STORM WATER MANAGEMENT PLAN REPORT

SUPPORTING REPORT FOR THE EIA REPORT FOR AGES (LIMPOPO) PTY (LTD)

COMPILED FOR:

Matrigenix (Pty) Ltd

UPON INSTRUCTION FROM:

AGES LIMPOPO (PTY) LTD

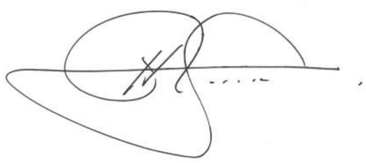
BY MATUKANE AND ASSOCIATES (PTY) LTD

29 September 2022

Contents

Declaration

I hereby declare that Matukane and Associates (Pty) Ltd and the directors of the company are independent of the CLIENT and the projects related to this report in terms of the definition of “independent” as stated in the Environmental Impact Assessment Regulations of 2014.



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ENVIRONMENTAL MANAGEMENT PROGRAMME STORM WATER MANAGEMENT REPORT

1. Introduction

Matukane and Associates (Pty) Ltd was appointed by AGES Limpopo (Pty) Ltd to conduct a desktop study, and to compile a report on the STORM WATER MANAGEMENT PLAN for the proposed Lichtenburg Solar Park for client. The proposed development is envisaged for Portion 10 of Farm number 27 IP Registration Division in the Ditsobotla Local Municipal area, in the Ngaka Modiri Molema District Municipality in the Northwest Province.

2. Context of the SWMP in accordance with legal requirements

To establish the status of the project in terms of an Environmental Authorization (EA).

A storm water management plan (SWMP) is normally one of the conditions of an EA.

The following guiding legislation is applicable:

- National Environmental Management Act (Act 107 of 1998)
- National Water Act ((Act 36 of 1998)
- Conservation of Agricultural Resources Act (Act 43 of 1983)

No specific Regulations guiding storm water management could be found, thus sound rational engineering principles must be followed in the planning, design, construction, and operation of the solar power generation facility.

Aspects of importance are:

- Water quality;
- Mitigating the hydrologic impact of the solar farm development;
- Flood-lines where relevant.

3. Storm Water Management Plan

3.1. Purpose

The purpose of the Storm Water Management Plan (SWMP) is:

- To provide guidance aligning all phases of development, and the eventual operation, to the relevant Acts of Law.
- To provide for rational thinking in concept development and design.
- To minimise the risk of on site and / or downstream damage due to hydrological impact. This includes exposure to runoff associated with normal rain, as well as during more extreme flood events.
- To minimise the risk to on-site and / or downstream contamination by storm water washing away possible waste on site.

- To consider the impact of rain on the site, the impact of water entering the site from higher ground, and the impact of water leaving the site.

This is not a design report; guidance is given in it for compliance by the eventual design- implementation- and operational teams.

3.2. Technical Parameters

Following is a discussion of the various aspects impacting on the SWMP for a specific site, with elements highlighted for a conclusive discussion of the SWMP.

As indicated by the document title, the plan deals with storm water. Generally, in South Africa, and specifically so in this project area, it is dry for most of any given year. The impact that storm water may have on the site is not visible before such event occurs.

It is important to point out and emphasise that diligence in storm water management is essential and a full-time task, also during dry periods. Lack of precautionary measures may lead to the slow degradation of the site, rendering it susceptible to serious damage in the event of unexpected flooding, and subsequent potential damage to equipment on site due to gradual erosion from normal rainfall events, or huge damage as a result of extreme flood events.

3.2.1. Geographical Orientation

Image 1 below depicts the geographical setting.

Image 1: Spatial Positioning

The Lichtenburg site is situated in the Ditsobotla Local Municipal area, in the Ngaka Modiri Molema District Municipality in the Northwest Province.

The coordinates at the approximate centre of the site are 26.020 South and 26.750 East, at approximately 1450 m above sea level.

The nearest town is Lichtenburg, 9.5 km to the Southeast, and reachable via the R505 towards Ottoshoop.

3.2.2. Topography

The Lichtenburg site is situated in the bigger quaternary catchment C31A. The site is characterized by an east-west watershed in the bottom half of the southern side, and an east-west drainage line in the northern half. The site is flat, with a slope of approximately 0.6% (very low).

The site forms an enclosed basin, with water draining towards the west. The topography is such that water cannot drain out of the area. There is however no signs of the accumulation of surface water, leading to the conclusion that all storm water is absorbed into the ground.

