

Trowbridge Process Description

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Summary of Site Activities

A summary description of all activities carried out with the Trowbridge BC is provided below.

Anaerobic digestion of indigenous and imported sludges >100te/day
Sludge / cake import and storage
Sludge screening
Sludge thickening
Liquor balancing
Dewatering
Digester boilers
Biogas storage and utilisation

Overview of activities

The Trowbridge BC treats indigenous sewage sludges arising from sewage treatment processes operated within the wider Trowbridge WRC (Water Recycling Centres), as well as sewage sludges generated by smaller WW 'satellite' WRCs. The principal activities undertaken within the installation include:

- Sludge reception and screening;
- Raw sludge thickening;
- Anaerobic digestion (including associated heat generation from the Digester Boilers to support AD activities);
- Liquor balancing;
- Digested sludge dewatering;
- Storage and maturation of digested sludge prior to transfer off site for land spreading as an agricultural soil conditioning agent;
- Use of biogas (a renewable energy source) to fuel combined heat and power (CHP) and/or boilers, generating electricity and / or heat to support the AD process; or used in the Gas to grid plant which upgrades the calorific value of the biogas to be used in the gas network.
- Raw material storage and use;
- Surface water and process liquor collection and transfer to Trowbridge WRC for treatment;

- Waste storage and transfer off site

The information below is a non-technical description of the sludge treatment process, including the key assets and associated infrastructure at Trowbridge BC. The process is displayed pictorially in the Process Flow Diagram (PFD). The location of the assets and infrastructure referred to are shown in Trowbridge Asset Plan. A Photolog, showing asset locations and photographs of assets, is provided as Appendix 13 of the original application submitted in July 2021.

This information will be used to identify and assess the significance of the main sources of contamination (i.e., locations where sludges and liquors are stored / transferred) at the Bioresources Centre that would have the potential to cause pollution of the ground and / or the local water environment.

Sludge Storage & Treatment

- 1x Sludge reception tank; (A)
- 2x Sludge strainpresses; (B)
- 2x Pre-thickened sludge tanks.
Pre-thickened storage tank 1; (C), pre-thickened storage tank 2; (D)
- 2x Gravity belt thickeners; (E)
- 1x GBT Filtrate pumping station; (F)
- 1x Thickened sludge tank; (G)
- 6x Acid Phase Digestion; (H1-6)
- 2x Mesophilic Anaerobic Digesters; (I1 & I2)
- 2x Secondary Digesters; (J1 & J2)
- 2x Dewatering Belt Press; (K)
- 2x Belt Press Stack,
Belt Press Stack; (K1) Belt Press Stack 2; (K2)
- 2x Dewatering Centrifuge; (L)
- 2x Skip loading areas,
Skip loading area 1; (L1), Skip loading area 2; (L2)
- 1x Dewatering liquor transfer pumping station; (M)
- 2x Liquor balancing tanks; (N1 & N2)
- 1x Return liquor pumping station; (O)
- 1x Centrate Safety Vent; (P)
- Skip Storage area; (Q)

Biogas Collection, Storage and Utilisation

- 1x Gas Holder; (R)
- 1x Dehumidifier Chiller; (S)
- 2x Boilers; (T)
- 2x Boiler Stack; (T2)
- 1x CHP Engine; (U)
- 1x CHP Stack; (U1)
- 1x Waste Gas Burner (Flare Stack); (V)

- 1x Gas upgrading plant (W)
- 1x Grid entry unit; (W1)
- 1x Biomethane Flare; (X)
- 3x Propane tanks; (Y)

Site assets

- 1x Diesel tank (Z1)
- 1x Site generator (Z2)

Sludge treatment process

The following text provides a summary description of the sludge treatment process at Trowbridge BC. Each asset in the summary description is provided with a corresponding letter which is referenced in the Trowbridge Asset Plan to show its location within the installation.

