- **anthracene** (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

- **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Acute Tox. 4 H302

- **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Skin Irrit. 2 H315

- **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2 H351

- **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

- **polychlorobiphenyls; PCB** (EC Number: 215-648-1, CAS Number: 1336-36-3)

CLP index number: 602-039-00-4
Description/Comments: Worst Case: IARC considers PCB Group 1; Carcinogenic to humans; POP specific threshold from ATP1 (Regulation 756/2010/EU) to POPs Regulation (Regulation 850/2004/EC). Where applicable, the calculation method laid down in European standards EN 12766-1 and EN 12766-2 shall be applied.
Data source: Regulation 1272/2008/EC - Classification, labelling and packaging of substances and mixtures. (CLP)
Additional Hazard Statement(s): Carc. 1A H350
Reason for additional Hazards Statement(s):
29 Sep 2015 - Carc. 1A H350 hazard statement sourced from: IARC Group 1 (23, Sup 7, 100C) 2012

- **ethylbenzene** (EC Number: 202-849-4, CAS Number: 100-41-4)

CLP index number: 601-023-00-4
Description/Comments:
Data source: Commission Regulation (EU) No 605/2014 – 6th Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP6)
Additional Hazard Statement(s): Carc. 2 H351
Reason for additional Hazards Statement(s):
03 Jun 2015 - Carc. 2 H351 hazard statement sourced from: IARC Group 2B (77) 2000

- **coronene** (EC Number: 205-881-7, CAS Number: 191-07-1)

Description/Comments: Data from C&L Inventory Database; no entries in Registered Substances or Pesticides Properties databases; SDS: Sigma Aldrich, 1907/2006 compliant, dated 2012 - no entries; IARC – Group 3, not carcinogenic.
Data source:
http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=17010&HarmOnly=no?fc=true&lang=en
Data source date: 16 Jun 2014
Hazard Statements: STOT SE 2 H371

Appendix B: Rationale for selection of metal species

antimony {antimony trioxide}

Worst case scenario.

arsenic {arsenic pentoxide}

Arsenic pentoxide used as most hazardous species.

barium {barium sulphide}

Chromium VII at limits of detection. Barium sulphide used as the next most hazardous species. No chromate present.

cadmium {cadmium sulfate}

Cadmium sulphate used as the most hazardous species.

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Worse case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected.

lead {lead compounds with the exception of those specified elsewhere in this Annex (worst case)}

Chromium VII at limits of detection. Lead compounds used as the next most hazardous species. No chromate present.

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight

molybdenum {molybdenum(VI) oxide}

Worst case CLP species based on hazard statements/molecular weight.

nickel {nickel sulfate}

Chromium VII at limits of detection. Nickel sulphate used as the next most hazardous species. No chromate present.

selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}

Harmonised group entry used as most reasonable case. Pigment cadmium sulphoselenide not likely to be present in this soil. No evidence for the other CLP entries: sodium selenite, nickel II selenite and nickel selenide, to be present in this soil.

zinc {zinc sulphate}

Chromium VII at limits of detection. Zinc sulphate used as the next most hazardous species. No chromate present.

chromium in chromium(III) compounds {chromium(III) oxide}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass

chromium in chromium(VI) compounds {chromium(VI) oxide}

Worst case CLP species based on hazard statements/molecular weight. Industrial sources include: production stainless steel, electroplating, wood preservation, anti-corrosion agents or coatings, pigments.

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.1, May 2018
HazWasteOnline Classification Engine Version: 2020.44.4173.8310 (14 Feb 2020)
HazWasteOnline Database: 2020.44.4173.8310 (14 Feb 2020)

This classification utilises the following guidance and legislation:
WM3 v1.1 - Waste Classification - 1st Edition v1.1 - May 2018
CLP Regulation - Regulation 1272/2008/EC of 16 December 2008
1st ATP - Regulation 790/2009/EC of 10 August 2009
2nd ATP - Regulation 286/2011/EC of 10 March 2011
3rd ATP - Regulation 618/2012/EU of 10 July 2012
4th ATP - Regulation 487/2013/EU of 8 May 2013
Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
5th ATP - Regulation 944/2013/EU of 2 October 2013
6th ATP - Regulation 605/2014/EU of 5 June 2014
WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014
Revised List of Wastes 2014 - Decision 2014/955/EU of 18 December 2014
7th ATP - Regulation 2015/1221/EU of 24 July 2015
8th ATP - Regulation (EU) 2016/918 of 19 May 2016
9th ATP - Regulation (EU) 2016/1179 of 19 July 2016
10th ATP - Regulation (EU) 2017/776 of 4 May 2017
HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017
13th ATP - Regulation (EU) 2018/1480 of 4 October 2018
POPs Regulation 2004 - Regulation 850/2004/EC of 29 April 2004
1st ATP to POPs Regulation - Regulation 756/2010/EU of 24 August 2010
2nd ATP to POPs Regulation - Regulation 757/2010/EU of 24 August 2010

APPENDIX 7.4

GROUNDWATER QUALITY DATA (GII, 2022)

Element Materials Technology
Unit 3 Deeside Point
Zone 3
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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland

Attention :	Stephen Kealy
Date :	25th May, 2022
Your reference :	11789-04-22
Our reference :	Test Report 22/7669 Batch 1
Location :	City Quay
Date samples received :	11th May, 2022
Status :	Final Report
Issue :	1

Three samples were received for analysis on 11th May, 2022 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Phil Sommerton BSc
Senior Project Manager

Element Materials Technology Environmental UK Limited
Registered in England and Wales
Registered Office: 3rd Floor Davidson Building, 5 Southampton Street, London WC2E 7HA
Company Registration No: 11371415

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 11789-04-22
Location: City Quay
Contact: Stephen Kealy
EMT Job No: 22/7669

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-5	6-10	11-15									
Sample ID	BH01	BH02	BH03									
Depth	4.30	3.30	3.70									
COC No / misc												
Containers	V H P G	V H P G	V H P G									
Sample Date	10/05/2022	10/05/2022	10/05/2022									
Sample Type	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1									
Date of Receipt	11/05/2022	11/05/2022	11/05/2022									
											LOD/LOR	Units	Method No.
Dissolved Aluminium #	<20	<20	<20								<20	ug/l	TM30/PM14
Dissolved Antimony #	<2	<2	<2								<2	ug/l	TM30/PM14
Dissolved Arsenic #	<2.5	<2.5	<2.5								<2.5	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5	<0.5	<0.5								<0.5	ug/l	TM30/PM14
Dissolved Calcium #	24.9	448.5$_{AB}$	370.2$_{AA}$								<0.2	mg/l	TM30/PM14
Total Dissolved Chromium #	<1.5	<1.5	<1.5								<1.5	ug/l	TM30/PM14
Dissolved Cobalt #	<2	<2	<2								<2	ug/l	TM30/PM14
Dissolved Copper #	<7	<7	<7								<7	ug/l	TM30/PM14
Total Dissolved Iron #	58	<20	<20								<20	ug/l	TM30/PM14
Dissolved Lead #	<5	<5	<5								<5	ug/l	TM30/PM14
Dissolved Magnesium #	5.6	492.0$_{AB}$	54.1								<0.1	mg/l	TM30/PM14
Dissolved Manganese #	4	552	552								<2	ug/l	TM30/PM14
Dissolved Mercury #	<1	<1	<1								<1	ug/l	TM30/PM14
Dissolved Nickel #	<2	3	9								<2	ug/l	TM30/PM14
Dissolved Potassium #	2.8	144.8$_{AB}$	31.1								<0.1	mg/l	TM30/PM14
Dissolved Selenium #	<3	<3	<3								<3	ug/l	TM30/PM14
Dissolved Sodium #	46.3	4074.3$_{AC}$	136.4								<0.1	mg/l	TM30/PM14
Dissolved Zinc #	50	17	68								<3	ug/l	TM30/PM14
PAH MS													
Naphthalene #	<0.1^{SV}	<0.1^{SV}	<0.1^{SV}								<0.1	ug/l	TM4/PM30
Acenaphthylene #	<0.005^{SV}	<0.005^{SV}	<0.005^{SV}								<0.005	ug/l	TM4/PM30
Acenaphthene #	<0.005^{SV}	<0.005^{SV}	0.006^{SV}								<0.005	ug/l	TM4/PM30
Fluorene #	<0.005^{SV}	<0.005^{SV}	<0.005^{SV}								<0.005	ug/l	TM4/PM30
Phenanthrene #	<0.005^{SV}	0.025^{SV}	0.036^{SV}								<0.005	ug/l	TM4/PM30
Anthracene #	<0.005^{SV}	<0.005^{SV}	<0.005^{SV}								<0.005	ug/l	TM4/PM30
Fluoranthene #	0.015^{SV}	0.025^{SV}	0.086^{SV}								<0.005	ug/l	TM4/PM30
Pyrene #	0.015^{SV}	0.022^{SV}	0.074^{SV}								<0.005	ug/l	TM4/PM30
Benzo(a)anthracene #	0.006^{SV}	0.012^{SV}	0.027^{SV}								<0.005	ug/l	TM4/PM30
Chrysene #	0.006^{SV}	0.010^{SV}	0.035^{SV}								<0.005	ug/l	TM4/PM30
Benzo(bk)fluoranthene #	<0.008^{SV}	0.015^{SV}	0.051^{SV}								<0.008	ug/l	TM4/PM30
Benzo(a)pyrene #	<0.005^{SV}	0.009^{SV}	0.028^{SV}								<0.005	ug/l	TM4/PM30
Indeno(123cd)pyrene #	<0.005^{SV}	<0.005^{SV}	0.018^{SV}								<0.005	ug/l	TM4/PM30
Dibenzo(ah)anthracene #	<0.005^{SV}	<0.005^{SV}	<0.005^{SV}								<0.005	ug/l	TM4/PM30
Benzo(ghi)perylene #	<0.005^{SV}	<0.005^{SV}	0.014^{SV}								<0.005	ug/l	TM4/PM30
PAH 16 Total #	<0.173	<0.173	0.375								<0.173	ug/l	TM4/PM30
Benzo(b)fluoranthene	<0.008	0.011	0.037								<0.008	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.008	<0.008	0.014								<0.008	ug/l	TM4/PM30
PAH Surrogate % Recovery	52^{SV}	59^{SV}	47^{SV}								<0	%	TM4/PM30
VOC TICs	ND	ND	ND									None	TM15/PM10
Methyl Tertiary Butyl Ether #	<0.1	<0.1	<0.1								<0.1	ug/l	TM15/PM10
Benzene #	<0.5	<0.5	<0.5								<0.5	ug/l	TM15/PM10
Toluene #	<5	<5	<5								<5	ug/l	TM15/PM10

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 11789-04-22
Location: City Quay
Contact: Stephen Kealy
EMT Job No: 22/7669

Report : Liquid

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-5	6-10	11-15								LOD/LOR	Units	Method No.
Sample ID	BH01	BH02	BH03										
Depth	4.30	3.30	3.70										
COC No / misc													
Containers	V H P G	V H P G	V H P G										
Sample Date	10/05/2022	10/05/2022	10/05/2022										
Sample Type	Ground Water	Ground Water	Ground Water										
Batch Number	1	1	1										
Date of Receipt	11/05/2022	11/05/2022	11/05/2022										
Ethylbenzene #	<1	<1	<1								<1	ug/l	TM15/PM10
m/p-Xylene #	<2	<2	<2								<2	ug/l	TM15/PM10
o-Xylene #	<1	<1	<1								<1	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	104	104	105								<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	100	99	101								<0	%	TM15/PM10
GRO (>C4-C8) #	<10	<10	<10								<10	ug/l	TM36/PM12
GRO (>C8-C12) #	102	<10	<10								<10	ug/l	TM36/PM12
GRO (>C4-C12) #	102	<10	<10								<10	ug/l	TM36/PM12
EPH (C8-C40) #	3330	<10	<10								<10	ug/l	TM5/PM30
Sulphate as SO4 #	32.7	993.7	623.4								<0.5	mg/l	TM38/PM0
Chloride #	80.9	6956.2	216.4								<0.3	mg/l	TM38/PM0
Nitrate as NO3 #	3.5	<0.2	19.0								<0.2	mg/l	TM38/PM0
Nitrite as NO2 #	<0.02	<0.02	0.98								<0.02	mg/l	TM38/PM0
Total Ammonia as NH3 #	0.12	2.55	7.60								<0.03	mg/l	TM38/PM0
Total Alkalinity as CaCO3 #	58	238	470								<1	mg/l	TM75/PM0
COD (Settled) #	37	201	29								<7	mg/l	TM57/PM0
Electrical Conductivity @25C #	427	21677	2501								<2	uS/cm	TM76/PM0
pH #	6.96	7.77	7.80								<0.01	pH units	TM73/PM0

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 11789-04-22
Location: City Quay
Contact: Stephen Kealy
EMT Job No: 22/7669

SVOC Report : **Liquid**

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-5	6-10	11-15	LOD/LOR	Units	Method No.
Sample ID	BH01	BH02	BH03			
Depth	4.30	3.30	3.70			
COC No / misc						
Containers	VHPG	VHPG	VHPG			
Sample Date	10/05/2022	10/05/2022	10/05/2022			
Sample Type	Ground Water	Ground Water	Ground Water			
Batch Number	1	1	1			
Date of Receipt	11/05/2022	11/05/2022	11/05/2022			
SVOC MS						
Phenols						
2-Chlorophenol #	<1	<1	<1	<1	ug/l	TM16/PM30
2-Methylphenol #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2-Nitrophenol	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4-Dichlorophenol #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4-Dimethylphenol	<1	<1	<1	<1	ug/l	TM16/PM30
2,4,5-Trichlorophenol #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,4,6-Trichlorophenol	<1	<1	<1	<1	ug/l	TM16/PM30
4-Chloro-3-methylphenol #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
4-Methylphenol	<1	<1	<1	<1	ug/l	TM16/PM30
4-Nitrophenol	<10	<10	<10	<10	ug/l	TM16/PM30
Pentachlorophenol	<1	<1	<1	<1	ug/l	TM16/PM30
Phenol	<1	<1	<1	<1	ug/l	TM16/PM30
PAHs						
2-Chloronaphthalene #	<1	<1	<1	<1	ug/l	TM16/PM30
2-Methylnaphthalene #	<1	<1	<1	<1	ug/l	TM16/PM30
Phthalates						
Bis(2-ethylhexyl) phthalate	<5	<5	<5	<5	ug/l	TM16/PM30
Butylbenzyl phthalate	<1	<1	<1	<1	ug/l	TM16/PM30
Di-n-butyl phthalate #	<1.5	<1.5	<1.5	<1.5	ug/l	TM16/PM30
Di-n-Octyl phthalate	<1	<1	<1	<1	ug/l	TM16/PM30
Diethyl phthalate #	<1	<1	<1	<1	ug/l	TM16/PM30
Dimethyl phthalate	>>221	3	2	<1	ug/l	TM16/PM30
Other SVOCs						
1,2-Dichlorobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
1,2,4-Trichlorobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
1,3-Dichlorobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
1,4-Dichlorobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
2-Nitroaniline	<1	<1	<1	<1	ug/l	TM16/PM30
2,4-Dinitrotoluene #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
2,6-Dinitrotoluene	<1	<1	<1	<1	ug/l	TM16/PM30
3-Nitroaniline	<1	<1	<1	<1	ug/l	TM16/PM30
4-Bromophenylphenylether #	<1	<1	<1	<1	ug/l	TM16/PM30
4-Chloroaniline	<1	<1	<1	<1	ug/l	TM16/PM30
4-Chlorophenylphenylether #	<1	<1	<1	<1	ug/l	TM16/PM30
4-Nitroaniline	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Azobenzene #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Bis(2-chloroethoxy)methane #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Bis(2-chloroethyl)ether #	<1	<1	<1	<1	ug/l	TM16/PM30
Carbazole #	<0.5+	<0.5+	<0.5+	<0.5	ug/l	TM16/PM30
Dibenzofuran #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Hexachlorobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
Hexachlorobutadiene #	<1	<1	<1	<1	ug/l	TM16/PM30
Hexachlorocyclopentadiene	<1	<1	<1	<1	ug/l	TM16/PM30
Hexachloroethane #	<1	<1	<1	<1	ug/l	TM16/PM30
Isophorone #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
N-nitrosodi-n-propylamine #	<0.5	<0.5	<0.5	<0.5	ug/l	TM16/PM30
Nitrobenzene #	<1	<1	<1	<1	ug/l	TM16/PM30
Surrogate Recovery 2-Fluorobiphenyl	129	123	126	<0	%	TM16/PM30
Surrogate Recovery p-Terphenyl-d14	143SV	132SV	127	<0	%	TM16/PM30

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 11789-04-22
Location: City Quay
Contact: Stephen Kealy
EMT Job No: 22/7669

