PORT OF TOWNSVILLE

MANAGEMENT of 1.5Mm3 of POTENTIAL ACID SULPHATE SOIL from DREDGE MATERIAL

Capacity Upgrade Project - Overview

Port of Townsville is in Cleveland Bay, North Queensland. Cleveland Bay is within the GBRMPA.

Capacity Upgrade Project - Overview

Completed Rock Wall - 2021

- 2.2 km rock wall
- 4.6 Mm3 capacity
- Dredge contractor selected prior to rock-wall completion

Dredging and Reclamation

Dredging commenced - 2022

- Two-year dredging campaign
- 14 km of shipping channel being widened
- Average daily production rate of 4,500m3/ day

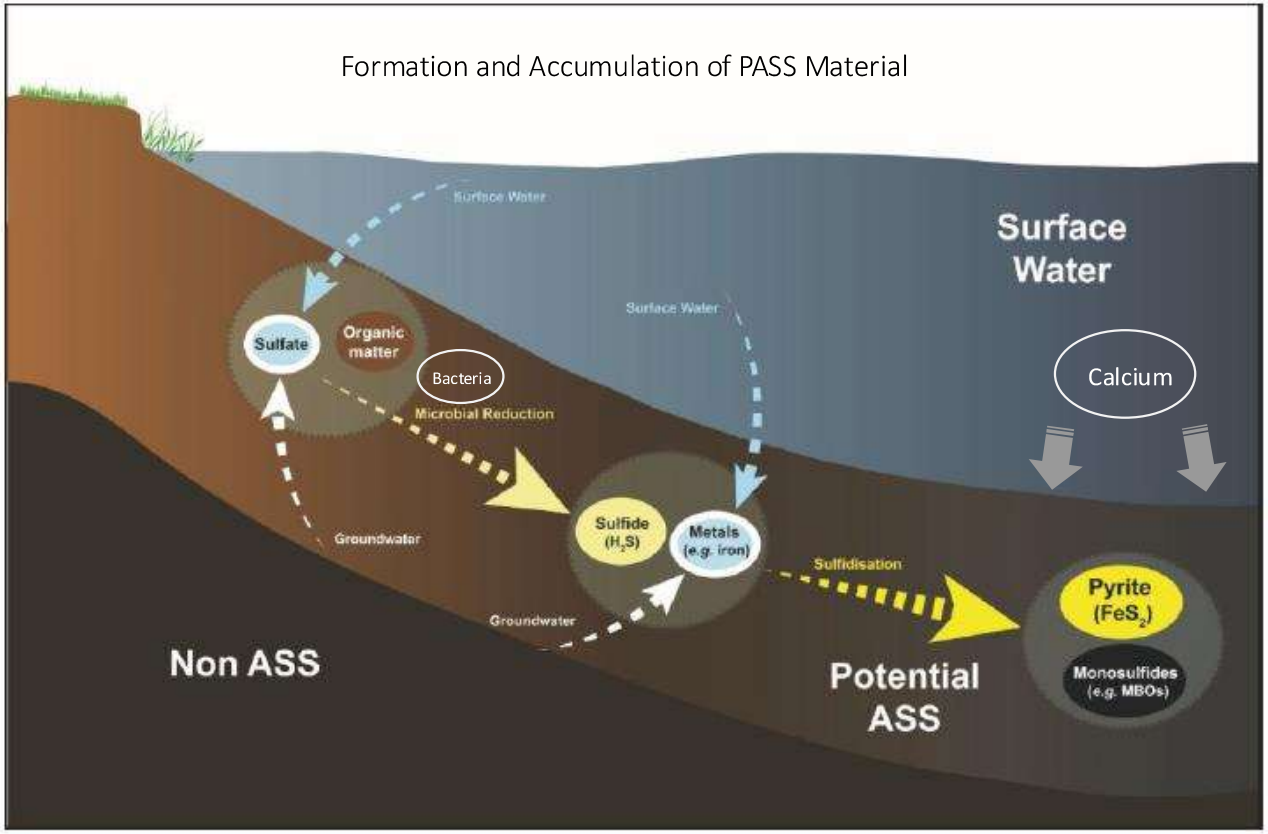
Dredging

- Backhoe dredge
- Two barges - 2,000m3
- Tugs and support vessels

Reclamation

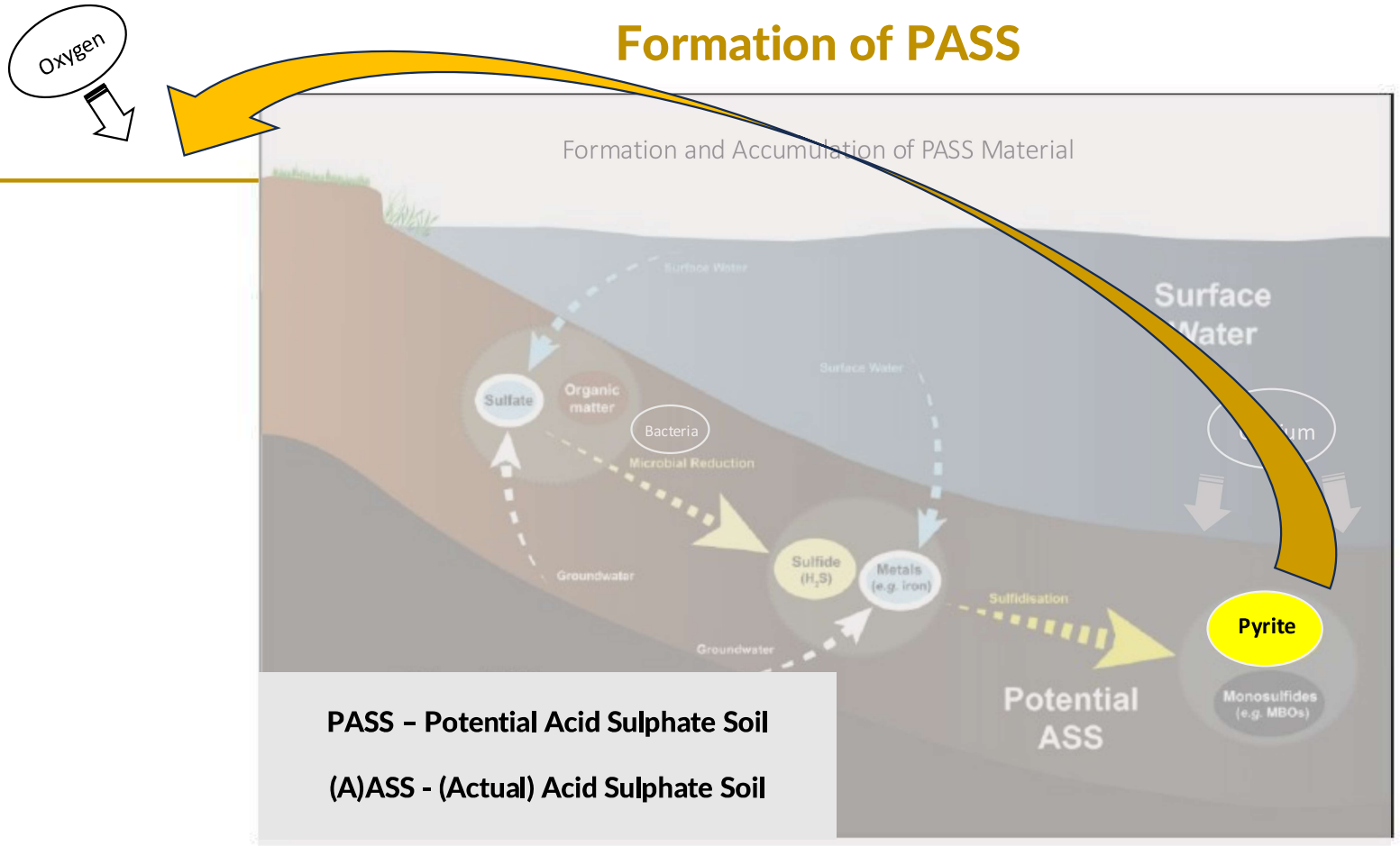
- 3.7Mm3 to come to shore
- Unloaded using excavators and moxis
- Placed by tipping then pushed with dozers

Formation of PASS



Note: not to scale.
Source: Adapted from EPHC & NRMMC (2011) and Ward et al. (2013).

Formation of PASS



PASS – Potential Acid Sulphate Soil

