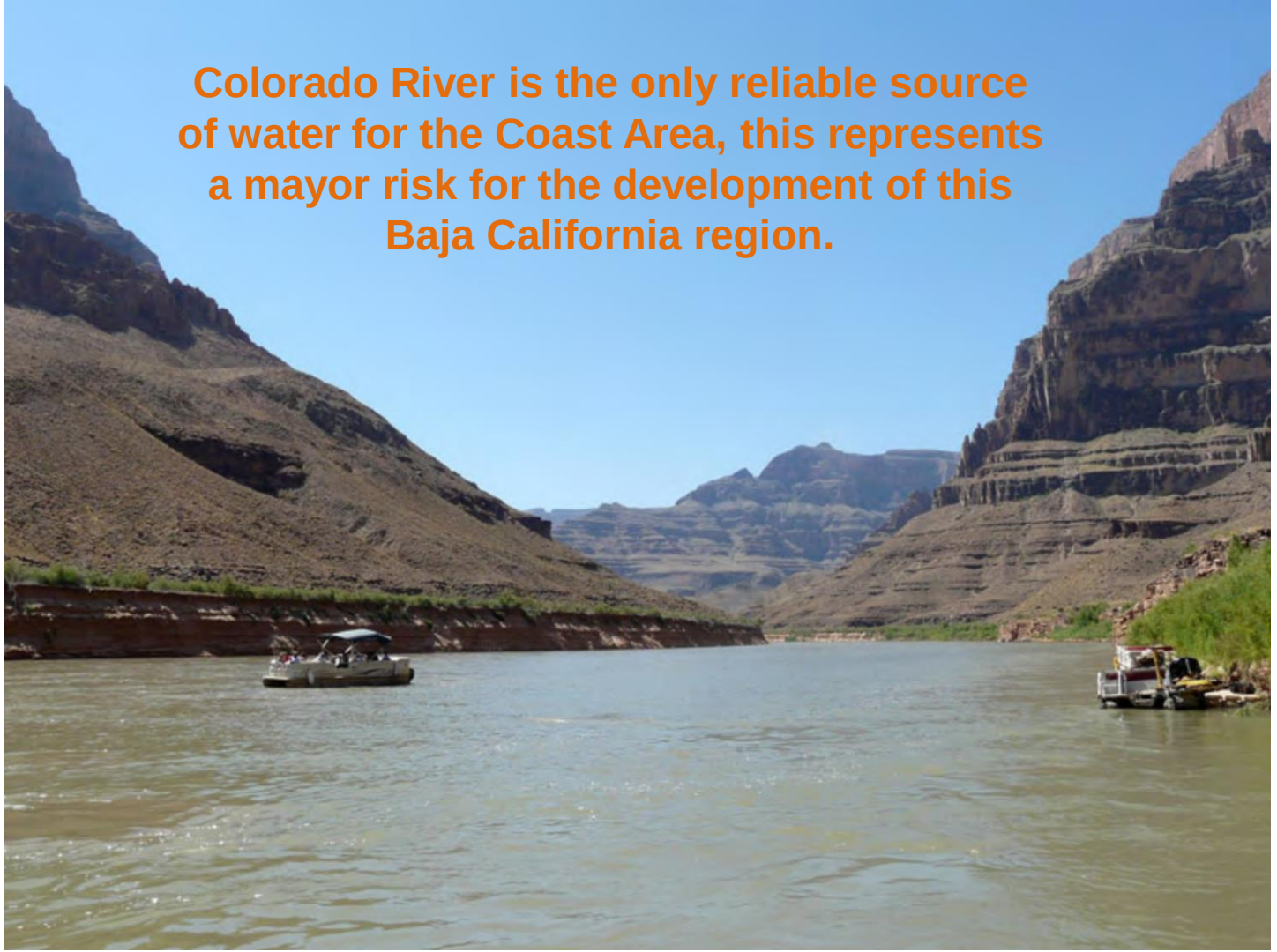
Strategic Diversification of Baja California's Water Supply Portfolio and the role of the Western Hemisphere's Largest Desalination Project

Ignacio (Iñaki) del Campo / John Tonner

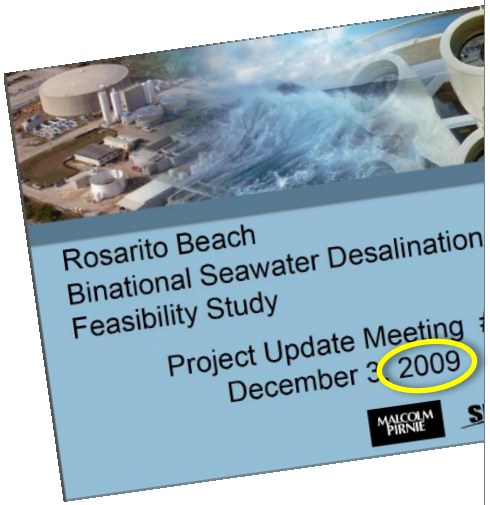
CWCO


Colorado River is the only reliable source of water for the Coast Area, this represents a mayor risk for the development of this Baja California region.

