

# **APPENDIX 2**



**WasteServ Malta Ltd**

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# **TA'ZWEJRA LANDFILL – CLOSURE PLAN**

## **GAS COLLECTION SYSTEM**

### **SPECIFICATION AND CONSTRUCTION QUALITY ASSURANCE PLAN**

**February 2010**

**TA' ZWEJRA LANDFILL  
MALTA**

**CONSTRUCTION QUALITY ASSURANCE  
PLAN**

**GAS COLLECTION SYSTEM**

<b>Client:</b>	WasteServ Malta Ltd	Scott Wilson Ltd
<b>Job No:</b>	D117657	Royal Court
<b>Doc No:</b>	D117657/Gas/2	Basil Close
<b>Status:</b>	Issue 2	Chesterfield
<b>Date:</b>	February 2010	Derbyshire
		S41 7SL
		Tel: 01246 209221
		Fax: 01246 209229
<b>Written</b>		Fay Veligradi
<b>Checked</b>		Barry Gore/Diane Merrick
<b>Approved</b>		Barry Gore
		(Head of Waste Management)

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## **1.0 INTRODUCTION**

- 1.1 This specification describes the installation of a Gas Collection System to enhance the control of gas migration at the Ta'Zwejra landfill site in Malta, as required.
- 1.2 The installation of the Gas Collection System forms part of the site restoration works and shall include the drilling and installation of gas extraction wells, including associated wellheads and all connecting pipework, manifolds, condensate draining legs and gas pipework mains. Works shall take place after the installation of the intermediate low permeability capping system.
- 1.3 This document presents the Construction Quality Assurance Plan for these gas collection system works.

### Definitions:

- 1. Employer is WasteServ Malta Ltd and shall include their employees and personal representatives.
  - 2. Contractor will be appointed by the Employer and will include the Contractor's personal representatives and any Subcontractors
  - 3. Works Supervisor will be appointed by the Employer and shall be independent of the Contractor.
  - 4. Pipework dimensions refer to outside diameter.
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- 1.4 This Specification and CQA Plan identifies the duties and responsibilities of the Works Supervisor and the Contractor. In addition, it presents a method of working which, when followed, shall provide effective mechanisms to ensure that these duties and responsibilities are carried out, and that the gas collection system is installed in accordance with the stated Specification and CQA Plan and the materials and workmanship employed are of an appropriate and approved quality.

## **2.0 DESCRIPTION OF THE WORKS**

### **2.1 Scope of Works**

2.1.1 The full scope of the works to be covered by this CQA Plan will comprise the following main components:

- Surveying and setting-out of the works including the location of the gas wells;
- Confirmation of the installation location of the gas collection system wells, manifolds and condensate draining legs with the Works Supervisor;
- Confirmation of the installation location of the gas collection system pipework (connecting and main), including required falls, with the Works Supervisor;
- Gas collection system components and pipework acceptance, handling and storage;
- Installation of gas wells to required depth, including all components and wellheads;
- Installation of manifolds and condensate draining legs;
- Installation and connection of pipework (connecting and main);
- Conformance pressure testing of the completed system;
- Quality control procedures on all of the above;
- Surveying of the works and production of as-built drawings.

### **2.2 Works to be performed by the Contractor**

2.2.1 The works to be performed by the Contractor shall comprise (but not be limited to):

- All surveying and setting out necessary for the works;
- The procurement of all required materials;
- The delivery, handling and storage of all required materials;
- Temperature monitoring prior to commencement and for the duration of the works.;
- Temporary ground preparation necessary for installation works;
- Drilling of boreholes to the required depth;
- Installation of the gas well pipework, gravel surround, bentonite seals and wellheads;
- Installation of manifolds and condensate draining legs;
- Installation of the gas collection system pipework (63mm OD) between wellheads and manifolds;

- Installation of the gas collection system pipework (180mm OD) between manifolds and the gas main;
- Installation of the gas collection system mains ( 250mm OD) and condensate draining legs;
- Connection of the gas mains to the existing Gas Treatment Plant;
- All permanent connections to the wellheads, manifolds, condensate draining legs and mains;
- Pressure testing of the complete gas pipework from manifold inlets (including dewatering vessels) to the point of connection to the Employer's existing infrastructure;
- Leak Tests of all connecting pipework, from the wellheads to the manifolds;
- The construction of associated temporary access roads where required;
- Any other works deemed necessary by the Works Supervisor or Employer.

2.2.2 The Contractor shall ensure that all works carried out and all materials used for the construction of the Gas Collection System Works comply with this Specification and CQA Plan. It is the Contractor's responsibility to demonstrate this compliance (by providing evidence) at any time, if required by the Works Supervisor.

### **2.3 Duties to be performed by the Works Supervisor**

2.3.1 The duties to be performed by the Works Supervisor shall comprise (but not be limited to):

- Construction Quality Control (CQC) of the gas collection system components and materials by verifying Manufacturers Quality Control certification from the supplier.
- Construction Quality Assurance (CQA) by way of independent verification that the works have been carried out in accordance with the CQA Plan.
- Checking the progress of each gas well prior to the end of the working day to certify that no well shall be left without a 'gas tight/sealed' installation overnight.
- Supervision of on-site pressure testing and countersigning the pressure testing certificates in the presence of the Contractor.
- Maintaining records of progress, any changes to the CQA Plan and results received.
- Liaison with the Malta Environment and Planning Authority (MEPA) representative during the works, if required to do so by the Employer.
- Liaison with the Employer's representatives regarding any operational waste disposal activities and the active landfill gas and leachate management operations.
- The production of a Final Report for submission to the Employer.

## **2.4 Construction Stages – Work Method Statements**

2.4.1 Prior to commencement of each stage of the Gas Collection System works, the Contractor shall submit a full method statement and risk assessment for the approval of the Works Supervisor showing compliance with the Specification & CQA Plan. The method statement shall be submitted five working days prior to commencement of the work stage to facilitate discussion and amendment of the working practices if required. The method statement shall be discussed with the Employer prior to approval if requested. The method statement shall include details on the following work stages:

- Proposed method for the delivery, handling, checking and storage of materials prior to incorporation in the permanent works;
- Proposed method for carrying out surface temperature monitoring to identify hot areas, prior to the commencement of the gas collection system installation.
- Proposed method (including plant) for the drilling of the gas wells, including disposal of the waste arisings;
- Proposed method for carrying out temperature monitoring inside the drilled boreholes, prior to the installation of the gas well pipework/casing. This would determine whether there is a need for changing the gas well's materials specification (i.e. the possible use of steel pipework/casing as specified in drawing D117657/TZ/GAS/04);
- Proposed method for the installation of the gas well pipework/casing (including end caps), gravel surround, bentonite seals and wellheads, including verification with the Works Supervisor of the installation depth for each material;
- Proposed method for the installation of the manifolds and condensate draining legs, including all groundwork/ground surface preparation;
- Proposed welding methods and equipment to be used for the pipework, including preparation of joints prior to welding;
- Proposed methods for the installation of the pipework in the permanent works, including securing on the slopes and the excavation to create trenches where pipes are crossing benches;
- Methodology to be used for on-site conformance pressure and leak testing of the complete installation, from the wellheads of the drilled wells to the point of connection to the Employer's existing infrastructure, including methods for dealing with failures and the associated remedial works;
- Proposed method for the connection of the gas collection system to the Employer's existing gas management infrastructure, including liaison during any shutdowns of the Employer's active gas extraction system and conformance with any Permit to Work system.
- Methodology for effecting a temporary seal to drilled boreholes or installed gas wells should conditions dictate that a complete 'gas tight/sealed' installation might not be completed before the end of the working day.



- Proposed method for the cleaning of any item of plant/equipment that may come into direct contact with waste prior to demobilisation;

2.4.2 Commencement of any work stage is subject to approval of the method statement by the Works Supervisor. Any works commenced by the Contractor prior to discussion of the proposed methods and approval of the method statement will be at the Contractor's own risk and any material placed may be subject to removal/remediation to the satisfaction of the Works Supervisor.

## **2.5 Setting Out and As-Built Construction Surveys**

2.5.1 Prior to the commencement of works and throughout the Construction Quality Assurance programme, surveys shall be undertaken by the Contractor to confirm that construction is being carried out in accordance with the CQA Plan. Details of the surveys to be undertaken by the Contractor are detailed in Section 9.0.