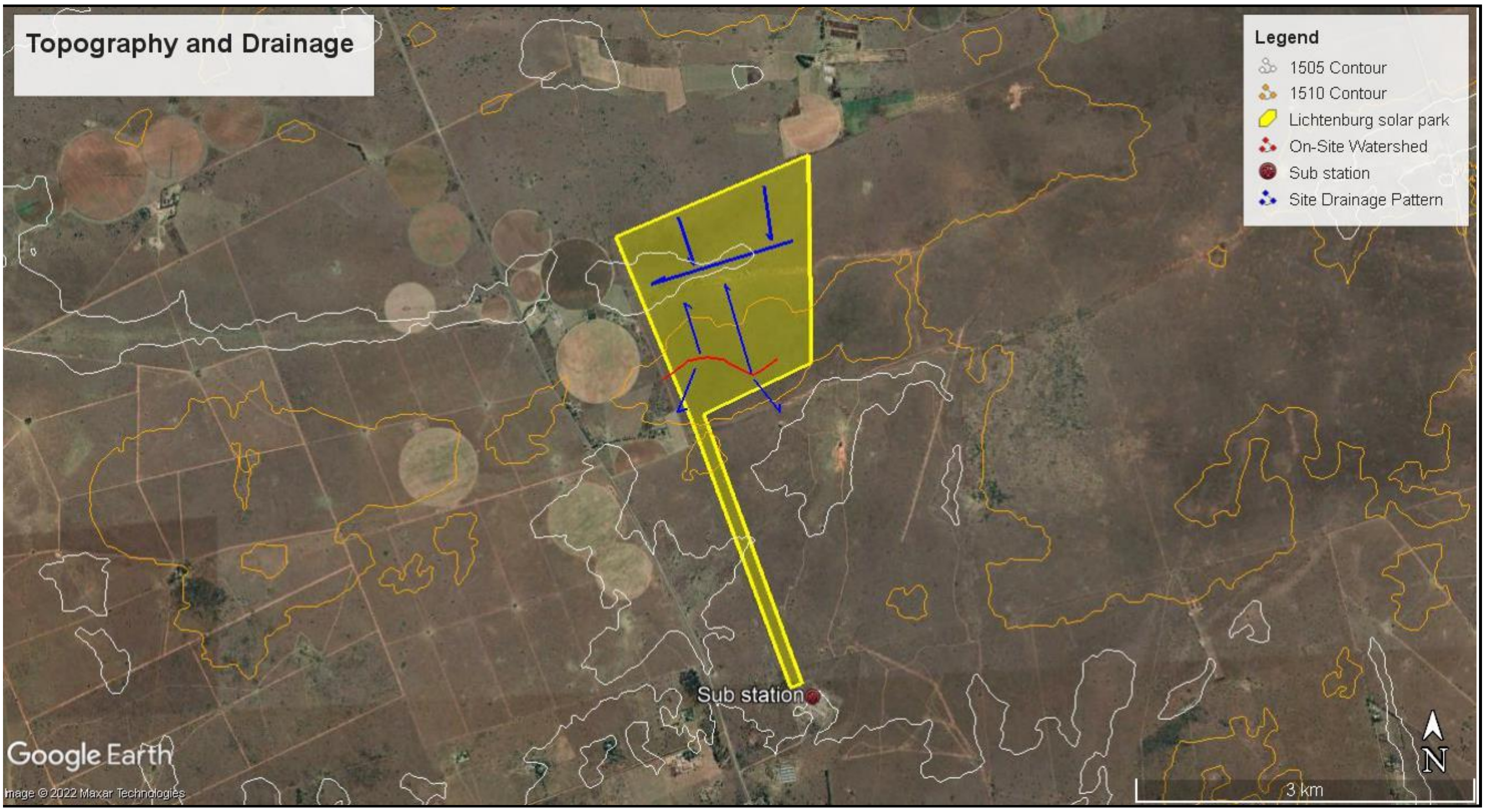

Image 2: Site Topography

3.2.3. Surface Conditions

3.2.3.1. Terrain

The larger area consists of plains (> 80% with a slope < 5%) and pans with low relief, with low-medium drainage density of 0 to 2 km/km2 and low-medium stream frequency of 0 to 6 stream/km2 (Kruger, 1983). There is an east-west natural drain line on the site.

