



Scientific Aquatic Services

Applying science to the real world

221 Riverside Lofts, Tygerfalls Boulevard,
Tygervalley, Cape Town, 7569
Cell +27 83 415 2356
Cell +27 71 413 2245
admin@sasenvgroup.co.za
www.sasenvironmental.co.za

EnviroAfrica CC

Attention: Ms. Inge Erasmus

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TECHNICAL MEMORANDUM

FRESHWATER RISK ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED JADE HILL DAM, ON THE FARM STINKFONTEIN 26/383, CERES, WESTERN CAPE PROVINCE

The proposed Jade Hill dam will be constructed within an episodic drainage line. It is the opinion of the ecologist that the drainage line, from an ecological perspective, does not conform to the definition of a true riparian resource and therefore does not enjoy protection as a watercourse in terms of the National Water Act, 1998 (Act No. 36 of 1998) and will not trigger a listed activity in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) in terms of listed activities pertaining to watercourses. It is the opinion of the freshwater ecologist that the proposed dam development will have a 'low' risk significance on the drainage line habitat and ecology, ecological and socio-cultural service provision and on hydrological function and sediment balance during the construction and operational phases, provided that clear, well-conceived and ecologically sensitive mitigation measures provided in this report are implemented.

It is the opinion of the ecologist that the ecological condition of the downstream reach of the episodic drainage line is unlikely to be altered significantly by the proposed dam and the operation thereof and the proposed activity can be authorised by a confirmation of General Authorisation process.

INTRODUCTION

Scientific Aquatic Services (SAS) was appointed to conduct a watercourse verification for the proposed Jade Hills Dam, hereafter referred to as the "proposed dam". The proposed dam is located on the farm Stinkfontein Portion 26/383, which is approximately 4.5 km east of the town Ceres, Western Cape Province. Agricultural activities dominate the area surrounding the proposed dam (Figure A and B – Appendix 1).

During the watercourse verification study (SAS, 2019)¹, it was concluded that there are no true wetlands or riparian resources within the footprint area of the proposed dam, although an episodic drainage, line is present. This feature is considered to be ecologically degraded. Given the site findings and the aspects of the drainage line as presented in the freshwater resource field verification report (SAS, 2019), it is the opinion of the ecologist that the drainage line, from an ecological perspective, does not conform to the definition of a watercourse that supports aquatic ecosystems with

¹ Scientific Aquatic Services (SAS). 2019. Freshwater Resource Verification for the proposed Jade Hill Dam, on the farm Stinkfontein 26/383, Ceres, Western Cape Province. Report Reference number: 219013.



an associated riparian zone. The drainage line does, however, convey small volumes of water during the rainy season and is therefore likely to have a 1 in 100 year floodline associated (although not formally determined). The 1:50 000 topographical maps (Figure B – Appendix 1) show the system as a watercourse and, in consultation with the relevant Breede Gouritz Catchment Management Agency (BGCMA) officials, it is concluded that the drainage line does enjoy protection in terms of the definition of a watercourse, as defined by the National Water Act, 1998 (Act No. 36 of 1998), the episodic drainage line is “a natural channel in which water flows regularly or intermittently”, and therefore the required Department of Water and Sanitation’s Risk Assessment Matrix was applied.

PROJECT DESCRIPTION

The proposed Jade Hills Dam is located within the north-eastern corner of the Farm Stinkfontein Portion 26/383 (Figure A and B – Appendix 1). The proposed Jade Hills Dam will lead to the flooding of the drainage feature (identified by SAS 2019 as an episodic drainage line) which drains in a northerly direction. The proposed storage capacity of the dam is 67 600m³. A dam wall of 11.1 meters in height will be constructed with a spillway designed to drain water from the dam into the downgradient portion of the drainage feature. The proposed dam wall design is provided in Figure C (Appendix 1). The predicted run-off from the drainage feature is approximately 2,000m³ per annum (*pers comm.* Sarel Engineers). Water will be metered when abstracted groundwater enters the dam as well as when it is abstracted from the dam.

