Construction Environmental Management Plan

Gas Collection System and Flare Installation for Existing Landfill Site

Penrith Landfill, Mulgoa Road, Mulgoa

Penrith Waste Services

July 2021

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Project Name: Gas Collection System and Flare Installation for Existing Landfill Site

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Client: Penrith Waste Services

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1 Introduction

Biogas Systems Australia (BSA) has been contracted by Penrith Waste Services (PWS) to design, install and operate a landfill gas extraction and combustion system at the Mulgoa Road landfill. The site consists of two parcels of land which are located at 842 Mulgoa Road (Lot 201 DP 804405) and 844-848 Mulgoa Road (Lot 22 DP537922).

On Lot 201, a gas extraction system (GCS) and 500 m^3/hour flare unit is proposed to be constructed. The construction is part of a proposed Development Application and is part of ongoing landfill management operations. The purpose of the system is to control potential off-site gas migration and generate carbon credits. The proposed GCS layout and flare details are in Appendix A. Details of the GCS and flare have been provided in a previous document (BSA, 2019).

This Construction Environmental Management Plan (CEMP) outlines measures to mitigate environmental or nuisance impacts during construction of a Gas Collection System (GCS) and flare at the Penrith Landfill. The CEMP details monitoring requirements, roles, responsibilities and reporting requirements.

1.1 Objective of this CEMP

The objective of the CEMP is to provide specific project details to supplement the development application for Construction Consent (CC) presented to the NSW Government Department of Planning, Industry and Environment.

This Construction Environmental Management Plan (CEMP) and Waste Management Plan (WMP) sub-plan have been prepared to outline and describe how Biogas Systems will, during their site works, comply with the project management recommendations and relevant legislation. This CEMP describes how Biogas Systems will minimise the environmental risks and achieve environmental outcomes for the project by providing a structured approach to ensure appropriate environmental control measures are implemented. Furthermore, Biogas Systems is committed to ongoing environmental protection and ecologically sustainable development.

This CEMP will be available to all personnel and sub-contractors via the project document control management system. The document is uncontrolled when printed. One controlled hard copy of the CEMP and supporting documentation will be maintained by the project manager at the project office.

1.2 Revisions and Amendment

A document review process is implemented to ensure that environmental documentation, including this CEMP and sub-plans are updated as appropriate for the specific works that are occurring on-site.

1.3 Changes to the Project

Any changes in scope of works must be communicated to Biogas Systems project management team. The project management team will then carry out an additional environmental assessment in consultation with Penrith Waste Services (the 'Principal') to determine if any project modification and/or environmental management processes may be required.

2 Site Overview

2.1 Location

The GCS and flare system will be constructed at 842 Mulgoa Road, Mulgoa. The site is identified as Lot 201 deposited plan 804405. A summary of site details is presented in Table 2.1.

Table 2.1 – Site Details

Item	Description
Site name and address	Mulgoa Road Landfill
Real property description	Lot 201 Deposited Plan 804405
Current site owner	Penrith Waste Services
Operational timeframe	1960s to present
Area	25.46 ha
Volume	344 250 tonnes (Approximately 350 000 m^3)
Waste composition	Non- putrescible wastes, construction and demolition and commercial and industrial

2.2 Surrounding Land Use

The land use of the surrounding area is summarised in Table 2.2 below.

Table 2.2 - Surrounding Land Uses

Direction	Use
North	Rural land
South	Rural land and residential dwellings approximately 300 m to the south
East	Rural land and residential dwellings 500 m to the east
West	Nepean Christian School

2.3 Site History and Management

This section summarises the site history presented in previous reports (CES, 2011) (APP, 2009). Shale extraction and waste disposal has been undertaken on Lot 201 since the 1960s. The site has been used for disposal of commercial and industrial wastes as well as commercial and demolition wastes. Prior to 1990 the operation was owned and operated E. Kelly Pty Ltd who carried out extractive operations for a period of over 30 years. Since 1990, the site has been owned and operated by PWS as a Class 2 Solid Waste Landfill site under a licence (licence no. 3438) issued under the Protection of the Environment Operations Act 1997.

2.4 Environment Protection Licence

An Environment Protection Licence (EPL) 3438 is active for the site. The EPL outlines monitoring requirements, maximum scale and load limit for contaminants relating to these activities. The EPL is active for the following scheduled activities:

1. Waste disposal (application to land)
2. Waste storage

In addition to these activities, the EPL addresses gas, leachate, surface water and groundwater monitoring and reporting requirements for the landfill.

3 Environmental Setting

A summary of the key information from previous reports (CES, 2011 and APP, 2009) is provided in the following sections.

3.1 Regional Geology

Sydney is broadly divisible into two main geomorphological units, these being the central Cumberland Plain and elevated sandstone plateaux to the north, south, west and east. The site lies on the western margin of the Cumberland Plain, a low lying, undulating shale landscape composed of the Triassic Wianamatta Group. These rocks were deposited on a broad, low lying coastal plain between 190 and 225 million years ago.

3.2 Site Specific Geology

The site is underlain by rocks belonging to the Bringelly Shale formation, a member of the Wianamatta Group. The Bringelly Shale is more than 50 m thick at Mulgoa Landfill and is underlain by the Triassic Hawkesbury Sandstone Formation. There are no known faults or lineaments in the surrounding geology at the site.

Remnant natural soils at the site are shallow to moderately deep (up to 1 m) red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and drainage lines. The dominant soil material is friable brown to black loam (up to 30 cm deep) overlying 10 to 20 cm of hard setting brown clay and up to 90 cm of strongly pedal, mottled brown clay. The total soil depth is less than 1 m. Soils are infertile and hard setting with low permeability and low water holding capacity. The soils are moderately erodible.

3.3 Hydrology and Hydrogeology

The hydraulic conductivity of the Bringelly Shale at Mulgoa Landfill is of the order of 10-8-1m s. Low hydraulic conductivity coupled with low hydraulic gradients (<0.02) result in low regional groundwater flow velocities. The general groundwater flow direction at the site is from the southwest to northeast. The absence of continuous faults or lineaments at the landfill further reduces the potential for groundwater migration from the site.

Groundwater associated with the Wianamatta Shale is characterised by naturally high salinity and ammonia concentrations. Naturally occurring high levels of these parameters reflect the deposition of organic-rich sediment in low energy coastal environments and may be incorrectly attributed to leachate contamination.

3.4 Landfill Gas

A baseline estimate for the total abatement from the Site (BSA, 2018) has found that a sustainable flow of landfill gas (LFG) from 12 or 16 wells will yield between 65000 to 85000 T/CO_2e.

4 Summary of Proposed Work

The GCS is comprised of wells and pipe laid beneath the surface of the site, connected to a high temperature enclosed flare. The GCS will utilise the natural gradient of the site to dewater condensate from the gas flow lines.

In summary, the initial design and construction will include the following:

- Installation of up to 24 gas extraction wells in the waste mass, drilled with a 450 mm diameter auger on a tracked piling rig. Spoil generated from drilling to be held in designated skips and disposed of each day off-site at a licenced waste facility.
- Installation of 90 mm flow lines to reticulate LFG from extraction wells to the flare system via the main header line.
- Main header line to consist of 160 mm pipe.
- Trenches are to be dug with an excavator, with remedial works to re-seal compacted clay cap over pipe trenching each day.
- Each well will have individual control and measurement of gas flow, pressure, and composition.
- In-line barometric condensate traps installed to remove any condensate build up within the main header line close to flare.
- Installation of a 150 m^3/h capacity High Temperature (HT) Lo-Cal enclosed ground flare powered by on-site three phase power supply.
- The flare will have automatic shutdown, restart with remote dial in telemetry.
- Commissioning and testing GCS and flare to ensure pressure testing of GCS and flare to meet performance requirements.
- Fencing enclosing the flare for security purposes.
- Construction Quality Assurance reporting.
- Operations and maintenance.
- Monthly reporting.

Detail of the GCS layout and components are presented in Appendix A.