VOC Report : **Liquid**

EMT Sample No.	1-5	6-10	11-15									
Sample ID	BH01	BH02	BH03									
Depth	4.30	3.30	3.70									
COC No / misc												
Containers	V H P G	V H P G	V H P G									
Sample Date	10/05/2022	10/05/2022	10/05/2022									
Sample Type	Ground Water	Ground Water	Ground Water									
Batch Number	1	1	1									
Date of Receipt	11/05/2022	11/05/2022	11/05/2022									

Please see attached notes for all abbreviations and acronyms

											LOD/LOR	Units	Method No.
VOC MS													
Dichlorodifluoromethane	<2	<2	<2								<2	ug/l	TM15/PM10
Methyl Tertiary Butyl Ether #	<0.1	<0.1	<0.1								<0.1	ug/l	TM15/PM10
Chloromethane #	<3	<3	<3								<3	ug/l	TM15/PM10
Vinyl Chloride #	<0.1	<0.1	<0.1								<0.1	ug/l	TM15/PM10
Bromomethane	<1	<1	<1								<1	ug/l	TM15/PM10
Chloroethane #	<3	<3	<3								<3	ug/l	TM15/PM10
Trichlorofluoromethane #	<3	<3	<3								<3	ug/l	TM15/PM10
1,1-Dichloroethene (1,1 DCE) #	<3	<3	<3								<3	ug/l	TM15/PM10
Dichloromethane (DCM) #	<3	<3	<3								<3	ug/l	TM15/PM10
trans-1-2-Dichloroethene #	<3	<3	<3								<3	ug/l	TM15/PM10
1,1-Dichloroethane #	<3	<3	<3								<3	ug/l	TM15/PM10
cis-1-2-Dichloroethene #	<3	<3	<3								<3	ug/l	TM15/PM10
2,2-Dichloropropane	<1	<1	<1								<1	ug/l	TM15/PM10
Bromochloromethane #	<2	<2	<2								<2	ug/l	TM15/PM10
Chloroform #	25	<2	<2								<2	ug/l	TM15/PM10
1,1,1-Trichloroethane #	<2	<2	<2								<2	ug/l	TM15/PM10
1,1-Dichloropropene #	<3	<3	<3								<3	ug/l	TM15/PM10
Carbon tetrachloride #	<2	<2	<2								<2	ug/l	TM15/PM10
1,2-Dichloroethane #	<2	<2	<2								<2	ug/l	TM15/PM10
Benzene #	<0.5	<0.5	<0.5								<0.5	ug/l	TM15/PM10
Trichloroethene (TCE) #	<3	<3	<3								<3	ug/l	TM15/PM10
1,2-Dichloropropane #	<2	<2	<2								<2	ug/l	TM15/PM10
Dibromomethane #	<3	<3	<3								<3	ug/l	TM15/PM10
Bromodichloromethane #	7	<2	<2								<2	ug/l	TM15/PM10
cis-1-3-Dichloropropene	<2	<2	<2								<2	ug/l	TM15/PM10
Toluene #	<5	<5	<5								<5	ug/l	TM15/PM10
trans-1-3-Dichloropropene	<2	<2	<2								<2	ug/l	TM15/PM10
1,1,2-Trichloroethane #	<2	<2	<2								<2	ug/l	TM15/PM10
Tetrachloroethene (PCE) #	<3	<3	<3								<3	ug/l	TM15/PM10
1,3-Dichloropropane #	<2	<2	<2								<2	ug/l	TM15/PM10
Dibromochloromethane #	<2	<2	<2								<2	ug/l	TM15/PM10
1,2-Dibromoethane #	<2	<2	<2								<2	ug/l	TM15/PM10
Chlorobenzene #	<2	<2	<2								<2	ug/l	TM15/PM10
1,1,1,2-Tetrachloroethane #	<2	<2	<2								<2	ug/l	TM15/PM10
Ethylbenzene #	<1	<1	<1								<1	ug/l	TM15/PM10
m/p-Xylene #	<2	<2	<2								<2	ug/l	TM15/PM10
o-Xylene #	<1	<1	<1								<1	ug/l	TM15/PM10
Styrene	<2	<2	<2								<2	ug/l	TM15/PM10
Bromoform #	<2	<2	<2								<2	ug/l	TM15/PM10
Isopropylbenzene #	<3	<3	<3								<3	ug/l	TM15/PM10
1,1,2,2-Tetrachloroethane	<4	<4	<4								<4	ug/l	TM15/PM10
Bromobenzene #	<2	<2	<2								<2	ug/l	TM15/PM10
1,2,3-Trichloropropane #	<3	<3	<3								<3	ug/l	TM15/PM10
Propylbenzene #	<3	<3	<3								<3	ug/l	TM15/PM10
2-Chlorotoluene #	<3	<3	<3								<3	ug/l	TM15/PM10
1,3,5-Trimethylbenzene #	<3	<3	<3								<3	ug/l	TM15/PM10
4-Chlorotoluene #	<3	<3	<3								<3	ug/l	TM15/PM10
tert-Butylbenzene #	<3	<3	<3								<3	ug/l	TM15/PM10
1,2,4-Trimethylbenzene #	<3	<3	<3								<3	ug/l	TM15/PM10
sec-Butylbenzene #	<3	<3	<3								<3	ug/l	TM15/PM10
4-Isopropyltoluene #	<3	<3	<3								<3	ug/l	TM15/PM10
1,3-Dichlorobenzene #	<3	<3	<3								<3	ug/l	TM15/PM10
1,4-Dichlorobenzene #	<3	<3	<3								<3	ug/l	TM15/PM10
n-Butylbenzene #	<3	<3	<3								<3	ug/l	TM15/PM10
1,2-Dichlorobenzene #	<3	<3	<3								<3	ug/l	TM15/PM10
1,2-Dibromo-3-chloropropane	<2	<2	<2								<2	ug/l	TM15/PM10
1,2,4-Trichlorobenzene	<3	<3	<3								<3	ug/l	TM15/PM10
Hexachlorobutadiene	<3	<3	<3								<3	ug/l	TM15/PM10
Naphthalene	<2	<2	<2								<2	ug/l	TM15/PM10
1,2,3-Trichlorobenzene	<3	<3	<3								<3	ug/l	TM15/PM10
Surrogate Recovery Toluene D8	104	104	105								<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	100	99	101								<0	%	TM15/PM10

Client Name: Ground Investigations Ireland
Reference: 11789-04-22
Location: City Quay
Contact: Stephen Kealy

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/7669						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/7669

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

[redacted]fficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

[redacted]here appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x5 Dilution
AB	x10 Dilution
AC	x50 Dilution

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/7669

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.				
TM15	Modified USEPA 8260B v2:1996. Quantitative Determination of Volatile Organic Compounds (VOCs) by Headspace GC-MS.	PM10	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.				
TM16	Modified USEPA 8270D v5:2014. Quantitative determination of Semi-Volatile Organic compounds (SVOCs) by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.	Yes			
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes			
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes			
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.	Yes			

EMT Job No: 22/7669

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM57	Modified US EPA Method 410.4. (Rev. 2.0 1993) Comparable with ISO 15705:2002. Chemical Oxygen Demand is determined by hot digestion with Potassium Dichromate and measured spectrophotometerically.	PM0	No preparation is required.	Yes			
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			
TM75	Modified US EPA method 310.1 (1978). Determination of Alkalinity by Metrohm automated titration analyser.	PM0	No preparation is required.	Yes			
TM76	Modified US EPA method 120.1 (1982). Determination of Specific Conductance by Metrohm automated probe analyser.	PM0	No preparation is required.	Yes			

CHAPTER 8

HYDROLOGY

awnconsulting
A Trinity Consultants Company

8.0 HYDROLOGY

8.1 INTRODUCTION

8.1 This chapter presents an assessment of the existing environment and the likely effects of the proposed development on hydrology of the site and the surrounding area. The impact on land, soils, geology, and hydrogeology is addressed in Chapter 7 (Lands, Soils, Geology and Hydrogeology).

8.2 This chapter presents an assessment of the existing environment and the likely effects of the proposed development on hydrology within the local environment.

8.2 METHODOLOGY

8.3 This assessment was considered in the context of the available baseline information; potential effects; consultations with statutory bodies and other parties and other available relevant information. The assessment was carried out according to the methodology specified in the following guidance documents:

- Environmental Protection Agency (EPA) Guidelines on the Information to be Contained in Environmental Impact Statements (2002)[1];
- EPA Advice Notes on Current Practice (in the Preparation of EIS) (2003)[2].
- 'Guidelines on the Information to be contained in Environmental Impact Statements' (EPA, 2022)[3];

8.4 The following sources of information were consulted:

- Latest EPA Envision water quality monitoring data for watercourses in the area[4];
- Eastern River Basin District (ERBD) Management Plan – Liffey Water Management Unit and Programme of Measures – ERBD[5]
- The Planning System and Flood Risk Management, Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government (DoEHLG) and the Office of Public Works (OPW))[6]
- Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites (Eastern Regional Fisheries Board (ERFB))[7]
- Dublin City Council (2005) Greater Dublin Strategic Drainage Study: Technical Documents of Regional Drainage Policies. Dublin: Dublin City Council[8]
- Greater Dublin Regional Code of Practice for Drainage Works: Version Draft 6.0 (Wicklow County Council, South Dublin County Council (SDCC), Meath County Council, Kildare County Council, Fingal County Council, Dún Laoghaire- Rathdown County Council & Dublin City Council)[9]
- Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors" (CIRIA 532, 2001)[10]

8.5 The quality, magnitude and duration of potential effects are defined in accordance with the criteria provided in the EPA Guidelines (Chapter 1, Table 1.2.)

8.6 In addition, due cognisance is also given to the document entitled '*Guidelines on* Procedures *for Assessment and Treatment of Geology, Hydrology and Hydrogeology*

for National Road Schemes' by the National Roads Authority (NRA, 2009) where appropriate. The NRA criteria for rating the magnitude and significance of impacts at EIA stage are also relevant in determining impact assessment and are presented in Appendix 8.1.

8.7 This EIAR Chapter relies on the Site Specific Flood Risk Assessment (Byrne Looby, 2022) and Engineering Assessment report (Byrne Looby, 2022) as well as Chapter 2 of this EIA Report.

8.3 RECEIVING ENVIRONMENT

8.3.1 Site Area Description

8.8 The lands primarily comprise the former City Arts Centre Building and associated hard standing bounded to the north by City Quay, to the west by Moss Street, and to the south by Gloucester Street South. The City Quay Covid testing centre and City Quay National school along the eastern boundary of the subject lands.

8.9 The City Quay Arts site is one of the most significant brownfield sites in Dublin City centre and presents an exceptional opportunity to deliver a high-density development in the city's central core Located at the junction of City Quay and Moss Street. The site is also bounded to the south by Gloucester Street South.

8.10 For many years the site has been vacant, with the abandoned City Arts Centre building, occupying the north-west corner of the site, now a derelict ruin. The only activity on the site since the mid 1990 's has been its use for surface car parking. A small storage shed is located along the western perimeter of the yard.

8.11 The site is ideally placed to be part of an emerging cluster of buildings which will frame the backdrop and urban setting of the customs house. The City Quay site can be developed as part of a balanced massing on the South Quays to include the recently approached scale of the Tara Steet Tower and College Square developments, which will reinforce the symmetrical setting of the Customs House on the North Quays.

8.12 The current 0.22 ha site is brownfield and is 100% hard standing. The area within the site is currently used for car parking. Within the boundary there is an existing semi-derelict three storey building at the northwest corner of the site.

8.13 The receiving environment in terms of hydrology is described in the following sections.

8.3.2 Hydrology

8.14 The development is located within Hydrometric Area No. 09 (Liffey and Dublin Bay Area of the Irish River Network. It is within Dodder Sub-Catchment (Dodder_SC_010) which is part of the River Liffey catchment.

8.15 The River Liffey rises between Kippure and Tonduff in the Wicklow Mountains, and flows for about 129km through Counties Wicklow, Kildare and Dublin before discharging into the Irish Sea at the mouth of Dublin Bay. The River Liffey catchment encompasses an area of approximately 1,369km^2.

8.16 The River Liffey (IE_EA_090_0400, 09_2111) is the closet waterbody to the site. This waterbody is located approx. 0.02 km to the north of the proposed development site.

The River Liffey discharges to Dublin Bay Natura Site approx. 1.54 km to the east of the Proposed Development site.

8.17 As per Chapter 12 of this EIA Report, there is potential for a section of a disused underground stream called the 'Gallows Stream' to cross the proposed development area. Documentary sources refer to the stream as rising near Leeson Lane, off Leeson Street, and flowing close to Government Buildings (Oram 2004; Sweeney 2017). However, based on the available site investigations it was not encountered.

8.18 The River Liffey and Liffey Estuary Upper is classified as *'Moderate'* and *'Good', respectively.* Both waterbodies are classed with a WFD risk score of *'Under Review.*

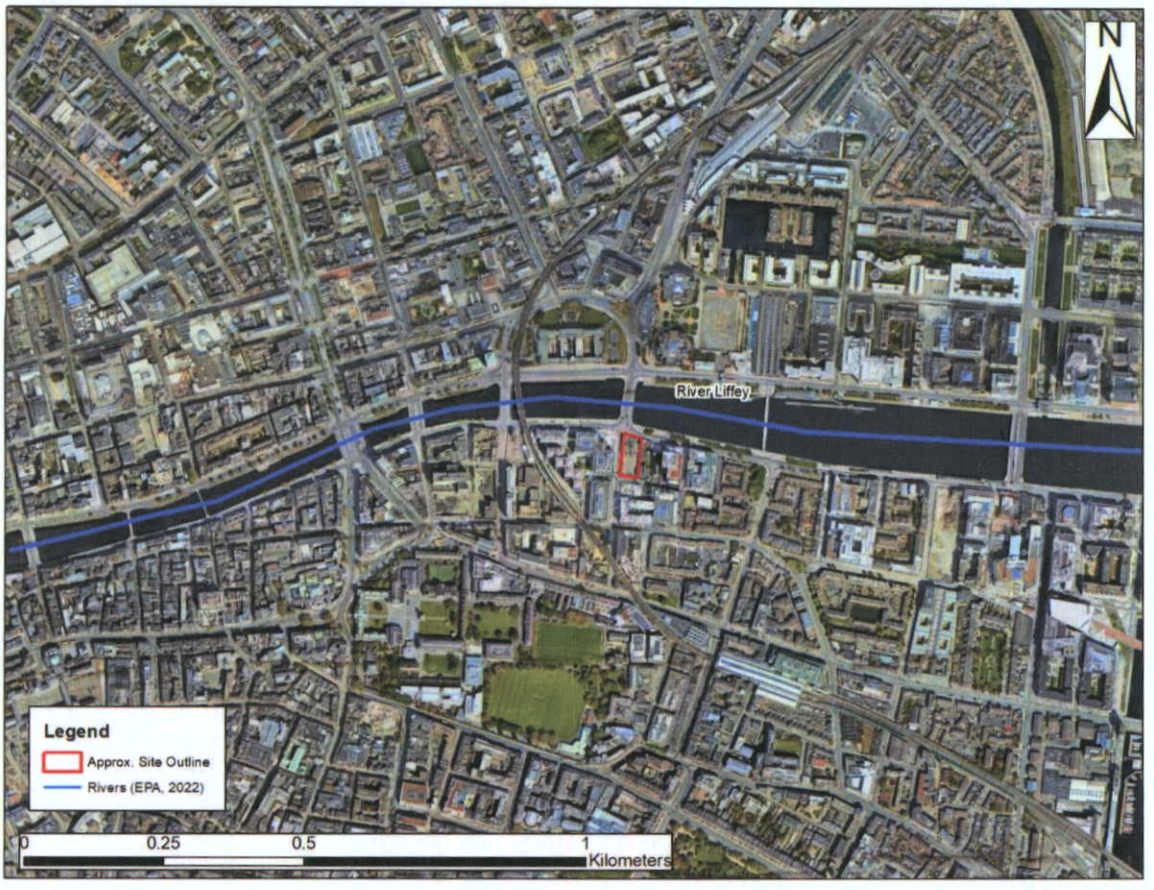

Figure 8.1 *Hydrological Environment*

8.3.3 Water Quality

8.19 The existing site is within Hydrometric Area No. 09 (Liffey and Dublin Bay Area of the Irish River Network. It is within Dodder Sub-Catchment (Dodder_SC_010) which is part of the River Liffey catchment, as shown in Figure 8.1 above.

8.20 The development is located within the ERBD, as defined under the EU Water Framework Directive (2000/60EC) European Communities Directive 2000/60EC, establishing a framework for community action in the field of water policy, (commonly known as the Water Framework Directive [WFD]).

8.21 The WFD requires 'Good Water Status' for all European waters, to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' means both 'good ecological status' and 'good chemical status'.

8.22 The Liffey Estuary Upper is considered *'Moderate'* due to the waterbody being classed as *'Potentially Eutrophic'*. However, this improves status further downstream after the Talbot Memorial Bridge where it is classed as *'Intermediate'*. These waterbodies are transitional waterbodies.

