Overview of Singapore’s Deep Tunnel Sewerage System

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Deep Tunnel Sewerage System Phase 2 (DTSS 2)
PUB
Outline

- Background of Singapore’s Deep Tunnel Sewerage System (DTSS)
- Objectives & Benefits of DTSS
- DTSS Phase 1
- DTSS Phase 2
PUB Manages the Complete Water Cycle

- Stormwater management
- Rain collection
- Sea treatment of used water
- Desalination of raw to potable water
- NEWater collection of used water in sewers
- Rain collection in drains & reservoirs
- Treatment of used water in sewers
- Domestic indirect potable use
- Industry direct non-potable use
- Water for All: Conserve, Value, Enjoy
Principles in Play

The principles that guides our future plans to ensure an adequate supply of water for all:

- To capture every drop of rain that falls on Singapore
- To collect every drop of used water
- To recycle every drop of water more than once
DTSS Concept

- Used water superhighway to meet Singapore’s long-term needs
- Integral part of Singapore’s water supply strategy

Water for All: Conserve, Value, Enjoy
Benefits of DTSS

Benefits:

- More cost effective
- Free up valuable land
- Ensures sustainability of NEWater
- Robust, Reliable and Resilient

Existing WRPs & Pumping Stations – 300 ha
DTSS Phase 1

Cost - $3.4 billion
Implementation period – 2000 to 2008

<table>
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<tr>
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<th>Tunnel</th>
<th>Link Sewers</th>
<th>Changi WRP</th>
<th>Outfall</th>
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<td>3.3 - 6m dia / 48km</td>
<td>0.75 – 3m dia / 60 km</td>
<td>176 MGD</td>
<td>3m dia / 5 km</td>
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49 Main contractors and consultants, with over 300 sub-contractors and suppliers
- 6 D&B Tunnels
- 28 Link Sewer Contracts
- 12 Construction Packages
- 7 Equipment Procurement
- 1 Outfall Contract
- 16 Consultancy Contracts
### Changi Water Reclamation Plant (CWRP)

- **Phase 1 capacity**: 176 MGD (800,000 m³/day)
- **Ultimate capacity**: 528 MGD (2,400,000 m³/day)
- **Construction period**: 2001 to 2008
- **Cost**: $2.2 Billion

#### Key Facilities
- DTSS Pumping Station
- Effluent Junction Chamber
- Liquids Treatment Module
- Electrical & Operations Building
- Solids Treatment Building
- NEWater Factory
- Digesters
Current Used Water Infrastructure

Comprises of:
- Networks of comprehensive sewers and tunnels from DTSS Phase 1
- Pumping stations
- Centralised Water Reclamation plants

CURRENT SYSTEM

- Jurong WRP (45 mgd)
- Kranji WRP (34 mgd)
- Ulu Pandan WRP (79 mgd)
- Changi WRP (174 mgd)
DTSS Phase 2

- Project started in 2014
- PES and Project Management awarded to BV/AECOM
- Preliminary Design in Progress

Consists of:
- Tunnels
- Link Sewers
- Water Reclamation Plant/Outfall
Deep Tunnel Sewerage System Phase 2 Project
Presentation to Singapore Water Association Networking Night

30 April 2015

Water for All: Conserve, Value, Enjoy

In association with
AGENDA

• INTRODUCTION
• CONVEYANCE (LINK SEWERS AND TUNNELS)
• TUAS WATER RECLAMATION PLANT (TWRP)
• TIMELINE & DELIVERY APPROACH
• INTEGRATED WASTE MANAGEMENT FACILITY (IWMF)
INTRODUCTION
Scope of Professional Engineering Services by B&V+AECOM JV

• Project commenced in April 2014
• Feasibility Study (9 months) – Part A1 (complete)
• Preliminary Design (21 months) – Part A2 (in progress, complete in January 2016)
  • Link Sewers
  • Tunnels
  • Tuas WRP and Outfall
• Engineering Services for the IWMF
• Program Management (Part B) for:
  • TBM tunnelling works to be executed under D&B contracts
  • Detailed design of Link Sewers Tuas WRP and Outfall
  • Construction of Link Sewers Tuas WRP and Outfall
CONVEYANCE
(LINK SEWERS AND TUNNELS)
Link Sewers and Tunnels

- South Tunnel: ~31 km
- Non-Domestic Tunnel: ~9 km
- Link Sewers: ~60 km
TUAS WATER RECLAMATION PLANT (TWRP)
Tuas Water Reclamation Plant (TWRP)
Tuas Water Reclamation Plant

- Unlike CWRP, TWRP will treat 2 used water streams, which are conveyed separately.

- TWRP’s initial treatment capacity
  - Used Water Treatment: 176 MGD (800,000 m³/day)
    - Domestic Module: 143 MGD (650,000 m³/day)
    - Industrial Module: 33 MGD (150,000 m³/day)
  & NEWater Treatment
Tuas Water Reclamation Plant

Advanced treatment plant that will be robust and reliable, energy efficient, space efficient and will require less manpower to operate and maintain

- MBR direct to RO for NEWater (No MF/UF Stage)
- Separate Domestic and Industrial Treatment Streams
- Energy Efficient Technologies
- Maximise NEWater recovery
- Wet Weather Sidestream Treatment
Tuas Water Reclamation Plant

Technologies are being tested and proven in Singapore

- Piloting Bio-EPT @ UPWRP
- UASB Demo Plant @JWRP
- Piloting Food Waste and Sludge Co-Digestion @ UPWRP
- Demo Scale @UPWRP
Co-location of TWRP and IWMF - Overview

- IWMF receives & treats municipal solid waste, food waste, NRP recyclables and dewatered sludge, producing electricity, heat, ash, used water and recyclables.

- TWRP receives & treats used water; producing biogas, sludge & water
DTSS Phase 2 Timeline
Delivery Approach for DTSS Phase 2 and IWMF
INTEGRATED WASTE MANAGEMENT FACILITY
Key Drivers of IWMF

- Maximise Resource & Energy Recovery
- Minimise Environmental Impact
- Optimise IWMF-TWRP Co-location Synergies & Land Footprint
- Keep Waste Disposal Cost Affordable
- Optimise Waste Management System Resilience
- Develop a World-Class Solid Waste Treatment Facility
Scope and Approach

- Ramboll are sub-consultants to B&V + AECOM JV
- Detailed layout plan of the IWMF
- Systems and Processes within the IWMF
- Evaluation of technologies and optimal capacity
  - Incineration technology selection and no./capacity of lines
  - Flue gas cleaning and turbine cooling
  - Incineration Bottom Ash (IBA) and Incineration Fly Ash (IFA)
  - Source Segregated Food Waste (SSFW) and Source Sorted Recyclable Waste (SSRW)
  - Drying and Incineration of Sludge (co-incineration and/or fluidised bed)
- Financial and administrative arrangements
IMWF and TWRP – Overall site concept

- Phase 1 (MSW) 4 lines
- Phase 2 (MSW) 4 lines
- Wet cooling tower
- Non-domestic (Initial)
- Domestic (Initial)
- Sludge Incineration
- Fluidized bed
- Weigh bridges
- Ramp up to Bunker
- Sludge Incineration 2 lines Fluidized bed
- Sludge dewatering (TWRP)
- LIQUIDS FACILITIES
- BIOSOLIDS (Future)
- BIOSOLIDS (Initial)
- NEWater Storage
- PUMPING STATIONS