

Limerick WWTP Upgrade and Regional Bioresource Centre

Appendix 16.4 - Stormtank Hydraulic Modelling Memo

June 2026



Formerly JB Barry Partners who became part of Egis in 2023

MEMO ON HYDRAULIC MODELLING OF LIMERICK AND CORCANREE TO ASSESS STORM SPILLS

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1 PROJECT DRIVER

In order to support projected growth in the region and meet future demands of Limerick City and surrounding areas, the treatment capacity of the Limerick (Bunlicky) WWTP needs to be significantly increased to serve a future projected population equivalent (PE) of 285,000 over 10 years with provision for expansion to 325,000 PE. This essential project will also ensure compliance with environmental regulations and protect the Shannon, a designated Special Area of Conservation.

2 LMD MODEL (1994 PRELIMINARY REPORT)

The original Limerick Main Drainage (LMD) Model was constructed and calibrated in the 1990's by JB Barry & Partners as part of the Limerick Main Drainage Preliminary Report. The LMD PR recommended the following major infrastructural works;

- New WWTP at Bunlicky downstream of the city and adjacent to the Irish Cement works. This was designed for a PE of 130,000 and includes storm water storage of 7,500m³.
- New Pumping Station at Corcanree Business Park. This serves most of the city and pumps foul flows to the WWTP with excess storm flows being pumped to the Shannon.
- Interceptor Sewers on both banks of the River Shannon collecting outflows from existing outfalls and routing these to Corcanree PS.

3 2021 ANALYSIS OF MODEL WITH TIME SERIES RAINFALL (TSR)

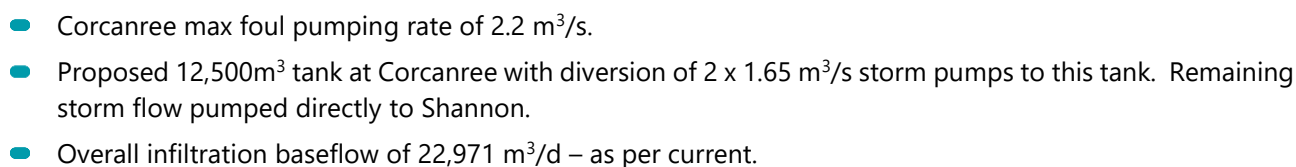
An updated Drainage Area Plan (DAP) was awarded to RPS in 2018 – see Section 5 below. Prior to receipt of the Stage 2/Stage 3 reports and models, an exercise was undertaken by JB Barry/EGIS using the 1990's LMD models to quantify the likely spill frequency at Corcanree and Bunlicky under current and future loadings. The LMD model was updated as follows;

CURRENT MODEL

- Population Equivalent (PE) of 113,431 including domestic, commercial, institutional loadings. Industrial flow of 16.34 l/s (equating to PE of 35,302 @40 l/PE/day).
- Mungret industrial flow of 40.9 l/s.
- Overall infiltration baseflow of 22,971 m³/d (266 l/s) distributed by domestic population.
- Corcanree foul pumping at max rate of 1.25 m³/s to WWTP.
- Corcanree storm pumping at 11.25 m³/s to Shannon.

FUTURE UPGRADED MODEL

- Future PE increased to 325,000 (ultimate PE for upgraded Limerick WWTP).
- This included future PE of 48,291 (20,991 + 27,300) from Mungret.
- Mungret catchment pumped @ 200 l/s to Limerick Inlet.



The results are summarised below and were submitted to Uisce Eireann in October 2021. The results show that if the Shannon were to be considered as Contact/Recreational (i.e. less than 7 spills per bathing season) then under the current scenario, Corcanree would be compliant, but Bunlicky would fail.

Assessing the SWO's under the rUWWTD (Recast Urban Wastewater Treatment Directive) using spill vs the annualised volume of DWF, shows that both SWOs would be compliant under current and future scenarios.

