FEHILY TIMONEY & COMPANY
CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES
CORK DUBLIN

Q: LW11-080-04/Let002/DO'S/MG

Administration
Environmental Licensing Programme
Office of Climate, Licensing and Resource Use
EPA Headquarters
PO Box 3000,
Johnstown Castle Estate
Co. Wexford

ENVIRONMENTAL PROTECTION AGENCY
30 JAN 2012

25 January 2012

RE: Certificate of Authorisation for Carcur Closed landfill Application Register No. H0002-01. Response to Request for Further Information issued by the EPA Office of Climate, Licensing and Resource Use dated 8 September 2011

Dear Sirs,

With regard to the above referenced RFI, as requested, I enclose for your information two hard copies and one pdf copy, on CD-ROM, of the response document.

Please contact me if you require any further information.

Yours sincerely,

Declan O'Sullivan
for and on behalf of **Fehily Timoney and Company**

Encl.

CARCUR CLOSED LANDFILL SITE – APPLICATION TO EPA FOR CERTIFICATE OF AUTHORISATION

RESPONSE TO REQUEST FOR FURTHER INFORMATION INTERIM SUBMISSION

ORIGINAL

January 2012

EXEMPLAR HIBERNIAE

FEHILY TIMONEY & COMPANY

CARCUR CLOSED LANDFILL SITE – APPLICATION TO EPA FOR CERTIFICATE OF AUTHORISATION

RESPONSE TO REQUEST FOR FURTHER INFORMATION INTERIM SUBMISSION

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User is Responsible for Checking the Revision Status of this Document

Rev. Nr.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date
0	Final Issue	DO'S/MG	DD		25-01-2012

Client: Wexford County Council.

Keywords: Certificate of authorisation, risk assessment, EPA Request for further information

Abstract: This document is an Interim Response to the Request for Further Information issued by the EPA on September 8th 2011

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1. INTRODUCTION

In February 2011, Wexford County Council (WCC) acting on behalf of Wexford Borough Council (WBC submitted an application to the Environmental Protection Agency (EPA) for authorisation under Waste Management (Certification of Historic Un-licensed Waste Disposal and Recovery Activity) Regulations, 2008 for the closed Carcur Landfill Site on the northern outskirts of Wexford Town.

The certificate of authorisation related to a previous risk assessment carried out on the site.

On September 8th 2011, WCC received a request for further information (RFI) in relation to the said application.

This document represents WCC's interim response to the RFI.

Fehily Timoney and Company (FTC) was appointed by WCC to prepare this response.

For clarity and for the avoidance of confusion, the section numbers in this response correspond to the numbering sequence of the RFI.

2. RFI

2.1. Waste Perimeter and foreshore designation

i. *On the Waste Management Act Section 22 Register, it has been stated that the area of the waste is approximately 5.5 ha. If the waste body is >5 ha the leachate and landfill gas source hazard scoring matrix scores should be increased from 7 to 10 as outlined in the Code of Practice (COP). Clarify the area of waste and if necessary recalculate the relevant SPR linkage scores.*