5 Gas Collection System and Flare System Construction Quality Assurance

Construction shall employ proven techniques to ensure a well-built system, and a construction quality assurance (CQA) program shall be implemented to make sure that the system is built in accordance with the required design considerations (such as pipe slopes and well depths). Field engineering decisions will need to be made in some instances to account for unforeseen conditions at the time of construction.

Before construction begins, a professional surveyor shall stake out each well and collection piping routes. The surveyed elevations and well identification numbers shall be recorded (and assigned) and written on stakes positioned at each well location.

A qualified CQA engineer/scientist shall be present during construction to provide CQA to monitor and document the techniques used. Typically, the first step in construction of a GCS is drilling the vertical wells. As the driller gets set to drill each well, the designated CQA engineer/scientist shall verify the elevation and depth of the well to avoid drilling through the base of the landfill. Drill logs will be recorded for each well, using the template, SF4.02 (Appendix B).

The CQA engineer/scientist shall keep accurate records of the pipe depth, pipe location, and the location of special fittings such as tees that mark where a lateral pipe is joined to the header. Other important structures such as condensate traps or condensate sumps shall be documented on the as-built drawings to include any deviations from the design plan. Installation inspections will be recorded using an Inspection Test Plan (ITP) template, SF 4.01 (Appendix B).

The flare supplier and CQA engineer/scientist will carry out operational checks (Table 5.1) prior to the Air Emission Contractor taking samples (see following section). These commissioning checks will be recorded using the Flare Commissioning Report template, SF 8.11 (Appendix B).

Table 5.1 – Summary of Commissioning Checks

Item	Factors involved	Checks	Comments
Flare operational requirements	Flame/combustion process	Yes	Temperature, excess air and retention time
	Maintenance record	Yes	Available for inspection
	Operations manual	Yes	Available for use
	Operator training	Yes	Competent personnel on-call
	General condition	Yes	Is the system fully operational
Extraction system	Well balancing	Yes	Effective balancing will be evident from gas quality and site records. Well balancing must be carried out by technically competent and trained staff
	Oxygen content	O_2 at acceptable concentration	High O_2 implies a leaking system or over-extraction.
	General condition	Yes	Is the system operational
	Liquid in gas collection pipework	No	Condensate blockages characterised by a “sloshing” sound and indicated by rapid fluctuations in gas flow rate, temperature and increasing negative pressure

Item	Factors involved	Checks	Comments
Site operational requirements	Is the well installation programme designed to control migration effectively?	Yes	
	Do the extraction system and its operation meet the requirements of site licence?	Yes	Insufficient or poorly installed wells may meet the letter, but not the intention, of a licence
	Are the operating instructions available for use by the operators?	Yes	
	Is the emission standard being achieved	Yes	Instrumental monitoring for verification
Environmental compliance	Are there odours?	No	
	Monitoring records of inlet and outlet gas quality		Available for inspection and up-to-date, complete with regular written reviews
	Is the surrounding radiative heat excessive?	No	
	Does the flame temperature match the specification?	Yes	
	Can the residence time be ascertained?	No	
	Are there low-temperature spots within the chamber?		Within the section designated as meeting the design requirement
	Is casual access by the public prevented?	Yes	
Health and safety	Are clear instructions on how to stop and isolate the unit readily available?	Yes	
	Are emissions monitoring requirements being complied with?	Yes	
	Is the type and design of flare suitable for the location?	Yes	
	Are emergency procedures in place and effectively disseminated and understood?	Yes	

5.1 Emission Testing

Following on-site commissioning, a National Association of Testing Authorities (NATA) accredited Contractor will undertake the compliance emission monitoring. The NATA contractor will be independent of the Site Owners.

- Testing procedures are NATA accredited in accordance with ISO/IEC 17025 and AS4323.1.
- NATA accreditation number recorded.

- Principal and senior level technicians accredited under The American Source Evaluation Society's QSTI program.

The initial program of testing shall be annually subject to passing all compliance tests.

5.2 Post Construction Phase

5.2.1 Monitoring

The flaring system shall operate on a continuous basis, or as required. Site conditions are expected to change over time and the rate of LFG extraction will vary temporally and across locations within the waste mass. These changes shall require periodic monitoring and adjustment of the vacuum applied to each gas extraction well to:

- Maintain or increase collection efficiency.
- Prevent excessive vacuum application.
- Minimize the potential migration of LFG.
- Optimise flare combustion and potential shutdowns.

Monitoring will detect undesirable subsurface combustion that can result if excessive vacuum is applied to the wellfield (introducing oxygen into the waste mass). Monitoring shall be conducted at sufficient frequency to promote optimal system operation and to allow for effective system maintenance. System monitoring shall involve examining LFG conditions at the wellheads and the waste mass surface. Wellhead monitoring parameters shall include:

- Volumetric flow rate and vacuum.
- Methane, carbon dioxide oxygen, balance gas concentration (%v/v), carbon monoxide and hydrogen sulphide.

Measurements of carbon monoxide and hydrogen sulphide will be recorded to provide information about the potential for subsurface fires as well as the corrosive potential of the LFG to subsurface materials. Effective system operation will generally be expected to fall within the following approximate monitored ranges:

- Methane: 20 to 60%v/v.
- Oxygen: up to 10%v/v (depending on extraction effort).
- Carbon monoxide and hydrogen sulphide: less than 100 ppm.

The flare blower shall be regularly monitored for unusual noise, temperature, or excessive vibration. For sustained operation, the flare must receive LFG flow of sufficient methane content before steady-state operation can be attained.

5.2.2 Maintenance

Detailed documentation of scheduled maintenance and GCS management shall be included within the Site GCS Maintenance and Management Plan and shall include a maintenance history of equipment and contain trouble shooting of potential problems. The GCS operation shall depend on effective maintenance, which generally falls into the following categories:

- Planned – Maintenance scheduled at periodic frequencies such as daily, monthly, annual, and multi-year as appropriate to prevent system failure, ensure reliability of meters and optimize operation.

- Routine – Maintenance occurring in the normal course of operation or during regular monitoring efforts.
- Unplanned / Emergency – Not all maintenance is planned. Some maintenance may be required by component failure or in emergencies. The Site GCS Maintenance and Management Plan shall proactively consider failures that will result in emergencies, plan maintenance to enact in these events, and post signage to avoid compounding hazards resulting from system failures. System or equipment failures shall be investigated to determine causes and identify future preventative measures.

Planned maintenance of the flare system includes scheduled inspections of all relevant components of the system to ensure safe, efficient, and reliable operation. Maintenance includes:

- Visual inspection of the flare tips and flare stack for damage or deterioration.
- Inspection of the exterior surface for indications of heat degradation, such as paint discoloration.
- Monthly assessment of the overall integrity of the internal insulation. Tears or wear of the insulation will be repaired if necessary.
- Removal of the flare tip for cleaning if an obstruction is suspected. This includes measurement of the pressure differential between the flare inlet flange and the flare tip exit, and cleaning of tips if necessary.
- Inspection of all thermocouple assemblies and replacement at least yearly.
- Quarterly inspection of the pilot assembly, ignition rod, electrode, and insulators for damage, with repair or replacement if necessary.
- Verification of pilot gas supply pressure and pilot ignition.
- Inspection of the flame detection components and cleaning relevant components.
- Verification of proper operation of the air damper louvers and lubrication if necessary.
- Semi-annual removal and cleaning of the flame arrester element. Measurement of the pressure differential across the element and cleaning, if necessary.

The maintenance technician is responsible for daily operations and maintenance, and scheduled maintenance, such as greasing blowers. The technician will have a copy of the flare operations manual and plans for scheduled servicing and maintenance and will follow those instructions as specified and required.

The LFG flare is to be inspected regularly, as per the manufacturer's recommendations, to ensure that proper service and maintenance is performed to maximize optimum performance. Spare parts are to be kept on-site and made available should they be required. The manufacturer is also available as a contingency measure for additional resources or troubleshooting should they be required.

