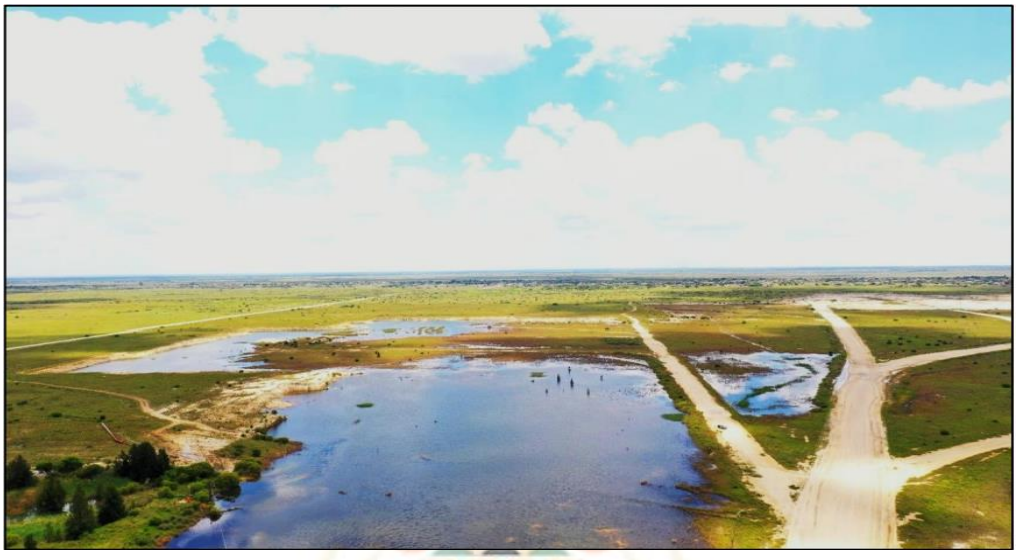
WATER USE LICENCE APPLICATION SUMMARY REPORT

THE LAFARGE TSWANA LIMESTONE QUARRY ON A PORTION OF FARM DRIEFONTEIN 46 PORTION 0, FARM RONDEFONTEIN PORTION 0 AND FARM RIETSCHRAAL 58 PORTION 0, NORTH WEST PROVINCE IN WARD 17 WITHIN DITSOBOTLA LOCAL MUNICIPALITY, NGAKA MODIRI MOLEMA DISTRICT MUNICIPALITY, NORTHWEST PROVINCE

Reference No: WU23173



NAME OF APPLICANT:

Lafarge Mining South Africa (Pty) Ltd

Prepared by: **Afzelia Environmental Consultants (Pty) Ltd.** **236 Ninth Avenue, Windermere, Durban, 4001** **Tel: 031 303 2835** **E-mail: info@afzelia.co.za**	**On behalf of:** **Greenmined Environmental** **Tel: 076 792 6327** **Email:** **Murchellin.S@greenmined.co.za**	**Prepared for:** **Lafarge Mining South Africa (Pty) Ltd** **Contact person: Uneysa Taljard** **Postal Address:** **P.O. Box 188** **Lichtenburg 2740** **uneysa.taljard@lafarge.com**

EAP Company Details	Report Writer	Signature	Date
Afzelia Environmental Consultants Environmental Assessment Practitioner Number is 2019/1078	Ms Deshni Naicker		26th October 2022
Greenmined Environmental Environmental Assessment Practitioner Number is 2021/4203	Mrs Murchellin Saal		26th October 2022
Lafarge Mining South Africa	Mrs. Uneysa Taljard		26th October 2022

1. Applicant details

Name of applicant: **Lafarge Mining South Africa (Pty) Ltd**
Postal address: **1 Manana Road, Industrial Site, Lichtenburg, 2740**
Cell phone number: **+27659131666**
Office number: **+27186333011**
E-mail address: **uneysa.taljard@lafarge.com**

2. Person submitting application

Afzelia Environmental Consultants (Pty) Ltd was appointed by Greenmined Environmental on behalf of Lafarge Industries South Africa (Pty) Ltd to conduct a Water Use Authorisation Application (WUAA) process and obtain an authorisation for the existing Lafarge Tswana Limestone Quarry on a portion of Farm Driefontein 46 portion 0, Farm Rondefontein Portion 0 and Farm Rietschraal 58 Portion 0, North West Province in Ward 17 within Ditsobotla local Municipality, Ngaka Modiri Molema District Municipality, Northwest Province

The EAP (Ms Deshni Naicker) that compiled the Water Use Licence Report is registered with the Environmental Assessment Practitioners Association of South Africa (EAPASA) from the 31st August 2020. The Registered Environmental Assessment Practitioner Number is 2019/1078.

3. Background and purpose

3.1 Background

Lafarge Mining South Africa (Pty) Ltd operates a cement manufacturing facility at Lichtenburg, Northwest Province that includes the Tswana Limestone Quarry and a manufacturing plant.

The existing operation was authorised on the 13th August 2001 (File Reference No. RDNW(KL) 6/2/2/101)) by the Department of Minerals and Energy - Mineral Development (North West Region). Since then, the area has continuously been used for mining limestone that is used for cement production and packaging.

The Applicant (Lafarge) had applied for a conversion of an older mining right, which was granted on the 08th March 2013 (DMR Ref No: NW30/5/1/2/2/454MR) and is valid for a period of 30-years ending on the 07th March 2043. The Mining Right is attached as **Appendix 25** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

The Tswana quarry has a current production capacity of 1 800 000 tons per annum (t/a) of limestone. The production rate at the Tswana quarry will need to be increased to 2 000 000 tons per annum (t/a) in order to achieve Lafarge's objective of increasing the production of cement at the Lichtenburg Plant.

Even though the Mining Right is valid till March 2043, the life of the mine can be longer. The entity will apply for a new mining right at that time should they wish to continue operating.

The operation of the Tswana Limestone quarry will make use of water from the Quarry Sump for dust suppression, abstract groundwater from an existing borehole to supply water to two Jojo tanks for domestic use and process water, stockpiles, captures and storing stormwater runoff and rainwater in the quarry pit, and the releasing / discharging of water when and if necessary due to extreme rainy conditions into the Polfonteinspruit River. The releasing of water into the Polfonteinsruit River will only be undertaken with the necessary water monitoring results.

As such, a Water Use Authorisation Application (WUAA) is required in accordance with the National Water Act (NWA), 1998 (Act No. 36 of 1998) in terms of Section 21. This document forms part of the WUAA.

The water uses which will be applied for in terms of Section 21 of the NWA (Act 36 of 1998) include:

- **Section 21 (a) of Act** - Taking water from a water resource (abstraction of Groundwater from Borehole1 - Water abstracted from the borehole to supply water to two Jojo tanks (Domestic and process water use). However, drinking water is bought and not used from the borehole.).
- **Section 21 (b) of Act** – Storing water (Water stored in Quarry Sump 1 / Mine Pit Wetland (W1) will be utilised for dust suppression).
- **Section 21 (j) of Act** - Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people (Water will utilised from Sump 1 for Dust suppression along haul roads/crushing plant).
- **Section 21 (f) of Act** - Discharging waste or water containing waste in a water resource through a pipe, canal, sewer, sea outfall or other conduit (Discharging of wastewater into the Polfonteinspruit River).
- **Section 21 (g) of Act** - Disposing of waste in a manner which may detrimentally impact on a water resource (Limestone Stockpiles Storm water runoff from workshop, administrative buildings, and water from wash bay that is captured in Sump 1 will be used as dust suppression at crushing plant and a long-haul road.
- **Section 21 (c)** - Impeding or diverting the flow of water in a watercourse (Discharging wastewater into the Polfonteinspruit.
- **Section 21 (i) of Act** – Altering the bed, banks, course or characteristics of a watercourse (Discharging wastewater into the Polfonteinspruit).

Need and Desirability for the Project

Northwest Province is a growing market surpassing national trends and, as such, demand for Lafarge's products in Northwest Province has already exceeded existing production capacity. The proposed expansion is therefore required to meet the growing product demand and ensure that provincial and national economic development is not hampered.

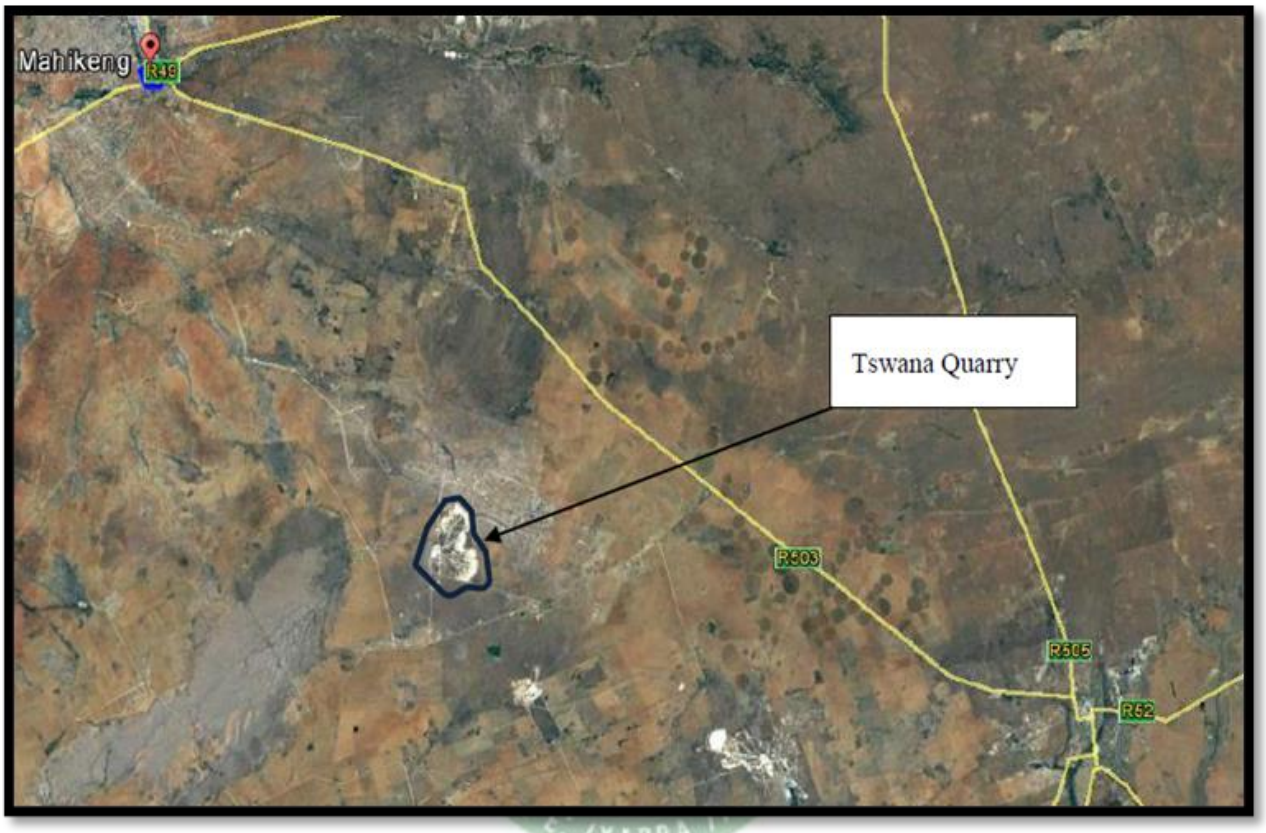
Additionally, the benefits associated with the mining operation are detailed in both the Lichtenburg Plant original EMPR and the EMPR amendment. In summary:

- ✓ Job retention - approximately 345 are employed on a permanent basis in addition to temporary and contract employment,
- ✓ Local economic benefits are derived as a result of wage income and increased demand for goods,
- ✓ Training is provided to employees resulting in an improvement of the local skills base,
- ✓ Support is given to the local and national economy by the purchase of goods and services,
- ✓ Lafarge will achieve profits from the increase in the production of cement resulting in increased tax revenues for the government,
- ✓ Lafarge will continue to support projects that will benefit the local community leading to improved living conditions and improvement of skills,
- ✓ Support to local municipality in terms of road repairs, road construction, upgrading of youth centres, town clean-up, water supply etc,
- ✓ Support to schools in terms of adopt a school, fundraising campaigns, sport activities, giving books to learners, waste recycling projects,
- ✓ Support to small enterprises- historically disadvantage communities, courier services, tent hiring, shirt printing, gardening services, maintenance contractors etc; and
- ✓ Initiation of historically disadvantaged communities business forum.

3.2 Location of water uses

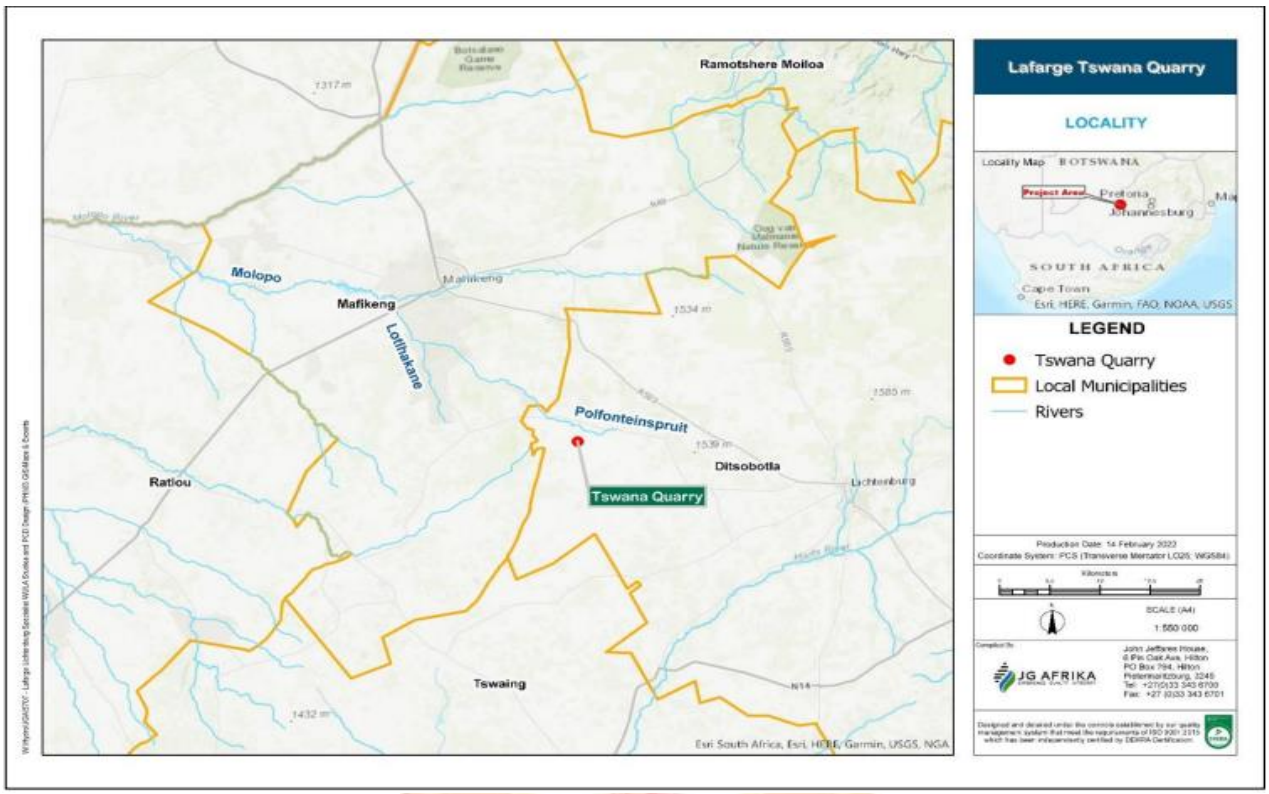
The Lafarge Tswana Limestone Quarry operation is situated in Ward 17 within Ditsobotla Local Municipality, Ngaka Modiri Molema District Municipality which is part of the Northwest Province. The Lafarge Tswana Limestone Quarry is located about 45km from Lichtenburg near the settlement of Bodibe and approximately 37 Km west of the cement factory in Lichtenburg. There is rail line that is used to transport the crushed limestone to the cement plant. The Tswana Limestone Quarry is connected to the R503 via secondary roads. Refer to **Figure 1** below for the Locality Aerial Map showing boundaries of Lafarge Tswana Limestone Quarry and **Figure 2** for the Topographic Map of the Lafarge Tswana Limestone Quarry.

The Geographic co-ordinates of the Lafarge Tswana Limestone Quarry are **29°45'29.68"S | 30°48'17.31"E.**



(Source: Tswana quarry geohydrological report)

Figure 1: Locality Aerial map showing boundaries of Lafarge Tswana Limestone Quarry



(Source: Tswana quarry Wetland report compiled by JG Afrika, 2022)

Figure 2: Topographic map of the Lafarge Tswana Limestone Quarry

The Tswana Limestone Quarry is located on the land held in trust by the State for the Bodibe tribe. The Department of Rural Development and Land Reform acts as custodian and royalties from the quarry accrue to the State.
The property details including the extent of the Lafarge Tswana Limestone Quarry is reflected in **Table 1** below.

Table 1: Property Details

Property description	Title Deed number	Owner
Farm Driefontein 46 Portion 0 (Remaining Extent), Northern West Province	T1007/1887BP	Department of Rural Development & Land Reform
Farm Rietschraal 58 Portion 0, North West Province	T5235/1999	Department of Rural Development & Land Reform
Farm Rondefontein 47 Portion 0, North West Province	T2/1976BP	Department of Rural Development & Land Reform

4. Administrative documents and other technical reports submitted to support the WULA

4.1 Administrative documents

4.1.1 List all administrative documents relevant to the application as per WULA regulation

- Certified ID copy of the applicant (Mrs Uneysa Taljard) and Mr. James Kirkpatrick– uploaded to ewulaas system 3/3/2022.
- Proof of Payment Application Fee - uploaded to ewulaas system 3/3/2022.
- Deeds Document (Land Parcel 46 of the Major Region IO) - uploaded to ewulaas system 3/3/2022.
- Certified Passport Copy of at least one member of the Company (Mr James Kirkpatrick) - uploaded to ewulaas system 3/3/2022.
- Company Registration certificate (COR 39 – LMSA) - uploaded to ewulaas system 3/3/2022.
- BEE Certificate - uploaded to ewulaas system October 2022.
- Appointment / resolution letter - uploaded to ewulaas system 3/3/2022.

