Erosion Control Plan

Short term measures to remedy adverse effects of the unlawful dam construction at 17/232 Redford Farm

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For

Ecoroute / Ecosense

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I consider myself bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);

• At the time of conducting the study and compiling this report I did not have any interest, hidden or otherwise, in the proposed development that this study has reference to, except for financial compensation for work done in a professional capacity;

• Work performed for this study was done in an objective manner. Even if this study results in views and findings that are not favourable to the client/applicant, I will not be affected in any manner by the outcome of any environmental process of which this report may form a part, other than being members of the general public;

• I declare that there are no circumstances that may compromise my objectivity in performing this specialist investigation. I do not necessarily object to or endorse any proposed developments, but aim to present facts, findings and recommendations based on relevant professional experience and scientific data;

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• All the particulars furnished by me in this document are true and correct.

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1. INTRODUCTION

The land-owners of 17/232 Redford Farm commenced with the construction of an instream dam without any environmental authorisations. As a result, a rectification process has been initiated by the Department of Environmental Affairs & Development Planning (DEA&DP) under Section 24g of the National Environmental Management Act (NEMA; Act No. 107 of 1998). The activities also triggered Sections 21 a), b), c) and i) water uses of the National Water Act (NWA; Act No. 36 of 1998). These water uses are defined as follows:

Section 21a): Taking water

Section 21b): Storing water

Section 21c): Impeding or diverting the flow of water in a watercourse, and

Section 21 i): Altering the bed, banks course or characteristics of a watercourse

Confluent Environmental were appointed by the land-owner to conduct the Aquatic Specialist study required for the Section 24g and water use authorisation process. During the initial site visit, it was clear that in its current state, the excavated dam area represents a significant threat to the water resource downstream in terms of erosion and sedimentation. This report provides the following information:

- Erosion risk presented by the unlawful activity;
- Extent of current sedimentation;
- Justification for immediate implementation of erosion control measures, and
- Recommended mitigation measures.

2. EROSION RISK

The fist site visit was conducted on 17 June 2021. During the site visit it was noted that extensive excavation for the dam had been conducted on steep slopes the valley and included topsoil, subsoils, and underlying rock (Figure 1). The total area cleared of vegetation where earth-moving and excavation took place was 1.17 ha. No dam wall had been constructed and the topsoil removed in the process is currently stockpiled elsewhere on the farm. Remaining soils are piled at various points in the dam and terraces have been excavated along the valley sides.

The dam is located towards the top of the catchment and very little runoff is expected from surrounding areas. This aspect reduces the expected flows through the original watercourse and off the slopes. However, the sheer volume and area of soil disturbance, along with the steep gradient of the slopes exacerbates the erosion risk substantially.

Portion 17 / 232 borders the Whiskey Creek Nature Reserve, and the dam has been excavated into a non-perennial tributary of the Whiskey Creek. It is therefore of important that the ecological integrity of the conservation area downstream is protected from foreseeable and preventable impacts associated with the dam.

Figure 1. Photos of the excavated dam area and enlargement of the 'outflow' leading to the watercourse below.

3. SEDIMENTATION EXTENT

When soil is eroded and is washed into a watercourse, it eventually settles out onto the stream bed. This process is termed sedimentation, and has many negative effects for aquatic ecosystems including:

- Smothering habitat, feeding and breeding areas for algae, plants, amphibians and macro-invertebrates;
- Poor water quality due to increased suspended sediment which can clog the gills of aquatic biota; and,
- The above factors can negatively impact on recruitment of biota and the biodiversity of streams.

At the time of the first site visit, a silt fence was observed which had been erected by the earthmoving contractor at the outflow of the dam. The silt fence had been overwhelmed by sediment which filled the fence making it lie flat with no further function (Figure 2). The length of the watercourse below the dam was walked to determine the extent to which sedimentation had occurred at that time. This is easily determined because the subsoils washing down are a much lighter colour than the original stream bed. A GPS point was taken at this point, which measured 25 m downstream of the outflow, which is still on the land-owner's property.

