

Section D Infrastructure and Operation Attachments

Attachment D1 Infrastructure

Donegal County Council holds Waste Licence ref. W0062-1 for Churchtown Landfill Site. The site closed on 31st August 2000.

The landfill facility at Churchtown occupies an area of approximately 9.7 hectares in the townland of Churchtown, near Lifford, Co. Donegal.

The site is located approximately 3km south west of Lifford and bordered to the northwest by the N15, the main Lifford to Ballybofey Road. The ground to the northeast and southwest of the site is the low lying and gently undulating flood plain of the River Finn both areas being used for grazing. The southeastern boundary is formed by the River Finn. Site Location and Layout are shown on Drawings IBR01015/100 and IBR1015/103.

A willow bed and an Integrated Constructed Wetland (ICW) has been installed on top of the landfill. There are two separate ICW systems; ICW Area A and ICW Area B (denoted Ponds 1A-1E and Ponds 1B-5B in the drawings respectively). Due to the layout and location of the willow bed the volumes of leachate is split between the two ICW areas. The volume of leachate to be treated through each ICW is relative to the treatment area within each ICW system.

The use willow bed and two separate ICWs, which will discharge to perimeter surface water drains, was deemed most practical for the site, both in terms of cost, construction and maintenance. These wetlands form part of a pilot study within the ANSWER/WaterPro Project to assess the use of biofiltration systems in the treatment of contaminated water and leachate of which Donegal County Council is a partner.

The Waterpro Project is designed to help meet the aims of this Interreg IVA project in part by using SRC Willow, both on local farms irrigated with wastewater effluent and also to irrigate leachate from Churchtown Landfill Site. This will help provide Biomass for heating/power generation on a cyclical basis.

A Specified Engineering Work (SEW) for these restoration works was submitted and agreed with the Agency in 2014 with works completed in 2016. This waste licence review is to include emission limit values for discharge to surface water.

a) j) Not applicable. Site is closed.

k) **Sewerage and surface water drainage infrastructure, including location and sizes of pipes, outlets, invert details, treatment facilities, etc.**

Not applicable. Site is closed.

l) u) Not applicable. Site is closed.

Attachment D.2 Facility Operation

Site is closed. Site visits by supervisory staff will be as required to ensure adequate maintenance and monitoring at the site. The site has been fenced off and is kept locked at all times when the facility is unsupervised. Please refer to D4 with regards to leachate extraction and treatment at the facility.

Attachment D 3 Liner System

The site is an unlined site historically operated on a dilute and disperses principal, whereby solid waste was tipped directly onto the underlying excavated surface with leachate allowed to percolate directly through the soils with no engineered liner installed. Landfilling began in 1987 and the site ceased operations on the 31st August 2000.

Attachment D 4 Leachate Management

Leachate Extraction

Leachate is extracted from 3 No. Pumping stations (Sump 1, 2 and 3) on site. A common 90mm HDPE leachate pumping main has been laid through the full length of the site within an existing site access road as shown on Drawing IBR1015/103. Sump 1, 2 and 3 are connected to the 90mm pumping main adjacent to each extraction point.

Treatment System

The Willow Plantation (area is approx 400m long with widths varying from 50m – 70m) is divided into four zones with two main irrigation feed points each located centrally between Zone 1 and 2 and Zone 3 and 4. The connection to willow plantations is via 80mm leachate pumping main via an isolating valve, a strainer and a Flowmeter. The Willows are planted in double rows.

Each ICW pond is above a 0.5 m clay cap and is banded using imported subsoil material that provides containment and processing of the influent contaminated waters. Each pond is comprised of a dense vegetation cover and shallow water depth (100-200mm). The base area of each pond is level, with a level difference occurring from one pond to the next. Gravity flow is provided through the system from Pond 1 to the outlet of Pond 5. Each pond is connected by means of 150mm diameter inter-connecting pipes. The pipes are placed at the bottom of the pond floor and water levels can be managed within each pond by adjusting bends on the outlet pipe of each pond.

The irrigation distribution system, flowmeters, flow analyser and motorised valves are contained within 3.0m diameter precast concrete chambers.

