anne bindoff CONSULTANCY

Reg no: 2014/011805/07

MOTIVATION IN SUPPORT OF THE APPLICATION TO EXCLUDE SETTLING POND 1 SLUDGE FROM THE DEFINITION OF WASTE

for

UMFOLOZI SUGAR MILL South Africa

by

Anne Bindoff

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Revision 3.

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DETAILS OF THE SPECIALIST

Name of Company: Anne Bindoff Consultancy
Name: Anne Bindoff: Director/Owner
Qualifications: MSc (Eng – Enviro) UKZN, BSc (Chem and App Chem) UKZN, HED UNISA. RMPASA and Plant Science Consultants Association (PSCA) attendance for GHS training
Professional Affiliations: RPMASA, IWMSA, PSCA
Professional Registration: SACNASP: application pending
Company Specialities: Environmental Management, specialising in Waste Management, Hazardous Waste, Legal aspects, GHS: UN Standards Safety Data Sheet Compilations for Hazardous chemicals, Agri-Remedies (New standards) and fertilizers (New standards)

EXPERIENCE:

- **Regulatory DAEA/EDTEA:** Pollution and Waste Management: Acting Assistant Manager ILembe DM 2006 - 2009
- **Corporate: SAPPI Mandeni:** 2009 – 2013: Environmental Specialist: SHEQ systems, landfill site management, waste management, legal compliance for permits licences, waste classifications, water permits, waste permits, etc
- **Own Business: Anne Bindoff Consultancy: As above**
  Clients:
  - **Sappi Mandeni:** Hazardous waste removal.
  - **INDIFLORA: Brookdale Assessment Centre** - Rehabilitation: Waste removal for legal compliance.
  - **Aquasol:** SDS and labels, HCA and DALRD new requirements.
  - **NCP Chlorchem**: Waste assessment.
  - **Intellichem:** Tremcards supply.
  - **IFF:** Tremcards supply.
  - **SAPREF:** Tremcards supply.
  - **Bowisolve:** Legal requirements for road transportation of waste/Hazardous waste.
  - **Andermatt Madumbi:** Agri-remedies SDS assessments and advisory.
  - **RPMASA:** GHS training for Safety Data Sheets.
  - **IWMSA:** Hazardous waste management training.
  - **ECOGUARD:** Agri-remedies SDS compilations – new requirements and advisory.
  - **Aquasolve:** Supply of Safety Data Sheets: Fertilizers, new agricultural standards as per Dept of Labour HCA requirements.
  - **Dow/Corteva:** SDS advisory and tremcards supply.
  - **BPL**: Tremcards Supply.
  - **WALLACE AND GREEN ENVIRONMENTAL SPECIALISTS**: Waste Specialist
    - Motivation in support of the removal of Sumitomo Mill waste ash and rubber compound from definition of waste.
    - Motivation in support of the removal of various waste streams from Illovo mills: Eston, Noodsberg.

- Motivation in support of the removal of various waste streams from Gledhow Sugar Company (Pty) Ltd.
- Motivation in support of the removal of various waste streams from Umfolozi Sugar Mill South Africa.

2. INTRODUCTION

(https://www.umfolozisugarmill.co.za)

Umfolozi Sugar Mill (Pty) Ltd (here-after referred to as USM) is situated in Matubatuba, Zululand, Northern Kwazulu Natal. It is a leading producer of Very High Polarity (VHP) brown sugar, which is sold in the Southern African Customs Union (SACU) and to various cross-border regional markets.

Figure 1: Broader view of the Umfolozi Sugar Mill (Source: Google Earth, 2023)

In a radius approximately 250m to 450m south of the mill are the following:

- Settling Pond 1, (300m);
- Anaerobic Pond 2 Sludge (400m); and
- Passveer Ditch (450m).

Figure 2 illustrates the location of the Settling Pond 1 Sludge.

