

TAISEI-CSCEC P103

EARTH CONTROL MEASURES

for

CONTRACT P103

DESIGN & CONSTRUCTION OF RIVIERA

INTERCHANGE STATION AND TUNNELS FOR CROSS

ISLAND LINE- PUNGGOL EXTENSION

Client
LTA

Builder
TAISEI – CSCEC JV

Designer
T.Y LIN

Architect
GreenHilli Pte Ltd

QEC
BG&E TOH CK



CONTENT

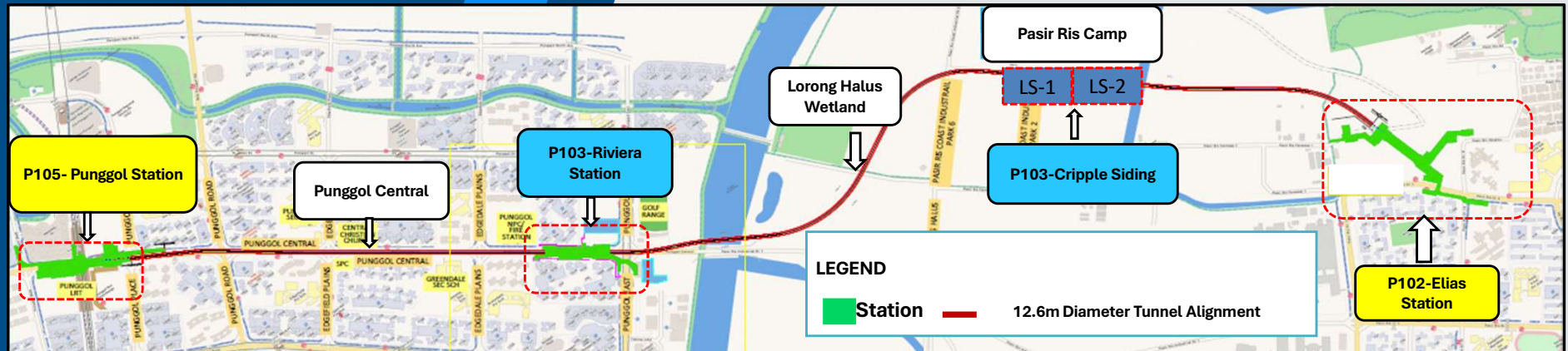


中國建築
CHINA STATE CONSTRUCTION

- **Project Overview**
- **Water Ways**
- **ECM Design**
- **ECM Measures**
- **Innovative Solutions and Technologies**
- **Recycling of Treated Water**
- **Inspection, Monitoring and Maintenance for ECM**
- **SIDS : Quality of Final Discharge from Site**
- **Challenges and Mitigation Measures**



PROJECT OVERALL PLAN

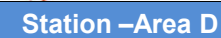
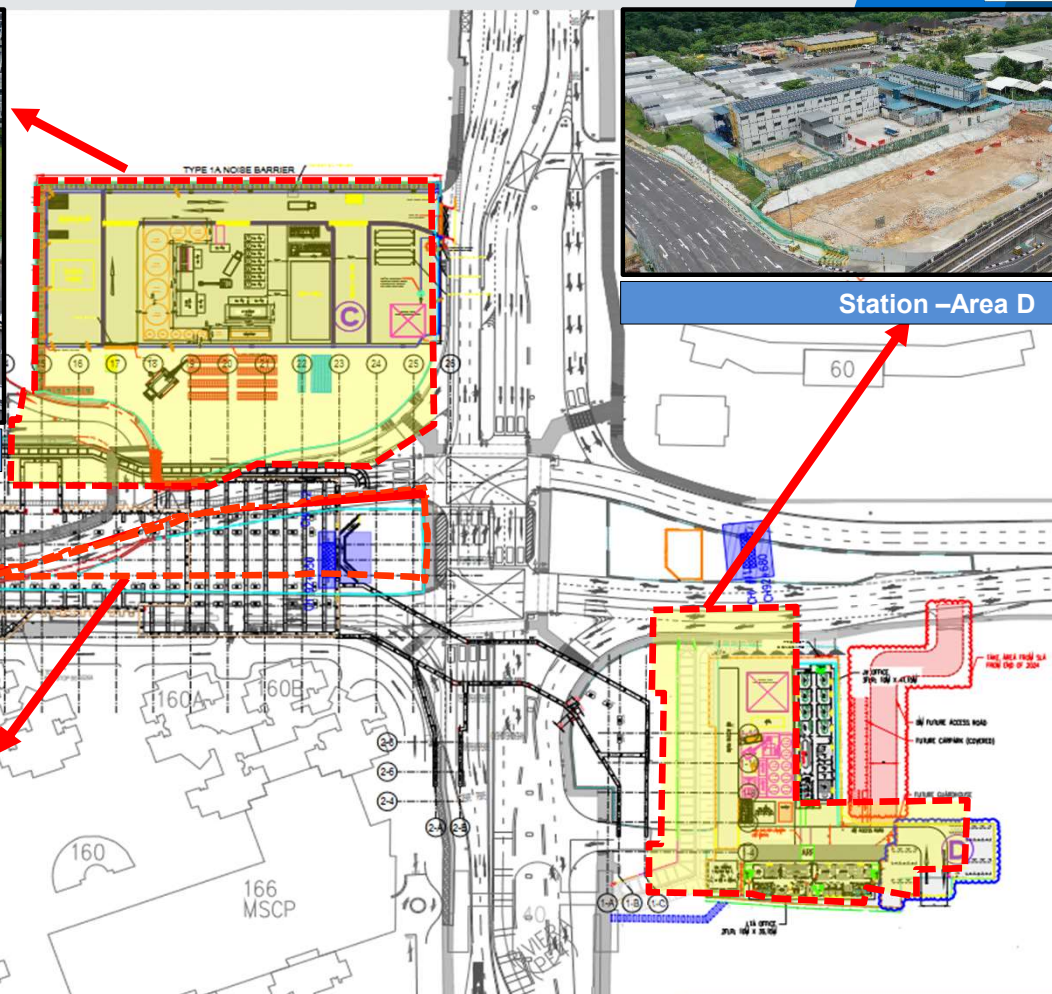


PROJECT SUMMARY: CONTRACT P103

➤ Scope of Work:

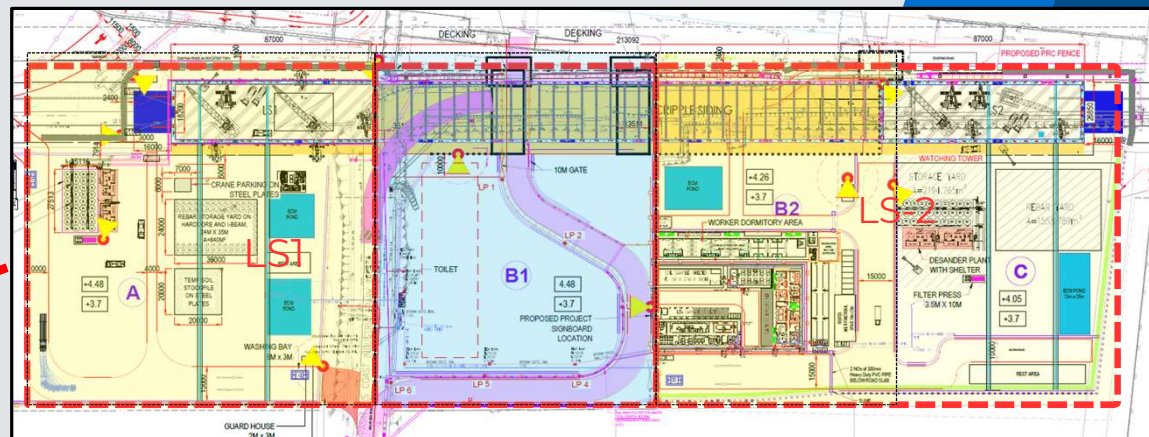
- Riviera Interchange Station Construction with 4 Entrances & 2 Service Structures
- Cripple Siding Cut & Cover Tunnel Construction with 2 Launching Shafts at East & West ends
- Bored Tunnel: LS1 to P105 (Large Diameter, 3.5 km) with 10 Cross Passages
- Bored Tunnel: LS2 to P102 (Large Diameter, 0.9 km) with 2 Cross Passages
- Shallow Ground Improvement works for Bored Tunnelling along Punggol Central from Edge Field Plains to Punggol Plains
- Demolition and Reconstruction of POBs & RCBC drains to facilitate the Bored Tunnelling





