Hydrological Assessment for the Proposed Dam for the Dartford Farming Trust in Underberg, KwaZulu-Natal

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Prepared By:

Hunts Green Consulting (Pty) Ltd

Prepared For:

Emanzini WULA Consultants

Attention To:

S'boniso Nduli

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Hunts Green Consultants (Pty) Ltd
Burkina Faso | Côte d'Ivoire | D.R. Congo | Malawi | Mali | South Africa | Tanzania
Directors: S Baqa | L Lembede | G Sumari (Non-Executive)
email: info@huntsgreen.com | website: www.huntsgreen.com

HUNTS GREEN

HYDROLOGICAL ASSESSMENT FOR THE PROPOSED DAM FOR THE DARTFORD FARMING TRUST IN UNDERBERG

KWAZULU-NATAL, SOUTH AFRICA

DECEMBER 2023

Required Client Review and Approval

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Design and Engineering	No			
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STRICTLY CONFIDENTIAL

EXECUTIVE SUMMARY

Emanzini WULA Consultants commissioned Hunts Green (Pty) Ltd to undertake a hydrology assessment to supplement a Water Use Licence Application for the proposed contruction of a farm dam to be used for the abstraction of surface water for the Dartford Farming Trust in Underberg, KwaZulu-Natal. The applicant intends to build a 1 500 000 m^3 storage dam that will be used for the irrigation for pastures of about 155 ha at FS_7604_0 & FS_8581 PTN 0, In addition the neighboring two properties would benefit from the dam for the irrigation of 190 ha of vegetables at FS_9162 PTN 0 and FS_9161 PTN 0.

The study area is located within the T51C quaternary catchment within the Pongola Mtavuma Water Management Area (WMA 4) and is drained by the Mzimkhulu River downstream.

A water resources yield simulation model was set up to account for a range of water uses within the catchment and was used to evaluate the historical yield at the proposed dam abstraction point. Present-day flows were obtained from naturalized flows after accounting for registered water users, streamflow reduction activities (forestry) and abstraction by alien invasive plants within the study area. The total reserve requirement was calculated for the environmental maintenance of low flows.

Analysis indicates a Mean Annual (adjusted) Runoff into the proposed dam of **5.2 Mm^3/annum**. The irrigation requirement of perennial pastures is estimated to be approximately 570 mm. The average annual dam yield to irrigate an area 155 ha of pastures was calculated at **860 500 m^3**. The dam simulation accounts for 90 mm per month (190 ha) released during summer, which would contribute to the irrigation of undefined vegetable crops below the dam. These water demands are met by the proposed dam with an Assurance of Supply of 70% (the dam remains more than 75% full and there are no curtailments of supply to meet demands for at least 70% of the time). There is more than enough water available in the river and from the proposed storage dam to justify granting the proposed licence. The dam design, together with dam operation and maintenance plans will still need to also be approved in terms of dam safety legislation.

For the flood delineation, the HEC-RAS model was used to simulate the 1:10 year flood event according to requirements of the Conservation of Agricultural Resources Act (CARA 43 of 93), which states in Clause 3 (b) '*Except on authority of a written permission by the executive*

officer, no land user shall cultivate any land on his farm unit within the flood area of a watercourse or within 10 m horizontally outside the flood area of a wartercourse'. The 1:10-year floodline and the 10 m buffer from the flood area were mapped (Figure 7-2). It is recommended that no cultivation takes place within this delineated area.

The stormwater management of the slurry dams was undertaken. Slurry originates from the dairy and consists of a mixture of wash water, dung and urine. Slurry inputs from the dairy are estimated at 20-25 m^3 per day. The slurry ponds store between 3700 and 4000 m^3 of dairy waste-water in earth dams The wastewater from the slurry ponds is used to irrigate pastures through the center pivot and/or tractor drawn slurry spreader.

The stormwater management on the farm is adequate and there are no concerns with pollution of nearby watercourses. Any spillages that occur would be limited to overland flow, with minimal contribution to the Rivers, which are situated approximately 300 to 400 m away from the ponds (see Figure 8-3). Soils adjacent to the slurry ponds are deep, well drained hutton soils, and most of the nutrient-rich overland flows from any slurry spillages would infiltrate into the soils. No significant impacts to the environment or downstream users are anticipated in the event of spillages.

Open drains that convey slurry should always be kept clear and free of litter that may block flow. The grassed trench should be maintained to prevent erosion and sedimentation build up in the slurry dams. The shed area of the dairy farm could be fitted with gutters and downpipes for rainwater harvesting in storage tanks, increasing local on-site water availability. Any future expansion of the dairy herd would increase volumes of slurry and would require a re-assessment of waste handling facilities and revised evaluation of the potential impacts of excess nutrient rich wateron the environment, and to downstream water users. To ensure compliance with the National Water Act (36 of 1998) for disposal of waste by irrigation, no irrigation should take place within 100 m of a watercourse.

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LIST OF ACRONYMS & ABBREVIATIONS

AIP	Alien Invasive Plants
CARA	Conservation of Agricultural Resources Act (CARA 43 of 93)
DEM	Digital Elevation Model
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
DTM	Digital Terrain Model
EWR	Ecological Water Requirements
NWA	National Water Act
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MIPI	Midgley and Pitman
Mm^3	Million cumic meters
RM3	Rational method Alternative 3
SDF	Standard Design Flood
SRA	Streamflow Reduction Activities
WARMS	Water use Authorization & Registration Management System
WMA	Water Management Area
WRC	Water Resources Commission
WUL	Water Use License

1 Introduction

Emanzini WULA Consultants commissioned Hunts Green (Pty) Ltd to undertake a hydrology assessment to supplement a Water Use Licence Application for the proposed contruction of a farm dam to be used for the abstraction of surface water for the Dartford Farming Trust in Underberg, KwaZulu-Natal. The applicant intends to build a 1 500 000 m^3 storage dam that will be used for the irrigation for pastures of about 155 ha at FS_7604_0 & FS_8581 PTN 0, In addition the neighboring two properties would benefit from the dam for the irrigation of 190 ha of vegetables at FS_9162 PTN 0 and FS_9161 PTN 0.

The study area is located within the T51C quaternary catchment within the Pongola Mtavuma Water Management Area (WMA 4) and is drained by the Mzimkhulu River downstream, which discharges into the Indian Ocean in a south easterly direction. The local setting of the Dartford farm project area is indicated in Figure 2-1.

2 Scope of Work

The scope of work required for the study includes the following:

1. Hydrology and Climate Analysis:
    a. Catchment delineation and determination of catchment areas from upstream to adjacent dam site points
    b. Determination and preparation of climate data (rainfall, evaporation and runoff)
2. Hydrological Modelling and Yield Analysis:
    a. A water resources yield model was set up to include the following:
        i. 84 years' time series rainfall data from 1920 to 2004
        ii. Monthly average Symons Pan evaporation data
        iii. Desktop Ecological Water Requirements (EWR)
        iv. Water abstractions within the catchment of the study area
        v. Streamflow reduction activities (SRA) including forestry and alien invasive plants (AIP)
        vi. Registered water uses which were obtained from the Department of water and Sanitation (DWS) Water use Authorization & Registration Management System (WARMS) database.
3. Floodline Delineation and Mapping
    a. Peak Flow Calculation

i. Widely used and recommended methods including the Rational Method Alternative 3 (RM3), Standard Design Flood (SDF) and the Midgley & Pitman (MIPI) were used to calculate the peak flows for delineated sub-catchments at the Project Area (SANRAL, 2013).

ii. Design rainfall depths were determined using the Design Rainfall Programme for South Africa and the modified Hershfield equation as input to the RM3 and SDF methods, respectively.

iii. Hydraulic modelling was conducted in HEC-RAS. The pre- processing will involve generation of the channel geometry, including the river network, banks, flow paths and cross sections.

4. Reporting

   a. A report will be provided to present the findings of the study as well as conclusions and recommendations derived from the study.