INTRODUCTION/MAIN OBJECTIVES OF THE PROJECT

- Provide Basic Public services to the Population
- Guarantee water supply in the area of Tijuana-Tecate-Playas de Rosarito - 2.8 milion people
- This area represents 52% of Baja California State Population.
- Rosarito SWRO Desalination Plant (Baja California - Mexico) will be the largest plant in Latin America 4.4 m3/s (380,000 m3/day) by 2,024
- The Government of Baja California decided to launch a bid for a PPA (Public Private Association) to Build and Operate during 40 years the largest Desalination plant in Latin America
- One of the most efficient in terms of Energy consumption (less than 3 kwh/m3)
- This presentation will focus as well in
  - Seawater intake location
  - Pretreatment selection (high risk of Algae Bloom and the potential risk of O&G presence)

A “FEW” STEPS BACK



A LANDMARK BINATIONAL SWRO PLANT ADDRESS SUSTAINABLE WATER SUPPLY ISSUES

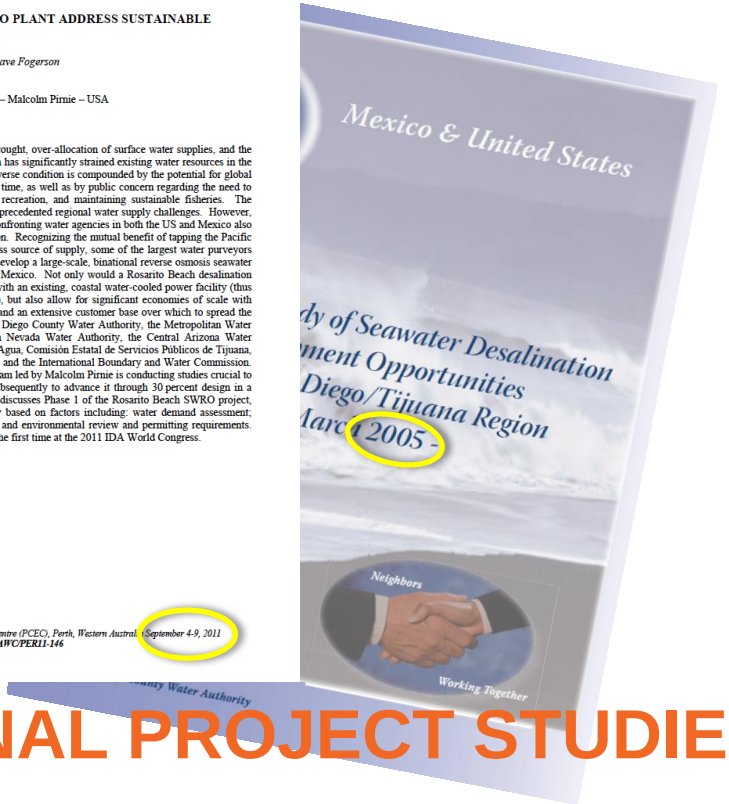
Authors: *Brent Alspach, Rick Kennedy, Dave Fogerson*

Presenter: *Brent Alspach*
Senior Environmental Engineer – Malcolm Pirnie – USA

Abstract

The combination of a severe and prolonged drought, over-allocation of surface water supplies, and the burgeoning water demand of a growing region has significantly strained existing water resources in the southwest US and northwest Mexico. This adverse condition is compounded by the potential for global climate change to yield less precipitation over time, as well as by public concern regarding the need to maintain environmental flows for aesthetics, recreation, and maintaining sustainable fisheries. The combination of these factors has resulted in unprecedented regional water supply challenges. However, the common problems of historic proportion confronting water agencies in both the US and Mexico also provide an opportunity for historic collaboration. Recognizing the mutual benefit of tapping the Pacific Ocean as a drought-proof and virtually limitless source of supply, some of the largest water purveyors on both sides of the border have partnered to develop a large-scale, binational reverse osmosis seawater desalination plant at a site in Rosarito Beach, Mexico. Not only would a Rosarito Beach desalination plant have the advantage of being co-located with an existing, coastal water-cooled power facility (thus resulting in lower capital and operating costs), but also allow for significant economies of scale with respect to both the large capacity of the plant and an extensive customer base over which to spread the costs. Participating agencies include: the San Diego County Water Authority, the Metropolitan Water District of Southern California, the Southern Nevada Water Authority, the Central Arizona Water Conservation District, Comisión Nacional del Agua, Comisión Estatal de Servicios Públicos de Tijuana, Comisión Estatal del Agua de Baja California, and the International Boundary and Water Commission. Working on behalf of the partner agencies, a team led by Malcolm Pirnie is conducting studies crucial to determine the feasibility of the project and subsequently to advance it through 30 percent design in a phased implementation approach. This paper discusses Phase 1 of the Rosarito Beach SWRO project, which focused on studying concept feasibility based on factors including: water demand assessment; siting evaluation; power supply investigation; and environmental review and permitting requirements. The results of Phase 1 are being presented for the first time at the 2011 IDA World Congress.