The GCS is subject to a variety of stresses from the site environment such as system collapse caused by waste settlement, corrosion or aging of materials (including ultraviolet degradation), and damage because of heavy equipment meeting the wells and piping. GCS maintenance activities may include:

- Repair or replacement of damaged wells and valves.
- Removal of leachate and condensate blockages.
- Re-grading or replacement of pipe affected by settlement of the waste mass.

- Replacement of components that have failed because of aging or fatigue.

Major repairs may require the temporary shutdown of the blower and flare system. Blowers are subject to vibration, belt wear, bearing deterioration and seal damage. Wear necessitates regular routine and scheduled maintenance as well as particular attention to sounds during system start-up and shutdowns. Flares are subject to thermal stress that can be exacerbated if the flare is operated at temperatures or flows above manufacturer recommendations. Maintenance generally involves inspecting the flare for heat damage, maintaining pilot fuel and igniters, preventing condensate build-up, and checking the general mechanical condition.

5.2.3 Shutdowns

Planned shutdowns and maintenance will be coordinated to make efficient use of system downtime. System shutdowns may also be unplanned. Shut-down procedures shall be included within the Site GCS Maintenance and Management Plan. Examples of conditions leading to an unplanned shutdown may include the following:

- Insufficient LFG flow to the flare or energy use project. For example, a liquid blockage in the header piping can severely restrict LFG collection.
- Insufficient methane content to the flare. For example, if machinery runs over a wellhead, causing high oxygen and low methane levels in the collected LFG.
- Blower failure. For some sites, care should be exercised to ensure that a complete shutdown (not extracting any LFG) does not result in gas migration.

A contractual obligation will be on the equipment supplier to ensure they can supply and fit a replacement blower unit within 5 days (on catastrophic failure) or 24 to 48 hours on less critical items such as small component failure i.e., UV sensors. Spare components such as sensors are typically kept with the flare and can be changed quickly. Normal attendance on shutdown is 24 hours.

All monitoring, maintenance and shutdowns will be recorded using standard template forms. Monthly GCS monitoring and balancing will be recorded using template form SF 4.03, presented in Appendix B. Flare monitoring and maintenance will use template form, SF 8.10, presented in Appendix B.

6 Environmental Risk Assessment

The following is a list of the key environmental aspects applicable to the management of the site during remediation works:

- Air quality (dust and odour)
- Soil
- Noise
- Vibration
- Water Quality
- Traffic
- Visual
- Waste
- Cultural and heritage
- Flora and fauna
- Asbestos; and
- Access and security.

6.1 Risk Assessment Methodology

The risk assessment is based on a methodology that evaluated potential impacts in terms of consequences and likelihood, that is the consequence on the environment of the potential impact and the likelihood of the potential impact occurring. The application of this risk assessment will allow for the identification of activities that required management/mitigation measures.

The consequence to the environmental of a potential impact will be determined by assess the intensity/severity of the impact, the spatial extent of the impact, and the duration of the impact. These will be assessed according to the ratings represented in Table 6.1. Rating numbers are applied chronologically in relation to the intensity/severity level of the associated impact, i.e., an impact with a rating of 1 has a Low Intensity/Severity and a rating of 5 has a High Intensity/Severity.

Table 6.1 – Determination of the Consequence of a Potential Impact

Intensity/Severity of Impact		Rating
Insignificant	Natural, cultural and/or social function and processes will not be affected by the potential impact. Environmental nuisance. Limited impact to a local area, no long-term effects	1
Low	Localised short to medium term impact to the environment. Environmental nuisance.	2
Moderate	Natural, cultural and/or social function and processes are altered by the potential impact. Material environmental harm.	3
Major	Widespread or off-site release, medium to long term impact. Major financial loss / damage to site. Material to serious environmental harm.	4
Catastrophic	Serious environmental harm, release off-site with detrimental widespread environmental damage	5
Spatial Extent of the Impact		**Rating**
On-site	The impact will occur on site, and there will be no offsite affected.	1
Local	The impact will occur within a 5km radius of the site.	2
Regional	The impact will occur within a 100km radius of the site.	3
National	The impact will occur within the borders of Australia	4
International	The impact will occur have an international effect.	5
Duration of the Impact		**Rating**
On-site	The impact will occur on site, and there will be no offsite affect.	1
Local	The impact will occur within a 5km radius of the site.	2
Regional	The impact will occur within a 100km radius of the site.	3
National	The impact will occur within the borders of Australia.	4

Table 6.2 – Probability of Occurrence of Impact

Probability of Occurrence of Impact		Rating
Rare	The possibility of the impact occurring is very low either because of design or historic experience.	1
Unlikely	Environmental impact could occur at some time	2
Possible	There is a distinct possibility that the impact will occur.	3
Likely	The impact will most likely occur	4
Certain	The impact cannot be considered transient, even when mitigation measures are applied.	5
Frequency of Occurrence of the Impact		**Rating**
Annual/less	The impact will occur at least once in a year.	1
6 months	The impact will occur at least once in 6 months.	2
Monthly	The impact will occur at least once a month.	3
Weekly	The impact will occur at least once a week.	4
Daily	The impact will occur at least once a day.	5

The potential consequences and likelihood of the impact (Table 6.2) are then assessed in totality to determine the significance of the potential risk. The potential significance is categorised into four categories, namely 'Low', 'Moderate', 'High' and 'Extreme' (Table 6.3). These four categories can be described as follows:

- Low: There will be no significant impact to the environment. The implementation of management measures will ensure the significance of the impact does not increase. Review controls to ensure continued effectiveness and look for improvements.
- Moderate: There could be a significant impact to the environment. The impact should be managed. Introduce additional controls to reduce the risk to as low as reasonably practicable.
- High: There will be a significant impact to the environment. The mitigation measures may manage the impact however the impact should be avoided where possible. Risk must be reduced before work commences. Required approval for work to proceed.
- Extreme: Risk must be reduced immediately as highest priority. There will be a significant impact to the environment, regardless of the mitigation measures implemented. The impact should be avoided where possible, alternately managed in a responsible manner. Work must not to commence until the risk is reduced.

Table 6.3 – Determination of the Likelihood of an Impact

Likelihood	Consequences				
	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Certain to Occur (1)	H	H	E	E	E
Likely (2)	M	H	H	E	E
Possible (3)	L	M	H	E	E
Unlikely (4)	L	L	M	H	E
Rare (5)	L	L	M	M	H
Low	There will be no significant impact to the environment. The implementation of management measures will ensure the significance of the impact does not increase. Review controls to ensure continued effectiveness and look for improvements.				
Moderate	There could be a significant impact to the environment. The impact should be managed. Introduce additional controls to reduce the risk to as low as reasonably practicable				
High	There will be a significant impact to the environment. The mitigation measures may manage the impact however the impact should be avoided where possible. Risk must be reduced before work commences. Required approval for work to proceed.				
Extreme	Risk must be reduced immediately as highest priority. There will be a significant impact to the environment, regardless of the mitigation measures implemented. The impact should be avoided where possible, alternately managed in a responsible manner. Work must not to commence until the risk is reduced ALARP				

6.1 Environmental Impacts (if no controls implemented)

There are numerous environmental risks associated with the site remediation works. A risk assessment has been completed for these works, assuming no controls are implemented.

6.1.1 Air Quality

There will be ground disturbance due to soil excavations associated with civil and remediation works and drilling operations. Soil will be systematically excavated and managed. Excavated topsoil from trenching will be temporarily stockpiled for same-day rehabilitation. Spoil generated from drilling will be removed after completion of drilling and stored in designated bins for same-day removal.

Due to the nature of this impact, the dust generated from these activities may cause a local impact due to the deposition of particulate on surrounding buildings and infrastructure. This impact is of moderate to extreme with no controls in place due to the high probability for dust generation on site and the contamination classification of the soils.

Due to the nature of the contamination, odour may occur during excavation of this material. This impact is of low significance due to the proximity of sensitive receptors.