////// CURRENT PROGRESS AT LAUNCH SHAFT

Cripple Siding



NEAREST WATERWAYS



Sungai Serangoon

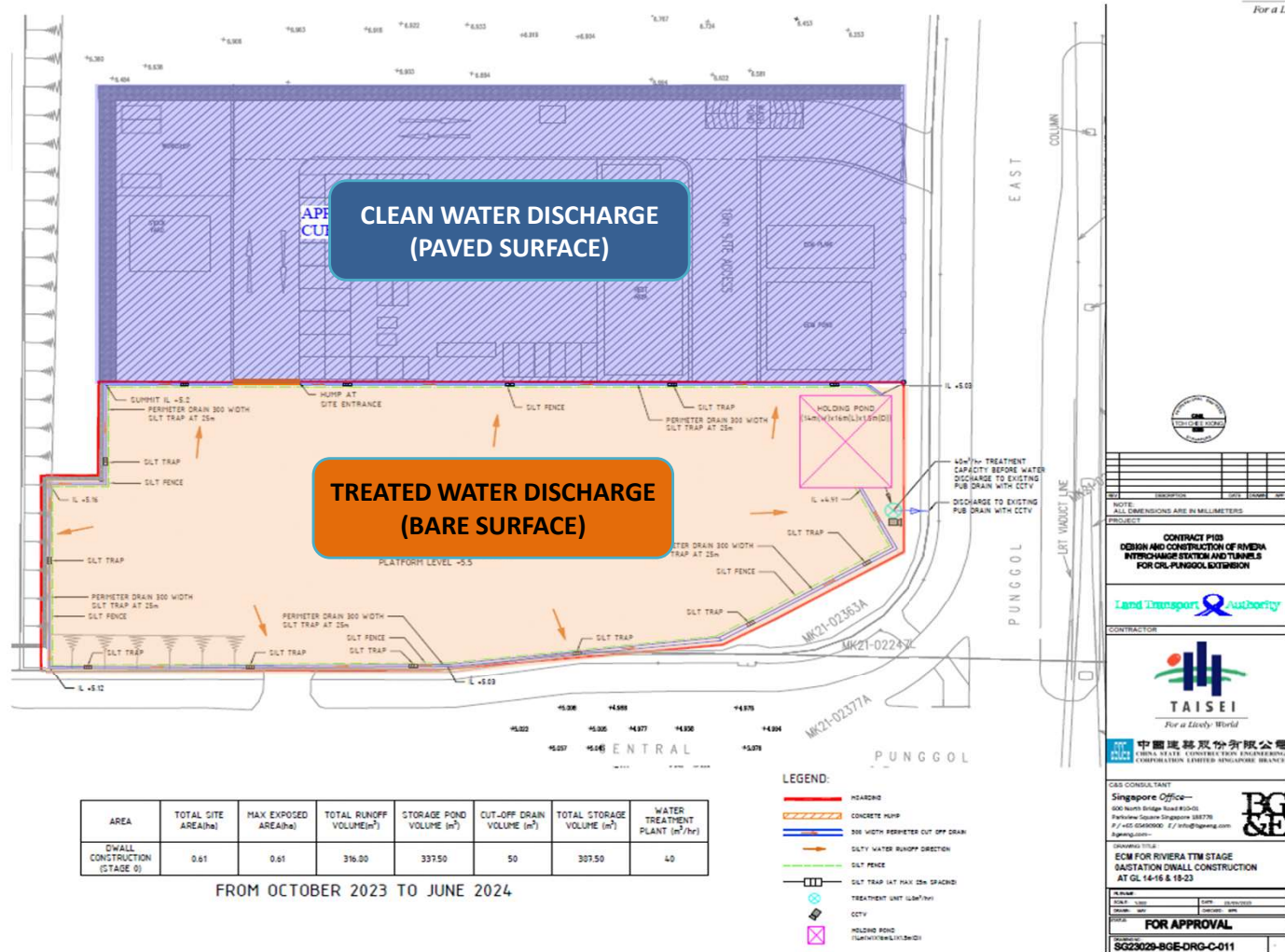
EARTH CONTROL MEASURES DESIGN & IMPLEMENTATION

STATION ECM DESIGN

ECM implemented are for two types of water discharge from site;

- Treated water and;
- Surface water run-off

This is largely due to space constraints and to reduce chemical treatment usage



ECM IMPLEMENTATION AT STATION



ECM Pond(40m3)



Additional Storage Tank (12m3)



ECM Treatment Plant(40m3)



Perimeter Drain

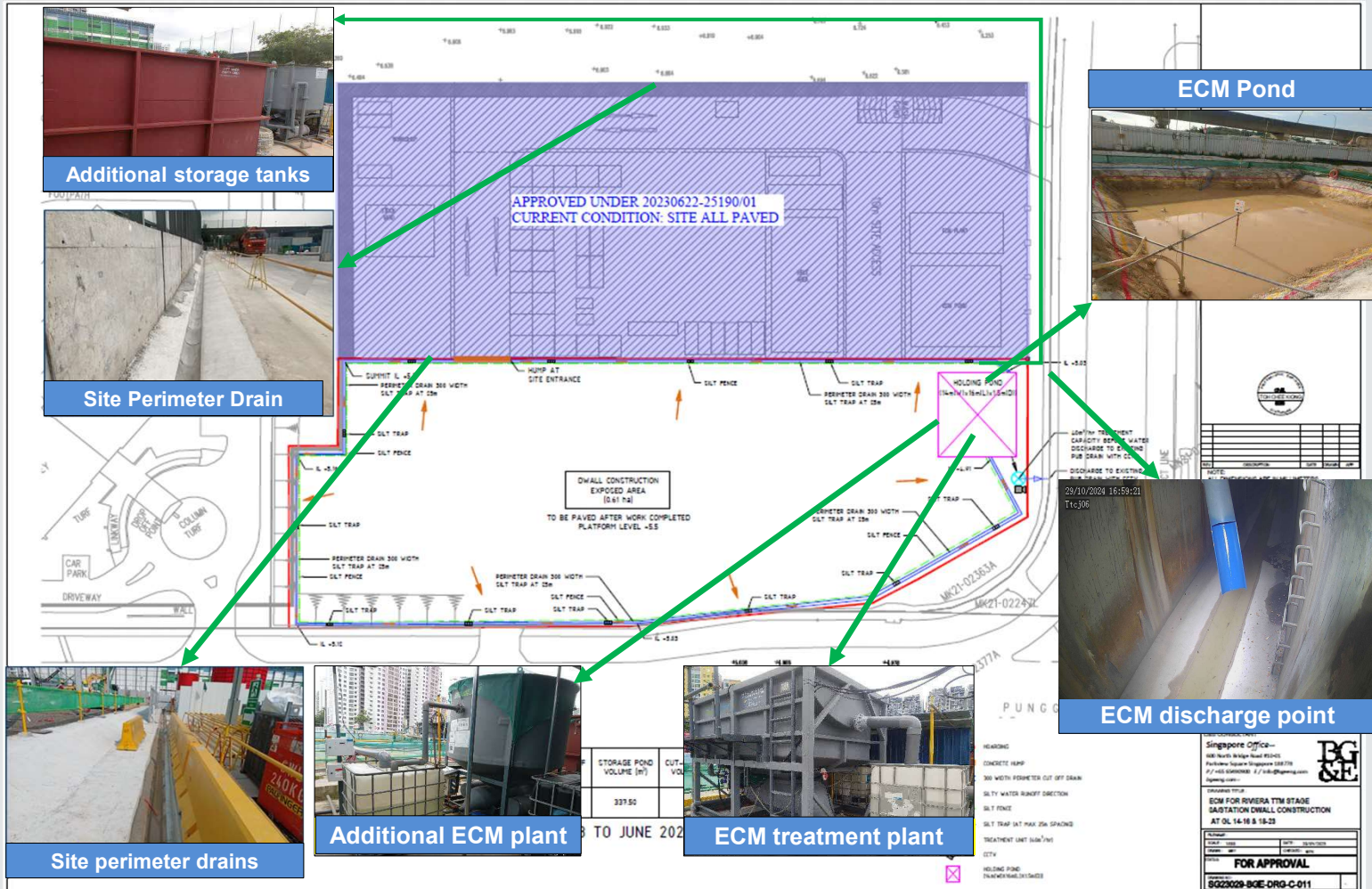


Additional Treatment Plant (20m3)



