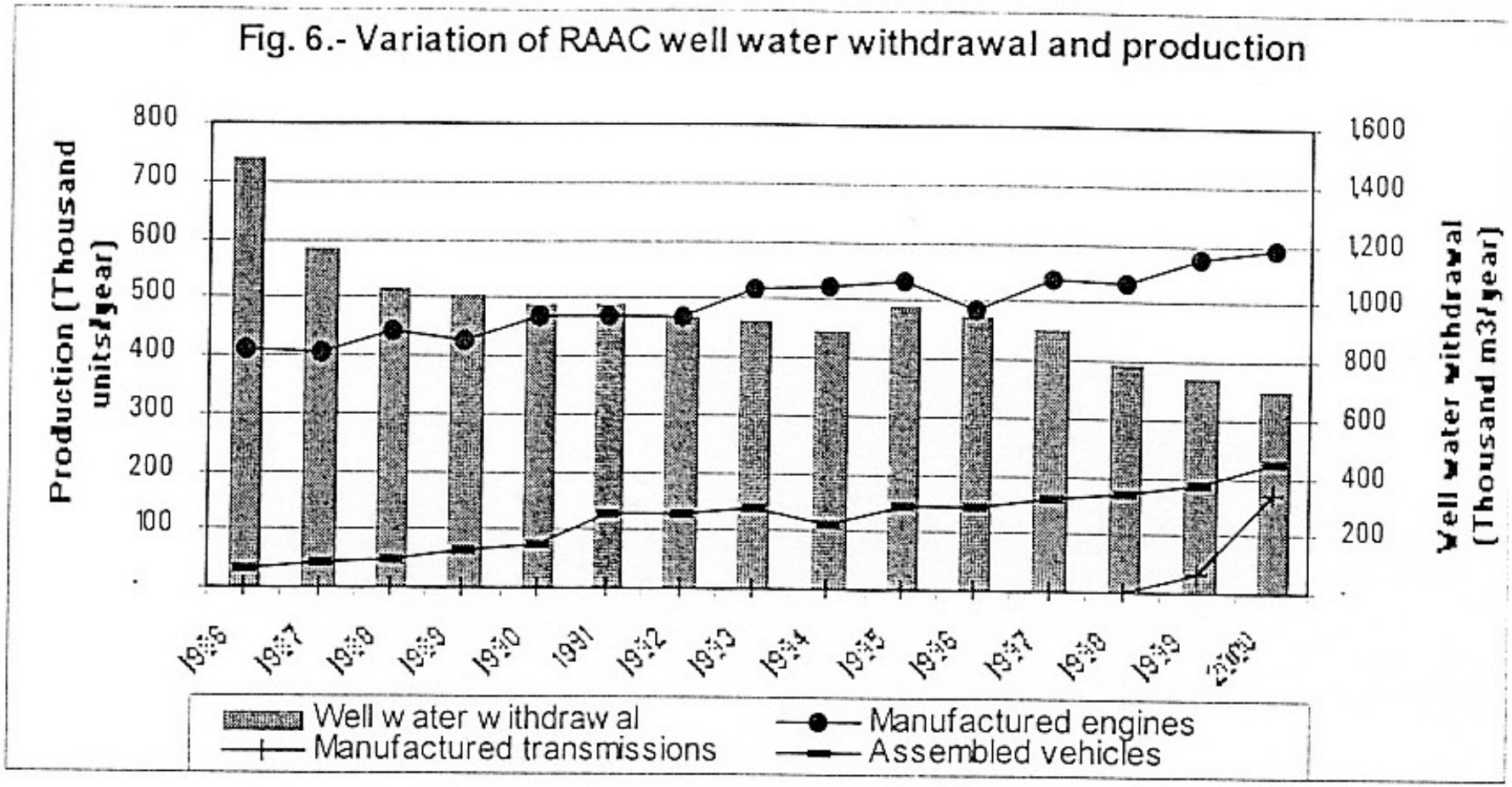


Fig. 6.- Variation of RAAC well water withdrawal and production
Production (Thousand units/year)
800
700
600
500
400
300
200
100
1,600
1,400
1,200
1,000
800
600
400
200
Well water withdrawal (Thousand m3/year)
1985
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
Well water withdrawal
Manufactured transmissions
Manufactured engines
Assembled vehicles

