

TUAS WRP

DTSS 2



Design and Implementation of TWRP

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Tuas WRP Project Director, CH2M (now Jacobs)

11 July 2018



SAFETY • SCHEDULE • BUDGET • QUALITY



Agenda



🌀 Raising the Bar

- » *Safety*
- » *Innovation*
- » *Working with Others*

🌀 Delivery of TWRP

- » *Project Overview*
- » *Major TWRP Components*
- » *Tendering and Construction Timeline*
- » *Contract Packages*
- » *Tendering Requirements & Scope*
- » *Key Project Delivery Requirements*
- » *Progress and Ongoing Preparation Works*
- » *Project Challenges*

🌀 Summary and Next Steps





Raising the Bar



TWRP Safety Mission



- To fully implement PUB's DTSS 2 Safety Mission
- To team with the Contractors to create a collaborative safety culture committed to PUB's Mission of ZERO HARM
- We will not compromise on safety for any reason
- We will recognise and reward safe performance
- We will continuously learn and improve our approach to the safety and health of everyone involved in the delivery of TWRP



Workplace Safety and Health



- No fatalities or life-changing incidents
- Full compliance with all statutory regulations
- Implementation of PUB's safety requirements and life-saving rules
- Don't know, don't care – eliminate both

Fatal and Major Injuries increased for Construction



Workplace Safety and Health



- ❶ Raise the bar for Personal Protective Equipment (PPE)

- ❷ Safety Training Facility with hazard simulators

- ❸ Incentive & Disincentive Scheme

» Rewards for *commitment and demonstrable actions leading to exemplary performance in safety*

» Deductions for *poor safety performance including inadequate supervision of sub-contractors*

» Monthly assessment and scoring of KPIs in line with safety targets

» Progressive incentive payments during delivery



Being Stuck and Crash Experience



Plant Design Features




● TWRP will include many advanced treatment processes including:

- » *Biosorption*
- » *Membrane bioreactors*
- » *Production of NEWater (NW) and Industrial Water (IW) for use by industry*
- » *Hydrolysis of biosolids prior to anaerobic digestion*
- » *Co-digestion of biosolids and imported food waste and greasy waste*

● First large-scale applications of Industrial ecology

- » *Waste or byproduct of one industry/process is used as an input into an adjacent process*
- » *Move from a linear to a cyclical or closed-loop system*

Higher quality
treated effluent



TSS² < 1 mg/l
BOD³ < 10 mg/l

² Total Suspended Solids
³ Biochemical Oxygen Demand



More than double
energy recovery

x2



More than
85%
NEWater recovery



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SMART Innovations



SMART Personnel

» *Wearable technologies: high visibility, real-time tracking, vital tracker, H2S sensor and body camera*

SMART Operations and Maintenance

» *Use of autonomous vehicle, deploying drones and autonomous robots*

SMART Assets

» *Use of Augmented Reality (AR) coupled with a Building Information Modelling (BIM) software*



Collaborative Multi-Agency Implementation



- Working with the **National Environment Agency** on the IWMF design and synergies
- Security by Design – **Ministry of Home Affairs (MHA)**
- Expanded and Integrated BIM Usage – **Building and Construction Authority (BCA)**
- Green Mark Programme – BCA
- Landscape Replacement Area + Solar Power – **Urban Redevelopment Authority (URA)**
- Liaising and approvals with many other agencies





Delivery of TWRP



Project Location



- 68 hectares of reclaimed land
- Limited development
- Site bounded by sea water intake canal and Tuas Power



IWMF
~14Ha



Project Overview



1. Influent Pumping Stations
2. Liquids (Domestic and Industrial Used Water) Treatment Facilities
3. Biosolids Treatment Facility
4. NW and IW Storage & Pumping
5. Wet Weather Treatment
6. Admin/O&M with Visitor Gallery



