ETHEKWINI MUNICIPALITY- HITACHI

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HITACHI
Inspire the Next

SEA WATER

DESALINATION AND REUSE PROJECT

Presented by : Lalitha Moodley

BACKGROUND

- Current studies underway by EWS to assess Inner City Water Demands indicate an non-peaked demand of approximately 65 Ml/day
- This demand outstrips the supply of 50 Ml/day and thus the need to augment the supply by 15 Ml/day by 2020. This is to be done in a phased approach as the demand grows with development in the Inner City.
- Hitachi has been in discussion with eThekwini Municipality for since 2013.
- A visit in March 2013 by EWS and Umgeni Water to Japan to see the RW technology, led to a general MOU between Hitachi and EWS.

Hitachi in the Water Business

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From System and EPC *1 to BOT*2/BOO*3/Concession

MWSC *4 (Maldives)

HSWS *5 (UAE)

BOT /BOO Concession

Purification Plant

Sewage Plant

Supervision and Control system

Operation and Management

Membrane Bioreactor system

EPC

Water Distribution Control System

Pipe Network Management System

Products and Systems

Desalination RO*6 unit

Pump (Irrigation)

*1. EPC : Engineering Procurement Construction
*2. BOT : Build-Own-Transfer
*3. BOO : Build-Own-Operate

*4. MWSC : Male' water and sewerage company
*5. HSWS : Hi Star Water Solutions LLC
*6. RO: Reverse Osmosis

The Long Road to Project Inception

- Sought and obtained Council Resolution to enter into negotiations with Hitachi on a Project with "no Cost to Council"
- Hitachi in the meantime approached various funding agents to fund the project including JICA and NEDO
- New Energy Development Organization (of Japan) agreed to fund the Project
- EThekwini signed a MoU with NEDO
- An "Implementation Document" was discussed and Developed with Hitachi

High Level Technical comparison of Energy-saving desalination and conventional desalination

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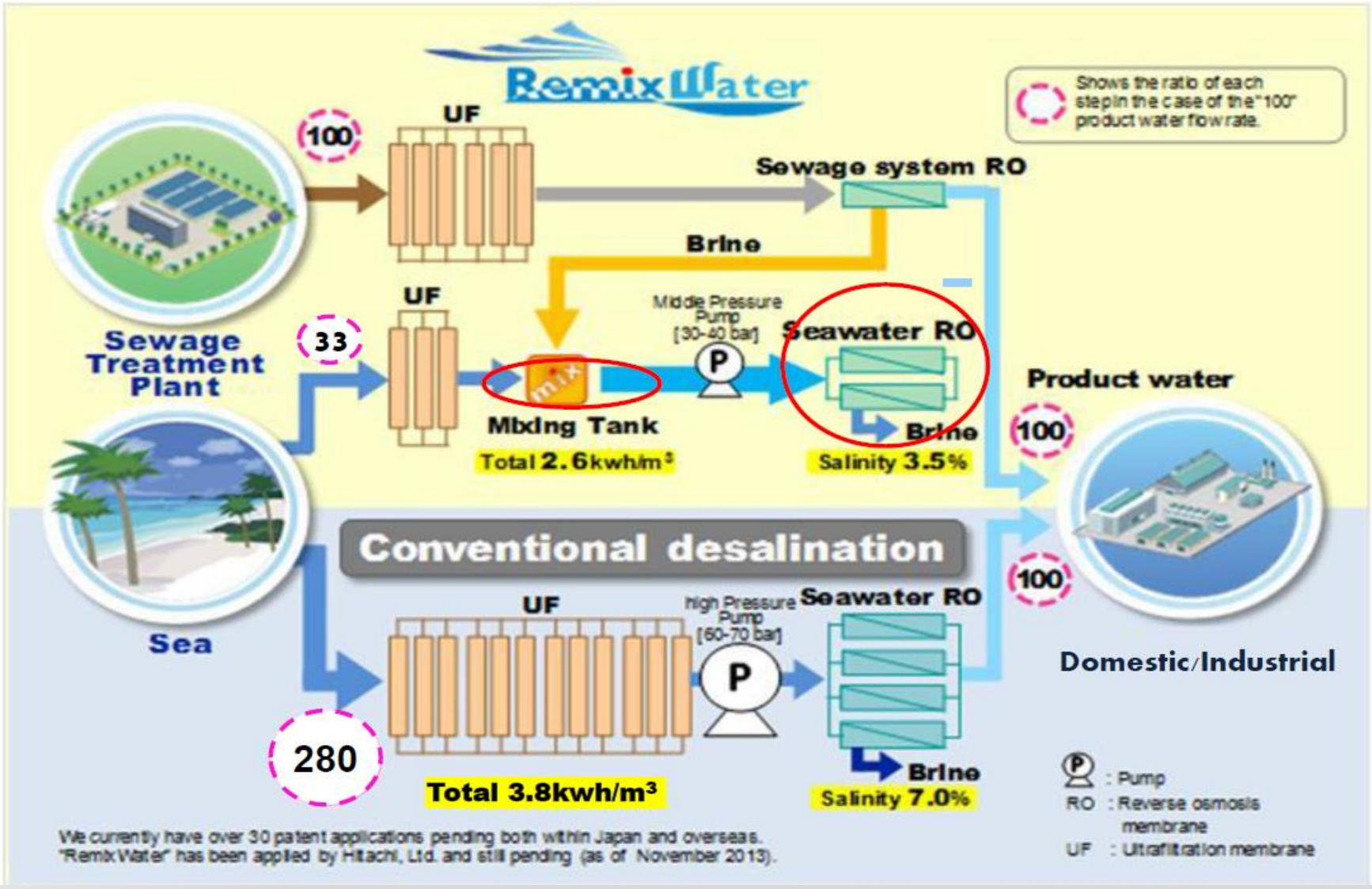
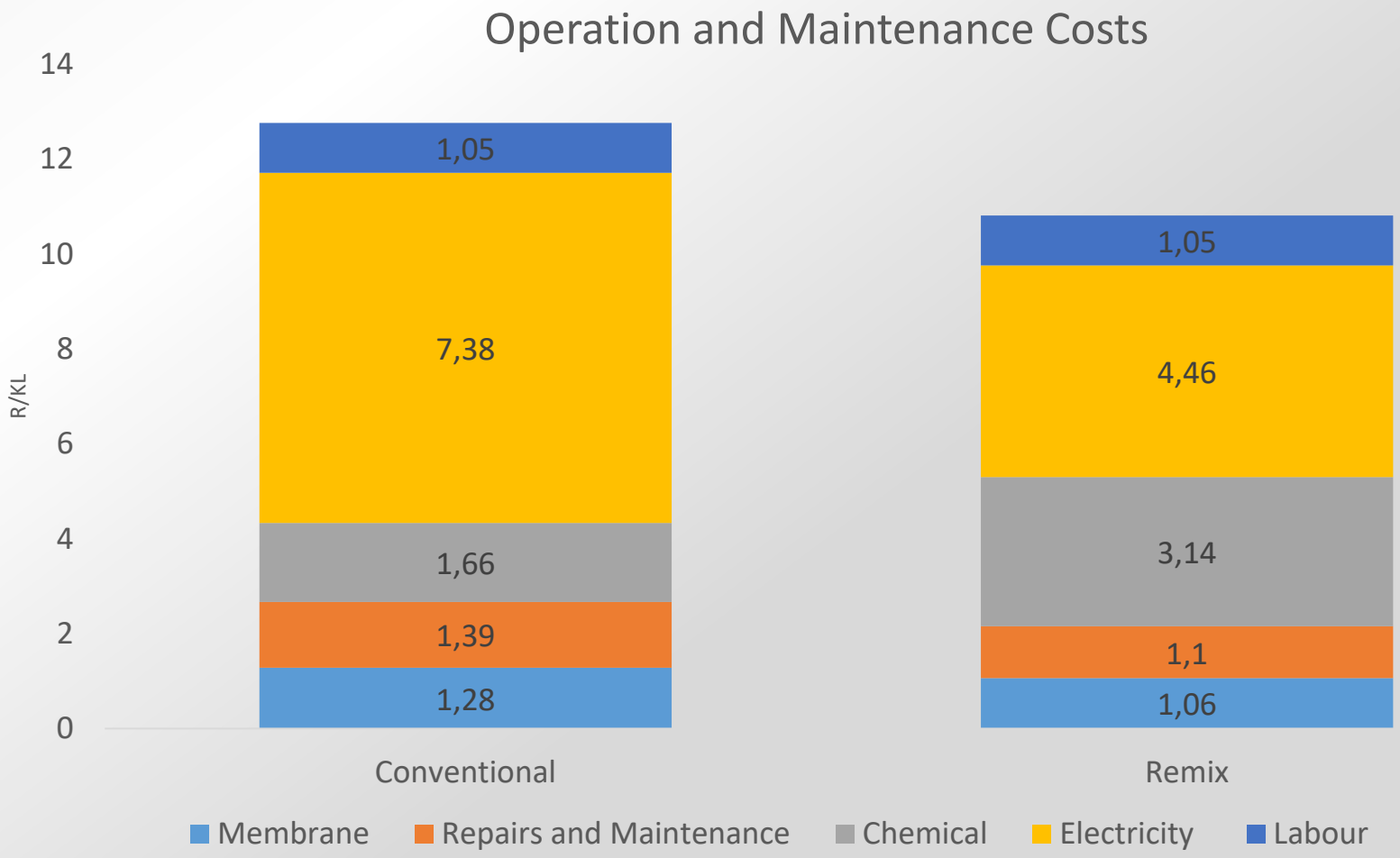


