# Structural Assessment of Bunds At Mekatek Ltd, Amex Park, Llanstephan Road, Johnstown, Carmarthen, SA31 3NF

TDA-01276-REPT-01

Structural Engineer's Report

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## Memorandum


## Author

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## Date

9th August 2022

## Subject

Assessment of existing bund walls and bases on storage areas at Mekatek.

## TDA Project Number

TDA-01276-REPT-01

## 1.0 Introduction

Thomas Davies Associates Ltd inspected the bund walls and base slab of the following areas at Mekatek.

Area 1 Oil Storage Survey

Area 2 Transfer Building Survey

Area 3 Leachate Offload Area Survey

Area 4 Sewerage Off Loading Area Survey

Typically for each area a visual inspection was carried out along the bund walls and bases.

For each of the areas concrete hardness tests were carried out using a Schmidt hammer. A Schmidt hammer also known as a rebound hammer is a device to measure the elastic properties or strength of concrete, mainly surface hardness and penetration resistance. The hammer measures the rebound of a spring-loaded mass impacting against the surface of a sample. The test hammer hits the concrete at a defined energy. Its rebound is dependent on the hardness of the concrete and is measured by the test equipment. By reference to a conversion chart, the rebound value can be used to determine the concrete's compressive strength.

A cover meter survey to determine the presence of reinforcement in the concrete base slab and walls was also used.

A level survey was carried out on areas and the results are shown in drawings TDA-01275-DWG-01 to 04.

General views of the bund areas are shown in the photographs in each section.

<u>What is not included in this survey</u>

We have not lifted any drain or gulley covers as part of our inspection.

No below ground drain survey has been carried out to check the integrity of the system.

The survey has not included verticality checks on the oil tanks in the oil storage areas (area 1) or an assessment of the load carrying capacity and suitability of the existing piles.

The survey has not included a check on the walls (below ground) which contain the sewage in Area 4.

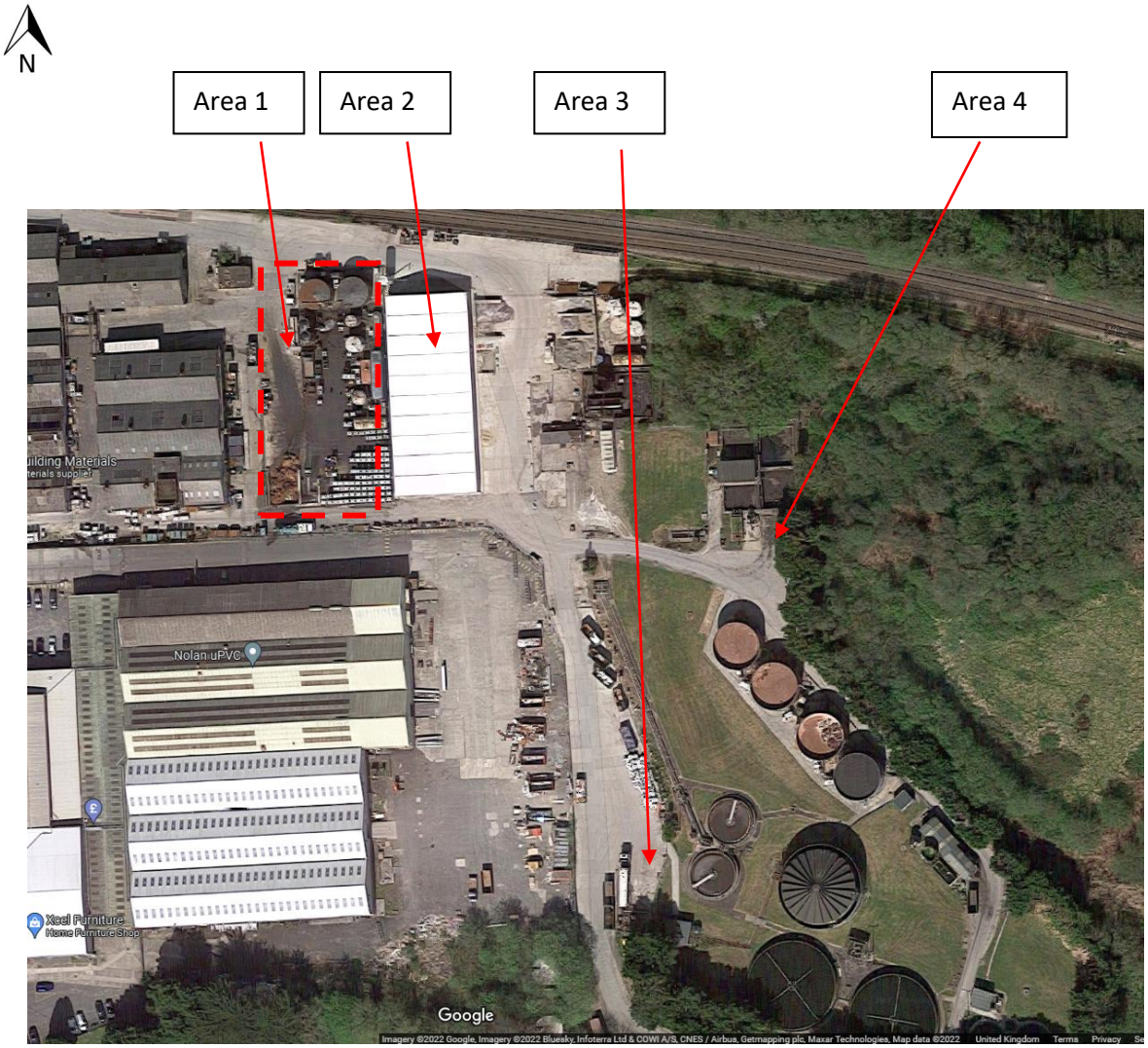



Figure 1. Plan View of Mekatek, Carmarthen

The report is based on the Ciria C736 "Containment systems for the prevention of pollution"

Extract from Ciria C736

### 4.2.1 The '110 per cent' and '25 per cent' rules

The basis for much industry practice in the past has been the 110 per cent and 25 per cent rule. Although not following the risk-based approach recommended in this guide, this practice has been in use for many years.

