# Stormwater Strategy

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| Project: | Narngulu Peak Planning<br>Stormwater Strategy |
| Client: | CBH |
| Author: | |
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| CBH Document #: | TBC |

## Document Status: Client Review

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| A | J. Bridge | - | J. Bridge | 01.05.26 |
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## Disclaimer



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# 1. Introduction

## 1.1. The Project

CBH are proposing to add an additional 161,130t of storage by constructing 4x new temporary open bulkheads (TBH 21-25) at their existing Narngulu site as part of their 2026/27 peak planning project.

Refer to **Appendix A – CBH Concept Design** for full details of the proposal.

**Figure 1** shows the overall Narngulu CBH site and **Figure 2** shows the existing established area of the site and the location of the proposed new bulkheads.

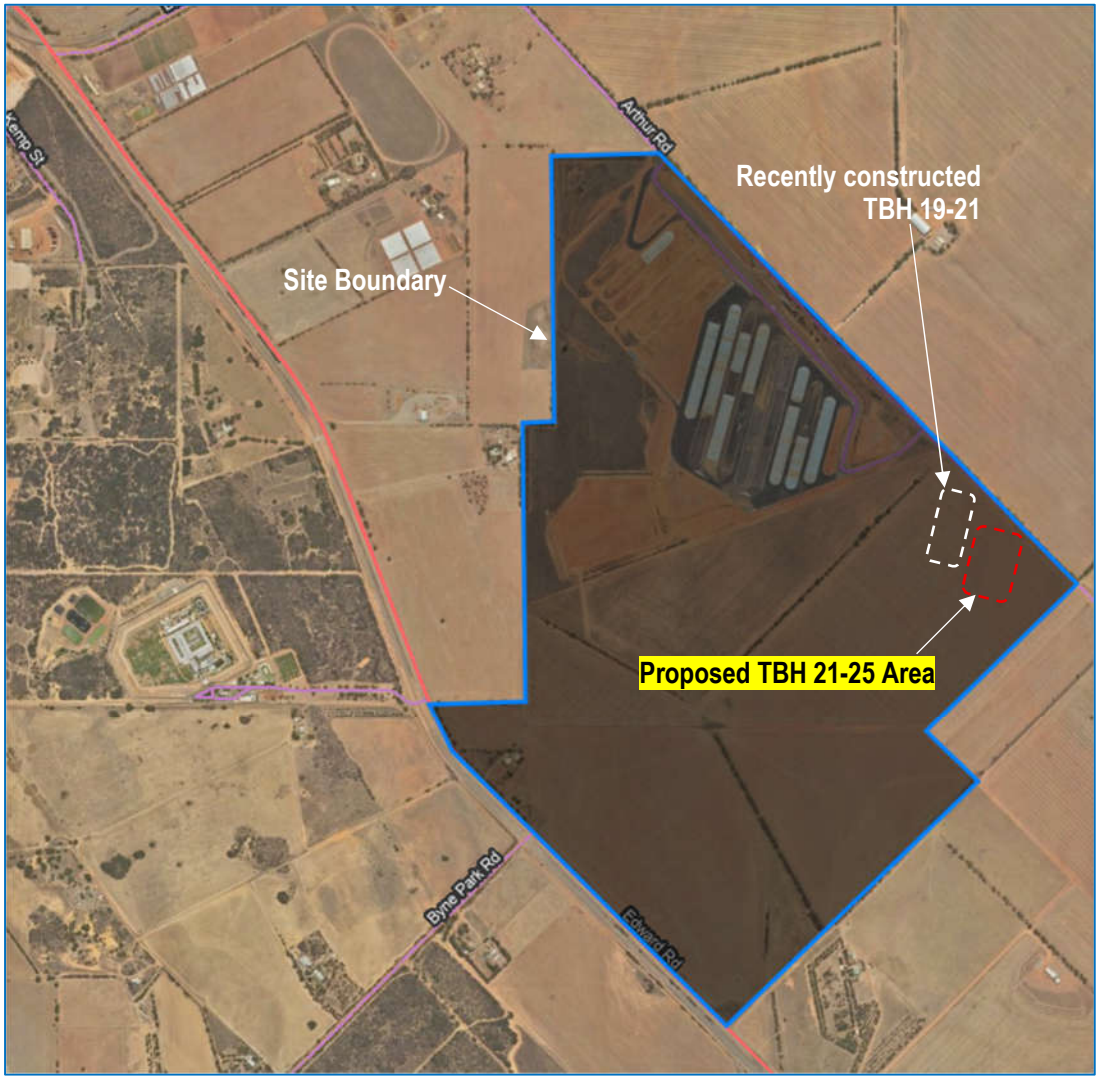



**Figure 1: CBH Overall Site**

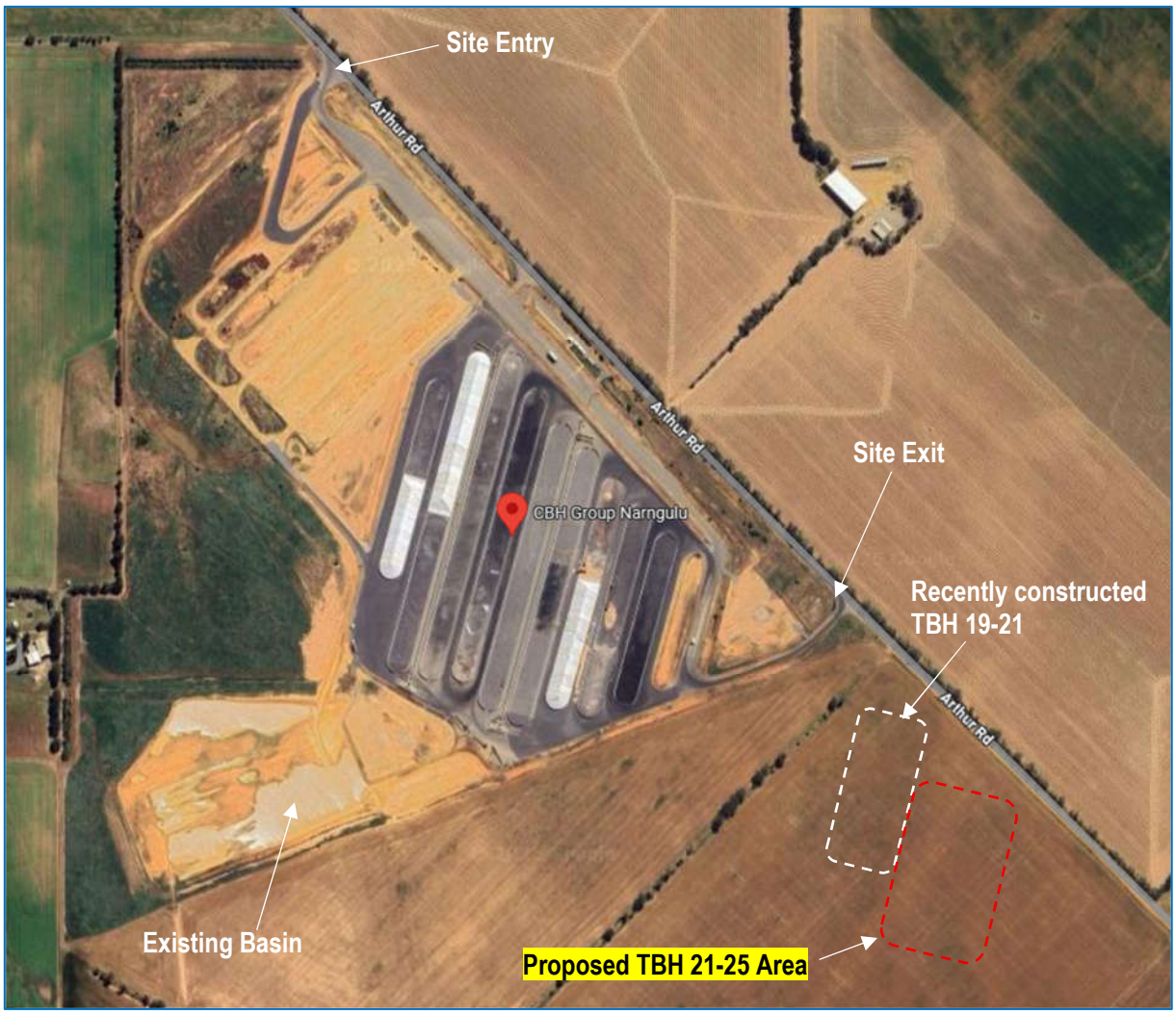



**Figure 2: Existing Established Site**

Shawmac have been commissioned by CBH to prepare the 30% design for the works including drainage.

## 1.2. Purpose

The purpose of this report is to document the drainage strategy to inform the 30% design.

# 2. Existing Situation

## 2.1. Site Characteristics

The CBH site is currently occupied by permanent OBH's 01/02/03/04/05/06/07/08/09 and temporary emergency TBH's 10/11/12/13/14.

The majority of the OBH's are located in the north-eastern portion of the site. The remaining southern and south-eastern portions of the site are vacant and used for cropping.