OUTCOME OF THE FRESHWATER VERIFICATION ASSESSMENT

Please refer to the freshwater resource field verification (SAS, 2019) for details pertaining to the identified episodic drainage line. A delineation of the identified episodic drainage line relative to the proposed dam footprint area is provided by Figure D (Appendix 1).

Since the episodic drainage line cannot be defined as a watercourse that supports an aquatic ecosystem and associated riparian zone, the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) cannot be calculated and thus will not be included in the consideration of the DWS Risk Assessment. This is considered a limitation to the application of the DWS Risk Assessment and the BGCMA officials took note of this during the pre-consultation meeting.

RISK ASSESSMENT

The DWS Risk Assessment Matrix, promulgated in Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to activities as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998), was used to calculate the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat, and biota) of the episodic drainage line associated with the proposed dam.

When evaluating the potential impacts of the proposed dam on the drainage line, the following aspects were taken into consideration:

- The area in which the proposed dam is located (including the episodic drainage line) is deemed to be significantly transformed due to extensive cultivation activities within the catchment. This has altered the movement of water in the landscape and impacted the biodiversity thereof. Thus, the episodic drainage line is considered ecologically degraded (SAS, 2019).
- This episodic drainage line could, potentially, have historically been more pronounced and hosted a larger diversity of species. Due to the transformation of its surrounding ecological corridor and the impact of the existing dam (located south-east of the proposed dam area) on the hydrological functioning of the drainage line, it is not expected that it would provide habitat to a large variety of faunal species during the wet season, and even less during the dry summer seasons.
- All activities related to the construction of the dam wall are site-specific, thus not of a significant extent relative to the drainage line, and therefore have a limited spatial extent; and
- All impacts are considered easily detectable, and the mitigation measures thereof are considered to be practically implementable.



Risk Analysis: Consideration of impacts and application of mitigation measures

The results of the risk assessment are summarised in Table A (Appendix 2), including key mitigation measures for each activity. There are four key ecological impacts on the drainage line that are anticipated to occur namely:

- Loss of habitat and ecological structure;
- Changes to the sociocultural and service provision;
- Impacts on the hydrology and sediment balance; and
- Impacts on water quality (when surface water is present).

Overall, the activities related to the proposed dam development are deemed to pose a 'Low' risk significance to the episodic drainage line. This is attributed to the already degraded ecological integrity of the drainage line, as well as the overall absence of indigenous vegetation and limited hydrological drivers which could potentially be impacted.

Nevertheless, possible edge effects that can arise from the construction activities include the disturbance of soils leading to increased sedimentation of the downgradient reach of the drainage line, erosion and possible further proliferation of alien and invasive vegetation. With the implementation of the recommended mitigation measures (see Table A – Appendix 2), the risk that such effects would occur on the drainage line is considered to be low to very low.

During the operational phase of the dam, all operational activities are considered to pose a 'Low' risk significance to the drainage line and its downgradient reach, provided that the appropriate impact mitigation measures are implemented. The spillway and the dam wall should regularly be inspected for erosion, especially after heavy rainfall events when overflow from the dam is expected and the flow, velocity is increased. If erosion is noted, this should be rectified immediately, preferably by the reinstatement of the downgradient drainage line embankments through compaction of soil and revegetation thereof. If erosion is pronounced, erosion control devices such as reno mattresses should be considered, in consultation with a freshwater ecological specialist.

Since all the activities associated with the proposed construction and operation of the Jade Hill dam pose a 'Low' risk significance to the episodic drainage line (with the condition of implementing the specified mitigation measures), these activities could be motivated to the DWS to be authorised by means of a confirmation of General Authorisation (GA). However, the regional DWS officer should be consulted and should guide the process to follow in terms of the National Water Act, 1998 (Act No. 36 of 1998). Furthermore, the considerations as stipulated in GN538 as published in Government Gazette 40243 of 2016 as it relates to activities as stipulated in Section 21(a) and (b) of the National Water Act, 1998 (Act No. 36 of 1998).