Where a single bulk liquid tank is bunded, the recommended minimum bund capacity is 110 per cent of the capacity of the tank.

Where two or more tanks are installed within the same bund, the recommended capacity of the bund is the greater of:

1 110 per cent of the capacity of the largest tank within the bund.

2 25 per cent of the total capacity of all of the tanks within the bund, except where tanks are hydraulically linked in which case they should be treated as if they were a single tank

The existing 110 per cent recommendation for single tanks and hydraulically linked multi-tank installations implies a margin of 10 per cent, which is discussed as follows. The recommendation for other multi-tank installations, the 25 per cent rule, is based on the assumption that it is unlikely that more than one tank will fail at any one time. This may be reasonable in circumstances where the contents escape from a primary tank as a result of, for example, tank corrosion or operator error, which is likely to affect only one tank at any one time. However, there may be credible scenarios such as fire or explosion or acts of vandalism that could affect all of the tanks within a bunded area.

## Area 1 Oil Storage Area

## 1.0 Introduction

Thomas Davies Associates Ltd. Inspected the oil storage area at Mekatek on on 21st July 2022. The inspection took place in hot sunny weather.

The Client "Mekatek" supplied to us original construction drawings of this area carried out by Roger Casey. From these drawings (16138 series ) we were able to determine the construction method of the base and walls and also that the waste soluble oil tanks to the north of the bund are on piled foundations. Parts of the drawings are shown in figure 3.

The front of the oil storage area is the north elevation and the rear is the south elevation. These points of the compass reference will be used throughout the report to describe the location and defects or repairs recommended. In describing the defects to the bund walls all references to front, rear, left and right assume that the bund walls is viewed from the centre of the oil storage area.

