CONCEPTUAL STORMWATER MANAGEMENT PLAN

The purpose of the conceptual SWMP is to ensure that clean and dirty water are adequately separated, by diverting clean water away from dirty areas, and ensuring that dirty water from the operation is captured, contained and managed appropriately.

Terminology

The following definitions are relevant to the SWMP. These are provided here for clarity, as they are commonly referred to in this section of the report:

Activity: Any mining related process on the mine including the operation of washing plants, mineral processing facilities, mineral refineries and extraction plants; the operation and the use of mineral loading and off-loading zones, transport facilities and mineral storage yards, whether situated at the mine or not; in which any substance is stockpiled, stored, accumulated, dumped, disposed of or transported;

Clean area: This refers to any area at or near a mine or activity, which is unlikely to cause pollution of a water resource as a result of mining activities, but has the potential to become contaminated;

Clean water system: This includes any dam, other form of impoundment, canal, works, pipeline and any other structure or facility constructed for the retention or conveyance of clean unpolluted water;

Dam: This includes any return water dam, settling dam, tailings dam, evaporation dam, catchment or barrier dam and any other form of impoundment used for the storage of unpolluted water or water containing waste (i.e. contain polluted water);

Dirty area: This refers to any area at a mine or activity which causes, has caused or is likely to cause pollution of a water resource (i.e. generate polluted water);

Dirty water system: This includes any dam, other form of impoundment, canal, works, pipeline, residue deposit and any other structure or facility constructed for the retention or conveyance of water containing waste; and

Watercourse: This is defined in the NWA as -

A river or spring;

A natural channel in which water flows regularly or intermittently;

A wetland, lake or dam into which, or from which, water flows; and

Any collection of water which the Minister may, by notice in the *Gazette,* declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Design Philosophy

The following design philosophy was adopted to guide the development of the SWMP, and is based on GN R704 and the DWS Best Practice Guideline (BPG) G1: Storm Water Management:

Confine or divert any unpolluted water to a clean water system, away from a dirty area;

Runoff from dirty areas must be captured, contained and managed appropriately;

Clean and dirty water systems must be designed and constructed to prevent cross contamination;

Dirty water must, as far as possible, be recycled and reused or treated and discharged;

Clean and dirty water systems must convey/contain runoff from the 50 year storm event, and should not lie within the 100 year floodline or within a horizontal distance of 100 m from any watercourse, whichever is the greater of the two; and

Appropriate maintenance and management of stormwater related infrastructure should be ensured at all times.

Assumptions and Limitations

The following are key assumptions and limitations for the conceptual SWMP:

The SWMP and associated calculations are based on the project description provided. Should the project description or infrastructure layout change, then the SWMP will need to be revised; and

The channels were sized to take the maximum flow calculated at the downstream end of the contributing catchment, and it is assumed that the channel sizing will be uniform along the entire length.

Clean and Dirty Areas

Dirty areas include the following areas:

Dump area;

Finger and vibrating screens;

Slurry receiving sump;

Emergency stormwater dam; and

Coarse material stockpile.

Clean areas include all areas adjacent to the abovementioned dirty areas. The clean and dirty areas are indicated on **Figure** Error! No text of specified style in document.**-1** and **Figure** Error!

No text of specified style in document.**-2**. **Table** Error! No text of specified style in document.**-1** provides the sizes of the dirty areas at each dump.

Table Error! No text of specified style in document.**-1: Dirty area sizes at each dump**

Dump	Dirty Area Size (m^2)
4L3	470 467
4L4	300 227
4L6	585 844

Proposed Stormwater Measures and Conceptual Designs and Sizes

The proposed SWMPs are indicated on **Figure** Error! No text of specified style in document.**-1** and **Figure** Error! No text of specified style in document.**-2**. The SWMPs have been designed as a closed system (i.e. no discharge of dirty water to the environment). Stormwater measures proposed to separate clean and dirty water areas include paddocks, open trapezoidal channels (trenches), berms and containment facilities (slurry sumps and emergency stormwater dams). These are discussed in further detail below.