- Mining right - Tswana Lime - uploaded to ewulaas system 3/3/2022.
- Copy of Property Zoning Documents where water use occurs.
- Clearance letter from the Department of Rural Development and Land Reform indicating that the property where the water uses are taking place are not under land claims
- VAT Registration: 4160231454

4.2 Reports and other technical documents

4.2.1 List all Reports and other technical documents relevant to the application as per WULA regulation or any other information requested formally by the Department and indicate compilers of the documents and dates of compilation.

Table 2: List of reports and other technical documents submitted

Number	Report Title	Compiled by	Date of report
1	Integrated Water and Waste Management Plan (IWWMP)	Afzelia Environmental	October 2022
2	Water Use Licence Application Report	Afzelia Environmental	October 2022
3	Section 27 Motivation	Afzelia Environmental	August 2022
4	Baseline Hydrology and Impact Assessment	JG Afrika	August 2022
5	Water Balance Study	JG Afrika	October 2022
6	Tswana Quarry Stormwater Management Plan	JG Afrika	August 2022
7	Lichtenburg Lafarge Cement Plant and Tswana Quarry Stormwater Infrastructure and Pollution Control Dams Preliminary Design Report	JG Afrika	May 2022
8	Floodline Study Report	JG Afrika	March 2022
9	Assessment of two wetlands in the vicinity of the Lafarge Tswana Limestone Mine Report near Bodibe in relation to a Water Use Licence Application	JG Afrika	March 2022
10	Environmental Management Plan Report	SRK Consulting	July 2006
11	Geohydrological Report	JG Afrika	September 2022
12	Groundwater Quality Report	Aquatico Scientific	August 2022
13	Proof of payment of licence processing fee/Letter of waiver from DWS	Greenmined Environmental	March 2022
14	Public Participation Advert Notice	Greenmined Environmental	April 2022
15	Public Participation	Greenmined Environmental	June 2022
	Notification of Specialist studies	Greenmined Environmental	October 2022
16	Master Layout Plan	JG Afrika	October 2022
17	Civil Designs - Lichtenburg Lafarge Cement Plant and Tswana Quarry Stormwater	JG Afrika	May 2022

	Infrastructure and Pollution Control Dams Preliminary Design Report		
18	Water Supply Technical Report – (Refer to Water Use Licence Application Report)	Afzelia Environmental Consultants	October 2022
19	Topographic Map	JG Afrika (Refer to Wetland Report)	March 2022
20	Mining Permit	DMR	August 2013
21	Contingency Plans		Not Applicable
22	Financial Provision	Pear Environmental (Pty) Ltd	2021

5. Project Description

The Tswana Limestone Quarry operations involve mining limestone rock from opencast pits using conventional drilling and blasting methods. The topsoil and overburden are removed by means of trucks and relocated to an area near the open pit. The mined limestone material is loaded onto haul trucks by excavators and transported to the primary crusher. Following the crushing process, the materials are transported to the Lafarge Cement Plant via railway.

The operational phase mining activities area is 10km X 14km consisting of the following:

- ✓ Blasting
- ✓ Excavating
- ✓ Crushing and production lines
- ✓ Stockpiling and transporting of material via rail.

The infrastructure at the Tswana mining area entails:

- ✓ Railway line and siding
- ✓ Crushing Plant and production lines
- ✓ Workshops
- ✓ Office complex

The quarry has already been developed; therefore, the construction phase is not applicable. The increased production rates at the Tswana Limestone Quarry will not result in any real change to the existing situation other than:

- ✓ More frequent blasting activities,
- ✓ Increased rail traffic to Lichtenburg necessitating the rail bypass loop, and
- ✓ Increased number of operational days (5 to 6) and number of shifts of work (2 to 3).

Please refer to **Figure 3** below which depicts the Master Layout Plan for the Tswana Limestone Quarry.

Table 3: Water Uses to be applied for:

Water use(s)	Watercourse	Purpose (Activity)
Section 21(a) Taking water from water resource	Tswana Quarry Borehole 1 26° 4.571'S | 25° 46.819'E	Water will be abstracted from the Quarry Borehole 1 for the following purposes: ✓ Domestic. ✓ Operation. ✓ Dust suppression sprayers. – crusher area. Drinking water is bought and not used from the borehole.
Section 21 (b) Taking water from water resource	Tswana Quarry Dam 26° 4'28.64"S | 25°48'8.43"E	Water from the Quarry Dam will be used for Dust suppression - Water will be collected by a truck for dust suppression.
Section 21 (j) Removing, discharging or disposing of water found underground	Tswana Quarry 26°04'20.53"S | 25°48'17.14"E	Water extracted from Sump 1 will be used for Dust suppression along crushing plant – Tswana Quarry.
Section 21 (f) Discharging waste or water containing waste into a water resource	Tswana Quarry 26°3'11.94"S | 25°48'13.09"E	Discharging water into the Polfonteinspruit.
Section 21 (c) Impeding or diverting the flow of water in a watercourse	Tswana Quarry 26° 3'11.94"S | 25°48'13.09"E	Discharging water into the Polfonteinspruit.
Section 21 (i) Altering the bed, banks, courses or characteristic s of a watercourse	Tswana Quarry 26° 3'11.94"S | 25°48'13.09"E	Discharging water into the Polfonteinspruit.
Section 21 (g) Waste discharge related water use	Tswana Quarry 26°07'99.2" S | 25°80'02.9" E	Dust Suppression along crushing plant.
Section 21 (g) Waste discharge related water use	Tswana Quarry Limestone stockpile 26° 4.807'S | 25° 47.917'E	Limestone Loading Tunnel stockpile

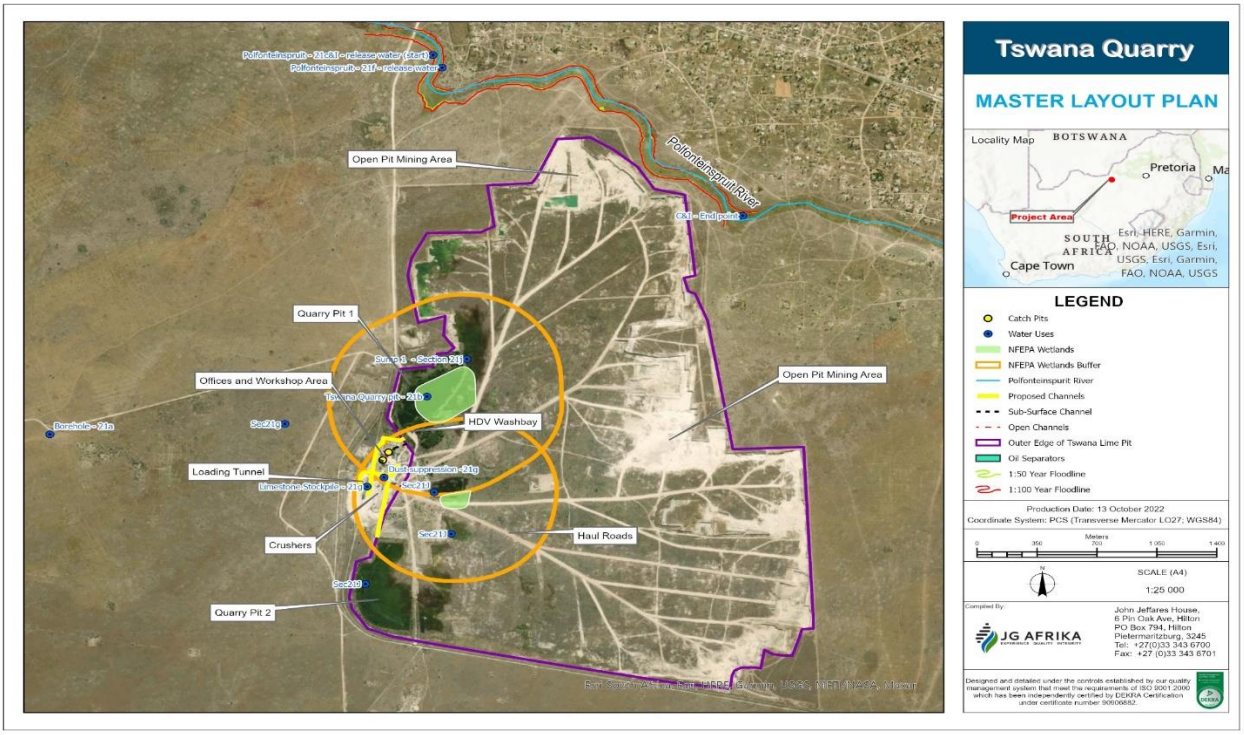


Figure 3: Tswana Limestone Quarry – Master Layout Plan (JG Afrika, October 2022)

6. Methods statement (only for 21 (c) and (i) activities)

A number of assumptions and decisions have been made in order to undertake the design of the stormwater infrastructure. These have been detailed below, along with the reasons behind the decision or assumption.

6.1. Shape of Stormwater Channels

In order to maintain consistency across the site, and for ease of construction, the cross-sectional shape of the stormwater channels has been kept consistent (for each type of channel lining), with the exception of the concrete lined channels where two cross-sectional profiles have been recommended. For all concrete lined channels, apart from those within the coal stockyard itself, a trapezoidal channel with side slopes of 1V:1.5H has been used. This shape is close to the most hydraulically efficient shape for a channel and provides practical side slopes for construction purposes (with steeper slopes becoming more difficult to construct. For channels within the coal stockyard, a triangular channel with side slopes 1V:6H has been considered. The alternate cross-sectional shape for these channels allows for light vehicle traffic, such as a bobcat, to travel across the channels. The range of vehicle traffic required to cross the channels within the coal stockyard will be confirmed during detailed design. The cross-sectional profile and steel reinforcing required for these channels will then be re-considered and modified accordingly. It is also understood that additional upgrades to the CSY itself may occur in future and it is important that the stormwater infrastructure is compatible with these upgrades.

For grass lined channels, the channels have also been designed in a trapezoidal shape, with side slopes of 1V:3H being used. This is typically the maximum side slope used for grass lined channels, as recommended by the Drainage Manual (SANRAL, 2013). With side steeper than 1V:3H there is increased possibility for erosion and slope instability.

Some sections of the grass lined channels on the Tswana Limestone Quarry are lined with reno-mattresses. This is to provide erosion protection and typically the profile of the reno-mattress lined sections follows that of the grass lined sections of channels

6.2. Minimum Design Slopes

As per the Drainage Manual (SANRAL, 2013), the minimum allowable slope for a concrete lined channel is 0.25%. This is recognised as being an extremely gradual slope for a channel and has only been used where completely necessary. As the Lichtenburg area is particularly flat, this slope has been used for a number of the channels. Typically, a slope of 0.5% and steeper has been targeted for the concrete lined channels.

As a guideline, stormwater channels can increase in slope along the length of the channel, but it is preferred for the channels slopes not to decrease as this can lead to non-uniform flow and potentially a build-up of sediment. This principle has been followed in almost all cases, except where it becomes impractical or cannot be achieved due to limitations in the sites' topography

6.3. Road Crossings

Due to the large plant and trucks travelling in and around the two sites, all road crossings have been designed as culverts. Open channels are typically preferred as they are easier to monitor and maintain, however, as a result of the depth of the channels crossing the roads and the required vertical alignments to ensure no issues are encountered by the vehicles, the channels would become excessively wide and lose their cost efficiency.

Therefore, culverts have been used instead. These are typically box culverts which require less cover above the culvert, and therefore (at least in this case), prevent unnecessary changes in the slope of the channels.

As per the Department of Transport typical sections and guidelines, a minimum cover of 300 mm has been maintained as an absolute minimum above all box culverts on the site. Generally, this minimum is well surpassed.

It is anticipated that openings for culverts under existing dirt roads would be done by conventional trenching ('open excavation') and existing concrete road surfaces would be saw cut prior to excavation for culvert pipes/ box culvert units. Allowances have been made within the preliminary design costing for construction of all required culverts. Detailed specifications, construction level detailing and further refined costing for culverts will be done during detailed design.

7. Stormwater Management Plan

7.1. Stormwater Infrastructure and Preliminary Design Report

JG Afrika Pty Ltd (JG Afrika) were appointed by Lafarge Mining South Africa (Pty Ltd (Lafarge) to provide a preliminary design of the Stormwater Management Plan (SWMP) infrastructure to manage the dirty water from the Lafarge Tswana Lime Quarry (LTQ) for the purposes of a Water Use Licence Application (WULA). The full report is attached in **Appendix 20** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP) and summarised below.

The LTQ stormwater infrastructure includes four interconnected channels (A to D) and one isolated channel (E) which discharges into an existing dam as shown in Table 1. The channels are designed to accommodate 1 in 50-year flood peaks ranging from 0.14 m^3/s to 0.5 m^3/s. The interconnected channels are concrete lined trapezoidal channels with 1V:1.5H side slopes, 600 mm wide bases and longitudinal slopes at a minimum of 0.25% due to the flat terrain of the Lichtenburg area. The side slopes for earth and reno mattress lined channels are 1V:3H (JG Afrika, Preliminary SWMP, 2022).

For the purposes of road crossings five culverts were designed of which four are box-shaped culverts and one is pipe shaped. The culverts were designed to accommodate 1 in 50-year flood peaks ranging from 0.14 m^3/s to 0.5 m^3/s similar to the flood peaks accommodated by the channels (JG Afrika, Preliminary SWMP, 2022).

In order to maintain consistency across the site, and for ease of construction, the cross-sectional shape of the stormwater channels has been kept consistent (for each type of channel lining), with the exception of the concrete lined channels where two cross-sectional profiles have been recommended (JG Afrika, Preliminary SWMP, 2022).

For grass lined channels, the channels have also been designed in a trapezoidal shape, with side slopes of 1V:3H being used. This is typically the maximum side slope used for grass lined channels, as recommended by the Drainage Manual

(SANRAL, 2013). With side steeper than 1V:3H there is increased possibility for erosion and slope instability (JG Afrika, Preliminary SWMP, 2022).

Some sections of the grass lined channels on the Tswana Quarry are lined with reno-mattresses. This is to provide erosion protection and typically the profile of the reno-mattress lined sections follows that of the grass lined sections of channels (JG Afrika, Preliminary SWMP, 2022).

As per the Drainage Manual (SANRAL, 2013), the minimum allowable slope for a concrete lined channel is 0.25%. This is recognised as being an extremely gradual slope for a channel and has only been used where completely necessary. As the Lichtenburg area is particularly flat, this slope has been used for a number of the channels. Typically, a slope of 0.5% and steeper has been targeted for the concrete lined channels (JG Afrika, Preliminary SWMP, 2022).

As a guideline, stormwater channels can increase in slope along the length of the channel, but it is preferred for the channels slopes not to decrease as this can lead to non-uniform flow and potentially a build-up of sediment. This principle has been followed in almost all cases, except where it becomes impractical or cannot be achieved due to limitations in the sites' topography (JG Afrika, Preliminary SWMP, 2022).

Due to the large plant and trucks travelling in and around the site, all road crossings have been designed as culverts. Open channels are typically preferred as they are easier to monitor and maintain, however, as a result of the depth of the channels crossing the roads and the required vertical alignments to ensure no issues are encountered by the vehicles, the channels would become excessively wide and lose their cost efficiency (JG Afrika, Preliminary SWMP, 2022).

Therefore, culverts have been used instead. These are typically box culverts which require less cover above the culvert, and therefore (at least in this case), prevent unnecessary changes in the slope of the channels. As per the Department of Transport typical sections and guidelines, a minimum cover of 300 mm has been maintained as an absolute minimum above all box culverts on the site. Generally, this minimum is well surpassed (JG Afrika, Preliminary SWMP, 2022).

It is anticipated that openings for culverts under existing dirt roads would be done by conventional trenching ('open excavation') and existing concrete road surfaces would be saw cut prior to excavation for culvert pipes/ box culvert units. Allowances have been made within the preliminary design costing for construction of all required culverts. Detailed specifications, construction level detailing and further refined costing for culverts will be done during detailed design (JG Afrika, Preliminary SWMP, 2022).

The SWMP proposed the inclusion of five stormwater channels for the Lafarge Tswana Quarry (LTQ) site, channels A through to E. Four of the five channels are interconnected (channels A to D), whereas channel E is independent and discharges into an existing dam (JG Afrika, Preliminary SWMP, 2022). The proposed layout of the channels can be seen in **Figure 4** below, as taken from the SWMP.

The contributing catchment areas (also indicated in **Figure 4** below), design rainfall depths and required capacity, based on the 1:50 year return period flood peak, for the channels as taken from the SWMP. The selection of concrete channel lining was in order to assist with maintenance and the transport of sediment which is often contained within the stormwater runoff (JG Afrika, Preliminary SWMP, 2022).

Additionally, due to the flat topography of the quarry site it was necessary to reduce the slopes of the channels to an absolute minimum of 0.25% in some areas, which was necessary in order to prevent excessive channel depths and large top widths. In total the site requires approximately 1.14 km of concrete lined channel, 189 m of grass lined channel, with a short section (32 m in total) of reno-mattress lining on the channel at the start and end of the grass lined sections to provide protection against erosion, particularly at the end of the channel where the slope increases as the channel discharges into the dam. Five culverts are required to convey the water beneath roads and railways (JG Afrika, Preliminary SWMP, 2022).

