

Innovation through Integration and Optimisation

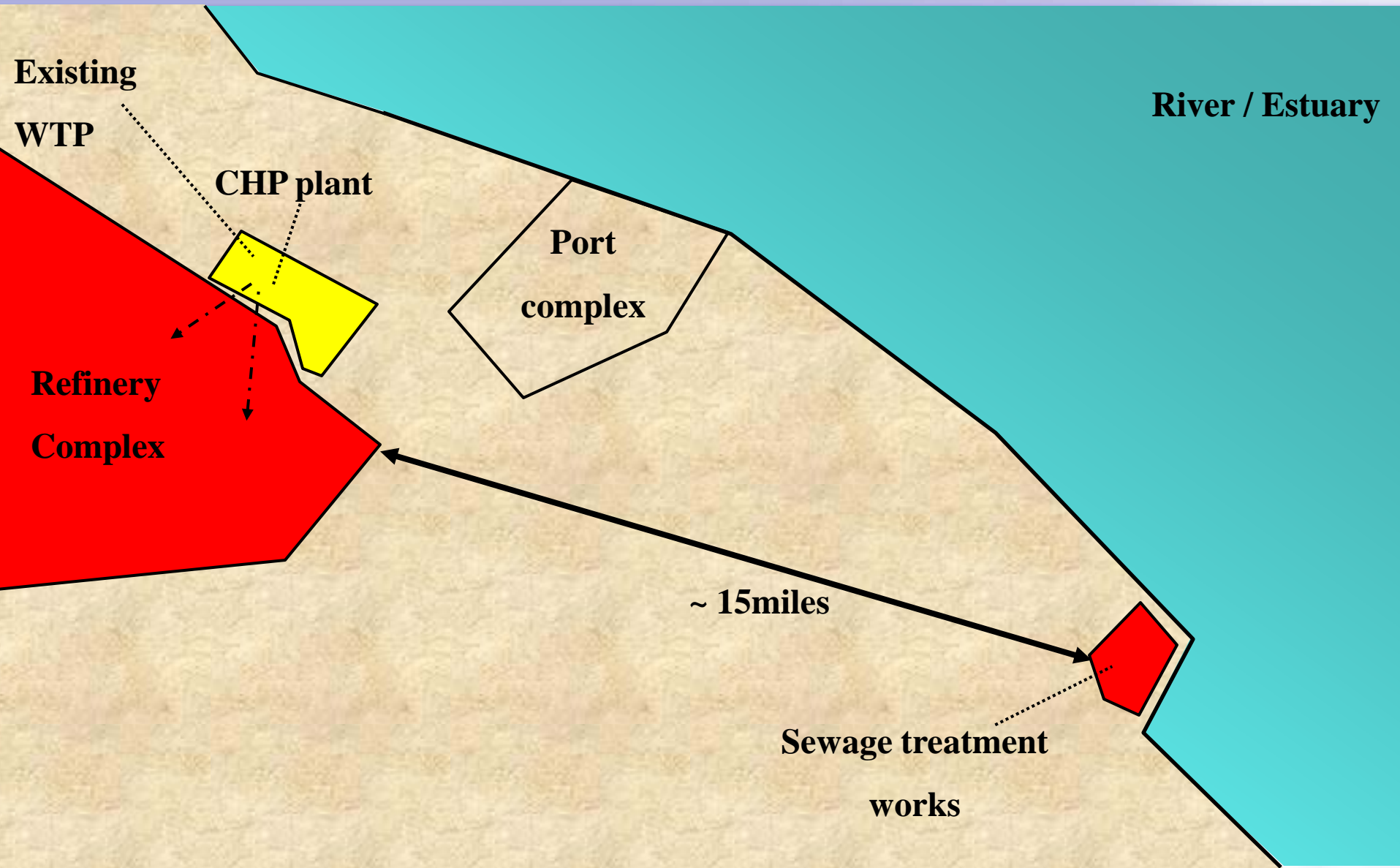
John Ord

MWH

Key Facts

- High purity water demand
 - 2,200m³/h - <50μS/cm
- Demineralised water demand
 - 700m³/h - <0.2μS/cm
- Existing treatment plant
 - 200m³/h - <50μS/cm
 - 300m³/h - <0.2μS/cm
- Addition capacity needed
 - 2,000m³/h high purity
 - 400m³/h demin
- Existing supply at capacity