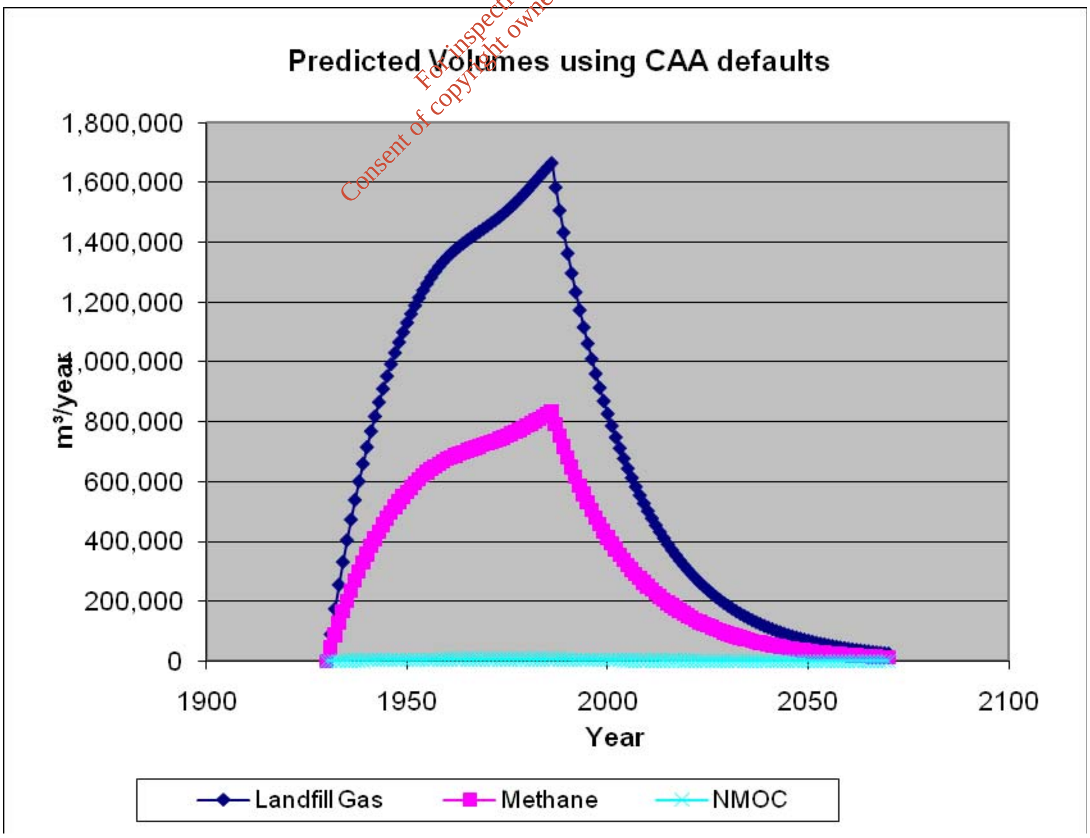
Response

Insofar as can be determined from trial holes and site investigations, the area of the waste body covers up to 6.3 ha.

Referring to Table 1a and 1b of the COP, pre 1977 sites, i.e. those that were 30 years old at the time of publication of the COP are given a rating of 3 (if greater that 5 ha). A large part of the site was used as a municipal landfill from 1933 to 1985. The majority of the landfill area was in-filled during the 1960s and 1970s. The site closed in 1985 and has not been used since for any purpose. Thus the majority of the site is more than 30 years old and a small part is less than 30 years old.

The effect of age is natural biodegradation of the waste. Referring again to Table 1a, it could be argued that, from a biodegradability perspective, the site is now more akin to a C&D waste landfill than to a municipal waste landfill.

Using the landfill gas prediction model (below) for the site it is clear that the predicted biodegradability of the waste is, by now, less than one third of that when the landfill was operational.



It can be argued that the site is 70% metamorphised from biodegradable to inert thus a lower score could well be applied both to 1a and 1b.

ii. A large portion of the waste body is located in an area zoned as a transitional water body. As such it seems that the waste is likely to have been deposited in an area designated as foreshore. If this is the case, confirm the amount of waste deposited in the foreshore and provide a map which highlights the area of land that is considered as foreshore and the perimeter of the waste body.

Response

Prior to waste deposition, the entire area currently occupied by waste was a mud flat, partially cut-off from the estuary by the construction of the Great Southern Railways embankment. The deposition of waste that commenced in the 1930s progressively reduced the area of mud flat to what is today. Waste deposition ceased in 1985.

Thus 85% of the waste, variously estimated at up to 287,000 m^3, is placed on the 'foreshore'.

Drawing LW10-080-03 submitted with the original application for certificate of authorization has been modified as LW11-080-3-001 showing the original pre-deposition high water mark in relation to the waste placement.

Examination of the site investigation boreholes confirms the existence of a layer of silt (mud-flat material) under the waste where the original mudflats are depicted on pre-landfill maps.

iii If it is confirmed that waste has been deposited in an area designated as foreshore, describe the relevance and implications of the Foreshore Acts 1933 to 2005

Wexford County Council had discussions with Department of Environment Community and Local Government concerning the Certificate of Authorisation. The proposed works on the foreshore as detailed in the application for the Certificate of Authorisation requires a Foreshore Licence/Lease. The Foreshore application to the DOELG will incorporate the authorised environmental protection works and Wexford Borough Council will submit an application for the necessary consent on issue of the Certificate of Authorisation.

2.2. Subsoils

i. Groundwater vulnerability was deemed to be low and received a score of 0.5 in accordance with the COP as it was determined that the site was underlain by peat. From the borehole testing results provided, 4 of the 16 boreholes identified the presence of peat, therefore, it cannot be demonstrated the site is fully underlain by peat. This being the case, you should reassign the appropriate SPR linkage score and also take into account the outcome of Point 3 (i) below

Section 4.3.2.1 of the COP discusses leachate migration pathways, Table 2a refers to groundwater vulnerability. It is true to say that a score of 0.5 was given on the basis that there was a peat layer under the waste. Clearly, as highlighted in the RFI, the borehole logs do not bear that out. Boreholes 02, 03 and 10 are in waste and indicate the presence of a layer of peat. All other boreholes in waste indicate the presence of silt. As indicated in Response 1 ii above, the material under the majority of the waste is estuarine silt. A literature study was undertaken that demonstrates that the hydraulic permeability of estuarine silt is ca 10^{-8} m/s (Johnston 2004), remarkably similar to peat, also ca. 10^{-8} m/s (Kneale 1987).

Notwithstanding the lack of description in the original report, there is no impact on the site's scoring in the COP.

2.3. Groundwater

i. Water is present in the waste body to a relatively high level. Confirm if waste is sitting in the groundwater table. If this is confirmed, consider the assignation of extreme vulnerability score (3) for Leachate Migration Pathways in accordance with the COP and recalculate relevant S-P-R linkage scores.