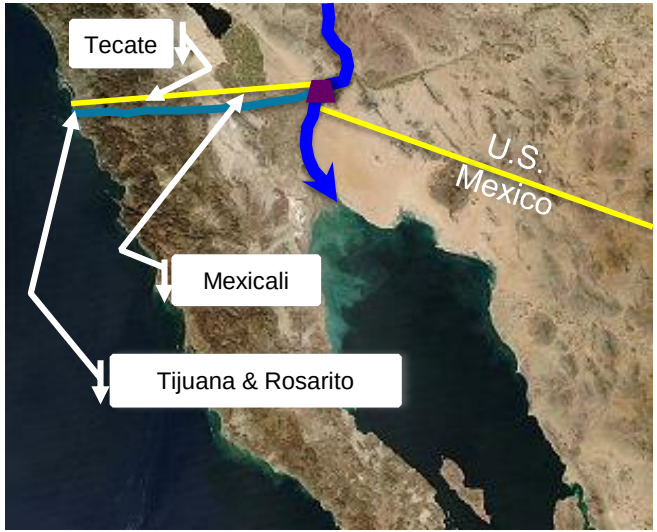
IDA *World Congress/Perth Convention and Exhibition Centre (PCEC), Perth, Western Australia, September 4-9, 2011*
REF: IDAWC/PER11-146



ORIGINAL BINATIONAL PROJECT STUDIES

BACKGROUND

- Tijuana/Rosarito receive up to 4.4 m^3/s of untreated water from the Colorado River
- Water is transported 200 km
- Tijuana and Rosarito's water supply is vulnerable to seismic damage of the canal and aqueduct infrastructure
- Tijuana and Rosarito are exceeding their concession. They are borrowing water from other users



U.S./Mexico Border
Colorado River
Canals and Aqueducts
Morelos Dam

Proyección del Consumo de Agua Tijuana-Rosarito

Tipo de usuario	2016	2017	2018	2019
Doméstico popular	1,049	1,077	1,106	1,136
Doméstico medio	1,799	1,847	1,897	1,948
Doméstico residencial	425	437	448	460
Comercial	276	284	291	299
Industrial	247	254	260	267
Gobierno	152	156	160	165
Total Demanda	**3,948**	**4,054**	**4,164**	**4,276**
Agua Río Colorado	3,780	3,780	3,780	3,780
Agua de pozos	37	37	37	37
Agua Presa Rodriguez	33	33	33	33
Pérdidas en Potabilizadoras	53	53	53	53
Pérdidas en la red	456	456	456	456
Total Oferta	**3,341**	**3,341**	**3,341**	**3,341**
Déficit o superavit	**(607)**	**(713)**	**(823)**	**(935)**