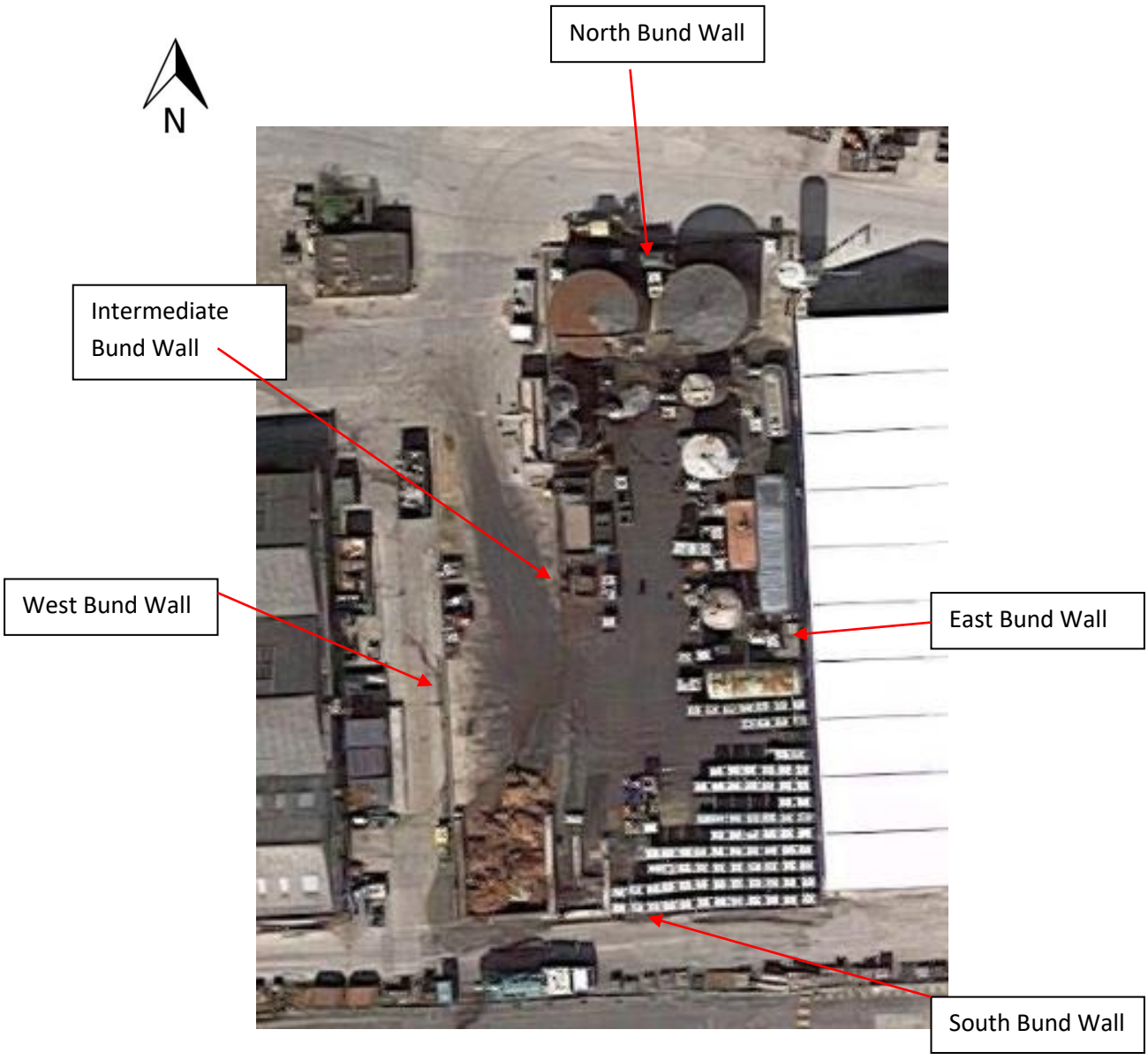



Figure 2 Plan View of Oil Storage Area

Photograph 1.1, General View of the Oil Storage Area

## 1.2 Inspection Results

### 1.2.1 General Observations on Bund Floor

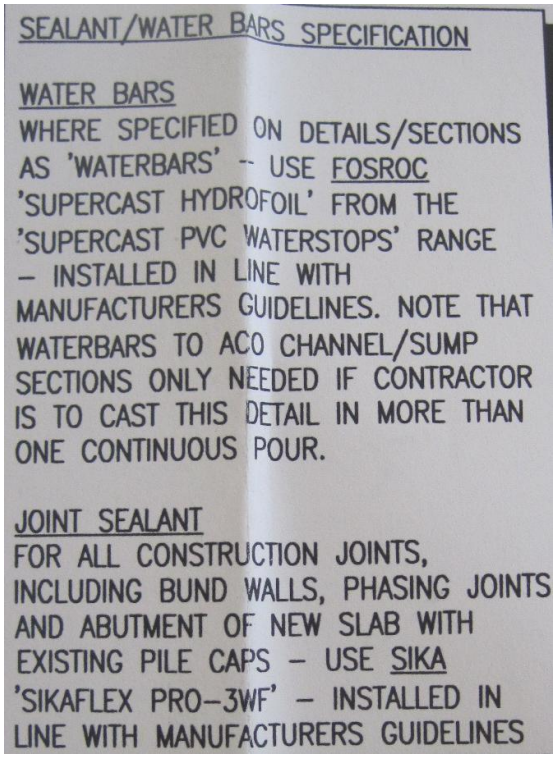
Overall the base of the bund, and surrounding area is in a good condition as shown in photograph 1.1, 1.2 and 1.3. The sealant at the surface of the joints of the concrete base have been removed presumably pressure washed away as shown in photograph 1.4.

We believe from studying original drawings that the base of the bund is a ground bearing reinforced concrete base 275mm thickness, Extracts of original construction drawings are shown in Figure 3 below which indicates the inclusion of water bars and a sealant at each construction joint in both the base and walls.

All contamination falls to a single gulley shown in photograph 1.5.

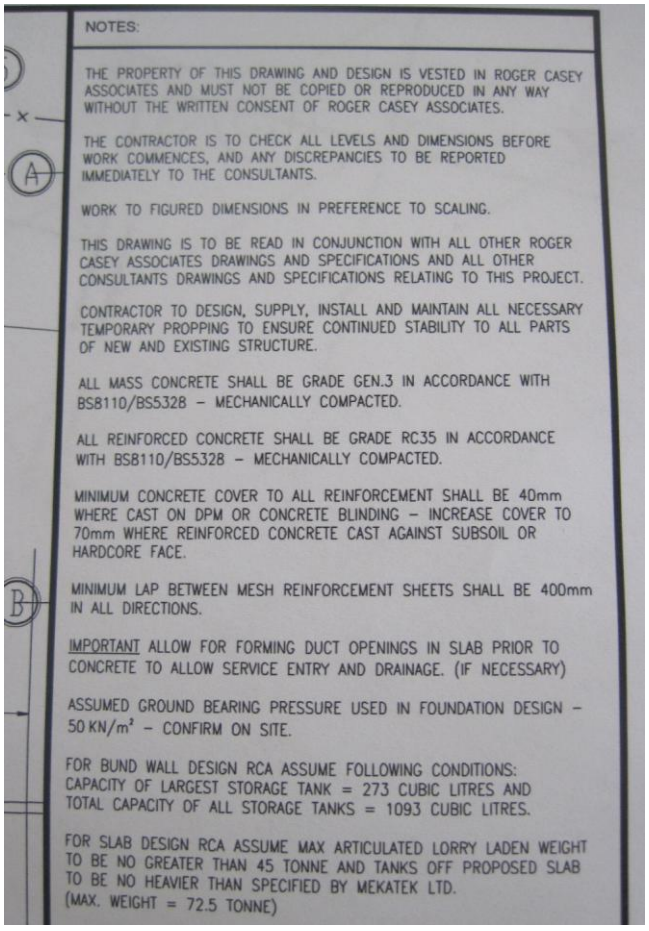
The concrete cover meter reading confirmed there was reinforcement in the base and bund walls but type, diameter and depth of cover is unknown. We believe from the readings that mesh reinforcement has been included during construction of the base.

The Schmidt hammer test gave an indication of concrete strength in excess of 25N/mm$^2$.


SEALANT/WATER BARS SPECIFICATION

WATER BARS
WHERE SPECIFIED ON DETAILS/SECTIONS AS 'WATERBARS' -- USE FOSROC 'SUPERCAST HYDROFOIL' FROM THE 'SUPERCAST PVC WATERSTOPS' RANGE – INSTALLED IN LINE WITH MANUFACTURERS GUIDELINES. NOTE THAT WATERBARS TO ACO CHANNEL/SUMP SECTIONS ONLY NEEDED IF CONTRACTOR IS TO CAST THIS DETAIL IN MORE THAN ONE CONTINUOUS POUR.

