GreenCape

Industry brief
2021

Circular economy solutions for primary, waste activated and digested wastewater sludge

Glossary

BBF	Biosolids beneficiation facility
CCT	City of Cape Town
DFFE	Department of Forestry, Fisheries and the Environment
EIA	Environmental Impact Assessment
MIR	Market intelligence report
RTS	Refuse Transfer Station
SAWIS	South African Waste Information System
SLA	Service level agreement
SWM	Solid Waste Management
VAT	Value added tax
WAS	Waste activated sludge

Main Insights

The City of Cape Town (CCT) currently spends ~ R60 million[1] per year to dispose of (or apply to land) the ~ 200 dry tonnes per day of dewatered primary and waste activated wastewater sludge it generates, with an average moisture content of 83% (range 58 - 92%).

This waste is not only a growing liability to the CCT, but is increasingly being viewed as a valuable resource. This is largely driven by a number of regulatory changes, most notably the national ban on liquid wastes to landfill that was implemented in 2019, and a Western Cape provincial restriction of organic wastes to landfill which is being phased in.

As a result, the CCT is transitioning towards anaerobically digesting its wastewater sludges in bio-solids beneficiation facilities (BBFs) to:

- Produce A1a class treated digestate cake that is safe for unrestricted use, nutrient rich, odour free and low in contaminants.
- Work towards sustainable sludge treatment including electricity generation from biogas, reusable heat generation and recovery of nutrients.
- Reduce its climate change liability.

This presents an upcoming opportunity for interested service providers offering circular solutions to manage primary and waste activated sludge in the short-to-medium term, and the digestate cake in the medium-to-long term.

[1] The most recent service level agreement for sludge disposal and land application was awarded in May 2020 (SCMB 82/11/20) to the value of R193 million over 3 years, as listed in the tender awards of the CCT.

Banner image courtesy of ©Agriman

Context

This brief provides interested service providers with market intelligence around this future opportunity and includes the following:

1. Background description of the market opportunity
2. Sludge quality and quantity data
3. Potential beneficiation (circular economy) options
4. Complementary opportunities to beneficiate other organic wastes
5. Key policies and regulations
6. Overview of CCT's procurement processes

A circular economy minimises waste; regenerates ecosystems; and keeps products, components, and materials, including biological materials, at their highest use and/or value for as long as possible. Municipalities, notably metropolitan areas, are large consumers of goods and services. As such they are well placed to drive circularity at scale. Nowhere is this more relevant than the City of Cape Town with its planned shift to wastewater sludge and digestate beneficiation.

Background

The CCT disposes approximately 199 dry tonnes per day of dewatered wastewater sludge (Figure 1). This makes up 74% of the provincial sludge production.

Half of the CCT's sludge (the waste activated sludge), in dry mass, is applied to agricultural land, while the other half (primary and blended sludge) is treated and sent to Vissershok private landfill.

