

STORMWATER MANAGEMENT PLAN

1. PURPOSE

It is understood that activities associated with developments can impact negatively on drainage systems. By taking greater cognisance of natural hydrological patterns and processes it is possible to develop stormwater management systems in a manner that reduces these potentially negative impacts and mimic nature. The main risks associated with inappropriate stormwater management are increased erosion risk and risks associated with flooding. Therefore, this Stormwater Management Plan and the Erosion Management Plan are closely linked to one another and should be managed together.

This Stormwater Management Plan addresses the management of stormwater runoff from the development site and significant impacts relating to resultant impacts such as soil erosion and downstream sedimentation. The main factors influencing the planning of storm water management measures and infrastructure are:

- » Topography and slope gradients;
- » Placing of infrastructure and infrastructure design;
- » Annual average rainfall; and
- » Rainfall intensities;

The objective of the plan is therefore to provide measures to address runoff from disturbed portions of the site, such that they:

- » do not result in concentrated flows into natural watercourses i.e. provision should be made for temporary or permanent measures that allow for attenuation, control of velocities and capturing of sediment upstream of natural watercourses.
- » do not result in any necessity for concrete or other lining of natural watercourses to protect them from concentrated flows off the development if not necessary.
- » do not divert flows out of their natural flow pathways, thus depriving downstream watercourses of water.

This Stormwater Management Plan must be updated and refined once the construction/ civil engineering plans have been finalised following detailed design.

2. RELEVANT ASPECTS OF THE SITE

The most prominent hydrological features within the study area, mainly located on top of the plateau, are a number of non-perennial pans and farm dams. Other smaller pans and farm dams occur throughout the study area. There are no major perennial rivers in close proximity to the proposed development site, but a number of non-perennial rivers and streams traverse the study area. The most notable of these is the Tankwa River and its tributaries that have their origin within this region.

The proposed development occurs at the intersection of the following catchments within the Nama Karoo Ecoregion:

- » E23A – Tankwa;
- » E23B - Knoffelhoeks River catchment; and
- » D56C – Unknown tributary of the Riet River catchment

Since the production of the original aquatic assessment (December 2015/January 2016), the wetland classification system using Hydrogeomorphic units as described by Ollis et al., (2013) was widely adopted later in 2016/2017, thus for the purposes of this statement the lowland areas with or without drainage areas and / or watercourses have been subdivided as follows:

- » Watercourses, with the exception of the low-lying rivers along the grid corridor did not contain any riparian obligate vegetation (Plate 1 & 2);
- » Seep wetlands (Plate 3); and
- » Depressions (Plate 4).

Based then on the Macfarlane & Bredin (2016) buffer model, a buffer of 59m is proposed for these areas, which is considerably less than the buffer distance used in the EIA specialist assessment (i.e. 100m) Thus, all of the wetland areas have been excluded from the development footprint, with the closest system being approximately 100m from an access road.

3. STORMWATER MANAGEMENT PRINCIPLES

In the design phase, various stormwater management principles (that are consistent with any applications submitted for water use authorisation - which would take precedence in the case of any inconsistencies) should be considered including:

- » Prevent concentration of stormwater flow at any point where the ground is susceptible to erosion.
- » Reduce stormwater flows as far as possible by the effective use of attenuating devices (such as swales, berms, silt fences). As construction progresses, the stormwater control measures (stipulated in any applicable risk assessment matrix) are to be monitored and adjusted to ensure complete erosion and pollution control at all times.
- » Minimise the area of exposure of bare soils to minimise the erosive forces of wind, water and all forms of traffic.
- » Ensure that development does not increase the rate of stormwater flow above that which the natural ground can safely accommodate at any point in the sub-catchments.
- » Ensure that all stormwater control works are constructed in a safe and aesthetic manner in keeping with the overall development.
- » Plan and construct stormwater management systems to remove contaminants before they pollute surface waters or groundwater resources. Implement the principle of separating clean and dirty run-off streams (typically from bunded areas or those areas associated with hydrocarbon storage or the facility substation).
- » Contain soil erosion, whether induced by wind or water forces, by constructing protective works to trap sediment at appropriate locations. This applies particularly during construction.
- » Avoid situations where natural or artificial slopes may become saturated and unstable, both during and after the construction process.
- » Design and construct roads to avoid concentration of flow along and off the road. Where flow concentration is unavoidable, measures to incorporate the road into the pre-development stormwater flow should not exceed the capacity of the culvert. To assist with the stormwater run-off, gravel roads should typically be graded and shaped with a 2-3% crossfall back into the slope, allowing stormwater to be channelled in a controlled manner towards the, natural drainage lines and to assist with any sheet flow on the site.
- » Design culvert inlet structures (where a water use authorisation has been obtained for applicable structures) to ensure that the capacity of the culvert does not exceed the pre-development stormwater

flow at that point. Provide detention storage on the road and/or upstream of the stormwater culvert where permissible to do so.

- » Design outlet culvert structures (where a water use authorisation has been obtained for applicable structures) to dissipate flow energy. Any unlined downstream channel must be adequately protected against soil erosion.
- » Where the construction of a building causes a change in the vegetative cover of the site that might result in soil erosion, the risk of soil erosion by stormwater must be minimised by the provision of appropriate artificial soil stabilisation mechanisms or revegetation of the area. Any inlet to a piped system should be fitted with a screen, or grating to prevent debris and refuse from entering the stormwater system.
- » Preferably all drainage channels on site and contained within the larger area of the property (i.e. including buffer zone) should remain in the natural state so that the existing hydrology is not disturbed.

3.1. Engineering Specifications

A detailed Stormwater Management Plan with engineering specifications describing and illustrating the proposed stormwater control measures must be prepared by the Civil Engineers during the detailed design phase and should be based on the underlying principles of this Stormwater Management Plan. This Stormwater Management Plan, must also consider control measures authorised by the applicable water authority, where applicable. This should likewise include erosion control measures. Requirements for project design include:

- » Erosion control measures to be implemented before and during the construction period, including the final stormwater control measures (post construction).
- » All temporary and permanent water management structures or stabilisation methods must be indicated within the detailed comprehensive Stormwater Management Plan.
- » The drainage system for the site should be designed to specifications that can adequately deal with a 1:50 year intensity rainfall event or more to ensure sufficient capacity for carrying storm waters around and away from infrastructure.
- » Procedures for stormwater flow through a project site need to take into consideration both normal operating practice and special circumstances. Special circumstances in this case typically include severe rainfall events.
- » An on-site Engineer or Environmental Officer must be responsible for ensuring implementation of the erosion control measures on site during the construction period.
- » The EPC Contractor holds ultimate responsibility for remedial action in the event that the approved stormwater plan is not correctly or appropriately implemented and damage to the environment is caused.

During the construction phase, the contractor must prepare a Stormwater Control Method Statement to ensure that all construction methods adopted on site do not cause, or precipitate soil erosion and shall take adequate steps to ensure that the requirements of the Stormwater Management Plan are met before, during and after construction, and in line with any applicable water use authorisation. The designated responsible person on site, must be indicated in the Stormwater Control Method Statement and shall ensure that no construction work takes place before the relevant stormwater control measures are in place.

An operation phase Stormwater Management Plan should be designed and implemented if not already addressed by the mitigations implemented as part of construction, with a view to preventing the passage of concentrated flows off hardened surfaces and onto natural areas.