2.5.2 Surveys shall be undertaken on a fixed 20-metre spaced string where verification of the fall of the gas collection system pipework is required, with further survey points included to identify any abrupt change of grade and details such as pipework joints and connections on the as-built construction drawings.

2.5.3 The as-built surveys shall include the details of all gas wells, manifolds, condensate draining legs, pipework (including all joints and connections) and connection to the Employer's existing gas management infrastructure.

2.5.4 Survey drawings shall be referenced to local grid and Ordnance Datum.

## **2.6 Existing Gas and Leachate Management Infrastructure**

2.6.1 Any disconnections required shall be carried out under a Permit to Work system managed by the Works Supervisor. Under no circumstances shall the Contractor disconnect existing leachate and gas management infrastructure unless authorised to do so under the Permit to Work system.

### **3.0 DELIVERY, STORAGE AND HANDLING OF COMPONENTS AND MATERIALS**

#### **3.1 General**

- 3.1.1 To ensure the optimum performance of the gas collection system components and materials, they shall be transported, handled and stored prior to and during installation in a manner that does not impair the physical or chemical properties of any component of the material and in accordance with the manufacturer recommendations. All personnel involved in handling shall be made aware of the types of activities that may result in damage.

#### **3.2 Delivery of Components and Materials**

- 3.2.1 The Works Supervisor shall supervise the delivery and unloading of the components and materials to ensure that no damaged deliveries are incorporated in the permanent works.
- 3.2.2 Components and materials shall be taken from the delivery vehicle using suitable equipment. They shall not be dragged, pushed or allowed to fall onto the ground or vehicle from any height. All precautions shall be taken to avoid damage. The Works Supervisor will not accept components and materials that cannot be unloaded from the delivery vehicle in a manner that precludes causing damage.
- 3.2.3 During unloading, the Works Supervisor will complete a visual inspection to identify any damage or suspected damage on delivery. Any damaged components or materials shall be labelled and segregated for further investigation. Goods delivered without the full labelling shall be suspected of damage.
- 3.2.4 The delivered items will be checked against the specification. The Works Supervisor shall record the delivered components and materials and include notes on the condition of the goods.
- 3.2.5 Fabricated components shall be marked with a unique, permanent serial number for the purposes of traceability. The serial number shall be located in a position that will be accessible for viewing once the fabrication is installed. The pressure test certificate and as-built construction drawing shall make reference to the serial number of the fabrication. Fabrications supplied without a valid pressure test certificate, where applicable, and an as-built construction drawing shall be rejected. Similarly, fabrications with inaccurate drawings or without a serial number shall also be rejected.
- 3.2.6 Electro-fusion couplers shall be delivered to site in packaging that will protect the couplers from contamination and the Contractor shall ensure that the couplers are kept in the packaging provided by the manufacturer until required for use in the works.
- 3.2.7 The Contractor shall obtain a copy of the manufacturer quality control (MQC) certificates for all components and materials used in the Works and these shall be passed on to the Works Supervisor.

#### **3.3 Storage**

- 3.3.1 Before taking delivery of the components and materials, the Contractor and Works Supervisor shall agree the location of the storage facility before the preparation of an area suitable for both the reception and storage of the material.

- 3.3.2 The storage facility shall be located where the components and materials will not be affected by site activities (e.g. site traffic). The area shall be situated away from vegetation and be rolled to provide a firm, flat and horizontal surface that shall be prepared to avoid puncturing or other damage. It shall be of a sufficient size to enable pipework to be stored on an area of flat ground large enough to accommodate the full length of the pipes in such a way that they will not be damaged or deformed. The storage area shall be flat, firm and provide cover for the components and materials.
- 3.3.3 Components shall not be stacked in a manner that may cause stress or damage. They shall not be stored in a manner that may allow them to fall and be damaged or cause injury to persons.
- 3.3.4 To protect the components and materials, the base of the storage area shall be dry, well drained and stable. The storage area shall provide protection from the following:
- Standing water;
  - Chemicals;
  - Contamination ;
  - Excessive heat ( $>70^{\circ}\text{C}$ ) and sparks; (dependant upon manufacturers recommendations);
  - Vandalism, animal and plant infestation;
  - Puncture;
  - Any other environmental condition that could impact on the physical properties.

Particular attention shall be paid to perforated well casing to ensure the perforations remain intact and clear prior to installation.

- 3.3.5 The correct storage of all gas collection system components and materials lies with the Contractor. Any damage occurring shall be recorded by the Contractor and Works Supervisor, who may instruct isolation of individual components to allow further inspection.
- 3.3.6 Should the Contractor wish to use components or materials that are suspected as being damaged, the Contractor shall demonstrate to the Works Supervisor that these components or materials will operate in the manner proposed and not inhibit the operation of the gas collection system.

### **3.4 Handling of Components**

- 3.4.1 Responsibility for correct handling of the components and materials on site lies with the Contractor and shall be carried out so as not to cause damage and to be in accordance with good health and safety practice.
- 3.4.2 Components and materials will be handled using appropriate equipment that will not cause damage or threaten the integrity. Any damage caused during handling shall be recorded by the Works Supervisor and rectified or segregated for further inspection or testing.
- 3.4.3 Should components or materials become damaged during delivery, storage or handling, the goods shall be segregated and clearly labelled to ensure that they are not used in the permanent works.

## **4.0 INSTALLATION OF GAS WELLS**

### **4.1 General**

- 4.1.1 Vertical gas wells shall be installed across the Ta'Zwejra landfill area at typically 30 to 40m intervals. The proposed locations are shown on Drawing D117657/TZ/GAS/01.
- 4.1.2 Gas wells shall be installed to the design shown on Drawing D117657/TZ/GAS/02.
- 4.1.3 The Contractor shall complete drilling and installation logs for all gas wells. These shall be available for inspection by the Works Supervisor at any time.
- 4.1.4 Gas wells shall be permanently labelled and cross-referenced with the as-built survey drawings.

### **4.2 Prior to Commencement of Works**

- 4.2.1 Temperature Monitoring: As there is evidence of subterranean fires at Ta'Zwejra landfill, the Contractor shall carry out surface temperature monitoring prior to commencement of any works, to determine the location of any hot areas. Temperature monitoring must also be carried out after the drilling of each borehole has taken place and before the installation of gas wells. Temperature monitoring data will determine whether there is a need for some gas wells and connecting pipework to be constructed with steel material (as opposed to MDPE).
- 4.2.2 The Contractor shall provide a provisional plan of the phasing of gas well drilling and installation to the Works Supervisor prior to starting drilling works. The phasing plan shall be designed to minimise tracking of plant and equipment over the waste surface between gas well locations and the developments of rutting/exposing of the waste and daily cover/existing capping regulating layer material. The phasing plan should be submitted to the Works Supervisor at least five working days prior to commencement of drilling for approval, in time for amendments to be made if required by the Works Supervisor.
- 4.2.3 Prior to drilling the wells, a section of the GCL cap shall be cut out and removed to allow drilling to take place straight into the waste mass. The drilling operation should be such that no snagging of the capping geosynthetic occurs.
- 4.2.4 Drilling shall be carried out by a specialist Contractor with the appropriate level of experience in the drilling of boreholes in waste. Personnel shall hold certification for drilling to a recognised training agency/industry standard (e.g. British Drilling Association). Certificates shall be submitted to the Works Supervisor for approval at least five working days prior to commencement of the works.
- 4.2.5 Drilling and gas well installation shall be phased to ensure that all wells are drilled, installed and sealed at the end of each working day. Should it be likely during the working day that this is not feasible, the Contractor shall bring this to the attention of the Works Supervisor immediately and an action plan agreed for implementation.

