

**Chapter****8****Mitigation Measures****8.1 Introduction**

In the control of potential environmental impacts from the implementation of the proposed Project as discussed in Chapter 7, pollution preventive and mitigation measures are recommended in this chapter for concurrent implementation with the Project. Mitigation measures proposed as part of this assessment can be categorised as the following:

- Prevention – Related to project options and prevention is commonly addressed during the pre-construction or planning stage of the Project and is associated with the preliminary aspects of the Project including site and technology selection;
- Control – Related to the controlling of pollutant or other associated potential impacts, control may include the implementation of various measures during the construction and operation stages of the proposed Project, including engineering measures, monitoring and audit activities, or on-going social engagement; and
- Compensatory – Related to the lessening or the balancing of any unavoidable environmental impact, compensatory measures maybe included where liable and applicable, including the establishment of nature reserves, or greater Project Proponent involvement or sponsorship in the surrounding community.

## 8.2 Marine Water Quality

Potential impacts on marine water quality were assessed and discussed in Chapter 7 of this EIA report. Hydraulic modelling tools were used to simulate possible impacts during the reclamation and dredging stage, land work construction, and operational stage. The impacts were separated into temporary and permanent impacts. Based on the assessment of the impacts, the following are proposed mitigating measures to prevent or minimize the potential impacts.

### 8.2.1 Erosion and Sediment Controls

The main objectives of land disturbing pollution preventive and mitigating measures (LDP2M2) are to protect, restore and enhance the environmental quality at the Project site and its surrounding areas through a proper and systematic planning, implementation, monitoring and auditing of mitigation measures on erosion and sedimentation. This LDP2M2 addresses the findings of the impact assessment of the proposed reclamation / dredging and construction activities for Phase 1 only which covers the development of about 500 acres. Similar LDP2M2 concept may apply to Phase 2 and Phase 3 development which will be elaborated in the respective environmental management plans at a later stage prior to the development of those phases.

#### 8.2.1.1 During Reclamation / Dredging Works for Phase 1

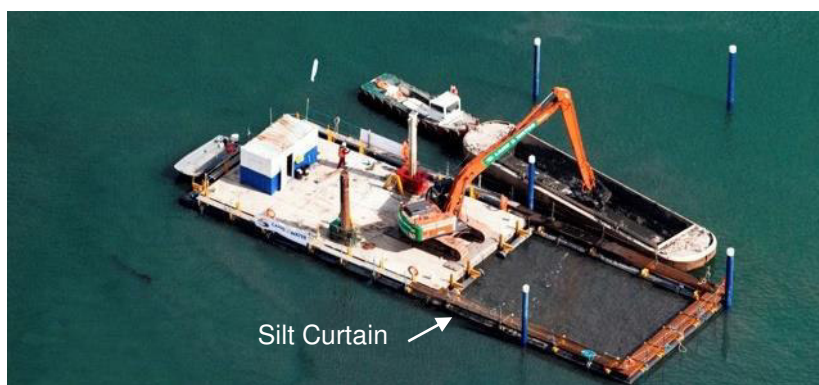
This stage involves the reclamation activities which are sub divided into Phase 1a, Phase 1b and Phase 1c, respectively. The recommended LDP2M2 for marine works are presented below.

Development Phase	Reclamation Sub-Phases	Area (acres)
1	1a	191
	1b	120
	1c	189

- Minimal vegetation clearing is envisaged as the proposed Project site are mainly from the beach to the water area.
- Prior to the reclamation activity, silt curtain will be installed and sand bund will be constructed along the boundary of area to be reclaimed. The embankment of the bund shall have a low gradient of 1V: 3H and 1V: 5H respectively or gentler.
- A weir box shall be positioned at the lowest point of the area to be reclaimed and connected to a discharging pipe to release the displaced water from the Project site to the sea during reclamation works. The weir box is approximately 80 cm in depth and has a width of approximately 1.5 m. On the front side of the box, wooden boards can be inserted, allowing the overflow level of the box to be regulated. In front of the weir box, a 'lake' will be created by means of adjusting the overflow height. Inside the reclamation bund, 2 or 3 of these weir boxes will be placed in parallel creating a total overflow with a width of 3 or 4.5 m. When the sand has reached the height of the initial box level, a second box level will be installed on top of the first box. The height of the second box will be some 2 to 2.5 m. More weir boxes can be

added on top to raise the reclamation level to as high as 18 m. The outflow pipelines will remain at the lowest weir box.

- Floating silt curtains will be positioned 5 m to 10 m away from the discharge pipe of the weir box to further contain any sediment from discharge directly into the sea. These silt curtains shall be placed extending far enough to allow suspended sediment to settle and shall only be removed after the overall reclamation works have been completed.
- Water quality at the discharge point of the weir box (after passing through the silt curtains) shall be monitored in a daily (visual inspection) and weekly (water analysis) manner during the reclamation period.
- Other containment facilities such as sheet piling and geotube embankment maybe used to replace sand bund for other associated construction work.
- Permanent shoreline protection with armour rocks or vertical walls will be constructed as soon as the required platform level is achieved and compacted.
- Overall LDP2M2 layout for Phase 1a, Phase 1b and Phase 1c during marine works are presented as Stage 1 and Stage 2 in **Figure 8.2.1, Figure 8.2.2, and Figure 8.2.3** respectively.
- Application of silt curtain around the dredged area during dredging with grab dredgers to ensure that the suspended sediment in the water is contained as shown below.



- Overflows from Trailer Suction Hopper Dredgers (THSD) shall be controlled based on density of the soil-water mixture through outlet equipped with adjustable valve. No overflow shall be allowed should the dredged material is of high level of fine clay material.
- THSD's hopper and barges carrying sand / dredged material shall provide proper containment to avoid any spill from the bottom doors or overspill outlets during transportation.

### 8.2.1.2 During Land Works for Phase 1

Construction that involve the land works will also be initiated based on the planned Phases. Recommended LDP2M2 for these stages of works are described below.

- Construction entrance stabilization shall be constructed at the entrance to the Project site. Besides slowing down the traffic speed, the stabilised entrance will ensure that sediment from

the work areas is trapped and not carried onto the public road and existing drain and this also serve as a dust control measure.

