Asset Management
Asset Standard
Odour Management Plan

Crawley STW

CRAWS1ZZ

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It is a business requirement to comply with standards. Compliance issues will be escalated to the relevant governance group for further action as appropriate.

For further information/advice, please e-mail: am.standards@thameswater.co.uk.

Owner Review Requirements

Document to be reviewed when any changes are made to the site or processes.

Local Review Requirements

Site Manager should be informed when handwritten amendments are made to this document.

Revision No	Reason for Revision	Prepared by	Approved by	Date
1	-		[redacted]	November 2010
2	Provision of New Sludge Dewatering Plant		[redacted]	August 2011
3	Amendment to Section 5.1		[redacted]	February 2012
4	-		[redacted]	March 2013

Revision No	Reason for Revision	Prepared by	Approved by	Date
5	Conversion and validation of OMP into new Standard format, inclusion of Odour Improvement Plan Template	[redacted]		June 2014
6	New Sludge Treatment Centre permit application	[redacted]	[redacted]	April 2022
6.1	Sludge Treatment Centre Permit Resubmission	[redacted]	[redacted]	November 2023
6.2	PFD and site plan update	[redacted]	[redacted]	March 2024
6.3	Site plan Updated	[redacted]	[redacted]	April 2024

0.3 Sign Off

Operations Area Manager	[redacted]	Date: April 2024
Process Manager	[redacted]	Date: April 2024

0.4 Glossary of Terms

TERM	DESCRIPTION
AD	Anaerobic Digestion
BNR	Biological Nutrient Removal
CHP	Combined Heat and Power
CSM	Customer and Stakeholder manager
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EMS	Environmental Management System
EPR	Environmental Permitting (England and Wales) Regulations 2016
FFT	Flow to Full Treatment
H4	Environment Agency - How to comply with your permit – H4 Odour Management, March 2011
ICA	Instrumentation Control & Automation
IED	Industrial Emissions Directive
OCU	Odour Control Unit
OMC	Operational Management Centre
OMP	Odour Management Plan
PFT	Picket Fence Thickener
PM	Process Manager
PS	Pumping Station
PST	Primary Settlement Tank
Receptors	Sensitive receptors are any fixed buildings or installations where odour annoyance may occur, such as residential homes, schools, hospital, offices, shops or garden centres. Open areas such as playgrounds and public footpaths should also be listed where these are known to have been effected by odour
SAP	Thames Water's enterprise resource and planning system
SCADA	Supervisory Control And Data Acquisition
SOM	Site Operating Manual
STC	Sludge Treatment Centre
STW	Sewage Treatment Works
TCM	Technically Competent Manager

TM	Team Manager
UWWTD	Urban Waste Water Treatment Directive

1 Introduction

This Odour Management Plan (OMP) forms part of Crawley STW Best Operating Practice and is a constituent part of the Environmental Management System (EMS). A key related document is the Site Operating Manual (SOM) – this document can be found as a hard copy in the Crawley STW administration building and on Thames Water's database SharePoint, within the EMS pages.

The purpose of this OMP is to define how the potential and actual sources of odour from Crawley STW are identified, and how, as far as is reasonably practicable, they are controlled and recorded. It is primarily a management guide; detailed operational procedures are contained within the SOM.

Changes to OMP procedures are captured in the SOM as part of the periodic reviews of this document..

The effectiveness of the odour control measures will be reviewed annually or sooner if any of the following occur:

- If the site in question acquires any other permitted activity with the potential to increase the risk of odour off site.
- When significant changes are made to the site which may affect odour, e.g. capital spend.
- As a result of a change in pattern of odour complaints, increase in public concern and as soon as possible after a significant incident.
- When the site management changes.
- If there is a material change in relevant regulations or guidance.
- If there is an odour release incident
- If a contingency measure is triggered

This OMP is an operational document that has been developed following a review of the potential risk areas for odour release. It details operational and control measures appropriate to the reduction or elimination of the impact of odours from wastewater treatment works. It provides detail to allow operators and maintenance staff to understand the operational procedures for both normal and abnormal conditions.

This OMP was updated in 2022 to incorporate appropriate odour control measures for activities that will be newly regulated under an Environmental Permit issued under the Environmental Permitting (England and Wales) Regulations 2016 (EPR), following the principles transposed through the Industrial Emissions Directive. This follows the reinterpretation of the Industrial Emissions Directive in exclusion of UWWTD activities - meaning that anaerobic digestion (AD) on a Sewage Treatment works now needs an Environmental Permit.

The Odour Management plan has been structured to distinguish between the two regulatory regimes, which are fully described in the Site Information chapter. The wastewater treatment process is covered by the Urban Wastewater Treatment Directive (UWWTD). The Environmental Permit for the Sludge Treatment Centre (STC) covers various process including but not limited to, the AD process, combustion of biogas in the CHP plant and the storage of resulting sludge. This OMP responds to odour risks from both UWWTD and STC permitted processes (referred to as the Sludge Treatment Centre Permit).

This OMP is stored electronically on SharePoint within the EMS page. A hard copy is kept on site within the Site Operating Manual.

1.1 Relevant Guidance

Where this Odour Management Plan relates to STW activities regulated under the UWWTD this OMP may still draw upon elements of best practice taken from H4 but this should not be inferred as H4 being applicable to these activities.

The following guidance has been used to inform the contents of the OMP where it relates to activities regulated under EPR through the Sludge Treatment Centre Permit. This guidance does not apply to UWWTD activities:

- Environment Agency - How to comply with your permit – H4 Odour Management', March 2011 (H4)
- Commission Implementing Decision (EU) 2018/1147 of 10 August 2018 establishing best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council (Waste Treatment BAT Conclusions)

The OMP format used is in line with that adopted for other Thames Water sites.

2 Site Information

2.1 Location and Receptors

Site Address:

Crawley STW
Radford Road
Crawley
West Sussex
RH10 3NW
Permit number: EPR/HP3632TS/V005
What 3 words: successes.forced.gear

Crawley STW is located to the south east of Gatwick Airport between the A23 and B2036.

Crawley STW treats sewage from Crawley Town, the trading estate to the north of Gatwick airport, run off water from the runway which is stored in a lagoon managed by the airport, and outlying villages. The outlying villages include Copthorne, Crawley Down, Turners Hill and the Alexander Hotel. There is a mixture of commercial, agricultural and water storage lagoons from Gatwick airport immediately adjacent to the site. The nearest residential properties are located approximately 300-400 m to the south and 500 m to the east. The plant serves a Population Equivalent of 160, 000 (including flows of 45,000 Population Equivalent from Gatwick airport).

Receptors

The nearest receptors are indicated in Table 2.1 below and have been marked on the site location map in Figure A of Appendix 4:

Table 2.1 - Location of potentially sensitive odour receptors

Receptor Number	Receptor Type	Receptor Name	Approximate distance to the nearest site bounduary (km)	Direction from the site	Receptor sensitivity
1	School	Forge Wood Community Centre	0.75	South	High
2	School	The Gatwick School	0.82	South-West	High
3	School	Burstow Park School	1.98	East	High
4	Open area	Grattons Children's Play Area & Local Nature Reserve	1.89	South	High

5	Commercial	Gatwick Airport Business Park (Between the railway and Gatwick Rd)	0.15	West	Medium
6	Hotel	Oldlands Farm	0.35	South	High
7	Residential	Residential Area at Radford Rd	0.31	East	High
8	Hotel	Oakhurst B&B	0.46	South-East	High
9	Residential	Residential Area at Balcombe Rd	0.41	North-East	High
10	School	Cranbrook Independent Nursery & Pre School (1)	0.66	East	High
11	School	Kid Co Ltd	0.66	East	High
12	School	Cranbrook Adventurers Out of School Club	0.70	North-East	High
13	Light industrial / commercial	Taylors Pitstop	0.65	East	Medium
14	Residential	Residential Area at Steers Ln	0.52	South-East	High
15	Residential	Residential Area at Cornwell Ave	0.59	South	High
16	Transport	Gatwick Airport - South Terminal commercial area	0.88	North	Low
17	Transport	Gatwick Airport - North Terminal commercial area	1.68	North-West	Low
18	Commercial	Lowfield Heath - Business &	1.17	West	Medium

		Commercial area			
19	Hotel	Premier Inn Gatwick Airport South Hotel	1.81	South-West	High
20	School	Brookfield Day Nursery & Holiday Club	1.98	West	High
21	Light industrial	Royal Mail	0.99	South-West	Medium
22	Light industrial	Industrial Park (between the railway and Jenner Rd)	0.57	South-West	Medium
23	Commercial	Burstow Nurseries & Garden Centre	1.08	East	Medium
24	Commercial	Maple Business Park	1.78	North-East	Medium
25	Residential	Residential Area at Green Ln	1.54	North-East	High
26	Commercial	Sussex Manor Business Park	1.46	South-West	Medium
27	Light industrial	Manor Royal - industrial area	1.57	South-West	Medium
28	Light industrial	Industrial area between Fleming Way and Hydehurst Ln	1.55	South-West	Medium
29	Residential	Horley Residential Area (West from the railway)	1.39	North-West	High
30	Residential	Horley Residential Area (East from the railway)	1.52	North	High

31	Residential	Residential Area at Fernhill Rd	1.07	North-East	High
32	Hotel	Hilton London Gatwick Airport	0.93	North	High
33	Hotel	Courtyard by Marriott London Gatwick Airport	1.00	North-East	High
34	Commercial	McDonald's	1.20	North	Medium
35	Commercial	KFC	1.20	North	Medium
36	Residential	New built near M23 Junction 10	0.90	South-East	High
37	Residential	Along Tinsley Ln	1.59	South	High
38	Residential	New built at Worsell Dr near M10 and Copthone Way	1.65	South-East	High
39	Commercial	Amazon DRH1	1.56	South-East	Medium
40	Commercial	DHL Parcel UK Depot	1.51	South-East	Medium
41	Residential	New built near A2011, the railway and Fruldoon Pond	1.47	South	High
42	School	Cranbrook Independent Nursery & Pre School (2)	1.51	North-East	High
43	Open area	Riverside Garden Park	1.60	North-West	Low
44	Light industrial/commercial	R & M Autocare	1.80	South-East	Medium
45	School	Roshe School	1.95	South-East	High

2.2 Off-site sources of odour

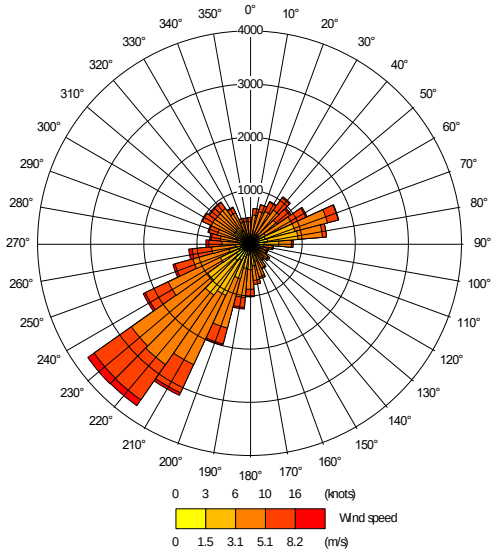
Surrounding the plant, potential off-site sources of odour have been identified as follows:-

- Gatwick airport, using a glycol lagoon
- Farmers, spreading slurry on the land

2.3 Wind Rose and Weather Monitoring

Gatwick Airport meteorological station (approximate location NGR E 526749 N 140281) is located approximately 2.4 km west of the site and is considered the closest most representative meteorological monitoring station to the site. Data is recorded at the meteorological station in hourly measurements and the figure below presents the relationship between the frequency and speed of wind from compass point directions for the combined years 2011 – 2015. The figure illustrates the predominant wind direction to be southwesterly, which means receptors northeast of the site would have the highest probability of experiencing potential increases in odour emissions.

Figure 2.31: Gatwick Wind Rose, 2011-2015



There is no on-site weather station at Crawley. Weather on site can be reviewed if complaints are received or during periods of abnormal operations. The internal 'Weather' SharePoint site provides adverse weather information, and the UK Met Office website can also be used.

2.4 Site Layout and Treatment Processes

Details of the site layout and treatment processes are given in the following sections of the Site Operating Manual and are therefore only given summary attention in this OMP:

Section	Description
1	Governance & Control

2	Location, key layout plans and diagrams. Site services, including power, water, drainage, SCADA and ICA. Consent details, process overview, chemical and waste handling.
3	Detailed description of each treatment process, including sludge and odour control.
4	Maintenance
5	Plant control, monitoring, and logging.

The following sections describe the processes of wastewater and sludge treatment and should be read in conjunction with the site plan and process flow diagrams given in Figures B, D and F located in Appendix 4.

2.5 Process Description

2.5.1 UWWTD activities

Wastewater Treatment

Crude sewage arrives at the works inlet well from three mains and is then pumped from the inlet well to a raised inlet. The sewage is screened and screenings are washed trough a washpactor unit and then deposited into a skip. The screened sewage then passes to two Dorr detritors for grit removal. The cleaned and dried grit is deposited into a skip. There is an emergency storm weir at the inlet works after the detritors. The storm overflows combine into a single line and discharge through a dedicated storm outfall into the Gatwick stream. The storm water is returned to the inlet well under gravity through a branch off the storm pump line.

The sewage from the inlet works gravitates to a distribution chamber and then feeds the nine PSTs. Scum traps are fitted to each tank and the scum mixes with the sludge in the chamber and gravitates to the ‘new’ sludge pump house. Ferric Sulphate is dosed to the PSTs for load reduction.

A separate set of chemical dosing pumps is provided to allow simultaneous/topup dosing of chemical to the aeration lanes. There are three diffused air activated sludge plants that run in parallel.

The mixed liquor passes over weirs at the end of the lanes of the activated sludge plants to a common channel and feeds the fourteen Final Settlement Tanks. Each tank is fitted with a scum board and a scum trap. RAS is drawn off the FSTs and returned to the aeration plant. The SAS is pumped to a single SAS line and terminates at the SAS holding tank prior to being thickened.

The effluent from the FSTs then continues on to the tertiary treatment plant. There is one tertiary treatment disc filter plant and one tertiary treatment sand filter plant that serve all three stages. Two slow head sand filters treat a proportion of the effluent from stages two and three, and the remainder of the effluent is mixed with the effluent from stage one and is treated by the disc filter plant.

The overflow from stages one, two and three enters a channel that feeds five emergency rapid gravity filters. The filtered final effluent from each unit combines, enters the final effluent culvert and is then sent to outfall number two, where it is discharged to the Gatwick stream.

2.5.1 Activities under Sludge Treatment Centre Permit

The STC treats both indigenous sludges and imported sludge cake. Indigenous sludge is generated from the incoming flow to the STW, which passes through the aerobic treatment process under the UWWTD. Indigenous sludge is then pumped to two Picket Fence Thickeners (PFTs) and is thickened.

Liquor weirs over the edge of the PFTs and returns to the Works Inlet via the site drainage. SAS from elsewhere in the UWWTD process is thickened using SAS Thickening Plant with the addition of a liquid polymer to aid coagulation. Filtrate returns to the Works Inlet via the site drainage.

The STC comprises an offloading point for permitted imported tankered wastes toward the west of the installation. The waste arrives at the STC via tanker and is discharged and is pumped to the inlet, where it combines with other sewer derived materials and subject to aerobic treatment, under the UWWTD.

All imports will be assessed using the Thames Water standard waste pre-acceptance checks to ensure that they are appropriate for treatment via the UWWTD. Once pre-approved as suitable for treatment via the UWWTD route, the waste carriers are approved. Wastes will be subject to appropriate waste acceptance checks in accordance with Thames Water procedures. Incoming tanker vehicles are directed to the inlet offloading point, which is an impermeable surfaced area, equipped with sealed drainage.

Indigenous thickened primary sludge and SAS is mixed in the Sludge Blending Tank before being pumped to the Thermal Hydrolysis Plant (THP) Dewatering Feed Buffer Tank. The blended sludge is pumped to Pre-THP Dewatering Plant, where sludge is dewatered with the addition of a powder polymer from a silo and liquor returns to the Works Inlet via site drainage. Thickened sludge is then pumped to the THP Feed Silo. Undigested sludge cake can also be imported to Crawley STC via a cake hopper within the Cake Import Facility. Imported cake is transferred via screw conveyors to the THP Feed Silo to be mixed with indigenous sludge.

Thickened, blended sludges from the THP Feed Silo are then subject to a THP Process with the application of temperature and pressure, used to enhance the digestion of the sludge, in an enclosed system. From the THP Process, sludge is transferred to one of the two Primary Digester Tanks at the site. The Primary Digester Tanks are above ground tanks of concrete construction. Following treatment over an appropriate number of days within the Primary Digester Tanks, digested sludge is transferred to the Digested Sludge Buffer Tank and then is pumped for dewatering in the Digested Sludge Dewatering Plant. As required, digested sludge can be temporarily stored within one of the Sludge Contingency Tanks. The Digested Sludge Dewatering Plant uses a powder polymer to aid coagulation with the liquor returning to the Works Inlet via the site drainage for further treatment. Dewatered sludge is conveyed into the enclosed and odour abated cake barn, prior to removal from the site under the Sludge Use in Agriculture Regulations 1989 (SUiAR), and in accordance with the Biosolids Assurance Scheme (BAS). Undigested sludge can also be imported to the cake barn (in the Raw Sludge Zone) for temporary storage in the event that the cake import facility is unavailable for use.

Biogas from the Primary Digester Tanks is captured and transferred to one of the two double membrane Biogas Storage holders. The biogas transfer pipeline is equipped with condensate pots that capture entrained moisture from the generated biogas and allow it to be drained into the site drainage system for treatment. The Biogas Storage holder, THP vessels and Primary Digester Tanks are fitted with pressure release valves (PRVs) as a safety precaution in the event of over pressurising the system.

The biogas is taken from the Biogas Storage holders for combustion in the CHP Engines, generating electricity for use both within the site and for export to the grid, and steam to the THP process. The biogas pipeline is equipped with a siloxane filter to remove entrained siloxane from the biogas. In the event that additional steam is required by the THP process, biogas or diesel may be used in the onsite dual-fuelled heat recovery boiler. An emergency flare is available for use during periods of essential maintenance and for emergency use. The flare is utilised under 10% of the year or less than 876 hours per year.

This OMP includes the import of treated sludge cake from other works, for temporary storage within the cake barn (Digested Sludge Zone), pending offsite recovery. All such imports will be subject to

appropriate waste pre-acceptance and acceptance checks, prior to import, including checking whether the incoming cake complies with the requirements of SUiAR and BAS.

Imported treated sludge cake is offloaded into the Digested Sludge Zone in the Cake Barn, so as to be stored separately to indigenous sludge cake. The waste stream is the same as that arising from the treatment of sludge within the Crawley STC with the same characteristics, composition and eventual end use – application to land. As such, the infrastructure which is acceptable for use for site cake is appropriate for the imported material.

Cake is stored on an impermeable engineered surface within the cake barn, for the shortest time practicable, the duration depending on factors such as prevailing weather and availability of the landbank.

3 Site Management Responsibilities and Procedures

3.1 Site Roles

Figure 3.1 - Site Roles

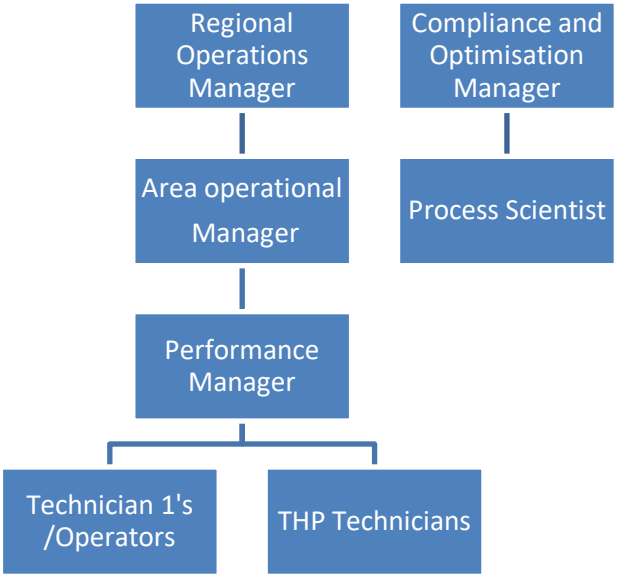


Table 3.1 - Tasks and Responsibilities

Role	Tasks and Responsibilities
Regional Operations Manager	Responsible for the overall performance of STW in this region.
Area Operations Manager	Responsible for overall performance of the STW in the area, including assessing the scope of, and updating the OMP as it is implemented.
Performance Manager	Responsible for overall performance of the STW and will be responsible for • Odour control and management at the site • Day-to-day implementation of the OMP • Dealing with customer complaints • Assessing the scope of, and updating, the OMP as it is implemented. • Day-to-day operation of the STW • Ensuring staff Thames Water staff undergo appropriate training
Technician 1/Operator	Day to day duties include maintaining and operating process equipment.
Process Scientist	Reports to Compliance and Optimisation Manager. Responsible for process monitoring, improvement and troubleshooting.