6.1.2 Soil

The waste under the area where the GCS is to be installed is capped with 1.5 – 3 m of clay (BSA, 2019). The underlying materials are part of the original landfill mass and are expected to be contaminated.

There is the potential for soil to be exposed to contaminated waste after drilling and excavating waste material. In addition, there is the potential for soil contamination from vehicles in the form of oil and fuel leaks.

There is a potential for contamination from handling and disposal of waste materials. This is a medium impact on site. There is a potential for site-wide contamination if the materials are not handled correctly in accordance with regulatory requirements. This impact is of moderate significance.

There is a potential for erosion from exposed ground following earthworks. This will be an on-site impact and is of a high significance. This erosion could result from rainfall and/or wind movement on exposed surfaces, especially due the gradient of the slope. Vehicular traffic could also contribute to erosion.

Potential soil loss from the site will be primarily due to the movement of surface runoff following rainfall events, vehicle interactions and due to the generation of dust. Inadequate surface water management will also result in soil loss or distribution across the site. This will be a local impact and is of extreme significance.

6.1.3 Noise

Operational noise would result from site workers, vehicles and machinery utilised during the works. The site is surrounded by industrial developments and are not considered to be sensitive receptors. If not managed appropriately, noise impacts are expected to be moderate. The flare blower will be housed in an acoustic enclosure to minimise noise impacts.

6.1.4 Vibration

Operational vibration would result from vehicles, machinery and ancillary site facilities utilised during the civil and remediation works. If not managed appropriately, noise and vibration impacts are expected to be low.

6.1.5 Water Quality

During site works there may be oil and fuel leaks from vehicles which could result in the contamination of surface water. This impact will be local and will be of high significance.

Surface water could possibly become contaminated due to soil sediments entering the system because of erosion of disturbed surfaces and inadequate stormwater management. Stormwater bunds have been constructed on the inside perimeter of the landfill cap to collect stormwater. This will be a local impact of high significance.

6.1.6 Traffic

There will be increase vehicle traffic on Mulgoa Road due to site works, however the daily impact will be moderate significance predominantly in the mobilisation to site and during the importation of building materials following civil earthworks. This is of low significance.

6.1.7 Visual

The aesthetics of the site will alter during the project due to the civil and remediation works. It is expected that this will be a positive impact, with moderate significance.

A poor site condition during the works will have a negative aesthetic impact on the surrounding areas. Given the location of the site, this will be an on-site impact and will have moderate significance.

6.1.8 Waste

Incorrect disposal of material excavated as part of the drilling works will have a regional high impact. In addition, incorrect waste management on site will have an on-site high impact.

The site activities may generate general and recyclable wastes. Incorrect management of this waste (including recyclables) and lack of a waste management area can result in litter, excess waste and potentially odours. This will be an on-site high significance impact.

6.1.9 Cultural and Heritage

The site is within land which has previously been disturbed and there has been no previous assessment of cultural heritage known to Biogas Systems or which the client has communicated to us. Although not previously assessed due to the high level of disturbance at the site in recent times, the probability of encountering Aboriginal and/or European cultural and heritage sites/artefacts is unlikely.

6.1.10 Flora and fauna

The site is disturbed with a long history of commercial/industrial land use. Scattered opportunistic shrubs and small grasses are present in portions of the site. Native fauna is not present onsite. During excavation works, topsoil and ground cover (predominantly grasses) will be disturbed and remediated to reproduce its previous form. This impact will be limited to the site and due to the limited presence of flora and fauna, the significance of the impact is expected to be low.

6.1.11 Asbestos

There is potential for asbestos containing material (ACM) to be present in the waste material excavated from vertical drilling into the landfill mass. The probability of encountering ACM on-site is likely, as the landfill is comprised of construction and demolition waste materials. The significance of this impact is moderate.

Incorrect removal and/or disposal of any ACM may be a regional impact with a medium significance, due to the location of the landfills in NSW. The health-risks associated with the incorrect removal and disposal of ACM is of high significance.

6.1.12 Access and Security.

Given the location of the site, the potential for unauthorised site access is expected to be possible with high impact. Furthermore, site damage and vandalism associated with unauthorised site access is expected to be of extreme significance.

6.1.13 Unexpected Finds Protocol

There is a small chance buried material may be encountered when undertaking excavation that is unexpected. This may be in the form of unexpected waste or asbestos material. The contractor, Biogas Systems, will have an Unexpected Finds Procedure in place that details having trained

personnel on-site that are able to recognise unacceptable and potentially contaminated material, and then manage the material.

If in the event unexpected finds/materials are encountered, the Unexpected Finds Procedure will be implemented.

7 Environmental Management Plan

This environmental management plan has management and mitigation measures that have been identified through the evaluation of the risks identified in Section. The following environmental aspects are to be managed:

- Air quality (dust and odour)
- Soil
- Noise
- Vibration
- Water Quality
- Traffic
- Visual
- Waste
- Cultural and heritage
- Flora and fauna
- Asbestos; and
- Access and security

7.1 Environmental Objectives

The environmental objectives that are to be achieved via the implementation of this CEMP are summarised in Table 7.1.

Table 7.1 – Environmental Objectives of the CEMP

Aspect	Environmental Objective
Air Quality (dust and odour)	Prevent dust generation and migration off site Monitor dust levels onsite Prevent odour generation (where possible) and migration off site
Air Quality (GHG emissions)	Reduce the generation of GHG emissions
Soils (erosion)	Avoid or prevent adverse impacts to soil. Adequately maintain surface water drainage patterns, prevent soil erosion and sediment loss Prevent the uncontrolled migration of soils to surrounding areas
Soils (contamination)	Prevent contamination of the soil i.e., from spills Where contamination is known to exist onsite (contamination hotspot), instil management practices to limit the spread of contamination
Noise	Comply with legislative and regulated noise management guidelines Limit noise outputs Minimise the impacts that noise has on fauna and adjacent sensitive stakeholders
Vibration	Comply with legislative and regulated vibration management guidelines Limit vibration outputs – implement best work practices Minimise the impacts that vibration has on fauna and adjacent sensitive stakeholders
Surface Water	Prevent adverse environmental impacts to surface water resources

Aspect	Environmental Objective
	Prevent contamination of run-off water
Groundwater	Prevent impacts to groundwater resources
Traffic	A road reserve dilapidation report is to be undertaken prior to works commencing Prevent risks to the environment by complying with traffic management plan Prevent risk to worker health and safety by complying with traffic management plan
Visual	Keep aesthetics of the site to a high standard
Waste	Appropriate waste management to meet the waste management hierarchy requirements Prevent adverse environmental impacts associated with impacted soils and / or wastes encountered or exhumed during works
Cultural and Heritage	Prevent impacts to cultural and heritage sites Artefacts and significant finds will be protected
Flora and Fauna	Remove and manage exotic flora where required
Weeds and Feral Animals	Prevent the spread or introduction of exotic species Avoid creating an environment that may attract pest/feral animals
Socio-economic	Ensure stakeholders and community are engaged during all phases of the project Maintain a complaint register
Asbestos	Appropriate ACM finds management procedure
Occupational Health and Safety	Maintain a safe and healthy working environment Toilet facilities will be provided during the works A COVID management plan shall be in place during the works
Access and Security	Prevent impact / harm to visitors and workers Prevent impact / harm to public health and safety Prevent unauthorised site access Secure equipment and plant when not in operation

7.2 Mitigation Measures

The mitigation measures detailed in Table 7.2 will assist in the mitigation of the impacts caused by the work activities on site, as well as ensure that all environmental objectives are met. The waste management plan has been provided in a separate section (Section 7.3).