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Project Overview



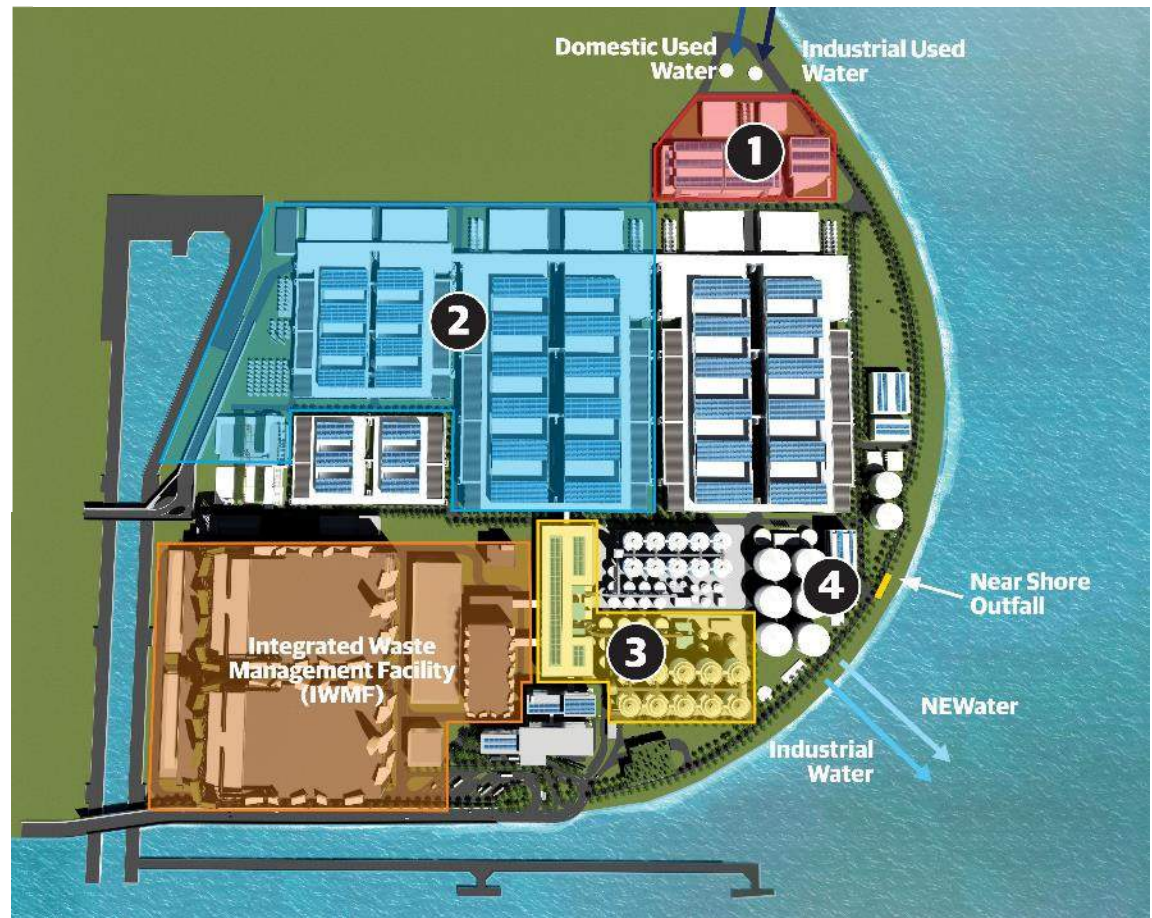
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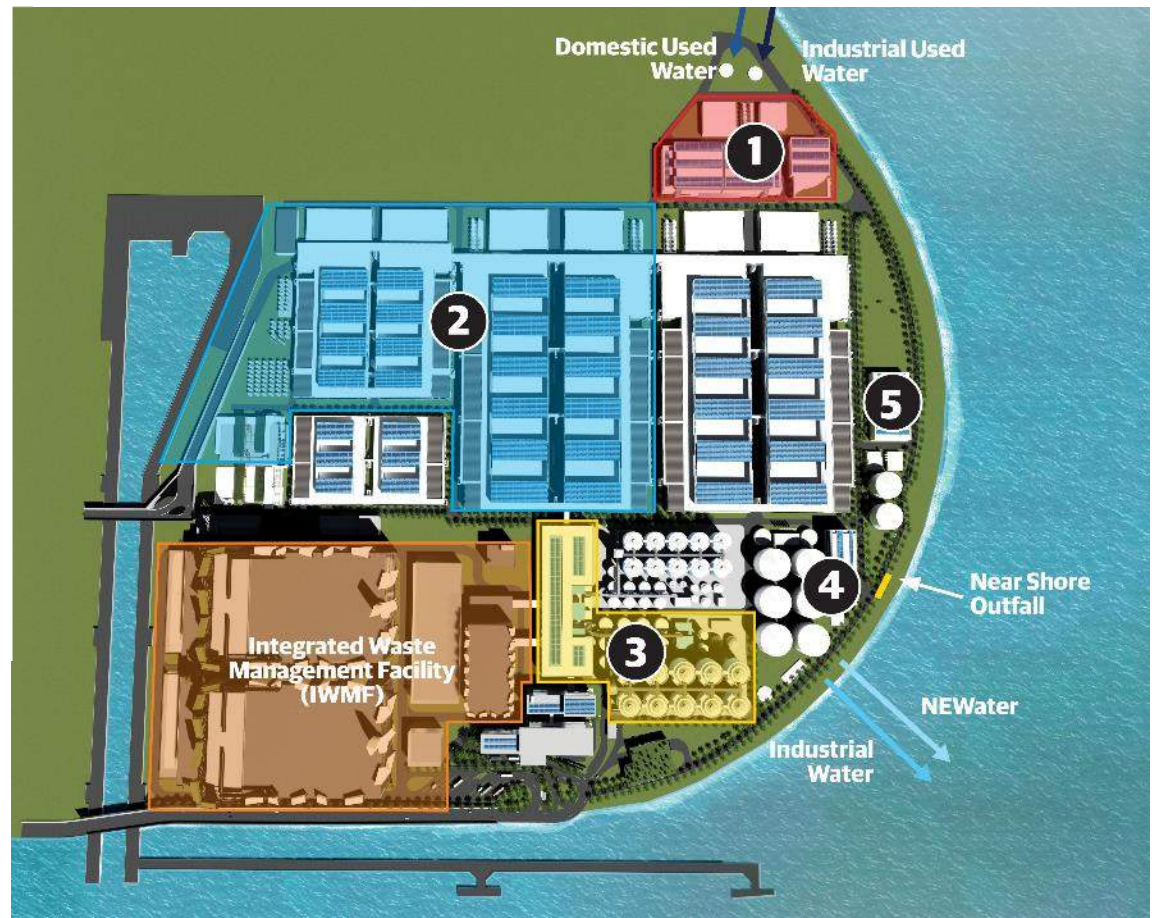
