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SSE Generation Ireland Limited

Campile, New Ross, Co Wexford

Industrial Emissions Licence Review
Operational Report

Reference Number:	Operational Report
Version:	1
Date of Issue:	22-09-2020

Contents

Document Sign Off			
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Originator:	**Signature:**	**Reviewer:**	**Customer Contact:**
Mark McGarry	[signature]	Niamh McMahon	Jonathan Storey
Document History:			
Report Revision Number	**Revision Date**	**Section Revised**	**Reason for Revision**

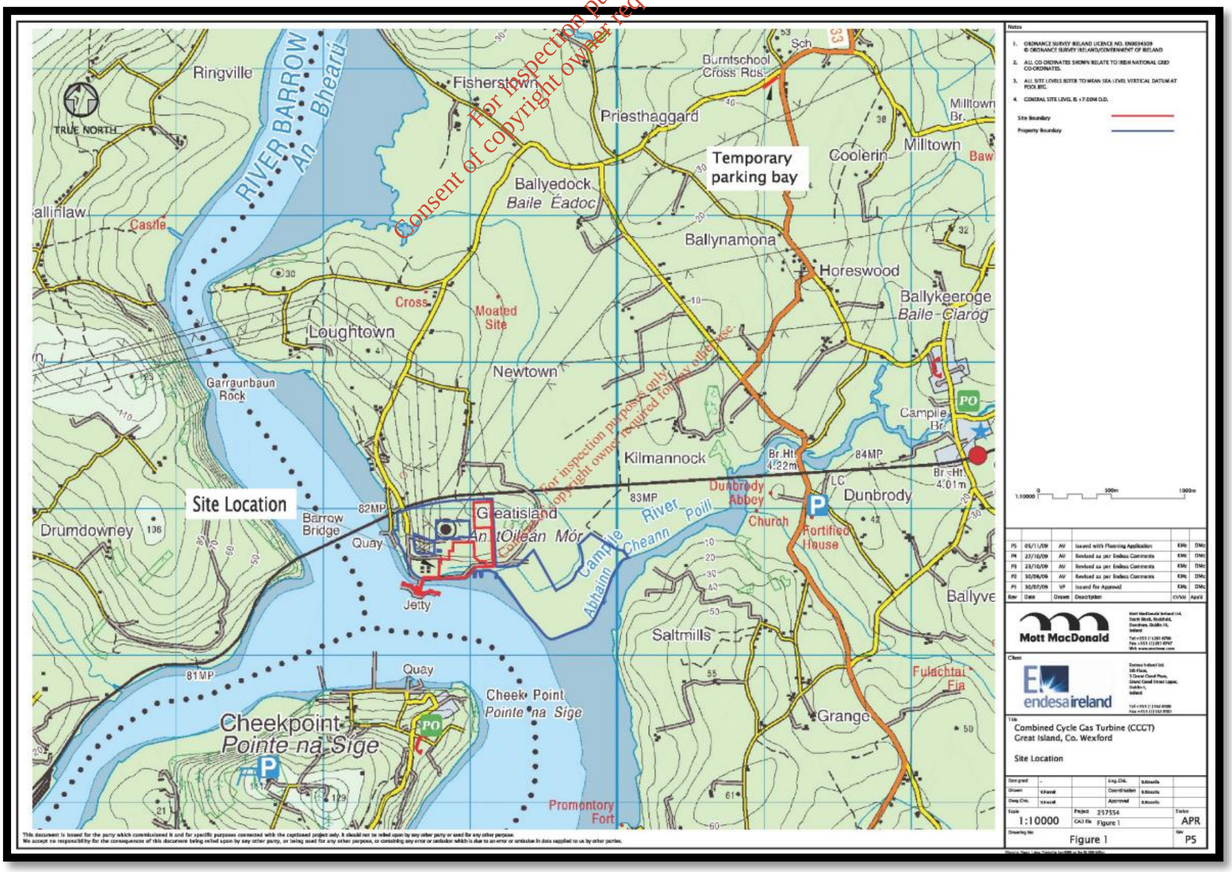
1. Introduction

This Operational Report has been prepared for SSE Generation Ireland Limited (referred to hereinafter as SSE) as part of an application for an Environmental Protection Agency (EPA) Industrial Emissions Licence Review at its facility at the Great Island Generating Station, Campile, New Ross, Co. Wexford. The activity is listed in the amended First Schedule of the EPA Act 1992, as amended;

2.1 Combustion of fuels in installations with a total rated thermal input of 50 MW or more

SSE is located in the townland of Great Island, 3.5km west of Campile village and approximately 15km south of New Ross, Co. Wexford. It is located on the confluence of the River Suir and the River Barrow estuary. The 464MW natural gas fired Combined Cycle Gas Turbine (CCGT) power plant was constructed within the confines of an ESB power plant which has since been decommissioned. The ESB plant comprised of two 60 MW units and a 120 MW unit which ceased operation due to been at the end of their useful lifespan. The CCGT has a primary fuel source of natural gas directly supplied by the Bord Gais, and has the capability to switch to distillate oil as a secondary fuel. Distillate oil is stored in bunded holding tanks on site, filled directly from boats that can operate from the SSE owned jetty.

2. Site Location



3. Description of Site Activities

The CCGT operational area occupies approximately 19 acres of the 143 acres of the Great Island Power Plant site. Older buildings from the previous ESB power plant are still in place on site, adjacent to the operational area of the new CCGT plant.

The station is prepared to operate on a continuous basis, 365 days per year with personnel working in shift arrangement. The number of working hours required from this installation is determined by EirGrid, who manage the entire electricity supply network.

There is a security building at the entrance to this site which is occupied permanently by security personnel. Car parking facilities are made available outside the boundary of the installation for most traffic with only permitted vehicles allowable on internal roads. The installation is enclosed in its entirety by secure perimeter fencing.

The CCGT has a nominal capacity of 464 MW and exports electricity, via an underground cable, to the onsite existing switchyard. The plant normally operates on full load resulting in a plant efficiency of approximately 58%.

The installation provides for a second designated car park area inside the boundary at the main offices. The control room, operations and canteen are located in this building. The site comprises a significant maintenance department of skilled technicians to complete routine maintenance and repairs throughout the facility.

Contractors who would be on site for longer periods of time in significant development or maintenance projects are provided with a separate contractor's compound for storage, offices and parking within this site boundary.

4. Combined Cycle Process

A gas turbine, burning natural gas, drives a generator for electricity production. Exhaust gases from the gas turbine pass through a Heat Recovery Steam Generator (HRSG) to generate high-pressure steam. The steam generated in the HRSG drives a steam turbine, which also turns the generator providing additional electrical power. The steam is condensed back to water via a Condenser for re-use in the HRSG. This condenser is cooled by a once through direct cooling system.

Figure 5-1: Combined Cycle Process

The combined cycle process consists of two thermodynamic cycles working together to produce electricity as efficiently as possible. The first cycle comprises a gas turbine and an electrical generator coupled together on one main shaft, which rotates at high speed. The gas turbine consists of a compressor section, a combustion chamber and a turbine section. Air is drawn in through an intake filter, compressed and fed into the combustion chamber where fuel is injected and ignited. The resulting hot combustion gases passing through the turbine section rotate the shaft, driving the compressor and the electrical generator to produce the rated electrical power output. Operation of a gas turbine, as described above, is referred to as open or simple cycle mode.

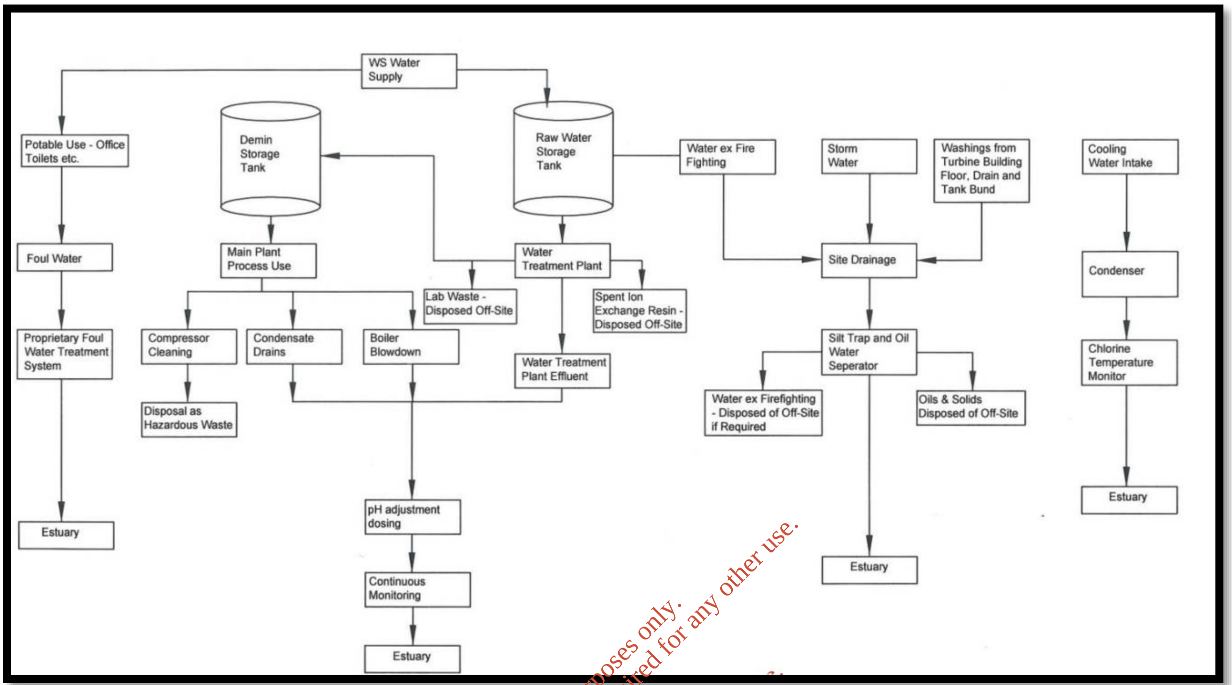
It is possible to generate approximately 50% more electricity from the hot exhaust gases by passing them through a HRSG or boiler, which uses the heat from the exhaust gases to generate steam, which is fed to a steam turbine. Exhaust gases from the CCGT are discharged to the atmosphere via a stack located at the outlet of the HRSG.