(A)ASS - (Actual) Acid Sulphate Soil

Environmental Legislation

Steps in The Port Expansion Project PASS management:

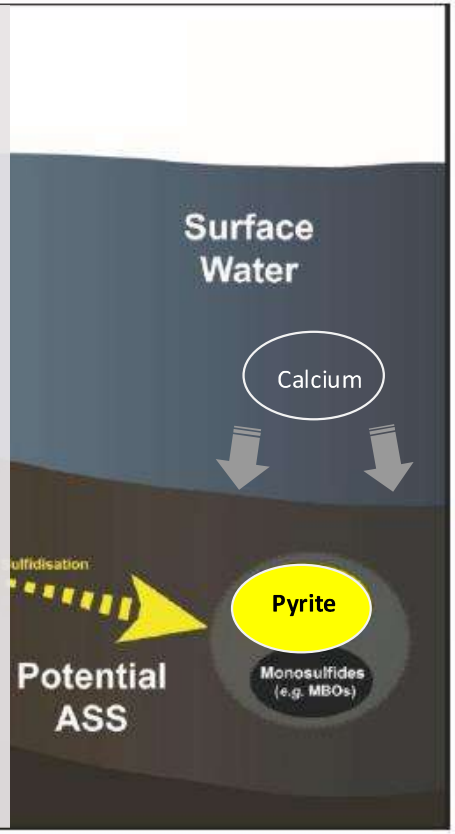
- **2011-2018** - Development of Project EIS
  - The EIS consideration of PASS/ASS was initially sea placement.
- **2015** - Sustainable Ports Development Act removed sea placement option (mandated for all capital dredge material in the GBRWHA to be placed on land).
  - EIS PASS volume estimates were low
- **2017 -** Project EIS State approval issued
- **2018 -** EPBC approval granted
- **2018** - Federal requirements changed with the release of the *National acid sulfate soils sampling and identification methods manual (Sullivan et al., 2018)*
  - Queensland Acid Sulphate Soils Technical Manual had not been updated at this time

Testing for PASS

Lab testing (Chromium suite analysis) assess acid forming capacity of the material as well self-neutralising capacity (SNC) - contributions from calcium in the dredged material

What changed in new legislation?