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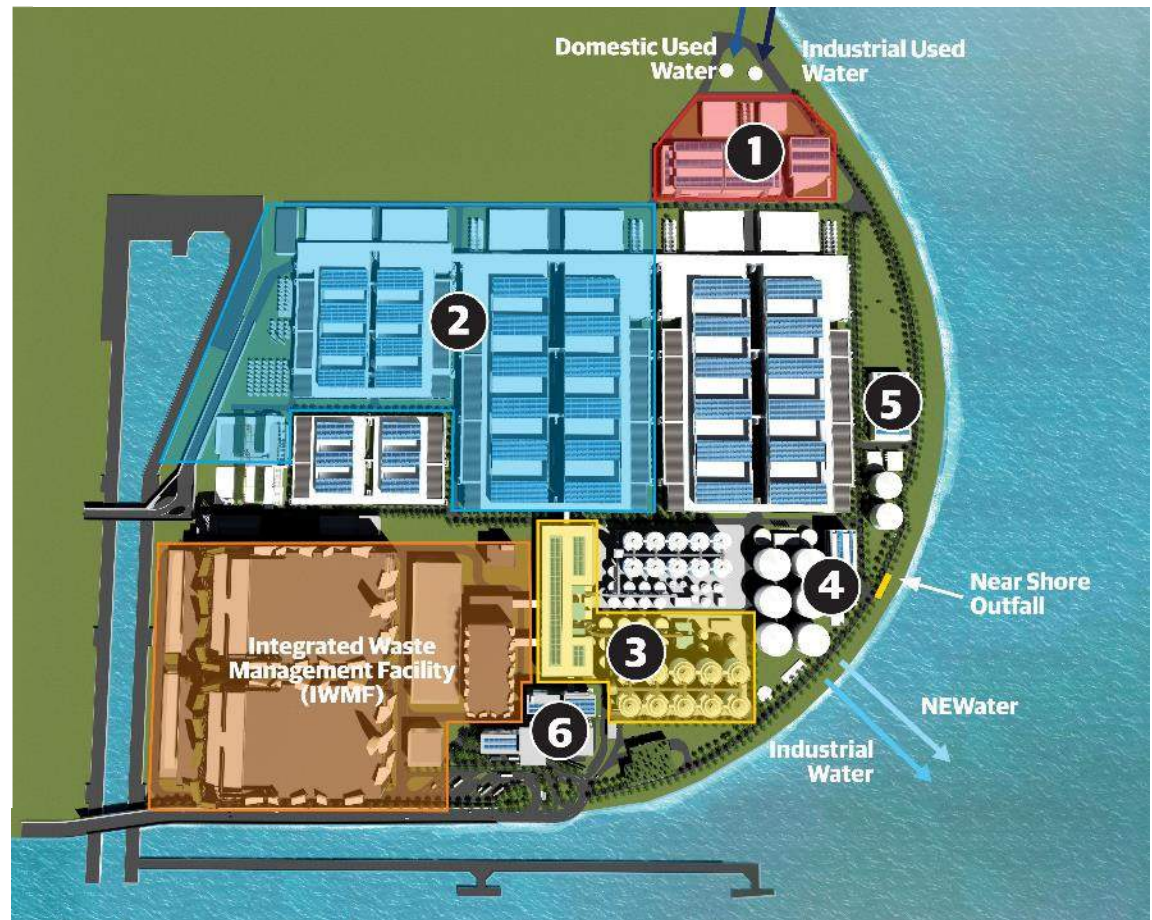
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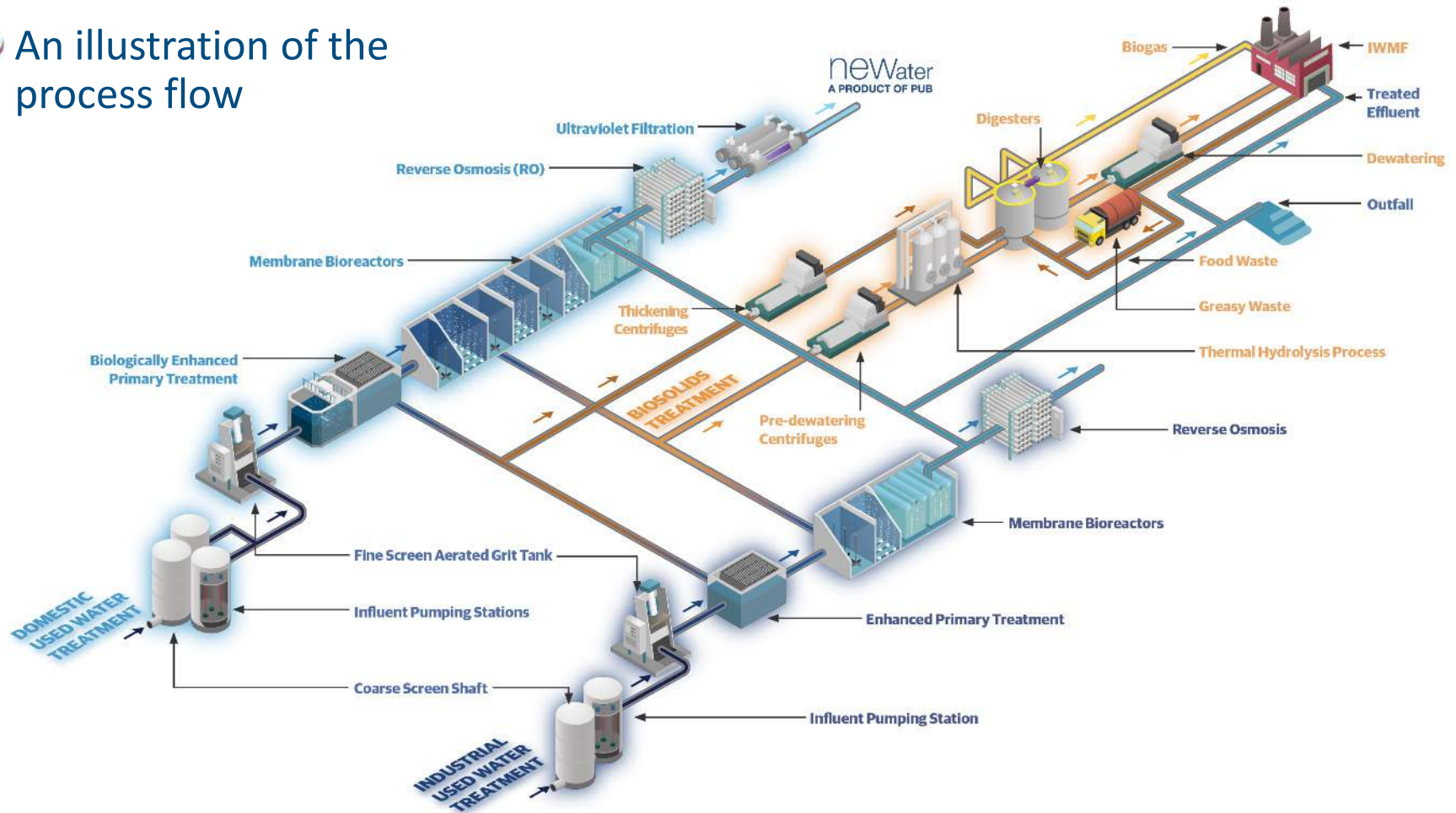
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Major TWRP Components