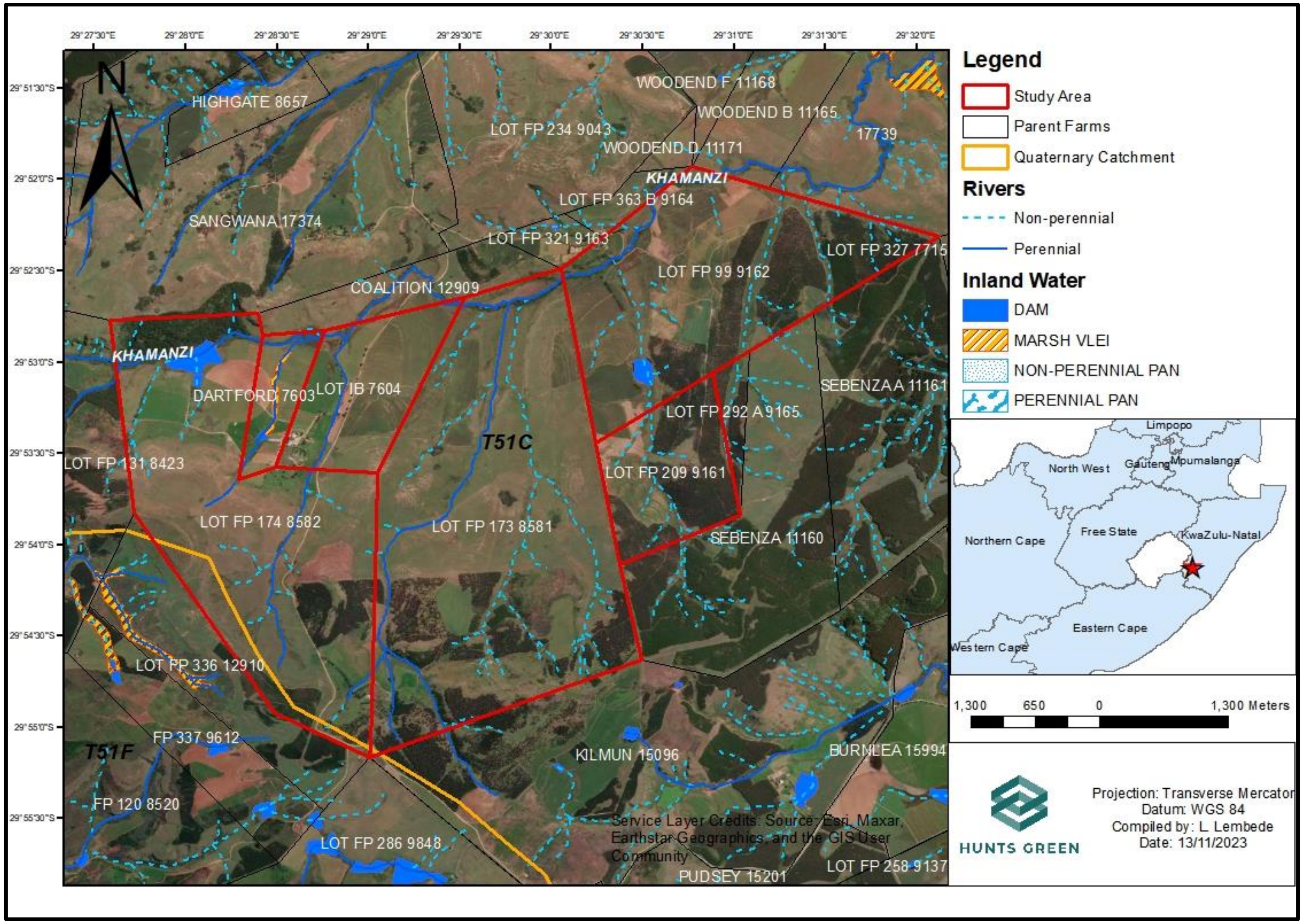

Figure 2-1: Local Setting of the Project Area

3 Assumptions and Limitations of the Study

The following assumptions and limitations of this study are applicable:

- The yield assessment was based on quaternary scale naturalized flows adapted from the WR2012 database downscaled to proposed dam sites.
- Estimation of historical flows was conducted based on desktop estimations of EWR, registered water uses, quaternary catchment average monthly evaporation, AIP and forestry as stream reduction activities, downscaled from quaternary catchment data to proposed dam site abstraction points.
- No accounting for sediment accumulation was included in the yield model, which assumes negligible sediment yield in the project area.
- The crop water demand varies monthly. Monthly water demands were not calculated for the irrigation of various (undefined) vegetable crops on neigbhouring properties. An allowance was made for minimal (deficit) downstream irrigation.The study is based on estimated historical river flow at the inlet of the proposed dam.

4 Methodology

The methodology adopted to this hydrological assessment in terms of the catchment hydrology, ecological water requirements and the yield assessment is summarised below.

4.1 Hydrology and Water Uses

The elevation data was obtained from ALOS satellite data, which was used to delineate the upstream catchment area draining into proposed abstraction points. Hydrology and climate information for the study area was obtained from the 2012 South African Water Resources Study (Bailey & Pitman, 2015).

The naturalized streamflow data with a hydrological year period from 1920 to 2009 for the study site was downscaled from the naturalized flow data for the quaternary catchment. Long-term monthly average evaporation data was obtained from the WR2012 database (Bailey & Pitman, 2015).

The sources for water use information include WARMS data, WR2012 database and observations from Google Earth ™ pro and visual observations during the site visit.

4.2 Desktop Ecological Water Requirements

The calculation of the EWR was conducted in accordance with the stipulations from the Section 12(1)(b) of the National Water Act (Act No. 36 of 1998). Catchment features were used together with the physical characteristics of the delineated sub-catchment to determine the Ecological Reserve Category and were cross-validated with the gazette classes. The total maintenance category of the annual EWR was used for the quaternary and subsequently downscaled to the delineated site sub-catchment.

4.3 Yield Modelling

A water resources yield simulation model was set up to account for a range of water uses within a catchment at a monthly time step and was used to evaluate the yield at the proposed abstraction point. The time series of naturalised runoff, rainfall and evaporation were obtained from the WR2012 database (Bailey & Pitman, 2015).

4.4 Floodline Delineation

Catchment delineation was undertaken using the Advanced Land Observing Satellite (ALOS) World 3D – 30m (AW3D30) global digital surface model (DSM) data (JAXA, 2015). This dataset is stored in a raster GeoTIFF format referenced to the Hartebeesthoek 94 Datum (WGS84 ellipsoid).

Widely used and recommended methods including the Rational Method Alternative 3 (RM3), Standard Design Flood (SDF) and the Midgley & Pitman (MIPI) were used to calculate the 1:10, 1:50 and 1:100-year peak flows for the delineated sub-catchments (SANRAL, 2013). Design rainfall depths were determined using the Design Rainfall Programme for South Africa and the modified Hershfield equation as input to the RM3 and SDF methods, respectively.

The 1:10 year design rainfall depth was used in the model according to the Conservation of Agricultural Resources Act (CARA 43 of 93), which states in Clause 3 (b) '*Except on authority of a written permission by the executive officer, no land user shall cultivate any land on his farm unit within the flood area of a watercourse or within 10 m horizontally outside the flood area of a wartercourse*'. Within the CARA regulation, flood area, in relation to a watercourse, is defined as the area which in the opinion of the executive officer is flooded by flood water during a 1:10 year flood.

HEC-RAS was used to model total energy of water by applying basic principles of mass, continuity and momentum as well as roughness factors between all cross sections (US Army

Corps of Engineers, 1995). A height is calculated at each cross-section, which represents the level to which water will rise at that section, given the calculated initial peak flows for the 1:10-year event on all river sections.

Analyses are performed by first modelling flows at the sub-catchment outlet, and then moving upstream. Manning's Roughness Coefficients (n) for the left and right overbanks of the main River were set at 0.01 to 0.035 to represent medium to dense bush and short grass on the river banks, respectively while the main channel roughness was 0.07 to represent a sluggish reach with deep pools (Chow, 1959).

4.5 Stormwater Management Plan

The stormwater management practices at the Dartford Trust Farm were assesed during a site visit on the 27th of November 2023. Recommendations may be made to improve stormwater management, where applicable. The effectiveness of the stormwater management in the farm will be assessed based on the objectives of stormwater management, which include the following:

- The need to protect the welfare and safety of people, and to protect property from flood hazards by safely routing and discharging stormwater from development sites;
- The opportunity to conserve water and make it available to the public for beneficial uses; and
- The responsibility to preserve the natural environment.

5 Catchment Climate and Hydrology

The study area is located within quaternary catchment T51C within the Pongola Mtavuma Water Management Area (WMA 4) and is drained by the Mzimkhulu River downstream, which discharges into the Indian Ocean in a south easterly direction (Figure 5-3). The characteristics of the T51C quaternary catchment are summarised below.