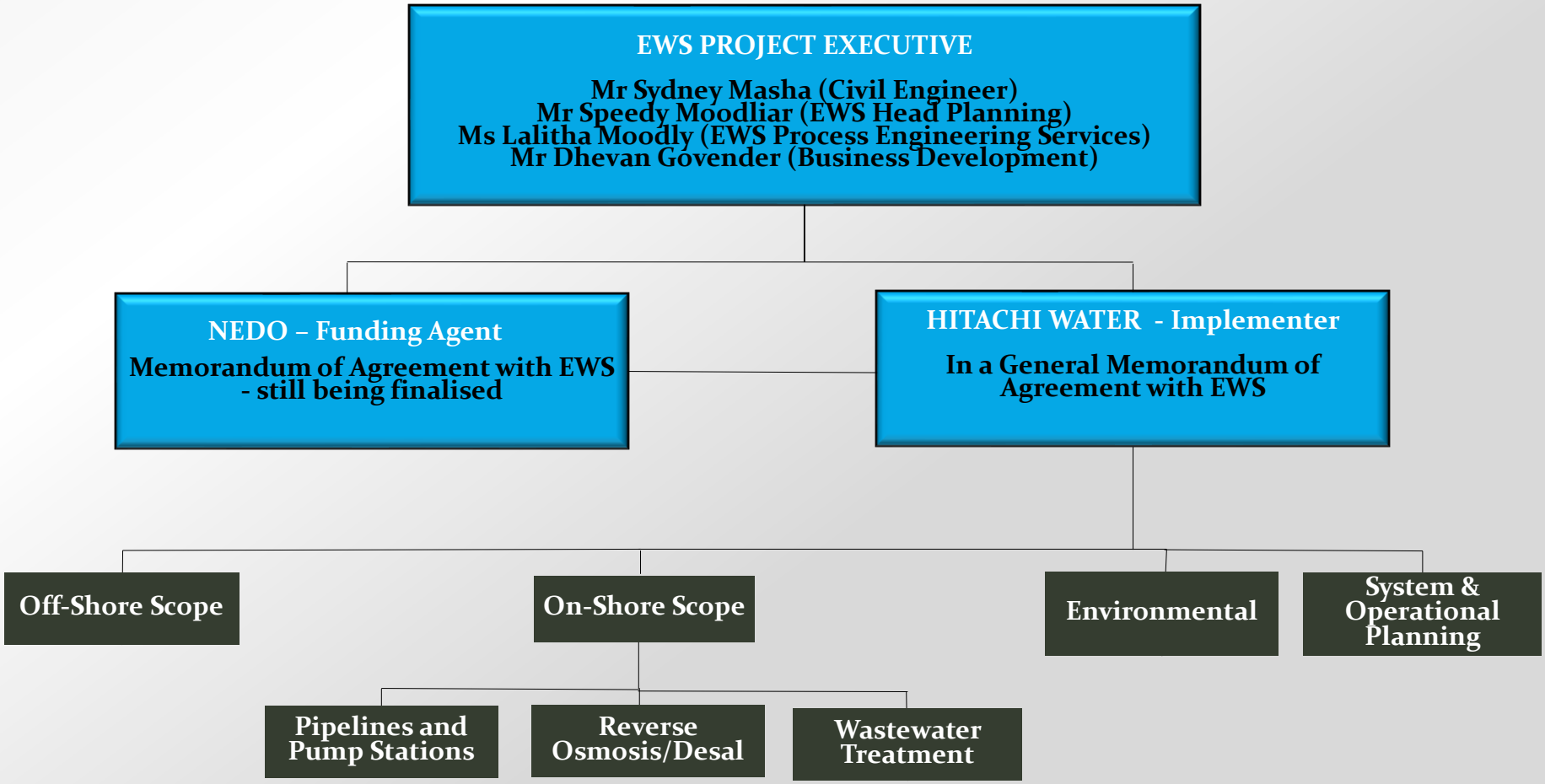
Conventional & Remix Desalination



WHAT PROJECT ?

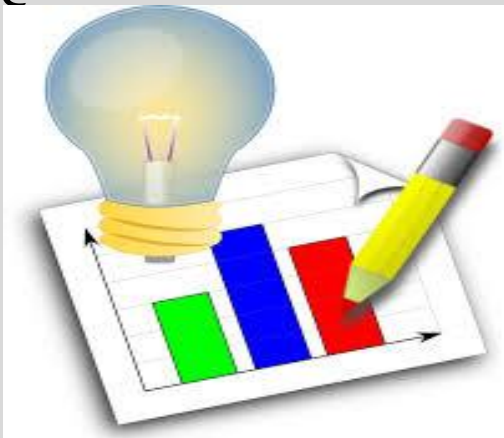
- Hitachi to **DEMONSTRATE** that the concept would work for South Africa by building a Pilot Scale plant with an Outflow Capacity of 6.25 MLD .
- They would have a demonstration period of 1 year to prove that the plant could meet SANS 241 quality standard for drinking water.
- During the “Demonstration phase” all water would be discarded to the outfall.
- All costs to be borne by NEDO (or Hitachi)

THE PROJECT TEAM



PRE FEASIBILITY AND SITE SELECTION

- AURECON were the consultants selected to undertake the Pre Feasibility for Hitachi
- They also looked at several different sites for a location for the Project .
- These included : Northern WWTW , Kwa Mashu WWTW , Tongaat WWTW and Central WWTW
- Looked for sites with :
  - Low Industrial Effluent in the incoming sewage
  - Close to the ocean
  - An easy discharge for the Brine
- Central WWTW ticked all the boxes



PROJECT SITE

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PROJECT PLANNING PHASE

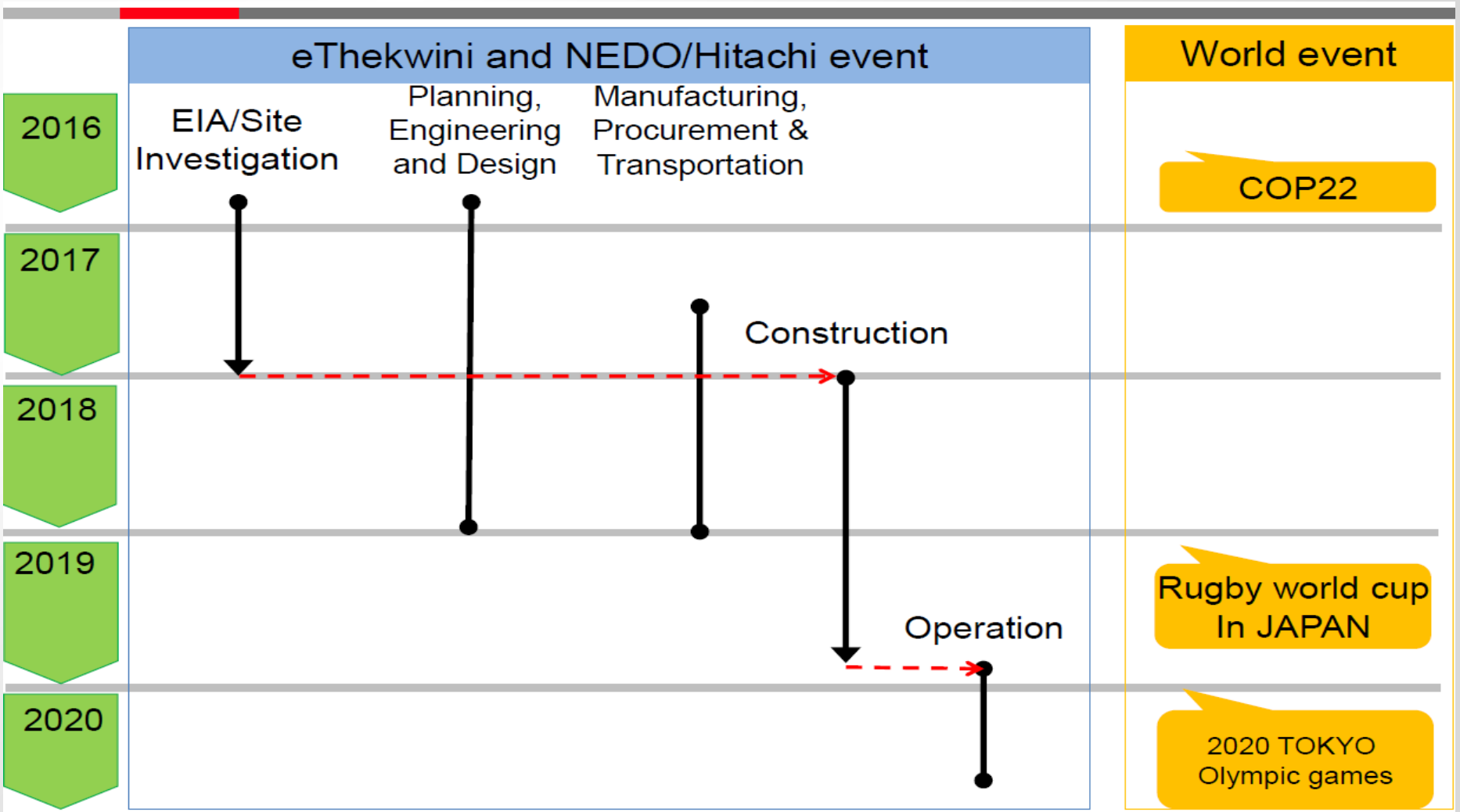
- Necessary Site data collected :
  - Drawings
  - Effluent Quality
  - Effluent Quantity
  - Sampling

- Permission to Occupy
- Authorizations ?? ??