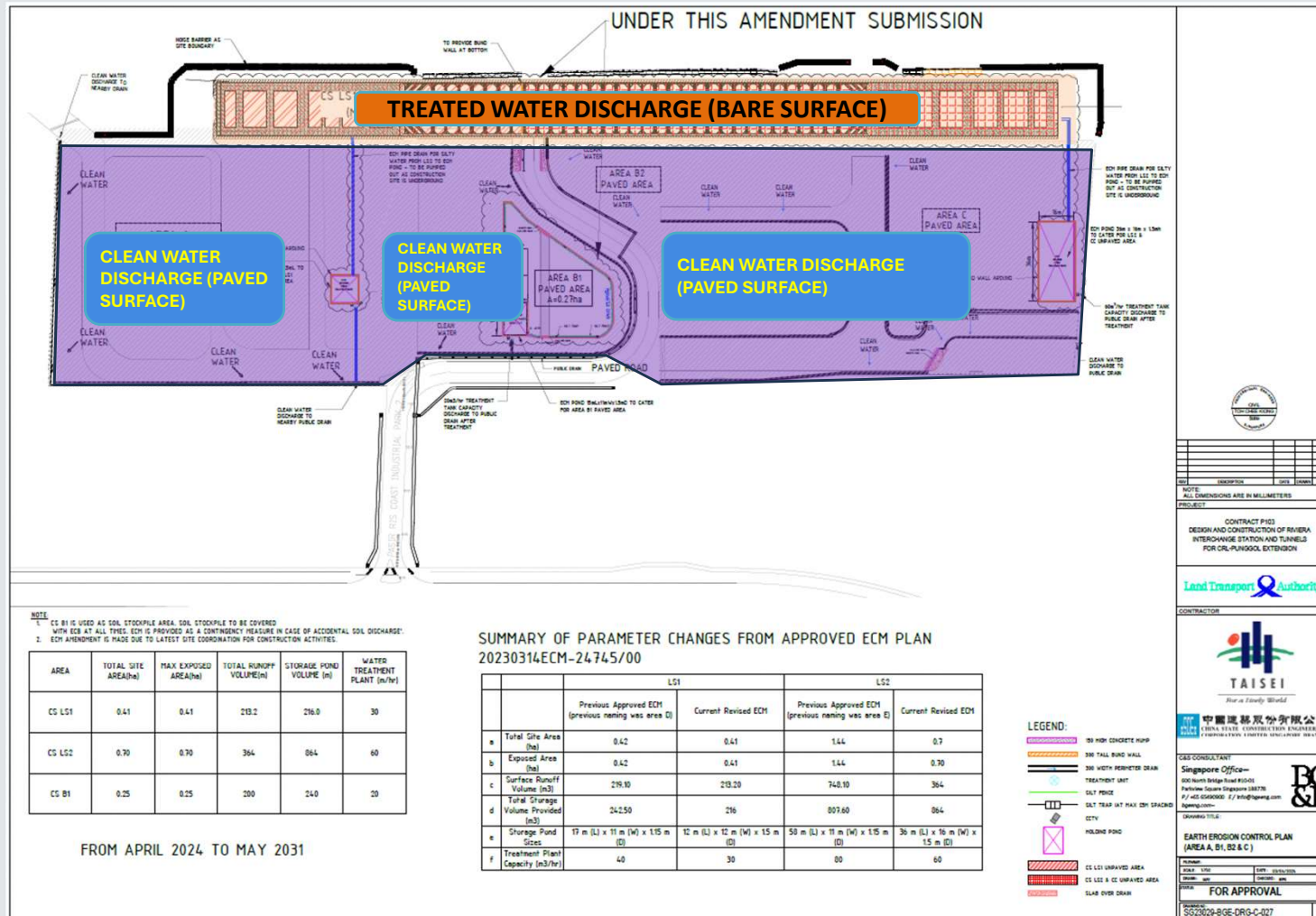
SIDS

STATION ECM



ECM Design
ECM Pond Capacity = 33m³
Treatment Plant Capacity = 40m³
Additional Storage Capacity = 12m³
Additional Treatment Plant Capacity = 20m³

TCSJV P103
provide additional measures to ensure poor silty discharge are avoided



ECM IMPLEMENTATION LAUNCH SHAFT



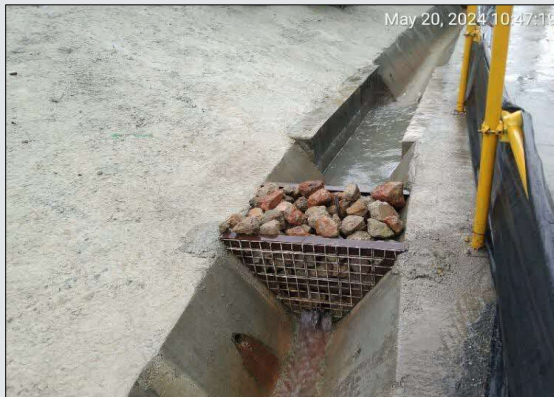
ECM Sedimentation Pond



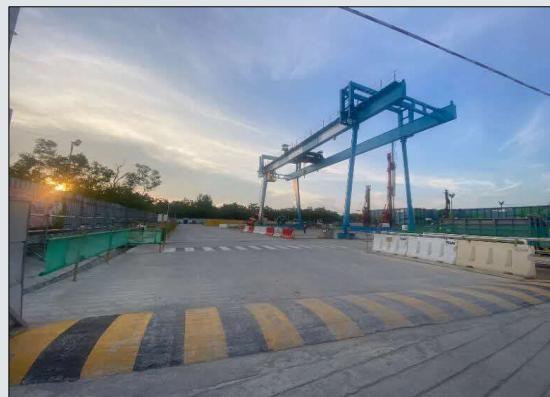
ECM Treatment Plant



ECM Discharge point



Silt Trap



Concrete hump at site entrances



SIDS

LAUNCH SHAFT ECM



ECM Treatment Plant



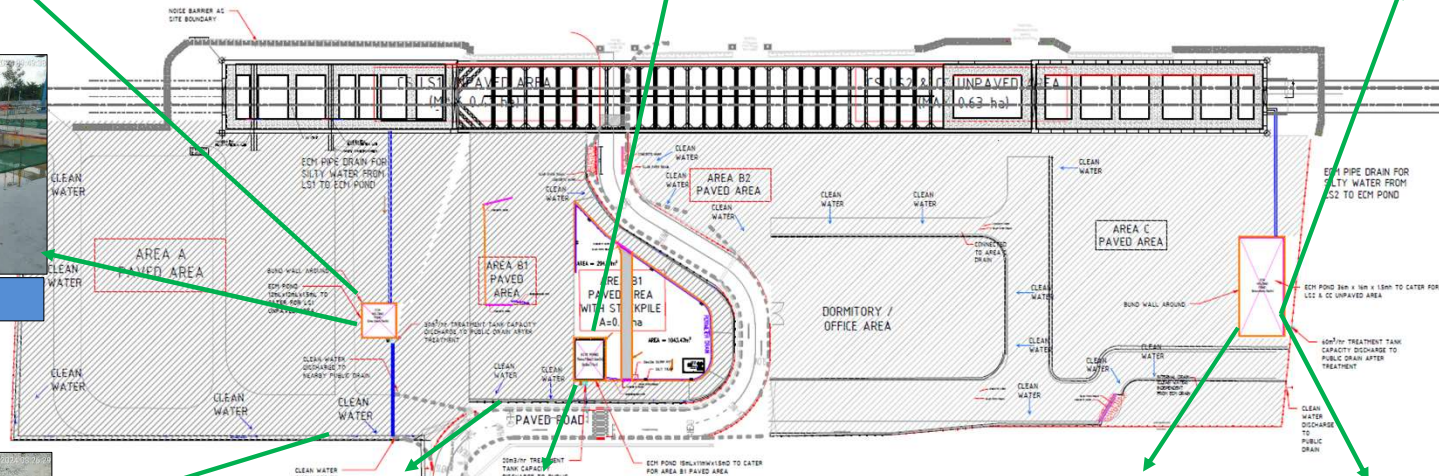
ECM Pond



ECM Discharge Point



ECM Pond



ECM Discharge Point



ECM Discharge Point



ECM Treatment Plant



ECM Pond



ECM Treatment plant

INNOVATIVE SOLUTIONS AND TECHNOLOGIES

ECM INNOVATIVE METHODS

SMART SWITCH CONTROL SYSTEM

Smart Switch Control



Smart Switch
Control Box

CCTV Camera at Sampling Tank



CCTV CAMERA

TSS Monitoring System



Discharge to Public Drain

Implementation
of automatic cut
off for silty water
discharge.