- Temporary access road of about 6 m width and 300 mm thick crusher run and compacted is constructed within the work areas.
- Vehicle wash trough with silt trap is to be constructed at the exit point from the Project site prior entering to the public road. Wash water shall be reused where possible and any overflow of wash water shall be treated at silt trap to discharge quality of 50 mg/L of suspended solids prior to discharge.
- The first level of defence Best Management Practices (BMPs) within the work area, i.e. sediment basin / silt trap and cut off/ earth drain; shall be put in place before commencement of work at site. Sediment basin shall be placed at the end of the cut-off / earth drain. All surface runoff shall be diverted to the sediment basin / silt trap and treated to discharge quality of 50 mg/L of suspended solids prior to discharge off-site.
- Rock filter check dams shall be installed along the cut off/ earth drains (600 mm width) at each turning of the cut off/ earth drains and the entrance/exit point of the proposed sediment basin / silt trap to reduce flow velocity and promote sedimentation within the affected area.
- Temporary waterway crossing (i.e. culvert) to be constructed wherever required within the Project site.
- Top soil, rock aggregates as well as overburden stockpiles shall be barricaded with silt fence to minimize sediment wash out respectively.
- Overall LDP2M2 layout for Phase 1a, Phase 1b and Phase 1c during land works are presented as Stage 3 in **Figure 7.2.106, Figure 7.2.107 and Figure 7.2.108** respectively.

### **8.2.1.3 Best Management Practices**

Proposed BMPs construction details are as depicted as **Figure 8.2.4, Figure 8.2.5, Figure 8.2.6, Figure 8.2.7, Figure 8.2.8, Figure 8.2.9, Figure 8.2.10 and Figure 8.2.11.**

### **8.2.1.4 Inspection and Maintenance Programme**

Maintenance schedules and instructions for maintaining control measures shall be developed by the Project's Qualified Person. Among the inspection and maintenance programmes are:

#### **Site Inspection**

A self-auditing program will be established based on an inspection checklist. A site inspection using the checklist shall be conducted by the Qualified Person:

- At least daily, weekly, bi-weekly or monthly; and
- Immediately after a storm event.