Table 7.2 – Summary of mitigation and control measures

Aspect	Potential Impact	Mitigation and control measures
Air quality	Dust	Dust suppression measures will be implemented, as per the recommendation in 'Dust Assessment Handbook' (NSW EPA, 2019). A stabilised site entry/exit point will be established, including large gravel or aggregate or ballast to limit offsite dust generation and drag-out. Street sweeping on adjacent roads will be completed as required. Work surfaces to be regularly watering, however, care will be taken to prevent excess watering to limit damage and erosion. During windy periods, the movement of soils and dust generating activities will be limited. The lifting height of the excavator loader bucket when transferring soil or waste onsite or into trucks will be minimised and unloading speed controlled to reduce wind-borne dust. Delivery trucks to travel at reduced and controlled speeds on site. Site haul roads are to be lightly watered regularly, as required, compacted (where possible) and covered with hard wearing surface i.e., coarse gravel. Vehicle traffic onsite will be limited to essential traffic and designated tracks. To limit dust generation and road wear, onsite vehicle speed to be limited to 10 km/h. Speed limit signs will be erected onsite. If applicable, exposed areas will be sealed as soon as is practically possible. Visual monitoring of dust generation and the effectiveness of associated management controls will be regularly undertaken during the project.
	Odour	Odour mitigation relates to the waste excavated during drilling. This waste will be placed into a skip bin each day, which will be covered.
	GHG emissions	All vehicles will be maintained, and in a good working order. Vehicle traffic onsite will be limited to essential traffic. Maximum onsite vehicle speed to be limited to 10 km/h. Material disposal will, where practicable, be local to reduce GHG emissions generated from transport over long distances.
Soil	Soil contamination	Any spills that occur on unsealed ground to be cleaned up as soon as practically possible. Spill-response materials and equipment will be available at the site, in proximity to machinery and any dangerous goods storage locations i.e., oils, fuels. Appropriate containment will be utilised for the storage of any fuels and other dangerous goods. Drip trays are to be placed under vehicles and machinery during periods of set down i.e., overnight. Daily inspections to be undertaken to ensure that this is in place.

Aspect	Potential Impact	Mitigation and control measures
		Vehicles leaking oil or hydraulic fluids are to cease activities immediately and are to be repaired as soon as practicable prior to recommencement of activities. Refuelling of vehicles and machinery to only be undertaken by licenced company. A register will be kept of all spills and incidents. Any excavation/surface scraping of contaminated soil, including contamination will be conducted with an environmental consultant onsite. Survey records will be provided showing the final excavation and soil conditions. Soil tracking documentation and records to be updated and maintained throughout the project.
	Erosion	Vehicle traffic to be limited to the designated tracks. Tracks are to be lightly watered regularly, as required, compacted (where possible) and covered with hard wearing surface i.e., coarse gravel. Disturbance of soil will be staged during works, as appropriate. In the event of significant rain event (i.e., storm) earth moving/disturbing works to be postponed, as far as is practical. Excavations will be designed to decrease velocity of any surface water entering the excavation, i.e., grading walls.
	Loss of soil	Dust suppression measures to be implemented throughout project i.e., watering down of site, vehicle traffic to use designated tracks, staging of soil disturbing works, covering exposed soils with, surface sealant, Forticon plastic and/or coarse material i.e., gravel fill.
	Introduction of foreign material(s)	All imported material to be visually inspected and to be weed and seed free.
	Stockpiles	Stockpiling of soil is not a necessary measure during the construction process of the GCS and subsequent remediation works.
Noise and vibration	Noise generation	The site is located away from residential areas. However, due to the nature of the works, the following measures will be implemented: • Activities will be planned and carried out at times to minimise the potential for noise to pose a nuisance or impact. • Regular works will be conducted between 7am and 7pm, Monday to Saturday. • Approval to complete works outside of the above-mentioned times will need to be obtained from the relevant body. Noise approvals are generally the responsibility of the local council, however, due to the sensitivity of the site, this approval lies with the NSW EPA. • Any extremely noisy activities will be closely monitored on-site and conducted at times to limit impact. • All vehicles and plant will be appropriately serviced and maintained to ensure it is in good working order to minimise noise. • During work breaks, vehicles will be turned off or wound down to decrease noise generation.

Aspect	Potential Impact	Mitigation and control measures
		The flare system will have the blower enclosed in an acoustic housing to minimise noise.
	Vibration	Throughout the entire project, management of site vibration and compliance with relevant guidelines is ultimately the responsibility of the Principal. However, Biogas Systems will implement control measures to enable vibration compliance as far as is reasonably practicable, summarised as follows. • Care will be taken when loading or unloading materials. • All vehicles are to be appropriately serviced and maintained to ensure it is in good working order to minimise vibration.
Surface water	Contamination	All spills will be cleaned-up to avoid contamination of run-off.
	Runoff	Interaction between surface runoff and disturbed soil poses a potential risk to the water quality that will leave the site boundary. Therefore, the following measures will be implemented: • Stormwater run-off will be monitored throughout the project. • Stormwater runoff paths will be diverted away from stormwater outlets. • Where required, excess surface water entering the excavations may be pumped out via use of a vac truck or similar and disposed of off-site by an organisation licenced to handle liquid waste.
Groundwater	Contamination -	The management of groundwater will be managed in accordance with the NSW EPA 'Guidelines for the Assessment and Management of Groundwater Contamination (NSW EPA, 2007). All spills on exposed surfaces to be cleaned up to avoid contamination of the groundwater. Drip trays are to be placed under vehicles and machinery. When working in excavations, there is a significant risk for workers to encounter perched water and / or groundwater. Where required, excess groundwater water entering the excavations will be pumped out via use of a vac truck or similar and disposed of off-site by an organisation licenced to handle liquid waste.
Traffic	Vehicular traffic	Cognisant of local council by-laws concerning traffic management and transport of hazardous waste. On-site traffic management measures to be implements, including the use of designated access roads and speed limits. Site vehicle traffic to be limited to essential traffic. All vehicles / machinery to be used on site are to be maintained and in good working order.
Visual	Aesthetics	The planned regular removal of contaminated soils from the site will also aid in keeping the site tidy and decrease available settlement areas for fauna and decrease dust and odour generation. Good housekeeping practices will be enacted during the project.
Cultural and heritage	Artefacts	If artefacts or items/areas that may have significance are uncovered, works in the area will cease and the area will be barricaded off, immediately following the discovery.

Aspect	Potential Impact	Mitigation and control measures
		A suitably qualified heritage consultant would be appointed to assess the finds.
Flora and fauna	Introduction / spread of exotic species	All vehicles, plant and materials will be clean prior to entering or exiting the site. Weekly visual inspections to identify any weeds will be undertaken. If required, any imported material, including soils and gravel, will be visually weed free. The site will be well maintained, and free of organic waste, to discourage the settlement of feral/native animals.
	Disturbance to flora/fauna	The disturbance of flora and fauna during civil and remediation works will be limited to the excavation of topsoil and its same-day remediation. There is no proposed works outside of the site boundary. However, due to the nature of the civil and remediation works, the following measures will be implemented: • Works should cease if fauna observed in proximity to works. Engagement of a certified animal catcher / handler, as necessary.
Asbestos	Exposure to workers	If ACM is encountered, works are to stop in that location and the area is to be adequately delineated. ACM to be removed by appropriately qualified and experienced asbestos removalist. Full PPE to be worn during removal. Airborne fibre monitoring (AFM) to be conducted by a certified third-party during removal processes. Asbestos should be transported and disposed of in accordance with the legislation and regulations, at a licenced asbestos disposal facility. Disposal certificates, and associated transport records, are to be maintained.
Access and security	Risk of injury	Appropriate signage will be erected during the works. Ensure the site is adequately fenced and secure i.e., lock and secure machinery and equipment the end of daily works. Site security officer at entry/exit point to manage site access if required. Ensure visitors to the site are signed in and inducted (where necessary) or escorted by a person inducted to the site. Ensure the WHSE Plan is developed and implemented during ongoing site use.

7.3 Waste Management Plan

The objective of the waste management plan is to store all site waste correctly until disposal to an appropriately licenced facility. The control which will be put in place and performance measures are detailed in Table 7.3.