ECM INNOVATIVE METHODS

SMART SWITCH CONTROL SYSTEM



Control Panel

Implementation of automatic cut off for silty water discharge



TSS Sensor

If TSS level reaches 30mg/L
treatment plant will automatically shutdown.

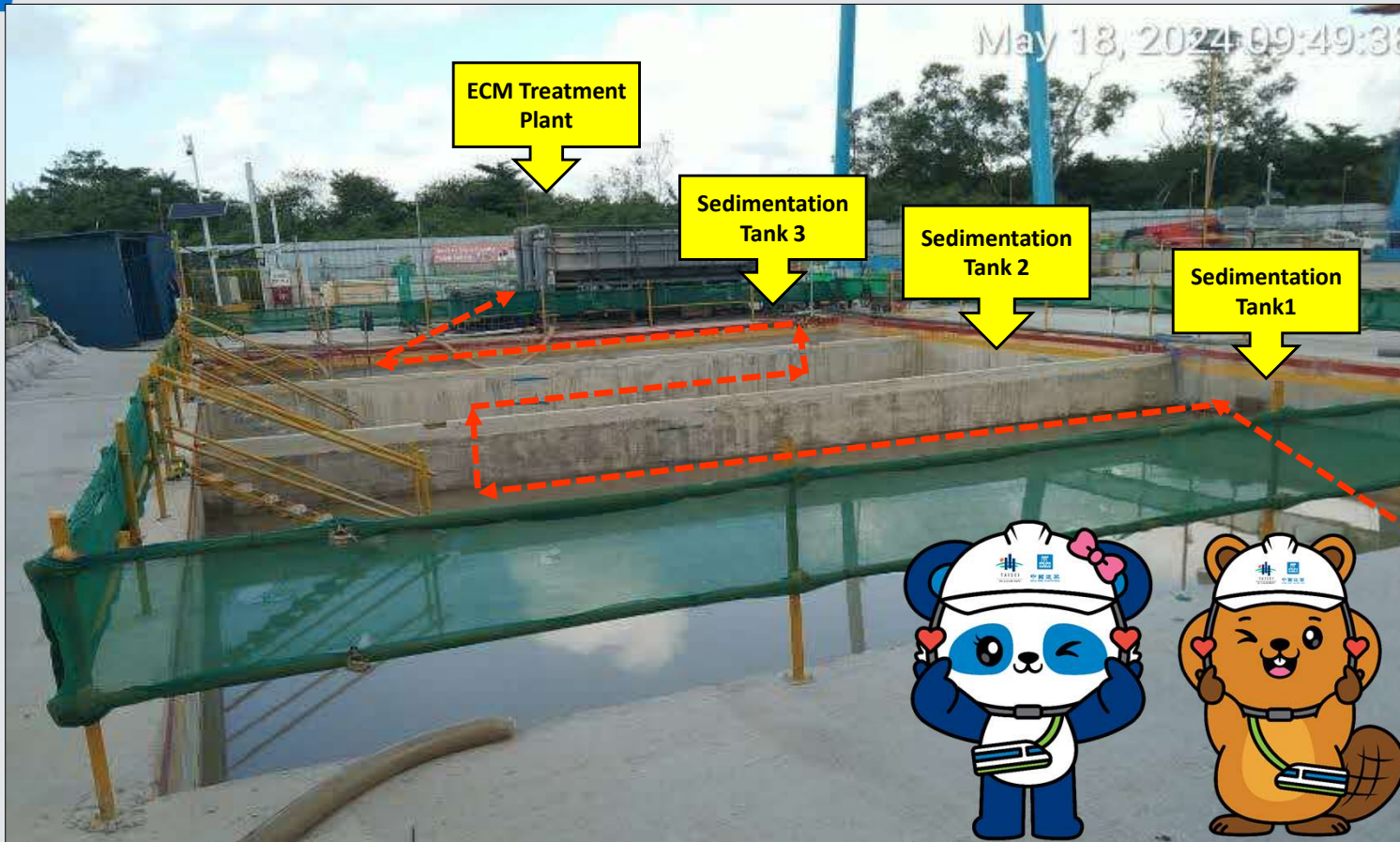


Sampling Tank and CCTV



ECM INNOVATIVE METHODS

BAFFLE FLOW METHOD



Silty water flow:

Sedimentation Tank 1



Sedimentation Tank 2



Sedimentation Tank 3



ECM Treatment plant

By adopting this baffle flow method, the core silt will settle in the individual tanks. This aids treatment plants to be more efficient in the treatment of fine silt, reducing chemical consumption and facilitating easier maintenance

ECM INNOVATIVE METHODS

PAVED SURFACES



80% of site surface is paved with concrete to reduce silty water generation.

Runoff from the paved surfaces flows directly into the public drains.



RECYCLING OF TREATED WATER FOR DUST CONTROL



Sprinkler System



Sprinkler System



Collection pond & sprinkler pump

ECM treated water is used for dust control onsite.

INSPECTION, MONITORING AND MAINTENANCE OF ECM

INSPECTION, MONITORING & MAINTENANCE

Simple pictorial operating procedures for ECM operators' ease of reference



1 Check the Chemical Level before start the ECM Plant



2 Start the ECM Plant



3 Check the chemical dosage



4 Check water treatment Condition



5 Check TSS level



6 If TSS level with in 50ml, Discharge the water into public drain

INSPECTION, MONITORING & MAINTENANCE



ECMO DAILY INSPECTION CHECKLIST FOR EACH AREA

DAILY CHECKLIST OF EARTH CONTROL MEASURES

Area Location: P103- CS [LS-1 & LS-2] Date: 10-10-2024

Inspected By: Surendran ECO Time: 9:30 AM

S/N	Description	✓	x	NA	Remark/Follow up Action
1	Perimeter Cut-off drain silted	✓			Clear all the perimeter down road
2	Silt traps silted		✓		
3	Silt fence damaged	✓			
4	Silt fence not properly embedded		✓		
5	Protect bare slopes and stockpiles with close turfing or erosion control blanket or lean concrete	✓			No erosion in holding pond is already empty.
6	Sedimentation plant in functional	✓			
7	Holding pool full (muddy water)	✓			
8	Sludge pool full	✓	✓		
9	TSS continuous monitoring system turn on and functional	✓			
10	Sufficient stock of sedimentation chemicals available on site	✓			
11	Provide adequate size and number of sedimentation sumps or storage tanks before treatment of silty water	✓			
12	Provide adequate size and number of sedimentation sumps or storage tanks before discharge and along the perimeter cut-off drain	✓			
13	Provide treatment unit/coagulant unit to treat silty water before discharge into public drain	✓			
14	Pave up all construction access and bare surfaces with concrete, milled waste, etc	✓			

Inspected by: Surendran ECO / ECMO

Acknowledged by: CM / PM

DAILY CHECKLIST OF EARTH CONTROL MEASURES

Area Location: P103- Station [RECB-1 to 4] Date: 11-10-2024

Inspected By: Surendran ECO Time: 13:40 hrs

S/N	Description	✓	x	NA	Remark/Follow up Action
1	Perimeter Cut-off drain silted		✓		
2	Silt traps silted		✓		
3	Silt fence damaged	✓			To replace the damaged silt fence at RECB-3
4	Silt fence not properly embedded		✓		
5	Protect bare slopes and stockpiles with close turfing or erosion control blanket or lean concrete	✓			
6	Sedimentation plant in functional	✓			
7	Holding pool full (muddy water)		✓		
8	Sludge pool full		✓		
9	TSS continuous monitoring system turn on and functional	✓			
10	Sufficient stock of sedimentation chemicals available on site	✓			
11	Provide adequate size and number of sedimentation sumps or storage tanks before treatment of silty water	✓			
12	Provide adequate size and number of sedimentation sumps or storage tanks before discharge and along the perimeter cut-off drain	✓			
13	Provide treatment unit/coagulant unit to treat silty water before discharge into public drain	✓			
14	Pave up all construction access and bare surfaces with concrete, milled waste, etc	✓			