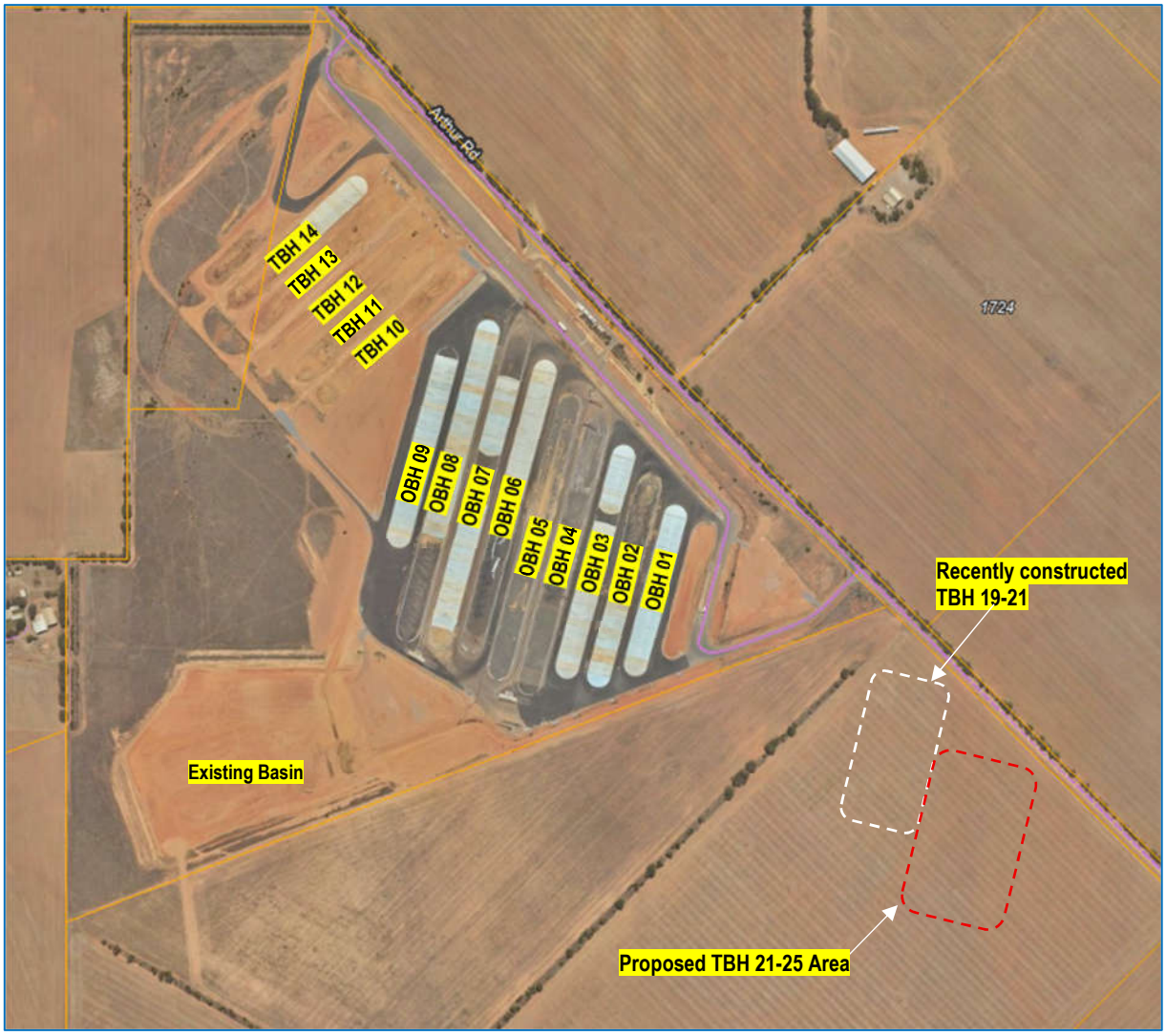



**Figure 3 : Existing Site**

## 2.2. Geotechnical

Galt Geotechnics undertook a geotechnical investigation and study of the site in June 2022 (J1801254 010 R Rev 0, 12/07/2022). Galt described the subsurface soil conditions at the undeveloped portion of the site ( Lot 14 Arthur Road, where the emergency bulkheads are proposed) were generally consisting of:

- Central and Southern Part of OBH16 to OBH19
    - Silty SAND (SM): fine to coarse grained, sub-angular to angular, pale brown to brown, approximately 15-20 % low plasticity fines, typically dry, ranging from medium dense to very dense (apparent high density due to desiccation of fines), present from ground surface and extending to depths ranging from 0.2 m to 1.2 m; overlying.
    - Clayey SAND (SC)/ Sandy CLAY (CL-CI): fine to coarse grained, sub-angular to sub-rounded, red brown becoming brown with depth, approximately 20-40 % low to medium plasticity fines, trace gravel, moist, typically medium dense to very dense or stiff to hard, extending to a depth of up to 2.5 m.
- Northern Part of OBH16 to OBH 21
    - Silty/Clayey SAND (SM-SC): fine to medium grained, sub-angular to sub-rounded, brown, approximately 15% non-plastic to low plasticity fines, trace organics typically in the upper 100 mm, typically dry, typically dense to very dense (high density due to desiccation of fines), present from surface to depths ranging from 0.2 m to0.4 m; overlying
    - Clayey SAND/Sandy CLAY (CL-CI): low to medium plasticity, red-brown, with 30-70 % fine to medium grained sand, typically moist, extending to depths to the maximum investigated depth of 2.5 m.

Groundwater was not encountered in the test pits during that investigation (mid-winter) or previous investigations (near the end of summer). The only exception was the presence of standing water across the north-eastern part of the existing basin on the southern end of Lot 15. Given that no groundwater inflow was noted in any nearby test pits, it is expected that this standing water is stormwater runoff that has perched on the silty sand/clayey sand.

Galt have commented that the previous field and laboratory testing using the falling head method indicates that the unsaturated hydraulic conductivity of the in-situ soils is very low, particularly when compacted. Therefore, Galt has advised that for the purposes of drainage design, the site soils are to be considered impermeable.

## 2.3. Environmental

As the surrounding land is almost completely cleared for cropping, there are no particular environmental concerns, with the exception of some trees within the site that will not be impacted by the proposed expansion.

**Figure 4** provides an excerpt of the 1:100,000 Geoscience Australia Topographic Map '*Geraldton*' and shows the environmentally features surrounding the site.