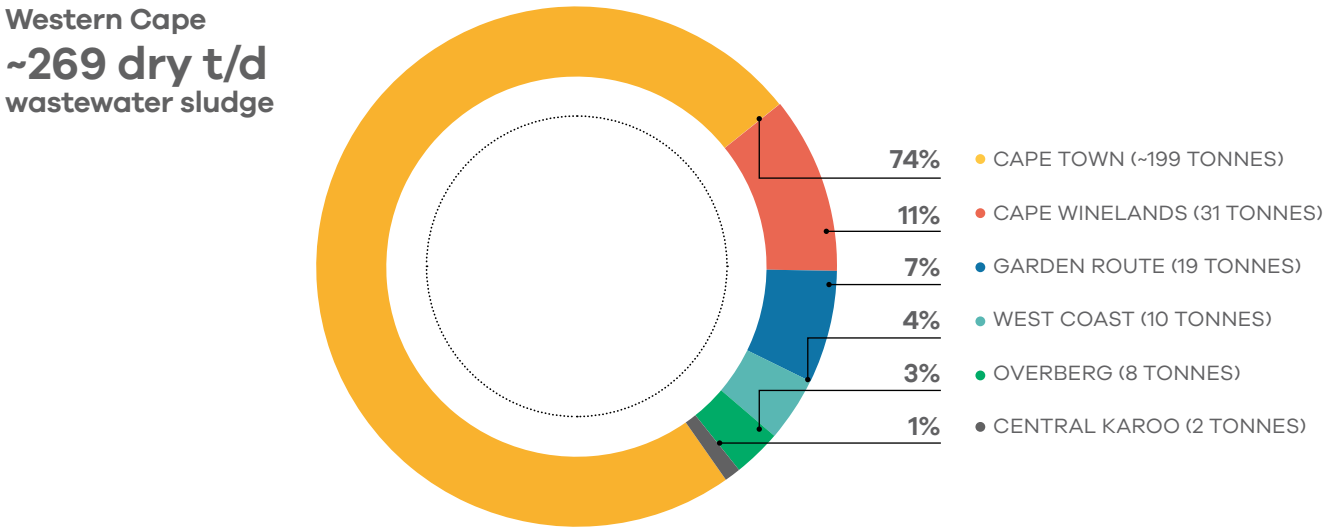

Figure 1: Total sludge (waste activated, primary and blended) production distribution for the Western Cape in dry tonnes per day (Green Drop 2013, GreenCape analysis 2021)

However, the disposal of sludge to landfill is a growing liability, most notably for the Western Cape municipalities. A such, local governments must facilitate an alternative to landfill disposal. This is primarily due to two key regulatory changes:

- **Liquid waste landfill ban (2019):** As of August 2019, the nationwide ban of liquid[2] waste disposal to landfill came into effect as required by the Norms and standards for disposal of waste to landfill (Notice R 636 of Government Gazette No. 36784, 23 August 2013).
- **Organic waste landfill restrictions (2027):** Objective 3 of Goal 3 of the Western Cape Integrated Waste Management Plan (DEADP, 2018), sets waste landfill diversion targets for organic waste. All Western Cape based municipalities, including the CCT, are required to reduce the landfilling of organics by 50% by 2022, and 100% by 2027.

[2] As defined by Section 5.1.q of Notice R 636 of Government Gazette No. 36784, 23 August 2013.

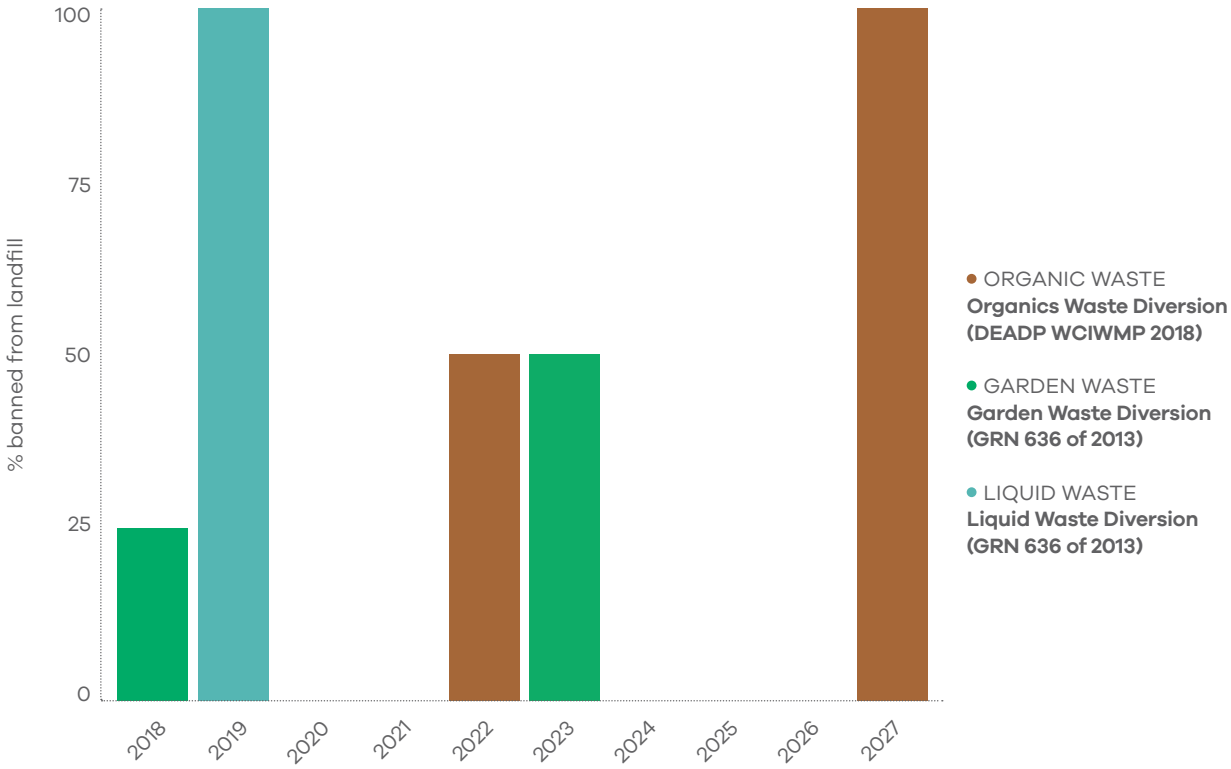

Figure 2: Timelines for the restriction and prohibition of waste to landfill in the Western Cape
(GreenCape Waste MIR, 2020)