The high pressure steam produced in the HRSG is supplied through inter-connecting pipework to the steam turbine which is coupled to the same generator as the gas turbine (i.e. 'single shaft' design), further driving the generator to produce more electricity. The steam is expanded to vacuum conditions in the steam turbine to extract as much energy as possible. The steam is then fed to the Condenser where it is condensed back to water and fed back to the HRSG to generate more steam thereby conserving water within a closed cycle. The cooling required for the condensing the steam back to water is provided by once through cooling water from the local estuary.

5. Water Usage

The following schematic illustrates water supply, treatment and wastewater from the installation.

Figure 6-1 Water Flow Diagram



A detailed description of all of the water treatments and waste water generated in the CCGT process is provided hereunder.

5.1 Water Treatment

Water is required on site for the purposes of domestic type use, fire-fighting, feed water to the HRSG and water injection (to minimise NOx formation in the event of firing on distillate). Water is also required from the estuary for cooling purposes.

Water, of drinking water quality, is pumped directly to the site from the local Wexford County Council water supply. Feed water for use in the HRSG and water injection is directed from a dedicated raw water storage reservoir (12,000 m^3) to an on-site water treatment plant for pH adjustment and demineralisation. The water is treated by ion exchange and pH adjusted by Sulphuric Acid (H_2SO_4) and Sodium Hydroxide (NaOH). Demineralised water is stored in a dedicated storage tank prior to use.

The water treatment plant generates an effluent, comprising regeneration washings and concentrated dissolved salts, which discharge into the process waste water discharge tank.

High purity demineralised water is required for use in the HRSG. The feed water is de-aerated and dosed with conditioning chemicals, by controlled dosing, to prevent scaling and corrosion build-up in the HRSG. HRSG water is subject to daily quality checks to ensure the water is within the required limits specified by the HRSG supplier.

5.2 Foul Waste Water

Foul water is generated from the use of potable water in the plant buildings (i.e. offices, toilets, etc.). It is treated in a proprietary secondary water treatment system. Treated foul water flow is monitored prior to discharge in accordance with the EPA requirements.

Figure 6-2-1: Foul Wastewater – Existing Licence Conditions

Emission Point Reference No:	SW3a (Foul Water Treatment System)
Name of Receiving Waters:	Barrow Estuary
Location of Final Discharge at SW3:	268905E, 114524N
Location of Compliance Point:	To be agreed by the Agency Note1
Volume to be emitted:	Maximum in any one day: $9.5m^3$

Parameter	Emission Limit Value
pH	6-10
BOD	25mg/l
Suspended Solids	35mg/l
Ammonia	5mg/l
Total Phosphorus	2mg/l

Note 1: Location of Compliance Point for SW3a shall be agreed by the Agency and shall be located at a point upstream of the connection with the surface water discharge.

Note 1: Technical amendment B (2014)

There is a second foul water system employed at the contractor's compound which is treated and discharged to ground via an approved percolation area. Details of this treatment system are attached to the appendix of this report.

5.3 Storm Waters

There are currently 4 licensed storm water emission points at the installation, namely (SW1, SW3b, SW4 and SW12). SW7 which was a previously licensed storm water emission point was instructed to cease emissions on commencement of the CCGT. However, it was never the case that this storm water line would cease as it is required to collect uncontaminated rain water from a specific area of the installation. This licence application is requesting the reintroduction of SW7 in the reviewed licence. The engine room drains (which were part of the old ESB plant) mentioned in the original licence has since been decommissioned therefore contamination with hydrocarbons is no longer relevant. These storm water lines are designed and strategically located around the installation to collect uncontaminated rain water and discharge to the Barrow Estuary. Each storm water line is assessed in line with the requirements of IE licence conditions. The lines have been fitted with silt traps and oil/ water interceptors to prevent any excessive losses of solids from hardstand areas at the installation or oil losses from vehicles using internal roads and car parks.

Figure 6-3-1: Storm water – Existing Licence Conditions

Emission Point Reference No: SW1 [Note 1], SW3b [Note 1, 2], SW4 [Note 1], SW12 [Note 1]

Control Parameter	Monitoring Frequency	Key Equipment/Technique
pH	Daily	On-line pH probe with recorder
TPH	Daily	Standard Method
Visual Inspection	Daily	Sample and examine for colour and odour
Suspended Solids	Monthly	Standard Method

Note 1: On commencement of commercial operation of the new CCGT plant.
Note 2: SW3b shall be located at a point upstream of the connection with the foul water discharge.

Note 1: Technical amendment B (2014);
Note 2: Licence review request to include SW7 in this table;
Note 3: There has been an agreed with the Agency that TPH analysis be reduced from daily to monthly.

5.4 Process Wastewater

It is a necessary part of this operation to continuously "blow-down" approximately 1% of circulating water from the HRSG (i.e. 5 m^3 /hr) in order to remove the build-up of salts within the HRSG drums.

The blow-down water, condensate drain waste water and effluent arising from the water treatment plant, are discharged to the process wastewater discharge tank where its quality and temperature is monitored prior to discharge. The pH is monitored, and adjusted as required. Dissolved oxygen, pH, conductivity and temperature are continuously monitored, using an on-line analyser. If the waste water is deemed within licence limits, it is pumped to the current discharge point in the estuary.

The process waste water discharge outlet is fitted with an automatic sampler which samples water discharges over a given period as directed by the EPA.

Figure 6-4-1: Process Wastewater – Existing Licence Conditions

Emission Point Reference No: SW13-Process Waste Water
Name of Receiving Waters: Barrow Estuary
Location: 268951E,114600N

Parameter	Emission Limit Value
	mg/l
pH	6-9 -
BOD	20
Suspended Solids	30
Total Dissolved Solids	5,000
Mineral Oil	20
Ammonia (as N)	5
Phosphorous (as P)	5

Note 1: Technical Amendment A (2012)

5.5 Cooling Water: Screen Wash Water

Incoming cooling water is taken from the Barrow estuary close to the jetty and passed through a series of 5 mm mesh screens to remove organic debris, juvenile fish and other mollusc from the incoming waters. This water is chlorinated to prevent larval organisms in the intake water from colonising surfaces of the cooling circuits. Biofouling is a serious problem for power stations as it reduces flow and can compromise the heat transfer efficiency of condensers. Chlorination is the most widely used method of biofouling prevention as its effective in protecting the CCGT.

Approximately 30,000 m^3 / hour of water is screened through a 5mm mesh. The filters are backwashed every hour discharging back to the Barrow Estuary. A condition had been included in Licence No: P0606-03 to cease discharging from this location on commencement of the CCGT. However, this was never part of the original plant design, therefore in this licence review application it is requested to amend this condition in the licence.

It is requested in this application to reintroduce this emission point into the licence under the same conditions as outlined below without the inclusion of Note 1.

Figure 6-5-1: Cooling Water: Screen wash water – Existing Licence Conditions

Emission Point Reference No:	SW8-Cooling Water Screen Wash water Note 1
Name of Receiving Waters:	Barrow Estuary
Location:	26861E,11452N
Volume to be emitted:	Maximum in any one day: 1,970m^3

Parameter	Emission Limit Value
Chlorine	0.5mg/l

Note 1: On commencement of commercial operation of new CCGT plant discharges from SW8 shall cease.

Note: Original Licence Condition.

5.6 Condenser Cooling Water

Cooling water would be considered the main emission to water from the installation. This water is abstracted from the estuary at a rate up to the maximum allowable of 792,000 m³/day. Screened, chlorinated cooling water is pumped from the cooling water pump house to the steam turbine condenser and to the coolers of the closed cooling water systems. The cooling water is then discharged to the estuary via the outfall culvert SW2.