### **4.3 Setting Out Locations and Drilling Depths**

- 4.3.1 The location of each gas well is shown on drawing D117657/TZ/GAS/01. The Contractor shall survey/set out each gas well location based on this drawing. It is important that the Contractor confirms the existing restoration level at each location. The Works Supervisor shall ensure that levels are as shown on the Gas Well Depths schedule in Appendix C ("Restoration Level"). Should a discrepancy be present, the Contractor shall immediately inform the Works Supervisor and the Employer, and the depths of the gas wells shall be adjusted accordingly. This is important in order to ensure that there is no damage caused on the sidewall or basal lining system by the drilling works.
- 4.3.2 The Contractor shall mark out each location using an appropriate marker. Any temporary marker such as pegs or paint shall be subject to confirmation of the location in the presence of the Works Supervisor should drilling not commence immediately following setting out.
- 4.3.3 Any damage to, or suspected movement of, the marker prior to commencement of drilling shall be brought to the attention of the Works Supervisor immediately. No drilling shall commence until authorised by the Works Supervisor.
- 4.3.4 The provisional drilling depth for each gas well is shown in Appendix C "Gas Well Depths" schedule and shall be confirmed by the Works Supervisor prior to commencement of the works. It should be noted that the drilling depth includes the capping thickness (600mm of regulating layer, GCL and restoration soils).

### **4.4 Drilling**

- 4.4.1 Gas wells shall be drilled to 350mm diameter using a rotary barrel auger or other technique approved by the Works Supervisor in advance of the works.
- 4.4.2 Drilling shall continue to the depth confirmed by the Works Supervisor. The drilling depth shall not be exceeded in order to prevent penetration of any sidewall or basal lining system. Should the Contractor suspect at any time that a lining system to the landfill is being penetrated by drilling activities, irrespective of whether or not drilling depths have been exceeded, drilling shall cease immediately and the Works Supervisor shall be notified without delay.
- 4.4.3 Waste material brought to the surface during drilling shall be disposed of by the Contractor in a manner agreed with the Works Supervisor. No waste shall be left exposed overnight. The Contractor shall keep drilled waste material and surrounding daily cover/existing regulating layer materials separate. Where an area of daily cover/existing regulating layer material becomes contaminated, it shall be removed and replaced with clean daily cover or capping regulating layer material, as agreed with the Works Supervisor. Contaminated material shall be disposed in a manner agreed with the Works Supervisor.

### **4.5 Gas Well Installation**

- 4.5.1 The Contractor shall confirm the drilled depth and the installation detail with the Works Supervisor prior to gas well installation. Installation shall not commence until the Works Supervisor has confirmed all the details.
- 4.5.2 Installation of the gas well shall be supervised by the Works Supervisor.

- 4.5.3 Gas wells shall be constructed using MDPE well casing. The casing shall be joined by threaded connections or butt fusion welding to give a flush internal and external fitting. The gas wells shall be constructed from 160mm PN-6 SDR-11 casing. A length of 5m plain casing shall be used to prevent the location of a joint within the bentonite seal and prevent the ingress of bentonite or waste into the well. The perforated well screen shall have a 5% to 10% open area. An end cap shall be installed on the bottom of the well screen and secured in place.
- 4.5.4 The annulus of the gas well shall be filled with a washed, 20mm to 40mm non-calcareous gravel (e.g. basalt). Care shall be taken during installation to prevent bridging. The gas well annulus shall be sealed with a bentonite seal. Where bentonite is used it shall be in granular form. The use of bentonite pellets will not be acceptable. Gravel placement shall not commence until the installation has been agreed with the Works Supervisor. Similarly, bentonite placement shall not commence until the gravel installation has been agreed with the Works Supervisor. The Works Supervisor shall keep separate logs of all the installation checks.
- 4.5.5 Bentonite shall be placed into standing water using the following method: A dry bag of bentonite shall be placed to form a dry layer on top of the gravel pack. The gas well annulus shall then be filled with clean, uncontaminated water and the remaining bentonite slowly emptied into this standing water until the annulus is full. Bentonite pellets shall be rejected.
- 4.5.6 In all areas the gas wells shall be installed as follows:
- A 5m long plain well casing
  - Gravel pack (non-calcareous) from 3m below the GCL liner to well base
  - Bentonite seal from the GCL liner to 3m below GCL level.
- Also see drawing D117657/TZ/GAS/02 for installation details.
- 4.5.7 Perforated well casing shall be installed below the plain casing on all wells, being cut to length to suit the drilled well.
- 4.5.8 All scrap debris and offcuts of pipework shall be removed from the working area and disposed of accordingly as soon as practicable. The Contractor's attention is drawn to the hazard of wind blown debris.
- 4.5.9 A temporary seal to drilled boreholes or installed gas wells shall be installed should conditions dictate that a complete 'gas tight/sealed' installation might not be completed before the end of the working day.

#### **4.6 Wellhead Installation**

- 4.6.1 The wellheads shall be based around a 125mm x 63mm diameter black MDPE reducing tee. The wellheads shall be fabricated from black MDPE using knife-edge butt fusion welding techniques and fittings to provide a compact assembly. All joints on the wellhead shall be internally de-beaded. The wellhead shall be capable of connecting to the gas well. A gas tight seal shall be provided by a 160mm to 125mm flexiseal reducer. Wellheads shall be installed to the design shown on Drawing D117657/TZ/GAS/02.
- 4.6.2 The wellhead shall allow for the movement of the gas well in relation to the waste in both the horizontal and vertical directions with a 63mm flexible hose connection. The flexible hose connection shall be approximately 1.0m to 2.0m in length and shall be fitted in a manner that prevents the accumulation of condensate. The hose shall be fastened using plated or stainless steel clamps. The connection between the flexible hose and the connecting pipe shall be

- located within 200mm of the well casing. No part of the hose including the stainless steel clamps shall be buried.
- 4.6.3 The top blanking flange shall include monitoring facilities that shall comprise of a 2" BSP leachate dipping point with a threaded cap, which must be removable by hand, and a 1/4" ball gas sample valve and barb. A dust cap shall be attached by a non-perishable line, of a type and quality agreed by the Works Supervisor.
- 4.6.4 A ball valve, or similar subject to agreement with the Works Supervisor, shall be installed between the flexible hose and the wellhead.
- 4.6.5 A permanent label shall be attached to the well indicating the reference number.
- 4.6.6 Following completion of the gas wells, the cap will be sealed around the wells using a GCL top hat. The top hat shall overlap the GCL placed on the regulating layer by no less than 500mm and shall be sealed with bentonite powder. The GCL will be sealed to the sides of the well using bentonite paste or other selected sealant. A flexible coupler shall be used to hold the GCL to the gas well head, as shown on drawing D117657/TZ/GAS/02
- 4.6.7 Should "hot" areas ( $>75^{\circ}\text{C}$ ) be identified during temperature monitoring, then gas wells to be installed in these areas should be constructed with steel material and in accordance with the specifications shown on drawing D117657/TZ/GAS/04. These gas wells shall be connected to the system only after monitoring at the gas wells shows that the temperature has substantially reduced ( $<75^{\circ}\text{C}$ ).

## **5.0 INSTALLATION OF ANCILLIARY COMPONENTS**

### **5.1 General**

- 5.1.1 Manifolds and condensate draining legs shall be installed across the Ta Zwejra site area. The proposed locations are shown on Drawing D117657/TZ/GAS/01. The locations shall be confirmed by the Works Supervisor on site during the contract period.
- 5.1.2 Manifolds and condensate draining legs shall be installed to the design shown on Drawing D117557/TZ/GAS/02.
- 5.1.3 Manifolds and condensate draining legs shall be permanently labelled and cross-referenced with as-built survey drawings.
- 5.1.4 Detailed fabrication drawings for the proposed manifolds and condensate draining legs shall be forwarded to the Works Supervisor for approval at least five working days prior to the date required for the order to be placed.

### **5.2 Manifold Installation**

- 5.2.1 The location of each manifold shall be confirmed by the Works Supervisor and the Contractor shall survey/set out each location based on this agreed location. The Contractor shall confirm the existing ground level at each location and agree this with the Works Supervisor.
- 5.2.2 The manifolds shall be fabricated from 180mm diameter black MDPE to PN-6 SDR-17.6 with a single valved outlet for connection to the gas main and a 180mm blank end as shown on Drawing D117557/TZ/GAS/02. The manifolds shall provide a sufficient number of 63mm inlets for the connecting pipework from the gas wells. The exact number is shown on drawing D117657/TZ/GAS/01 and shall be confirmed by the Works Supervisor prior to manufacture.
- 5.2.3 Isolating and control valves shall be provided for each incoming gas line. The valves shall be ball valves or similar subject to agreement with the Works Supervisor. The inlets shall be permanently marked as to the well number on each line with a suitable durable label.
- 5.2.4 Gas sample valves (1/4") shall be provided immediately upstream of each isolating and control valve.
- 5.2.5 The outlet of the manifold shall comprise of a single 180mm MDPE pipe of SDR-17.6 fitted with a butterfly valve for isolation and control. Gas sample valves shall be provided immediately downstream of the manifold isolating and control valve.
- 5.2.6 Manifolds shall be factory tested to 1 bar gauge and supplied to site with a pressure test certificate.
- 5.2.7 Incoming lines shall have adequate falls (minimum 1:25) towards the manifold and the manifolds shall be laid to fall towards the outlet to facilitate drainage of condensate.
- 5.2.8 Each manifold shall be installed within an integral MDPE chamber, of robust construction, as shown on Drawing D117657/TZ/GAS/02. The chamber shall be sealed with a lockable lid of robust design, sealing against water ingress and capable of being easily lifted by one person. The chamber lid design employed must enable the lid to remain, or be locked in, an open position while access is made to the chamber.