Leachate Treatment

The primary treatment option for the extracted leachate is to the willow plantation. Leachate is pumped to the willow plantation before discharge to surface water. If treated leachate levels are unacceptably elevated, the leachate is pumped into the nearest pumping station chamber (No 1 or 2) to be treated further by circulating via the willow/ICW's before discharging to surface water.

Willow Plantation Treatment

The Willow plantation is supplied with leachate on a timed basis (Currently applied 5am and 5pm daily to Zone 1 and 2 and Zone 3 and 4). A number of factors dictate leachate treatment and application rates within Willow Plantation and are as follows:

1. Precipitation.
2. Temperature
3. Visual inspection manual intervention.

A rainfall meter and temperature probe have been installed to enact the controls required of the leachate dosing system to the Willow Plantation zones and ICW's. Temperature, precipitation and trigger levels have been set to allow for activation and deactivation of leachate pumping and dosing to Willow Irrigation zones and ICW's accordingly. The max daily flow to date to the willow is currently 15m³ to Zone 1 and 2 and 15 m³ to Zone 3 and 4.

A system main pressure is maintained to allow for sufficient treatment via the irrigation laterals installation. The two outlets from the Willow plantation are being monitored by Ammonia analysers and flowmeters and recorded on the SCADA system. When any sample reaches a limit of 3 mg/l ammonia, a motorised valve will shut and divert flow via gravity into the nearest pumping station chamber (No1 or 2) for recirculation in the willow/ICW's. This scenario shall continue until sample has reached acceptable limits. Collected runoff effluent meeting the required parameters is discharged to adjacent surface water drains as shown on the drawings. All values are recorded, alarmed and trended on the SCADA system. Discharge flow from each monitoring chamber is recorded and monitored including leachate applied to the treatment zones, treated flows to surface water drains and flows redirected back to the system for re-distribution and additional treatment.

Integrated Constructed Wetland Treatment (ICW's)

Wetlands both natural and constructed have an innate ability to cleanse water through physical, chemical and biological processes. The main treatment processes include;

- Uptake and transformation of contaminants/nutrients by micro-organisms and plants.
- Breakdown and transformation of contaminants/pollutants by micro-organisms and plants.
- Filtration and chemical precipitation through contact with substrate and plant litter.
- Settling of suspended particular matter.
- Chemical transformation of pollutants
- Absorption and ion exchange on the surface of plants, sediment, and litter (of particular relevance to the capture and storage of phosphorous).
- Predation and natural die-off of pathogens (e.g. E. coli and Cryptosporidium)

Flow of leachate to ICW's is controlled on the pumping main with an actuated valve within a precast concrete chamber along with flow measurements via flow meter. Flow of leachate to ICW's is via a weir chamber and flow split on a 60 / 40 percentage basis relative to their areas (approx 60% to A series pond and remaining 40% to B series ponds).

The maximum volume of leachate pumped from Churchtown landfill to ICW's is currently 50m³/day.

Where leachate is available over and above the treatment capacity of the willow plantation (either through seasonal increases in leachate generation, wet/frosty weather conditions or manual operator intervention) leachate can be diverted to the ICWs as a secondary alternative. The system also allow the site operator to intervene and permit periodic irrigation of the ICWs when sufficient leachate is available during dry weather which would ordinarily be applied to the willow plantation in order to maintain the ICWs.

The SCADA system monitors all site equipment and run the entire plant automatically. The leachate pumping main is controlled at different pressures depending what it is supplying, either ICW's or Willow Plantation irrigation system.

Leachate is monitored at three monitoring wells located within the waste body, designated as L1, L2 and L3.

Discharge Rates

Discharge rates from the ICW systems will be variable depending on the volumes to be treated and on climatic conditions. With higher rates of discharge during the winter months and reduce or no discharges during the summer months.

The maximum volume of leachate applied to the willow and ICWs to date is 80 m³/day. This was monitored by the sampling of the effluent from the system for ammonia to ensure this volume of leachate was treated. Precipitation and potential evapotranspiration (mm) has been taken from Malin Head, Co Donegal. The annual total mean precipitation and potential evapotranspiration averaged per day has been used to calculate the maximum flow m³/day based on the above assumptions. This gives an estimated maximum flow of 136 m³/day as shown in Table D below. This maximum flow rate has been used in the assimilation capacity. As previously stated discharge rates from the willow and ICW systems will be variable depending on the volumes to be treated and on climatic conditions. With higher rates of discharge during the winter months and reduced or no discharges during the summer months.