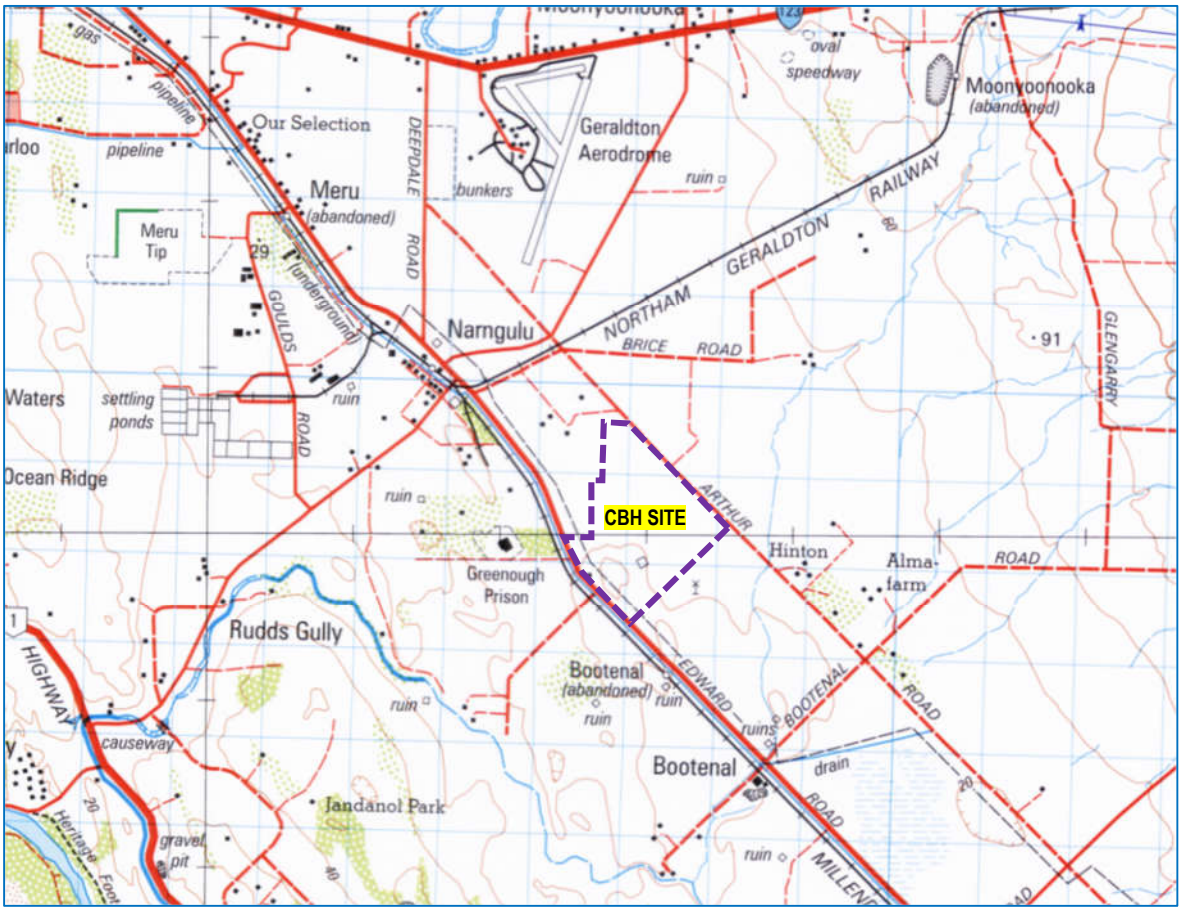



**Figure 4: 1:100,000 Geoscience Australia Topographic Map Excerpt**

## 2.4. Terrain

The natural terrain has a series of ridges grading towards isolated low spots within the CBH site at grades typically between 0.5%-3%. The CBH site falls from high points of 24m and 22m AHD along the north-west boundary and north-east boundary, respectively, to isolated low points varying from 19.5 and 20m AHD as well as 18.29m AHD at the existing basin. **Figure 5** shows the natural terrain surrounding the site (2m contours).