- Imported sludge is transferred from tankers into the Sludge Reception Tank (A), as well as indigenous sludge pumped from the adjoining Trowbridge WRC.
- The sludge from the Sludge Reception Tank (A) is pumped forward to the 2no Strainpresses (B) and the strained sludge is discharged into 2no. Pre-thickened sludge tanks (C & D) for storage.
- The strained sludge is thickened by 2no Gravity belt thickeners (GBT) (E) and the resulting thickened sludge is transferred into the Thickened sludge tank (G) before being forwarded for digestion.
- Liquors from the 2no GBTs (E) are transferred to the head of the works via GBT Filtrate pumping station [F].
- The digestion process is made up of two phases:
 - The Acid Phase Digestion (APD) (H1-6) and Mesophilic Anaerobic Digestion (MAD) (I1 & I2) which make up the first phase.
 - And the Secondary Digesters (J1 & J2) making up the second phase.
- The Boilers (T) supplies heat directly to the APD (H1) which is current operated around 30°C, and supplies heat to be used in the MADs (I1 & I2) currently operated around 36°C to facilitate biological activity.
- Digested sludge is decanted from the MADs (i1 & i2) and flows via gravity into the Secondary Digesters (J1 & J2)
- From the Secondary Digesters (J1 & J2) digested sludge is pumped to the Dewatering equipment to either 2No Dewatering Belt Press (K) with associated ventilation systems each with its own 'Belt Press Stack' (K1 & K2) or to 2No Dewatering Centrifuge (L)

- Liquor generated by the dewatering process is forwarded to the Dewatering Liquor Transfer Pumping Station (M) before being pumped into 2No Liquor balancing tanks (N1 & N2). Liquor is then returned the head of works for treatment at Trowbridge WRC via the Return liquor pumping station (O). A 'Centrate Safety Vent' (P) has been installed on the centrate line as it discharges into the existing drainage before flowing to the Dewatering Liquor Transfer Pumping Station (M).
- The digested cake ('dewatered sludge') from the dewatering activity (K & L) is conveyed to skips in Skip loading areas (L1 & L2) and transferred the Skip Storage Area (Q) before being sent off site for disposal.

Biogas Collection, Storage and Utilisation

- The biogas generated from the digestion process is collected and stored within the Gas Holder (R).
- The biogas exits the Gas Holder (R) and passes through a 'Dehumidifier Chiller' (S). The purpose of this is remove moisture from the gas protecting the downstream gas utilisation equipment.
- Biogas is primarily utilised by the Gas to Grid Plant which comprises of the Gas upgrading plant (W), Biomethane Flare; (X), Grid entry unit; (W1) and 3No Propane tanks; (Y). If the biogas does not meet the required standard or the Gas to Grid Plant has failed, the biogas will be utilised by the CHP Engine (U) and the 2No Boilers; (T) each with their own exhaust stack adjacent, CHP Stack (U1) and 2No Boiler Stack (T2). Each of these biogas consumers has their own stack. These are all connected to a common support structure, but the flue stacks all remain independent of each other with their own emissions.
- To ensure that no biogas is vented to atmosphere the site has a Waste Gas Burner (Flare Stack) (V), this utilises excess biogas when the Gas Holder (R) reaches a selected level setpoint.
- The 'Gas Upgrading Plant' (W) is a gas refinery stage of the Gas to Grid process where incoming biogas is upgraded into biomethane.

Biogas is compressed and then cooled in a heat exchanger before entering the bottom of an absorption column where it meets a counter current of process wash water. The process wash water 'scrubs' the biogas of H₂S and CO₂ with the gas vented from the top of the column.

The used or contaminated water then passes through to a flash column where the pressure is reduced so that any methane dissolved in the water is 'flushed' out as a gas and vented from the top of the column for recycling to the absorption column via the gas compression stage.

Water from the flash column is fed to the top of a desorption column filled with plastic media where it meets a counter current of air blown in from the bottom of the column to desorb CO₂ and separate it from the water. Cleaned water is collected at the bottom of the

column for re-use and the air and CO₂ waste gas stream is vented to atmosphere via a carbon odour control unit.

Biomethane vented from the top of the absorption column passes through an adsorption drier stage to remove water from the gas. Dried, biomethane under pressure passes onto a carbon odour control unit stage of the process to remove impurities such as siloxanes before the Grid Entry Unit (W1).

- The startup of the Grid Entry unit (W1) accepts gas from the Gas Upgrading Plant (W). The addition of propane from the Propane tanks (Y) is added to control the calorific value of the gas before being exported to the gas distribution network, additional requirements are also completed during this phase to comply with the standards of the gas transporter, such as odorant as an additive to the gas.
- The Biomethane Flare (X) is used when the gas is rejected from the gas distribution network or upon start-up of the plant whilst stabilising the biomethane ready for export.