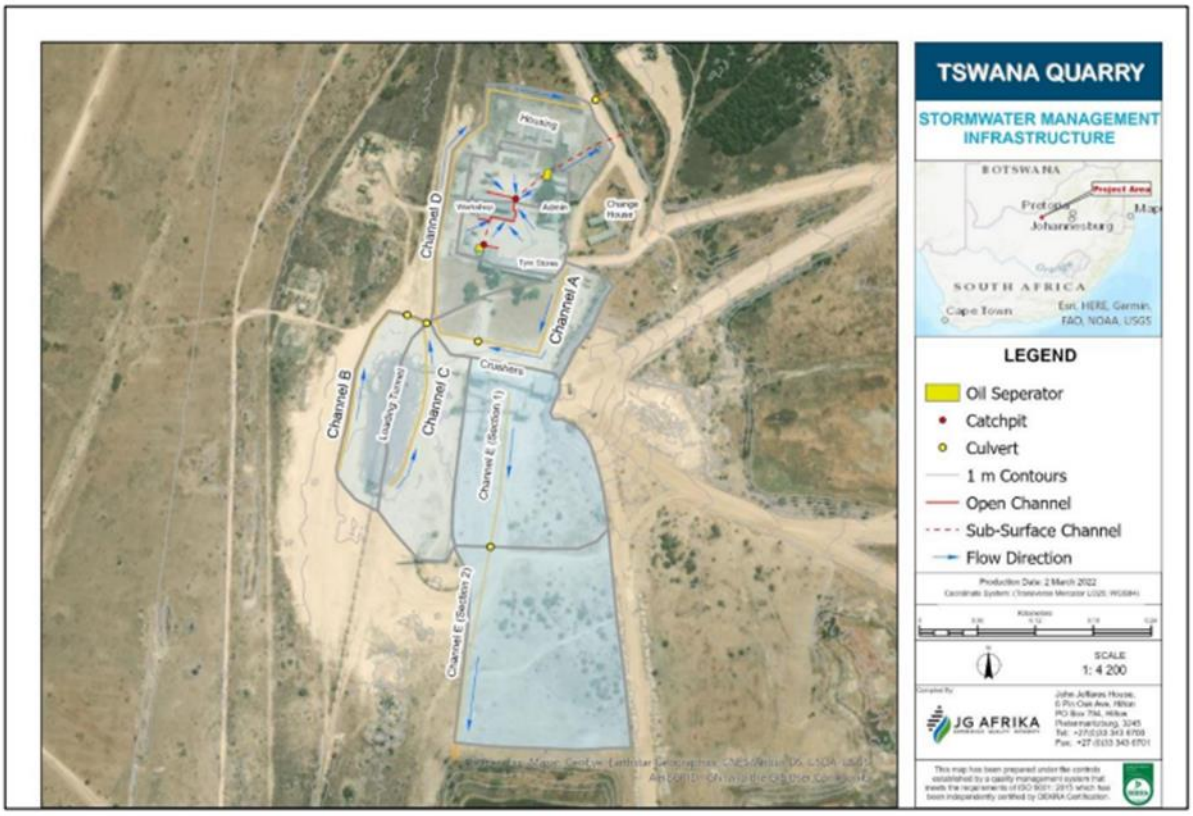


Figure 4: Proposed Stormwater Management Infrastructure (JG Afrika, March 2022)

7.2. Stormwater Management Plan Revision 01

JG Afrika (Pty) Ltd were appointed by Lafarge Industries South Africa (Pty) Ltd to undertake a stormwater management plan (SWMP) and General Notice 704 (GN704) audit for the Lafarge Tswana Limestone Quarry. The stormwater management plan is largely based on the findings of the General Notice 704 and stormwater management plan study undertaken in 2019. Refer to **Figure 5** Tswana Quarry Site Plan. The full report is attached in **Appendix 20** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP) and summarised below.

Section 26 (1) of the NWA (Act No. 36 of 1998) provides for the development of regulations that:

- ✓ Require that the use of incoming and discharging water from a water resource be monitored, measured, and recorded,
- ✓ Regulate or prohibit any activity in order to protect a water resource or in-stream or riparian habitat,
- ✓ Prescribe the outcome or effect that must be achieved through management practices for the treatment of waste, or any class of waste, before it is discharged or deposited into or allowed to enter a water resource.

GN704 (Government Gazette 20118, 4 June 1999) was drawn up to address these issues in relation to mining activities. A summary of the principal conditions from GN704, upon which the proposed SWMP is based, includes:

- ✓ **Condition 4, which describes the location of infrastructure and mining activities**. Any residue deposit, dam, reservoir, together with any associated structure must not be located within the 1:100-year floodline or within 100m of any watercourse or borehole,
- ✓ **Condition 6, which deals with capacity requirements of clean and dirty water systems**. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained, and operated such that these systems do not spill into each other more than once in 50 years, and
- ✓ **Condition 7, which describes the measures which must be taken to protect water resources**. All dirty water or substances which cause or are likely to cause pollution of a water resource either through natural surface flow or by seepage must be contained.

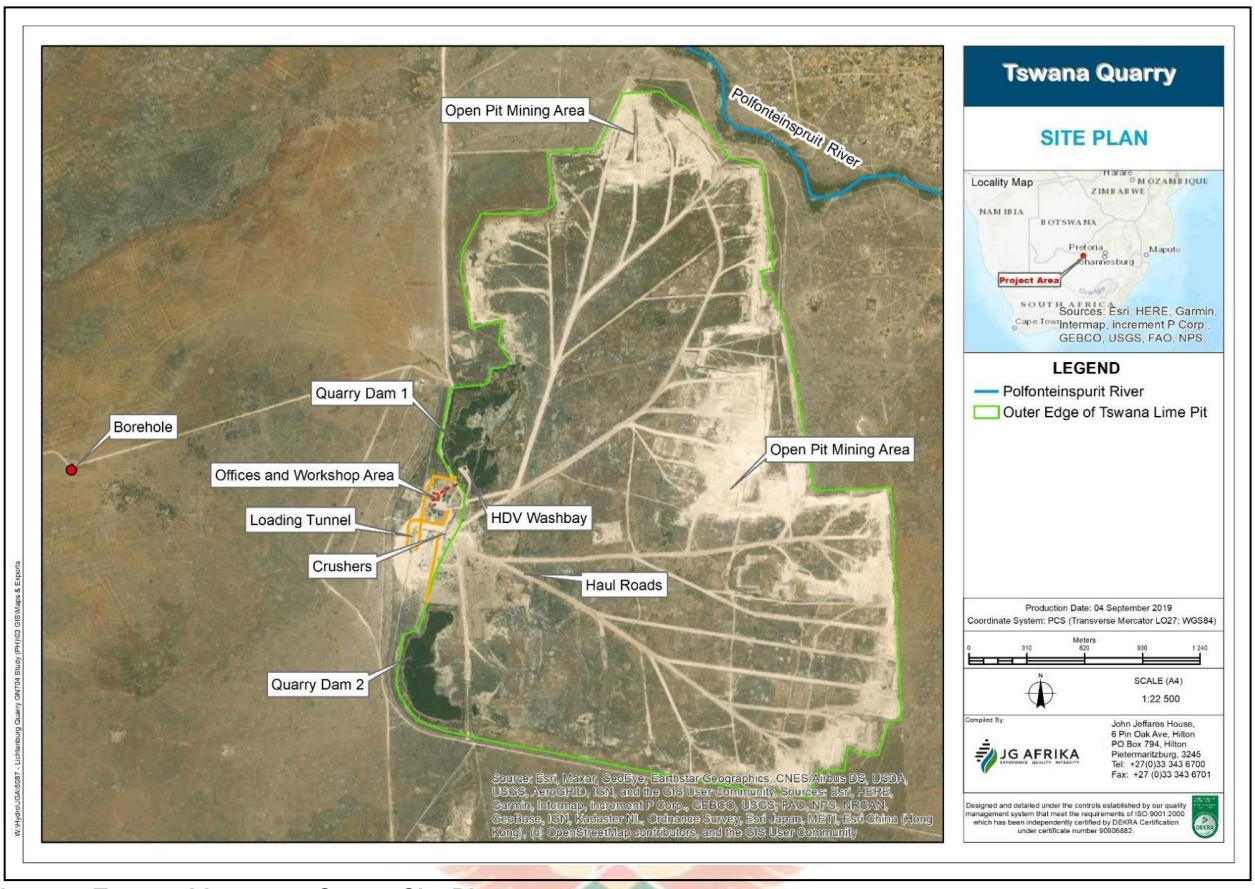


Figure 5: Tswana Limestone Quarry Site Plan

8. Rehabilitation Plan

A site rehabilitation plan has been compiled and must be implemented to address the negative impacts that might occur and to return the receiving environment to an acceptable level of integrity. The site rehabilitation plan has been incorporated into the EMPr attached in **Appendix 13** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

The proposed management / rehabilitation measures are as follows:

- ✓ Contamination of wetlands through spillage of hydrocarbons such as fuel and oils. This impact is one which should not happen and so is in the avoid/prevent level of the hierarchy,
- ✓ Future loss of wetlands as a result of mining activities. This impact is unavoidable and is in the repair/restore level of the hierarchy,
- ✓ Abstraction of water for uses in the mine such as dust suppression. This impact is in the minimise level of the hierarchy,
- ✓ Grazing by livestock at site W3 is reducing the plant biomass there and is probably also reducing plant diversity. This impact, although taking place in the study area, is not the responsibility of Lafarge. It would belong to the minimise level of the hierarchy, and
- ✓ Various alien invaders have infested the site area including *Lantana camara*, *Rubus cunefolius* and *Solanum mauritianum.* The removal of alien invasive vegetation must be undertaken prior to the re-vegetation of disturbed areas and landscaping. The control needed to eradicate the specific species is provided in detail in the EMPr attached in **Appendix 9**.

Since the Polfonteinspruit, which is a natural feature of the landscape, is outside the mining area, it is not expected that the operators will result in mine-related impacts. The mine appears to be having little effect on the Polfonteinspruit despite being within 100 m of the delineated boundary in places. It is therefore recommended that the edge of the workings be stabilized and grassed in those areas. It is also recommended that, should the mining right area ever be expanded in the

future, that it not be closer than 100 m from the delineated edge of the Polfonteinspruit at any point. In this way a buffer strip may be created on the southern side of the spruit.

Expansion of the built-up area of Bodibe in a direction toward the Polfonteinspruit may happen in the future but for the moment the area is held open for livestock grazing and so some buffering is happening. It is not known if a dry climatic spell might lead to the area once again being cultivated for food crops, but nothing can be done about it for the present.

9. Water Uses applied for:

The application includes the following water uses as detailed in **Table 4** below.

Table 4: Water Uses Applied for:

Water use(s) activities	Purpose	Capacity/ Volume (m^3, tonnes and/or m^3/annum)/ dimension (Area (ha) Length/depth, (m)), *Only put what is applicable*	Property Description	Co-ordinates
Section 21(a)				
Abstraction of Groundwater from Tswana Quarry Borehole 1.	✓ Domestic. ✓ Operation. ✓ Dust suppression sprayers. – crusher area. Drinking water is bought and not used from the borehole.	25 769 m^3 /annum.	Portion of Driefontein 46 IQ and Rietschraal 58 IQ and a Portion of Springbokpan 61 IQ.	26° 04' 32.84"S 25°46' 48.56"E
Section 21(b)				
Tswana Quarry Pits	Water from the Quarry Pits will be used for dust suppression - Water will be collected by a truck for dust suppression.	480 000m^3 Approximately 2 meters in depth.	Portion of Driefontein 46 IQ and Rietschraal 58 IQ and a Portion of Springbokpan 61 IQ	26° 04' 28.64"S 25°48' 08.43"E
Section 21 (c & i)				
Polfonteinspruit.	Discharging water into the Polfonteinspruit.	700 000 m^3/ annum	Portion of Driefontein 46 IQ and Rietschraal 58 IQ and a Portion of Springbokpan 61 IQ	26° 03' 11.94"S 25° 48' 13.09"E
Section 21(g)				
Tswana Quarry – Sump 1.	Dust suppression at the crushing plant and along the haul roads.	24 528 m^3/annum (Jojo tanks) Dust suppression at crushers) 1 681 m^3/annum (Tankers dust suppression on roads)	Portion of Driefontein 46 IQ and Rietschraal 58 IQ and a Portion of Springbokpan 61 IQ	26° 07' 99.20" S 25°80' 02.90" E
Tswana Quarry - Limestone stockpile.	Dust suppression at the Loading Tunnel stockpile.	8000/tons	Portion of Driefontein 46 IQ and Rietschraal 58	26° 04' 80.70"S 25°47' 91.70"E

Water use(s) activities	Purpose	Capacity/ Volume (m^3, tonnes and/or m^3/annum)/ dimension (Area (ha) Length/depth, (m)), *Only put what is applicable*	Property Description	Co-ordinates
			IQ and a Portion of Springbokpan 61 IQ	
Section 21(f)				
Polfonteinspruit.	Discharging water into the Polfonteinspruit.	700 000 m^3/ annum	Portion of Driefontein 46 IQ and Rietschraal 58 IQ and a Portion of Springbokpan 61 IQ	26° 03' 11.94"S 25°48' 13.09"E
Section 21(j)				
Tswana Quarry – Sump 1	Water extracted from Sump 1 will be used for dust suppression along crushing plant – Tswana Quarry	1681.66 m^3/annum	Portion of Driefontein 46 IQ and Rietschraal 58 IQ and a Portion of Springbokpan 61 IQ	26° 04' 20.53"S 25°48' 17.14"E

10. Description of the Environment

10.1. Climate

The Tswana Limestone Quarry lies within an arid to temperate climatic region (Köppen-Geiger Climate Classification Maps, 2018). Rainfall occurs mostly during the summer. The climate category can be described as dry and hot during the summer months and cold during the winter months. As flow measurements are limited in the lease area, the mean annual runoff (MAR) was determined using the assumption that the rainfall-runoff response of most of the catchment is the same as that of the regional rainfall-runoff response as determined in the WR90 project (Midgley, Pitman and Middleton, 1994). Catchment areas and the mean annual runoff (MAR) for Lichtenburg up and downstream of affected areas are shown in **Table 5,** and the summary of climatic statistics in **Table 6** below.

Table 5: Natural MAR (from WR90, Midgley, Pitman and Middleton, 1994).

Site Name	Area (km^2)	MAR (mill m^3)
Tswana Quarry area	98.8	0.909

Table 6: Summary of climatic statistics

Average annual rainfall	600 mm
Rainfall season	November to March
Month of highest rainfall	January
Month of lowest rainfall	August
Maximum temperature	33˚C in January
Minimum temperature	0˚C -3˚C in July
Sunshine duration	90% in July, 65-80% in summer months
Maximum average monthly evaporation	9.9 mm in October and December
Minimum average monthly evaporation	3.5 mm in June
Wind description	Light to moderate from the north-eastern sector
Maximum 24 hr rainfall	99 mm in March
24 hr maximum in 1:50 year return period	104.5 mm in December

24 hr maximum in 1:100-year return period	120.2 mm in December
Extreme weather events	These have included hail (1-3 occurrences per year), frost (31 to 60 days per year) and snow in the past

It is evident that most of the rainfall falls over the summer period (September to March), with a total rainfall depth over these seven months equating to 509.4 mm. It is also noted that low rainfall values are recorded over the winter months (April to August), during which a total of 91.5 mm of rainfall falls on average. The wettest recorded year over the 1950 to 2000 period was 1 099.2 mm in 1967.

The monthly distribution of average daily maximum temperatures shows that the maximum temperatures range from 18.9°C in June to 28.7°C in January. The region is the coldest during the month of June when the temperature drops to -0.4°C on average.

The annual potential evaporation rate for the area is 1 952 mm and the highest evaporation rates occur during the hotter summer months of September to March.

10.2. Topography, Soil and Geology

The topography of the area is generally flat and gently undulating. The Tswana Limestone Quarry lies in an area which has generally low topography. The valley within which it is located slopes toward the Polfonteinspruit and the linear gradient down the length of the mine is approximately 0.1% (JG Afrika, Wetland Assessment, 2022).

Soil depth at the Tswana Limestone Quarry is limited to approximately 300 mm over the limestone deposit. Agricultural potential is very low in this area. It was found that examination of the soil characteristics for typical wetland indicators is confusing for two reasons. The first of these is that no traces of the mottling, typically associated with hydromorphic (redoximorphic) soils, could be found. This is partly thought to be a consequence of the mining that has been undertaken (JG Afrika, Wetland Assessment, 2022).

The second reason for the lack of mottling in the soils may be a natural characteristic of the region. The auger holes produced a heavy dark grey to black organic (not peat) and clay-rich soil. Since the region where the quarry is located is strongly dolomitic in terms of its geology, modifications to the generic approach of identifying wetlands may be necessary (JG Afrika, Wetland Assessment, 2022).

10.3. Vegetation (terrestrial and riparian)

The natural vegetation in the area is Carltonville Dolomite Grassland. (Type Gh 15). Due to the mining activities, the vegetation on the site is severely transformed but some indigenous terrestrial plant species were found within the 500 m radius around the mine (JG Afrika, Wetland Assessment, 2022).

The Tswana Limestone Quarry site falls within Acocks veld type “Dry Cymbopogon-Themeda Veld”. A common feature of this Grassveld is the absence of a clearly dominant grass species, except in small patches. Some of the areas are still open for grazing and for this reason the most palatable grass species have been heavily grazed. In general, the most visible common grass species are: *Eragrostis echinochloidea; Aristida adscensionis; Aristidia congesta; Cymbopogon plurinodis; Cynodon dactylon; Eragrostis lehmanniana; Eragrostis superba; Stipagrostis uniplumis; Fingerhutia Africana; Heteropogon contortus; Themeda trianda; Triraphis andropogonoides;* and *Hyparrhenia hirta*. Trees are sparsely distributed but these may have been utilised for firewood or for other purposes by the local communities.

The region within which the mine is situated has experienced a prolonged period of wetter than average rainfall, therefore much of the vegetation in the mined area now has characteristics of a hygrophilous grassland, which blends into wetland in many places (JG Afrika, Wetland Assessment, 2022).

