NAAZ QUARRY

BASELINE HYDROLOGICAL AND IMPACT ASSESSMENT SPECIALST STUDY

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REVISION 00

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SYNOPSIS

Specialist baseline hydrological study and impact assessment required as part of the Water Use Licence Application.

KEY WORDS:

Naaz Quarry, National Water Act 36 of 1998, Baseline Hydrological Study and Impact Assessment

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO 9001: 2015 which has been independently certified by DEKRA Certification.

Quality Management ISO 9001 DEKRA Certified

Verification	Capacity	Name	Signature	Date
By Author	Hydrologist	Jédine Govender	Jédine	30/03/2021
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NAAZ QUARRY BASELINE HYDROLOGICAL AND IMPACT ASSESSMENT SPECIALST STUDY

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1 INTRODUCTION

JG Afrika (Pty) Ltd were appointed by Greenmined Environmental Consulting (Pty) Ltd to undertake a series of hydrological specialist studies for the proposed Naaz Quarry located near Pietermaritzburg in KwaZulu-Natal. The proposed quarry site falls within Portion 0 (Remaining Extent) of the farm Thandisizwe No. 16691 in the uMshwathi Local Municipality. The hydrological specialist studies are required as part of a Water Use Licence Application (WULA) for the quarry, based on the requirements of the National Water Act (Act 36 of 1998), and include a baseline hydrological and impact assessment and a stormwater management plan. This report constitutes the Baseline Hydrological and Impact Assessment Study.

The objectives of this baseline hydrological study are to:

- Describe the climatic, hydrological, landuse and topographical conditions of the study area by defining the general catchment conditions of the study site.
- Identify and delineate stream and river channels and their associated catchment areas in the vicinity of the quarry.
- Determine the Mean Annual Runoff (MAR) for the project area and any contributing catchments in the vicinity of the quarry site.
- Undertake an impact assessment of the quarry, focusing on the potential risks associated with the quarry related specifically to local and regional hydrology. Using the impact assessment, mitigation measures have been provided to reduce the risks associated with the identified potential impacts.

1.1 Declaration of Independence

It should be noted that JG Afrika have been appointed to conduct an independent baseline and hydrological impact assessment for the proposed Naaz Quarry. JG Afrika have undertaken this study in an objective manner, even if this results in views and findings that are not favourable to the Applicant or Client. JG Afrika have the expertise required to undertake the necessary studies and the resultant report presents the results in an objective manner. The main author of the report, Ms Jédine Govender is a qualified Hydrologist at JG Afrika with an MSc. in Hydrology. Ms Govender has undertaken this study under the guidance of Mr. Phillip Hull, who is an Associate and Senior Hydrologist at JG Afrika, has an MSc. in Hydrology, is professionally registered and has 14 years of relevant project experience.

2 SITE DESCRIPTION

2.1 Locality

The location of the proposed Naaz Quarry is presented in **Figure 2-1**. As depicted in this map, the study area is located approximately 10 km north east from the Pietermaritzburg city centre, within Portion 0 (Remaining Extent) of the farm Thandisizwe No. 16691 in the uMshwathi Local Municipality in KwaZulu-Natal. A site plan, of the proposed quarry is provided in **Figure 2-2**. As depicted in **Figure 2-2**, a small drainage line is located along the eastern boundary of the quarry site. This drainage line is a tributary of an unnamed non-perennial stream, which flows to the uMngeni River, located approximately 9.3 km downstream of the project site.

Hydrologically, the study area is located in the Mvoti to Umzimkhulu Water Management Area (WMA No. 11), in the U20G quaternary catchment. The study catchment Mean Annual Precipitation (MAP) is 895 mm and the Mean Annual Evaporation (MAE) is 1 200 mm. The land uses within the study catchment were identified using Google Earth aerial imagery and classed according to the South African National Landcover Database (NLC, 2018) which predominantly consisted of commercial agriculture (sugarcane) and to a lesser degree, grasslands.