In response to these two regulatory restrictions, the CCT is starting the transition towards anaerobically digesting its total wastewater treatment work sludges. Over the next 15 years, the CCT will be investing in the establishment of two regional BBFs, with a third facility planned to serve future demand.

A service contract (SCMB 82/11/20) is currently in place to dispose of (or apply to land) the CCT's sludge. This contract will expire at the end of June 2023. However, it is expected that the CCT will re-tender for disposal, land application and/or beneficiation services for primary, waste activated and blended sludge.

Once the first BBF has been commissioned, waste actived sludge (WAS) and digestate cake will be available as part of the service contract, as well as emergency beneficiation/disposal of primary and blended sludge, in case diverting is required.

All the primary and blended sludge will be digested at the first BBF, but there will be insufficient capacity to digest all of the CCT's WAS until the second BBF is commissioned (approx. within 15 years). In the long term, an increased sludge production associated with population growth will require a third BBF facility or another circular solution for the WAS.

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Quality and quantity of sludge produced

Quality and quantity data from the CCT's 2019 sludge disposal and 2016-2019 sludge characterisation records have been made available on the GreenCape website to inform potential solution providers and assist them with determining appropriate beneficiation processes. A summary of the classification[3] (Table 1) and quantity (Table 2) of the CCT's wastewater sludges indicates that both the primary sludge and WAS are low in contaminants (class a) and reasonably stabilised (class 1 or 2) for beneficial utilisation.

Digestate quality and quantity data is anticipated to be made available to the public once the first BBF has been commissioned and digestate production has stabilised.

Table 1: CCT dewatered sludge classification[4]

Classification[3]	Primary sludge		Waste activated sludge	
	Range	Average	Range	Average
Microbiological Class	B - C	B	A - C	B
Stability Class	1 - 2	1.8	1 - 2	1.6
Pollutant Class	a	a	a	a

Table 2: Total dewatered sludge disposed by the CCT in 2019[5]

Sludge type (all dewatered)	Disposed quantity (dry tonnes / day)
Primary Sludge	43.90
Waste Activated Sludge	97.10
Blend	58.06
Total	**199.06**

Potential circular economy uses

Figure 3 lists various circular options for beneficiating sludge and digestate identified in the vicinity of the CCT, including the existing solution providers that have established businesses that could currently beneficiate sludge, as well as the theoretical beneficiation methods that are not currently established, but could be considered implementing. 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.

For more details on some of these options, visit the Alternative Waste Treatment Guide presented by the Department of Forestry, Fisheries and the Environment (DFFE).

[3] Classification in terms of the Guidelines for the Utilisation and Disposal of Wastewater sludge Volume 1 (Snyman and Herselman, 2006)

[4] Based on samples from 2016 to 2019 at 12 of the 17 wastewater treatment works that produce sludge in the CCT.

[5] Based on actual hauled values for 12 of the 17 wastewater treatment works that produce sludge, with theoretical values for remaining 5 works.