Table 5-1: Summary of Climate Characteristics of Quaternary Catchments

Catchment Name	Area (km^2)	Evaporation Zone	MAE (mm)	Rain Zone	MAP (mm)	MAR (mcm)
T51C	462	29A	1300	T5B	952	95.4

Figure 5-1 shows the historical distribution of rainfall, with the 90th percentile of monthly rainfall representing extreme wet conditions and the 10th percentile represents drought events.

Rainfall will normally vary between the 30th and 70th percentiles, which indicate steady summer rainfall over a 6-month period and a shorter, relatively dry winter period.

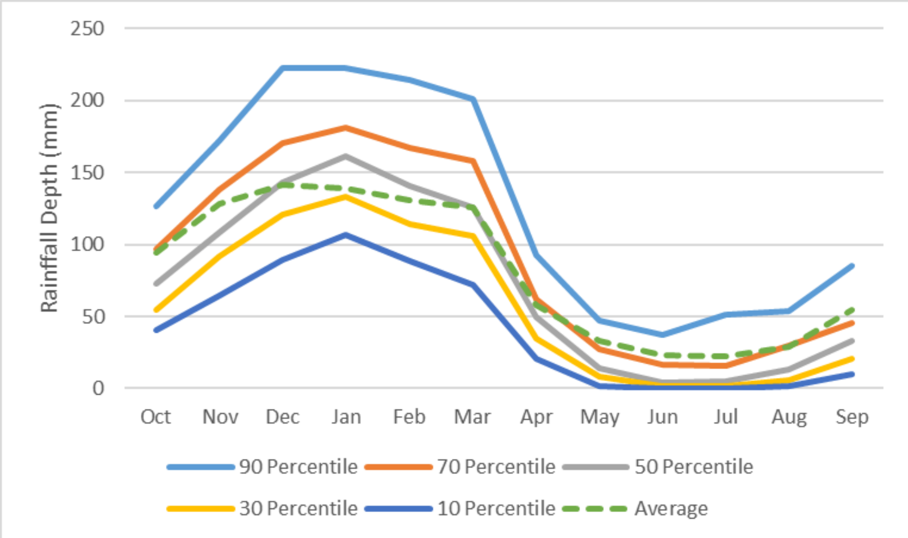

Figure 5-1: Monthly Rainfall Distribution for Quaternary Catchment T51C

The naturalized runoff for quaternary catchment T51C and for the delineated upstream runoff contributing catchment for the study area is approximately **120 Mm^3/annum** and **10M m^3/annum**, respectively (Bailey & Pitman, 2015). The quaternary catchment experiences wet months between November to April, followed by drier months between May to October (Figure 5-2). The driest month is July, with an average of 2.1 Mm^3, while the wettest month is February, with an average runoff of 22.9 Mm^3.