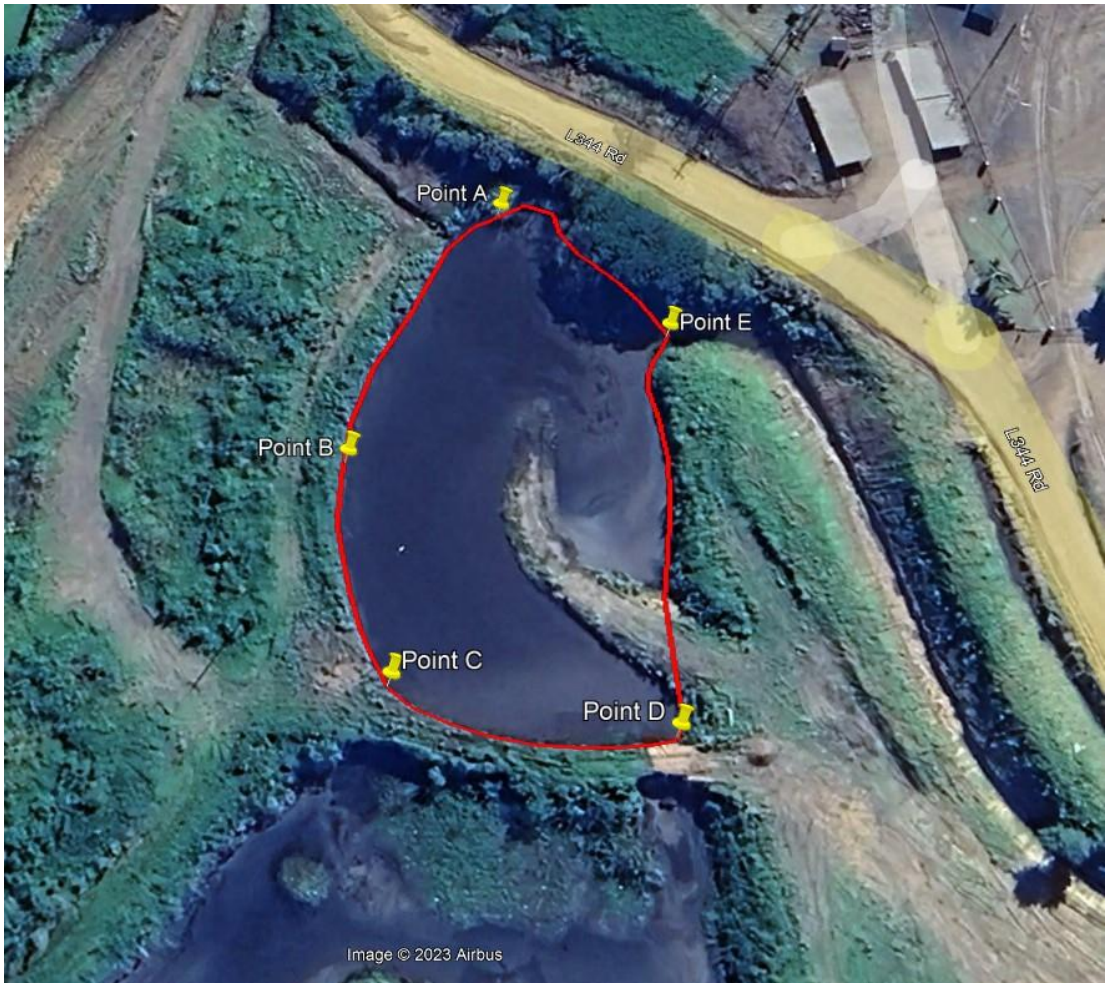

Figure 2: The location of the Settling Pond 1 Sludge (Source: Google Earth, 2023)

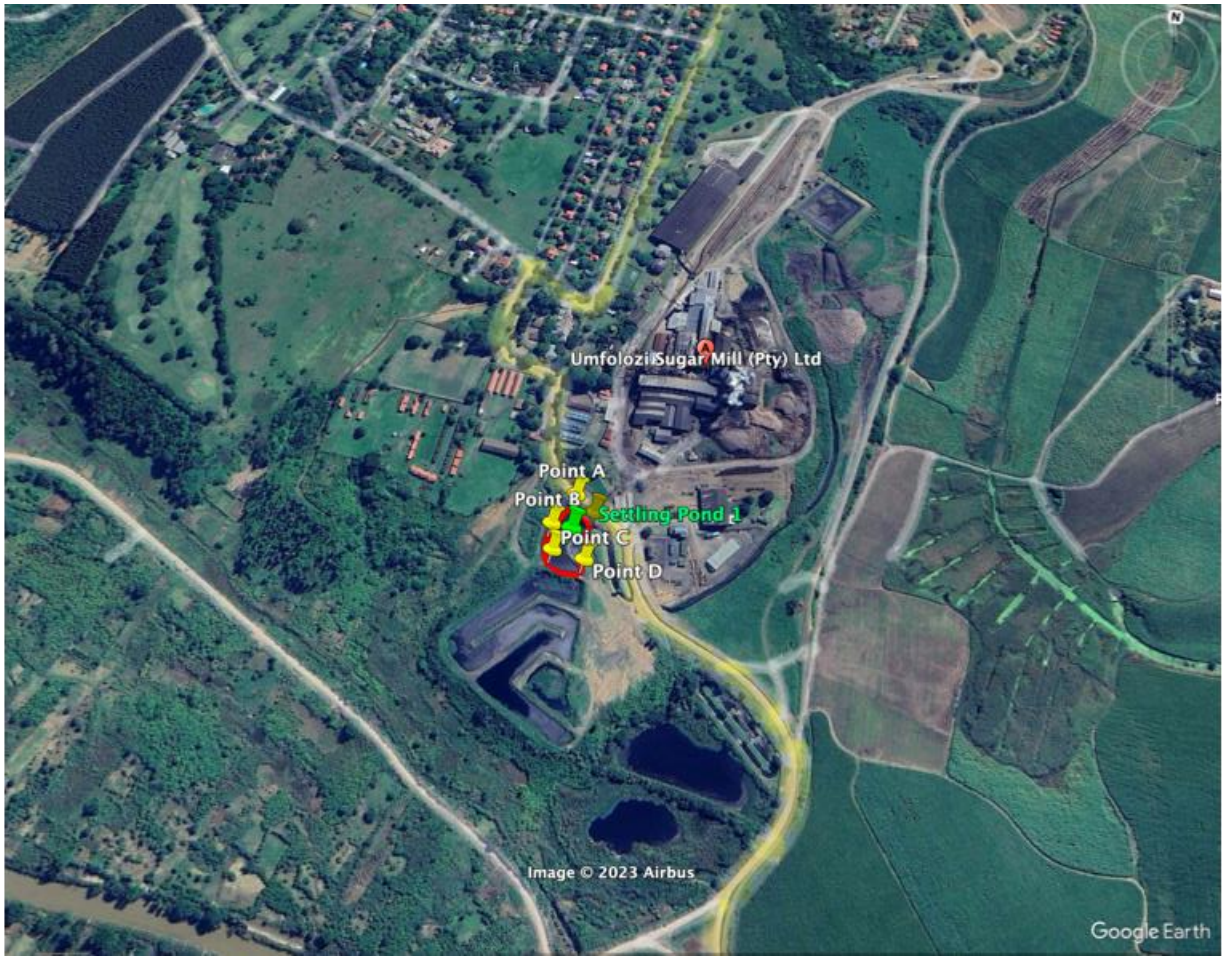

Figure 3: The Broader location of the Settling Pond 1 Sludge (Source: Google Earth, 2023)

Table 1: Geographical co-ordinates of the Settling Pond 1 Sludge

REFERENCE	LATITUDE			LONGITUDE		
A	28°	26’	45.72” S	32°	10’	56.64” E
B	28°	26’	47.17” S	32°	10’	55.75” E
C	28°	26’	48.31” S	32°	10’	56.00” E
D	28°	26’	48.56” S	32°	10’	57.53” E
E	28°	26’	46.42” S	32°	10’	57.63” E

2. LEGISLATIVE FRAMEWORK

2.1. Acts:

- The Constitution of the Republic of South Africa, Act 108 of 1996
- Dept Of Water Affairs (DWA):
  - National Water Act (NWA): (Act 36 of 1998)
  - Water Quality Guidelines. 1996. Various
  - Guidelines for the Utilisation and Disposal of Wastewater Sludge. Vol 1 - 5
- National Environmental Management Act (NEMA): Act No 107, 1998. 27 November 1998. (NEMA)
- National Environmental Management: Waste Act. (NEM:WA) No. 59 of 2008.
- The National Environmental Management: Waste Amendment Act (NEM:WAA), 2014 (Act No 26 of 2014)

- National Environmental Management: Waste Act (59/2008): National Waste Management Strategy, 2020 (NWMS)
- National Road Traffic Act (RTA), No. 93 of 1996
- Occupational Health and Safety Act (**OHSA)** no: 85 of 1993

2.2. National Norms and Standards. Listed Activities and other relevant documents

- **NEM:WA** Regulation 331 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality 2013
- The Framework for the Management of Contaminated Land, Department of Environmental Affairs (DEA), May 2010
- National Norms and Standards for the Storage of Waste. 2013
- NEM:WA (Act 59 of 2008) Government Notices (23 August 2013):
  - R.634 Waste classification and Management Regulations
  - R.635 National norms and standards for the assessment of waste for landfill disposal
  - R.636 National norms and standards for disposal of waste to landfill
- National Environmental Management: Waste Act (59/2008): Regulations regarding the exclusion of a waste stream or a portion of a waste stream from the definition of waste (18 July 2018)
- **SANS 10234 (2019)(2nd ed):** Globally Harmonized System (GHS) of Classification and Labelling of Chemicals
- **GHS:** UN Standards Purple Book 9th ed
- **WHO:** Guidelines for Drinking-water Quality. FIRST ADDENDUM TO THIRD EDITION. Volume 1. Recommendations (3rd ed.)