Fuente: Elaboracion propia con información de CESPT
Litros por segundo

A “FEW” STEPS BACK

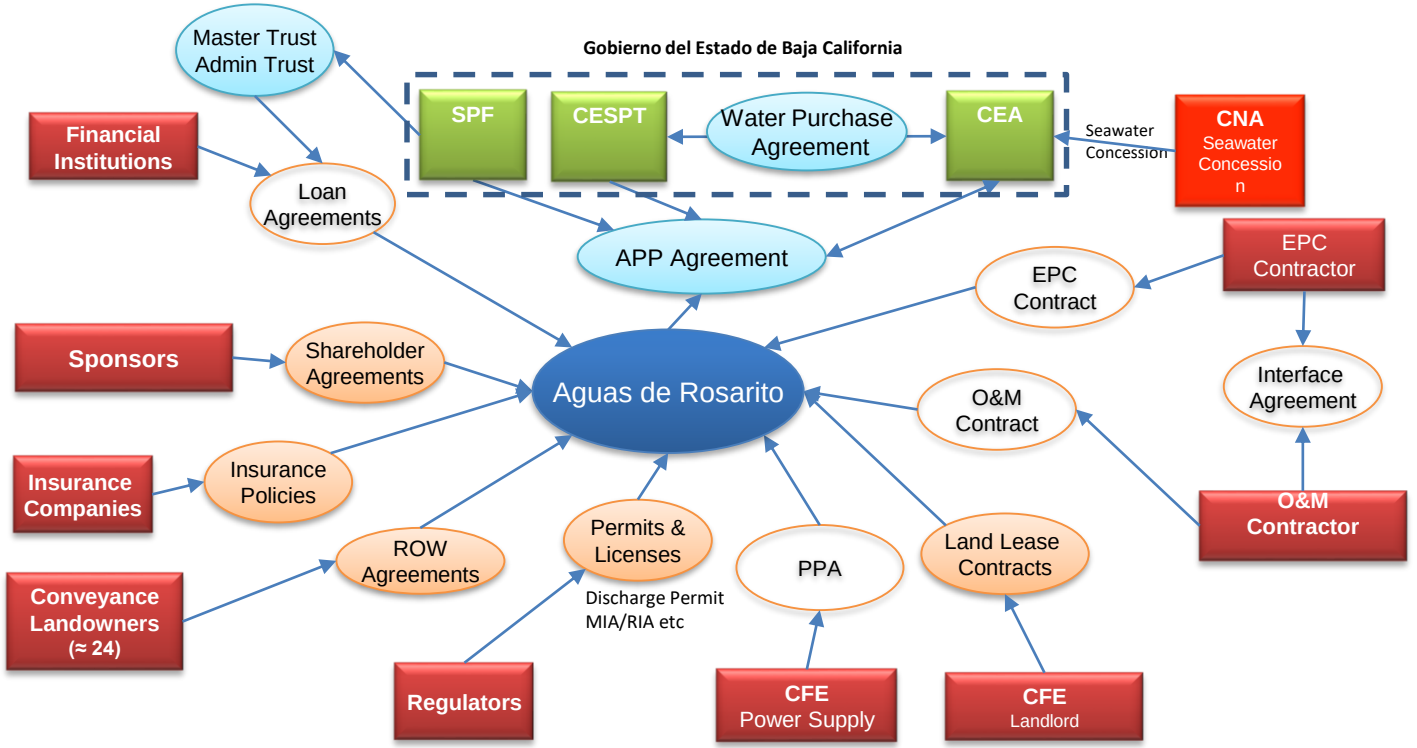
Rosarito SWRO

STAKEHOLDERS

APP PROCESS

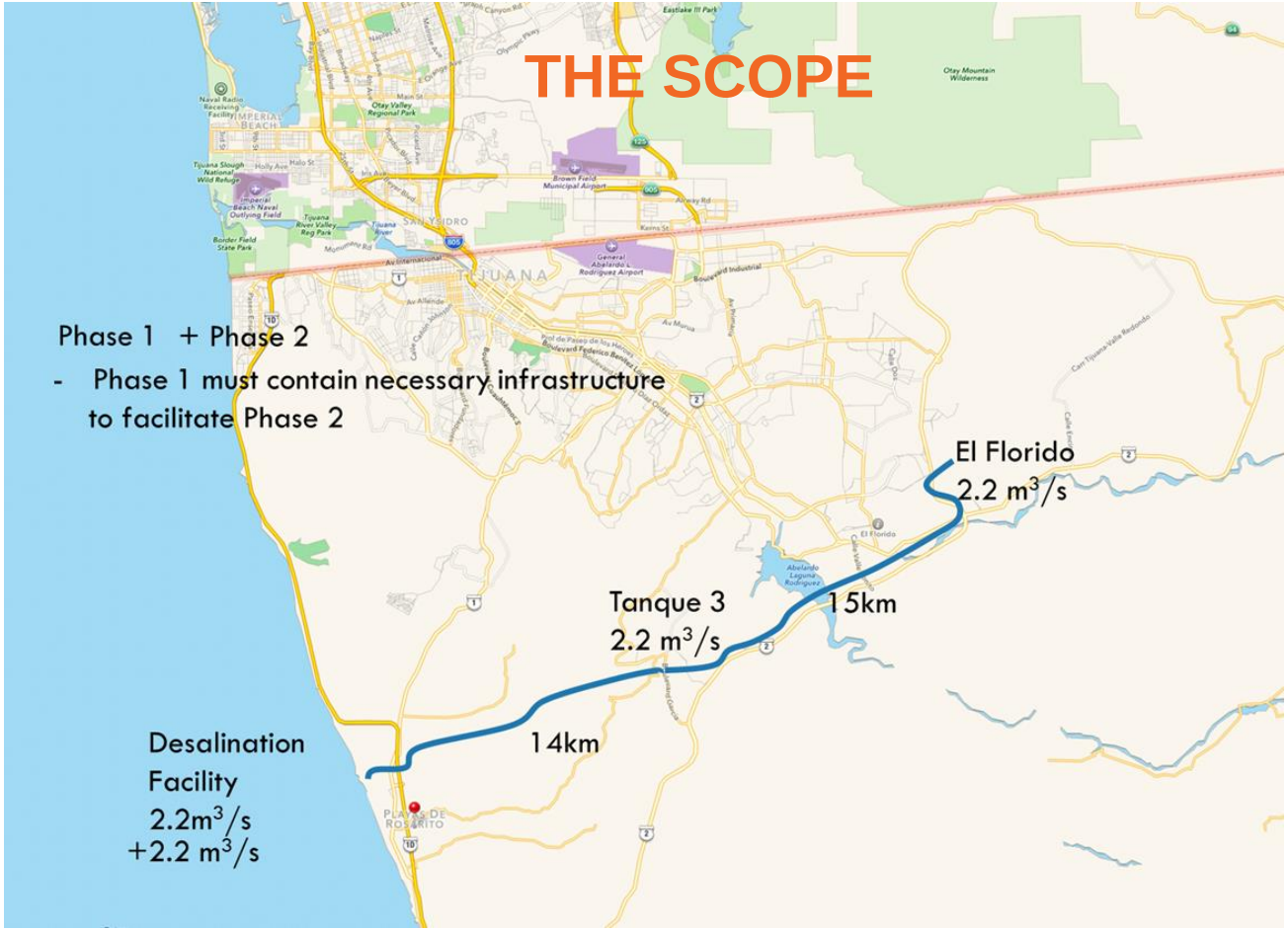
- RFP/ITB issued Nov 2015 for 4.4 m3/s Delivered to El Florido in 2 phases
  - Phase 1; 2.2m3/s delivered to Tanque 3 with **key infrastructure for 4.4 m3/s**
  - Phase 2; additional 2.2 m3/s delivered to El Florido TO BE IN SERVICE BY 2024
- Off taker will obtain Concession for the use of national water as feed water source
- Bidders free to select
  - a project site in the general Rosarito area
  - conveyance routes
  - source and discharge water location

APP PROCESS



APP= PPP Agreement **LTSA** = Long Term Service Agreement **EPC** = Engineer, Procure, Construct **PPA** = Power Purchase Agreement

THE SCOPE


Phase 1 + Phase 2
- Phase 1 must contain necessary infrastructure to facilitate Phase 2
El Florido
2.2 m³/s
Tanque 3
2.2 m³/s
15km
14km
Desalination Facility
2.2m³/s
+2.2 m³/s