It was, however, noted that such conditions are not permanent as plants such as *Hyparrhenia tamba* (Thatch Grass), *Gomphocarpus fruticosus* (Cotton Milkweed), and *Searsia lancea* (Karee), which are not commonly found in waterlogged conditions, were also present. Plants found in more natural conditions in the 500 m radius around the mining right area are listed in the below **Table 7**: Plant species observed in mined areas (JG Afrika, Wetland Assessment, 2022).

Table 7: Plant species observed in mined areas.

Water Dependence	Scientific Name	Common Name
Wetland Facultative	*Andropogon eucomus*	Snowflake Grass
	Eragrostis gummiflua	Gum Grass
	Imperata cylindrica	Cottonwool Grass
	Melinis repens	Natal redtop Grass
	Paspalum scrobiculatum	Ditch grass
Wetland Obligate	*Typha capensis*	Bullrush
	Phragmites australis	Common Reed
	Elionurus muticus	Lemon Grass
	Leersia hexandra	Wild Rice Grass
	Persicaria Spp.	Knot weeds

10.4. Water Management Area

The study area forms part of the Crocodile (West) and Marico water management area (WMA) and falls within the D41A quaternary drainage system known as the Polfonteinspruit catchment area as shown in **Table 8** below.

The Tswana Limestone Quarry is located just beneath the 1500 m contour line to the west of the upper reaches of the drainage basins of the Harts River and Molopo River. The plateau to the north, east and south forms the main watershed between the drainage basins of these rivers and the drainage basins of the rivers running northwards (towards Groot Marico) and southwards (towards the Taaibosspruit). The Polfonteinspruit River flows adjacent to the northern boundary of the Tswana Limestone Quarry and drains into the Lotlhakane tributary which eventually drains into the Molopo River. (JG Afrika, Wetland Assessment, 2022).

Table 8: Catchment Characteristics

Quaternary Catchment	River System	Wetland Type	Condition Rating	Water Management Area	Bioregion
D41A	Molopo - Orange	Artificial Depressions	Category Z/1	Crocodile (West) and Marico	Dry Highveld Grassland

10.5 Wetland Assessment

A Wetland Assessment was undertaken by the JG Afrika (Pty) Ltd in March 2022 as a component of the environmental and WUA processes. The full report has been included in **Appendix 14** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

The main findings of this Wetland Assessment report have been summarised below:

The study areas for each of the wetland sites are included in the relevant sections covering each site. However, for all of the sites the definition of the Regulated Area of a wetland or watercourse was taken into consideration. Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) for Water Uses as defined in Section 21(c) and (i)", Notice 509 of 2016, specifies that the "regulated area of a watercourse" is to mean:

- ✓ *The outer edge of the 1 in 100-year flood line and / or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam,*
- ✓ *In the absence of a determined 1 in 100-year flood line or riparian area, the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench, or*
- ✓ *A 500m radius from the delineated boundary (extent) of any wetland or pan.*

While the above criteria are considered, the actual wetland study area was taken to be the 500 m radius around the mine since it also captured a length of the Polfontein Spruit River. The wetlands in the vicinity of Tswana Limestone Quarry, as shown in **Figure 6** below, are all Wetland Map 5 listed but three, all within the mining right area, are also National

Freshwater Ecosystem Priority Areas (NFEPA) listed.
Examination of the terrain within the mining right area revealed that much of it had, at some time in the past, been mined down to a level where the pit base was a short distance below the natural ground surface. As a result, the water table, which is naturally shallow, has co-incidentally been exposed in many places. Following the heavy rains that had fallen in the time prior to the site inspection, every deeper mine pit was at least partially filled with water and extensive areas of flat ground outside the mine pits were water-logged (JG Afrika, Wetland Assessment, 2022).

The issue relating to the difficulty in delineating wetlands is that there were originally very few wetlands in the area, other than those directly associated with the Polfontein Spruit. Because of the difficulty in determining the edges of wetlands, areas of wetland are mapped based on both the Wetland Map 5 sites and on direct field observations. In order to make the delineation as meaningful as possible, the sites are grouped into two categories and candidate sites are examined more closely (JG Afrika, Wetland Assessment, 2022). These categories are defined as follows:

It must be noted that the separation of the two wetland types is not absolute since the wetlands are highly dynamic in terms of their extent and properties. Shallow areas that have been mined can appear to be mine pit wetlands but lack the necessary inundation period to develop true wetland vegetation. The classification of such sites was then sometimes based on examination of Google Earth images from several different times to see if the site dries out or not (JG Afrika, Wetland Assessment, 2022).

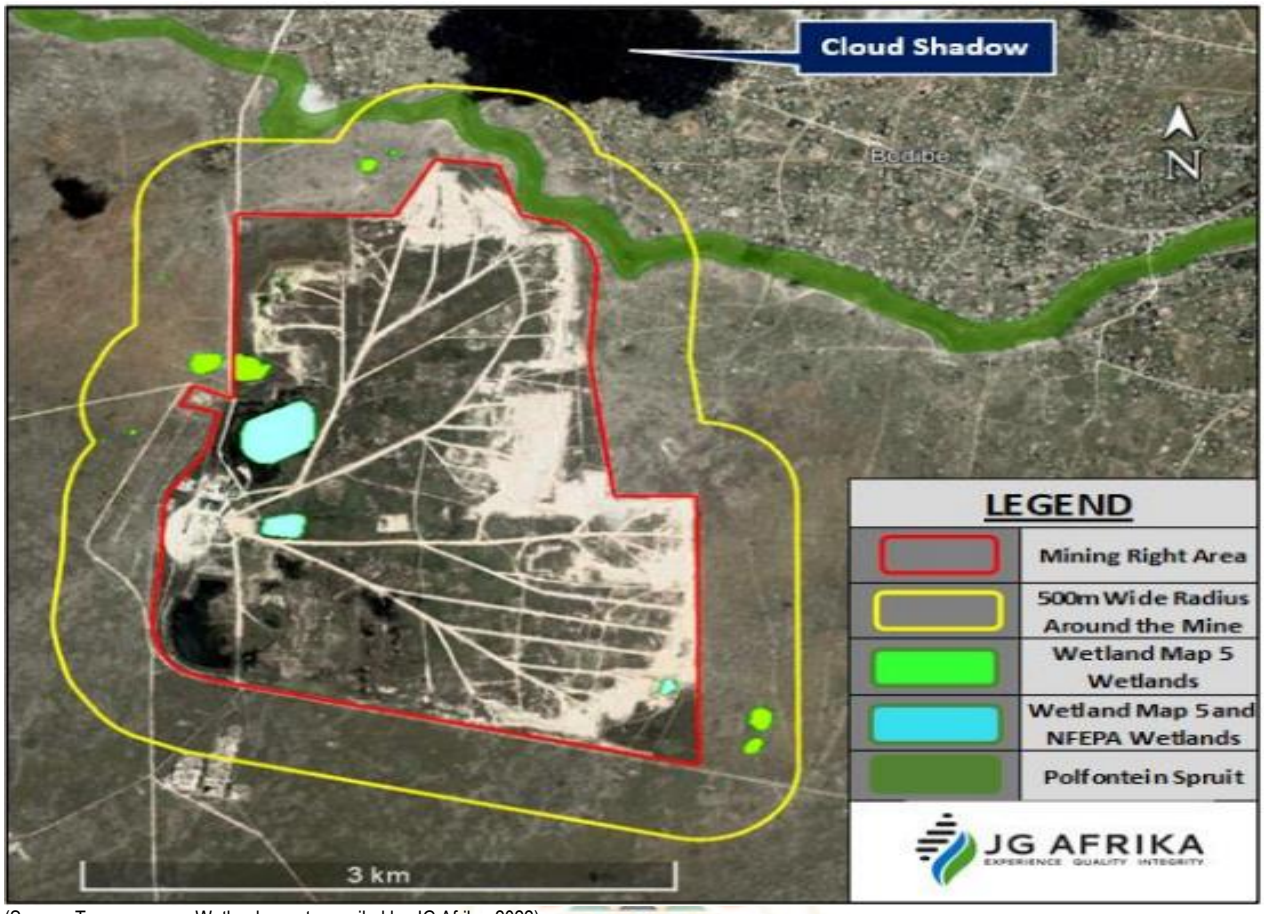
As indicated above, two palustrine wetland types, which are Mine Pit wetlands and Depression Wetlands, are recognised. Both types are artificial as they most closely fit the definition of a Depression Wetland. Water levels in the mine pits will be closely associated with the ground water table with rainfall and surface flows only making up some of the volume. Rainfall is of considerable importance to these wetlands as the depth of the water table will be driven by it (JG Afrika, Wetland Assessment, 2022). Details of the delineated three wetlands subjected to assessment are shown on **Table 9** below and **Figure 6**.

Table 9: Details of the delineated three wetlands

Site	Area (Ha)	Wetland Type	Land use
W1	11.2	Pit	Mining Area
W2	3.1	Depression	Mining Area
W3	0.98	Depression	Unmined Area

The WET-Ecoservices model indicates that the levels of ecosystem service delivery from the three wetlands are generally "**Intermediate" to "Low**". Even the higher scores obtained for services such as "Flood Attenuation", "Sediment Trapping" and "Erosion Control" are misleading since the figures are based on the vegetation cover in the sites but are meaningless as the sites generally have no inflows or outflows that leave the area. Wetland W3 does offer some benefit in the form of "Natural Resources" (provision of grazing for livestock) which the others do not offer (JG Afrika, Wetland Assessment, 2022).

It is noted that the three sites can vary considerably between wet and dry years and so their ecological state will also vary accordingly. Therefore, they are rated to have a variable PES ranking. At times their functionality would suggest a **PES Category A system,** however the application of this score to an artificial wetland may be questionable (JG Afrika, Wetland Assessment, 2022).



(Source: Tswana quarry Wetland report compiled by JG Afrika, 2022)

Figure 6: Wetlands in the Tswana Limestone Quarry study area

It is believed that the sites have **Moderately Low to Intermediate** Ecological Importance as they are able to support aquatic biodiversity in a region which is very dry at times. Site W1 is able to function as a refuge at times when other systems are completely dry on the surface, and so act as a source of recolonisation for times of wetter conditions (JG Afrika, Wetland Assessment, 2022).

It is unlikely that provision of buffers would be of any benefit to the wetlands within the mine area. There are no incoming or outgoing watercourses and so the wetlands are all endorheic. The wetland areas outside of the mine are on community land used for grazing of livestock. It is not possible to provide buffers in such areas, however, should any form of developed land use ever take place there, then buffers should be developed as may be appropriate at the time (JG Afrika, Wetland Assessment, 2022).

The 500 m radius around the mining right area includes a section of the Polfontein Spruit. The Polfontein Spruit flows past the Tswana Mine in a southeast to northwest direction. The source is located some 7.5 km upstream of the mine and the stream eventually joins the Molopo River some 45 km away near Mafikeng (JG Afrika, Wetland Assessment, 2022).

It is therefore thought that, in its natural state, the Polfontein Spruit in the study area was an Unchanneled Valley Bottom with some lateral flow inputs from either side but has now become a Channelled Valley Bottom (CVB) and is classified as such in Wetland Map 5. The same conditions exist for considerable distances both upstream and downstream of the site and so the study area may be considered to be representative of a longer section of the Polfontein Spruit (JG Afrika, Wetland Assessment, 2022).

The Polfontein Spruit has been severely impacted upon by human activities. It is apparent that the channel is far from natural as almost its entire length has been either used for agriculture in the past or has been deeply pitted. It is assumed that the pits were excavated for the purpose of providing surface water for livestock, but it is also clear that excavation for extraction of material for block making is still being done, although not on a large scale (JG Afrika, Wetland Assessment, 2022).

The Polfontein Spruit is the only watercourse in the area which has permanent or semi-permanent water even if only very little. A tributary channel flows in from the north and enters the main channel opposite the mine. It is now almost obliterated in the built-up area of Bodibe. The linear gradient of the channel down the study section is approximately 0.5% (JG Afrika, Wetland Assessment, 2022)

The overall PES Category for the Polfontein Spruit Score is **Category E**. The result of the PES modelling is similar to that listed in Wetland Map 5. There are no red listed species data, and a search of the Animal Demography Unit Virtual Museum indicated no species of concern. The findings that the site was of an Intermediate EIS were not unexpected, since it has been subject to numerous impacts in the past. Adequate protection from ongoing impacts could raise the score substantially.

It is to be noted that, although there has been mining activity at the site for some 40 years, the mine only approached to within 100 m of the delineated channel in 2016. However, as noted in the section above, there appear to be no visible impacts on the wetland as a result of the incursion. Therefore, it is considered that, if the proposed mitigatory measures are applied, there are no new risks to the Polfontein Spruit system.

It is recommended that the mining right area, if ever to be enlarged, approach no closer than 100 m from the delineated edge of the wetland and so this distance is recommended as a general buffer for the site. The purpose of the buffer strip is to ensure that the mine does not have any further effect on the Polfontein Spruit, which is already impacted upon by various agricultural and pastoral activities originating from the Bodibe Community.

10.6 Surface Water Quality

Aquatico was commissioned by Lafarge Industries to sample, analyse and evaluate the physical, chemical and bacteriological quality of surface (monthly).

The results of the August sampling period can be found below:

Surface water

- The water quality sampled at Tswana Lime Pit was compared against the General Authorisation limit and the SAWQG for Livestock Watering.
- The water at Tswana Lime Pit can be described as neutral, non-saline (Tswana Lime Pit) to saline and hard (Tswana Lime Pit) to very hard. All of the analysed variables complied with the General Authorisation limit at Tswana Lime Pit during August 2022. The compliant ("unaffected") water quality might be a result of the influx of fresh rainwater that causes a dilution effect (Monthly Water Quality Assessment Aquatico, 2022).

10.7 Geohydrological Report

A Geohydrological Report was prepared by JG Afrika (Pty) Ltd, in support of the water use authorisation for Lafarge Tswana Quarry. The aim of the assessment was to determine the sustainable yield of the current supply borehole designated LQBH4, conduct a hydrocensus to establish potential receptors, and to develop a numerical groundwater flow and mass transport model, to determine risk and impact. The Geohydrological Report is attached as **Appendix 17** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

A summary of the findings of the assessment are found below:

The project area is underlain by a karst aquifer type and the aquifer class unit in terms of the South African Aquifer Classification System is characterised as *Major* (JG Afrika, Geohydrological Assessment, 2022).

Borehole Yield Assessment

The yield testing of the borehole was carried out by JG Afrika (Pty) Ltd over the period 02 to 03 August 2022, in accordance with the guidelines of the South Africa National Standard SANS10299-4:2003 Part 4: Test Pumping of Water Boreholes. The maximum daily volume that can be abstracted from the borehole using the conservative critical drawdown is 91.6 kl/d. Given the pump cycle observed on site, the borehole likely operates at less than 7.5 hours per 24 hour cycle. This is

inferred to be a reasonable representation of the main strike depth and the borehole is considered to be operating within the design of its sustainable yield (JG Afrika, Geohydrological Assessment, 2022).

Groundwater Quality

A groundwater sample was collected from the borehole for chemical analysis by JG Afrika (Pty) Ltd during the site assessment and tested for selected determinants of the Domestic Consumption SANS241 raw water suite. The results of analysis indicated that all the determinants analysed were within the screening limits. The groundwater is therefore potable and suitable for domestic use without treatment (JG Afrika, Geohydrological Assessment, 2022).

Borehole Management Plan

Based on the analysis of the yield test data and water quality, a summary of the borehole management plan is listed below:

- Water quality for the LQBH4 borehole fell within the SANS241 limits;
- There were no compounds or risks of concern;
- Biannual monitoring was recommended;
- The water use application abstraction rate should be 1.86 l/s on a 24 hour duty to accommodate the maximum sustainable yield of the borehole. This equates to approximately 58657 m^3/a.

Hydrocensus

A hydrocensus was required to determine existing groundwater use in the project area and to establish possible impacts on existing resources from the Tswana Lime Quarry site activities. The hydrocensus further served to collect current water levels from known resources for the development of the groundwater model.

The National Groundwater Archive (NGA) of the Department of Water and Sanitation was interrogated to establish the existence of any groundwater resources and groundwater use in proximity to the site. The NGA reported 74 (No.) resources within 5 km of the site. A field verification hydrocensus was also carried out. A total of nine (9 No.) resources were identified during the previous and current survey. One (1 No.) water supply borehole, four (4 No.) monitoring boreholes and three (3 No.) unused boreholes were identified (**Figure 7**). (JG Afrika, Geohydrological Assessment, 2022).

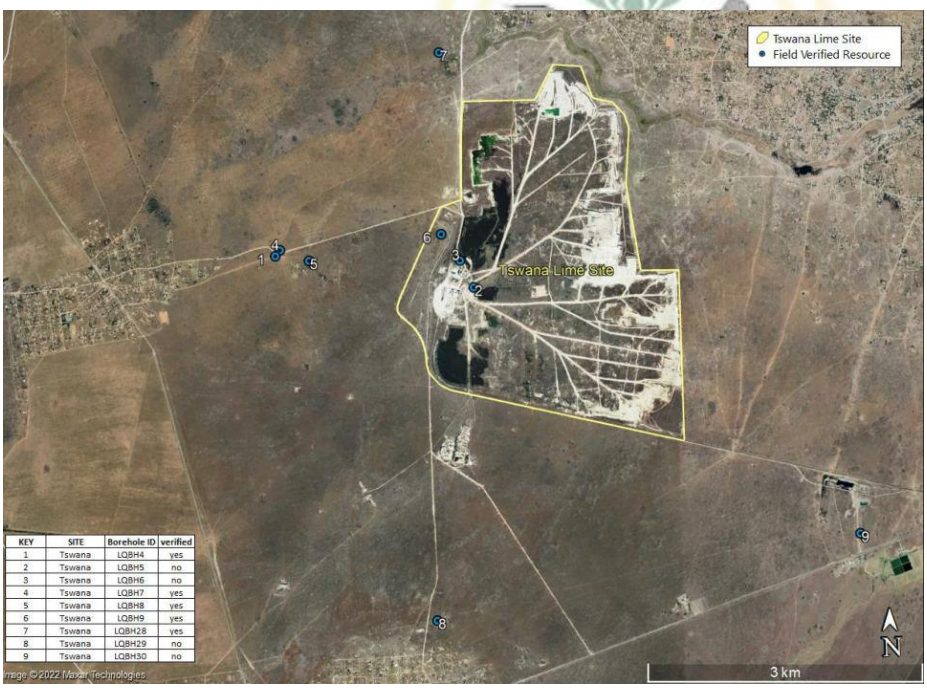


Figure 7: Field Verified Resources (After Tucana Solutions 2017)

Numerical Groundwater Model

To determine the impact on the receiving environment, the groundwater flux into the mine pits was modelled through the numerical groundwater flow model, and the potential sources of pollution were modelled through the use of mass transport. Four time steps at 25, 50, 75 and 100 years for mass transport were considered. The model outputs were to simulate groundwater influx associated with the quarry pits and determine mass transport travel distances for the individual model layers over the model time steps in 25 year increments.