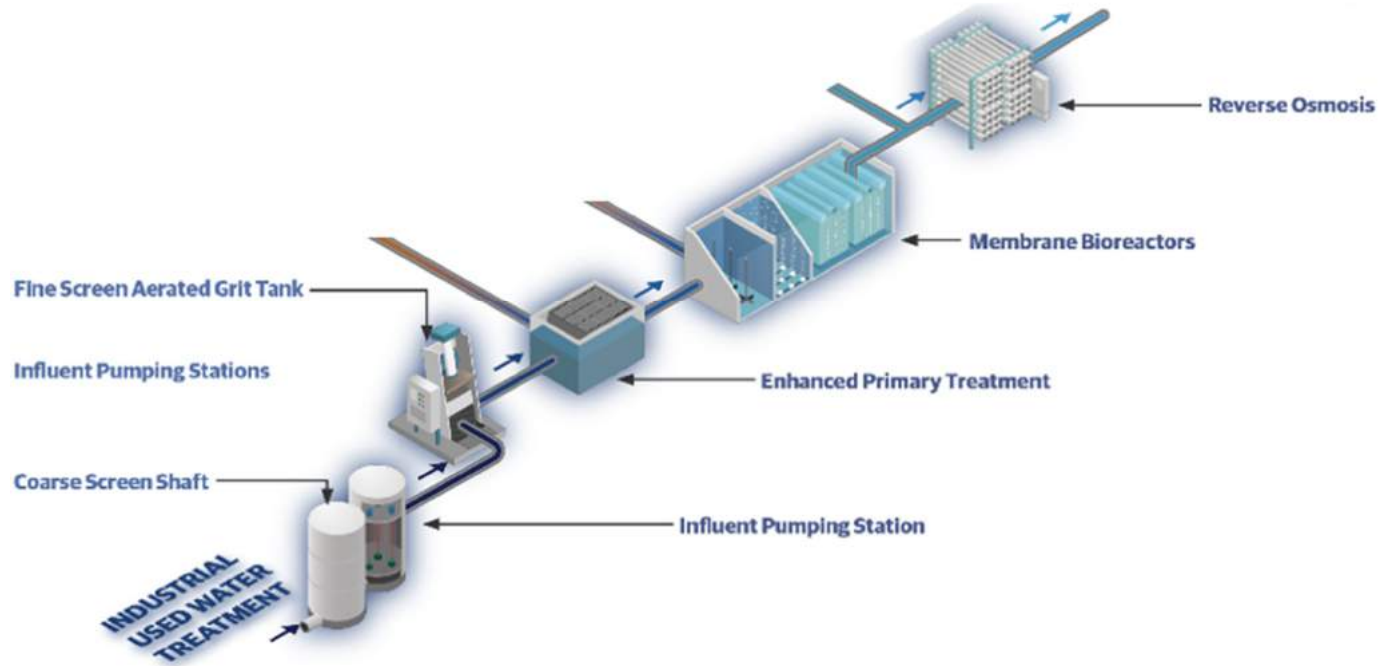


An illustration of the process flow

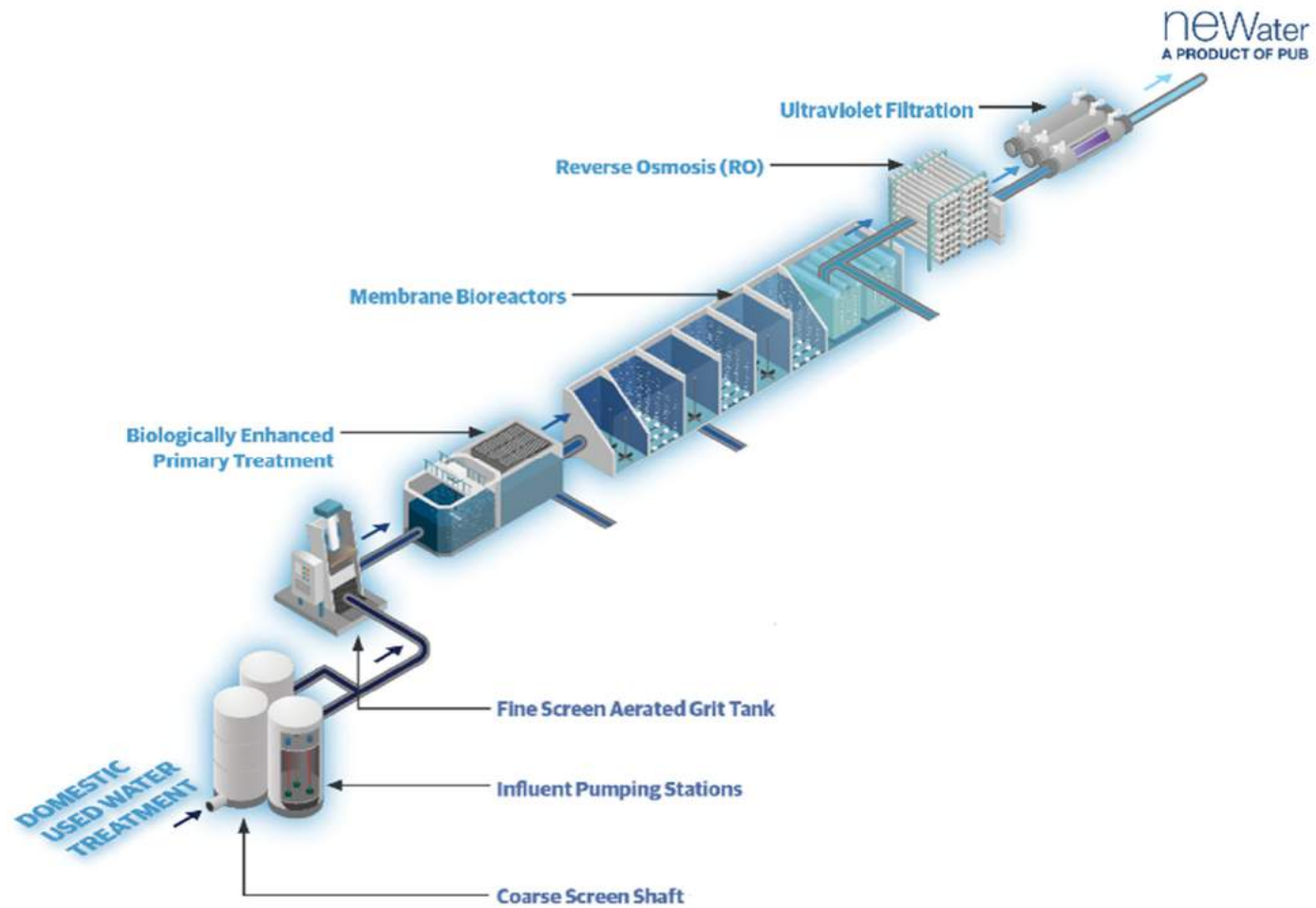


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Industrial Liquids

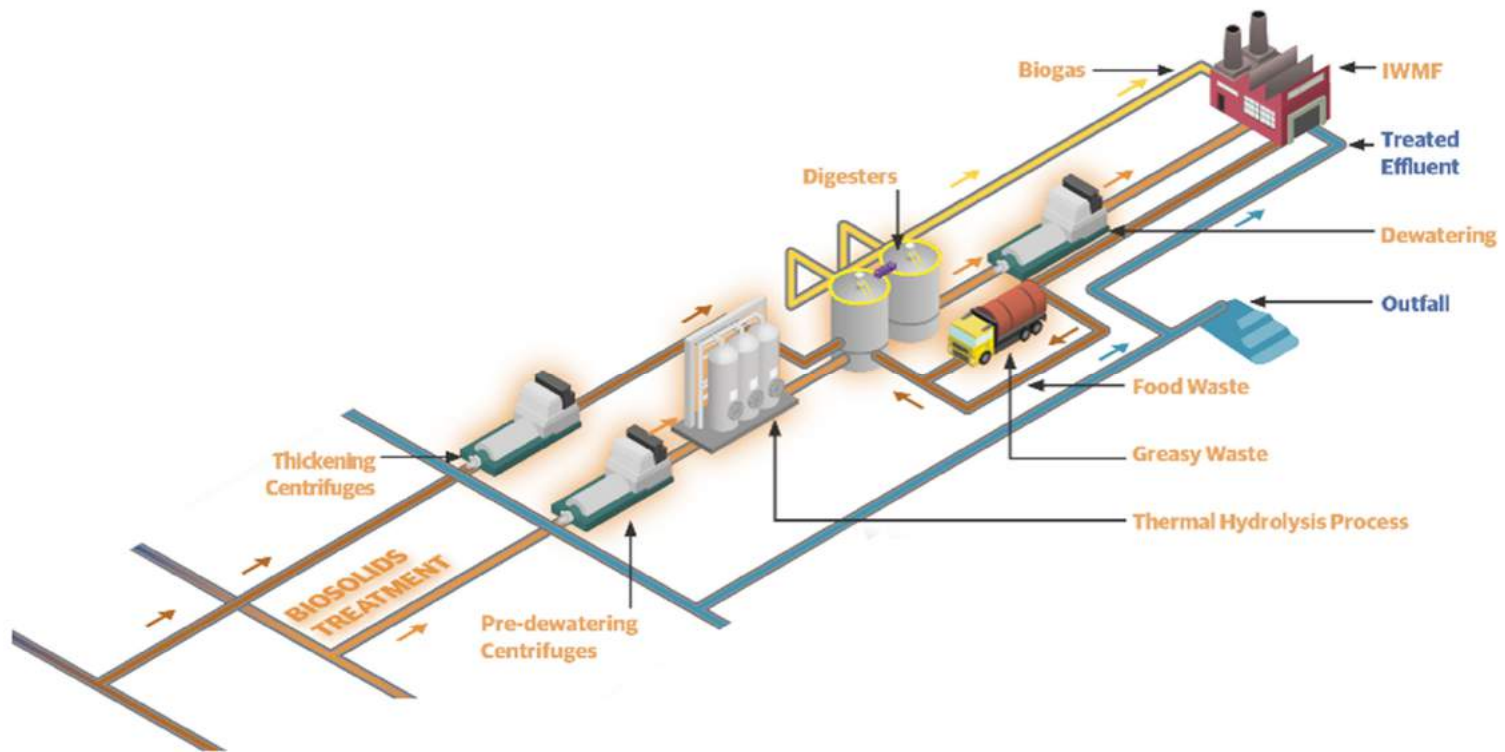


Domestic Liquids



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Biosolids



Tendering and Construction Timeline



⦿ Milestone 1 – June 2023

» *Industrial used water influent pump station and treatment stream commissioned and into production*

⦿ Milestone 2 – August 2024

- » *Domestic used water influent pump station and one-half of liquid treatment stream commissioned and into production*
- » *NEWater plant commissioned and into production*

⦿ Milestone 3 – December 2025

» *Completion and commissioning of whole of Tuas WRP (Phase 1)*



Contract Packages (11 nos.)



No.	Name	Description
C1A	Site Development Works	<ul style="list-style-type: none"> • Temporary site wide support infrastructures and services • Permanent yard piping, utilities, 22 kV, port sewer, near-shore outfall
C2A	Influent Pumping Stations	<ul style="list-style-type: none"> • Two coarse screen shafts, three pumping stations, rising mains • Two 66 kV substations
C3A	Industrial Liquids Modules	<ul style="list-style-type: none"> • Headworks, primary treatment, secondary treatment, tertiary treatment to produce Industrial Water
C3B	Domestic Liquids Modules – Primary	<ul style="list-style-type: none"> • Headworks and primary treatment
C3C	Domestic Liquids Modules – Secondary and NEWater	<ul style="list-style-type: none"> • Secondary treatment including MBR, and NEWater production
C3D	Product Water Storage and Pumping	<ul style="list-style-type: none"> • Storage and pumping of NEWater and Industrial Water
C4A	Biosolids and Digesters	<ul style="list-style-type: none"> • THP, digestion, thickening, dewatering, solids conveyance
C5A	Plant Monitoring and Control System	<ul style="list-style-type: none"> • SCADA/PLC system with progressive buildout
C6A	Administration and Operations Buildings	<ul style="list-style-type: none"> • Two separate buildings
C6B	Site Completion	<ul style="list-style-type: none"> • Scope to be defined, includes roads, CCTV, main entrance and etc.
C6C	Wet Weather Treatment Facility	<ul style="list-style-type: none"> • Domestic used water overflow treatment and discharge