Figure 2. Photo showing the overwhelmed silt fence (indicated by red arrow) from the upstream (left) and downstream (right) perspective.

4. JUSTIFICATION FOR EROSION CONTROL

In terms of the Section 24G of the NEMA, the further prevention and degradation of the environment can be considered whilst the application is ongoing. Below are some of the provisions:

i. *immediately cease the activity pending a decision on the application submitted in terms of this subsection*
ii. *investigate, evaluate and assess the impact of the activity on the environment*
iii. ***remedy any adverse effects of the activity on the environment***
iv. *cease, modify or control any act, activity, process or omission causing pollution or environmental degradation*
v. *contain or prevent the movement of pollution or degradation of the environment*
vi. *eliminate any source of pollution or degradation*

Potentially 24G (1) (iii) could apply to the circumstances in this case.

If nothing is done to mitigate inevitable soil losses from the excavated dam, sedimentation downstream is likely to progress to a serious degree in terms of depth and distance from the site. Typical timeframes required to obtain the necessary environmental authorisations to conduct further work in the watercourse range from 9 – 18 months. During this extended period, a substantial amount of sedimentation will occur if not mitigated. While it is understood that an aspect of the Section 24G process is to consider all impacts related to unlawful activities when determining their severity, it must be considered that the intention of both the NEMA and the NWA is to protect natural resources. In this case the water resource.

5. EROSION CONTROL RECOMMENDATIONS

The dam basin consists of steep sides covered in soil, steep sides covered in rock, terraced flat areas, and the original watercourse at the bottom of the valley which is now covered in recent sediment deposit. All these areas currently have no vegetative cover. The steeply sloping valley sides present a challenging scenario for erosion control. The gradient combined with terracing, different levels, and different substrates will make erosion control in these areas a complex undertaking.

It is therefore recommended that erosion control measures be focussed on the bed of the original watercourse through a series of hay bale check dams. These are relatively cost-effective and easy to install. At least one check dam should be installed under supervision of an Environmental Control Officer (ECO) or an Aquatic Specialist. This should be the lowest check dam as it is the most important intervention. Supervision must also cover the on-site location of additional sites for each of the upstream check dams. A theoretical layout of the location of each check dam is provided in Figure 3.

Figure 3. Proposed location of 6 hay bale check dams along the watercourse bed.

5.1 Hay bale check dam methods

- Bales should be bound with wire or nylon string. Twine bound bales are less durable.
- The check dams should cross the stream bed and extend slightly up the slope on both sides of the valley (Figure 4).

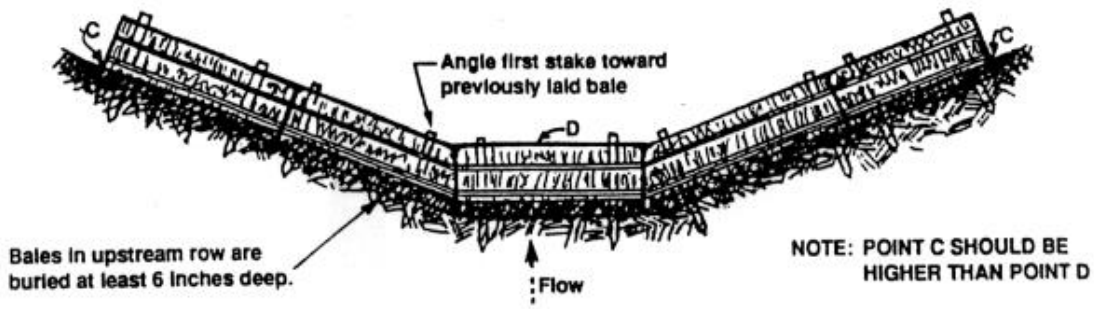

Figure 4. Cross-section of a hay bale check dam.