DESIGN AND PROCUREMENT PHASE

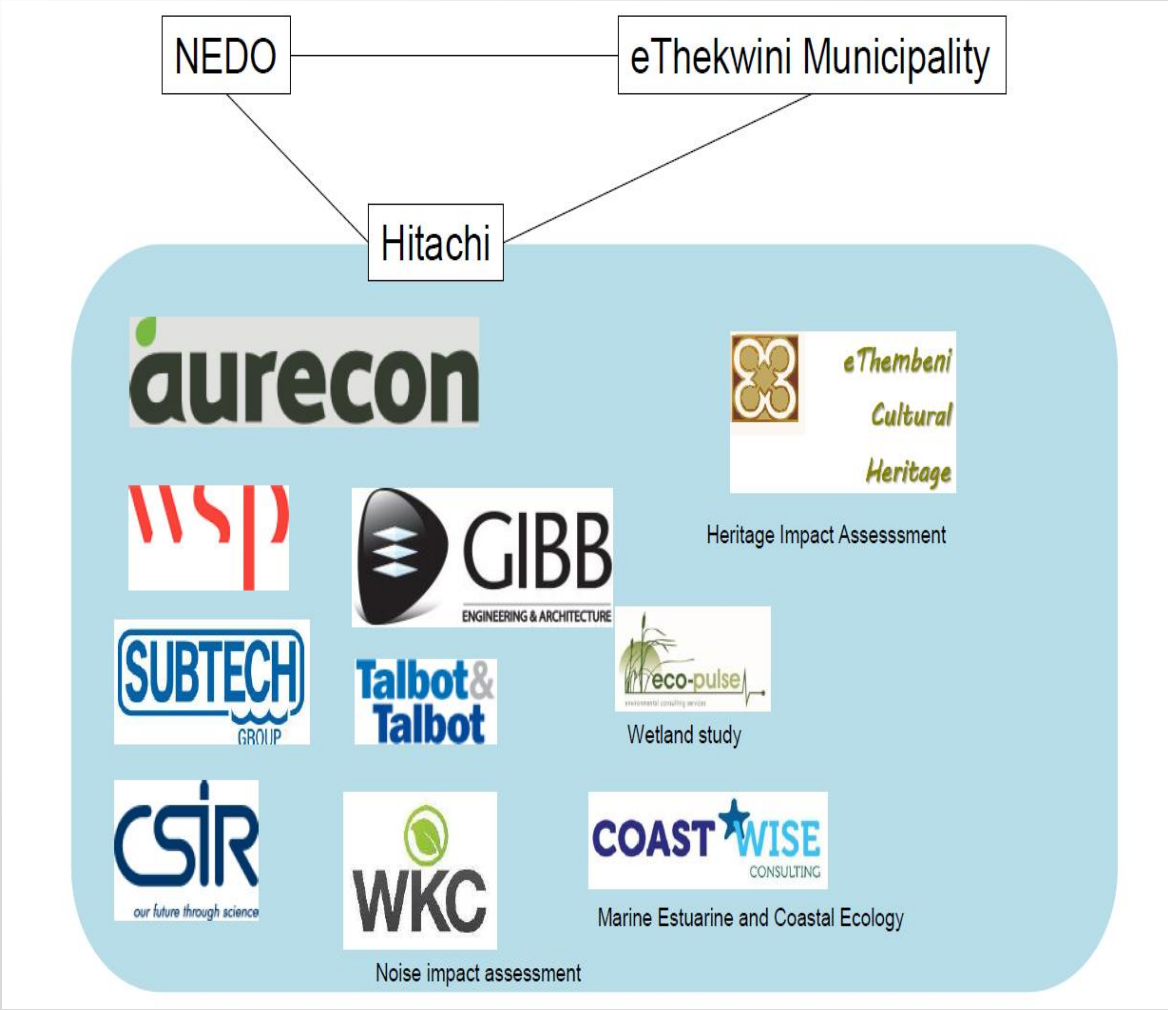
- SUB COMMITTEE FORMED not to be confused with the Steering committee
- CHARTER OF VALUES spelt out:
  - Purpose of the Committee – Primary Functions and Approval Responsibilities
  - Membership & Roles of Members
  - Meetings – Schedule and Process

HIGH LEVEL SCHEDULE



EIA /SITE INVESTIGATION TEAMS

- AURECON – CONTRACT MANAGEMENT SERVICES
- GIBB – ENVIRONMENTAL AUTHORISATIONS :
  - EIA ,WUL , CWDP
- WSP – MARINE INVESTIGATIONS
- Many other sub consultants perform Specialist studies



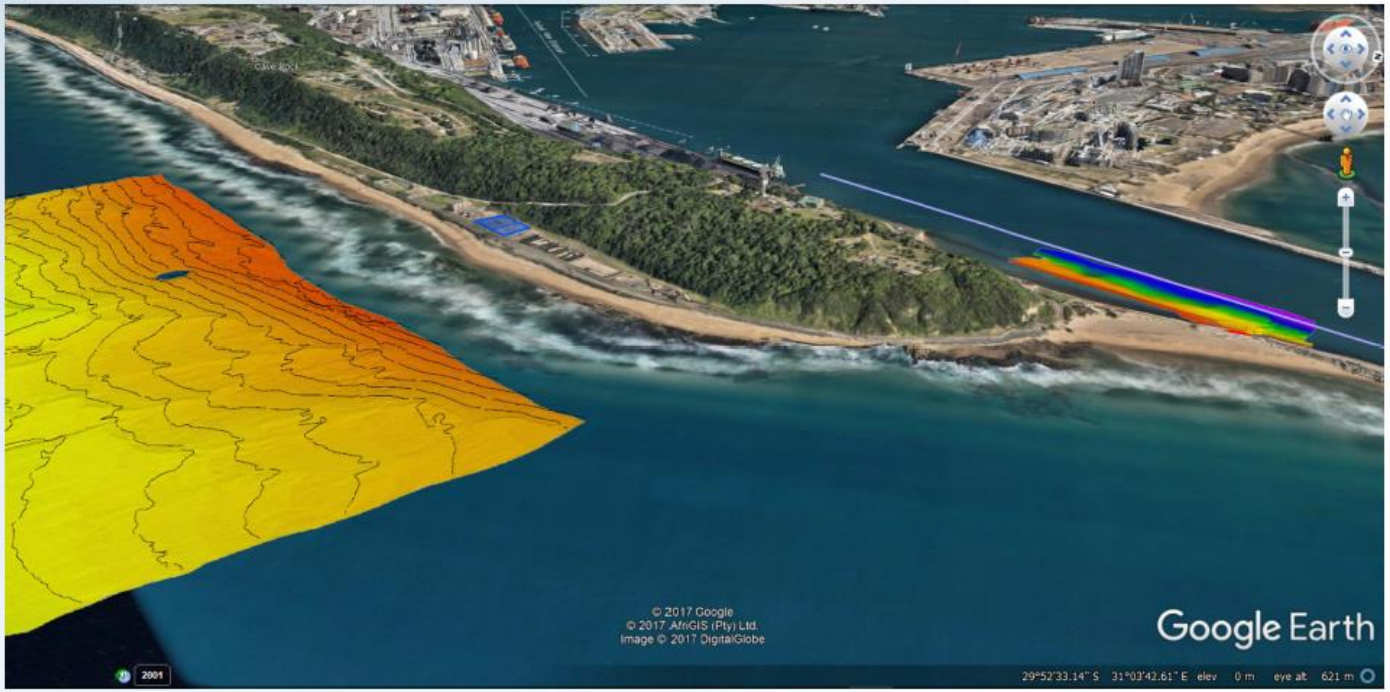
MARINE INVESTIGATION SCOPE

Field Investigations

WHY

- Understand the surrounds and environment
- Inform designs
- Option study on intake
- Old site with substantial unknown services
- Reduce risk