Geographic layout

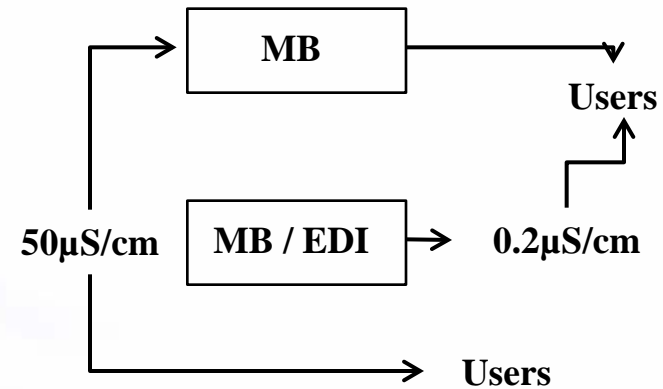
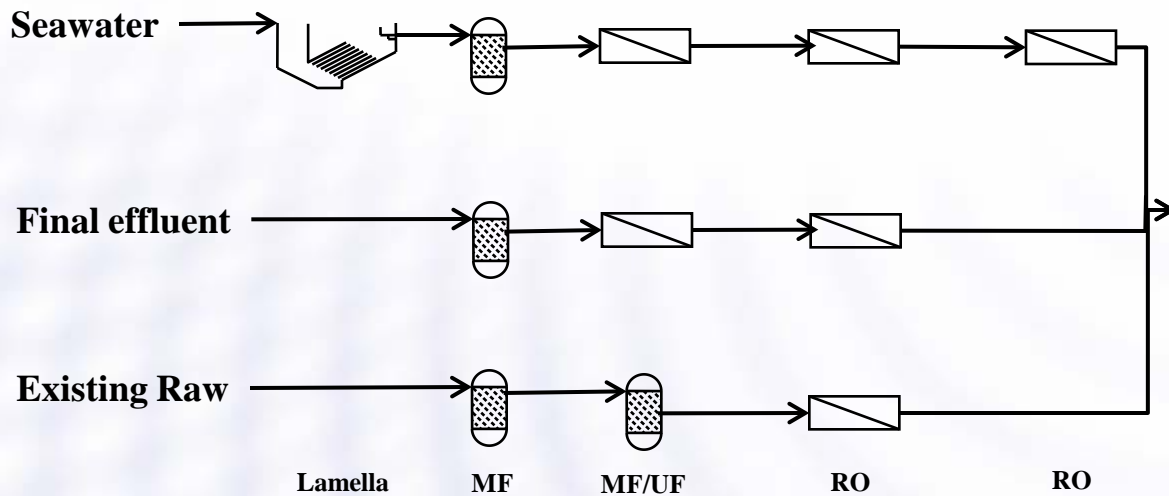


Challenge

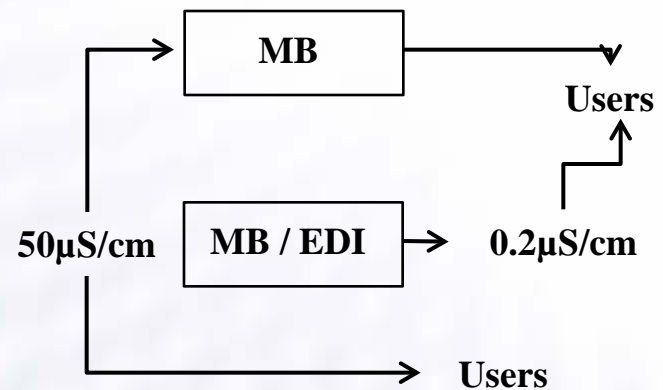
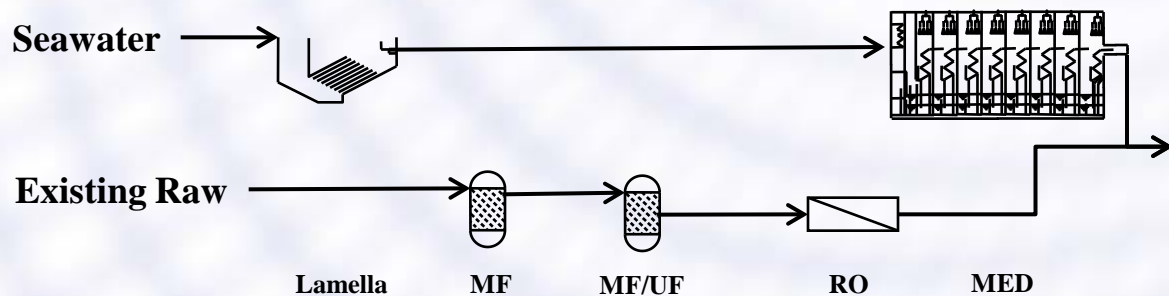
- Identify most financially viable and sustainable solution
 - Refurbish and upgrade
 - Seawater Desalination
 - Membrane
 - Thermal
 - Final Effluent Re-use
 - Membrane
 - Thermal
 - Demineralisation
 - Membrane / electrical
 - Chemical