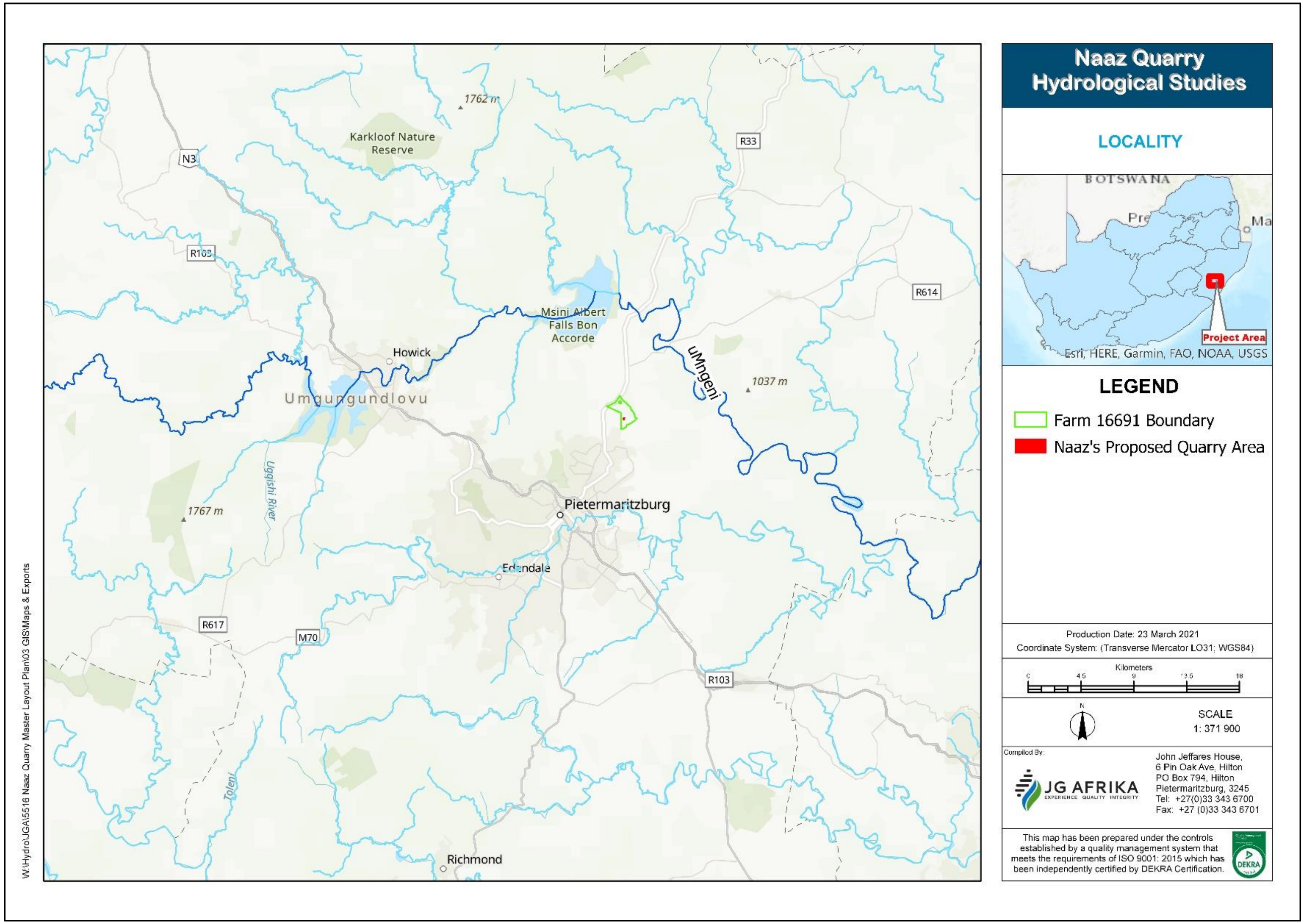

Figure 2-1 Naaz Quarry Locality Map

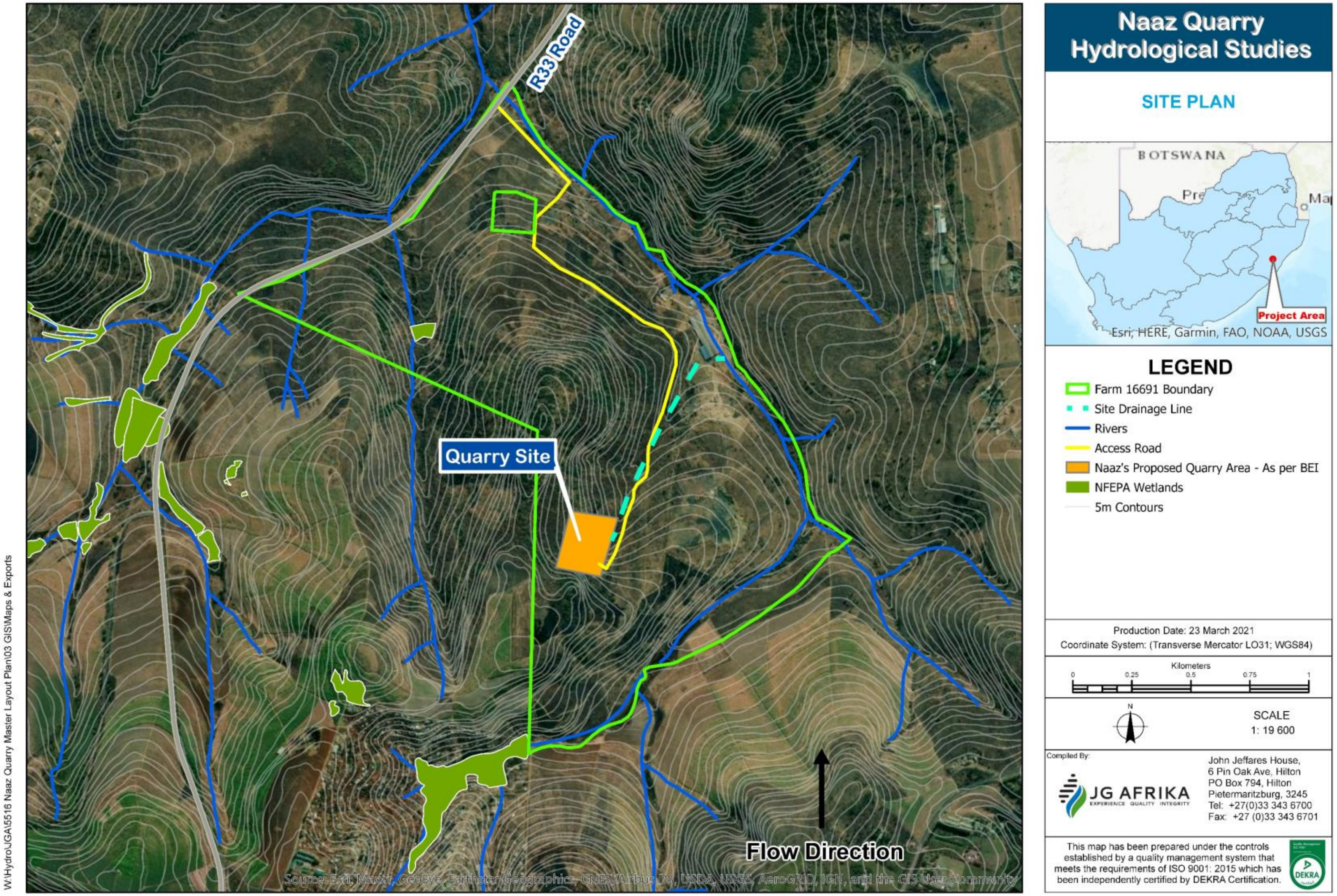

Figure 2-2 Naaz Quarry Site Plan

2.2 Proposed Naaz Quarry Mining Operations Description

The proposed Naaz Quarry operations will involve mining dolerite from one opencast pit on Portion 0 (Remaining Extent) of the farm Thandisizwe No 16691, using conventional drilling and blasting methods. The material will be removed by means of tipper trucks and relocated to a crushing plant to be screened to various sized stockpiles. The aggregate will be stockpiled until it is transported from the site. All mining related activities will be contained within the approved mining permit boundaries.

The proposed mining of dolerite will comprise of activities that can be categorised into three phases according to the Final Basic Assessment Report (2021):

1. Construction Phase – which will include demarcating the permitted mining area, vegetation removal, topsoil stripping and stockpiling, as well as the introduction of mining machinery and equipment onto site.
2. Operational Phase – which will involve the mining of dolerite from the permitted area using open cast mining methods. This will include blasting in order to loosen the hard rock. Thereafter, loosened material will be transported to the crushing and screening processing plant where it will be screened to various sized stockpiles before it is sold and transported from site to clients.
3. Decommissioning Phase – which includes the rehabilitation of the affected environment prior to the submission of a closure application to the Department of Mineral Resources and Energy (DMRE).

2.3 Climate Description

The Naaz Quarry lies within a subtropical climatic region (Weiseer and Muller, 1983). Rainfall occurs throughout the year and the climate category can be described as humid and warm to hot during the summer months and cool and dry during the winter months.

