Northern Ireland Sanitary Survey Review

Belfast Lough
Sanitary Survey Review
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1.1	05/09/2017	54,57	Corrected longitude for RMP4
2.0	24/11/2022	iii, 15, Appendix 2, Appendix 3, and Appendix 4	Redact geographic coordinates and specific information relating to the addresses of discharges at request of FSANI and NIW
2.1	08/12/2022	Appendix 6, Table 2	Redact geographic coordinates of WWTWs

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Review Specification and Introduction

Sanitary surveys are used to demonstrate compliance with the requirements stated in Annex II (Chapter II Paragraph 6) of Regulation (EC) 854/2004, whereby if the competent authority decides in principle to classify a production or relay area it must:

- make an inventory of pollution sources of human/animal origin likely to be a contamination source for the production areas;
- examine the quantities of organic pollutants which are released during the different periods of the year, according to the seasonal variations of both human and animal populations in the catchment area, rainfall readings, wastewater treatment, etc.;
- determine the characteristics of the circulation of pollutants by virtue of current patterns, bathymetry and the tidal regime in the production area;
- establish a sampling programme of bivalve molluscs in the production area, which is based on the examination of established data, and with a number of samples, a geographical distribution of the sampling points and a sampling frequency, which must ensure that the results of the analysis are as representative as possible for the area considered.

The EURL Good Practice Guide (GPG) for the monitoring of bivalve molluscs harvesting areas recommends the re-evaluation of sanitary surveys every six years. Location, extent and nature of fisheries and faecal pollution sources may change over time and the review is conducted to determine whether the sampling plan and/or production area boundaries remain appropriate and protective of public health.

As specified by FSA in NI, this review is comprised of a brief desktop search of publicly available information together with a shoreline survey. In general, no additional requests are submitted to external bodies. However, an exception was made with respect to information on sewage discharges this review for Belfast Lough: data requests were submitted to both the Northern Ireland Environment Agency and Northern Ireland Water.

The review is intended to identify significant changes in:

- Historic microbiological data.
- Sewage treatment and sewerage infrastructure.
- Housing and development.
- Harvester operations.

The output of the review is a report identifying any new information that has been obtained and/or whether major elements of the original sanitary survey can be regarded as essentially unchanged. That report includes an overall assessment as to whether the production area/classification zone boundaries and/or RMPs should be modified from those recommended in the original report and if so, a description of the revised boundaries and a revised sampling plan with the boundaries and RMP(s) locations.

In 2008, a sanitary survey was conducted for Belfast Lough to identify the location, extent and nature of the shellfishery and the potential sources of faecal contamination to the shellfishery, and to recommend boundaries and sampling plans for the production areas.

The resulting sanitary survey report included a recommended sampling plan for the fishery. This is listed in the following page alongside the sampling plan recommended following findings from this review.

The present report constitutes a review, primarily of publicly available information, in order to assess changes that have occurred since the 2008 sanitary survey report (see the Review Specification section for further detail). It is not intended to present detailed information relating to pollution sources that were identified in the previous report. This review should be read in conjunction with the 2008 sanitary survey report.

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1. Area Description and Fishery

Belfast Lough is a large sea lough on the northeast coast of Northern Ireland. The lough covers a total area of 130 km^2 with a maximum depth of 23 m, and is divided into Inner and Outer Belfast Lough for the purposes of the Urban Waste Water Treatment Directive (UWWTD) (NIEA, 2011). The River Lagan flows through the City of Belfast and into the head of the lough. The location of Belfast Lough is shown in Figure 1.1.

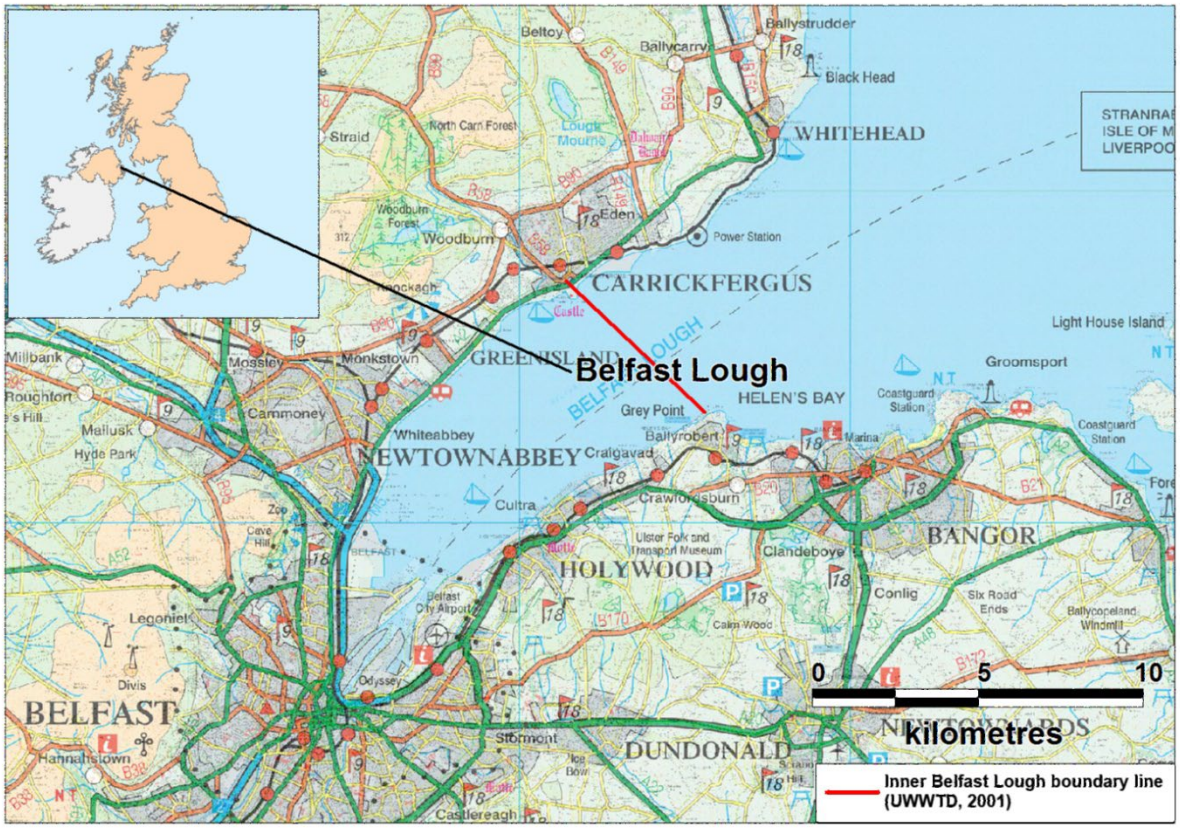


Figure 1.1 Location of Belfast Lough

The bivalve shellfisheries in Belfast Lough currently consist of bottom culture mussel operations that are licensed by the Department of Agriculture and Rural Development (DARD). The boundaries for the licensed farms are confined to the area below mean low water. The shoreline survey identified the presence of large quantities of mussels in the intertidal area.

In the 2008 report, 13 bottom culture mussel farms were classified out of a total of 25 licensed sites. In 2014, 14 mussel farms were classified in Belfast Lough, which are listed in Table 1.1 and displayed in Figure 1.2.

Table 1.1 Shellfisheries classified in 2014, Belfast Lough

Zone	RMP	FSA Site Name[1]	DARD Site Name (Code)	DARD Code No.	Species
Lower Inner	RMP1	Middle Bank	S Middle Bank	B1	Common mussels (*Mytilus edulis*)
Inner	RMP2	Gallagher	Jordanstown	B7	
		McLaughlin	North Shore	B10	
		Ross' Rock	Newtownabbey	B6	
		The Moorings	Jordanstown	B11	
Inner	RMP3	Dougold	Jordanstown	B3	
		Whitehouse Roads	Whitehouse Roads	B2	
		C. Fresh	Whitehouse Roads	B4	
		Steele	W of Oyster Bank	B5	
		Henning	Jordanstown	B8	
Middle	RMP4	Urey	Jordanstown	B12	
		Folly Roads	Folly Roads	B14	
Outer	RMP5	Dougold Carrickfergus	Thompsons Point	B20	
Holywood South	RMP6	Holywood South	Cultra	B24	

[1]As the 2014 Classified Harvesting Area list

Since the 2008 sanitary survey report, two sites have been declassified (Navital North and Navital South) and three new sites have been classified (Folly Roads, Holywood South and Whitehouse Roads).

Throughout this report, the FSA site name will be used when referring to specific beds. All mussel sites lie within Inner Belfast Lough. All except Holywood South also lie within the previously designated Shellfish Waters Directive (SWD) Belfast Lough designated Shellfish Water boundary. The previously designated area continues to be afforded equivalent protection under the Water Framework Directive (WFD): i.e., Holywood South still lies outside of that designated area.

Current RMPs and their locations identified by FSANI are listed in Table 1.2 and displayed in Figure 1.2. Current locations of RMPs 1-5 remain the same as those recommended in the 2008 report. The species classified under RMP 1 has changed from cockles to mussels, whilst numbering conventions have changed for RMPs 2 and 3 since the 2008 report (See Table 1.2). Holywood South (RMP 6) was classified in 2009.

Table 1.2 RMPs with the 2008 and current naming conventions and locations in Belfast Lough

RMP Name	2008 RMP No.	2014 RMP No.	Latitude (degrees)	Longitude (degrees)	Irish Grid Reference
Middlebank	RMP 1	RMP1	54.6446	-5.8809	J 36782 79453
Ross's Rock	RMP 3	RMP 2	54.6669	-5.8934	J 35901 81911
Dougold	RMP 2	RMP 3	54.6625	-5.8819	J 36658 81443
Urey	RMP 4	RMP 4	54.6765	-5.8593	J 38068 83045
Dougold Carrick	RMP 5	RMP 5	54.7038	-5.8274	J 40031 86147
Holywood South	-	RMP 6	54.6658	-5.8007	J 41884 81972

-Not applicable (area classified since 2008)

The boundaries of the present classification zones are based on boxes used by AFBI for modelling purposes (termed E2K boxes in the sanitary survey report). The licensed and classified sites within Inner Belfast Lough are all subtidal and harvested by dredging. No observations relating to the boundaries of the mussel farms were made during either the 2008 or 2013 shoreline surveys, owing to the bottom culture production method. During the 2013 shoreline survey, large native mussel beds were noted along much of the northern and southern shoreline and two members of the public were observed harvesting shore mussels along the north shore.