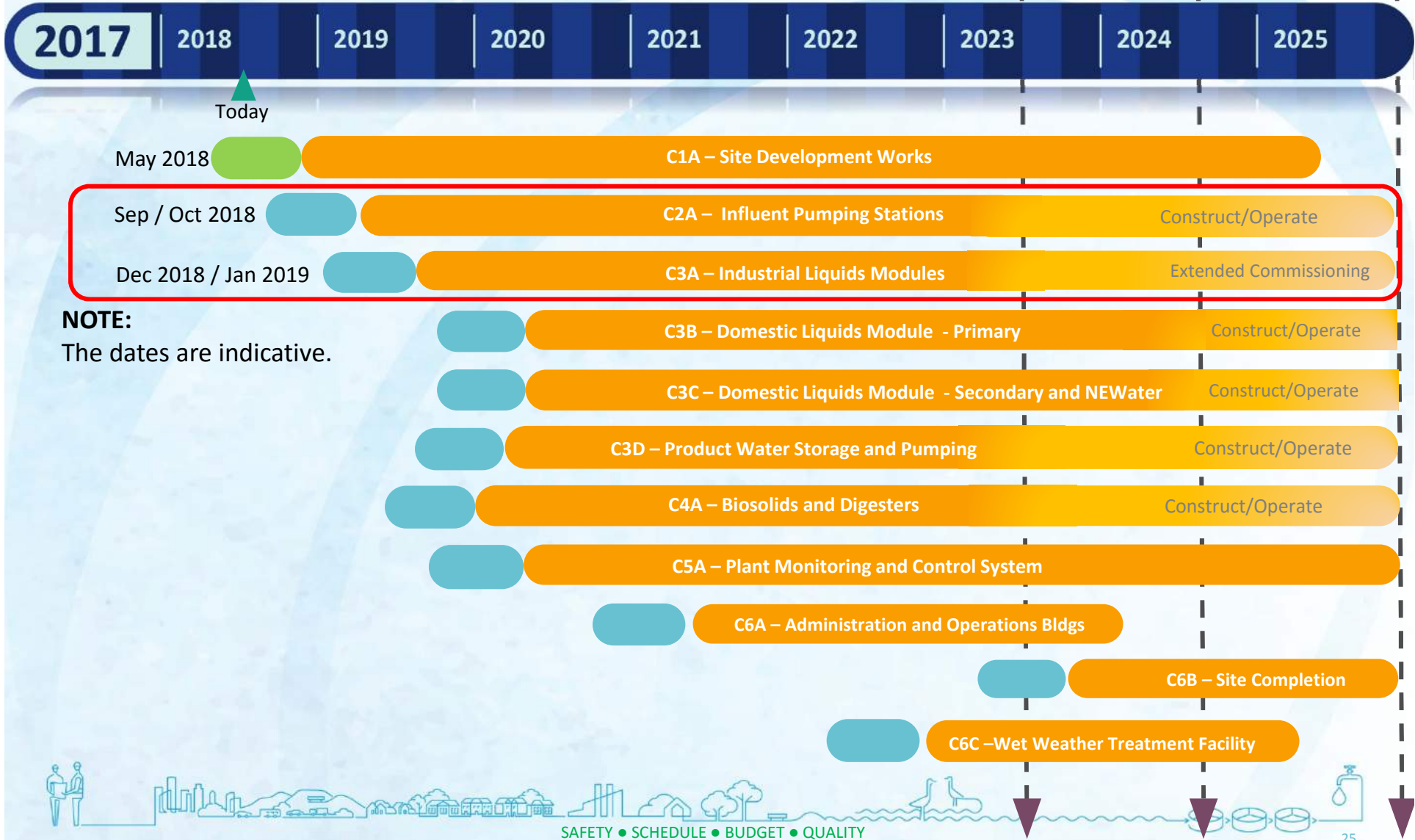


Tendering and Construction Timelines

Milestone 1
Industrial Used Water
Commissioned

Milestone 2
Domestic Used Water &
NEWater
Commissioned

Milestone 3
Completion of
Testing and
Commissioning of
TWRP

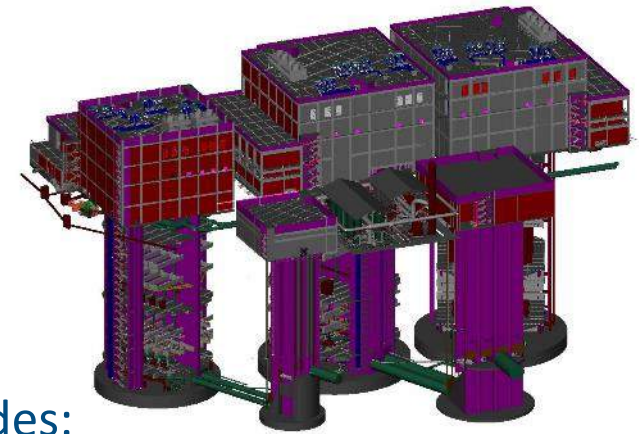
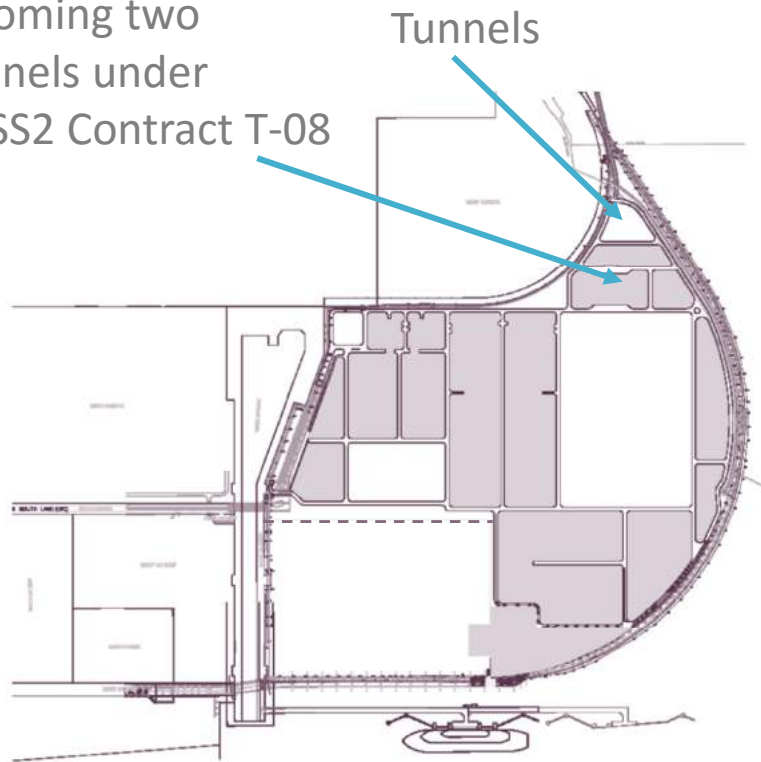


NOTE:
The dates are indicative.