JOINT SEALANT
FOR ALL CONSTRUCTION JOINTS, INCLUDING BUND WALLS, PHASING JOINTS AND ABUTMENT OF NEW SLAB WITH EXISTING PILE CAPS – USE SIKA 'SIKAFLEX PRO-3WF' – INSTALLED IN LINE WITH MANUFACTURERS GUIDELINES


NOTES:

THE PROPERTY OF THIS DRAWING AND DESIGN IS VESTED IN ROGER CASEY ASSOCIATES AND MUST NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THE WRITTEN CONSENT OF ROGER CASEY ASSOCIATES.

THE CONTRACTOR IS TO CHECK ALL LEVELS AND DIMENSIONS BEFORE WORK COMMENCES, AND ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE CONSULTANTS.

WORK TO FIGURED DIMENSIONS IN PREFERENCE TO SCALING.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ROGER CASEY ASSOCIATES DRAWINGS AND SPECIFICATIONS AND ALL OTHER CONSULTANTS DRAWINGS AND SPECIFICATIONS RELATING TO THIS PROJECT.

CONTRACTOR TO DESIGN, SUPPLY, INSTALL AND MAINTAIN ALL NECESSARY TEMPORARY PROPPING TO ENSURE CONTINUED STABILITY TO ALL PARTS OF NEW AND EXISTING STRUCTURE.

ALL MASS CONCRETE SHALL BE GRADE GEN.3 IN ACCORDANCE WITH BS8110/BS5328 – MECHANICALLY COMPACTED.

ALL REINFORCED CONCRETE SHALL BE GRADE RC35 IN ACCORDANCE WITH BS8110/BS5328 – MECHANICALLY COMPACTED.

MINIMUM CONCRETE COVER TO ALL REINFORCEMENT SHALL BE 40mm WHERE CAST ON DPM OR CONCRETE BLINDING – INCREASE COVER TO 70mm WHERE REINFORCED CONCRETE CAST AGAINST SUBSOIL OR HARDCORE FACE.

MINIMUM LAP BETWEEN MESH REINFORCEMENT SHEETS SHALL BE 400mm IN ALL DIRECTIONS.

IMPORTANT ALLOW FOR FORMING DUCT OPENINGS IN SLAB PRIOR TO CONCRETE TO ALLOW SERVICE ENTRY AND DRAINAGE. (IF NECESSARY)

ASSUMED GROUND BEARING PRESSURE USED IN FOUNDATION DESIGN – 50 KN/m$^2$ – CONFIRM ON SITE.

FOR BUND WALL DESIGN RCA ASSUME FOLLOWING CONDITIONS: CAPACITY OF LARGEST STORAGE TANK = 273 CUBIC LITRES AND TOTAL CAPACITY OF ALL STORAGE TANKS = 1093 CUBIC LITRES.

FOR SLAB DESIGN RCA ASSUME MAX ARTICULATED LORRY LADEN WEIGHT TO BE NO GREATER THAN 45 TONNE AND TANKS OFF PROPOSED SLAB TO BE NO HEAVIER THAN SPECIFIED BY MEKATEK LTD. (MAX. WEIGHT = 72.5 TONNE)

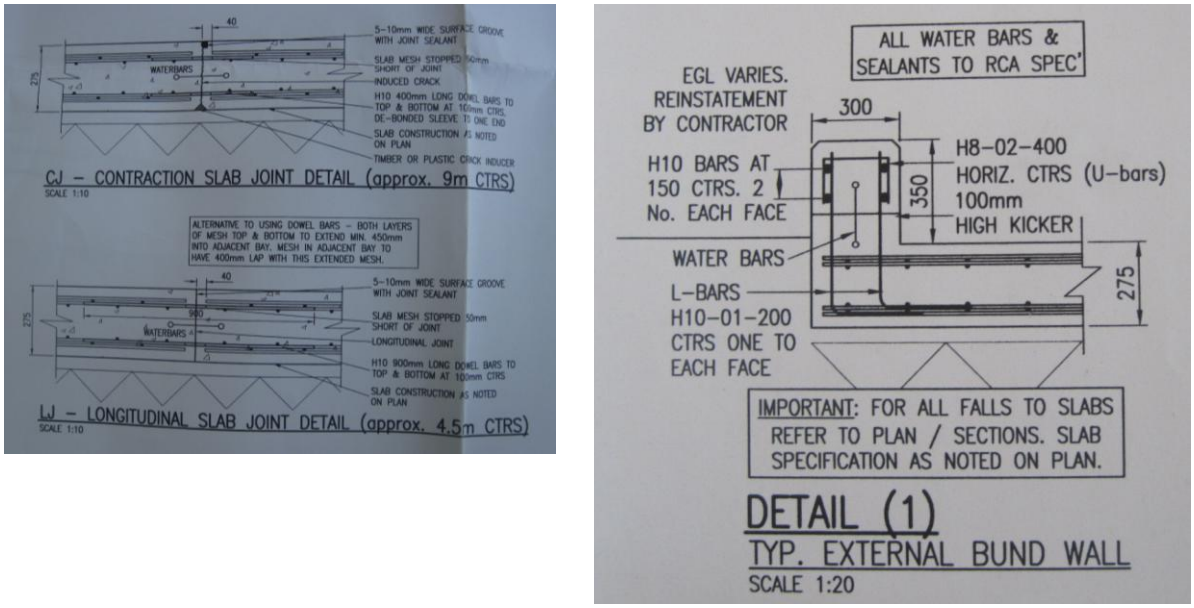



Figure 3. Extracts Taken From Clients Original Drawings

Photograph 1.2. View Looking North


Photograph 1.3. View Looking South

Photograph 1.4  Typical construction joint (showing missing sealant at surface)

Photograph 1.5. View Of Gulley At Dead Low Point Of Base

Photograph 1.6.  View Of Joints At The North End Of The Oil Storage Bund

### 1.2.2 North Bund Wall

Overall the condition of the north bund wall is good. However, the construction joint approximately 7m from the east wall has a crack 5mm wide which requires repair, see photograph 1.7 and 1.8. The internal wall height at the area of the joint is 370mm and area of spalling is 110mm wide.