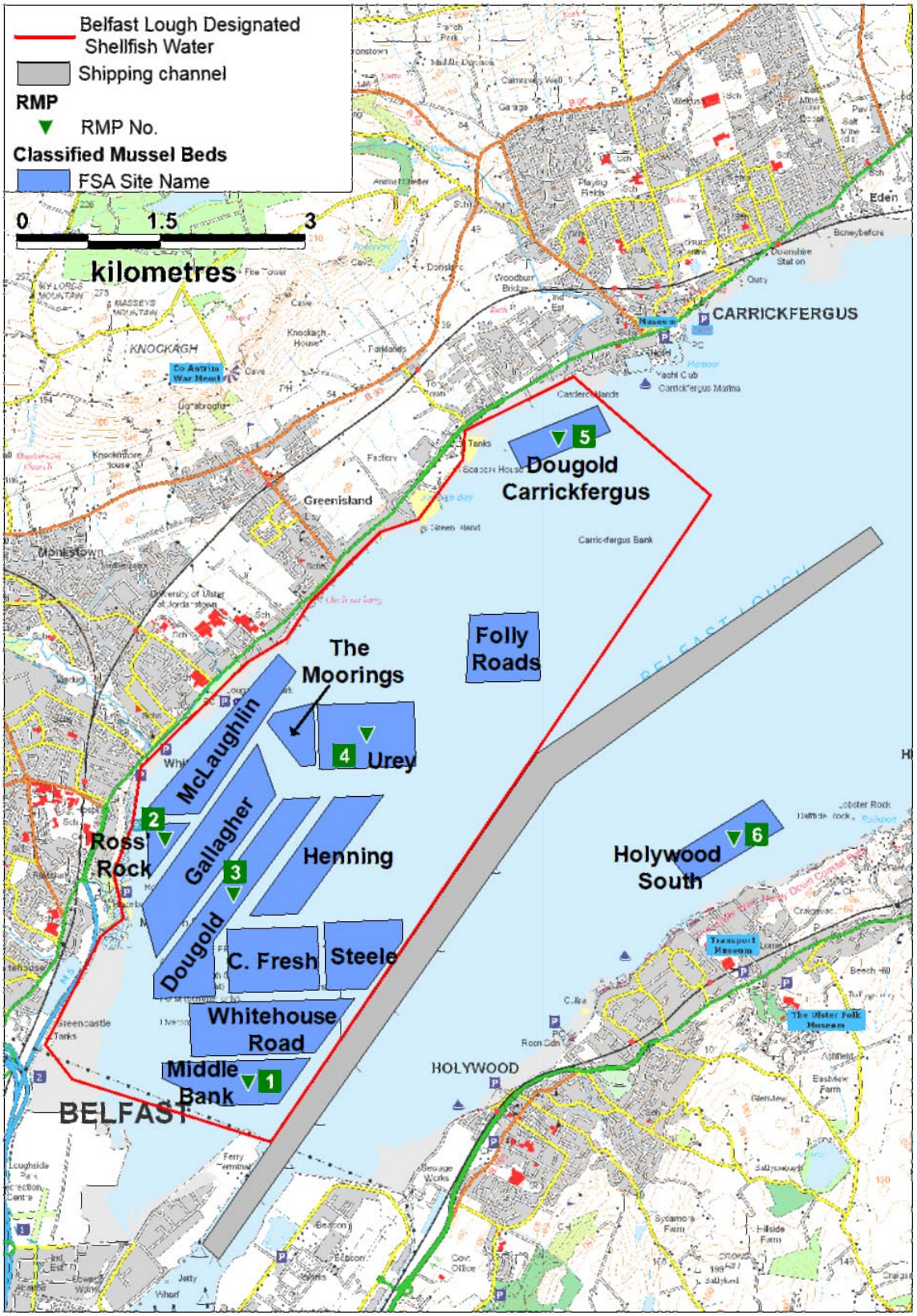


Figure 1.2 Currently classified mussel sites, RMPs and the Designated Shellfish Water boundary

2. Population and Human Sewage Impacts

2.1 Population

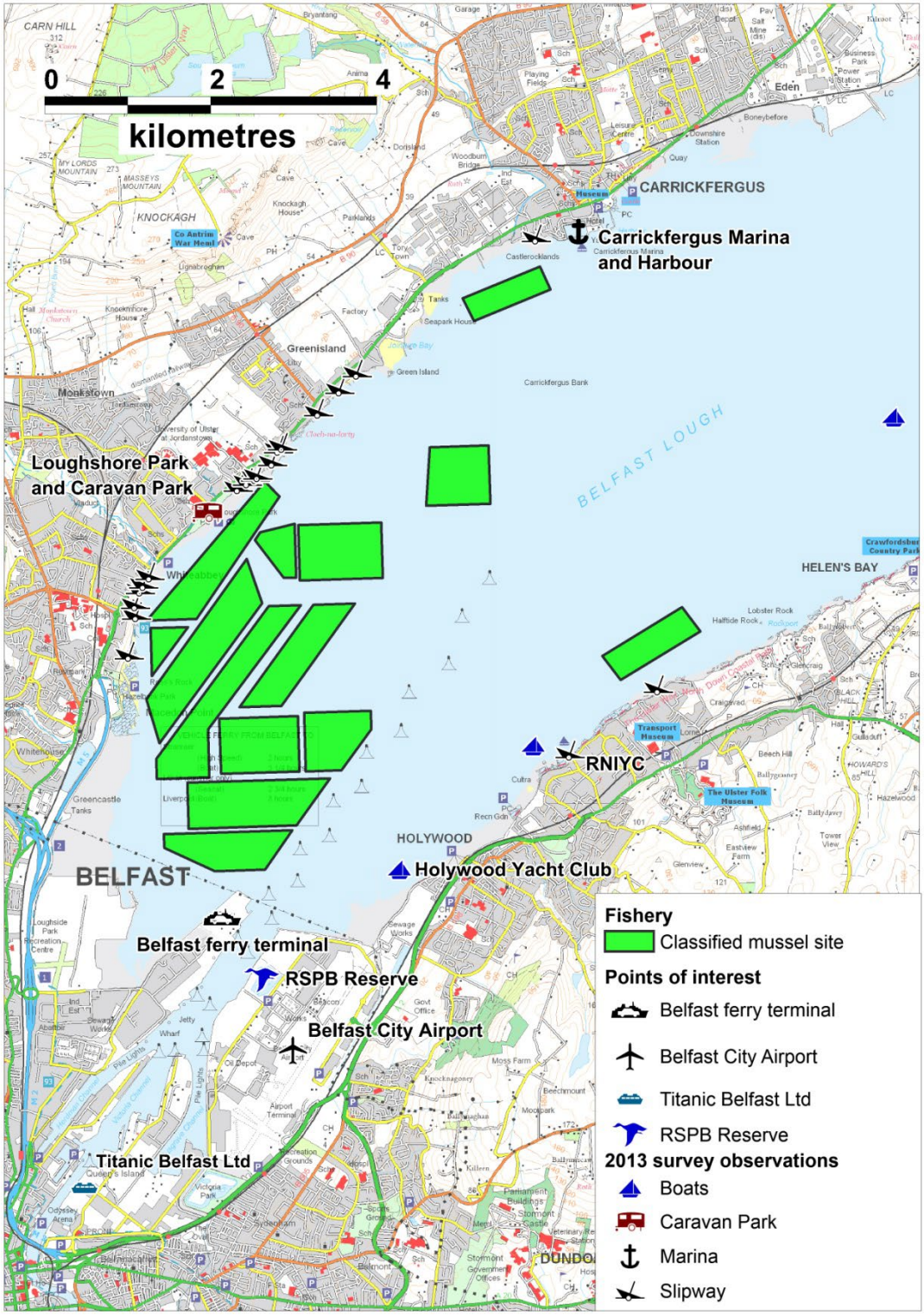


Figure 2.1 Human population associated 2013 shoreline survey observations and points of interest around Belfast Lough

The 2008 report identified that the land immediately adjacent to Inner Belfast Lough was urban. The lough was also noted to lie within two counties; County Antrim and County Down. Population was centred on Belfast (the capital city of NI) located at the head of the lough, with approximately one third of NI population residing in the Belfast area. Other towns were also present along the north (Newtownabbey and Carrickfergus) and south (Holywood and Bangor) shores. Marinas were identified at Belfast, Carrickfergus and Bangor and the lough was reported as being popular with yachtsmen. Moorings were observed off Holywood, Newtownabbey, Whitenhead and Ballyholme, though no further observations on the sizes or numbers of boats present were reported.

Population figures according to the 2001 and 2011 censuses were obtained for the four boroughs immediately adjacent to Belfast Lough and are listed in Table 2.1.

Table 2.1 Population Census data from 2001 and 2011, for the four boroughs around Belfast Lough

Borough	2001 population	2011 population
Belfast	277,391	280,962
Newtownabbey	79,995	85,139
North Down	76,323	78,937
Carrickfergus	37,659	39,114
Total	**471,368**	**484,152**

The total population residing in the four boroughs around Belfast Lough increased by 2.7% between 2001 and 2011. The population density in 2010 was shown to be highest in Belfast borough (Office for National Statistics, 2012).

Since the 2008 report, a large number of planning applications have been submitted to the Department of Environment Northern Ireland for the areas around Belfast Lough. These were downloaded from the planning portal (Department of the Environment Northern Ireland, 2014) in January 2013, and their distribution was viewed through Geopii (Geopii, 2014). The majority of applications were for housing modifications such as extensions and for new industrial units/premises, predominantly within the Belfast area. There were also a large number of applications for new houses on both the north and south shores, all of which included proposals to connect wastewater to mains sewerage.

Planning applications also included an extension of the Jordanstown Loughshore Caravan Park, Newtownabbey, and replacement of the associated amenity block in 2010; a large number of applications for accommodation, restaurants and shops in the Belfast Harbour area; and upgrades to the pedestrian coastal pathway between Holywood and Helen's Bay on the south shore. The applications that did not mention connection to the public sewerage system did not mention discharge to the environment and so it is assumed that sewerage connection will have been intended.

The applications therefore reflect the increase in population and changes in use of areas rather than additional point sources of pollution.

Upgrades are also planned at Belfast Lough Royal Society for the Protection of Birds (RSPB) reserve located adjacent to the City Airport at the head of the lough, which at present operates an observation viewpoint that receives an estimated 150,000 visitors per year (RSPB, 2014). The visitor centre is closed until September 2014 whilst a larger visitor centre is being built. It is anticipated that visitor numbers will increase upon reopening due to the planned improvements to access. No information was provided on sewage management.

Over the past ten years there has been vast investment, rejuvenation and development in the Titanic Quarter, located in and around Belfast Harbour. The focus of this 30+ year project has been Belfast Titanic Ltd., which opened in 2012 and attracted over 800,000 visitors in its first year of opening (Belfast Harbour, 2012). The area also offers an important business and events park, with many of the planning applications since 2008 relating to restaurants and retail premises within this area. Overall, the Titanic Quarter aims to provide homes and employment for 50,000 people (Titanic-Quarter, 2014).

Belfast Harbour represents the main gateway to Northern Ireland and as such operates a very busy port, receiving daily trade and passenger freight from across the world. In 2012 alone, freight vehicles on the Stena Line ferry increased 21% (Belfast Harbour, 2012). This increase was suggested to reflect improvements to the ferry terminal and the introduction of the new superfast Stena Line crossings (Belfast Harbour, 2012). Cruise ships also regularly dock in Belfast, and in 2014 are expected to bring 110,000 visitors to the Belfast area (Belfast Harbour, 2014a).