CONCLUSION

It is the opinion of the freshwater ecologist that, since the episodic drainage does not conform to the definition of a watercourse that supports aquatic ecosystems with an associated riparian zone, the proposed dam development will have a 'low' risk significance on the freshwater habitat and ecology, ecological and socio-cultural service provision and on hydrological function and sediment balance during the construction and operational phases, provided that clear, well-conceived and ecologically sensitive mitigation measures provided in this memorandum are implemented, and general good planning and monitoring are strictly adhered to.

Provided appropriate impact mitigation measures are implemented, it is the opinion of the ecologist that the ecological condition of the downgradient reach of the episodic drainage line is unlikely to be altered significantly by the proposed dam and the operation thereof and the proposed activity can be authorised by a confirmation of the General Authorisation process in terms of the water uses stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998).

We trust that this information will be sufficient and that we have interpreted your requirements correctly. Please do not hesitate to contact us if there are any aspects you would like to discuss further.



Yours Faithfully,

Digital Documentation Not Signed for Security Purposes
Christel du Preez



Reviewed by: Amanda Mileson and Kim Marais (Pri.Sci.Nat)

APPENDIX 1

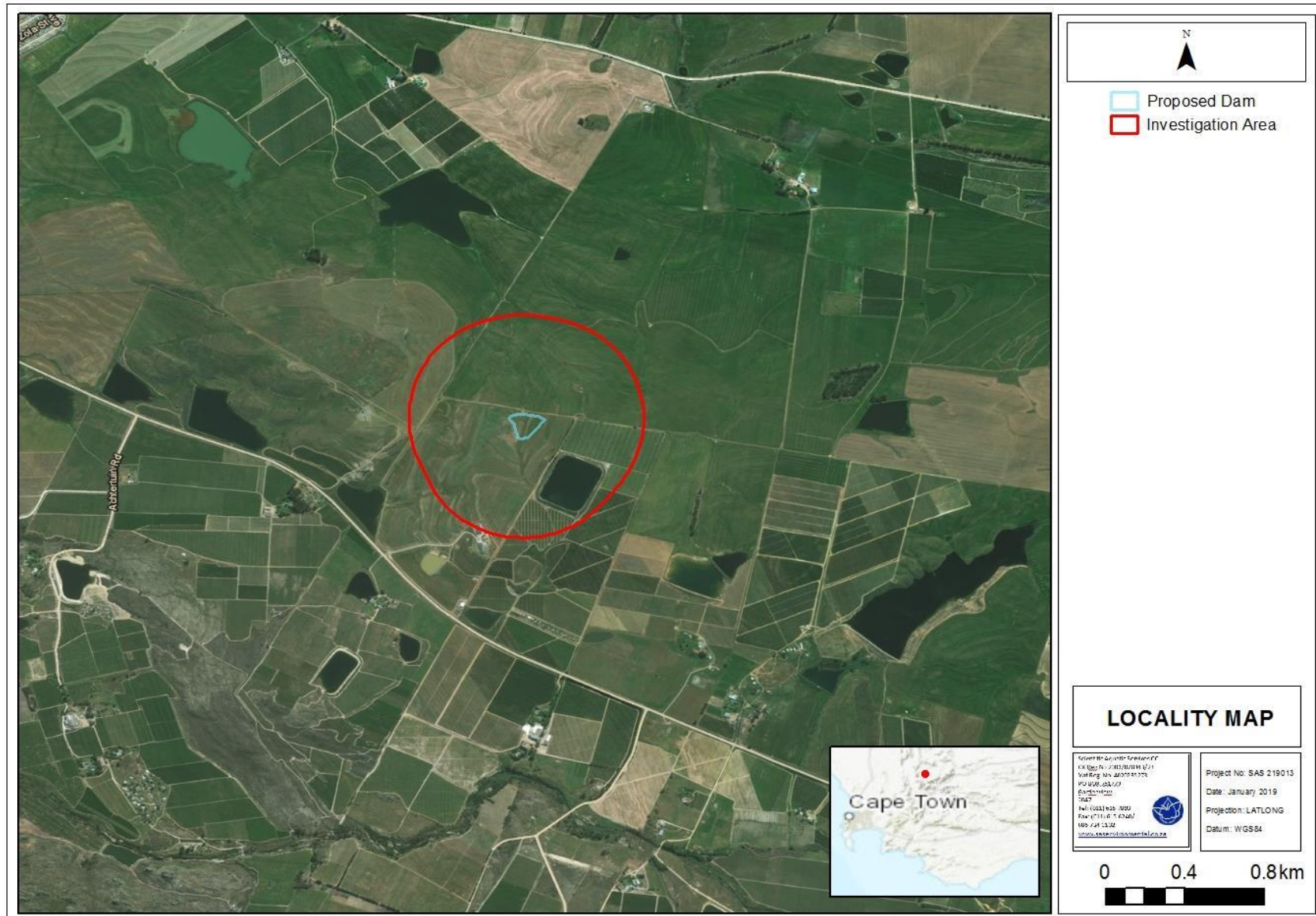


Figure A: Digital satellite image depicting the footprint area of the proposed dam in relation to the surrounding areas.