Temperature data for the project area was obtained from the South African Weather Services (SAWS) meteorological station 0239812 A, as presented in **Table 2-1**. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures range from 12.4°C in June to 21.2°C in January. The region is the coldest during June when the mercury drops to 5.1°C on average during the night.

Table 2-1 Temperature Recorded for Years 1950 – 2000 at SAWS 0239812 A

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. Temperature (°C)	21.2	19.4	20.4	17.5	15.4	12.4	13.2	14.7	16.2	17.5	18.1	20.3
Min. Temperature (°C)	16.0	14.7	15.0	11.6	8.6	5.1	5.5	7.3	9.8	11.5	12.8	14.8
Max. Temperature (°C)	26.4	24.1	25.8	23.5	22.2	19.8	20.9	22.2	22.6	23.5	23.4	25.8

2.3.1 Rainfall and Evaporation

Rainfall data for the project area was obtained from the SAWS rainfall station 0239812 A. This rainfall station is located approximately 3.3 km south east from the project site and was selected based on its record period and the reliability of the historical rainfall data. The details of this rainfall station are presented in **Table 2-2**. The mean monthly rainfall amounts over the period 1950 to 2000 are presented in **Table 2-3**. From **Table 2-3**, it is evident that most of the rainfall falls over the summer period (October to March). It is also noted that low rainfall values are recorded over the winter months (April to September).

Table 2-2 Rainfall Station Details

Station Number	Station Name	MAP (mm)	Years Assessed	Reliability (%)	Longitude	Latitude
0239812 A	Bloemendal	885	1950 - 2000	67	30^0 28’	29^0 31’59"

Table 2-3 Average Rainfall Depths Recorded for Years 1950 – 2000 at Rainfall Station 0239812 A

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	MAP
Rainfall Depth (mm)	145.7	121.7	100.8	53.4	26.9	13.0	17.9	30.0	55.5	88.6	104.8	127.1	885

There is a high degree of variation in the annual rainfall in the data obtained from rainfall station 0239812 A. The lowest recorded annual rainfall value over the assessed period is 460.6 mm, recorded in the year 1992. **Table 2-4,** which presents the 10 wettest years over the 1950 to 2000 period, indicates the wettest recorded year over this period was 1 447.6 m in 1987.