Belfast City Airport (George Best Airport) is located at the head of Belfast Lough. During the 2013 survey a large number of flights were observed arriving and departing from the airport. According to Civil Aviation Authority (CAA) 2012 statistics, Belfast City Airport received 2,232,913 passengers (Civil Aviation Authority, 2012). Belfast International Airport also lies approximately 10 km west of Belfast Lough and was reported to receive 3,947,716 passengers in 2012.

The Harbour, City Airport and International Airport (located to the west of the city) all provide gateways for significant numbers of visitors to the city. Belfast City Council (2013) identified that there were 7.59 million visitors in 2012. These will obviously contribute a significant additional loading to the sewerage network in the area. No seasonal information was given for Belfast but general figures for Northern Ireland indicate that visitor numbers are highest in the second and third quarters (NISRA, 2013).

The current pleasure boat berthing area in the Belfast Titanic Quarter comprises of a 40 berth facility at Abercorn Basin. This was installed in 2009, but there are future

plans to replace the facility with a new 200 berth marina (Belfast Harbour, 2014b). The operating rules for leisure craft state: “No discharge of noxious substances, refuse or sewage into Harbour”. It is not known what mechanisms are in place for enforcement of this rule.

During the 2013 shoreline survey, no observations were made in the vicinity of the harbour owing to health and safety issues. However, large trade and passenger freighters were seen on both survey days entering into and leaving Belfast Harbour during mid to high tides.

Carrickfergus Marina holds 280 berths for mostly private boats and yachts (Irish Cruising Club, 2008). Carrickfergus harbour lies to the east side of the marina. During the 2013 survey, approximately 200 leisure boats were observed at the marina, with a further 35 fishing/leisure vessels moored within the harbour, where there were also two slipways.

During the 2013 shoreline survey, 11 boats were moored offshore adjacent to Holywood Yacht Club, with one boat also observed just east of Helen’s Bay. A jetty and two slipways (one in disrepair) were also noted at the Royal Northern Ireland Yacht Club. A total of 18 private slipways were also observed along the shoreline of Belfast Lough, 17 of which were located on the north shore between Whitehouse and Carrickfergus and one noted on the south shore.

There is therefore significant potential for leisure craft traffic in Belfast Lough and there is usually more potential for discharge of sewage from such craft than from large vessels that operate under strict requirements with regard to holding, treatment and discharge of sewage.

Conclusions

Overall, the area surrounding Belfast Lough is largely urban, with the densest population lying in Belfast City at the head of the lough. The population has increased since the 2008 sanitary survey report. The area receives a large number of visitors a year which will add significantly to the overall number of people present throughout the year, but especially during the main tourist season. This will have an effect on the load going to sewers. The resident population has only shown a relatively small increase over the ten years between censuses. There is a significant amount of leisure boating activity around the area.

2.2 Sewage Discharges

The 2008 sanitary survey report contained a map of principal sewage discharges to saline waters in Figure 11 and a map of the discharge-related observations from the shoreline survey in Figure 17. The details relating to the discharges displayed in the former map were not available to Cefas and so a request for information on sewage discharges in the vicinity of Belfast Lough was submitted to both Northern Ireland Environment Agency (NIEA) and Northern Ireland Water (NIW).

Public sewage discharges

The discharge information provided in the previous sanitary survey in 2008 has been compared to more recent additional data supplied by NI water and NIEA (Table 2.2). Some assets detailed in the original AFBI sanitary survey have been discounted from further analysis in this review in the light of new information from NIW/NIEA which revealed that these assets do not discharge to inner Belfast Lough. Due to the large number of discharges potentially affecting the shellfish beds located in the inner Belfast Lough, those discharging to the outer Belfast Lough have been excluded from Table 2.2 and further analysis as they will have a lesser effect on the shellfisheries. The current principal sewage discharges to inner Belfast Lough and the River Lagan catchment, discharging from NI Water and Private Finance Initiative (PFI) public assets are discussed below.

NIW identified that Greenisland, Kinnegar and Seahill Waste Water Treatment Works (WWTW) discharges currently receive secondary treatment. Carrickfergus and Belfast WWTW discharges are issued consents by NIEA to discharge tertiary treated effluent; however the tertiary treatment at both these works is designed to reduce the total nitrogen content and not the microbial content of the effluent.

The discharge identified as Newtownabbey WWTW in the sanitary survey report did not appear under that name in the data sets supplied by NIW and NIEA. However, the mapped location in the sanitary survey report coincided with the location given for Whitehouse WWTW (also recorded during the 2013 shoreline survey), and it is therefore assumed that these represent the same WWTW. The name Whitehouse WWTW has been used in this review. The discharge is secondary treated.

Drumbeg, Dunmurry, Edenderry Belfast and Newtownbreda WWTWs are all located within the River Lagan catchment, which eventually discharges to Belfast Lough. All of these except Drumbeg are tertiary treated. The River Lagan will therefore constitute a significant source of sewage input to the head of the lough.

Other NIW public continuous discharges (septic tanks) have not been included in the list of principal continuous discharges in Table 2.2 as they have comparatively very low population equivalents (PE), however they are shown on the map of NIW discharges (Figure 2.2) and included as a table in the appendices (Appendix 1).

These septic tanks are few in number, generally situated away from the coast and due to their relatively low PEs are not considered to be principal discharges to inner Belfast Lough; however they will be likely to add to the faecal coliform loading of nearby watercourses discharging to the lough.

NIW and NIEA provided consent number and location information for a large number of consented public intermittent (combined sewer overflow (CSO) and emergency relief overflow (ERO)) discharges. Most of these are shown in Figure 2.2, although those located further up the River Lagan catchment are not shown (these are, however, listed in Appendices B and C, NIW and NIEA data respectively).

Figure 2.3 shows a larger scale map of the Inner Belfast Lough area with the location of the public continuous and intermittent discharges shown in relation to the classified shellfish beds.

