



MPUMALANGA GREEN CLUSTER AGENCY

INDUSTRY BRIEF:

Sewage sludge beneficiation opportunities in
Mpumalanga, South Africa





List of acronyms:

DFFE	Department of Forestry, Fisheries and the Environment
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
ML/d	Million litres per day
SAWIS	South African Waste Information System
WSA	Water Service Authority
WWTW	Wastewater Treatment Works

Intended audience

This brief is written for policy makers, municipalities, investors and solutions providers that are interested in the market, and includes the following:

- Background to Mpumalanga wastewater infrastructure and estimated sludge volumes.
- Potential beneficiation options.
- Key policies and regulations.

Key insights:

- Although there is limited information on the sludge volumes and quality produced in the province of Mpumalanga, it is estimated that ~32 tons/day of undigested sludge, and 7 tons/day of digested sludge, are produced by 10 of the largest municipal WWTWs in the province.
- This represents an opportunity for solutions providers to offer circular economy sludge beneficiation solutions, thereby diverting waste from landfill and reducing municipal sludge management costs.
- The potential energy recovery and agricultural/commercial beneficiation solutions are complementary, because by-products from the energy recovery options are well suited to the agricultural and commercial options.

Context

The Mpumalanga province of South Africa faces socio-economic and environmental challenges arising from its resource intensive economic activities that contribute to climate change. Carbon intensive industries like mining, power generation and petro-chemicals are the core economic drivers in the province. The region is also currently navigating high levels of unemployment, inequality and poverty, even as pressure mounts to transition away from its current coal based economy. Under the leadership of the Mpumalanga Department of Economic Development and Tourism work has begun to design a strategic intervention for the green economy in the province to attract investment and create jobs.

This strategy identified the concept and theory of cluster development as an effective way to transition to an economy that has the ability to provide labour absorbing capacity through competitive green jobs. The Mpumalanga Department of Economic Development and Tourism, working with GreenCape and with support from the international development finance community, has set up the Mpumalanga Green Cluster Agency. This cluster focusses on unlocking and unblocking economic opportunities in the green economy, with the aim of making a contribution to regional economic diversification and job creation efforts.

Purpose of brief

The aim of this brief is to highlight potential sewage sludge beneficiation opportunities in the province of Mpumalanga, as this represents an opportunity for investors and solutions providers, as well as an opportunity to reduce municipal costs by diverting sludge from landfill.

Sewage sludge handling and disposal have been considered the most troublesome phase of municipal wastewater treatment. This is because of the high capital and operational costs, as well as the complexity and environmental challenges posed by the handling and disposal methods.

The problem is becoming more complex due to rising volumes of sewage and increasingly stringent disposal and reuse government regulations. However, despite this complexity, sewage sludge represents a valuable resource (in terms of its organic and inorganic composition) that can be beneficiated in various products, including fertiliser and soil conditioners, source of energy and commercial products such as bricks, aggregates, etc.

2. Background to Mpumalanga wastewater infrastructure and sludge quantity data

In Mpumalanga, there are 17 local municipalities, delivering wastewater services through a sewer network comprised of 76 wastewater treatment systems. There is a total *installed* treatment capacity of 352 million litres per day (Ml/d) in these 76 WWTWs, with the majority of this capacity (92%) residing in the 43 medium, large and macro-sized treatment plants.

The four local municipalities with the largest combined *operational* capacities are Emalahleni (44.2 Ml/d), Govan Mbeki (8 Ml/d)¹, Mbombela (47.3 Ml/d) and Steve Tshwete (28.7 Ml/d). Table 1 provides an overview of the large and macro wwtws in emalahleni, govan mbeki, mbombela and steve tshwete local municipalities.

Table 1: Large and macro WWTWs in eMalahleni, Govin Mbeki, Mbombela and Steve Tshwete local municipalities.