DESIGN INPUTS

SEAWATER

Parameters	Units	Value
Cl	mg/l	20,064
S	mg/l	2,734
Br	mg/l	90
HCO3	mg/l	144
F	mg/l	0
I	mg/l	0
Na	mg/l	10,916
Mg	mg/l	1,321
Ca	mg/l	349
K	mg/l	670
Si	mg/l	1
Sr	mg/l	6
TDS	mg/l	36,353
SS	mg/l	30
Turbidity	NTU	20
TOC	mg/l	5
O&G	mg/l	10
Hydrocarbons *	mg/l	0.5 (max*< 1)

TREATED WATER

Parameters	Units	Value
pH	-	6.5 – 8.5
TDS	mg/l	< 1,000
Chloride	mg/l	< 250
Hardness (as CaCO3)	mg/l	> 45
Turbidity	NTU	< 5
LSI	-	-0.5 <LSI< 0.5
Calcium	mg/l	500
Boron	mg/l	2.4

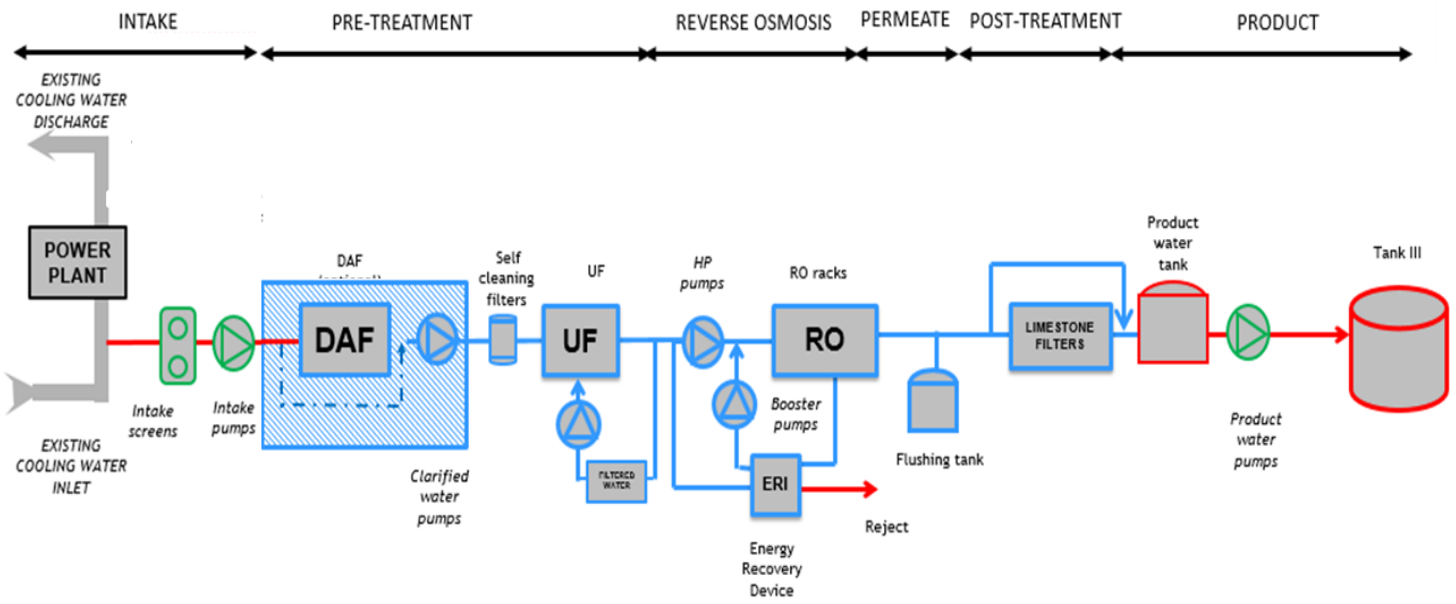
TEMPERATURE RANGE

13 - 25

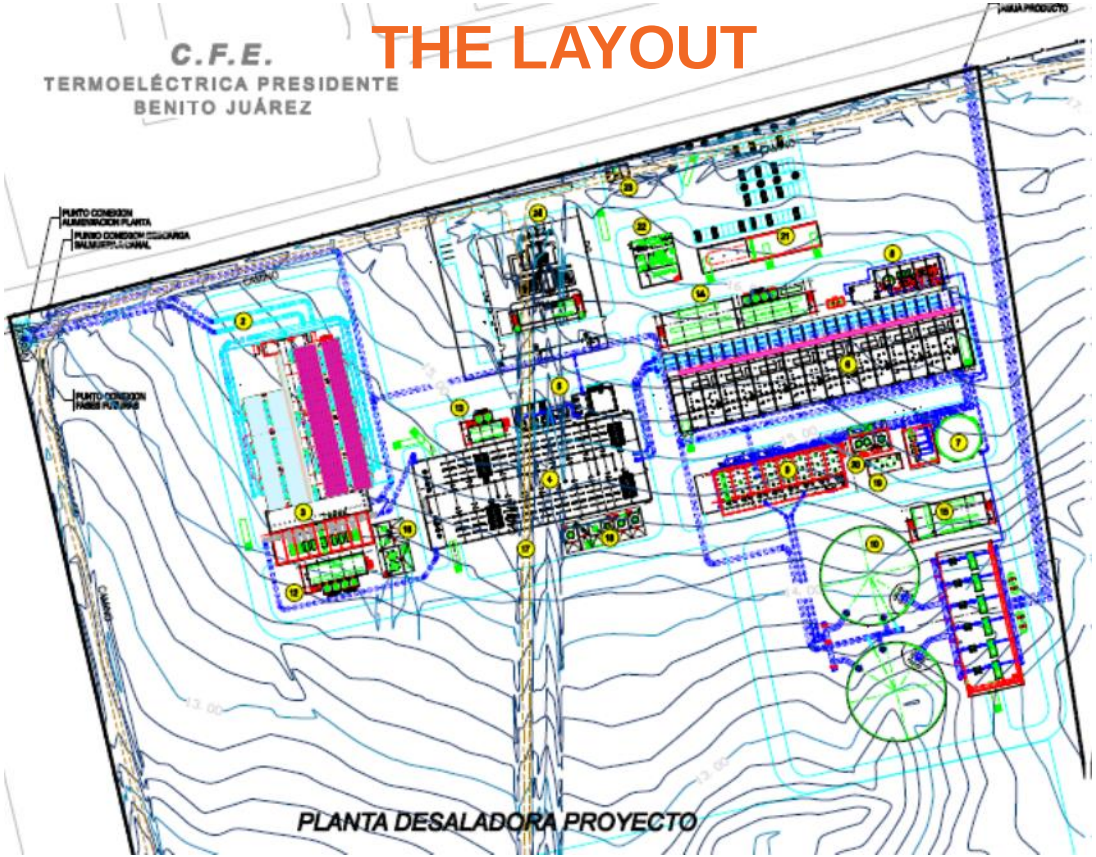
“AVAILABILITY”

- Project site adjacent to CFE Benito Juarez power plant (up to 8,8 m3/s)
  - Geotech and surveys complete
  - Environmental Studies
- Lease for land within CFE’s site and immediately adjacent to residual water pozos AND CFE’S INTAKE CANAL
  - Geotech and survey complete
- Identified a feasible conveyance route
  - Geotech and surveys for the conveyance alignment complete
  - Environmental Studies
- Discharge dispersion modeling
- Commitment from CFE to provide 80 MW of power at 230kV
- 14 months of Seawater data