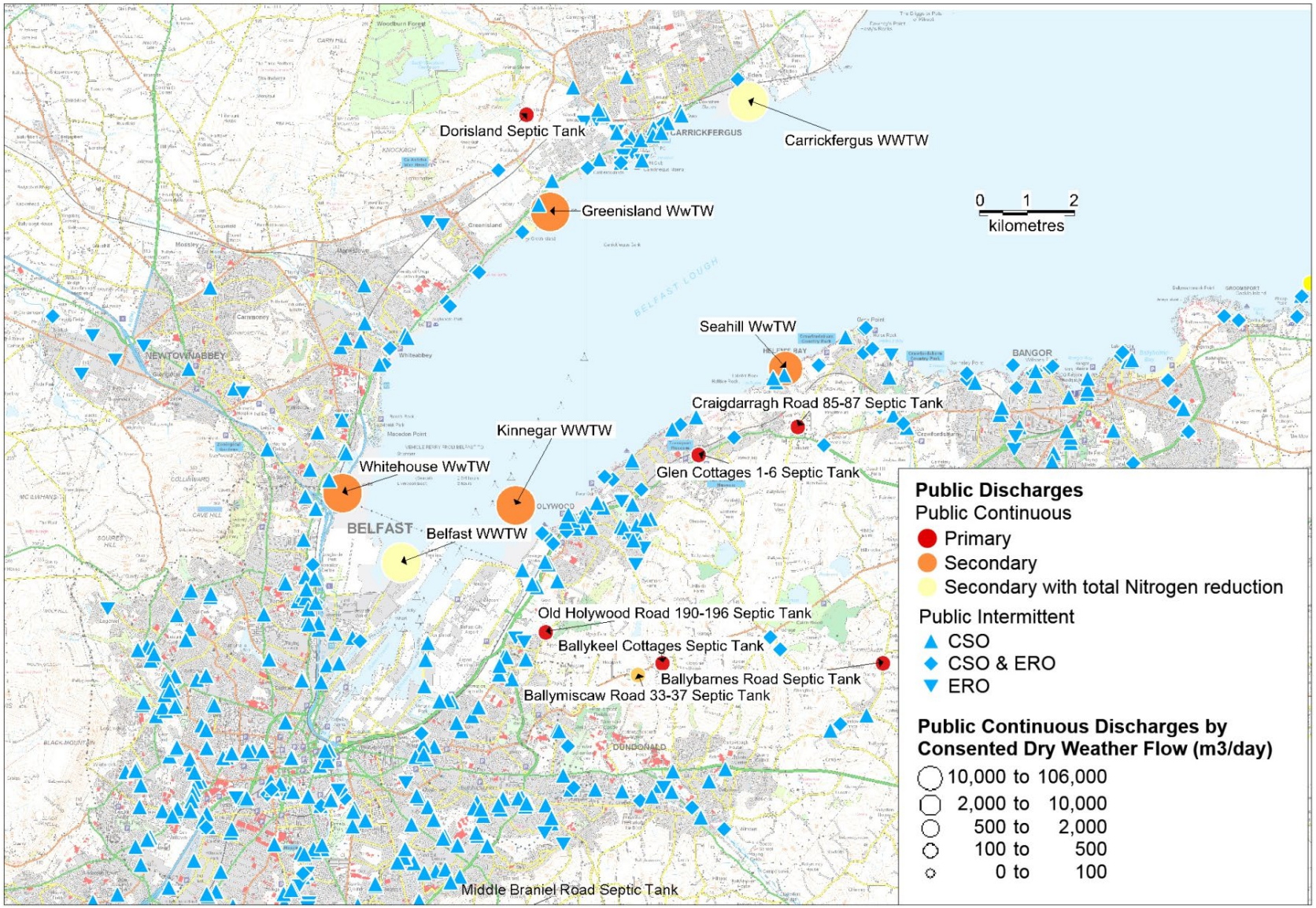


Figure 2.2. Consented public discharges

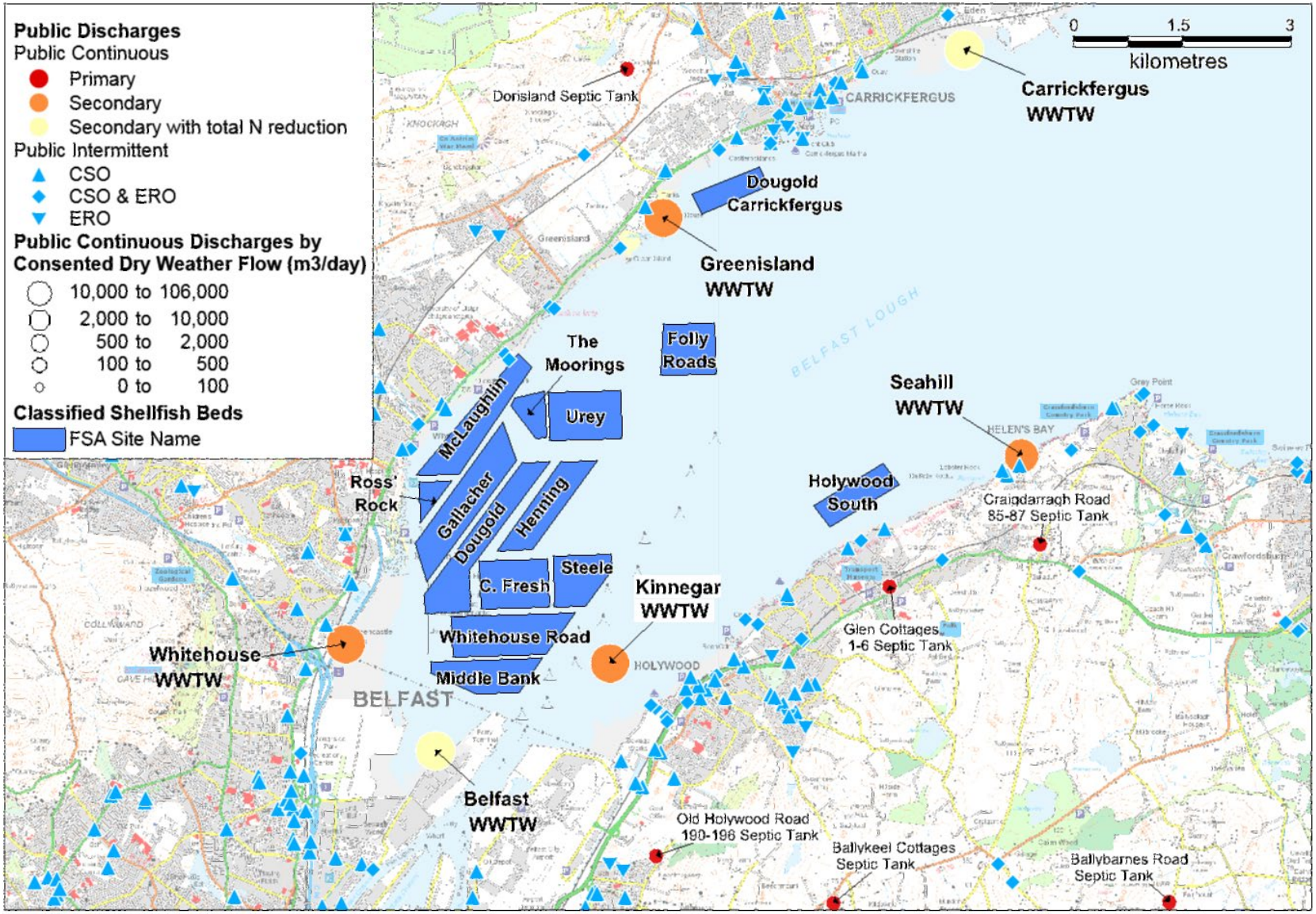


Figure 2.3. Location of consented public discharges in relation to the classified shellfish beds

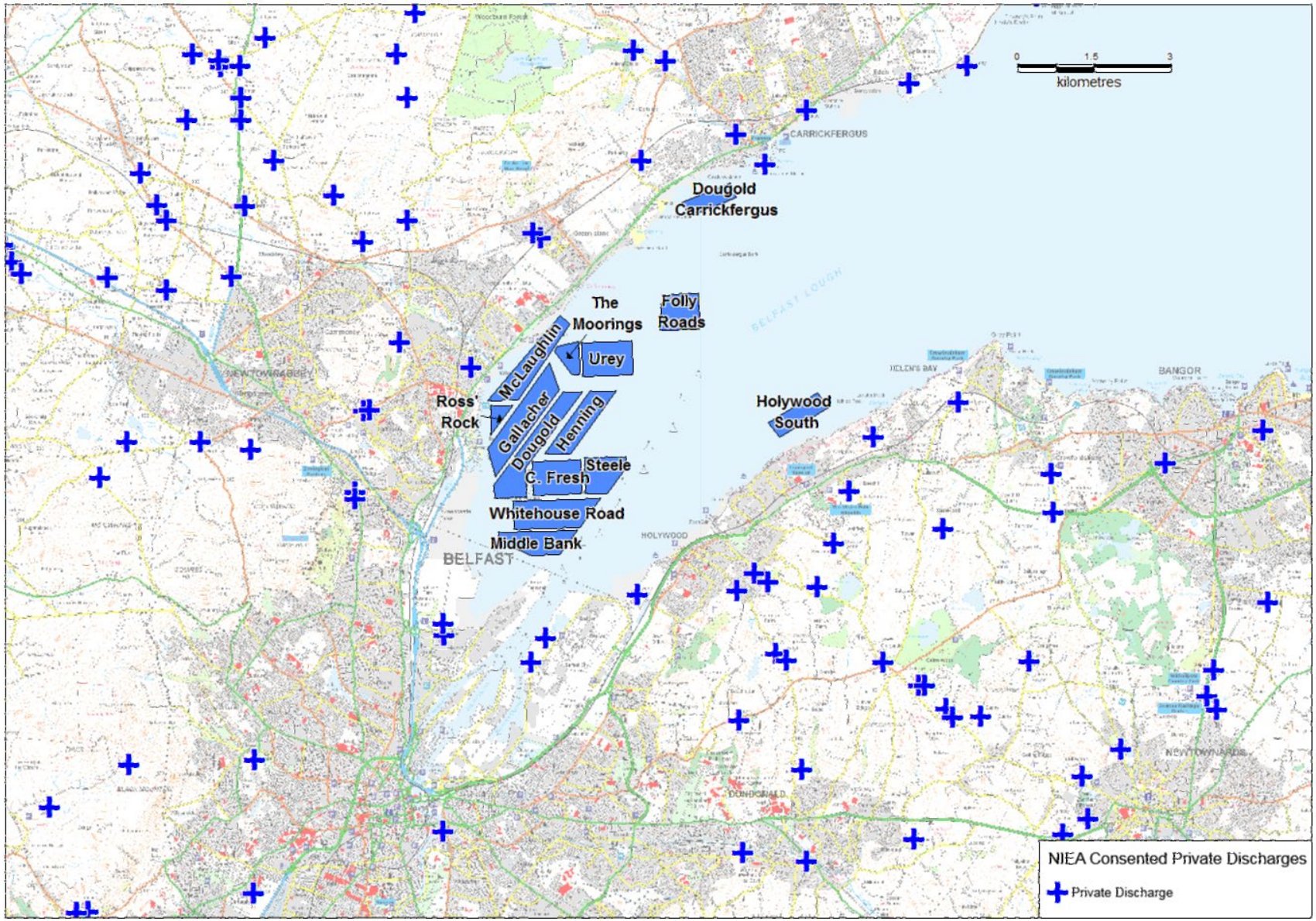
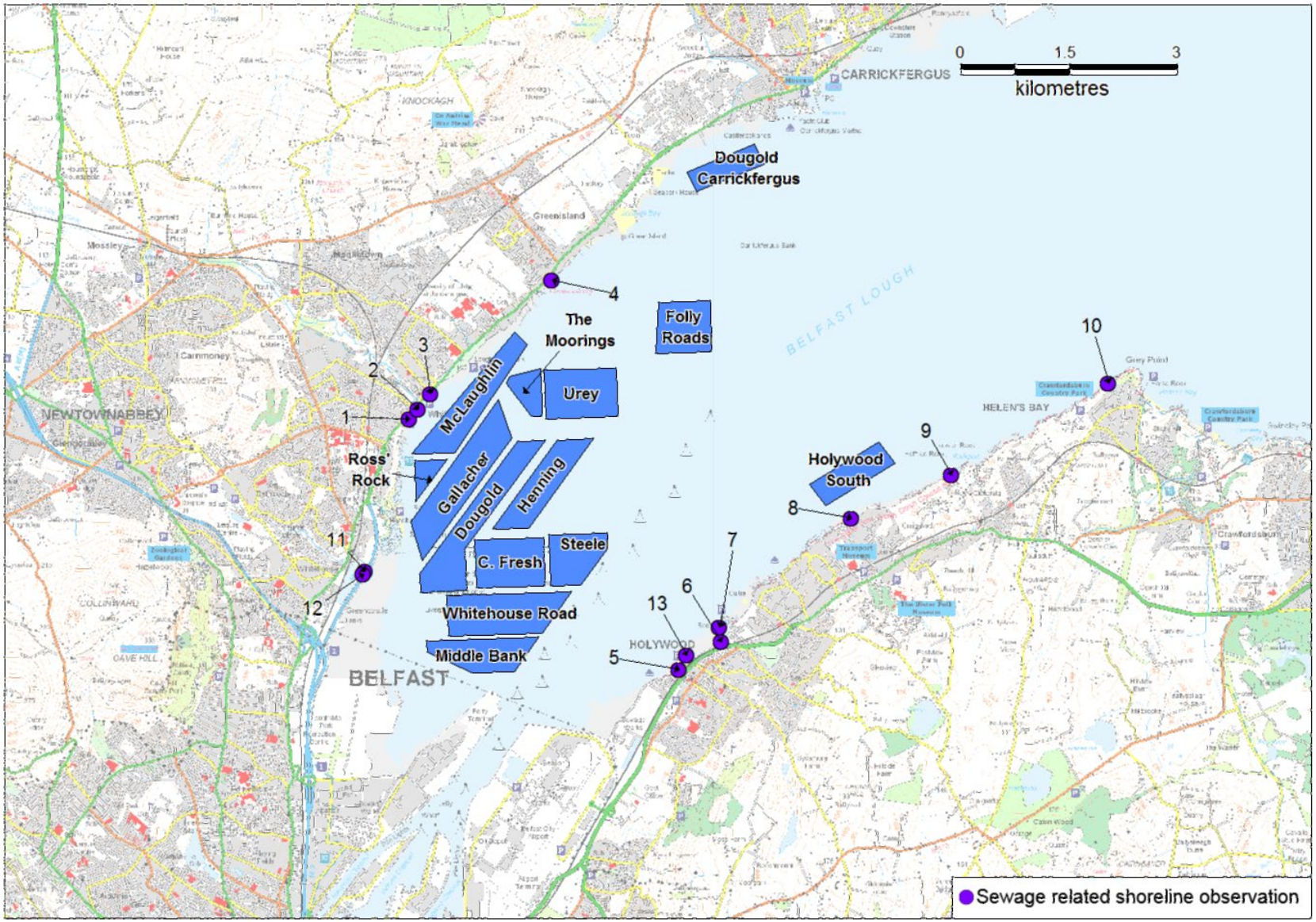


Figure 2.4 NIEA Consented private discharges



(Number on the map correspond to the entries in Table 2.4)

Figure 2.5**Sewage related shoreline survey observations**

Table 2.2 Changes and additional information on the principal continuous wastewater treatment works (WWTW) discharging to inner Belfast Lough (including via the Lagan catchment) since the previous sanitary survey (2008)