C2A - Influent Pumping Stations



IPS adjacent to incoming two tunnels under DTSS2 Contract T-08



Scope includes:

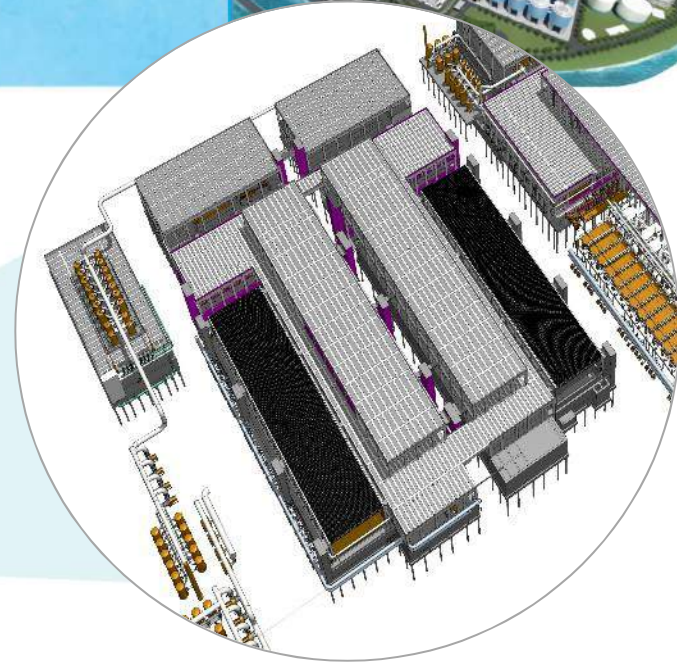
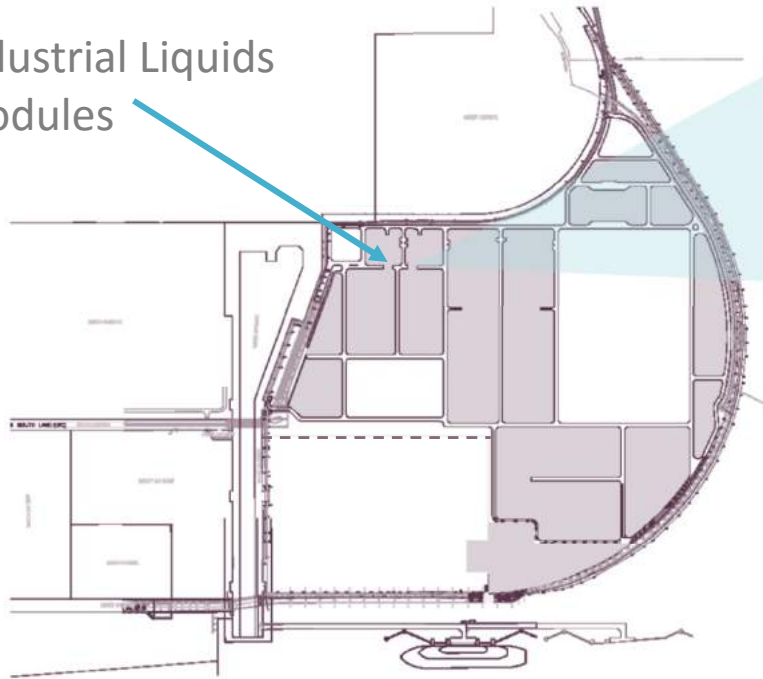
- » 2 coarse screen shafts and 3 pump station shafts with mined connections from T-08
- » Shaft diameters from 20 m to 48 m ID; depths at 60 m and 80 m
- » Domestic IPS – 16 pumps with total pumping capacity of 1,950 MLD
- » Industrial IPS – 10 pumps with total pumping capacity of 450 MLD
- » 6 rising mains underground to liquids modules headworks
- » Centralised odour control facility



C3A - Industrial Liquids Modules



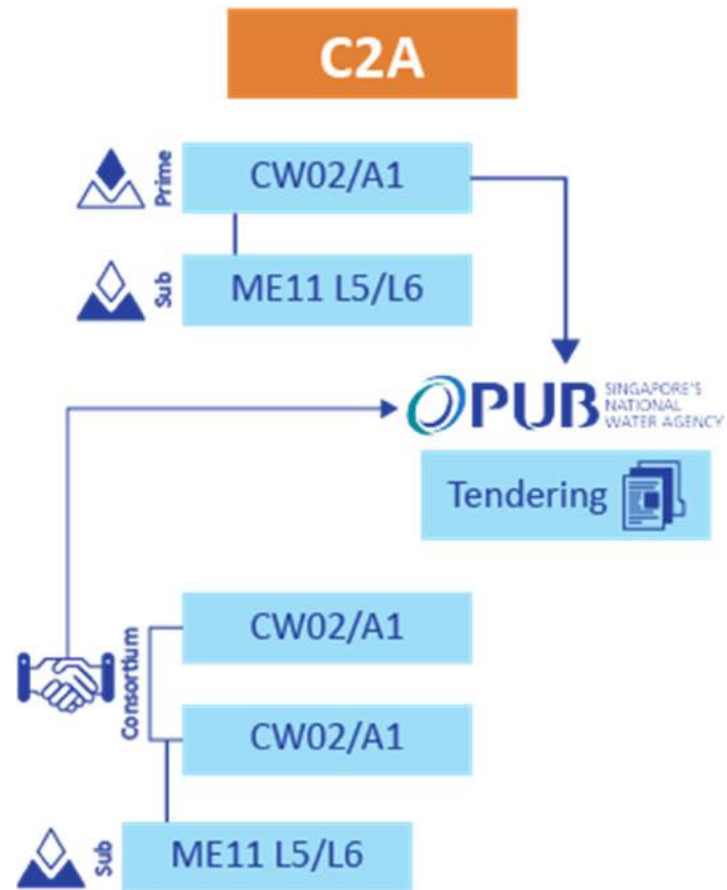
Industrial Liquids Modules



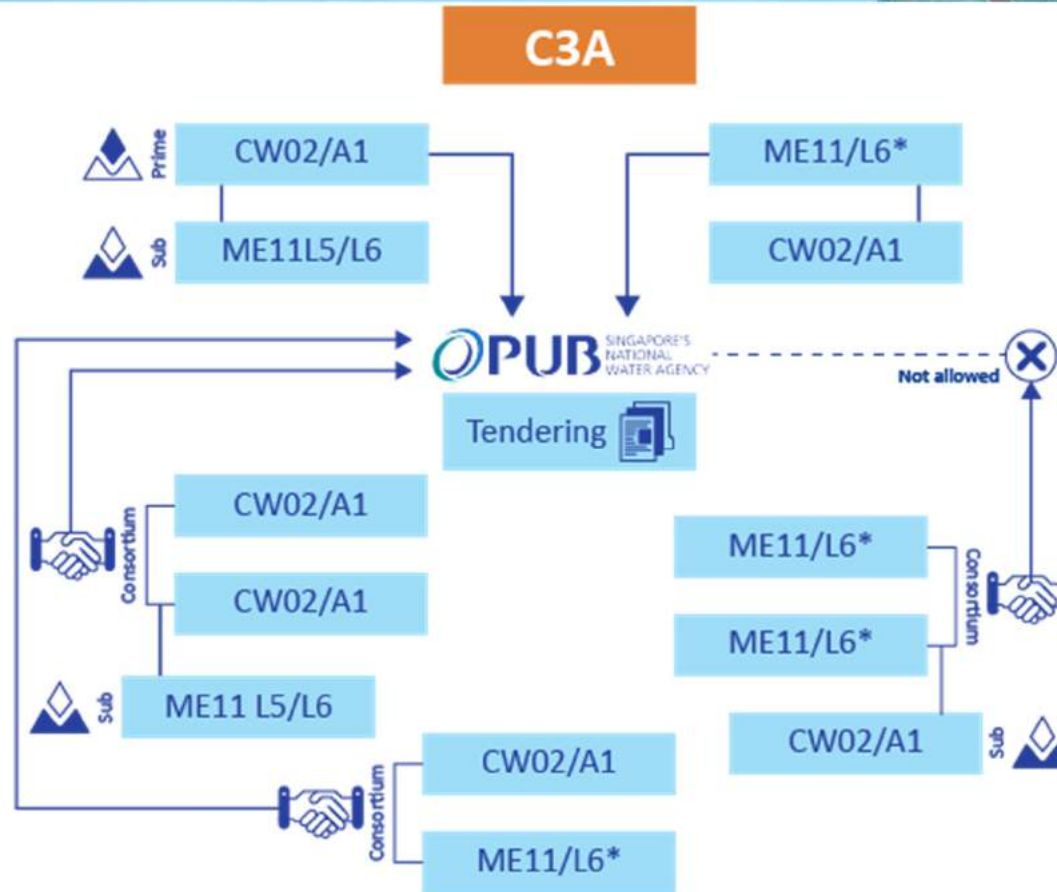
- » *Two liquid treatment modules*
- » *Headworks, primary treatment tanks, secondary bioreactor and membrane tanks*
- » *Ceramic and polymeric membranes*
- » *Industrial Water production*
- » *Odour control facility*