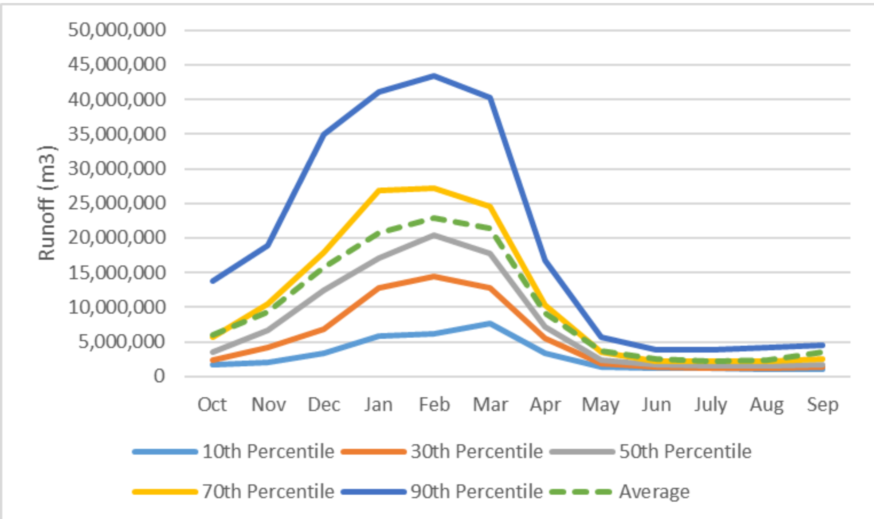

Figure 5-2: Naturalized Flow within Quaternary Catchment T51C

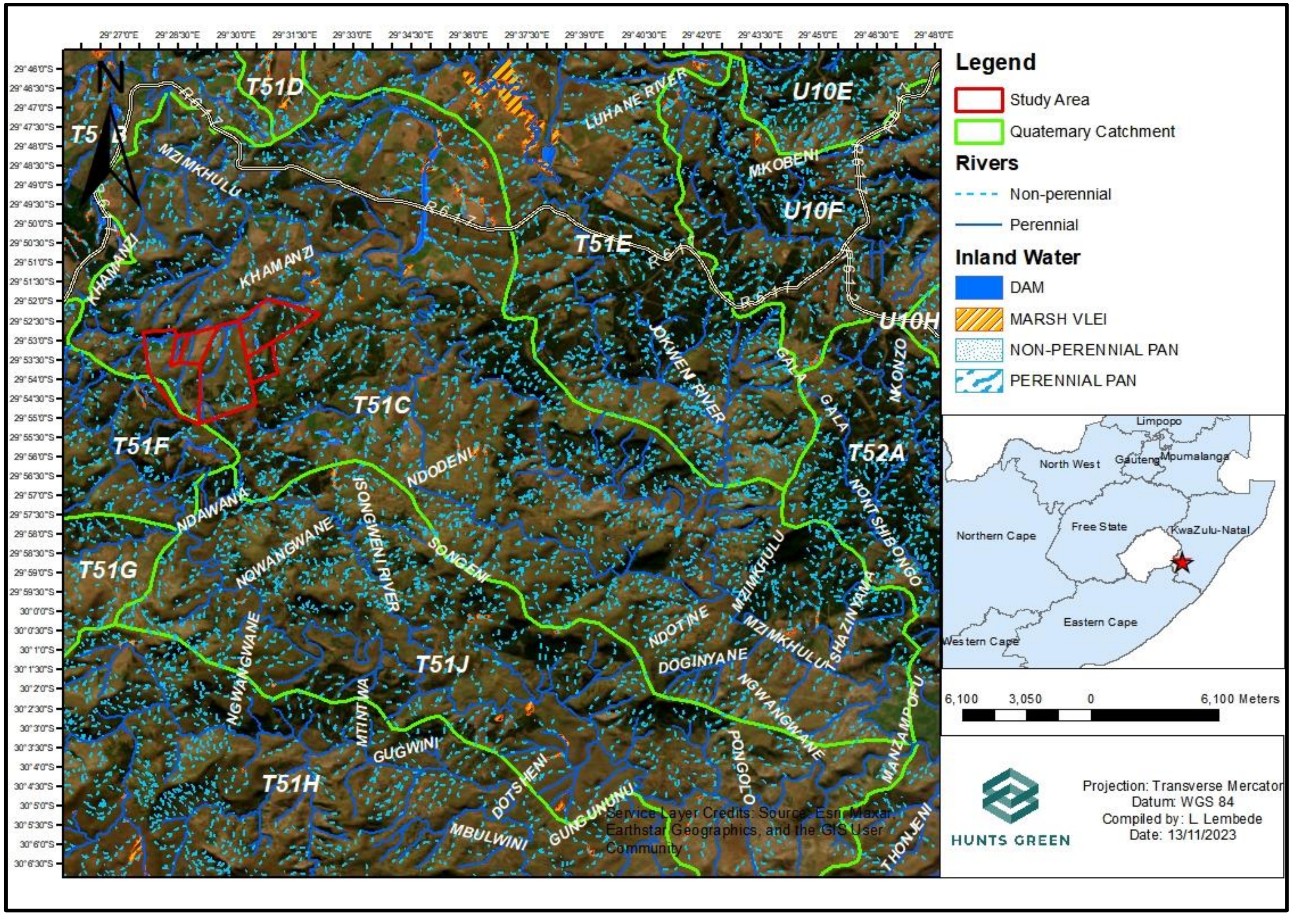

Figure 5-3: Locality of Quaternary Catchment T51C

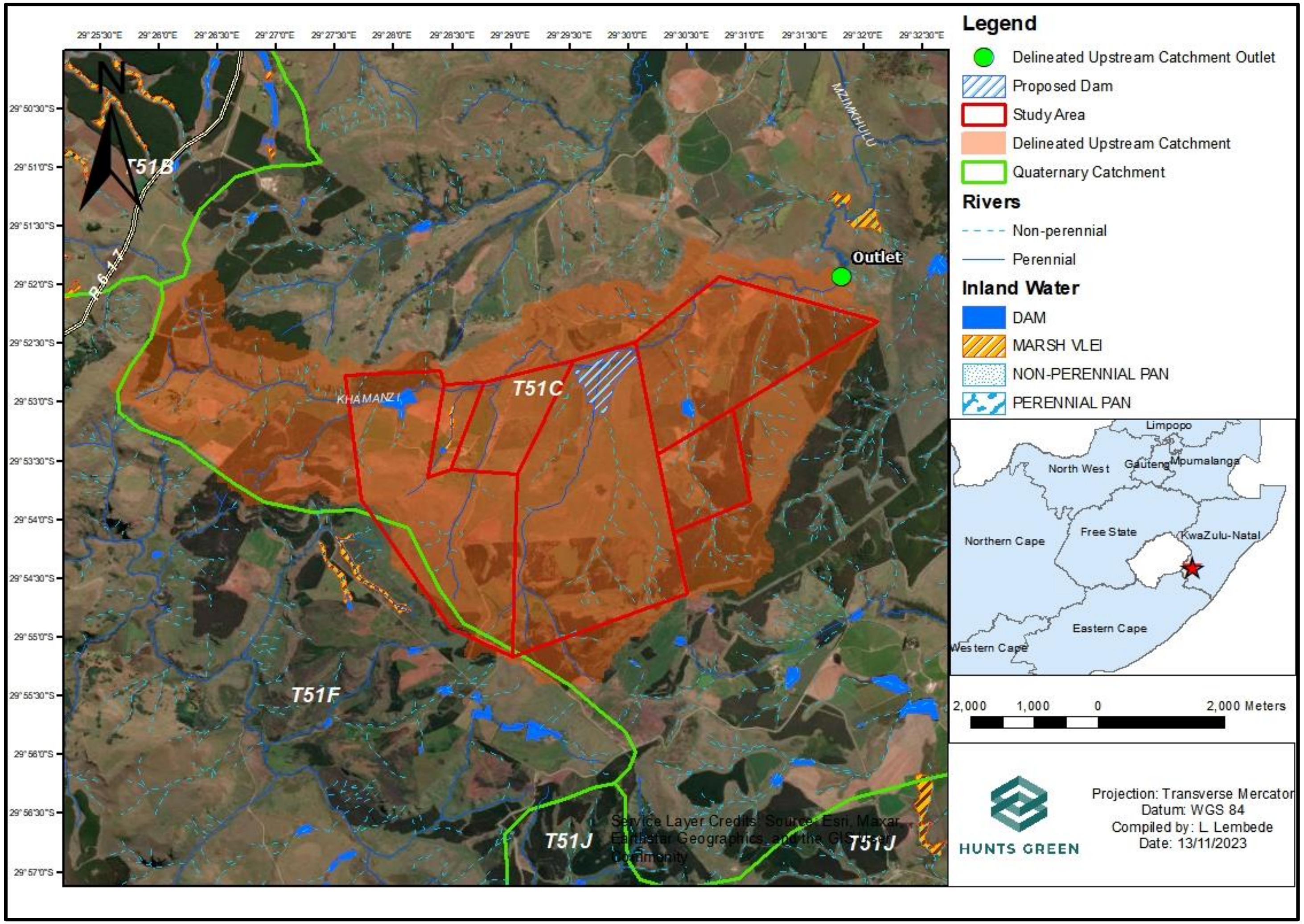

Figure 5-4: Delineated Upstream Subcatchment for the Study Area

6 Yield Modelling

The Section presents the findings of the yield assessment.

6.1 Water Use Analysis

Present-day flows were obtained from naturalized flows after accounting for registered water users, streamflow reduction activities (forestry) and abstraction by alien invasive plants within the delineated sub-catchment (see Table 6-1). The delineated subcatchment is approximately 26 km^2 (see Figure 6-1), which is approximately 5.6% of the T51C quaternary catchment. Ecological Water Requirements (EWR) were also accounted for and reserved to ensure sustainability of aquatic ecosystems within the relevant catchments.

The proportions of the catchment area that is occupied by forestry and alien vegetation was determined from the WR2012 database and observations from Google Earth ™ pro, both of which indicated an area of approximately 8.2 km is occupied by forestry/ alien vegetation. This observation was verified during the site visit to the farm portions, during which it was noted that most of the plantations in the catchment area were mainly Wattle and Eucalyptus plantations.

Water users in the delineated subcatchment were identified from the WARMS database. Two registred water users were identified (see Figure 6-2), with one water user registered for abstracting 46 080 m^3/annum for agriculture irrigation and another registered to abstract 500 m^3 for a Schedule 1 water use.

The Desktop Environmental Status (ERC) for the study area is C, which represents a moderately modified catchment. The total reserve requirement was calculated for the environmental maintenance of low flows.

Table 6-1: Summary of Water Users in the Study Area

Forestry/ Alien Vegetation	Registered Water Uses	EWR
Mm^3/annum		
11.01	0.04658	8.63