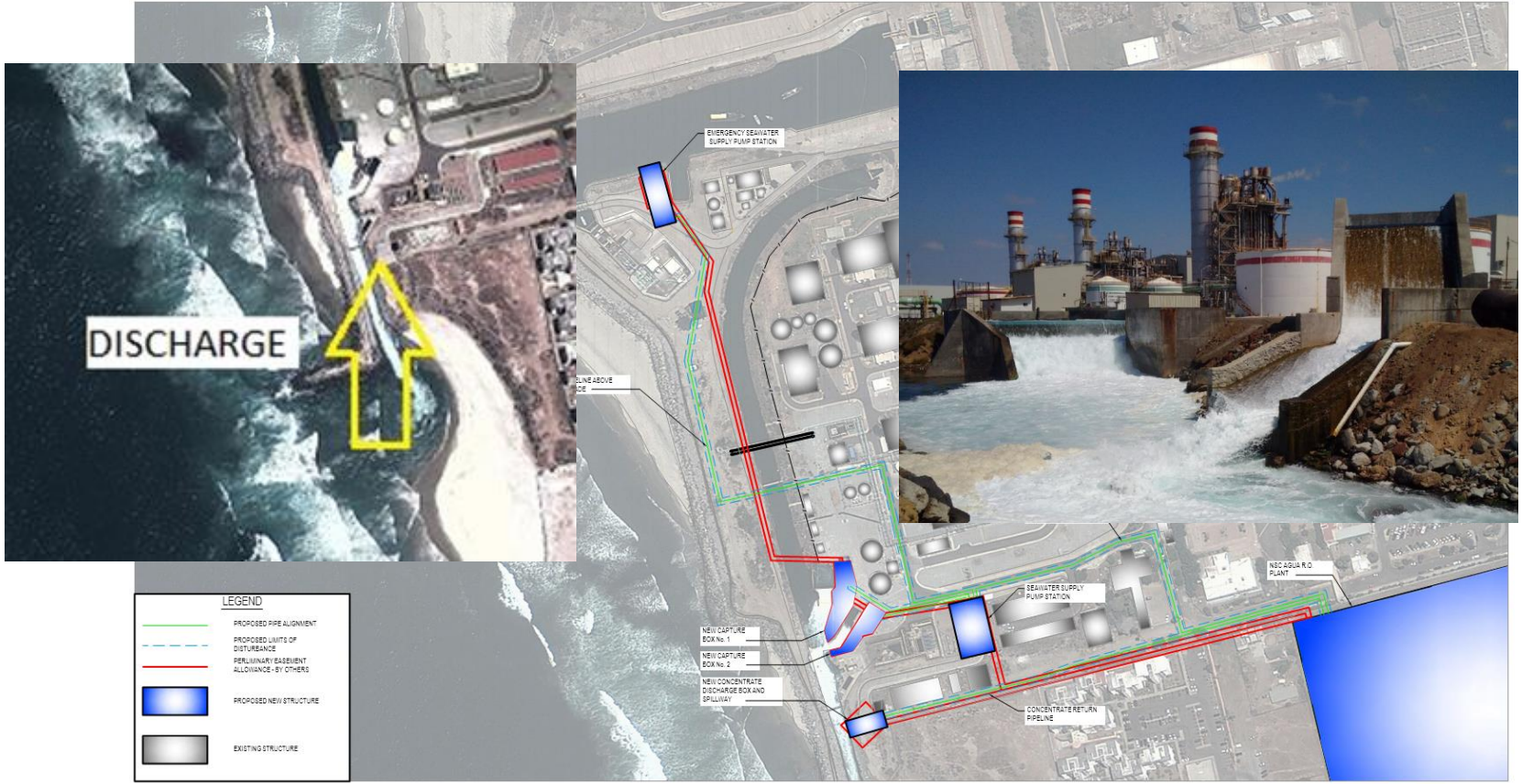
THE PROCESS


INTAKE
PRE-TREATMENT
REVERSE OSMOSIS
PERMEATE
POST-TREATMENT
PRODUCT
EXISTING COOLING WATER DISCHARGE
POWER PLANT
EXISTING COOLING WATER INLET
Intake screens
Intake pumps
DAF
Clarified water pumps
Self cleaning filters
UF
FILTERED WATER
HP pumps
RO racks
RO
Booster pumps
ERI
Energy Recovery Device
Reject
Flushing tank
LIMESTONE FILTERS
Product water tank
Product water pumps
Tank III
4,4 m3/s
2,2 m3/s
2,2 m3/s and CW for 4,4 m3/s