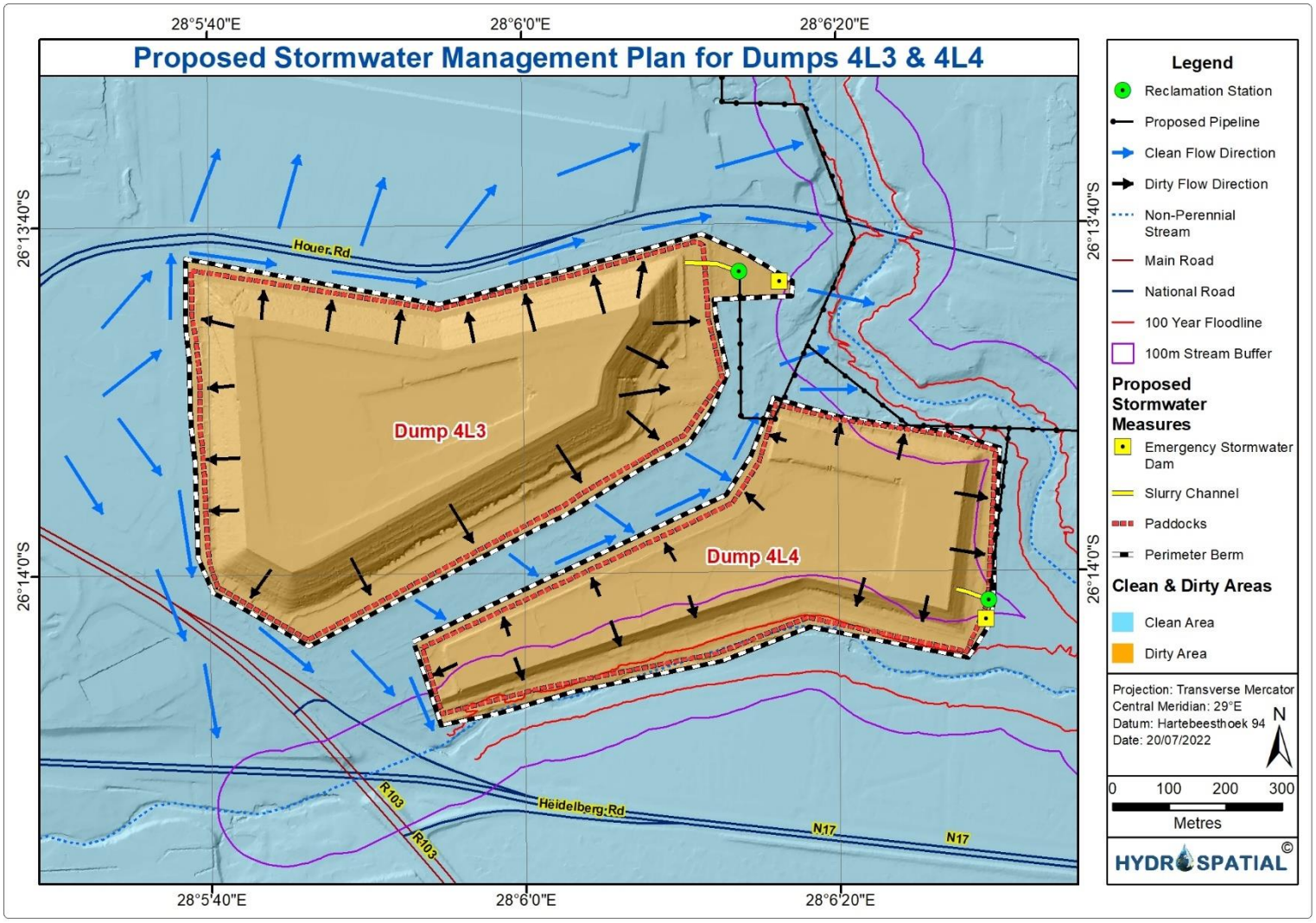
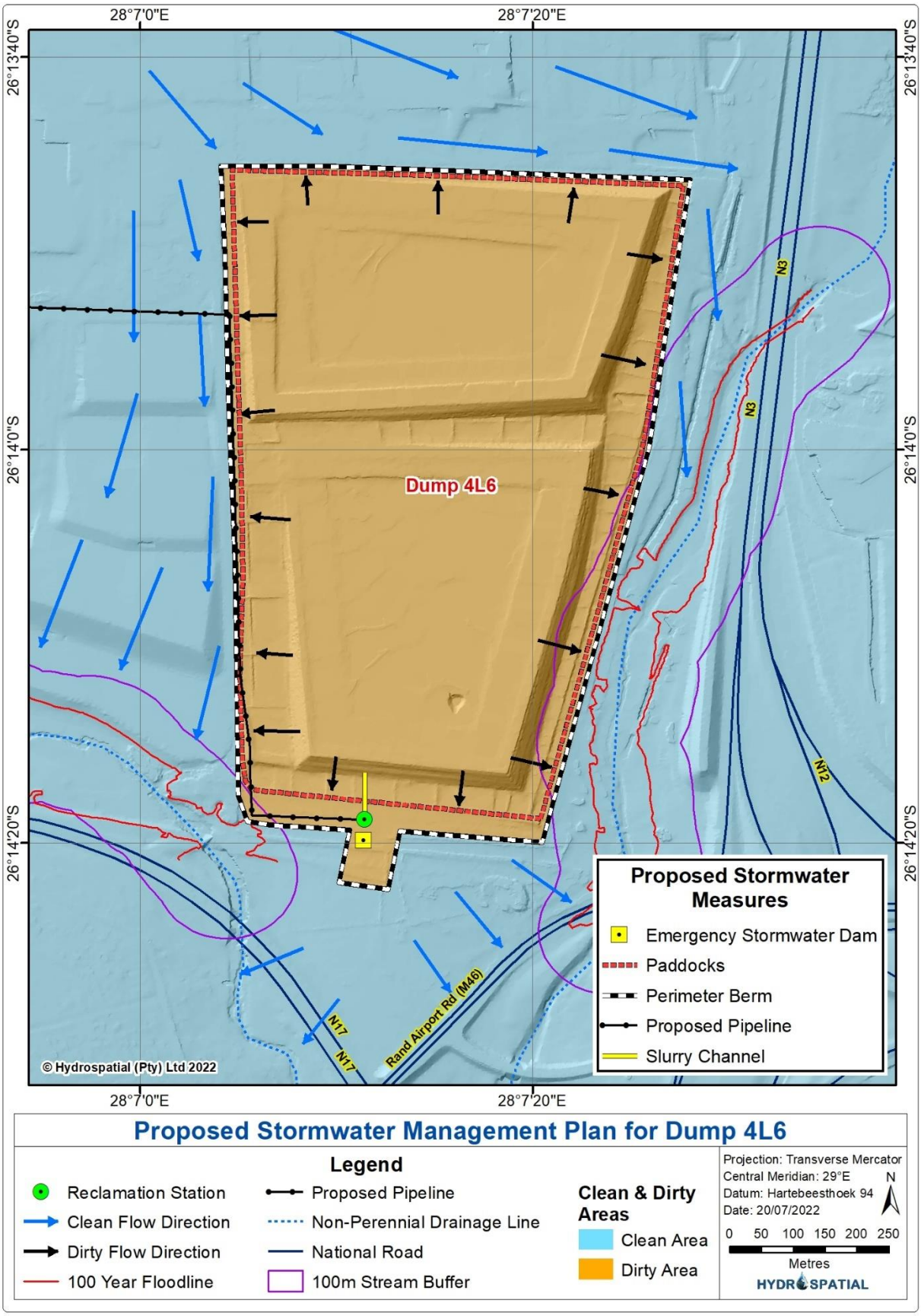