Figure 6-6-1: Condenser Cooling Water: Existing Licence Conditions

Emission Point Reference No:	SW2-Condenser Cooling Water
Name of Receiving Waters:	Barrow Estuary
Location:	269030E,114580N

Volume to be emitted:	Maximum in any one day:	1,204,080m³	792,000 m³ Note 1
	Maximum rate per hour:	50,170m³	33,000 m³ Note 1

Parameter	Emission Limit Value	
Temperature	15°C above estuarine water 12 °C (98%ile of hourly values over a year) See also Condition 5.7	12°C above estuarine water Note 2 10°C (98%ile of hourly values over a year) Note 2 See also Condition 5.7
Thermal Load	352 MW_{th} (maximum) 335 MW_{th} (98%ile of hourly values over a year)	330 MW_{th} (maximum) Note 2 316 MW_{th} (98%ile of hourly values over a year) Note 2
	mg/l	
Chlorine	0.5mg/l	0.3mg/l Note 2

Note 1: This discharge rate shall apply from the date of commencement of commercial operation of the new CCGT.
Note 2: The emission limit value shall apply from the date of commencement of commercial operation of the new CCGT.

Note 1: Technical amendment B (2014)

6. Combustion Process Control

The plant operates on an advanced computerised control system which ensures optimum combustion conditions and high boiler performance that supports the minimisation of emissions. The computerised control system includes a programme to ensure a safe and sequential system of shut down. The use of advanced materials, good plant and combustion chamber design, the use of high performance monitoring and process control techniques and maintenance of the combustion system reduces atmospheric emissions.

The system is manned on site 24 hours a day and also has remote supervision by the equipment supplier to ensure it operates to its peak performance. Strategic parts of the system are fitted with remote monitoring, remote camera and detailed statistical live programmes of analysis to ensure that the CCGT operates at high efficiency and minimal waste.

7. Above Ground Installation (AGI)

The plant operates on natural gas with a backup of gas oil in the event commercial or other situations that may dictate switching over. The volume of natural gas consumed varies on an annual basis depending on the number of hours the installation has been called upon to operate. The volume of gas used in a typical year would be between 350 – 500 million m^3.

Natural gas is supplied to the site from the Bord Gáis Network (BGN), which passes through a gas conditioning plant located in the Above Ground Installation (AGI) compound. This comprises of the following inventory:

• Liquid and dust separator;
• Dew point heater/boiler unit;
• Pressure reducing station;
• Electrical switch room/control room.

The gas is filtered, pre-heated, metered and pressure reduced prior to supply to the gas turbine, as required. The AGI asset is owned, operated and maintained by Gas Networks Ireland.

8. Fuel Types

Natural gas is a clean fuel resulting in negligible emissions of Particulate Matter, Carbon monoxide and Sulphur Dioxide. The main atmospheric pollutants of concern relating to natural gas firing are Nitrogen Oxides (NOx). The primary mechanism for the formation of NOx in gaseous fuels is from nitrogen in the air during the combustion process, referred to as "thermal NOx".

The gas turbine generator is fitted with a dry low NOx burner. Thermal NOx is formed at high temperatures. The dry low NOx burner optimises the air/fuel ratio producing a uniform low temperature flame in the combustion chamber to minimise the production of NOx.

Although the CCGT is normally fuelled by natural gas, distillate storage and pumping facilities are also available at the installation. The plant will only operate on distillate in the event of an interruption to gas supply and for short duration testing during normal operations, as required by the system operator.

To comply with the requirements of the Commission for Electricity Regulation (CER) the storage capacity of the back-up fuel supply should be such as to allow the plant to be operated continuously at its full output for maximum a period of five (5) days in a gas supply interruption event.

Distillate is stored in bunded fuel oil storage tanks within the installation boundary. Thorough NDT (Non-Destructive Testing) inspection has been undertaken on these tanks and bund integrity assessments carried out in line with licence conditions to ensure their integrity and protection of the environment in the event of an incident.

Distillate is limited to a maximum Sulphur content of 0.1% by contract with the supplier. Water injection will be employed when the plant is operating on distillate to further reduce NOx concentrations in the emissions to atmosphere. Water will be injected directly into the combustion chamber. The evaporation of water will require heat which is then not available to heat the flame decreasing the flame temperature and reducing the amount of NOx produced.

9. Continuous Emissions Monitoring

Exhaust gases from the CCGT discharge to the atmosphere via a sixty (60) metre stack located at the outlet of the HRSG. The stack incorporates an in-situ proprietary Continuous Emission Monitoring System (CEMS) hut and unit. The selection, installation, calibration, ongoing quality assurance and annual surveillance testing (cross-checks) of the CEMS is undertaken in accordance with EN 14181 – Quality Assurance of Automated Measuring Systems and all relevant standards referred to therein.

The emissions are tightly controlled, alarmed and reported to the EPA on an annual basis. The following excerpt from the licence summarises the emission limit values associated with this emission point:

Figure 10-1: A2-1 Emission Limit Values (Technical Amendment C)

Emission Point Reference No.:	A2-1 (Firing on Natural Gas)	
Rating:	741 MW_{th} Thermal Input	
Location:	Main Stack (Adjacent to Heat Recovery Steam Generator)	
Volume to be emitted:	Maximum in any one day:	66,156,480m^3
	Maximum rate per hour :	2,756,520m^3
Minimum discharge height:	60 m above ground	

Parameter	Emission Limit Value mg/m^3 (From 01/01/2016)
Oxides of Sulphur (as SO_2)	10
Nitrogen Oxides (as NO_2)	50
Carbon Monoxide (Note 1)	100
Dust	5

Note 1: ELV's for NO_2 and CO shall apply only above 70% load.

B.1 Emissions to Air

Emission Point Reference No.:	A2-1 (Firing on Gas Oil)	
Rating:	741 MW_{th} Thermal Input	
Location:	Main Stack (Adjacent to Heat Recovery Steam Generator)	
Volume to be emitted:	Maximum in any one day:	71,694,720m^3
	Maximum rate per hour :	2,987,280m^3
Minimum discharge height:	60 m above ground	

Parameter	Emission Limit Value mg/m^3 (From 01/01/2016)
Oxides of Sulphur (as SO_2)	50
Nitrogen Oxides (as NO_2)	90
Carbon Monoxide (Note 1)	100
Dust	20

10. Auxiliary Boiler

The plant has been fitted with an auxiliary boiler, which is operated intermittently, to provide heat during start up periods. The frequency of use of this boiler is very limited and depends on the dispatch pattern of the CCGT. This is considered a minor emission point for the facility.

11. Electrical Transformer

The electricity generated is fed to a generator transformer where the voltage is stepped up to 220 kV. The power generated is then transferred to the onsite existing switchyard via an underground cable. The switchyard is and will continue to be owned by and maintained by ESB Networks.

12. Emergency Diesel Generator

An emergency distillate generator is provided to supply electricity to essential auxiliary systems in the event of an interruption to power supply or a low voltage supply from the national grid. The generator will not operate under normal conditions, other than for short duration testing for a maximum period of thirty (30) minutes per week.

13. Fire Fighting Equipment

The raw water reservoir hold 1,140m^3 of raw water for firefighting purposes in addition to a separate tank with a capacity of 500 m^3 dedicated for firefighting.

The pumps will only be used in an emergency and for short duration testing for a maximum of 30 minutes, once a week.

Water and foam based fire protection and suppression systems are installed in accordance with National Fire Protection Association (NFPA) guidelines. The gas turbine area is fitted with Carbon Dioxide (CO_2) suppression systems. Fire alarms and fire extinguishers are placed in all buildings on site in accordance with best practice guidelines. Training in their use is provided by a suitably qualified specialist. Fire doors comply with BS 476- 22:1987 - Fire tests on building materials and structures.

A Fire Emergency Response Plan has been developed, as part of the Emergency Response Plan, (reviewed and updated where required) and implemented in consultation with the local fire department.

14. Chemical Storage

Sulphuric Acid (H_2SO_4) and Sodium Hydroxide (NaOH), for use in the water treatment plant, are stored in 300 and 500 litre bunded bulk chemical storage tanks tanks respectively. All chemicals stored at the facility are in line with the requirements as laid out in the licence. Sodium Hypochlorite (14 – 15%) is stored in a 43,000 litre tank which is fully bunded and integrity tested. Road tankers fill this tank periodically in a bunded area.

Conditioning and laboratory chemicals are stored in a chemical store within the water treatment plant. The storage room is provided with appropriate ventilation and temperature control.

Drums and IBC's are stored on drip trays / spill pallets. Storage areas are enclosed fully containing any spills within.

A spill kit is located in close proximity to the chemical store. Laboratory chemicals are stored in relatively small quantities. Only experienced and trained personnel are permitted access to the chemical storage areas.

As required, conditioning chemicals are transferred around the plant to holding areas and tanks located. The transfer route is kept clear of all obstacles to allow the safe transfer of chemicals. Dosing tanks are fitted with level indicators and located within bunds. Transfer of chemicals where required is undertaken by trained personnel only.

All bunds are subject to regular inspections, integrity testing and emptying procedures.