The sustainable yield of the supply borehole was determined as 58656 m3/a through yield testing of the borehole. The model pit inflow results indicated that the net inflow from groundwater is in continual balance with the evaporation component resulting in a near zero net flow. The variability of the contribution from rainfall is offset by continuous evaporation, resulting in a general water balance in the pits, and as a result, the pit levels fluctuate periodically.

The mass transport results showed a strong dependence on the characteristics of a structural lineament through the project area. It was evident that the plume movement is affected by the pumping taking place at LQBH4 as the plume moves in that direction. More field data is required to confirm the effect of this feature, as the hydraulic conductivity of the structure was determined through the calibration process. Model calibration is also non-unique due to the many degrees of freedom that exist in the unknown parameters and/or uncertainty in measured results. To improve the model confidence, more data would be required to refine the current model. In particular, monitoring points around the pits would enhance the model output for determining groundwater flux into the pits. Additional monitoring boreholes were proposed around the pits and along the structural feature (JG Afrika, Geohydrological Assessment, 2022).

Quantitative Environmental Risk Assessment and Mitigation

The quantitative environmental risk assessment (ERA) identifies operational phase activities that may impact on the groundwater receiving environments. Most activities identified scored LOW or MODERATE for the pre mitigation ratings. Stockpiles scored HIGH. Most scores can be reduced with the introduction of mitigation measures. The potential impacts include:

- Aquifer dewatering
- Deterioration of groundwater quality
- Recharge of the groundwater system
- Impacts on downstream users
- Future pit decant
- Salt loading through evaporation process
- Prolonged leaks from stockpiles and impacts on groundwater
- Mobilisation of existing elevated compounds
- Increased turbidity loading from construction areas
- Major loss of contaminant dam overflows

Additionally, the aquifer vulnerability was considered as medium to high, and the Parsons Groundwater Quality Management System gives the site a High Level of Protection index for the second variable vulnerability (JG Afrika, Geohydrological Assessment, 2022).

Groundwater Monitoring Programme

It is recommended that groundwater sampling be carried out in accordance with the Water Research Commission's Comprehensive Guide for Groundwater Sampling JG Afrika's standard operating procedures for environmental monitoring and field work.

The current groundwater analysis suite being applied at the Tswana Limestone Quarry Site is summarized in **Table 10,** with the inclusion of additional recommended analysis.

Table 10: Analysis Suites

Frequency	Analytical List	Objective
Bi-annually	pH, EC, Ca, Mg, Na, K, Total Alkalinity, F, Cl, NH4(N), NO3(N), PO4, SO4, Al, Fe, Mn	Water quality and impacts
	SANS214:2015 – Raw Water	Domestic consumption
Annually	Ba, As, Co, Cr, Ni, Pb, Se, Sr, V, Zn, Mn, Cu, Ga, Ge, Rb, Y, Zr, Sn, W, Bi,	Water quality and impacts

	Th, U, Hg	

The existing and proposed groundwater monitoring locations are presented in **Figure 8**. It is noted that LQBH5 and LQBH6 need to be reinstated, and additional monitoring boreholes may include NBH1 to NBH3 to augment the data set (JG Afrika, Geohydrological Assessment, 2022).

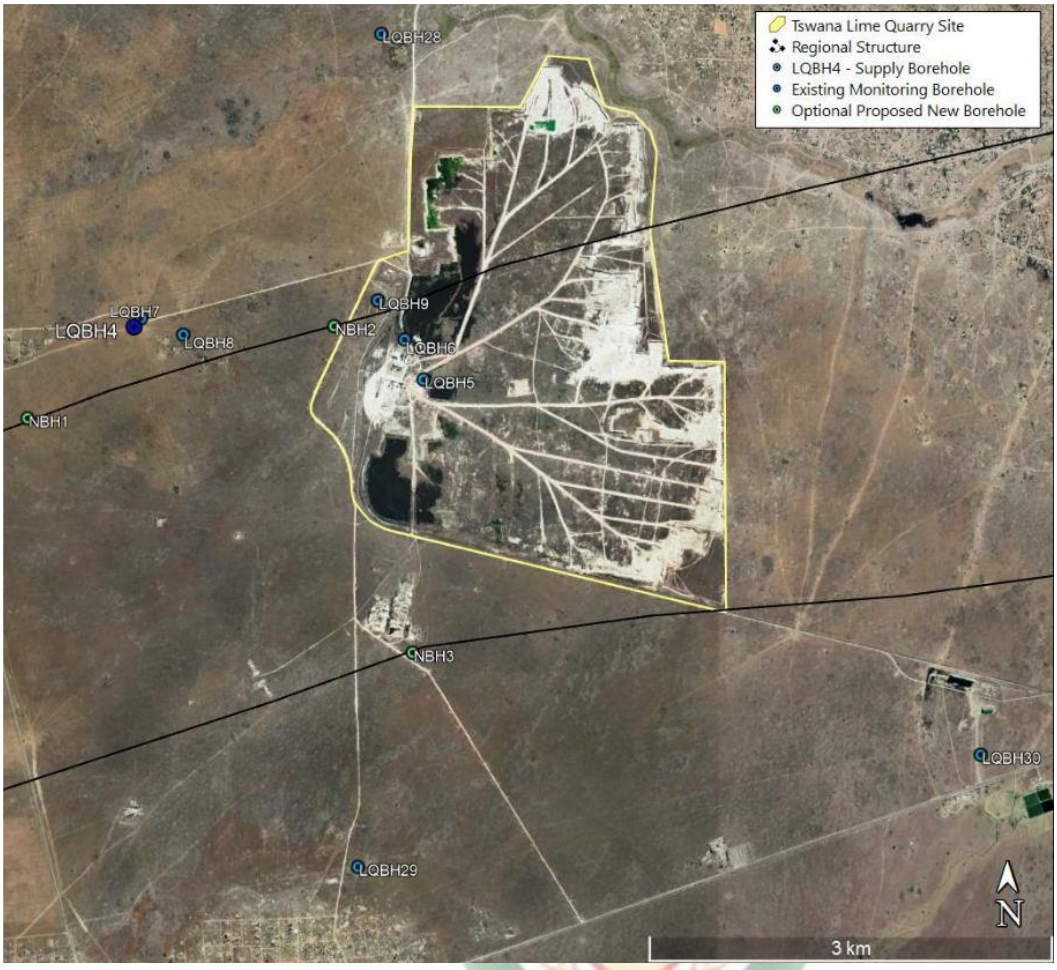


Figure 8: Tswana Lime Quarry Groundwater Monitoring Network

11. Impacts and mitigation measures

The potential impacts and mitigation measures that are expected from the proposed activities are presented in **Table 11** below**.**

Table 11: Summary of Impacts and Mitigation Measures

Water Use Activity	Impacts of the Activity on the Water Resources	Operation		Impact after Mitigation
		Impacts	**Mitigation Measures**	
During operation phase • Abstraction of groundwater and surface water for uses in the mine such as dust suppression and vehicle washing at the Wash Bay.	**Changes in Catchment Water Resources**	○ Abstraction of groundwater and surface water. ○ Reduction of groundwater quantity, lowering of groundwater level. ○ Interference with minimum flow requirements. ○ Limiting Flow to the downstream environment. ○ Disturbance of natural flow regime. ○ Lowered water surface. ○ Loss of wetland space.	• Mitigation may be achieved by means of drawing water from different mine pits in a rotational fashion. • Some measure of mitigation may be achieved through leaving worked out pits in a condition that will hold water at least some of the time so that wetlands may have some change of becoming established.	**Low**. The area associated with any impervious surfaces is insignificant compared to the local and regional catchment areas. Therefore, the significance rating for changes in water resources as a result of an increase in impervious areas is insignificant
During operation phase • Tswana Quarry mining operation. • Clearance of vegetation. • Stripping and stockpile of topsoil. • Earth moving activities. • Blasting. • Excavation. • Crushing, screening, and production lines.	**Erosion and sedimentation**	○ Loss of topsoil. ○ Loss of soil structure ○ Increased sediment inputs. ○ Increase in on-site and off-site erosion. ○ Increased wind and water erosion. ○ Siltation. ○ Increased silt load. ○ Compaction of soils. ○ Decrease in the productivity of land. ○ Increased stormwater runoff volume and velocity.	• Areas earmarked for mining operation must be securely delineated to ensure a controlled footprint area. Activity outside of the delineated work footprint is STRICTLY prohibited. • Rehabilitation must take place continuously to ensure that bare surfaces are rehabilitated as soon as practically possible. • Run off control measures must be provided at rehabilitated areas and roads where necessary. • Roads must be maintained regularly. • Storm water management techniques must be designed and placed correctly to ensure that storm water runoff is controlled and channelled effectively to prevent soil erosion and sedimentation. • All stormwater runoff from areas likely to be a source of sediment contamination must be directed	**Low.** Open and disturbed areas are predominantly located within the open pit area. Therefore, any erosion or transport of sediment will be limited to within the open pit. It is unlikely that sediment will be transported to the downstream environment, which means this identified potential impact is associated with a low significance

Water Use Activity	Impacts of the Activity on the Water Resources	Operation		Impact after Mitigation
		Impacts	Mitigation Measures	
• Stockpiling and transporting of materials via rails. • Operation of stormwater infrastructure.			to a sediment trap, where sediment will be deposited rather than entering into the receiving environment. • Erosion protection measures must be installed at all pipe culverts or storm water drainage pipe outlets located along the routes. This is a requirement in addition to velocity control measures e.g., Berms, sandbags, reno mattress and hessian sheets, erosion control blankets, silt fences, geotextiles such as soil cells and retention or replacement of vegetation. • Cut and fill slopes stabilisation will be required to avoid erosion. This may be achieved through effective use of erosion control measures (gabions). • Water must not be allowed to flow down cut or fill slopes without adequate soil erosion protection in place. • Attenuation of stormwater from the road is important to control the velocity of runoff towards the natural environment. i.e., stormwater must not be deposited directly into any wetlands. • Water spreaders must be used to reduce the velocity of flow. • Energy dissipaters must be constructed at any surface water outflow points. • Install sediment barriers to prevent sediment flow into the natural watercourse. • The parking lot design must incorporate various soft engineering features to improve drainage. This must include areas draining into swales with	

Water Use Activity	Impacts of the Activity on the Water Resources	Operation		Impact after Mitigation
		Impacts	Mitigation Measures	
			planted gardens (trees to provide shade), perforated parking bays or areas, etc. • Areas sensitive to erosion must be identified and monitored to ensure that erosion risks are minimised. • Any erosion features must be stabilised following dilapidation of stormwater infrastructure with soft engineering (preferred over hard engineering options) such as re-sloping and stabilising. Where risks are high, unstable/eroding banks must be reinforced/stabilised using appropriate engineering works such as gabions/rock pack/geotextile bags.	
During operation phase • Tswana Quarry mining operation. • Clearance of vegetation. • Stripping and stockpile of topsoil. • Earth moving activities. • Blasting. • Excavation. • Crushing, screening, and production lines. • Stockpiling and transporting of materials via rails.	**Increased impervious area (Hardened surfaces)**	○ Change in volume and velocity of stormwater runoff. ○ Drainage patterns change due to increased hardened surfaces. ○ Changes in flood hydrology. ○ Disturbance of surface drainage patterns. ○ Possible input of pathogens ○ Alterations to flow volumes and patterns. ○ Change in the hydrological and geomorphological dynamics of the natural environment. ○ Impeding the flow of water.	• Attenuation of stormwater from the road is important to control the velocity of runoff towards the natural environment. • Address increased runoff volumes at source. • A disturbed area as a result of maintenance works must be rehabilitated as soon as maintenance in an area is complete or near complete. • The revegetation of the exposed soil must be undertaken once construction activities have ceased. • The grass must be allowed to lengthen and thicken naturally to facilitate reduction in runoff velocity and volume, increase sediment deposition within the buffer zone and increase infiltration of stormwater. • Stockpiled topsoil must be used for rehabilitation and placed in original profiles following completion of activities. Finished soil levels must be graded to match the natural topography of the site. All	**Low**. As mentioned in the Baseline Hydrology and Impact Assessment previously, the area associated with impervious surfaces is insignificant. Further to this, any stormwater runoff from the project site will be into the open pit, which means that there will be no increase in the discharge rate or downstream flood hydrology as a result of the quarry

Water Use Activity	Impacts of the Activity on the Water Resources	Operation		Impact after Mitigation
		Impacts	Mitigation Measures	
• Operation of stormwater infrastructure.			stripped topsoil MUST be appropriately used on the site. • The design and use of SUDS which includes, but is not limited to, swales, filter strips and infiltration trenches that capture runoff, filter out the pollutants and allow for the diffuse release of water into the receiving environment is paramount to limiting the long-term effects of an increase in hardened surfaces adjacent to the watercourse areas. • It is important to maintain any SUDS feature that are installed on the site. Un-maintained SUDS features may eventually fail operationally as a result of sediment build up and the effect this has on vegetation growth. • The use of SUDS features can also be used to remediate the natural environment that will be impacted through allowing for erosion control, attenuation of water which will promote vegetation growth in these areas.	
During operation phase • Tswana Quarry mining operation. • Clearance of vegetation. • Stripping of topsoil. • Earth moving activities. • Blasting. • Excavation.	**Potential pollution on surface water and groundwater**	○ Discharging waste or contaminated water (Hydrocarbon spills, pit dewatering and sewage spills). ○ Water pollution. ○ Reduction of surface water quality. ○ Reduction in Catchment Water Quality. ○ Potential impact on wetlands and groundwater as a result of on-site accidental fuel spills and leaks or as a result of leachate from waste disposal areas and infiltration through soil of dirty water.	• Clean and dirty water separation and compliance with Regulation 704 of the National Water Act must be adhered to. • Provision of bunded facilities: all oil and fuel storage facilities are bunded as specified by government notice No. 704. • MSDS' for hydrocarbon materials must be easily accessible on site and the relevant personnel are to be familiar with their content • The water quality must be monitored twice a year (April and October).	**Moderate.** Although reducing water quality for downstream users/eco-systems is associated with a high significance, the likelihood of contamination from the quarry site to the downstream environment is limited. This is largely due to most of the stormwater runoff from the site discharging into the open pit (which cannot discharge to the downstream environment). Possible sources of contamination were identified at the

Water Use Activity	Impacts of the Activity on the Water Resources	Operation		Impact after Mitigation
		Impacts	Mitigation Measures	
• Crushing, screening, and production lines. • Stockpiling and transporting of materials via rails. Operation of stormwater infrastructure.		○ Mismanagement of waste and pollutants like hydrocarbons, solid waste and hazardous substances resulting in these substances entering and polluting sensitive natural environments either directly through surface runoff, or subsurface water movement. ○ Potential pollution of wetlands and soil. ○ Contamination of soil and surface water resource. ○ Potential impact on wetlands and groundwater. ○ Increase in first flush effect of the pollutants into adjacent natural environment. ○ Contamination of water resources through toxic organic and/or heavy metals from fuel storage, chemicals stored on site.	• A chemical analysis must be done on every sample and a report submitted monthly to the Department of Water and Sanitation. • Hazardous chemical substances must be stored within a bunded and roofed area to prevent spills from occurring directly on the ground / soil and the ingress of stormwater ○ "Watertight" bund to have a volume equal to 1.5 times the stored volume. ○ Spills in the bund to be recorded including photographs. • Handling of hazardous chemical substances (i.e., re-fuelling, pouring of oil etc.) must be done on a lipped spill tray and must not take place within 100m of wetlands areas or watercourses. • Spillages of fuels, oils and other potentially harmful chemicals must be cleaned up immediately and contaminants properly drained and disposed of using permitted solid/hazardous waste facilities (not to be disposed of within the natural environment). Any contaminated soil must be removed, and the affected area rehabilitated immediately – consult with relevant l specialists if spills occur. • Machinery must 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. • The sizing and positioning of "dirty" stormwater channels and recommendations on bunding around areas containing potential for surface water contamination must be designed such that:	workshop area of the quarry, were hydrocarbon stores are located. These hydrocarbon stores still pose a threat to the ecosystems present in the open pit and Quarry Sump 1. Management of these sources of potential contamination are therefore still associated with a high importance.