Table 7.3 Waste management plan

Type of Waste	Control Measures	Frequency	Performance Measure
Soil waste	Drilling works will excavate waste from the body of the landfill mass. This waste is to be stored in designated skips and covered and taken off-site to a licenced disposal facility once truck carrying capacity is reached. Disposal certificates, as well as transport documents, should be placed on record. All waste leaving site will be adequately sealed to prevent accidental loss during transportation.	Daily, as required	Material disposed to appropriate facilities. Materials tracking sheet up to date
Litter	Adequate waste management measures should be implemented to prevent the generation of litter onsite. Good housekeeping practices will be enacted during the project. All litter will be placed into labelled lidded bins. Recycle materials such as cardboard, timber, pallets and scrap metal wherever possible.	At all times	No observed litter generated from construction activities on site.
Odorous waste	Waste placed in skip bin each day will be located in a low impact area and covered each day.	Daily	No odours from construction activities detected at site boundary
Dangerous goods and fuels	Storage of dangerous goods and fuels to be in accordance with NSW chemical and Safe Work requirements.	At all times	Dangerous goods and fuels stored in appropriate areas on site.

7.4 Summary of Environmental Risk

This successful implementation of the mitigations measures and the waste management plan will decrease the significance of the impacts as well as the likelihood, thus reducing the risk onsite.The residual environmental risks after all mitigation measures have been enacted are shown in Table 7.4. The level of significance is determined by the consequence and likelihood that an aspect's associated impact will occur.

Table 7.4 – Summary of residual environmental risk

Aspect	Potential Impact	Likelihood	Consequence	Significance
Air quality	Dust generation - nuisance	Likely	Insignificant	Moderate
	Dust generation - dust deposition	Likely	Insignificant	Moderate
	Odour generation - nuisance	Likely	Insignificant	Moderate
	Greenhouse gas emissions	Likely	Insignificant	Moderate
Soil	Soil contamination - on-site materials handling and vehicle movement	Unlikely	Minor	Low
	Soil contamination - vehicle oil and fuel leaks	Unlikely	Minor	Low
	Soil contamination - off-site disposal and materials handling	Unlikely	Minor	Low
	Erosion	Possible	Moderate	High
	Loss of soil	Unlikely	Minor	Low
Noise and vibration	Noise generation - vehicle movement, use of machinery, site works	Unlikely	Minor	Low
	Vibration - vehicle movement, use of machinery, site works	Unlikely	Minor	Low
Surface water	Contamination - spills	Rare	Minor	Low
	Incorrect management of run-off	Rare	Minor	Low
Groundwater	Contamination - spills. Potential contamination sources include leaching of contaminants into the water table	Rare	Minor	Low
Traffic	Vehicular traffic	Possible	Minor	Moderate
Visual	Aesthetics - site works	Possible	Insignificant	Low
	Aesthetics - site condition	Possible	Insignificant	Low
Waste	Incorrect disposal of overburden and waste	Unlikely	Minor	Low
	Incorrect waste management on site	Unlikely	Minor	Low
	Incorrect disposal and recycling of general waste (litter)	Unlikely	Minor	Low

Aspect	Potential Impact	Likelihood	Consequence	Significance
Cultural and heritage	Damage / uncovering of Aboriginal cultural heritage / archaeological sites	Rare	Minor	Low
Cultural and heritage	Damage / uncovering of European cultural heritage / archaeological sites	Rare	Minor	Low
Flora and fauna	Terrestrial: Introduction / spread of exotic species (flora and fauna)	Unlikely	Insignificant	Low
	Terrestrial: Disturbance to flora / fauna	Unlikely	Insignificant	Low
Asbestos	Exposure to workers if identified in fill material	Unlikely	Moderate	Moderate
	Incorrect disposal of ACM	Unlikely	Moderate	Moderate
Access and security	Unauthorised site access	Unlikely	Insignificant	Low
	Site damages and vandalism	Unlikely	Insignificant	Low

8 Implementation

8.1 Roles and responsibilities

The roles and responsibilities for execution of the CEMP is outlined in Table 8.1.

Table 8.1 – Roles and Responsibilities for the CEMP

Responsible party	Task
Biogas Systems	Implementation of CEMP including the following: • Maintains ultimate responsibility for implementation of the CEMP. • Acknowledge that the CEMP is an important document for the safe operation and management of the Site. Make an executive manager responsible for implementation. • Review plans for future works and associated method statements as required, to check that adequate environmental management measures are incorporated into the planning and are aligned with this CEMP. • Maintenance of any site controls or protection measures which form part of this CEMP. • Maintenance of the document so that it continues to reflect the site conditions, best practice occupational health and safety recommendations and any changes to the regulatory framework. • Notify the NSW EPA when required as outlined in Section 60(4) of the CLM Act.
Employees of Biogas Systems	• Notify the site owner or its representative of any situation which they consider may represent a potential health risk (such as unexpected finds). • Respond to the directions of the site owner, project manager or other person with delegated authority with respect to environmental matters. • Do not undertake any works (without the permission of the site owner) which may potentially cause environmental impacts (such as disturbance of the landfill capping layer).
Biogas Systems sub-contractors	• Subcontractors employed during any future works will have contractual obligations placed on them to comply with the CEMP. As part of the tender briefing process, potential subcontractors should be made aware of their obligations to minimise the environmental impacts of their works. • Subcontractors and suppliers will be required to attend inductions where specific environmental issues are addressed if deemed appropriate. They will be made aware of their requirements to adhere to the CEMP in the induction program. • Ensure that risks have been assessed and suitable control measures implemented where the site cap will be disturbed. • Ensure the gas mitigation system and capping are protected during future works. • Ensure that operatives are briefed on the presence of contaminated material below the cap and the potential for landfill gas in trenches, excavations, enclosed voids or within the gas mitigation system.

8.2 Stakeholder Consultation

Penrith Waste Services is responsible for all stakeholder management and community consultation. Stakeholder management will be critical to the success.

8.3 Training and Inductions

Prior to personnel commencing work on site, including subcontractor employees, a site-specific induction shall be completed (refer to the WHS Management Plan). In addition to the WHS Management Plan, the following information will be addressed:

- Description of the site conditions
- Introduction to the objectives and expectations of this CEMP.
- Environmental management measures pertinent to this CEMP.
- Roles and responsibilities associated with the management of the site.
- The incident reporting process.
- The Emergency Preparedness and Response Plan.
- Unexpected finds protocol.
- Overview of inspection process.
- Record keeping and document control.

No person should be allowed to access and work on the site without first successfully completing the induction.

9 Reporting/Review

9.1 Incident Reporting

The EPA shall be notified of any incident that represents a threat to the environment. This relates to soil, water and air impacts.

If an acute or explosive risk from LFG occurs from drilling or pipelaying works, then works should cease and monitoring implemented. If the risk intensifies, then the emergency services (NSW Police, NSW Fire and Rescue) should be notified immediately.

9.2 Emergency Contacts

In the event of an incident which has resulted in an acute risk to human health or explosion then dial triple zero to request the required assistance. For incidents that are not considered to put human health in imminent danger then the Project Manager and/or the Site Owner should be notified. Details of the Project Manager and Site Owner should be provided during the site induction.

The list of contacts in Table 9.1 below outlines the contact details which may be called upon or require notification in an emergency.

Table 9.1 – Emergency Contacts List

Service	Number
All life-threatening emergencies	000 (triple zero)
NSW State Emergency Services (SES) – emergency in floods and storms	132 500
NSW Police Assistance – Non-life-threatening calls	131 444
Inner West Council – Emergency after hours:	02 9392 5000
Ausgrid – Power failure, power lines down	13 13 88
Jemena Gas	13 19 09
Sydney Water	13 20 90
Telstra	13 22 03
Optus	13 13 44

9.3 Review

Biogas Systems shall review the environmental performance of the site (across the duration of the construction works). The review should:

- Analyse the monitoring results and compare them against the relevant statutory requirements, limits or performance measures/criteria and monitoring results of previous years.
- Identify any non-compliance over the last year and describe what actions were or are being taken to ensure compliance.
- Identify any trends in the monitoring data.
- Outline any actions that are required to be implemented to improve environmental performance.
- Identify any additional activities on-site and adjacent to site that may impact LFG migration pathways.