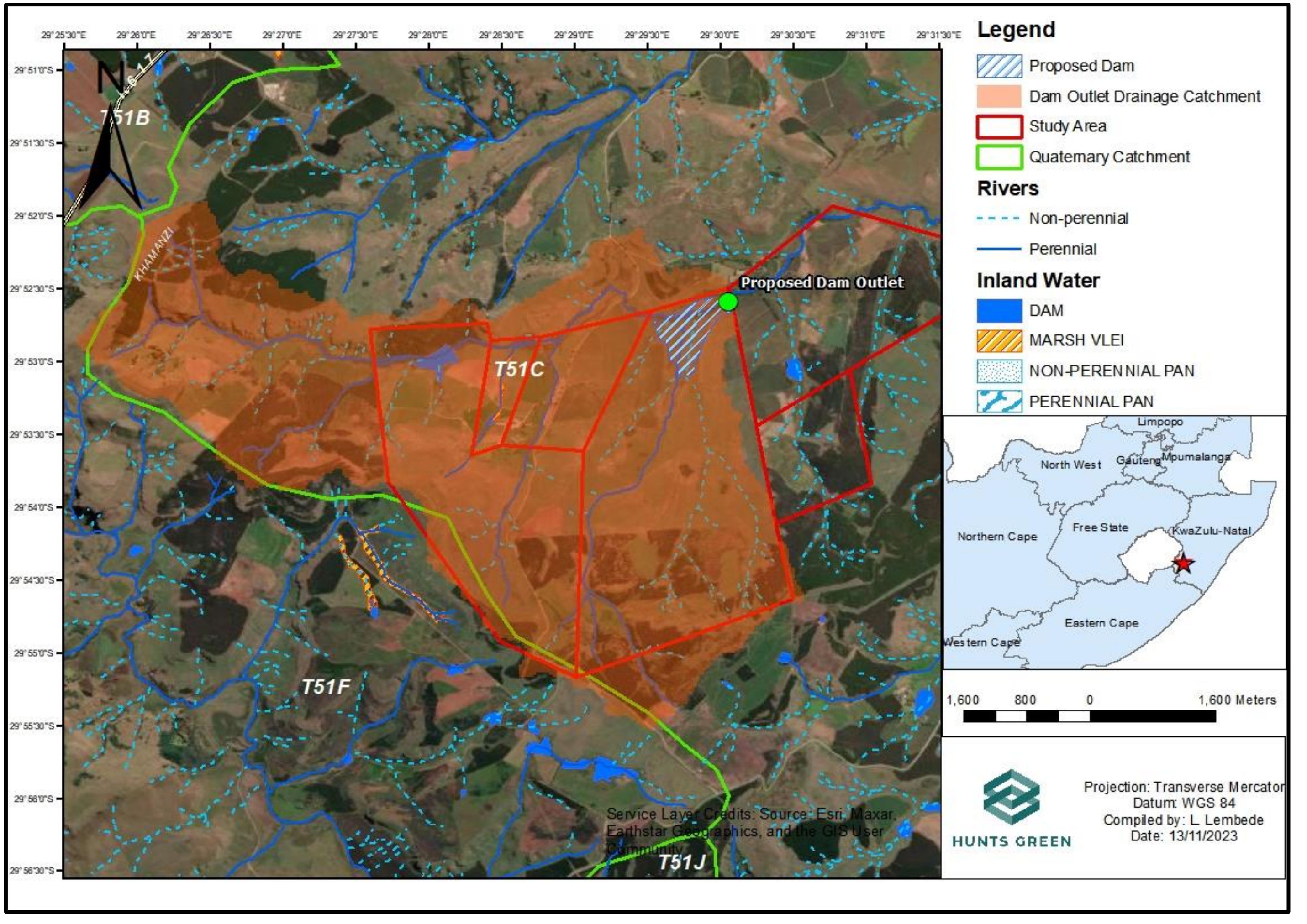

Figure 6-1: Delineated Upstream Subcatchment for the Proposed Dam Outlet

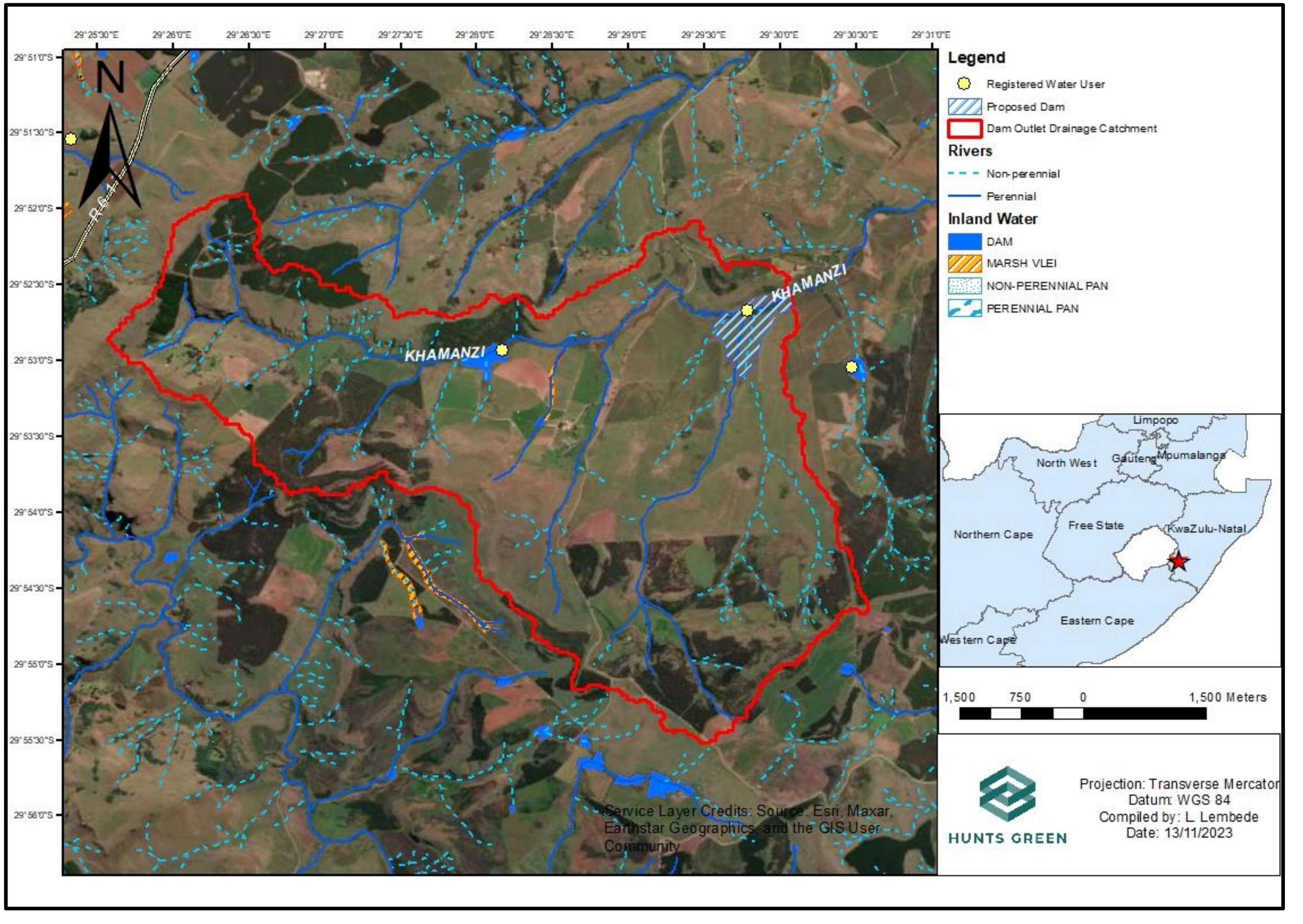

Figure 6-2: Registered Water Users in the WARMS database

6.2 Dam Yield

The findings of the study indicate a historical MAR of **5.2 Mm^3/annum** for the proposed farm dam. The calculated yield of the dam considered all the identified water users, inflows, and water losses from the system. The monthly distribution of the annual yield is presented in Figure 6-3. It should be noted that the simulation indicates inflows into proposed dams to be highly seasonal with periods of very low flow between June to September. Periods of low flow determine the yield of the dam and not the mean annual runoff since the dams are expected to provide irrigation water even during the low-flow periods.

Analysis indicates a Mean Annual (adjusted) Runoff into the proposed dam of **5.2 Mm^3/annum**. The irrigation requirement of perennial pastures is estimated to be approximately 570 mm. The average annual dam yield to irrigate an area 155 ha of pastures was calculated at **860 500 m^3**. The dam simulation accounts for 90 mm per month (190 ha) released during summer, which would contribute to the irrigation of undefined vegetable crops below the dam. These water demands are met by the proposed dam with an Assurance of Supply of 70% (the dam remains more than 75% full and there are no curtailments of supply to meet demands for at least 70% of the time). There is more than enough water available in the river and from the proposed storage dam to justify granting the proposed licence. The dam design, together with dam operation and maintenance plans will still need to also be approved in terms of dam safety legislation.