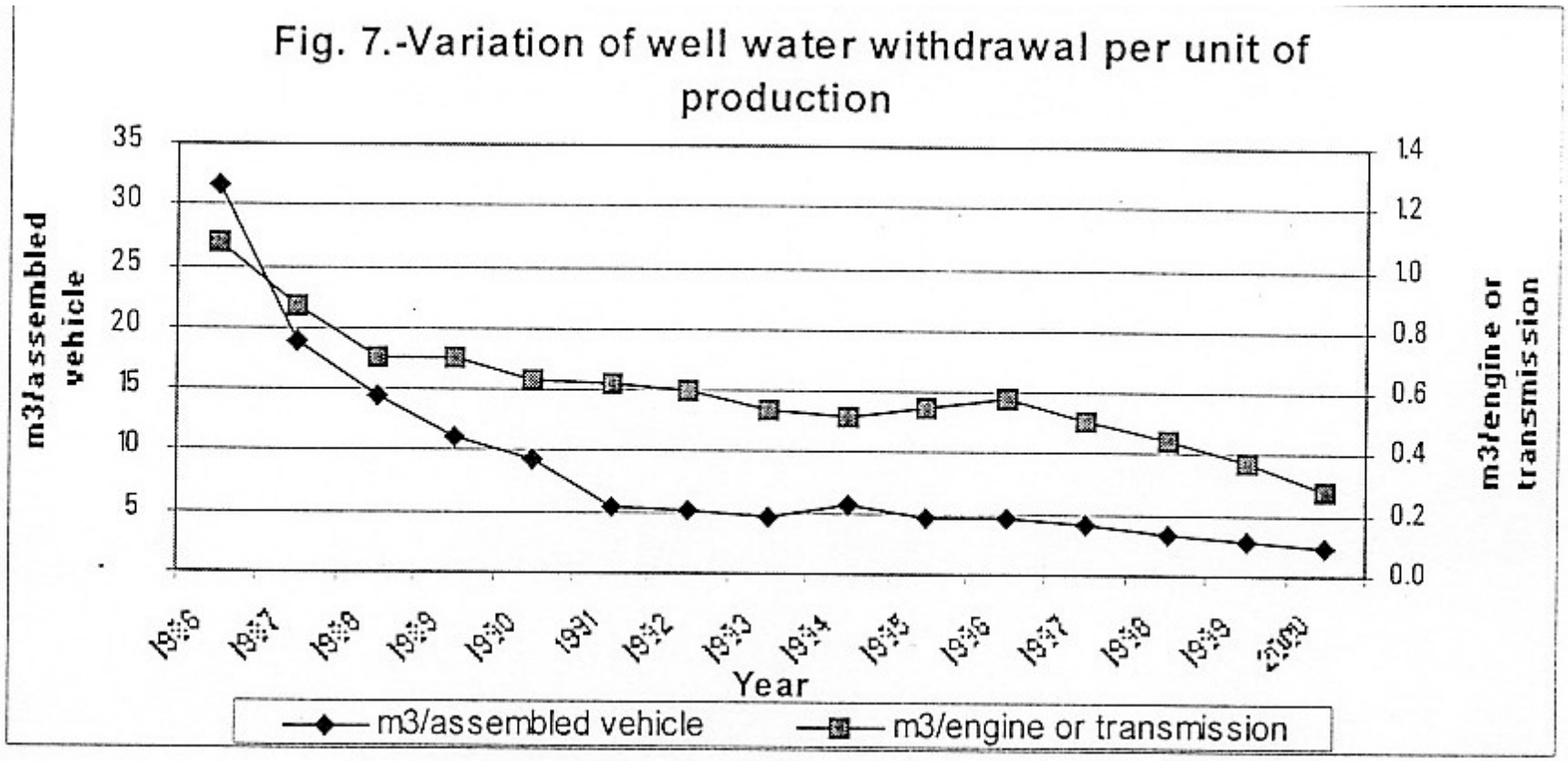


Fig. 7.-Variation of well water withdrawal per unit of production
m3/assembled vehicle
m3/engine or transmission
35
30
25
20
15
10
5