Surface Water Quality

8.23 Q Values are used to express the biological water quality by the EPA, based on changes in the macro invertebrate communities of riffle areas brought about by organic pollution. Q1 indicates a seriously polluted water body, Q5 indicates unpolluted water of high quality.

8.24 The River Liffey is classed as *'Poor'* at the closet river station to the site - LIFFEY - 0.2 km d/s Chapelizod Bridge (Lynch's Lane) (RS09L012360) approx. 6.05 km upstream (west). This is an operational station, with a current status of *Poor* (Q-value of 3) in 2019. The descriptions of each of the Q Ratings are shown in Table 8.1.

Table 8.1 EPA Biological Q Ratings

Quality Ratings	Quality Class	Pollution Status	Condition
Q5, Q4-5, Q4	Class A	Unpolluted	Satisfactory
Q3-4	Class B	Slightly Polluted	Unsatisfactory
Q3, Q2-3	Class C	Moderately Polluted	Unsatisfactory
Q2, Q1-2, Q1	Class D	Seriously Polluted	Unsatisfactory

8.3.4 Water Supply

8.25 Byrne Looby have prepared an Engineering Assessment Report (EAR) which is provided with the planning application documentation. This together with the planning drawings provides detail on the existing and proposed water supply, drainage and wastewater plan for the site.

8.26 A pre-connection enquiry has been made to Irish Water (IW). It is envisaged that a connection agreement can be made to provide potable water for the proposed development. An extract from the Irish Water sewer network indicates 2 x no. connections (250mm Ductile Iron pipe) exist from the proposed site connecting into the IW network at Moss Street. Existing Water Supply Network records indicate that there is another 250mm DI watermain located on City Quay and a 5" Cast Iron water main at Gloucester Street.

8.3.5 Foul Sewage

8.27 From the available Irish Water maps, it is noted the existing wastewater network in the streets surrounding the site at the proposed development is a combined wastewater network conveying both Storm and Foul discharge.

8.3.6 Surface Water Drainage

8.28 As stated above from the available Irish Water maps, it is noted that the existing wastewater network in the adjoining streets surrounding the proposed site is a combined wastewater network conveying both storm and foul discharge.

8.29 From the aerial images and survey information available it is noted that the existing surface water drainage travels unrestricted to the combined public sewers.

8.3.7 Flooding

8.30 The existing road levels around the site boundaries range from 2.950m – 3.150m OD on Moss Street. Entrances to the ground floor level of the proposed building will be 1m higher than the existing surrounding ground level to assist with flood defence. The proposed development will have a double level basement with the lowest finished basement floor level set at approximately -5.50m OD, a depth of 9.5m below the highest ground floor level. The site's main vehicular access will be provided from Gloucester St, via a car lift to basement -2 level where some parking spaces will be provided (details shown on architects' plans).

8.31 Pedestrian access will be provided to the proposed building from the street frontage at Moss Street where it is envisaged this will be the main entrance for occupants.

8.32 A Flood Risk Assessment for the site has been undertaken by Byrne Looby and is presented in Appendix 8.2. A summary of the flood risk for the site is provided below.

8.33 A Flood Risk Assessment has been undertaken for the subject site and proposed development at City Quay, Dublin. The proposed development involves the construction of multi-storey commercial development.

8.34 The subject site lies within Flood Zones A, B and C.

8.35 The development of a commercial complex is classified as a less vulnerable development under the FRM Guidelines. This includes the art centre which is considered a commercial property under the FRM Guidelines.

8.36 The less vulnerable development adopts the precautionary approach to setting of finished floor levels as noted in Section 5.16 of the FRM Guidelines and is robust to breach, overtopping and climate change scenarios. Commercial development and art centre is proposed to be sited above the 0.5% AEP coastal flood level with allowance for climate change and freeboard (at **4.0mOD**), with other less vulnerable uses at existing streetscape level to ensure continuity within the streetscape but protected with demountable barriers to address the food risk.

8.37 The proposed development will not impact of flood extent, depth, risk or flood routes elsewhere.

8.38 Whilst there will be reliance on existing defences of the South Campshire Flood Protection Scheme to protect the development, the development has measures in place that will, on their own, protect the development to the required design standard in the FRM Guidelines.

8.39 Ancillary building facilities, such as heating, back-up power and sprinkler systems will be protected from flooding.

8.40 Mitigation measures to reduce residual risk of flooding for greater than design event and or breach/overtopping are suggested in Section 7 of the FRA. The residual risk of flooding has been adequately addressed by the implementation of certain mitigation measures such as users of the building should be made aware that the building is in a Flood Zone and that the raised lobby areas inside the building provide refuge during a flood to a very high standard of protection (0.5% AEP event plus freeboard plus climate change, a Flood Risk Management Plan for the property will be developed and Dublin City Council Code of Practice for Flood Resilience and Resistant Developments shall be followed.

8.41 A justification test for the proposed development has been undertaken which demonstrates the appropriateness of the development and how it meets the requirements of The Planning System and Flood Risk Management, Guidelines for Planning Authorities (2009), local zoning objective whist respecting the local streetscape and urban fabric.

8.3.8 Rating of Site Importance of the Hydrological Features

8.42 Based on the TII/NRA methodology, the site importance of hydrological features at this site is rated **Medium Importance** based on the following:

- There is no direct connectivity to a major receiving waterbody for the site.
- There are no surface water sources of potable water or amenity or fisheries value in the surrounding area.
- The receiving water has a *Moderate* water status.

8.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

8.43 The proposed building extends to 24 floors above ground floor and also contains 2 basement levels.

8.44 The building structure is reinforced concrete columns with flat-slab post-tensioned floors on a piled and rafted foundation.

8.45 There are 2 basement levels, the lower of which provides 11 car parking spaces including 2 disabled accessible spaces and 20 motorbike spaces.

8.46 The Proposed Development is described in further detail in Chapter 2 (Description of the Proposed Development). The characteristics of the proposed development with regard to hydrology environment are outlined below.

8.4.1 Water Supply

8.47 The water supply for the site has been designed in accordance with Irish Water Code of Practice and standard construction details. A pre-enquiry connection form has been issued to Irish Water and a copy of same is provided in the Engineer's Report (Byrne Looby, 2022) submitted as part of this planning application.

8.48 It is anticipated that there will be ample water supply from the existing surrounding watermain network to service the proposed development inclusive of fire flow requirements. This will be confirmed following Irish Water's assessment.

8.49 It is intended that water conservation measures will be used for the development. These measures will be implemented for both potable and non-potable water demands of the proposed development.

8.50 The post development peak hour water demand rate for the proposed development is estimated at 186 m^3/day based on the Engineer's Assessment report which is attached with this planning application.

8.4.2 Foul Sewage

8.51 The foul drainage has been designed in accordance with Industry standards - the Building Regulations and in accordance with the recommendations contained in the Technical Guidance Documents, Section H and will be laid strictly in accordance with Irish Water's requirements for taking in charge.

8.52 The available Irish water maps show that the existing wastewater network in the streets surrounding the site at the proposed development is a combined wastewater network conveying both Storm and Foul discharge.

8.53 The foul discharge from the proposed development was determined to be 12.94 l/s (DWF[1]) based on the Engineer's Assessment report which is attached with this planning application.

8.4.3 Surface Water Drainage

8.4.3.1 Construction

8.54 The key civil engineering works which will have a potential impact on the water and hydrological environment during construction of the proposed development are summarised below.

- Excavations are required for foundations of the proposed buildings and installation of associated services included within the development.
- Excavations for the two (2) no. basement levels.
- Possible discharge of collected rainwater during excavation works and groundworks (the extent of which is dependent on the time of year development works are carried out);
- Construction activities will necessitate storage of cement and concrete materials, temporary oils, and fuels on site. Small localised accidental releases of contaminating substances including hydrocarbons have the potential to occur from construction traffic and vehicles operating on site.
- Localised excavations (cuts) and infill (build-up) as part of the designed elevation changes across the proposed development site.

8.4.3.2 Operation

8.55 The proposed surface water network design has been designed in accordance with The Greater Dublin Regional Code of Practice for Drainage Works.

[1] Dry Weather Flow - the average daily flow to a waste water treatment works (WWTW) during a period without rain

8.56 The proposed development will attenuate the surface water on site before discharging to the combined public sewers in either City Quay, Moss Street or Gloucester Street. There will be no increase in impermeable area arising from this proposed development application and therefore the previously permitted surface water drainage proposals including Sustainable urban Drainage Systems (SuDS) will remain as current.

8.57 Although the existing site is brownfield in nature, the proposed development will limit storm water discharge to 2l/s, in accordance with the Greater Dublin Regional Code of Practice for drainage works. The discharge will be restricted using a flow control device - Hydrobrake, located at the first chamber upstream of the connection to the discharge pipe exiting the site to the existing Irish Water combined sewer system.

8.58 As part of the Dublin City Development Plan 2016 -2022, objective SIO3 requires *"all new* development *to provide a separate foul and surface water drainage system and to incorporate sustainable urban drainage systems."*

8.59 The proposed development design incorporates SuDS, Green Blue Roofs and Control of Paving / Grassed areas respectively.

8.60 The proposed development incorporates SuDS as part of the drainage strategy. Surface water from the development will be attenuated within the site boundary prior to being discharged to a maximum flow rate of 2l/s to the existing Irish Water combined sewer(s).

8.61 The design for the proposed development at 1-6 City Quay includes the following SuDS systems:

- Green Roof for approximately 50% of the roof area. This is achieved via a combination of roof gardens with raised beds and pots, rolled-out green planting cells that are filled with soil or compost and planted up with low growing perennials and grasses.
- The attenuation of surface water within the site boundaries to limit the rate of discharge via a reinforced concrete stormwater storage tank located at basement -2 level. A pumping system will then raise the stormwater for discharge to the existing Irish Water Combined sewer at street level. The attenuation tank is designed to attenuate a 1:100 year + 20% climate change storm event using WinDes hydraulic modelling software.

8.62 The following volumes can be stored in the proposed attenuation systems:

- Green Roofs – 15m^3.
- Attenuation Tank located on the basement level – 112m^3.
- This provides a total storage volume of 127m^3.

8.63 Refer to Engineer's Report (Byrne Looby, 2022) submitted as part of this planning application for further details on the surface water management and drainage details.

8.5 POTENTIAL IMPACTS OF THE PROPOSED DEVELOPMENT

8.64 The potential impacts during construction and operation phases of the proposed development on the surface water environment are outlined in the following paragraphs.

8.5.1 Construction Phase

8.65 The key civil engineering works at the proposed development will involve the excavation of material for foundations and deliveries of imported engineering fill, crushed stone, concrete, reinforcement and other construction materials. Other construction activities will include site storage of cement and concrete materials, oils and fuels.

Increased Run-off and Sediment Loading

8.66 Surface water run-off from site preparation, levelling, landscape contouring and excavations during the construction phase may contain increased silt levels or become polluted from construction activities. Run-off containing large amounts of silt can cause damage to surface water systems and receiving watercourses. Silt water can arise from excavations, exposed ground, stockpiles, and access roads.

8.67 During the construction phase at this site there is potential for an increase in run-off due to the introduction of impermeable surfaces and the compaction of soils. This will reduce the infiltration capacity and increase the rate and volume of direct surface run-off. The potential impact of this is a possible increase in surface water run-off and sediment loading which could potentially impact local drainage. Previous uses of the site and site testing has indicated elevated metals such as lead and zinc with trace sample of asbestos. It is envisaged that further environmental testing will be carried out prior to disposal of the subsoil. Hazardous material will be removed at the start of the project. There is no risk to the surrounding hydrological environment once its disposed off-site to a licenced facility by a licenced contractor.

8.68 There is a possible direct pathway from the excavations works area to the surface water drainage system onsite via over land flow. Mitigation measures highlighted in Section 8.7 will be employed to remove the risk to the drainage system on the site.

Uncontrolled Discharges, Fuel and Other Accidental Spills

8.69 During the construction phase, there is a risk of accidental pollution incidences from the following sources:

- Spillage or leakage of fuels (and oils) stored on site.
- Spillage or leakage of fuels (and oils) from construction machinery or site vehicles.
- Spillage of oil or fuel from refuelling machinery on site.
- The use of concrete and cement.

8.70 Machinery activities on site during the construction phase may result in contamination of runoff into surface water. Potential impacts could arise from accidental spillage of fuels, oils, paints etc. which could impact surface water if allowed to runoff into surface water systems and/or receiving watercourses.

8.71 Concreting operations carried out near surface water drainage points during construction activities have the potential to lead to discharges to a watercourse. Concrete (specifically, the cement component) is highly alkaline and any spillage to a local watercourse would be detrimental to water quality and local fauna and flora.

8.72 The implementation of the mitigation measures detailed in Section 8.7 will ensure that any impact will be mitigated.

Wastewater

8.73 Welfare facilities will be provided for the contractors on site during the construction works. During construction, portable sanitary facilities will be provided with waste collected and disposed of appropriately. There are no predicted adverse impacts on wastewater during construction.

Summary of Construction Phase Impacts

8.74 A summary of construction phase impacts for the proposed development (with and without mitigation) following EPA (2022) EIA guidelines is provided below.

8.75 The magnitude of the impact for the construction phase without mitigation (design) measures is *Short Term* in duration with a *Moderate Adverse* impact rating to the hydrological environment in close vicinity of the proposed development site.

8.76 However, with the implementation of design measures and mitigation measures (Section 8.7 below) for the proposed development site the impact of the construction phase is *Short Term* in duration with an *Imperceptible* impact rating.

8.5.2 Operational Phase

8.77 During operation the site will operate in compliance with the requirements of an Irish Water (IW) licence for discharge to sewer. Potential impacts are summarised below.

Surface Water Runoff

8.78 Without proper control measures, increase in hard stand would result in increase in the rate of run-off. DCC requires all new developments to adhere to the practice of Sustainable Urban Drainage Systems (SuDS) for the control of surface water on site. This is highlighted in the Greater Dublin Strategic Drainage Strategy and the design has been incorporated SUDs within the drainage design for the proposed development.

Uncontrolled Discharges, Fuel and Other Accidental Spills

8.79 There is a potential for localised leaks and spillages from vehicles along access roads and in parking areas. Any accidental emissions of oil, petrol or diesel could cause contamination if the emissions enter the water environment unmitigated.

8.80 There is no direct pathway to surface water from this site, however there is an indirect pathway via the drainage system. Mitigation measures mentioned above and below in Section 8.6 will avoid potential impact on offsite and onsite watercourses.

Foul Water

8.81 The proposed development will lead to an increase in foul water discharge as described above.

Water Supply

8.82 The proposed development will result in an increased demand for water from the DCC water supply system as described above.

Summary of the Operational Phase Impacts

8.83 A summary of operational phase impacts for the proposed development (with and without mitigation) following EPA (2022) EIA guidelines is provided below.

8.84 The magnitude of the impact for the operational phase without mitigation and design measures is *Temporary* in duration with a *Not Significant* impact rating to the hydrological environment in close vicinity of the proposed development site.

8.85 However, with the implementation of design and mitigation measures (Section 8.7 below) for the proposed development site the impact of the operation phase is *Long-term* in duration with an *Imperceptible* impact rating.

8.6 DO NOTHING SCEANRIO

8.86 Should the proposed development not take place, the runoff from the site will continue to directly enter the existing drainage system.

8.87 It is noted that the proposed redevelopment for the site should have a positive gain for the receiving waters as the drainage design will comply with GDSDS Guidelines resulting in attenuated run-off from the site and improved water quality management.

8.7 REMEDIAL AND MITIGATION MEASURES

8.88 The design of the proposed development has taken account of the potential impacts of the development and the risks to the water environment. Measures have been developed to mitigate the potential effects on the local water environment. These measures seek to avoid or minimise potential effects in the main through the implementation of best practice construction methods and adherence to all relevant legislation.

8.89 The following mitigation measures are designed to address the impacts associated with the construction and operational phase of the project. Due to the inter-relationship between this Chapter (Hydrology) and Chapter 7 (Land, Soils, Geology and Hydrogeology) the following mitigation measures discussed will be considered applicable to both.

8.7.1 Construction Phase

8.90 During the construction phase, mitigation measures have been applied for the following potential impacts:

- Increased runoff and sediment loading
- Fuel and Chemical Handling

8.91 These mitigation measures will ensure that no contaminated runoff or untreated wastewater will enter any watercourses during construction of the proposed development.

8.92 An outline Construction Environmental Management Plan (CEMP) has been submitted as part of this application. Prior to commencement of construction the CEMP will be updated and finalised to incorporate any conditions imposed by the competent

authority. The outline CEMP incorporates the mitigation measures outlined above as they relate to the construction phase. The outline CEMP includes emergency response procedures in the event of a spill, leak, fire or other environmental incident related to construction. This is an active document which will be continuously updated to manage risk during the construction programme. All relevant personnel working on the site will be trained in the implementation of the procedures.