AFBI Sanitary Survey (2008) Discharge Information			Discharge Information obtained from NIW/NIEA for Cefas Sanitary Survey Review (2013)						NIW information		NIEA information		
Principal Discharges	**Treatment level**	**PE (2001)**	**Discharge Name**	**Consent Number**	**IGR of discharge**	**Discharges to**	**Frequency of Discharge**	**Treatment level**	**Consented Design PE**	**Consented DWF (m3/d)**	**Treatment level**	**PE**	**Consented Design PE**
Carrickfergus	**Primary**	**34500**	**Carrick-fergus WWTW**	6405/ 2007	[redacted]	Inner Belfast Lough	Continuous	Secondary	35330	10150	Secondary with total nitrogen reduction	<10,150	15,000 to 50,000
Greenisland	**Secondary**	**34500**	**Green-island WWTW**	6489/ 2007		Inner Belfast Lough	Continuous	Secondary	14000	4750	Secondary	<4,750	2,000 to 10,000
Newtown-abbey	**Part-Secondary**	**75161**	**White-house WwTW**	6565/ 2007		Inner Belfast Lough	Continuous	Secondary	100000	33049	n/a	n/a	n/a
Belfast	**Secondary**	**275000**	**Belfast WWTW**	6380/ 2007		Inner Belfast Lough	Continuous	Secondary	300000	105400	Secondary with total nitrogen reduction	105,400	>100,000
Kinnegar	**Secondary**	**110000**	**Kinnegar WWTW (PFI)**	879/ 99		Inner Belfast Lough	Continuous	Secondary	n/a	36800	Secondary	n/a	15,000 to 150,000
Seahill	**-**	**2970**	**Seahill WWTW**	0425/ 2009		Inner Belfast Lough	Continuous	Secondary	7825	1780	Secondary	<1,780	2,000 to 10,000
	-	**-**	**Drumbeg WWTW**	6464/ 2007		River Lagan Catchment	Continuous	Secondary	1919	363.2	n/a	n/a	n/a
	-	**-**	**Dunmurry WWTW**	6471/ 2007		River Lagan Catchment	Continuous	Tertiary	62479	11405	n/a	n/a	n/a
	-	**-**	**Edenderry Belfast WWTW**	6472/ 2007		River Lagan Catchment	Continuous	Tertiary	481	95	n/a	n/a	n/a
	-	**-**	**Newtown-breda WWTW**	6566/ 2007		River Lagan Catchment	Continuous	Tertiary	44375	12185	n/a	n/a	n/a

Note. Co-ordinates were not provided in the original Sanitary Survey report, so when they could be cross referenced by asset name, the IGRs were taken from a combined data set formed from separate data supplied by the NIW/NIEA. Coordinates were redacted from this table at the request of FSANI and NIW. In general assets mentioned in the original AFBI sanitary Survey which discharge to the outer lough have been excluded from this table and further consideration, due to the large number of discharges to the inner lough and River Lagan catchment.

Intermittent Discharge Spill Data

Annual spill data was provided for Kinnegar WWTW for the period from March 2010 to June 2014 by Coastal Industrial Ltd (United Utilities) (Table 2.4). Kinnegar has a large number of annual spill events (generally >100 spills per year), however the percentage of time spilling is fairly low (generally <1.5% since April 2010). It is not possible to say how many of the spills from Kinnegar WWTW were 'significant' as the volumes spilt during this time were not provided. NIEA require a standard of a maximum of 10 spills per annum from intermittent discharges deemed to influence Designated Shellfish Waters. A spill is deemed "significant" if it exceeds 50 m^3 in volume (NIEA *pers. comm.*, 2014).

Spill data was sought for other intermittent discharges associated with WWTWs discharges into Inner Belfast Lough but this was not available. The data for Kinnegar has therefore been given as illustrative of a major intermittent discharge in the area. However, this is one of a number of such discharges and provision of the data is not meant to imply that Kinnegar has a greater influence that other intermittent discharges. The potential relative impacts cannot be evaluated in the absence of other data,

Planned improvements to the Holywood sewer network include installation of a new pumping station by Spring 2015. This will pump:

- wastewater (to Kinnegar WWTW)
- excess storm water (which currently spills from three Holywood CSOs to the lagoons behind the WWTW) via a new pipeline next to the existing tidal inlet/outlet pipe from the lagoons directly to Belfast Lough (NI Water2)

The work will combine the impact from the CSOs into one larger source and may increase the faecal loading to inner Belfast Lough near to Kinnegar WWTW CSO and Holywood.

NIW identified that reliable information on spill frequency for NIW storm overflows discharging faecal pollution to Belfast Lough was not available. They stated that they believe that '*the sea water quality will meet and in fact exceed EU standards for such discharges*' (John Collins, *pers. comm.,* 2013). However, it is not possible to reliably assess the impact of storm overflow spills without reliable spill frequency and volume data.

NIW have planned improvements or remedial works to deliver water quality improvements to Belfast Lough in the next 3 years. These are intended to '*continue to deliver Base Maintenance capital expenditure at a number of assets to sustain serviceability, and drainage area plans are being progressed in the Bangor catchment, which includes additional attenuation and closure of CSOs. Capital expenditure (circa £10 million) is planned to comply with bathing water requirements,*

involving upgrades to seven sewage pumping stations and upgrade or closure of 20 combined storm overflows, and additional storm storage or attenuation. Work is split into a number of work packages, to be delivered in sequence with substantial work completed on five packages. Luke's Point and Bangor Marina work packages are to commence in early 2014 and complete 18 months thereafter' (Angela Halpenny *pers. comm.*, 2013).

Table 2.3 Annual number of spills from Kinnegar WWTW (April to March)

Date	Events during Period	Cumulative Duration				Percentage of time spilling
	No.	Days	Hours	Mins	Secs	%
2010/11	199	5	10	8	13	1.486
2011/12	103	0	12	12	24	0.139
2012/13	134	0	21	43	8	0.248
2013/14 *	21	0	6	10	17	0.282

*2013/14 data is only a 3 months data sub set, from April 2013 to June 2013.

Private sewage discharges

NIEA provided consent number and location information for a large number of consented private discharges (domestic and industrial intermittent) most of which are displayed on the Figure 2.4, although some further up the River Lagan catchment are not in view. The full list is tabulated in the appendices for reference (Appendix D). The private discharges are frequently described as unspecified, although some are labelled as emergency discharges. As the NIEA provided no further quantitative information (Dry Weather Flow (DWF) or PE) on these private domestic and industrial sewage discharges, they are therefore assumed to be very low PE compared to the public discharges., However, their contribution to the faecal pollution of Belfast Lough cannot be assessed further due to a lack of information.

Sewage-related shoreline survey observations (2013)

Sewage-related observations and samples from the shoreline survey are displayed in Table 2.4. Sanitary debris was noted in eight of the observations made during the shoreline survey, suggesting that there had been discharges of unscreened wastewater into Belfast Lough. The locations of these observations are displayed on the map given in Figure 2.5. Other shoreline survey observations included unpleasant, sewage-related smells, usually in the vicinity of discharges from pipes or watercourses. The highest *E. coli* concentrations related to samples taken from outlets along the north shore. Observation numbers given in the following paragraphs relate to the numbers in the first column of Table 2.4 and the map labels in Figure 2.5.

Observation 1 related to a watercourse with a result of 15,000 *E. coli* cfu/100 ml. This result indicates that the watercourse is moderately contaminated with faecal pollution. As sanitary debris was also observed in the vicinity, it suggests that a combined sewer overflow could recently have discharged nearby. The nearest reported NIW discharges to the observation are Coastguard Row WWPS (CSO and ERO) and Shore Road Whiteabbey CSO and as they are reported to discharge from outfalls approximately 100-200m away from the observation, they could be associated with the sanitary debris.

Observation 2 was associated with a watercourse that had a sewage smell. However, the *E. coli* result of 2000 cfu/100 ml was lower than would be expected from significant sewage contamination. The nearest NIW asset associated with this watercourse is Whiteabbey Shore Road WWPS which NIW information showed discharges to a river. However, several other consented CSOs discharge to the watercourse higher up the catchment.

Observation 3 was associated with an outfall that had a strong sewage/chemical toilet smell. The sample yielded the highest *E. coli* concentration from the shoreline survey at 208,000 cfu/100 ml. This is a very high faecal bacteria load for a freshwater source, and indicates significant faecal contamination. The flow from this discharge was too small to measure and therefore a loading could not be estimated. There is no identified consented public or private discharge at this location.

The above three observations were within approximately 400 m of one another and therefore could represent a combined area of faecal contamination in close proximity to the shellfish beds.

Observation 4 was related to a watercourse that was noted to smell of silage. The sample result of 20,000 *E. coli* cfu/100ml indicates moderate faecal contamination.

Observation 7, on the south shore, related to a pipe with a strong associated smell. There was no obvious flow at the time of the survey. A seawater sample from pooled water under the pipe indicated moderate contamination (7100 *E. coli*/100 ml). This pipe could be associated with consented NIW assets Seapark Holywood CSO and/or Bangor Road Seapark CSO.

Observation 13 relates to a concrete pipe associated with a strong smell of urine. The recorded location suggests it is likely to have been the end of the pipe of the Shore Road Holywood CSO. A sample taken from the pipe contained 8000 *E. coli* cfu/100 ml which does not indicate a high level of faecal contamination.

Sanitary debris was also noted at several locations along the South Shore which were not seemingly associated with nearby pipes or watercourses. In these cases it was not possible to determine whether the sanitary debris had been recently deposited, from nearby NIW assets, or if it had been re-deposited on the shoreline

by the wind/tide from discharges further away. It is however evidence that significant amounts of unscreened sewage do discharge to Belfast Lough. It is expected that these will contribute to faecal contamination in the inner Lough, as well as the physical pollution of the shoreline with sanitary debris.

Table 2.4. Cefas Shoreline Survey Sewage Related Observations

Map label no.	Shore	Waypoint No.	Date	Time	Irish Grid Ref	Sample Result (*E. coli* cfu/ 100ml)	Description
1	North	16	10/09/2013	07:21	IJ 35809 82691	15000	Outfall pipe - signs of flow. Lots of sanitary debris (also in 20 m radius from the pipe).
2	North	18	10/09/2013	07:37	IJ 35918 82823	2000	Large watercourse, smells of sewage.
3	North	21	10/09/2013	07:55	IJ 36094 83027	208000	Outfall in concrete block, strong smell of sewage/chemical toilets, small flow - not enough to measure.
4	North	45	10/09/2013	09:57	IJ 37767 84598	20000	Watercourse through culvert, smell of silage
5	South	2	10/09/2013	06:33	IJ 39526 79233	n/a	Several items of sanitary debris.
6	South	13	10/09/2013	07:25	IJ 40109 79618	n/a	Two pieces sanitary debris on beach.
7	South	17	10/09/2013	07:41	IJ 40080 79818	7100	End of pipe. Smelly. No obvious flow. Seawater sample from pool in front of pipe.
8	South	46	10/09/2013	09:25	IJ 41904 81318	n/a	Sanitary debris.
9	South	56	10/09/2013	10:14	IJ 43287 81917	n/a	Sanitary debris.
10	South	67	11/09/2013	06:54	IJ 45455 83182	47	Seawater sample. Sanitary debris on shore.
11	South	73	11/09/2013	08:13	IJ 35191 80589	n/a	Sanitary debris.
12	South	74	11/09/2013	08:16	IJ 35160 80547	100	Sample from lagoon by westernmost of two sets of 3 large outlet pipes. Sanitary debris.
13	South	77	11/09/2013	09:05	IJ 39629 79435	8000	End of concrete pipe. Smell of urine.

