

STORMWATER MANAGEMENT PLAN

1. PURPOSE

It is widely recognised that developments could 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 Storm Water 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

There is a complete absence of wetlands within the study area. The only water feature within the Project Development Area (PDA) is an excavated pit (33° 05.014 S 18° 25.702 E) that holds water from rainfall but this it outside of the development footprint; there are no natural wetlands (incl. drainage lines) present within the development site. Other water features in the immediate surrounding areas include an earthen farm dam (2 km west of the development site), and concrete-wall dam (3.5 km north of the

development site). Seasonal drainage lines occur adjacent south and west to the development site. The only major rivers that occur in the area are the Sout River, a perennial river that lies 3-5 km to the south and south-west of the site, and the perennial Berg River which is located approximately 15 km north of the site.

3. STORMWATER MANAGEMENT PRINCIPLES

In the design phase, various stormwater management principles 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 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.
- » 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 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.
- » Design outlet culvert 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 engineering specifications Stormwater Management Plan 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 Storm-water Management Plan. This should 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 Final/Updated 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 storm water 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 onsite Engineer or Environmental Officer to 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. 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 operational 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.