Role	Tasks and Responsibilities
Duty Manager	The duty manager is centrally based (off-site) and is responsible for event management across the business.
Customer Centre	Responsible for receiving all customer calls, logging them and passing them to the appropriate operational departments.
Technically Competent Manager	Hold the required WAMITAB qualification to support the activities on site under EPR, ensuring permit conditions are complied with.
Customer and Stakeholder Manager (CSM)	Responsible for managing liaison with all external customers and stakeholders in liaison with customer centre, escalation team, local govt. liaison team etc.
Compliance and Optimisation Manager	Responsible for process investigations and technical assistance.

Site is manned between 07:30 and 17:00. The site is not manned out of hours but there is a remote monitoring with a link to call out system.

3.2 Key Contacts

Role	Name	Email address	Phone Number
Operations Area Manager	[redacted]	[redacted]	[redacted]
Performance Manager	[redacted]	[redacted]	[redacted]
Customer Centre	[redacted]	[redacted]	[redacted]
Technically Competent Manager	[redacted]	[redacted]	[redacted]

3.3 Operator Training

Staff working on site undergo a site induction that is carried out by the Performance Manager. The site induction includes direction to the presence and location of the various operational procedures which include the SOM and the OMP. In addition, Site Tech 1's undergo a specific programme of training which covers management of activities on site.

All training records are currently held on Learning on Tap where they are accessible by the site Performance Manager and individual members of staff.

4 Odour Critical Plant Operation, Monitoring and Management Procedures

Odour prevention and reduction is achieved at Crawley through at least an annual review, or sooner as mentioned in Section 1, of the Odour Risk Assessment, Odour Improvement Plan and Odour Management Plan. In combination with the maintenance and monitoring carried out on site mentioned in sections 4 and 5.

Through our Odour Management Plans and maintenance procedures, the primary focus is on effective process control to minimise the risk of off-site odour nuisance. Similarly, our site-based frontline Wastewater Treatment Operations team are focussed on effectively managing the on-site process.

4.1 Odour Sources, Critical Issues and History

There was 1 formally recorded complaint in 2018, none recorded 2019-2022.

An odour risk assessment of the activities at Crawley and mitigation under normal and abnormal conditions is included in Appendix 1.

Critical Odour Issues, Emergency Response and Mitigation Measures are summarised in Tables 4.3 to 4.7.

4.2 Identification of Odour Critical Plant

4.2.1 Odour Risk Assessment

Odour Risk Assessment is not a 'one-off' exercise but an on-going process. The Odour Risk Assessment should be reviewed whenever the site undergoes an operational or capital change which could significantly affect odour.

It is constructed in the following manner:

- Each part of the treatment process is considered under different operating modes - e.g. normal, failure, abnormal: system overload, summer conditions, maintenance etc.
- The nearest customers to the particular odour source are identified.
- The likely frequency and duration of occurrence for each eventuality is identified.
- A score is assigned to the severity (0 – 5) of odour under each operating mode.
- A score is assigned to the probability (0 – 5) of causing an odour nuisance for each operating mode.
- Multiplying the severity of odour and probability of causing an odour nuisance generates a 'Current Odour Emission Risk' score. Between 0 (zero risk) and 25 (maximum risk), this is used to decide where mitigation should be applied in the short term, and determine where in the longer term enhanced improvement measures are required. Where improvements are identified as necessary (i.e., where suitable mitigation measures are not already in place), entries are made onto the Odour Improvement Plan.
- The need for operational mitigation, enhanced measures and customer communication is stated and brief details given.

Items scored in the Odour Risk Assessment with a risk score greater than 10, and where existing operational mitigation measures are not sufficiently robust, will have Improvement Plans generated to address the odour issues. The Odour Improvement Plan for Crawley STW is included in Appendix 2.

4.2.2 Potential Odour sources

The following list of potential UWWTD odour sources been identified during the risk assessment:

- General
- Incoming Sewers & Reception Wet Well
- Storm lagoon
- Screens
- Screenings skips
- Grit Removal Equipment, Drainage
- Grit skips
- Flow & Distribution to Primary Settlement Tanks
- Primary Settlement Tanks
- Primary Raw Desludge Pumping
- Flow & Distribution to Secondary Treatment
- Activated Sludge Plant Lanes & Zones
- Secondary Treatment - Anoxic zone
- Flow & Distribution to Final Settlement Tank
- Final Settlement Tanks
- Scum Removal System
- RAS Chambers & Pumping
- SAS Chambers & Pumping
- SAS Buffer Tank
- Back Wash Returns

The following list of potential odour sources under the Sludge Treatment Centre Permit have been identified during the risk assessment:

- Primary Raw Sludge Thickening & Pumping – PFTs
- Sludge blending tank
- SAS Screening unit
- SAS Screening skips
- digested buffer sludge tank
- Return Liquors
- Thermal Hydrolysis Plant
- Digester Feeding, Mixing & Discharge
- sludge contingency tanks
- Strain press
- Primary raw sludge screening skips
- SAS Belt thickener
- Belt thickener
- Liquor PS
- Cake import facility
- Cake Barn (including cake imports)
- Vehicle Loading
- Vehicle Wheels Wash
- Biogas Storage
- CHP
- Boilers
- Waste Gas Burner

- Odour Control Units (OCUs 1, 2 & 3)

4.2.3 Odour Critical Plant

The following list of odour critical plant have been identified during the odour risk assessment:-

- Primary Settlement Tanks
- Primary Raw Desludge Pumping
- Primary Raw Sludge Thickening and Pumping - PFTs
- Digested sludge buffer tank
- Thermal Hydrolysis Plant
- Digester Feeding, Mixing and Discharge
- Odour Control Unit

4.2.4 Waste Storage for Sludge Treatment Centre Permit

Waste is not stored on site prior to treatment through the UWWTD or AD process. A list of the main tanks relating to the sludge treatment process and their associated volumes and retention times is shown below.

Table 4.0 Sludge Treatment Centre Permit Tank Inventory

Tank Purpose	Number	Operational Volume (m^3)	Construction	Average Retention Time under normal operations
Picket Fence Thickeners	2	522	Glass coated steel	YTD ave 800m3/d= 15.7 hours
Sludge Blending Tank	1	59	Steel	1 hour
THP Dewatering Feed Buffer Tank	1	448	Concrete	2.5 days
THP Feed Silo	1	195	Steel	1.2 days
THP Process	1	n/a	Steel	<1 day
Primary Digester Tank	2	1,966	Concrete	Between 12.7 & 13.5 days
Digested Sludge Buffer Tank	1	177	Steel	YTD ave 302m3/d= 14 hours
Sludge contingency tanks	4	680	Concrete	NA

Tank Purpose	Number	Operational Volume (m^3)	Construction	Average Retention Time under normal operations
Pre-THP polymer silo	1	24 tonnes	Steel	NA

An inventory of potential odorous materials relating to the Sludge Treatment Centre Permit is shown in Table 4.1 below. Air Emission Points are listed, and the locations shown on the site plan in Figure C of Appendix 4.

Table 4.1 Odorous materials for Sludge Treatment Centre Permit

Odorous and potentially odorous material (any solid, liquid or gas)	Location of odorous materials on site	Maximum quantity on site at any given day	Maximum time held on site (hours or days)	EWC Codes	Type of emission	Odour potential High Risk / Medium Risk / Low Risk
Cake (including imports)	Cake Barn	4000	60 days	19 06 06	Point Source (see OCU entry)	Low
Undigested cake imports	Cake import facility	1000	60 days	19 02 06	Point Source (see OCU entry)	Medium
Biogas bags	See Air Emission Point Plan	3600 m3 (2 x1800m3 gas bags)	Continuous operation	N/A	Point source	Low
Liquor	Liquor is continuously pumped to the head of works	Liquor is continuously pumped to the head of works	Continuous pumping of liquors	16 10 02	Diffuse	Low
Primary Sludge	PFTs; Sludge blending tank	Refer to Table 4.0 Site Tank Inventory	Retention times for each stage of the process are detailed in Table 4.0	19 08 05	Point source (see OCU entry)	Medium/High
Surplus Activated Sludge	SAS thickening plant; Sludge blending tank	- Refer to Table 4.0 Site Tank Inventory	- Retention times for each stage of the process are	19 08 05	Diffuse Point Source (see OCU entry)	Medium/High

Odorous and potentially odorous material (any solid, liquid or gas)	Location of odorous materials on site	Maximum quantity on site at any given day	Maximum time held on site (hours or days)	EWC Codes	Type of emission	Odour potential High Risk / Medium Risk / Low Risk
			detailed in Table 4.0			
Raw Sludge screenings	Under screenings	1 Skip	Skips emptied within 24 hours of being full	19 08 01	Diffuse	Low / Medium
Odour Control Units (OCU)	See section 5	See section 5	-	-	Point source	Medium

Table 4.2 Odorous raw materials for Sludge Treatment Centre Permit

Raw Material	Odorous	Storage	Mitigation	Odour Risk
1.Flopam 640HIB 2.Flopam FO 4650MPM 3.Flopam 4440MPM	Mild odour	1 2,000 litres stored in 2x 1,000 litre IBCs on portable bunds 2.24 tonnes bunded silo 3. 4.5 tonnes stored within 750 KG bulk bags	1.fully contained 2.fully contained 3.stored in a building	Low Low Low
FLOFOAM 681F	Mild odour	4,000 litres stored within 4x 1,000 litre IBCs on portable bunds.	Fully contained	Low
Texaco HDAX 650 LFG0	Oil	2,500 litres of clean oil and 2,500 litres of dirty oil in double skinned tanks	Fully contained	Low
Delo XLC antifreeze 40/60	Solvent	2,000 litres stored within 2x 1,000 litre IBCs on portable bunds	Fully contained	Low
Brentagg Caustic Soda 30%	Odourless	400 litres bunded tank within boiler container	Fully contained	Low
Nalco 77211	Sulphurous	400 litres bunded tank within boiler container	Fully contained	Low
Nalco 22310	Ammoniacal	50 litres bunded tank within boiler container	Fully contained	Low
White Diesel	Petroleum	21,800 litres	Fully contained	

Hydrosoft tablet salt	Odourless	25KG bags on a one tonne pallet. Stored outside boiler house		Low

Low odour raw materials are chosen for use, as far as practicable.

4.3 Odour Control Measures

The SOM referred to above complies with Thames Water's Asset Standards – Operating Standards. It states the operational procedures to be followed in order to maintain and operate plant to agreed company standards. These standards include, where appropriate, procedures for ensuring that generation of odour is kept to a minimum.

The routine operational tasks carried out at Crawley STW to specifically mitigate against generation of odour are listed in the above SOM.

4.3.1 Odour Control Unit

STC OCU units

OCU 1 (A15) extracts air from the following process units of the dewatering area:

- Biofilter (1 No.) with lava rock media
  - Dewatering belts (2 No.)
  - Works drainage pumping station
- Annular carbon filters
  - Sludge cake storage building
  - Off-gases from biofilter

OCU 2 (A16): Lava rock biofilter – lava rock (1 No.) followed by a Deep Bed Carbon unit (2 No.) extracts air from the following process unit of the thickening area:

- Picket Fence Thickeners (2 No.)

OCU 3 (THP OCU A17) pumice stones followed by carbon filter, extracts air from the following process units:

- SAS buffer tank (UWWTD)
- Sludge Blending tank
- THP Dewatering feed buffer tank
- Belt thickeners (Pre THP dewatering plant)
- Cake import facility
- THP feed silo

The Block Flow Diagram showing the Odour Control Systems is displayed in Figure F of Appendix 4. A Process Flow Diagram of the existing Odour Control Systems (OCUs 1, 2 & 3) is displayed in Figure E of Appendix 4.

4.3.2 Site Specific Measures and abnormal events

H4 has been used to guide the preparation of this OMP where it relates to activities regulated under the Sludge Treatment Centre Permit. As this guidance does not apply to UWWTD activities, where reference to H4 is made within this document this should not be inferred as H4 being applicable to UWWTD activities. Specific tasks and measures taken in intermittent, abnormal, and emergency events associated with the control of odours at Crawley STW are summarised in the tables below.

The routine operational tasks carried out at Crawley STW to specifically mitigate against generation of odour are also listed in the tables below. Appendices 5 and 6 contain the Site Rounds and Sludge Round checks that are carried out on site.

Table 4.3. - Summary of routine odour mitigation tasks for assets under UWWTD

Process	Odour and Offensiveness L/M/H	Specific Tasks	Responsibility	Monitoring	Frequency	Trigger for action	Remedial action and timescale
General	L	Ensure site is kept clean and tidy	Site Tech 1s Performance Manager	Visual Inspection	Daily	Spillage identified	Clean up as soon as possible and no later than the end of the day
	L	Any spillages to be cleaned up as soon as practicable	Site Tech 1s	Visual Inspection	As required	Spillage identified	Clean up as soon as possible and no later than the end of the day
Cess import ***Linked tasks in appendix 5 section 2.1***	Cess (M)	Manual cleaning. Closed couple connections before entering the inlet. Hosed down/checked daily. Monthly PPM	Site Tech 1s	Visual Inspection	As required	Spillage identified	Clean up as soon as possible and no later than the end of the day
Screens & Screenings skips ***Linked tasks in appendix 5 section 2.3 and 2.4***	Crude sewage / organic smell (Medium)	Any blockage to be cleared and service resumed as soon as practicable	Site Tech 1s	Visual Inspection	As required	Spillage identified	Clean up as soon as possible and no later than the end of the day
		Ensure skips are removed from site as soon as practicable and ensure covered when removed from site. Rag skip emptied every 2 days, grit skip emptied as required. Full skips not left on site more than 3 days.	Site Tech 1s, Biffa	Visual Inspection	As required	Spillage identified	Clean up as soon as possible and no later than the end of the day
		Screenings area should be kept clean and tidy	Site Tech 1s	Visual Inspection	Daily	Spillage identified	Clean up as soon as possible and no later than the end of the day

Process	Odour and Offensiveness L/M/H	Specific Tasks	Responsibility	Monitoring	Frequency	Trigger for action	Remedial action and timescale
		Monitor and clean area regularly. General maintenance, manual cleaning every other day, per site walk around.	Site Tech 1s	Visual Inspection	Daily	Spillage identified	Clean up as soon as possible and no later than the end of the day
		Spillages cleared as soon as practicable	Site Tech 1s	Visual Inspection	As required	Spillage identified	Clean up as soon as possible and no later than the end of the day
Storm Lagoon	Sewage (Low)	Retention time minimised, automatically returned once out of storm conditions.	Site Tech 1s	Visual Inspection	As required	Spillage identified	Clean up as soon as possible and no later than the end of the day

Process	Odour and Offensiveness L/M/H	Specific Tasks	Responsibility	Monitoring	Frequency	Trigger for action	Remedial action and timescale
PSTs ***Linked tasks in appendix 5 section 3***	Organic (Low)	Scrapers should be regularly checked and maintained to ensure they are working effectively and any blockages cleared. If scraper fails and sewage goes septic drain and hose tank if unable repair within 72 hours	Site Tech 1s	Visual Inspection	As required	No alarms on rotation only visual	If scraper operation impaired remedial action is manually desludge the tank by the Tech 1 within 2 working days. Attention to scraper fail alarm will be addressed within 1 working day and if cannot be resolved a job raised on SAP for M/E to resolve in 1 working day. Tanks may require cleaning or emptying which may take up to 3 months to complete. Funding to support scaffolding and cleaning may be required.

Process	Odour and Offensiveness L/M/H	Specific Tasks	Responsibility	Monitoring	Frequency	Trigger for action	Remedial action and timescale
		Ensure there is appropriate scum removal in place and working correctly	Site Tech 1s	Visual Inspection	As required	Visual inspection	Removal of accumulated material in scum boards within 3 working days – if mechanical or blockage, a tanker/jetter will be needed and this should be done on a weekly basis
		Ensure fat traps are regularly cleaned and blockages removed	Site Tech 1s	Visual Inspection	As required	Traps identified as having cracks, breaks or blockages	Removal of accumulated material in traps to timescales as above
		Monitor sludge blanket depths. If levels exceeded report to Performance Manager and desludge affected tank. Manually dipped 3 times a week to check blanket levels. **Note:** average depth to the sludge blanket from the top water level is 3.5 metres; the action limit is 3 metres	Site Tech 1s	Visual Inspection	3 times a week – sludge dips carried out	Sludge rises to a certain level	Hand de-sludge tanks/increase timers

Process	Odour and Offensiveness L/M/H	Specific Tasks	Responsibility	Monitoring	Frequency	Trigger for action	Remedial action and timescale
		Manage desludging to ensure retention times are minimised	Site Tech 1s	Visual Inspection	Daily	Blanket at a certain level	Hand desludge then investigate on why.
		Identify any gassing or septicity issues by regular monitoring and prevention of the build-up of solids.	Site Tech 1s	Visual Inspection	As required	Site can be affected by blocked desludging valves or failed desludging pumps and this will result in increased sludge blanket and rising sludge	Site Manager to investigate with solutions within days/a few weeks depending on whether repairs or replacements.
		Ensure any tank drained down is hosed out as soon as practicable to remove any sludge	Site Tech 1s	Visual Inspection	As required	Residual sludge identified after tank drain down	Manual clearance by hose following identification

Process	Odour and Offensiveness L/M/H	Specific Tasks	Responsibility	Monitoring	Frequency	Trigger for action	Remedial action and timescale
Final Settlement Tanks ***Linked tasks in appendix 5 section 5***	None	If tanks are taken out of service, ensure once drained that they are hosed down	Site Tech 1s	Visual Inspection	As required	Rotation failure, blanket high, compressor issues	Drain and clean tank out for investigation
Incoming Sewers & Reception Wet Well	Sewage (L)	Manual cleaning	Tech 1	Closed couple connections before entering the inlet. Hosed down/checked daily. Monthly PPM	Daily	Spillage	Clean up straight away
Grit Removal Equipment, Drainage ***Linked tasks in appendix 5 section 2.5***	Organic smell (Low)	Ensure skips are removed from site as soon as practicable. Full skips are not to be stored on site	Tech 1	Visual inspection	Daily	Spillage	Clean up straight away
Grit skips ***Linked tasks in appendix 5 section 2.5***	Organic smell (Medium)	Grit skip emptied as required. Full skips not left on site more than 3 days.	Tech 1	Visual inspection	Daily	Half full to be booked in	Biffa to collect
Flow & Distribution to Primary Settlement Tanks	Crude sewage (Low)	Manual cleaning if overspills or block.	Tech 1	Visual inspection	Daily	Visual inspection	Clean up straight away
Primary Raw Desludge Pumping	Sludge smell (Medium)	Monthly maintenance.	Tech 1	Visual inspection	Daily		