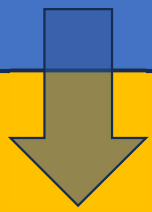
- The methods relating to the consideration and assessment for Self-neutralisation
  - the fineness (reduction) factor changed from 1.5 to 3
  - additionally the calculation was for fine fraction only (sieved at <500um).



Project PASS Management

NIL PASS

due to sea disposal

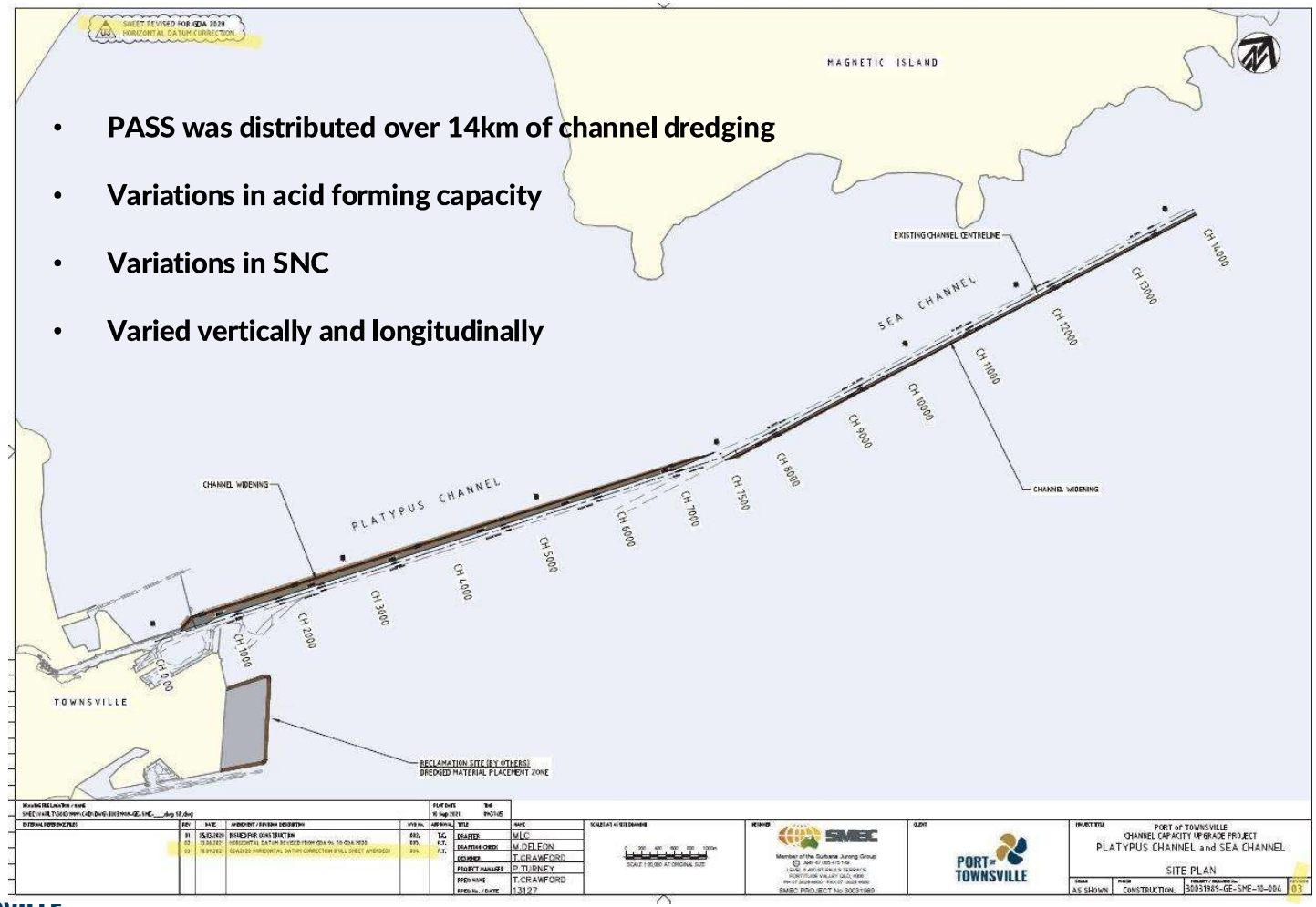


900,000m3 PASS

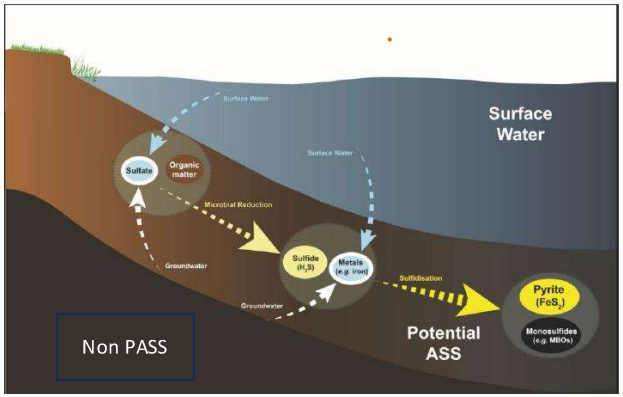
All material brought to land and changes to SNC calculations