3. CONTACT DETAILS OF THE USM

Table 2: Contact Details of the USM

Applicant:	Umfolozi Sugar Mill (Pty) Ltd		
Trading name (if any):	Umfolozi Sugar Mill Environmental Technologist		
Contact person:	Yolande Sajiwan		
Physical address:	Corner of Mill and Club Lane, Riverview, Mtubatuba, 3935		
Postal address:	Private Bag X12, Mtubatuba		
Postal code:	3930		
Telephone:	035 550 7700	Cell:	083 571 7206
E-mail:	YSajiwan@usm.co.za	Fax:	-

4. USM MILL INTEGRATED MANAGEMENT SYSTEM PROFILE

Declarations in the USM SHEQ&FS policy:

Commitment:

USM is committed to sustainability; this relates to our compliance mission odf “DO NO HARM” by protecting:

- Staff, visitors and contractors, by supplying a safe environment
- Our environment
- Our assets and our plant

Through the implementation of the Integrated Management System (IMS) with a clear objective:

- To prevent injuries to all people on site, by preventing our pollution and reducing water and energy consumption.

4.1. Vision, mission and values

The following is an extract of the vision and mission of the USM:

- To sustain customers with quality products and service
- To sustain growers with fair and transparent interactions
- To sustain employees with a safe and high-spirited environment
- To sustain surrounding communities through job creation and poverty alleviation initiatives.

USM is situated in a deeply rural, poverty-stricken district of KwaZulu-Natal and actively participates in the local community by enhancing and developing the skills of disadvantaged community members and contributing to the upliftment of the broader area.

USM:

- Plays a significant role in the local community as it crushes sugarcane from approximately 60 commercial farmers and more than 1500 small-scale farmers and employs approximately 310 permanent staff,
- Supports the local small scale cane growers and the rest of the cane is grown on the Umfolozi Flats,
    - Approximately 1.3 million tons of sugar cane is crushed in an average year with “normal” climatic conditions over a 36 week milling season. 65% of the sugar cane is produced on the Umfolozi flats and delivered on the narrow gauge railway.
    - Between 4% and 10% is delivered by Small Scale Growers, some of which is delivered on the narrow gauge railway and the balance on the road.
- Currently employ people, mainly form the local community,
- Is committed to sustainability and is awake to opportunities to expand its production of renewable electricity, bio-ethanol, and sustainable aviation fuel (SAF) as market opportunities arise. Currently, USM generates renewable electricity which is exported onto the national electricity grid and sold to third-party customers.

1.2 Compliance

The commitment to compliance is indicated in the listed documentation undergirded by the SHEQ Policy. The following documents are listed for the records for compliance to best practice in this industry at the USM:

- USM Code of Conduct and Business Ethics **(Attachment 1)**
- Occupational Health and Safety Certificate (NOSA 4 Star) **(Attachment 2)**
- Waste Management Licence **(Attachment 3)**

- Water Use Licence **(Attachment 4)**
- SHEQ FS Policy **(Attachment 5)**

This report serves as a basis for the application to remove sludge waste from the definition of waste as per the NEM:WA legal requirement and is compiled as the basis for the risk assessment and the risk management plan. This is done to manage the sludge waste stream as a beneficiated product for supply to the farmers for soil fertilizer. This report fulfils the requirements as set out in the legislative framework given in Section 2 above.

2. FACILITY WASTE GENERATION PROCESS

The production process is the place where the waste streams at each stage of the sugar production process are generated. The following sections describe the process very briefly. The effluent Settling Pond 1 sludge. Refer to Figure 3 - Effluent treatment plant process flow chart.

2.1. Production process description

(https://www.umfolozisugarmill.co.za/mill.html.)
Refer to Figure 4: showing the USM production process. The link provides a useful visual reflection of the process as the link gives photographs of the activity. The process flow is important to understand the inputs for the effluent waste stream generated and where the waste is generated in the process

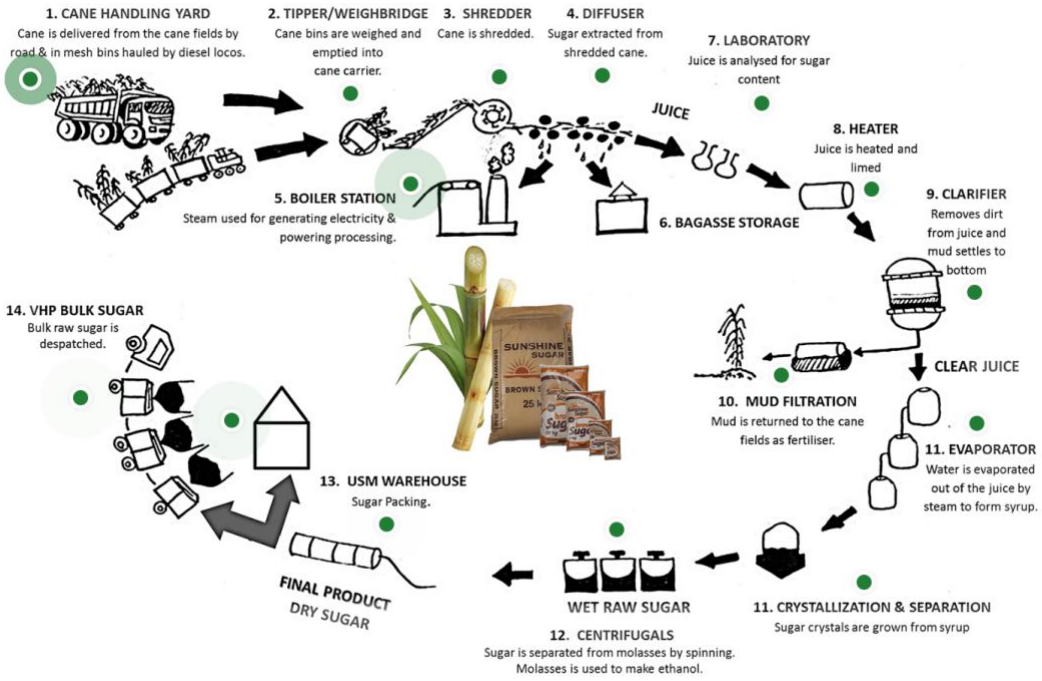

Figure 4: The USM production process

The process flow chart given on the website is reflected in Figure 4: **:** Schematic process flow diagram showing bagasse, boiler ash, filter cake smuts and molasses production. A brief description of the process follows:

Approximately 1.3 million tons of sugar cane is crushed in an average year with “normal” climatic conditions over a 36 week milling season. 65% of the sugar cane is produced on the Umfolozi flats and delivered on the narrow gauge railway. Between 4% and 10% is delivered by Small Scale Growers, some of which is delivered on the narrow gauge railway and the balance on the road.

The cane is weighed over a weighbridge and then tipped onto a conveyor/carrier to a shredder.
Bagasse waste generation: The cane is then transferred to a diffuser where the sugar is extracted. The fibre is then squeezed to remove as much moisture as possible leaving a dry fibrous solid which is the bagasse, and then either sent to:

- the boilers to be used as fuel to generate heat and steam for the process of sugar extraction

or

- sent to the Bagasse Storage area

The other waste stream generation processes are described as follows: The juice is sent for purification to remove by flocculating the non-sucrose components by heat and lime addition with other additives for optimal separation. This is then sent to the clarifier. The clarified overflow is taken to evaporators to crystallise out the sucrose, and the underflow/sludge is sent to the mud filter where the mud is concentrated to produce the filter cake.

The bagasse currently is used as a biofuel in the boilers to produce steam. The fly ash from the wet scrubber technology (which is used for PM abatement in the USM boilers) and the bottom ash produced are quenched to cool down and a slurry is formed. This is combined with the filter cake to produce smuts and stored in licenced temporary storage dams.

The schematic in figure 5:Schematic process flow diagram showing bagasse, boiler ash, filter cake smuts and molasses production gives the overview of the process where the waste streams are formed.

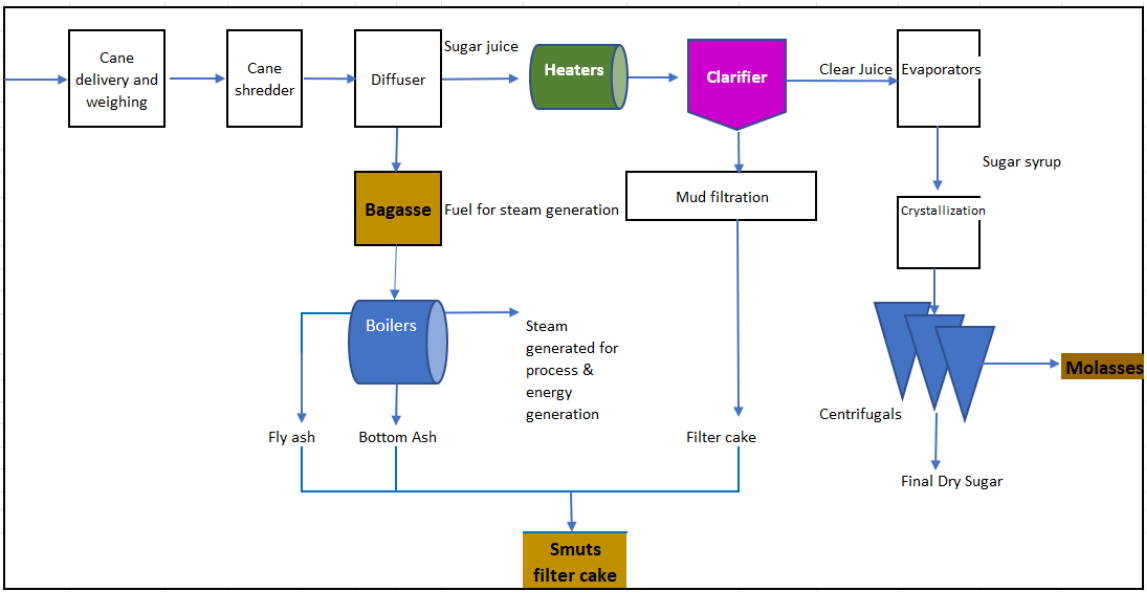

Figure 5: Schematic process flow diagram showing bagasse, boiler ash, filter cake smuts and molasses production. Each of these units present spills and need to be washed away into the effluent treatment syste

2.2. Water abstraction for sugar processing

Figure 6 below shows the process for purifying river water for suitability to feed into the sugar processing plant for appropriate uses.

Water is abstracted from the Umfolozi River to use in the abstraction of sugar from sugar cane. This water needs to be processed to be deemed suitable for among others; steam generation in the boilers, for the diffusers to dissolve out the sugars from the sugar cane, and for general use around the mill. The process is shown in the schematic of Figure 5: Schematic process flow diagram showing bagasse, boiler ash, filter cake smuts and molasses production. The treatment process generates a sandy sludge with the river sand from the raw river water. The reuse of this sandy sludge would be used for blockmaking to suit the needs of the local community for generating their own income.