WWTW	Municipality	Design capacity (Ml/d)	Operational capacity (Ml/d) ³	Rough estimate of total sludge produced (tons/day) ²
Klipspruit	eMalahleni	10	10.30	4.4
Naaupoort	eMalahleni	10	6.80	2.9
Riverview	eMalahleni	11	11.11	4.7
Ferrobank	eMalahleni	17	9.18	3.9
Thubelihle	eMalahleni	10	0.7	0.3
Embalenhle	Govan Mbeki	8	3.2	1.4
Evander	Govan Mbeki	16	No information	0
Kanyamazane	Mbombela	12	4.02	1.7
Kingstonvale	Mbombela	26	20.25	8.6
Boskrans	Steve Tshwete	45	25.2	10.7
Total		165	90.8	38.6

¹ The operational capacities for Bethal and Evander WWTWs in Govan Mbeki Municipality were not reported in the Green Drop report, hence the actual combined operational capacity is higher than reported here.

² Design and operational capacities are from the 2022 Green Drop reports (DWS)

³ DWS data from Green Drop audits 2022

⁴ The volumes in Table 1 are rough estimates, and need to be verified on site with the respective municipalities. The estimate is based on the Marx et al. 2004 sludge production calculation guideline, based on the plant's operational capacity

Of the WWTWs listed in Table 1, 3 WWTWs achieved a 2022 Green Drop score of above 80%: Kanyamazane (84%), Kingstonvale (88%) and Boskrans (88%). In addition, these 3 WWTW are located in municipalities (Mbombela and Steve Tshwete) that both received unqualified audit outcomes for the 2020/21 financial year.

The total volumes of sludge produced by the large and macro sized WWTW listed in Table 1 are estimated to be in the order of 32 tons per day for undigested and 7 tons per day for digested sludge⁵.

Data for the quality of the sludge produced is not available to the public at the time of writing. However, the sludge compliance status in the province, is reported in the Green Drop report (DWS, 2022) as follows:

- 17 of the 76 plants (22%) classify their biosolids according to the Water Research Commission (WRC) Sludge Guidelines.

- 1 of the 76 plants (1.3%) monitors sludge streams (Kingstonvale WWTW in Mbombela).

- 3 of 76 plants (4%) have sludge management plans in place.

- 19 of 76 plants (25%) use sludge mostly for agricultural purposes, but also landfill application and commercial products.

3. Potential beneficiation options

Figure 1 lists various options for beneficiating sludge and digestate⁶.

As there is very limited information available on the sludge, and more detailed investigations need to be undertaken to ascertain the most appropriate beneficiation option.

In general, energy recovery and agricultural/commercial beneficiation solutions are complementary, because by-products from the energy recovery options are well suited to the agricultural and commercial options.

Case study: The City of Tshwane Metropolitan Municipality won the 2021 Green Economy Change Champions Competition for its project that adds value to bio-solids produced at waste water treatment facilities.