Location



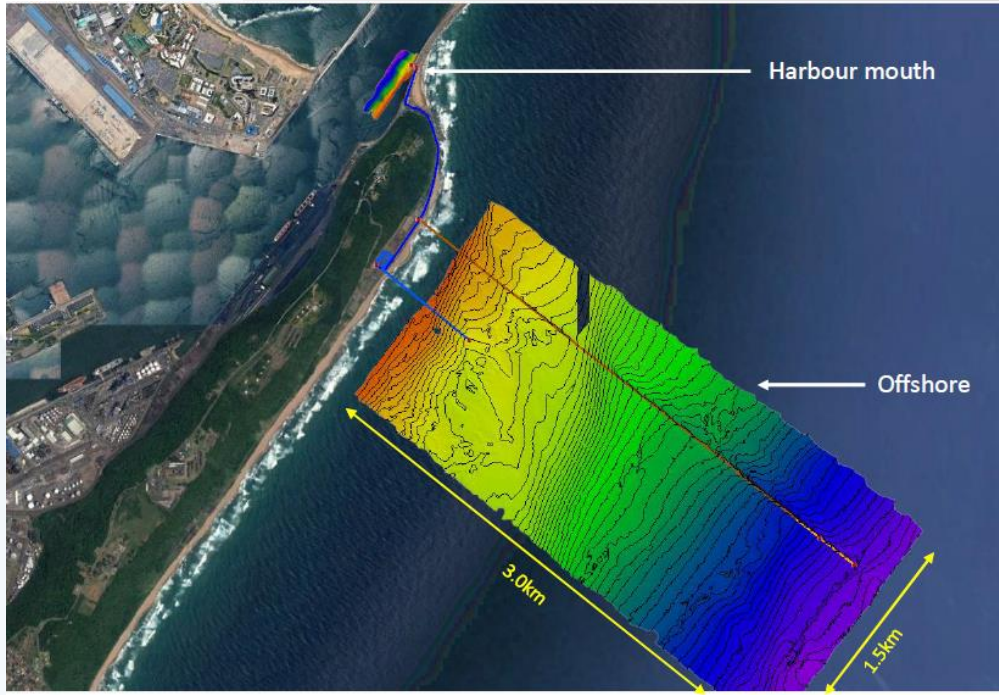
MARINE INVESTIGATION

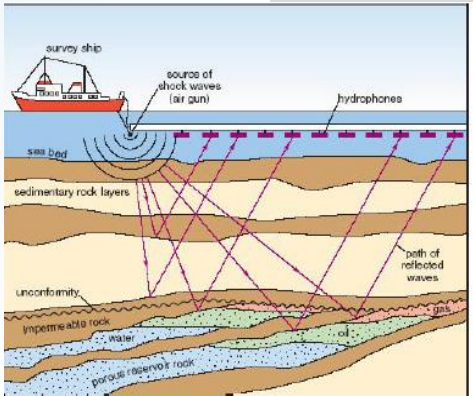
Marine Work

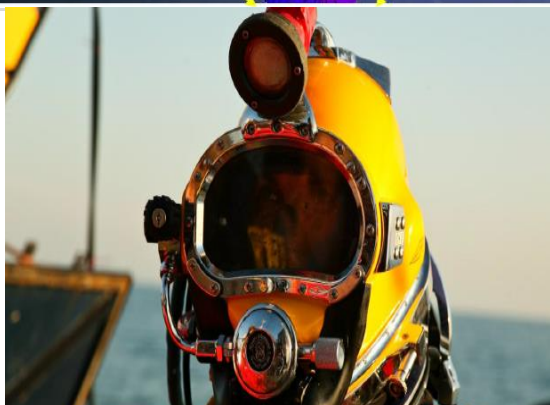
- A-1 Bathymetric survey (multi-beam)
- A-4 Geophysical survey (pinger)
- A-5 Diver survey:
  - Intake route
  - CWWTW outfall
  - Harbour mouth
- A-6 ROV survey CWWTW Diffuser
- A-7 Current and Wave measurement via ADCP
- A-8 Seawater quality sampling and analyses

Onshore Work

- B-1 & B-4 Topographical survey
- B-2 & B-5 Geotechnical investigation
  - For foundations (boreholes and trail pits)
  - For HDD
  - Groundwater yield testing (CWWTW CP System influence)
- B-3 & B-5 Geophysical investigation (GPR)
- B-6 Sewage quality sampling and analyses







B-2 & B-5 Geotechnical investigation (For foundations)

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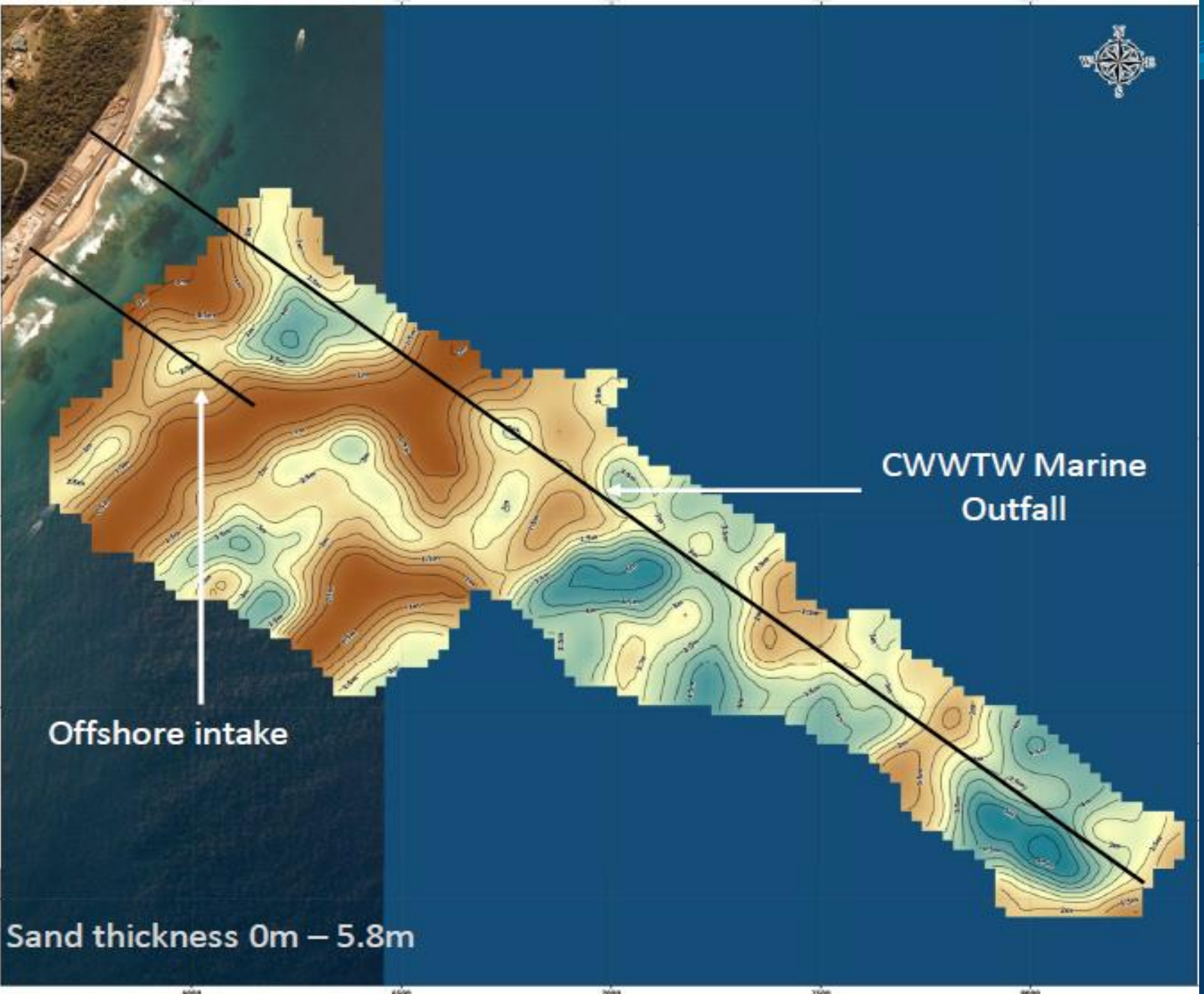
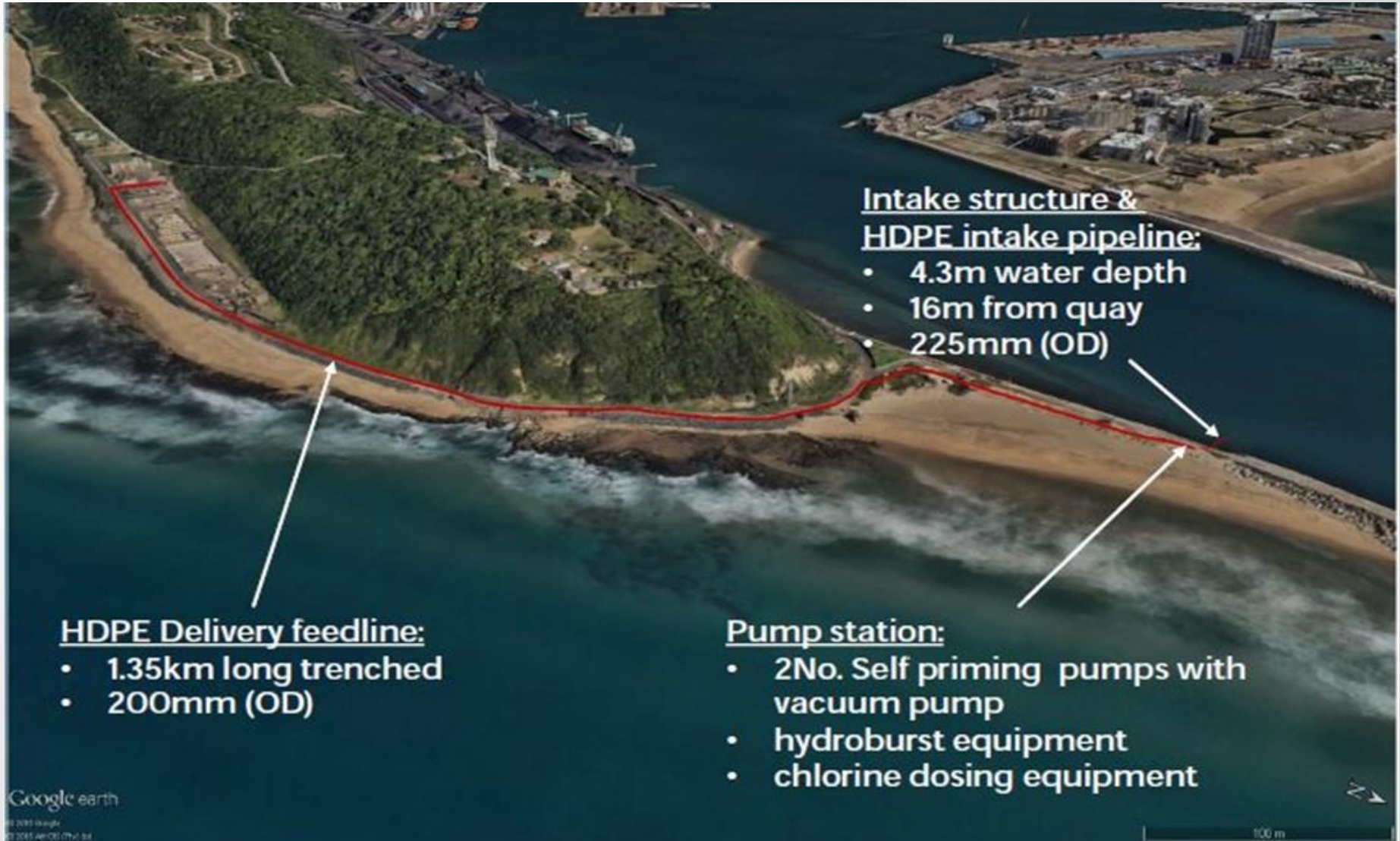
B-2 & B-5 Geotechnical investigation (Groundwater yield testing)

POSITION	Latitude/Longitude (hddd°mm'ss.s")
BH1	S29 52 47.3 E31 03 28.6
BH2	S29 52 45.6 E31 03 29.0
BH3	S29 52 48.2 E31 03 28.9
BH4	S29 52 47.0 E31 03 28.0