Inspected by: Surendran ECO

Acknowledged by: CM / PM

DAILY CHECKLIST OF EARTH CONTROL MEASURES

Area Location: P103- Station [Area-C,D & Y] Date: 11-10-2024

Inspected By: Surendran ECO Time: 9:30 AM

S/N	Description	✓	x	NA	Remark/Follow up Action
1	Perimeter Cut-off drain silted		✓		
2	Silt traps silted		✓		
3	Silt fence damaged	✓			To replace the damaged silt fence at Area-C
4	Silt fence not properly embedded	✓			To rectify the damaged silt fence at Area-D
5	Protect bare slopes and stockpiles with close turfing or erosion control blanket or lean concrete	✓			
6	Sedimentation plant in functional	✓			
7	Holding pool full (muddy water)		✓		
8	Sludge pool full		✓		
9	TSS continuous monitoring system turn on and functional		✓		To clean the sensor regularly at Area-D
10	Sufficient stock of sedimentation chemicals available on site	✓			
11	Provide adequate size and number of sedimentation sumps or storage tanks before treatment of silty water	✓			
12	Provide adequate size and number of sedimentation sumps or storage tanks before discharge and along the perimeter cut-off drain	✓			
13	Provide treatment unit/coagulant unit to treat silty water before discharge into public drain	✓			
14	Pave up all construction access and bare surfaces with concrete, milled waste, etc	✓			

Inspected by: Surendran ECO / ECMO

Acknowledged by: CM / PM

INSPECTION, MONITORING & MAINTENANCE



Weekly / Ad-hoc ECM inspection carried out by LTA



INSPECTION, MONITORING & MAINTENANCE



Monthly
ECM
inspection
carried
out by
QECF






INSPECTION, MONITORING & MAINTENANCE

ECM INSPECTION MONTHLY REPORT BY QECP



Attachment 1 – QECP Inspection Checklist				
S/N	BEST MANAGEMENT PRACTICES	INSPECTION	COMPLIANCE	ACTIONS
1	Construction Sequences & Scheduling	Clearing of construction areas carried out in phases?	Yes / No / N/A	
2	Stockpiles of Earth Materials	Stockpile location according to ECM plan?	Yes / No / N/A	
3	Stabilization through laying of rolled waste, lean concrete, turfing, etc.	Location according to ECM schedule?	Yes / No / N/A	
4	Stockpiles of Earth Materials	Construction according to ECM schedule?	Yes / No / N/A	
5	Silt Traps	Any signs of damage at silt control areas?	Yes / No / N/A	
6	Sedimentation Basins / Storage Ponds	Any signs of damage at silt control areas?	Yes / No / N/A	
7	Treatment Units / Polymer Blocks	Stockpile location according to ECM plan?	Yes / No / N/A	
8	Perimeter cutoff drains	Protected against sedimentation?	Yes / No / N/A	
9	Wheeled wash areas, silt-trap points	Installation of silt traps including location according to ECM schedule?	Yes / No / N/A	
10	Others	Installation of basins / ponds including location according to ECM schedule?	Yes / No / N/A	

Date of Inspection: 3/10/2024
 Name of Inspecting Officer: Mr. KANG WEE PIENG
 Appointment: QECP REP
 Date & Time of Site Visit: 3/10/2024 15:00 hrs
 Weather Condition: SUNNY
 Project Title: CONTRACT#180 DESIGN & CONSTRUCTION OF RIVERA INTERCHANGE STATION AND TUNNELS FOR CRL - PUNGGOL EXTENSION
 Location of Site: PUNGGOL CENTRAL
 Project Duration: 64 Months
 Type of Present Construction Activity: PUNGGOL EAST SITE OFFICE AREA (Localized ECM) Interim ECM at Area-C
 PUB Permit Number: ECM/2022/2172180/01
 Owner / Developer: LTA
 GP for project: QECP for ECM: EY TOH CHEE KOONS
 EEO: SURENDRA
 Owner / Developer's Representative on-site: T.HABA
 Date of ECM Plan: July 2023
 Last Date of ECM Plan Review: N/A
 ADDITIONAL INFORMATION
 Date & Time of Previous Site Visit: 26/04/2024
 Date of Last Inspection Report: 26/04/2024
 Issues Identified in Previous Site Visit: NIL
 This site inspection has been certified by:
 OP / QECP: [Signature]
 Date: 11/06/2024
 Contractor: TCSIV
 Date: 11/06/2024
 Owner/Developer: LTA
 Signature: [Signature]
 Date: 12/06/2024
 Note: Earth Control Measures is for the treatment of silt water due to site water. Construction wastewater (slurry, bentonite, etc.) due to tunnelling, boring, etc. shall be separately treated.

Attachment 3 – Inspection Photos

Observation	Close-out Action
ECM Plants/CCTV  <p>Observation: ECM pond well maintained.</p>	N.A.
 <p>Observation: Sampling tank well maintained</p>	N.A.
 <p>Observation: Discharge point well maintained</p>	N.A.

Attachment 3 – Inspection Photos

 <p>Observation: Site Access well maintained</p>	N.A.
 <p>Observation: Stagnant water in the drain</p>	Stagnant water been cleared

Closed out by: [Signature] Signature & Date: [Signature] 11/06/2024
 (Contractor)

INSPECTION, MONITORING & MAINTENANCE

ECM INSPECTION MONTHLY REPORT BY QECP



Attachment 1 – QECP Inspection Checklist	
S/N	INSPECTION
1	Construction Sequence & Scheduling
2	Stockpiles of Earth Materials
3	Stabilization through laying of milled waste, lean concrete, tuffing, etc.
4	Stockpiles of Earth Materials
5	Silt Traps
6	Sedimentation Basins / Storage Ponds
7	Treatment Units / Polymer Blocks
8	Perimeter cut-off drains
9	Wheelbar wash areas, entry/exit points
10	Others

Any other observations / comments:

Occupier to ensure all erosion & sedimentation control measures are in place to prevent any silty discharge public drains

All exposed & bared surfaces to be laid with lean concrete or covered with canvas sheet (ECB)

Attachment 3 – Inspection Photos	
Observation	Close-out Action
ECM Plants/CCTV 	N.A.
ECM pond well maintained 	N.A.
Sampling tank well maintained 	N.A.
Site access well maintained 	N.A.

Attachment 3 – Inspection Photos	
<p>ECM Discharge point well maintained</p>	NA
<p>Stockpile was cleared.</p>	<p>Improper cover the stockpile.</p>
<p>Silt deposit in perimeter drain.</p>	<p>Perimeter drain was cleared.</p>

closed out by: Signature & Date: 11/06/2024

INSPECTION, MONITORING & MAINTENANCE

Robust maintenance regime guides provided for easy reference



ECM TREATMENT PLANT OPERATORS

Project: P103 Location: Lunch Staff

DAY SHIFT	NIGHT SHIFT
 NAME: [Name] ID: [ID]	 NAME: [Name] ID: [ID]

TAISEI - CHECK JV P103 DESIGN AND CONSTRUCTION OF RIVERA INTERCHANGE STATION AND TUNNEL FOR CIL PUNGOL EXTENSION

SOP FOR ECM OPERATION

1. Check the Chemical and Level before start the TSS pump
2. Start the treatment plant
3. Check the treatment stage
4. Check water treatment plant
5. Check TSS level
6. TSS level with the treatment plant