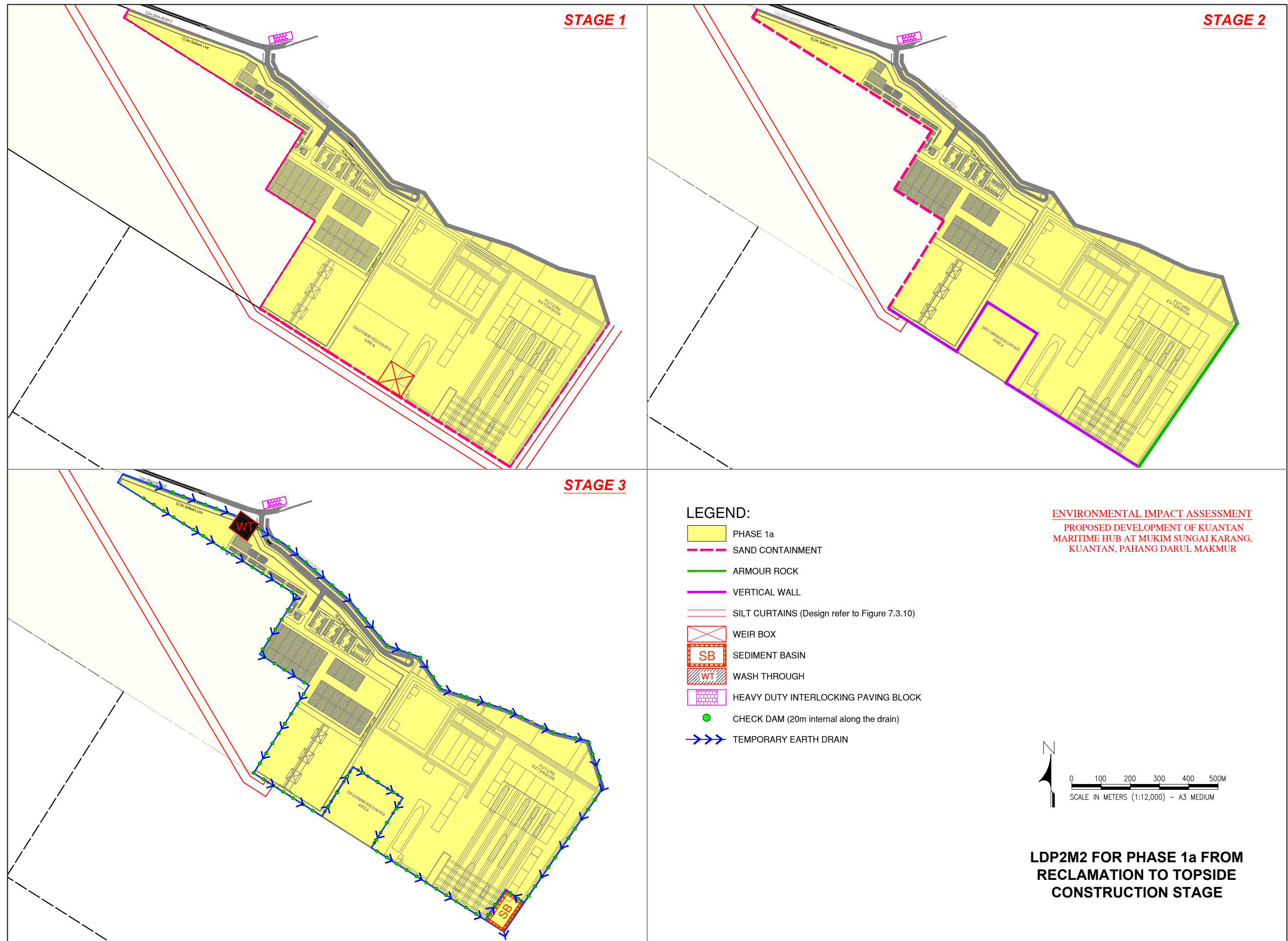


FIGURE: 7.2.106

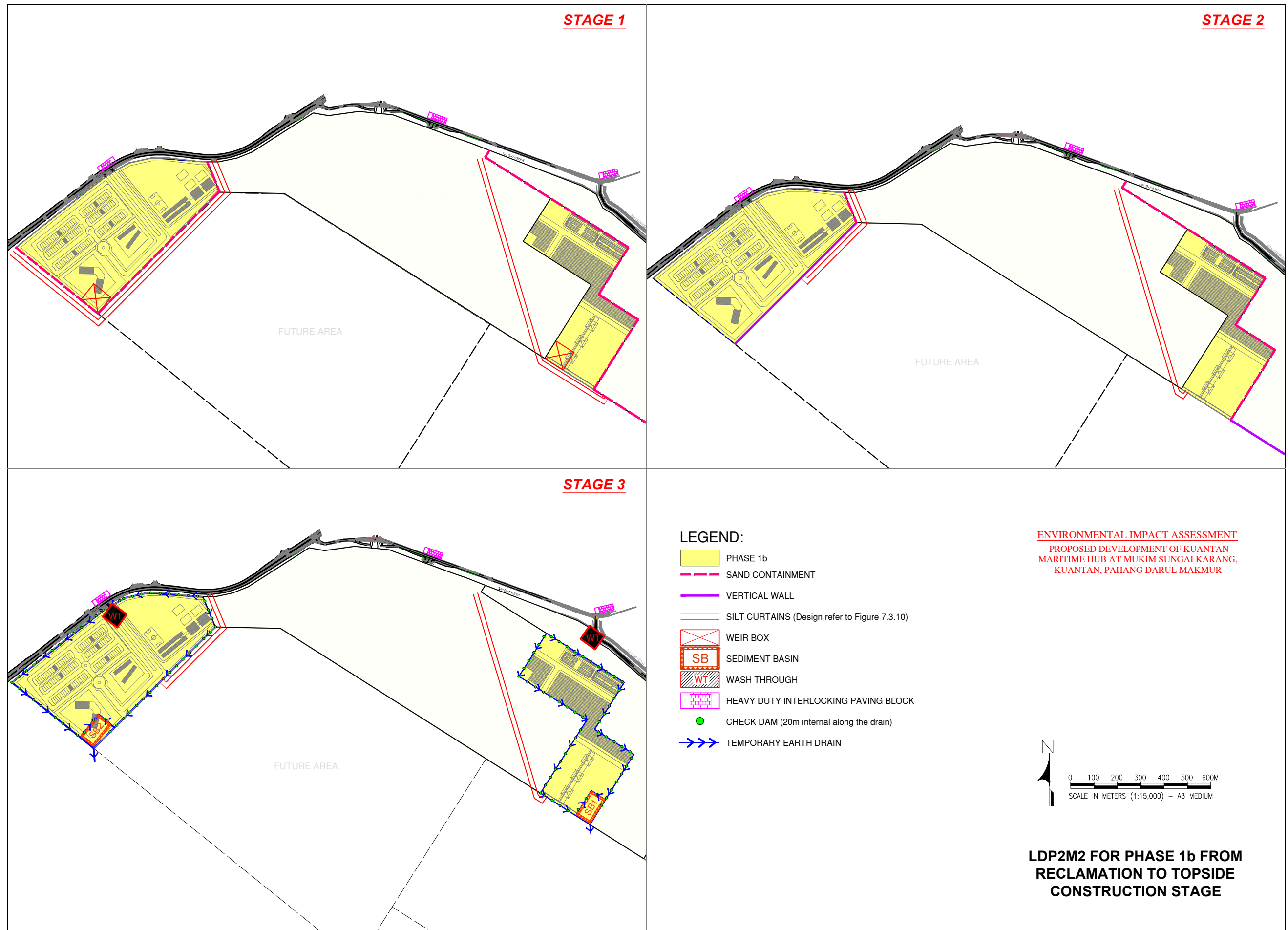


FIGURE: 7.2.107



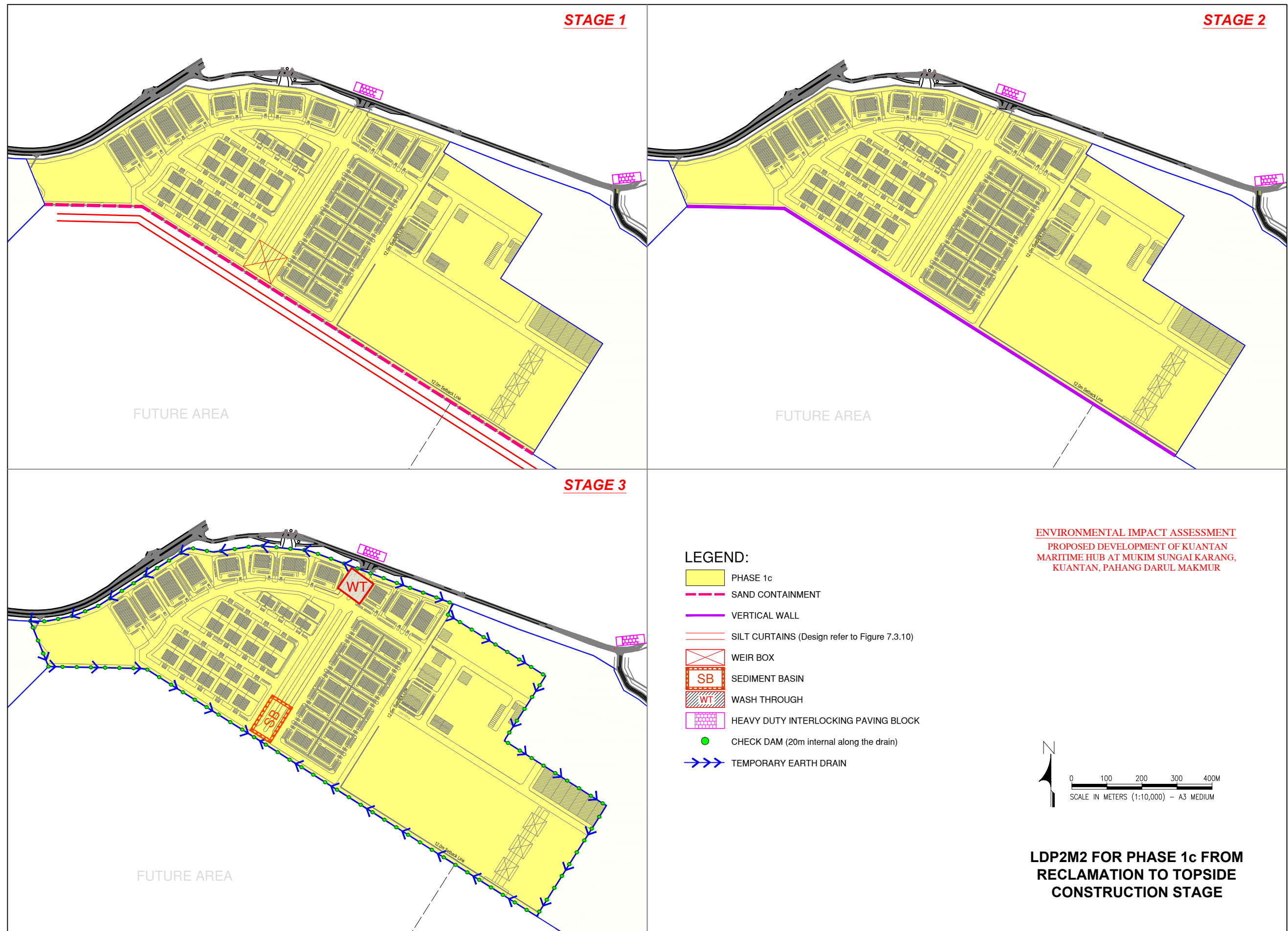
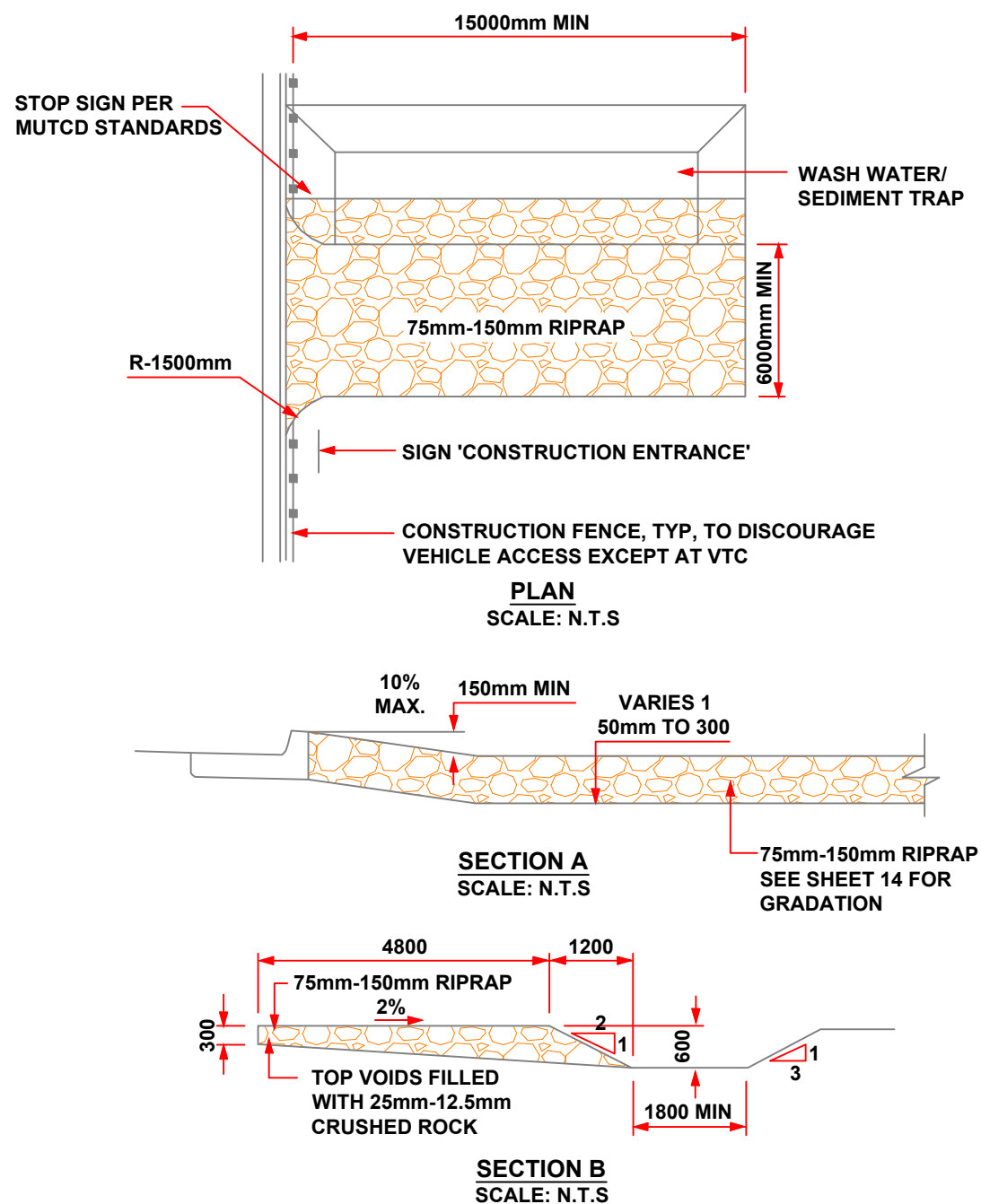


FIGURE: 7.2.108



#### VEHICLE TRACKING CONTROL INSTALLATION NOTES

1. ALTHOUGH NOT NORMALLY USED. THE COUNTY RESERVES THE RIGHT TO REQUIRE VEHICLE TRACKING CONTROL WITH WHEEL WASH FACILITIES AT SITES WHERE TRACKING ONTO PAVED AREAS BECOMES A SIGNIFICANT PROBLEM.
2. IF VEHICLE TRACKING CONTROL WITH WHEEL WASH FACILITIES ARE REQUIRED, ALL WHEELS ON EVERY VEHICLE LEAVING THE SITE SHALL BE CLEANED OF MUD USING A PRESSURE-WASHER, THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A WATER SOURCE.
3. VEHICLE TRACKING CONTROL PADS SHALL CONSIST OF HARD, DENSE, DURABLE STONE, ANGULAE IN SHAPE AND RESISTANT TO WEATHERING. ROUNDED STONE OR BOULDERS WILL NOT BE ACCEPTABLE, THE STONES SHALL BE 3" WITH A MAXIMUM SIZE OF 6", THE STONE SHALL HAVE A SPECIFIC GRAVITY OF AT LEAST 2.6 CONTROL OF GRADATION WILL BE BY VISUAL INSPECTIONS.
4. ANY CRACKED OR DAMAGE CURB AND GUTTER AND SIDEWALK SHALL BE REPLACED BY CONTRACTOR.
5. A STOP SIGN INSTALLED IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD). AS AMENDED, SHALL BE INSTALLED FOR EXISTING TRAFFIC AT THE VTC.