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Year
m3/assembled vehicle
m3/engine or transmission

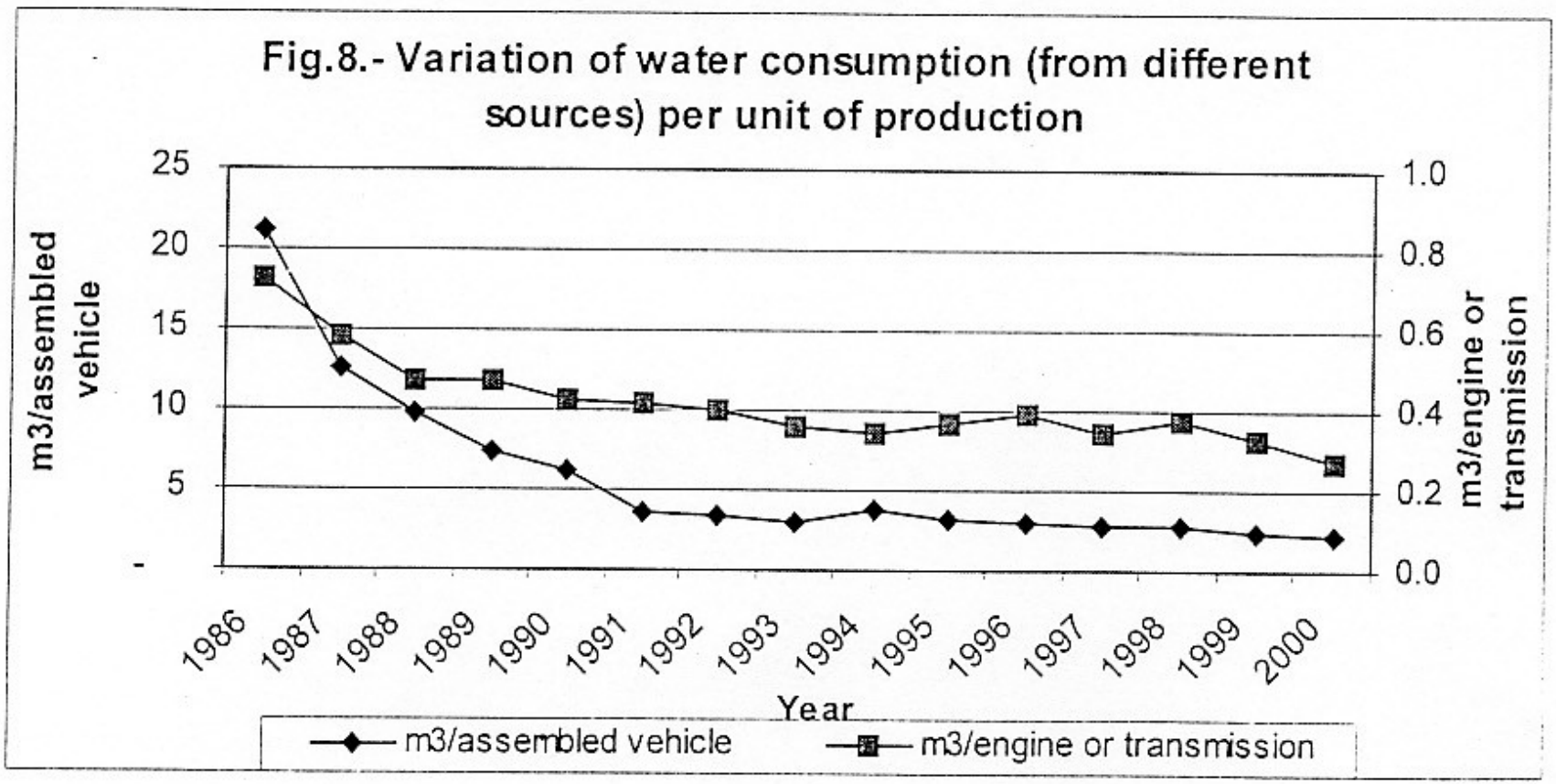
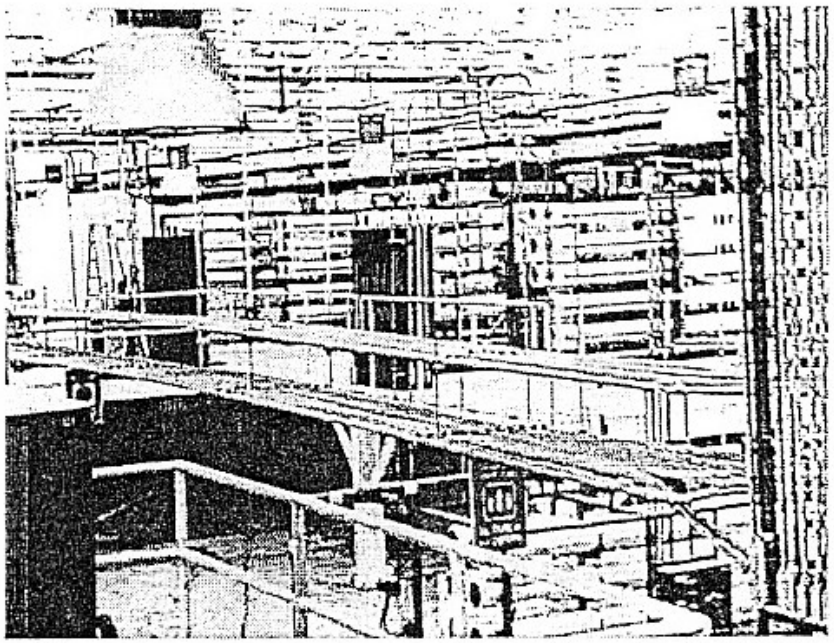
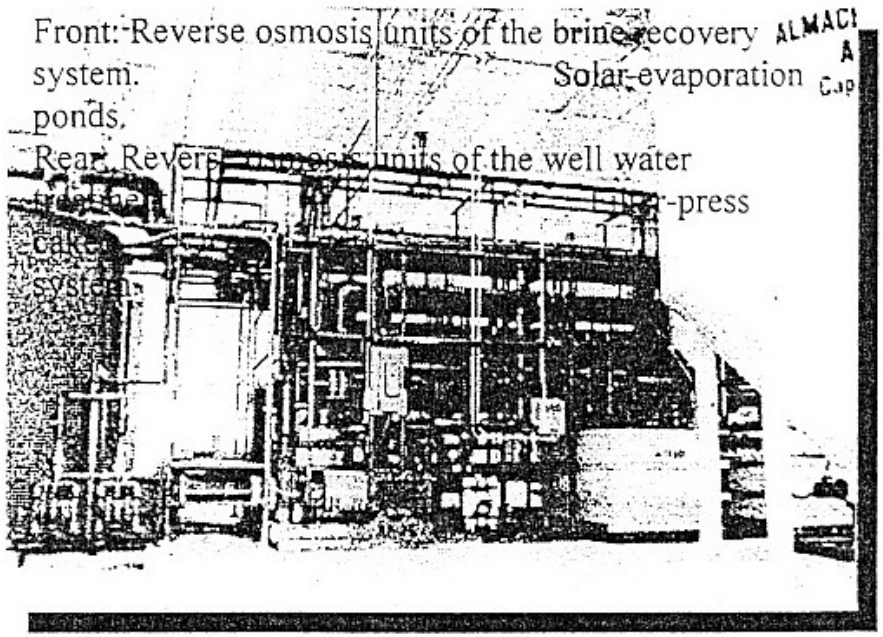