Potential Process Solutions

• Membrane driven



• Thermal driven



Project Specific issues

- Seawater
 - Highly variable – 200 to 3,500mg/l TSS
 - Intake close to port jetties and shipping
- Water demand
 - CHP plant expansion – excess steam
 - New industries moving to area
- Power
 - Limit on HV capacity in area
 - Project will enable HV upgrade
- Local WwTW
 - Carbonaceous WwTW
 - Land limitations at WwTW

Unit costs

- Summary of unit cost comparison

	Unit				
Power	KWh/m ³				
	\$/m ³				
Power - adjusted	KWh/m ³				
	\$/m ³				
Chemicals	\$/m ³				
Membranes	\$/m ³				
Specific OPEX	\$/m ³				
CAPEX Factor	H/M/L				
	Score				
Capacity limit	% of req'd				
Ranking					

Unit costs

- Summary of unit cost comparison

	Unit	Seawater RO			
Power	KWh/m ³	7			
	\$/m ³	0.8			
Power - adjusted	KWh/m ³	3			
	\$/m ³	0.34			
Chemicals	\$/m ³	0.08			
Membranes	\$/m ³	0.1			
Specific OPEX	\$/m ³	0.52			
CAPEX Factor	H/M/L	High			
	Score	3			
Capacity limit	% of req'd	Upto 100%			
Ranking					

Unit costs

- Summary of unit cost comparison

	Unit	Seawater RO	FE RO Re-use		
Power	KWh/m ³	7	2.1		
	\$/m ³	0.8	0.24		
Power - adjusted	KWh/m ³	3			
	\$/m ³	0.34			
Chemicals	\$/m ³	0.08	0.05		
Membranes	\$/m ³	0.1	0.07		
Specific OPEX	\$/m ³	0.52	0.36		
CAPEX Factor	H/M/L	High	Medium		
	Score	3	2		
Capacity limit	% of req'd	Upto 100%	Upto 34%		
Ranking					

Unit costs

- Summary of unit cost comparison

	Unit	Seawater RO	FE RO Re-use	Existing RO	
Power	KWh/m ³	7	2.1	1.7	
	\$/m ³	0.8	0.24	0.2	
Power - adjusted	KWh/m ³	3			
	\$/m ³	0.34			
Chemicals	\$/m ³	0.08	0.05	0.05	
Membranes	\$/m ³	0.1	0.07	0.02	
Specific OPEX	\$/m ³	0.52	0.36	0.27	
CAPEX Factor	H/M/L	High	Medium	Low	
	Score	3	2	1	
Capacity limit	% of req'd	Upto 100%	Upto 34%	Upto 16%	
Ranking					

Unit costs

- Summary of unit cost comparison

	Unit	Seawater RO	FE RO Re-use	Existing RO	Seawater Thermal
Power	KWh/m ³	7	2.1	1.7	2.6
	\$/m ³	0.8	0.24	0.2	0.29
Power - adjusted	KWh/m ³	3			
	\$/m ³	0.34			
Chemicals	\$/m ³	0.08	0.05	0.05	0.05
Membranes	\$/m ³	0.1	0.07	0.02	-
Specific OPEX	\$/m ³	0.52	0.36	0.27	0.34
CAPEX Factor	H/M/L	High	Medium	Low	High
	Score	3	2	1	3
Capacity limit	% of req'd	Upto 100%	Upto 34%	Upto 16%	Upto 100%
Ranking					