Table 2-4 Ten Wettest Years Recorded for Period 1950 – 2000

Ranking	Year	MAP (mm)
1	1987	1 447.6
2	1976	1 155.6
3	1985	1 149.8
4	1957	1 083.3

Ranking	Year	MAP (mm)
5	1959	1 062.2
6	1991	1 057.7
7	1990	1 046.3
8	1978	1 030.0
9	1956	1 027.8
10	1996	1 022.9

While rainfall is generally variable on a month-to-month basis, this is not the case with evaporation. Evaporative demands do not vary significantly from one year to next (i.e. evaporation in one October-month, for example, is similar to evaporation in the next October-month). Therefore, it is generally considered to be acceptable to apply 12 average monthly evaporation values over the year. The evaporation data used for the Naaz Quarry was obtained from Evaporation Zone 30B (Middleton and Bailey, 2008). Catchment evapo-transpiration is calculated by applying 12 monthly evapo-transpiration conversion factors, as presented in **Table 2-5**. Similarly, evaporation losses from an exposed water body are calculated by applying 12 monthly lake evaporation conversion factors, as presented in **Table 2-5**. The annual potential evaporation rate for the area is 1 200 mm (WR, 2012). From **Table 2-5**, the highest evaporation rates occur during the hotter summer months of October to March.

Table 2-5 Naaz Quarry Potential Evaporation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Evaporation Rate (mm)	145	124	120	87	70	57	62	74	90	107	124	140	1 200
Lake Evaporation Factor	0.84	0.88	0.88	0.87	0.85	0.83	0.81	0.81	0.81	0.81	0.82	0.83	
Evapotranspiration Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.80	0.80	0.80	1.00	1.00	

2.3.2 Design Rainfall

The 24-hour design rainfall depths (point rainfall) for the 1:2, 1:10, 1:20, 1:50, 1:100 and 1:200 year recurrence intervals were extracted using the Design Rainfall Estimation Utility (Smithers and Schulze, 2003) and are shown in **Table 2-6**, below.

Table 2-6 24-hour Design Rainfall Depths

Duration (hr)	Rainfall Depth (mm)						
	1:2	**1:5**	**1:10**	**1:20**	**1:50**	**1:100**	**1:200**
24	62.9	91.5	115.5	143.2	187.3	227.6	275.4

2.4 Hydrology

As presented in **Figure 2-3**, the project site is located in the uMngeni River Catchment within the Quaternary Catchment U20G of the Umvoti to Umzimkhulu Water Management Area (WMA No. 11). Based on Department of Water and Sanitation (DWS) river coverages and 5 m contours, a drainage line (unnamed drainage line) alongside the eastern boundary of the proposed quarry drains into an unnamed tributary and eventually into the uMngeni River (*cf*. **Figure 2-3**). The uMngeni River is located approximately 9.3 km downstream of the project site.

The catchment area of the unnamed drainage line and its tributaries, within the vicinity of Portion 0 (Remaining Extent) of the farm Thandisizwe No. 16691 and the proposed Naaz Quarry, is approximately 16.74 km^2, as depicted in **Figure 2-3**. For the purposes of this study, this is considered the local catchment area. Quaternary Catchment U20G (considered as the regional catchment for the purposes of this study), within which the quarry is located, has a catchment area of 498 km^2 and a Mean Annual Runoff (MAR) of 49.68 million cubic meters (MCM). Details of the Quaternary Catchment U20G, including its associated MAR volume and MAR depth are provided in **Table 2-7** (WR, 2012).

Table 2-7 Quaternary Catchment Details

Quaternary Catchment	Catchment Area (km^2)	Evaporation Zone	Rain Zone	Water Management Area	MAR (MCM)	MAR Depth (mm)
U20G	498	30B	U2C	11	49.68	99.8