Figure Error! No text of specified style in document.**-1: Proposed stormwater management plan for dumps 4L3 and 4L4**


28°7'0"E
28°7'20"E
26°13'40"S
26°14'0"S
26°14'20"S
Dump 4L6
N3
N3
N12
N17
N17
Rand Airport Rd (M46)
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Proposed Stormwater Measures
Emergency Stormwater Dam
Paddocks
Perimeter Berm
Proposed Pipeline
Slurry Channel
Proposed Stormwater Management Plan for Dump 4L6
Legend
Reclamation Station
Clean Flow Direction
Dirty Flow Direction
100 Year Floodline
Proposed Pipeline
Non-Perennial Drainage Line
National Road
100m Stream Buffer
Clean & Dirty Areas
Clean Area
Dirty Area
Projection: Transverse Mercator
Central Meridian: 29°E
Datum: Hartebeesthoek 94
Date: 20/07/2022
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0 50 100 150 200 250
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Figure Error! No text of specified style in document.**-2: Proposed stormwater management plan for dump 4L6**

Berms and Slurry Channels

The purpose of the berms is to act as a barrier between clean and dirty areas, by diverting clean water away from dirty areas, and ensuring that dirty water is contained. The purpose of the open channels is to convey slurry from the working area of the dump, as a result of hydraulic reclamation, to the finger and vibrating screens, and then to the reclamation station slurry sump. It is unlikely that the channels will be lined, as they will, as far as possible, be established within existing dirty area of the dump. The proposed eastern berm at 4L3, the northern, eastern and southern berms at 4L4, as well as the eastern and south-western berms at 4L6, occur within the 100 m watercourse buffer. It is recommended that a GN R704 Regulation exemption is applied for. It is proposed that the berms should be at least 1 m in height, with side slopes of between 1V:2H to 1V:3H. The berms should be vegetated with indigenous vegetation to prevent erosion. **Figure** Error! No text of specified style in document.**-3** provides an indication of the proposed channel and berm design.