Process	Odour and Offensiveness L/M/H	Specific Tasks	Responsibility	Monitoring	Frequency	Trigger for action	Remedial action and timescale
Flow & Distribution to Secondary Treatment	Organic smell (Low)	Enclosed system underground.	Tech 1	Visual inspection	Daily		
Activated Sludge Plant Lanes & Zones ***Linked tasks in appendix 5 section 4***	Earthy smell (Low)	Monthly maintenance on DO probes.	Tech 1	Visual inspection	Daily	Visual inspection	NA
Flow & Distribution to Final Settlement Tank	None	Daily checks as part of site rounds	Tech 1	Visual inspection	Daily	Rotation sensors on tanks alarm out	Investigation on why tank has failed. Tank to be drained and cleaned once out of service
Scum Removal System	Slight earthy smell (Low)	Checked daily, unblock if blocked.	Tech 1	Visual inspection	Daily	Visual inspection	Unblock when needed
RAS Chambers & Pumping	Earthy smell (Low)	Daily checks on pumps.	Tech 1	Visual inspection	Daily	Visual inspection	Clean up straight away
SAS Chambers & Pumping	Earthy smell (Low)	Clean area, monthly maintenance on pumps	Tech 1	Visual inspection	Daily	Visual inspection	Clean up straight away
Filtration - Disc Filters ***Linked tasks in appendix 5 section 7.2***	None	Monthly planned maintenance. Checked daily.	Tech 1	Visual inspection	Daily	Units are alarmed	Repair ASAP as potential a major risk for compliance

Process	Odour and Offensiveness L/M/H	Specific Tasks	Responsibility	Monitoring	Frequency	Trigger for action	Remedial action and timescale
Back Wash Returns	Earthy smell (Low)	Daily checks on pumps.	Tech 1	Visual inspection	Daily	Pumps are alarmed/ visual checks	Replace pump at earliest possible
SAS Buffer Tank ***Linked tasks in appendix 5 section 8.1***	Earthy smell (Low)	Daily visual checks on balancing tanks.	Tech 1	Visual inspection	Daily	Spillage identified	Clean up straight away

Table 4.4: Summary of routine odour mitigation tasks for assets under Sludge Treatment Centre Permit

Odour source	Odour and offensiveness L/M/H	Specific odour management tasks	Responsibility	Monitoring	Monitoring Frequency	Trigger for action	Remedial action and timescale
Cess Reception ***Linked tasks in appendix 5 section 2.1***	Cess (M)	Ensure tankers coupled correctly Daily checks	Tech 1	Visual inspection	Daily	Spillage	Clean up straight away
Sludge blending tank ***Linked tasks in appendix 6 section 3***	Raw sludge smell (Medium)	Tank is cleaned every 3-4 months by contractors.	Tech 1	Visual inspection	Daily	Spillage	Clean up straight away

Odour source	Odour and offensiveness L/M/H	Specific odour management tasks	Responsibility	Monitoring	Monitoring Frequency	Trigger for action	Remedial action and timescale
Cess Reception	Cess (Medium)	Manual cleaning	Tech 1	Closed couple connections before entering the inlet. Hosed down/checked daily. Monthly PPM	Daily	Spillage	Clean up straight away
Primary Raw Sludge Thickening & Pumping – PFTs ***Linked tasks in appendix 5 section 8.2***	Raw sludge smell (Low)	Daily/weekly/monthly maintenance. Serviced by OCU.	Tech 1	Visual inspection	Daily	Failed OCU	Contact specialist contractors ASAP
SAS Screening unit ***Linked tasks in appendix 5 section 2.3 and 2.4***	Earthy smell (Low)	Bypassed	Tech 1	Visual inspection	Daily	Spillage identified	Clean up straight away
SAS Screening skips ***Linked tasks in appendix 5 section 2.3 and 2.4***	Earthy smell (Low)	Currently not in use	Tech 1	Visual inspection	Daily	Overfilled skips	Clean up straight away. Contact Biffa

Odour source	Odour and offensiveness L/M/H	Specific odour management tasks	Responsibility	Monitoring	Monitoring Frequency	Trigger for action	Remedial action and timescale
Return Liquors	Sludge smell (Low)	Daily visual checks as per site rounds. Ensure all site drainage is operating correctly and is not blocked. Return liquor wet wells pumped down regularly to reduce sediment build up.	Tech 1	Visual inspection	Daily	Blockage/spillage	Clean up straight away
Thermal Hydrolysis Plant - THP feed silo	Sludge smell (Low)	Weekly and monthly maintenance. OCU maintained	Tech 1	Visual inspection OCU connected to SCADA	Daily	OCU failure	Contact specialist contractor
Thermal Hydrolysis Plant - THP units	Sludge smell (High)	Daily/weekly/monthly maintenance as per site round. Serviced by OCU.	Tech 1	Visual inspection	Daily	OCU failure	Contact specialist contractor
Digester Feeding, Mixing & Discharge ***Linked tasks in appendix 6 section 6***	Sulphur compounds (Medium)	Daily/weekly/monthly maintenance as per site round. Enclosed.	Tech 1	Visual inspection	Daily		Clean up straight away
Sludge contingency tanks	Sludgy earthy smell (Low)	Daily visual checks	Tech 1	Visual inspection	Daily		

Odour source	Odour and offensiveness L/M/H	Specific odour management tasks	Responsibility	Monitoring	Monitoring Frequency	Trigger for action	Remedial action and timescale
Strain press	Sludgy earthy smell (Low)	Daily/monthly/weekly maintenance. OCU maintained	Tech 1	Visual inspection OCU connected to SCADA	Daily	Spillage	Clean up straight away
Primary raw sludge screening skips	Organic smell (Medium)	Skips not held on site longer than 3 days.	Tech 1 Biffa.	Visual inspection	As required	Overfilled skips	Clean up straight away. Contact Biffa
SAS Belt thickener ***Linked tasks in appendix 5 section 8.3***	Earthy smell (Low)	Daily/weekly/monthly maintenance. Enclosed in a building with ventilation system	Tech 1	Visual inspection	Daily	Spillage	Clean up straight away
Belt thickener ***Linked tasks in appendix 5 section 8.3***	Sludge smell (Low)	daily/weekly/monthly maintenance. With covers and abated by OCU.	Tech 1	Visual inspection OCU connected to SCADA	Daily	Spillage	Clean up straight away
Digested Sludge Buffer Tank &Liquor PS	Sludge and ammonia smell (Low)	Daily checks, check on levels and pumps. Tanks covered and vent pipe.	Tech1	Visual inspection	Daily	Spillage	Clean up straight away
Cake import facility	Sludge smell (Low)	daily/weekly/monthly maintenance. Enclosed building with shutter door, extractors for fumes, OCU abated.	Tech 1	Visual inspection	Daily	Shutter door damage	Repair/replace door

Odour source	Odour and offensiveness L/M/H	Specific odour management tasks	Responsibility	Monitoring	Monitoring Frequency	Trigger for action	Remedial action and timescale
Cake Barn (including digested cake imports) ***Linked tasks in appendix 6 section 16 and 17***	Sludge and ammonia smell (Low)	Cake barn - enclosed building with OCU. Cake in storage forms a crust after a day or two reducing risk of odour. No additional turning or handling during cake storage. Imports subject to pre-acceptance checks.	Tech 1	Visual inspection	Daily	Cake left on floor	Clean up straight away
Vehicle Loading ***Linked tasks in appendix 6 section 16 and 17***	Sludge and ammonia smell (Low)	Covered vehicles and loading in the enclosed building, OCU abated.	Tech 1	Visual inspection	Daily	Cake left on floor	Clean up straight away
Vehicle Wheels Wash	Sludge and ammonia smell (Low)	Contractor cleaning every 3 months. Checked daily.	Tech 1	Visual inspection	Daily		
Biogas Gas Bag Storage ***Linked tasks in appendix 6 section 8***	None (Low)	Daily visual checks	Tech 1	Visual inspection	Daily	Smell of gas around bags	isolate the source with valves situated around site
Boilers	Methane (Low)	Daily checks	CHP Team	Visual inspection	Daily	Smell of gas	isolate the source with valves situated around site

Odour source	Odour and offensiveness L/M/H	Specific odour management tasks	Responsibility	Monitoring	Monitoring Frequency	Trigger for action	Remedial action and timescale
Waste Gas Burner	Slight sulphide smell (Low)	6 months planned maintenance. Daily checks.	Tech 1	Visual inspection	Daily	Smell of gas	isolate the source with valves situated around site
Standby Generators	None	Monthly mandatory check, used as required	Tech 1	Running inspection	Monthly	Oil/water spillage around generator	Clean up straight away
OCU 1, 2 & 3 ***Linked tasks in appendix 5 section 9***	Earthy smell (Low)	Daily checks and monthly checks by ERG	Tech 1	Visual Inspection	Daily	OCU failure	Contact specialist contractor

Table 4.5: Intermittent, abnormal, and emergency events for assets under UWWTD

Process stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
Incoming Sewers & Reception Wet Well	Retention time in the network: stronger smell	ab	Wells ran low to avoid this.	Failure of a storm or dry weather pump would require utilisation of rolling critical spares. Up to 3 days to replace reflecting use of on-site crane. Limited odour risk from pump failure	L

Process stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
Incoming Sewers & Reception Wet Well	Large spillage due to combination of power failure and loss of emergency generation	Ab	Call specialist contractor to clean up spillage		M
Storm lagoon	Storm return system fails	Ab	Find cause and resolve		M
Screens	Maintenance	P	Planned maintenance	Blockages delt with straight away	M
Screens	During winter: frozen machinery	A	Abnormal weather event: wait and then clean / defrost		L
Screens	Mechanical failure / Blockage resulting in localised flooding	Ab	Fix the screens (job to be raised to maintenance) / Any blockages to be cleared and service resumed as soon as practicable		M
Washpactors unit	Washwater failure	Ab	Rag spillages to be cleaned up	Rag to be cleaned up straight away after spillage	M
Screenings skips	Skips not collected by contractor	Ab	Chase contractors, arrival in 1-2 days	2 rag skips and 1 grit skip present. **Ab**: Skips only accumulate due to presence of liquids. Ramps and tankering used as appropriate. Coverings used	M

Process stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
Grit Removal Equipment, Drainage	Grit build up in detriotor (due to plant failure)	Ab	Raised the job to Maintenance		M
Grit Removal Equipment, Drainage	Maintenance	P	Planned maintenance		M
Grit skips	Skips not collected by contractor	Ab	Chase contractors		M
Flow & Distribution to Primary Settlement Tanks	Blockage in pipes	Ab	Unblock and contact contractors	Book in tanker to jet through line on drain line or scum line	L
Primary Settlement Tanks	Tank drained down for cleaning and maintenance	P	Ensure any tank drained down is hosed out as soon as practicable to remove any sludge	As soon as the tank is out of service	L
Primary Settlement Tanks	Failure of desludge pump	Ab	Hand desludge and replace pump		M
Primary Settlement Tanks	Scraper failure	Ab	Hode tank for repair / Raise job to Maintenance		M
Primary Settlement Tanks	High level of sludge blanket	Ab	Find the cause and resolve		M
Primary Settlement Tanks	Low flows	Ab	Take one PST out on stage 1		M
Primary Raw Desludge Pumping	Maintenance	P	Planned maintenance		M
Primary Raw Desludge Pumping	Failure of desludge pump	Ab	Find the cause and Hand desludge		H

Process stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
Flow & Distribution to Secondary Treatment	Blockage (rag, sewage)	Ab	Find cause and resolve	Call in a tanker to jet through the line	L
Activated Sludge Plant Lanes & Zones	Filamentous mousse	Ab	Chemical dosing into aeration to remove filamentus and spray water onto mousse		M
Activated Sludge Plant Lanes & Zones	Maintenance	P	Planned maintenance, contractors to come in monthly		M
Activated Sludge Plant Lanes & Zones	RAS spillage	ab	Clean ASAP		M
Anoxic zone	Failure of mixing	Ab	Spray water onto mousse and debris and raise job to fix pumps		M
Flow & Distribution to Final Settlement Tank	RAS spillage	Ab	Clean ASAP	Call in a tanker to clean the area to avoid any unwanted odour	L
Final Settlement Tanks	Drain for cleaning and maintenance	P	Planned maintenance	Clean tank as soon as it is empty to avoid unwanted odour	L
Final Settlement Tanks	Build up of mousse due to filaments	Ab	Find the cause and resolve		L
Scum Removal System	Build up of scum due to plant failure	Ab	Find the cause and repair		L

Process stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
RAS Chambers & Pumping	Spillage	Ab	Clean area	Call in a tanker to clean the area	L
SAS Chambers & Pumping	Maintenance	P	Planned maintenance		L
SAS Chambers & Pumping	Spillage	ab	Clean up	Call in a tanker to clean the area	L
Back Wash Returns	Pump failure/blockage	Ab	Find cause and resolve		M
SAS BufferTank	Failure of equipment leading to accumulation of sludge in aeration lanes	Ab	Investigate cause and raise job for repair		M

Table 4.6: Intermittent, abnormal, and emergency events for assets under Sludge Treatment Centre Permit

Process stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
Cess import	Splillage	Ab	Clean up	Clean area straight away	M
Sludge blending tank	Spillages	Ab	Clean up		L
Sludge blending tank	Pump failure	Ab	Find cause and resolve		L
Primary Raw Sludge Thickening & Pumping - PFT	Maintenance	P	Planned maintenance		L
Primary Raw Sludge Thickening & Pumping - PFTs	Failure of plant: one PFT out of service	Ab	Investigate cause and raise job for repair		M
Primary Raw Sludge Thickening & Pumping - PFTs	Sludge spillages	Ab	Clean ASAP	Call in a tanker to clean the area	M
SAS Screening unit	Failure of unit leading to spillage of screenings	Ab	Manual cleaning / Inverstigate and raise job to maintenance		L
Digested sludge buffer tank	Maintenance	P	Planned maintenance		M
digested sludge buffer tank	Pump failure	Ab	Investigate and raise job		M
digested sludge buffer tank	Spillages	Ab	Clean up	Call in a tanker to clean the area	M

Process stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
Return Liquors	Heavy sludge returning from PFTs and SAS belts	ab	Investigate cause and raise job if needed		M
Thermal Hydrolysis Plant - THP feed silo	Blockage in conveyor or silo requiring cleaning	Ab	Clear blockage		H
Thermal Hydrolysis Plant - THP units	Build up of excess pressure leading to release from PRV to reduce frequency	Ab	Isolate / Find cause and resolve		H
Digester Feeding, Mixing & Discharge	Maintenance / Cleaning	P	Pump out digested sludge through screens to tankers		H
Digester Feeding, Mixing & Discharge	Whessoe valve fails	Ab	Investigate cause and raise job if needed		M
Digester Feeding, Mixing & Discharge	Leaking roof	Ab	Find fault and escalate		M
Sludge Contingency tanks	More than one tank in use	Ab	Pumped out once full.		M/L
Strain press	Maintenance	P	Planned maintenance		L
Strain press	Failure of OCU	Ab	Find cause and raise job		M
Primary raw sludge screening skips	Skips not collected by contractor	Ab	Chase contractors		M
SAS Belt thickener	Maintenance	P	Planned maintenance		L

Process stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
SAS Belt thickener	Plant failure	Ab	Investigate and raise job to maintenance		L
SAS Belt thickener	Spillages	Int	Clean up	Clean up straight away to avoid bad odour	L
Belt thickener	Failure of dewatering equipment resulting in too thin sludge to THP unit	ab	Two belts on site, use of other belt. Otherwise, pump of sludge rounds.		L
/ Liquor PS	Leaking covers on belts (klampresses)	Ab	Investigate cause and raise job if needed	Clean up once resolved the issue	M
Cake import facility	Failure of enclosure leading to failure to extract odours to odour control unit	Ab	Stop cake imports, make repairs to failures.		M
Cake Barn (including digested cake imports)	Doors left open	int	Close the doors		M
Vehicle Loading	Doors of the sludge storage building left open	Int	Clean up		M
Vehicle Loading	Sludge on wheels	Int	Clean up	Clean up straight away to avoid bad odour	L
Vehicle Wheels Wash	Build up of sludge in the sump	Ab	Clean up	Clean up straight away to avoid bad odour	M

Process stage	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
Biogas Storage	Leaking of the biogas storage	Ab	Isolate gas		M
CHP	Maintenance	P	Planned maintenance		L
CHP	Leaking of the CHP system	Ab	Isolate gas		M
Boilers	Maintenance	P	Planned maintenance		L
Boilers	Leaking of the biogas boiler system	Ab	Isolate gas		M
Waste Gas Burner	Maintenance	Ab	Planned maintenance		L
Waste Gas Burner	Failed to ignite: methane not burnt	Ab	Find fault and raise job		L
OCU 1, 2 & 3	Maintenance	P	Planned maintenance		L
OCU 1, 2 & 3	Failure of unit, media requires replacement or irrigation system fails	ab	Investigate and repair ASAP		M (OCU 3 - L)

Table 4.7: General Intermittent, abnormal, and emergency events

Incidents and emergencies	Event	Status	Ops mitigation	Expansion of TWUL operational response to odour under Int/Ab/E events	Odour risk after mitigation
Fire	Failure of OCU fans or sludge building	E	Tanker from site. Raw sludge thickened and stored in enclosed cake barn, either directly spread to land to re-processed.		Low/Medium
Severe weather	Transport of sludge from site inhibited resulting in back up of sludge in site resulting in additional odour release from tanks and PSTs	E	Event unlikely as there is provision for 14 days storage on site.		Low
Flooding	Flooding causing process or equipment problems	E	Not an identified problem at Crawley. Site incident procedures would be followed.	Contact LMC	Low
Illness/absence of key staff	Accumulation of sludge/loss of odour control etc.	E	Task allocation is independent of individual staff.		Low
Power cuts	Loss of power to fans leading to loss of odour control	E	Emergency power generation for critical activities until power restored.		Low
Other incidents	Transport of sludge to land inhibited for other reasons leading to back up of sludge in site resulting in additional odour release from tanks and PSTs	E	Provision for 14 days storage on site. Transport to other STWs if necessary		Low

4.3.3 Spillages

Spillages significant enough to cause odorous emissions will be cleared as soon as practicable. The person discovering the spillage will inform site management, who will utilise resources as required to clear it.

Spill response guidance is also available in the Pollution Prevention Essential Standard at Environmental Management System - Pollution Prevention (sharepoint.com).

4.4 Routine Monitoring

Overall plant performance is assessed daily as part of the generic Site and Sludge inspections rounds, which apply to Thames Water large STW sites, and have been included in Appendices 5 and 6, respectively.

The objective of these are to ensure that treatment processes, including odour control, are checked for effective operation as per the SOM. Any of the checks that result in performance of the process outside of the limits defined in the SOM or a fault being detected will require an Operator to change the process to bring the plant back into acceptable limits or the fault needs to be logged and reported for follow up maintenance/repair.

Various process parameters are monitored using a combination of online instruments (to measure flows, temperatures, pressures, levels); samples that are taken to our UKCAS accredited laboratories,or run through sampling tests at the on-site laboratories (%DS, pH, alkalinity, ammonia).

The online instruments all have signals that are taken back to the site SCADA system and these 'alarm' if the readings are outside pre-set trigger points. Similarly, laboratory analysis samples will have expected ranges, which if outside of these, a notification is sent to the site process controllers.

In all instances that parameters are out of 'range', the operational teams will carry out an investigation to understand the cause and initiate corrective actions. If the reasons are not obvious, the process optimisation team is contacted to evaluate further.

Additionally, each week the various recorded parameters are recorded in the site Cockpit reports to look at trends. These are used to establish if there are gradual changes in performance over time so that early intervention can be carried out.

A range of process parameters are subject to routine monitoring or checking to ensure that the digestion process is operating optimally so that the required sewage cake output quality is achieved.

- pH: At a THP digestion site such as Crawley the processes is maintained around pH 8 but within the range 7.5-8.6 (this is % dry solids and digester load dependant) for healthy operation.
- alkalinity: Levels dependant on feedstock characteristics (primary sludge: surplus activated sludge (SAS) ratio). Advanced digestion (THP) typically, 5,000 - 10,000mg/litre (target range from 6,000-8,000 mg/litre) but is dependent on % dry solids and digester load.
- temperature: minimum target of 40°C for advanced digestion. This is maintained within the range 36-45°C for THP AD.
- HRT (hydraulic retention time): minimum target is 12-days, there is no upper limit. Retention times shall not be less than 12-days during plant outages to keep the product pathogen kill efficiency control.
- OLR (organic loading rate): see table below - this is dependent on the primary/SAS ratio. Crawley fits into the fourth row of the table.
- Dry solids feed: see table below, Crawley has a target of 10%DS, but this can vary between 8-14%DS and impacts the HRT.