CWWTW Marine Outfall
Offshore intake
Sand thickness 0m – 5.8m

LOCATION OF INTAKE INFRASTRUCURE



WATER QUALITY ANALYSIS

DESIGN OF WASTEWATER REUSE

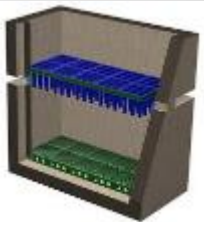
- Understanding what is existing and how to use it
- Designing for tertiary treatment of wastewater – Process technology selection
- Blending into the Remix System

REMIX WATER TECHNOLOGY

Central WWTW Feed

BWRO
75% Recovery

AOP



Stabilization

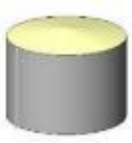
Cl_2

Post Treatment

Recovery
60%

Seawater Feed

DAF



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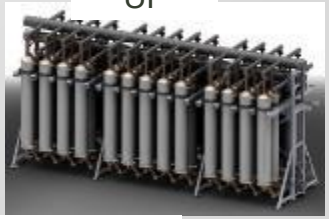
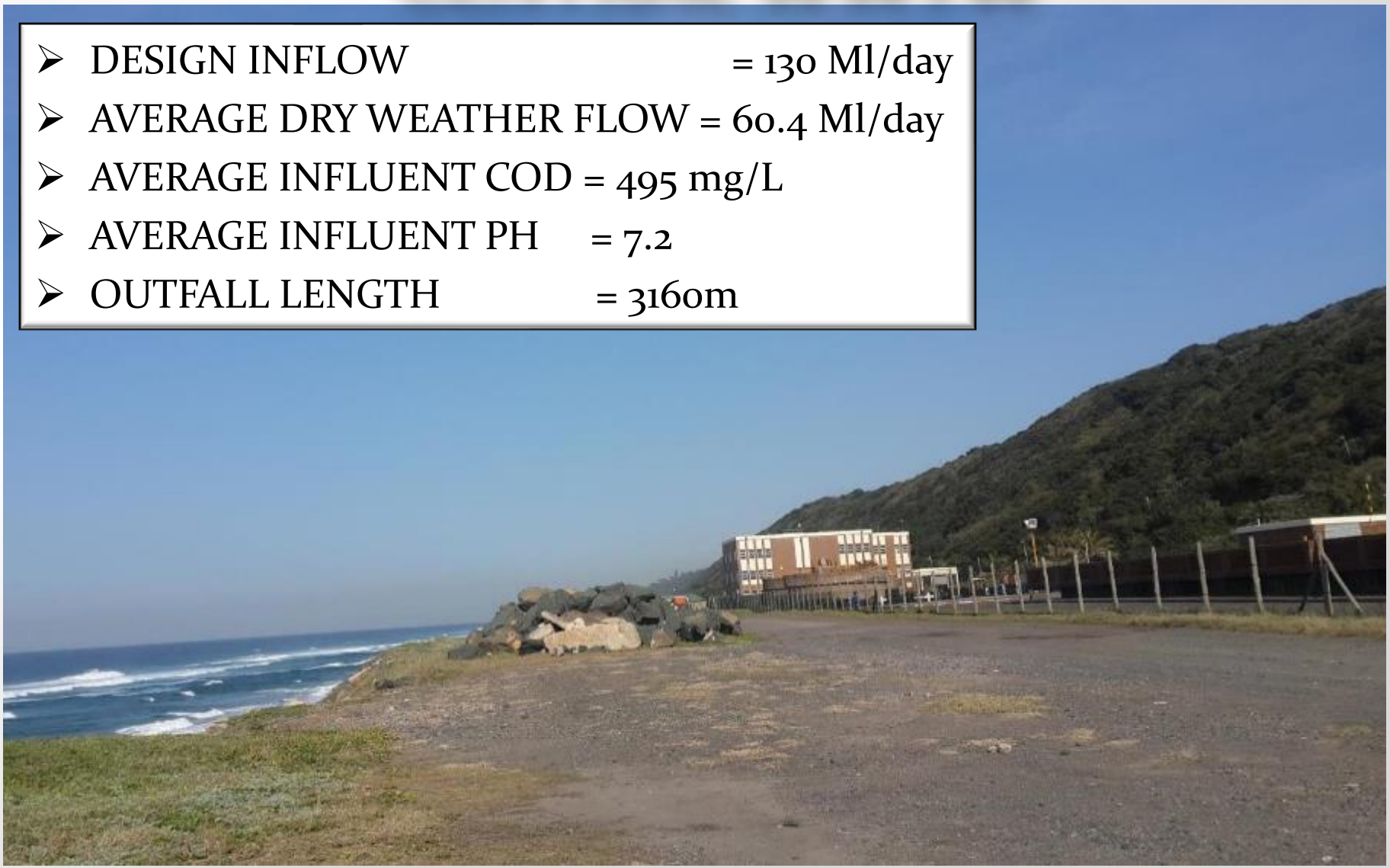


SWRO pre-treatment

SWRO

EXISTING INFRASTRUCTURE : CENTRAL WWTW

- DESIGN INFLOW = 130 Ml/day
- AVERAGE DRY WEATHER FLOW = 60.4 Ml/day
- AVERAGE INFLUENT COD = 495 mg/L
- AVERAGE INFLUENT PH = 7.2
- OUTFALL LENGTH = 3160m



EXISTING INFRASTRUCTURE

Infrastructure Component	Unit Number and Size/Volume	Process Capacity	Status of Current Operation	Notes	
Inlet Works: Screens	2No. 2m wide Mechanical Front Raked Screens. Space for 3rd screen used as bypass channel	Detailed hydraulic capacity not checked. Reports suggest that the inlet works sized for 130 Mℓ/d peak hydraulic flow.	One screen operational	Inlet Works constructed over 50 years ago. Requires civil, mechanical and electrical refurbishment	
Inlet Works: Degritters	4No. 6m diameter vortex-type degritters		Operational		
PSTs	10 No. rectangular PSTs Each PST 32x12m Total Weir Length of 180 m currently	Based on current Weir Length, capacity of 73 Mℓ/d peak flow is possible.	PSTs are currently undergoing refurbishment	Weir lengths of PSTs can be extended to increase capacity. PSTs are over 50 years old and require civil, mechanical and electrical refurbishment	
Final Balancing Tank	Rectangular Balancing Tank 85x30m ~3m deep	Volume of roughly 7.6 Mℓ, could potentially provide 2.4 hours storage	Operational. Used to balance flows at high tide when sea level too high to discharge directly	Appears to be in good condition. Joints and concrete would need to be inspected to assess whether it can be reused in any future upgrades.	
Sludge Gravity Thickeners	2No. 17m diameter. ~4m high. Elevated	-	Decommissioned. Not good state of repair.	No plans to be reinstated	 
Sludge Incineration Plant	Housed in 3 Storey Building	-	Decommissioned	No plans to be reinstated	

DESIGNING FOR TERTIARY TREATMENT OF WASTEWATER – PROCESS TECHNOLOGY SELECTION

Process objectives

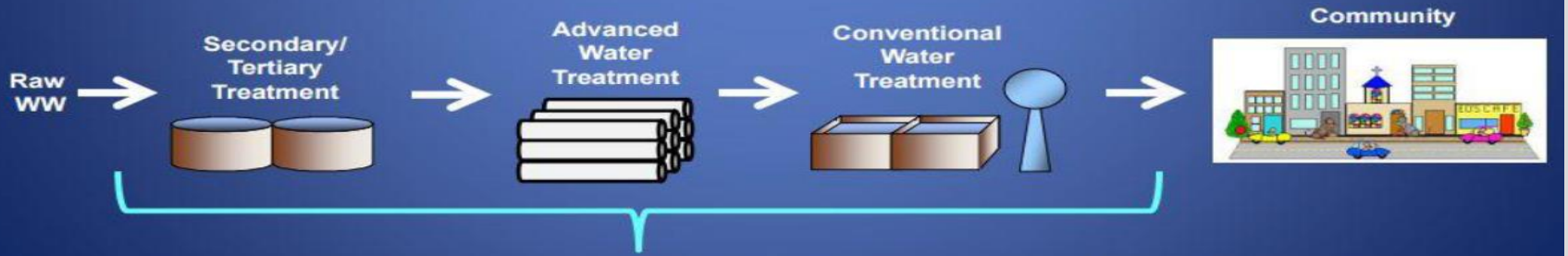
What are we taking out of the water?

- Salinity (TDS)
- Nitrates
- Iron Fe & Manganese Mn
- Total organic carbon (TOC)
- Aluminium
- Pathogens
- Hormones
- Pharmaceuticals

DESIGNING FOR TERTIARY TREATMENT OF WASTEWATER – WHAT ABOUT PATHOGEN REMOVAL ?