Waste is not sitting in the groundwater table. Referring to response 1 ii above, waste was originally placed on existing mud flats that we can assume were above low-water level. It is fair to say that before the waste was placed, the elevation of the mud flats was approximately the same as that of the remaining mud flats just inside the railway embankment.

The surcharge of the waste will have consolidated the underlying silt resulting in the gradual expressing of pore water. It is also possible that some silt was displaced laterally as the waste face advanced. The result is that the silt level under the waste has been depressed to form a 'bowl' filled with waste. The consolidated silt is forming an aquatard. When we consider the depth at which water was struck in the context of the topographic survey and the silt level, we can see that perched leachate was found as against groundwater. Clearly, as rain falls, it percolates through the waste and recharges the perched leachate. Ultimately, leachate seeps from the waste to the surface water. It is clear that the passage of time has resulted in natural degradation of the waste with a consequent reduction in concentration of pollutants in the leachate.

Borehole	Ground Level	Water Strike	Water (leachate) Level	Depth to Silt/Peat	Bottom of Waste
02	4.196	2.5	1.695	7.0	-2.804
03	4.829	4.0	0.829	6.5	-1.671
04	5.523	4.0	1.523	6.9	-1.377
05	5.011	4.0	1.011	7.5	-2.489
06	5.125	5.0	1.125	8.5	-3.375
07	4.01	5.0	-1.0	7.5	-3.49
08	6.182	4.5	1.682	7.5	-1.138
09	4.397	5.0	1.397	7.0	-2.603
10	3.909	3	0.909	4	-0.091
15	5.0	6.0	-1.0	6.5	-1.50

Referring to Table 2a of the COP, there is no reason to suggest that the vulnerability of the aquifer to leachate contamination is anything other than low (score 0.5).

ii, Point 4 (iii) below discusses high ammonia levels in the leachate impacting on groundwater and surface water bodies. Clarify the mitigation measures to break the SPR linkages between leachate (not generated by rainwater but by groundwater/estuarine water within the waste body) and groundwater and local surface water bodies.

a. Also clarify the mitigation measures which will be put in place to prevent leachate migration to the reed beds and ponds in the south and east part of the park boundaries as outlined in drawing number WX101-08-01-01 of the proposed eco park.

It is not likely that any leachate is being caused by groundwater infiltration. If that was happening, groundwater would be welling-up from under the waste and absorbing contaminants before discharging to the stream/estuary- a most unlikely scenario.

Given the low-permeability of the underlying strata (see 2 i. above) and the inherent low permeability of the lower layers of old waste is (5 x 10^{-6} m/s)[1] it is not likely that, at high water, significant (or any) estuarine water is forced into the waste. The tidal range at Wexford is one of the lowest in Ireland thus the inflow and ebb of water to the basin inside the railway embankment is expected to be minimal. Furthermore, the hydrostatic head that would drive water into the waste from the estuary cannot be more than 1 m (and is at most times a lot less)and can exist only for approximately 25% of the tidal cycle (i.e. less than 3 hours). If we assume published data for waste permeability and if we assume a 1 m head, water would penetrate just 54 mm into the waste. In conclusion, leachate arising at Carcur landfill is exclusively rainfall-generated.

With respect to leachate and the reed beds, the mitigation measures referred to in the application and discussed later in this response will have the effect of reducing the quantity of leachate being generated. In any case, the concentration of leachate is well below what is to be expected at a typical landfill. That is because (as previously discussed) the landfill is well on the way to becoming inert through natural degradation.

Even after mitigation (which is based on regrading and top-sealing) there is no guarantee of 100% cessation of leachate generation however the quantity will be low. The EPA manual Landfill Site Design acknowledges the role that reed beds can play in 'polishing' leachate. In summary, migration will minimised by prevention of leachate generation.

iii. Groundwater samples were tested for seven parameters: temperature, dissolved oxygen, pH, conductivity, ammonia, chloride and total organic carbon. Groundwater samples tested demonstrated a wide range in total organic carbon results, high conductivity, high levels of chloride and ammonia.

a. *Demonstrate from the information presented in the application if the required provisions of the groundwater directives can be achieve, i.e. that discharges of hazardous substances and non-hazardous substances and substances in List I and List II are likely to be in a quantity and concentration so small as to not represent any present or future danger of deterioration in the quality of the receiving groundwater or surface water.*

It is important to clarify which of the 'groundwater' samples were actual groundwater and which were in fact leachate samples from within the waste mass.