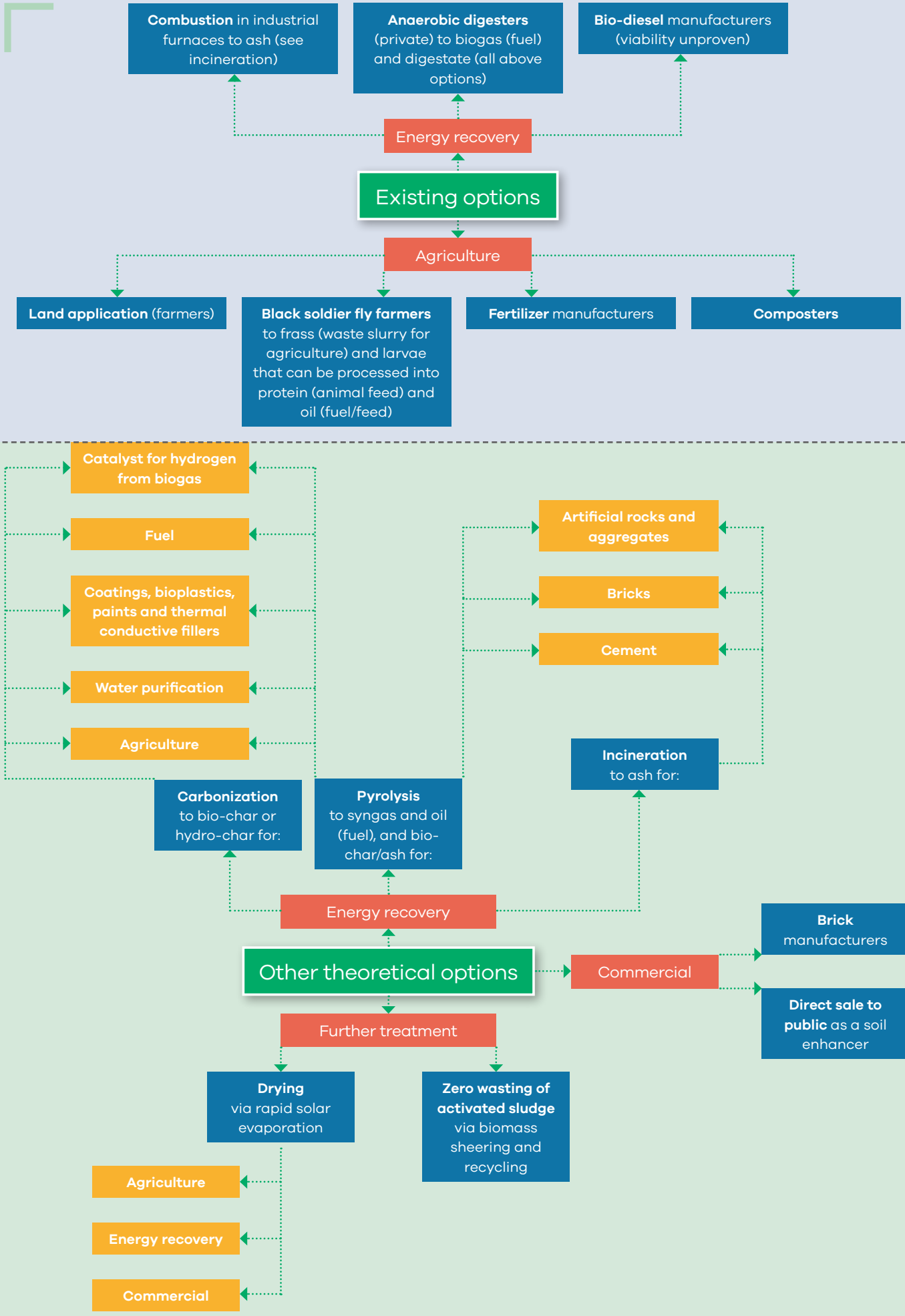

Figure 3: Options for beneficiating sludge and digestate identified in the vicinity of Cape Town

Collaborative options with other organics

Service providers should take note of additional CCT organic waste related opportunities expected in the coming years. These will be formalized in the CCT's twenty-year Waste Sector Plan, currently under development. This plan is expected to be made public in May 2022.

The detail of this plan is not yet available to the public. However, in light of the organic waste landfill restrictions noted above, organic waste will form a key focus. This should result in the establishment of organic waste interventions and potential contracts with the private sector. This provides service providers an opportunity to leverage sludge or digestate beneficiation solutions with the below considerations:

- **Garden greens chipping:** The CCT outsources chipping and removal of garden greens to the private sector. The current contract is under appeal, but once commenced, the contract will run for approximately 3 years prior to re-tender. From July 2019 to June 2020, a total of 55 242 tonnes of garden greens were chipped and diverted from landfill for processing, whilst an estimated 87 000 tonnes[6] of garden related waste was landfilled.

- **Animal carcass disposal:** The CCT outsources the collection and disposal of ad hoc animal carcasses to the private sector. The current contract is up for re-tendering in early 2021 and will likely be re-tendered again in early 2024. Currently, this tender is strictly for landfill disposal, but other treatment options may be explored in future.