8.93 As a minimum, the CEMP will be formulated in consideration of the standard best international practice including but not limited to:

- CIRIA, (2001), Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors
- Construction Industry Research and Information Association (CIRIA) Environmental Good Practice on Site (C650), 2005
- BPGCS005, Oil Storage Guidelines.
- Eastern Regional Fisheries Board, (2006), Fisheries Protection Guidelines: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites·
- CIRIA 697, The SUDS Manual, 2007.
- UK Pollution Prevention Guidelines (PPG) UK Environment Agency, 2004

Management of sediment loading and water quality

8.94 During the construction phase, any drains carrying a high sediment load will be discharged via a settling pond and/or filter strip prior to discharge. An overflow weir shall be built into the settling pond which shall accommodate overland flow.

8.95 No concrete batching facility will be required at the site. All concrete will be brought to site by truck. Wet concrete operations will be contained within the site boundary of the proposed development. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated storm water to groundwater.

8.96 The generation of runoff from stockpiles of soils, excavated during construction, will be prevented from entering watercourses by diverting runoff for settlement and once completed via the surface water retention pond on site, and removing the material off-site as soon as possible to designated storage areas.

Fuel and Chemical Handling

8.97 The following mitigation measures will be taken at the construction stage in order to prevent any spillages of fuels and prevent any resulting impacts to surface water systems;

- Designation of a bunded refuelling areas on the site;
- Provision of spill kit facilities across the site;
- Where mobile fuel bowsers are used the following measures will be taken:
    - Any flexible pipe, tap or valve will be fitted with a lock and will be secured when not in use;
    - The pump or valve will be fitted with a lock and will be secured when not in use;
    - All bowsers will carry a spill kit and operatives must have spill response training; and

- Portable generators or similar fuel containing equipment will be placed on suitable drip trays.

8.98 In the case of drummed fuel or other potentially polluting substances which may be used during construction the following measures will be adopted:

- Secure storage of all containers that contain potential polluting substances in a dedicated internally bunded chemical storage cabinet unit or inside a concrete bunded areas;
- Clear labelling of containers so that appropriate remedial measures can be taken in the event of a spillage;
- All drums to be quality approved and manufactured to a recognised standard;
- If drums are to be moved around the site, they should be done so secured and on spill pallets; and
- Drums to be loaded and unloaded by competent and trained personnel using appropriate equipment.

8.99 All contractors will be required to implement mitigation measures included in the CEMP.

8.100 All ready-mixed concrete will be brought to site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline waste waters or contaminated storm water to the underlying subsoil. Wash-down and washout of concrete transporting vehicles will take place at an appropriate facility offsite.

8.7.2 Operational Phase

8.101 During operation the site will operate in compliance with the requirements of an Irish Water (IW) licence for discharge to sewer. The following containment measures are included within the design to reduce potential for environmental impact.

Surface Water Drainage

8.102 The proposed development will provide a significant improvement to the local drainage catchment as it is proposed to provide full attenuation for increase in hardstand area in compliance with the requirements of the Greater Dublin Strategic Drainage Study.

8.103 A number of measures will be put in place to minimise the likelihood of any spills entering the water environment to include the design of the car park, and on-site speed restrictions.

8.104 A flood risk assessment was undertaken in accordance with the OPW's 'The Planning System and Flood Risk Management Guidelines for Planning Authorities', November 2009. Refer to Section 8.3.7 Flooding above for the findings of the flood risk assessment. The Flood Risk Assessment for the proposed development can be found as Appendix 8.2 at the end of this report.

Foul Water

8.105 The proposed development will operate within the requirements of the licence issued.

Water Supply

8.106 Flow monitoring for the purpose of billing and leakage monitoring shall be installed at the interface of the public and private mains. The detail of the meter and enclosure required shall be agreed with the water authority in advance of construction.

8.8 RESIDUAL IMPACT OF THE PROPOSED DEVELOPMENT

8.8.1 Construction Phase

8.107 The effect on the water during construction, after the implementation of mitigation measures highlighted in Section 8.6.1, is considered to have a ***short term, imperceptible effect with a neutral impact on quality,*** i.e. an impact capable of measurement but without significant consequences. This is based on the following assessments.

8.108 There will be no significant increase in runoff from the site during construction and run-off quality will be mitigated if required.

8.8.2 Operational Phase

8.109 The potential effects of the operational phase of the Proposed Development on the hydrological environment have been considered.

- The proposed development will not negatively impact on any surface waterbody during operation.
- There will be no increase in flood risk as result of the site operation.

8.110 It is not anticipated that any effects will arise following the implementation of the mitigation measures discussed in Section 8.6.2 above. As such the effect is considered to have a ***long term- imperceptible effect with a neutral impact on quality*** i.e. an impact capable of measurement but without significant consequences.

8.9 MONITORING OR REINSTATEMENT

8.9.1 Construction Phase

8.111 Monitoring of the site drainage systems will be undertaken during the construction phase to confirm that there is no impact on surface water during the construction of the development.

8.9.2 Operational Phase

8.112 Stormwater and foul sewer maintenance for the overall landholding will be undertaken in accordance with the requirements of the suppliers.

8.10 CUMULATIVE IMPACTS OF THE PROPOSED DEVELOPMENT

8.113 The cumulative impact of the proposed development with any/all relevant other planned or permitted developments are discussed below. Related and permitted,

concurrent, and future developments are listed in Chapter 2 (Description of the Proposed Development).

8.10.1 Construction Phase

8.114 In relation to the potential cumulative impact on hydrology during the construction phases, the construction works which would have potential cumulative impacts include:

- Contractors for the proposed development will be contractually required to operate in compliance with the CEMP which includes the mitigation measures outlined in this EIA report. Other developments will also have to incorporate measures to protect water quality in compliance with legislative standards for receiving water quality (European Communities Environmental Objectives (Surface Water) Regulations (S.I. 272 of 2009 and S.I. 77 of 2019). As a result, there will be minimal cumulative potential for change in the natural hydrological regime. The cumulative impact is considered to be neutral and imperceptible.
- Surface water run-off during the construction phase may contain increased silt levels or become polluted from construction activities. Run-off containing large amounts of silt can cause damage to surface water systems and receiving watercourses.
- Contamination of local water sources from accidental spillage and leakage from construction traffic and construction materials unless project-specific CEMPs are put in place for each development and complied with. As stated, there are no notable surface water features onsite and no direct hydrological pathways to offsite surface water bodies.
- There is a potential for contamination of watercourses during the construction phase. However, mitigation measures are required to manage sediment run-off and fuel leakages during construction and operation. All developments are required to ensure they do not have an impact on the receiving water environment in accordance with the relevant legislation European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009) such that they would be required to manage runoff and fuel leakages.

8.115 The residual cumulative impact on water and hydrology for the construction phase is anticipated to be ***short-term***, ***imperceptible effect with a neutral impact on quality***, once appropriate mitigation measures to manage water quality runoff in compliance with legislative requirement are put in place for each development.

8.10.2 Operational Phase

8.116 Potential cumulative impacts included in the operational phase include:

- Increased hard standing areas will reduce local recharge to ground and increase surface water run-off potential if not limited to the green field run-off rate from the site;
- Increased risk of accidental releases from fuel storage/delivery unless mitigated adequately i.e. bunded tank;
- Increased risk of accidental discharge of hydrocarbons from car parking areas and along roads and unless diverted to surface water system with petrol interceptor; and
- Any additional foul discharges should be treated where appropriate and/or diverted to the foul sewer system and not directly to ground.

8.117 Similar mitigation measures to those described in Section 8.7 will need to be implemented to protect water quality.

8.118 Increase in wastewater loading and water supply requirement is an impact of all developments. Each development will require approval from the IW confirming available capacity in the water and wastewater infrastructure. The surface water and foul drainage infrastructure and water supply requirements for the proposed development has been designed to accommodate the future indicative substation development.

8.119 Development will result in an increase in hard standing which will result in localised reduced recharge to ground and increase in run-off rate. However, each permitted development are required by the Local Authority and IW to comply with the Greater Dublin Strategic Drainage Strategy (GDSDS) and Local Authority and IW requirements by providing suitable attenuation on site to ensure greenfield run-off rates and ensure that there is no increase in off-site flooding as a result of development.

8.120 The residual cumulative impact on water and hydrology for the operational phases is anticipated to be ***long-term***, ***imperceptible effect with a neutral impact on quality***, once appropriate mitigation measures to manage water quality runoff in compliance with legislative requirement are put in place for each development.

8.11 DIFFICULTIES ENCOUNTERED IN COMPILING INFORMATION

8.121 There were no difficulties encountered during the writing of this EIAR chapter.

8.12 REFERENCES

CIRIA, (2011). *Environmental good practice on site;* Construction Industry Research and Information Association publication C692 (3rd Edition - an update of C650 (2005); (I. Audus, P. Charles and S. Evans), 2011

CIRIA, (2012). *Environmental good practice on site –pocket book;* Construction Industry Research and Information Association publication C715 (P. Charles, and G. Wadams), 2012

EPA, (2002). EPA *Guidelines on the information to be contained in Environmental Impact Statements*; (March 2002); Environmental Protection Agency, Co. Wexford, Ireland

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APPENDIX 8.1

METHODOLOGY FOR ASSESSMENT OF IMPACTS

EIAR Guideline tables for Hydrology

Table 7.1: Criteria for rating impact magnitude at EIS stage – Estimation of magnitude of impact on hydrology attributes (NRA, 2009)

Magnitude of Impact	Criteria	Typical Examples
Large Adverse	Results in loss of attribute and/ or quality and integrity of attribute	Loss or extensive change to a water body or water dependent habitat
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	Calculated risk of serious pollution incident >1% annually2
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	Increase in predicted peak flood level >10mm1
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	Negligible change in predicted peak flood level1
Minor Beneficial	Results in minor improvement of attribute quality	Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually2
Moderate Beneficial	Results in moderate improvement of attribute quality	Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually2
Major Beneficial	Results in major improvement of attribute quality	Reduction in predicted peak flood level >100mm1

Additional examples are provided in the NRA Guidance Document

1 Refer to Annex 1, Methods E and F, Annex 1 of HA216/06

1 Refer to Appendix B3 / Annex 1, Method D, Annex 1 of HA216/06

Source: 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' by the National Roads Authority (NRA, 2009)

Table 7.2 Criteria for Rating Impact Significance of Hydrological Attributes (NRA, 2009)

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities
High	Attribute has a high quality or value on a local scale	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2- 3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities Local potable water source supplying <50 homes Quality Class D (Biotic Index Q2, Q1) Flood plain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

Source: 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' by the National Roads Authority (NRA, 2009)

APPENDIX 8.2

FLOOD RISK ASSESSMENT

Byrne Looby, 2022

City Quay

Flood Risk Assessment

Bakkala Consulting Engineers

Report No. B1876-BLP-FRA-R-W-001
11 January 2022
Revision 00

BAKKALA
CONSULTING ENGINEERS

BYRNELOOBY

IRELAND | UK | UAE | BAHRAIN | KSA

BYRNELOOBY

Document Control

Document: Flood Risk Assessment

Project: City Quay

Client: Bakkala Consulting Engineers

Report Number: B1876-BLP-FRA-R-W-001

Document Checking:

Revision	Revision/ Review Date	Details of Issue	Authorised		
			Prepared By	Checked By	Approved By
00	11 January 2022	For Information	Kagiso Selaledi	Seán Harrington	Seán Harrington

Disclaimer: Please note that this report is based on specific information, instructions and information from our Client and should not be relied upon by third parties.

BYRNELOOBY

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Contents

1 Introduction

1.1 Background

Ventaway Limited, the Client has identified land situated at City Quay, Dublin in Dublin City Centre for proposed development.

Bakkala Consulting Engineers, acting for the Client has therefore commissioned ByrneLooby to conduct a Flood Risk Assessment (FRA) for the proposed development which is the construction of a new multiple office block development and all associated site development works and infrastructure provision at City Quay, Dublin City Centre. The development is described in detail under Section 2 of this report.

1.2 Purpose of Report

This flood risk assessment report has been prepared to accompany an application by Ventaway Limited to Dublin City Council for planning permission for the proposed development. This report includes a Stage 1 – Flood Risk Identification, a Stage 2 – Initial Flood Risk Assessment and a Stage 3 Detailed Flood Risk Assessment for the proposed development.

A Stage 1 Flood Risk Identification determines if there is a risk of flooding to the development, while Stage 2 Initial Flood Risk Assessment confirms the sources of flood risk, appraises the adequacy of existing information and Stage 3 Detailed Flood Risk Assessment looks closely at how the proposed development will mitigate flood risk from the identified source.

1.3 Flood Risk

Understanding flood risk is a key step in managing the impacts of flooding. Flood risk is a combination of the likelihood of flooding and the potential consequences arising. The methodology used for this Flood Risk Assessment is based on "*The Planning System and Flood Risk Management, Guidelines for Planning Authorities (2009)' (FRM Guidelines)"* published jointly by the Department of Environment, Community and Local Government (DECLG) and the Office of Public Works (OPW). These guidelines recommend a staged approach to flood risk assessment that covers both the likelihood of flooding and the potential consequences.

The likelihood of flooding is normally defined as a percentage probability of a given magnitude or severity occurring or being exceeded in any given year. The consequence of flooding depends on the hazards associated with the flooding, and the vulnerability of people, property and the environment potentially affected by a flood.

The assessment of flood risk requires an understanding of where the water comes from (i.e. the sources), how and where it flows (i.e. the pathways) and the people and assets affected by it (i.e. the receptors).

The principal sources are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow and river and coastal floodplains and their defence assets. The receptors can include people, their property, and the environment. All three elements must be examined as part of the flood risk assessment including the vulnerability and exposure of receptors to determine the potential consequence.

2 Site Location and Description

2.1 Site Location

The site is located in the Dublin City Centre, at the junction between Moss Street and City Quay, as shown in Figure 2-1.

The site is currently made up of a derelict three storey commercial property which borders City Quay and Moss Street in the northwest of the site. The south of the site is made up of hardstanding areas.

The area surrounding the site is generally made up of commercial premises. The River Liffey and Talbot Memorial Bridge are located directly north of the site.

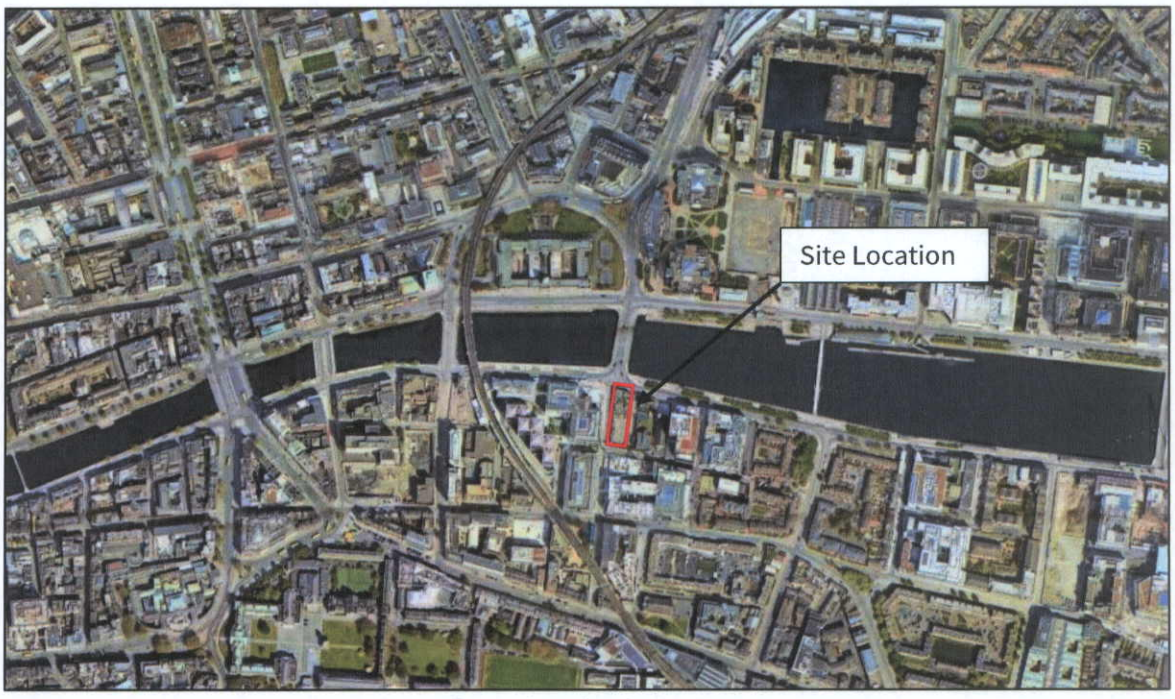

Figure 2-1: Site Location

2.2 Neighbouring Structures

The site borders City Quay, directly north of the site, Moss Street, directly west of the site, and Gloucester Street South directly south of the site.