PASS Quantity

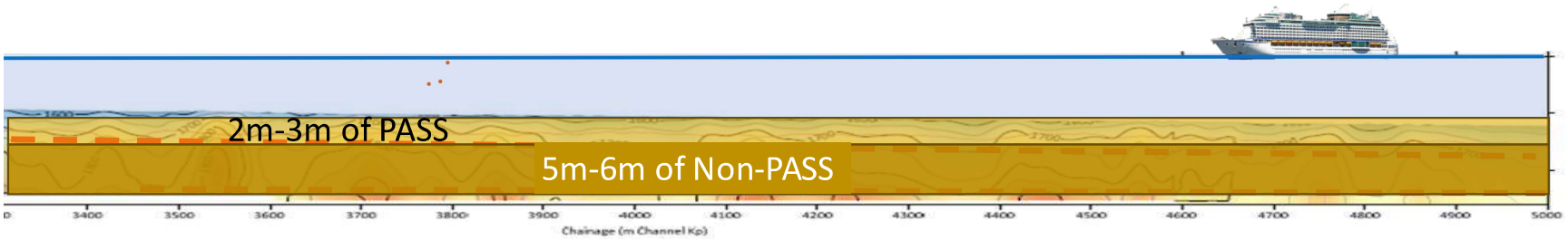
- PASS was distributed over 14km of channel dredging
- Variations in acid forming capacity
- Variations in SNC
- Varied vertically and longitudinally



PASS Quantity

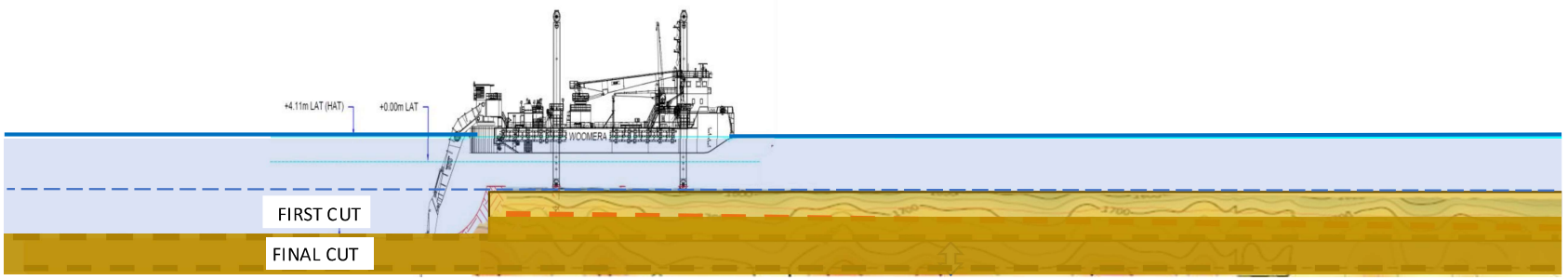


Insitu estimated PASS volume = 900,000m3 (Holocene layer)