KEY INDICATOR	CURRENT MODEL		FUTURE MODEL	
	CORC	WWTP	CORC	WWTP
Spills per Annum	16.9	42.0	1.1	12.4
Spills per Bathing Season	5.8	11.3	0.4	4.0
Total Spill Volume per annum	139,577	292,094	8,453	39,288
Annual DWF	15,447,233	17,364,510	22,340,242	24,880,381
Total Spill Volume related to annual DWF ¹	0.9%	1.7%	0.0%	0.2%

Notes;

1. Compliance assumed to be achieved if spill < 4% of annual DWF

As part of the verification of the performance of the WWTP at Bunlicky, flow and volumetric data measurements have been collated from Performance Management Systems (PMS) Reports by the plant operator. Data from 2021 to 2025 is presented below.

YEAR	CORC INFLOW	MUNGRET INFLOW	TOTAL INFLOW	WWTP STORM O/F	CORC STORM O/F ¹	RAINFALL (mm)
2020	17,893,626	4,213,195	22,106,821	2,708,639	1,333,917	1,134.2
2021	15,429,151	1,496,089	16,925,240	1,001,636	Not available	930.4
2022	15,918,889	2,083,261	18,002,150	1,767,293	Not available	996
2023	18,547,906	3,027,476	21,575,382	3,053,552	1,255,155	1,608
2024	15,097,628	3,547,159	18,644,787	1,512,999	475,310	914
2025	15,327,213	3,833,714	19,160,927	1,991,966	678,865	1,165

Notes;
1. Corcanree storm volume estimated from hours pumping



The table above shows that the measured storm overflow volumes at Corcanree and Bunlicky greatly exceed those predicted for the TSR series. Further analysis of this is undertaken using the DAP models (see further Section 5 below).

5 UPDATING OF LIMERICK MODEL UNDER DAP (RPS, 2024)

5.1 DAP Stage 2 – Verified Model

The Limerick Drainage Area Plan (DAP) was awarded to RPS Group in 2018. This involved the complete re-construction and verification of the Limerick Main Drainage Model using up to date sewer and flow surveys. The model was verified using a 2021 flow survey with 170 monitors. The final DAP Stage 2 Report was submitted by RPS in 2024.

The final verified model included the following loadings. It should be noted that for the DAP models, all non-domestic loadings were included under Trade flow, whereas previously it was included as a PE. These includes commercial, institutional and industrial loadings.

TABLE 5-1: VERIFIED MODEL LOADINGS

	CORCANREE	MUNGRET	TOTAL
Domestic Population	88,494	5,832	94,326
Trade Flow (l/s)	80.2	76.9	157.1

A brief assessment was undertaken by EGIS whereby the verified DAP model was analysed using the TSR rainfall and compared with the previous predicted results as well as the measured data from the PMS reports. As can be seen in the table below, the results align themselves more closely with the measured data (Table 4.1), than was the case for the original analysis using the updated 1990's model (Table 3.1). Examination of the predicted results show a large input from groundwater and tidal infiltration over what was previously assumed.

It should be noted from the table below that the spill frequency is used just as a comparative indicator and not reflective of the applicable discharge criteria.

TABLE 5-2: ENVIRONMENTAL ASSESSMENT OF VERIFIED DAP MODEL

KEY INDICATOR	PREDICTED RESULTS - VERIFIED MODEL	
	CORCANREE	WWTP
Spills per Annum	45.1	92.8
Spills per Bathing Season	11.2	18.8
Total Spill Volume per annum	445,250	893,182

5.2 Stage 3 – DAP Stage 3 Risk Assessment

The DAP verified model was used as the basis for the hydraulic and environmental risk assessment under the DAP Stage 3 Report. This was submitted by RPS in 2024.

The loadings used in the Stage 3 Current and Strategic Models are as summarised below. As shown on the tables, different trade flow loadings were used for the network analysis and for the SWO analysis.