Reference is made to the application documentation at Sub-appendix 1 if Appendix D.1.B. Having drilled the boreholes, gravel pack was installed for its entire depth barring approximately 1 m from the surface down. Thus a water sample taken from the borehole is representative of water that has leached from the soil that was drilled. The status of each sample is tabulated as follows:-

[1] Krishna R Reddy et al 2009

Borehole Number	Strata Drilled	Comment	Groundwater	Leachate
1	Gravel, boulders and clay	This is not in MSW, the sample should not be leachate	√	
2	Topsoil, clay and waste	This borehole is through waste, the sample should be leachate		√
3	Topsoil, clay and waste, silt and peat	This borehole is through waste, the sample should be leachate		√
4	Topsoil, clay and waste, silt	This borehole is through waste, the sample should be leachate		√
5	Topsoil, clay, waste and silt	This borehole is through waste, the sample should be leachate		√
6	Clay, waste, gravel, silt	This borehole is through waste, the sample should be leachate		√
7	Clay waste silt	This borehole is through waste, the sample should be leachate		√
8	Clay, boulders, waste, silt	This borehole is through waste, the sample should be leachate		√
9	Clay waste silt	This borehole is through waste, the sample should be leachate		√
10	Clay waste peat	This borehole is through waste, the sample should be leachate		√
11	Clay	This is not in MSW, the sample should not be leachate	√	
12	Clay gravel	This is not in MSW, the sample should not be leachate	√	
13	Boulders, silt, clay, gravel	This is not in MSW, the sample should not be leachate	√	
14	Boulders, silt, clay, peat	This is not in MSW, the sample should not be leachate	√	
15	Clay waste silt	This borehole is through waste, the sample should be leachate		√
16	Clay	This is not in MSW, the sample should not be leachate	√	

Clearly, Samples 1, 11, 12, 13, 14, and 16 represent groundwater. An extra round of sampling has been undertaken for boreholes 3, 7, 12 and 14.

> *b. If the above cannot be demonstrated, provide additional groundwater sampling results for a greater number of hazardous and non-hazardous parameters outlined in the 'Classification of Hazardous and Non-Hazardous Substances in Groundwater' (EPA December 2010) and describe how the required provisions of the groundwater directives and the European Communities Environmental Objectives (Groundwater) Regulations 2010, can be achieved.*

Extra monitoring was carried out on November 26th 2011 at representative accessible borehole locations. BH3 is in waste (representing leachate), BH7 is on the eastern boundary on the waste, BH14 is on the southern boundary of the waste and BH12 is outside the waste to the south, adjacent to the stream.

As would be expected, being outside the waste body, representative of groundwater conditions, many parameters were analysed at lower levels in BH12 than in the other three boreholes, namely COD, BOD, chloride, orthophosphate, sulphate, fluoride, ammonia (as NO_3N), electrical conductivity, calcium, magnesium, sodium, potassium, nickel, zinc, iron and boron. Additional analysis of the borehole results since 2009 indicates lower levels of ammonia, electrical conductivity and chloride in the boreholes outside the waste, namely BH12 and BH13. The recent round of monitoring results in BH12 (22/11/2011) follows this trend.

All results, where applicable, are lower than the Inert Landfill Waste Acceptance Criteria Limits in all Boreholes assessed (Table 1-1).

Assessment of the results from 22/11/11 against the European Communities Environmental Objectives (Groundwater) regulations, 2010 (S.I. No.09 of 2010) indicates that in BH12 all parameters except chloride and iron are analysed at lower than the new Groundwater Threshold Values (Table 1-1).

Based on the chloride, sodium and electrical conductivity levels detected in the assessed boreholes, there is evidence of low level saline intrusion into the groundwater regime. This reflects intrusion in shallow groundwater (sand and gravel aquifer) – based on the depth of the boreholes drilled. Levels of sodium are much higher in BH14 (424 mg/l) that in BH3 (43 mg/l); BH3 is more distant from the estuary than BH14.

Table 2–1: Groundwater results from 22/11/2011

Notes	Unit	Limits (EC GW Regs 2010 - SI No 9 of 2010)	Inert Landfill Waste Acceptance Criteria Limits	BH3	BH7	BH12	BH14
Parameter				11.20 on 22/11/11	12.10 on 22/11/11	3.30 on 22/11/11	2.50 on 22/11/11
DTW	mbgl	--	--	2.36	3.27	0.3	1.36
Temperature	oC	25*	--	10.3	13.6	11.6	12.4
Nitrate	mg/l NO3N	37.5	--	<1.1	<1.1	<1.1	<1.1
BOD	mg/l	--	--	7.2	4.2	1.2	12.2
COD	mg/l O2	--	--	124	52	10	120
DO	mg/l O2	NAC*	--	5.6	6.96	8.45	8.92
Chloride	mg/l Cl	24-187.5	800	70	287.5	50.5	67.5
Orthophosphate	mg/l P	0.03*	--	0.16	0.1	<0.03	0.08
Sulphate	mg/l SO4	187.5	1000	100.2	68.5	53.7	65.8
Flouride	mg/l F	1*	10	0.23	0.04	0.3	0.49
Ammonia	mg/l NO3N	--	--	83.6	71.8	0.26	71
Nitrite	mg/l N	375	--	<0.05	<0.05	<0.05	<0.05
EC	us/cm	800-1875	--	2300	2760	448	4040
pH	pH-units	>6.5-<9.5*	--	6.9	6.9	6.5	7.2
Calcium	mg/l	200*	--	177	211	33	194
Magnesium	mg/l	50*	--	54	56	22	108
Sodium	mg/l	150	--	43	152	32	424
Potassium	mg/l	5*	--	51	56	2	111
Nickel	mg/l	0.015	--	0.013	0.006	0.003	0.018
Chromium (total)	mg/l	0.0375	0.5	0.003	0.001	0.001	0.005
Cadmium	mg/l	0.00375	0.04	<0.0001	<0.0001	<0.0001	0.0002
Copper	mg/l	1.5	2	0.007	0.002	0.002	0.18
Lead	mg/l	0.01875	0.4	0.003	<0.001	0.001	0.047
Zinc	mg/l	0.1*	4	0.02	0.009	0.004	0.11
Manganease	mg/l	0.05*	--	0.833	0.928	0.415	0.385
Iron	mg/l	0.2*	--	3.39	3.14	1.76	5.24
Arssenic	mg/l	0.0075	0.5	0.002	0.001	0.002	0.007
Boron	mg/l	0.75	--	0.61	0.57	0.09	1
Mercury	mg/l	0.00075	0.01	<0.0001	<0.0001	<0.0001	<0.0001
Cyanide	mg/l	0.0375	--	<0.02	<0.02	<0.02	0.03
Total organic carbon	mg/l	NAC*	500	24	15	17	17