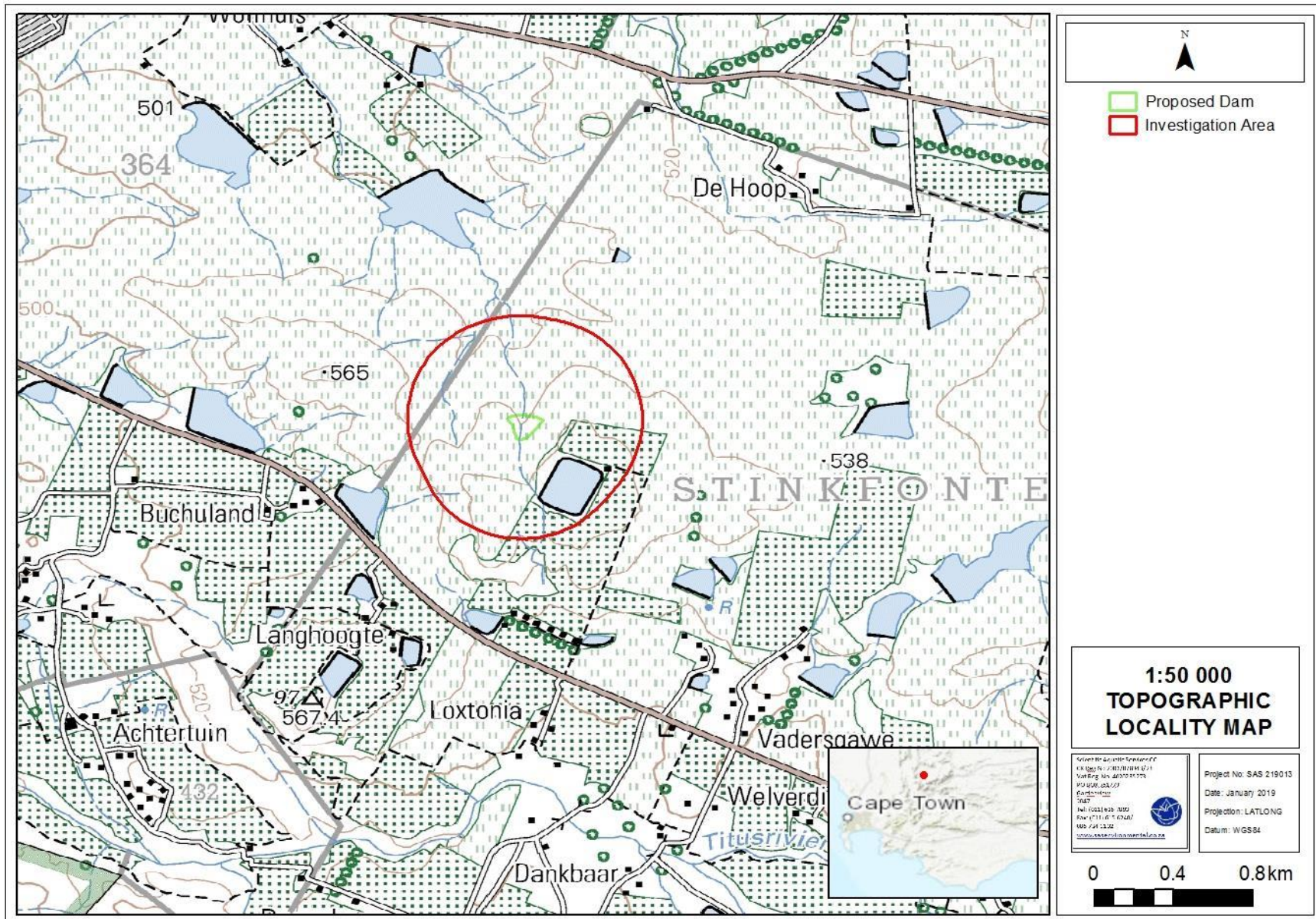


Figure B: Location of the footprint area of the proposed dam depicted on a 1:50 000 topographical map, in relation to surrounding areas.