Photograph 1.7, Internal Face of North Bund Wall

Photograph 1.8, Close Up Of Construction Joint

### 1.2.3 East Bund Wall

The internal height of the east bund wall is 380mm and the bund wall is 250mm wide with a 35mm chamfer. The east bund wall is very good condition.

Photograph 1.9 View of East Bund Wall

### 1.2.4 South Bund Wall

The south bund wall is in good condition.

### 1.2.5 Intermediate Bund Wall

Photograph 1.10, View Of Intermediate Bund Wall Looking North

### 1.2.6 West Bund Wall

Overall the west bund wall is in good condition. However, there is concrete spalling to the construction joint as shown in photograph. There is a crack over 5mm width which requires repair, see photograph 1.11.

Photograph 1.11, Close Up Of External Face Of West Wall

Method Statement for Repairing the bund

1. Remove all loose material / break away the loose concrete to the walls of the bund.
2. Scabble wall to expose aggregate at the location of the joint. This can be carried out with a pressure washer or scabble gun.
3. Make good using renderoc HB 45 by Fosroc, concrete repair (or similar approved) leaving a 20mm x 15mm groove for new sealant.
4. After 24hrs the sealant can be applied.

   Provisional Item

5. We would recommend the joint area is painted with an epoxy resin See Appendix A, (150mm either side of joint) to provide additional protection.
6. Prime the area.
7. Paint Epoxy Resin to the newly repaired wall and base joints.

At the south west corner inside the bund walls concrete block have been stacked three blocks high as shown in photograph 1,12.

Photograph 1.12, View Of Concrete Block Wall At The South West Corner

Photograph 1.13  View Of Spalling Of Concrete At Joint Location

# Area 2 Transfer Building

## 2.1 Introduction

Thomas Davies Associates Ltd. Inspected the transfer building at Mekatek on on 21st July 2022. The inspection took place in hot sunny weather.

## 2.2 Inspection results

Contaminated material is stored in IBC's (Intermediate Bulk Containers) and placed in various bays depending on the material contained. The material is stored under an aluminium framed building which has a stretched fabric roof structure. Each bay has its own underground separate storage tanks and the IBC's are stored on the concrete base in each bay.

Each separating bay wall comprises of "pot block" type wall with reinforcement and a concrete core.

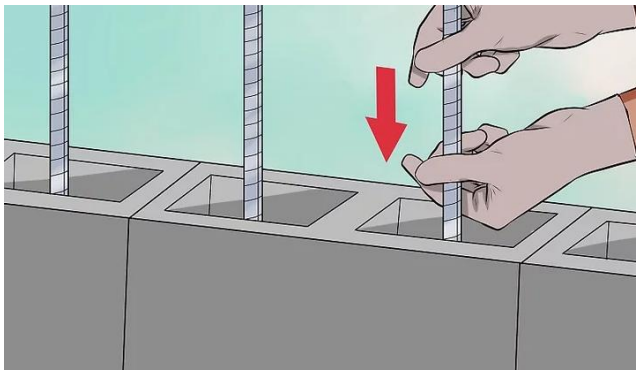


Figure 2.1 Example of a reinforced concrete "pot block " wall used as the separating bay walls.

At the end of each wall is a vertical steel "crash barrier" as shown in photograph 2.1.

There are wall joints at approximately 10m intervals to the perimeter wall.

The concrete cover meter reading showed there to be reinforcement in the base and walls. However, type, diameter and depth of cover is unknown. We believe from the readings that mesh reinforcement has been included during construction of the base. The Schmidt hammer test of the floor slab gave an indication of concrete strength in excess of 30N/mm$^2$.

As-built drawings of the inspected foundation base are not available. We are unsure of the thickness of the concrete slab.

## 2.3 Summary and Recommendations

The floors and bay walls are in good condition with no signs of deteriation observed during the inspection. Any cracking present in the floor slab is classed as non-structural.

Photograph 2.1, Typical Views (Internal) Of The Transfer Building

Photograph2,2, Views Of The Steel Gulley Covers And “Aco” Drains Present In The Transfer Building

Photograph 2.3, View of “Aco” type drainage currently installed to prevent water ingress into the building.

## Area 3 – Leachate Offload Area

### 3.1 Introduction

Thomas Davies Associates Ltd. Inspected the leachate offload area at Mekatek on 6th July 2022. The inspection took place in hot sunny weather.

### 3.2 Inspection Results

On three sides (to the perimeter) of the bunded area there is a masonry wall 240mm thickness, comprising of 7N Blocks laid on flat with 12mm concrete render to the front and rear face. The height of the walls are approximately 530mm at the south end and 240mm at the north east corner. A 50mm concrete fillet has been constructed at the base of the wall inside the bund.

We believe the wall is constructed off the reinforced concrete raft base. Please refer to drawing TDA-01276-DWG-03 for the base levels as measured on site. The location of missing copings is also shown.