TABLE 5-3: LOADINGS FOR NETWORK HYDRAULIC RISK ASSESSMENT

	CURRENT	STRATEGIC
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	Corc	Mung	Total (WWTP)	Corc	Mung	Total (WWTP)
Dom Pop	90,027	7,276	97,303	126,732	15,637	142,370
Trade Flow – Network (l/s)¹	86.2	81.4	167.6	259.3	154.0	413.3
<i>Notes;</i> 1. The full trade flows were used in the hydraulic risk assessment to simulate peak DWFs.						

TABLE 5-4: LOADINGS FOR SWO ENVIORNMENTAL RISK ASSESSMENT

	CURRENT			STRATEGIC		
	Corc	Mung	Total (WWTP)	Corc	Mung	Total (WWTP)
Dom Pop	90,027	7,276	97,303	126,732	15,637	142,370
Trade Flow – SWO (l/s)¹	43.1	48.6	91.7	134.1	92.4	226.5
Trade PE²	26,593	29,974	56,567	82,734	57,019	139,752
Total PE	116,620	37,250	153,870	209,466	72,656	282,122
Formula A (l/s)	1,918	301	2,219	2,856	586	3,442
<i>Notes;</i> 1. Trade flows reduced based on trading hours. 2. Based on 140 l/PE/day						

As stated earlier, trade flows in the DAP models include all non-domestic sectors (Commercial, Institutional, Industrial). It is therefore difficult to compare the total strategic loadings from the DAP with the design ultimate Feasibility PE of 325,000. However, assuming a daily consumption of 150 l/PE/day on average, the PE for the above network trade flow would be 238,000 – giving an overall network PE of **380,000**. It is normal that the network PE would exceed the final WWTP PE to allow for growth in all zoned areas.

The main conclusions of the Stage 3 Risk Assessment were;

- The hydraulic assessment highlighted a number of flood risk zones in the city network due to lack of sewer and/or pumping station capacity. Upgrades for these are considered in the Stage 4 DAP Report (see below).
- The environmental risk assessment showed that a number of SWO's (including Corcanree and Bunlicky) failed the minimum criteria to discharge Formula A under current and future loading conditions.
- For this DAP assessment, Formula A (not Modified Formula A) was the applicable flow for both Corcanree and Bunlicky.
- For this assessment, it is assumed that the following upgrading works are included in the Strategic model. These proposals were included in the Corcanree Storage Report (JB Barry, 2021);
 - New 12,500m³ storage tank at Corcanree (based on 2 hours of Formula A less Pass Forward Flow).
 - Diversion of 2 of the Corcanree storm pumps to the new tank.
 - New rising main from Corcanree to Bunlicky main treatment with maximum capacity of 879 l/s.

An assessment of spill frequency and volumes was included in the Stage 3 Report. This used Time Series Rainfall (TSR) from Shannon Airport over a 10 year period from 2012-2021. As can



be seen from the results below Corcanree and Bunlicky SWO's would fail the criteria if discharging to Contact/Recreational waters (7 spills per Bathing Season).

If assessed under the rUWWTD, the annual spill exceeds the 4% maximum threshold for annual DWF except at Corcanree for the Strategic scenario.

TABLE 5-5: ENVIRONMENTAL ASSESSMENT OF STAGE 3 DAP MODEL

	CURRENT		STRATEGIC	
	CORC	WWTP	CORC	WWTP
Spills per Annum (>50m3)	68	145	15	91
Spills per Bathing Season (>50m3)	25	20	11	10
Annual Spill volume (m3)	725,636	1,730,913	235,639	1,185,859
Annual DWF	13,075,772	15,599,190	18,697,064	23,577,890
Total Spill Volume related to annual DWF	5.6%	11.1%	1.2%	5.0%

As a check, JB Barry/EGIS ran a simulation of one of the TSR events (2020) with the latest Current Stage 3 model received from UE in order to verify the spills and spill volume in the DAP Report. The results are summarised below.