- 5.2.9 A permanent drain shall be installed in the base of the chamber to allow any water that collects within the chamber to drain away.

### **5.3 Condensate Draining Leg Installation**

- 5.3.1 The location of each condensate draining leg shall be confirmed by the Works Supervisor and the Contractor shall survey/set out each location based on this agreed location. The Contractor shall confirm the existing ground level at each location and agree this with the Works Supervisor.
- 5.3.2 The condensate draining legs to be installed in the ring main should be fabricated around a 355mm to 250mm MDPE tee. Tee pieces should be moulded and not fabricated.
- 5.3.3 Construction details of the condensate draining legs are shown on Drawing D117557/TZ/GAS/02

## **6.0 INSTALLATION OF CONNECTING PIPEWORK AND GAS MAINS**

### **6.1 General**

- 6.1.1 Pipework to connect the gas wells to the manifolds shall be 63mm black MDPE to PN-6 SDR-17.6 and jointed using electro-fusion or fully automatic butt-welding techniques.
- 6.1.2 Pipework to connect the manifolds to the ring main shall be 180mm black MDPE to PN-6 SDR-17.6 and jointed using electro-fusion or fully automatic butt-welding techniques.
- 6.1.3 Pipework to construct the gas mains shall be 250mm black MDPE to PN-6 SDR-17.6 and jointed using fully automatic butt-welding techniques. Gas mains shall be installed on restored ground across the capping area.
- 6.1.4 The proposed pipework routes are shown on Drawing D117657/TZ/GAS/01. The exact routes shall be confirmed by the Works Supervisor on site during the contract period prior to installation..

### **6.2 Prior to Commencement of Works**

- 6.2.1 The Contractor shall provide a provisional plan for the phasing of pipework installation to the Works Supervisor prior to commencing installation works. The phasing plan shall be designed to minimise dragging of pipework across the installed capping system and the tracking of plant and equipment over the existing ground along the pipework route and the subsequent developments of rutting of the capping restoration soils material. The phasing plan should be submitted to the Works Supervisor at least five working days prior to commencement of pipework installation for approval, in time for amendments to be made if required by the Works Supervisor.
- 6.2.2 Pipework installation shall be carried out by a specialist contractor with the appropriate level of experience in the installation of landfill gas collection systems. Personnel shall hold certification for welding to a recognised training agency/industry standard. Certificates shall be submitted to the Works Supervisor for approval at least five working days prior to commencement of the works.
- 6.2.3 The Contractor shall submit a proposed methodology for the welding and installation of the pipework. The methodology shall be approved by the Works Supervisor prior to any installation works commencing.

### **6.3 Setting Out Routes**

- 6.3.1 The pipework routes shall be confirmed by the Works Supervisor and the Contractor shall survey/set out each route based on this agreed information. The Contractor shall confirm the existing ground conditions for each route and agree these with the Works Supervisor.
- 6.3.2 The Contractor shall mark out each route using an appropriate marker. Any temporary marker such as pegs or paint shall be subject to confirmation of the location in the presence of the Works Supervisor should pipework installation not commence immediately following setting out.
- 6.3.3 Any damage to, or suspected movement of, the marker prior to installation shall be brought to the attention of the Works Supervisor immediately. Should this occur no installation shall commence until authorised by the Works Supervisor.

- 6.3.4 All pipework to connect the gas wells to the manifolds and the manifolds to the ring main shall be laid to maximise the fall. Ideally falls should be 1:25 or greater. Where this is not achievable, connecting pipeline routes shall be agreed with the Works Supervisor. The Contractor shall survey proposed connecting routes to determine levels and falls and mark routes on the site.
- 6.3.5 In general, the connecting pipework shall be surfaced laid on the top of the restoration soils and secured in place by suitable steel hoops driven into the ground at the location of every joint. Where the connecting pipework crosses benches, pipes shall be protected by at least 150mm of fine material/sand, before covered with crushed stone, as shown on drawing D117657/TZ/GAS/02.
- 6.3.6 The pipework to construct the ring main shall fall to the condensate draining legs. All falls on the ring main shall be at least 1 in 50 on the landfill where the fall and gas flow are in the same direction. Where the fall and gas flow are in opposite directions the falls on the main shall be at least 1 in 25. In any location where these falls cannot be achieved an alternative route shall be agreed on site with the Works Supervisor.
- 6.3.7 The ring main shall be covered with a minimum of 300mm crushed granular material (<50mm), as shown on drawing D117657/TZ/GAS/01. Material can be provided by the Employer at source (adjacent to the site) but needs to be crushed by the Contractor to the required type.
- 6.3.8 An as-built survey of the gas collection system shall be used by the Works Supervisor to check pipework falls.

#### **6.4 Pipework Welding and Installation**

- 6.4.1 Pipework shall be jointed using either electro-fusion or butt-welding techniques in accordance with the CQA Method Statements in Appendix A.
- 6.4.2 A log of all electro-fusion and butt-welding joints shall be prepared for submission to the Works Supervisor. Any failed joints shall be brought to the attention of the Works Supervisor immediately.
- 6.4.3 Pipework shall be installed in accordance with the CQA Method Statement in Appendix B.
- 6.4.4 Connections to the existing gas collection system ring mains (Maghtab) shall be by means of 90 degree 'Tee' couplers.

## **7.0 CONNECTION TO EXISTING SYSTEM**

- 7.1 All connections to the existing gas collection system shall be carried out under a Permit to Work system issued by the Works Supervisor. No connection work to the existing gas collection system shall commence until the Works Supervisor has signed the Permit to Work and issued the required documentation to the Contractor.
- 7.2 The Contractor shall provide a provisional plan of the phasing of connections to the existing gas collection system to the Works Supervisor prior to requesting the Permit. The phasing plan shall be designed to minimise the need to shut down the active gas collection system. The phasing plan should be submitted to the Works Supervisor at least five working days prior to requesting the Permit for approval, in time for amendments to be made if required by the Works Supervisor.
- 7.3 A schematic plan of the connection to the existing system is shown on drawing D117657/TZ/GAS/03RevA.
- 7.4. Connections to the existing gas collection system ring mains (Maghtab) shall be by means of 90 degree 'Tee' couplers with lever operated wafer butterfly valves, with coated cast iron body, sandwiched between standard spigot HDPE or steel stab flanges, secured with galvanised steel backing rings and a full set of bolt assemblies. An access chamber shall be built around each connection. Levers should be long enough to be operated from the top of the chamber. Details of the connections configuration are shown on drawing D117657/TZ/GAS/03RevA.
- 7.5 Connection to the existing system also involves the replacement of sections of the four existing inlets with flexible steel or MDPE fittings, as shown on drawing D117657/TZ/GAS/03RevA. The length required to be replaced shall be agreed with the Employer.

## **8.0 COMPLETION CERTIFICATION**

- 8.1 On completion, the gas collection system will be subject to three different kinds of conformance pressure testing:
- Pressure test to one bar gauge for one hour on all gas mains pipework to the manifold inlets, including the condensate draining legs;
  - Vacuum test to maximum working suction on the same infrastructure noted above;
  - Leak test on all connecting pipework from wellhead to manifold under normal operating conditions.
- 8.2 All fabrications, apart from wellheads, shall be factory pressure tested to one bar gauge and supplied to site with a successful pressure test certificate to demonstrate compliance.
- 8.3 A typical pressure test certificate is included in Appendix D. The Contractor may submit an alternative form of certificate provided all the information contained on the certificate in Appendix D is included.
- 8.4 The method statement submitted by the Contractor shall detail the procedure for verification of all conformance pressure testing following the backfill of any trench or restoration soil materials.
- 8.5 The Works Supervisor shall witness and approve all conformance pressure testing and shall counter-sign the pressure test certificate. The Contractor shall give the Works Supervisor at least 24 hours notice of the intention to carry out the test.