Total rainfall in millimetres for Malin_head

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2017	56.7	85.1	96.9	41.1	25.6								305.4
2016	166.3	130.7	72.7	52.9	65.6	72.4	109.9	79.9	94.7	37.6	113.9	76.0	1072.6
2015	176.0	85.8	123.1	64.7	137.0	56.1	132.7	111.0	29.7	71.9	222.9	272.9	1483.8
2014	162.2	189.9	71.6	33.4	86.8	48.6	86.0	95.3	23.0	131.4	134.4	150.5	1213.1
mean	119.7	87.4	88.4	64.7	58.4	70.2	80.8	95.4	96.4	120.6	108.6	116.4	1107.0

Potential Evapotranspiration (mm) for Malin_head

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2017	21.8	24.2	38.5	54.6	n/a								139.1
2016	24.2	26.5	39.0	51.4	75.7	71.5	72.7	60.3	47.1	37.2	26.2	24.0	555.8
2015	24.3	19.0	36.5	52.3	62.1	73.5	71.1	65.1	50.1	33.7	27.3	26.1	541.1
2014	20.5	24.7	36.9	58.2	63.2	75.0	82.4	68.7	47.3	36.4	17.3	24.3	554.9
mean	20.8	25.9	34.4	50.7	68.6	74.0	70.8	60.8	46.6	32.0	23.0	19.7	527.3

Table D Estimated maximum flow

Area m ²	Leachate m ³	Rainfall mm	Potential Evapotranspiration mm	Flow m ³ /day
Willow 24,000	30	72.79	34.67	68.12
ICW 11,165	50	33.86	16.13	67.73

Wetland planting

The plant species used in the ICW ponds is that similar to other ICW systems and which are native to the region, these include Carex riparia, Typha latifolia, Typha angustifolia, Glyceria maxima and Iris pseudacorus. Other plant species were used to enhance the biodiversity and habitat potential of the site, both on within the ponds and along the embankments. Planting on embankments was done so as not to restrict access. The wetland planting density is as follows:

- Pond 1A and 1B: 3 plants per 2m²,

- Pond 2A-5A & 2B-5B: 1 plant per m².

The plant species used in the ICW ponds have an ammonia tolerance maximum threshold of 200mg/l. Higher concentrations can be tolerated at times, however excessive ammonia concentrations for sustained periods of time may result in die off of the vegetation in the initial cell.

Operation and maintenance

ICWs are designed to be as self-maintaining and as self-operable as possible. The main maintenance procedures are as follows:

1. Water level management and flow maintenance – Maintain an operational water level of ~100-200mm. Overtime there will be a build up of vegetation and sediment in the cells, which will require the outlet pipes to be adjusted to maintain appropriate water depths.
2. Vegetation monitoring and maintenance – The vegetation in the wetland cells should be assessed regularly to ensure they are well. Vegetation, especially grassed areas, around the wetland cells should be maintained to provide for easy and safe access for monitoring and maintenance.
3. Maintenance of access – fences, gates and access routes should be maintained to ensure safe and easy access is maintained, while also restricting access for livestock.
4. Maintenance of inlet and outlet pipes – The area around the inlet and outlet pipes should be kept clear so that flows between cells are maintained and that vegetation or sediments do not build up in or around the pipework.
5. Sediment/sludge management – Overtime there will be a build up of sediment in the wetland cells, which will need to be cleaned out to maintain the proper functionality of the ICW.

Desludging is dependent on the cell No, cell area, and influent loading. The initial wet-land cell will require cleaning out first, however this is not expected for at least 5-10 years. Sediment build up in the wetland will include metals accumulated. The management of sludge will depend on the contamination concentrations and the proposed reuse or disposal.

The willow will be managed in accordance with Short Rotation Coppice Willow Best Practice Guidelines

<https://www.afbini.gov.uk/sites/afbini.gov.uk/files/publications/Short%20rotation%20coppice%20willow%20best%20practice%20guidlines.pdf>

Cutback (coppicing) after the first year of growth is the standard practice in willow biomass production systems. This was undertaken in Churchtown in 2017. The willow will be coppiced in a cycle of between two and four years depending on yield.