#### VEHICLE TRACKING CONTROL WITH WHEEL WASH MAINTENANCE NOTES

1. GFSC MANAGER SHALL INSPECT VEHICLE TRACKING CONTROL WITH WHEEL WASH FACILITIES DAILY, ACCUMULATED SEDIMENT SHALL BE REMOVED FROM PAD SURFACE.
2. ACCUMULATED SEDIMENT IN THE WASHWATER/SEDIMENT TRAP SHALL BE REMOVED WHEN THE SEDIMENT DEPTH REACHES AN AVERAGE OF 12-INCHES.
3. VEHICLE TRACKING CONTROL WITH WHEEL WASH FACILITY SHALL BE REMOVED AT THE END OF CONSTRUCTION, THE RIPRAP MATERIAL REMOVED OR, IF APPROVED BY THE COUNTY, USED ON SITE, AND THE AREA TOPSOILED DRILL

NOTE: ALL UNITS IN MILIMETERS(mm)

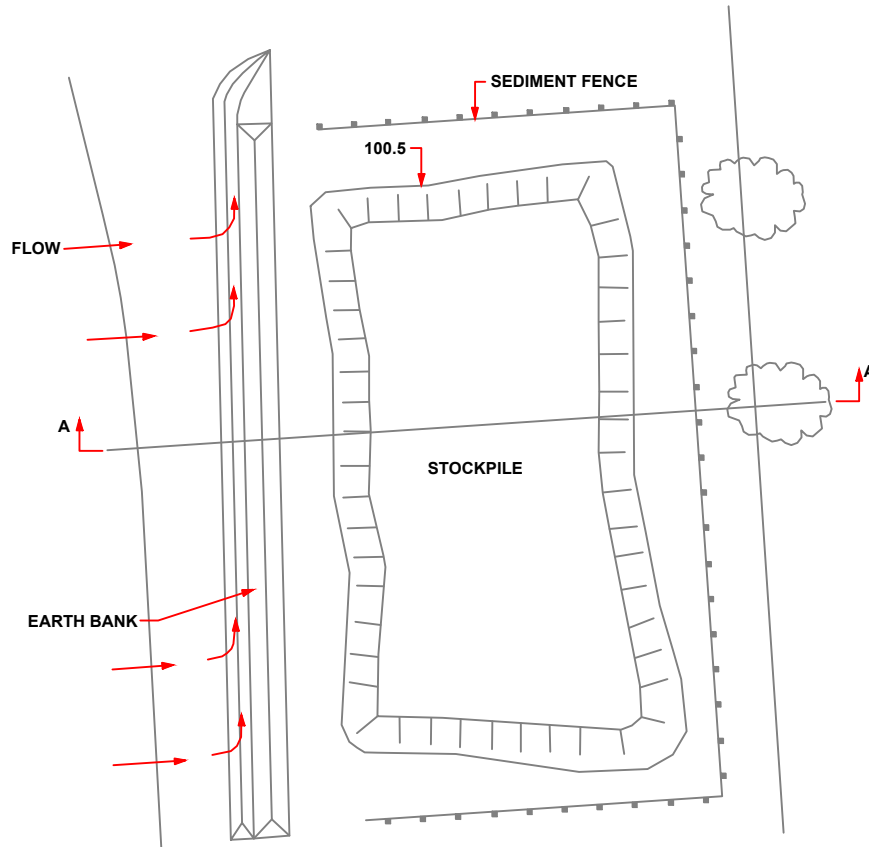
#### ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED DEVELOPMENT OF  
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PAHANG DARUL MAKMUR

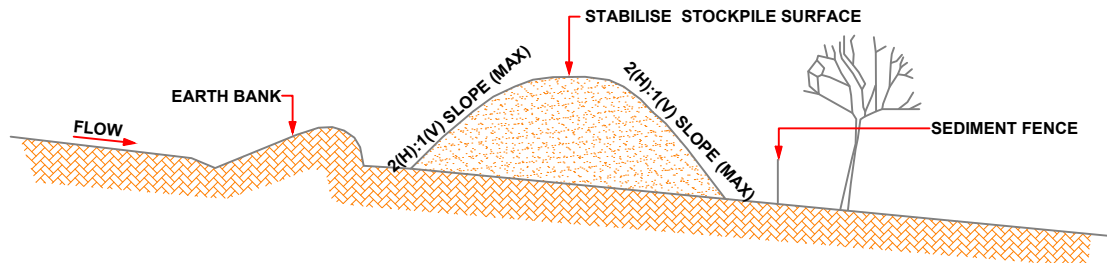
#### CONSTRUCTION ENTRANCE STABILIZATION WITH WHEEL WASH FACILITIES



## PLAN



## SECTION A-A



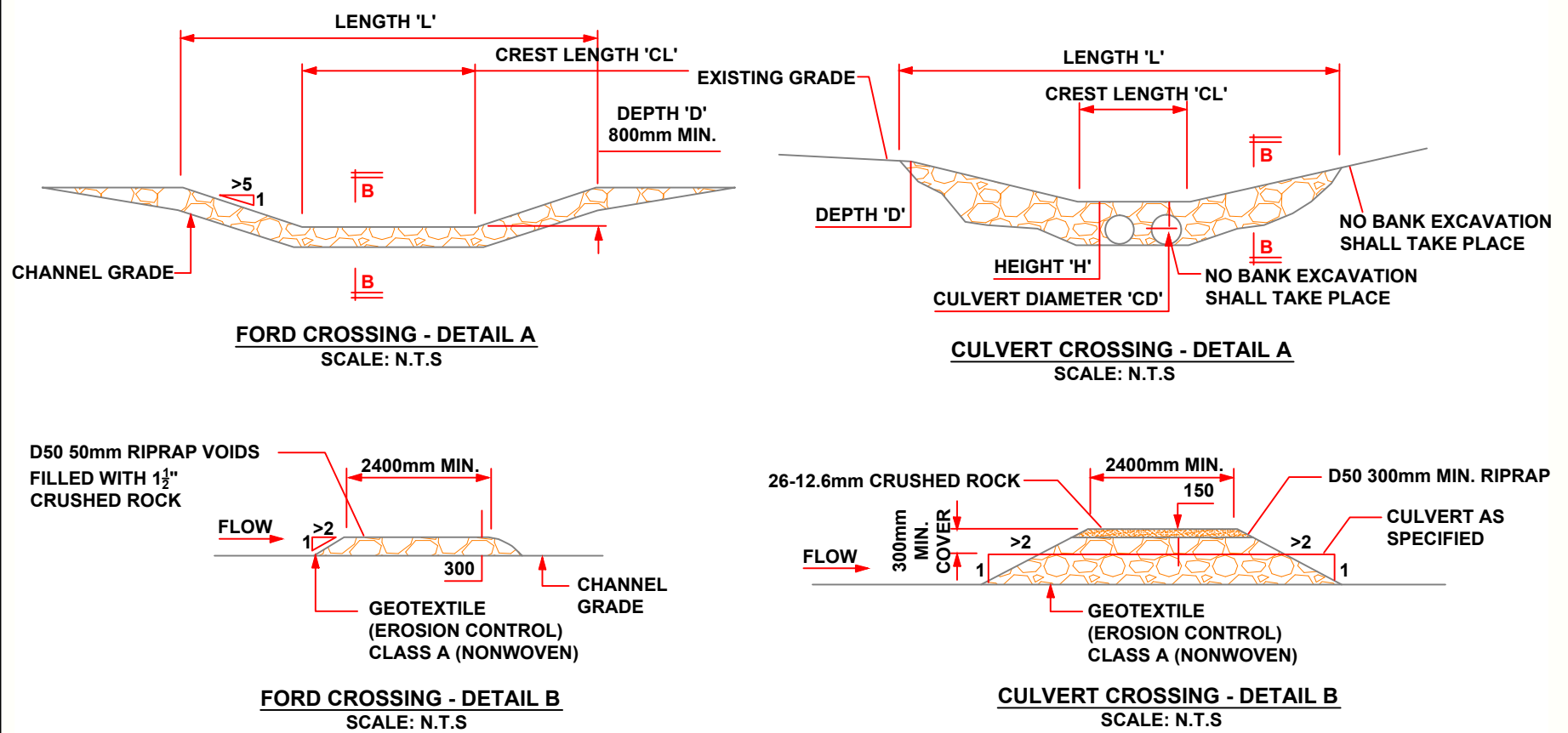
### CONSTRUCTION NOTES:

1. LOCATE STOCKPILE AT LEAST 5 METRES FROM EXISTING VEGETATION, CONCENTRATED WATER FLOWS, ROAD AND HAZARD AREAS.
2. CONSTRUCTION ON THE CONTOUR AS A LOW, FLAT, ELONGATED MOUND.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2 METRES IN HEIGHT.
4. REHABILITATE IN ACCORDANCE WITH THE ESCP.
5. CONSTRUCT EARTH BANK (STANDARD DRAWING SDI-5 ON THE UP SLOPE SIDE TO DIVERT RUNOFF AROUND THE STOCKPILE AND A SEDIMENT FENCE (STANDARD DRAWING SDI-11) 1 TO 2 METRES DOWN SLOPE OF STOCKPILE.

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### SOIL & SPOILS STACKPILE



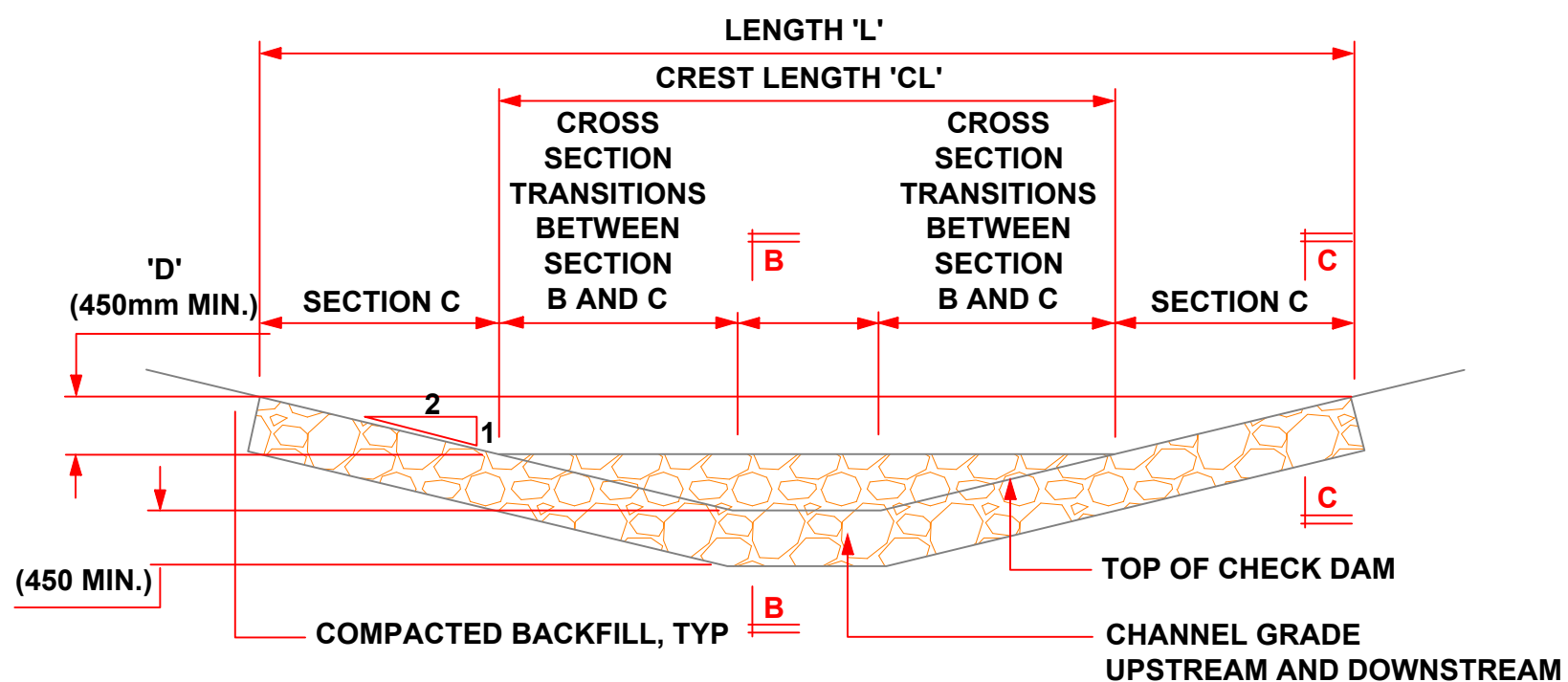
**TEMPORARY STREAM CROSSING INSTALLATION NOTES:**

1. SEE PLAN VIEW FOR:
  - LOCATION OF TEMPORARY STREAM CROSSING.
  - STREAM CROSSING TYPE (FORD OR CULVERT).
  - FOR FORD CROSSING: LENGTH 'L', CREST LENGTH, 'CL' AND DEPTH 'D'
  - FOR CULVERT CROSSING: LENGTH 'L', CREST LENGTH 'CL' CROSSING HEIGHT 'H', DEPTH 'D', CULVERT DIAMETER 'CD' AND NUMBER TYPE AND CLASS OR CAUCE OF CULVERTS.
2. TEMPORARY STREAM CROSSING DIMENSIONS. D50, AND NUMBER OF CULVERT INDICATED (FOR CULVERT CROSSING) SHALL BE CONSIDERED MINIMUM DIMENSIONS: ENGINEER MAY ELECT TO INSTALL LARGER FACILITIES . ANY DAMAGE TO STREAM CROSSING OR EXISTING STREAM CHANNEL DURING BASEFLOW OR FLOOD EVENTS SHALL BE THE CONTRACTORS RESPONSIBILITY.
3. FOR A TEMPORARY STREAM CROSSING THAT WILL CARRY LOADS. THE TEMPORARY STREAM CROSSING MUST BE DESIGNED BY THE DESIGN ENGINEER.