TAISEI - CHECK JV P103 DESIGN AND CONSTRUCTION OF RIVERA INTERCHANGE STATION AND TUNNEL FOR CIL PUNGOL EXTENSION

ECM PLANT

NO ENTRY EXCEPT FOR AUTHORISED PERSONNEL ONLY

TAISEI - CHECK JV P103 DESIGN AND CONSTRUCTION OF RIVERA INTERCHANGE STATION AND TUNNEL FOR CIL PUNGOL EXTENSION

MEASUREMENT OF TSS

Location: Area Y @Pumpout Canal

80mg/L, 200mg/L, 800mg/L, 1000mg/L

TAISEI - CHECK JV P103 DESIGN AND CONSTRUCTION OF RIVERA INTERCHANGE STATION AND TUNNEL FOR CIL PUNGOL EXTENSION

ENV SDS

SCAN QR CODE

TAISEI - CHECK JV P103 DESIGN AND CONSTRUCTION OF RIVERA INTERCHANGE STATION AND TUNNEL FOR CIL PUNGOL EXTENSION

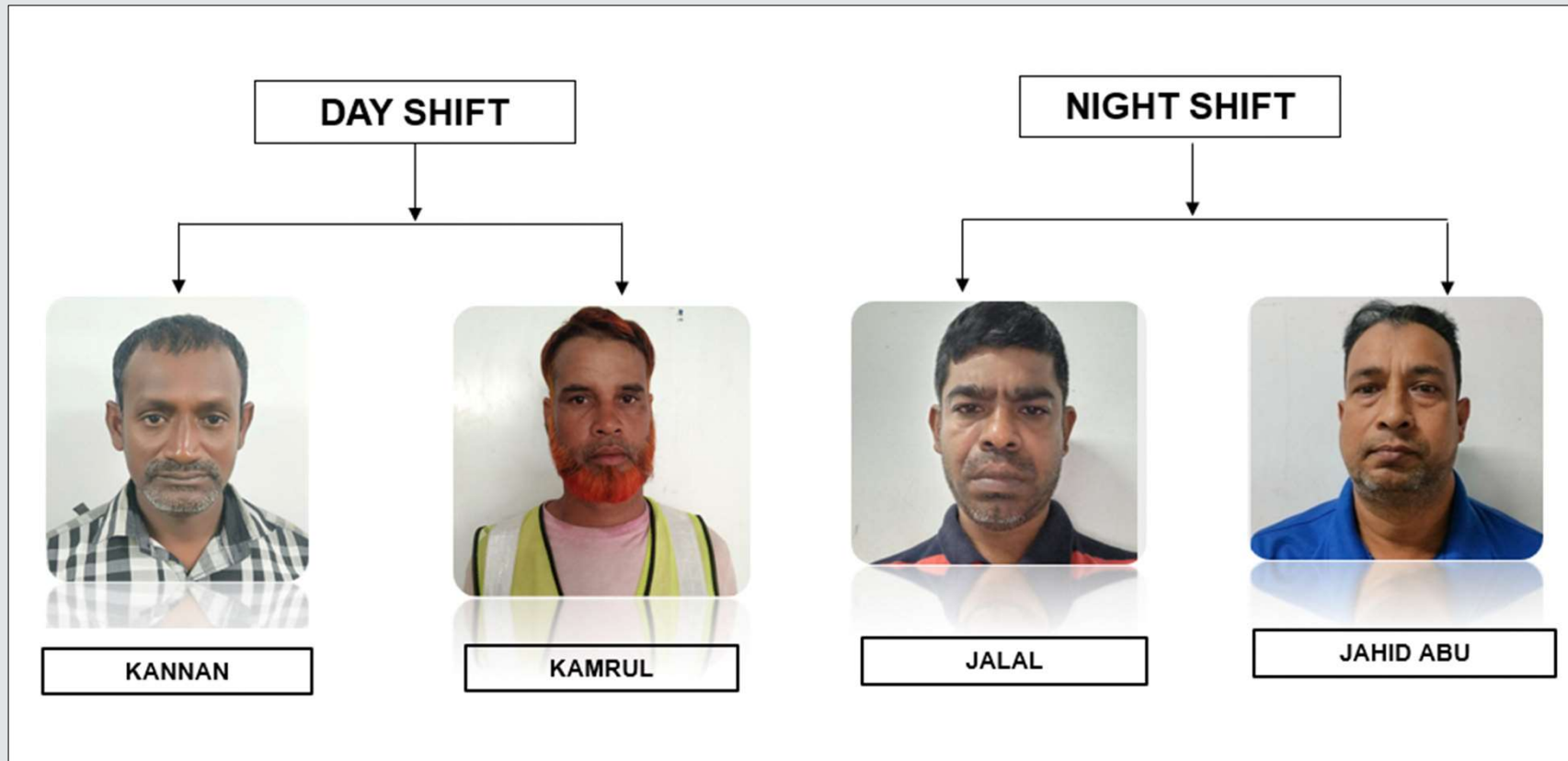
ENVIRONMENTAL MAINTENANCE CHECKLIST

Item	Check	Result
1. Check the Chemical and Level before start the TSS pump	✓	
2. Start the treatment plant	✓	
3. Check the treatment stage	✓	
4. Check water treatment plant	✓	
5. Check TSS level	✓	
6. TSS level with the treatment plant	✓	