- **Household organics:** The CCT is trialing eight food waste drop-offs throughout Cape Town. These, as well as previous trials, will assess the most appropriate mechanisms for potential future rollout of food waste drop-off or aggregation services. If rolled out, this may result in the outsourcing of services to the private sector. This includes landfill alternative treatment or beneficiation services. A total of ±172 000 tonnes[7] of food related general waste was landfilled in the period July 2019 to June 2020.

- **Mechanical biological treatment by-products:** The CCT is planning to upgrade its Athlone Refuse Transfer Station (RTS) into an integrated waste management facility. The concept design of this facility is still being finalized, with the objective to ensure that a clean materials recovery facility is established, as well as diversion of organic waste from landfill. This is a potential medium to long term opportunity. The CCT is also in the very early stages of planning an integrated waste management facility in Bellville, the details of which have not yet been finalised.

In light of the landfill restrictions for organic waste, all Western Cape based local municipalities, including the CCT, are required to develop and implement organic waste diversion plans. These plans may include amending current policies. There may be an opportunity to leverage these municipal contracts to strengthen the business case for sludge or digestate beneficiation. Interested service providers could keep a lookout for these waste plans in development.

[6] 87 000 tonnes was estimated based on 1) the fraction of garden greens (7.37%) in the CCT's municipal solid waste as reported in a 2018 waste characterisation study, and 2) 1.19 million tonnes of municipal solid waste was sent to general waste landfill in the period July 2019 to June 2020 as documented in the CCT's data portal for waste disposal. This approximates to 87 000 tonnes.

[7] The same estimation as above was completed for the food waste which is 14.52% of the municipal solid waste, which equates to approximately 172 000 tonnes.

Relevant 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 3**.

- The **Guidelines for the Utilisation and Disposal of Wastewater sludge Volume 1 to 5** are the governing regulations for sludge beneficiation.
- Due to the high water content of wastewater sludge and digestate, even after mechanical dewatering (filter belt press or centrifuge), each utilisation option requires a Water Use License, unless within the thresholds of the relevant General authorisations.
- As sludge is considered a waste (hazardous if it has a pollutant class of c), any beneficiation facility currently requires a Waste License, attainable via an Environmental Impact Assessment (EIA) or Basic Assessment process.
- Norms and standards for composting and for organic waste treatment are being developed that will allow facilities to operate without a Waste License, provided they comply with standard procedures and capacity limitations set forth.

Table 3: 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)	Overarching governance of any action that involves waste.
	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.
	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.

Table 3: Summary of key policies and regulations relevant to the beneficiation of wastewater sludge and digestate continued...

Applicable uses	Legislation	Relevance
Within CCT	CCT Integrated Waste Management By-law (Page 1602, Western Cape Provincial Gazette No. 6651, 21 August 2009)	Requires waste transporters, recyclers, re-users, sorters and generators to submit an integrated waste management plan for authorisation to conduct their services in the CCT.
Treatment solutions	Draft Norms and standard for organic waste treatment (Notice 275 of Gazette No. 44340, 29 March 2021, awaiting promulgation)	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 fertilizers (Notice 972 of Gazette No. 41100, 08 September 2017)	List the requirements which must be met to register a fertilizer, compost or soil enhancer for sale to the public.
Composting	National Norms and standard for organic waste composting (Notice 561 of Gazette No. 44762, 25 June 2021)	Allows for composting of compostable organic wastes (including organic sludges) of more than 10 tonnes per day without an EIA or Waste License, as long as the prescribed procedures are followed.

City of Cape Town's procurement processes

GreenCape has published an industry brief on entering the South African water market, which guides readers through general water sector procurement requirements and recommendations. In addition, the following sources can be consulted for assistance when bidding on CCT tenders:

- The CCT's Supply Chain Management Policy
- Relevant webpages on the CCT's website, such as the Tender Portal, guiding articles in City Connect, and the CCT's supplier database.
- Landfill gate fees can be found in Section 2.3 of the GreenCape 2021 Waste Market Intelligence Report (MIR) or the CCT's latest budget annexure for tariffs.

Next steps

For further information and support on any of the content provided here, please contact GreenCape's
Water sector desk: Rudi Botha rudi@greencape.co.za
Waste sector desk: Sam Smout sam@greencape.co.za

Additionally, the CCT has a New Technology Platform to give the City a better understanding of innovative water sector technologies in the market. It gives companies the opportunity to present their products and services to government in a fair manner. For details on how to submit information to the committee, please contact Water.NewTechnology@capetown.gov.za.