Oils and greases used for the lubrication of the main mechanical components are stored in a designated bunded area within the stores building.

15. Laboratory

There is an on-site laboratory for analysis of water and other samples as required. There are low volumes of equipment and chemicals in use at this laboratory as the site is supported by independent laboratories for specific compliance monitoring.

16. Ancillary Services

The installation has an administration building, workshops, mess room, stores, gatehouse, car parks, cooling water intake/outfall, raw water storage, tank farm, etc. Foul water arising from the occupied buildings is discharged to the foul water treatment system as per licensed conditions and is treated in the proposed new secondary treatment plant prior to discharge. All waste arising is categorised and managed in accordance with regulatory requirements.

17. Hours of Operation

The installations electricity production schedule is dictated by EirGrid, which is variable depending on demand, contracts with alternative power suppliers and wind energy available to the grid on any given day. The plant is designed and in a position to operate 24 hours a day, 365 days per year. The offices are manned during normal weekly hours, and shift work applies for plant operators to provide full cover on the CCGT plant.

18. Abatement & Continuous Monitoring /Control Systems

Emission Point	Control	Abatement
A2-1 (Gas Turbine Main Stack)		
Oxides of Nitrogen	Dry Low NOx burners	-
Oxides of Nitrogen	Water Injection when fuelled on Gas Oil	-
Carbon Monoxide	Controlled Combustion	-
Oxygen	Burner Management System	-
SW2		
Temperature	Temperature probes / AMS	-
Flow	Meter	-
SW13		
pH	Dosing pumps Agitator pH Meter / Recorder	pH balancing
Flow	Flow meter	-
Conductivity	Conductivity meter / recorder	-
Temperature	Temperature probe / recorder	-
TOC	TOC Analyser / recorder	-

Appendix: Contractor Compound WWTP

Tpw Systems Ltd
Total Wastewater/Sewage Solutions

- Site Assessment, Design, Supply & Installation
- Septic Tank, Sewage & Wastewater Treatment Systems
- Percolation Area and Wetland Systems

www.TPW.ie

Ballyheige, Screen
Enniscorthy, Co. Wexford
053/9137650 087/2600438
E: npquaid@gmail.com

Client - SSE Great Island, New Ross, Co Wexford
Main Contractor – David Flynn Ltd, Co. Waterford

Ref; Supply and installation of wastewater Treatment system, Contractors Compound.

Dear Sir Madam

I can confirm that we have supplied and fitted ;-

Treatment System
Eurotank P11 plant EN12566/3 SR66 certified as per attached site specific proposal and specifications, loadings and drawings provided.

The soil polishing filter
150m2 pipe network on 200m2 infiltration area bed with integrated pump discharge pipe network as originally specified, Attached site specific, low pressure pipe network design.

Storage Tank
Molloy precast 25m3 single tank as per attached drawing.

The system is fully fitted, commissioned and ready for use.

Images of Installation

Percolation area

Treatment System

Storage Tank

Please find attached

- Site specific report and Treatment System certification
- Low pressure pipe network design
- Maintenance agreement
- Owners Manual.
- User Do`s Dont`s
- Installation certification.

Kind Regards

Nigel Quaid, Tpw Systems Ltd.
087/2600438

Tpw Systems Ltd
Total Wastewater/Sewage Solutions

Ballyheige , Screen
Enniscorthy
Co. Wexford
Y21 W656
CRO 523683

PHONE 00353 87 2600438 EMAIL npquaid@gmail.com WEB www.TPW.ie

EuroTank

Wastewater Treatment Systems

Mr Joseph Dempsey
DFL Ltd.
Waterford

Date 12/2/20

REF: Site Specific Proposal for EuroTank Wastewater Treatment System

- Sizing and Specification
- Drawings/Configurations
- En12566/3 SR66 Certification
- Important Notes
- Specification for Ground Disposal, Percolation area, Tertiary Treatment System Options,
  - Gravity Discharge Percolation Trenches ☐
  - Pumped Discharge ☒
  - Sand Polishing Filter, Tertiary Treatment ☐

For Your Client;

Client Name, **SSE Power St.**

Site Address;. **New Ross, Co. Wexford**

Our Ref; DFL sse LP SSR

Dear Joseph

Thank you for your enquiry re upgrade Wastewater Treatment System for your Clients SSE Great Island

We have examined all the documents you sent and noted that the specification is for Secondary wastewater Treatment System, polishing filter and Storage for peak flow.

The following is our proposal to supply and install the entire plant.

Storage

The original specification was for storage tanks of **25m3** to cater for peak season staff off-side from the treatment plant.
The storage we propose is in 1 Tank.

Treatment System and polishing Filter

The original specification was for P10 treatment plant with 150M2 soil polishing filter.
We are proposing our P11 plant This will be sufficient for 25 staff calculated as per Table 3 Epa Code of practice as follows.
Plant is designed for Hydraulic loading of 1650lts
The soil polishing filter is a 150m2 pipe network on 200m2 infiltration area bed with integrated pump discharge pipe network as originally specified.

Certification

We can offer a full cert of compliance with Epa Code of Practice for the entire built system

We have examined the information sent to us by you and noted the following;

Tvalue 38.22	Pvalue 34.44
Bedrock shale @ none m Below Ground Level	Watertable/Mottling/ingress @ nom below Ground Level
Population Equivalent PE 11	Industrial with Hydraulic loading 1500

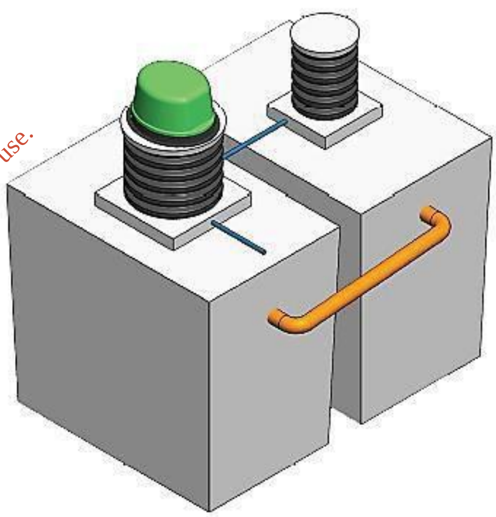
Specification for Secondary Wastewater treatment system with pump discharge soil polishing filter semi raised **150m2 pipe network on 200m2 inmfiltration area.**

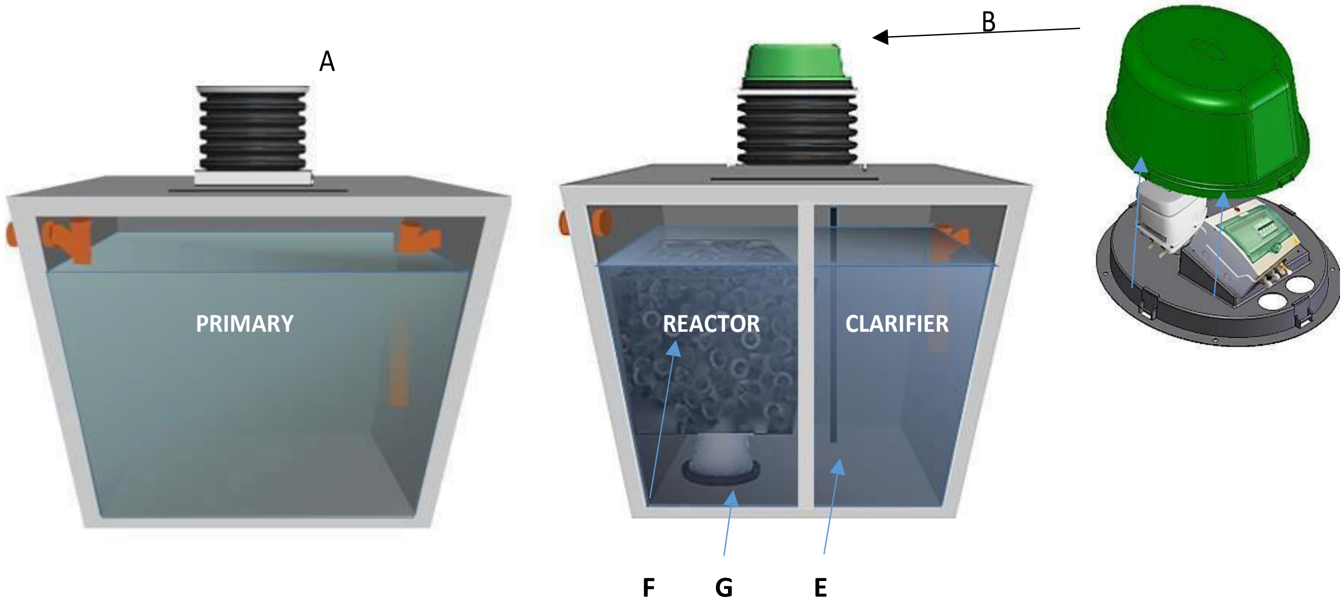
PROPOSAL

We propose our **EuroTank BAF P11** Secondary Wastewater Treatment plant as alternative with no change to infiltration via soil Polishing Filter **150m2 on 200m2 infiltration area.**