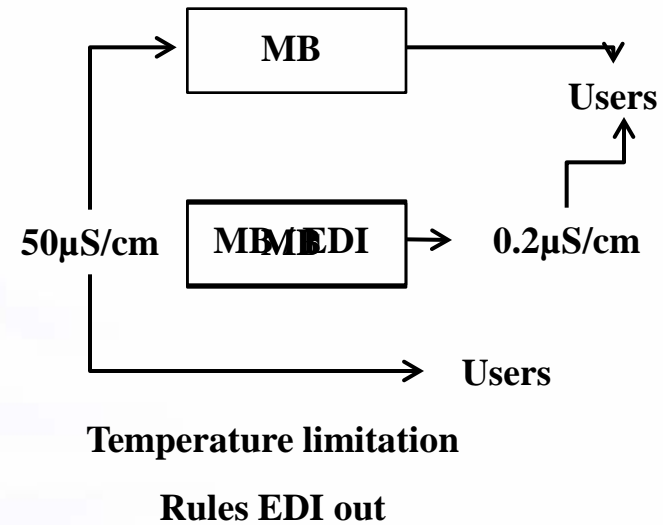
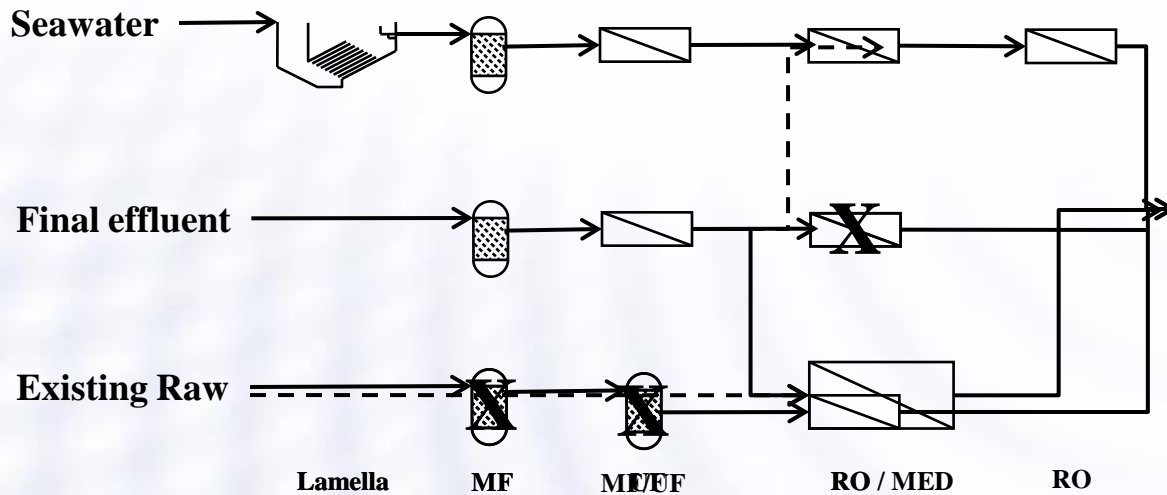
Unit costs