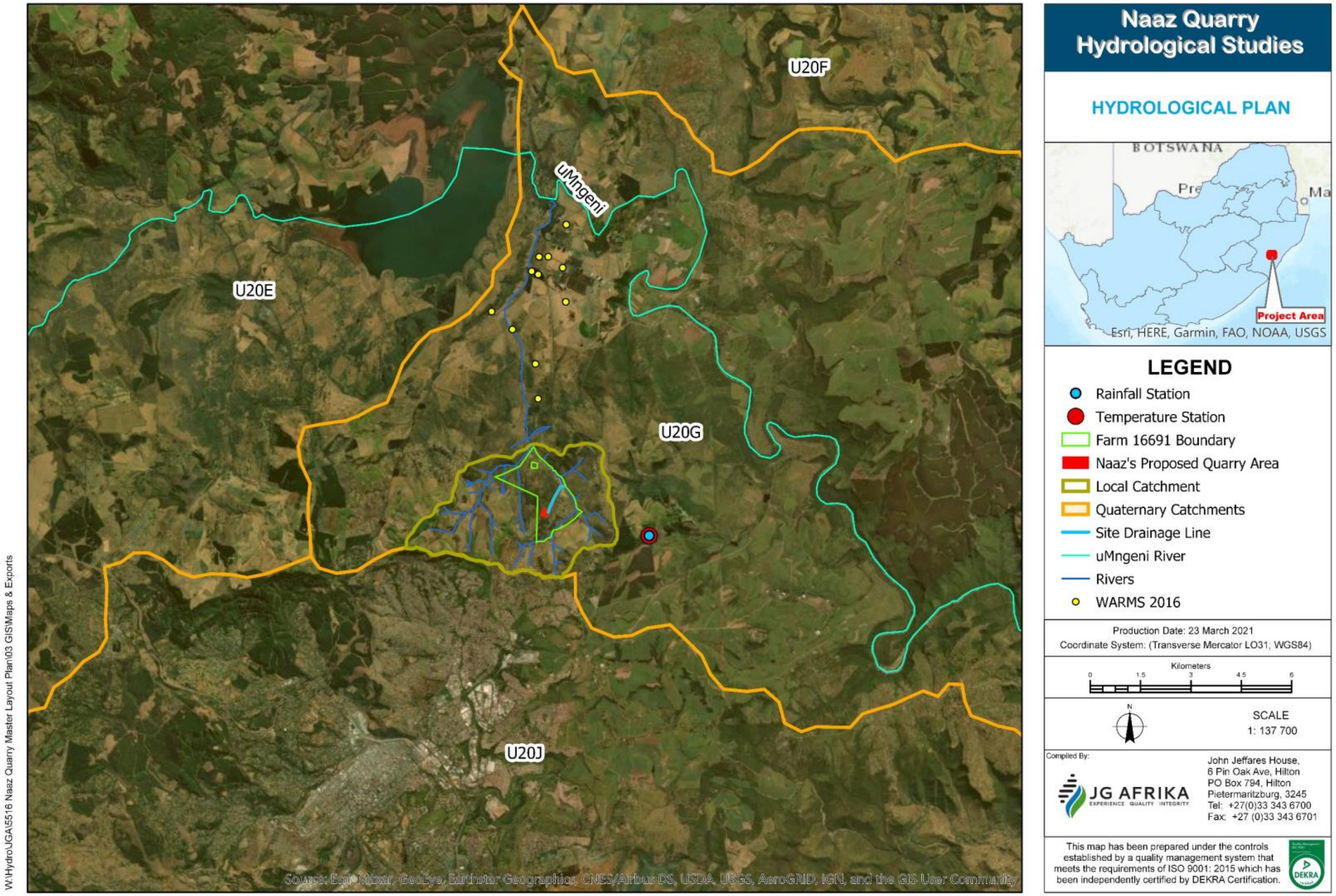

Figure 2-3 Hydrological Plan of the Naaz Quarry Site

3 HYDROLOGICAL IMPACT ASSESSMENT

3.1 Risk Assessment Methodology

In order to be compliant with statutory requirements, a hydrological impact assessment was undertaken as per the DWS Risk Assessment Matrix (2016).

The risk rating matrix methodology used is based on the following quantitative measures:

- The severity of each impact.
- The spatial extent or geographic sense of each impact occurring.
- Duration of occurrence.
- The frequency of each activity.
- The frequency of each impact.
- Legal issues of the activity.
- Detection of the impact.

In order to determine the significance of each identified potential impact, a numerical value has been linked to the respective factor. **Table 3-1** provides the ranking scales used in this assessment.

Table 3-1 Risk Rating Matrix

RISK ASSESSMENT KEY (Referenced from DWA RISK-BASED WATER USE AUTHORISATION APPROACH AND DELEGATION GUIDELINES)	
RATINGS	
SEVERITY	
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
SPATIAL SCALE	
Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5
DURATION	
One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4

RISK ASSESSMENT KEY (Referenced from DWA RISK-BASED WATER USE AUTHORISATION APPROACH AND DELEGATION GUIDELINES)	
RATINGS	
More than life of the organisation/facility, PES and EIS scores, a E or F	5
FREQUENCY OF THE ACTIVITY	
Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5
FREQUENCY OF THE INCIDENT/IMPACT	
Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5
LEGAL ISSUES	
No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
DETECTION	
Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Based on the ranking scales presented in **Table 3-1**, the significance of each impact is calculated using the following formula:

Significant Value = (Severity + Spatial Scale + Duration) x (Frequency of Activity + Frequency of Incident +Legal Issues + Detection).

The risk significance rating has been subdivided into three categories, as presented in **Table 3-2**. This ranking system is based on the DWS risk assessment requirements and has therefore been used to determine risk significances in this study.

Table 3-2 Risk Assessment Significance Value

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	(M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

3.2 Impact Assessment

The following potential hydrological impacts were identified to be associated with the Naaz Quarry and, therefore, included as part of this impact assessment:

- Changes in catchment water resources;
- Changes in catchment water quality; and
- Changes in catchment flood hydrology.

Table 3-3 presents the results of the significance ratings attributed to each of the identified potential impacts for both the pre- and post-mitigation scenarios.

Table 3-3 Significance Ratings of Identified Potential Impacts

Nature of Impact	Severity	Spatial Scale	Duration	Frequency of Activity	Frequency of Incident	Legal Issues	Detection	Significance Score	Significance / Mitigation Measure
Pre-Mitigation									
Changes in Catchment Water Resources due to:									
An increase in impervious areas	1	2	4	1	3	1	1	**42**	**Low**, due to the insignificant size of the quarry compared to the local and regional catchment areas.
Abstractions	1	2	4	1	1	1	1	**28**	**Low**, water will be bought and transported to the mining area by trucks and stored in tanks until used. The main use of this water will be for dust suppression.
Limiting Flow (Capturing of contaminated stormwater)	1	2	4	2	2	1	1	**42**	**Low**, volume of water to be captured is insignificant compared to local and regional runoff volumes.