Tendering Requirements: Contract 2A BCA Registrations



Tendering Requirements: Contract 3A BCA Registrations



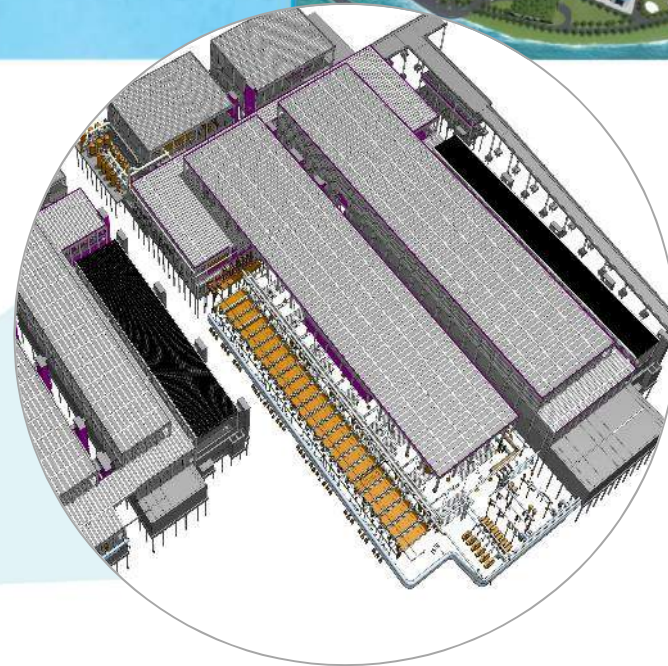
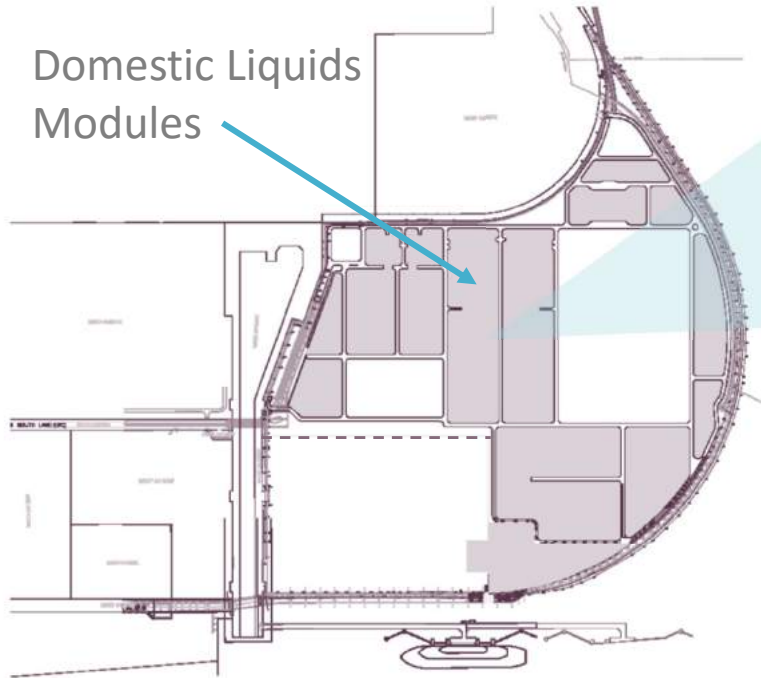
*Min. paid-up capital and minimum net worth of \$15 million (equivalent to Civil Engineering A1 financial grade)



C3B & C3C - Domestic Liquids Modules



Domestic Liquids Modules



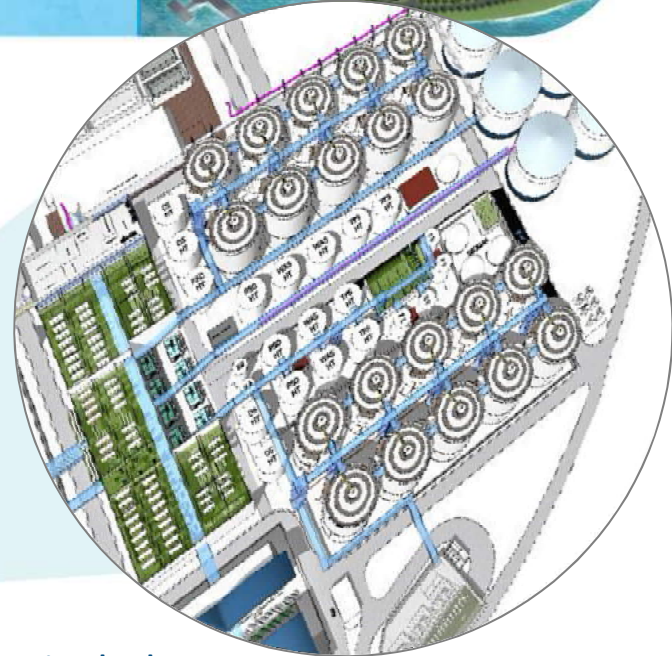
- » *Two liquid treatment modules*
- » *Headworks, primary treatment tanks, secondary bioreactor and membranes tanks*
- » *Polymeric membranes*
- » *NEWater production*
- » *Odour control facilities*



C4A - Biosolids Treatment



Biosolids
Facilities



- » **To IWMF** > biosolids, biogas, odorous air
- » **From IWMF** > electricity, steam, food waste

Scope includes:

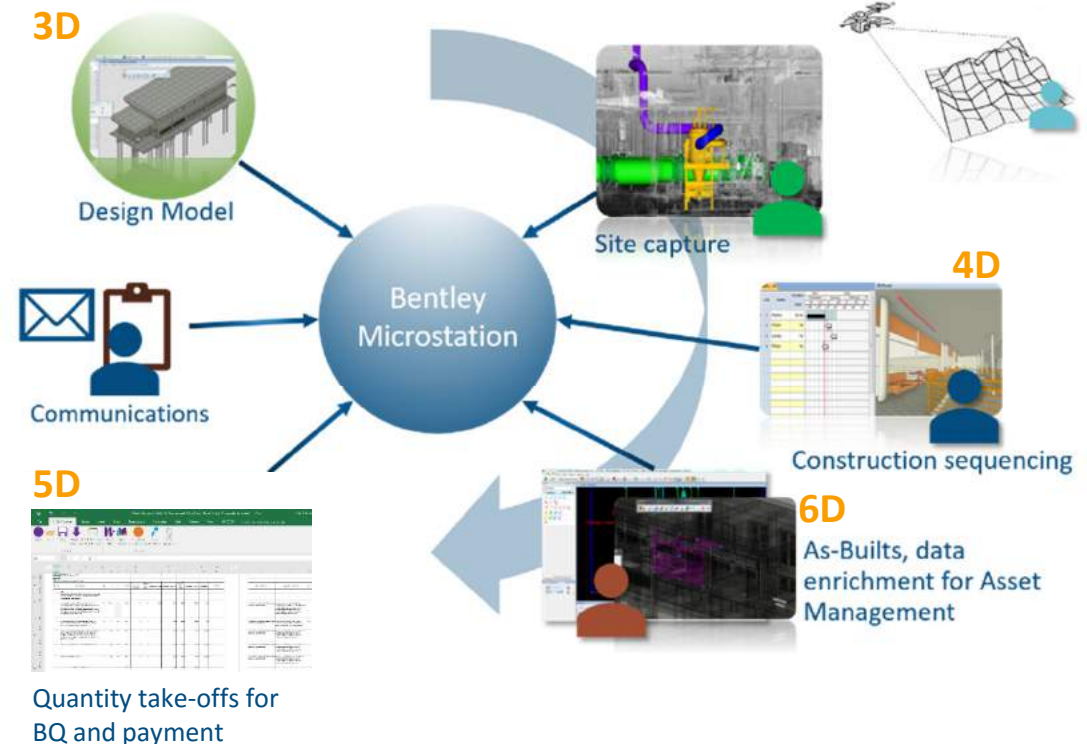
- » Biosolids building with space for future equipment
- » Thermal hydrolysis pre-digestion, centrifuges for pre-dewatering and thickening
- » 10 silo digesters – potential construction with post-tensioned precast panels
- » Majority of the IWMF interfaces
- » Food waste and greasy waste receiving and treatment