TABLE 5-6: CHECK OF STAGE 3 SWO RESULTS

	CURRENT (DAP Stage 3 Report)		Predicted Current (2020 only)	
	CORC	WWTP	CORC	WWTP
Spills per Annum (>50m3)	68	145	76	208
Total Spill Volume	725,637	1,730,912	1,097,446	2,671,534

Although the 2020 spills and volumes predicted by EGIS are higher than in the Stage 3 Report, it should be noted that the rainfall in 2020 was ~20% higher than the average for the 10 year TSR period.

5.3 Committed Works Report (RPS, 2025)

As part of the preparation of the DAP Stage 4 Report (see Section 5.5 below), a Committed Works Assessment Report was presented by RPS on 4th June 2025. The following were assumed to be included as **Committed Works**;

- Upgrade Foul Pumps Rates at Corcanree from 1,250l/s to 1,989l/s.
- New 12,500m³ storm tank at Corcanree (as per Stage 3 Strategic).
- Diversion of 2 x Storm pumps to new tank with the remaining 6 pumping directly to outfall culvert (as per Stage 3 Strategic).
- Routing of one of the Corcanree Rising mains to new process stream at Bunlicky (bypassing Bunlicky storm tank) with a maximum pumped flow of 879 l/s.



- The remaining pumped flow from Corcanree goes to the existing WWTP along with the existing pumped flow of 203 l/s from Mungret. This Corcanree flow is throttled back to 662 l/s if the Bunlicky storm tank is filled. This allows a FFT of 865 l/s if combined with the Mungret pumped flow.

The Report contained the results of an SWO assessment using only 1 year from the TSR Series (2012) and the results are shown below. No further years were assessed. As stated earlier, the predicted spill frequency is used just as an indicator of the improvement achieved through the committed works

TABLE 5-7: ENVIRONMENTAL ASSESSMENT OF COMMITTED WORKS MODEL

	CURRENT LOADINGS		FUTURE LOADINGS	
	Corcanree	WWTP	Corcanree	WWTP
Spills per Annum (>50m3)	5	26	9	79
Total Spill Volume	101,576	122,000	160,461	561,095
Total Spill Volume related to annual DWF	0.8%	0.8%	0.9%	2.3%

Although this is just for 1 year, the results show a marked decrease in spills and spill volume as a result of construction of the **Committed Works**.

As a check of the results, EGIS also ran the model for 2012 – the results are shown below. These show that there is a small increase in spill frequency and volume at both Corcanree and the WWTP for the current and future loadings.

TABLE 5-8: CHECK OF COMMITTED WORKS SWO RESULTS

	CURRENT LOADINGS		FUTURE LOADINGS	
	Corcanree	WWTP	Corcanree	WWTP
Spills per Annum (>50m3)	5	31	11	83
Total Spill Volume	136,225	168,856	232,212	517,001
Total Spill Volume related to annual DWF	1.04%	1.08%	1.2%	2.2%

5.4 DAP Stage 4 / IDP Report (RPS 2025)

All of the interventions necessary to ameliorate the risks identified in the Stage 3 Report were included in the DAP Stage 4 & Infrastructural Development Plan (IDP) Report submitted by RPS in 2025. A DAP Stage 4 hydraulic model was also submitted. This model contained a number of scenarios, including;

- Current Loadings with existing infrastructure.
- Current Loadings with **Committed Works**.
- Future (Strategic) Loadings with **Committed Works**.
- Future (Strategic) Loadings with Stage 4 Upgrades.

The Scenarios with the **Committed Works** only were assessed by EGIS using the 2012 TSR Event to verify the above spills results (see under Section 5.4 above). The results show a minor increase in spills and volume at both Corcanree and the WWTP.

A comprehensive set of interventions were proposed under the Stage 4 / IDP Report. In summary, these are.