Type of Digestion	**0%- 35% SAS[x]**	**36%- 45% SAS**	**46%- 50% SAS**	**51%- 55% SAS**	**>55% SAS**	**Max Feed %DS**
MAD[*] in Conventional Digestion	3	2.5	2	1.75	n/a	6

MAD after Pre-pasteurisation	4.5	4	3.5	3	n/a	7
MAD after Acid Hydrolysis	4.5	4	3.5	3	n/a	7
MAD after Thermal Hydrolysis	7	6.5	6	5.5	5.5	14

* mesophilic anaerobic digestion
[X] surplus activated sludge, arising from the UWWTD treatment route.

- VFA (volatile fatty acid) concentration: There is no specific range for VFAs as it depends on the feedstock. It is used as an indicator of digester health rather than a process control. The production of organic acids depends on the volume of solids fed to the digester. The typical range for VFAs in a primary digester is between 50 and 800 mg/L. When VFA concentrations climb above 1000 mg/L, the digester could be overloaded or experiencing other problems.
- Ammonia - Ammonia concentrations of 50 to 1000 mg/L are beneficial, but ammonia levels of 1500 to 3000 mg/L (pH greater than 7.4) could be inhibitory but not always. An ammonia concentration higher than 3000 mg/L for prolonged period is toxic.
- VFA to Alkalinity ratio: Very important parameter to monitor for digestion process. The VFA to alkalinity ratio of below 0.4 is good and above this threshold value means diminishing alkalinity and low pH i.e. sour digester content. As long as this ratio is maintained higher VFA and alkalinity digester content can be acceptable and the digestion process is deemed healthy. Anaerobic digestion process is always controlled based on holistic parameters based but not based on single parameter.

Sniff Testing

Sniff testing has been incorporated into our Odour Improvement Plan (Appendix 2). This is to allow time to ensure that the most effective sniff testing can be carried out using personnel not sensitised to smells on site.

The procedure will be undertaken in response to complaints or if a risk of odour nuisance at sensitive receptors is expected and/or has been substantiated.

- Sniff testing will normally be carried out at by someone not routinely based at site, who are less sensitised to odour produced on site.
- Assessing potential odour sources within the Urban Waste Water Treatment (UWWT) and Sludge Treatment Centre (STC) processes and attempt to trace the odour to its source.
- The procedure and recording form which will be used can be found in appendix 7 of the OMP.

Site operatives' complete daily walkovers of site which includes assessing 'Is site odour level is acceptable'. This is captured and recorded in the e-log book to ensure steady state monitoring.

Further details of routine monitoring tasks are included in the Site Operating Manual.

4.4.1 Performance Checks and Testing

The H_2S concentration is continuously monitored on the outlet of each OCU.

As per the Planning Application No. WSCC/061/12/CR, an annual testing of the OCU for the THP Plant will be implemented to prove continuing compliance with the odour emissions levels proposed.

4.5 Record Keeping

Records of routine monitoring, site and sludge inspection rounds and sludge blanket checks are kept on SAP . Records of skip management, which collect wastes generated from UWWTD activities, and any spillages and remedial actions are held in the ELogbook. Sludge blanket levels are recorded on run charts and electronically via the Cockpit.

There is a SCADA system on this site.

A monthly condition report on the OCUs is sent to the Performance Manager by the contractor and stored on SharePoint.

Records for the following tasks are kept on site for five years:

- Sludge levels in PSTs
- Sludge volumes

As per the Planning Application No.: WSCC/061/12/CR records of the annual testing will be retained on site for inspection by the County Planning Authority upon request.

4.6 Emergency Response and Incident Response Procedures

Emergencies such as fire, flood and severe weather are managed by Thames Water's Incident Management and Business Resilience team. The processes employed can be found on Thames Water's SharePoint site and are entitled: 'Incident Management Arrangements'. This is a company confidential document and therefore, is not included in the Appendices of this document.

Hazard reporting and accidents are all recorded on the Health and Safety software database SpheraCloud (https://sphera.com) and monitored by Thames Water's Safety, Health & Wellbeing team.

In the event of power failure, the site will run on island mode for critical plant, this doesn't include odour control units and some leakage of odour may occur from below covers until power is restored.

Absence of key staff does not affect the running of Crawley STW, as Tech 1s from other sites can be called upon to cover, if required.

Irrespective of such constraints, our Operations Team and odour contractor have recommended consideration of the following techniques either proactively (so accompanying planned or reactive works with known odour risk) and in an investigative capacity attached to an incident:

(a) Targeted use of 'Jerome' hydrogen sulphide analysers
(b) Targeted use of sniff tests ('calibrated nose')
(c)H2S measurements of stored materials where septicity is either present, or the material is at risk of septicity from continued storage especially in the open air, for example, prior to de-watering where measurements of sulphide & dissolved O2 would inform a condition assessment. Quantities and storage times precipitating a need for such assessments. This recommendation is being raised with the Area Process Scientist.

(d) Inclusion of temporary odour suppressants/misting agents and continued access to process critical spares (odour minimisation by early intervention).
(e) Further expansion of odour risk within site incident planning (this is already referenced in Tables 4.5, 4.6 & 4.7 under relevant Intermittent; Abnormal Operation & Emergency scenarios)

(g) For PSTs, asset condition (wear/damage) would consider odour risks where assets are taken offline
(h) Telemetry/alarming of whessoe valve releases – there is an existing phased project within TWUL to enhance this at our sludge locations

5 Maintenance and Inspection of Plant and Processes

5.1 Routine Maintenance

5.1.1 General Requirements

Site staff have a schedule to ensure routine maintenance for key mechanical items. In addition, a dedicated maintenance team provide additional support for more specialised equipment, e.g. regular calibration of Dissolved Oxygen probes.

In addition to the routine operational tasks, planned preventative and defect maintenance of plant is carried out. Plant which may have an impact on odour release is assigned an appropriate criticality rating to ensure effective performance is maintained. Plant assessed to be odour critical is listed in Section 4.2.3 above.

All maintenance procedures are detailed in the SOM, and when carried out are captured on the corporate system SAP, which generates work requests for the various activities for the treatment process assets at the appropriate frequency.

5.1.2 OCU Selection and Performance Validation

OCU 1 (A15) – Dewatering area and cake barn

The nominal design basis for the system is summarised below.

Parameter	Value	Units
High odour air extraction rate (dewatering, tanks, PS)	1,818	Am^3/hr
Low odour air extraction rate (sludge building)	75,652	Am^3/hr
Total air extraction	77,471	Am^3/hr
Design temperature	0 to 20	°C
High odour design average inlet H_2S concentration	89.8	ppm
High odour design maximum inlet H_2S concentration	138.6	ppm
Low odour design average inlet H_2S concentration	1.0	ppm
Low odour design maximum inlet H_2S concentration	5.0	ppm
Design inlet humidity	70	%RH
Outlet H_2S concentration	0.010	ppm
Design system H_2S removal efficiency	99.14	%
Area classification inside duct	Zone 1	-
Area classification outside duct (local to fan)	Zone 2	-

For continuous operational monitoring:

- Visibility of fans on SCADA for loss of extraction from odorous sources

For periodic operational monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged.

OCU 2 (A16) PFT

The nominal design basis for the system is summarised below.

Parameter	Value	Units
Design total air extraction rate	397	Am^3/hr
Design temperature	0 to 20	°C
Design average inlet H_2S concentration	100	ppm
Design maximum inlet H_2S concentration	150	ppm
Design inlet humidity	70	%RH
Outlet H_2S concentration	0.012	ppm
Design system H_2S removal efficiency	99.99	%
Area classification inside duct	Zone 1	-
Area classification outside duct (local to fan)	Zone 2	-

For continuous operational monitoring:

- Visiblity of fans on SCADA for loss of extraction from odorous sources

For periodic operational monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged.

OCU 3 (A17) Pre THP and Cake Import Facility

Parameter	Value	Units
Design total gas flow rate from high odour area (Note1)	1,220	Nm^3/hr
Design average inlet H_2S concentration from high odour area (Note1)	100	ppm
Design maximum inlet H_2S concentration from high odour area (Note1)	150	ppm
Design average inlet RSH concentration from high odour area (Note1)	20	ppm
Design maximum inlet RSH concentration from high odour area (Note1)	30	ppm
Design average inlet DMS concentration from high odour area (Note1)	20	ppm
Design maximum inlet DMS concentration from high odour area (Note1)	30	ppm
Design average inlet odour concentration from high odour area (Note1)	1,612,602	ou_E/m^3
Design maximum inlet odour concentration from high odour area (Note1)	2,418,902	ou_E/m^3
Design total gas flow rate from cake import building	4,089	Nm^3/hr
Design average inlet H_2S concentration from cake import building	1	ppm
Design maximum inlet H_2S concentration from cake import building	5	ppm
Design average inlet RSH concentration from cake import building	0.2	ppm
Design maximum inlet RSH concentration from cake import building	1	ppm
Design average inlet DMS concentration from cake import building	0.2	ppm
Design maximum inlet DMS concentration from cake import building	1	ppm
Design average inlet odour concentration from cake import building	16,126	ou_E/m^3
Design maximum inlet odour concentration from cake import building	80,630	ou_E/m^3
Design temperature	0 to 20	°C
Design system H_2S removal efficiency	99.99	%
Design system RSH removal efficiency	99.99	%
Design system DMS removal efficiency	99.99	%
Required outlet odour	<1000	ou_E/m^3
Area classification inside duct	Zone 1	
Area classification outside duct (local to Fan)	Zone 2	

For continuous operational monitoring:

- Visibility of fans on SCADA for loss of extraction from odorous sources

For periodic operational monitoring:

- Inlet and outlet Hydrogen Sulphide concentrations recorded and assessed for removal efficiency and below maximum designed inlet loading during monthly inspections. Following the monthly inspections, hydrogen sulphide concentrations are trended by ERG which would enable identification of a decrease in H_2S removal. Should this occur, ERG would include this in the recommendation section of their inspection report, for example media replacement.
- System integrity checked during daily site rounds and monthly inspections to confirm extraction points and routes undamaged.

Evidence of the systems continuing ability to treat the input flow are confirmed by monthly inlet and outlet odorous gas (hydrogen sulphide) concentrations. Examples of such reductions are given in 5.1.3 iii) of the OMP

5.1.3 Maintenance and Monitoring of Odour Control Units

At Crawley STW there is a service contract with a specialist Contractor for the OCU. They carry out monthly inspections of the OCU. The detail below highlights the scope of work required from our OCU Maintenance Contractors through their monthly visits.

Operation and maintenance of OCUs is delivered in accordance with the Company's Asset Standards and Equipment Maintenance Standards. This is either delivered in house by Operations or outsourced to contractors. Refer to the Odour Control Unit Asset Standard and Site Operating Manual for more information. The scope of this table includes anticipated monitoring requirements of emissions to air from the OCU outlets; TWUL's own site round checks as they pertain to OCUs; followed by a further five key performance indicators reflecting discussion with our specialist OCU inspection contractor as of greatest relevance to Crawley.

Table 5.1 : Performance Monitoring and Maintenance Checks

Parameter	Monitoring Method	Action if red flag identified and Expected timescales	Frequency	Biofilter	Carbon	Chemical scrubber
Performance monitoring						
Gas inlet temperature (5-40C)	Temperature probe	Investigate any anomalies relating to temperature, such as individual process checks	Monthly	X	X	X
Gas outlet temperature (5-40C)	Temperature probe	Investigate any anomalies relating to temperature, such as individual process checks				
Gas inlet flow rate or velocity (6m/sec)	Calibrated velocity meter	Investigate any anomalies relating to flow rates; velocities and pressure drop across the system by measuring the inlet and outlet pressure. Check fan functionality; presence of obstructions; bring forward contractor service. If fan replacement needed c. 2* months minimum typical duration depending on severity of issue/condition of back up fan (*time of order to mobilisation; assumes second duty fan runs; timescale includes time to install replacement and fabrication). If solely an electrical issue, recourse to TWUL ICA Technician mostly likely within a week. Other root causes are usually blocked media; duct and failure of non-return dampers around fan sets.	Monthly	X	X	X
Gas outlet flow rate or velocity (6m/sec)	Calibrated velocity meter					
Gas inlet humidity (Post biofilter humidification > 90% Carbon units <70%)	Hygrometer	Check any preheaters fitted to system before carbon, or check irrigation is working on biofilter.	Monthly	X	X	-
Back pressure (to assess media thatching or media compaction) Typically systems work around 0.5 kPA	Calibrated digital pressure meters	Values above threshold would be 'RAG' banded in the OCU contractor inspection reports. If pressure gauges are over-pressurised to the extent fouling is or has occurred to be treated as high priority. Check for blockages, poor FFE quality/check if media is of a type susceptible to biodegradation.	Monthly	X	X	X

pH of discharge irrigation water (2-3pH)	pH paper	Less than 2 increase irrigation.	Monthly	X	-	-
pH of scrubber liquor (9.2 pH)	Calibrated pH probe (calibrated with standard solutions)	Recalibrate pH probe and check dosing and chemical availability	Continuous	-	-	X
Redox potential of scrubber liquor (700-730 mV)	Calibrated redox probe (calibrated with standard solutions)	Recalibrate redox probe and check dosing and chemical availability	Continuous	-	-	X
Gas inlet/outlet concentrations for hydrogen sulphide (50ppb used for media change out)	Drager Tubes/CEN TS 13649 for sampling NIOSH 6013 for analysis OR US EPA M11 *	Check functionality of odour control unit. If repair or replacement media required raise a job on SAP or APS risk and arrange for contractor repair. Timescale Bespoke to root cause/see later entries. Arrange re-test post remedial work. Major repairs up to 6 months depending on complexity	Monthly/ 6 monthly	X	X	X
Gas inlet/outlet concentrations for ammonia (20mg/m3)	EN ISO 21877 OR CEN TS 1369 for sampling NIOSH 6016 for analysis *	Check functionality of odour control unit. If repair or replacement media required raise a job on SAP or APS risk and arrange for contractor repair. Timescale Bespoke to root cause/see later entries. Arrange re-test post remedial work. Major repairs up to 6 months depending on complexity	6 monthly	X	X	X
Gas inlet/outlet concentrations VOCs and RSH	RSH – Drager tubes VOC – PID as isobutylene		Quarterly	x	x	x
Maintenance checks and inspections						
Check integrity of tank covers for damage and ensure access hatches are closed		Close hatches ASAP	Daily	X	X	X
Check building & door integrity for damage or leakage; doors closed (if required)		Closed doors ASAP	Daily	X	X	X
Check damper positions on ductwork are in the correct positions		Correct positioning	Daily	X	X	X
Check irrigation and humidification systems are functioning		Turn on systems or investigate malfunction.	Daily	X	-	-
Check for free discharge of effluent from drain		Investigate blockage	Daily	X	-	-
Check irrigation water supply is working at required rate		Visual check on flow gauge, investigate if required.	Monthly[1]	X	-	-
Check condensate removal points for free flow of liquid		Visual check	Daily/Monthly[1]	X	X	X

Check OCU condition for signs of damage or leaks	Call specialist contractor if identified	Daily / Monthly[1]	X	X	X
Check general ductwork for signs of damage or leaks	Condition of ductwork would be 'RAG' banded in the OCU contractor inspection reports. If broken, then odours not being conveyed to OCU and can be indicated by low inlet load. Worst case the ductwork is disconnected ('sucking air') such that odour removal is not taking place.	Daily / Monthly[1]	X	X	X
Check spray pattern from irrigation nozzles and clean nozzles as required	Adjust spray pattern, clean the strainer and unblock nozzles or replace as deemed necessary. Timescale durations of c. 2 weeks where just irrigation required.	Daily / Monthly[1]	X	-	X
Check flexi joints between fans and ductwork for leaks	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)	Monthly	X	X	X
Check fans for excessive vibration or noise, belt tension and bearing temperature	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)	Monthly	X	X	X
Check irrigation water pH	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)	Monthly	X	-	-
Check irrigation pumps condition and operation	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)	Monthly	X	-	
Check chemical reagent levels and supply	Order when required. Ensure no low-level alarms.	Weekly	-	-	X
Check chemical dosing and blow down pump condition and operation	If outside pH levels, investigate. Initiates blow down to correct level.	Daily/Monthly	-	-	X
Check blow down rate is within correct range	If outside pH levels, investigate. Initiates blow down to correct level.	Monthly	-	-	X
Check ph and Redox probes are working and in calibration	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the	Monthly	-	-	X

	maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)				
Check recirculating liquor strainer and replace if necessary	Flows recorded on SCADA	Monthly	-	-	X
Check water softener is working correctly (if installed)	Water hardener test papers used to check water quality.	Monthly	-	-	X
Check dampers are operational and in good condition	Swap over duty fan to stand by fan and record flow volumes to identify issue.	Monthly	X	X	X
Inspect electrical control panel and check for faults and alarms	Visual inspection by monhtly contractor and investigation any alarm conditions.	Monthly	X	X	X
Simulate duty / standby fan and pump changeover	Contractor inspection reports 'RAG' band these issues with a level of detail to then inform the maintenance response. Timescale durations of 1 to 2 months typical depending on complexity (time of order to mobilisation)	Monthly	X	X	X
Check H_2S meter is functioning and calibrated (if installed)	Check calibration is still in date during monthly contractor inspection.	Monthly	X	X	X

**Only on OCU's that fall within the STC permit*

Condition of the media in the OCU is monitored by performance checks and by additional testing as required.

The OCUs at Crawley are covered by a service and maintenance contract. External contractors inspect the OCU on a monthly and quarterly basis and reports are sent to the Performance Manager. Figure 5.1 below highlights the scope of work required from our OCU Maintenance Contractors through their monthly visits. Monitoring during the visits is as follows:

- Monthly – flow (m^3/h), differential pressure(kPa) and hydrogen sulphide(ppm) at both the inlet and outlet. Where applicable, monitoring may also include fan hours run and removal efficiency of hydrogen sulphide.
- Quarterly – VOC(ppm) and mercaptans(ppm) at the inlet and outlet.

>50ppb hydrogen sulphide will be used as a threshold value for media change out. More detailed maintenance procedures are located in the SOM.

The OCUs are specifically designed to minimise the release of odour, bioaerosols and microorganisms.

Optimum flow rates; trigger levels; odorous components/concentrations in the gas stream and associated physical properties are all important to OCU function and are described below:

(i)Optimum flow rate through the system to allow for effective treatment.

A '**Maximum velocity in duct work'**; rather than volume; is the key design aspect informing effective treatment for new/existing OCUs. Not exceeding 10m/second in a piece of ductwork will avoid noise break out; the industry benchmark for new plant being 8m/second. Given velocity is directly related to the volume; the specification is +/- 20% to reflect instrumentation variation; and therefore the OCU is checked to see ***if they can meet 6m/second*** with escalation in monthly contractor inspection reports where this value is not reached. This is a good indicator of functionality, appropriate sizing, and system health.

ii) The trigger levels/ranges for action if processes monitoring parameters are breached/ outside optimal parameters.

All OCUs, irrespective of media type, *will stipulate a minimum of 30 seconds* ***retention time***, for a biofilter to achieve a minimum of 95% removal efficiency. A minimum of 2-3 seconds retention time for Carbon filters.

H2S readings are reported in the monthly service reports which inform odour equivalents (OEs). The accepted OEs for H2S at 0.5 part per million is equivalent to 1,000 odour units. A "red action" would be raised for any value 3 parts per million on the discharge from the biofilter and 0.5ppm from the subsequent carbon filter. There is a relationship between increases in discharge efficiency from the biofilter since if this rises it will start to exhaust the carbon filter defining the red action. Contextual knowledge must inform any triggers for action; rather than focusing on a single value. For example, the normal arrangement is to have a biofilter followed by a carbon filter (as a polisher), and in a circumstance where you exceed what is placed on the carbon filter, this will result in premature use of the carbon informing the red action since it left unchecked would result in far earlier depletion of the carbon than normal condition.