Nature of Impact	Severity	Spatial Scale	Duration	Frequency of Activity	Frequency of Incident	Legal Issues	Detection	Significance Score	Significance / Mitigation Measure
Reduction in Catchment Water Quality due to:									
Erosion from disturbed open ground	3	2	3	2	4	5	2	**104**	**Moderate**, due to the likelihood of erosion (numerous open areas), and potential impact of sediment on downstream eco-systems.
Discharging waste or contaminated water (Hydrocarbon spills, pit dewatering and sewage spills)	4	2	4	5	4	5	2	**160**	**Moderate**, reducing water quality for downstream users/eco-systems is associated with a high risk. However, the degree to which the downstream water quality can be changed, considering the quarry activities, is moderate.
Changes in Flood Hydrology due to:									
An increase in impervious areas	2	2	4	4	3	5	2	**112**	**Moderate**, it is likely that there will be an increase in stormwater runoff which is associated with a high risk. However, the degree to which the downstream water quantity can be changed, considering the quarry site size, is considered moderate.
Altering the bed, banks, course or characteristics of a water course	3	2	4	5	3	5	3	**144**	**Moderate**, mainly due to the proximity of the quarry to the unnamed drainage line along its eastern boundary.
Post-Mitigation									
Changes in Catchment Water Resources due to:									
An increase in impervious areas	1	2	4	1	3	1	1	**42**	**Low** – no mitigation measures required (refer to **Section 3.2.1**)
Abstractions	1	1	1	1	1	5	1	**24**	**Low** – no mitigation measures (refer to **Section 3.2.1**)
Limiting Flow (Capturing of Contaminated Stormwater)	1	1	4	1	1	5	1	**48**	**Low** – no mitigation measures required (refer to **Section 3.2.1**)
Reduction in Catchment Water Quality due to:									
Erosion from disturbed open ground areas	1	1	3	1	2	5	1	**45**	**Low** - implement erosion control measures proposed in **Section 3.2.2**
Discharging Waste or contaminated water into a water resource through a sewer or other conduit (pit dewatering and sewer waste)	1	1	4	1	1	5	1	**48**	**Low** – implement mitigation measures as outlined in **Section 3.2.2**.
Changes in Flood Hydrology due to:									
An increase in impervious areas	1	1	4	1	1	5	1	**48**	**Low** – Develop a stormwater management plan for the site (i.e. stormwater to be attenuated in the stormwater pond or dam), as outlined in **Section 3.2.3**.
Altering the bed, banks, course or characteristics of a water course (quarry within 100m of watercourse)	1	1	4	1	1	5	1	**48**	**Low** – implement mitigation measures as outlined in **Section 3.2.3**.

3.2.1 Changes in Catchment Water Resources

A hydrological analysis of the local (unnamed drainage line adjacent to the quarry and tributaries within the vicinity of the quarry) and regional (U20G quaternary catchment) catchments hydrology was undertaken to determine the potential impact of the quarry on the local and regional hydrology. The hydrological analysis consisted of assessing catchment Mean Annual Evaporation (MAE), MAP and MAR, based on results obtained from the Water Resources of South Africa Study (WR2012) undertaken in 2012. Furthermore, an analysis of the licensed water abstractions downstream of the quarry, within the U20G Quaternary Catchment was undertaken using the 2016 DWS Water Authorisation and Registration Management System (WARMS) database. The database indicated that there are number of licenced water users located downstream of the study area, between the quarry and the uMngeni River. These licenced abstractions mostly include water users for irrigation and domestic purposes, as presented in **Figure 2-3** and indicated in **Table 3-4**.

Table 3-4 Water Users Downstream of the Naaz Quarry Site

Registration Water Use	Property	Property (Ha)	Volume m3/year	Sector	QUAT	Source
21079379/1	Zeekoegat	295	1500	Schedule 1	U20G	Tributary of Umgeni River
21028102/3	Shallow Drift	125	10000	Clean Water Dam	U20G	Tributary of Mgeni River/Shallow Drift No. 15565 Ptn 28
21028111/1	Shallow Drift	129	193440	Livestock	U20G	Umgeni River
21132604/3	Zeekoegat	162	168000	Clean Water Dam	U20G	Tributary Of Mgeni River/Zeekoegat No 1173 Ptn 18 : Dam 01
21133729/3	Retief	62	2500	Clean Water Dam	U30B	Tributary of Mgeni River/Retief Dam
21154340/1	Zeekoegat	95	87500	Irrigation	U20G	Tributary of Mgeni River
21185637/1	Zeekoegat	81	500	Schedule 1	U20G	Tributary of Mgeni River
21130848/1	Shallow Drift	21	12000	Irrigation	U20G	Mgeni River
21184825/1	Shallow Drift	45	128000	Irrigation	U20G	Tributary of Umgeni River
21184825/3	Shallow Drift	45	170000	Clean Water Dam	U20G	Tributary of Mgeni River/Shallow Drift Dam
21144110/1	Shallow Drift	2	650	Irrigation	U20G	Tributary of Mgeni River