Water Use Activity	Impacts of the Activity on the Water Resources	Operation		Impact after Mitigation
		Impacts	Mitigation Measures	
			○ 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). ○ "Clean" stormwater runoff diversion infrastructure will be sized to divert runoff generated during the 1:50 year storm event as per the GN704 requirements. • Areas that may result in the contamination to groundwater must be sufficiently lined to meet with regulatory requirements. • Strict management and disposal of waste must occur during the lifespan of the mining operation. • All domestic waste must be regularly removed from the quarry site on a regular basis and dumped in appropriate waste handling facilities. • Strict housekeeping practices are to be implemented. • Regular collection of domestic waste and disposal at a suitable permitted waste disposal site. • The mining operation site must be kept clean on a daily basis and all litter must be collected and disposed of in waste bins on site. • All waste generated during construction is to be disposed of as per the EMPr attached in **Appendix 13**. • Berms upslope and downslope of areas likely to be a source of sediment contamination must be implemented. Upslope berms will ensure limited surface flows through areas associated with sediment loss. Downslope berms will ensure that	

Water Use Activity	Impacts of the Activity on the Water Resources	Operation		Impact after Mitigation
		Impacts	Mitigation Measures	
			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. • A collection and disposal strategy must be implemented to ensure that waste is removed at least twice per month and taken to a suitably permitted landfill site. • Domestic / organic waste to be removed on a weekly basis. • Hazardous waste must be stored separately and disposed of at a suitably permitted hazardous landfill site. • Long-term sewage containment management and/or treatment facilities implemented at the quarry must be sufficiently sized, such that spillages of untreated sewage to the environment are unlikely. • All machinery and equipment must be inspected regularly for faults and possible leaks and must have drip trays to contain oil leakage, these must be serviced off-site. • All equipment found to be leaking oil, hydraulic fluid, or fuel to be removed from site immediately. • Waste bins must be secured and have lids to prevent litter from being blown and spread over the area. • Separation and recycling of different waste materials must be undertaken where possible. • Regular quality monitoring of waste before discharge.	

Water Use Activity	Impacts of the Activity on the Water Resources	Operation		Impact after Mitigation
		Impacts	Mitigation Measures	
			• Compliance to appropriate construction standards of the waste storing and drainage systems. • Implementation of best practice procedures for storage and handling hazardous substances. • Immediately report significant spillages and initiate an environmental site assessment for risk assessment and remediation. • Fuels and hydrocarbon stores must be lined and bunded such that spills from the store areas will not enter the receiving environment. • Spill kits must be available on site to ensure that any fuel or oil spills are cleaned-up and discarded correctly. • Storm water outlet structures and attenuation ponds must be maintained and inspected on a monthly basis to ensure that littler is removed and correctly disposed of (at a permitted landfill site). • All disturbed soils must be rehabilitated with local plant species to ensure that alien vegetation does not invade the area. • All soils compacted as a result of construction activities must be ripped and profiled. • Water on the road must be diverted away to minimise the amount of water running directly from the road into wetlands. Such drainage must lead the water to vegetated filter strips, which remove particles and contaminants from the water. • Regular maintenance and checking of the infrastructure such as surface water drainage, road surface and kerbing must however take place over the lifespan of the project.	

Water Use Activity	Impacts of the Activity on the Water Resources	Operation		Impact after Mitigation
		Impacts	Mitigation Measures	
			• Regular checking the integrity of underground infrastructures (sewage and stormwater drains and manholes) for cracks identification and possible blockages. • The likelihood of dust being produced must be reduced. Dust suppression methods include: o Limiting the speed of all mining equipment/vehicles to 40 km/h on the internal haul roads. o Site management are to ensure denuded areas (dust source) are kept to a minimum. o 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. o Compacted dust collected by the crusher plant should be cleaned weekly to eliminate it as a dust source. o Water downstream of quarry must be monitored to ensure no degradation of water quality occurs.	
During operation phase • Tswana Quarry mining operation. • Clearance of vegetation. • Stripping of topsoil. • Earth moving activities. • Blasting.	**Proliferation of alien invasive vegetation**	o Encroachment of invasive species into disturbed areas o Disturbance of indigenous vegetation. o Alteration of habitat structure. o Lower biodiversity (both number and quality of species). o Change nutrient cycling and productivity. o Increased water usage.	• An alien invasive management programme must be incorporated into EMPr and must be implemented throughout the operational and rehabilitation phases of the development to prevent its introduction and spread, as per the legislative requirements specified under the Conservation of Agricultural Resources Act, 1983 amended in 2001 and the National Environmental Management: Biodiversity Act 2004 (Act No, 10 of 2004).	**Moderate - Low** A site rehabilitation plan has been compiled and must be implemented to address the negative impacts that might occur and to return the receiving environment to an acceptable level of integrity.

Water Use Activity	Impacts of the Activity on the Water Resources	Operation		Impact after Mitigation
		Impacts	Mitigation Measures	
• Excavation. • Crushing, screening, and production lines. • Stockpiling and transporting of materials via rails. • Operation of stormwater infrastructure.		○ Modify food webs. ○ Destruction of indigenous species.	• Ongoing invasive alien plant control must be undertaken and implemented for the clearing/eradication of alien species during the operational phase of the quarry and particularly in the disturbed areas as these areas could quickly be colonised by invasive alien species. • Re-instate indigenous vegetation (grasses and indigenous trees) in disturbed areas as soon as practically possible so as to attain environmental integrity of the area. • All disturbed soils must be stabilised with a suitable indigenous grass seed mix and ongoing weed control is undertaken. • The quarry must be rehabilitated as specified in the Rehabilitation Plan. • Minimise disturbance during setting out and site establishment. • All areas of disturbance resulting from the implementation of the mining operation must be cleared of alien invasive vegetation in accordance with Section 28 of the NEMA (Duty of Care). • A landscape rehabilitation plan must be prepared for approval by the ECO. • All areas disturbed must be rehabilitated to an acceptable state and must be monitored afterwards to prevent these areas from being colonised by alien invasive species.	Various alien invaders have infested the site area including *Lantana camara, Rubus cunefolius* and *Solanum mauritianum.* The removal of alien invasive vegetation must be undertaken prior to the re-vegetation of disturbed areas and landscaping. The control needed to eradicate the specific species is provided in detail in the EMPr.

12. Water Balance, Water Demand and Water Supply Analysis

12.1 Water Balance

JG Afrika (Pty) Ltd were appointed by Lafarge Industries South Africa (Pty) Ltd to undertake a Water Balance Study for the Tswana Lime Quarry. This water balance study is 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). The Water Balance Report is attached as **Appendix 19** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

The objectives of this water balance study are to:

- ✓ Compile a graphic representation of the water flow reticulation for the quarry and its associated workshop, crusher and administration areas,
- ✓ Determine the volume of water required in the various activities associated with the quarry, and
- ✓ Define the water sources, changes in water storage and mechanisms, and volumes of water losses associated with the quarry.

Figure 9 below presents the resulting water balance for the Tswana Limestone Quarry for annual average water balances. Water inputs into the various infrastructure are generally presented on the left of the diagram and outflows are presented on the right of the diagram. Values provided in **Figure 9** are in cubic meters per annum (m^3/annum).

12.2 Water demand

The water balance for the Tswana Lime Quarry was based on a number of assumptions (based on experience with similar projects), information supplied by management of the quarry and notes taken during a site visit in January 2022. The accuracy of the resulting water balance is therefore related to the accuracy of the assumptions/estimations made in the compilation of the water balance. The water balance compiled as part of this project provides average daily water movement in cubic meters for annual average, dry period average (based on the months of July) and wet period (based on the months of February (JG Afrika, Water Balance, 2022)).

The water balance results are summarised as follows:

- ✓ Drinking water has been excluded from the water balance study as this is brought onto site from an external source and is used strictly for drinking purposes.
- ✓ Domestic water (used for the ablutions, cleaning purposes etc.) has been allowed for in the water balance. The total domestic water use is estimated at 3.65 m³ /day (or 1332 m³ /year). This water sourced from an onsite borehole, from which water is pumped to two Jojo Tanks and then distributed to the various areas of use.
- ✓ In addition to the domestic water use from the Jojo Tanks, water used for dust suppression is by far the biggest water user at the quarry. The water used for dust suppression purposes at the crushing plant equates to 67.2 m³ /day (or approximately 25 000 m³ /year).
- ✓ Flow meter records of water pumped from the borehole indicated significantly more water being pumped than what is estimated to be used at the quarry. Upon investigation of this, it was noted that community members often puncture the water supply pipeline so that they are able to provide drinking water to their livestock. This loss of water is estimated to be approximately 230 m³ /day (84 000 m³ /year), and has been captured in the water balance accordingly.
- ✓ Two main sumps were identified within the open pit. These were called Quarry Sump 1 and Quarry Sump 2. Quarry Sump 1, located to the northeast of the workshop area, is used for washing of vehicles (on the bank of sump) and for dust suppression along the haul roads (estimated to be 4.6 m³ /day or 1682 m³/month). For the purposes of the water balance study, due to the fact that all of the sumps are located within the open pit and are connected, the quarry sumps were treated as a single entity (JG Afrika, Water Balance, 2022).

Based on the water balance study, the following recommendations are provided:

- ✓ Flow meters should be installed on the pipeline used to supply water for dust suppression at the crushing plant. This will allow for more confidence to be gained in the water balance and the results associated with the water balance.

- ✓ Confirmation on the volume of water lost between the borehole and the Jojo Tanks should be investigated further. Based on the water balance results, the volume of water lost to the environment along this pipeline is significant. Interventions to try to reduce the volume of water lost would then also need to be investigated, so that these losses can be mitigated against (JG Afrika, Water Balance, 2022).

12.3 Water supply analysis

The Water Balance Report that was compiled by JG Afrika (Pty) Ltd in April 2022 is limited to the reticulation associated with the Tswana Limestone Quarry. This includes water abstracted from the supply borehole, water used for dust suppression, domestic water requirements and the environmental water balance (rainfall, runoff, evaporation, and seepage) associated with the open pit and two main dams located within the open pit (JG Afrika, Water Balance, 2022).

The Following water reticulations have been included in the water balance schematic:

Borehole. The main source of water to the quarry is pumped from a borehole, located to the east of the quarry. Water is pumped from the borehole to the Jojo Tanks located near the workshop and administrative buildings. A significant amount of water is lost to the environment. This is as a result of leaks along the pipeline between the borehole and the Jojo Tank. Based on discussions with Lafarge, it is noted that community members have been known to puncture the pipeline, which causes a leak and allows them to access water for their livestock (JG Afrika, Water Balance, 2022).

Jojo Tank. Water is circulated from the Jojo Tank to the administration buildings, change-house and kitchen and to housing units (currently not used) located on site. In addition to the domestic water uses, water from the Jojo Tanks is also used for dust suppression at the crushing plant (JG Afrika, Water Balance, 2022).

Workshop. Water used at the workshop area is limited to water used for washdowns and for domestic purposes, and is sourced from the Jojo Tanks, as mentioned above (JG Afrika, Water Balance, 2022).

Crushing Plant. Associated with the crushing process is a high risk of producing dust. Therefore, a total of eight sprayers are located at the crushing plant to reduce the amount of dust produced. The volume of water used at each of these sprayers has been estimated (as presented later in Table 3-1) for the purposes of this water balance (JG Afrika, Water Balance, 2022).

Open Pit. The open pit covers an extensive area to the east, northeast and southeast of the administration and workshop areas. It is not a deep excavation and is estimated to be less than 10 m deep at its deepest point (JG Afrika, Water Balance, 2022).

Quarry Sumps. Located within the open pit are several sumps, located along the western edge of the pit. These sumps capture stormwater runoff from within the pit and stormwater from the workshop and administration building areas and the crusher area. Water from Quarry Sumps is used at the HDV wash bay and is also used for dust suppression on the roadways within the pit. Due to the interconnection between the sumps, and the fact that they are all located within the open pit, for the purposes of this water balance they have been considered as a single entity (JG Afrika, Water Balance, 2022).

Wash Bay. The wash bay is located within the open pit, on the southern banks of the Quarry Sump 1. During washing, water is pumped directly from the sump to a high-pressure spray gun. Water from the wash bay then runs off directly back into the sump area. During the site assessment no signs of hydrocarbon contamination were noted in the vicinity of the sump and surrounding vegetation (JG Afrika, Water Balance, 2022).

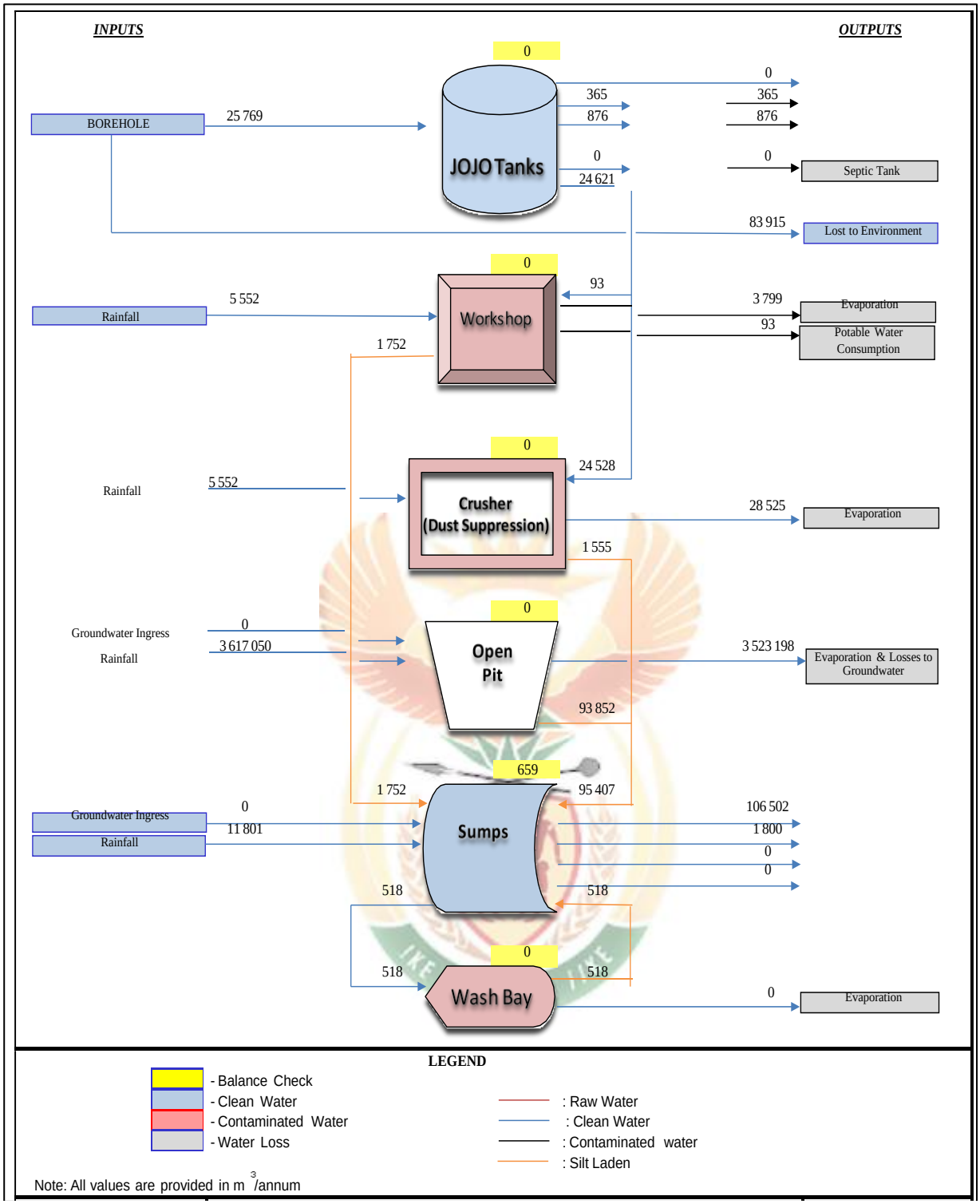


Figure 9: Tswana Lime Quarry Average Annual Water Balance

13. Environmental Management Programme

The objectives of the environmental management plan (EMP) are to:

- Ensure compliance with environmental legislation;
- Manage identified impacts;
- Provide a reference by which future performance can be audited.

In accordance with the Mineral and Petroleum Resources Development Act No 28 of 2002 (MPRDA), an amendment to the EMPR 2001 was required for the proposed modifications at the Tswana Limestone Quarry. The amended EMPR was undertaken by SRK Consulting in 2006 and is attached as **Appendix 13** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

Key features of this plan are summarized below:

- A water monitoring protocol (surface and ground) will be developed for the Tswana Limestone Quarry.
- Discussions will be held with the Ditsobotla Local Municipality regarding the additional abstraction of groundwater and the monitoring measures that Lafarge is implementing. The Ditsobotla Local Municipality needs to agree to the additional abstraction of groundwater.
- Continuous monitoring of stack emissions (Dust, NO2) needs to be undertaken at the plant and alarms triggered when emission limits set by the Chief Air Pollution Control Officer (CAPCO) are exceeded. Remedial action then needs to be taken to reduce, if not eliminate, potential environmental impacts depending on the situation and levels of emissions during the operational phase. This will include an emergency warning and response system for on-site personnel.
- A dust fallout monitoring network will be established within a 1-3 km radius of the quarry during the operational phase so as to determine 'hot spot' areas. This should include establishing baseline levels and identifying other sources of dust in the area.
- Blasting will not be undertaken when wind speeds exceed 5.4 m/s (this trigger for wind speed will need to be confirmed by site specific measurements) during the operational phase.
- Further detailed research will be undertaken into three historical settlements which have been identified in the vicinity of the Tswana Quarry and their heritage values. Discussions will also be held with the Bodibe people regarding the excavation/preservation of these.
- A communication plan will be developed for the Bodibe Community so as to ensure that relations between Lafarge and the Bodibe people improves and are built on a relationship of trust and mutual respect. This plan will need to be implemented for the life of the operation, with early planning and implementation being a pre-requisite for the successful continuation of operations at the Quarry. Key aspects that need to be addressed in these communications are:
    - heritage resources and their protection relocation
    - noise and air quality impacts
    - impacts of blasting
    - access to the quarry and grazing land
    - issues from previous operations: compensation and relocation
    - royalties and social investment
    - the development of effective communication structures

No fatal flaws were identified at the Tswana Limestone Quarry, however, there are impacts associated with the proposed operations which were identified that could constitute fatal flaws if not appropriately mitigated. These are the impact on heritage resources and the relationship that Lafarge has with the community of Bodibe. These impacts can be appropriately managed as suggested in the EMPR (refer to **Appendix 13**).