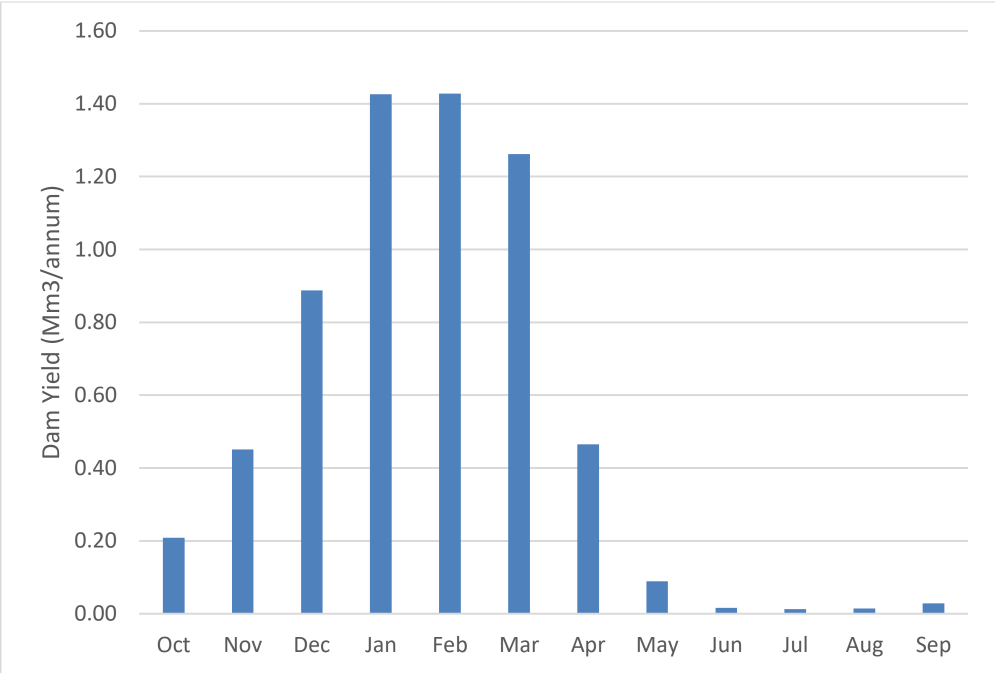

Figure 6-3: Mean Annual (Adjusted) Runoff Into The Proposed Dam

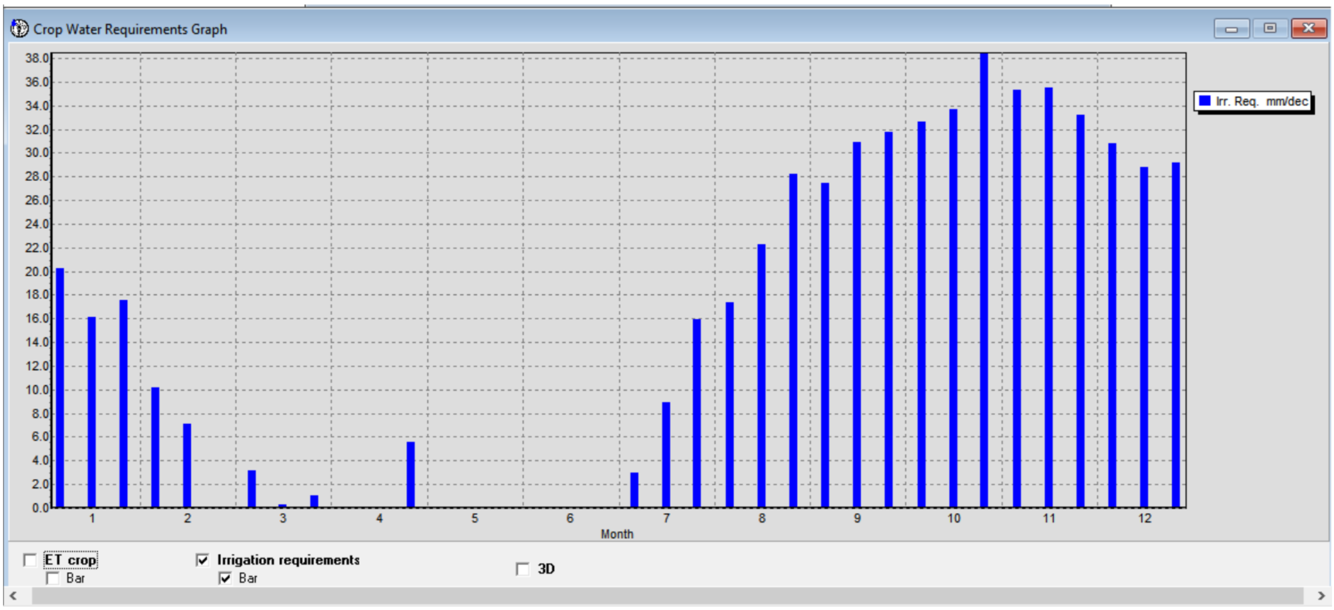

Figure 6-4: Monthly Irrigation Requirement of Perennial Pastures

7 Floodline Delineation

The 1:10-year Floodline on the selected River sections were analysed to evaluate the risks associated with the potential flooding in the study area for preservation of agricultural resources, for the protection of water resources and the protection of infrastructure. The selected streams include the two Un-named tributaries of the Khamanzi River and a Section on the Khamanzi River which traverse irrigated fields within the study area (Figure 7-1).

7.1 Design rainfall depths

Design rainfall depths for the 1:2-year to 1:100-year return periods were calculated using the Design Rainfall Software for South Africa (Smithers and Schulze, 2000). The rainfall station that was used is Banavei with SAWS number 0238022_W, which is situated approximately 5 km from the centroid of the study area. The rainfll depths for the selected rainstation are presented in Table 7-1. The rainfall depths with durations equal to the time of concentration (Tc) of assessed catchments were used to calculate peakflows using the RM3 method. The recalibrated modified Hershfield equation was used to determine precipitation depths used in the SDF method (Alexander, 2002).

Table 7-1: 24-Hour Design Rainfall for the Study Area

	Return Period					
Duration	**2year**	**5year**	**10year**	**20year**	**50year**	**100year**
5 m	12	16.2	19.3	22.4	26.9	30.6
10 m	16.1	21.8	25.9	30.2	36.2	41.1
15 m	19.1	25.9	30.8	35.8	43	48.8
30 m	24.2	32.6	38.8	45.3	54.3	61.6
45 m	27.7	37.4	44.5	51.9	62.2	70.6
1 h	30.5	41.2	49	57.1	68.5	77.8
1.5 h	35	47.2	56.2	65.5	78.5	89.2
2 h	38.5	52	61.9	72.1	86.5	98.2
4 h	44.8	60.5	72	83.9	100.6	114.2
6 h	48.9	66.1	78.6	91.6	109.9	124.7
8 h	52.1	70.3	83.7	97.5	117	132.8
10 h	54.7	73.8	87.8	102.4	122.8	139.4
12 h	56.9	76.8	91.4	106.5	127.8	145
16 h	60.6	81.8	97.3	113.4	136	154.4
20 h	63.6	85.9	102.1	119	142.8	162.1
24 h	66.1	89.3	106.3	123.9	148.6	168.7

7.2 Peak Flows

The runoff contributing subcatchments were delineated for the streams in proximity to the study area (Figure 7-1). The peak flows for the 50 and 100 year return periods for subcatchment 1 were included for comparison of the different methods in peak flow estimates (Table 7-3). Peak flows calculated using the SDF and MIPI methods are of the same order of magnitude. The 1:10 year MIPI peak flow was used in HEC-RAS for hydraulic modelling as a more conservative estimate. Catchment characteristics and calculated peak flows are presented in Table 7-2, while Table 7-4 presents the peak flows in the delineated subcatchments.

Table 7-2: Characteristics of the Delineated Subcatchments

Subcatchment	Area	Longest Watercourse (L)	Distance to Centroid (Lc)	Elevation (mamsl)		Slope
	km²	*km*	*km*	*10%L*	*85%L*	*(m/m)*
1	26	7.7	4.36	1493	1639	0.0253
2	10.4	4.96	2.35	1544	1663	0.0320
3	1.1	1.89	0.99	1547	1727	0.1270
4	14.0	5.47	3.08	1539	1661	0.0297
5	3.3	3.52	1.58	1542	1632	0.0341

Table 7-3: Peak Flows of Delineated Sub-catchment using the RM3, SDF & MIPI Methods

Subcatchment	Method								
	RM3			SDF			MIPI		
	1:10yr	1:50yr	1:100yr	1:10yr	1:50yr	1:100yr	1:10yr	1:50yr	1:100yr
	(m³/s)								
1	81	157	215	93	198	251	**98**	185	233

Table 7-4: Peak Flows of Delineated Sub-catchments using the MIPI Method

Subcatchment	Peak Flow		
	m³/s		
	1:10yr	1:50yr	1:100yr
1	**98**	185	233
2	**56**	106	134
3	**15**	28	35
4	**68**	127	160
5	**28**	53	67

7.3 Inundation Results

The selected Rivers in proximity to the study area were modelled for the 1:10-year Floodline in Hec-RAS and the inundation boundary was extracted and overlaid with the proposed irrigation areas (Figure 7-2). In accordance with Clause 3(b) of the CARA (43 of 93) '*Except on authority of a written permission by the executive officer, no land user shall cultivate any land on his farm unit within the flood area of a watercourse or within 10 m horizontally outside the flood area of a wartercourse'*.

The 1:10-year Floodline and the 10 m buffer from the flood area is presented in Figure 7-2. It is recommended that no cultivation takes place within this delineated area to ensure compliance with the relevant regulations.