## **9.0 DOCUMENTATION**

### **9.1 Records to be Produced/Completed by the Contractor**

9.1.1 Records shall be kept at all times when work is in progress at the site.

9.1.1.1 The following site records shall be produced and signed by the Contractor:

- Daily records detailing the extent and type of any works carried out, including details of the types of plant and equipment used, any mechanical breakdowns and standing time, personnel on site, Sub-contractors, material deliveries, materials used, a record of the weather on each day of the works and any other information in connection with the works deemed necessary by the Works Supervisor and the Contractor;
- Installation records in connection with drilling, gas well installation, manifold and draining leg installation and the construction, welding and installation of the connecting and ring main pipework, compressed air lines and condensate discharge pipework. Also temperature monitoring records are required prior to the commencement of works and during the installation of gas wells. As a minimum, the information shown on the CQA record sheets in Appendix C shall be provided.

9.1.1.2 The following surveys and drawings shall be produced and signed by the Contractor:

- A survey (3-D) of the capped landfill, prior to the commencement of any works. This is required to ensure that the final profile is in accordance with the profile shown on drawings D117657/TZ/GAS/01, and the levels of the capped landfill are the levels shown on the drawings plus 0.6m (capping thickness).
- Construction/as-built specification drawing for all fabrications, as provided by the manufacturer;
- A 3-D plan of the as-built gas collection system showing all gas wells, manifolds, draining legs and the routes and joints of all connecting and ring main pipework, including connections to the existing gas collection system. Infrastructure shall be labelled with the unique reference number. The plan should include topographic features from the site survey, including the survey base stations;
- A 3-D plan of the as-built pipework joints, with all joints labelled with the unique reference number. Where joints are too close together to be distinguished, a magnified view shall be produced;
- A detailed as-built level and coordinate survey of sections for each pipework route, invert of pipework, showing the fall of the pipework and ground level at 20m intervals.

9.1.2 Surveys shall be produced to local grid and Ordnance Datum. The detailed survey information shall be submitted to the Works Supervisor in a hard copy (printed in full colour where necessary) and a three-dimensional electronic format (approved by the Works Supervisor), on completion of the works.

9.1.3 Completed records shall be submitted, together with relevant supporting documents and drawings, to the Works Supervisor for approval, who shall indicate his approval. If there are any discrepancies, omissions or other areas of non-compliance the Works Supervisor shall give the Contractor notice of items requiring attention.

## **9.2 Records to be Produced/Completed by the Works Supervisor**

9.2.1 The Works Supervisor shall produce and sign the following records:

- Site diary detailing the extent and type of any works carried out, including details of the types of plant and equipment used, any mechanical breakdowns and standing time, personnel on site, including Contractor, Sub-contractors, visitors, regulatory authorities and Employer, a record of the weather on each day of the works and whether the works are being undertaken within the specified conditions and any other relevant information in connection with the works;
- Records of delivery, handling and storage of materials, including the identification of any damaged or segregated gas collection system components and materials;
- CQA records of drilling, gas well installation, manifold and draining leg installation and the construction, welding and installation of the connecting and ring main pipework, compressed air lines and condensate discharge pipework;
- Level of supervision by the Works Supervisor;
- Any remedial action required to the existing and installed gas collection system;
- Testing procedure and reports of compliance pressure tests;
- Any other relevant matters detailed in the CQA Plan.

9.2.2 The Works Supervisor shall complete and sign the record sheets, and inform the Contractor on a daily basis of any areas of non-compliance and indicate the required remedial action to rectify any problems.

## **10.0 FINAL REPORT**

10.1 On completion of the works and scheduled conformance pressure testing, the Works Supervisor shall produce a Final Report to be submitted to the Employer. The report will form a permanent, well-documented record of the work carried out, the materials and construction methods used and the conformance pressure testing undertaken. Photographs of the various stages and elements of the work shall be included.

10.2 Typical sections for the report would include:

- Introduction;
- Description of the works;
- Materials used in construction;
- Gas collection system installation details;
- Conformance pressure testing logs;
- Failures / Non-Compliance Problems, including remedial action taken;
- Drawings;
- Photographs;
- Works Supervisor Site Records.

10.3 The as-built survey drawings shall contain all the information detailed in Section 9.0.



## **11.0 WORKS SUPERVISION**

- 11.1 Quality Control Procedures for works supervision shall be in accordance with those specified within this document. The Works Supervisor shall be on site at all times during the works carried out in accordance with the CQA Plan. If any drilling works, gas well, manifold and draining leg installation, pipework welding, pipework installation and conformance pressure testing is carried out when the Works Supervisor is not on site, the Works Supervisor may require that any section of the works is uncovered and proper installation demonstrated. The Works Supervisor may instruct that any such installed material is removed and replaced in conformance with these procedures.

## **APPENDIX A**

### **CQA METHOD STATEMENT- PIPEWORK WELDING**

### **Pipe Jointing – Butt Fusion**

1. All butt fusion joints to be made using fully automatic welding equipment following industry standard procedures.
2. All butt fusion joints to be performed in a proprietary shelter with covered floor.
3. Proprietary pipe supports will be used where necessary.
4. Large diameter pipes to be moved by mechanical means.
5. The job code for the works will generally be “Pilsworth North Cell 12”, but will be agreed with the Works Supervisor prior to the commencement of the works.
6. The operator code will be “XY” where X and Y are the operator’s initials.
7. The weld parameters shall be set up for WATER pipes, the appropriate SDR rating and the pipe outside diameter.
8. A test joint will be made at the start of each shift or after changing pipe sizes.
9. All joints will have the joint number, operator’s initials and the date marked permanently on the pipework.
10. All test, redundant and failed joints will be marked as above, cut out and retained for inspection.
11. A written/printed log of all joints will be maintained and supplied to the Works Supervisor at the end of each working day. These shall include test, failed and permanent joints.
12. A print out of all joints will be taken at the end of each shift.
13. All butt fusion welding data shall be downloaded by data transfer before any welding machines are demobilised from site.
14. Debeading of joints will not be required. However, the Works Supervisor reserves the right to request this procedure to be carried out.
15. All pipework joints to be recorded on as-built survey drawings.
16. The Works Supervisor shall reject all joints where the CQA procedure is not followed as described above.

## **Pipe Jointing – Electro-Fusion**

1. All electro-fusion joints to be made using automatic welding equipment following industry standard procedures.
2. All electro-fusion joints to be carried out using the appropriate clamps. Where this is not possible, the joint shall be witnessed by the Works Supervisor prior to backfilling and the non-use of clamps recorded.
3. The job code for the works will generally be “Pilsworth North Cell 12”, but will be agreed with the Works Supervisor prior to the commencement of works.
4. The operator code will be “XY” where X and Y are the operator’s initials.
5. Pipe shall be prepared for welding by drying and cleaning the end and scraping evenly using a proprietary pipe scraper. Swarf to be removed.
6. Place pipe in proprietary restraining clamp.
7. Electro-fusion couplers shall not be removed from the protective packaging until the surfaces to be welded have been prepared. Contaminated couplers shall be rejected by the Works Supervisor.
8. Remove electro-fusion coupler from sealed bag. Check for cleanliness and place over pipe, ensuring it is pushed up to the centre stops.
9. Prepare second pipe as above.
10. Push second pipe into coupler and check penetration depth, ensuring fitting cannot be moved along length of pipe. Tighten restraining clamp.
11. Check weld time shown on the coupler is displayed on control box display.
12. Press “start” and wait for control box to finish cycle.
13. Clamps not to be removed until cooling period is complete.
14. Where the Works Supervisor has permitted the non-use of clamps, no other joints on that section of pipe may be carried out until the cooling time has lapsed.
15. All joints shall have the joint number, operator’s initials and the date marked permanently on the pipework or coupler.
16. All failed joints will be marked as above, cut out and retained for inspection.
17. A written/printed log of all joints will be maintained and supplied to the Works Supervisor at the end of each working day. These shall include test, failed and permanent joints.
18. A print out of all joints will be taken at the end of each shift.
19. All pipework joints to be recorded on as-built survey drawings.
20. The Works Supervisor shall reject all joints where the CQA procedure is not followed as described above.