Park Rite City Quay Car Park and Citywest Covid-19 Test Centre borders the site in the north east of the site, while City Quay National School borders the site along the south east boundary. It is currently understood that these adjacent structures do not have any basements.

2.3 Proposed Development

The proposed works consist of:

- Demolition of the existing buildings on site;
- Site enabling works and site clearance;
- Construction of embedded retaining wall to allow basement excavation;
- Construction of two level basement;
- Construction of 27 storeys; and
- Associated infrastructure.

A section showing the proposed development is shown as Figure 2-2, with the proposed double level basement footprint shown as Figure 2-3.

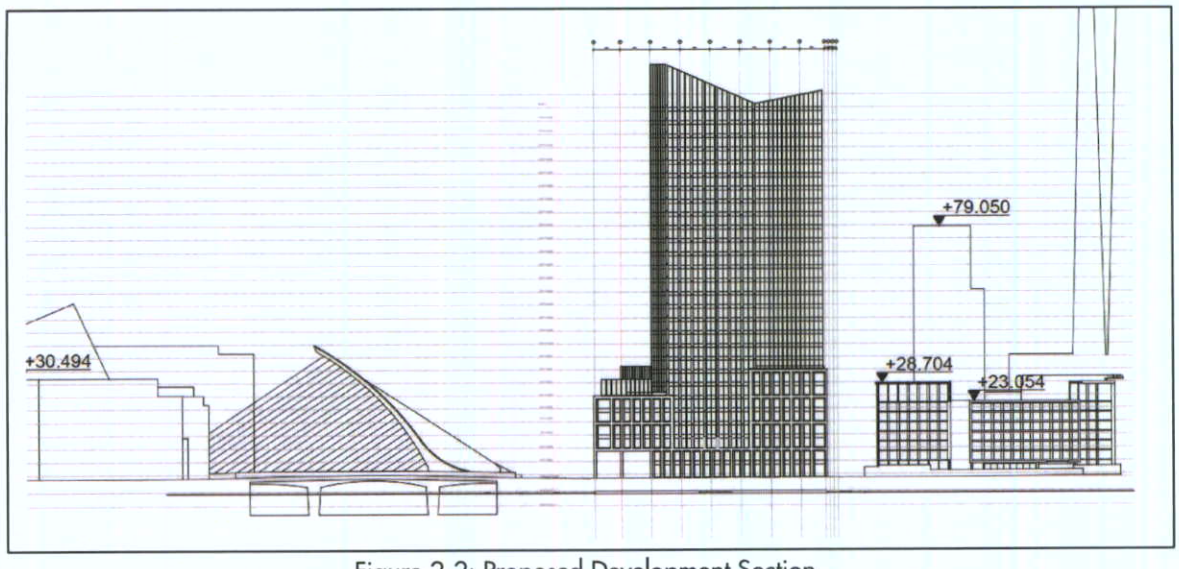

Figure 2-2: Proposed Development Section

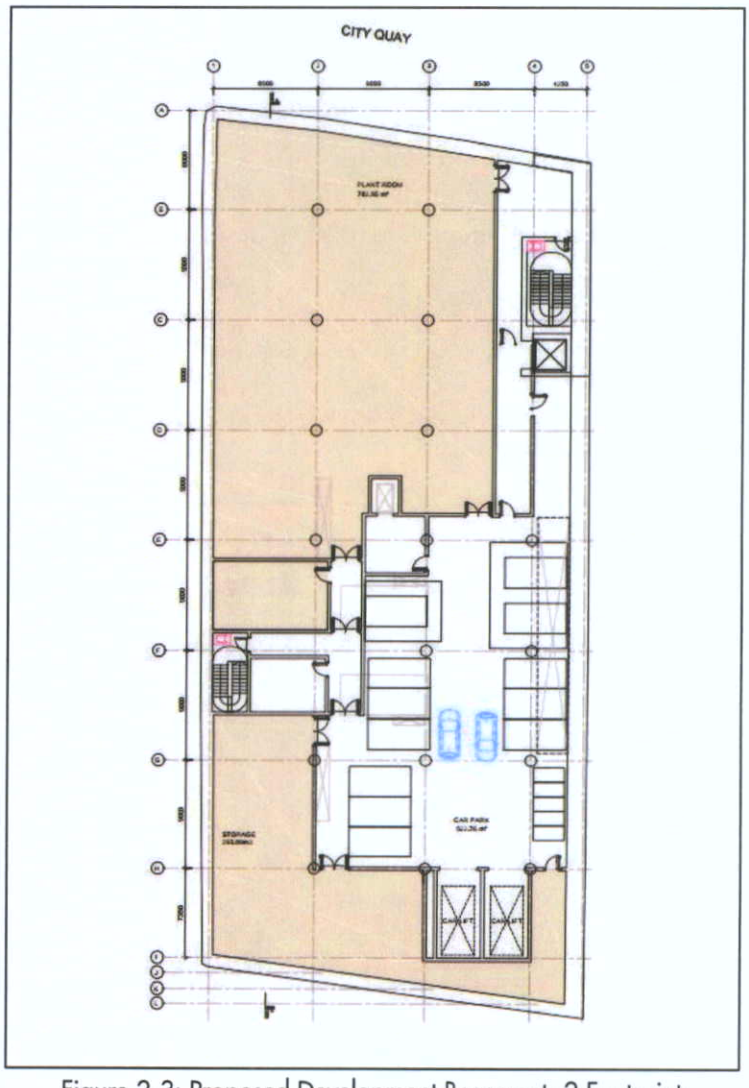

Figure 2-3: Proposed Development Basement -2 Footprint

3 Planning Guidelines & Flood Risk Assessment

3.1 The planning system and Flood Risk Management Guidelines for Planning Authorities

The FRM Guidelines provide "*mechanisms for the incorporation of flood risk identification, assessment and management into the planning process…*". This ensures a consistent approach throughout the country requiring identification of flood risk and flood risk assessment to be key considerations when preparing development plan, local area plans and planned developments.

"The core objectives of the FRM Guidelines are to:

- Avoid inappropriate development in areas at risk of flooding;
- Avoid new developments increasing flood risk elsewhere, including that which may arise from surface water run-off;
- Ensure effective management of residual risks for development permitted in floodplains;
- Avoid unnecessary restriction of national, regional or local economic and social growth;
- Improve the understanding of flood risk among relevant stakeholders; and
- Ensure the requirements of EU and national law in relation to the natural environment and nature conservation are compiled with at all stage of flood risk management

The key principles of the FRM Guidelines are to apply the Sequential Approach to the planning process i.e. :

- Avoid the risk, where possible,
- Substitute less vulnerable uses, where avoidance is not possible, and
- Mitigate and manage the risk, where avoidance and substitution are not possible."

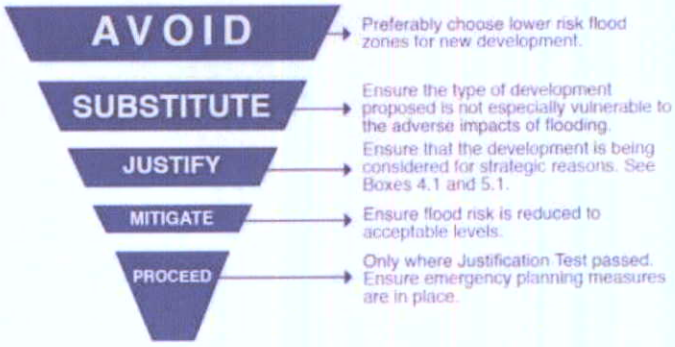

Figure 3-1: Sequential Approach Principles in Flood Risk Management

When the Sequential Test's '**avoid** and **substitute**' principles are not appropriate then the FRM Guidelines require that a Justification Test be applied to assess the appropriateness, or otherwise of particular developments that are being considered in areas of moderate or high flood risk. Figure 3-2 below illustrates the sequential approach mechanism adopted for the planning process which applies to this FRA.

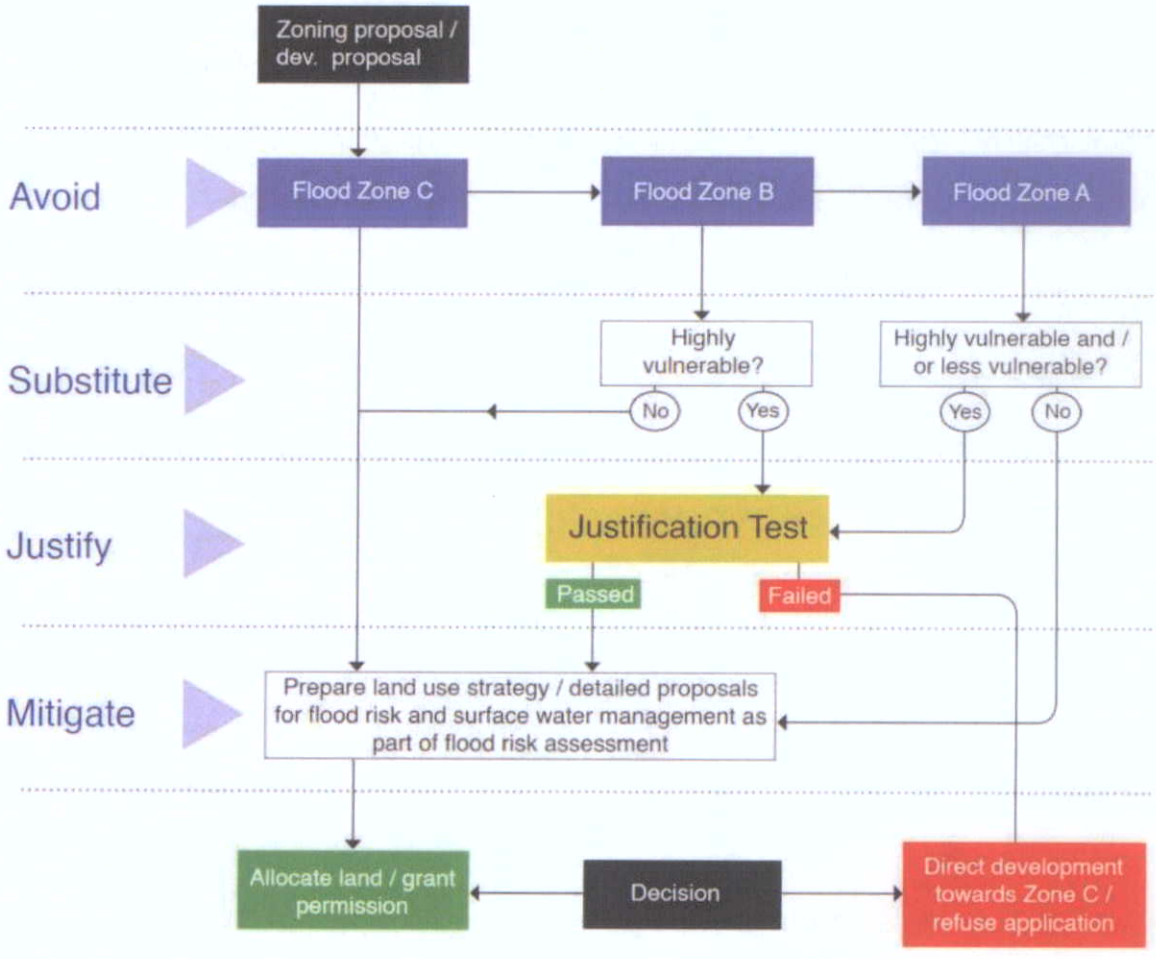

Figure 3-2: Extract of FRM Guidelines, Sequential Approach mechanism in the planning process

3.2 Flood Risk Assessment

The assessment of flood risk requires an understanding of where the water comes from (i.e. the source), how and where it flows (i.e. the pathways) and the people and assets affected by it (i.e. the receptors).

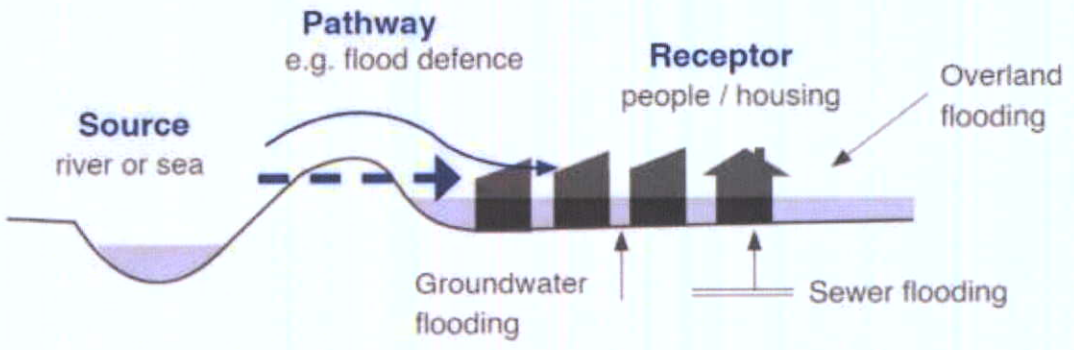

Figure 3-3: Source-Pathway-Receptor Model

The principal sources are rainfall or higher than normal sea levels. The principal pathways are rivers, drains, sewers, overland flow and river and coastal flood plains and their defences assets. The receptors can include people, their property and the environment. All three elements must be examined as part of the flood risk assessment including the vulnerability and exposure of receptors to determine its potential consequences. Mitigation measures typically used in development management can reduce the impact on people and communities i.e. by blocking or impeding pathways. The planning process is primarily concerned with the location of receptors and potential sources and pathways that might put those receptors at risk.

Risk to people, property and the environment should be assessed over the full range of probabilities, including extreme events. The flood risk assessment should cover all sources of flooding, including the effects of run-off from a development on flood risk both locally and beyond the development site.

3.2.1 Flood Risk Assessment Stage

The FRM Guidelines outline that a staged approach should be adopted when carrying out a flood risk appraisal or assessment. "These stages are:

- *Stage 1 Flood risk identification*
- *Stage 2 Initial flood risk assessment*
- *Stage 3 Detailed flood risk assessment*

The FRM Guidelines require a FRA be undertaken to assess flood risk for individual planning applications. This FRA comprises Stage 1, 2 and 3 involving both identification and more detailed

assessment of flood risks and surface water management related to the planned development site.

3.3 Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range. They are a key tool in flood risk management within the planning process as well as in flood warning and emergency planning. There are three types or levels of flood zones defined for the purposes of the FRM Guidelines. Table 3-1 describes the three flood zones.

Table 3-1: Flood Zones

Zone	Description
Zone A High probability of flooding	This zone defines areas with the highest risk of flooding from rivers (i.e. more than 1% probability or more than 1 in 100) and the coast (i.e. more than 0.5% probability or more than 1 in 200).
Zone B Moderate probability of flooding	This zone defines areas with a moderate risk of flooding from rivers (i.e. 1% to 0.1% probability or between1 in 100 and 1 in 1000) and the coast (i.e. 0.5% to 0.1% probability or between 1 in 200 and 1 in 1000).
Zone C Low probability of flooding	This zone defines areas with a low risk of flooding from rivers and the coast (i.e. less than 0.1% probability or less than 1 in 1000).

The FRM Guidelines (on Flood zones) state at Section 2.25 that:

> *"The provision of flood protection measures in appropriate locations, such as in or adjacent to town centres, can significantly reduce flood risk. However,* ***the presence of flood protection structures should be ignored in determining flood zones****. This is because areas protected by flood defences still carry a residual risk of flooding from overtopping or breach of defences and the fact that there may be no guarantee that the defences will be maintained in perpetuity. The likelihood and extent of this residual risk needs to be considered, together with the potential impact on proposed uses, at both development plan and development management stages, as well as in emergency planning and applying the other requirements of these Guidelines in chapter 3.* ***In particular, the finished floor levels within protected zones will need to take account of both urban design considerations and the residual risk remaining****.* (Emphasis Added)"

Section 3.4 of the FRM Guidelines goes on to state:

> *"As outlined in paragraph 2.25 the* ***flood zones ignore the presence of defences****. Areas that benefit from an existing flood relief scheme or flood defences have a reduced probability of flooding but can be particularly vulnerable due to the speed of flooding when overtopping or a breach or other failure takes place. Because this residual risk of flooding remains, the sequential approach and the Justification Test apply to such defended locations. The range of residual risks is described in Appendix A."*

Section 5.16 of the FRM Guidelines then state:

"Where development has to take place in areas at risk of flooding following the application of these Guidelines, the risks should be mitigated and managed through the location, lay-out and design of the development to reduce such risks to an acceptable level. The residual risks to the proposed development should be considered carefully, taking into account the type of development and its vulnerability, how flood risks to the occupants will be managed, insurance provision, scale of the risks and the provision of flood defence works. ***A precautionary approach would be to set floor levels above the 1% flood level ignoring the moderating effects of flood defences. However, within an existing built-up area the approach above may not produce an appropriate streetscape and therefore for proposed developments with a lower vulnerability, flood resistant and flood resilient construction methods to reduce the impact of flooding would be appropriate.*** *In this situation the flood risk assessment should be thorough and measures to manage these residual risks carefully detailed. More information on flood risk management by design is available in Appendix B. In all cases, a precautionary approach should be taken to allow for uncertainties in data and risk assessment procedures and to enable adaptability to future changes in risk,* ***including the effects of climate change****."*

3.4 Proposed Development's Vulnerability

The proposed development comprises of commercial development only for the site. Commercial Development is considered less vulnerability development and to provide less vulnerable development, within Flood Zone A or B requires a Justification Test to be completed to justify development in this moderate flood risk area.