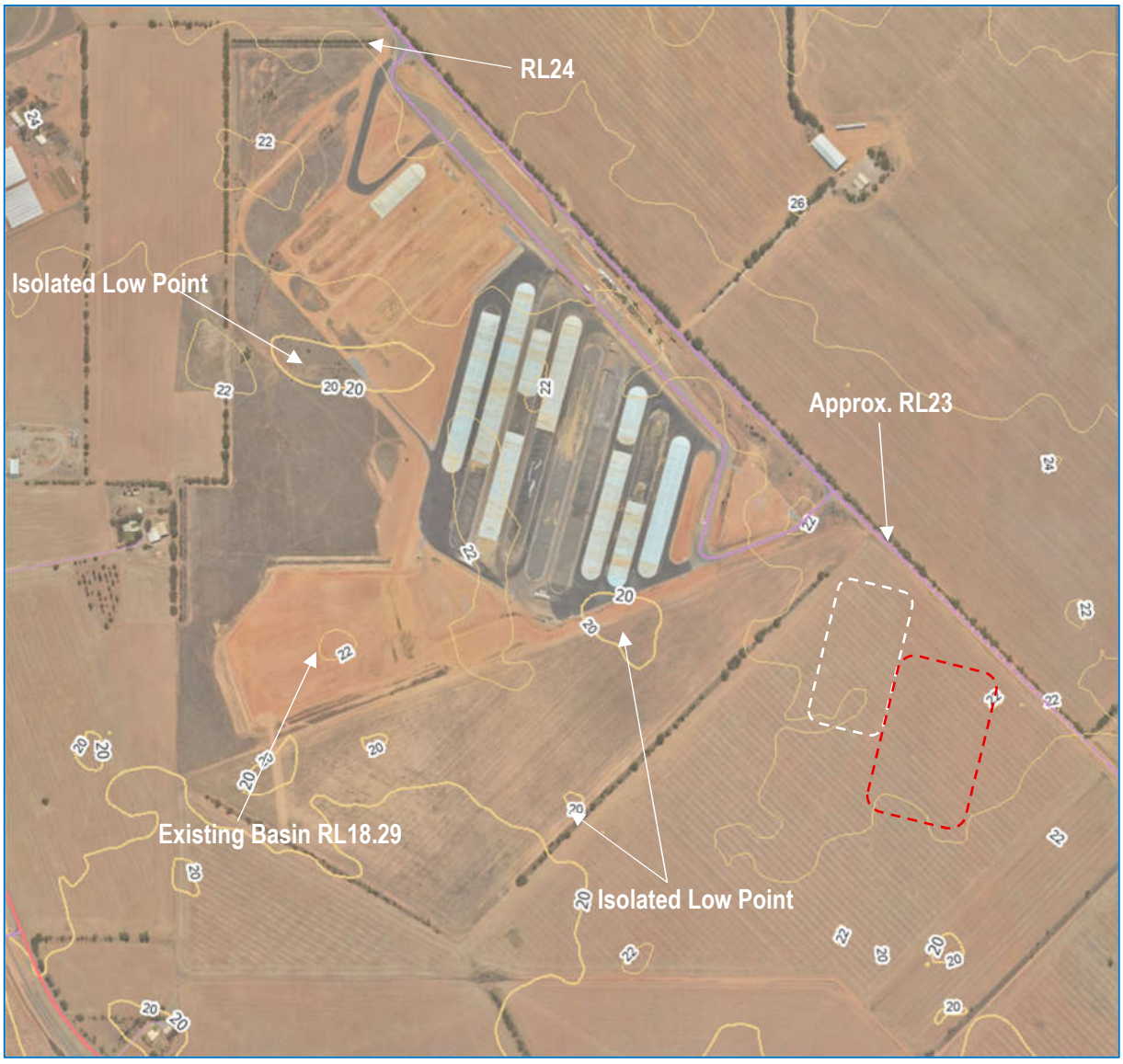



**Figure 5: Existing Site Contours**

## 2.5. Surface Water Catchments

The CBH site consists of several catchments that direct stormwater to isolated low points and existing basins within the site. There are also existing earth bunds that limit the flow from external catchments.

Stormwater from the existing west emergency bulkheads is predominantly directed to an existing low point to the south that acts as a natural retention basin.

Stormwater from the existing permanent bulkheads, a small portion of the existing west emergency bulkheads, and a portion of the proposed TBH area is directed to an existing constructed basin in the southwest of the site.

The recently constructed east side emergency bulkheads (TBH 19-21) involves directing runoff to the existing low spot west of the TBHs 19-21. From there, stormwater will overtop into the existing drain and ultimately discharge into the existing basin located in the southwest portion of the site.

The majority of the undeveloped catchments including the proposed TBH 21-25 area naturally flow to the east and south and offsite and is not captured within the existing basins.