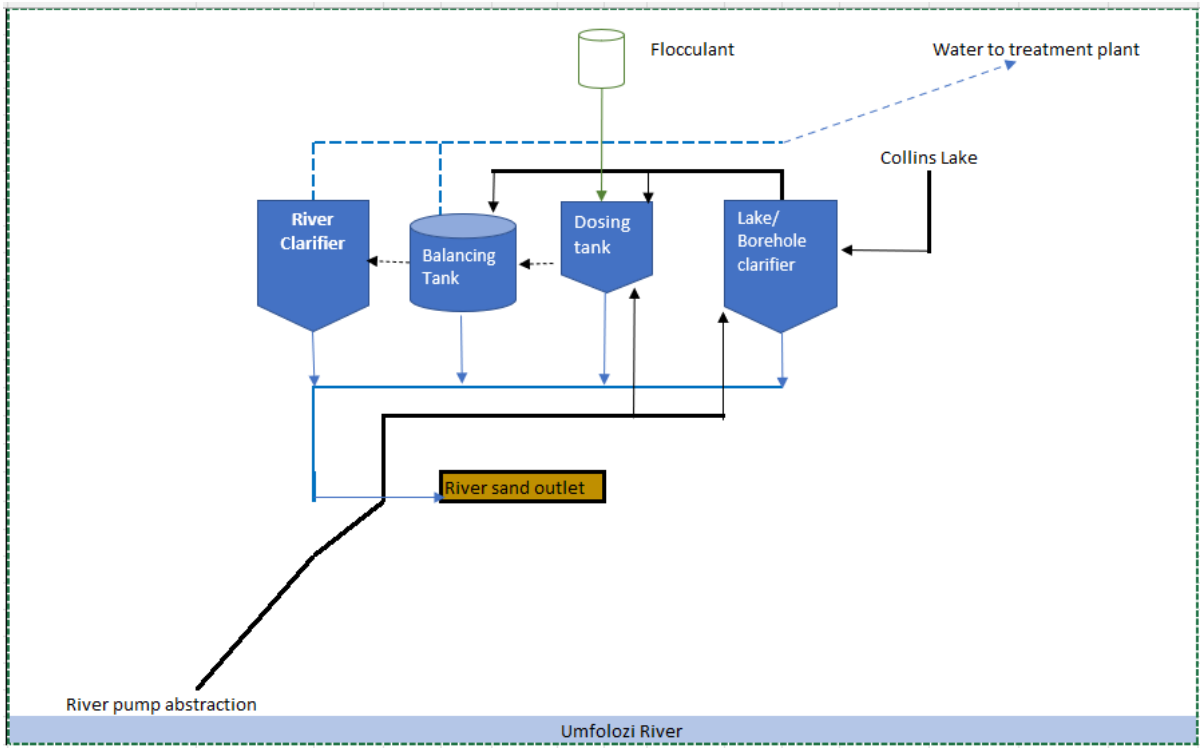

Figure 6: Process for purifying river water for suitability to feed into the sugar processing plant for appropriate uses.

2.3. Effluent treatment works

The waste generating process specific to the Settling Pond 1 Sludge is the Effluent Treatment Plant. Figure 3 outlines the waste generating process.

2.3.1. Decsription of the Effluent Treatment Plant

All of the processes in producing sugar involve spills of solids like crystalline sugar, sugar cane fibre, stalks etc and liquids like sugar juice, process water, process chemicals, and other liquids as run-off within the plant. The solid waste is swept up into containers, and put back into the processing system. This liquid effluent stream is washed together with any stormwater run-off into an effluent treatment works. The processes must be run to best practice to minimise these solid and liquid effluent flows.

The liquid effluent which would be rich in sugars and other sugar cane based organic and inorganic materials needs to be treated to reduce the chemical oxygen demand (COD) of the effluent to acceptable levels before discharging into the natural water sources as well as returning suitable effluent water back int the system. The following describes this process.

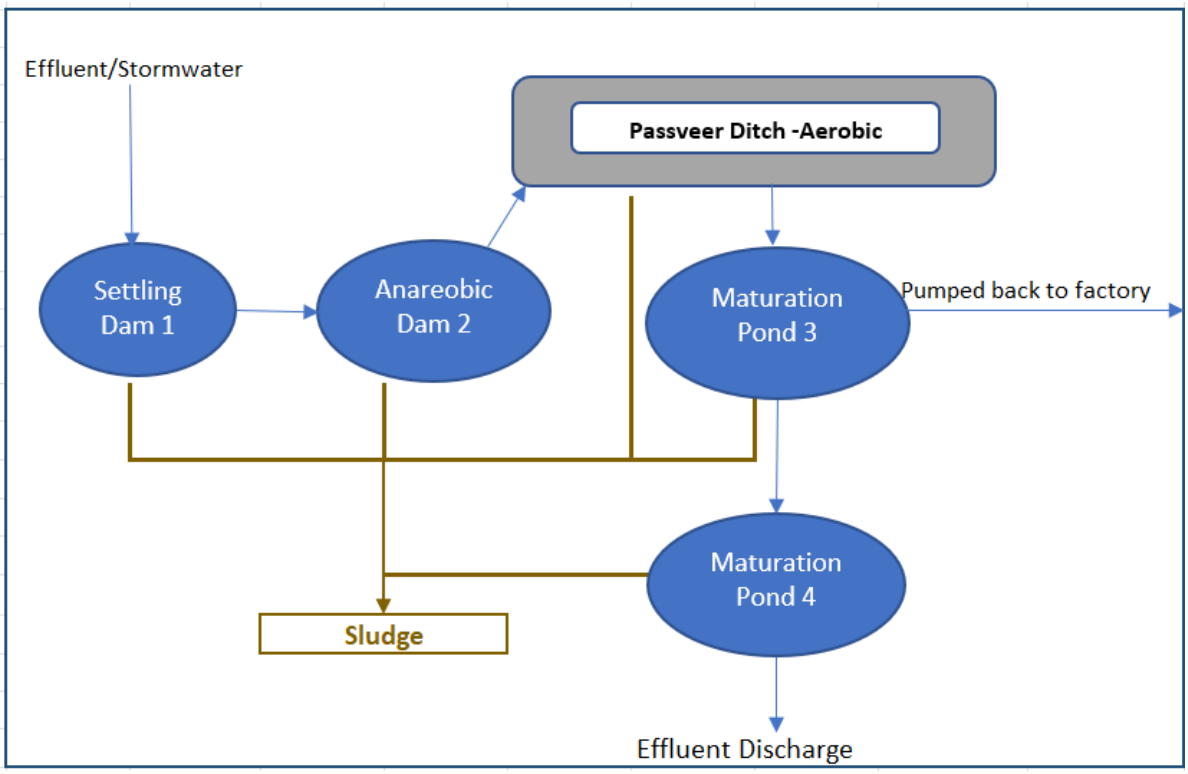

Figure 7: Effluent Treatment Plant

The **primary effluent** high in organic components and salts from the mill is captured into **settling pond 1.** The gross solids are screened out of the effluent stream and reused into the system or disposed of appropriately. The remaining solids are settled in pond 1 to produce a sludge. The overflow is pumped to the **anaerobic pond 2.**

Anaerobic pond 2: The organics are reduced by up to 90% in an anaerobic process. The solids are settled where the underflow sludge is combined with the settling pond 1 sludge. The overflow is taken to the **Passveer Ditch.**

Passveer ditch: the effluent is agitated mechanically to high oxygen aerobic conditions. The solids formed are settled as a sludge. It is combined with the other sludge streams. The liquid overflow is take to the **maturation pond 3**

Maturation pond 3: to polish off the stabilization of the remaining organics. This liquid is pumped back to the sugar processing or to the next **maturation pond 4.**

Maturation pond 4: to take the COD levels down to acceptable levels for effluent discharge. The sludge streams are all combined here, and are used for soil enhancing.