Trigger levels are more difficult to identify for other parameters, such as mercaptans and ammonia since the design assumptions for OCUs are informed by H2S removal. Removal for these parameters is therefore limited. For Total VOCs, *in respect to methane rather than small chain VOCs*, there is no removal.

From a qualitative value, from visual inspections, 'red flags;' would include if irrigation pipework to the biofilter is broken (no water entry to media); neither extraction fan running; broken ductwork leading to the OCU sucking in atmospheric air.

On identification of such red flags, such that the effective function of the OCU is at risk of being compromised, the following actions would be taken:

(i) For significant issues relating to any aspect of 'condition monitoring' - including effective function of the biofilters - impacting upon parameter reductions at the inlet/out; differential pressures or irrigation volumes – the Performance Manager would urgently contact Head of Maintenance at ERG to book in reactive maintenance attention. Timescales would be of highest priority but response times/duration dependent on the issue identified

(ii) For issues relating to housekeeping (leaks) or issues relating to OCU power supply (electrics) – for example, impacting either fan operation - these would be referred to a TWUL Electrician for assessment and either rectified by the area operational team or escalated to an external contractor where repairs are more complex. Timescale for expectation of resolution would typically be within 24 hours.

For either (i) and (ii) if any significant pollution risk (odour) was identified the Performance Manager would contact TWUL's incident help desk. A supporting risk would be recorded in APS (risk assessment software) to support funding where a need for remedial works was identified.

iii) Odorous components in the gas stream and concentrations of emissions

The monthly contractor inspections of each OCU provide data for H2S; VOC; Mercaptans (RsH). The sampling methodology being Drager (gas analysis) tube for c. 30 seconds to 2 minutes duration.

To achieve an appropriate level of surveillance on OCU performance, outside of the contractor monthly inspections, there is additional oversight from the Operations Management Team through

- Visibility using local SCADA control panels for OCUs, which records fan status
- Daily site rounds by Thames Water technicians. These are Psion based checks using SAP Plus for escalations including, for example, internal MANDAT tickets or identifying a need for contractor support. The tasks in the daily checks mirror the numbered tasks in the contractor 'Monthly Health Checks'. See Figure 5.1 and section 9 in Appendix 5 in the OMP. There is connectivity between the site rounds and SCADA, for example, if excessive noise is recorded this could relate to an operational fault in OCU fan, and in turn, is visualised on the local SCADA screens.

iv) Physical properties of the air stream at point of control i.e., humidity, optimum temp, pH for effective odour control

For **humidity**, *the gas is humidified before being received by a biofilter*, so this parameter has less relevance. Biofilters post humidification standard being > 90%. Carbon units humidity standard should be set at <70%.

For **temperature**, this is fairly constant throughout the year as this is informed by the need to achieve fairly constant temperatures in the digestion process. A range of 20 to 40°C being standard.

pH will be slightly variable depending on the H2S that is there from the condensing air stream contributing to SO2 formation. This tends not to be an issue at the biofilter itself since the active component of the biofilter will in itself produce SO2 as a waste product from converting the H2S.

pH off a bio-scrubber is checked on the quarterly inspections since it might suggest an issue with the active component of the biofilter being impacted by the accumulation of its waste product thereby making the lower part of the bed inactive. A pH of 2 to 3 would be expected as a theoretical upper limit to liquor discharged from the biofilter but recorded values are significantly less; pH 4 to 5 being typical (reflecting the logarithmic scale). Note if efficiency of the process is being impacted; pH would also be part of the investigative checks (i.e., more than quarterly).

Figure 5.1 – Monthly OCU Health Checks

Monthly Health Checks

Biofilter

Please enter any comments you may have in the yellow comments boxes

Number	Task	Comments
1	Examine ductwork for any signs of damage or leaks and check condensate drains are free flowing	
2	Visually inspect the Odour control system will be made and any defects or deterioration of the housings will be reported.	
3	Check the airflow through the system and any anomalies investigated.	
4	Measure the pressure drop across the system by measuring the inlet and outlet pressure. Record any abnormalities	
5	Measure the contaminate levels (primarily H2S) at the inlet and at the stack	
6	Check visually all fans, check for excessive noise and report any necessary maintenance to be undertaken as applicable.	
7	Examine the irrigation system to ensure correct operation including spray pattern, clean the strainer and unblock nozzles or replace as deemed necessary.	
8	Take a sample of the drainage water and measure the pH value and compare to target pH value (this is not pH 7 for modern biotech)	
9	Check all hatches and doors for integrity and ensure they are closed	

Chemical Scrubber

Please enter any comments you may have in the yellow comments boxes

Number	Task	Comments
1	Examine ductwork for any signs of damage or leaks and check condensate drains are free flowing	
2	Check visually all fans, check for excessive noise and report any necessary maintenance to be undertaken as applicable.	
3	Visually inspect the Odour control system will be made and any defects or deterioration of the housings will be reported.	
4	Check the airflow through the system and any anomalies investigated.	
5	Measure the pressure drop across the system by measuring the inlet and outlet pressure. Record any abnormalities	
6	Measure the contaminate levels (primarily H2S) at the inlet and at the stack	
7	Check visually all fans, check for excessive noise and report any necessary maintenance to be undertaken as applicable.	
8	Examine the recirculation pumps and distribution pipework to ensure correct operation, clean the strainer and check trough / distributor.	
9	Carry out a functional check of the dosing system ensuring target pH and Redox are achieved, and validate the probe calibration using a handheld unit	
10	Calibrate if necessary	
11	Visually check the seals of all hatches note any leaks.	
12	Visually check the wet scrubber housing, note any significant deterioration	
13	Scrubber dosing cabinet - Check chemical dosing pumps for leaks	
14	Scrubber dosing cabinet - Check that dosing rates are correct	
15	Scrubber dosing cabinet - Check all valves, instruments and pipe-work for leaks	
16	Scrubber dosing cabinet - Check inside of cabinet for chemical residue and dirt and wash if necessary	
17	Scrubber dosing cabinet - After wash down check catch-pot high level alarm is working before draining	

Carbon Adsorber

Please enter any comments you may have in the yellow comments boxes

Number	Task	Comments
1	Examine ductwork for any signs of damage or leaks and check trapped condensate drains are free flowing. If a manual drain valve is provided, operate the valve until the flow of condensate ceases and leave valve in closed position.	
2	Check visually all fans, check for excessive noise and report any necessary maintenance to be undertaken as applicable.	
3	Visually inspect the Odour control system will be made and any defects or deterioration of the housings will be reported.	
4	Check the airflow through the system and any anomalies investigated.	
5	Measure the pressure drop across the system by measuring the inlet and outlet pressure. Record any abnormalities. Read off Delta-P gauge if fitted or using a portable manometer	
6	Measure the contaminate levels (primarily H2S) at the inlet and at the stack	
7	Check visually all fans, check for excessive noise and report any necessary maintenance to be undertaken as applicable.	

5.1.4 Records

Maintenance history records are kept electronically on SAP or the company's SharePoint system.

5.2 Fault Reporting

Faults identified during routine inspections are reported to the Performance Manager who assesses criticality before entering the task into the job scheduling system for allocation to an appropriate person to a timescale appropriate to the criticality.

5.3 Emergency Repairs

24-hour maintenance cover is available at the discretion of the Performance Manager or WOCC, with planned follow up.

Less urgent repairs are assessed for criticality and dealt with during normal working hours.

6 Customer Communications

6.1 Customer Odour Complaints Process

Customer contacts regarding Crawley STW will be made via the Customer Services Centre, Operations will investigate and take appropriate action. Complaints may also be received from the local council and Environment Agency.

Customers / residents are encouraged to communicate with local Thames Water Operations via the Customer Centre to report if they are noticing odour from Crawley STW, to ensure that all contacts are recorded and actioned. Customers have 3 main options to report complaints to Thames Water:

1. Thames Water Website – "Report A Problem" at https://www.thameswater.co.uk/contact-us/report-a-problem/report-a-problem-online.

2. Email - customer.feedback@thameswater.co.uk with the subject 'Crawley Sewage Treatment Works'

3. Telephone - Customer Services 0800 316 9800

If the customer / resident would prefer to contact either Crawley Borough Council or the Environment Agency instead, their contact details are as follows:

Crawley Borough Council – Environmental Services
Telephone: 01293 438000

Environment Agency – 0800 80 70 60

The Complaints Process for odour complaints received locally is detailed in the diagram of Appendix 3.

Customer contacts regarding Crawley STW that are received directly on site are responded to by the local Operations team. The Performance Manager, at the earliest opportunity, will inform the Customer and Stakeholder Manager (CSM) of the contact details in order that they can ensure the complaint is captured and recorded by the Customer Services Centre.

Complaints received via Customer Services Centre:

- Complaint information is logged electronically by the Customer Services Centre.
- An action is raised to Waste Operations Control Centre (WOCC) who contact the CSM by telephone and email the complaint information to both the CSM and Performance Manager
- The Performance Manager and CSM will review the complaint and take action to investigate (see section 6.3)
- The CSM is responsible for contacting the customer and updating them on the outcome of the investigation.
- Any problems are noted and remedial work actioned. An update of action taken and feedback given to the customer is emailed to the WOCC by the CSM.
- The WOCC update the electronic complaint report and it is closed down.

Complaints received via email or post:

- Complaint information is logged electronically by Customer Relations and allocated a Case Manager.
- The complaint is emailed to the CSM who reviews the complaint and investigates with the Performance Manager (see section 6.3).
- Actions taken are emailed back to the Case Manager who updates the electronic system and updates the Customer.

Complaints received via Customer Centre out of normal working hours

- For a large number of calls, or serious concerns, the Out of Hours Coordinator will be contacted to respond.
- For all other calls Crawley STW site management will investigate and respond the next working day.

6.2 Customer Communication Plan

The Customer Communication Plan in Appendix 3 identifies how and when contact will be made with customers and stakeholders in relation to stable, abnormal and emergency site operation.

6.3 Investigating a complaint

Upon receiving a complaint the Thames Water have 24 working hours to respond to the customer with an update. Within these 24 hours, the Customer & Stakeholder Manager will contact to the Performance Manager who will carry out an investigation to determine whether the odour source is coming from the Thames Water site. If the odour is decided to be from the Thames Water site, then the root cause is investigated.

Should the source of the odour be confirmed as coming from the Thames Water Operations then the performance manager will review all activities currently taking place on site, including any maintenance, cleaning, and non-standard activities to identify the root cause, and ensure appropriate mitigation measures are in place.

If the performance manager cannot identify the source of the odour, but complaints persist, the Customer & Stakeholder Manager will ensure the customer who made the complaint is contacted, and obtain further details. These details include their address in relation to the site location, the time of occurrence and for how long. If odour problems continue to persist, Thames Water may even ask the customer to keep a detailed odour diary to ensure their issue can be fully addressed.

The root cause investigation may include site walkaround checks, which look for irregularities such as spillages / open doors and hatches, ensuring appropriate measures as detailed in table 4.3-6 are in place. It may also include off-site visits to the Customer location.

When the root cause of the odour is found, the customer will be updated with an explanation and provided with a timescale for its resolution. Furthermore, the situation is assessed for hazards to determine any possibility of health risk to the local community.

To ensure any limitations regarding everyday staff becoming desensitised to the odour, if site odour complaints persist with no result in locating its source, personnel who do not spend prolonged time on a single site, such as the Area Operations Manager, will participate in the walkaround checks.

6.4 Notification of Operations with Potential to Cause an Odour Problem

Where operations may impact on local residents, notification will be made to the Customer Centre who will log the details on their Bulletin Board. This will be used to provide information directly to customers who call with queries. Letter drops may also be used.

The Environmental Health Officer of Crawley Borough Council – Environmental Services - 01293 438000 will be contacted directly if there are risks of odour generation (e.g. digester cleaning, tank cleaning or process issues). NOTE: This will only take place on known sensitive sites where Local Authorities and the EHO are already involved

For assets under STC permit, we will notify the EA in accordance with the permit conditions and notifications procedure, see appendix 3.

If notified by the Environment Agency that the activities are giving rise to pollution outside the site due to odour, Thames Water shall investigate and carry out a review of the OMP and appropriate measures if deemed necessary.

Appendices

Appendix 1. Odour Risk Assessment

Crawley%20Risk%20Assessment%202023.xls

Appendix 2. Odour Improvement Plan

Odour Improvement Plan Crawley STW

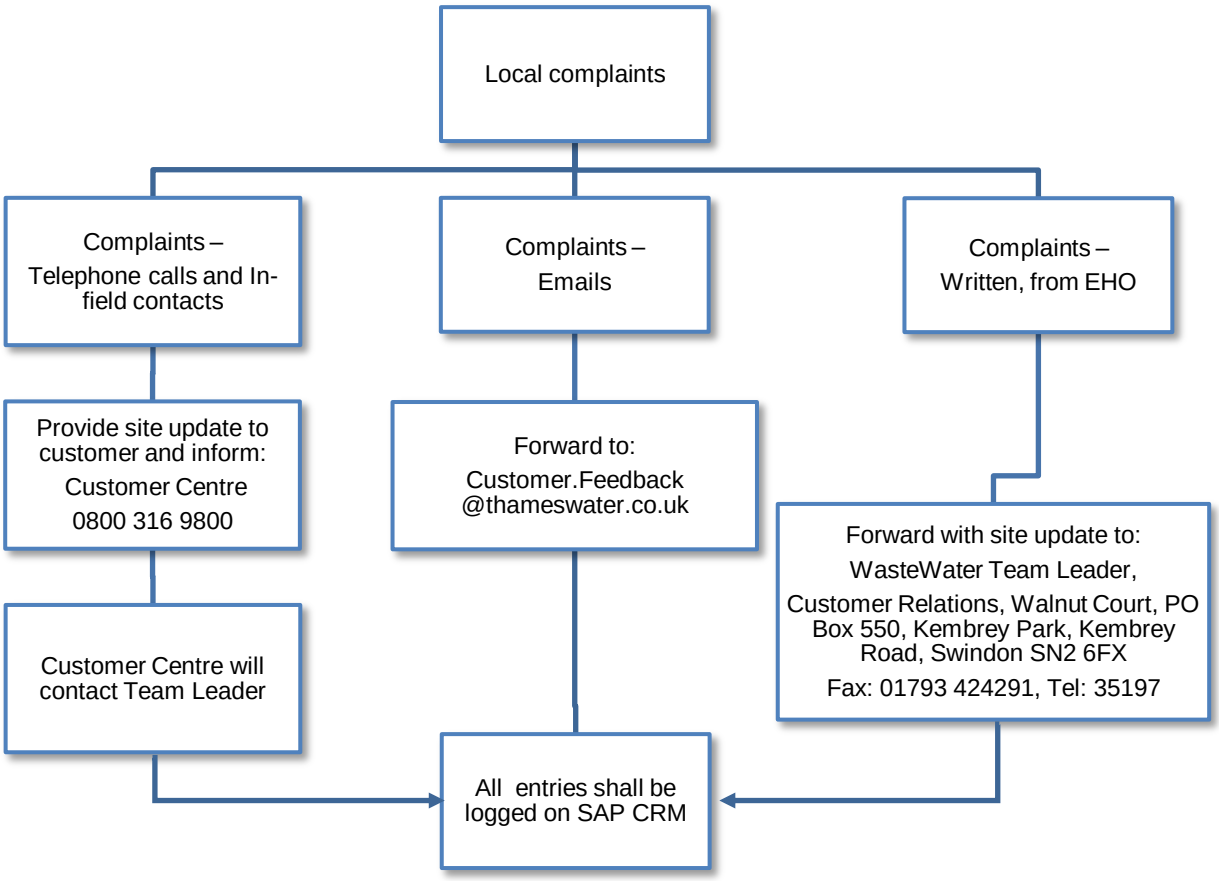
Review Date: Nov-23

Process Stage	Owner	Plan	Action	Expected difficulties	Measures to mitigate	Timeframe
Storm Tank	Matt Evans	New storm tank to be installed at Crawley	Early design phase		Currently storm lagoons are in use	Jun-24
Odour Control Units	Matt Evans	Recommendations from monthly inspection reports to be actioned		funding	Daily site rounds and monhtly inspections to identify issues early	ongoing
Sniff Testing	Odour Specialist	Implement Sniff Testing	Procedure written for sniff testing, in order to achieve effective sniff testing personnel needs to be identified to carry out the procedure who are not acclimatised to smells on site.	Resource	daily site rounds	6 months from permit issue

Appendix 3. Customer Communications Plan

Complaints Process

All locally received complaints are re-directed to the Customer Centre. Please see below for details.



IMPORTANT NOTE:

Any communications received from the local Member of Parliament or senior council officers need to be forwarded to the Local/Regional Government Liaison person:

Name:	Miles Evans	Huw Thomas
Telephone:	07747 647304	07747 640011

Communications

Level 1	Stable operations: Compliant with Operational Asset Standards.			
Communications Approach	Standard regular proactive contact with key stakeholders.			
Stakeholders External	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Local council(s) Environmental Health Department	As required but at least quarterly	Telephone / email / meeting	Update on operational activity on site	Performance Manager and Customer & Stakeholder Manager
Local residents associations *(if applicable)*	As required but at least annually	Telephone / email / meeting	Update on operational activity on site	Performance Manager and Customer & Stakeholder Manager
Environment Agency	As required	Telephone / email / meeting	Update on operational activity on site	Performance Manager and environmental permitting team
Stakeholders Internal	**Frequency of Contact**	**Method & Level of Contact**	**Aim of Contact**	**TW Contact/Level**
Press Office	As required	Report sent out by operations to the business	Update the business on operational activity on site	Duty Manager
Customer Centre (Swindon)	As required	Report sent out by operations to the business	Update the business on operational activity on site	Duty Manager

Level 2	Unstable operations: • Non-compliant with Operational Asset Standards on one or more sub-processes leading to increased odour risk.			
Communications Approach	As Level 1 plus: • Use of Contact Centre Bulletin Boards / Briefing Contact Centre agents / Briefing statement with Q&A prepared for the press office (to use reactively). • Monthly discussions with, and quarterly visits from, the EHO. • Commence proactive communications with other stakeholders.			
Stakeholders External	**Frequency of Contact**	**Method & Level of Contact**	**Aim of Contact**	**TW Contact/Level**
Local council(s) Environmental Health Department	Immediately then monthly	Telephone / email / meeting	Report unstable operation with action plan	Performance Manager and Customer & Stakeholder Manager
Local residents associations *(if applicable)*	Immediately then monthly	Telephone / email / meeting	Report unstable operation with action plan	Performance Manager and Customer & Stakeholder Manager
Environment Agency	Potential for notification procedure	As required as per notification procedure	As required as per notification procedure	Pollution desk
Stakeholders Internal	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Press Office	Immediately then weekly	Q&A prepared for press office by Operations	To enable the press office to deal with queries from the press (reactive only).	Duty Manager
Customer Centre (Swindon)	Immediately then weekly	Telephone / email	To enable the Customer Centre to deal with queries from the press (reactive only).	Duty Manager
Other areas/stakeholders outside Crawley STW potentially impacted				
Stakeholder	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Local businesses	Immediately then monthly	Telephone / email / meeting	Report unstable operation with action plan	Performance Manager and Customer & Stakeholder Manager