Population Equivalent PE	PE11
Certification	By Pia Gmbh To En12566/3 SR66 as listed for Irish use. (ATTACHED)
Effluent Quality As per Pia Test	BOD_5 - **12 mg/lt** *<20mg/l required* SS - **15 mg/lt** *<30mg/l required* NH_4-N - **0.3 mg/lt** *<20mg/l required* Exceeding Irish Requirement
Electrical- Consumption - *Cable -* Protection *Not Included	0.62 kwH/D c €167/Year 2.5mm2 x 3 core SWA (up to 100m run) RCD 16 amp,230v ,30ma ,Bs 4293 standard
Concrete	45N, Fibre reinforced
Alarm	Audible for pump failure
Outlet	Gravity or Pumped
Optional Extra`s	Risers – 600mm Dbl wall Coripipe Pump stations Integrated pumped distribution piping

ExampleP6 EUROTANK BAF 2A2





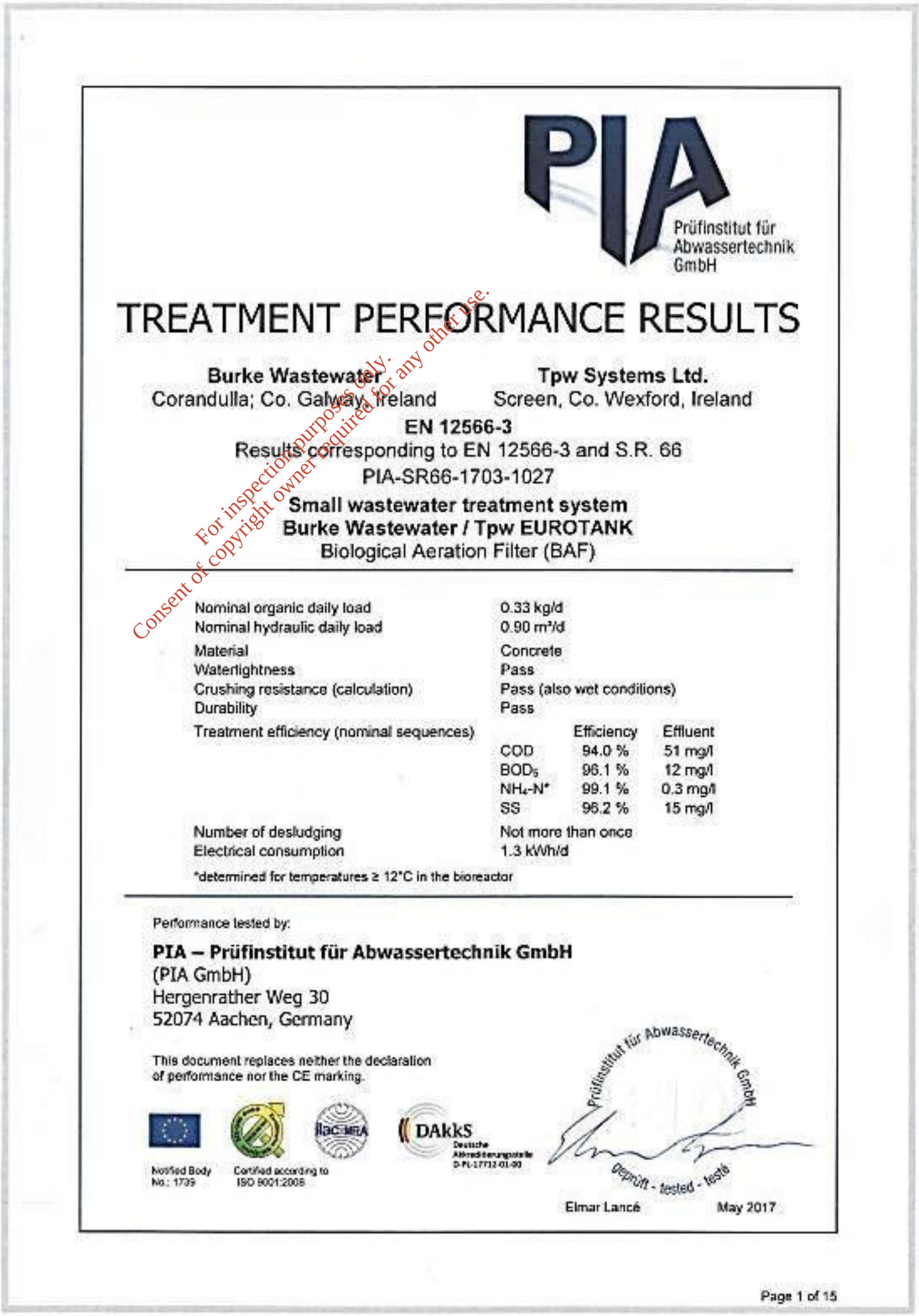
A Pvc Risers, sealed no leaks, Ground Adjustable
B: Blower, Aesthetic control unit housing
C: ECO Blower unit
D: Control unit with built in Mcb`s & alarm
E: Sludge return, solids removal & activated sludge
F: Media Bed G: Aeration Diffuser

Internal Treatment Process & Chamber Layout

The unit consists of 3 chambers housed in 2 Tanks

CHAMBER 1 – Primary settlement tank/chamber, receives & settles raw sewage
CHAMBER 2 – Reactor Chamber, Biological treatment by use of aeration and high specification media
CHAMBER 3 – Clarifier, Any remaining suspended solids are allowed to settle & are transferred by airlift to primary chamber to aid denitrification.
Final effluent leaves chamber 3 via gravity or optional effluent pump.

EN12566/3
SR66 CERTIFICATION



PIA Prüfinstitut für Abwassertechnik GmbH

TREATMENT PERFORMANCE RESULTS

Burke Wastewater
Corandulla; Co. Galway, Ireland

Tpw Systems Ltd.
Screen, Co. Wexford, Ireland

EN 12566-3
Results corresponding to EN 12566-3 and S.R. 66
PIA-SR66-1703-1027
Small wastewater treatment system
Burke Wastewater / Tpw EUROTANK
Biological Aeration Filter (BAF)

Nominal organic daily load	0.33 kg/d		
Nominal hydraulic daily load	0.90 m³/d		
Material	Concrete		
Watertightness	Pass		
Crushing resistance (calculation)	Pass (also wet conditions)		
Durability	Pass		
Treatment efficiency (nominal sequences)		Efficiency	Effluent
	COD	94.0 %	51 mg/l
	BOD_5	96.1 %	12 mg/l
	NH_4-N*	99.1 %	0.3 mg/l
	SS	96.2 %	15 mg/l
Number of desludging	Not more than once		
Electrical consumption	1.3 kWh/d		

*determined for temperatures ≥ 12°C in the bioreactor

Performance tested by:

PIA – Prüfinstitut für Abwassertechnik GmbH
(PIA GmbH)
Hergenrather Weg 30
52074 Aachen, Germany

This document replaces neither the declaration of performance nor the CE marking.

Notified Body No.: 1739
Certified according to ISO 9001:2008
DAkkS Deutsche Akkreditierungsstelle D-PL-17712-01-00

Prüfinstitut für Abwassertechnik GmbH geprüft - tested - testé

Elmar Lancé
May 2017

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Infiltration Area/Percolation

The following is a typical specification and layout for an infiltration suitable for this application and site

Sized in accordance with *Option 2 Section 10.1 & Table 10.1 Epa Code Of Practice. And subsequent clarifications NOV 2012.*

For T value of 34 and PE of 10 **= report recommends soil polishing filter of 150m2**

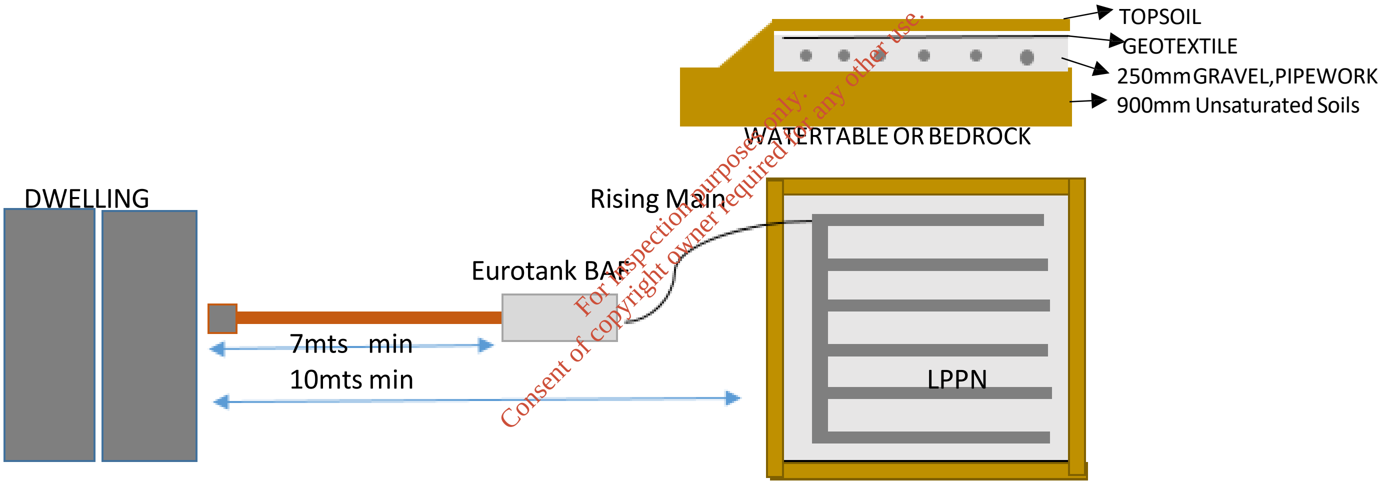
Additional information on site specifically designed integrated pump discharge pipe network;-