* = IGV levels (EPA, 2003. Towards Setting Guideline Values for the Protection of Groundwater in Ireland).

3. SURFACE WATER

i. *An additional stream to Stream 1 seems to be visible from the boundary wall opposite Parkside Estate. (just behind the 'Wexford' sign). This stream seems to flow north and has a strong odour. Update the application where applicable with respect to this stream and he associated odour issue.*

The site was re-visited specifically to look at this issue at low-water on 18th November 2011. There are a number of drains discharging to the stream/estuary (see picture 23. Page 27 of environmental assessment, January 2009 – previously submitted). Of particular note is the stream shown on the following photograph. Clearly, it is un-related to the landfill. Notwithstanding the inspector's observations, expressed in the RFI, there was no noticeable odour at the time of the above referenced visit.

Monitoring was carried out at SW1 at ebb tide (high tide @ 15.52) and at SW4 at when the tide was out (low tide at 9.54 am).

Electrical conductivity, ammonia (mg/l NO_3N) and chloride levels (all leachate indicator parameters) are low in SW1. The levels are indicative of unpolluted waters.

Chloride, electrical conductivity and sodium levels are elevated at SW4, indicating the influence of the estuary on these parameters. In SW4, levels of Ammonia (as NO_3N), representing a leachate indicator parameter are low and similar to the levels recorded at SW1 upstream. In SW4, BOD levels are low, although elevated COD levels are observed.

Table 3.1– Surface water results

Surface Water Analytical Results - SW1												
Sampling Date			03/10/2006	10/02/2009	01/05/2009	05/10/2009	07/07/2010	12/10/2010	01/02/2011	12/07/2011	26/10/2011	22/11/11 Tide going out
Parameters	**Units**	**Surface* Water/relevant criteria**	**Baseline**	**Quarterly**	**Quarterly**	**Quarterly**	**Quarterly**	**Quarterly**	**Quarterly**	**Quarterly**	**Quarterly**	**Additional sample**
Temperature	Deg Cel.	25	12.2	9.6	nr	17.6	15.7	10.4	6.1	13.2	9.9	10.3
Dissolved Oxygen	mg/l	>5	7.22	8.21	nr	5.65	7.93	8.88	8.9	9.01	9.37	
Dissolved O_2 Saturation	$\%O_2$	>60	68.1		nr	59.6	80	80	70			
BOD	mg/l	5	2	0.8	<2	3	0.8	<0.5	1.7	1.5	1.8	
Conductivity	mS/cm	1	0.424	0.332	0.317	0.285	0.372	0.526	369	495	382	
COD	mg/l	40	<15	<3	14	23	<3	3	<10	<10	14	
pH	pH	6.0-9.0	7.95	7.45	7.6	7.4	8.01	7.52	7.4	7.4	7.2	
Chloride	mg/l	250	26	27	25.67	21.81	24	29	37.5	32	25	32
Ammoniacal Nitrogen	mg/l		<0.2	0.03	<0.01	0.099	<0.02	<0.02	0.07	0.07	0.06	
Nitrate											5.5	
Nitrite											<0.05	
Potassium	mg/l	--	4.3	16.6	2.41	3.47	2	2	2	1.9	2.5	
Sulphate	mg/l	200	58	42	25.67	40.9	19	35	41.91	123.2	93.04	
Total Suspended Solids	mg/l	50	<10	6	83	37	4	<2	<10	<10	<10	
Total Oxidised Nitrogen	mg/l		2.6	2.3	1.26	1.11	1.4	0.8	<2.5	1.5	<5	
Total Phosphorus	mg/l	0.4	<0.05	<0.02	0.137							
Total Alkalinity	mg/l	--	110	110	343							
Total Organic Carbon	mg/l	NAC	6	16.1	5.31							
Dissolved Mercury	µg/l	1	<0.05	<0.05	<0.2							
Dissolved Cadmium	µg/l	5	<1	<0.5	<0.09							
Dissolved Chromium	µg/l	50	2	<0.2	<0.93							
Dissolved Iorn	µg/l	200	<2	368	326.1							
Dissolved Lead	µg/l	50	<1	<0.2	0.4							
Dissolved Nickel	µg/l	50	1	145	0.5							
Dissolved Zinc	µg/l	3000	19	223	<4.6							
Dissolved Magnesium	µg/l	--	7945	8000	5110							
Total Cyanide	mg/l	0.05	<0.05	<0.2	<.005							
Surface film (visual)	--	--	None	None	nr							
Gross Solids (visual)	--	--	None	None	nr							
Odour	--	--	None	None	nr							