There is surface cracking visible to the concrete base slab as shown in photograph 3.2. The cracks are less than 2mm width and not detrimental to the slabs structural strength / integrity or will lessen the ability for the base to resist the ingress of contamination.

There is a 50mm concrete coping surmounted to the majority of the wall but is missing in at the southwest corner as shown on photograph 3.3. Each existing concrete coping is 910mm length 250mm wide and 50mm height. The purpose of the coping is to protect the top of the masonry wall from the elements, i.e. rainwater, snow or ice causing the masonry to degrade.

The concrete cover meter reading showed there to be reinforcement in the base but type, diameter and depth of cover is unknown. We believe from the readings that mesh reinforcement has been included during construction of the base. The Schmidt hammer test gave an indication of concrete strength of the base in excess of 28N/mm$^2$.

As-built drawings of the inspected foundation base are not available. We are unsure of the thickness of the concrete slab.

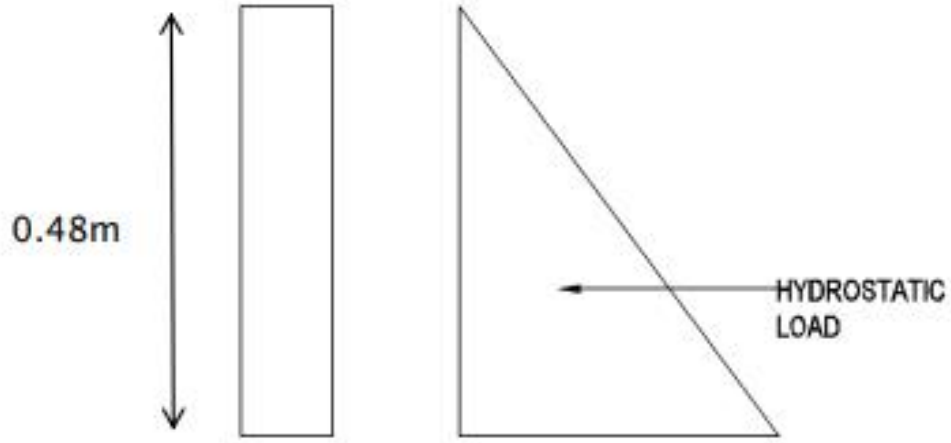
Photograph 3.1, View Of The Leachate Offload Area

Photograph 3.2, View Of Cracking To The Surface Of The Concrete Base

Phptograph 3.3, View Of Missing Coping To The Top Of The Wall

## 3.3 Assessment of block on flat wall to resist forces if bund was full.

Bund wall at max height 530mm – 50mm = 480mm (0.48m)




Overturning Check:

Height of Wall: 0.48m

$\gamma_w = 10kN/m^3$

$\gamma_{wall} = 21kN/m^3$

Characteristic Overturning Moment:

$\gamma_w \times H \times \frac{H}{3} \times \frac{1}{2} = 10kN/m^3$

$$10kN/m^3 \times 0.48m \times 0.5m \times 0.48m \times \frac{0.48m}{3} = 0.18kNm/m$$

Characteristic Restoring Moment:

$\gamma_{wall} \times H \times t \times \frac{t}{2} = 10kN/m^3$

$$21kN/m^3 \times 0.48m \times 0.215m \times \frac{0.215m}{2} = 0.23kNm/m$$

$$FOS = 0.23/0.18 = 1.27$$

As 1.27 > 1.0 Leachate Bund Wall is suitable for overturning

# Area 4 Sewerage Off Loading Area Survey

## 4.1 Introduction

Thomas Davies Associates Ltd. Inspected the sewerage off loading area at Mekatek on 6th July 2022 and again on 21st July 2022. The inspection took place in hot sunny weather. At the time of the first survey a green storage container was located over the outfall gulley. However, the second survey the bin had been moved and full access was made available.

## 4.2 Inspection Results

The bund is in good condition. The east bund wall is 280mm mm wide and varies in height from the outfall gulley (deepest) to the south end of the bund (most shallow).

The north bund wall is 450mm wide. We noted that the handrails which were fixed to this wall have been impacted and there is localised damage to the concrete wall at the base of the standard as shown in photograph 4.2.

The concrete cover meter reading showed there to be reinforcement in the base and walls but type, diameter and depth of cover is unknown.

The Schmidt hammer test gave an indication of concrete strength in excess of 25N/mm$^2$.

As-built drawings of the inspected foundation base are not available. We are unsure of the thickness of the concrete slab.

Photograph 4.1, View of Sewerage Off Loading Area Lookin North

Photograph 4.2, Damage To Base Of Handrail Standard (North Bund Wall)


Photograph 4.3, View Of North East Corner


Photograph 4.4, Close Up Of North East Corner

## 4.3 Summary and Recommendations

Overall the condition of the concrete base and walls are in good condition. There is slight damage to the wall at the base of a handrail stanchion as shown in photograph 4.3. and the height of the wall at the north east corner is to be increased by 170mm as shown in figure 4.1.