Fig.8.- Variation of water consumption (from different sources) per unit of production
m3/assembled vehicle
m3/engine or transmission
25
20
15
10
5
-
1.0
0.8
0.6
0.4
0.2
0.0
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
Year
m3/assembled vehicle
m3/engine or transmission

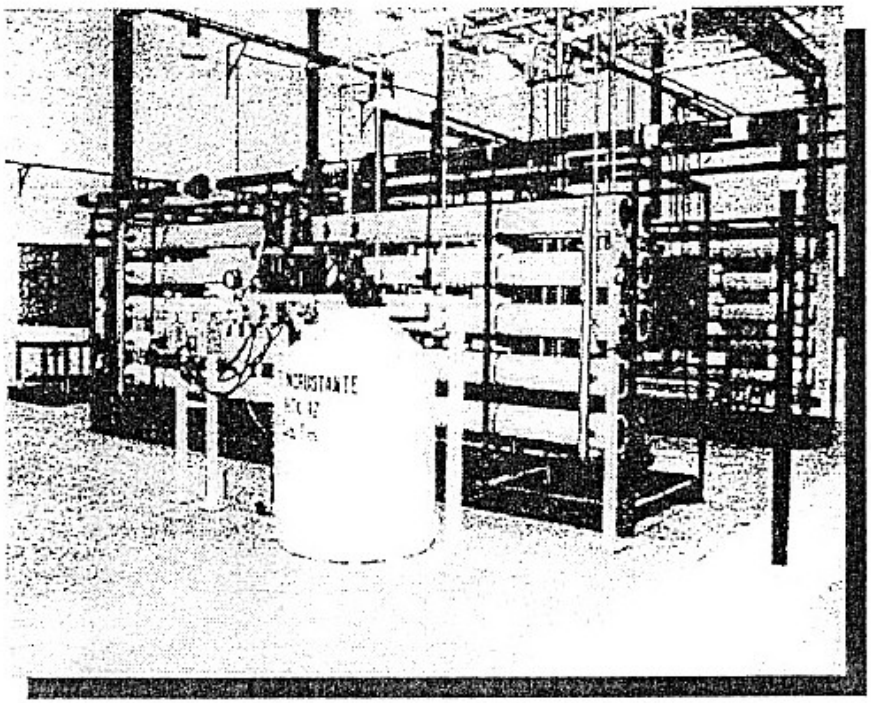


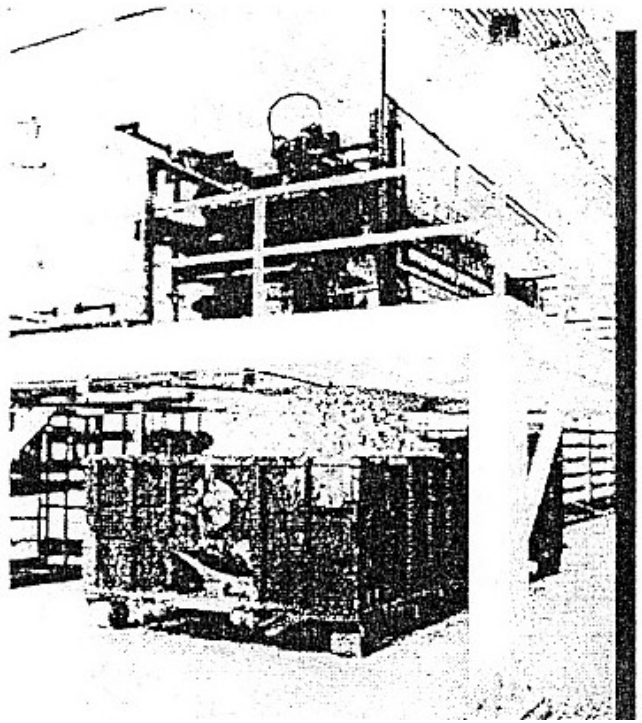
Reverse osmosis units used for well- water desalting.



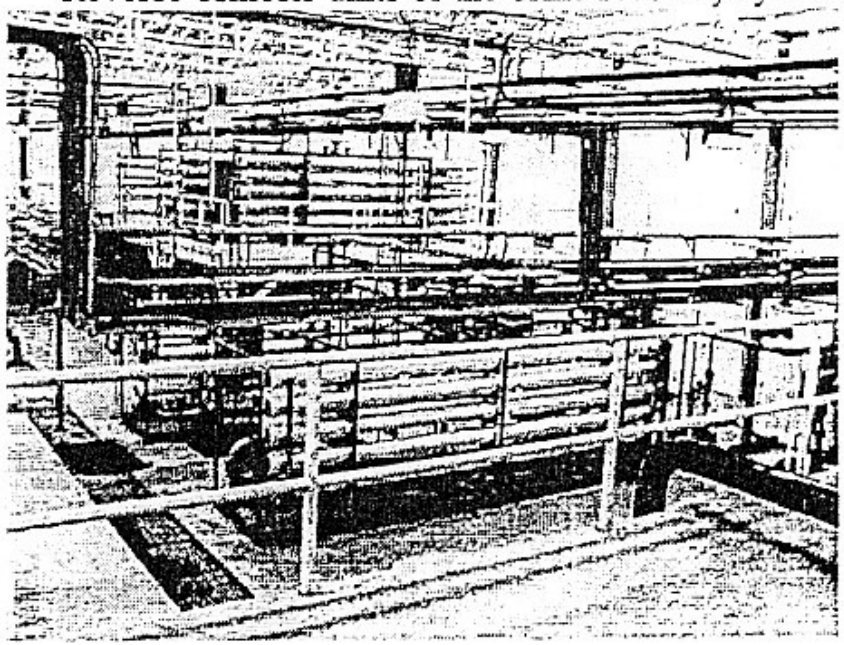
Front: Reverse osmosis units of the brine recovery system.
Solar evaporation ponds.
Rear: Reverse osmosis units of the well water
-press

Microfiltration unit of the brine recovery system.

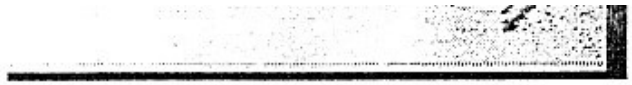




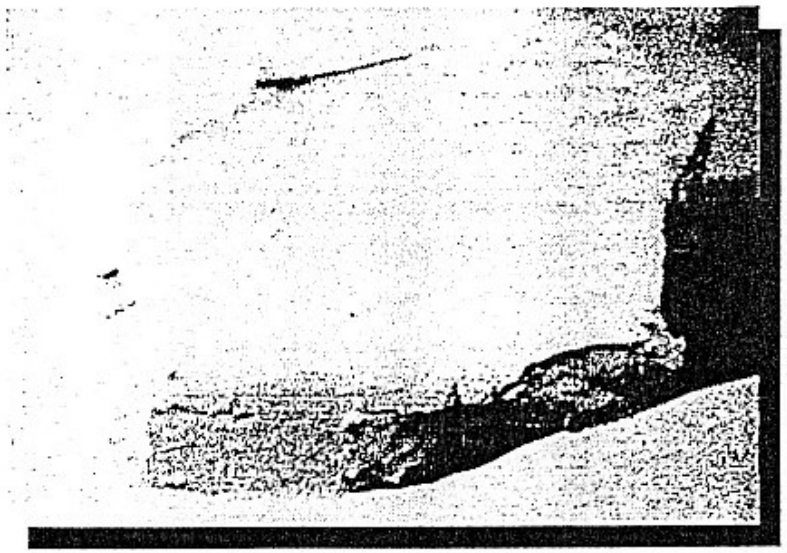
Reverse osmosis units of the brine recovery system



Front: Reverse osmosis units of the brine-recovery system Rear: Reverse osmosis units of the well water treatment system

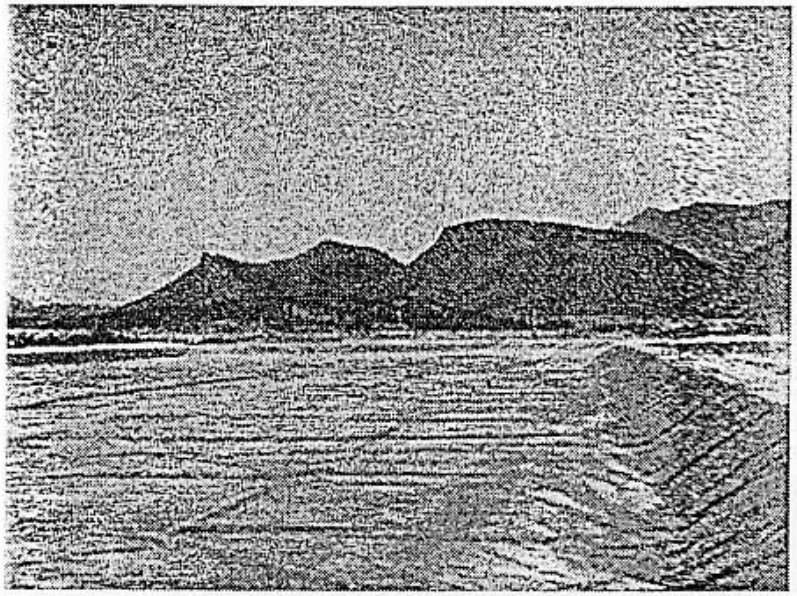


Filter press for softening sludge.