Attachment D 5 Landfill Gas Management

Site is closed. Passive landfill gas vents (18) have installed at the facility as shown on Drawing IBR01015/105.

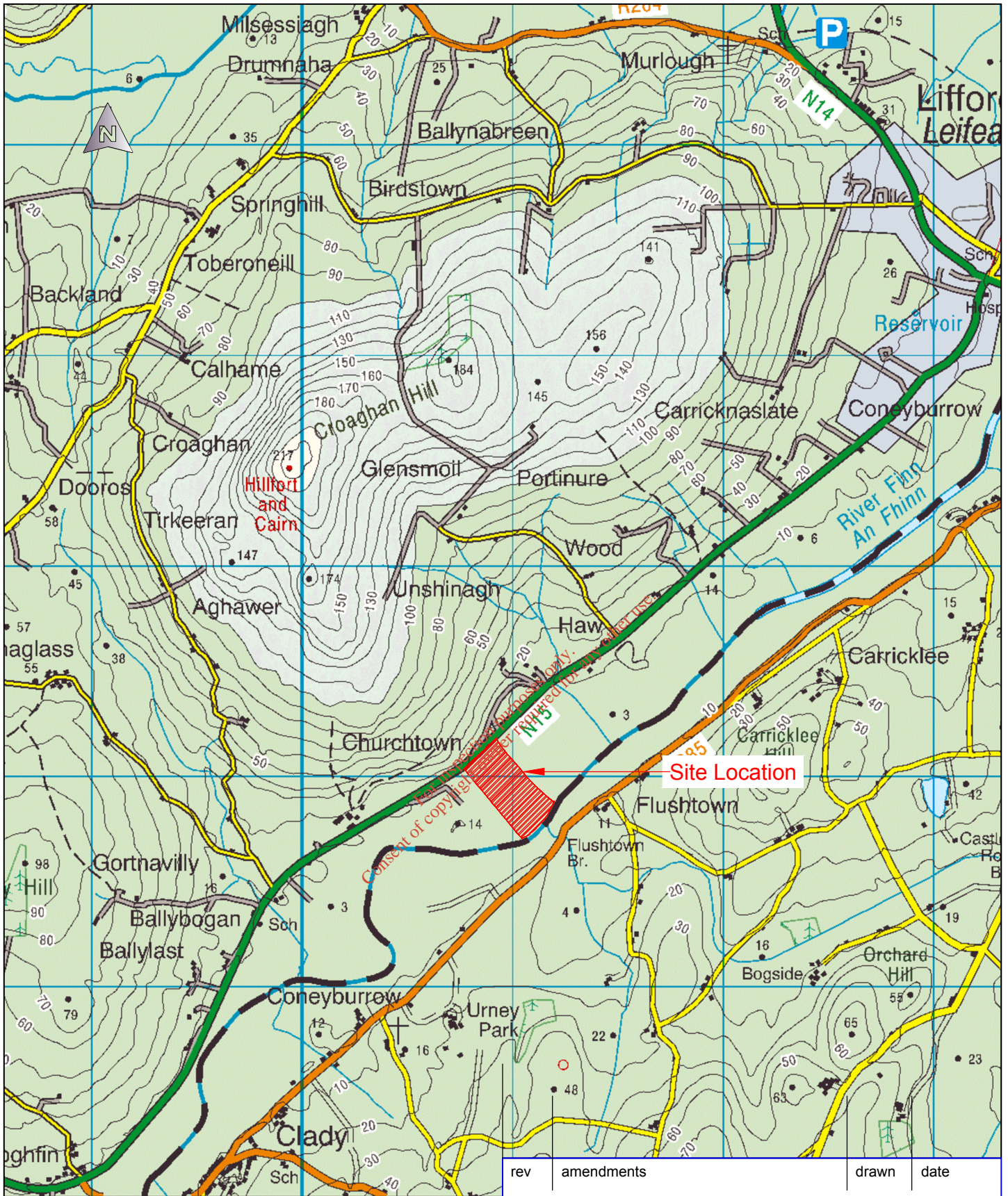
Attachment D6 Capping System

The existing landfill was capped with a permanent low permeability clay liner in conjunction with a willow and reed plantation and constructed wetland installed in 2014-2015. A 0.15 to 0.45 metre thick topsoil and 0.5 m clay cap with a permeability of 1×10^{-8} m/s was installed at the facility. The willow plantation is situated in the centre and above the capped waste (Zones 1 to 4) with a series of constructed wetlands along western and eastern side of willow plantation (Drawing IBR1015/103).