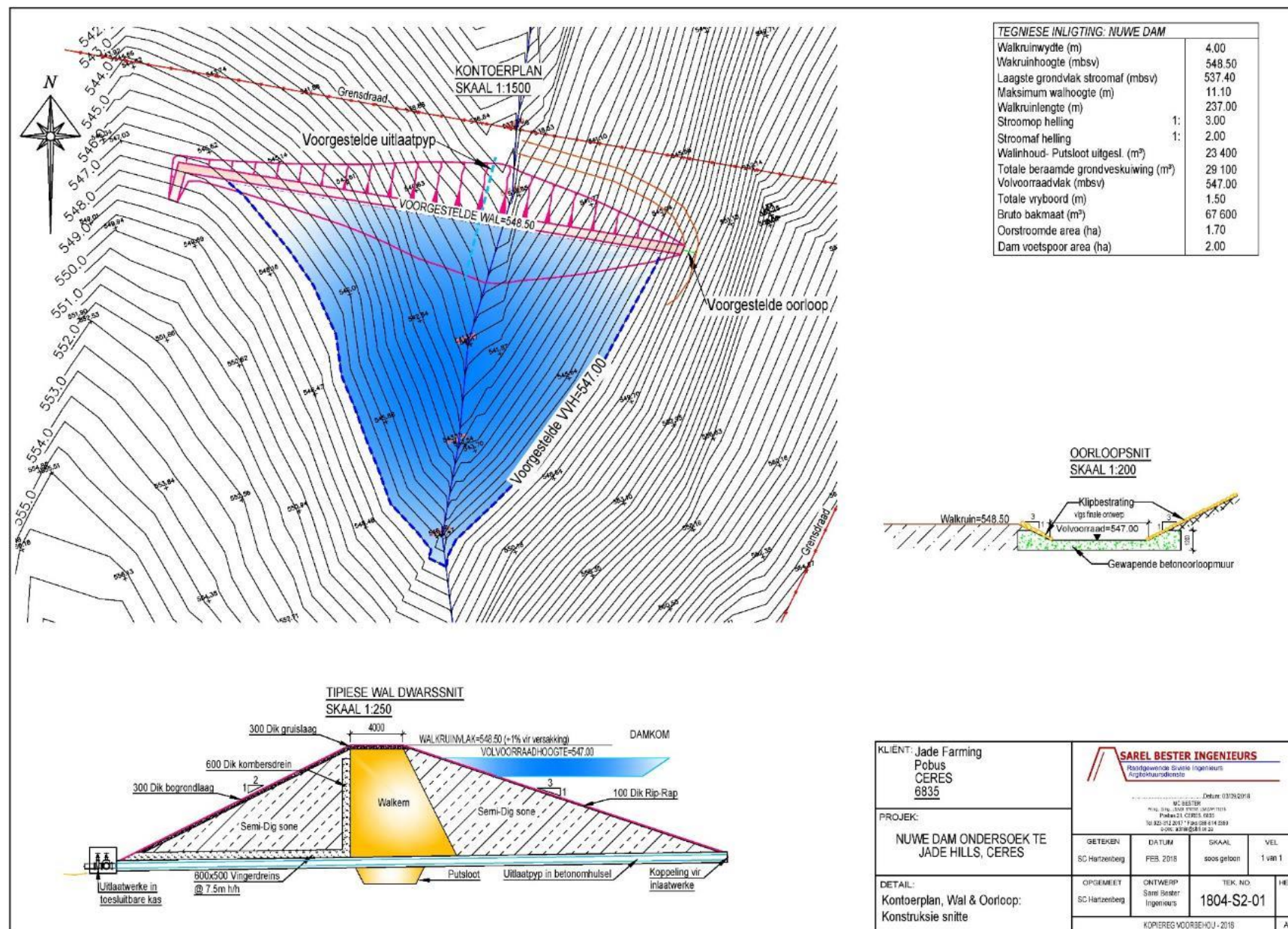


Figure C: Proposed design drawing of the Jade Hill dam and associated dam wall (Sarel Besters Ingenieurs, 2018).