**Figure 6** below shows the existing internal and external catchments impacting the site.

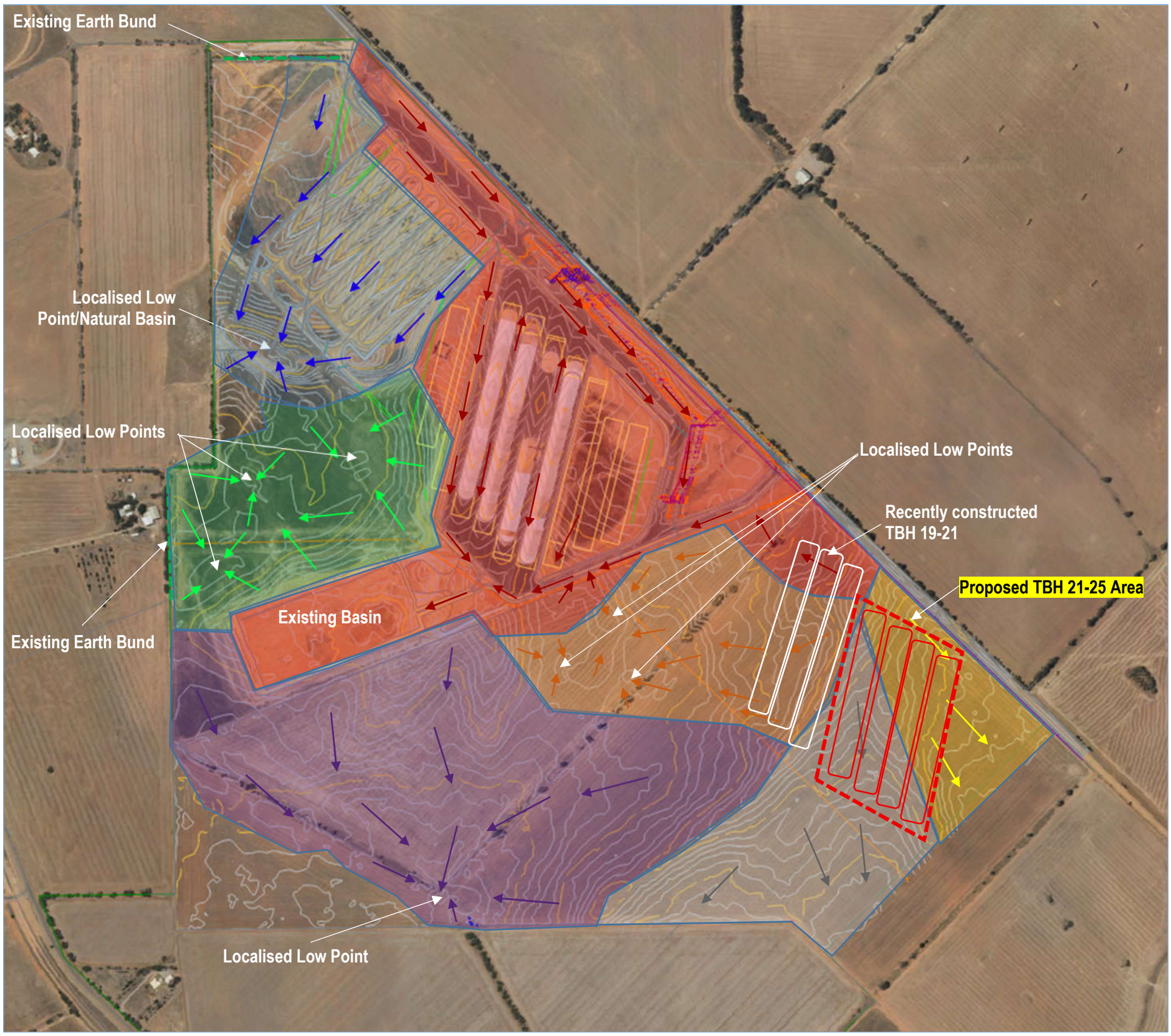



Figure 6: Existing Catchments

# 3. Stormwater Management Strategy

## 3.1. Strategy

Several stormwater management options were assessed to manage runoff from the proposed TBH 22-25 areas. These included the following:

- Option 1 involved directing stormwater to the existing low spot to the west (similar to the recently constructed TBH 19-21). The assessment confirmed that there would be significant cut along the existing drains to direct the stormwater to the low spot through the existing ridge line. In addition, the low spot would need to deepen to allow the drain to daylight.
- Option 2 involved installing basins in the east and south east corner of the site. Due to the flat terrain in this area, this would have resulted in increasing the levels of the proposed TBH's (and therefore increase in fill), to ensure adequate freeboard from the basin tailwater levels. In addition, in larger events, the basins would overtop into the adjacent neighbouring land to the east, creating difficulties for CBH to monitor and maintain any downstream impacts outside of their site. It is also unlikely that this basin could not be designed to be free draining without also significantly increasing the levels of the proposed TBH's (and therefore increase in fill) to ensure adequate freeboard.
- Option 3 involves installing a basin to the south that allows any overtopping of the basin into CBH controlled land. A bund would also be considered to protect the neighbouring land to the east from potential backflow from the basin. There is also a possibility that the due to the flat terrain in this area, this would have resulted in increasing the levels of the proposed TBH's (and therefore increase in fill), to ensure adequate freeboard from the basin tailwater levels, particularly if the basin is to be free draining.
- Option 4 involves installing a basin further into the undeveloped land to the south within the undeveloped portion of the CBH site. This would allow greater flexibility with THB levels and freeboard. In addition, the basin could be design sympathetically to allow for future CBH expansions to the south. In addition, there could be existing low spots in the south area that could act as a basin and therefore reducing required earthworks. The provided survey does not encompass this south portion of the CBH site and additional survey would be required to proceed with this option.

Among the options explored, the preferred drainage strategy is Option 4, with Option 3 being the next preferred if Option 4 is not feasible.

Refer **Figure 7** for the proposed Option 3 and Option 4 (preferred) drainage strategy.