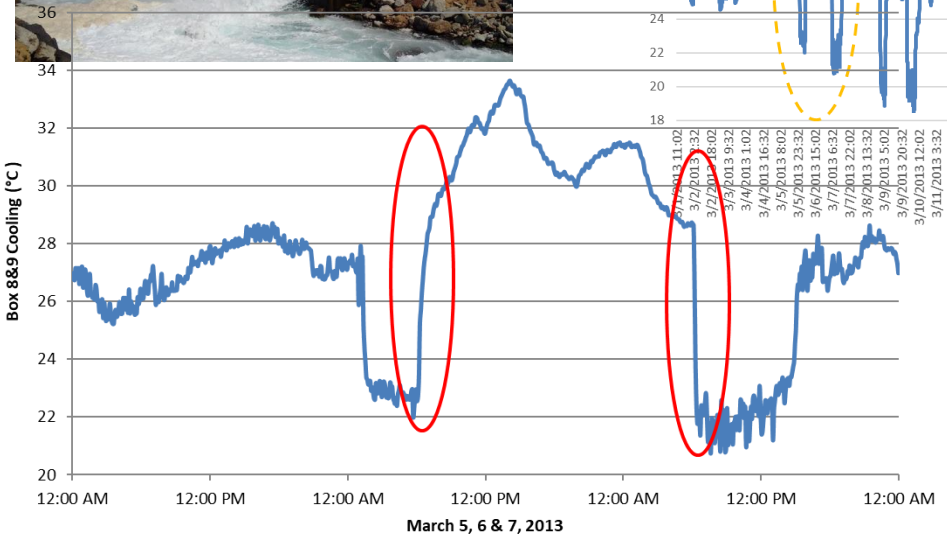
THE LAYOUT

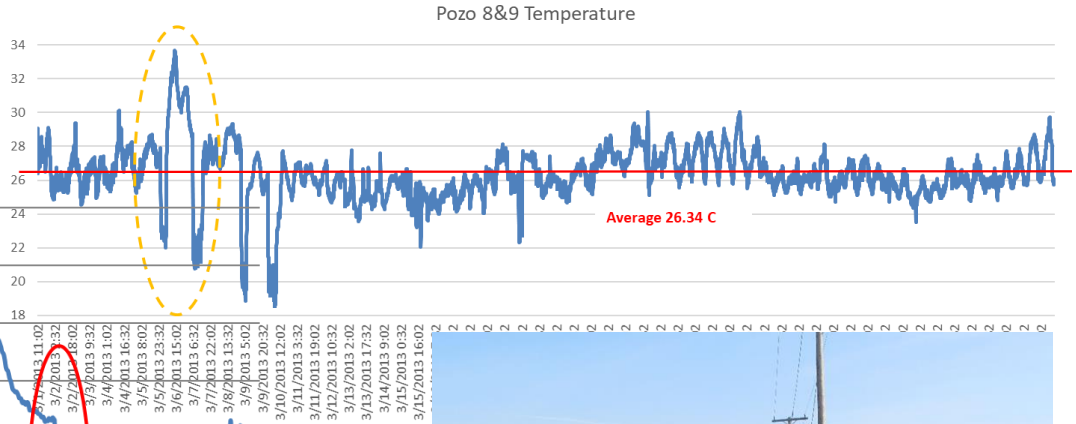

C.F.E.
TERMOELÉCTRICA PRESIDENTE
BENITO JUÁREZ
PLANTA DESALADORA PROYECTO

INTAKE AND DISCHARGE



INTAKE SELECTION

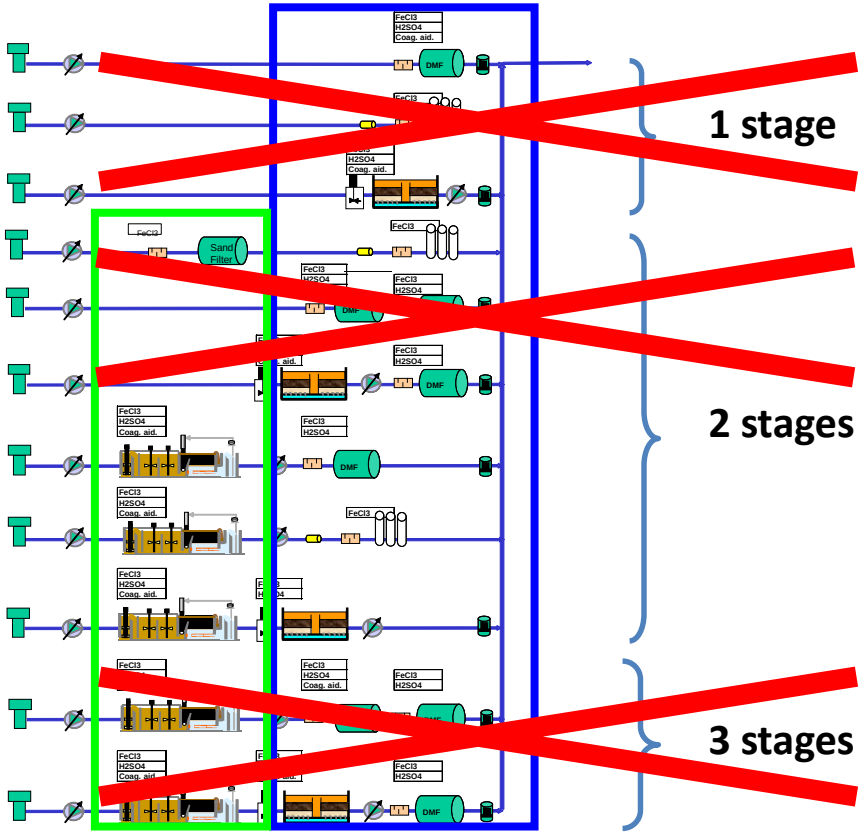




PRETREATMENT SELECTION

- Main challenges to face
  - Algae bloom
  - Hydrocarbons
  - Reliability
- Decision based in NPV and life cycle cost

PRETREATMENT SELECTION



	SeaDAF™ + DMGF	SeaDAF™ + DMPF	SeaDAF™ + UF
DAF	55	55	55
DMGF	35		
DMPF		40	
UF			45
CAPEX	90	95	100

	SeaDAF™ + DMGF	SeaDAF™ + DMPF	SeaDAF™ + UF
Energy	74	76	78
Reagents	18	18	6
Replacements	6	6	4
OPEX	98	100	88
NPV 30 years	97	99	92

Percentage

RO SELECTION

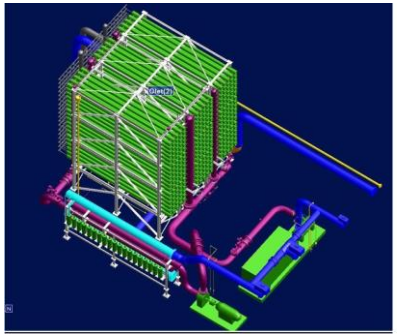
- RO Energy consumption represents 60-70% of the Total SWRO Plant
- UF selections allows more design options for the RO (Flux, Recovery, Configuration)
- Flux and Recovery
  - Better NPV
  - N-1 Operation possible

15 lmh & 48%

- Design
  - Higher Capex/Lower OPEX

Hybrid Design with VFDs in HP Pumps

- 8 RO trains x 228 PV x 7 membranes



HOW TO BE BELOW 3 KWH/M3?

- ENERGY CONSUMPTION
  - MAIN PUMPS ARE VFD DRIVEN
  - SELECTION OF EQUIPMENTS BASED IN EFFICIENCY VS CAPEX

	SEC (kWh/m³)
Intake	0.181
Pre-treatment	0.407
RO	2.215
Remin	0.012