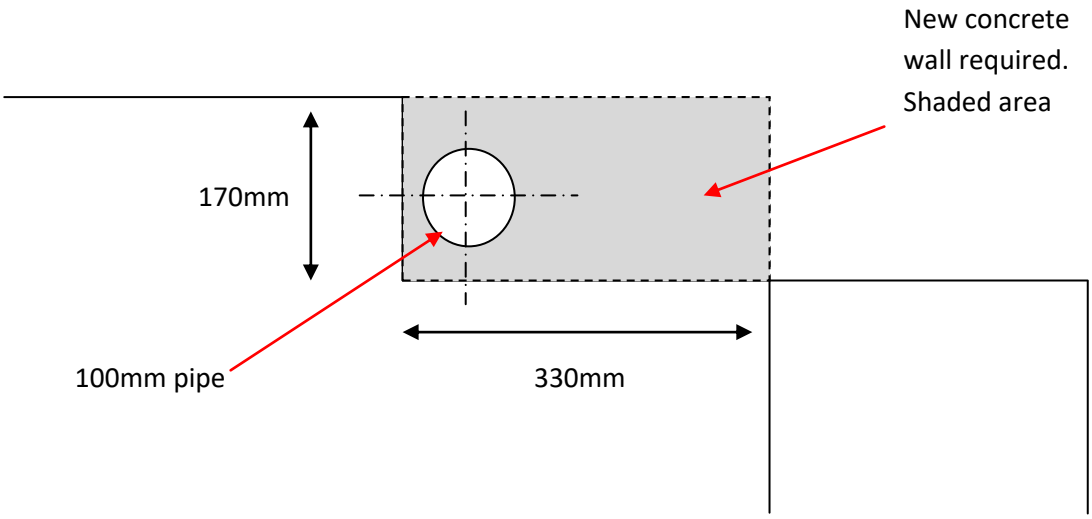



Figure 4.1 New wall to be constructed (shown shaded)

Method of construction

1.Remove (temporarily relocate the pipe).

2. Scabble the face of the existing wall to expose the aggregate.

3. Install 10mm diameter dowel rods 90mm embedment with resin. Ten anchor bars 200mm length are required. Space dowel rods 150mm apart one each face with 40mm cover.

4. Fix A193 mesh to the dowel rods, ensure 40mm cover.

5. Fix formwork and pour new concrete. If the pipe is required in its original location use a puddle flange to surround the pipe at the intersection of the wall and pipe.

## 5.0 Recommendations for Repair

Overall the quality of the bund bases and bund walls are good. Mekatek are to be commended on the quality of the bunds and their ability to contain the contaminated material. To maintain the bund the following areas are to be addressed.

The recommendations have been ranked in order of priority:

### PRIORITY 0 – Urgent

These should be undertaken as soon as possible.

### PRIORITY 1 – High

The repairs should be undertaken as soon as possible i.e. within 1 year. These include strengthening works which otherwise left unattended would affect the structural integrity of the platform.

### PRIORITY 2 – Medium

These should be undertaken within the next 1-2 years.

### PRIORITY 3 – Low

These may be left for a few years without seriously compromising the integrity of the structure. However, they should be carried out within the next 3-5 years.

Tables 5.1to 5.4 below indicates the works that should be undertaken to the storage areas with their priority.

Table 5.1 Area 1 Oil Storage Area

| Item No. | Description of Works | Priority |
|---|---|---|
| 1.1 | Repair concrete walls where spalling to the joints at the bund walls has occurred as shown in photographs 1.8, 1.11 and 1.13. Slot to be primed with sika primer – 215 and filled to the surface with Sikaflex-Tank N. (Mekatek to confirm suitability of product with contents stored) A paint may be applied to protect the concrete further (see appendix A). | 0 |
| 1.2 | Replace the sealant to the top of the joints at the surface of the concrete base as shown in photograph 1.4. The slot to be primed with sika primer – 215 and filled to the surface with Sikaflex-Tank N. with . A paint may be applied to protect the concrete further as per 1.1 | 0 |

Table 5.2 Area 2 Transfer Building Survey

| Item No. | Description of Works | Priority |
|---|---|---|
| 2.1 | Monitor the existing cracks which are at construction join locations. Suggest yearly inspection. | 2 |

Table 5.3 Area 3 Leachate Offload Area

| Item No. | Description of Works | Priority |
|---|---|---|
| 3.1 | Ensure drains are area kept clear and free from debris (ongoing good site procedures) | 0 |
| 3.2 | Replace coping stones which are missing to protect the masonry wall. | 1 |
| 3.3 | Clear vegetation from behind the south and east bund walls. | 1 |

Table 5.4 Area 4 Sewerage Offloading Area

| Item No. | Description of Works | Priority |
|---|---|---|
| 4.1 | Construct a new “part” bund wall as shown in section 4.1 to ensure the height of bund wall is maintained throughout. | 0 |

Further additional areas of concrete spalling (area 1) or loose copings (area3) may be exposed once cleaning and clearing takes place. We believe the stated figures provide an indication of quantities required for repair as carried out by a competent contractor.