Conclusions

Whitehouse, Kinnegar and particularly Belfast WWTW are only secondary treated and have high consented design PE, plus associated CSOs. These WWTW's are likely to have a large continuous and intermittent contribution to the faecal pollution of Belfast Lough, particularly considering they are at the head of the lough/estuary where there is least tidal flushing and they add to the background faecal pollution from a large number of CSO's and other WWTWs discharging to the River Lagan. However, these WWTWs all discharge approximately 1.5km away from the nearest shellfish beds which will allow for some dilution and dissipation of the discharge plume before it reaches the shellfish beds and, therefore pose a moderate to high risk to shellfish hygiene and public health.

Greenisland WWTW also provides only secondary treatment for its relatively large consented design PE, and discharges approximately 500 m from the nearest classified shellfish bed (Dougold Carrickfergus). A very high *E. coli* result (Sample BLNS 14, 20,000 *E. coli* cfu/100ml) was obtained from a water sample taken from south west of Greenisland WWTW at Cloch-na-larty. This location is approximately 100 m from the edge of a classified shellfish bed (McLaughlin). The combined effect of the continuous, intermittent and possible contaminated watercourse discharging into inner Belfast Lough in this area potentially poses a high risk to shellfish hygiene and human health.

A water sample taken from an outfall in the vicinity of Whiteabbey yielded a very high *E. coli* result (sample BLNS7 with 208,000 *E. coli* cfu/100ml) indicating significant faecal contamination. The location is approximately 500 m from the nearest shellfish bed.

At Carrickfergus WWTW, the additional treatment of the wastewater to reduce total nitrogen does not reduce microbial content of the wastewater and should therefore be considered as secondary treated when assessing faecal contamination to Belfast Lough. There are also a large number of CSOs present in the vicinity that discharge less than 1km from the shellfish bed. This area is likely to pose a low to moderate risk to shellfish hygiene and human health.

All samples taken by Cefas in the vicinity of CSO's indicated relatively low faecal loadings from these sources. However, there are a very large number of CSOs and ERO's potentially discharging to inner Belfast Lough and the River Lagan catchment. As well as discharging unsightly sanitary debris, the CSOs and EROs are potentially a large risk to public health and shellfish hygiene in Belfast Lough, especially during wet weather storm events. Significant investment (£160 million) has been made in the sewerage infrastructure around Belfast, completed in 2010 under the Stormwater Management project: The Belfast Sewers Project to improve water quality in the River Lagan (NI Water1). However, there is still a large number of CSOs potentially

discharging untreated wastewater to the watercourses in the catchment of the River Lagan and watercourses draining directly to Belfast Lough, as well as CSOs discharging to the shoreline. The number of CSOs continues to pose a large intermittent faecal pollution risk to Belfast Lough, particularly when their cumulative effect during wet weather storm events is considered.

3. Farm Animal Population and Agricultural Impacts

No observations of livestock or agricultural infrastructure were made during either the 2008 or 2013 shoreline surveys. Information on agricultural based contamination sources have only been obtained through desk based internet searches.

The 2008 sanitary survey report noted that the immediate area around Belfast Lough contained very productive agricultural land with 415 farms in the catchment area. These included dairy, sheep, pig and arable crop farming. The majority of the agricultural land was said to be distributed along the southern shoreline, in County Down. The information was taken from 1993 agricultural census data.

The DARD agricultural census report for 2013 contained information on the number of farm animals by rural district. Table 3.1 shows the number of farm animals given in that report as being present in the rural districts bordering Inner Belfast Lough. The figures for Larne are not representative of impacts within the catchment of the lough as that district extends a significant distance along the northeastern coast of Northern Ireland. However, the other data shows that there is potential for significant faecal contamination from farm animal sources entering Inner Belfast Lough via watercourses (the presence of built-up areas around the shoreline means that there should not be direct contamination of the coastline from such sources).

The Department of Agriculture and Rural Development (DARD) promote sustainable agriculture development in Northern Ireland, and oversee both European and national policies and regulation. Among key policy aims are improving water quality and increasing the amount of agricultural land. Improvements include increasing education and awareness of how farming practices can impact the nearby water quality and sustainability of farming on land. No information was found as to whether any studies have been undertaken in the area to determine the effectiveness of these measures with respect to water quality improvement.

It is difficult to determine from the available information whether the potential for contamination from farm animals has changed since the 2008 sanitary survey. However, it is the case that such contamination is likely to contribute to the *E. coli* loadings observed in watercourses entering the lough.

Table 3.1. DARD agricultural census data (2013) for urban districts bordering Inner Belfast Lough

	Livestock numbers							
Rural District	**Dairy cows**	**Beef cows**	**Total cattle**	**Breeding ewes**	**Total sheep**	**Sows & gilts**	**Total pigs**	**Total poultry ('000)**
Larne	7327	9619	44854	66967	136991	399	4580	284
Newtownabbey	23	341	1407	93	268	880	10624	0
Co. Antrim Urban/Belfast	99	600	2111	2895	5991	0	0	11
Co. Down Urban/Belfast	206	101	887	402	901	0	0	0
Castlereagh	1395	192	4055	1158	2075	2	12	0

4. Wildlife and other non-farm animals

Information on pollution sources from wildlife has been obtained through the shoreline surveys conducted in 2008 and 2013, and through a desk-based internet search undertaken for this review. Shoreline survey observation information only relates to the time of the surveys undertaken on 16th to the 18th January 2008 and on the 10th and 11th September 2013. Wildlife observations from the 2013 shoreline survey are displayed in Figure 4.1.

The 2008 sanitary survey report referred to Belfast Lough Inner area of special scientific interest (ASSI) and mapped the areas covered by the special area of conservation and RSPB reserves. During the 2008 shoreline survey, birds including gulls, oystercatchers, curlews, cormorants and crows were observed, with a large number of pet dogs also noted along the shoreline at the time of the survey. The 2008 sanitary survey report concluded that the two bird sanctuaries located at the head of Belfast Lough may significantly contribute to contamination levels in the lough, particularly during times when birds were present in dense numbers. The Discussion section of the sanitary survey report included the statement that: “There is little evidence of widespread shoreline contamination from wild or domestic animals although significant bird aggregations may occur in the intertidal particularly on the south western quarter of the lough”.

Conservation areas

Several conservation areas are located in Belfast Lough and are listed in Table 4.1 alongside information on the area they cover and their qualifying features. The majority of these areas use the boundaries set by the Inner ASSI boundaries set in 1987, though updates have taken place to take into account the development around Belfast Harbour.

Pinnipeds

Harbour seals are found around Northern Ireland’s coasts, with the largest breeding colony situated in Strangford Lough, approximately 50 km south of Belfast Lough. In a study by Duck (2006), 63 harbour seals were seen along Belfast Lough’s southeast shoreline, whilst three seals were seen to the northwest shoreline in August 2002.

In the same study, 21-30 grey seals were also observed, though they were found outside Belfast Lough along shoreline south of the lough (Duck, 2006). Grey seals are predominantly found along exposed, rocky shores, such as those located in outer Belfast Lough.

Two seals were observed in the water along the northwest shoreline during the shoreline survey in 2013.

Table 4.1 Belfast Lough conservation areas and associated information

Site name and classification date	Area	Qualifier
Belfast Lough Inner ASSI (1987)	The intertidal foreshore and bordering land (reclaimed and being reclaimed e.g. Victoria Park). Extends to a notional line drawn between Greencastle (north) and Holywood bank (south).	Significant numbers of wintering waders and waterfowl, particularly redshanks and oystercatchers, as well as the on-shore feeding populations of goldeneye and scaup which feed in the area at high water. Large numbers of wigeon, mallard, teal, dunlin, ringed plover and bar-tailed godwit are also found throughout much of the area
Belfast Lough Outer ASSI (1996)	The intertidal area and bordering land extending from the notional line drawn between Greencastle (north) and Holywood bank (south) and between Kilroot (north) and Horse Rock (south).	Important numbers of great crested grebe and nationally important wintering populations of oystercatcher, ringed plover, redshank and turnstone
Belfast Lough RAMSAR site (1998)	Coincides with the Outer Belfast Lough ASSI, extending to mean low water. Within the harbour area, it closely follows the Inner Belfast Lough ASSI, but has been redrawn to take into account port development and landfill since 1987.	Internationally important wintering populations of Redshank Nationally important populations of Shelduck, oystercatchers, purple sandpiper, dunlin, black-tailed godwit, bar-tailed godwit, curlew and turnstone. The lough is also important for many other waterfowl species e.g. great crested grebe, scaup, eider, goldeneye and red-breasted merganser.
Belfast Lough SPA (1998)	Coincides with the Belfast Lough Ramsar site and the notional boundary of the Outer Belfast Lough ASSI, extending to the mean low water mark	Internationally important wintering numbers of Redshank. The site also supports nationally important numbers of shelducks, oystercatchers, purple sandpipers, dunlins, black-tailed godwit, bar-tailed godwit, curlew and turnstone and is used by waterfowl e.g. great crested grebe, scaup, Eider, goldeneye, and red-breasted merganser
Belfast Lough Open Water SPA (2009)	Coincides with the Outer Belfast Lough ASSI, extending below mean low water mark	Significant European wintering population of great crested grebe Nationally important numbers of Cormorants, shelduck, scaup, eider, goldeneye and Red-breasted Merganser.

Cetaceans

Northern Ireland inshore waters are reported to host both resident and migratory cetacean species, with dolphins and harbour porpoise most commonly spotted near-shore (Sea Watch Foundation, 2012). No cetaceans were observed during the 2013 shoreline survey.

Seabirds

According to the qualifying features for all of the conservation areas listed in Table 4.1, birds including seabird, waterfowl and wading bird species are present in significant numbers in areas around Belfast Lough. Key species include redshank, great crested grebe, cormorant, goldeneye, shelduck and oystercatcher.

As well as the main conservation areas there is also the Belfast Lough RSPB reserve, which is comprised of two adjacent sites: a brackish lagoon and a nature conservation area (NCA). Both are located at the head of Belfast Lough within the Belfast Harbour area. The RSPB manages the lagoon system by alternating water levels and maintaining habitat areas to create ideal conditions for various species to flourish (RSPB, 2014). Seasonal changes in bird populations are common. In spring black-tailed godwits, breeding moorhens, coots and mallards, swallows and common terns are common; summer is the time of breeding Arctic and common terns; autumn is when black tailed godwits, oystercatchers, redshanks, dunlins and curlews are present and winter is the best time to see wildfowl such as teal and wigeon. No information was obtained on the seasonal fluctuations in bird numbers, however.

The British Trust for Ornithology report on wetland birds for 2011/12 identified that black-tailed godwit populations in Belfast Lough had increased (Austin, 2014). The population has significant concentrations towards the harbour and in the Victoria Park areas, both at the head of the lough. The largest bird populations around the lough are reported to be (figures represent 2011/12 counts): Oystercatchers (3915), Eider ducks (3673), Black-headed gulls (2797), Redshanks (862), and Herring gulls (859). The Scaup population had been reported to exceed 1000 in previous years but the 2011/12 count was only 51.