*Extract from FT&C Report January 2007

Surface Water Analytical Results - SW4

Sampling Date			03/10/2006	10/02/2009	01/05/2009	05/10/2009	07/07/2010	12/10/2010	01/02/2011	12/07/2011	26/10/2011 (13.00hrs)	22/11/11 at ebb tide
			Alcontrol LI	**Q-Lab**	**Euro**	**Euro**	**Q-Lab**	**Q-Lab**	**Q-Lab**	**Q-Lab**	**Q-Lab**	
Parameters	**Units**	**Surface* Water / relevant criteria**	**Baseline**	**Quarterly**	**Quarterly**	**Quarterly**	**Quarterly**	**Quarterly**	**Quarterly**	**Quarterly**	**Quarterly**	**Additional sample**
Temperature	Deg Cel.	25	12.5	8.6	nr	17.6	18.7	10.9	7	16.2	9.1	10.4
Dissolved Oxygen	mg/l	>5	5.31	8.42	nr	5.84	9.67	8.87	8.9	9.04	9.29	11.52
Dissolved O_2 Saturation	$\%O_2$	>60	50.2		nr	61.6	97	80	89			
BOD	mg/l	5	<2	1.3	<2	3	1.5	1.1	<1	2.2	1.8	4
Conductivity	mS/cm	1	2.415	0.526	29.4	3.49	34.1	27.7	17500	15700	1029	15700
COD	mg/l	40	34	6	36	23	12	100	141	<100	20	96
pH	pH	6.0-9.0	7.75	7.65	7.7	7.5	8.57	8.29	8	7.9	7.5	8
Chloride	mg/l	250	669	74	9593.92	1011.45	4883	11219	7250	8175	205	6800
Ammoniacal Nitrogen	mg/l		0.8	<0.02	0.26	0.568	0.02	<0.02	0.05	0.31	0.15	
Nitrate											8.1	2.4
Nitrite											0.07	0.1
Potassium	mg/l	--	19	10	188.2	18.02	58	200	98.6	70.7	4.7	154
Sulphate	mg/l	200	115	44	1450.92	153.18	2600	1500	1070.4	1131.2	65.14	840.8
Total Suspended Solids	mg/l	50	33	4	33	165	4	6	13.6	51	11	
Total Oxidised Nitrogen	mg/l		2.4	3.1	4.04	1.82	1.8	0.9	<2.5	<1.0	<5	
Total Phosphorus	mg/l	0.4	0.15	<0.02	<0.011							
Total Alkalinity	mg/l	--	180	160	108							
Total Organic Carbon	mg/l	NAC	6	18.1	4.17							2.5
Dissolved Mercury	µg/l	1	<0.05	<0.05	0.4							<0.0001
Dissolved Cadmium	µg/l	5	<1	<0.5	<0.09							<0.0001
Dissolved Chromium	µg/l	50	4	<0.2	6.5							<0.001
Dissolved Iorn	µg/l	200	<2	400	124.5							
Dissolved Lead	µg/l	50	<1	<0.2	<0.38							<0.001
Dissolved Nickel	µg/l	50	<1	2	2.4							0.002
Dissolved Zinc	µg/l	3000	20	125	<4.6							0.003
Dissolved Magnesium	µg/l	--	47,420	885	624.6							335
Total Cyanide	mg/l	0.05	<0.05	<0.02	<0.005							<0.02
Surface film (visual)	--	--	None	None	nr							
Gross Solids (visual)	--	--	None	None	nr							
Odour	--	--	Slight saline odour	None	nr							

*Extract from FT&C Report January 2007

ii. *Provide a drawing to demonstrate the extent the tide encroaches on the landfill. Confirm whether the proposed mitigation measures will prevent estuarine waters entering the landfill area (taking into consideration the trench associated with Stream 1's previous pathway in the north.*

Referring to the responses to queries 3 i. and 3 ii, it is clear that tidal encroachment is not a significant issue at this site. That is for two reasons:

- The tidal prism at Wexford is one of the smallest in Ireland and elevation of the landfill is such that there is only minimal hydrostatic head (and a short period of time) available to force tidal water into the waste. It is calculated in response to question 3 ii. That the encroachment would be only 54 mm and would thus be represented only by line thickness on a drawing.
- The waste by its age and nature is of a low permeability as are the underlying silts, clays and peat. Even if there was an available hydrostatic force, the low permeability of the medium would prevent significant encroachment.