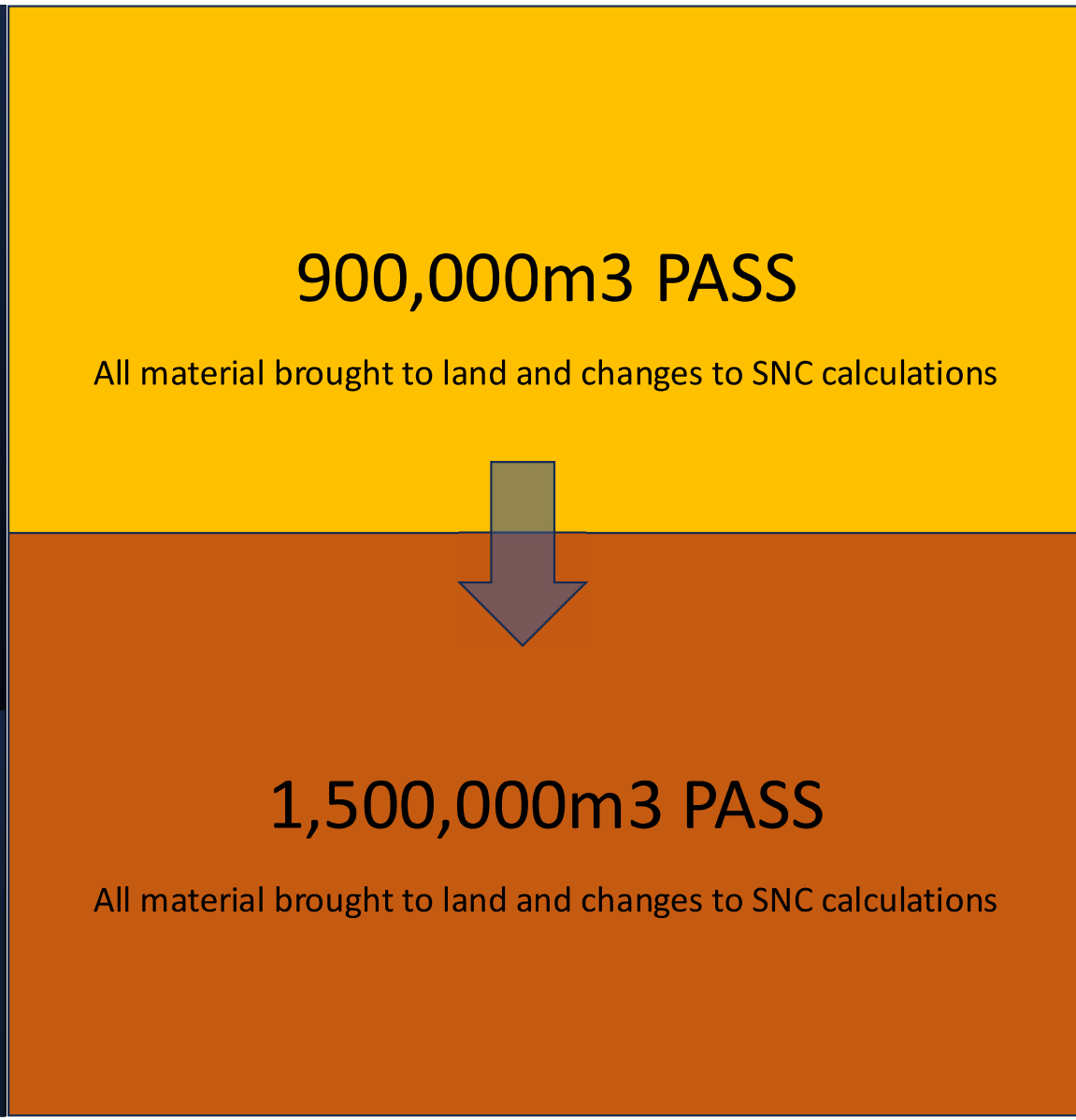


PASS Quantity

Estimated volume for PASS management = Holocene layer + ~ 25% Pleistocene layer



Management of PASS



Traditional PASS Management

Additional Neutralising Agent

Potential acidity (untreated):

= acid forming capacity – self neutralising capacity

= **Pyrite Sulfide – Calcium Fine Fraction**

All material identified as PASS during investigations is required to be treated

Treatment involves addition of an acid neutralising agent

Potential acidity (treated):

= acid forming capacity – self neutralising capacity – neutralising agent

= **Pyrite Sulfide – Calcium Fine Fraction – Ag Lime**

Traditional PASS Management

Example of mixing in a neutralising agent

Management of PASS

Challenges for this project

- Large volumes
    - 3,700,000 m3 total/ 1,500,000 m3 to be treated
    - >4,000m3 / 24 hours for 2 years
- Significant set up costs and high handling costs
- Lab turn-around times 5-7 days (fine fraction requirements) so treated material needed to be held for a week.
- All wet weather delay costs would transfer to principle
- Estimated $30M to $40M extra costs using traditional method
- Potential to end the project