10 References

APP. (2009). Statement of Environmental Effects - land restoration for final landform and rehabilitation works of the Mulgoa Landfill and Quarry: Lot 201 DP 804405 & Lot 22 DP 537922, Mulgoa Road, Mulgoa. APP Corporation.

BSA. (2018). Landfill gas resource assessment at Mulgoa Landfill, Penrith NSW. Adelaide: Biogas Systems Australia.

BSA. (2019). Proposal to supply an ERF compliant 500 cube per hour landfill gas flare at the Penrith landfill,. Adelaide: Biogas Systems Australia.

CES. (2011). Landfill Closure Plan - Mulgoa Road Landfill, Mulgoa, NSW. Penrith: Penrith Waste Services.

NSW EPA . (2012). Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases. Sydney: NSW EPA.

NSW EPA. (2007). Guidelines for the Assessment and Management of Groundwater Contamination. Sydney: NSW EPA.

NSW EPA. (2016). Environmental Guidelines: Solid Waste Landfill. Sydney: NSW EPA.

NSW EPA. (2019). Dust Assessment Handbook. Sydney: NSW EPA.

Appendix A – Figures

PENRITH WASTE SERVICES
PENRITH LANDFILL

LOT & CELL BOUNDARIES

POINT	EASTING	NORTHING
1	283679.238	6256459.631
2	283804.910	6256440.662
3	283837.745	6256658.198
4	283689.425	6256680.585
5	283878.656	6256170.959
6	283521.304	6256855.339
7	283696.501	6256194.255
8	283672.261	6256566.873
9	283968.169	6256789.086
10	283897.170	6256306.339

SCALE 1:1000

25 00 25 50

METRES

BM GIN RL 68.075
BM GIN RL 68.09
BM DH&W RL 68.11
TRUCK WASH

LOT 201
DP 804405
25.46 ha

LOT 22 IS CURRENTLY BEING REGRADED & A CLAY BUND WALL IS BEING CONSTRUCTED ALONG THE COMMON BOUNDARY LOT 201 IS FILLING UP TO THE BUND WALL

LOT 22
DP 537922

DAM

ACCESS ROAD

LANDFILL 380m²

LANDFILL 170m²

LANDFILL 300m²

CELL 1

CELL 2

SP 1
2,040m²

PORTION 28
DP 97650

LOT 22
DP 537922

HORIZONTAL PROJECTION: MGA GRID
VERTICAL DATUM: AUSTRALIAN HEIGHT DATUM

LOT 1 DP 222144

PLAN OF PROPOSED GAS COLLECTION SYSTEM
PENRITH WASTE SERVICES
MULGOA ROAD MULGOA

CIVILCAD SOFTWARE LICENCE No 3438

SCALE 1:1000
DATUM: AHD
CONTOUR INTERVAL 1.0
DRAWN BY SW

BIOGAS SYSTEMS AUSTRALIA

ORIGIN OF LEVELS: SSM 21833 RL 37.974

A1

Appendix B – QA/QC Template Forms

SYSTEM FORM **FLARE COMMISSIONING REPORT**	**BIOGAS SYSTEMS SF 8.11** Issue B February 2019

Note required PPE must be worn and used at all times.

Name of Technician:	
Site/Location:	
Date:	Time:
Flare Type (i.e. Lo-Cal, standard, elevated):	
Flare size (m^3/hr):	

To be completed for all installation, service and repair visits.

1. Record all instrument readings and valve settings on arrival
2. Record all changes and repairs made
3. Record all parts, materials & components fitted or used
4. Check that pressure and vacuum gauges are zeroed
5. Record all instrument readings and valve settings on departure
6. Leave site clean and tidy
7. Note future remedial action needed and see that it is carried out

ACTION **STATUS**

Stationery checks

Check control panel operation:

Wiring diagram approved	
Wiring correct to diagram	
Switches mechanically sound	
Component wiring diagrams all assigned and numbered correctly	
Timer links in correct position	
Temperature readout(s)	
Other component conditions (specify)	
Note hours run from run meter	
Check earth bonding	

Check mechanical features

Door locks	
Nuts, bolts tight, correct number and correct length	
Booster mounting	
Paint finish	
Pipework	
Flexible connectors	
General condition	

Check gas booster

General condition	
Motor start/stop	

Electrical inspection

PLC programme approved, meets specification and is operational	
HMI functioning	
Telemetry outputs all functioning	
Note hours run from hours run meter	
Slam shut opens and closes	
Pressure switches wired correctly and functioning	
Wiring installed correctly, neat and tidy	
Panel instrumentation wired up correctly, neat and tidy	
Control panels generally complete and ready for commissioning	
Flow meter operational	

INSULATION RESISTANCE TEST BY 500V MEGGER

Disconnect the PLC and any other electronic items before carrying out this test. Check that they are not connected to any power supply

Motor starter panels

R-Y phases	MΩ	R-B phases	MΩ
Y-B phases	MΩ	R-N phases	MΩ
Y-N phases	MΩ	B-N phases	MΩ

Confirm all readings exceed 0.5 MΩ

Control panels

R-Y phases	MΩ	R-B phases	MΩ
Y-B phases	MΩ	R-N phases	MΩ
Y-N phases	MΩ	B-N phases	MΩ

Confirm all readings exceed 0.5 MΩ

Earth loop impedance

Confirm impedance test and earth continually on all electrical equipment and cables is OK.

Run up on air

Check operational functions

		Setting	Status
Gas alarm relays	Oxygen		
	Methane		
	Other (specify)		
Gas analyser calibration	Oxygen		
	Methane		
	Other (specify)		

Inverter Drive Operation

Setting	Status
%	

Pressure switches

		Setting	Status
Shutdown on:	High pressure	100 MBAR	
	Low delivery pressure	1 MBAR	
	Burner line over pressure	100 MBAR	
	Burner line under pressure	1 MBAR	
	Pilot Low gas pressure	250mbar	
	Valve proving		
	Low vent line pressure on vent	N/A	
	Vent and burn “incorrect switching” function operational	N/A	
	Low methane	15%	
	High oxygen	10%	

		Status
Other switches	Condensate pump on	
	Condensate pump off	
	High condensate trip	
	High condensate alarm	
	Flame sensor	
	Emergency stop	
	Restarts OK after shutdown	
	On vent – valve opening and shutting	
	Flame temperature mechanism operational	
	Condensate pump starting and stopping on level switches	
	Flash back switch operational	
	Flash back alarm	
	Propane low gas pressure switch	
	Pilot valve proving switch	

Pressure test: see job card for details (if applicable)

Comments:

Air performance test in works
Unit set at maximum flow rate

	Readings
Flow	
Inlet pressure: prior to flame knockout pot	
Inlet pressure: after knockout put	
Outlet pressure: after flame arrester	
Outlet pressure: prior to burner	
Amps per phase	
Check manometer calibration with pilot tube (calculation)	
Gas velocity (V)	
Pipe diameter	
Pipe cross-sectional area (A)	
Flow rate V x A	

Gas performance tests on site

Unit set at minimum specified flow rate (wait 30 mins prior to taking readings)	Readings
Record hours run at start of test	
Time at start of test	
Flow	
Inlet pressure: prior to flame KO pot	
Inlet pressure: after KO pot	
Outlet pressure: after flame arrester	
Outlet pressure: prior to burner	
Amps per phase	
Methane %	
Oxygen %	
Flame temperature	
Motor temperature	

Comments:

Unit set at maximum specified flow rate (wait 30 mins prior to taking readings)	Readings

Record hours run at start of test	
Time at start of test	
Flow	
Inlet pressure: prior to flame KO pot	
Inlet pressure after KO pot	
Outlet pressure: after flame arrester	
Outlet pressure: prior to burner	
Amps per phase	
Methane %	
Oxygen %	
Flame temperature	
Motor temperature	