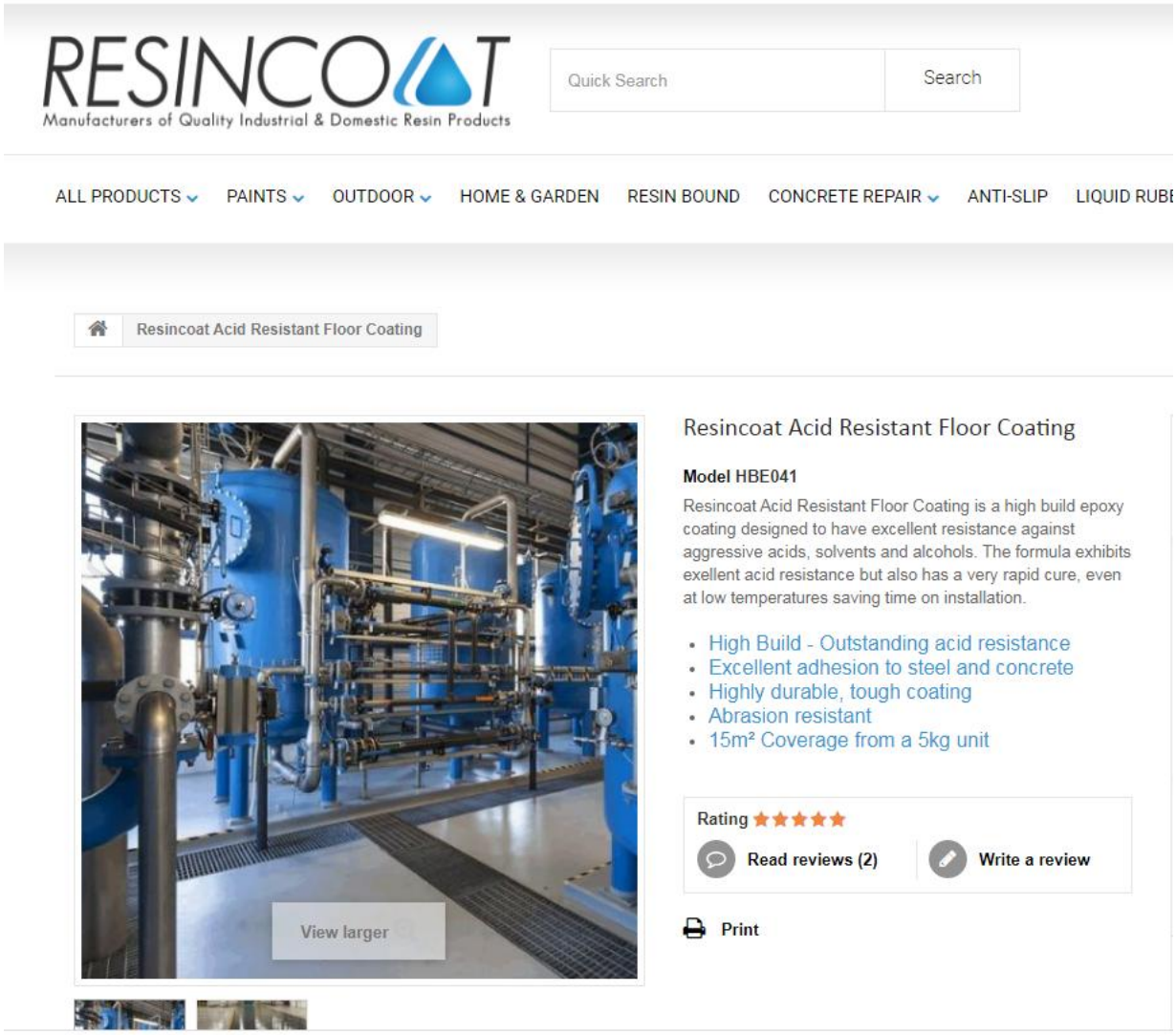
To coat the repaired joints we have specified Resincoat Acid resistant coating model HBE041 and are confident it is correct, but we are not privy to the exact material stored in the vessels inside the bund. Please confirm with Mekatek process/material engineers that it is OK to use as a coating.

Please note. Contractors working inside the storage areas are required to wear appropriate PPE such as suitable boots, overalls, gloves and a bright luminous tabard (including glasses in the transfer building) as a minimum when works carried out inside the storage areas as per Mekatek's health and safety specification.

END.

# APPENDIX A

The following is suitable to coat the joint areas  of the oil storage bund ((or similar approved)



## APPENDIX B

# EXTENT & LIMITATIONS OF SURVEY

**Capacity of Structural Members:** The members are visually inspected to assess general adequacy by our experienced engineer. Any members which are visually deemed to be suspect (based on deformation, damage or suspicions of being undersized) are checked further. Our inspection does not include a full back structural analysis of the building structure.

**Subsoil conditions & Foundations:** No trial pits will be excavated to expose the foundations or localised drainage. We will refer to our local knowledge of the subsoil conditions . No comment will be made on land contamination (as this is beyond the scope of this report type) and any Solicitors land check will provide only basic search material that may require you to instruct a specialist in the field to comment further detail.

**Below Ground Drainage:** Drainage is inspected where possible to do so and inspecting chambers and visible pipework.

**Members:** Visual inspection only and no opening up of the fabric will be carried out.

**Damage:** We will take all reasonable care to prevent and damage to the structure. Note that if damage has already occurred to an area due to structural defect and needs to be repaired in any case, further probing may be carried out by the Engineer. Often the possible cause of a problem can be confirmed with only minor further damage which the owner and or potential owner must accept without and recourse to the Engineer.

**Proprietary Systems:** Often proprietary systems are used within buildings e.g. precast concrete units, and sometimes it is not possible to determine the exact construction of such system. The Engineer will use reasonable skill and care to determine the appropriateness of such a system for its intended use, and use published tables were appropriate.

**Limitation of Survey through Instruction:** The Engineer may have been told by the client, the client's solicitors or other advisors of certain information which leads the Engineer to decide that certain part(s) of the building will not need to be inspected, e.g. certain parts of the building will be demolished, or maintenance of certain parts of the building is the responsibility of third parties. Inspection of some of the items may therefore not be relevant. If this is the case, the Engineer will record these provisos prior to carrying out the survey or within the report with appropriate rationale.

**Liability:** Under normal circumstances, the appropriate standard of acre will be the skill and care reasonably to be expected of a competent Engineer performing a survey of the type in question. The client will only look to the employer for recompense (and not to the individual) if there is a finding of negligence.

**Dimensional Survey:** A structural survey does not cover or record existing dimensions but may make reference to approximate dimensions where deemed appropriate to give an indication of scale.