- No South African Standard for Reuse water
- Look for Strictest world wide standard. E.g. California , Australia, Texas etc.
- Use a Multi barrier Approach to attain standard

	Cryptosporidium	Giardia	Virus	Total Coliform
$\log_{10}$ removal	10	10	12	9



DESIGN OF SEAWATER DESALINATION

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Central WWTW Feed

BWRO
75% Recovery

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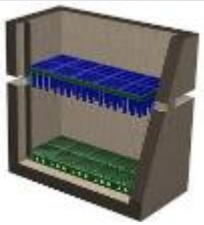

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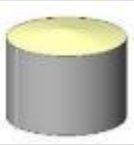

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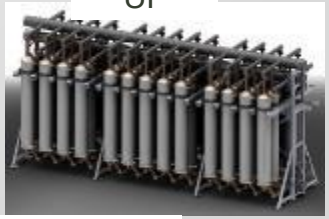
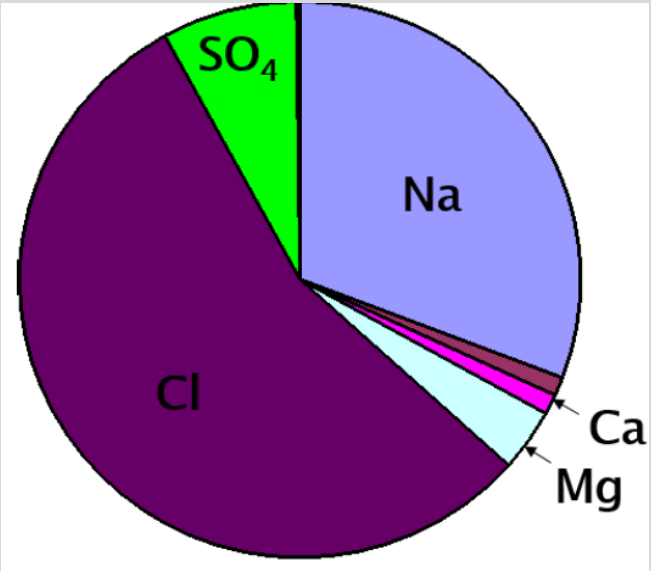


SWRO pre-treatment

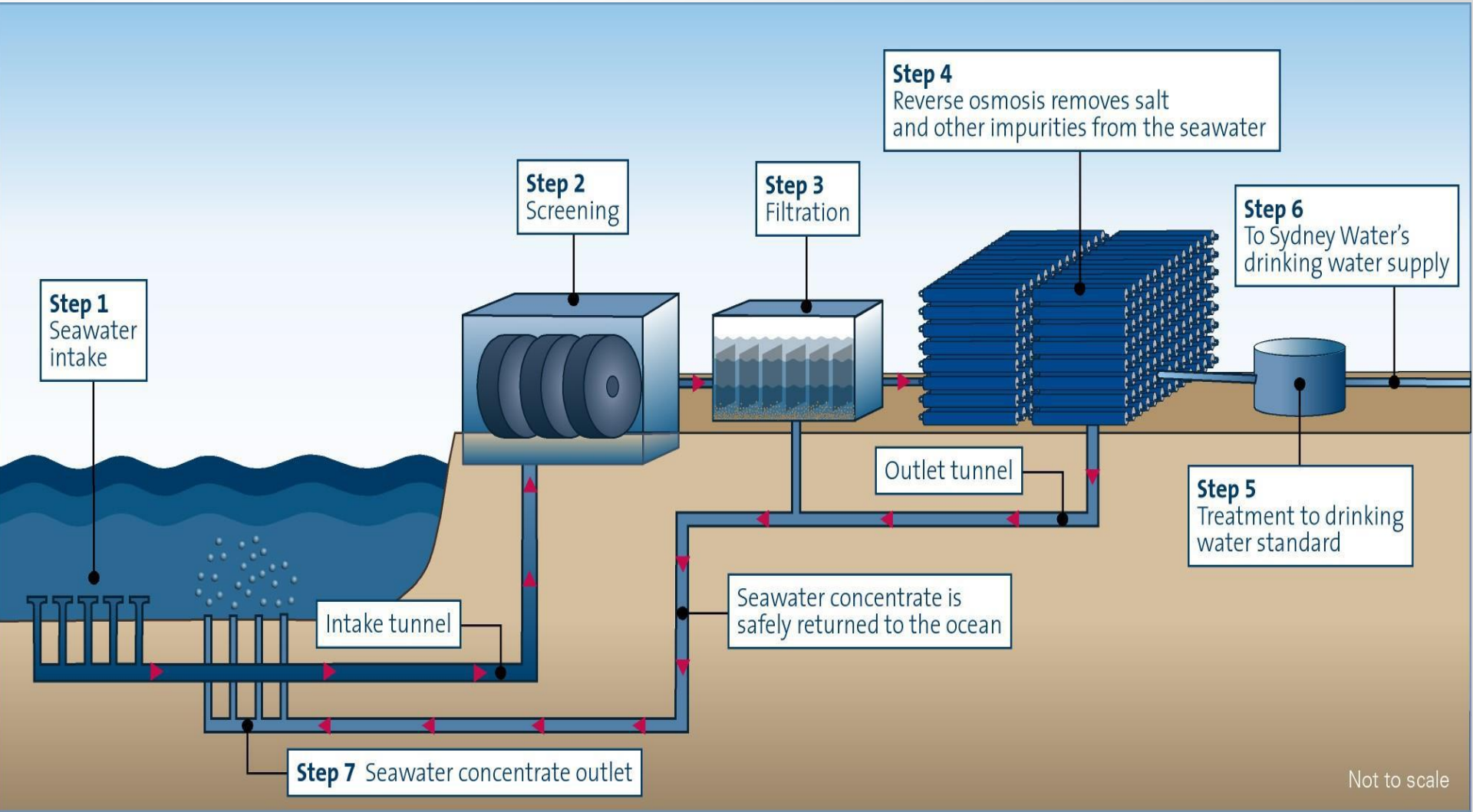
SWRO

DESIGN OF SEAWATER DESALINATION

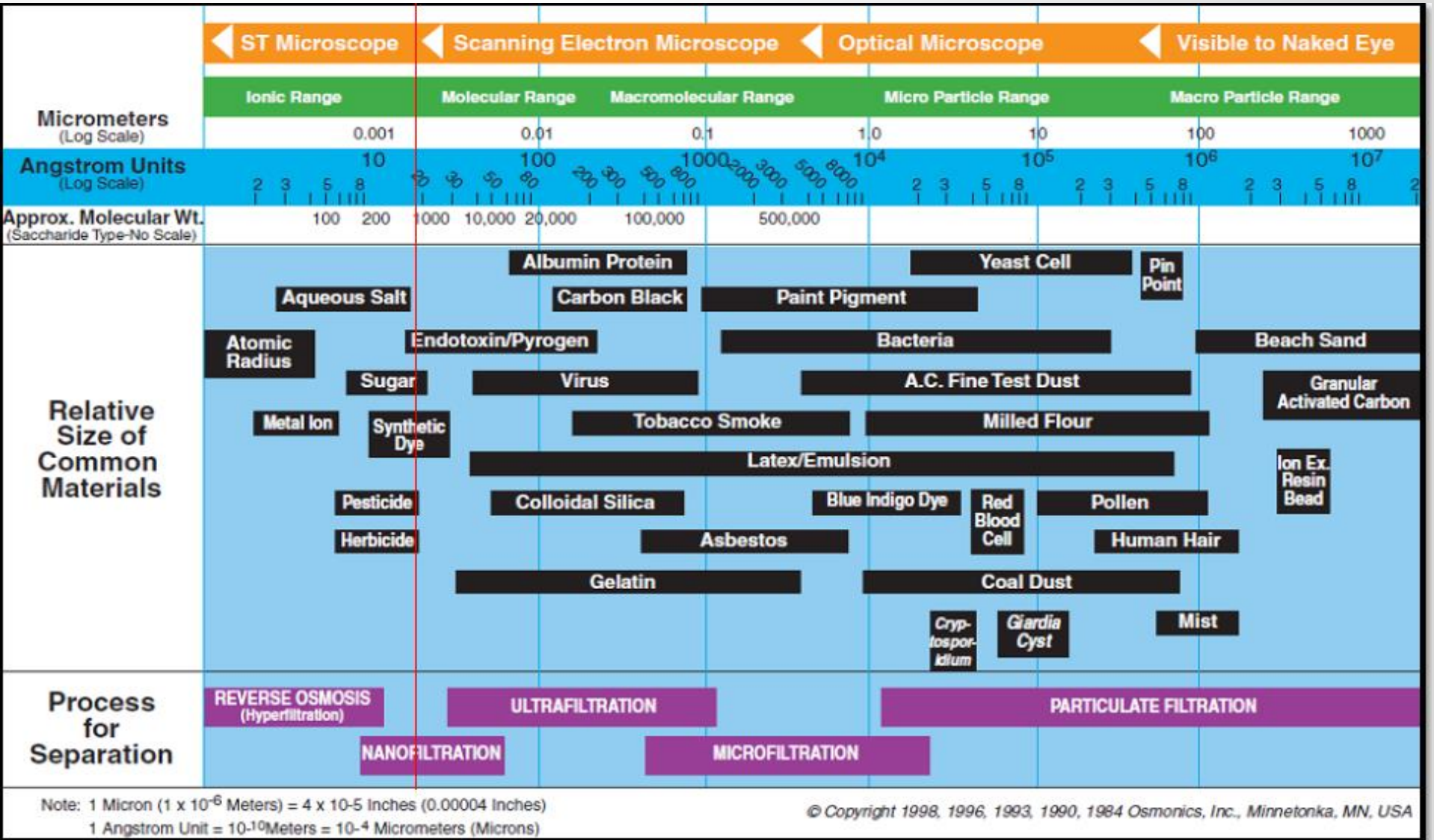
- What is in SEA Water ?
- Sea water is considered **Saline** .
- Saline : Water containing a mixture of salts in the region of ***30 to 50 ppt***
- Non Ionic Species
- Suspended Solids
- Dissolved Organic Compounds