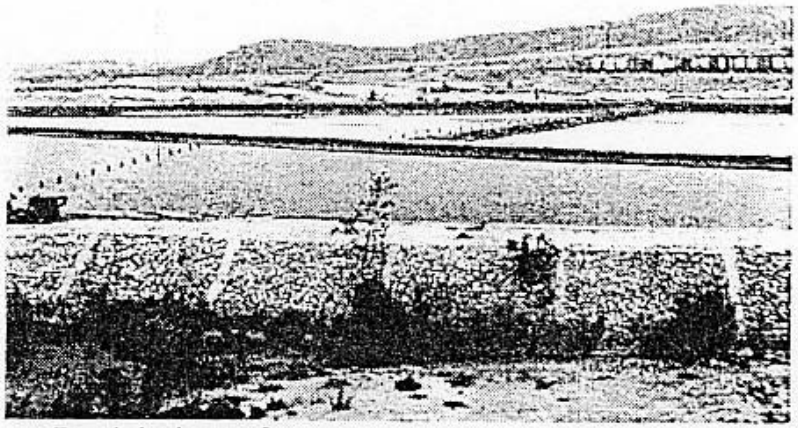


Filter-press cake.

2) Solar evaporation ponds



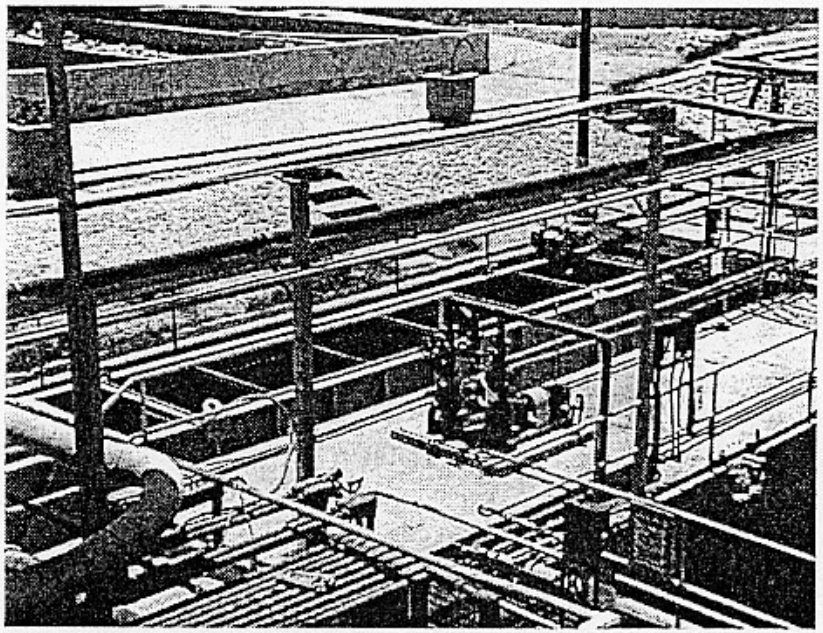
HDPE liner installed at
RAAC solar evaporation ponds.



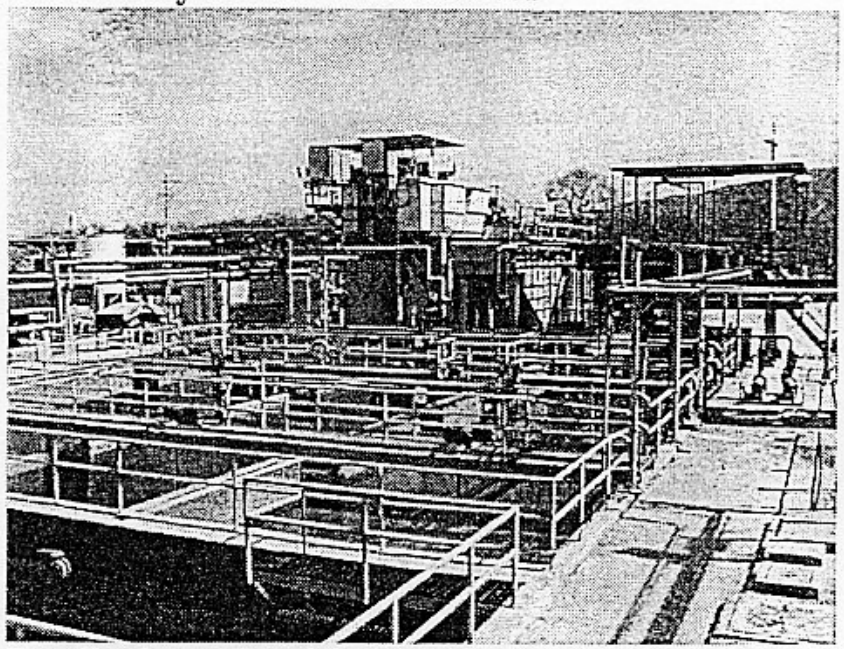
Partial view of RAAC solar evaporation ponds.

Equalization tanks of the physical-chemical treatment system for Assembly plant wastewater. Inclined plate separator is shown at the rear.