- Hay bales should be dug into a shallow trench approximately 15 cm deep.
- Soil must then be replaced and compacted around the base of the bales.
- The row of bales must be orientated perpendicular to the flow of water to capture water from the slope above.
- Bales must then be secured using wooden stakes hammered in the soil angled towards each neighbouring bale to ensure a seamless barrier (Figure 5).

No gaps must be present at the base of the bales as this will create preferential flow paths resulting in erosion. The purpose of this intervention is to capture high velocity runoff in a check dam and allow it to slowly filter through the bales.

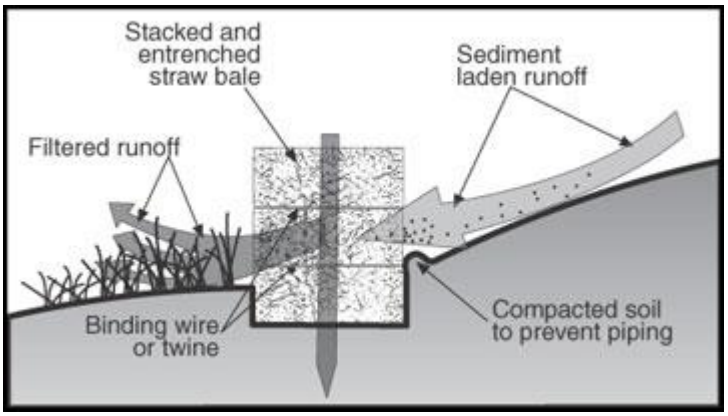

Figure 5. Cross-section of installed hay bale check dam indicating staking and excavation of bales into the soil.

- The lowest check dam at the outflow must include an additional row of hay bales downstream placed on their side in case the dam fills with water and overflows. This measure is to prevent erosion of a plunge pool below the bales (Figure 6).

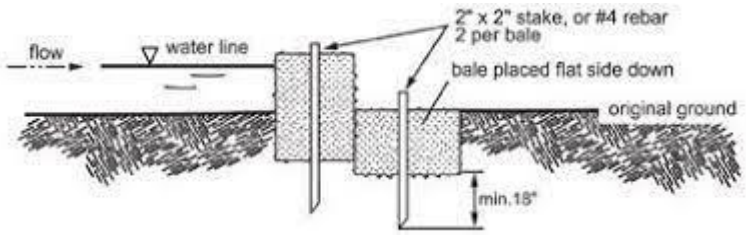

Figure 6. Cross section of the lowest check dam showing the second row of bales on their side.

- The timeframe for implementation should be as soon as possible (within 3 weeks) of approval of this plan by the DEA & DP and the BGCMA.

5.2 Materials required

An approximate list of the required materials based on typical bale dimensions (Figure 7) is provided below:

- Use straw / hay bales (Figure 7), not lucerne bales as the latter are too dense.

- Enough hay bales for ± 100 m distance (approximately 12 m per check dam), the few extra bales will cover that break apart and can't be used in the process.
- Scissors and nylon twine (± 400 m) which will be used to bind the bales.
- 2 wooden stakes for each bale. Stakes should measure 60 – 80 cm in length.
- Mallet type hammers.
- Wheelbarrows for transporting bales and equipment around.
- Spades and pick-axes to dig trench for the bales.
- 2 to 3 labourers.

Figure 7. Typically available bale dimensions (left) and a typical straw bale (right).

5.3 Monitoring

Monitoring in the form of photographs of the length of each of the check dams should be conducted on a monthly basis or following heavy rainfall events. Photos should clearly show the area upstream and downstream of the check dam. Photos should be sent to the aquatic ecologist and kept on record if requested by relevant authorities. The dams should be numbered from 1 to 6 for consistency. Where check dams are failing or erosion is still progressing to the point that it may cause sedimentation downstream, further interventions or maintenance may be required and should be undertaken using recommendations from the aquatic ecologist.

6. CONCLUSION

The installation of hay bale check dams will not prevent erosion from the slope areas of the dam, the aim of the intervention is to prevent sedimentation of the stream bed below which is very difficult to mitigate once it has occurred.