However, in built up urban centres and subject to the Justification Test and adequate consideration of the flood risk and residual flood risk, less vulnerable development is permitted in flood Zones A or B, including at level lower than the 1% AEP flood level where raising ground levels is not appropriate given the existing urban fabric and streetscape setting.

In summary, part the development less vulnerable type development, can be sited in Flood Zones A or B subject to the residual risk being addressed and deemed to be suitably mitigated.

4 Data Collection

4.1 Flood History

4.1.1 Old OSi Maps

A review of the historic 6" and 25" OSi maps notes that the area along the south bank of River Liffey and at the proposed development as being developed. The north banks are indicated as developed. Butt Bridge and the City of Dublin Junction Railway runs to the west of the proposed development site.

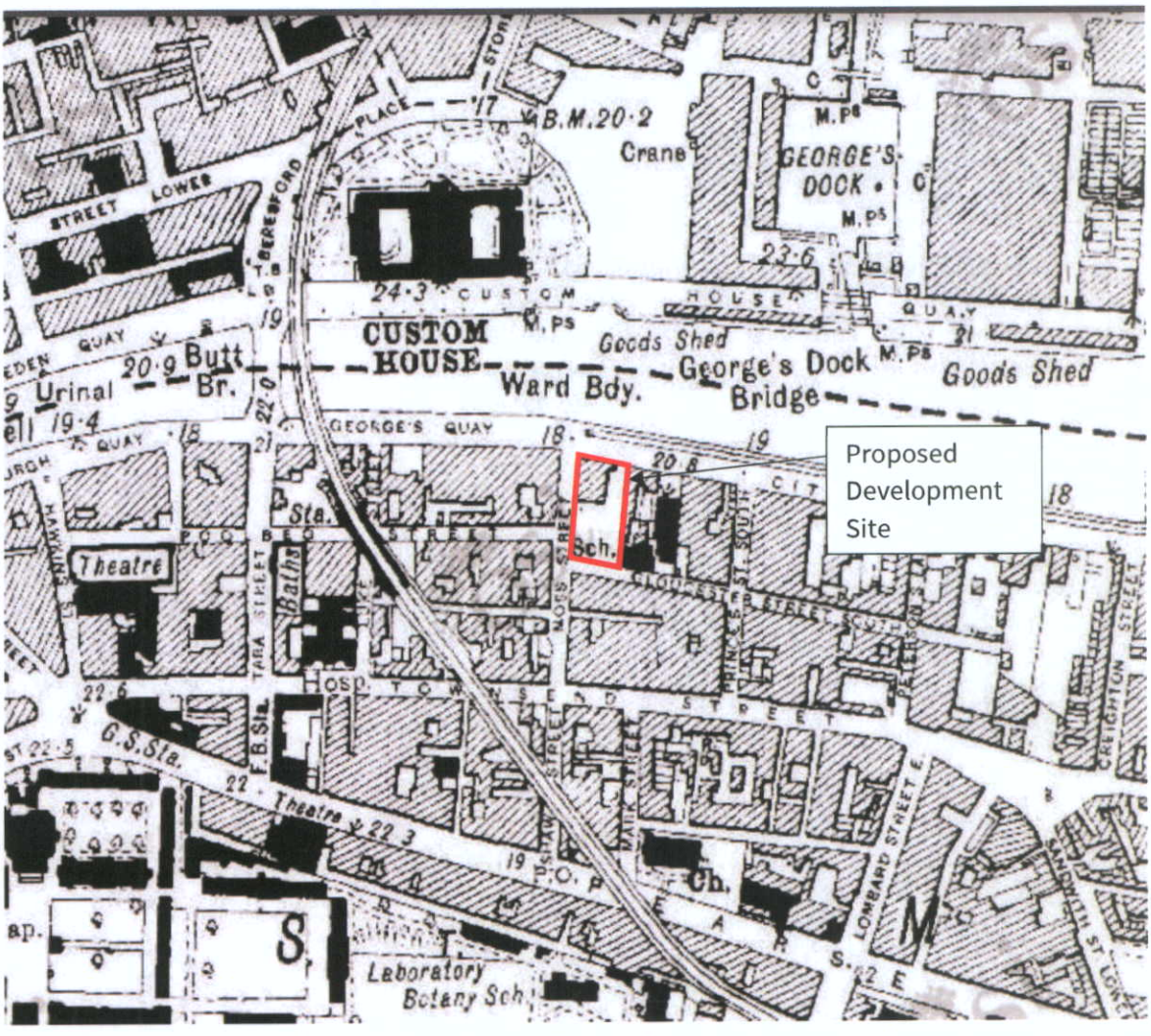

Figure 4-1: 6" OSi Map (source: www.geohive.ie)

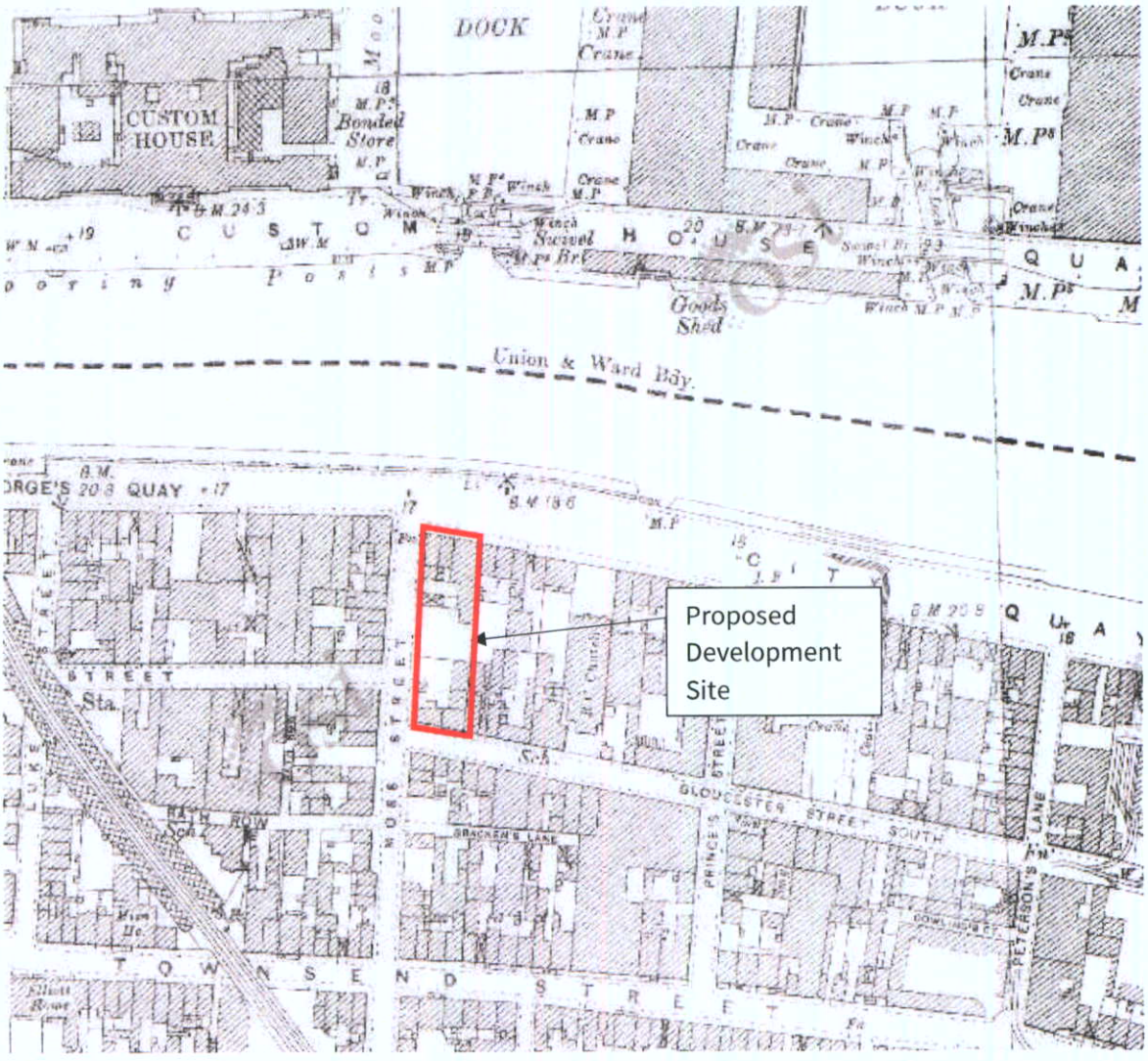

Figure 4-2: 25" OSi Map (source: www.geohive.ie)

4.1.2 Local Libraries and newspaper reports

An internet search for newspaper reports on flooding that might have occurred along George's Quay and Moss Street was undertaken. No specific accounts of flooding at the development site were found.

4.1.3 OPW Flood Database

A search of the OPW floodmaps.ie website for flood reports in the area surrounding the subject site was undertaken. The results indicated that at least three flood events have occurred as shown in Figure 4-3 overleaf. Reports on these historical flood events can be found in Appendix A and summarised below:

A. "Flooding South City, 11th June 1963", Report.

B. "DCFPP Final Report, April 2005, Tidal flood of February 2002", Report.

C. "Flood of 1 February 2002", Photos

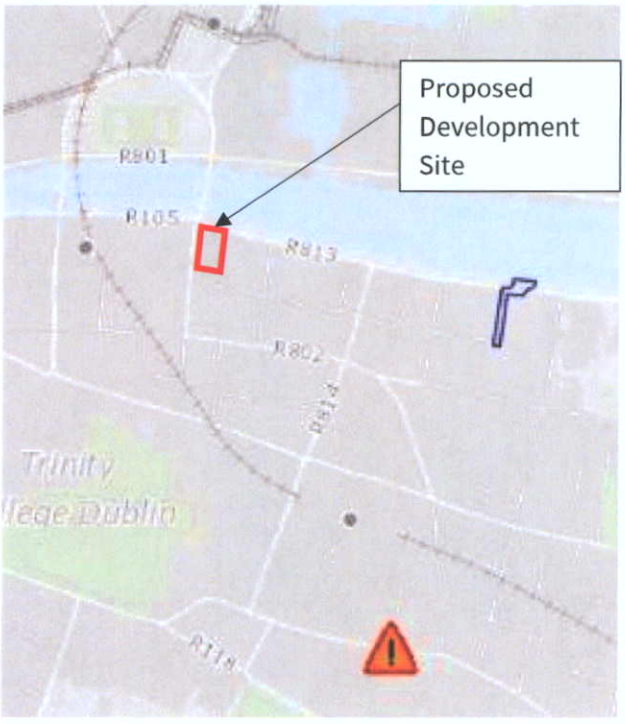

Figure 4-3: Locations of Past Flood Events (Source: www.floodinfo.ie)

4.2 Topography

A topographical survey of the proposed site was undertaken and is provided in Appendix E. The proposed site is developed on its northern portion along City Quay (2.96 to 3.06mOD) and its bordered by the City Quay National School along its western boundary. The elevation behind the old disused building varies between 3.07 to 3.20m OD and slopes from west to east. Moss street (2.95 to 3.15mOD) borders its east boundary while Gloucester Street (3.19 to 3.26mOD) south borders its southern boundary.

4.3 Geology and Groundwater

The geology in the area of the subject site was reviewed using www.gsi.ie. Geohive subsoil layer (see Figure 4-4 overleaf).

The area consists of urban (cyan) and GLs – Gravels derived from Limestones (green). The proposed development site is located in urban and consists of 65, marine basinal facies (Tobercolleen & Lucan Fms – "Calp"); Dark-grey argillaceous & cherty limestone & shale.

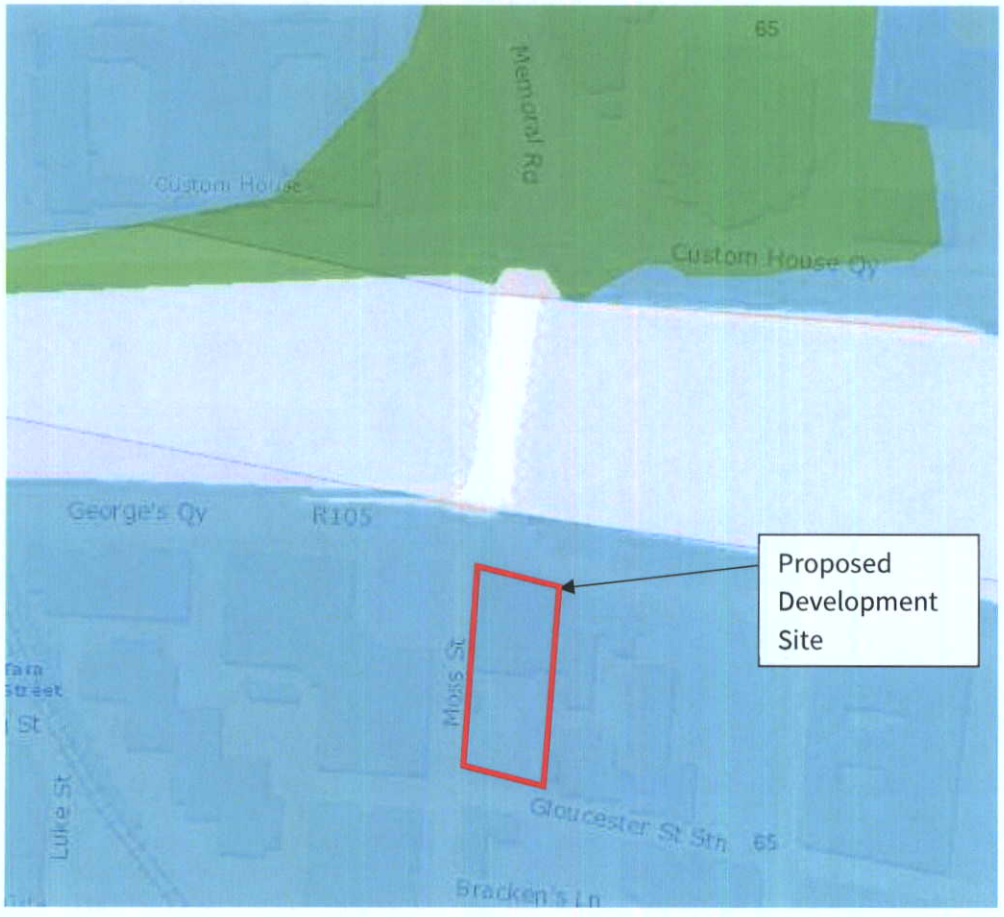

Figure 4-4: Geological Subsoil of the subject site (red outline)

The area consists of subsoil sections with low (blue and purple) levels of subsoil permeability. The subsoil at the subject site location is shown as having a low level of permeability (See Figure 4-5 below).

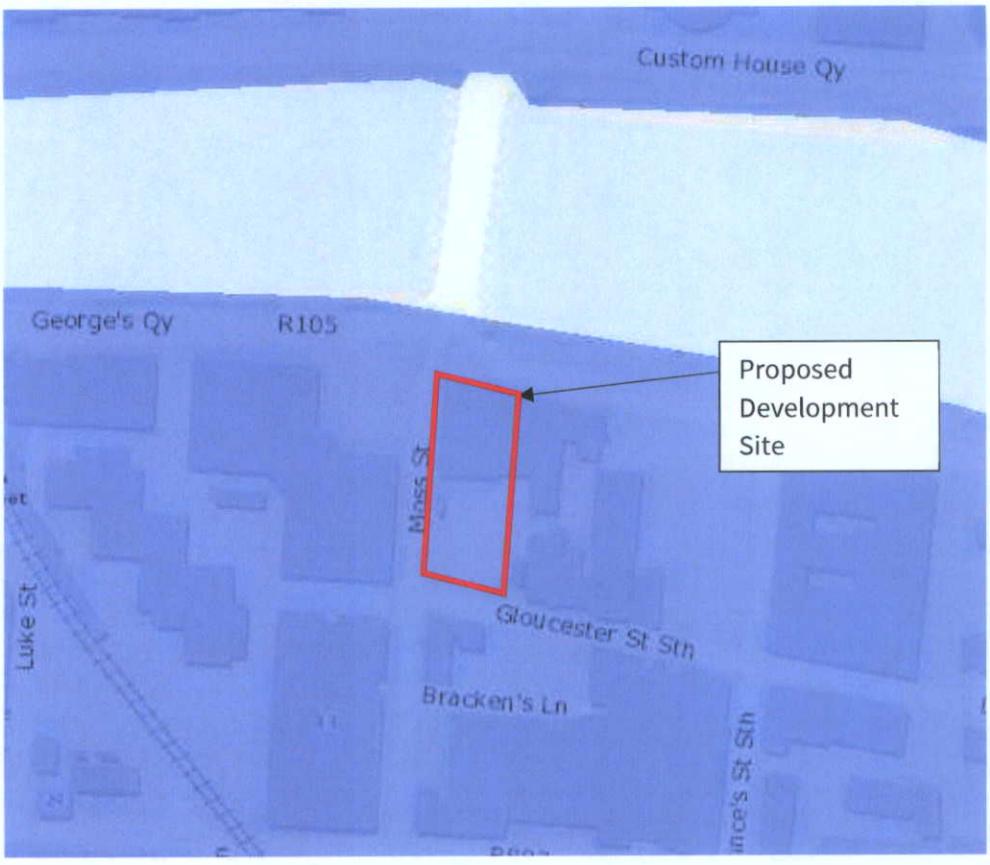

Figure 4-5: Subsoil Permeability of subject site (red outline)

Groundwater vulnerability conditions of the subject site has been classified as "Moderate" M and "Low" L, according to Geological Surveys Ireland Spatial resource website. This implies that the groundwater is not easily susceptible to an increase/ decrease in water levels, pollution and any changes in the water table. However, the site is generally flat and unlikely to suffer from an significant groundwater flooding risk at the surface.