20/11/24

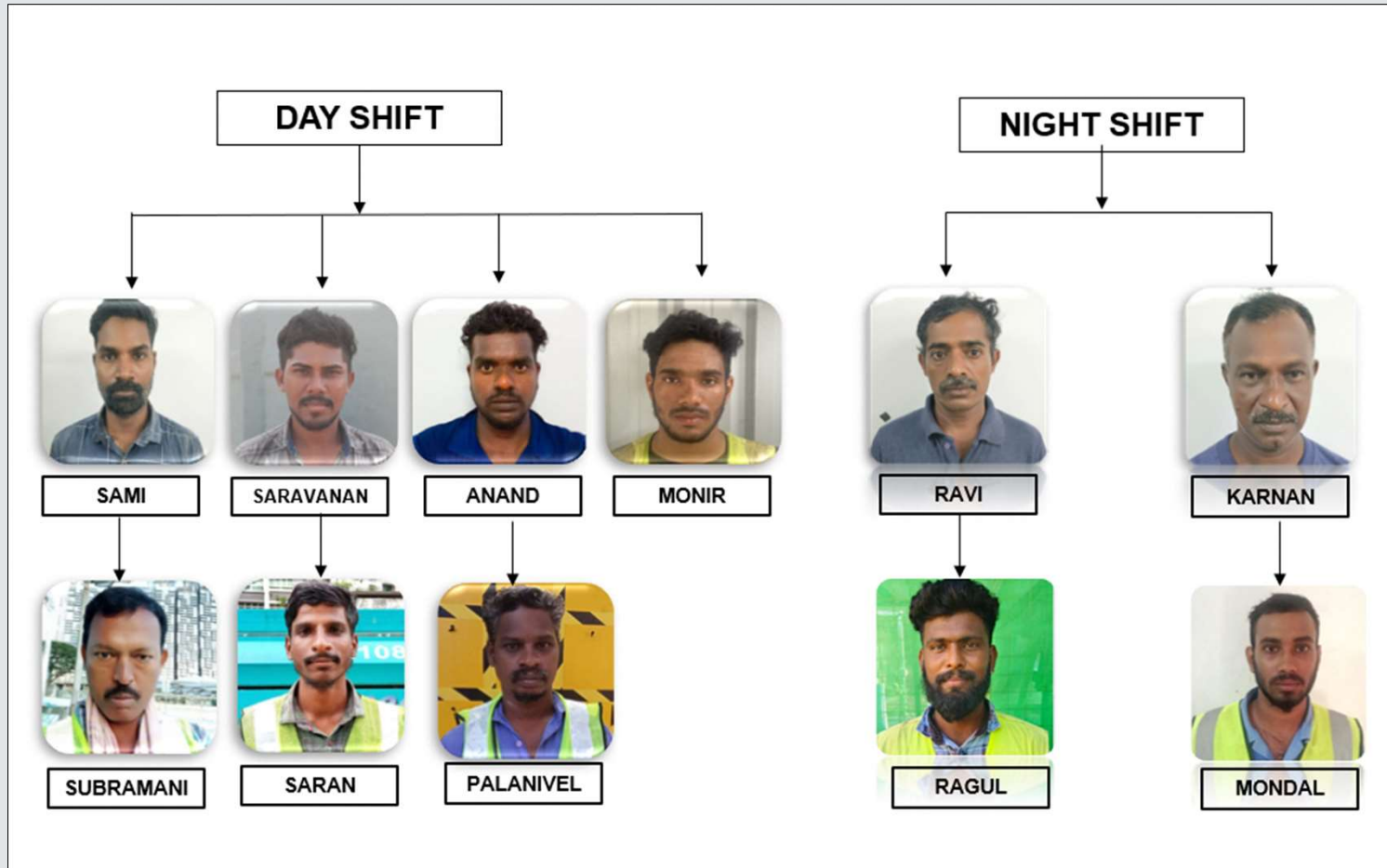
INSPECTION, MONITORING & MAINTENANCE

DEPLOYED COMPETENT ECM OPERATORS AT LAUNCH SHAFT



INSPECTION, MONITORING & MAINTENANCE

DEPLOYED COMPETENT ECM OPERATORS AT AREA-C,D & Y



INSPECTION, MONITORING & MAINTENANCE



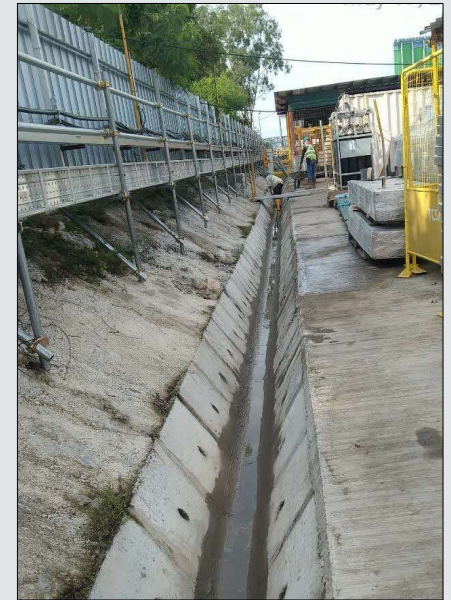
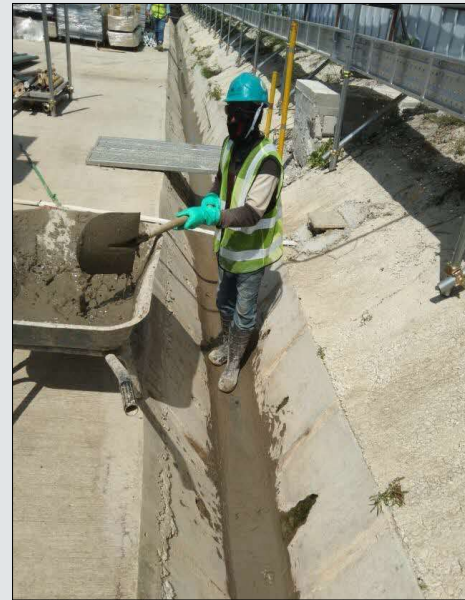
Maintenance of the ECM treatment plant is carried out after every plant operation.



INSPECTION, MONITORING & MAINTENANCE



Regular maintenance at perimeter drains



INSPECTION, MONITORING & MAINTENANCE



Regular sludge removal from ECM Ponds



VAC-JET Services Pte Ltd
 73, Upper Paya Lebar Road, #08-01F Centro Bianco, Singapore 534818.
 Tel: 6449 1600 Email: sales@vac-jet.com

GST Reg. No. / Co Reg. No:
 200706490N
 X71410M
No. 149805

DATE: 28/10/24 **SERVICE MEMO** Our Ref:
 Your Ref:

INVOICE TO: TAISEI - CSCEC - JV P103 **biSAFE₄**

JOBS DESCRIPTION		AMOUNT
Supply 13 ^{m3} Vacuum tanker for slurry disposal from TANK	Hydro-jetting	
	Rodding	
	Rotoworm	
	Rammer	
	Plunger	
	Vacuum	✓
Toxic waste, chemical waste, infectious waste and inorganic waste are prohibited.		
Site Location		
Pasir Ris Coast Ind Park 3		
Contact :	Tel:	
Name & Sign for VAC-JET Services Pte Ltd	Time Arrival: 1630	Time Left: 1730
Customer's Name / Sign / Stamp		FORM C

Customer's Name / Sign / Stamp: M. Mahan

INSPECTION, MONITORING & MAINTENANCE



Regular maintenance of site access and paved surfaces at site

INSPECTION, MONITORING & MAINTENANCE



Bare surfaces are covered with fire-retardant erosion control blanket in public areas

INSPECTION, MONITORING & MAINTENANCE

Regular monitoring of water / silt levels.



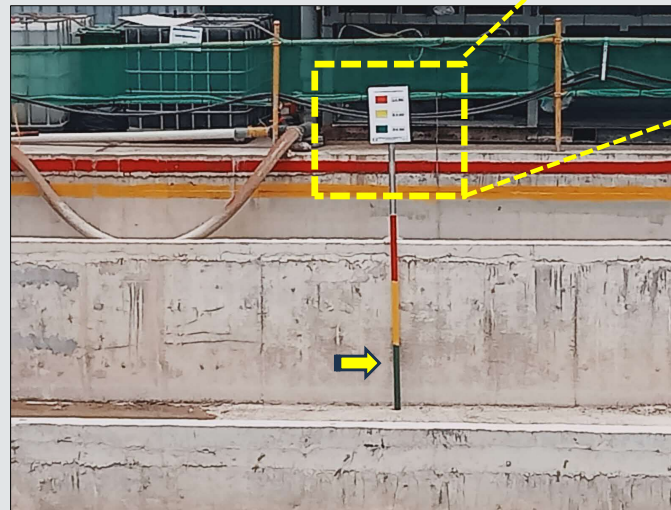
Legend:

Below Yellow: < 0.3m to 0.5m → 1 treatment plant will be activated during rain.

Yellow → Treatment plant will continue operation.

Red: → Silty water will be pumped to additional steel tank for temporary storage / Activate additional treatment plant to prevent overflow.