That is not to say that the underlying layers will not be affected by estuarine water. Clearly, strata below sea level will be subject to irrigation by estuarine water and it is to be expected that groundwater in the vicinity of the estuary will be 'brackish'.

The mitigation measures proposed will have no significant affect on the status quo regarding encroachment of estuarine water.

iii. *It seems that ammonia levels in groundwater within the waste body are having an impact on downstream surface water bodies as results in these locations show high ammoniacal nitrogen levels. Confirm whether ammonia in the groundwater located in the waste is causing an exceedance of the total ammonia standard in the European Communities Environmental Objectives (Surface Waters) Regulations 2009. Confirm whether mitigation measures will ensure that surrounding surface water bodies will not fail to meet the standards outlined in these Regulations due to the presence of the landfill.*

It is clear that the only significant cause of leachate arisings is rainfall percolating down through the waste that generates leachate which eventually seeps from the waste body to the adjacent surface water bodies. By its nature, decomposing waste, particularly near the surface/sides will be aerobic and a natural consequence of aerobic decomposition is the generation of ammonia. The proposed measures are designed to reduce rainfall percolation with an obvious knock-on effect of reducing the quantity of leachate being produced. Less leachate production will lead to a significant reduction in leachate emissions to surface water bodies with a consequent reduction in the concentration of compounds such as ammonia.

3.1 Landfill Gas

i. *Stony Park has not been identified as a potential receptor in the application. Provide updated information where applicable with regard to this receptor*

Stony Park is the most-recent development in the vicinity of the Carcur landfill. Its position relative to the landfill (oldest section) puts it at less potential risk than other housing developments e.g. Parkside or Farnogue. The original environmental assessment pre-dated the development of Stony Park.

It is confirmed that Stony Park is a potential receptor however, given the existence of a stream between it and the landfill (now well past its peak gas production stage) the risk that landfill gas can migrate across the stream and under the road is remote. A secondary (though un-verifiable) mitigation factor is that Stoney Park development is modern build and marketed as energy efficient.

The likelihood is that the houses are constructed to modern building standards requiring the provision of radon barriers beneath the floors.

There is a borehole between the landfill and Stoney Park where no evidence of landfill gas was found. The borehole is separated from Stoney park by a stream and the road.

ii. High Levels of Landfill gas (CO_2 and CH_4 were found to exist in certain bore holes outside the waste boundary. Provide evidence that landfill gasses are not at risk levels in the residential properties closest to these boreholes.

With respect to residential dwellings (and referring to Table 2.2 at Page 9 and the borehole location map at page 10 of the Environmental Assessment), the only directly relevant boreholes are BH12 (0% CH_4 and 0% CO_2), BH 13 (0% CH_4 and 0% CO_2), BH 14 (0.2% CH_4 and 0.2% CO_2) and BH 11 (0% CH_4 and 7.3% CO_2). The only reading that exceeds the intervention level is the CO_2 reading in BH 11. Given the low gas levels (particularly CH_4) and the separation by water underlain by low-permeability silts, it is evident that gassed will not be at risk levels in the adjacent properties.

iii. Justify how the proposed mitigation measure of passive venting of gas via the perimeter trench complies with the Landfill Directive 1999/31/EC Annex I Section 4.2 and 4.3

The purpose of the proposed gas trench is to maintain the risk of gas migration at a very low level. It is true to say that any gas that accumulates in the trench will, by design, ventilate harmlessly to the atmosphere.

Annex I Section 4.2 requires that gas shall be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and used. If the gas collected cannot be used to produce energy, it must be flared. Clearly the site is not currently receiving biodegradable waste but it did so albeit ca. 30 years ago. It is however recognised that section 4.2 is silent on when this clause will not apply.

The agency is invited to consider that Section 4.1 wherein the word *appropriate* is introduced is intended to be introductory to Sections 4.2 and 4.3 of the Directive.

It is clear from the borehole monitoring (Table 2.2 at Page 9) that only trace concentrations of gas arise outside the waste mass. Considering all of Section 4 of the Directive, it is possible that low/trace amounts of landfill gas will continue (at a time-related depleting rate) to ventilate to the atmosphere from the proposed trench.

If one was to succeed in capturing that gas, it will not be useable. The only viable method of flaring the gas would be to introduce surrogate propane burners through which the trench headspace would be routed resulting in the flaring of these trace amounts of gas. Combustion of the propane would produce a volume of exhaust gas (including CO_2) far in excess of the volume of gas that would be destroyed. This is notwithstanding the fact that CH_4 has 21 times the potential as greenhouse gas when compared with CO_2.

Strict interpretation of Section 4.2 and 4.3 would (apart from being impractical) imply that Section 9.6 of the EPA Landfill Manual - Landfill Site Design, is invalid advice.