The basement of the development will be design as a watertight structure that will exclude groundwater.

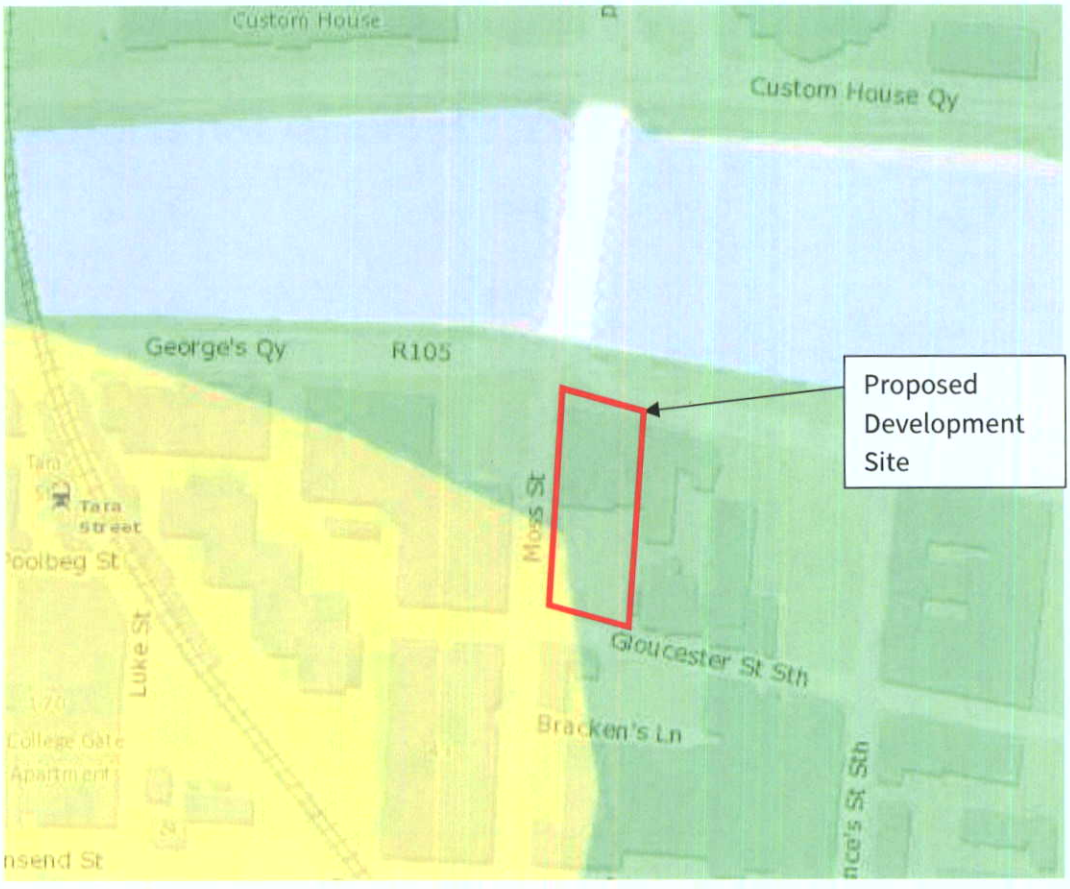

Figure 4-6: Groundwater Vulnerability - Code M and L

4.4 CFRAM Study

The Office of Public Works (OPW) and its partners, Dublin City Council have undertaken the Liffey & Dublin Bay River Basin Flood Risk Assessment and Management (FRAM) study, a catchment-based flood risk assessment and management study of the entire Liffey Catchment including its tributaries.

The fluvial current scenario flood extent maps relevant to the subject site area are shown in Appendix B. The maps show no flood extents up to the 0.1% AEP fluvial flood. This indicated that the site is in flood Zone C from the fluvial perspective.

The costal current flood extents relevant to the City Quay site are provided in Appendix B also. The flood map indicates the proposed site along City Quay to be at flood risk during a 0.5% AEP and 0.1% AEP tidal events. This indicates that parts of the proposed development site are in flood Zone A and B from a coastal perspective.

Table 4-1 overleaf shows the instream tidal flood levels for River Liffey (09LIFF00371), whilst Figure 4-7 overleaf shows an extract from mapping reference the locations of the nodes presented.

Table 4-1: Flood levels from the Liffey & Dublin Bay Catchment FRAM study

Node	River/Stream	10% AEP Flood Level (mOD)	0.5% AEP Flood Level (mOD)	0.1% AEP Flood Level (mOD)
09LIFF00230	Liffey	**2.67**	**3.12**	**3.35**

Note: Flood levels most appropriate to the proposed development.

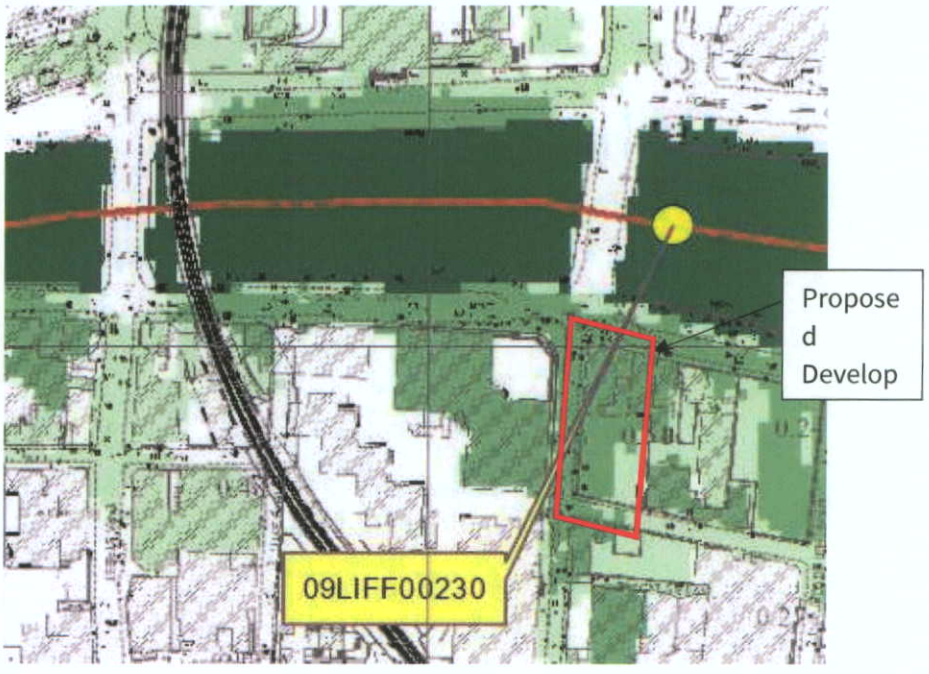

Figure 4-7: Extract from CFRAM Map No. E09LIF_EXCCD_F1_03

4.5 Local Area Plan

Flood zones were taken from Dublin City Council Development Plan, 2016-2022 and is presented in Figure 4-8. See full map in Appendix C.

The proposed development is classified as less vulnerable to flooding, its western regions lies with in Flood Zone A. The rest of the proposed development site lies in Flood Zone B and A. Development of office blocks in Flood zone A is considered appropriate provided the requirements of a Justification Test can be met.

Figure 4-8: Extract of Dublin City Development Plan Flood Zone Map, 2016-2022

4.6 Dublin Resilient City (Dublin Pluvial Study)

Dublin City Council in partnership with the Office of Public Works have developed pluvial flood risk mapping to cover at a high level (broad scale) to act as an indicator of pluvial risk in the greater Dublin City area. An extract from Map No. E09DCC_EXPCD_F0_02 is provided below indicating the potential for pluvial flood risk along Moss Steet to the west of the site.

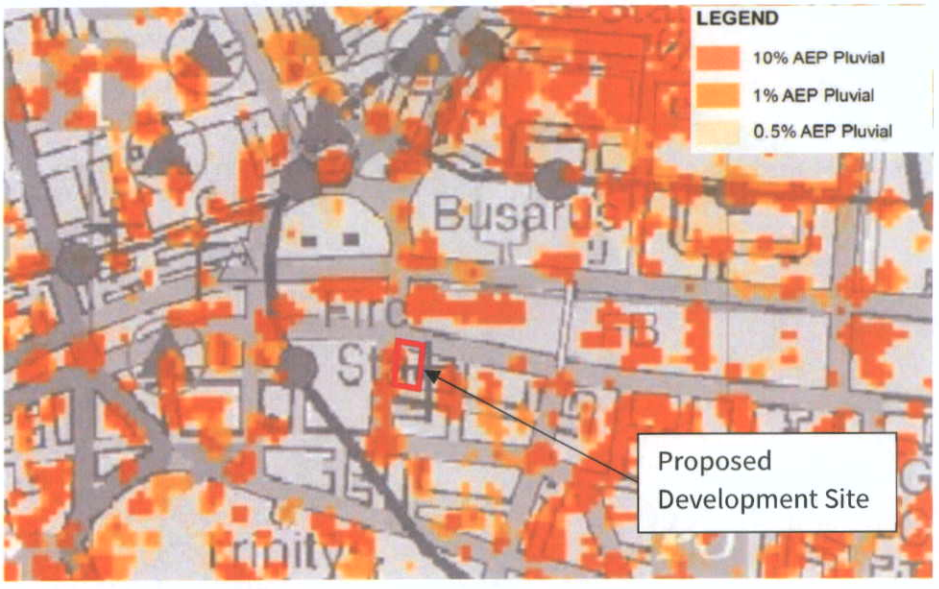

Figure 4-9: Extract of Map No. E09DCC_EXPCD_F0_02 from Dublin Pluvial Study

4.7 South Campshire Flood Protection Scheme

Dublin City Council in partnership with the Office of Public Works have developed and competed the South Campshire Flood Protection Scheme which comprises of circa 1km of riverside flood defences. City Quay area and the subject site is afforded protection by this flood relief scheme up to the 0.5% AEP flood event.

5 Stage 1 – Flood Risk Identification

5.1 Flood Risk Identification

Initial examination of the available existing data from historical flood information, topography survey, site investigation survey, geology, CFRAM maps and the Dublin City Council flood zone maps identified a potential flood risk to the scheme. Table 5-1 below lists the sources of existing data and potential flood risks identified.

Table 5-1: Stage 1 - Flood Risk Identification

Data Source	Potential for Flood Risk			
	Fluvial	Pluvial	Coastal	Groundwater
Historical data / Local Knowledge	No	No	Yes	No
Topography Survey	-	-	-	-
Desktop Geology	-	-	-	No
CFRAM/Dublin Pluvial Study	No	Yes	Yes	-
Local Area Plan	-	-	Yes	-

Based on Table 5-1, a Stage 2 – Initial Flood Risk Assessment is required to address the coastal flood mechanisms identified.

6 Stage 2 – Initial Flood Risk Assessment

6.1 Initial Coastal Risk Assessment

The costal flood risk is outlined in the Liffey & Dublin Bay Catchment Flood Risk Assessment and Management Study as outlined in Section 4.4 above. The maps indicate there is coastal flood risk throughout the proposed development site. The flood maps for the current scenario indicated that the proposed site location is at flood risk by the 0.5% AEP and 0.1%AEP flood extents. Flood zone maps taken from Dublin City Development Plan, 2016-2022 indicates Flood Zone A along the western areas of the proposed development and Flood zone B & C on the remaining areas.

The 0.5% AEP and 0.1% AEP flood event area provided within the CFRAM information and the levels from same can be utilised and combined with land register maps to further define the flood zone on the proposed development site.

Whilst overtopping and breach maps are not available, the FRM Guidelines outlined they should be based on the 0.5% and 0.1% AEP flood events respectively. It would be conservative to take the 0.5% and the 0.1% undefended levels from the CFRAM study as the peak level for breach and overtopping assessment. On this basis, no additional hydraulic modelling is needed and it is considered that a Stage 3 – Detailed Flood Risk Assessment can be conducted on the existing information in a quantitative manner.

6.2 Initial Pluvial Risk Assessment

The pluvial mapping generated for the Dublin City Pluvial Study was based on high level analysis and is not intended to indicate deveined extents of pluvial risk. The procedures used in the assessment do not take into account flood levels of the developments or the location specific time peak storm duration and associated time of concentration.

This area is positively drained however and it is considered that the pluvial risk in this area is relatively insignificant. The proposed development will include a surface water management plan and the floor area will be sited above the level present on Moss Street.

Given this information, it is considered that a Stage 3 assessment of the pluvial risk is not required and that the proposals to address surface water within the development site will be adequate to ensure the development is not at pluvial flood risk.

7 Stage 3 – Detailed Flood Risk Assessment

7.1 Proposed Flood Mitigation Measures

Based on the FRM Guidelines, the minimum finished floor level for a "less vulnerable" development should be in the 1 in 200-year tidal flood level (design event), with a suitable allowance for climate change and freeboard. Whilst climate change impacts are unknown, is is standard practice to adopt 500mm for sea level rise and to assume a 300mm freeboard value for hard defences (wall or floor raising). The desired minimum floor level is thus:

3.12 + 0.5 + 0.3 = of 3.92mOD.

This information is sufficient to determine the appropriate type of development suitable for the site and the finished floor levels for same. Based on the foregoing, a floor level for the development of ***3.92m OD*** would be desirable. However, the building must relate to the streetscape and footpath adjoining it and there are mixed establish practice in addressing this issue in proximity to the site. Some development have been constructed at street level with defences and other have raised or partially raised ground floor levels.

Less vulnerable uses such as commercial offices is appropriate below the desired 3.92m OD level, subject to assessment of and planning for the residual risk. For this development, it is proposed to provide a split level ground floor whereby the parts of the building accessible to the surrounding streets respect the existing levels, but raised areas are provide at stairwell and lift shafts to include a lobby space. The lower floor level is then built in a flood resilient manner to address residual risk.

The proposed development therefore has two ground floor levels, a lower level to match the street level and allow initial ingress into a lobby/foyer areas and a floor level of **4.00m OD**, for the key areas of the ground floor.

The proposed development has loading area (southside of the subject site) on the ground floor with a proposed floor level set at existing streetscape level. Likewise ESB substations and switch rooms are also at existing street level, along with one small lettable space and a bin storage area. Access to the car lift is also from existing street level.

Setting floor levels for the commercial units and substations at existing street level will require consideration of the residual risk of breach/overtopping of the defences and demonstrate compliance with the justification test.