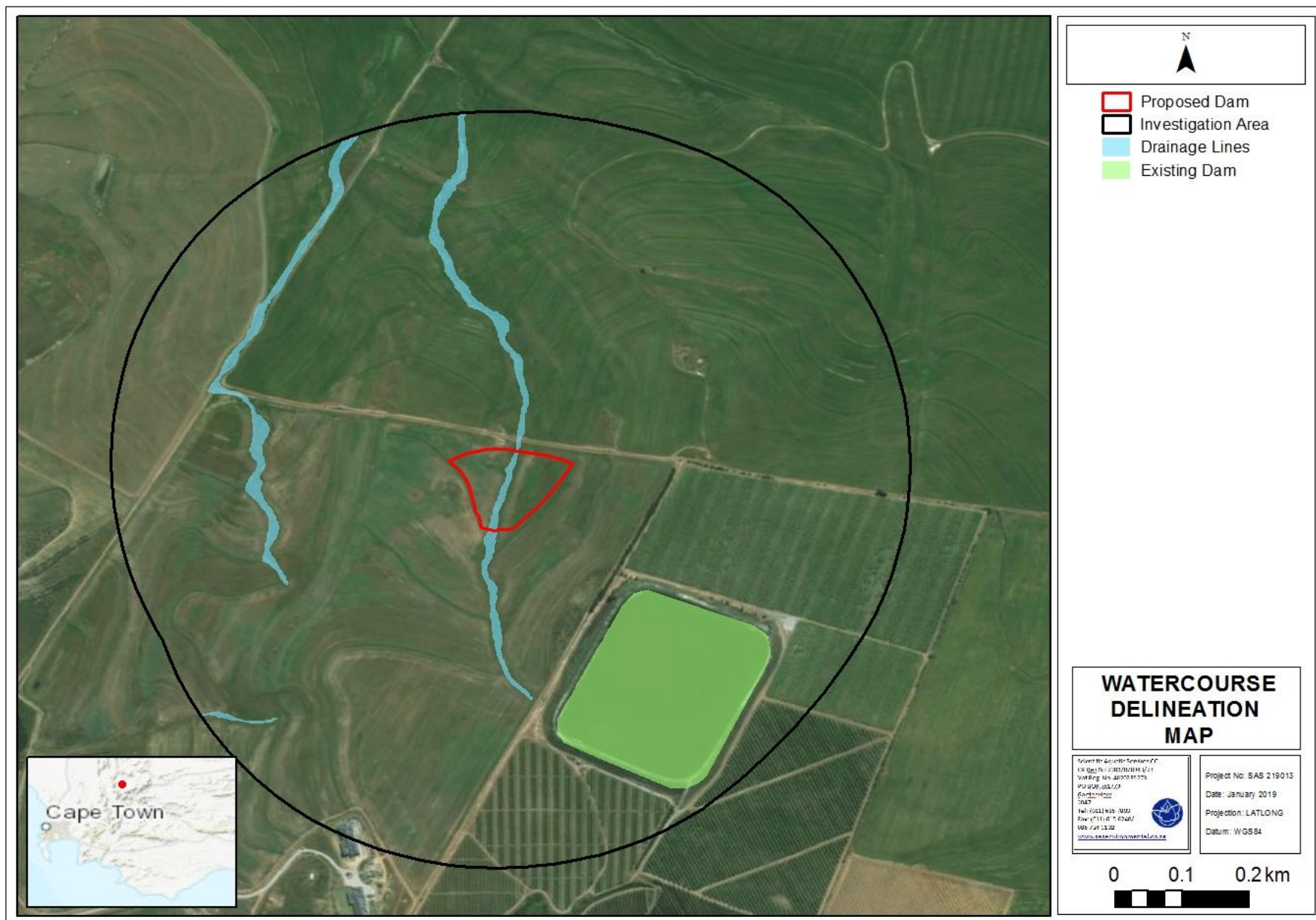


Figure D: The delineation of the drainage line located within the footprint area of the proposed dam, in relation to its investigation area.



APPENDIX 2

Table 1: A summary of the DWS Risk Assessment relating to the proposed Jade Hill dam.

No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
1	Construction Phase	Site preparation prior to construction activities.	Vehicular movement (transportation of construction materials) and access to the site.	*Degradation to the remaining vegetation within and surrounding the drainage line; *Transportation of construction materials can result in disturbances to soils, and increased risk of sedimentation/erosion; and *Soil and stormwater contamination from oils and hydrocarbons.	2	1	2	2	1,75	1	1	3,75	5	1	1	1	8	30	L	<p>*It is recommended that the construction activities be undertaken during the dry summer period when the flow is limited in the drainage line;</p> <p>*Due to the erosion that was noted within the drainage line, use should be made of existing roads to gain access to the proposed dam footprint area. Due to the relative accessibility of the site, no unnecessary crossing of the drainage line may be permitted. This will limit any further erosion of the drainage line and its downstream reach;</p> <p>*Contractor laydown areas, vehicle re-fuelling areas and material storage facilities to remain outside of the proposed dam footprint area;</p>
2			*Removal of vegetation and associated disturbances to soils	*Earthworks could be potential sources of sediment, which may be transported as runoff into the downgradient areas; *Exposure of soils, leading to increased runoff, and erosion, and thus sedimentation of the drainage line; *Increased sedimentation of the drainage line, leading to smothering vegetation associated with the drainage line; and *Further proliferation of alien vegetation as a result of disturbances.	1	1	3	3	2	1	1	4	5	1	1	1	8	32	L	<p>*All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential, and preferably only alien floral species to be removed. Based on the site conditions at the time of the field assessment (January 2019), very few vegetation species were present within the drainage line. Nevertheless, any indigenous species present outside of the dam footprint area must be preserved to maintain the current ecological condition of the immediate area and prevent any erosion and keep the soil profile intact. Once alien species are removed, they may not be stockpiled on site, but must immediately be removed from the site and disposed of at a registered waste disposal facility;</p> <p>*Exposed soils to be protected using a suitable geotextile covering such as hessian sheeting.</p>