TABLE 5-9: DAP STAGE 4 INTERVENTIONS SUMMARY

LOCATION	INTERVENTION	COMMENT
CORCANREE	- Foul pumps upgraded to 1,989 l/s 1 x rising main (879 l/s) to new Bunlicky Treatment Stream	Committed Works
	12,500m³ Storage Tank	Committed Works
	2 x Storm Pumps to Storage Tank 6 x Storm pumps to Outfall	Committed Works
	4 x Storm Pumps to Storage Tank 4 x Storm Pumps to Outfall	IDP / Stage 4
BUNLICKY	New Treatment Stream (879 l/s). Fed directly by dedicated Corcanree main	Committed Works
MUNGRET	- Foul pumps upgraded to 403 l/s – additional 200 l/s to new Bunlicky Treatment Stream - New 400 l/s storm pumps to Bunlicky Storage Tanks	IDP / Stage 4
UPSTREAM NETWORK	9 x Storage tanks for attenuation - Remove 6 x SWO's - Upgrade 8 x pumping stations - Remove 2 x Tide Inflows 5.1 km of new foul sewers 7.2 km of new storm sewers - Upgrade 44.6km of existing f/c sewers - Upgrade 1.8km of existing storm sewers	IDP / Stage 4

The Upgrades model was checked against the results in the Stage 4 / IDP Report as shown in the Table below.

TABLE 5-10: CHECK OF STAGE 4 UPGRADES SWO ASSESSMENT

	IDP REPORT		EGIS ANALYSIS	
	Corcanree	WWTP	Corcanree	WWTP
Spills per Annum (>50m³)	16.2	0	14.4	6.6
Total Spill Volume	295,725	0	240,635	8,166
Total Spill Volume related to annual DWF	1.7%	0.0%	1.4%	0.1%

Although the spill frequency at Corcanree was roughly similar to that in the Report, the EGIS simulations showed that the frequency at Limerick WWTP exceeded that in the Report, although the annual spill volume was relatively low. This may be due to minor instabilities in the model simulations.

The controls in the Upgrades model are similar to the Committed Works model but with the following additions;

- The pumped flow from Corcanree to the new WWTP stream is reduced to 679 l/s if the new Mungret pump (200 l/s) is switched on. This guarantees a maximum inflow to the new stream of 879 l/s. This is the Flow to Full Treatment (FFT) for the new stream as no overflow is included.



- There is no RTC on the Corcanree storm pumps. The start levels are adjusted so the 4 x storm pumps to the 12,500 tank are operated first until the tank fills to its TWL.

6 CONCLUSION

The EGIS simulations broadly confirm the DAP model outputs, with only minor differences observed, providing a good level of confidence in the modelling results.

The model outputs for the existing situation are consistent with operational monitoring data and demonstrate that storm overflow (SWO) discharges currently exceed acceptable thresholds, with spill frequencies of approximately 68 per annum at Corcanree and 145 per annum at the WWTP. Total spill volumes are in the order of 5.6% (Corcanree) and 11.1% (WWTP) of annual dry weather flow (DWF), indicating non-compliance with the recast Urban Wastewater Treatment Directive (rUWWTD).

The Committed Works proposal will result in a substantial reduction in both spill frequency and volume, with total spill volumes reducing to approximately 1–2% of annual DWF. This represents a significant improvement in network performance and is sufficient to bring the agglomeration into compliance with the requirements of the rUWWTD from Day 1 of operation.

The Stage 4/IDP upgrades will further improve system performance over the longer term as wider network improvements are delivered, with spill volumes reducing to approximately 0–1.4% of annual DWF.

TABLE 6-1: SUMMARY OF HYDRAULIC MODELLING RESULTS

Scenario	Location	Spills per Annum)	Spill Volume (% of DWF)	Compliance
Existing (Stage 3 DAP Results)	Corcanree	~68	5.60%	Non-compliant
	WWTP	~145	11.10%	Non-compliant
Committed Works Model (Current – Future Range)	Corcanree	5–9	1.0–1.2%	Compliant
	WWTP	26–79	0.8–2.3%	Compliant
Stage 4 Upgrades (DAP – Egis Results)	Corcanree	14–16	1.4–1.7%	Compliant
	WWTP	0–7	0.0–0.1%	Compliant

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