Developing a Novel Solution

Eliminate multiple-handling dredge material

Minimise delays to dredge spread

Ability to track all PASS placement

Minimise potential environment harm

Confidence of regulator

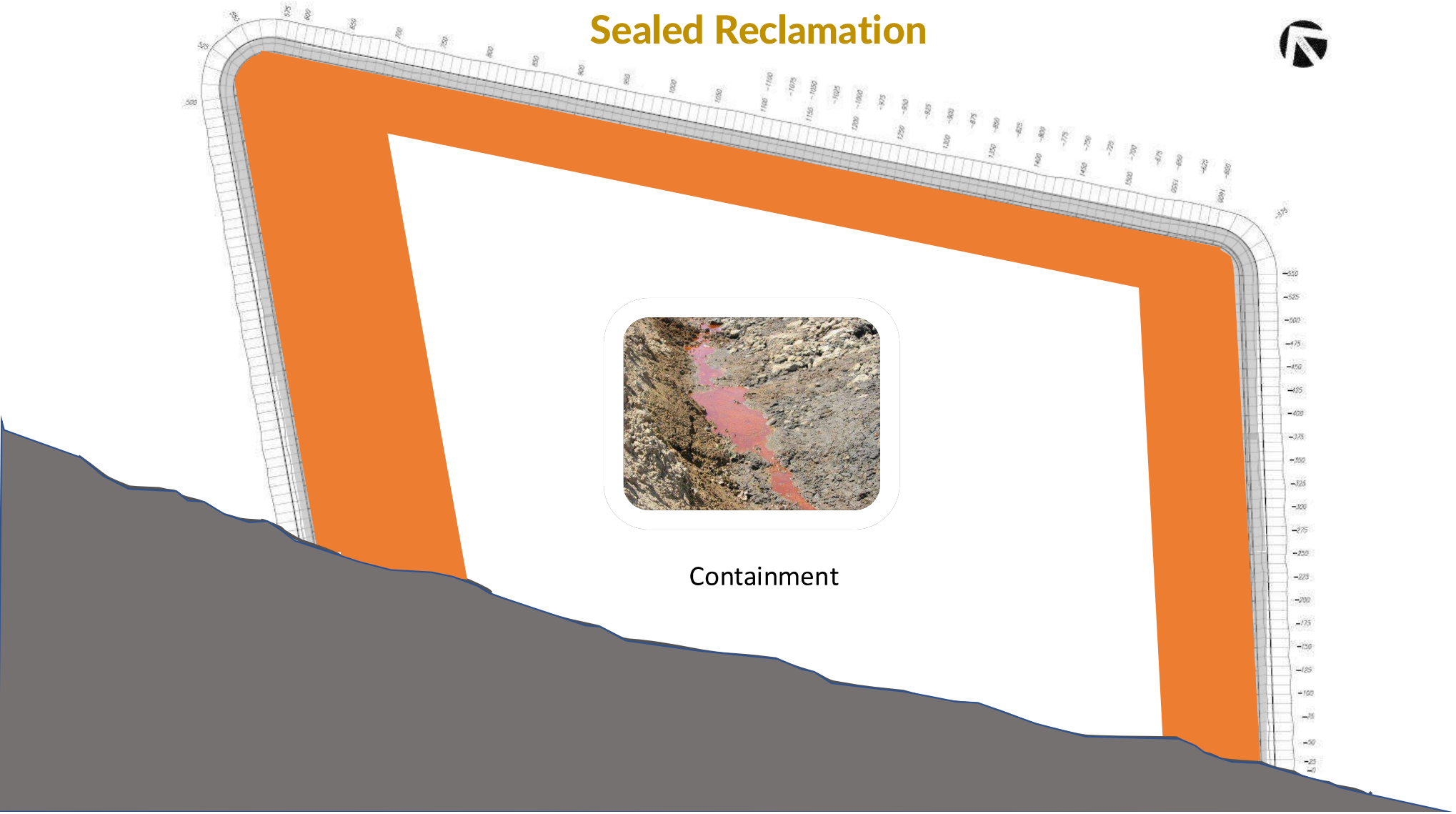
Developing a Novel Solution

Alternative project specific method was developed

- Expert Acid Sulphate Soils professional
- Very good technical knowledge in Dept Env and Science (willing to consider options and understood the inbuilt conservatism).
- Labs on board with priority testing
- Detailed ASSMP developed:
  - daily testing
  - GIS tracking of material placement
  - daily QA data sheet
  - corrective actions if/ when required
  - validation testing at completion of works
  - containment due to perimeter seal

Sealed Reclamation

Sealed Reclamation



Containment

PASS Treatment

Ag lime added to each moxi by excavator bucket

Initial Estimated Lime Dosing Rates

LOCATION	CHAINAGE	PROPOSED TREATMENT OPTION	PROPSED TREATEMENT RATE	NEUTRALISING AGENT WITH ENV OF >95% TONNES
TUF	Not applicable	B	2kg/m3	133
CHANNEL	0-1000	B	2kg/m3	764
	1000-2000	B	2kg/m3	727
	2000-3000	Nil		
	3000-4000	B	2kg/m3	723
	4000-5000	B	2kg/m3	552
	5000-6000	A	10kg/m3	2,029
	6000-7000	A	10kg/m3	1,428
	7000-7400	A	10kg/m3	56
	7400-8000	A	10kg/m3	449
	8000-9000	A	10kg/m3	949
	9000-10000	A	10kg/m3	739
	10000-11000	A	20kg/m3	851
	11000-12000	A	20kg/m3	474
	12000-13000	A	20kg/m3	381
	13000-14000	A	20kg/m3	282