No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
3		Construction activities related to the construction of the dam wall and the proposed spillway.	Bulk earthworks associated with importing of material, placing it and compaction thereof to construct the dam wall and proposed spillway.	Runoff from the imported material could increase the sediment load of the downstream reach of the drainage line.	1	2	3	2	2	1	1	4	5	1	1	1	8	32	L	*Ensure sediment control devices are in place before the start of the construction activities; *Maintain sediment/erosion control devices to minimise the risk of sedimentation of the downgradient drainage line reach using silt traps;
				Sedimentation and water quality impairment (increased hydrocarbons, suspended solids, hazardous substances and oils from the heavy machinery used) of the downgradient drainage line reach leading to further degradation of the downgradient habitat.	2	2	1	1	1,5	1	1	3,5	5	1	1	1	8	28	L	*The spillway outlet of the dam should be constructed from energy dissipating structures (such as Armorflex or reno mattresses) to slow down the velocity of water inflow into the downgradient drainage line reach and preventing erosion thereof; *Excavated materials and topsoil may not be contaminated, and it must be ensured that the minimum surface area is taken up by the stockpiles, and the stockpiles may not exceed 2m in height. Mixture of the lower and upper layers of the excavated soil should be kept to a minimum, for later usage as backfill material or as part of rehabilitation of the dam wall;
				Loosening and exposure of soils leading to <i>in situ</i> erosion, and sedimentation of the downgradient drainage line reach.	1	1	3	3	2	1	1	4	5	1	1	1	8	32	L	*All exposed soils must be protected for the duration of the construction phase with a suitable geotextile (e.g. Geojute or hessian sheeting) to prevent erosion and sedimentation of the downgradient drainage line reach; and *Construction of the dam wall should be done in a layered phased manner, where layers of imported material are placed on the dam wall and compacted. This process should be repeated until the desired height has been reached. <u>Mitigation measures applicable to the spillway:</u> *Energy dissipating structures should be installed at the spillway outlet to prevent erosion and scouring of the drainage line where the overflow will be discharged;