Level 3	Emergency • Temporary or transient activities not deemed to be compliant with Operational Asset Standards. High risk of odour emitting plant.			
Communications Approach	As level 2 plus: • Odour event set up internally (including OOH's cover from OMC (Kemble Court)). • Weekly discussions with EHO. • Monthly Stakeholder meetings, (internal and external – include MPs, Councillors, schools, businesses etc.). • Press release may be required.			
Stakeholder External	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Local council(s) Environmental Health Department	Immediately then weekly	Telephone / email / meeting	Report emergency event with action plan and update with progress	Level 5 Manager (Operations Manager) / Level 4 Manager (Regional Operations Manager)
Local residents associations (if applicable)	Immediately then monthly	Telephone / email / meeting	Report emergency event with action plan and update with progress	Performance Manager and Customer & Stakeholder Manager
Councillors / MPs for local areas	Immediately then monthly	Telephone / email / meeting	Report emergency event with action plan and update with progress	Level 5 Manager (Operations Manager) / Level 4 Manager (Regional Operations Manager)
Environment Agency	As required as per notification procedure	As required as per notification procedure	As required as per notification procedure	Pollution desk
Stakeholders Internal	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Press Office	Immediately then daily	Q&A and press release prepared by press office	To enable the press office to deal with reactive queries from the press and prepare a media strategy if required.	Duty Manager
Customer Centre (Swindon)	Immediately then daily	Telephone / email	To enable the Customer Centre to deal with queries	Duty Manager

			from customers (reactive only)	
Other areas/stakeholders outside Crawley STW potentially impacted				
Stakeholder	**Frequency of Contact**	**Method of Contact**	**Aim of Contact**	**TW Contact/Level**
Local businesses	Immediately then monthly	Telephone / email / meeting	Report emergency event with action plan and update with progress	Process / Site Manager

Appendix 4. Site Drawings

Figure A - Site receptor map

Figure B - Site plan of Crawley Sewage Treatment Works

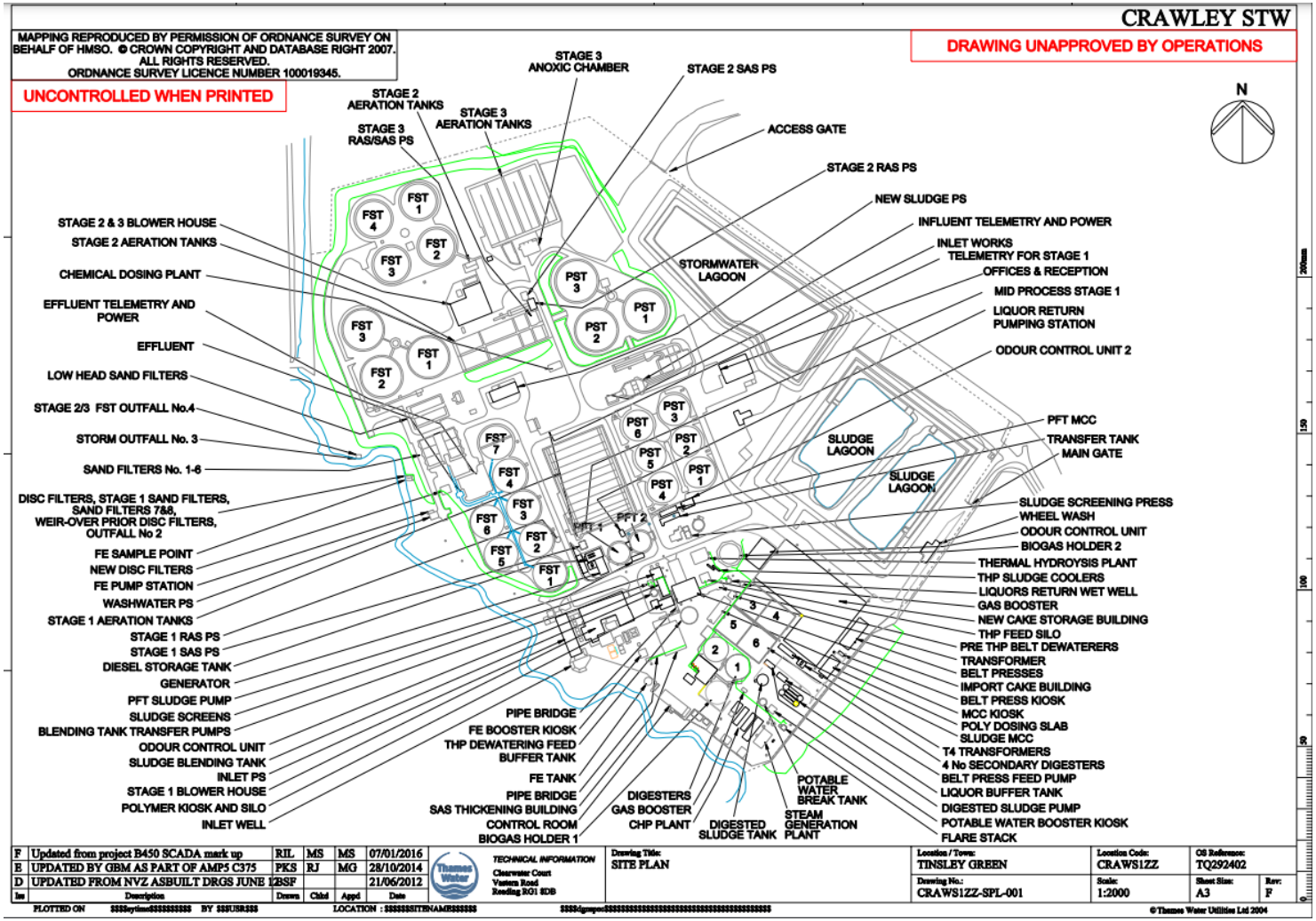


Figure C - Area Permitted under Sludge Treatment Centre Permit

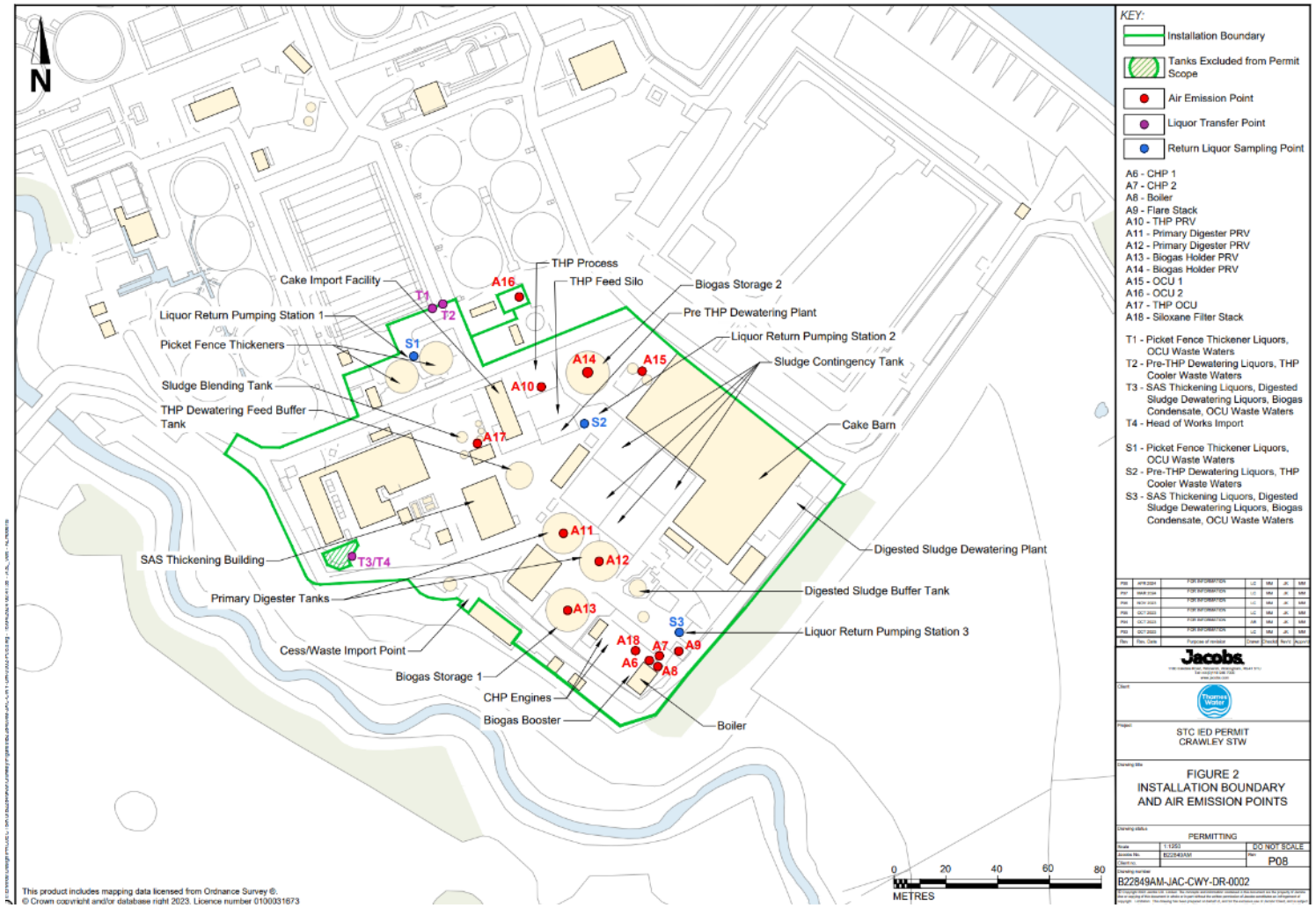


Figure D - Process Block Diagram of the Sewage Treatment Works

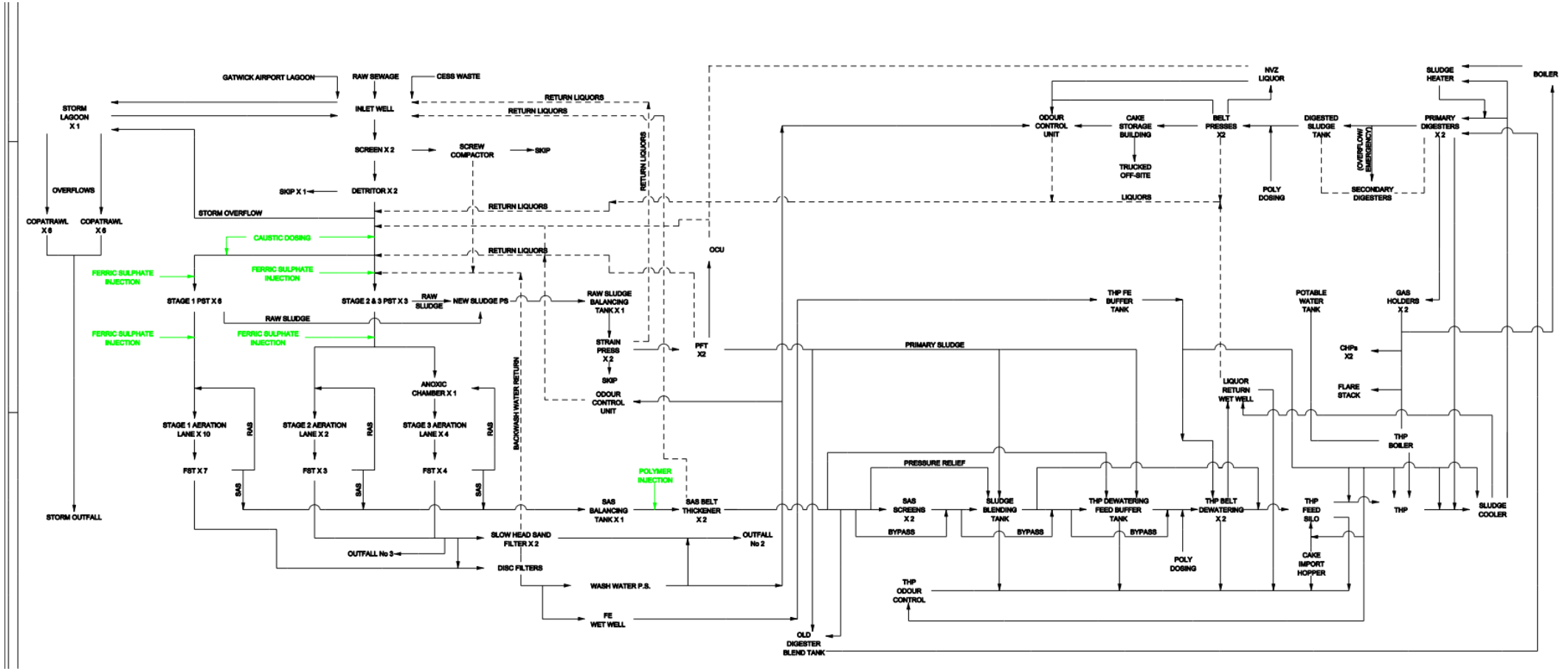


Figure E - Process Flow Diagram of the existing Odour Control Systems (OCUs 1, 2 & 3)

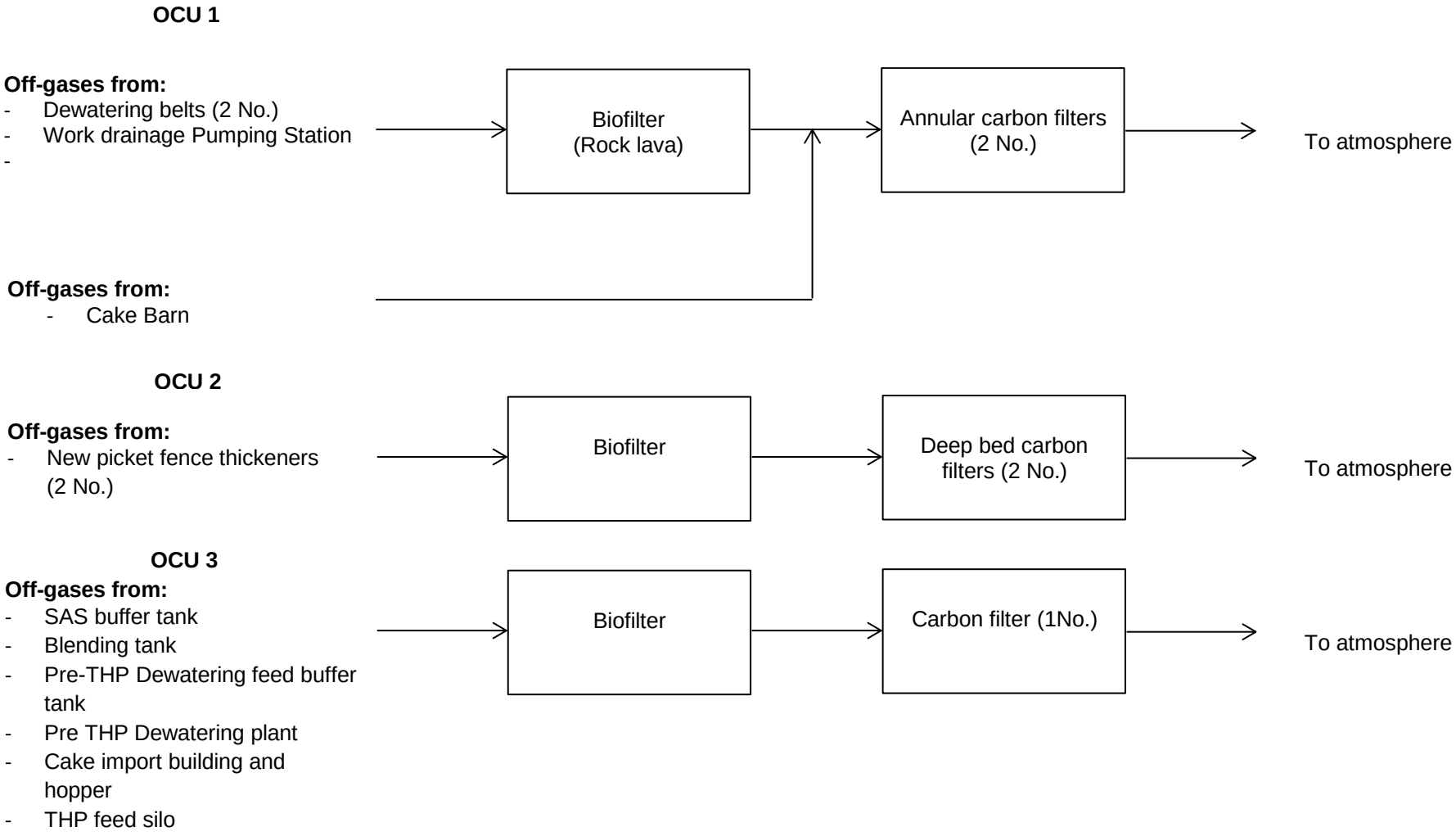
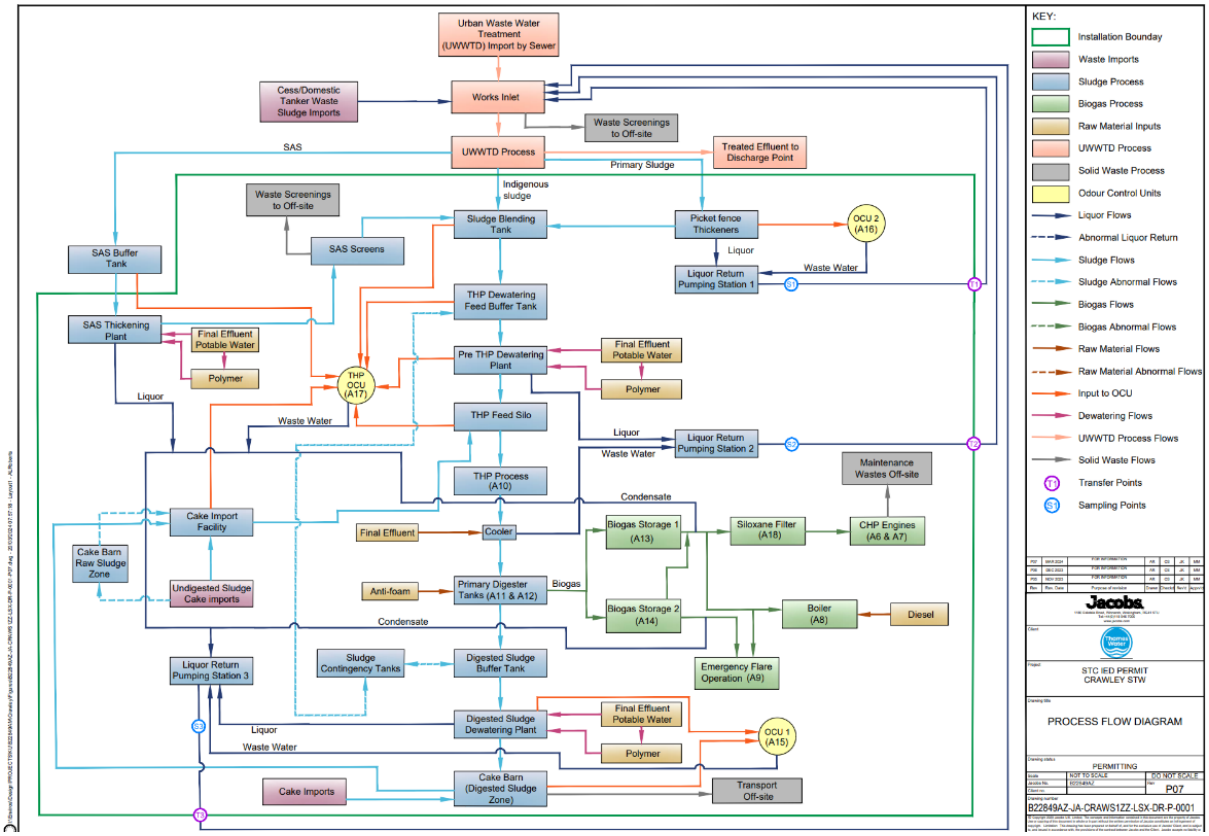


Figure F - Process Block Diagram showing process routes, raw material inputs and waste outputs