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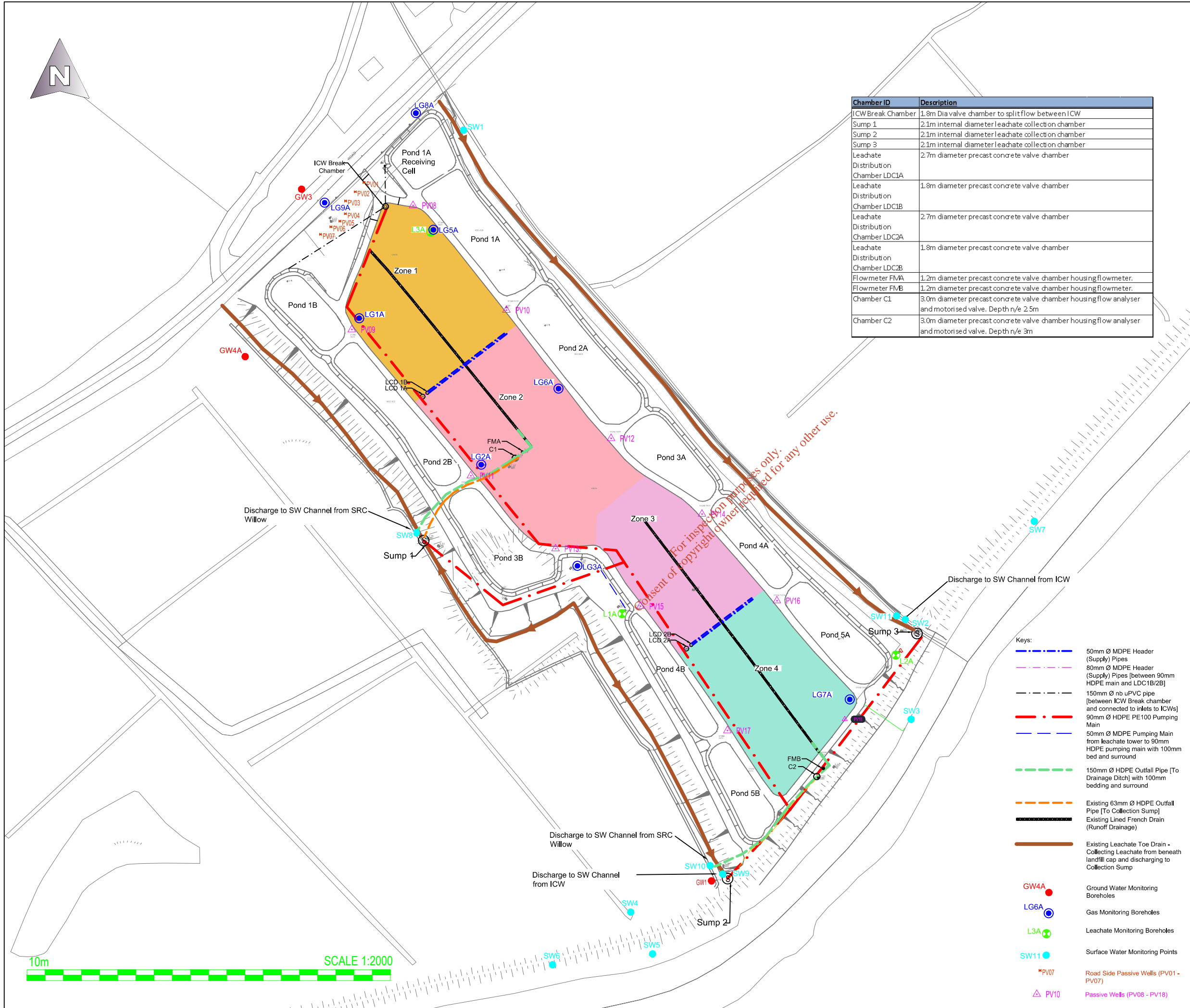
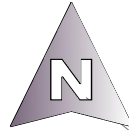
Appendix D Drawings