During the 2013 shoreline survey, birds were the most common wildlife observed. Species included gulls, herring gulls, common gulls, a black-backed gull, oystercatchers, herons, cormorants, ducks, eider ducks, crows, pigeons and starlings, as well as unidentified seabirds. Gulls were the most common type of bird, with dense concentrations located on the intertidal area at the head of the lough, the northwest shore and along the south shore.

Otters

The Eurasian otter (*Lutra lutra*) is a priority species under the NI biodiversity action plan (BAP). Although declines have been reported in NI populations in more recent years, otters are thought to use many of the watercourses that contain important otter prey species such as eels, as well as the shorelines of Belfast Lough (Department for Regional Development Northern Ireland, 2007). No otters were observed during the 2013 shoreline survey.

Pets

Dog walking is common along much of the Belfast Lough shoreline and adjacent land. Although owners face a fine if they fail to pick up their dog's excrement, dog fouling presents a significant problem, particularly along the southern shoreline. In particular, it is a large problem around the Seapark area in Holywood, with calls to invest in a new machine to gather and dispose of dog excrement from the coastal path and parkland (County Down Spectator and Ulster Standard, 2014). Since 2012, the Dog Watch Initiative in the Newtownabbey area has been reportedly successful at reducing dog fouling on the streets, through catching owners failing to pick up after their dog (Newtonabbey Borough Council, 2012). During the 2013 shoreline survey, dogs were observed along the southern shore, and adjacent grassland at Holywood and dog excrement was observed on the beach at Holywood.

Conclusions

Overall, birds remain the most significant contamination risk from wildlife. Seabirds, waders and waterfowl are present in significant numbers around much of the lough, though are particularly dense around the intertidal mudflat areas and RSPB reserves at the head of the lough. Seals were also shown to reside within Belfast Lough, and otters may also represent a modest input source from watercourses and some areas of Belfast Lough shoreline. Dog waste continues to present a potential source, particularly along the southern shoreline.

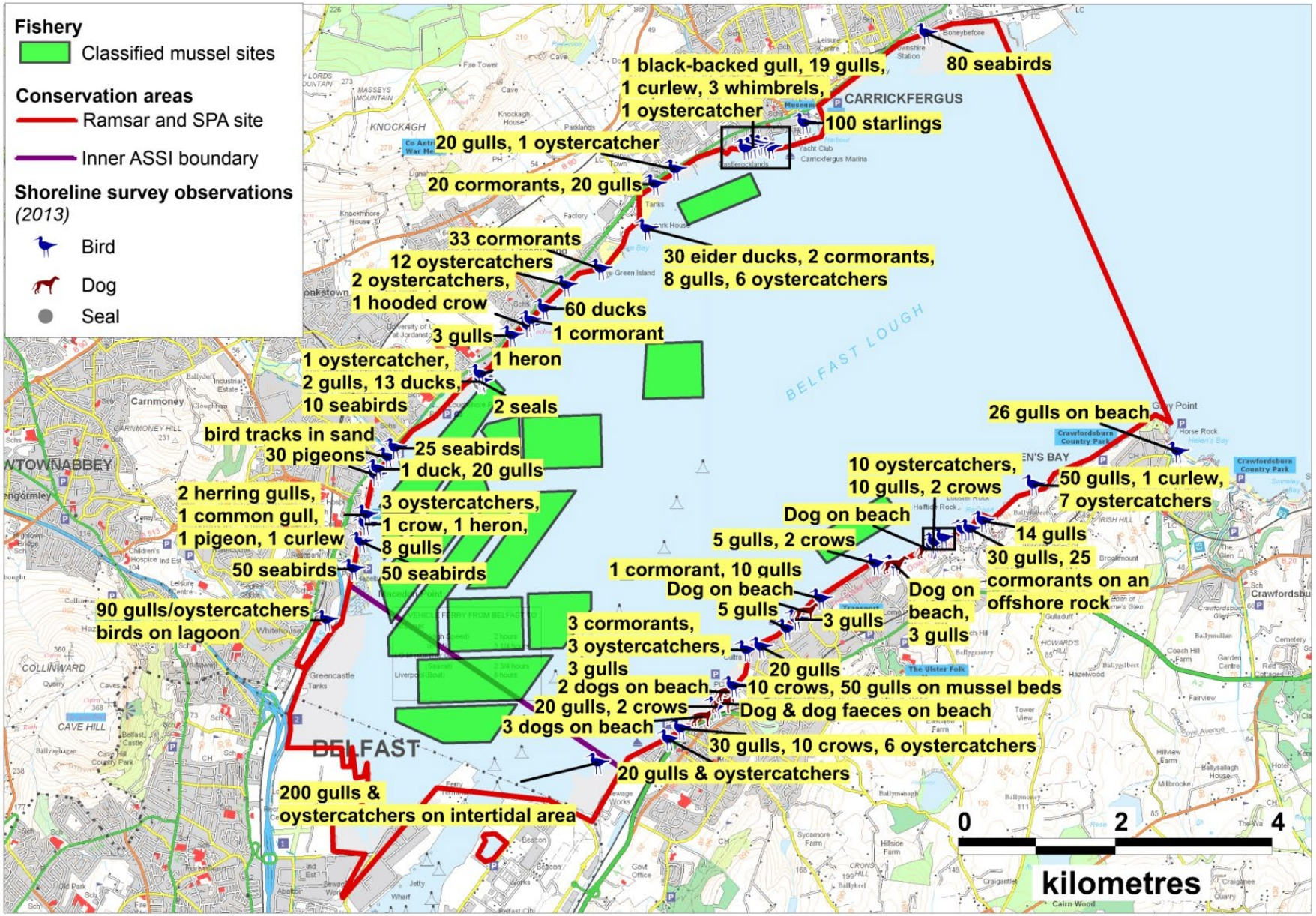


Figure 4.1 Map of current conservation area boundaries and wildlife observed during the 2013 shoreline survey around Belfast Lough

5. Watercourses

A number of watercourses discharge to Inner Belfast Lough. Some of the flow through culverts and others are uncovered. The most significant of these watercourses is the River Lagan, which discharges to the head of the lough. Several tributaries, such as the Blackstaff River, feed into the Lagan before it reaches the lough. Other main watercourses are:

- Three Mile Water (north shore)
- Woodburn River (north shore)
- Conns Water (Connswater River) (south shore, head of lough), formed by the confluence of the River Knock and the River Loop

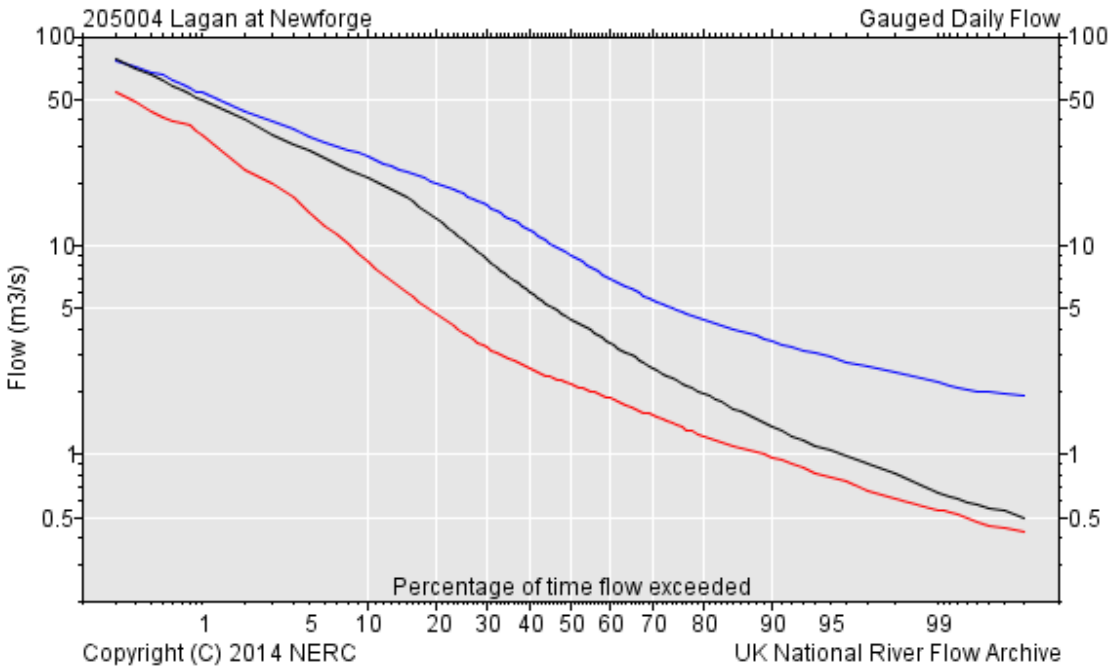
The locations of these rivers, from Rivers Agency data, are shown on the map in Figure 5.3. The River Agency GIS coverage downloaded from Spatial NI (www.spatialni.gov.uk) only contained the lines of the designated watercourses and a full watercourse data set is not available (James Edge, Rivers Agency, *pers. comm*., 2014)

Gauging stations are present on the Lagan and Knock and flow information related to these is reviewed below. The locations of the gauging stations are shown on the map in Figure 5.4.

A request was submitted to NIEA for data on microbiological contamination in watercourses entering Belfast Lough but it was identified to Cefas that no such data was available.

River Lagan

There are three gauging stations on the River Lagan and one on one of its tributaries (River Ravernet). The River Lagan gauging station most relevant to the discharge at the head of the lough is located at Newforge. However, other watercourses enter the Lagan below the gauging station and therefore the flows do not represent the total discharging to the lough. The National River Flow Archive (2014) contains summary data for the period between 1972-2012. Mean flow was 8.521 m^3/s and the base flow index was 0.44 m^3/s. The flow duration curve is displayed in Figure 5.1. The x-axis of the graph shows the percentage of time for which the flows on the left-hand y-axis are exceeded. The Q50 value, the flow which is exceeded for 50% of the time, on an annual basis, is given as 4.475 m^3/s. Flow in winter (blue) is markedly higher than in summer (red).