- Approximate quantity of sludge produced: unknown as the ponds are desludged and the sludges dewatered. They are not taken over the weighbridge.
- Sludge quantities removed by farmers: all of the sludge.

3. RECYCLING OR REUSING THE SLUDGE PRODUCED

3.1. Consequences of not recycling or reusing the sludge produced

The only recourse for the disposal of the sludge from Settling Pond 1 is to landfill if not recycled or reused. There are no restrictions or GHS hazards associated with this sludge. It is a type 3 waste to be disposed of at a Class 3 (GB+) landfill site.

Landfilling is the option chosen by many to dispose of waste as the most convenient option. Unfortunately landfilling as a waste management practice contributes to unnecessary high airspace use. This leads to very costly sourcing and development requirement for additional landfill space. So, in line with the NEM:WA: National Waste Management Strategy (NWMS - 2020); the focus is on amongst others to divert waste from landfilling and to implement the circular economy principles to beneficiate the waste as a resource in a safe and responsible manner.

Should the sludge not be permitted to be used as a fertilizer on the sugar cane fields, the requirement would be for USM to dispose to a permitted and properly managed landfill site which will incur the following:

- Cost of:
- Landfilling fees;
- Fuel which is changing and generally increasing monthly in 2023,
- Driver salaries,
- Truck fees and maintenance.
- The filling up of landfill space much quicker with treated sludge.
- Opportunities to earn an income for those with no or low income:
    - youth,
    - women and
    - entrepreneurs in general,

because of:

- The potential users of this waste stream have opportunities that may be lost due to the cost of buying the extra fertilizers to make up for the lost rich macro and micro nutrient value of the sludge. This would lead to other effects such as factors leading to the inability for the farmer to employ the local community to work the land to maximise the sugar cane output for the farmers. The sugar industry together with the unemployment rate are not in a healthy state currently, in South Africa.
- The opportunity to return to the agricultural soil that which the sugar cane crop removed in terms of nutrients and to add organics to the soils for enhancement would be lost to landfill.

3.2. Benefits of reuse and recycling

The sludge is to be used on the sugar cane farms for small scale growers as a soil conditioner and a nutrient source.

The benefits of reusing and recycling the sludge aligns with the objectives of the South African National Waste Management Strategy (NWMS) - 2020 and are also aligned with the Sustainable Development Goals (SDG) 2030. Examples of the relevant SDG's:

- **SDG 3**: To avoid/minimize waste related environmental factors that prevent ill-health and disease.

- **SDG 8**: Promoting the waste management sector as a key contributor to overall economic growth and development.
- **SDG 9**: Use of natural resources to improve people's standard of living without damaging the environment.
- **SDG 12**: Through: ensuring production patterns, implementing initiative that reduce waste, promote re-cycling, re-use.

The NWMS 2020 strategy is directing South Africa to a future with zero waste in landfills. This will be achieved through eight strategic goals, two of which are relevant for this report namely:

- **Goal 1:** Promote waste minimisation, re-use, recycling and recovery of waste. Focuses on implementing the waste management hierarchy, and with the ultimate aim of diverting waste from landfill.
- **Goal 8:** Establish effective compliance with and enforcement of the Waste Act. Ensures that everyone adheres to the regulatory requirements for waste management, and builds a culture of compliance.

The re-use of the sludge benefits:

- The company because of cost savings of diverting from landfilling.
- The soil on the farmland because of the moisture of the sludge, benefits the soils with the moisture and the nutrients.
- The community; through employment of people within the community due to cost savings through not having to buy commercial fertilizer.
- Potential to supply small community farmers to assist them with their soil management for growing their own food.
- Business creation and thus job creation.
- Investigate other practical uses of the sludge already being used globally and to investigate new uses.
- By correct management of the waste, the potentially hazardous components will be minimized.

To be able to benefit from this opportunity, the sludges will need to be characterised to understand the chemical and physical nature of the waste streams. It is then assessed for landfilling using the standard criteria and classified by Globally Harmonised Standards (GHS) aligned to the United Nations standard for health and environmental risk. Understanding these characteristics of the sludge will help to minimise the risk for use for the purpose of soil fertilizer. The following section describes this process and the results describe the nature of the waste.

4. METHODOLOGY USED TO ASSESS THE CHEMICAL/HAZARDOUS NATURE OF THE WASTE TO BE EXCLUDED

4.1. Rationale

Research work has been done for the use of sludge on agricultural crops.. There are promising results that this may be successful with proper understanding of its chemical makeup. The following section focuses on the chemical makeup of the sludge and the potential hazards and risks these pose in its proposed application. A risk assessment and a risk management plan will be formulated to minimise any harm to people and the environment.

The methodology adopted was as per NEM:WA (Act 59 of 2008) Government Notices (23 August 2013):

- R.634 Waste classification and Management Regulations
- R.635 National norms and standards for the assessment of waste for landfill disposal
- R.636 National norms and standards for disposal of waste to landfill.

Using this method, the classification of waste was done using the laboratory analyses results. The laboratory results can also be used to determine the GHS classification for human, and environmental risk. Then a risk assessment done with the mitigation plans.

4.2. Characterisation of the waste

The first approach will be to identify the components within the sludge using the standardised testing protocols. These will be described as follows:
The sludge sample was tested for its chemical composition, classified according to SANS 10234 for any hazards (physical, health or environmental), and for assessed for waste type and landfill class using the **NEM:WA Norms and standards Regulations** for assessment and classification of waste.

Refer to:

- Attachment 6a: Certificate of Analysis,
- Attachment 6b: Waste Assessment and Classification, and
- Attachment 6c: Safety Data Sheet - SDS.

for the complete and detailed information obtained for the following sections.

These give:

- the chemical composition from a prescribed list,
- the assessment of the waste for
  - waste type
  - the landfill class
- the GHS classification for any hazards from
  - the physical nature of the waste with any risks associated with it,
  - any risk to health, and
  - any risk to the environment.