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rev	amendments	drawn	date

 <p>Elmwood House T +44 (0) 28 90 667914 74 Boucher Road F +44 (0) 28 90 668286 Belfast W www.rpsgroup.com/ireland BT12 6RZ E ireland@rpsgroup.com</p>	<p>Drawing Number</p> <p style="font-size: 1.2em; font-weight: bold;">IBR1015/100</p>		<p>Rev</p> <p style="font-size: 1.2em; font-weight: bold;">0</p>	
	<p>Project</p> <p style="font-weight: bold;">Churchtown Licence Review</p>		<p>Title</p> <p style="font-weight: bold;">Churchtown Landfill Site Location</p>	
<p>Client</p>  <p>Comhairle Contae Dhún na nGall Donegal County Council</p>		<p>Architect</p>		
<p>Drawing Status</p> <p>Prelliminary</p>	<p>Sheet Size</p> <p>A4</p>	<p>Drawing Scale</p> <p>1:50.000</p>	<p>Project Leader</p> <p>AMcG</p>	<p>Drawn By</p> <p>AMB</p>
		<p>Date</p> <p>Mar '17</p>	<p>Initial Review</p> <p>CG</p>	



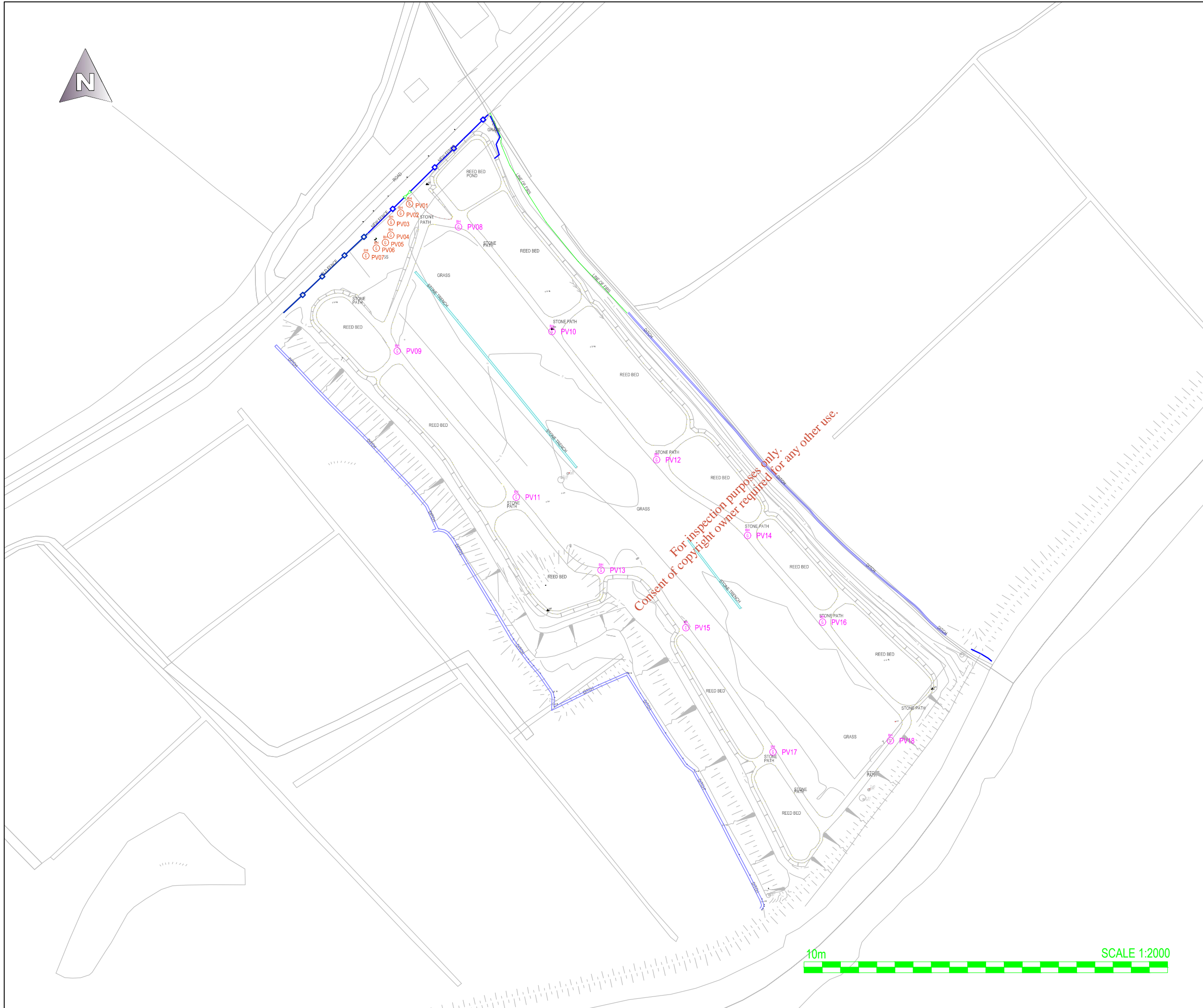
Chamber ID	Description
ICW Break Chamber	1.8m Dia valve chamber to split flow between ICW
Sump 1	2.1m internal diameter leachate collection chamber
Sump 2	2.1m internal diameter leachate collection chamber
Sump 3	2.1m internal diameter leachate collection chamber
Leachate Distribution Chamber LDC1A	2.7m diameter precast concrete valve chamber
Leachate Distribution Chamber LDC1B	1.8m diameter precast concrete valve chamber
Leachate Distribution Chamber LDC2A	2.7m diameter precast concrete valve chamber
Leachate Distribution Chamber LDC2B	1.8m diameter precast concrete valve chamber
Flowmeter FMA	1.2m diameter precast concrete valve chamber housing flowmeter.
Flowmeter FMB	1.2m diameter precast concrete valve chamber housing flowmeter.
Chamber C1	3.0m diameter precast concrete valve chamber housing flow analyser and motorised valve. Depth n/e 2.5m
Chamber C2	3.0m diameter precast concrete valve chamber housing flow analyser and motorised valve. Depth n/e 3m