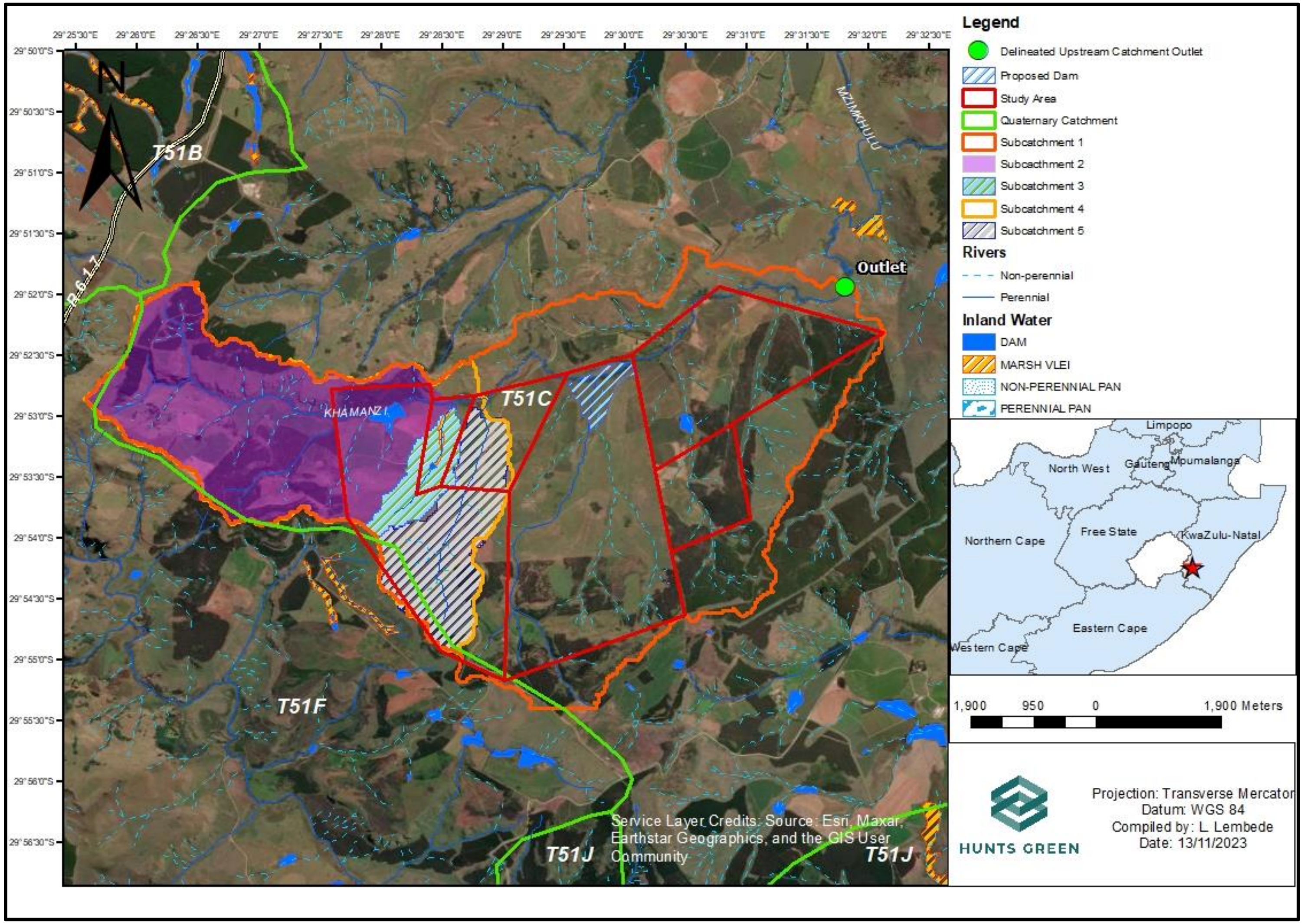

Figure 7-1: Delineated Subcatchments for the Modelled Rivers for the Floodline Delineation Assessment

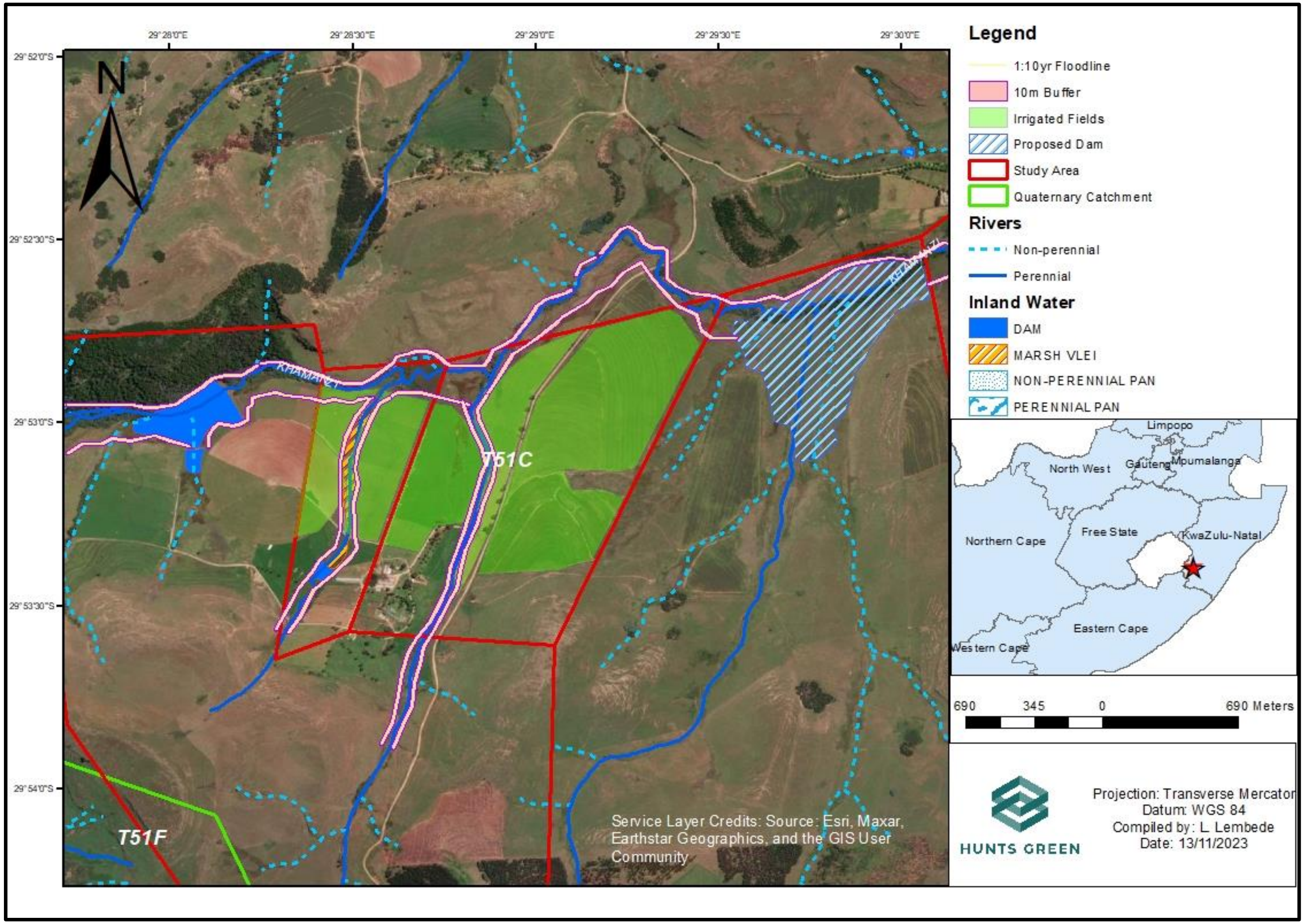

Figure 7-2: Representation of the 1:10-year Flood Inundation Extent and 10m Buffer for Modelled Rivers

8 Stormwater Management Plan of Slurry Dams

Slurry dams facilitate separation of the solid and liquid fraction of slurry through settling, which normally significantly improves water quality with each dam stage – if the dams are constructed correctly and are functioning as they should (Viljoen, 2019).

The slurry originates from the dairy farm and consists of a mixture of wash water, dung and urine. The slurry is conveyed from the dairy area to the slurry dams by a trench and a pipe that is mostly underground (see Figure 8-1). The inputs from the dairy area into the slurry ponds is estimated as 20-25 m^3 per day.

The slurry ponds are made up of clay filled earth dams, with an estimated storage capacity of approximately 3700 to 4000 m^3. The wastewater from the slurry ponds is used to irrigate pastures through the center pivot and/or tractor drawn slurry spreader. Historically, there have been very rare incidences of spillages from the sluddy ponds where extreme thuderstorms have filled the dams quicker than can be pumped.

The stormwater management in the farm is adequate and potential pollution of nearby watercourses will be negligible. Any spillages that occur would be limited to overland flow, with minimal contribution to the Rivers, which are situated approximately 300 to 400 m away from the ponds (see Figure 8-3). Additionally, the adjacent soils are deep, well-drained hutton soils, where most of the nutrient-rich overland flows from the slurry dams would infiltrate into the soils. No significant impacts to the environment or downstream users are initicapated in the event of spillages or from the existing stormwater management practices within the the Dartford Farm.

It is recommended that the trench and pipe used to convey the slurry are always kept clear and free of litter and substances that may cause blockages and potentially reduce the effectiveness of the conveyance of slurry.It was noted that the trench is grassed, it is also recommended that the grass cover is always maintained to prevent erosion and sedimentation build up in the slurry dams. Additionally, depending on the needs of the farmer, the shed area in the dairy farm may be fitted with gutters and downpipes (see highlighted area in Figure 8-1) for rainwater harvesting in a storage tank to increase water availability for on site use. It is further recommended that if there is an expansion of the herd size in future, which would increase inputs into the slurry dams and spillages occur more frequently, the storage capacity should be evaluated to ensure that the impacts of excess nutrient rich water remains minimal, with no significant impacts to the environment and downstream water users. To ensure compliance with the National Water Act (36 of 1998) for disposal of waste by irrigation, no irrigation should take place within 100 m of a watercourse.