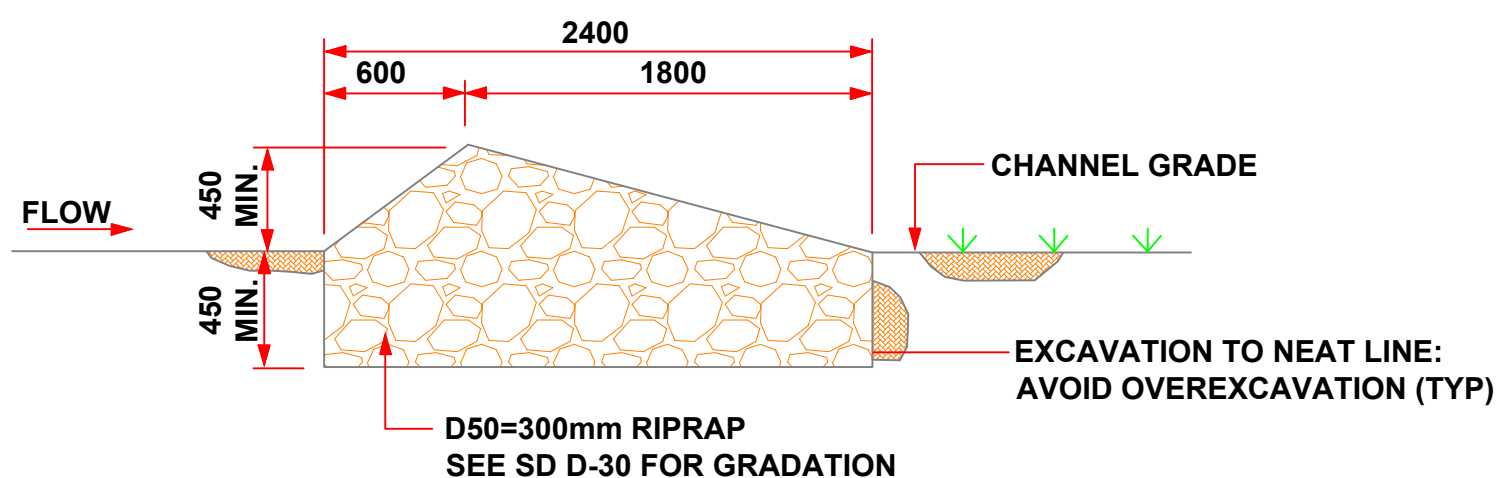
**TEMPORARY STREAM CROSSING MAINTENANCE NOTES:**

1. THE ESCP MANAGER SHALL INSPECT CHECK DAMS WEEKLY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF STREAM CROSSING SHALL BE REMOVED WHEN THE SEDIMENT DEPTH UPSTREAM OF CROSSING IS WITHIN 150mm OF THE CREST (FORD CROSSING) OR GREATER THAN AN AVERAGE DEPTH OF 300mm (CULVERT CROSSING).
3. STREAM CROSSING ARE TO REMAIN IN PLACE UNTIL NO LONGER NEEDED, BUT SHALL BE REMOVED PRIOR TO THE END OF CONSTRUCTION.
4. WHEN STREAM CROSSING ARE REMOVED, THE DISTURBED AREA SHALL BE DRILL SEEDED AND CRIMP MULCHED AND COVERED WITH EROSION CONTROL BLANKET OR OTHERWISE STABILIZED.

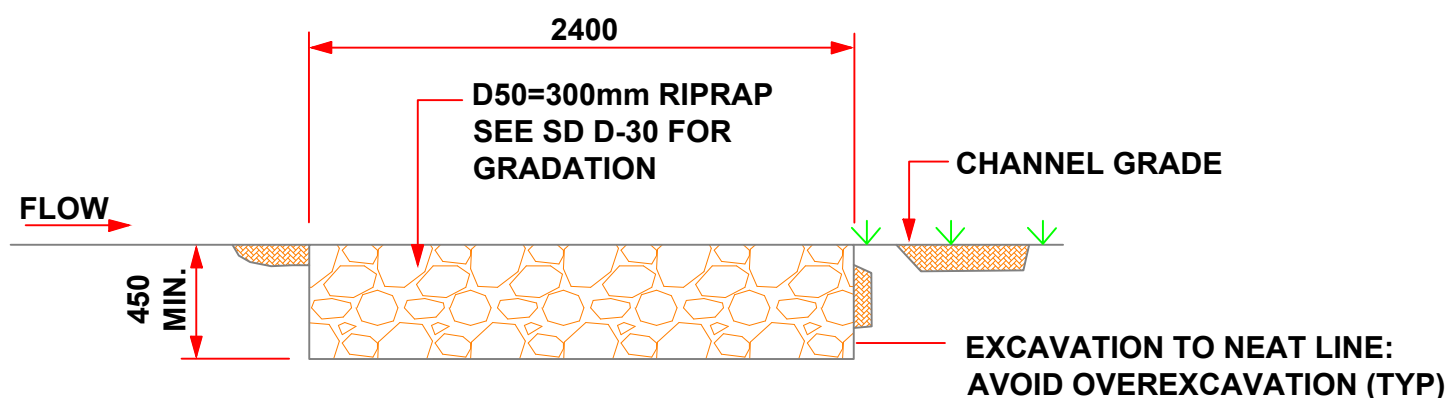
NOTE: ALL UNITS IN MILLIMETERS (mm)