Appendix 5. Site Rounds

ID	Instruction	Daily	Weekly
1	**Final Effluent**		
a)	Check the effluent quality at the sample point. Sample (ammonia, phosphorus, temperature & turbidity) in accordance with SOM. Record in site log book & via Direct Text.	**X**	
b)	Check final effluent sampling point is accessible. Highlight to manager if need to clean inline monitor, channel/chamber.	**X**	
c)	Check storm sampling point is accessible. Highlight to manager if need to clean inline monitor, channel/chamber.	**X**	
d)	Visual check on point of discharge to the watercourse if accessible. Check operability of outfall flap valve if fitted.	**X**	
e)	Check storm discharge point, if shared & if accessible.	**X**	
f)	Compensation water pumps. Check and clear ultrasonic head of cobwebs etc.	**X**	
g)	Check data and operation of inline monitor. Check inline monitor installation for damage, take appropriate action where required.	**X**	
h)	Remove and clean inline monitor probe.		**X**
i)	Check flow meter & flume is clear of debris. Take appropriate action.	**X**	
2	**Preliminary Treatment**	Daily	Weekly
a)	Check Crude sewage appearance. Does it look normal for the site?	**X**	
2.1	**Cess Waste Reception Point**		
a)	Note any suspicious activity or discharges as required	**X**	
b)	Check logger system is operating correctly	**X**	
c)	Check all pipework is in good condition	**X**	
d)	Where a macerator is fitted, check operation and oil reservoir	**X**	
e)	Where a manual stone trap is fitted, clear of accumulated material	**X**	
f)	Check grit bins are available and stocked with grit for winter	**X**	
g)	Carry out general housekeeping, remove litter, clear debris, washdown any spillages, empty bins	**X**	
h)	Ensure all signage is in good condition, clean and legible	**X**	
i)	Check washdown equipment is operating correctly	**X**	

ID	Instruction	Daily	Weekly
2.2	**Inlet / storm pumping station**	Daily	Weekly
a)	Check Ammeter reading, Too high could indicate a blockage. Too low could indicate an air lock or impeller damage. Where reading is unusual ensure appropriate action is taken.	**X**	
b)	Check the well level is within the normal operating limits taking into account the flow conditions at the time (such as storm conditions & peak flow to site). If level is too low or high, this could indicate control issues or pumping issues.	**X**	
c)	Check condition of the wet well. Does it have more than the usual scum or debris floating on top that will indicate the need for a wet well clean?	**X**	
d)	Check fault light(s) are not on, take appropriate action as required.	**X**	
e)	Check flow rate (where meter is fitted); is it within the normal operating range?	**X**	
f)	Inspect buildings, kiosks and control/switchgear panels for general condition, damage and that they are securely locked. Clean and tidy the interior of the buildings and/or Kiosks. Remove rubbish from site or if large volume arrange for collection.	x	
g)	Listen for undue pump noise and check for undue vibration by safely touching the lifting chain or guide rail.	**X**	
h)	Check non-return valve is operating correctly Non return valves prevent water from flowing back through the pump when it is not in operation. If a weighted arm is fitted is it at the usual angle? If it is low and chattering it could indicate the pump is blocked.	**X**	
i)	Check operation of the ultrasonic level control. Is it reading correctly? Compare the well level with the normal readout from the display. Check hard wired control floats, clean as required. Are floats weighed down with rag or debris preventing them from lifting if the water level rises?	**X**	
j)	Check pumps, pipelines and couplings for leaks where possible.		**X**
k)	Start the cleaning cycle manually where required.	**X**	
l)	Pumps - Log hours run		**X**
m)	Pumps - Log kWhrs		**X**
2.3	**Screen(s) / macerator(s)**	Daily	Weekly
a)	Check inlet channel level is normal taking into account the flow conditions at the time (such as storm conditions & peak flow to site).	**X**	

ID	Instruction	Daily	Weekly
b)	Check screen operation and check for screenings carryover. Check for blockages and blinding (hairpinning) on screen panels and remove where necessary. Check for rag rolling or rag balls upstream of the screen and remove where necessary. Check for any grit build up in front of screen	**X**	
c)	Inspect debris disposal mechanism for correct operation and verify screenings are being removed. Check & clean any obstructions impeding the operation of screen mechanisms.	**X**	
d)	Check screens bypass is available and clean	**X**	
e)	Clean area around screen. Check & clean screen panels of any obstructions.		**x**
f)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action to replace them if needed. Inspect grease pots and fill them when level is below the standard. Use grease nipples to lubricate required parts of screen.	**X**	
g)	Visually check unit and its associated equipment for the following: Safety & security with all panels locked & guards secure and in good condition. Excessive noise or vibration Overheating External damage, leaks, missing fixings Where applicable, ensure main and brush drives turn and that brushes are spinning	**X**	
h)	Check operation of wash water system for screens Ensure wash water pressure of spray bar is correct. Check the inline filter is present, clean and feeding the spray bars (where applicable). Check the spray bar pattern and clean the spray bar nozzles as required.	**X**	
i)	Check & clean accumulation of screenings and fat from debris disposal mechanism Check & clean launder chutes and channels for accumulation of grit, sand, rag, fat,	**X**	
j)	Check the lip, labyrinth or other seals between the screen and the channel wall are making an effective seal.	**X**	
k)	Visual check on the screenings removal brushes for blinding and wear. Clean the brushes as required. Ensure the brushes are in correct contact with the screen and that screenings are being removed.	**X**	
l)	Check and clean instrumentation probes, floats and ultrasonic heads (where applicable).	**X**	

ID	Instruction	Daily	Weekly
2.4	**Screenings handling**	Daily	Weekly
a)	Check control system and amps on panel for normal levels / operation, take appropriate action as required. Jumping amps indicates a blockage.	**X**	
b)	Where installed, visual check for normal operation of macerator. Look for visible blockages/build up on unit, high flows in front of macerator. Listen for unusual noise. Take appropriate action as required.	**X**	
c)	Where installed, check and empty stone trap.	**X**	
d)	Clean area around screenings handling units and skips.		**X**
e)	Check operation of wash water system for screenings handling. Check the inline wash water filter is present, clean and feeding the spray bars (where applicable Ensure wash water pressure of spray bar is correct. Check the inline filter is present, clean and feeding the spray bars (where applicable). Check the spray bar pattern and clean the spray bar nozzles as required.	**X**	
f)	Check screenings product quality and quantity, Check level of screenings in skip and change skip when full.	**X**	
g)	Check operation of auto drain.		**x**
h)	Where installed check operation of the trough desludge system. Check for grit build-up in trough - hose out where required.		**x**
i)	Visual check on condition and operation of brushes (ensure trough is being cleaned). If blinding occurs regularly have wear on screw brushes checked.		**x**
j)	Check screw conveyor and brushes for wear and central running.		**x**
k)	Clean and check mesh for blinding and hairpinning.		**x**
2.5	**Grit removal**	Daily	Weekly
a)	Check mechanical plant is operating correctly. Check equipment– Compressor, Rake, Detritor & Pista grit.	**X**	
b)	Check manually de-gritted constant velocity channels for build-up of grit, take appropriate action as required.	**X**	
c)	Check inflow and outflow for normal rate of flow and correct distribution.	**X**	
d)	Check volume, dryness and quality of grit produced.	**X**	
e)	Remove rag from the areas around baffles and mechanical equipment	**X**	
f)	Log manual de-gritting operations where required.	**X**	

ID	Instruction	Daily	Weekly
g)	Log abnormal grit volumes.	**X**	
h)	Clean grit channel as required. Check grit build up in inlet channels and clean out if necessary.		**X**
i)	Check operation of wash water system and check the inline filter is present, clean and feeding the spray bars (where applicable)	**X**	
j)	Check aerated grit channels for air flow and bubble pattern (where applicable).	**X**	
2.5	Skips	Daily	Weekly
a)	Check skip capacity is adequate, and inform contractor when skip is full.	**X**	
b)	Rake skip where required.	**X**	
c)	Remove excess water if there is a facility to do so.	**X**	
d)	Ensure only prescribed material is in the skip. Remove any materials not prescribed.	**X**	
2.6	**Storm separation and treatment**	Daily	Weekly
a)	Check Flow To Full Treatment penstock is set at correct level.	**X**	
b)	Check storm return system is operational, manually return storm contents where required.	**X**	
c)	Check storm tanks cleaning system, check level sensors, check tanks are clean and empty outside of storm conditions.	**X**	
d)	Check and clear storm screens where required. (automatic clearance and manual clearance linked to safe system of work)	**X**	
e)	Check screens bypass is available and clean	**X**	
f)	Check and clear/replace any outlet screening sacks		**X**
g)	Check separation weirs and clean where required.		**X**
h)	During storm check that the flow to treatment is normal. (Treating Flow To Full Treatment)		**X**
i)	Log abnormal flows. Log storm discharge flows. Log storm flows in dry weather conditions.		**X**
j)	Log storm events.		**X**
k)	Remove any debris in the system.		**X**
l)	Storm LTA – Visually check area is clean and operating within site parameters. Remove any debris.		**X**
m)	Storm LTA – Check for short circuiting during operation. Inspect banks for leakage		**X**
2.7	**Flow measurement**	Daily	Weekly

ID	Instruction	Daily	Weekly
a)	Check site is within flow permit (treating Flow To Full Treatment before going to storm). Check that flow is going through site as expected.	**X**	
b)	Check flow meter and flume and clean where required	**X**	
c)	MCERTS – Log & record flow meter readings	**X**	
d)	Check EDM (Event Duration Monitor) sensor is clean and weir is free of debris	**X**	
3	**Primary Treatment- Primary Settlement Tanks**	Daily	Weekly
a)	Check and log sludge level by dipping tanks (Mon/Wed/Fri)	**X**	
b)	Check bridge/scraper operation	**X**	
c)	Check de-sludge pump(s) and timer for normal operation	**X**	
d)	Check scum boards for breaks or carry under	**X**	
e)	Check scum trap for normal operation and clean/hose out	**X**	
f)	Check settled sewage quality (visual check only)	**X**	
g)	Check stilling chamber for rag, clear as necessary	**X**	
4	**Secondary Treatment**		
4.1	**Secondary Treatment – Activated Sludge**	Daily	Weekly
a)	Check air filters indicators for normal readings. Check blower control panel. Check the blowers for normal operation. Check there are no illuminated fault lights.	**X**	
b)	Check and record dissolved oxygen (D.O) readings, where probes are installed.	**X**	
c)	Sample, measure and record Mixed Liquor Suspended Solids (MLSS) /RASS concentration and sludge settleability (Stirred Specific Volume Index) (SSVI), (Monday/Wednesday/Friday)	**X**	
d)	Vent condensate from air lines		**X**
e)	Check SAS pump(s) are operating correctly	**X**	
f)	Check and record sludge return from the final settlement tanks (RAS rate)	**X**	
g)	Check D.O probe and / or timers are carrying out the correct control functions. Aeration control function.	**X**	
h)	Check flow distribution to aeration lanes if more than one lane present	**X**	
i)	Log changes to RAS rate, Log flows (where meters are fitted), Log KWh, Log SAS Rate.	**X**	
j)	Check and record bubble pattern and size of the bubbles	**X**	

ID	Instruction	Daily	Weekly
k)	Check mixers for rotation in anoxic (un-aerated) zones	**X**	
l)	Check recycle pumps are running, as required (Biological Nutrient Removal -BNR plants)		**X**
m)	Check redox monitor is operating correctly (BNR plants)		**X**
n)	Check VFA / liquor return (BNR plants)		**X**
o)	Check and record rate and frequency of SAS removal	**X**	
p)	Withdraw the D/O probe from the tank and remove clean		**X**
4.2	**Secondary Treatment – Biological Filters**	Daily	Weekly
a)	Visually check for correct flow distribution across the filter (radial distribution)	**X**	
b)	Keep filter surface clear of all debris and any significant moss or weed growth. Deal with ponding as appropriate.	**X**	
c)	Where recirculation is installed, check for normal operation at the correct flow rate	**X**	
d)	Check all air vents and under drains are clear and not flooded	**X**	
e)	Clear distribution arm orifices and or weir plates of debris	**X**	
f)	Remove end caps and rod/flush arms - clear debris from open channel arms	**X**	
g)	Check for appropriate flow distribution between filters to suit filter size	**X**	
h)	Check operation of distributor arms (uniform speed of rotation)	**X**	
i)	Check for leakage at the centre column seals and end caps. Short circuiting etc.	**X**	
j)	Check rotation timer. Check alignment of rotation alarm sensor and target plate	**X**	
5	**Secondary Settlement – Humus Tanks / Final Settlement Tanks**	Daily	Weekly
a)	Check correct operation of desludging pump(s) or valve(s)	**X**	
b)	Check scraper/bridge operation where installed	**X**	
c)	Check and log blanket level with portable blanket meter where detectors not fitted. (Monday, Wednesday, Friday)	**X**	
d)	Check tank surface for buildup of floating debris. Visually check effluent quality over the weir for solids carry over	**X**	
e)	Check RAS pump(s) are operating correctly (FSTs only)	**X**	
f)	Check Bellmouth and de-rag where required	**X**	

ID	Instruction	Daily	Weekly
g)	Check effectiveness of weir brushes, chains, “other systems” where fitted	X	
h)	Check scum boards for breaks or carry under	X	
i)	Check scum removal system for correct operation, clear any fouling where necessary	X	
j)	Check flow of recirculation bleed back/constant draw off where used	X	
k)	Check operation of fixed blanket detectors and alarms		X
l)	Check operation of Mallard pump by test running in hand, where installed		X
m)	Clear overflow weirs and launder channels of any build-up that will affect the tanks or effluent performance	X	
6	**Chemical Dosing**	Daily	Weekly
a)	Check that chemical is discharging, rather than dosing pump running dry (any nozzles blocked?)	X	
b)	Check chemical storage tank level - reorder as required. Log level in storage tank, Log discharge rate.		2 days a week
c)	Check for excessive vibration in the dosing pump		2 days a week
d)	Check the level in the internal bund and empty as required. Report any abnormalities.		2 days a week
e)	Visual check for leaks on tanks and visible chemical lines		2 days a week
f)	Check the trace heating system		2 days a week
g)	Check external storage tank bund for rainwater and/or chemical. Empty as appropriate.		X
7	**Tertiary Treatment**		
7.1	**Low Head Sand Filter**	Daily	Weekly
a)	Check smooth movement of bridge, unusual sounds and vibrations, and abnormal flow patterns	X	
b)	Check water level in each filter, compare with other units and relate to flow rate, and last backwash	X	
c)	Check unit isn’t in bypass	X	
d)	Check for evidence of chemical leaks	X	
e)	Check cleanliness of carriage & filter area	X	
f)	Check sodium hypochlorite level in the bridge tanks where fitted and fill from bulk tank	X	
g)	Check sodium hypochlorite bulk tank level	X	

ID	Instruction	Daily	Weekly
h)	Check the amount of sand in the wash water	**X**	
i)	Check the colour of the backwash water	**X**	
j)	Check the correct amount of hypochlorite is being dosed	**X**	
k)	Check water level in each filter, compare with other units and relate to flow rate, and last backwash	**X**	
l)	Log backwash timer settings and head loss	**X**	
m)	Log flows and flow rate, where meters are fitted	**X**	
n)	Clean the level sensor head		**X**
o)	Log clarity of feed (compare with final effluent)	**X**	
7.2	**Disc Filter**	Daily	Weekly
a)	Log backwash pressure	**X**	
b)	Check frequency of backwash is within correct range		**X**
c)	Check bypass is not working during normal operations	**X**	
d)	Check depth in and out of the drum for normal operation	**X**	
e)	Check drum is rotating in correct mode and sounds normal	**X**	
f)	Check all ancillaries are operating normally	**X**	
g)	Log flows and flow rate where meters are fitted	**X**	
h)	Sample and record turbidity on feed (compare with final effluent)	**X**	
i)	Inspect inside filter for large pieces of debris		**X**
j)	Check for accumulation of weed in backwash trough		**X**
k)	Check and clean backwash water strainer.		**X**
l)	Check for soundness of mesh panels by lifting inspection panels		**X**
m)	Check wash water pressure and nozzles for normal operation		**X**
8	**Raw Sludge Holding & Thickening**		
8.1	**Sludge Holding Tanks**	Daily	Weekly
a)	Check mixing regime is correct	**X**	
b)	Log levels in tank(s)	**X**	
c)	Decant liquors	**X**	
d)	Check tank(s) for ragging and blockages and clear or remove (where safe access is possible)	**X**	
e)	Check that holes on sludge cage(s) are clear where fitted, Clean sludge cage(s) dewatering holes (where safe access is possible)	**X**	
f)	Log tanker movements and compare with schedule	**X**	

ID	Instruction	Daily	Weekly
g)	Ensure any crust build up does not interfere with any control equipment/alarm floats	X	
8.2	Picket Fence Thickener	Daily	Weekly
a)	Check fence is rotating & “stop, look, listen,” for mechanical issues.	X	
b)	Check weir overflow quality and the surface of the unit. Clear any buildup of debris	X	
c)	Log blanket measurements / pump timers	X	
d)	Sample from discharge pump (run manually if necessary) and assess product quality. Sample, analyse and record % dry solids entering the PFT. Sample, analyse and record % dry solids out (Monday, Wednesday, Friday)	X	
e)	Check control system is operating normally	X	
f)	Log any changes to settings or duty	X	
g)	Log sludge flows in (where meters fitted) and out	X	
h)	Visually assess the dry solids & flow entering the PFT	X	
i)	Log hours run meters	X	
j)	Remove buildup of debris on the rake	X	
8.3	Belt Thickeners	Daily	Weekly
a)	Check for good floc formation. Check sludge on the top belt and assess the conditioning of the sludge. Check belt drainage and filtrate quality	X	
b)	Check product quality & quantity. Check condition of hopper	X	
c)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action.	X	
d)	Sample, analyse & record % Dry Solids on feed and sludge/cake (Monday, Wednesday, Friday)	X	
e)	Check sludge feed rate and log	X	
f)	Check poly dosing system. Log polymer usage, note each bag change/delivery. Make adjustments to optimise	X	
g)	Ensure wash water pressure is available at a minimum of 6 bar	X	
h)	Clean belt steering paddles and check they are functioning correctly	X	
i)	Clean hopper level probes and check they are functioning correctly	X	
j)	Wash Station - Check formation of spraying fans, rotate internal brush to clean spray nozzles. (Minimum twice daily)	X	
k)	Visual Check - Hydraulic Power Pack - Check oil level and top up using clean equipment and fresh oil as required, maintain as close	X	

ID	Instruction	Daily	Weekly
	to full level as possible. Oil level must not be allowed to fall below 3/4 as this will cause serious damage		
l)	Jet wash clean the belt filter.	**X**	
m)	Use low pressure water hose to clean complete machine, frame, rollers and hoppers.	**X**	
n)	Check condition of Belt Filter for blinding / blockages / good filtration	**X**	
o)	High pressure steam clean the belt from underside.		**X**
p)	High pressure steam clean complete machine, frame rollers and hoppers avoiding all electrical and instrumentation equipment		**X**
q)	Check condition of Belt Filter for wear i.e. Creasing / condition of seam to avoid failure / breakage and damage to other components		**X**
8.4	**Drum Thickeners**	Daily	Weekly
a)	Check for good floc formation. Check sludge feed rate. Check product thickness (visually). Check filtrate quality	**X**	
b)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action.	**X**	
c)	Sample for % dry solids analysis and record (Monday, Wednesday, Friday)	**X**	
d)	Check spray bar nozzles to ensure they are clear and spraying correctly. Check spray bar wash water pressure	**X**	
e)	Clean probes in discharge hopper, hose down and carry out cleaning duties	**X**	
f)	Log polyelectrolyte used – each drum/bag change	**X**	
g)	Log sludge inlet flow meter, monitor throughput	**X**	
h)	Check & clean flocculator tanks		**X**
i)	Check appearance of mesh, adjust cleaning and cleaning pause intervals if necessary.	**X**	
j)	Clean dry solids monitors sensors		**X**
k)	Clean foot valves on washwater suction lines		**X**
l)	Clean mechanical filter on washwater booster set		**X**
m)	Clean washwater booster secondary screen in channel		**X**
n)	Jet/remove fat deposits from thickened sludge discharge pipework		**X**
o)	Log hours run		**X**
9	**Odour Control**	**Daily**	**Weekly**
	Tasks for all Odour Control Units		