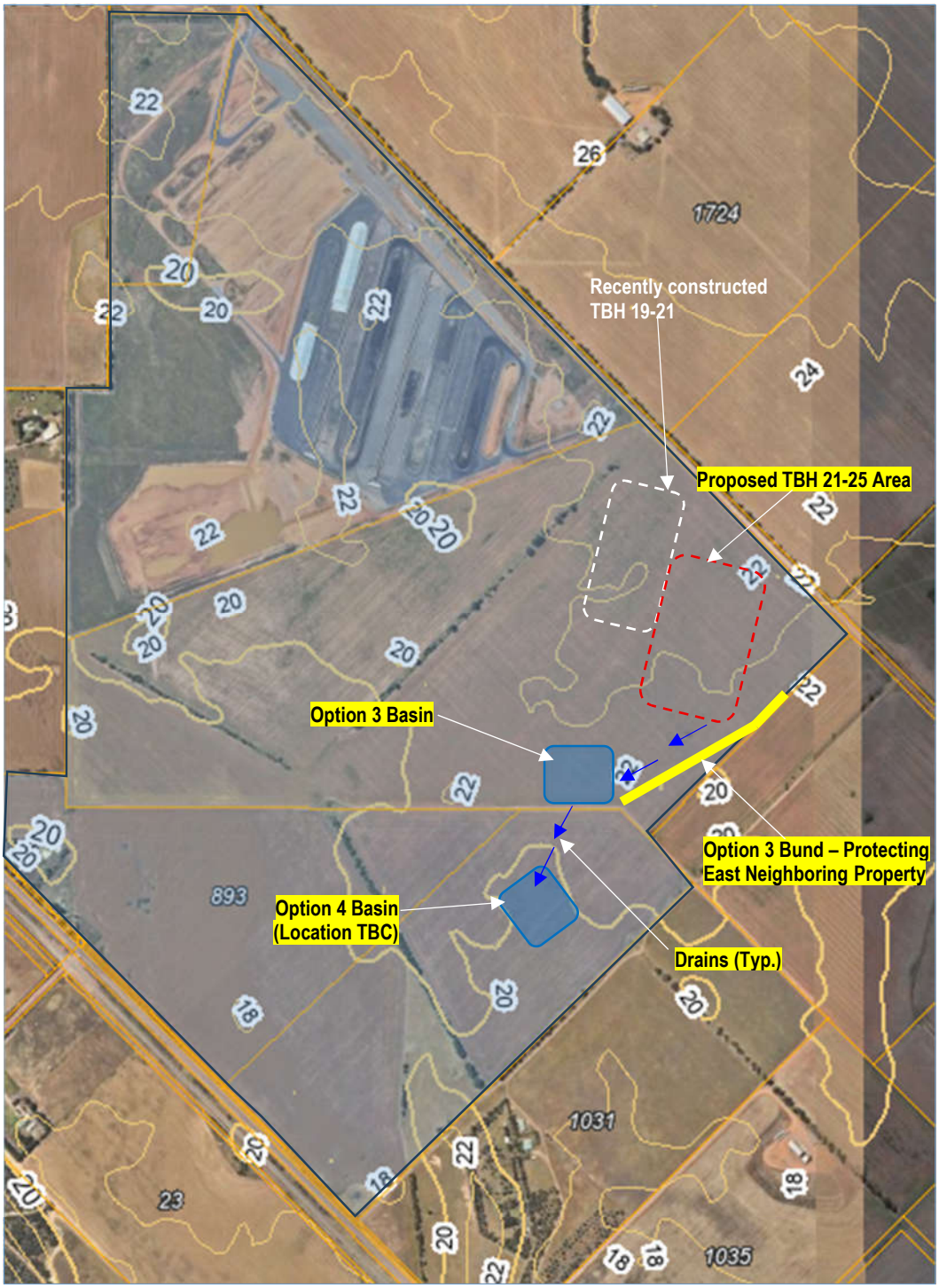



**Figure 7: Option 3 & Option 4 Strategy**

## 3.2. Design Criteria

Based on the adopted strategy and CBH's design specifications, the key stormwater management design criteria that will be adopted is as follows:

- Adequately protect the site from inundation and flooding both from internal catchments and external upstream catchments.
- TBHs are designed for a 5-year ARI event, including drains, culverts and basin.
- Manage, control and convey the design ARI event post development event with a free-board of 300mm. (Consideration may be given to a reduction to 150mm when flooding does not present a risk to infrastructure and operations).
- Open drains are to be set at a minimum 300mm deep below the bottom of pavement, or 600mm below surface where no pavement is to be installed.
- As per CBH Peak Planning Specification, no scour protection or road kerb to be implemented.
- Culverts may have a minimum cover of 400mm (RCP Class 4).
- Minimum culvert size of 450mm diameter.
- Minimum drain fall of 0.3%.