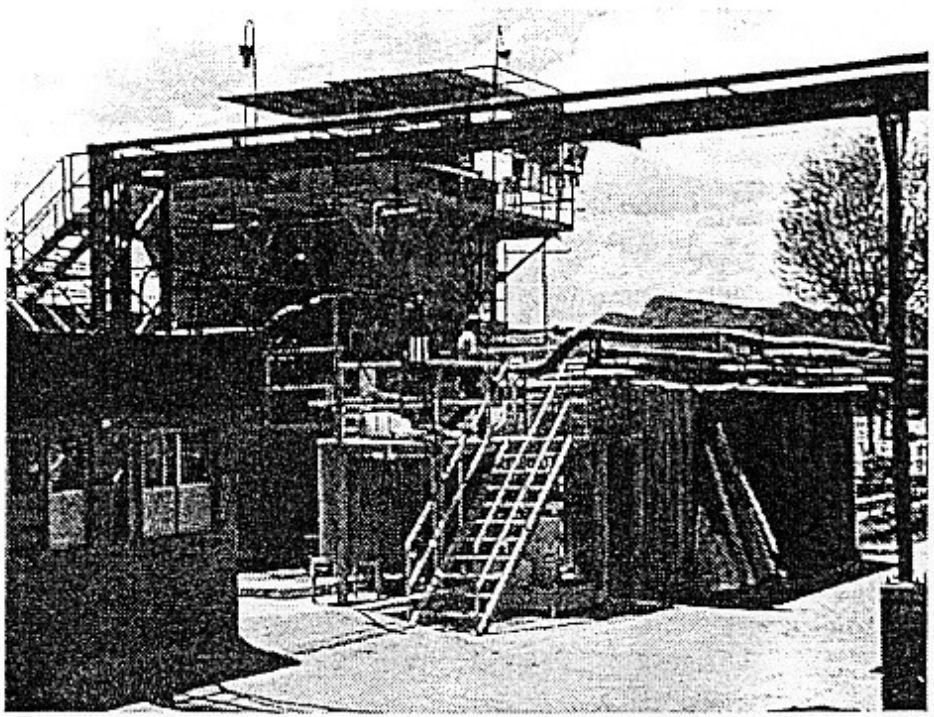
3) Physical Chemical Treatment for Assembly Plant Wastewater



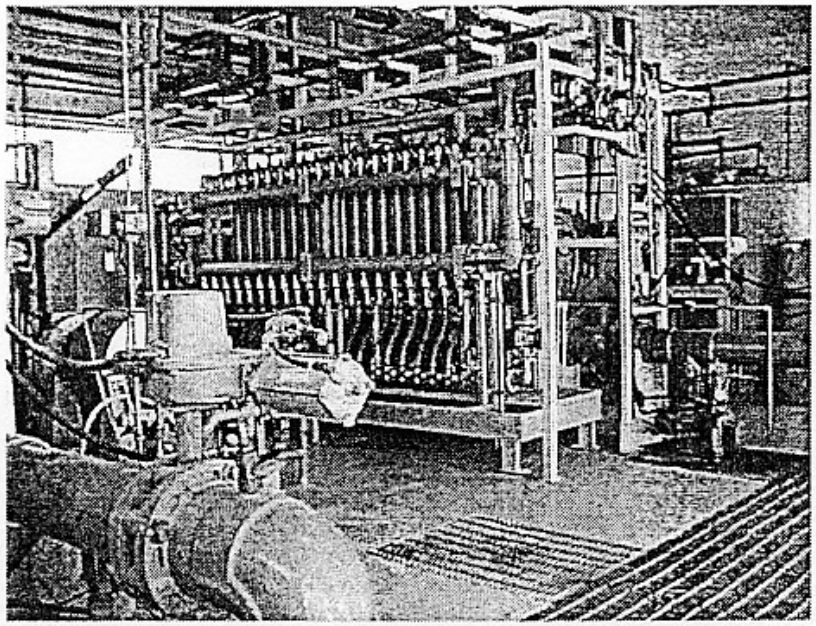
Top view of the grit solids separator used for preliminary treatment of Assembly plant wastewater.



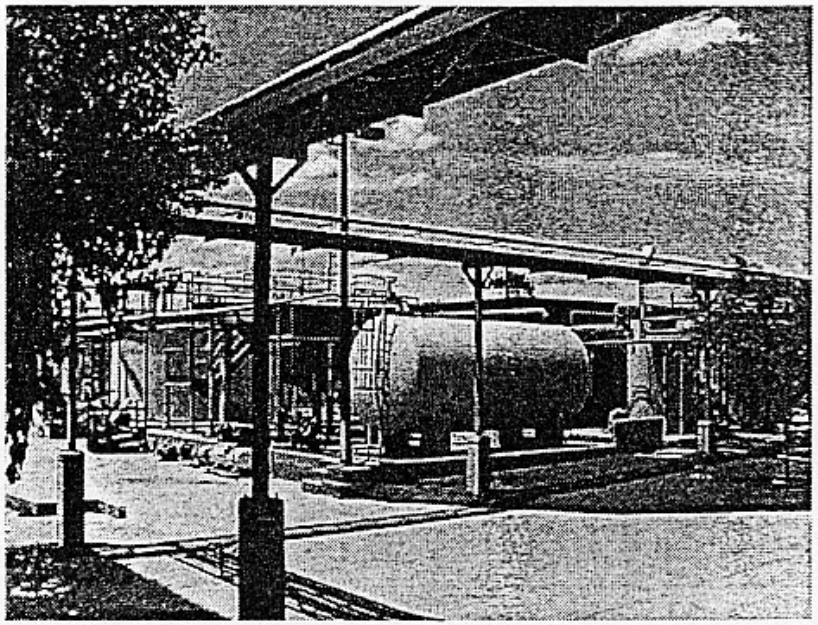
Equalization tanks of the physical-chemical treatment system for Assembly plant wastewater. Inclined plate separator is shown at the rear.



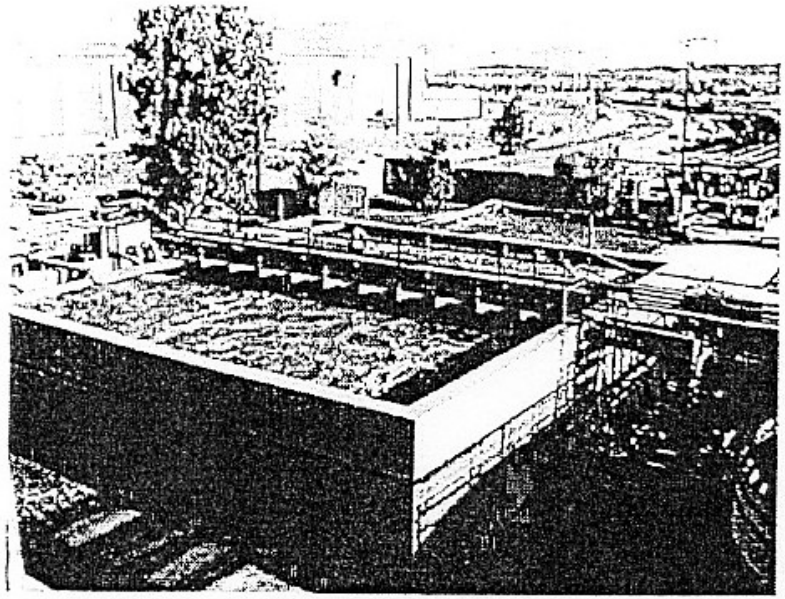
Side view of the inclined plate separator (lamela) used for Assembly plant wastewater physical-chemical treatment, and milk of lime preparation tanks.