ID	Instruction	Daily	Weekly
a)	Check covers, hatches and doors are closed	**X**	
b)	Confirm duty fan running and standby fan availability	**X**	
c)	Check damper position to ensure they have not been tampered with	**X**	
d)	Check ductwork for any signs of damage or leaks	**X**	
	Specific tasks for Biofilter OCU		
e)	Check the spray pattern from the irrigation nozzles and clean nozzles where required. (If possible)	**X**	
f)	Check for free discharge of effluent water to drain	**X**	
g)	Check for free discharge on any condensate removal points	**X**	
	Specific tasks for Chemical Scrubber OCU		
h)	Check water softener availability, check salt reservoir level, and top up if required.	**X**	
i)	Check stocks in bulk chemical tanks and reorder if required – tanker delivery	**X**	
j)	Check that the Redox and pH are within the agreed range – on dosing skid	**X**	
k)	Check duty and standby dosing pumps are available for each bulk chemical	**X**	
l)	Check the duty scrubber liquor recirculation pump is running and the standby is available in auto	**X**	
m)	Check that there is free drainage of scrubber blow-down liquor to drain	**X**	
n)	Check differential pressure gauges are within design range (if fitted)	**X**	
o)	General check for leaks in the scrubber liquor recirculation and dosing system – raise follow on work if any defects are identified	**X**	
	Specific tasks for Carbon OCU		
p)	Examine ductwork for any signs of damage or leaks and check trapped condensate drains are free flowing. If a manual drain valve is provided, operate the valve until the flow of condensate ceases and leave valve in closed position.	**X**	
q)	Check differential pressure gauge for over-pressure (if provided) – indicates media fouling	**X**	
10	**On Site Pumping**	Daily	Weekly
a)	Pumping System(s) (Drainage, Interstage, Washwater, Recirculation, Return Liquors etc.) operating correctly?	**X**	

ID	Instruction	Daily	Weekly
b)	Check Ammeter reading - too high could indicate a blockage. Too low could indicate an air lock or impeller damage.	**X**	
c)	Check the well level is within the normal operating limits - taking into account the flow conditions at the time. If level is too low or high, this could indicate control issues or pumping issues.		
d)	Check condition of the wet well- does it have more than the usual scum or debris floating on top that will indicate the need for a wet well clean?		
e)	Check fault light(s) are not on	**X**	
f)	Check flow rate (where meter is fitted); is it within the normal operating range?	**X**	
g)	Check for undue pump noise and vibration by safely touching the lifting chain or guide rail.	**X**	
h)	Check non-return valve. Non return valves prevent water from flowing back through the pump when it is not in operation. If a weighted arm is fitted, is it at the usual angle? If it is low and chattering it could indicate the pump is blocked	**X**	
i)	Check operation of the ultrasonic level gauge. Is it reading correctly? Compare the well level with the normal readout from the display.	**X**	
j)	Check pumps, pipelines and couplings for leaks. Check for visible leaks.	**X**	
k)	Start the cleaning cycle manually where required	**X**	
l)	Pumps - Log hours run	**X**	
m)	Pumps - Log kWhrs	**X**	
n)	Check hard wired control floats - are floats weighed down with rag or debris preventing them from lifting if the water level rises.	**X**	
o)	**Washwater Pumping** - Check the pipe line pressure from a gauge (where installed) on the pressure vessel or the pipe line manifold. Possible indication of strainer blockage	**X**	
p)	**Washwater Pumping** - Check operation of surge vessels (where installed).	**X**	
q)	**Washwater Pumping** - Check the strainers. If necessary, put automatic strainers in manual clean and inspect the manual strainers where local conditions allow.	**X**	
r)	**Washwater Pumping** - Check automatic filters are operating correctly	**X**	
11	**Distribution Chambers**	Daily	Weekly

ID	Instruction	Daily	Weekly
a)	Inspect all weirs and brush clean. Remove any debris, scum, algal growth, blanket weed, grit, etc. from the chamber. Check flow split is correct.	**X**	
b)	Ensure any rag is removed, especially from around the penstocks, gate valves and their spindles. Ensure none of this passes over the weir.	**X**	
c)	Check that all valve, penstock and weir operating positions are correctly set.	**X**	
d)	Check chamber for any visible leaks	**X**	

Appendix 6. Sludge Rounds

	Instruction	Daily	Weekly
1	**Liquid Sludge Import Facilities**	Daily	Weekly
a)	Check sludge logger device is fully operational	**X**	
b)	Check that the pattern of imports is in line with site requirements/agreement with tanker operators.	**X**	
c)	Check general area is clean and tidy	**X**	
d)	Check reception tank for rag/grit build up		**X**
2	**Sludge Screen**	Daily	Weekly
a)	Check sludge screen operation	**X**	
b)	Check screened sludge quality	**X**	
c)	Check / clean moisture sensor	**X**	
d)	Visually check unit and its associated equipment for the following: Safety & security with all panels locked & guards secure and in good condition. Excessive noise or vibration Overheating External damage, leaks, missing fixings	**X**	
e)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action to replace them if needed. Inspect grease pots and fill them when level is below the standard. Use grease nipples to lubricate required parts of screen.	**X**	
f)	Carry out checks on cold weather operation systems before frost sets in	**X**	
g)	Check screenings quality & quantity		**X**
h)	Check general area is clean and tidy		**X**
i)	Check washwater is operating correctly during period of sludge discharge Ensure wash water pressure of spray bar is correct. Check the inline filter is present, clean and feeding the spray bars (where applicable). Check the spray bar pattern and clean the spray bar nozzles as required.		**X**
j)	Clean steel probes on rotamat screen		**X**

	Instruction	Daily	Weekly
3	**Sludge Buffer & Blending Tanks** "Sludge Blending Tank" refers to a tank, into which more than one type of sludge is fed, requiring mixing: normally immediately prior to sludge digestion or dewatering. It may on some sites be referred to as a sludge holding tank or digester feed tank.	Daily	Weekly
a)	Check that mixer is operating correctly. Mixers are normally inhibited if the sludge level falls below a set level to protect the impellor, pump or blower.	**X**	
b)	Check for signs of stratification or poor mixing and rectify where necessary	**X**	
c)	Check pH and if less than 5 attempt to reduce septicity and freshen sludge	**X**	
d)	Check for ragging and blockages and clear or remove (where safe access is possible)	**X**	
e)	Check amps on mixer motor		**X**
f)	Check tank control system		**X**
4	**Sludge Treatment Inter Process Pumping**	Daily	Weekly
a)	Check Ammeter reading, Too high could indicate a blockage. Too low could indicate an air lock or impeller damage. Where reading is unusual ensure appropriate action is taken.	**X**	
b)	Check flow rate (where meter is fitted); Is it within the normal operating range?	**X**	
c)	Check the well level is within the normal operating limits taking into account the flow conditions at the time. If level is too low or high, this could indicate control issues or pumping issues.	**X**	
d)	Check operation of the ultrasonic level gauge. Is it reading correctly? Compare the well level with the normal readout from the display.	**X**	
e)	Listen for undue pump noise and check for undue vibration by safely touching the lifting chain or guide rail.	**X**	
f)	Check pumps, pipelines and couplings for visible leaks	**X**	
g)	Check non-return valve is operating correctly Non return valves prevent water from flowing back through the pump when it is not in operation. If a weighted arm is fitted is it at the usual angle?	**X**	

	Instruction	Daily	Weekly
	If it is low and chattering it could indicate the pump is blocked.		
5	**Pasteurisation**	Daily	Weekly
a)	Check batch rates according to sludge levels	**X**	
b)	Check digester temperatures in relation to pasteurisation plant	**X**	
c)	Check hmi panel	**X**	
d)	Check operation of biotherm reactor aeration blower package.	**X**	
e)	Check heat exchanger performance	**X**	
f)	Check digested sludge buffer tanks	**X**	
g)	Check blended sludge buffer tanks	**X**	
h)	Check operation of biotherm reactor mixer	**X**	
i)	Check operation of heat exchanger mixer	**X**	
j)	Check operation of scum cutter	**X**	
k)	Check pump and valve operation	**X**	
l)	Log and record flows, pressures and temperatures	**X**	
m)	Check % ds of feed sludge to pasteurisation plant (Monday, Wednesday, Friday)	**X**	
n)	Check, remove and clean temperature probe		**X**
6	**Primary Sludge Digestion**	Daily	Weekly
a)	Check sludge discharge to limpet chambers, where installed. Clear any blockages	**X**	
b)	Check digester feed system is working Clear any blockages	**X**	
c)	Check digester heating system is working & temperatures are within HACCP range.	**X**	
d)	Check digester mixing system is operating correctly	**X**	
e)	Log digester temperatures (HACCP) Log inlet and outlet temperatures of each boiler Log inlet and outlet temperatures of sludge and water in heat exchangers	**X**	
f)	Log sludge feed volumes into each digester and establish the retention time (HACCP)	**X**	
g)	Check operation of sludge and water recirculation pumps Check pumps, pipelines and couplings for leaks where possible.	**X**	

	Instruction	Daily	Weekly
h)	Monitor water supply where glycol is not used to heat exchanges that are exposed to elements, Ensure water is drained when heat exchanges are not in use.	X	
i)	Log use of secondary fuel within boilers.	X	
j)	Sample sludge into and out of digester. Analyse and record % dry solids. (Monday, Wednesday, Friday.) Analyse and record % volatile matter. (3 times a week Monday – Thursday)	X	
k)	Check digesters for foaming on the top.		X
l)	Remove grit from base of digester if facility is provided. **Do not** leave grit removal operation unattended and ensure valve is fully closed before leaving task.		X
m)	Sample, measure and record pH of digested sludge		X
7	**Secondary Sludge Digestion**	Daily	Weekly
a)	Check mixing system, for short-circuiting or separation, Mix before transfer to the next process, where facilities exist	X	
b)	Decant supernatant liquor when required	X	
c)	Log status of each tank	X	
d)	Record number of day's storage	X	
8	**Biogas Handling, Storage, & Utilisation.**	Daily	Weekly
a)	Check all condensate traps manually and drain or top up if necessary. This check is required **twice daily** in prolonged periods of warm weather. Check automatic u-tubes visually, to ensure that there are no gas leaks or freezing Check automatic drain traps working correctly. Use manual drains if automatic drains not working, report defects	X	
b)	Check glycol pressure relief valve and ensure liquid level visible in sight glass	X	
c)	Check pressure/vacuum relief (whessoe) valves are not passing biogas. Listen for gas passing, note any unusual smell, visual check of valve.	X	
d)	Check for genuine operation of flare stack / waste gas burner, e.g. chp is at full power and there is excessive gas make	X	
e)	Check and record dehumidifier temperature	X	
f)	Log gas volumes: produced, flared, to chp, to boilers	X	

	Instruction	Daily	Weekly
g)	Sample, monitor & record methane composition of biogas	X	
h)	Manually check gas isolation valve handle operation by closing & opening valve.		X
9	**CHP & Biogas Power Management**	Daily	Weekly
a)	Check automatic drain traps working correctly. Use manual drains if automatic drains not working, report defects	X	
b)	Check for genuine operation of flare stack / waste gas burner, e.g. CHP is at full power and there is excessive gas make	X	
c)	Check glycol pressure relief valve and ensure liquid level visible in sight glass	X	
d)	Check & log hours run	X	
e)	Check & log kwh exported (where relevant)	X	
f)	Check & log kwh generated	X	
g)	Check & log kwh used on site	X	
h)	Check & log use of secondary fuel	X	
i)	Check & log gas used	X	
j)	Check & log heat liberated from engine, heat dumped, heat liberated from boilers	X	
k)	Check & log engine temperatures and pressures, by exception	X	
l)	Check & log gas stream for methane composition		X
m)	Check automatic u-tubes to ensure that there are no gas leaks or freezing		X
n)	Check pressure/vacuum relief (whessoe) valves are not passing biogas. Listen for gas passing, note any unusual smell, visual check of valve.	X	
10	**Liquor Treatment**	Daily	Weekly
a)	Check return liquors and return rate	X	
11	**Chemical Dosing**	Daily	Weekly
a)	Check that chemical is discharging, not just dosing pump running (any nozzles blocked?)	X	
b)	Check chemical storage tank level - reorder as required	X	
c)	Check for excessive vibration in the dosing pump	X	
d)	Check the level in the internal bund and empty as required	X	
e)	Check for leaks on visible chemical lines	X	

	Instruction	Daily	Weekly
f)	Check the trace heating system	X	
g)	Check external storage tank bund for rainwater and/or chemical. Empty as appropriate.		X
h)	Check the correct amount of chemical is being delivered for the conditions		X
i)	Check storage tank can take delivery before delivering		X
12	**Sludge Dewatering – Belt Press**	Daily	Weekly
a)	Check poly dosing system, Log polymer usage, note each bag change/delivery, Make adjustments to optimize	X	-
b)	Check sludge feed rate and log	X	
c)	Check sludge on the top belt and assess the conditioning of the sludge, Check belt drainage and filtrate quality	X	
d)	Check product quality & quantity, Check condition of stockpile	X	
e)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action.	X	
f)	Ensure wash water pressure is available at a minimum of 6 bar	X	
g)	Clean belt steering paddles and check they are functioning correctly	X	
h)	Clean hopper level probes and check they are functioning correctly	X	
i)	Wash station - check formation of spraying fans, rotate internal brush to clean spray nozzles. (minimum twice daily)	X	
j)	Visual Check - Hydraulic power pack - check oil level top up using clean equipment and fresh oil as required, maintain as close to full level as possible. Oil level must not be allowed to fall below 3/4 as this will cause serious damage	X	
k)	Jet wash clean the belt filter.	X	
l)	Use low pressure water hose to clean complete machine, frame, rollers and hoppers.	X	
m)	Check condition of belt filter for blinding / blockages / good filtration	X	
n)	Steering flaps - check condition and correct operation for activation of the hydraulic steering mechanism and check for wear and replace as required	X	
o)	Sample, analyse & record % dry solids on feed and cake, (Monday, Wednesday, Friday)	X	
p)	High pressure steam clean the belt from underside.		X

	Instruction	Daily	Weekly
q)	High pressure steam clean complete machine, frame rollers and hoppers avoiding all electrical and instrumentation equipment		X
r)	Check condition of belt filter for wear i.e. Creasing / condition of seam to avoid failure / breakage and damage to other components		X
13	**Sludge Dewatering – Centrifuge**	Daily	Weekly
a)	Check condition of stockpile, Check quality of product	X	
b)	Check kwh, amps and hours run	X	
c)	Check poly dosing system	X	
d)	Check quality of centrate	X	
e)	Check sludge feed rate, Check quality of product in feed	X	
f)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action.	X	
g)	Log hours run	X	
h)	Log kwh hours run	X	
i)	Log polymer usage, note each bag change/delivery	X	
j)	Log sludge flow rate	X	
k)	Log volume of cake produced	X	
l)	Make adjustments to get optimum throughput, product quality and poly dosing	X	
m)	Sample, analyse & record % dry solids on feed and cake (Monday, Wednesday, Friday)	X	
14	**Poly Make Up, Storage, & Dosing – Liquid**	Daily	Weekly
a)	Poly make up storage & dosing – liquid - check supply of polymer held in IBC; Top up, replace, order as appropriate	X	
b)	Liquid - check dosing pumps & settings	X	
c)	Liquid - check dilution water is available	X	
d)	Liquid - clean up any spillages of liquid	X	
e)	Liquid - log usage of polymer i.e. IBCs level	X	
f)	Liquid - log settings of dosing pumps	X	
g)	Liquid - log type of polymer	X	
h)	Liquid - check polymer flowmeter pressure – if above 3 bar clean filter and mixer		X

	Instruction	Daily	Weekly
i)	Liquid - check made up solution appears ok	X	
j)	Liquid - check bunded area for spillages	X	
15	**Poly Make Up, Storage, & Dosing – Powder**	Daily	Weekly
a)	Dry powder - check dosing pumps & settings	X	
b)	Dry powder - check supply of polymer held in silo; Top up, replace, order as appropriate	X	
c)	Dry powder - check bunded area for spillages	X	
d)	Dry powder - check dilution water	X	
e)	Dry powder - check dry room / silo is heated, dry and doors are closed	X	
f)	Dry powder - check made up solution appears ok	X	
g)	Dry powder - check polymer is dry and flowing, look at screw drive and discharge to wetted head – "JETWET"	X	
h)	Dry powder - clean up any spillages	X	
i)	Dry powder - log settings of dosing pumps	X	
j)	Dry powder - log type of polymer, check using correct polymer.	X	
k)	Dry powder - log usage of polymer i.e. bags used	X	
l)	Dry powder - check polymer flowmeter pressure – if above 3 bar clean filter and mixer		X
16	**Sludge Cake Transfer**	Daily	Weekly
a)	Visually check auto lubrication systems (grease pot) are functioning correctly, take appropriate action.	X	
b)	Check conveyor rollers & keep clear	X	
c)	Check drive bearings for wear & operation	X	
d)	Check electric trip wire emergency stop wire	X	
e)	Keep general area clean. Clear up any spillages	X	
f)	Check belt condition	X	
17	**Sludge Cake Storage**	Daily	Weekly
a)	Ensure silo not filled above 70% capacity. Inform Bio-recycling of any changes to sludge production.	X	
b)	Keep general area clean to minimise odour	X	
c)	Log & record each storage pad bay activity and status if applicable	X	

	Instruction	Daily	Weekly
d)	Check wheel wash is operational	X	

Appendix 7 Sniff Testing Procedure

Odour sniff testing protocol:

Purpose

Sniff testing is conducted to assist in managing odours to prevent or minimise the risk of adverse odour impact offsite.

Frequency

The procedure is to be undertaken in response to complaints or if a risk of odour nuisance at sensitive receptors is expected and/or has been substantiated.

Pre-requisites for the assessor

The assessment is undertaken by a member of staff trained in the procedure. The assessment in response to complaints will normally be carried out by someone not based on site. The member of staff will normally be office based rather than operations based. This means that their senses are less likely to become affected by any site odours.

Assessors must comply with the following:

- They should not consume strongly flavoured food or drink (this includes coffee) at least half an hour before conducting the assessment.
- They should not smoke at least half an hour before conducting the assessment.
- They should not consume confectionary or soft drinks must be avoided for the duration of the assessment.
- Scented toiletries including perfume, deodorant or aftershave should not be applied less than an hour before conducting the assessment.
- If the assessment requires travelling between locations in a vehicle, this vehicle must not contain deodorises / air fresheners.
- If the assessor has a cold, sore throat, or sinus trouble they should not conduct the assessment.

Prior to the commencement of the inspection, the operator shall check the weather data including the wind direction, wind speed, temperature and rainfall.

Odour complaint investigation

Where possible, odour complaints will be actively investigated by an assessor. Timely receipt of a complaint is essential if such investigations are to have any value.

At each location the following procedure is undertaken:

a. The assessor will stand facing the wind and breathe deeply, for a period of 3-5 minutes.

b. The following information is recorded using the odour monitoring form.

   i. Time, wind speed and direction, temperature, precipitation.

   ii. The type of any odour(s) detected.

   iii. The intensity of any odours detected on a scale of 0 to 6.

   iv. The persistence of the any odours detected i.e. constant or intermittent.

   v. The likely source of any odours detected (e.g. a specified onsite IED source, a specified non IED sources, offsite odour source, etc).

   vi. Any abnormal conditions on site that may account for the odour e.g. broken duct, open door, unusual operation, spillage etc.

The pre-requisites for assessors and monitoring approach are as defined in the sniff testing procedure with the following exceptions:

- The first assessment should be conducted at the complainant's location.
- If site odours are detected, the assessor shall move back towards the site, assessing potential odour sources within the Urban Waste Water Treatment (UWWT) and Sludge Treatment Centre (STC) processes and attempt to trace the odour to its source.
- On site operations shall also be reviewed to identify any abnormal site operations or activities that could be responsible for elevated odour levels.
- The sensitivity of the offsite location to odours should be recorded as a comment.

The findings of the investigation should be reported back to the Thames Customer Services Centre so that feed-back can be provided to the complainant.

Odour monitoring form

Date: _____ Assessor name: _____

Time	Location	Receptor sensitivity (off site locations only)	Wind speed & direction	Temperature (degrees)	Rainfall (y/n)	Odours detected (description)	Intensity (0 – 6)	Persistence (intermittent / constant)	Perceived source	Other comments

Intensity			**Receptor Sensitivity**
1 Very faint odour	3 Distinct odour	5 Very strong odour	Low (e.g. footpath, road)
2 Faint odour	4 Strong odour	6 Extremely strong odour	Medium (e.g. industrial or commercial workplace)
			High (e.g. housing, pub/hotel etc.)

------- End of OMP ---