Figure 8-1: Trenches Conveying Sludge from Dairy Area to the Slurry Dams

Figure 8-2: Sludge Dams with Solids and Liquids

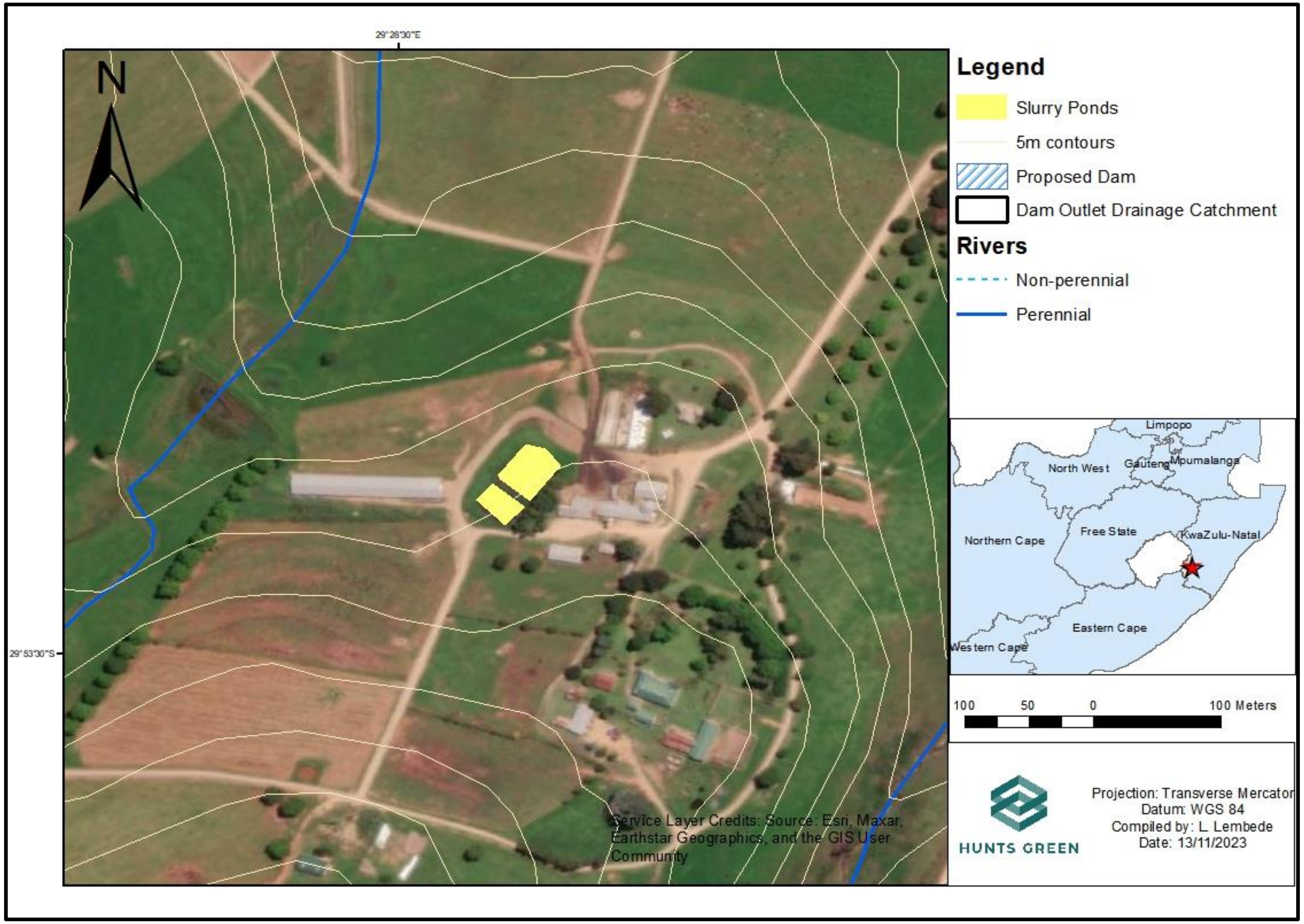

Figure 8-3: Layout Plan of the Slurry Ponds

9 Conclusions and Recommendations

Emanzini WULA Consultants commissioned Hunts Green (Pty) Ltd to undertake a hydrology assessment to supplement a Water Use Licence Application for the proposed construction of a farm dam to be used for the abstraction of surface water for the Dartford Farming Trust in Underberg, KwaZulu-Natal.

Analysis indicates a historical MAR of **5.2 Mm^3/annum** into the proposed farm dam. The irrigation requirement of perennial pastures is estimated to be approximately 570 mm. Irrigation supply for pastures, abstracted from the dam is approximately **860 500 m^3/annum**. Allowance is made to release 90 mm per month (190 ha) during the summer months, which would contribute towards irrigation of vegetables on downstream properties. These demands are met with a 70% Assurance of Supply.

For the flood delineation, the HEC-RAS model was used to simulate the 1:10 year flood event according to the Conservation of Agricultural Resources Act (CARA 43 of 93), which states in Clause 3 (b) '*Except on authority of a written permission by the executive officer, no land user shall cultivate any land on his farm unit within the flood area of a watercourse or within 10 m horizontally outside the flood area of a wartercourse*'. The 1:10-year floodline and the 10 m buffer from the flood area were mapped (Figure 7-2). It is recommended that no cultivation takes place within this delineated area to ensure compliance with the relevant regulations.

The stormwater management within the slurry dams of the Dartford farm was undertaken. The stormwater management in the farm is adequate and there are no concerns with polluting of nearby watercourses. Any spillages that occur would be limited to overland flow, with minimal contribution to the Rivers, which are situated approximately 300 to 400 m away from the ponds. Additionally, the adjacent soils are deep, well draining hutton soils, which would infiltrate most of the nutrient-rich overland flows from the slurry dams. No significant impacts to the environment or downstream users are initicapated in the event of spillages or from the existing stormwater management practices within the the Dartford Farm.

It is recommended that the trench and pipe used to convey the slurry are always kept clear and free of litter and substances that may cause blockages and potentially reduce the effectiveness of the conveyance of slurry. It was noted that the trench is grassed, it is also recommended that the grass cover is always maintained to prevent erosion and sedimentation build up in the slurry dams. Additionally, depending on the needs of the farmer, the shed area in the dairy farm may be fitted with gutters and downpipes for rainwater harvesting in a storage tank to increase water availability for on site use. It is further recommended that if there is an expansion of the herd size in future, which would increase inputs into the slurry dams and spillages occur more frequently, the storage capacity should be evaluated to ensure that the impacts of excess nutrient rich water remains minimal, with no significant impacts to the environment and downstream water users. To ensure compliance with the National Water Act (36 of 1998) for disposal of waste by irrigation, no irrigation should take place within 100 m of a watercourse.

10 Detailes of Specialist

This Specialist Report has been compiled by the following specialists:

Table 10-1: Details of the Specialist(s) who prepared this Report

Responsibility	Report Writing
Full Name of Specialist	Lungile Lembede
Highest Qualification	MSc Hydrology
Proffessional Accreditation	Pr. Sci. Nat. No. 125677
Years of experience in specialist field	>7

10.1 Declaration of the Specialist

I, **Lungile Lembede**, as the appointed specialists hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent:
- other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or
- am not independent, but another specialist that meets the general requirements set out in Regulation 13 have been appointed to review my work (Note: a declaration by the review specialist must be submitted);
- in terms of the remainder of the general requirements for a specialist, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the applicant, the Department and interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application;
- have ensured/will ensure that information containing all relevant facts in respect of the application was/will be distributed or was/will be made available to interested and affected parties and the public and that participation by interested and affected parties

was/will be facilitated in such a manner that all interested and affected parties were/will be provided with a reasonable opportunity to participate and to provide comments;

- have ensured/will ensure that the comments of all interested and affected parties were/will be considered, recorded and submitted to the Department in respect of the application;
- have ensured/will ensure the inclusion of inputs and recommendations from the specialist reports in respect of the application, where relevant;
- have kept/will keep a register of all interested and affected parties that participate/d in the public participation process; and
- I am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.

Signature of the specialist

Lungile Lembede

Full Name and Surname of the specialist

Hunts Green Consulting

Name of company

January 2024

Date

11 References

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