TYPICAL DESALINATION

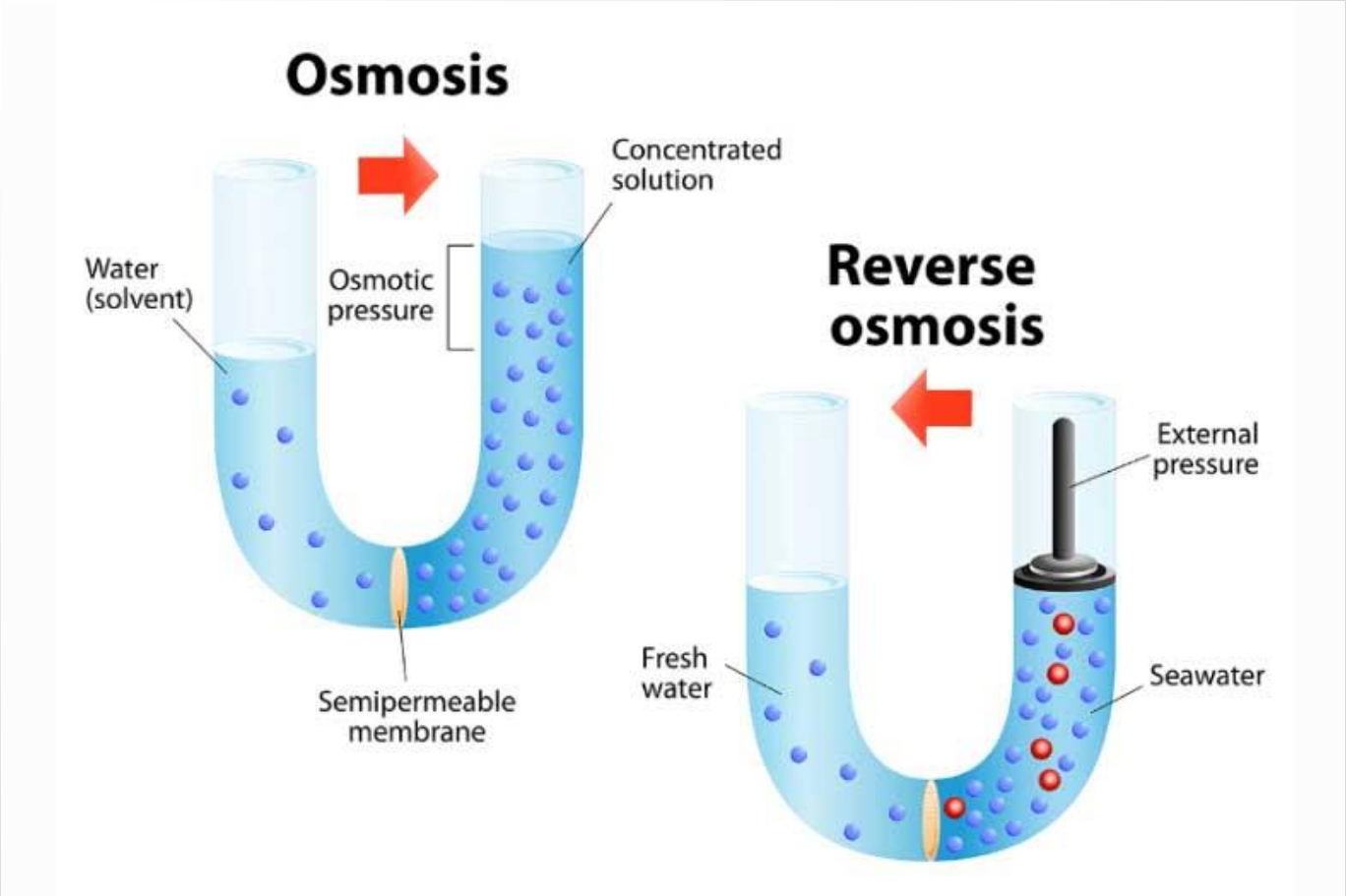


DESIGNING FOR SEAWATER ULTRAFILTRATION

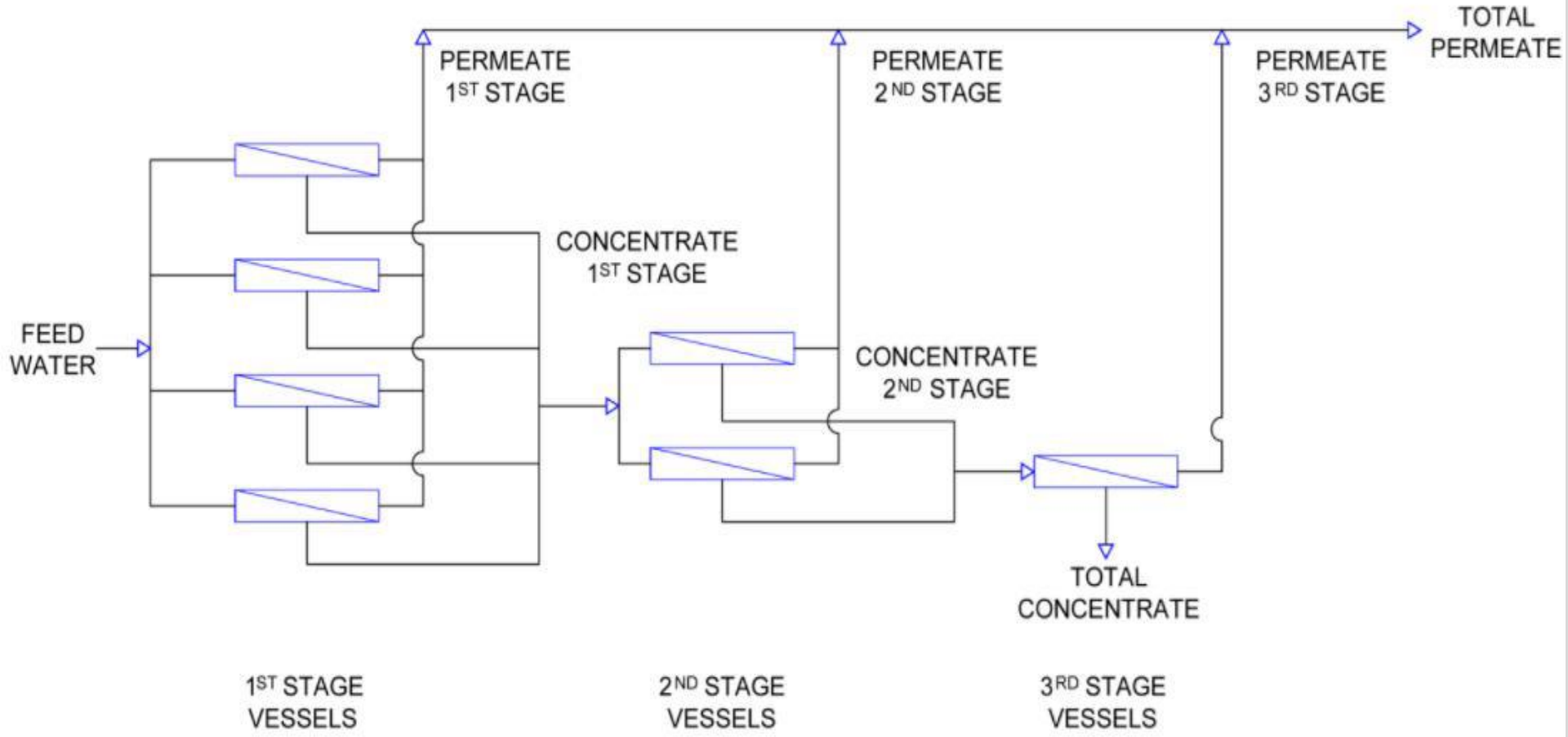


DESIGNING FOR REVERSE OSMOSIS

- What is Osmosis and Reverse Osmosis?