No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
																				<p>*At the outlet, rocks must be placed and vegetation established (if applicable considering the highly episodic nature of the system) to bind the soil of the bed, and to prevent erosion. This will also diffuse flow and lower the velocity of water into the lower reach of the drainage line; and</p> <p>*Upon completion of the construction activities, all footprint areas should be revegetated with indigenous vegetation.</p>
			*Covering the dam wall with topsoil and revegetation of the dam wall	<p>*Potential sedimentation for the downstream drainage line reach;</p> <p>*Potential proliferation of alien and invasive vegetation species.</p>	1	1	2	2	1,5	1	1	3,5	5	1	1	1	8	28	L	<p>*Previously removed soils (removed as part of the site preparation activities) should be used as topsoil for covering of the dam wall;</p> <p>*It should be ensured that the topsoil used are weed free to limit the establishment of alien and invasive vegetation species;</p> <p>*Re-seed the dam wall with indigenous species as soon as construction activities are completed.</p>



No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
4	Operational phase	Operation of the dam and the spillway.	Increased inundation caused by dam development.	*Changes in the wetting patterns and hydroperiod of the drainage line; *Loss of ecoservice provisioning by the drainage line; and *Increased periods of saturation along the edge of the dam.	3	1	1	1	1,5	1	1	3,5	5	5	1	1	12	42	L	*During the site visit undertaken by SAS in January 2019, no obligate freshwater vegetation species were noted in the drainage line. To increase the habitat of the immediate environment, indigenous obligate freshwater vegetation species should be established in the areas where extended periods of saturation would occur, such as within the drawdown area of the constructed dam; and *Implement an alien and invasive species control plan to prevent the establishment of such species.
5			Operation of the spillway associated with the dam.	*Erosion of the downstream drainage line reach where water enters the drainage line from the spillway; and *Potential increased sedimentation of the downstream drainage line due to erosion associated with the spillway.	2	1	2	2	1,75	1	2	4,75	5	3	1	1	10	47,5	L	*The spillway should regularly be inspected for erosion, especially after heavy rainfall events when overflow from the dam is expected and the flow, velocity is increased. If erosion is noted, this should be rectified, preferably by the reinstatement of the embankments through compaction of soil and revegetation thereof. If erosion is pronounced, erosion control devices such as reno mattresses should be considered, in consultation with a freshwater ecological specialist. *The spillway should be maintained free of any debris and silt/sediment.



No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph & Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Control Measures
6				Desilting activities resulting in the: *Removal of vegetation (terrestrial and wetland); and *Earthworks and silt stockpiling, the runoff from which has the potential to increase silt loads within the downstream drainage line.	1	3	2	2	2	1	1	4	5	1	1	1	8	32	L	
7		Maintenance of the dam.	Maintenance of the dam wall, including inspections, desilting and leak detection.	In the event where a leak has been detected within the dam wall itself, impacts include: *An increase in water quantity could cause extended periods of water saturation of the downstream drainage line reach; *Repair of a leak would entail the impacts as per Activity 1, 2 and 3 above.	3	2	2	2	2,25	1	1	4,25	5	1	1	1	8	34	L	Control measures applicable to this activity would be as per Activity 1, 2 and 3 above. Additionally, the following is applicable: *During desilting, silt associated with the dam should immediately be removed to prevent sedimentation of the downgradient drainage line reach. Additionally, during desilting, a temporary silt trap should be installed at the spillway. This must be emptied regularly and not permitted to reduce the capacity of the dam.