- Summary of unit cost comparison

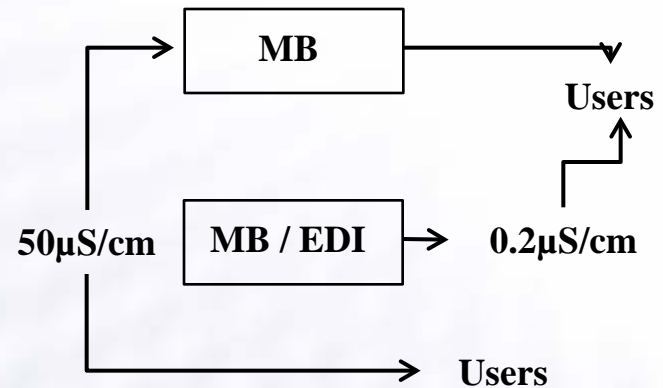
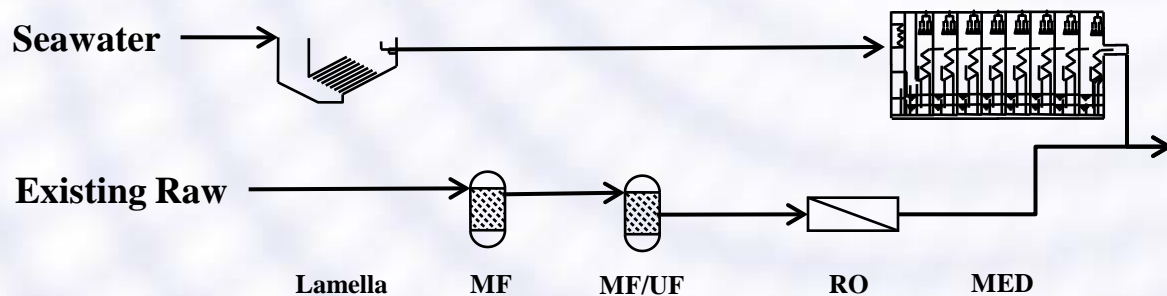
	Unit	Seawater RO	FE RO Re-use	Existing RO	Seawater Thermal
Power	KWh/m ³	7	2.1	1.7	2.6
	\$/m ³	0.8	0.24	0.2	0.29
Power - adjusted	KWh/m ³	3			
	\$/m ³	0.34			
Chemicals	\$/m ³	0.08	0.05	0.05	0.05
Membranes	\$/m ³	0.1	0.07	0.02	-
Specific OPEX	\$/m ³	0.52	0.36	0.27	0.34
CAPEX Factor	H/M/L	High	Medium	Low	High
	Score	3	2	1	3
Capacity limit	% of req'd	Upto 100%	Upto 34%	Upto 16%	Upto 100%
Ranking		4	2	3	1