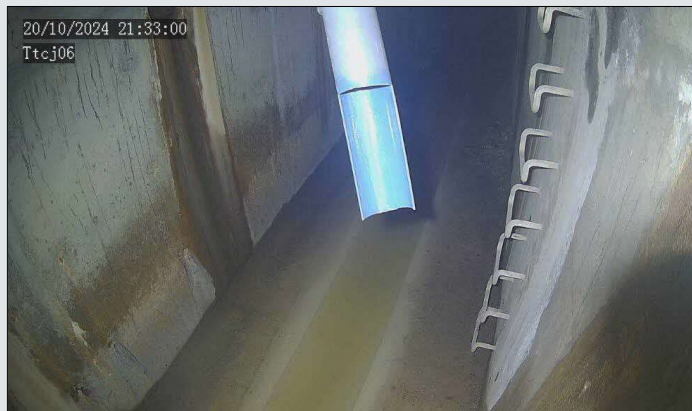
SILT LEVEL INDICATOR



**If Silt level reach to “Green Mark”
TCSJV will arrange to clear the silt**

SIDS : QUALITY OF FINAL DISCHARGE FROM SITE

SIDS-SILTY IMAGERY DETECTION SYSTEM

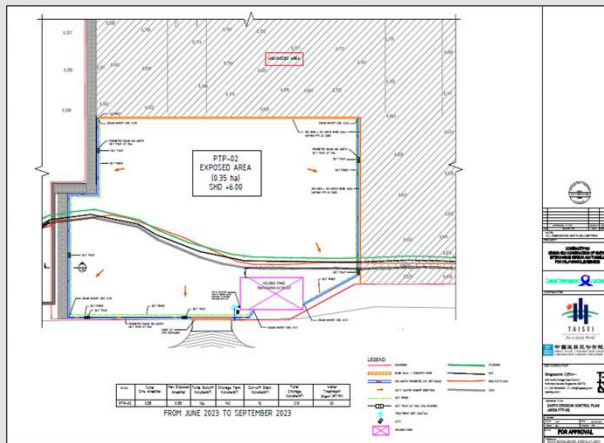


CHALLENGES AND MITIGATION MEASURES

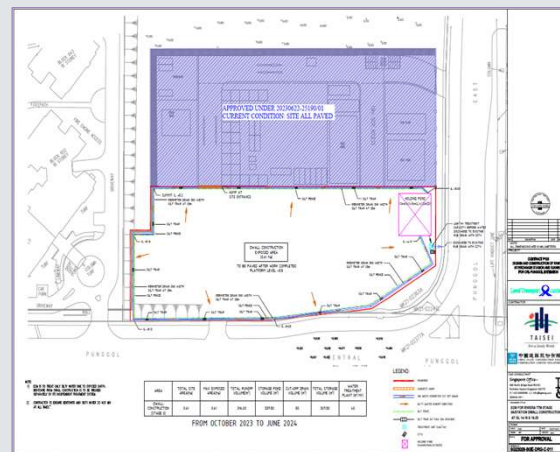
CHALLENGES AND MITIGATION MEASURES



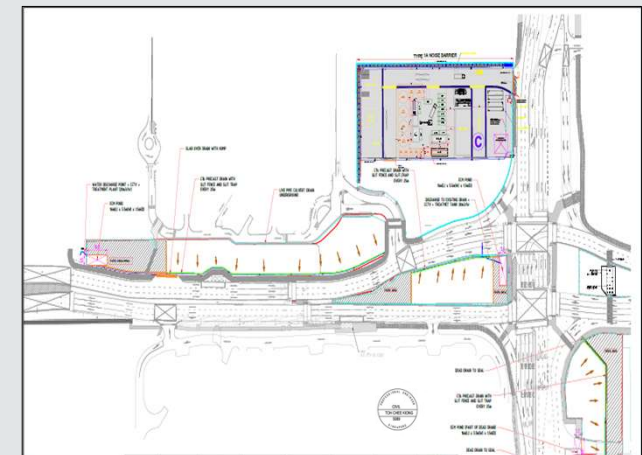
There are 9 traffic diversions in total, with each requiring at least 3 Earth Control Measures reconfigurations—posing a significant planning and strategy challenge



ECM IMPLEMENTATION JUN TO SEP 2023



ECM IMPLEMENTATION SEP TO JUN 2024



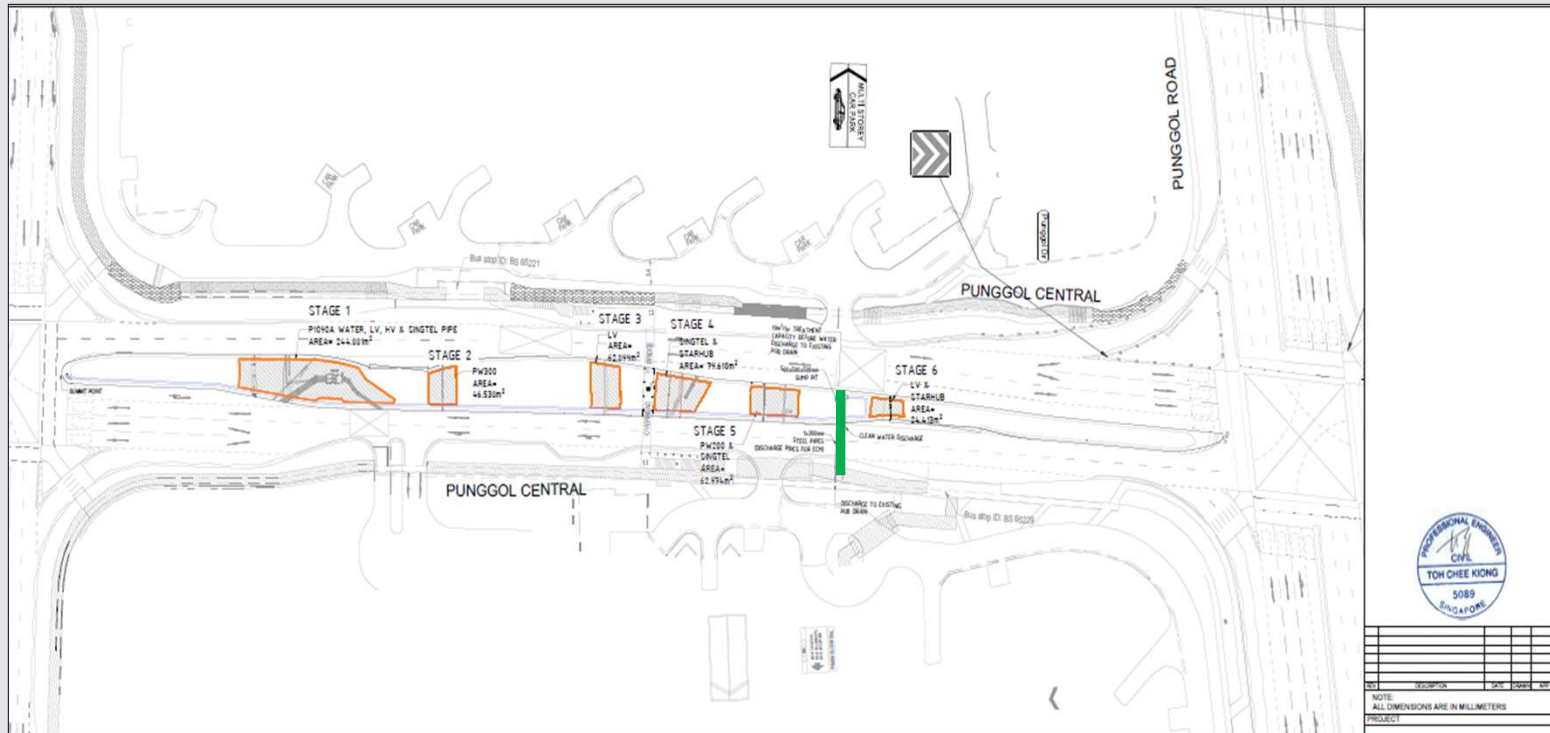
ECM IMPLEMENTATION FROM JUN 2024 TO MAY 2025

CHALLENGES AND MITIGATION MEASURES

Lack of Discharge Points

“Works at road Centre median due to ground improvement works means there is no discharge point”

Solution: TCSJV lay discharge pipes under traffic road and discharge clean treated water to the side table drainage inlet chamber



Future Challenges – Large Volume of Excavation

PLANNING

Brainstorming with the construction team, design team, and QECP to develop an adequate ECM plan for this bulk excavation area

IMPLEMENTATION

To identify the suitable location for an ECM pond on-site and to procure equipment with sufficient capacity for ECM treatment, including water pumps, steel pipes, and necessary technologies

MONITORING

To deploy a dedicated team for ECM monitoring and maintenance



Total excavation volume = 252
Olympic size pools

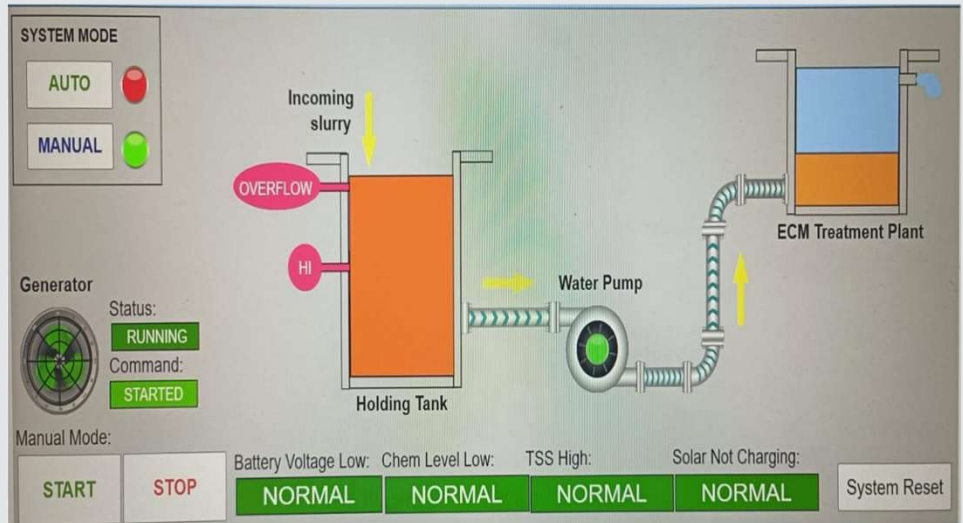
CHALLENGES AND MITIGATION MEASURES



Moving forward :



AI Camera for ECM



ECM Control and Monitoring

Remote Pump Monitoring System

Set up dewatering pumps to switch to auto mode and be controlled via mobile phone



THANK YOU

FOR YOUR ATTENTION