3.2.3.2. Soil

The geology of the broader area comprises predominantly dolomite and chert of the Chuniespoort Group. The crest position is usually dolomite and chert, with the mid-slope and foot slopes covered with some eolian sands.
According to Land type Survey Staff (2012) for land type Fa 10, the soil is predominantly from the Glenrosa soil form (Gs 14, Gs 16 and Gs 18), and in the lower terrain units of the Hutton soil form (Hu 24, Hu 26 and Hu 36), with a very shallow soil depth of between 50 to 900 mm.

The clay content in the topsoil is between 10 to 20 % and between 13 and 25 % in the subsoil (Land type Survey Staff, 2012). The soil has a relatively low water holding capacity, probably between 18 to 28 mm/m, but the actual water available in the profile would be much lower in the Glenrosa soil form, due to the very shallow soil depth of between 50 to 150 mm. The infiltration rate of the soil would be relatively low, in the range of 15 to 25 mm/h.

3.2.3.3. Erosion

Based on the slope gradient and soil erodibility index, the water erosion susceptibility is relatively high, Class 5 for the broader area; the areas near the natural drainage lines could even be higher. The general predicted soil loss is moderate (ARC-ISCW, 2004). Due to the shallowness of the soil and the annual rainfall of about 600 mm the soil has a low potential for regeneration if badly eroded. The sediment delivery potential is medium (ARC-ISCW, 2004).

The prevalence of the relatively sandy loam soil and the annual rainfall of about 600 mm resulted in low plant biomass production and low soil organic material, rendering the land susceptible to wind erosion. The wind erodibility index is Class 3c. In this Class, sand is sub-dominant, which makes it susceptible to wind erosion (ARC-ISCW, 2004).

3.2.3.4. Land Capability

The eight-class land capability is interpretive groupings of land units with similar potentials and continuing limitations or hazards. The area falls in Land Capability Class (vi). The class has very severe limitations that make it unsuited to cultivation and that restrict its use largely to grazing and wildlife. The grazing is between 26 and 30 Ha AU-1 (ARC-ISCW, 2004).

3.2.3.5. Vegetation

The area consists of Carletonville Dolomite Grassland (Gh 15) vegetation and is dominated by graminoids: Aristida congesta, Brachiaria serrata, Cynodon dactylon, Digitaria tricholaenoides and Themedia trianda (Mucina and Rutherford (2006).

3.2.4. Climate

The climate data of the area is obtained from the Lichtenburg weather station.

Table 1: Climate Data

Month	Average Rainfall (mm)	Average Precipitation Days (>1 mm)	Daily Max. Temp (ºC)	Daily Min. Temp (ºC)
Jan	131	5	30.2	15.6
Feb	90	7	29.0	15.3
Mar	82	8	28.1	14.1
Apr	66	7	26.4	11.4
May	7	3	23.4	6.1
Jun	1	1	21.5	1.9
Jul	8	1	20.0	1.5
Aug	15	2	19.0	5.1
Sep	22	3	23.1	8.5
Oct	33	5	26.9	12.9
Nov	60	5	29.8	14.6
Dec	94	5	30.5	16.1
Year	**609**	**55**		

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The long-term average annual rainfall is 609 mm for the weather station, of which 523 mm, or 86%, falls from November to April. Temperatures vary from an average daily monthly maximum and minimum of 30.2ºC and 15.6ºC for January to 21,5ºC and 1.9oC for June respectively. The yearly evaporation for quaternary catchment C31A is 1 860 mm per year.

3.2.5. Hydrological Setting

3.2.5.1. Hydrological Characteristics

The site is situated in the C31A quaternary catchment area. This area resembles a plateau that drains in all directions, with the project site forming a local depression without a surface outflow.
The area has an average rainfall of 609 mm per year. The average monthly rainfall is less than 51 mm per month (3.2.4). The average infiltration rate is 15 to 25 mm/hour (3.2.3.2).

The high evaporation rate causes the moisture holding layer of the soil to rapidly dry out, "resetting" the capacity to absorb rainwater. (To present interpretation).

The drainage channels are generally not well-defined, wide and shallow.

3.2.5.2. Hydrological Considerations

Three aspects of flow require consideration:

Drainage through the defined drainage channel from higher ground in the catchment area:

- If present, this requires the establishment of flood-lines and the exclusion of the area included in the 1:100-year flood-lines. There are no draining lines on this site requiring consideration. No formal flood-line provisions apply.

Surface flow and channels with limited impact reaching the site from higher ground:

- Not applicable in this case as it is on a plateau.