## **APPENDIX B**

### **CQA METHOD STATEMENT- PIPEWORK INSTALLATION**

## **Pipework Installation**

1. Excavation works to be carried out by means of tracked or wheeled excavator.
2. Machinery only to be operated by competent and trained personnel. Evidence of competency to be supplied to the Works Supervisor prior to the commencement of works.
3. The gas well to manifold connecting pipework shall be installed directly on the capping system (top of restoration soils). Where the connecting pipework crosses benches, pipes shall be protected by at least 150mm of fine material/sand, before covered with crushed stone, as shown on drawing D117657/TZ/GAS/02.
4. Excavation over the GCL capping system shall be limited to within 100mm, or greater, of the capping system, with hand excavation methods employed directly over the materials. The depth to the capping system shall be supplied by the Works Supervisor prior to the commencement of works.
5. Where possible, pipework runs connecting wells to manifolds will be shared.
6. If any capping system is breached/excavated, the Works Supervisor shall be informed immediately. Hand excavation should be completed to allow repair by others. Excavated hole to be taped off until repaired and backfilled.
7. Pipes to be strung out and joined.
8. Pipes to be jointed using either butt fusion or electro-fusion welding methods as detailed in Appendix A.
9. All gas main routes with less than 300 mm of cover material shall be identified to the Works Supervisor and marked above ground with pegs and bunting.
10. Sections of gas main around major joints and changes in pipework direction to be left exposed for surveying and pressure test. Excavation to be taped/fenced off.
11. Where the direction of pipe run is not obvious after reinstatement, pipe runs to be marked using pegs and bunting for surveyor to follow.
12. All exposed ends of installed pipework to be sealed at the end of each shift to prevent the ingress of water and debris.
13. After installation, 3D survey to be carried out on all pipework runs and by using the chainage and depth information.
14. As-built survey drawings to be provided.

## **APPENDIX C**

### **PROVISIONAL DEPTH OF GAS WELLS- SCHEDULE**

## **APPENDIX D**

### **CQA RECORD SHEETS**



## **DRAWINGS**

D117657/TZ/GAS/01: GAS MANAGEMENT SYSTEM LAYOUT

D117657/TZ/GAS/02: GAS MANAGEMENT SYSTEM DETAILS

D117657/TZ/GAS/03RevA: SCHEMATIC PLAN-CONNECTION TO EXISTING GAS SYSTEM

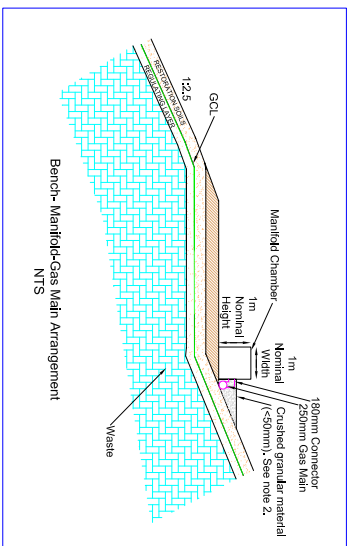
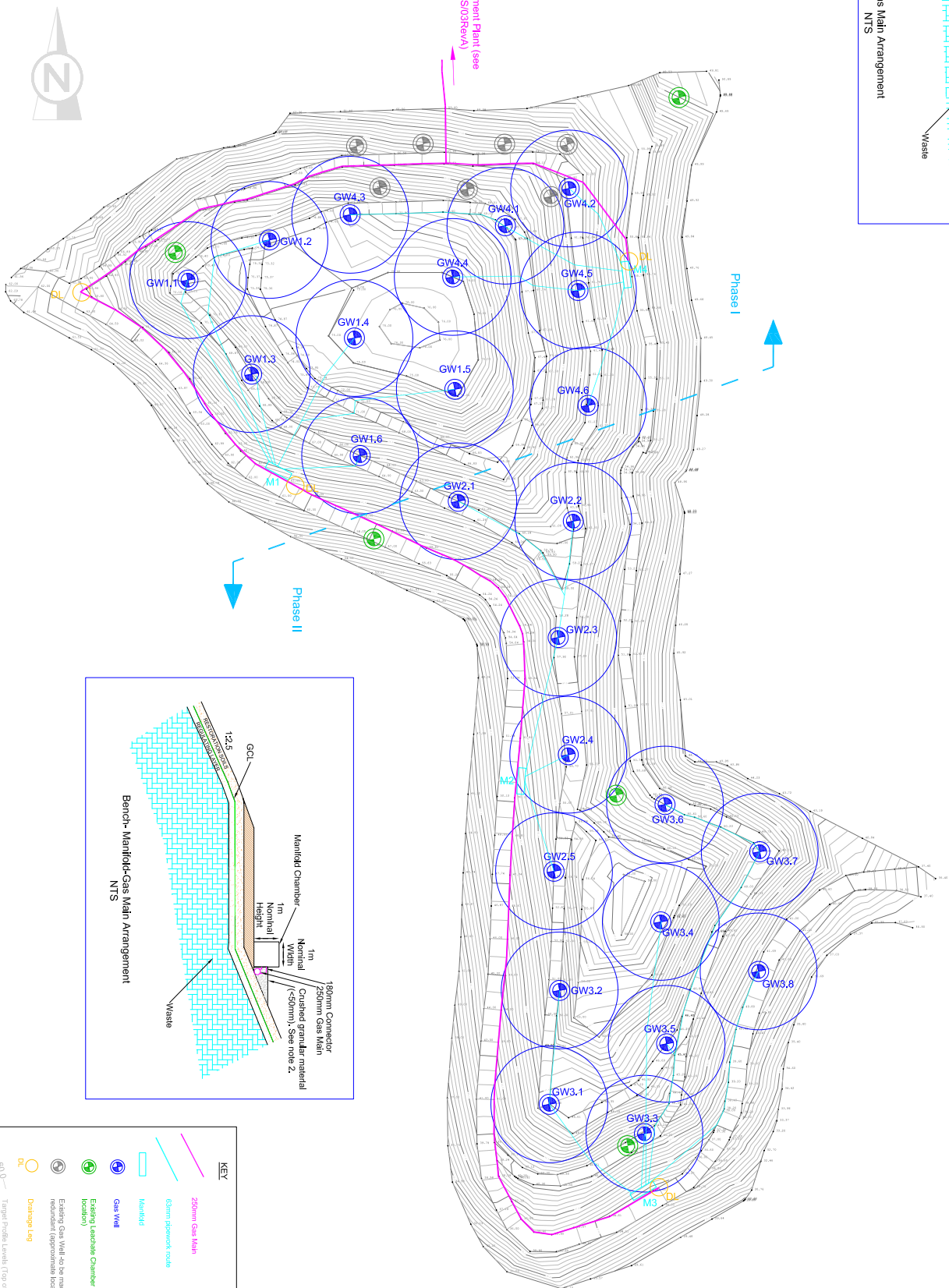
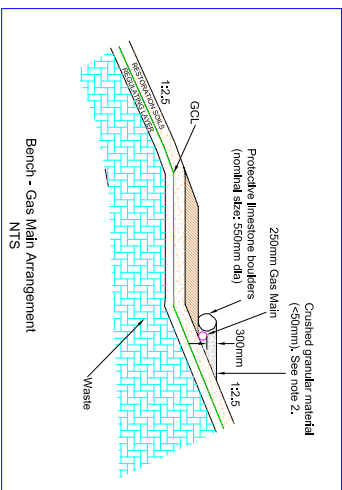
D117657/TZ/GAS/04: STEEL GAS WELLS SPECIFICATIONS