The second approach is to determine the hazard thresholds of the chemicals in soils and hence the effect on the environment and the health of the community. The following was used:

- **The Framework for Contaminated Land Rehabilitation (DEA- May 2010) guideline** was used, and compared with the Total Concentration values (TC) obtained as well as the Leachable Concentration (LC) results from the laboratory analyses obtained.

The sludges are then managed appropriately using the mitigation/management provided from the identified risks.

The settling pond 1 sludge:

- 26/09/2022 - sampled by USM.
- 28/09/2022 - sample received and testing started by Talbot and Talbot (T n T) Laboratories.
- 20/10/2022 - analytical, waste assessment and classification reported.

The analytical results are then examined to determine what, if any, risks there are to people and to the environment, and what the hazards are if any. The sludge is then managed appropriately using the mitigation/management provided with the identified risks. The engagement of an agronomist is key to the correct management of the sludge application onto the soils to ensure the soil ecosystem is well looked after.

4.3. Results

4.3.1. Waste assessment to landfill

The waste is chemically assessed as a **Type 3 waste**, which is a **low risk waste**, and to be disposed of at a **Class C Landfill** (General B^{+}).

4.3.2. GHS Classification and Hazard Management

Table 3: Summary of Settling Pond 1 sludge hazard classification

Classification in accordance with SANS 10234:2019:	
Physical	None identified
Health	None identified
Environment	None identified
Overall classification:	**Non-hazardous**

4.3.3. Relevant uses and restrictions on use

identified uses: WASTE - intended for transport by road or rail, and disposal.

Uses advised against: WASTE: if a commercial product residue, not intended for original use. KEEP AWAY FROM clothing. DO NOT eat, drink or smoke when using this product. AVOID release to the environment. Collect spillage.

4.3.4. Identifier/s.

Other identifier/s: As noted by the client, the sludge may have sucrose residue, bagasse dust and storm water runoff.

4.3.5. Precautionary measures

4.3.5.1. Prevention:

- KEEP AWAY FROM clothing.
- AVOID breathing dust., mist, vapours and spray.
- DO NOT get in eyes., on skin or clothing.
- DO NOT eat, drink or smoke when using this product.

4.3.5.2. Responses:

- Get medical advice / attention if you feel unwell.
- Fight fire with normal precautions from a reasonable distance.
- Collect spillage.
- IF SWALLOWED: Call a POISON CENTRE or doctor/physician if you feel unwell.
- IF INHALED: Call a POISON CENTRE or doctor/physician if you feel unwell.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If exposed or concerned: Call a POISON CENTRE or doctor/physician.
- If exposed or concerned: Call a POISON CENTRE or doctor/physician.

4.3.5.3. First-aid measures:

Immediate actions: If exposed or concerned: Call a POISON CENTRE or doctor/physician.
Actions to be avoided: DO NOT eat, drink or smoke when using this product. AVOID release to the environment.

Inhalation: AVOID breathing dust fume, mist, vapours, spray. IF INHALED: Call a POISON CENTRE or doctor/physician if you feel unwell.
Skin Contact: KEEP AWAY FROM clothing. DO NOT get in eyes, on skin, or on clothing.
Eye Contact: DO NOT get in eyes, on skin, or on clothing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Ingestion: DO NOT get in eyes, on skin, or on clothing. IF SWALLOWED: Call a POISON CENTRE or doctor /physician if you feel unwell.

Anticipated effects and symptoms summaries
Acute effects: Not specified due to classification; apply reasonable care.
Delayed effects: Not specified due to classification; apply reasonable care.
Symptoms/effects: Not specified due to classification; apply reasonable care.

4.3.5.4. Fire Fighting:

Unsuitable extinguishing media: Not specified due to classification; apply reasonable care.

Extinguishing media and methods: Not specified due to classification; apply reasonable care.
Specific hazards arising from the sludge: Not specified due to classification; apply reasonable care.
Protection of fire-fighters: KEEP AWAY FROM clothing. AVOID breathing dust, fume, gas, mist, vapours, spray. Fight fire with normal precautions from a reasonable distance.

4.3.5.5. Accidental release measures:

Responders, personal precautions, PPE: Keep away from clothing.
Environmental precautions: AVOID release to the environment. Collect spillage.
Methods and materials for containment and for clean-up: Not specified due to classification; apply reasonable care for containment and for clean-up.
Secondary disaster prevention measures: Not specified due to classification; apply reasonable care.

4.3.5.6. Handling and Storage:

Safe handling: DO NOT get in eyes, on skin, or on clothing. DO NOT eat, drink or smoke when using this product. AVOID release to the environment.
Safe storage: Not specified due to classification; apply reasonable care.
Technical measures: Not specified due to classification; apply reasonable care.
Incompatible materials: Not specified due to classification; apply reasonable care.
Packaging: Not specified due to classification; apply reasonable care.
Additional information: Eating, drinking and smoking in work areas is prohibited. Remove contaminated clothing and protective equipment, and wash hands after use and before entering eating areas

4.3.5.7. Engineered controls:

Not specified due to classification; apply reasonable care.

PPE:
Respiratory: Not specified due to classification; apply reasonable care.
Eye/Face: Not specified due to classification; apply reasonable care.
Skin/Body: Not specified due to classification; apply reasonable care.
Hygiene: Not specified due to classification; apply reasonable care.
Special conditions posing a hazard: KEEP AWAY FROM clothing.

6.3.3.9. Stability and Reactivity

No issues noted.

4.3.5.8. Disposal:

Dispose of contents/container to an approved facility in accordance with all applicable regulations and landfill requirements per section 13 of the safety data sheet.

5. CHEMICAL AND TECHNICAL SPECIFICATIONS – PRE-BENEFICIATION

Refer to the safety data sheet for the following information:
The chemical and technical specifications are obtained from the results of the chemical analysis: Interpretation of results in terms of

- leachability potential
- Long term stability and functionality
- Reactivity and environmental factors
- Storage requirements in RA an RMP
- Chemical and technical specification (post-beneficiation)

5.1. Laboratory results

Table 4: LC and TC laboratory results for the USM Settling Pond 1 sludge

	POND 1	**POND 1**
Chemical	**TC** (mgX/kg)	**LC**(mgX/L)
Antimony	<5	<0,05
Arsenic	<8	<0,08
Barium	25	**1,48**
Boron	<16	<0,16
Cadmium	<17	<0,17
Chromium Cr^{+3}	16,3	<0,16
Hexavalent Chromium	0,0375	<0,0031
Cobalt	<17	<0,17
Copper	<17	<0,17
Lead	<8	**<0,08**
Manganese	31	**2,87**
Mercury	**4.6**	**0,01**
Molybdenum	<31	<0,31
Nickel	<18	**<0,18**
Selenium	<63	<0,63
Vanadium	16,9	0,02
Zinc	9,65	0,23
Chloride	N/A	8,21
Cyanide (Total)	<10	<0,01
Fluoride	1,58	<0,06
Nitrate	N/A	<0,25
Sulphate	N/A	<2,5