Surface flow generated on site:

- Due to direct rainfall on site, sheet flow will occur, leading to the smallest of flow channels, interlinking with larger channels, resulting in drainage lines of a magnitude that need to be managed.

Flow speed of down-flowing water:

- A definite relationship exists between the flow speed of water and erosion. In general terms, the capacity of water to transport solid particles (thus to erode) is exponential to the flow- speed. A slight increase in flow speed thus gives rise to a proportionally larger erosion risk.
- The flow speed of surface flood water is of importance because of:
    - The potential damage to the development.
    - The potential downstream impact due to altering the natural flow pattern.
- The flow speed of flood water is a function of:
    - Climate, and specifically precipitation and the intensity of thereof.
    - Slope of the flow path of water: By way of the correct design of discharge channels on site, the flow speed of water can be manipulated. A longer flow path with a more gradual slope may slow down flow. Care must be taken not to slow down the water to the point that suspended solids may in turn be deposited in the channels. This will cause blockages that will require additional maintenance to clean up and to dispose of the material.
    - Vegetation on site: Vegetation forms a physical obstacle that dissipates energy from flowing water, having a slowing down effect.

4. Site specific Storm Water Management Plan

Upon conducting a detailed aerial survey, the picture emerges of an enclosed depression where water accumulates towards the north-western side of the site. It is clear that surface water cannot drain past this area and gets absorbed into the ground.