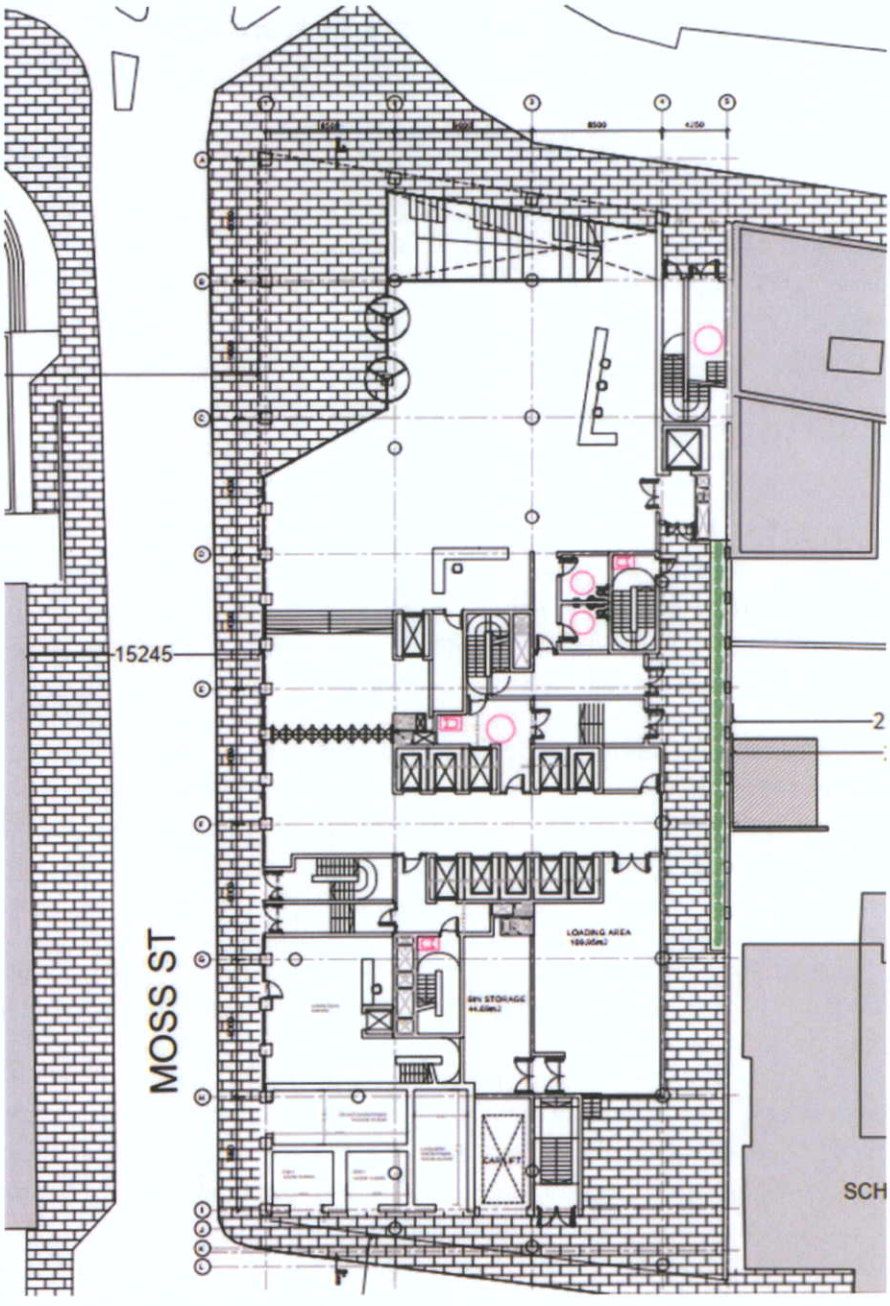

Figure 7-1: Extract of Proposed Ground Flood Layout

7.2 Breach and Overtopping Assessment

The source-pathway-receptor model of assessment is further defined in the Appendix B of the FRM Guidelines. In this, overtopping and breach analysis are recommended to assess the overall residual risk to the development. The assessment encourages the use of this analysis on a local scale.

7.2.1 Consideration of Breach

To address the residual risk, the proposed development was assessed for the 0.5% AEP event plus 500mm allowance for climate change. Peak flood levels of 3.12m OD (+0.5) was adopted. Appendix F illustrates the commercial buildings main finished floor levels are above this residual risk flood level, indicating good resilient to greater than design scenarios. Only the lobby areas is below this level, but it is proposed to provide demountable flood barrier to address this residual risk.

For the commercial properties set at 2.8-3.0m OD, the properties would be vulnerable to flooding should the existing defences be overtopped. It is therefore recommended that flood resilient construction and flood barrier at openings below 4.00m OD are incorporated into the design. These would only need to be erected for events predicted to be greater than the 10% AEP event.

Given the above residual risk measures, the development is considered to be highly resistance to flood risk.

Flood depths on the public roads adjoining the development are potentially greater than 1m in some areas, but flood depth less than 500mm are observed when accessed from the north via City Quay. In the event of an extreme emergency during the peak of the flood, such depths would be traversable, although it is acknowledged that typically depths of less than 300mm are preferred. This scenario is unavoidable.

Whilst escape for occupants is not required as the development is set above the FRM Guideline recommended levels, access from Gloucester Street would also be possible if needed. Further, the raised lobby area at the lift can be used as a staging area in the event of an emergency.

7.2.2 Consideration of Overtopping

A peak flood level of 0.1%AEP plus an allowance for climate change was adopted for overtopping assessment. The existing flood defences along River Liffey are overtopped at various stages, and peak water levels in the vicinity of the proposed development reach 3.85mOD (3.35+0.5). At such water levels, the lower floor levels would be at risk of flooding, but the upper raised areas would remain above flood level due to the freeboard provided. This scenario is an extreme scenario and again demonstrates that the development is well protected against flood risk.

7.2.3 Summary of Residual Risk Assessment

A site assessment, assuming the measures (ground raising and demountable defences) discussed in Section 7.1 above is outlined below.

Source	Pathway	Receptor	Likelihood	Consequence	Risk
Coastal	Breach – 0.5% AEP + CC	People –Occupants	Unlikely –two flood mitigation plans in place.	People – Low	Low
		Property- Commercial Building		Commercial Building – Medium	Low
		Property – Transport vehicles (Cars, Bikes, Motorcycles etc.)		Vehicles - None	Low
Coastal	Overtopping 0.1% AEP + CC	People – Occupants	Unlikely - two flood mitigation plans in place.	People – Low	Low
		Property- Commercial Buildings		Building – Medium	Low
		Property – Transport vehicles (Cars, Bikes, Motorcycles etc.)		Vehicles - Low	Low

In summary, the development is considered to have a very high standard of protection. The residual risk to the development for greater than design standard risk is considered acceptable. The combination of event that would lead to a significant flooding of the building is of a magnitude that is considered extremely unlikely.

7.3 Residual Risk & Mitigation Measures

The following residual risks and proposed measures to reduce the residual risk are to be incorporated:

- Users of the building should be made aware that the building is in a Flood Zone and that the raised lobby areas inside the building provide refuge during a flood to a very high standard of protection (0.5% AEP event plus freeboard plus climate change).
- The Flood Risk Management Plan for the property should be developed:
    - Commercial property occupants should receive a copy of the Flood Management Plan.
    - The plan should be updated to include any lessons learned if a flood event occurs or to address future climate change.

- The commercial development below the 0.1% AEP level should be considered and designed in the knowledge that it may become at risk of flooding, if the existing defence fails – Flood resilient construction to 4m OD shall be provided including demountable flood barriers to the car lift, ESB substations commercial areas on ground floor and various access points.
- Dublin City Council Code of Practice for Flood Resilience and Resistant Developments shall be followed.

7.4 Emergency Access and Egress

Emergency services have access to the site via Gloucester Street or Moss Street where flooding for the 0.5% AEP event is anticipated to vary between 0m to a maximum of 500mm just south of the proposed public access. Emergency services vehicles are generally considered capable of traversing through floods less than 300mm with ease. Fire tenders often deal with even deeper floods and access through 500mm should be possible if needed.

Importantly, the development includes for areas above the design standard flood level that can be used as staging areas in the event of an emergency during the peak of the flood event.

8 Justification Test

8.1 Requirements for Justification Test

As per the sequential approach outlined in Figure 3.2 of the FRM Guidelines a justification test is required where highly vulnerable development is proposed in Flood Zone A or B. A justification test is therefore required.

8.2 Justification Test

No.	Justification Test
1	***'The subject lands have been zoned or otherwise designated for the particular use of form of development in an operative development plan, which has been adopted or varied taking account of these Guidelines'.***
Response	The site is appropriately zoned for the proposed development. Further details may be found in the Planning Report.
2.	***'The proposal has been subject to an appropriate flood risk assessment that demonstrates':***
i.	***'The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk'.***
Response	The proposed development has been subjected to a flood risk assessment. The assessment demonstrates and concludes that the development will be protected by raising the finish floor level from the existing streetscape inside the building to be above the levels outlined in the FRM Guidelines. As the development comprises the redevelopment of an already developed site, there is no change in flood risk elsewhere or on the site.
ii.	***'The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;***
Response	The proposed development is situated in an urban area which is predominately commercial in nature. The proposal ensures that the 'less vulnerable' development has a minimum floor level of 4.0m OD, which is above the 0.5% AEP flood event with an allowance for climate change and freeboard. The chosen floor level exceeds the requirements of the FRM Guidelines. These measures considerably reduce the risk to people, the property, the economy without any negative impact on the environment to a very high standard. The risk to the occupants is therefore considered very low . The lower 'less vulnerable' development (commercial development) include measure to mitigate the residual risk of overtopping or breach of the existing flood defences. The

	commercial units will be designed to be resilient to flooding included appropriate wall and floor construction and inclusion of demountable barriers at building openings.
iii.	***'The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access;***
Response	The development includes multiple measure to avoid flood risk and the residual flood risk above the standard of design such that the level of risk is acceptable. It will also benefit from the South Campshire Flood Protection Scheme. The developers are aware the risk posed by climate change and the potential need to adapt the level of defence in response to sea level rise for example. A reasonable allowance for climate change has been built into the proposed defence. Section 7 outlined that reasonable access and staging areas for emergency services is being provided as part of the development.
iv.	***'The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.'***
Response	The proposed development is in accordance with the planning objectives and also in accordance with the Planning System and Flood Risk Management Guidelines and has been detailed specific to respect the existing streetscape and urban fabric in the immediate surroundings.

9 Conclusion

A Flood Risk Assessment has been undertaken for the subject site and proposed development at City Quay, Dublin. The proposed development involves the construction of multi-storey commercial development.

The subject site lies within Flood Zones A, B and C.

The development of a commercial complex is classified as a less vulnerable development under the FRM Guidelines.

The less vulnerable development adopts the precautionary approach to setting of finished floor levels as noted in Section 5.16 of the FRM Guidelines and is robust to breach, overtopping and climate change scenarios. Commercial development is proposed to be sited above the 0.5% AEP coastal flood level with allowance for climate change and freeboard (**at 4.0mOD**), with other less vulnerable uses at existing streetscape level to ensure continuity within the streetscape, but protected with demountable barriers to address the food risk.

The proposed development will not impact of flood extent, depth, risk or flood routes elsewhere.

Whilst there will be reliance on existing defences of the South Campshire Flood Protection Scheme to protect the development, the development has measures in place that will, on their own, protect the development to the require design standard in the FRM Guidelines.

Ancillary building facilities, such as heating, back-up power and sprinkler systems will be protected from flooding.

Mitigation measures to reduce residual risk of flooding for greater than design event and or breach/overtopping are suggested in Chapter 7 of this report. The residual risk of flooding has been adequately addressed.

A justification test for the proposed development has been undertaken which demonstrates the appropriateness of the development and how it meets the requirements of The Planning System and Flood Risk Management, Guidelines for Planning Authorities (2009), local zoning objective whist respecting the local streetscape and urban fabric.

Appendix A – Historical Flood Reports

Appendix B – CFRAM Flood Extents Map

Appendix C – Dublin City: City Quay Flood Zoning Map

Appendix D – Dublin City: City Quay Land Use Zoning Map

Appendix E – Topographical Survey Information

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Appendix F – Proposed Development Layout

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CHAPTER 9

AIR QUALITY

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9.0 AIR QUALITY

9.1 INTRODUCTION

This chapter assesses the likely air quality and climate impacts associated with the proposed development at 1-4 City Quay, Dublin 2 D02KT32, 23-25 Moss Street, Dublin 2 D02 F854 and 5 City Quay, Dublin 2 D02PC03. A full description of the development can be found in Chapter 2.

9.2 METHODOLOGY

This chapter has been prepared having regard to the following guidelines:

- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017)
- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2022)
- Advice Note on Preparing Environmental Impact Statements – Draft (EPA, 2015)
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (European Commission, 2013)
- Guidance on the Assessment of Dust from Demolition and Construction Version 1.1 (Institute of Air Quality Management (IAQM), 2014)
- UK Design Manual for Roads and Bridges (DMRB), Volume 11, Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 LA 105 Air quality (UK Highways Agency, 2019a)
- UK Design Manual for Roads and Bridges (DMRB) Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 14 LA 114 Climate (UK Highways Agency, 2019b)

9.2.1 Criteria for Rating of Impacts

9.2.1.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set.

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2011, which incorporate EU Directive 2008/50/EC, which has set limit values for a number of pollutants including NO_2, SO_2, carbon monoxide, benzene, lead, PM_{10} and $PM_{2.5}$. The limit values for NO_2, PM_{10} and $PM_{2.5}$, are relevant to this assessment as these pollutants are likely released from site activities during the construction and operational phases (see Table 9.1). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions.

Table 9.1 *Ambient Air Quality Standards Regulations*

Pollutant	Regulation [Note 1]	Limit Type	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	200 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
		Critical level for protection of vegetation	30 µg/m^3 NO + NO_2
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	50 µg/m^3
		Annual limit for protection of human health	40 µg/m^3
Particulate Matter (as $PM_{2.5}$)	2008/50/EC	Annual limit for protection of human health	25 µg/m^3

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

9.2.1.2 Dust Deposition Guidelines

The concern from a health perspective is focussed on particles of dust which are less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$) and the EU ambient air quality standards outlined in Table 9.1 have set ambient air quality limit values for PM_{10} and $PM_{2.5}$.

With regards to larger dust particles that can give rise to nuisance dust, there are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been stipulated for nuisance dust in respect of this development.

With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible emission level for dust deposition of 350 mg/(m^2*day) averaged over a one year period at any receptors outside the site boundary. Recommendations from the Department of the Environment, Heritage & Local Government (DEHLG, 2004) apply the Bergerhoff limit of 350 mg/(m^2*day) to the site boundary of quarries. This limit value can also be implemented with regard to dust impacts from construction of the proposed development.

9.2.1.3 Climate Agreements

Ireland is party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. The Paris Agreement, which entered into force in 2016, is an important milestone in terms of international climate change agreements and includes an aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to GHG emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made in the Paris Agreement on elevating adaption onto the same level as action to cut and curb emissions.

In order to meet the commitments under the Paris Agreement, the EU enacted *Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No. 525/2013* (the Regulation). The Regulation aims to deliver, collectively by the EU in the most cost-effective manner possible, reductions in GHG emissions from the Emission Trading Scheme (ETS) and non-ETS sectors amounting to 43% and 30%, respectively, by 2030 compared to 2005. Ireland's obligation under the Regulation is a 30% reduction in non-ETS greenhouse gas emissions by 2030 relative to its 2005 levels.

In 2015, the Climate Action and Low Carbon Development Act 2015 (No. 46 of 2015) (Government of Ireland, 2015) was enacted (the Act). The purpose of the Act was to enable Ireland '*to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050*' (3.(1) of No. 46 of 2015). This is referred to in the Act as the '*national transition objective*'. The Act made provision for, *inter alia*, a national adaptation framework. In addition, the Act provided for the establishment of the Climate Change Advisory Council with the function to advise and make recommendations on the preparation of the national mitigation and adaptation plans and compliance with existing climate obligations.

The first Climate Action Plan (CAP) was published by the Irish Government in June 2019 (Government of Ireland, 2019a). The Climate Action Plan 2019 outlined the current status across key sectors including Electricity, Transport, Built Environment, Industry and Agriculture and outlined the various broadscale measures required for each sector to achieve ambitious decarbonisation targets. The 2019 CAP also detailed the required governance arrangements for implementation including carbon-proofing of policies, establishment of carbon budgets, a strengthened Climate Change Advisory Council and greater accountability to the Oireachtas. The Government published the second Climate Action Plan in November 2021 (Government of Ireland, 2021a). The plan contains similar elements as the 2019 CAP and aims to set out how Ireland can reduce our greenhouse gas emissions by 51% by 2030 (compared to 2018 levels) which is in line with the EU ambitions, and a longer-term goal of to achieving net-zero emissions no later than 2050. The 2021 CAP outlines that emissions from the Built Environment sector must be reduced to 4 – 5 $MtCO_2e$ by 2030 in order to meet our climate targets. This will require further measures in addition to those committed to in the 2019 CAP. This will include phasing out the use of fossil fuels for the space and water heating of buildings, improving the fabric and energy of our buildings, and promoting the use of lower carbon alternatives in construction.

Following on from Ireland declaring a climate and biodiversity emergency in May 2019 and the European Parliament approving a resolution declaring a climate and environment emergency in Europe in November 2019, the Government approved the publication of the General Scheme for the Climate Action (Amendment) Bill 2019 in December 2019 (Government of Ireland 2019b) followed by the publication of the Climate Action and Low Carbon Development (Amendment) Act 2021 (No. 32 of 2021) (hereafter referred to as the 2021 Climate Act) in July 2021 (Government of Ireland, 2021b). The 2021 Climate Act was prepared for the purposes of giving statutory effect to the core objectives stated within the CAP.

The purpose of the 2021 Climate Act is to provide for the approval of plans '*for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by no later than the end of the year 2050*'. The 2021 Climate Act will also '*provide for carbon budgets and a decarbonisation target range for certain sectors of the economy*'. The 2021 Climate Act defines the carbon budget as '*the total amount*