Adjusted Lime Dosing Rates if required


Placed Dredge Material

Testing and Validation

Six sub-samples to a test sample – each GPS located


GPS Locations
C23
D22
150
E21
F20
C22
D21
100
E20
C21
D20
E19
50
B21

Port – Daily QA Checking

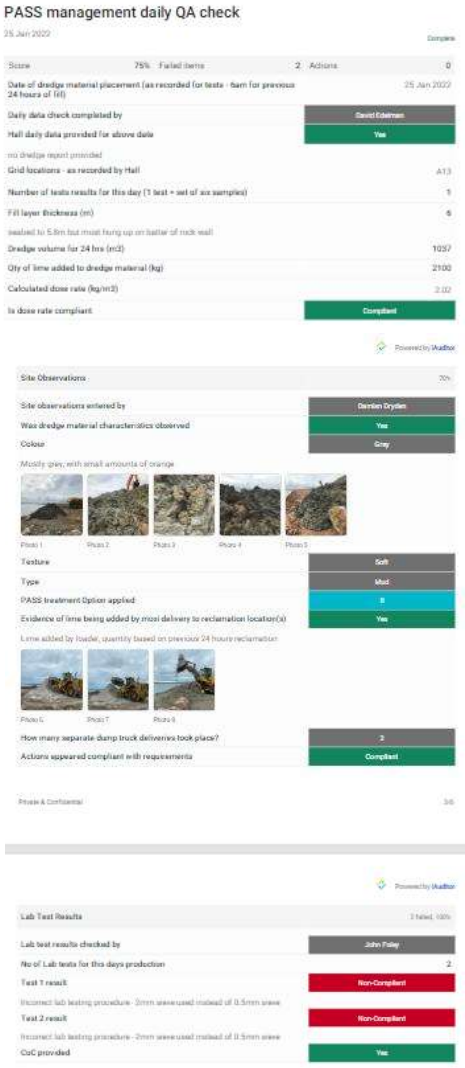
= Compliant item

= Non Compliant item

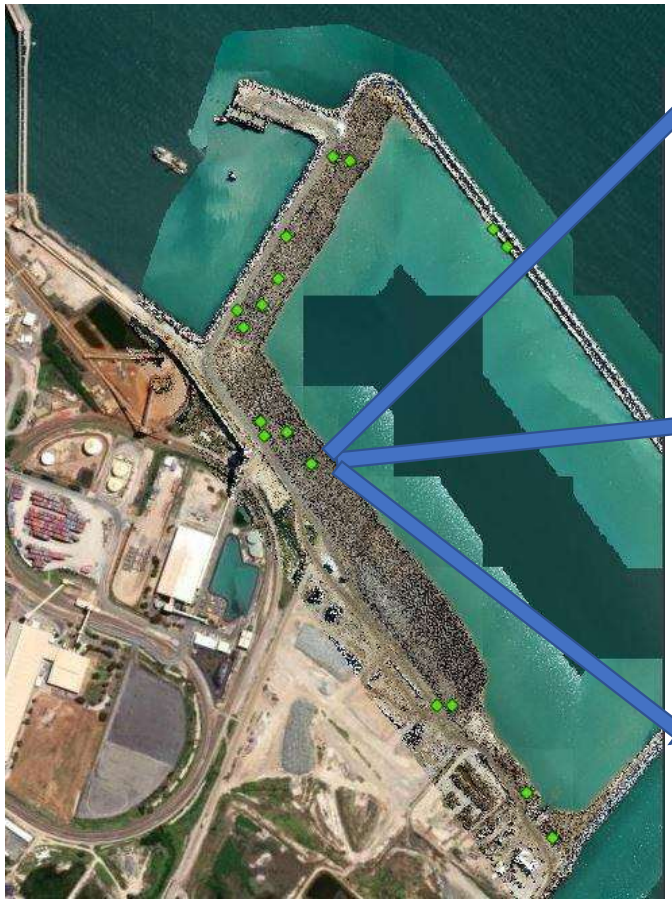
Dredging, reclamation and sampling

Material type, texture and colour and lime placement

Testing, CoC and results



Port GIS Data – Per Lot (1 to 4 Lots/ Day)



Reclamation placement data

Channel dredge data

Lime treatment and test result data

CU Project PASS Monitoring

2 of 30

6/7/2022, 12:00 AM

OBJECTID	277
Production Date	6/7/2022, 12:00 AM
X	483685.921000
Y	7871143.528000
Z	5.806000
Reclamation Grid Locations	A7,A8
Reclamation type	Dump face
Channel Dredge Location - Chainage start	3252
Channel dredge location - chainage end	3260
Channel Dredge Location - Lane	Cut 2
Channel dredge depth before cut	4.300000
Channel Dredge Location - Depth after cut	10.100000
first cut/final trim	first cut
Lot volume	703.000000
Treatment Method	B
Initial Dose Rate kg/m3	2
Sample ID	220607T2
[double_quote]Required Liming rate[double_quote] from PASS results spreadsheet	-18.064002
Pass (dosing adequate)/ Fail (to raise NCR)	Y
Is lot part of bund wall sealing? Y/N	
Lab batch number	CE159846

Testing and Validation

CU Project 2022

Summary of PASS Treatment Test Results

Dredge and Reclamation Date	Treatment Type	Dose Rate kg/m3	Sample ID	Chromium Reducible Sulfur (SCR) %S	Acid Neutralising Capacity %CaCO3 (seived ANC)	Sufficient Neutralising Capacity Y/N	Lab Test Conforming Y/N	Non Confomance Item	NCR Closed/ Comment
5-Feb-22	B	2	2202051A	0.068	3.0	Y	Y	-	-
5-Feb-22	B	2	2202051B	0.047	2.3	Y	Y	-	-
5-Feb-22	B	2	2202052A	0.048	3.5	Y	Y	-	-
5-Feb-22	B	2	2202052B	0.046	3.2	Y	Y	-	-
6-Feb-22	B	2	2202061A	0.059	3.6	Y	Y	-	-
6-Feb-22	B	2	2202061B	0.04	3.0	Y	Y	-	-
6-Feb-22	B	2	2202062A	0.054	3.5	Y	Y	-	-
6-Feb-22	B	2	2202062B	0.046	2.9	Y	Y	-	-
7-Feb-22	B	2	2202071	0.032	0.7	Y	Y	-	-
7-Feb-22	B	2	2202072	0.041	1.3	Y	Y	-	-
8-Feb-22	B	2	2202081	0.073	2.2	Y	Y	-	-
8-Feb-22	B	2	2202082	0.077	2.4	Y	Y	-	-
9-Feb-22	B	2	2202091	0.15	2.8	Y	Y	-	-
9-Feb-22	B	2	2202092	0.12	2.5	Y	Y	-	-
10-Feb-22	B	2	2202101	0.085	2.8	Y	Y	-	-
10-Feb-22	B	2	2202102	0.086	3.5	Y	Y	-	-
11-Feb-22	B	2	2202111	0.39	2.9	N	Y	Y	
11-Feb-22	B	2	2202112	0.41	3.0	N	Y	Y	
12-Feb-22	B	2	2202121	0.16	1.6	Y	Y	-	-
12-Feb-22	B	2	2202122	0.1	1.8	Y	Y	-	-
13-Feb-22	B	2	2202131	0.14	2.3	Y	Y	-	-
13-Feb-22	B	2	2202132	0.048	1.6	Y	Y	-	-
14-Feb-22	B	2	2202141	0.1	5.5	Y	Y	-	-
14-Feb-22	B	2	2202142	0.1	2.6	Y	Y	-	-
15-Feb-22	B	2	2202151	0.13	3.4	Y	Y	-	-
15-Feb-22	B	2	2202152	0.11	3.1	Y	Y	-	-
16-Feb-22	B	2	2202161	0.11	750.0	Y	Y	-	-
16-Feb-22	B	2	2202162	0.11	940.0	Y	Y	-	-