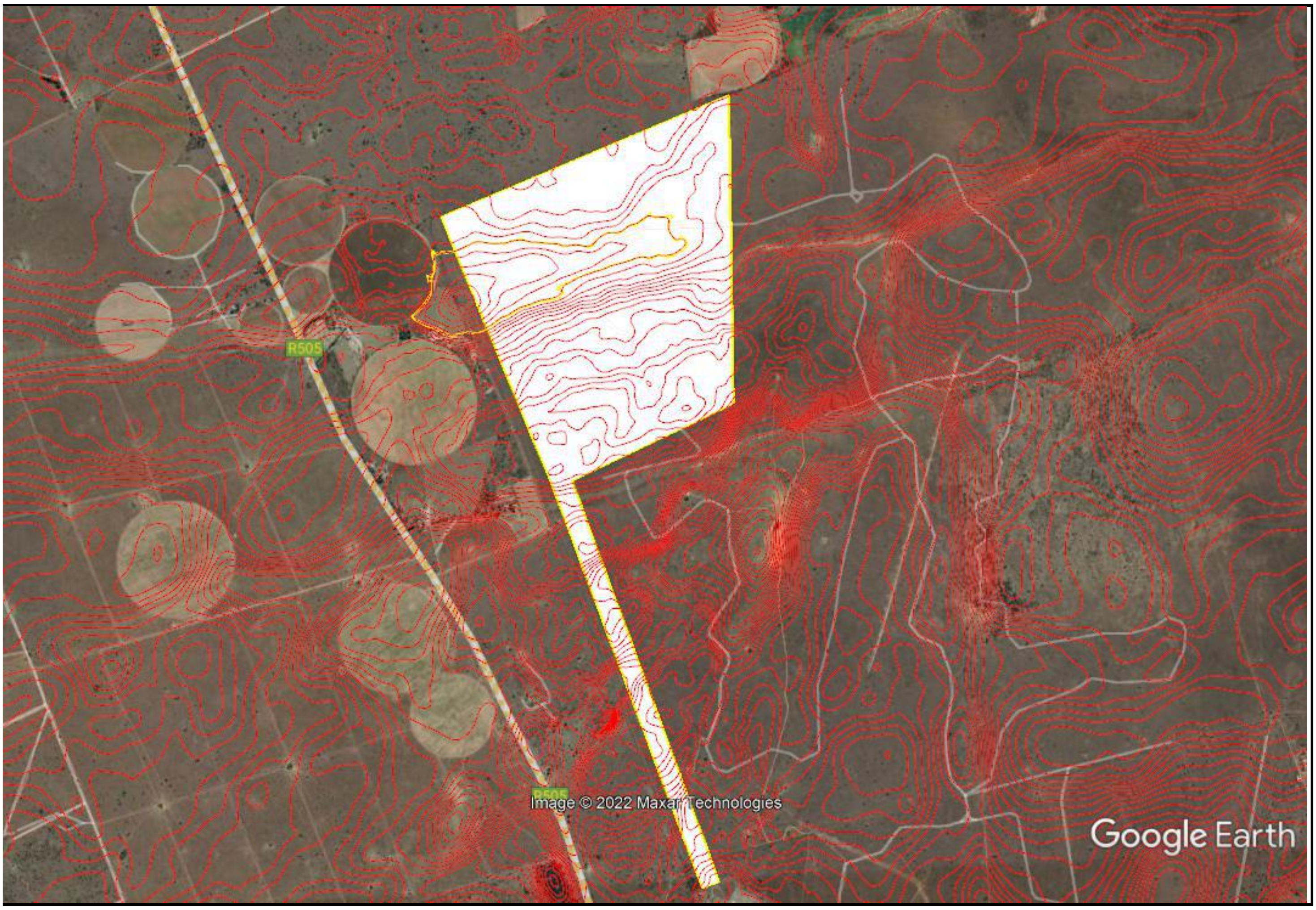

Image 3: Hydrological Characteristics with enlarged detail of the Lichtenburg Project Area

Through the application of the above, the following is pertinent to the future design, construction, and operation of the Lichtenburg solar development in order to meet the requirements set by the Department of Environmental Affairs:

"***A storm water management plan is to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increase soil erosion. The plan must include the implementing of appropriate design measures that will allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.***"

4.1. Planning and Design pertaining to the Storm Water Management Plan

Only a limited volume of storm water flows into the project area from higher up, and down to the lowest point of the depression. During the layout planning and design, care should be taken to guide the water down to the lowest point.

As stated previously, water drains down to the lowest point on the north-western side of the site. It is notable though that the flood water cannot flow out of the site/area. However, no signs of the accumulation (damming up) of surface water is observed. It follows that flood water gets absorbed in the soil. The concern arises about the presence of dolomite on the site. Known dolomitic areas exists in the vicinity of the site. Possible dolomitic structures underlying the site pose risks that should be assessed further.

In the light of the concern expressed above, an opinion regarding the possible dolomitic challenges was requested. It transpires that the project site is indeed underlain by the Monte Christo Formation chert rich dolomite, which is prone to huge sinkholes. Aspects like the depth of the dolomite and further technical characteristics impact on the risk. Further specialist investigation is recommended.

4.2. Construction Phase Storm Water Management

- It is recommended that access and service roads, as well as storm water systems are constructed at the commencement of the construction phase to ensure that suitable storm water management measures are in place at the least additional cost.

- These permanent routes must also be used for construction purposes. In order to preserve the natural state of the surface and vegetation as far as practically possible, off-road driving should be restricted to the absolute essential.

- Space for lay-down areas for construction material and for construction facilities is restricted on site. It is not possible to give clear directions in terms of its positioning. The following should however be considered:

  Discussion

- High resolution site survey data must be used to design storm water ditches to direct surface flood water past any stockpiles.

- Site clearing should be limited to the essential.

- Construction waste, including possible broken and damaged panels, must be collected and safely stored for disposal, in accordance with the relevant waste regulations, protocols, and product specifications. Care must be taken not to leave any waste on site that can lead to future contamination of the site or the downstream area.

- Training of construction personnel with regards to storm water management must be undertaken as part of their induction.

4.3. Operational Phase Storm Water Management

- Training of site personnel with regards to storm water management must be undertaken as part of their induction. Refreshment training must be undertaken periodically.

- Regular conditional inspections of all storm water infrastructure are required. Inspection data must be recorded and accumulated for tracking purposes. Regular reporting should be a scheduled management task.

- Any item found to be out of order, for instance accumulation of settled sand in a trench or erosion, must be attended to and corrected without delay in order to keep the storm water system in a good and fully functional condition. Record must be kept of all repairs.

- Specific attention must be given to inspections during and after any rain and/or flood event in order to kerb any damage that may occur.

- If any structures have to be erected in a flood line area, the Water Use Licences will contain various conditions about monitoring, maintenance, repair and reporting that must be complied with. It is essential to make this a key responsibility of the relevant manager.

5. Conclusion

The site is subjected to a limited flood risk and no identifiable flood line risks exist. Specific care should be taken during the design process to establish a drainage system to relay water swiftly from site. The likely presence of dolomite on site bears specific importance on the need for efficient drainage.

Proper attention must be given to the risk posed by the dolomite structures underlying the site.

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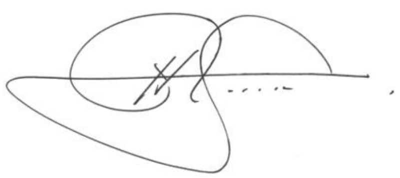

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