Description

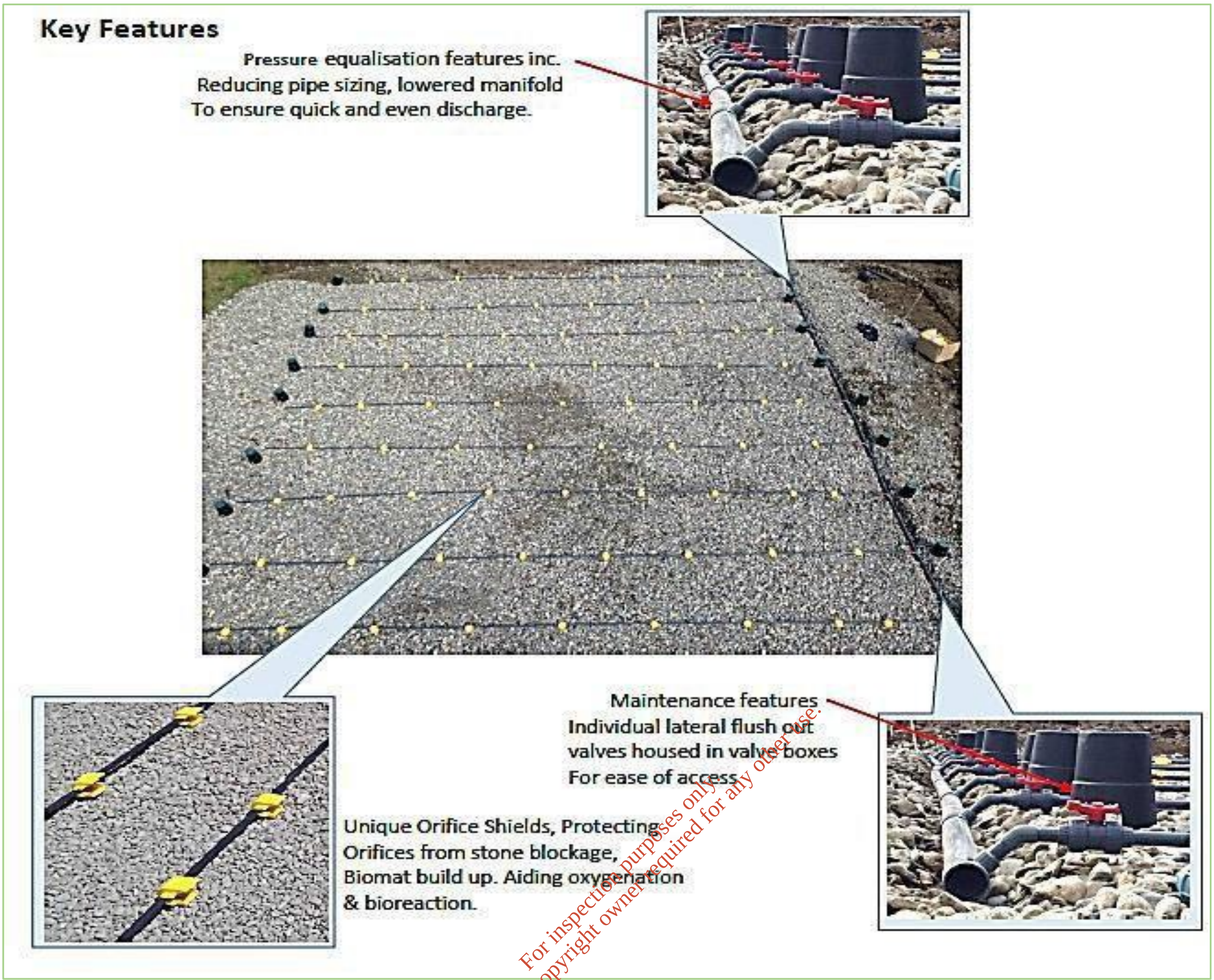
Treated wastewater or effluent from the proposed EuroTank BAF is pumped to the infiltration area via a rising main pipe to the main manifold of the Low pressure pipe network LPPN, which evenly distributes the effluent over the entire area in a bed of stone. The soil polishing filter may be at ground level or raised depending on the findings of the percolation test **but must have a minimum of 900mm of un-saturated free draining soil.**

Distribution gravel must be, 25mm clean crushed or pebble with a minimum of 250mm depth.

Schematic layout



*The pump system in Our EuroTank BAF and LPPN will be matched as an integrated system, with all site specific parameters, such as elevations, rising main length etc. calculated before installation. Full design report Available on request.



Important Notes
- This proposal is based on information from the site characterisation form supplied by the client for this site only.
- Final specification should be passed by Site Engineer before installation. Installation should also be supervised by suitably qualified Engineer and in accordance with installation instructions supplied with the unit.
- Installation should be in compliance with Epa Code of Practice 2009 guidelines with particular attention to separation distances to wells etc, with DoEHLG Building Regulations Part H and Planning Permission Conditions.
- Maintenance agreement is available after commissioning of the unit.

Tpw Systems Ltd Offer a Full Supply & Installation Service.

Please be assured of our full co – operation in the project and please let me know if you need more information

Kind Regards
Nigel Quaid, Tpw Systems Ltd 087 2600438
Email npquaid@gmail.com Web www.TPW.ie

Design of 150m² Low Pressure Pipe Distribution Network

Client **SSE Great Island**

For **Tpw Systems Ltd**

Munster Environmental
27 Oldcourt
Greenfields
Killumney Rd
Co. Cork

Contact:
Tim Clifford
info@munsterenvironmental.com
087-9903697

Design solution for 150sq.m Low Pressure Pipe Distribution Network.

The design of the low pressure pipe network is based on the *US EPA Wastewater Design Manual Onsite Wastewater Treatment and Disposal Systems, EPA 625/1-80-012*. The IRL Code of Practice makes reference to this design manual on page 103 of the CoP.

In the event of any future installation I will be in a position to supply, deliver and/or install, the Low Pressure Pipe Distribution Network.

Once the installation has been completed and pressure tested I will provide a commissioning certificate which can be submitted as part of the compliance certificate for the local authority.

Kind regards,

Tim Clifford

Tim Clifford, BSc.
Munster Environmental
087-9903697

Contents

Introduction:

The EPA COP Manual states on page 44 Section 10.1.1. Pumped discharge "The detailed design should conform to best practice as outlined in the design manuals".

Margaret Keegan, Inspector, Office of Environmental Enforcement, EPA in correspondence with Tim Clifford of Munster Environmental confirmed that the COP is not a complete design manual and one of the design manuals that the EPA would refer to is the US EPA design manual. (Correspondence between EPA & Munster Environmental pg.5)

The IRL Code of Practice makes reference to this design manual on page 103 of the CoP.

The design here within is based on the following docs:-

- US EPA design manual, US EPA (2002) Onsite Wastewater Treatment Systems Manual. No. PA/625/R-00/008.
- Design of Pressure Distribution Networks for Septic Tank- Soil Absorption Systems" by Otis, 1981.
- Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems" by the State of Wisconsin, Department of Commerce, 1999.
- IRL EPA Code of Practice
- Submitted Site Characterisation Report
- Mound Component Manual for Private Onsite Wastewater Treatment Systems (v2.0) 2001

Design Calculations:

Calculations and designs within the USA EPA Manual are based on Imperial measurements. i.e. Feet/inches and gallons.

Calculations within this proposal are based on both imperial and metric. i.e. Where pipe sizes have been calculated and expressed in imperial measurements these sizes have been converted to metric.

Technical Manuals from manufacturers have been used to cross reference the imperial pipe sizing with the equivalent metric sizing.

Pipe & Fittings:

PVC (polyvinyl chloride) pipe and fittings within the soil polishing filter are manufactured in accordance with Metric DIN 8061-2, KIWA 49 (rev 1) and Metric ISO 727, EN 1492, KIWA 54 respectively. The pipe and cement are UK Water Regulations Advisory Scheme Approved and Listed under licence no. 9902025. The PVC- Pressure pipe is rated at 10 bar and tested to 20° C.

Note: Under NO circumstances is "white" waste pipe to be used in any part of the Soil Polishing filter unless the product has the site specific pressure testing certification.