14. Rehabilitation Plan

A site rehabilitation plan has been compiled and must be implemented to address the negative impacts that might occur and to return the receiving environment to an acceptable level of integrity. The site rehabilitation plan has been incorporated into the EMPr attached in **Appendix 13**. The proposed management / rehabilitation measures are as follows:

- ✓ Contamination of wetlands through spillage of hydrocarbons such as fuel and oils. This impact is one which should not happen and so is in the avoid/prevent level of the hierarchy,
- ✓ Future loss of wetlands as a result of mining activities. This impact is unavoidable and is in the repair/restore level of the hierarchy,
- ✓ Abstraction of water for uses in the mine such as dust suppression. This impact is in the minimise level of the hierarchy,
- ✓ Grazing by livestock at site W3 is reducing the plant biomass there and is probably also reducing plant diversity. This impact, although taking place in the study area, is not the responsibility of Lafarge. It would belong to the minimise level of the hierarchy, and
- ✓ Various alien invaders have infested the site area including *Lantana camara*, *Rubus cunefolius* and *Solanum mauritianum.* The removal of alien invasive vegetation must be undertaken prior to the re-vegetation of disturbed areas and landscaping. The control needed to eradicate the specific species is provided in detail in the EMPr attached in **Appendix 13**.

Since the Polfonteinspruit, which is a natural feature of the landscape, is outside the mining area, it is not expected that the operators will result in mine-related impacts. The mine appears to be having little effect on the Polfonteinspruit despite being within 100 m of the delineated boundary in places. It is therefore recommended that the edge of the workings be stabilized and grassed in those areas. It is also recommended that, should the mining right area ever be expanded in the future, that it not be closer than 100 m from the delineated edge of the Polfonteinspruit at any point. In this way a buffer strip may be created on the southern side of the spruit.

Expansion of the built-up area of Bodibe in a direction toward the Polfonteinspruit may happen in the future but for the moment the area is held open for livestock grazing and so some buffering is happening. It is not known if a dry climatic spell might lead to the area once again being cultivated for food crops but nothing can be done about it for the present.

Financial Provision

The Department of Mineral Resources requires the holders of mining rights or mining permits to annually assess his or her environmental liability and increase his or her financial provision to the satisfaction of the Minister. This requirement ensures that the holder of the mining permit or mining right has sufficient funds to cover any environmental liabilities at any time, or during the mine closure. Costs are calculated for any concurrent rehabilitation; mitigation measures; and monitoring which may be required during pre-closure, closure and post closure of the mine.

The Financial Provisions for 2021 (refer to **Appendix 24**) for the Tswana Limestone Quarry were determined from the EMPr (refer to **Appendix 13**) and an approved financial guarantee provided by a financial institution is attached as **Appendix 24** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

15. Water quality

Based on the information analysed in IWMP report and supporting specialist studies, it is considered that there could be some concerns with the proposed mining operation from a hydrogeological perspective. Risks are generally assessed as moderate to low and with appropriate mitigation, potential impacts on surface and ground water resources are likely to be negligible. Thus, the quarry operation may continue, provided that the recommendations provided in this report, wetland report, geohydrological report, geotechnical report and SWMP are adhered to. It is recommended that ongoing groundwater and surface water monitoring be carried out to identify any impact that may arise during the operational phase.

The operation of the mine has resulted in the creation of a number of artificial wetlands in an area that was previously almost entirely dry which have been classified as being Depression Wetlands. However, as further areas within the mining right area are opened up for mineral extraction many of these wetlands may be lost or will be changed from their present state into mine pit wetlands.

The Polfonteinspruit, which flows by the northern end of the mining right area, is severely degraded as a result of the channel having been used for agricultural or pastoral purposes in the past and ongoing excavation activities. The areas affected in this way are large and further impacts come from overgrazing of the area by livestock.

The mine would have little effect on the Polfonteinspruit despite being within 100 m of the delineated boundary in some places, provided that the edge of the mining operation footprint be stabilized and grassed, and that it is not closer than 100 m from the delineated edge of the Polfonteinspruit.

Mitigation measures recommended in this IWWMP report and all specialist studies including rehabilitation plans to manage potentially significant impacts to surface and groundwater resources during both the operation phase have been incorporated into an Environmental Management Programme (EMPr) for the proposed development. The successful implementation of these management objectives would be best achieved through enforcement and monitoring for compliance by an independent qualified/trained Environmental Control Officer (ECO).

15.1. Monitoring and Control

An independent Environmental Control Officer (ECO) must be appointed by the authorisation holder or Applicant to ensure that the conditions as stipulated in the Water Use Authorisation (WUA) and the approved EMPr are adhered to (Refer to **Appendix 13**).

The authorisation holder or Applicant is obliged to adhere to the requirements of Section 28 of the NEMA (Duty of Care and Remediation of Environmental Damage) which states that: "(1) *Every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot be reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment*".

15.1.1. Surface Water Monitoring

The monitoring programme must be designed to enable the detection of potential negative impacts brought about by the Tswana quarry.

It is recommended that water sampling is undertaken in the vicinity of the site located to the east (downstream) of the quarry area for monitoring purposes. In addition to this, routine water quality monitoring must be completed within this sampling area at the specified GPS coordinates twice a year (April and October) during the operational phase.

A chemical analysis must be done on every sample and a report submitted monthly to the Department of Water and Sanitation.

15.1.2. Groundwater Monitoring

The groundwater monitoring plan is required to monitor the quarry's impacts on groundwater quality. It is recommended that additional borehole monitoring be carried out either on a quarterly or bi-annual basis. The water must be tested for pH, EC, TDS, macro nutrients and microbial organisms and hydrocarbon which may arise from the fuels and oil stored on site. The groundwater monitoring plan which has been included in **Appendix 17** of the IWWMP must be carried out as follows:

I. Groundwater samples must be collected by-annually.
II. Groundwater samples must be tested for macro and micronutrients including microbial contamination.
III. If required, a hydrocarbon analysis must be done. This may only be considered if a hydrocarbon contamination event on site has occurred.
IV. Depending on the level and/or type of contamination identified, remedial procedures by the hydrogeological consultant must be followed.
V. The water sampling must be carried out following strict protocol so that cross contamination or contamination of water does not occur during the sampling phase. Sterilised sample bottles must be used, and these can be obtained from the analytical laboratory.
VI. Depending on the professional carrying out the work, sampling methods may vary, but it is imperative that sterile equipment be used. It is suggested that basic parameters such as pH and EC be recorded in the field.
VII. The water sample(s) must be kept cool. In this regard, it is suggested that a cooler box with ice brick be used for this purpose. A sampling data sheet must be completed for each sample taken and kept as document control for the work carried out.
VIII. Water samples must be submitted to a SANAS accredited laboratory for testing. A groundwater monitoring report must be compiled in line with the DWS guidelines (JG Afrika , Hydrological assessment, 2022).

IX. A geophysical survey should be completed to determine the best positions for drilling of monitoring boreholes.

X. At least two monitoring boreholes must be drilled in the vicinity of the project site. Depending on the subsurface structures the area just northeast and southeast of the project site should be explored for the drilling of the monitoring boreholes.

XI. The monitoring boreholes should be yield tested in order to obtain the necessary aquifer parameters like transmissivity and hydraulic conductivity for input in the calibration of the numerical groundwater flow and transport model.

XII. A numerical groundwater flow and transport model must be compiled and calibrated in order to determine the potential risk for contamination of the aquifer.

XIII. The monitoring boreholes should never be utilised for abstraction purposes.

16. Risk Assessment

It is shown that the risks arising from possible spillage or leakage of hydrocarbons, and from loss of wetlands from future mining activities are both rated as "**Moderate**" before any mitigatory measures are taken. While the risks associated with hydrocarbons can be managed and be significantly reduced or even avoided, any losses due to future mining cannot be remediated to any great extent. Such losses must be accepted but the following must be considered:

- ✓ Loss of wetland as a result of mining. The area is being operated under an authorisation and so the excavations are a part of the operator's core business and must be accepted as being inevitable,
- ✓ Toxicity of the mined material. The extracted limestone is non-hazardous and so will not lead to contamination or pollution of the area and the Polfonteinspruit which flows from it,
- ✓ Recovery of wetland sites. The mine pits will in the future fill with water to some extent as has already happened with the existing worked-out pits. These areas will develop wetland habitat as has happened before,
- ✓ Status of the wetlands. The wetlands in the mining area are, with one possible exception, artificial. In the distant future it is possible that they will all cease to exist but no time scale for such change can be provided.

It is to be noted that, although there has been mining activity at the site for some 40 years, the mine only approached to within 100 m of the delineated Polfonteinspruit channel in 2016. However, there appear to be no visible impacts on the Polfonteinspruit as a result of the incursion. The risk associated with the mine activities to the Polfonteinspruit is considered to be **Low**. Therefore, it is considered that, if the proposed mitigatory measures are applied, there are no new risks to the Polfonteinspruit system

17. Watercourse Impact Report

An environmental audit regarding water management was required as part of the water use licence application for the Tswana Limestone Quarry.

The assessment focused on compliance with legal requirements and the site's own systems and procedures, as well as on impacts with regards to watercourse characteristics namely surface flow, interflow, groundwater flow, water quality, geomorphology, habitat and biota. Site visits and document reviewing was conducted and information from recently conducted specialist studies were used to reach conclusions.

The following table describes the matters which require attention, at the Tswana Limestone Quarry, in respect of water and waste management.

Theme	Matter/Issue
Water Conservation and Water Demand Management	A water efficiency evaluation should be done, as a minimum, by skilled persons. Lafarge Quarries are located in an area where most of the users are dependent on groundwater as their sole source of supply, therefore water management is critical to minimise over abstraction from boreholes.
Water Use authorisations	Specialist studies to inform the water use licence application were reconducted, and the application will be submitted before the end of October 2022. An IWUL has not been issued yet. Water use strategies should be aligned after the approval of the IWUL and IWWMP with the EMPr and its amendments.

Management of possible risks to groundwater resources	According to the Geohydrological Study 2017, the aquifers in the Lichtenburg area are highly sensitive to pollution risks and over abstraction. The current groundwater monitoring network was assessed during the geohydrological assessment conducted in 2022 which included yield testing of boreholes and updating of the numeric and transport flow model.
Management of possible risks to surface water resources	The Polfonteinspruit runs next to the Tswana Quarry with a Wetland system in the Quarry. The Tswana Quarry wash bay samples reported high levels of TSS, soaps, oils, and greases, which confirms the non-effectiveness of the oil separator. Refurbishment is required
Compliance Audit to and Exemption required in terms of GN 704 of 4 June 1999	Lafarge appointed Greenmined/JG Afrika to undertake a compliance audit against the conditions of GN 704 of 4 June 1999 and the development of a Storm Water Management Plan for the Cement Plant and the Tswana Quarry.
Disposal of residue in underground or opencast areas	Classification was conducted by Enviroserv to verify whether residue disposed of into the Quarries and used as backfill may cause pollution.
Diversion of clean storm water from dirty areas and capacity of diversion structures	Berms were constructed around the Quarries at the active mining area,Tswana, to prevent clean storm water from entering the Quarry. Adequate pollution control and maintenance measures will be provided and implemented at critical pollution control equipment. The affected storm water system will be able to contain the 1:50 year flood event volume.
Capacity of the affected water system	A capacity assessment has been done at the Tswana Quarry, to identify the capacity required for affected water storage to contain affected water during normal operations up to 1:50 year flood event.
Inspection and maintenance on clean and affected water channels	Inspections and maintenance currently done on the clean and affected water systems will need to be expanded once the recommended infrastructure is built, in order to ensure proper operation of these systems.
Biodiversity Management	The Tswana Limestone Quarry lies within sensitive areas. A biodiversity assessment was updated in 2022. The updated biodiversity assessment is critical in the rehabilitation on closure planning, and future management of all identified sensitive areas and protected plants, species and ecosystems.
Weeds and invader plant management	Implementation of a detailed eradication and control plan for the identification of weeds and invader plants is needed.

According to the Watercourse Impact Audit Report (October 2022), Lafarge will need to commence implementation of the recommendations of the specialist studies and closing of the findings identified during the audit, so long as legal authorisation for implementation of the recommendations of the specialist studies and closing of the findings identified during the audit do not require authorisation. Please refer to **Appendix 22** for the full Water Impact Audit Report.

18. Public Participation

A pre-application meeting for the Water Use Authorisation/Licence Application process was held with the DWS Regional Office on the 23rd of January 2022. The pre-application meeting requirement record, and attendance register are attached as **Appendix 23** in the document Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

English and Tswana site notices were erected at strategic points in the vicinity of the proposed site (Itsoseng community health centre, Tswana Limestone Quarry, Itsoseng Police Station, and Taxi Rank) on the 29th of April 2022 to inform the surrounding local residents and other Interested and Affected Parties (I&APs) of the Tswana Limestone Quarry Activities and are attached as **Appendix 23** in the Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

Registration and notification letters were also sent to inform stakeholders and I&AP's about the Tswana Quarry WULA on the 29th April 2022.

An advert was placed in a local newspaper namely, The Noordwester Newspaper, for English advertisement on 29th April 2022 (refer to **Appendix 23** in the Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

A public meeting invite was circulated in June 2022. The meeting was held on the 28th June 2022 at the Mothlako Primary School, Stand 10293, Kgomola, Bodibe. Refer to **Appendix 23** in the Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

The initial Public Participation Process of 60days was from the 29th April to the 24th June 2022, however, as per the DWS requirement letter dated 17th March 2022, specialist studies were still to be completed for the WULA Process for the Tswana Limestone Quarry. The specialist studies have now been completed and an email was circulated to all I&APs on the 18th October 2022 which can now be obtained from Greenmined Environmental (Pty) Ltd upon request or downloaded from the company website at https://www.greenmined.com/water-use-applications/ (refer to **Appendix 23** in the Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

No comments have been received to date. Should any comments be received Table 12 below will be completed.

Table 12: Outcome of the Public Participation

Person who commented	Comments (support/ object/ concerns)	Reasons for objections/ concerns	Applicant's response to the objection/concerns

19. Inputs/Authorisations from other Departments /Stakeholders

- Lafarge Mining South Africa Pty (Ltd) is in possession of a mining right (reference number: NW30/5/1/2/2/454MR), for the Tswana Limestone Quarry, which was issued by the Department of Mineral Resources on the 8th March 2013 **(**refer to **Appendix 25** in the Appendices section of the Integrated Water and Waste Management Plan (IWWMP).

- Lafarge Mining is also in possession of a water use certificate (Registration number: 26019718) which it obtained in 2006 from the Department of Water Affair and Forestry. Registered activities are listed below:
    - Section 21 (a) - Taking water from a water resource (For Tswana industrial water and drinking water).
    - Section 21 (b) - Storing water (For agricultural irrigation, and industry).

20. Conclusion and Recommendations

Based on the information analysed in this report and supporting specialist studies, it is considered that there could be some concerns with the proposed mining operation from a hydrogeological perspective. Risks are generally assessed as moderate to low and with appropriate mitigation, potential impacts on surface and ground water resources are likely to be negligible. Thus, the Tswana Limestone Quarry operation may continue, provided that the recommendations provided in this report, wetland report, geohydrological report, geotechnical report and SWMP are adhered to. It is recommended that ongoing groundwater and surface water monitoring be carried out to identify any impact that may arise during the operational phase.

The operation of the mine has resulted in the creation of a number of artificial wetlands in an area that was previously almost entirely dry which have been classified as being Depression Wetlands. However, as further areas within the mining right area are opened up for mineral extraction many of these wetlands may be lost or will be changed from their present state into mine pit wetlands.

The Polfonteinspruit, which flows by the northern end of the mining right area, is severely degraded as a result of the channel having been used for agricultural or pastoral purposes in the past, and present ongoing excavation activities within it. The areas affected in this way are large and further impacts come from overgrazing of the area by livestock.

The mine would have little effect on the Polfonteinspruit despite being within 100 m of the delineated boundary in places provided that the edge of the mining operation footprint be stabilized and grassed, and that it is not closer than 100 m from the delineated edge of the Polfonteinspruit at any point.

Mitigations measures recommended in this IWWMP report and all specialist studies including rehabilitation plans to manage potentially significant impacts to surface and groundwater resources during the operation phase have been incorporated into an Environmental Management Programme (EMPr) for the proposed development. The successful implementation of these management objectives would be best achieved through enforcement and monitoring for compliance by an independent qualified/trained Environmental Control Officer (ECO).

21. MOTIVATION IN TERMS OF SECTION 27(1) OF THE NATIONAL WATER ACT, 1998

The requirements contained in Section 27(1) of the National Water Act, 1998 (Act 36 of 1998) have been considered and are discussed further below.

S27 (a) Existing Lawful Water Uses

An existing lawful water use licence refers to the use of water which has taken place anytime during a period of two years before the establishment of the National Water Act. Lafarge Industries Ltd has been operating for over 60 years. No existing lawful water uses apply to the Tswana Limestone Quarry, however a previous water use authorisation (Registration number: 26019718) exists.

Registered activities are listed below:

- Section 21 (a) - Taking water from a water resource (For Tswana industrial water and drinking water).
- Section 21 (b) - Storing water (For agricultural irrigation, and industry).

In addition to the above mentioned water uses, the following activities have been operational and are being applied for through a new Water Use License Application:

- Section 21 (a) of Act - Taking water from a water resource (one borehole to the west of the quarry used for domestic and processing).
- Section 21 (b) of Act – Storing water (Water stored in sump for dust suppression).
- Section 21 (c) of Act – Impeding of diverting the flow of water in a watercourse (Discharging water into the Polfonteinspruit).
- Section 21 (j) of Act - Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people (Dewatering operation located at Quarry Pit 1).
- Section 21 (f) of Act - Discharging waste or water containing waste in a water resource through a pipe, canal, sewer, sea outfall or other conduit (the discharging of stormwater to the Polfonteinspruit River).
- Section 21 (g) of Act - Disposing of waste in a manner which may detrimentally impact on a water resource (Stormwater runoff from the crushing plant area, stormwater runoff from workshops and administration buildings to Quarry Pit 1, limestone stockpiles).
- Section 21 (i) of Act – Altering the bed, banks, course or characteristics of a watercourse (Vehicle tracks, rail and road crossings through wetlands, discharging water into Polfonteinspruit).