Details of the local catchment (Unnamed drainage line and surrounding tributaries of the uMngeni River within the vicinity of the proposed quarry) and regional catchment (Quaternary Catchment U20G) hydrology are presented in **Table 3-5**. Based on the respective catchment areas and information provided in the WR2012 study, the MAR of the local catchment (i.e. which includes the unnamed drainage line catchment area), in the vicinity of the quarry equates to 1.67 MCM (million cubic meters), and the MAR of the regional catchment (U20G) equates to 49.68 MCM. This is based on an average runoff depth of 99.8 mm/annum for the respective catchments. In order to determine the anticipated impact of the quarry on the catchment water resources (volume of water), the catchment area of the overall quarry site was compared to the local and regional catchment areas. Based on this, quarry site, with an area of approximately 0.05 km^2, comprises approximately 0.30 % of the local catchment area and approximately 0.010 % of the regional quaternary catchment area (V12G). The resulting impact on local and regional catchment resources is 0.30 % and 0.010 %, respectively. Based on this, the anticipated impact of the quarry on the local and regional catchment water resources (from a water volume perspective), as a result of an increase in impervious areas or limiting flow in the downstream channels (capturing of contaminated stormwater), will be negligible.

Table 3-5 Comparison of Regional to Local Catchment Hydrology

	Local Catchment	**U20G Quaternary Catchment**
Catchment Area (km^2)	16.74	498
MAR (MCM/annum)	1.67	49.68
Average Quaternary Runoff Depth (mm/annum)	99.76	
Catchment Area of Naaz Quarry (km^2)	0.05	
Percentage of Quaternary Catchment Affected by the Proposed Naaz Quarry	0.30	0.010
Flow Volume Traversing the Quarry Site (m^3/annum) Based on Affected Local Catchment Areas	4 987.95	
Average Daily Flow Rate Traversing the Quarry Site (m^3/s), Based on Annual Flow Volumes	**0.000158**	

It is JG Afrika's understanding that any water required for the implementation of the project will be bought and transported to site where it will be stored in tanks until used. Currently, no washing of material is proposed, and water will be mainly used for dust suppression. As a result, no water is currently planned to be abstracted from the local drainage lines for the purposes of augmenting water supply to the quarry. For this reason, the impact of extracting water from a drainage line and therefore reducing catchment water resources is expected to be negligible. If there is a requirement to source water from any of the drainage lines in the vicinity of the quarry in the future, it is recommended that a detailed water resources and reserve determination (determining the environmental water requirement) is undertaken to ensure a sustainable volume of water is abstracted. This will reduce the potential risk associated with negatively impacting upon the environment through abstractions.

3.2.2 Reduction in Catchment Water Quality

As presented in **Section 3.2.1**, there are a number of licenced water users located on the tributary of the uMngeni River, downstream of the proposed quarry. These abstractions include four for irrigation, two for domestic consumption and one for agricultural consumption (livestock). Any reduction in water quality for these licenced water users is associated with a high significance level. Potential types and sources of surface water contamination are as follows:

- High volumes of sediment entering the downstream environment from the crushing plant and associated infrastructure, overburden stockpiles and disturbed bare surfaces (sediment).
- Hydrocarbons from spillages around fuel and hydrocarbon stores, workshop areas and scrap yards.
- Spillages of untreated sewage.

In order to mitigate against these identified impacts, the following is proposed:

- Berms upslope and downslope of the area likely to be a source of sediment contamination should be implemented. Upslope berms will ensure limited surface flows through areas associated with sediment loss. Downslope berms will ensure that sediments eroded from areas associated with sediment loss will be trapped, therefore reducing the impact to the downstream receiving environment. It is recommended that the berms are constructed out of a non-erodible material.
- All stormwater runoff from areas likely to be a source of sediment contamination should be directed to a sediment trap or berm, where sediment will be deposited rather than entering into the receiving environment.
- Machinery should be regularly (at least daily) checked for oil leaks. During periods where the machinery is not in use, drip trays should be placed under the machinery to contain any spillages.
- Alternative dust suppression methods as recommended in the Final Basic Assessment Report (2021) will be used to restrict water use to an absolute minimum, these methods will include:
    - Limiting the speed of all mining equipment/vehicles to 40 km/h on the internal farm road to reduce dust.
    - Site management are to ensure denuded areas (dust source) are kept to a minimum.
    - Strips of used conveyor belts can be attached to the drop end of the crusher plant where crushed material falls onto the stockpiles. This will lessen the distribution of fine particles from the minerals.