	POND 1	POND 1
Chemical	**TC** (mgX/kg)	**LC**(mgX/L)
TDS	N/A	426
	Flashpoint at 22°C	No Flash
	Flashpoint at 60°C	No Flash
	Flashpoint at 93°C	No Flash
	pH (Aqueous Leach) @ 25°C*	7.9
	Moisture % m/m	36
	Calorific Value MJ/kg	No CV

NOTES:

- Where the laboratory report limit for a test is higher than the required specification limit, the raw data is reviewed and the detection limit highlighted in bold font if outside of specification.
- Bold analytical results exceed at least the lowest applicable concentration threshold per Appendix 1 of this report. Based on the results of the sample, analysis has identified one or more elements or chemical substances that exceed the TCT 0 and LCT 0 concentration threshold.

5.2. Hazardous or non-hazardous

Sludge is NON-HAZRDOUS ITO GHS SANS 10234 classification.

5.3. Leaching potential of components in the sludge

The leaching potential is shown in the concentrations of the leachate components when subjected to the testing fluid at pH of 5. The components in the table 5: LC and TC laboratory results for the USM Settling Pond 1 sludge above given on bold were leached out at levels which exceeded the thresholds for waste assessment.

Thus, the waste is classified as low risk TYPE 3 waste

- Disposal to a Class C Landfill site.

The following table 4 gives the SSV1 and 2 thresholds for contaminated soils:

Table 5: SSV1 and SSV2 guidelines for contaminated soils

Parameter	SSV1	SSV2	SSV2	SSV2	Protection of water Resource

	All Land-Uses Protective of the Water Resource (mg/kg)	**Informal Residential** (mg/kg)	**Standard Residential (mg/kg)**	**Commercial/ Industrial (mg/kg)**	**Protection of Human Health (Drinking water usage) (mg/kg)**	**Protection of Ecosystem Health (mg/kg)**
Metals and metalloids						
Antimony	-	-	-	-		-
Arsenic	5,8	23	48	150	5,8	580
Barium	-	-	-	-	-	-
Boron	-	-	-	-	-	-
Cadmium	7,5	15	32	260	7,5	37
Chromium Cr^{+3}	46000	46000	96000	790000	N/A	N/A
Hexavalent Chromium	6,5	6,5	13	40	19	260
Cobalt	300	300	630	5000	-	22000
Copper	16	1100	2300	19000	200	16
Lead	20	110	230	1900	20	100
Manganese	740	740	1500	12000	10000	36000
Mercury	**0.93**	**0,93**	**1**	**4,5**	**1**	**4,1**
Molybdenum	-	-	-	-	-	-
Nickel	91	620	1200	10000	91	1400
Selenium	-	-	-	-	-	-
Vanadium	150	150	320	2600	2000	-
Zinc	240	9200	19000	150000	3700	240
Anions	**SSL (mg/kg)**					
Chlorides	12 000					
Fluorides	30					
Nitrate/Nitrite	120					
Sulphates	4000					

There were no leachable exceedances in the SSV1 and SSV2 thresholds for contaminated soils. arsenic, cadmium and copper were exceeded with the TC figures, however, the TC figures represent the upper limit of the analytical instruments, hence cannot accurately represent the presence of the component in the sludge at these levels. There was a measured exceedance TC of mercury, however, no exceedance was measured for leaching. Thus, the sludge can be used on soils as a fertilizer but management is required for location and management of the product for human and environment health protection as a precautionary measure. There is no data available indicating risk to human or environmental health. However, any exposure to human or environment through run-off to natural water sources is NOT good agricultural practice due to:

- potential for harm

- loss of valuable materials
- the cost that was incurred in bringing the sludge to site and use on the land
- The protection of natural water sources

5.4. Long term stability and functionality

This sludge is to be used as a soil enhancer and when applied to the soil is incorporated into the soil by natural biological processes. The objective is to enable robust sugar cane growth. Hence this is a stable waste sludge and functional for its purpose. It has long term stability and functionality. There is no concern regarding the incompatibility of the sludge. It does require input from an agronomist regarding the potential for toxic mineral and salinity build up with repeated application over time.

5.5. Reactivity with environmental factors

Conditions to avoid: Not specified due to classification; apply reasonable care.
Incompatible materials: Not specified due to classification; apply reasonable care.
Hazardous decomposition: Not specified due to classification; apply reasonable care.
Additional information: Not specified due to classification; apply reasonable care.
No other environmental factor will affect the sludge to create a risk for its purpose. The Risk assessment will identify specific circumstances in the logistics of the transportation from the pond 1 to the farm. The Risk Management Plan addresses the issues that may be raised.

5.6. Chemical and Technical Specifications – Post-Beneficiation

Fertilizer use: the integration of the sludge into the soils facilitated by the microbes in the soils. Hence the sludge will eventually need to be supplemented by further additions for the purpose of fertilizing the soils. Post beneficiation results would be revealed in the robustness of the cane crop. The agronomist monitoring of the fields will reveal any issues to be concerned about. However, the application of the sludge into the soils also provides a diluting effect of the sludge and its components.

The overall outcome of the sludge analysis is that it is a low risk waste stream to be used in the intended beneficiation purpose.

5.7. Intended users of the waste stream

The intended users of the waste sludge are small scale sugar cane farmers and all the sludge is available to be used for application to the soils as a fertilizer.

6. IDENTIFICATION OF POTENTIAL RISKS AND THE MANAGEMENT THEREOF

Refer to attachment 7: Risk assessment of the USM Pond 1 sludge and to attachment 8: Risk Management Plan of the USM Pond 1 sludge.

7. Declaration by Specialist – Anne Bindoff

All information and instructions provided in this report in respect of the Risk Assessment and Risk Mitigations/Management Plan substance is given in terms of the provisions of the National Environmental Management: Waste Act (59/2008): Regulations regarding the exclusion of a waste stream or a portion of a waste stream from the definition of waste.
Information and data is based on available information given by Umfolozi Sugar Mill and is the best information available through general research based on this information as at the date of this report. It is presented in good faith, to be correct.

Name: Anne Bindoff

Signature: ..... **Date:** 28th September 2023.....