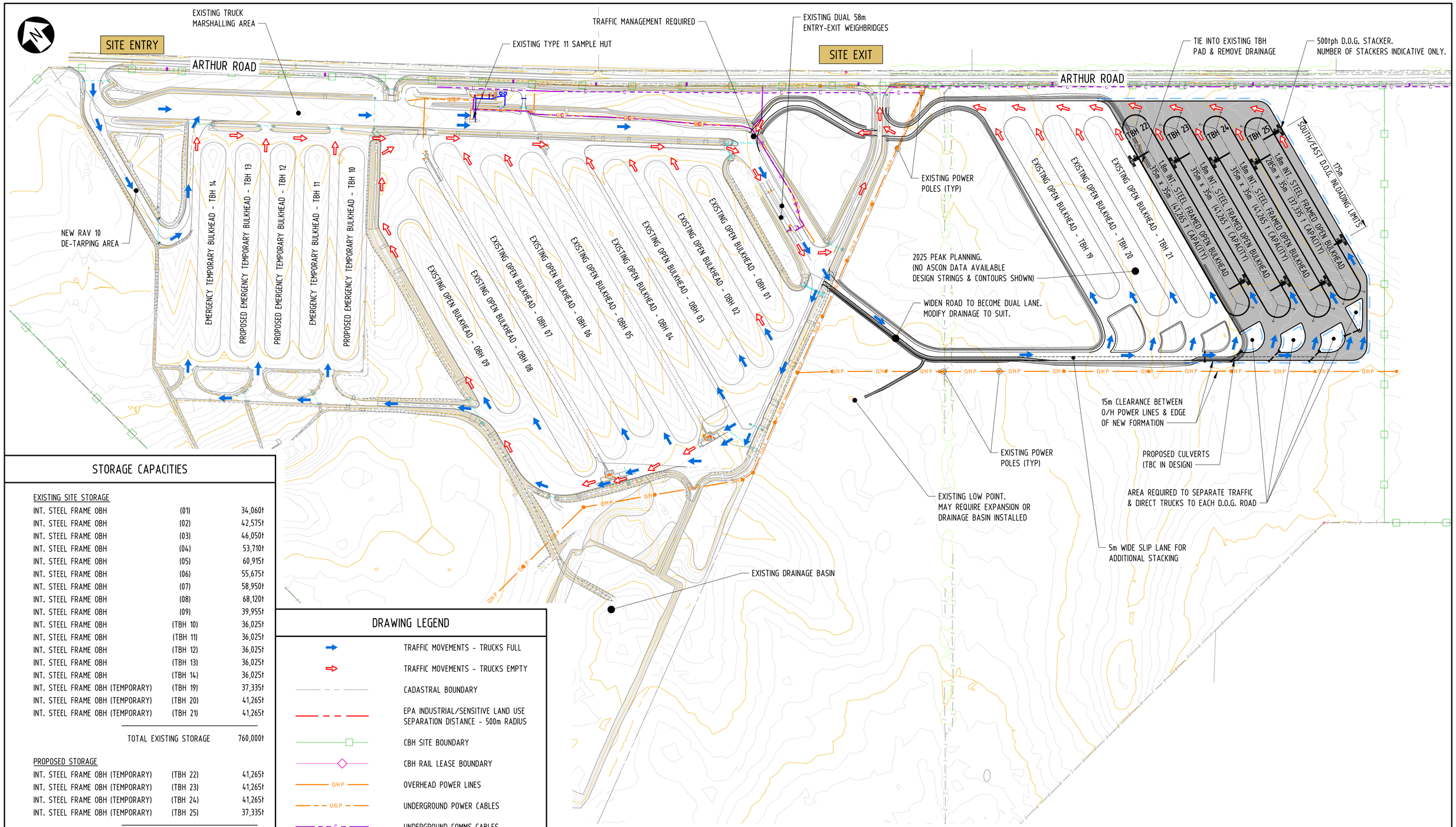
# 4. Works to be Completed

## 4.1. General

CBH is currently arranging for the survey of the site portion of the CBH site area to allow confirmation that Option 4 is the preferred option over Option 3.

Once the option is confirmed, the basins, culverts and drain sizes will be designed accordingly.

# Appendix A – CBH Concept Design




## STORAGE CAPACITIES

| | | |
|---|---|---|
| EXISTING SITE STORAGE | | |
| INT. STEEL FRAME OBH | (01) | 34,060t |
| INT. STEEL FRAME OBH | (02) | 42,575t |
| INT. STEEL FRAME OBH | (03) | 46,050t |
| INT. STEEL FRAME OBH | (04) | 53,710t |
| INT. STEEL FRAME OBH | (05) | 60,915t |
| INT. STEEL FRAME OBH | (06) | 55,675t |
| INT. STEEL FRAME OBH | (07) | 58,950t |
| INT. STEEL FRAME OBH | (08) | 68,120t |
| INT. STEEL FRAME OBH | (09) | 39,955t |
| INT. STEEL FRAME OBH | (TBH 10) | 36,025t |
| INT. STEEL FRAME OBH | (TBH 11) | 36,025t |
| INT. STEEL FRAME OBH | (TBH 12) | 36,025t |
| INT. STEEL FRAME OBH | (TBH 13) | 36,025t |
| INT. STEEL FRAME OBH | (TBH 14) | 36,025t |
| INT. STEEL FRAME OBH (TEMPORARY) | (TBH 19) | 37,335t |
| INT. STEEL FRAME OBH (TEMPORARY) | (TBH 20) | 41,265t |
| INT. STEEL FRAME OBH (TEMPORARY) | (TBH 21) | 41,265t |
| TOTAL EXISTING STORAGE | | 760,000t |
| PROPOSED STORAGE | | |
| INT. STEEL FRAME OBH (TEMPORARY) | (TBH 22) | 41,265t |
| INT. STEEL FRAME OBH (TEMPORARY) | (TBH 23) | 41,265t |
| INT. STEEL FRAME OBH (TEMPORARY) | (TBH 24) | 41,265t |
| INT. STEEL FRAME OBH (TEMPORARY) | (TBH 25) | 37,335t |
| TOTAL PROPOSED STORAGE | | 161,130t |
| TOTAL PERMANENT STORAGE | | 460,010t |
| TOTAL TEMPORARY STORAGE | | 461,120t |
| TOTAL SITE STORAGE | | 921,130t |

## DRAWING LEGEND

- TRAFFIC MOVEMENTS - TRUCKS FULL
- TRAFFIC MOVEMENTS - TRUCKS EMPTY
- CADASTRAL BOUNDARY
- EPA INDUSTRIAL/SENSITIVE LAND USE SEPARATION DISTANCE - 500m RADIUS
- CBH SITE BOUNDARY
- CBH RAIL LEASE BOUNDARY
- O/H P — OVERHEAD POWER LINES
- U/G P — UNDERGROUND POWER CABLES
- C — UNDERGROUND COMMS CABLES
- U/G W — UNDERGROUND WATER PIPES
- RAIL LINE
- PROPOSED OPEN DRAINS
- PROPOSED CULVERTS

## HATCHING LEGEND

AREA OF NEW WORKS 76,250m²

**PRELIMINARY ISSUE**
DO NOT USE FOR CONSTRUCTION
DATE 09.02.26

1:2500 @ A1
1:5000 @ A3
0 40 80 120 160 200 240 m



CBH GROUP
ABN 29 256 604 947

| REF DRAWING No. | REFERENCE DRAWING TITLE | REV | DATE | REVISION DESCRIPTION | BY | CHK'D | APP'D |
|---|---|---|---|---|---|---|---|
| - | - | B | 09.02.26 | REVISED & RE-ISSUED FOR REVIEW | JB | | |
| | | A | 30.01.26 | ISSUED AS CHECK PRINT AND FOR REVIEW | JB | | |

SCALE 1:2500
SHEET A1
PROJECT
CO-ORDINATE SYSTEM GCG94

| | | |
|---|---|---|
| DRAWN | J. Bullingham | 30.01.26 |
| CHECKED | | |
| DESIGNED | | |
| DESIGN APPR | | |
| PROJECT APPR | | |

TITLE
NARNGULU
2026 PEAK PLANNING
4 x ADDITIONAL OPEN BULKHEADS
CONCEPTUAL LAYOUT No. 1

ORG No 307-ENG-CI-DCO-0024
SHEET 1 OF 1
REV. B