  - Compacted dust collected by the crusher plant will be cleaned weekly to eliminate it as a dust source.
- The sizing and positioning of "dirty" stormwater channels, the sizing of a pollution control dam (if required) and recommendations on bunding around areas containing potential for surface water contamination should be designed such that:
  - Dirty stormwater channels and bunding walls will contain runoff generated during the 1:50 year storm event, as per the requirements stipulated in General Notice 704 (GN704) of the National Water Act (Act 36 of 1998).
- Areas that may result in the contamination to groundwater should be sufficiently lined to meet with regulatory requirements.
- The sizing and positioning of clean stormwater diversion channels or berms so as to keep "clean" stormwater runoff from mixing with "dirty" stormwater runoff should be designed such that:
  - "Clean" stormwater runoff diversion infrastructure will be sized to divert runoff generated during the 1:50 year storm event as per the GN704 requirements.
- All domestic waste should be regularly removed from the quarry site on a regular basis and dumped in appropriate waste handling facilities.
- Long-term sewage containment management and/or treatment facilities implemented at the quarry should be sufficiently sized, such that spillages of untreated sewage to the environment are unlikely.
- Fuels and hydrocarbon stores should be lined and bunded such that spills from the store areas will not enter the receiving environment.
- Water downstream of quarry should be monitored to ensure no degradation of water quality occurs.

If the beds or banks of a drainage line are affected activities associated with the proposed quarry, the following is recommended:

- All soil excavated during the construction process should be deposited outside of the river banks. This will limit the amount of fine sediments transported downstream (negatively affecting ecosystems).
- Once the quarry construction has been completed, rehabilitation of the affected areas should be undertaken. This should include planting indigenous vegetation to ensure that erosion from the construction site is avoided.

- The impact of the construction activity on floodlines should be investigated. It should be noted that General Notice 704 of the National Water Act (Act 36 of 1998) states that all mining related infrastructure and activities should be limited to areas outside of the 1:100 year floodline. If mining activities or mining related activities occur within the delineated 1:100 year floodline, an exemption to this regulation should be applied for with the DWS. It is therefore recommended that a floodline study is undertaken for the unnamed drainage line located adjacent to the quarry site.

In order to ensure that the areas containing hydrocarbons (i.e. workshop areas and stores) are not located within an area at risk to flooding, it is recommended that a floodline study of the unnamed drainage line adjacent to the project site is undertaken. This will inform areas that are safe for placement of infrastructure with a likelihood of containing hydrocarbons,, and therefore a high potential for impacting upon downstream water quality if flooded.

3.2.3 Changes in Flood Hydrology

Due to an increase in impervious areas and changes in catchment landcover characteristics associated with the quarry, there is a possibility that this will result in an increase in the peak discharge rates from the catchment in which the quarry is located, albeit relatively small. In order to reduce the impact of increased stormwater discharge rates, the following is recommended:

- Stormwater from roofed areas should be directed to JoJo tanks. This water should be used to augment water requirements for the quarry.
- Stormwater from road and parking areas should be appropriately managed. This should be addressed in the stormwater management plan that has been compiled for the project site.

It is, however, noted that through the process of excavation associated with the open pit of the quarry, stormwater runoff from the project site as a whole, may be reduced (as it is unlikely that stormwater will discharge from the open pit area).

4 DISCUSSIONS AND CONCLUSION

As part of this assessment, a general hydrological characterisation of the area in which the proposed Naaz Quarry is located was undertaken. This included defining the MAP, MAR and MAE for the project site. In order to determine the potential impact of the quarry on the local and regional hydrology, the catchment areas corresponding to these regions were defined. The local catchment area was defined as the catchment area of drainage lines in the vicinity of Portion 0 (Remaining Extent) of the farm Thandisizwe No. 16691, which included the unnamed drainage line along the eastern side of the quarry and the tributaries of the uMngeni River within the vicinity of the quarry site. The regional catchment area was defined as the Quaternary Catchment U20G, in which the quarry is located.

In addition to the hydrological characterisation of the quarry site, an impact assessment of the quarry on the local and regional hydrology was undertaken. Mitigation measures to reduce the significance of the identified potential impacts were provided. The potential impacts and mitigation measures identified included:

- Changes in catchment water resources. Based on the assessment undertaken, it was found that the potential impact of the quarry on catchment water resources (volume of water available to downstream users) is likely to be negligible. Based on this, no mitigation measures were recommended. Further to this, no wetland areas have been identified immediately downstream of the project site.
- Changes in catchment water quality. The sources of contamination were identified as increased sediment (from the crushing plant and stockpiles), hydrocarbon spills (through fuel stores and machinery on site), domestic and sewage waste. In order to reduce the risk of surface water contamination, numerous recommendations were made, largely with respect to management of contaminants at their source.
- Changes in catchment flood hydrology. The increase in impervious areas and changes in catchment landcover characteristics associated with the quarry, poses a possibility of an increase in the peak discharge values. It was recommended that all stormwater runoff from roofed areas is diverted to JoJo tanks for reuse at the project site (this will serve to reduce discharge rates from the project site). Stormwater runoff from parking or road areas is likely to be increased from what would occur under natural conditions. This needs to be addressed as part of the stormwater management plan. However, it is noted that that the quarry will include an excavation of materials (i.e. the open pit), from which stormwater runoff will not

discharge. Therefore, discharge rates from the project site, as a whole, is likely to be reduced from that under natural conditions.

It is concluded that if the proposed Naaz Quarry is compliant with the various regulations guiding the management and protection of water resources (as outlined in this report), the impact of the quarry on the local and regional hydrology will be low. In order for the quarry to be fully compliant, it is recommended that a formal stormwater management plan is implemented on site. It is also recommended that a floodline study is undertaken for the unnamed drainage line, located adjacent to the project site. This will inform the safe location of infrastructure associated with the proposed quarry.

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