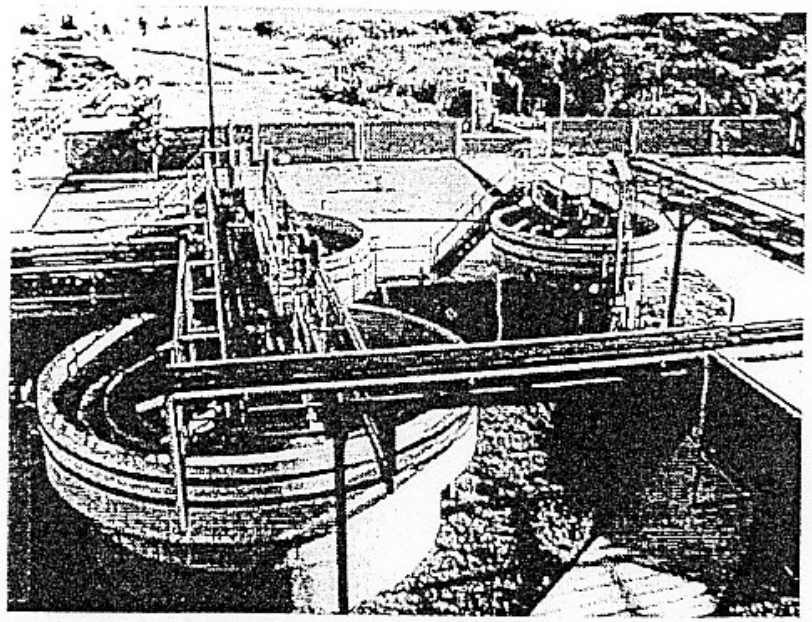
Ultrafiltration system used for removing emulsified oil from Engine and Transmission plant wastewater.



By-product oil collection tank (Engine and Transmission plant wastewater treatment are

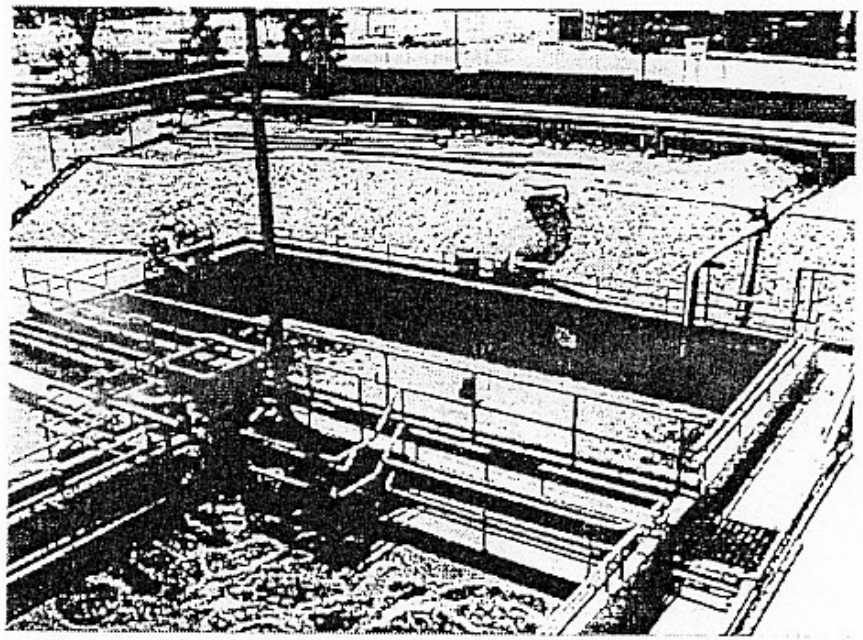


Aeration tank of the biological treatment system for Industrial wastewater.

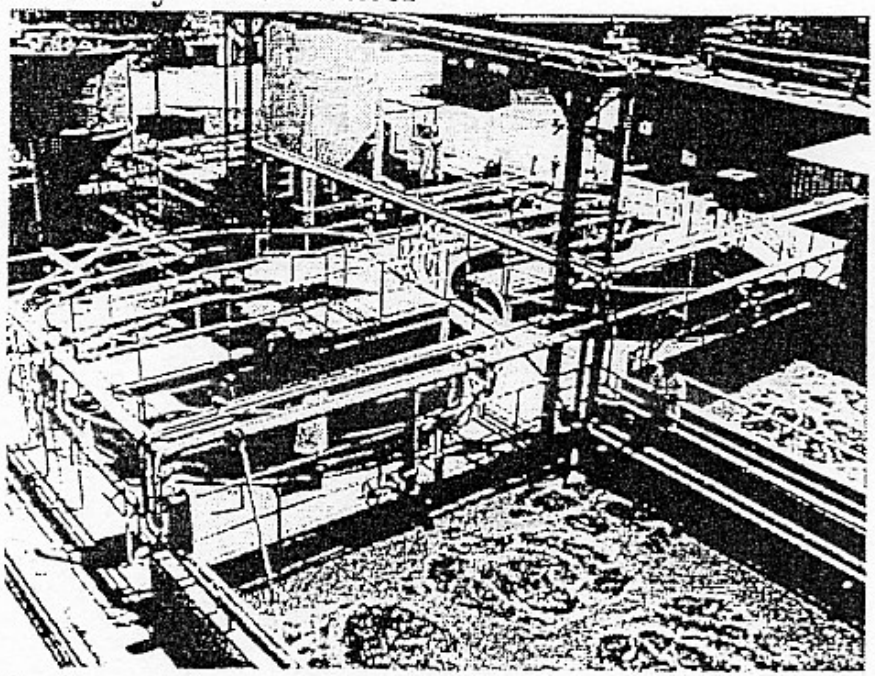


Clarification and sludge thickener tanks used at RAAC for settling industrial activated sludge.