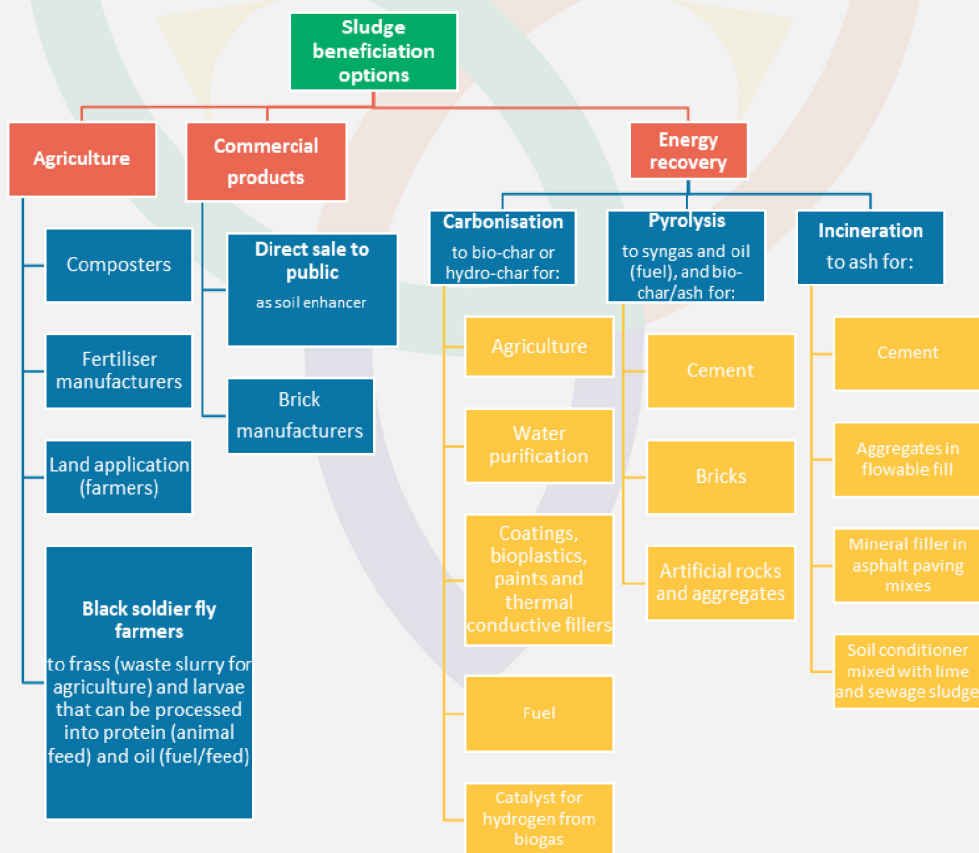


Figure 1: Options for beneficiating sludge and digestate

⁵ Estimated based on the Marx et al. 2004 sludge production calculation guideline based on the plant's operational capacity
⁶ Digestate is the residual slurry, containing up to 20% solids, generated from the anaerobic digestion (AD) process.

4. Key policies and regulations

The following are key regulatory requirements relevant to the beneficiation of wastewater sludge and digestate. For references to the applicable policies and regulations refer to the list provided in Table 2.

- The Guidelines for the Utilisation and Disposal of Wastewater Sludge Volume 1 to 5 are the governing regulations for sludge beneficiation (Snyman and Herselman, 2006).

- The DFFE have recently promulgated Norms and Standards for the Organic Waste Treatment (GN1984 of 2022)⁷. These Norms and Standards set minimum requirements for a wide range of organic waste treatment activities processing more than 10 tonnes per day⁸. This red tape reduction regulation subsequently replaces the need for undertaking a highly onerous, time consuming and costly Waste Management License process, which includes undertaking an associated Environmental Impact Assessment. One of these requirements is that applicable activities must register activities with the relevant provincial waste authorities. These Norms and Standards should be seen as progressive and reduce regulatory barriers for organic waste beneficiation.

Table 2: Summary of key policies and regulations relevant to the beneficiation of wastewater sludge and digestate