POINT2 - CU Project PASS Monitoring

Select Sample ID
220403T3

Select a date range
7/1/2021 - 7/1/2024

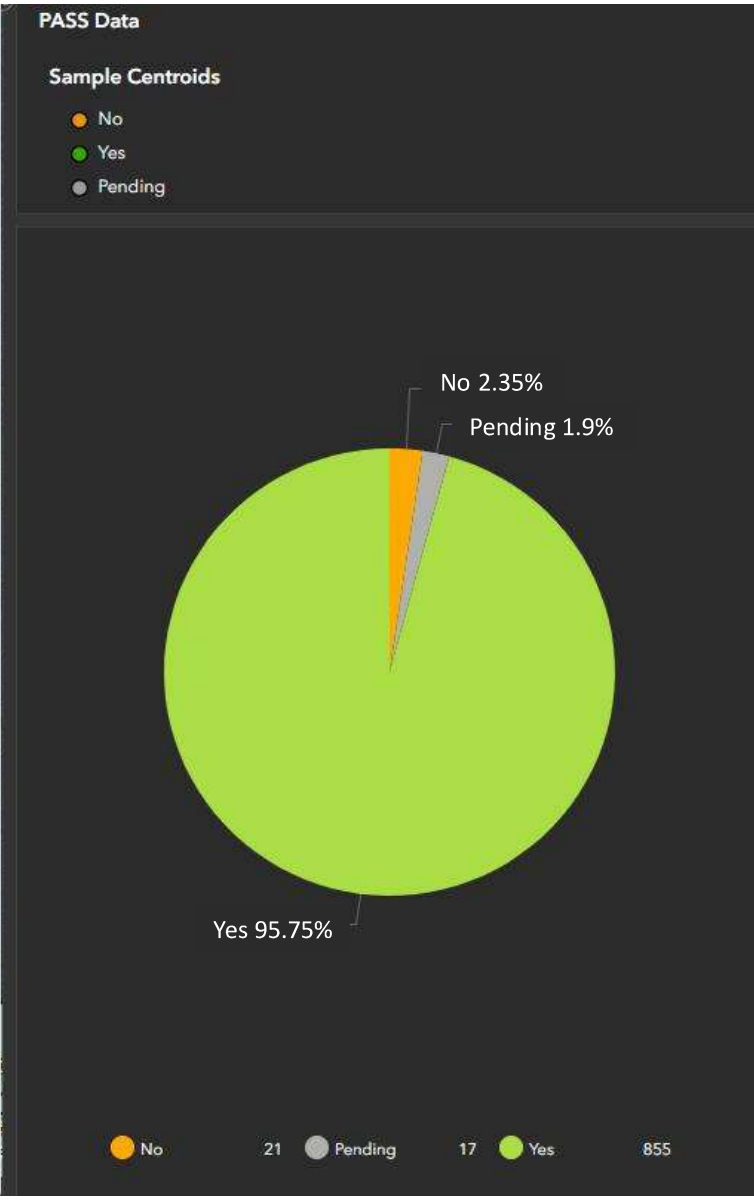
PASS Results
All Results

SubSamples Centroids: 220403T3

April 3, 2022

Production Date	April 3, 2022
Sample ID	220403T3
X	483377.69
Y	7,871,883.16
Z	4.29
Reclamation Grid Locations	B21,C21,E22,D22,F23, G23
Estimated placement zone	1
Direction material was pushed after sampling	120
Approximate distance material was pushed after sampling (centroid)	20
approximate final centroid Y	7,871,873.16
approximate final centroid X	483395.01
approximate final centroid Z (top of layer)	4.29
Channel Dredge Location - Chainage start	1,771
Channel dredge location - chainage end	1,795
Channel Dredge Location - Lane	Cut 3
Channel dredge depth before cut	3.50
Channel Dredge Location - Depth after cut	10.20
first cut_final trim	first cut
Lot volume	2,256.60
Treatment Method	A
Treatment Method_D	
Initial Dose Rate kg/m3	5
Initial Dose Rate kg/m3_D	
Required Liming rate (kg/m3) from PASS results spreadsheet	-7.455808588
Pass (dosing adequate)- Fail (to raise NCR)	Y
Chromium Reducible Sulfur (SCR) %S	0.034

Progressive Results



End Results

PASS treatment ended 2023 ~ $7M

Thank you

Sustainable Development Goals

- SDG 14 Life below water
- SDG 15 Life on land
- SDG 11 Sustainable cities and communities