Correspondence Munster Environmental/EPA

epa
Office of Environmental Enforcement

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Mr. Tim Clifford, B.Sc.
Munster Environmental,
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Greenfields,
Killumney Rd,
Co. Cork

23rd November 2010

Re: Design of pressurised distribution systems

Dear Mr. Clifford,

Further to your email in relation to the design of pressurised distribution systems, as you are aware the EPA is not in a position to approve or otherwise individual system designs. The *Code of Practice: Wastewater Treatment and Distribution Systems serving Single Houses, 2009* includes one type of design for pumped distribution, which has been tested by TCD in a research project '*An Investigation Into The Performance Of Subsoils And Stratified Sand Filters For The Treatment Of Wastewater From On-Site Systems - Final ERTDI Report 27 - Gill et al'* but the as code is not a complete design manual there is also a reference to detailed design conforming to best practice in design manuals. One of the design manuals that we would refer to is the US EPA *Design Manual Onsite Wastewater Treatment And Disposal Systems, EPA 625/1-80-012.*

I hope this clarifies the situation.

Yours sincerely,

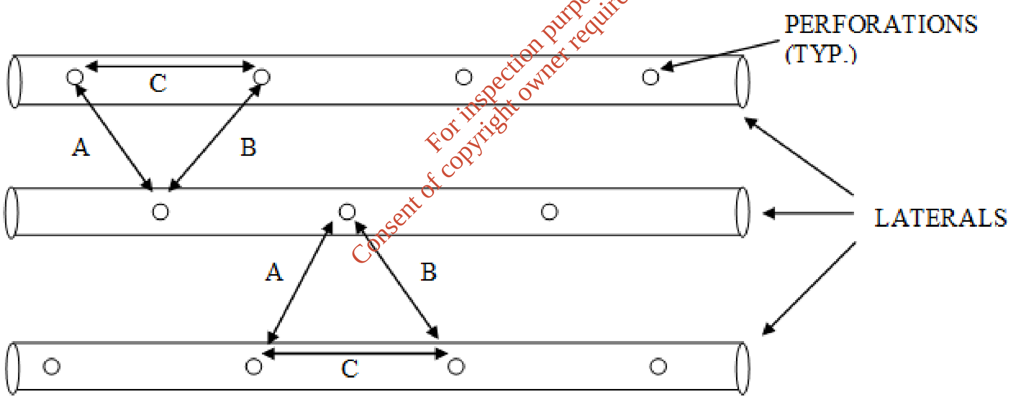
Margaret Keegan
Inspector
Office or Environmental Enforcement

Step 1: Design Parameters

FLOWS AND LOADS	
Area required (m^2) based on Total Daily Hydraulic Loading (l) and Hydraulic Loading Rate ($l/m^2/d$)	150 (min)
Volume of a single dose to Soil Filter	≥5 times the void volume of the lateral(s) and ≤ 20% of the Design Wastewater Flow
Head pressure at distal end of lateral(s)	≥ 2.5 ft
Flow velocity in force main and manifold	≥ 2 ft/sec and ≤ 10 ft/sec

Step 2: Select Perforation Size and Spacing

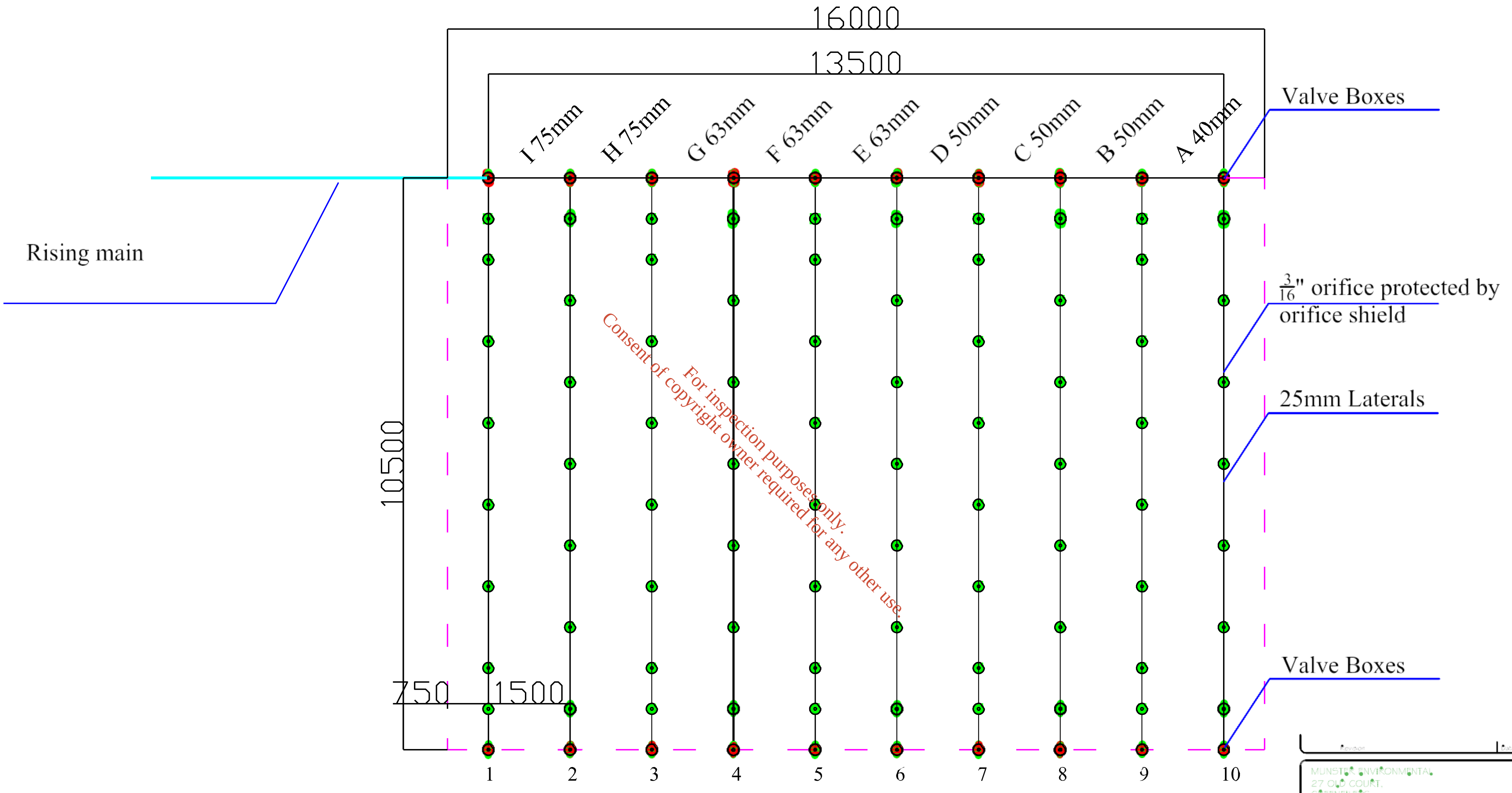
Uniform distribution can best be achieved by providing as many uniformly spaced perforations as is practical. The perforations between any two laterals are staggered so that they lie on the vertices of isosceles triangles. In this case, the number of perforations in each lateral may differ. All discharge calculations account for all perforations.



ISOSCELES LATERAL PERFORATION LAYOUTS

This design has perforation of $\frac{3}{16}$ inch with a maximum spacing between orifices of 1.50m (X=5ft.). For even distribution throughout the entire soil polishing filter the spacing between laterals is exactly the same as spacing between the orifices. i.e. 1.50m (5ft).

150Sq.m Low Pressure Pipe Network



Lateral No. 1,3,5,7,9 = 8 orifices   Lateral No. 2,4,6,8,10= 7 orifices

Total No.= 75 orifices

ZONE 1 & 2 identical layout. Each zone controlled by an indexing valve.

Notes

MUNSTER ENVIRONMENTAL
27 OLD COURT,
GREENFIELDS,
CORK.

SCALE 1:100
DATE Aug 15
TITLE 150sq.m Soil Polishing Filter
DRAWING NO.