### **Provisional Gas Well Depth**

	No	Formation Level (m)	Restoration Level (m)	Base Level (Drainage Layer) (m)	Difference (m)	Maximum allowed Gas Well Depth (m)	Proposed Gas Well Depth (m)
GW	1.1	72.7	73.3	56.94	16.36	11.36	11
GW	1.3	69.34	69.94	55.78	14.16	9.16	9
GW	1.6	65	65.6	53.92	11.68	6.68	6.5
GW	2.1	61.65	62.25	50.7	11.55	6.55	6.5
GW	1.2	74.28	74.88	60.27	14.61	9.61	9.5
GW	1.4	75.4	76	53.63	22.37	17.37	17
GW	1.5	75.13	75.73	49.4	26.33	21.33	21
GW	4.3	73.2	73.8	51.13	22.67	17.67	17.5
GW	4.4	75	75.6	49.15	26.45	21.45	21
GW	4.2	61.92	62.52	47	15.52	10.52	10.5
GW	4.1	68	68.6	48	20.6	15.6	15.5
GW	4.5	61.75	62.35	46.06	16.29	11.29	11
GW	4.6	61.28	61.88	45.07	16.81	11.81	11.5
GW	2.2	60.5	61.1	47.84	13.26	8.26	8
GW	2.3	58.09	58.69	37.99	20.7	15.7	15.5
GW	2.4	56.77	57.37	36.29	21.08	16.08	16
GW	3.6	50.64	51.24	38.84	12.4	7.4	7
GW	3.7	49.4	50	32.28	17.72	12.72	12.5
GW	3.8	41.39	41.99	25.18	16.81	11.81	11.5
GW	3.4	55.5	56.1	25.75	30.35	25.35	25
GW	2.5	53.93	54.53	27.17	27.36	22.36	22
GW	3.5	46.44	47.04	18.99	28.05	23.05	23
GW	3.2	50.72	51.32	21.1	30.22	25.22	25
GW	3.3	40.36	40.96	17.42	23.54	18.54	18.5
GW	3.1	46.99	47.59	19.78	27.81	22.81	22.5

#### **Notes:**

1. Formation levels derived from drawing: D117657/TZ/M/03RevB
2. Restoration levels derived from Formation levels plus 600mm (thickness of the Capping System)
3. Base levels derived from survey "Zwejra Drainage with closed sides", carried out by RCS Ltd.
4. The maximum allowed depth is the difference between the Base and Restoration Levels, minus a 5m "stand off"

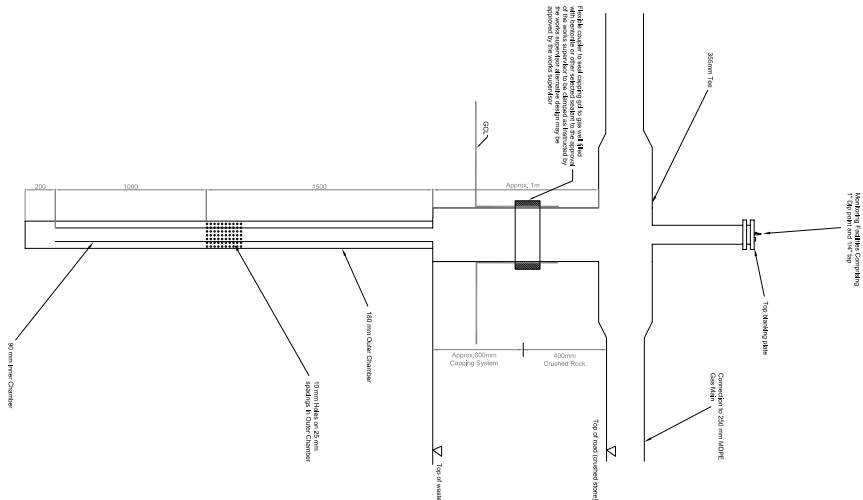
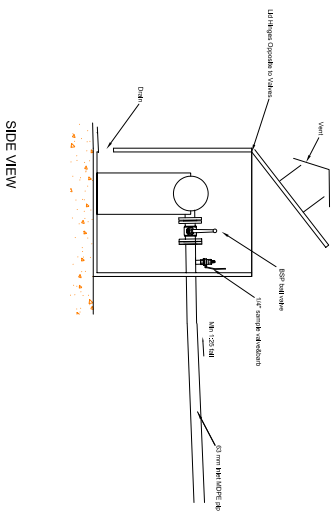
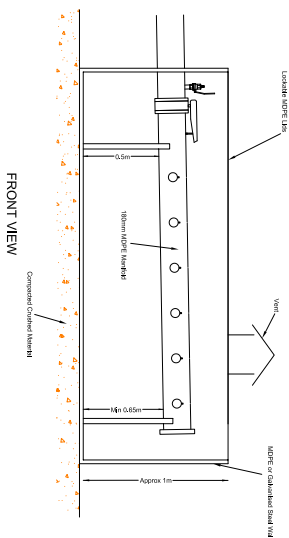
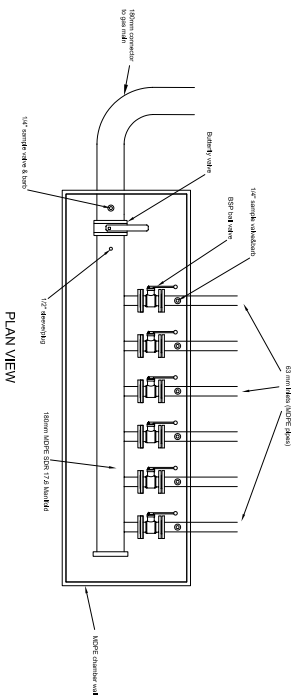
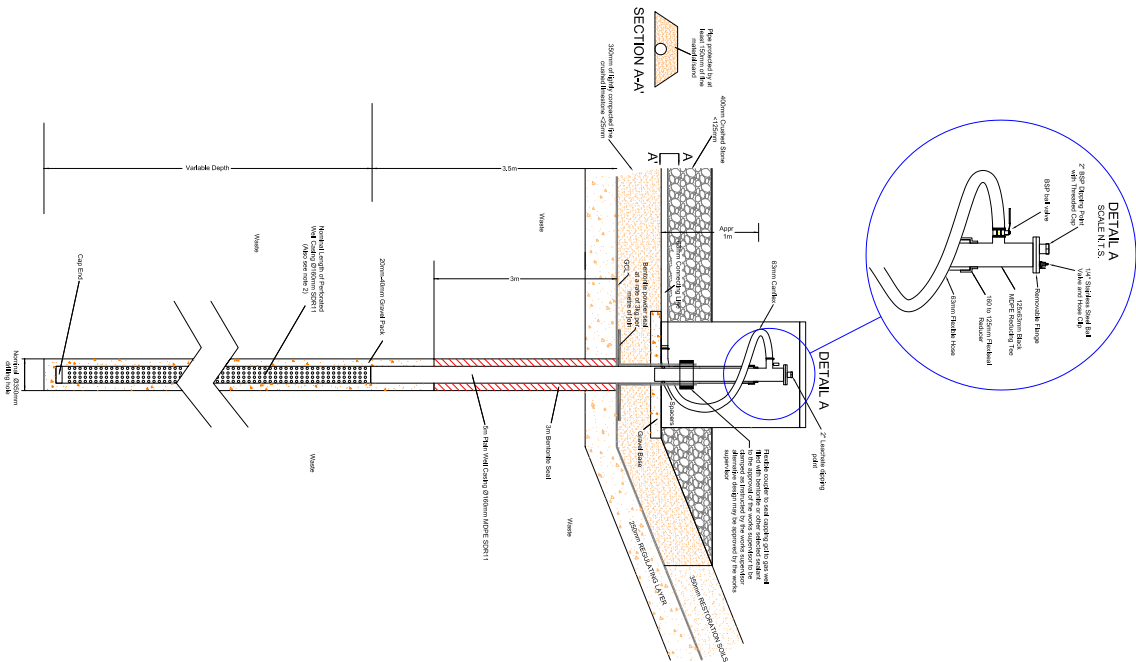
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## NOTES

1. Well locations and depths to be confirmed on site with the Motor Superintendent. Prohibited Well Depths have been provided in a schedule appended to the Totes Collection System Specification Plan documents.
2. Material to cover the gas main can be time-passed by the Employer (from season, adjacent to the fill) but needs to be crushed by the Contractor.

## NOTES

- For exact number of Inlets required for each manifold, please refer to drain D117657/TZ/GAS07.  
The perforated well screen shall have a 5% to 10% open area.