Integrated Process

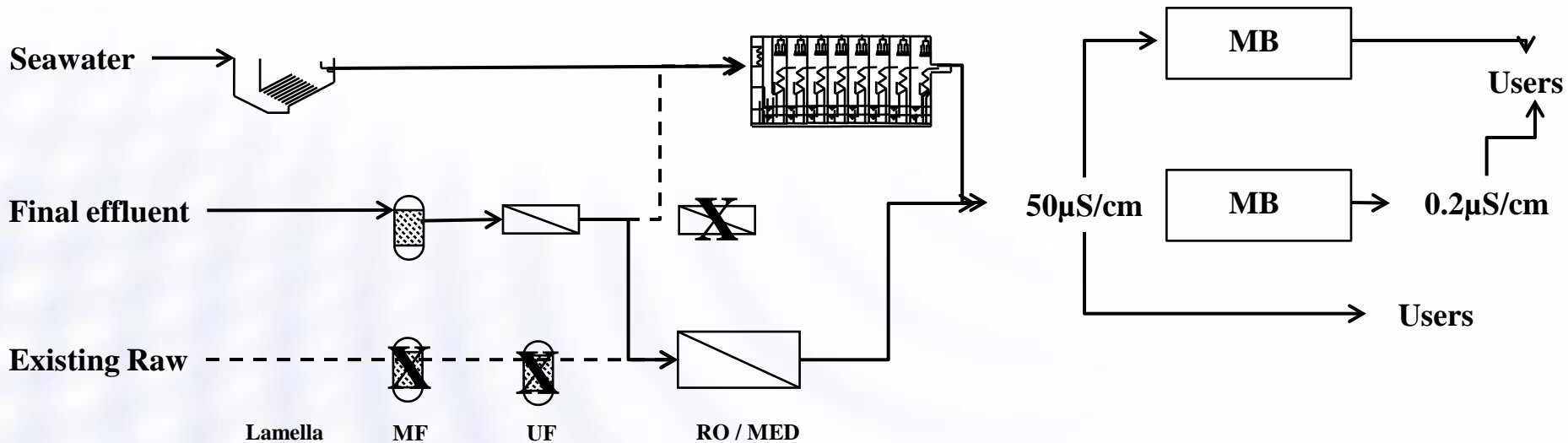
- Membrane driven



- Thermal driven



Integrated Process

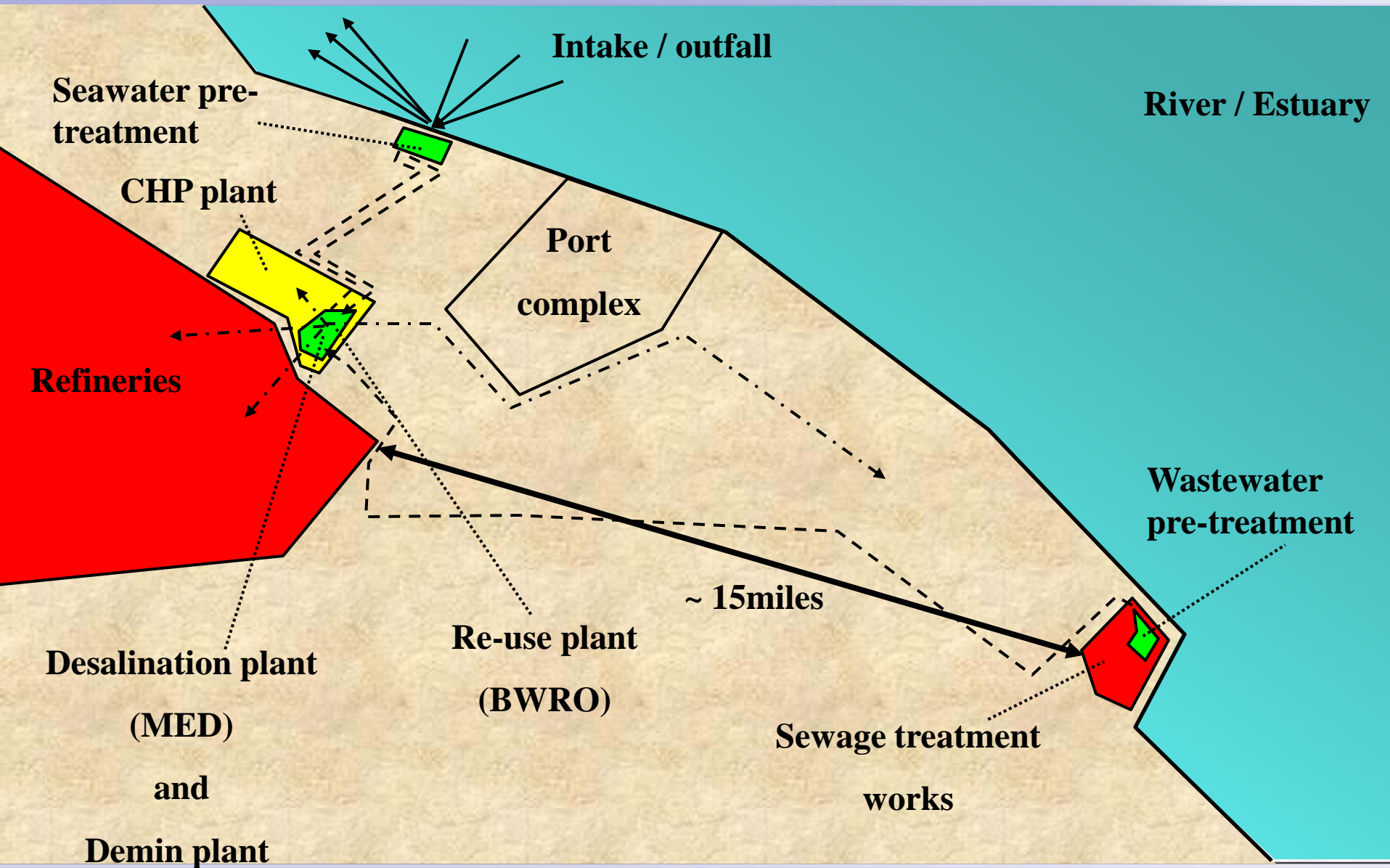


- Design philosophy
 - Base load MED
 - Peak load Re-use RO
 - Back-up FE supply with raw water
 - Back-up MED with RO standby

Lower than individual values ←

Specific cost	Unit	Value
Power	KWh/m ³	3.5
	\$/m ³	0.22
Chemicals	\$/m ³	0.05
Membranes	\$/m ³	0.03
Specific OPEX	\$/m ³	0.30
CAPEX Factor	H/M/L	High

Integrated Solution



Thank you for your time
Any Questions ?