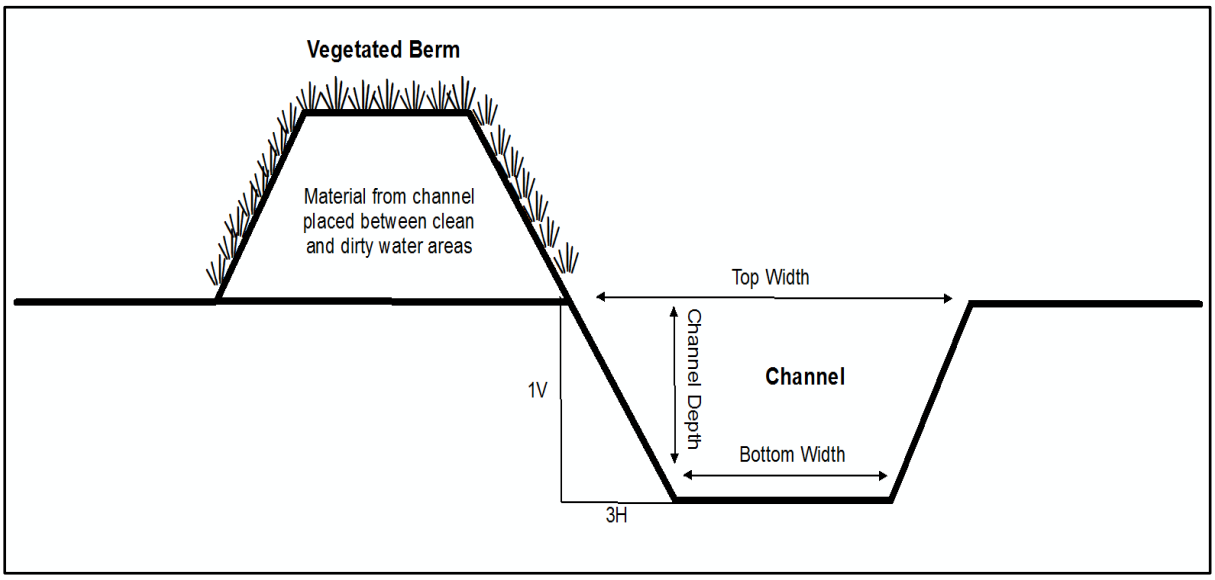

Figure Error! No text of specified style in document.**-3: Proposed channel and berm designs**

GN R704 requires that the clean and dirty water systems are designed, constructed, maintained and operated so that they do not spill more than once in 50 years. Therefore, the proposed slurry channels were sized to convey the 1:50 year peak flows. The peak flows were calculated using the Rational method described previously under section **Error! Reference source not found.**. The Manning's equation was used to calculate the conceptual trapezoidal channel sizes. The Manning's equation is described below:

$$Q = A\frac{1}{n}R^{2/3}S^{1/2}$$

Where:

Q = Peak flow (m^3/s)

A = Cross sectional area of the channel (m^2)

R = Hydraulic radius (m)

S = Longitudinal slope of channel (m/m)

n = Manning's roughness coefficient 'n'

A Mannings 'n' roughness coefficient of 0.030 was used for the channel calculations, as the channels are most likely to be earth lined. The proposed slurry channel sizes for the dumps are provided in **Table** Error! No text of specified style in document.**-2**.

Table Error! No text of specified style in document.**-2: Proposed trapezoidal slurry channel sizes**

Dump	Catchment Area (m^2)	1:50 Year Peak Flow (m^3/s)	Channel Bottom Width* (m)	Channel Top Width* (m)	Channel Depth* (m)	Side Slopes*
4L3	470 467	4.32	1	4.6	0.9	1V:2H
4L4	300 227	2.48	1	3.8	0.7	1V:2H
4L6	585 844	4.54	1	4.6	0.9	1V:2H

*See Figure Error! No text of specified style in document.**-3**

Paddocks

It is proposed that paddocks are established along the periphery of the dumps. The purpose of the paddocks will be to capture, contain and evaporate runoff from the side slopes of the dumps. Existing paddocks are in place around the dumps which can be used, however, these paddocks are old and silted up, and need to be upgraded.

Containment Facilities

The reclamation station slurry sump is located at a topographical low position below the dumps, so that the natural gradient can convey runoff towards the sump. The purpose of the slurry sump is to receive slurry from the working areas as a result of reclamation activities, after it has passed through the finger and vibrating screens, and to temporarily store slurry until it is pumped off site. The slurry sump has been sized to accept the daily inflows (rainfall, runoff and slurry) from the average wet period, using the water balance. This is discussed in further detail in section **Error! Reference source not found.** below.

It is proposed that emergency stormwater dams be established directly below the reclamation station slurry sumps. The purpose of the emergency stormwater dam is to capture any spills from the slurry sump. The engineering drawings and sizing's of the emergency stormwater dams is provided in Appendix A and was undertaken by Civil Concepts.

Recommendations

It is recommended that the proposed SWMPs are implemented in line with GN R704 Regulations. It is further recommended that an exemption from GN R704 is obtained for the proposed stormwater management measures that fall within the 100 m watercourse buffer. It should be kept in mind that these are historical dumps that were created prior to the establishment of GN R704.