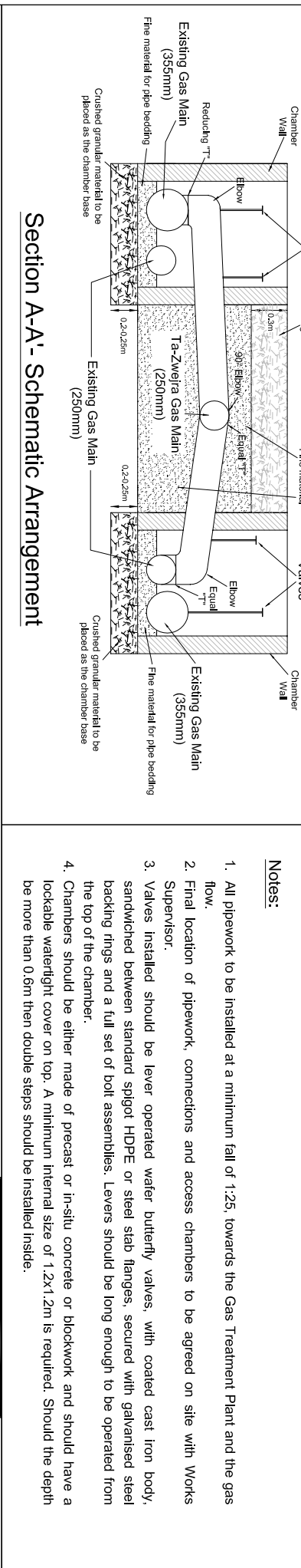



## FOR CONSTRUCTION

**TAZWEJRA LANDFILL  
CLOSURE PLAN  
INTERMEDIATE CAPPING AND  
GAS MANAGEMENT SYSTEM**

## GAS MANAGEMENT SYSTEM DETAILS

NTS		Approved	Date
Driver FY		BCG	
Stage 1 check DYM	Stage 2 check	Completed	August 09

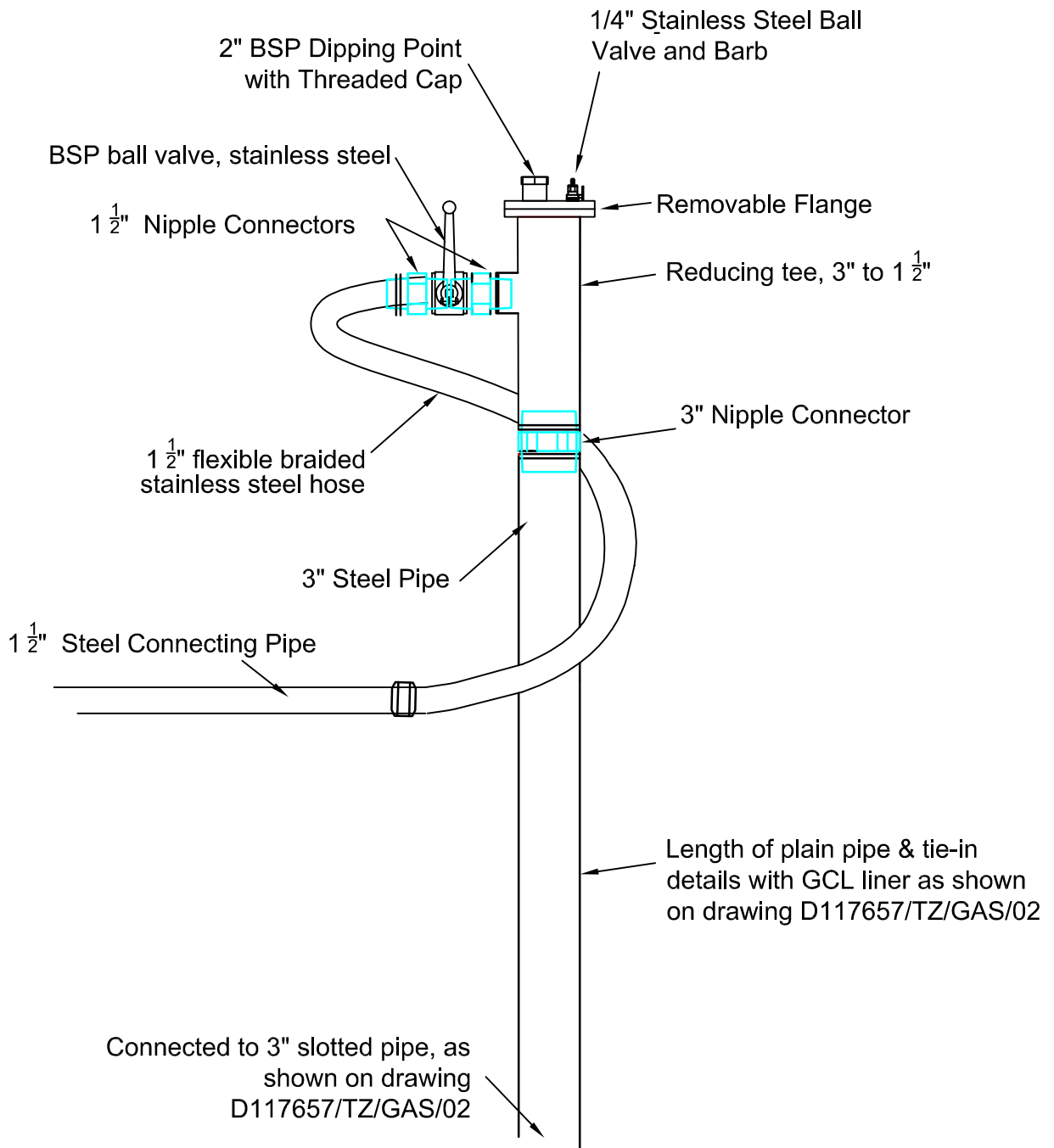


## Drawing Title

## D117657/TZ/GAS/03

Drw	FV	App	BCG	Rev	A
-----	----	-----	-----	-----	---

Chk	DVM	Date	SEP09	Date	19Oct09
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NOTE: For installation details see drawing D117657/TZ/GAS/02

Drawing Title

TA'ZWEJRA LANDFILL CLOSURE PLAN INTERMEDIATE  
CAPPING AND GAS MANAGEMENT SYSTEM

STEEL GAS WELL SPECIFICATION

**D117657/TZ/GAS/04**

Scale at A4 : NTS

Drw FV

App BCG

Rev

Chk

Date SEP'09

Date



www.scottwilson.com

Plot Date :  
AutoCAD File Name :

DB4V

## AS-BUILT DRILLING RECORD

[illegible]

# PRESSURE TEST CERTIFICATE

TEST No. \_\_\_\_\_

Date: \_\_\_\_\_

## SITE DETAILS

CLIENT: \_\_\_\_\_  
SITE: \_\_\_\_\_  
CONTRACTOR: \_\_\_\_\_  
WORKS SUPERVISOR: \_\_\_\_\_

## SYSTEM DETAILS

PIPE TYPE: steel ☐ polymer ☐  
NB<sub>1</sub> \_\_\_\_\_  $\phi_1$  \_\_\_\_\_ SDR<sub>1</sub> \_\_\_\_\_  
NB<sub>2</sub> \_\_\_\_\_  $\phi_2$  \_\_\_\_\_ SDR<sub>2</sub> \_\_\_\_\_  
NB<sub>3</sub> \_\_\_\_\_  $\phi_3$  \_\_\_\_\_ SDR<sub>3</sub> \_\_\_\_\_  
PIPE USE: Gas ☐ water ☐ air ☐  
OPERATING PRESSURE: \_\_\_\_\_ bar

## TEST DETAILS

SPECIFICATION CRITERIA: pressure: \_\_\_\_\_ bar time: \_\_\_\_\_ mins

### EXTENT OF TEST

FROM: \_\_\_\_\_  
TO: \_\_\_\_\_  
INCLUDING: \_\_\_\_\_  
\_\_\_\_\_

	charge	Settle	test start	interim 1	interim 2	interim 3	interim 4	test finish
time								
pressure								

$$\Delta P = \text{_____ bar} \quad \frac{\Delta P}{P_{\text{start}}} \times \frac{60}{\text{test duration}} \times 100 \% = \text{_____ \% per hr}$$

**PASS** ☐

**FAIL** ☐

Suspected points of failure: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Witnessing Works Supervisor**

**Contractor**

Name: \_\_\_\_\_  
Position: \_\_\_\_\_  
Signature: \_\_\_\_\_

Name: \_\_\_\_\_  
Position: \_\_\_\_\_  
Signature: \_\_\_\_\_