DESIGNING FOR REVERSE OSMOSIS



MEMBRANE TECHNOLOGY

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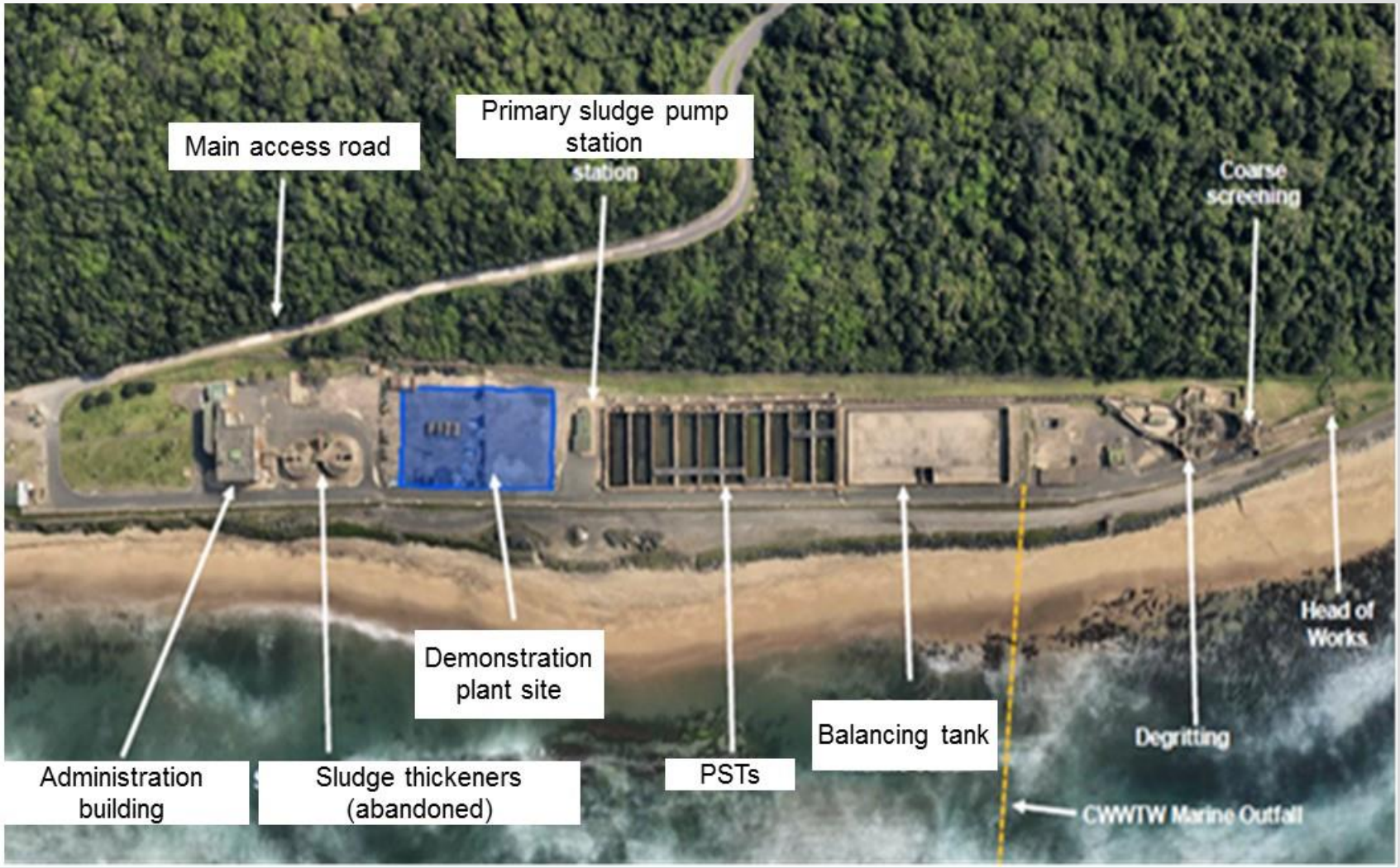
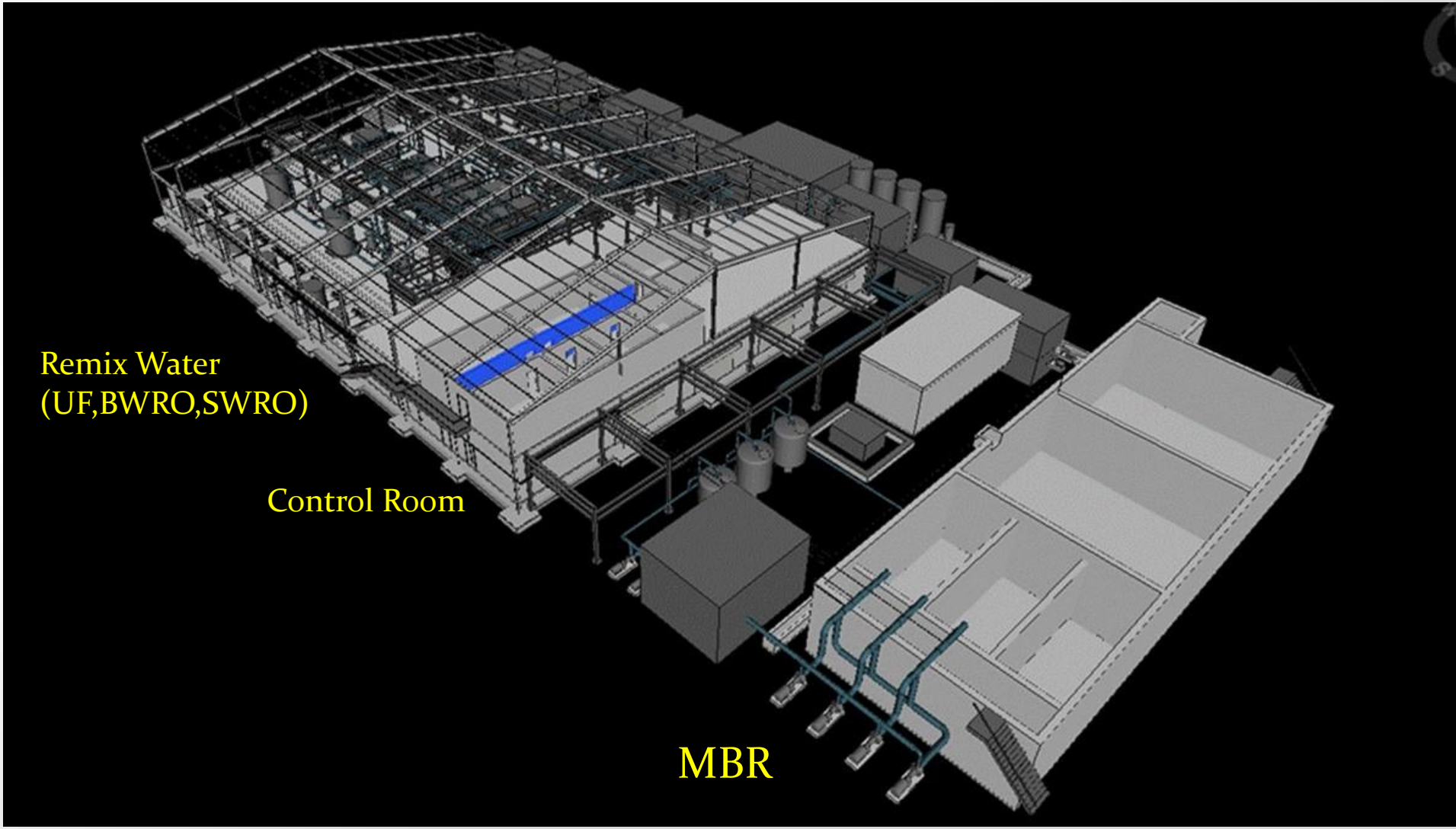
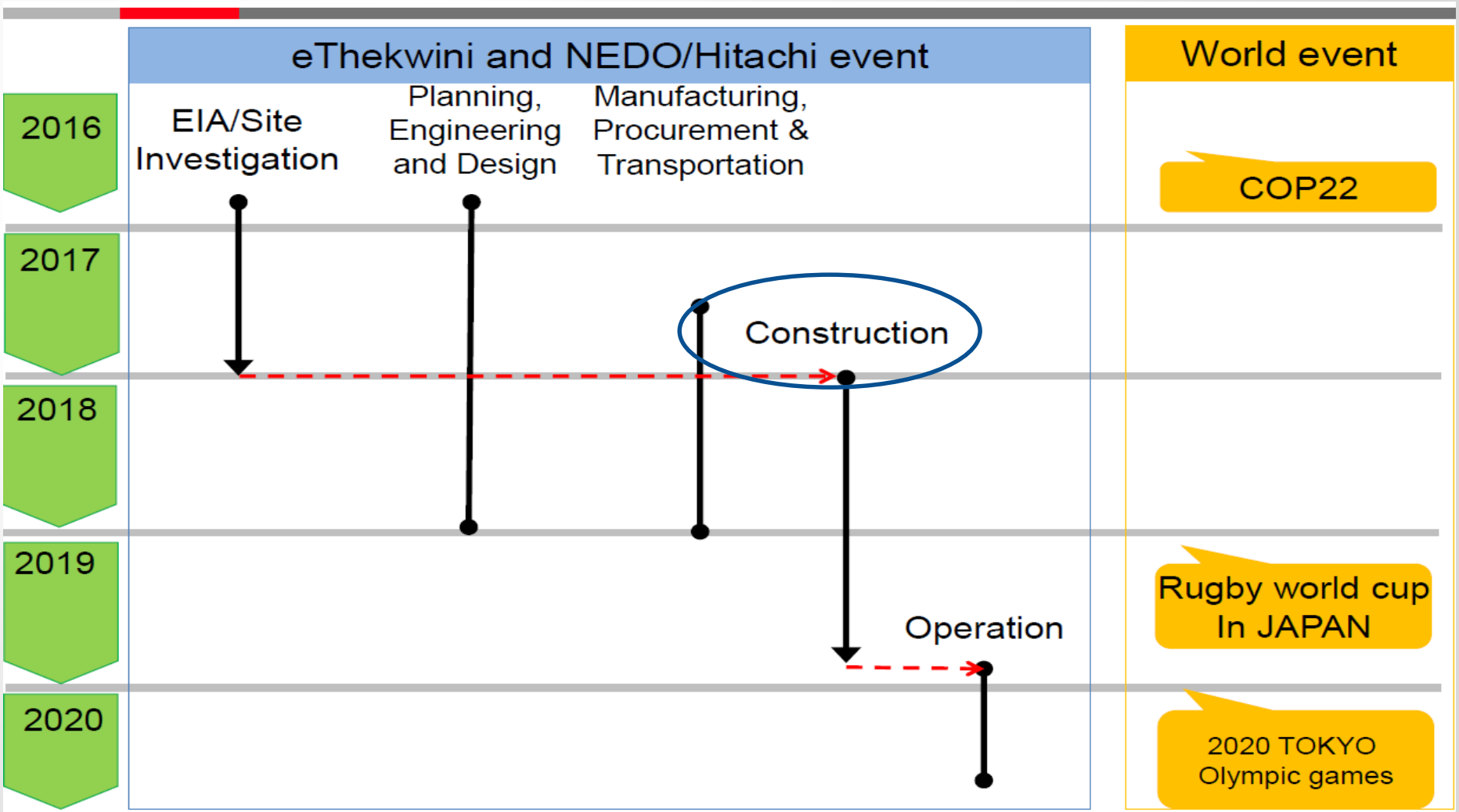
PROPOSED LAYOUT OF 6.25 MℓDAY (DEMONSTRATION PLANT)



Layout (basic design phase)



HIGH LEVEL SCHEDULE



CONSTRUCTION PROCUREMENT PHASE

- NEDO Proviso – No work to begin until all authorizations received.
  - EIA
  - CWDP
  - WUL

  } 2018

- Hitachi appointed WSP as Construction Management Services

- Stefanutti Stocks were appointed to undertake Construction Activities

CONSTRUCTION PROGRESS


CONSTUCTING MBR

INSIDE MACHINE BUILDING


SUB UNITS


LG Chem

SUB UNIT MBR

INTAKE PIPELINE

DEMO PLANT: SCHEDULE

Milestone	Year of Commission
Phase 1 (6.25 MLD)	2019

QUESTIONS

Thank You

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