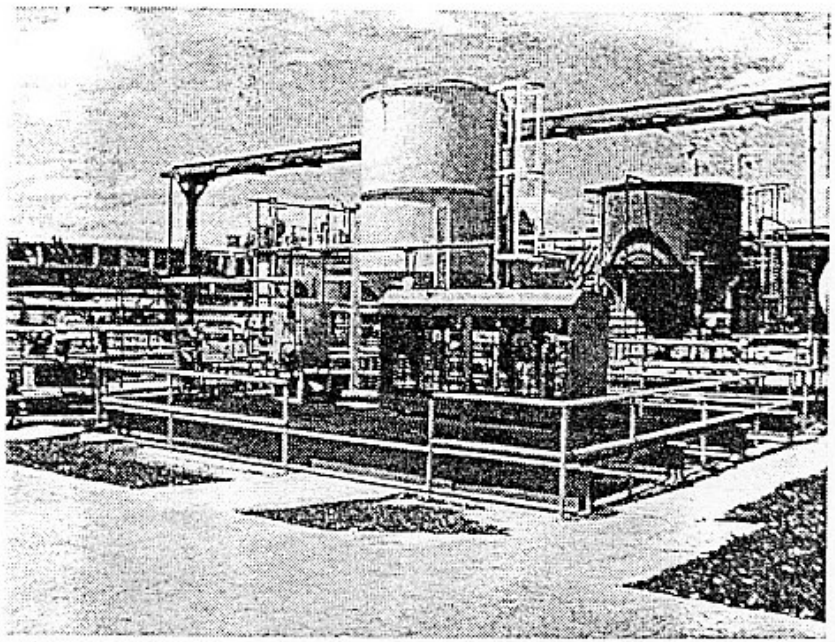
6) Biological Treatment for Sanitary Wastewater



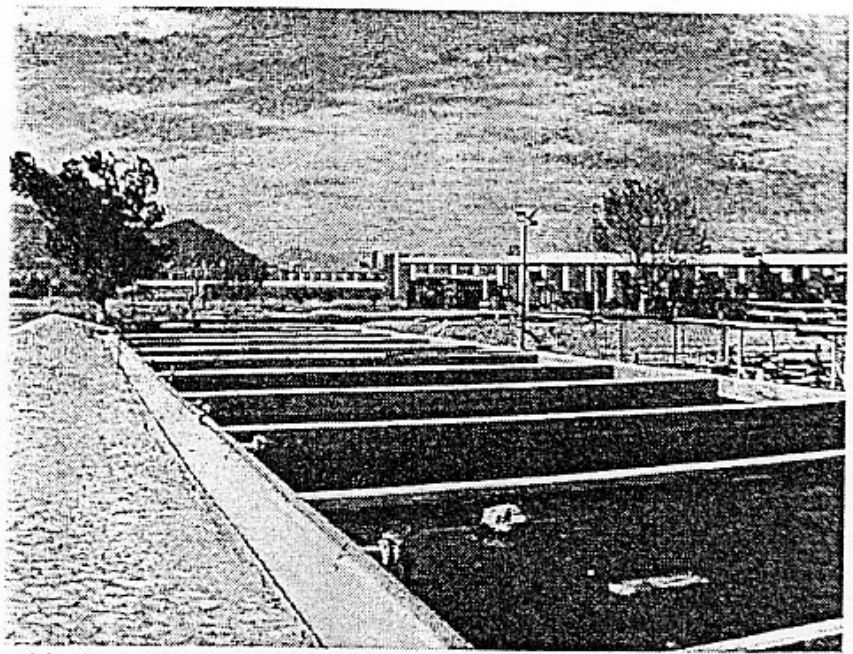
Sanitary system equalization tank.



Sanitary system aeration, clarification and digestion tanks.

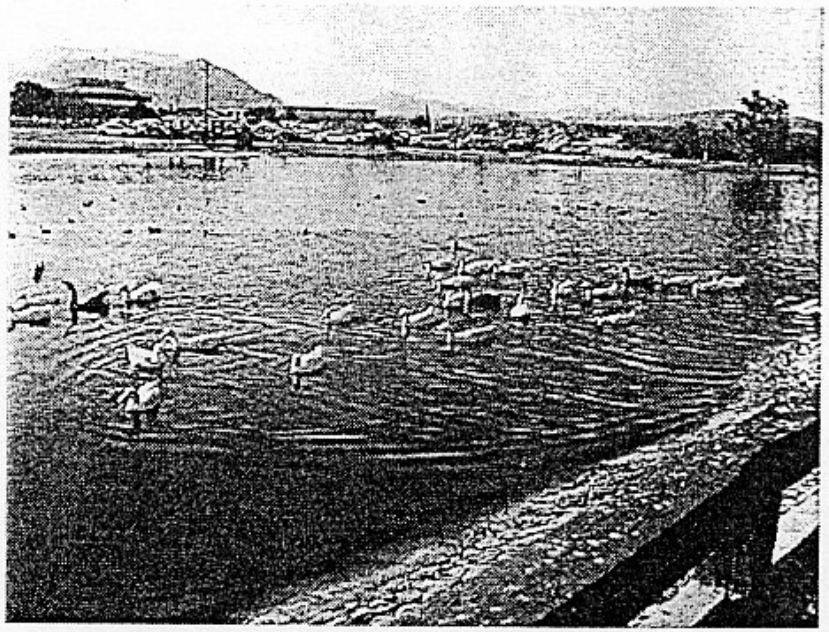


Digested sludge retention tank (white) and bag filtration system for digested sludge (located on top of the sanitary sludge digestion tank).



Sludge drying beds for dehydrating digested sludge from biological treatment systems.

Canna lilies/Rock filter for sanitary secondary effluent advanced treatment.



View of the treated water storage lagoon.