3.2 Designated Area

i The "Natura Impact Statement for the Proposed Rehabilitation of Carcur Landfill Site (FTC 2011)" provided with the application does not adequately demonstrate that there will be no significant impact(s) on the designated European sites associated with the landfill as a result of the planned rehabilitation of the site having regard to historic landfill activities a *You are therefore advised to revise the NIS report to include all the relevant summary data and information from the FTC 2009 report and all available data in relation to the parameters discussed in points 3(iii) and 4(iii) above to confirm recent and current water quality conditions in order to determine the impact of the landfill currently on the designated site and to predict the likely impact(s) of the rehabilitation project on water quality and the consequent implications for the European sites*

Ongoing surface water and groundwater monitoring is carried out quarterly on-site. The ongoing sampling analysis results indicate elevated levels of electrical conductivity, ammonia and chloride in BH2, BH3, BH5, BH6, BH7, BH8, BH11, BH12, BH13 and BH14. As detailed above (Section 3) water samples from many of these boreholes is representative of in-waste leachate and not contaminated groundwater.

BH11, BH12, BH13 and BH14 are more representative of (shallow) groundwater. The results from these wells also present elevated electrical conductivity, ammonia and chloride levels. It is likely that the electrical conductivity and chloride levels in the boreholes at levels above the range presented in Groundwater Regulations[2], is reflecting brackish waters conditions; indicating lateral estuarine influence (shallow saline intrusion) on the boreholes.

Ammonia levels are also elevated, to be expected as a result o the unlined nature of the landfill. The underlying material is silt, forming an aquitard is reducing the vulnerability of the bedrock aquifer to leachate generation.

By carrying out the proposed remediation actions and capping the waste the potential for infiltration of rainwater into the body of the waste will be reduced. This will have a direct effect on the potential volume of leachate produced in the landfill from 7,660 m^3 to 3,484 m^3 and there for the associated generation of leachate by-products, such as ammonia.

A supplementary round of water monitoring was carried out on groundwater (BH 12, BH14 BH7 & BH3) and surface water locations (SW4). The samples are being analysed for Electrical conductivity, pH, temperature, dissolved oxygen, Ammoniacal nitrogen, nitrite, nitrate, BOD, COD, TOC, metals (including; calcium, magnesium, manganese, sodium, potassium, iron, cadmium, chromium (total), copper, nickel, lead, zinc, arsenic, boron and mercury), sulphate, chloride, phosphorous (molybdate reactive phosphorus), cyanide and fluoride.

b *Where significant impacts on the designated Natura 2000 sites are likely you are asked t submit and Appropriate Assessment (Stage 2)*

ii *State and discuss whether the landfill site is having an impact on Wexford Harbour Inner (PA2_0059) and Wexford Harbour Outer (PA2_0058) Shellfish Areas.*

The Natura Impact Statement (NIS) for the Proposed Rehabilitation of Carcur Landfill Site is presently being reassessed and will be updated with cognisance to the results of the addition surface water and groundwater monitoring referred to above.

The revised NIS will adequately demonstrate whether there are significant impacts on the Natura 2000 sites as a result of the planned rehabilitation works. A Stage 2 Appropriate Assessment is not considered necessary for a number of reasons:

- In a recent report by the Marine Institute (McGovern *et al.*, 2011)[3] the water quality of coastal and transitional waters of Ireland was assessed in terms of hazardous substances (priority substances and other relevant pollutants) and coastal and transitional waters were classified in terms of chemical and ecological status. The overall status of Wexford Harbour was classified as good overall, including good status for biota.

[2] S.I. No 9. Of 2010 – European Communities Environmental Objectives (Groundwater) Regulations, 2010

[3] McGovern, E., Cronin, M., Joyce, E., and McHugh, B. 2011. An Assessment of Dangerous Substances in Water Framework Directive Transitional and Coastal Waters 2007-2009. *Marine Environment and Health Series*, 38.

Thus, the landfill is not currently having a significant impact on the water quality of the Natura 2000 sites, as water quality was classified as good in Wexford Harbour in 2011 (McGovern *et al.*, 2011). Natural decomposition of the waste results in a reducing risk to the waters in the estuary.

- In addition, the proposed installation of the new cap, the soil cover and sub-surface stone drainage layer will greatly reduce the quantities of leachate generated at the site, from 7,660 m^3 to 3,484 m^3. The rehabilitation works are predicted to enhance the water quality draining from the site to the adjacent SPA and SAC, and therefore, the impact of the rehabilitation works on the water quality of the designated sites will be positive.

Appendix 1

LW11-080-04-001-0 – Foreshore Intrusion

Rev.	Drawn	Chk'd	App'd	Rev Origin / Date	Description
A	SK	AR	SM	Cork 8.2.2011	ISSUE FOR RFI

Revision History: A

Name of Client

WEXFORD COUNTY COUNCIL

Name of Job

CARCUR CLOSED LANDFILL
APPLICATION TO EPA FOR
CERTIFICATE OF AUTHORISATION
(RFI)

Title of Drawing

FORESHORE INTRUSION

Scales Used: 1:2000

This Drawing was printed to A3

Dwg. No. LW11-080-04-001

Rev. A

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