Comments:

Unit set at 100% specified flow rate (wait 30 mins prior to taking readings)	Readings
Record hours run at start of test	
Time at start of test	
Flow	
Inlet pressure: prior to flame KO pot	
Inlet pressure: after KO pot	
Outlet pressure: after flame arrester	
Outlet pressure: prior to burner	
Amps per phase	
Methane %	
Oxygen %	
Flame temperature	
Motor temperature	

Comments:

On maximum flow rate

Noise levels dB(A) (if required)	

Draw sketch of reading locations and distances

	Status
Flame quality	
Hours run meter observed to be operational	
General rig condition	

Signed by Biogas Systems Technician: _____

Date:_____

PROJECT:		# INSPECTION AND TEST PLAN			
ITP REVISION:	1.0	ITP DATE:		ITP AUTHOR:	
ACTIVITY:		PROCESS:		LOT:	

CONTROL CODES; H = HOLD POINT; W = WITNESS POINT; S = SURVEILLANCE; R = REVIEW; NA = NOT APPLICABLE; (PD) – PROJECT DIRECTOR; (PM) – PROJECT MANAGER; (PE) – PROJECT ENGINEER; (SI) – SURVEYOR; (SS) – SITE SUPERVISOR; (CR) – CLIENT REPRESENTATIVE

REF NO	CONSTRUCTION PROCEDURE	SPECIFICATION / DRAWING REFERENCE	ACCEPTANCE CRITERIA	TEST / INSPECTION METHOD	TEST / INSPECTION FREQUENCY	DOCUMENT RECORD	BIOGAS SYSTEMS AUSTRALIA LTD		MAIN CONTRACTOR / CONSULTANT / AUTHORITY / CLIENT	
1.							CONTROL		CONTROL	
							SIGN & DATE		SIGN & DATE	
2.							CONTROL		CONTROL	
							SIGN & DATE		SIGN & DATE	
3.							CONTROL		CONTROL	
							SIGN & DATE		SIGN & DATE	
4.							CONTROL		CONTROL	
							SIGN & DATE		SIGN & DATE	
5.							CONTROL		CONTROL	

							SIGN & DATE		SIGN & DATE	
6.							CONTROL		CONTROL	
							SIGN & DATE		SIGN & DATE	
7.							CONTROL		CONTROL	
							SIGN & DATE		SIGN & DATE	
8.							CONTROL		CONTROL	
							SIGN & DATE		SIGN & DATE	

HOLE No.:
LOCATION: installation

Drilling method	Water	Scale (m)	Graphic log: Clay	Silt	Sand	Gravel	Waste	Description	Sample Number	Borehole Construction Details	Additional Observations
		0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20									

DRILLER
DRILLING METHOD
DATE
LOGGED BY

Water strike ▽

Standing water level

CLIENT:

PROJECT:

DATE: | **JOB No.:** | **FIG. No.:**

ID	DATE	CH4	CO2	O2	CO	H2S	Balance	Static Pressure	Differential pressure - GA/GFM/GEM	Differential pressure - Manometer	Differential pressure - Magnehelic	V Position (initially)	V Position (adjusted)	Colour of Orifice Plate	Comment
		%	%	%	ppm	ppm	%v/v	mb	mb	mb	mb	(% open)	(% open)		

FLARE001															
Drop Out Pot															
Pre Blower															
Sample Point 2															
Sample Point 3															
Flare Flow Rate (m^3/hr):															

SYSTEM FORM **FLARE SERVICING/MAINTENANCE/FAULT REPORT**	**BIOGAS SYSTEMS SF 8.10** Issue B February 2019

Note required PPE must be worn and used at all times.

Name of Technician:	
Site/Location:	
Date:	Time:
Flare Type (i.e. Lo-Cal, standard, elevated):	
Flare size (m^3/hr):	

To be completed for all installation, service and repair visits.

1. Record all instrument readings and valve settings on arrival
2. Record all changes and repairs made
3. Record all parts, materials & components fitted or used
4. Check that pressure and vacuum gauges are zeroed
5. Record all instrument readings and valve settings on departure
6. Leave site clean and tidy
7. Note future remedial action needed and see that it is carried out

Hours run (h)	Booster 1		Booster 2	

CH_4 (%)		CO_2 (%)		O_2 (%)	
CO (ppm)		H_2S (ppm)		Pressure (mbar)	

Inlet valve setting % open											
No. 1		No. 2		No. 3		No. 4		No. 5		No. 6	

Main control valve setting % open	

Inlet vacuum gauge readings starting side nearest knockout pot (mbar)											
No. 1		No. 2		No. 3		No. 4		No. 5		No. 6	

Inlet temp (^OC)		Inlet vacuum prior to KO pot filter (mbar)	
Vacuum after KO pot filter (mbar)		Vacuum after inlet flame arrester (mbar)	
Outlet pressure after gas booster (mbar)		Outlet gas temp (^OC)	
Pressure after slam shut (mbar)		Pressure after outlet flame arrester (mbar)	

Total flow (m^3)		Blower speed (%)	
Flow rate (m^3/hr)		Measuring instrument	
Flame temp (^OC)		Motor temp (^OC)	
Flame quality		Ambient temp (^OC)	

Manometer liquid level with rig shut down					
Type of liquid:					
Red SG - 0.8		Emissions analyser CO cell		Emissions analyser NOX cell	

Check for leaks with detector	
Condensate drain system check	
Knockout pot filter clean	

Booster model and serial no.			
Motor and fan seal greased			
Booster correction rotation			
Booster greased every 1,500 hours			
Booster oil changed every 5,000 hours			
Flexible connections		Mountings	
Bearing noise		Bolts tight	

Flame arrestor inlet		Outlet	
Pilot		Pilot light function	
UV sensor function		Indicator Lights	
Electrical connection		Hinges and valves	

Pressure switch function			
Suction		Setting	

Booster		Setting	
Burner		Setting	
Vent		Setting	
Other		Setting	

Comments:

Check signal, control and telemetry function	
Signal, control and telemetry report as required	
Report all changes to telemetry system	
Report all changes made to control program	
CH_4 analyser operation	
CO_2 analyser operation	
O_2 analyser operation	
CO analyser operation	
H_2S analyser operation	
Report all and any repairs	

Report all and any parts replaced or new parts fitted with sufficient detail	
Repairs	New part fitted

Gas analyser calibration report								
Gas used								
Before calibration	CH_4		CO_2		O_2		CO	
After calibration	CH_4		CO_2		O_2		CO	

Gas used								
Before calibration	CH_4		CO_2		O_2		CO	
After calibration	CH_4		CO_2		O_2		CO	

Report any further repairs or actions required.

Departure Report				
Hours run (h)	Booster 1		Booster 2	

CH_4 (%)		CO_2 (%)		O_2 (%)	
CO (ppm)		H_2S (ppm)		Pressure (mbar)	

Inlet valve setting % open											
No. 1		No. 2		No. 3		No. 4		No. 5		No. 6	

Main control valve setting % open	

Inlet vacuum gauge readings starting side nearest knockout pot (mbar)											
No. 1		No. 2		No. 3		No. 4		No. 5		No. 6	

Inlet temp (^{O}C)		Inlet vacuum prior to KO pot filter (mbar)	
Vacuum after KO pot filter (mbar)		Vacuum after inlet flame arrester (mbar)	

Outlet pressure after gas booster (mbar)		Outlet gas temp (^{O}C)	
Pressure after slam shut (mbar)		Pressure after outlet flame arrester (mbar)	
Total flow (m^3)		Blower speed (%)	
Flow rate (m^3/hr)		Measuring instrument	
Flame temp (^{O}C)		Motor temp (^{O}C)	
Flame quality		Ambient temp (^{O}C)	

Manometer reading	

List of sub-contractors carrying out work	

Signed by Biogas Systems Technician: _____

Date:_____