Additionally, there are seven licensed water users downstream of the Tswana Limestone Quarry. Details of the water users according to the 2022 DWS Water Authorisation and Registration Management System (WARMS) can be found in the table below (Extracted from JG Afrika Hydrology Impact Assessment, 2022). Currently no water is extracted by the quarry from the Polfonteinspruit River, which feeds into the Molopo River downstream. Therefore, downstream existing water users will not be negatively affected by the authorisation of the water uses mentioned above for the Tswana Quarry.

Registration/ Water Use No.	Sector	Volume m3/year	Source	Quaternary	Location
26020341/3	Water Supply Service	62	Molatedi Dam	D41A	-25.8561 S ; 25.50842 E
26020341/4	Water Supply Service	0.8	Pella Dam	D41A	-25.8561 S ; 25.5084 E
26020341/5	Water Supply Service	2	Madikwe Dam	D41A	-25.8807 S ; 25.5113 E
26033621/3	Water Supply Service	3650000	Scheme	D41A	-25.8572 S ; 25.5089 E
26038234/2	Industry (Non-Urban)	3326	Molopo River	D41A	-25.8864 S ; 25.5817 E
26048937/2	Mining	300	Molopo River	D41A	-25.9365 S ; 25.5969 E
26057310/5	Industry (Urban)	5300000	Scheme	D41A	-25.8572 S ; 25.5089 E

S27 (b) The need to redress the results of past racial and gender discrimination

Lafarge Mining recognises the need to redress the imbalances of the past and regards Black Economic Empowerment (BEE) to be one of the supporting pillars of the Transformation Process in South Africa. Lafarge draws on Corporate Centre for its human resource management and development strategies and planning which supports employment equity. Employment opportunities are directed towards local people, upholding the affirmative action, equal employment policies of the company. The following plans are implemented at Lafarge to assist in the implementation of Mining Charter objectives to redress imbalances of the past:

Training:

All employees, especially designated group members, are encouraged to participate in voluntary programmes that increase their skills or knowledge. Selection of candidates for Company training programmes is made solely on the basis of performance, development and potential without regard to race, creed, colour, sex, national origin, age or disability or any of the other categories of discrimination described in the Employment Equity Act.

Development:

Departmental managers ensure that procedures are established to ensure the upward mobility and growth of all suitably qualified employees, with due emphasis being placed on the promotion of designated employees.

Promotions and transfers are carried out without regard to race, sex, colour, creed, age, national origin or disability or any other discriminatory category. Exceptions may occur that fall within the implementation of the Company's employment equity initiatives, after due consideration of the inherent requirements for the position.

Compensation, benefits, use of facilities:

Each operating unit ensures that there is no unfair discrimination in matters of compensation and benefits for its employees. All Company facilities are continued to be maintained on a non-racially segregated and equal basis and with due regard to access and mobility for disabled employees.

Social and recreational activities:

All Company sponsored social and recreational activities are on a non-segregated basis. Management and supervisory personnel encourage all employees to participate in Company sponsored social and recreational activities to the fullest extent possible.

S27 (c) Efficient and Beneficial Use of Water in the Public Interest

One of the principles of the National Environmental Management Act (Act No. 107 of 1998 as amended) (NEMA) in section 2 (4) (o), states: "The environment is held in public trust for the people, the beneficial use of **environmental resources** must serve the public interest and the environment must be protected as the people's common heritage."

As a public trustee of the water resources, the Department of Water and Sanitation (DWS) must ensure that **water** is protected, used, developed, conserved, managed, and controlled in a sustainable and equitable manner for the benefit of all users.

Within the surrounding towns of the Tswana Limestone Quarry, groundwater is used extensively for municipal, domestic, industrial and agricultural practices. Water demands from groundwater sources are therefore highly stressed. Therefore, water is pumped only from one borehole located to the west of the Tswana Limestone Quarry to two Jojo tanks, which are

then distributed throughout site for various uses. The greatest volumes of water, besides for domestic use, are used for dust suppression, equating to 24 528m^3/year. According to the Water Balance Specialist Report, water quantities pumped from the borehole were significantly higher than estimates. This was likely linked to community members puncturing the pipes leading to the Jojo tanks to provide drinking water for their livestock.

Prior to the development of the Quarry Pits, no wetlands, beside the Polfonteinspruit, were found in the area. The operation of the mine has therefore resulted in the creation of numerous artificial wetlands. Although these wetlands may change form over time with increased mining, the area will still experience a net gain of wetlands at the end of the mine life span. These wetlands (specifically Quarry Pit 1) may offer a place of refugia for wildlife, particularly during dryer seasons when other wetlands have dried up. Other benefits arising from wetland areas include sediment trapping, nitrate assimilation, food for livestock, flood attenuation, erosion control and carbon storage.

Currently rainfall and runoff is captured within the open pit of the quarry, reducing the contributions to the Polfonteinspruit River, compared to natural flows. However, Lafarge Mining is in the process of applying for a water use license to pump the water within the pit into the Polfonteinspruit. As long as water quality is of good standard, the released water will increase flows to the Polfonteinspruit. This will be highly beneficial to the seven licensed water users downstream of the quarry which abstract water from the river for water services, mining and industrial activities.

S27 (d) The Socio-economic Impact of (i) the Water Uses(s) if authorised; or, (ii) of the Failure to authorise the Water Uses

The authorisation of water uses for the Tswana Limestone Quarry will provide the following socio-economic benefits:

- The North West Province is a growing market surpassing national trends in the cement industry and, as such, demand for Lafarge's products in the North West Province has already exceeded existing production capacity. The continued operation of the mine is therefore required to meet the growing product demand and ensure that provincial and national economic development is not hampered;
- Job retention - approximately 345 people are employed on a permanent basis in addition to temporary and contract employment;
- Local economic benefits are derived as a result of wage income and increased demand for goods;
- Training is provided to employees resulting in an improvement of the local skills base;
- Support is given to the local and national economy by the purchase of goods and services;
- Lafarge will achieve profits from the increase in the production of cement resulting in increased tax revenues for the government;
- Lafarge will continue to support projects that will benefit the local community leading to improved living conditions and improvement of skills;
- Support to local municipality in terms of road repairs, road construction, upgrading of youth centres, town clean-up, water supply etc;
- Support to schools in terms of adopt a school, fundraising campaigns, sport activities, giving books to learners, waste recycling projects;
- Support to small enterprises namely historically disadvantage communities, courier services, tent hiring, shirt printing, gardening services, maintenance contractors etc; and
- Initiation of historically disadvantaged community business forums.

If the water uses are not approved the continuation of the Tswana Limestone Quarry and future expansion of the Lafarge cement production line will not occur. As such the socio-economic benefits outlined above will not be achieved. Consequently, the South African economy will be negatively affected and the livelihood of communities will not improve as expected.

S27 (e) Catchment management strategy applicable to the relevant water resource

The Tswana Limestone Quarry is situated in the Molopo River Catchment within the Quaternary Catchment D41A of the Crocodile West and Marico Catchment Management Area. The Polfonteinspruit flows alongside the northern boundary of

the Tswana Quarry and flows into the Lotlhakane tributary which drains into the Molopo River. The Molopo River is located approximately 42 km downstream of the project site.

The Crocodile West and Marico Catchment Management Strategy highlights that the above-mentioned catchment is situated on a high yielding aquifer system, which is associated with boreholes which can yield between 5l/s to 20l/s. This water resource is most valued in this region. As such, the Catchment Management Strategy highlights the importance of groundwater, through strategy 1.3, and suggests that the quality and quantity of this water resource be monitored (DWAF, 2004). Lafarge Mining has upheld this policy by only making use of one borehole to extract groundwater.

Based on the updated water balance study (JG Afrika, August 2022), the following recommendations are provided to reduce water stress from the groundwater resource:

- Flow meters should be installed on the pipeline used to supply water for dust suppression at the crushing plant. This will allow for more confidence to be gained in the water balance and the results associated with the water balance.
- Confirmation on the volume of water lost between the borehole and the Jojo Tanks should be investigated further. Based on the water balance results, the volume of water lost to the environment along this pipeline is significant. Interventions to try to reduce the volume of water lost would then also need to be investigated, so that these losses can be mitigated against.

S27 (f) The likely effect of the water use to be authorised on the water resource and on other water users

The possible impacts of the Tswana Limestone Quarry relates to the pit wetlands on site (referred to as W1, W2 in the Wetland Specialist Report and Quarry Pit 1 in the Water Balance Report), and the Polfonteinspruit wetland which is found 100m outside the mine boundary.

The relevant potential impacts for the pit wetlands (Quarry Pit 1) include:

- The contamination of the wetlands through the spillage of hydrocarbons such as fuel and oils. Hydrocarbons are toxic and could lead to loss of aquatic biodiversity. This level of impact is one which should not happen if preventative measures such as drip trays are employed. During the site assessment, performed by JG Afrika, no signs of hydrocarbon contamination were noted in the Quarry Pit 1 and surrounding vegetation. Rather hydrocarbon contamination was found within the immediate vicinity of the contamination source (i.e. the diesel tank is bunded, there are oil separators to separate out hydrocarbons from water emanating from the service bay, the workshop area is roofed and any sources of hydrocarbons in this area are bunded). This highlights that the risk of contamination of the wetland is low.
- Future loss or change of wetlands as a result of mining activities. The loss of wetlands will result in a loss of aquatic biodiversity. It should be noted that over time, the depression wetlands might be replaced by pit wetlands which will be expected to have a longer persistence. This impact is unavoidable and is in the “Repair/Restore” level of the hierarchy.
- Abstraction of water for uses in the mine such as dust suppression. Water abstraction will result in a lowered water surface and loss of wetland space and habitat. This is a minor impact which is only likely to become an issue during periods of exceptionally low rainfall.
- Seepage from the wetlands (which may contain stormwater runoff contaminants) may contaminate the groundwater resources. The recommendations and conclusion of the geohydrological specialist report should be kept in mind in terms of monitoring.

The relevant potential impacts on the Polfonteinspruit include:

- Close proximity of the mine edge to the wetland edge. The mining right area lies well within the 500 m radius around the Polfonteinspruit channel, and at a few points, is within 100 m of the delineated edge of the system. Observations both on the ground as well as in figure 16 (according to the wetland report), indicate that the floor of the pit is at an elevation of approximately 1.5 m lower than the water surface in the Polfonteinspruit. It is therefore theoretically possible that the mine is creating a cone of depression in the water table which would be affecting the channel. The Polfonteinspruit could therefore be deprived of some water. There is, however, presently no discernible impact in the intervening area or on the two sides of the channel.

- Increased mining could result in an increase in exposed soil surfaces which may lead to greater erosion rates. These eroded soils may wash off into the wetlands increasing turbidity.
- The ongoing excavation of pits in the wetland to either provide open water or to extract material for block making. The degradation would have reduced wetland condition and functionality.
- Spillage of domestic sewage into downstream environments.
- Disturbance of the wetland in the lower area as a result of past draining and agricultural activities. These former two points have not been caused by Lafarge but rather are a result of past activities.

It is to be noted that, although there has been mining activity at the site for some 40 years, the mine only approached to within 100 m of the delineated channel in 2016. However, as noted above, there appears to be no visible impacts on the wetland as a result of the incursion. Therefore, it is considered that, if the proposed mitigatory measures are applied (Refer to the JG Afrika Wetland Report and Hydrological Report), there are no new risks to the Polfonteinspruit system.

S27 (g) The Class and the Resource Quality Objectives of the Water Resource

The Tswana Limestone Quarry is situated in the Molopo River Catchment within the Quaternary Catchment D41A. This catchment has been designated a water resource class II. Class II refers to "the configuration of Ecological Categories of the water resources within a catchment that results in an overall condition of that water resource which is moderately altered from its predevelopment condition" (Department of Water and Sanitation, Notice 562 of 2019). It is recommended that this quaternary catchment remain in an ecological category D.

The resource quality objectives for the above catchment according to the National Water Act (Act 36 of 1998), Government Gazette Notice 1388 of 8th December 2017, are represented in the table below:

Sub-component	Resource Quality Objective	Indicator/Measure	Numerical Limit
Quantity	Groundwater flow patterns based on piezometric elevations in aquifer units should not be reversed from its natural flow directions toward the local drainages. Discharge areas (i.e. Malapo Eye) should be protected against total depletion of water table (i.e. as the case is for Grootfontein Eye and Bodibe Eye	Water Levels - Depth to groundwater level from ground elevation. Time series water level monitoring (Monthly) vs. abstractions and rainfall input. Abstraction of groundwater within prescribed zones from the river course/wetland/eye-spring).	Dolomite aquifer systems: Saturation levels should not be lowered >6 metres below an average water level depth of ~19 m in the dolomite water area. Water level recession rate must be less than 0.75 m/a. Abstraction zoning: should be regulated (1000 m for karst aquifer systems).
	Groundwater balance (aquifer recharge and irrigation abstraction) needs to be assessed for wet and dry cycles (to secure groundwater yields during dry periods). Proper irrigation schedules need to be developed and applied at all times (100% compliance).	Abstraction - Volume (Q).Time series of abstraction-rainfall-water level of aquifer system. Annual groundwater balance (aquifer recharge and irrigation abstraction) needs to be for wet and dry cycles.	Annual abstraction should not be larger than 65% of average annual recharge (i.e. SI of 65%).
	Water balance Status	Calculation of Stress Indexes (Aquifer Unit Use/ Aquifer Unit Recharge) as percentages.	
Quality	Nitrate values in the recharge area must be maintained to support domestic water users. (Agricultural sources for nitrate).	Nutrients - Nitrate (NO3–N, mg/l). Bi-annual Monitoring Monthly monitoring at DWS gauging stations.	Nitrate: Less than 1.0 mg/l; Annual long-term trend should not approach the 95th percentile (3.0 mg/l).
	Salinity levels should not increase. Concentrations must be maintained at levels to secure a healthy water quality status.	Salts - Electrical Conductivity. Monthly monitoring at DWS gauging stations.	Electrical Conductivity: 50 mS/m; Annual long-term trend should not approach the 95th percentile (80 mS/m)47.

	Industrial/agricultural pollutants for Molopo, Grootfontein, Itsoseng (Bodibe) Eyes	Sulphates SO4 concentrations) Monthly water quality monitoring at source areas (eye's and well fields)	SO4: Less than 5.0 mg/l; Annual long-term trend should not approach the 95th percentile (30 mg/l).
Protection Zone	Protection of Intergranular and Fractured Aquifers: Protect lower sections of Madibe, Polfonteinspruit and Molopo River against industrial/ agricultural/microbial pollution.	Distance from drainage valley: based on 50 Day travel time (microbial) and 365 day dilution period (inorganic constituents).	<1000m protection zoning (DLMT aquifers) <500m protection zoning (hard rock aquifers).
		Distance from discharge area of dolomite eyes: based on 50 Day travel time (microbial) and 365 day dilution period (inorganic constituents)	<1000m protection zoning (hard rock aquifers)

When looking at the site-specific PES, wetland 1 (Pit 1 within the quarry boundary) and wetland 2 were identified as having a PES Category B. These wetlands were taken as being "natural", although it is known that they are an unnatural consequence of the mining operations. It was determined that the condition of each wetland would remain the same for the next five years. The Channelled Valley Bottom Wetland (situated north of the quarry around the Polfonteinspruit River) was given a PES Category E. This was largely due to degradation of the system from past agricultural activity and livestock grazing.

S27 (h) Investments already made and to be made by the Water User in Respect of the Water Use in Question

Lafarge currently operates 166 cement plants in 50 countries around the world with a production capacity in excess of 200 million tons. With the South African domestic market for cement growing, Lafarge is likely to continue to invest in its South African plants and mines to expand production and ultimately profits. Increased expansion and profits may lead to further local employment opportunities and support to local municipalities, schools, and community upliftment projects.

S27 (i) The Strategic Importance of the Water Use to be Authorised

The continued operation of the Tswana Limestone Quarry will be of strategic importance to Lafarge Mining South Africa (Pty) Ltd, the local community and the South African economy in general. The mine provides the raw materials which are essential for the cement production process at the Lafarge Cement Facility. The operation also employs 345 people, falling in line with the IDP vision for the Ditsobotla Local Municipality which states *"A developmental Municipality dedicated to the social and economic upliftment of its communities".* The continued operation will therefore improve socio-economic development as stated in the above sections.

S27 (j) The Quality of Water in the Water Resource which may be required for the Reserve and for Meeting International Obligations

The groundwater quality, in terms of bacterial coliforms, has been up to standard. Future monitoring, however, should include testing of chemical constituents (EMPr, 2015). The mined material, limestone, has also been approved as non-hazardous and so will not lead to contamination or pollution of the area and the Polfonteinspruit which flows from it. Additionally, the watercourse is not utilised by residence for drinking purposes, resulting in no potential health risks to the local community.

The Stormwater Management Plan (JG Afrika, August 2022) provides the following recommendations to prevent contamination of the watercourses through runoff:

- Several stormwater channels should be constructed;
- Regular maintenance of stormwater infrastructure to prevent pooling/flooding; and
- Regular clearing of sediment built up from conveyor belt spillages.

S27 (k) The Probable Duration of any undertaking for which a Water Use is to be Authorised

It is recommended that the duration of the Water Use Licence for the Tswana Limestone Quarry is to be issued as per the Approved Mining Right (DMR Ref NW30/5/1/2/2/454MR) that is valid for a period of thirty (30) years ending on the 07th March 2043.

22. Declaration by the applicant with signature confirming that the information submitted is correct.

[END OF WULA SUMMARY REPORT]