SIZE AND ORIENTATION	
Area Required (m²)	150 (actual size on plan 157.5)
Layout of Soil Polishing Filter (SPF) (m)	15 X 10.5
Manifold Configuration	End
Distance from 1st & last orifice to edge of SPF (m)	0.75 (1/2 the distance between laterals)
Distance from manifold to edge of SPF (m)	13.5 (44.3')
Manifold Length (m)	10.50 (34.5')
Lateral Length (m)	1.50
Distance between laterals (m)	150 (actual size on plan 157.5)

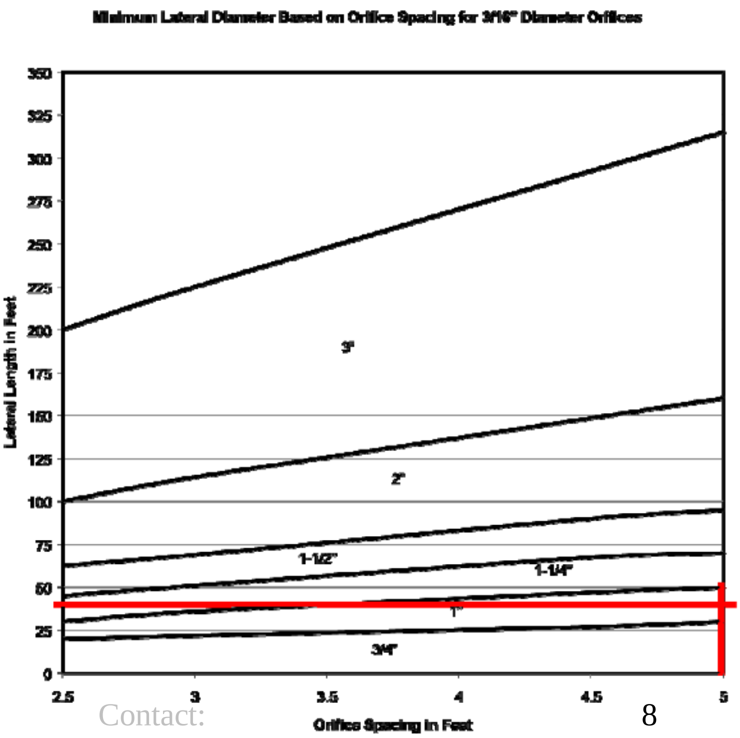
Step 3: Select Lateral Diameter

To ensure uniform effluent application over the entire length of the lateral trench, the first and last perforations in the lateral will be located one-half the perforation spacing from either end of the lateral i.e. 0.625m. However, to ensure even distribution throughout the soil polishing filter the first and last perforation will be located approx one-half the perforation spacing from either end of the perimeter of the soil polishing filter. i.e. 0.625m

3. LATERAL SIZING	
Diameter of lateral (from Graph 6)	1" or 25.4mm
Diameter of lateral in metric	22mm ID 25mm OD **closest metric sizing**
Diameter of discharge orifice (inches)	3/16"
Total Lateral Length (m)	10 (32.8')

Graph 6

From Graph: Minimum diameter for a 10.5m (34.5 ft) lateral with 1.50m (5 ft) spacing's is 1". In metric the closest pipe sizing is 22mm Internal Diameter and 25mm External Diameter.



Step 4: Calculate the Lateral Discharge Rate

From equation: $q = 11.79 d^{2} h_d^{0.5}$

Perforation diameter inches $\frac{3}{16}$

Inline Pressure in feet 2.50

Dimesionlist Coffecient 11.79

A $\frac{3}{16}$ perforation will have a discharge rate = 0.66 gpm

VIII. TABLES

Table 4
Discharge Rates in Gallons per Minute from Orifices[a]

Pressure in feet	Orifice Diameter			
	1/8	5/32	3/16	1/4
2.5	NP	NP	0.66	1.17
3	NP	NP	0.72	1.28
3.5	NP	0.54	0.78	1.38
4	NP	0.58	0.83	1.47
4.5	NP	0.61	0.88	1.56
5	0.41	0.64	0.93	1.65
5.5	0.43	0.68	0.97	1.73
6	0.45	0.71	1.02	1.80
6.5	0.47	0.73	1.06	1.88
7	0.49	0.76	1.10	1.95
7.5	0.50	0.79	1.14	2.02
8	0.52	0.81	1.17	2.08
8.5	0.54	0.84	1.21	2.15
9	0.55	0.86	1.24	2.21
9.5	0.57	0.89	1.28	2.27
10	0.58	0.91	1.31	2.33

Note a: Table is based on - Discharge in GPM = 11.79 x Orifice Diameter^2 in inches x (Pressure in Feet)$^{1/2}$
NP means not permitted

Step 4: Lateral Discharge Rate

LATERAL DISCHARGE RATE	
Discharge Rate per perforation (gpm)	0.66
Laterals No. 1,3,5,7,9	08 no. perforations each
Laterals No. 2,4,6,8,10	09 no. perforations each
Total No. perforations	85
Min Discharge Rate (gpm)	56.1

Step 5: Calculate the Manifold Size

Manifold Length 9 X 1.50m= 13.5m **(44.3ft)**

In order to save costs and improve performance, a telescoping manifold allowing smaller diameter pipe downstream can be designed. In this design, the value for **f** would be equally divided among all the segments and would be calculated as $0.1/9$

The following formula was used to calculate the diameter of the various segments.

$$F_i = \left(9.8\times10^{-4}\right)Q_i^{1.85}$$

$$D_m = \left[\frac{\sum_{i=1}^{M} L_i F_i}{f\, h_d}\right]^{0.21}$$

Li	Length of the Segment (ft)	5
Hd	Inline Pressure in (ft)	2.50
f	must be less than or equal to	0.1
Fi		from above

Segment No	Qi	Fi	Sum Fi	Dia (Inch)	Dia Metric (mm)	Nearest Pipe sizing in Metric (mm) OD
A	5.28	0.021	0.021	1.32	33.53	40
B	9.9	0.068	0.089	1.55	39.37	50
C	15.18	0.150	0.240	1.75	44.45	50
D	19.8	0.246	0.485	1.91	48.51	50
E	25.08	0.380	0.865	2.06	52.32	63
F	29.7	0.520	1.385	2.19	55.63	63
G	34.98	0.704	2.089	2.31	58.67	63
H	39.6	0.885	2.974	2.42	61.47	75
I	44.88	1.116	4.089	2.52	64.01	75

Thus, manifold segments: A 40mm segment
B-C-D 50mm segments
E-F-G 63mm segments
H-I 75mm segments

Please note: As this is a telescoping manifold the start of the manifold will consist of 3.0m of 75mm pipe, 4.5m of 63mm pipe, 4.5m of 50mm pipe and 1.5m of 40mm pipe. Total Length of manifold is 13.5m.

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MANIFOLD SIZING	
No. Segments	9
Manifold Segments	1.25
Manifold Length (m)	11.25
Manifold Diameter	A 40mm segment B-C-D 50mm segments E-F-G 63mm segments H-I 75mm segments

Step 6: Determine the Dose volume

DETERMINE DOSE VOLUME	
Crown elevation of the manifold is located below the lateral invert elevation.	
Manifold does not drain back to the pump chamber.	
Minimum dose volume is based on the lateral pipe volume only.	
Minimum dose volume is 5 times the total lateral volume.	
Number of Laterals	10
Diameter of Laterals	25mm OD 22mm ID **closest metric sizing**
Total Volume of Laterals L	40
Total Dose Volume L	**200**

Step 7. Calculate Friction Loss within the LPPN.

7(a) Network Losses = 1.31 h_d = 1.31 x 2.5 ft = 3.28ft

7(b) Losses due to Fittings = 3.6ft:

Section	No.	Component (mm)	Ext Dia (mm)	Int Dia (mm)	K, fitting Constant	Equivalent Length per Component (m)	Total Equivalent Length (m)	Total Equivalent Length (ft)	Max Flow rate (gpm)
Segment H-I	3	75 T	89	75	0.012	0.90	2.70		
	1	75 X 63 Bush	75	63	0.015	0.95	0.95		
						Total	3.65	**11.66**	49.50
Segment E-F-G	3	63 T	75	63	0.012	0.76	2.27		
	1	63 X 50 Bush	63	50	0.015	0.75	0.75		
						Total	3.02	**9.90**	49.50

Segment B-C	3	50 T	61	50	0.012	0.6	1.8		
	1	50 X 4 Bush	50	40	0.015	0.6	0.6		
						Total	2.40	**7.87**	49.50
Segment A	1	40 X 90°	51	40	0.03	1.20	1.20		
						Total	1.2	**3.94**	49.50
Laterals									
1-10	10	25 45°	25	22	0.014	0.31	3.08		
	3	75 X 50 Bush	75	50	0.014	0.70	2.10		
	9	50 X 25 Bush	50	25	0.014	0.35	3.15		
	3	63 X 50 Bush	63	50	0.014	0.70	2.10		
	1	40 X 25 Busher	40	25	0.014	0.35	0.35		
						Total	10.78	**35.36**	*5.28

- Odd No. Laterals have a discharge rate of 5.28gpm, Even No. Laterals have a discharge rate 4.62gpm. For the purposes of calculations the higher of the two rates was applied i.e. 5.28gpm.

Friction Losses Using Hazen-Williams Equation

Component	Equivalent Length (m)	Equivalent Length (ft)	Discharge Rate (gpm)	Friction Loss (ft)
H-I	3.65	11.97	49.50	0.127
E-F-G	3.02	9.91	49.50	0.246
B-C	2.4	7.87	49.50	0.67
A	1.2	3.94	49.50	.99
Laterals	10.78	35.36	5.28	1.57
			Total	**3.603**

Orifice Shields

A shield is required for any perforations located between the 10:00 o'clock and 2:00 o'clock positions and for any perforations located at the 6:00 o'clock position to reduce scouring of the soil above or below the laterals. An orifice shield is to be used over every orifice.

Summary.

- The required discharge rate for the filter is: 223 litres/min.
- The friction losses within the filter is 2.00 meters.
- The minimum discharge volume required is 200 litres per pump cycle.