**ELEVATION**  
SCALE: N.T.S



**SECTION B**  
SCALE: N.T.S

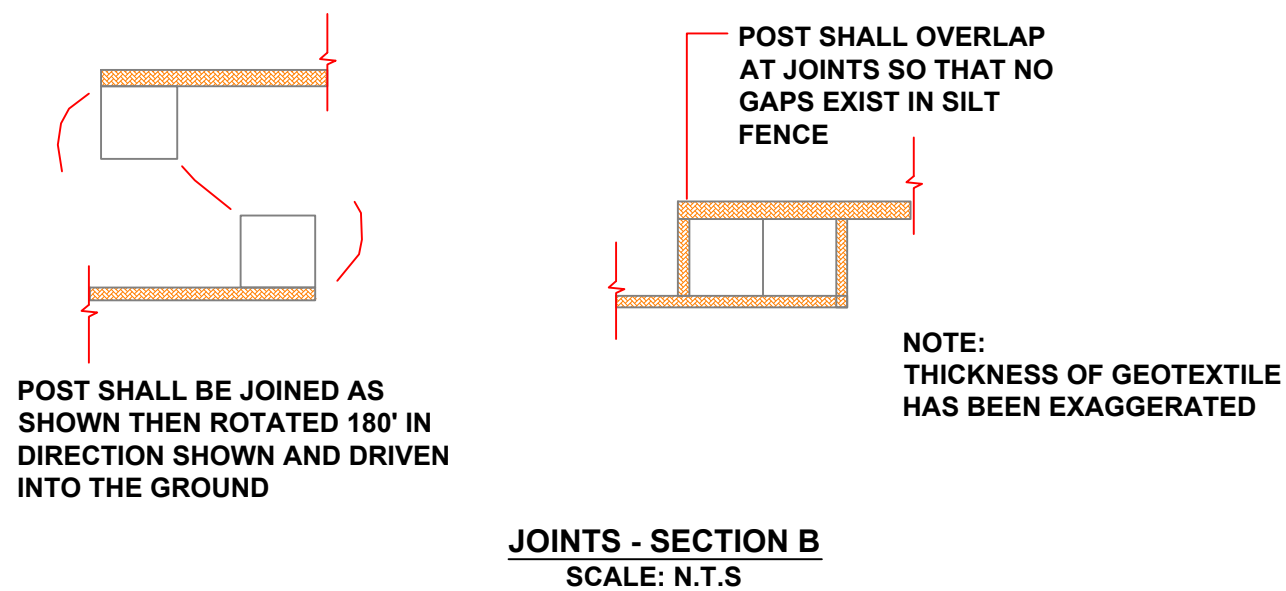
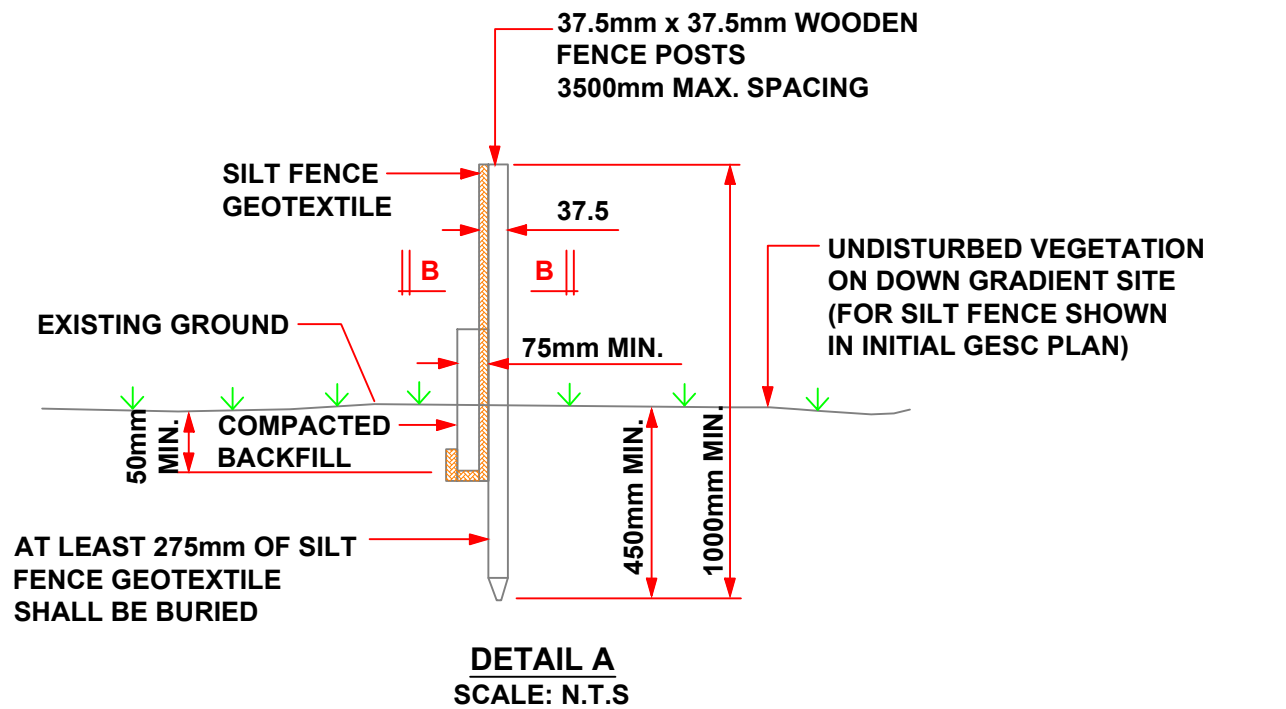


**SECTION C**  
SCALE: N.T.S

NOTE: ALL UNITS IN MILLIMETERS (mm)

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**ROCK FILLER  
CHECK DAM**



#### SILT FENCE INSTALLATION NOTES:

1. SEE PLAN VIEW FOR:  
- LOCATION AND LENGTH OF FENCE.
2. ANCHOR TRENCH SHALL BE EXCAVATED WITH TRENCHER OR WITH SILT FENCE INSTALLATION MACHINE, NO ROAD GRADERS, BACKHOES, ETC, SHALL BE USED, TRENCH SHALL BE COMPACTIONED BY HAND, WITH JUMPING JACK, OR BY THE WHEEL ROLLING, COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.
3. SILT FENCE INDICATED IN INITIAL ESCP PLAN SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

#### SILT FENCE MAINTENANCE NOTES:

1. THE ESCP MANAGER SHALL INSPECT SILT FENCE DAILY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT REACHES A DEPTH OF 150mm.
3. SILT FENCE SHALL BE REMOVED AT THE UPSTREAM DISTURBED AREA IS STABILIZES AND GRASS COVER IS APPROVED BY THE COUNTY. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL IT SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED.

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#### **SEDIMENT FENCES**