Applicable uses	Legislation	Relevance
All	National Water Act (No. 36 of 1998)	Overarching governance of any action that relates to water.
	National Environmental Management Act (No. 107 of 1998, and Amendment Act 62 of 2008)	Overarching governance of any action that poses a risk to environmental protection.
	National Environmental Management: Waste Act (No. 59 of 2008)	Schedule 1 (Section 19), Category A: identifies waste management activities that require a waste management licence. Annexure 1 - Waste Classification and Management Regulations GN 634 - (August 2013): specifies wastes that do not need to be classified (Regulation 4(1)) or assessed (Regulation 8(1)(a)) under SANS 10234. Sewage sludge is not specified under item 2 of Annexure 1; hence it must be classified and assessed according to SANS 10234.
	Waste Information Regulations (Notice R 625 of Gazette No. 35583, 13 August 2012)	Sludge is listed as both general waste (Annex. 3) and hazardous waste (Annex 4) and must comply with the data reporting procedures of the regulation to the South African Waste Information System (SAWIS).
	Environmental Impact Regulations (Notice R 982 of Gazette No. 38282, 04 December 2014)	The treatment, handling or processing of wastewater sludge may trigger an Environmental Impact Assessment (EIA) or Basic Assessment, to acquire a Waste License.
	Norms and standards for disposal of waste to landfill (Notice R 636 of Gazette No. 36784, 23 August 2013)	Sets the commencement date (August 2019) of the nationwide ban of liquid waste disposal to landfill.
	Guidelines for the Utilisation and Disposal of Wastewater sludge Volume 1 to 5 (Snyman and Herselman, 2006)	The prescribed reference for disposal or beneficiation of wastewater sludge referred to by all other legislation. Includes a classification system, based on microbiological, stability and pollutant parameters, which determines safe sludge utilisation options.
	Regulations for water use licence applications and appeals (Notice R 267 of Gazette No. 40713, 24 March 2017)	Due to the high water content of wastewater sludge, each utilisation option requires a Water Use License, unless within the thresholds of the General authorisations for Section 21(e).
	General authorisation for Section 21 (e, f, g and h) (Notice 169 of Gazette No. 36206, 04 March 2013)	Authorises activities involving the application / irrigation / discharge of waste containing water up to given quantity and quality thresholds, without a Water Use License.

⁷ National norms and standards for the treatment of organic waste NEMW Act, 2008 (Act No. 59 of 2008)

⁸ These norms and standards do not apply to any organic waste treatment facility treating: any infectious animal waste, raw sewage, or sewage sludge that does not meeting minimum quality standards as regulated under the national norms and standards for domestic water and sanitation services (GN982 of 2017)

All	Carbon Tax Act (No. 15 of 2019)	Allows for the taxation of public and private entities that produce in excess of a prescribed greenhouse gas threshold. Applicable to disposal, biological treatment, and incineration and open burning of solid waste, as well as the energy, manufacturing, and construction industries that recover heat and/or electricity from waste.
Treatment solutions	Norms and standard for organic waste treatment (Gazette No. 1984 of 2022)	Allows for treatment of organic wastes (including wastewater sludge) of up to 100 tonnes per day without an EIA or Waste License, as long as the prescribed procedures are followed, including a risk management plan, monitoring, record keeping, etc.
Thermal solutions	National Environmental Management: Air Quality Act (No. 39 of 2004)	To identify if there is the need to undertake an air emission licensing process.
Agricultural solutions	Regulations relating to fertilisers (Notice 972 of Gazette No. 41100, 08 September 2017)	List the requirements which must be met to register a fertiliser, compost or soil enhancer for sale to the public.
Composting	Draft Norms and standard for organic waste composting (Notice 1135 of Gazette No. 42681, 04 September 2019, awaiting promulgation)	Allows for composting of compostable organic wastes (but excludes wastewater sludge) of more than 10 tonnes per day without an EIA or Waste License, as long as the prescribed procedures are followed.

5. Conclusion and way forward

There is an opportunity for solutions providers and investors to offer circular economy sludge beneficiation solutions, thereby diverting waste from landfill and reducing municipal sludge management costs. These opportunities will grow as current wastewater infrastructure in the province is upgraded, as this will provide better sludge quality for beneficiation and reduce environmental risks. For further information on the sludge volumes, quality, landfill gate tariffs and offtake agreements, please consult the relevant municipalities.

For more information on this opportunity, please contact water@mpumalangagreencluster.co.za.

Disclaimer: GreenCape cannot be held responsible for any information drawn from external sources in this brief that is inaccurate.

6. References / Useful Resources

DWS (Department of Water and Sanitation). (2022). Green Drop report: Mpumalanga Province. URL: <https://ws.dws.gov.za/IRIS/lat-estresults.aspx>

Marx, C. J., Alexander, W. V., Johannes, W. G., & Steinbach-Kanes, S. (2004). A technical and financial review of sewage sludge treatment technologies. Water Research Commission Report, 4, 2-14.

Snyman, H. G. & Herselman, J. E. (2006). Guidelines for the utilisation and disposal of wastewater sludge. Water Research Commission.





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