Others	0.135
TOTAL SWRO Plant	**2.950**
Including Treated wáter Pumping	**4.450**

AT WHAT COST?

	Total Tariff MXN/m^3	Total Tariff USD/m^3	Total Tariff USD/10^3USG	Total Tariff USD/AF
T1 (CAPEX)	8.93	0.516	1.953	636.49
T2 (O&M FIX)	2.06	0.119	0.450	146.79
T3 (O&M VAR)	1.00	0.058	0.220	71.54
T4 (O&M ELEC)	3.49	0.202	0.765	249.17
TOTAL Rosarito APP	**15.48**	**0.895**	**3.388**	**1,103.98**

KEY POINTS

- "Talked about for many years" however the APP (PPP) process was started less than 3 years ago and now the largest SWRO project in the Western Hemisphere is under contract with extensive environmental and fiscal review processes in place
  - APP is a PPP model closer in some ways to the Australian "Alliance" approach than typical US PPP
- The project was VERY competitively tendered
- The rights and ownership of the water remain in the public sector
  - GobBC/GobMex can negotiate sale of water to other agencies or possibly trade rights
- The project is entirely privately financed but transparent irrevocable government support ensures low financing rates
- The primary public sector risk is "demand risk" or deciding how large the facility should be.
  - The APP Framework requires mandatory 3rd party socio-economic studies to determine the capacity.

THANKS!!!