- NOTES**
- Verifying Dimensions.
The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.
 - Existing Services.
Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.
 - Issue of Drawings.
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 - Keys:

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- Keys:**
- 50mm Ø MDPE Header (Supply) Pipes
 - 80mm Ø MDPE Header (Supply) Pipes [between 90mm HDPE main and LDC1B/2B]
 - 150mm Ø nb uPVC pipe [between ICW Break chamber and connected to inlets to ICWs]
 - 90mm Ø HDPE PE100 Pumping Main
 - 50mm Ø MDPE Pumping Main from leachate tower to 90mm HDPE pumping main with 100mm bed and surround
 - 150mm Ø HDPE Outfall Pipe [To Drainage Ditch] with 100mm bedding and surround
 - Existing 63mm Ø HDPE Outfall Pipe [To Collection Sump]
 - Existing Lined French Drain (Runoff Drainage)
 - Existing Leachate Toe Drain - Collecting Leachate from beneath landfill cap and discharging to Collection Sump
- GW4A Ground Water Monitoring Boreholes
 - LG6A Gas Monitoring Boreholes
 - L3A Leachate Monitoring Boreholes
 - SW11 Surface Water Monitoring Points
 - ▲ *PV07 Road Side Passive Wells (PV01 - PV07)
 - ▲ PV10 Passive Wells (PV08 - PV18)



rev	amendments	drawn	date
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Client			
Comhairle Contae Dhún na nGall Donegal County Council			
Project			
Churchtown License Review			
Title			
Leachate System			
Drawing Status	Sheet Size	Drawing Scale	
Preliminary	A3	1:2000	
Drawing Number			Rev
IBR1015 /103			-
Project Leader	Drawn By	Date	Initial Review
DD	AMB	May - 2017	JD



NOTES

1. Verifying Dimensions.
The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.
2. Existing Services.
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4. Date Surveyed 05 December 2014 by LSS Survey Services

5. Keys
-  Road Side Passive Wells (PV01 - PV07)
 -  Passive Wells (PV08 - PV18)

rev	amendments	drawn	date

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Client



Project
Churchtown License Review

Title
Passive Gas Vents Locations

Drawing Status	Sheet Size	Drawing Scale
Preliminary	A3	1:2000

Drawing Number	Rev
IBR1015 /105	-

Project Leader	Drawn By	Date	Initial Review
AMcG	AMB	May '17	AMcG