6D BIM



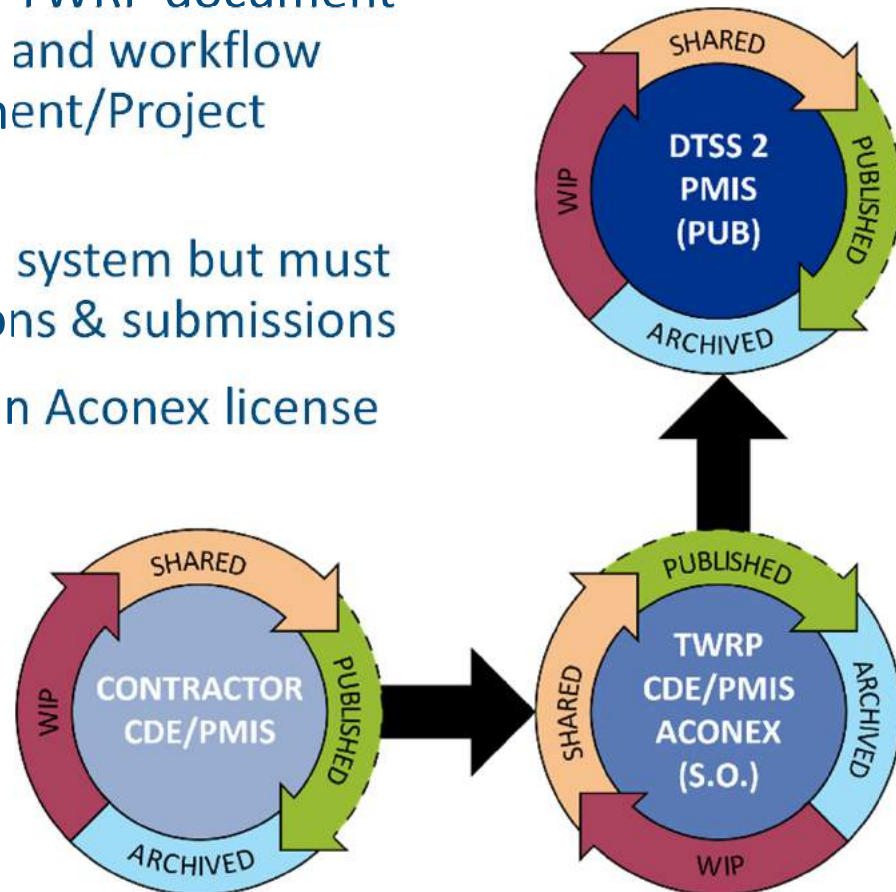
- Design provided in BIM model with limited 2D drawings
- Bentley Microstation platform with Navisworks
- Contractors to update model; MEICA design completion and construction as-builts
- Aligned to Singapore's BIM Guide (BCA)
- Contractors to deliver updated as-built model with COBie data embedded for all managed assets



Document Control



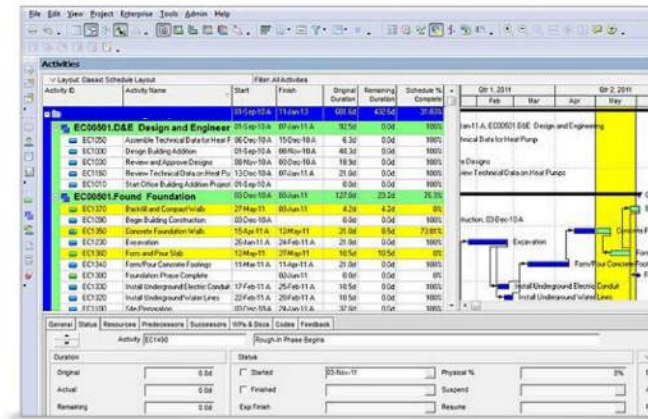
- Supervision team will use a single TWRP document system (Aconex) for all document and workflow control – Common Data Environment/Project Management Information System
- Contractors can choose their own system but must use S.O. system for communications & submissions
- Contractors to be provided with an Aconex license for access to S.O. TWRP system



Primavera P6 Programme



- Integrated project programme built on P6
- All contractors will be required to plan and report in P6
- Programmes to be resource-loaded
- Programmes linked to 3D Model in BIM for time-phasing



Plan, schedule, and control large-scale programs and individual projects using the interactive Gantt chart.



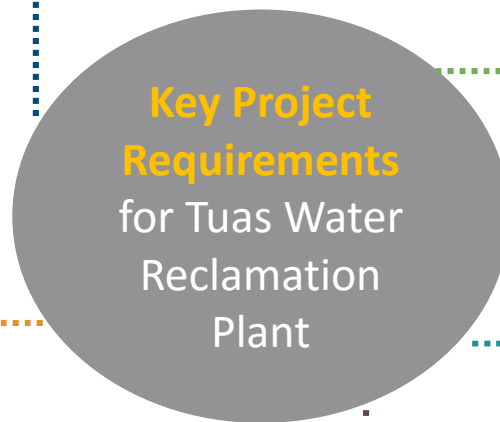
Summary of Key Project Delivery Requirements



6D BIM



Primavera P6 Programme



Key Project Requirements
for Tuas Water Reclamation
Plant



Safety Training Facilities



Smart Innovations



Document Control



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Ongoing Preparation Works



- Ground Improvement Work to complete Q3 2018

- Soil Investigation complete Q4 2018

- Access Bridges

 - » Route 2 in service

 - » Route 3 Q4 2018

- Other

 - » C1A Site Development Contract tendering in process; award by year end 2018

 - » Sitewide Instrumentation & Monitoring Contract tendering in process; award Q4 18



Project Challenges



🌀 Tight site

- » *Thousands of workers at peak*
- » *Thousands of vehicle movements on site*

🌀 Restricted Access

- » *Two land routes*
- » *Limited site road network*

🌀 Several tall structures

- » *38.5 m digester tanks*

🌀 Interfaces

- » *Between contracts and with incoming tunnels, IWMMF*
- » *With site-wide roads, utilities*

🌀 Competition with other major infrastructure programmes in Singapore

🌀 Meeting first milestone by June 2023; concurrent construction & operations thereafter





Summary and Next Steps



Key Takeaways



- **Safety is a MUST**
- **Timely** completion of project
- **Value for Money**
- Industry's **Collaboration** needed to succeed
- **Productivity and Innovations**



Upcoming



- Tenders rolling out in 2018:
 - » *Contract 2A – September / October 2018*
 - » *Contract 3A – December 2018 / January 2019*
- Use TWRP@jacobs.com mailbox for general queries



SAFETY ● SCHEDULE ● BUDGET ● QUALITY



Thank You