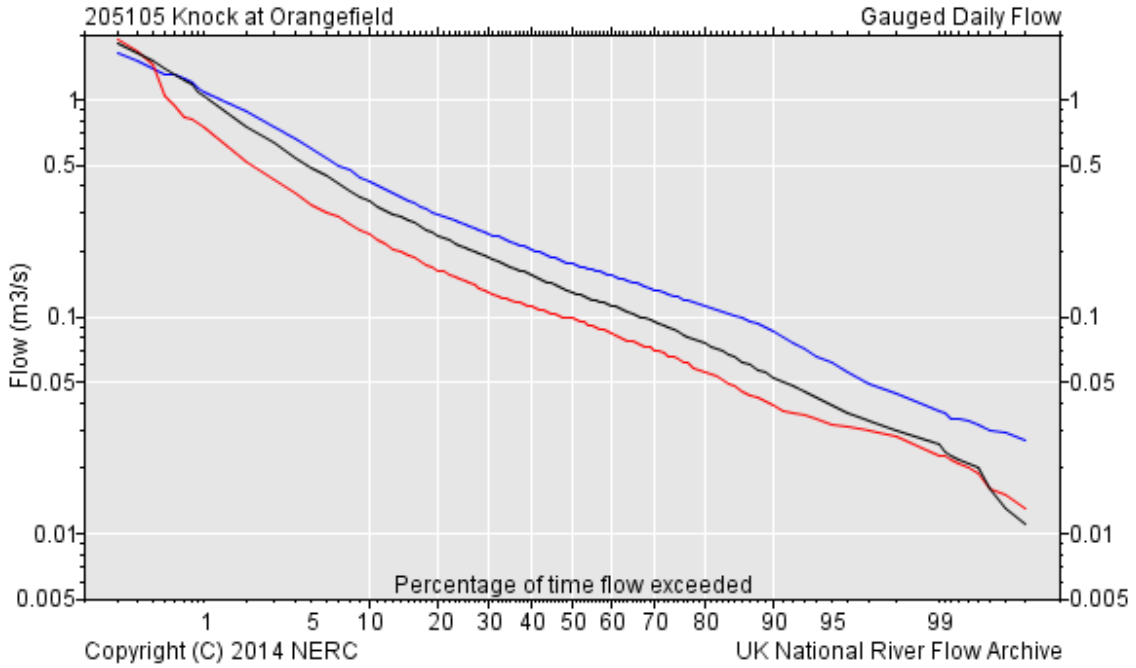


Key: Black line - annual; red line - June-September; blue line - December to March

Figure 5.1 Flow duration curve for the River Lagan, Courtesy of UK NRFA, 2014

River Knock

The gauging station on the River Knock is located at Orangefield. This is above the confluence with the River Loop and therefore does not represent the entire flow in Conns Water. The National River Flow Archive (2014) contains summary data for the period between 1983-2012, with mean flow measured at 0.184 m^3/s and a base flow index of 0.58 m^3/s. The flow duration curve is displayed in Figure 5.2. The x-axis of the graph shows the percentage of time for which the flows on the left-hand y-axis are exceeded. The Q50 value, the flow which is exceeded for 50% of the time, on an annual basis, is given as 0.13 m^3/s. Flow in winter (blue) is not signficiantly higher than that in summer (red).



Key: Black line - annual; red line - June-September; blue line - December to March

Figure 5.2 Flow duration curve for the River Knock, Courtesy of UK NRFA, 2014

Shoreline survey observations

The 2008 sanitary survey report did identify the prevailing weather conditions for the days of the shoreline survey. Sustained rainfall was noted to have fallen several days preceding the survey.

During the 2013 shoreline survey (9th and 10th September 2013), only light rain fell during the second survey day. Rainfall was reported on the three days prior to the survey with heavy rain on the 6th and light rain on the 7th and 8th of September.

The 2008 sanitary survey report did not present watercourse measurements or flow data, preventing comparisons of estimated loadings. Freshwater samples taken for the 2008 shoreline survey were examined for faecal coliforms (although *E. coli* concentrations were presented using a division factor) and thus it is not possible to directly compare the faecal indicator concentrations from the two shoreline surveys. Table 5.1 gives estimated watercourse loadings obtained from the 2013 shoreline survey measurements and samples. The watercourse observations are shown in Figure 5.4. In addition to the 23 listed watercourses, 31 areas of land drainage were noted during the survey: these were not sampled or measured.

Table 5.1 Watercourse loadings to Belfast Lough calculated from measurements taken during the 2013 survey

No.[1]	Description	NGR	2013 Loading (*E. coli* / day)
1	Hazelbank Stream	IJ 3550 8156	$1.6x10^{10}$
2	Three-mile River	IJ 3592 8282	$9.7x10^{10}$
3	Meadowbank Stream	IJ 3684 8375	$1.5x10^{11}$
4	Silver Stream	IJ 3724 8403	$9.5x10^{9}$
5	Shore Road Stream	IJ 3752 8441	$7.7x10^{9}$
6	Unnamed watercourse	IJ 3777 8460	$7.6x10^{10}$
7	Greenisland Stream	IJ 3783 8466	$3.4x10^{9}$
8	Unnamed watercourse	IJ 3822 8509	$1.5x10^{10}$
9	Unnamed watercourse	IJ 4280 8828	$3.7x10^{9}$
10	Downshire Road Stream	IJ 4280 8828	$1.9x10^{11}$
11	Woodburn River	IJ 4018 8678	$1.4x10^{11}$
12	Ashbourne Stream	IJ 3973 8660	$4.1x10^{11}$
13	Trooperslane Stream	IJ 3935 8634	$1.3x10^{10}$
14	Unnamed watercourse	IJ 3871 8562	$8.3x10^{9}$
15	Jointure Bay Stream	IJ 3861 8551	$2.4x10^{10}$
16	Unnamed watercourse	IJ 3982 7945	$8.6x10^{6}$
17	Motte Stream	IJ 3996 7953	$4.4x10^{10}$
18	Croft Burn	IJ 4020 7972	$2.7x10^{10}$
19	Whinney Stream	IJ 4045 8002	$6.4x10^{10}$
20	Cultra Stream	IJ 4174 8124	$1.9x10^{10}$
21	Unnamed watercourse	IJ 4337 8192	$8.1x10^{8}$
22	Unnamed watercourse	IJ 4363 8203	$5.0x10^{8}$
23	Conns Water	IJ 3634 7421	Not determined[2]

[1]Cross-refers to the labels in Figure 5.4.

[2]Watercourse was too large to safely measure flow.

During the 2013 survey, estimated watercourse loadings varied from low to moderate. The highest estimated loading was associated with a watercourse 500 m west of Carrickfergus Marina.

No loadings could be determined for Conns Water or the River Lagan. If the flows for the River Knock are taken as conservative estimates of the flows in Conns Water then, at a mean flow of 0.184 m^3/s and an *E. coli* concentration of 40000 *E. coli*/100 ml (from the 2013 shoreline survey sample), the loading would be $1.9x10^{11}$ *E. coli*/day.

Parker *et al.* (1979) undertook a microbiological survey of the River Lagan and reported average faecal coliform concentrations in the order of 10000/100 ml. Although there have been changes in storm-associated inputs since then, this is the only extant data available for this river. If this data is taken to reflect the current *E. coli* concentration in the river then, at a mean flow of 8.521 m^3/s (as at Newforge), the loading would be $2.1x10^{12}$/day. The flow at Newforge is considered to be an underestimate as the gauging station is above the entry point for a number of tributaries of the Lagan., However, the loading estimated using this flow does not appear unreasonable for such a large river passing through both agricultural and city areas.

Conclusions

The major loadings to Belfast Lough from watercourses are associated with those discharging to the head of the lough. These would mainly impact the shellfish beds on a falling tide. The mussel beds at the southwestern end of the Inner Lough (Middlebank (B1), Whitehouse Roads (B2) and Steele (B5)) will be most vulnerable to impact from these sources. Other inputs with moderate loadings are located along the northern shore and would predominantly impact the McLoughlin (B10), Ross' Rock (B6) and Dougold Carrickfergus (B20) mussel beds. On the southern shore, the western end of the Holywood South (B24) bed would be anticipated to receive greatest impact on the basis of the present data.

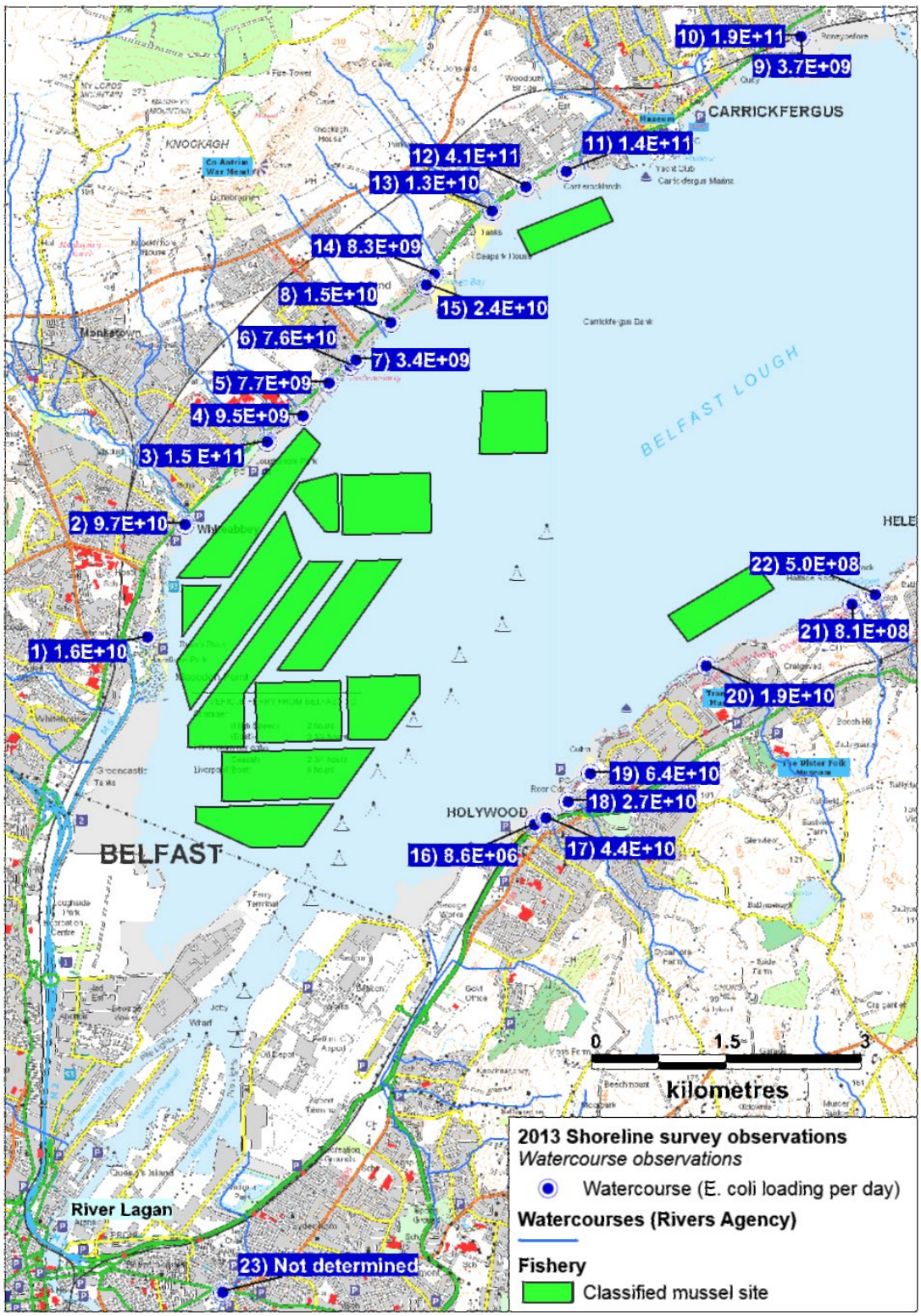


Figure 5.3 Estimated watercourse loadings into Belfast Lough (from data obtained from the 2013 shoreline survey)

Where the bacterial loading is labelled on the map, the scientific notation is written in digital format, as this is the only format recognised by the mapping software. So, where normal scientific notation for 1000 is $1x10^3$, in digital format it is written as 1E+03.

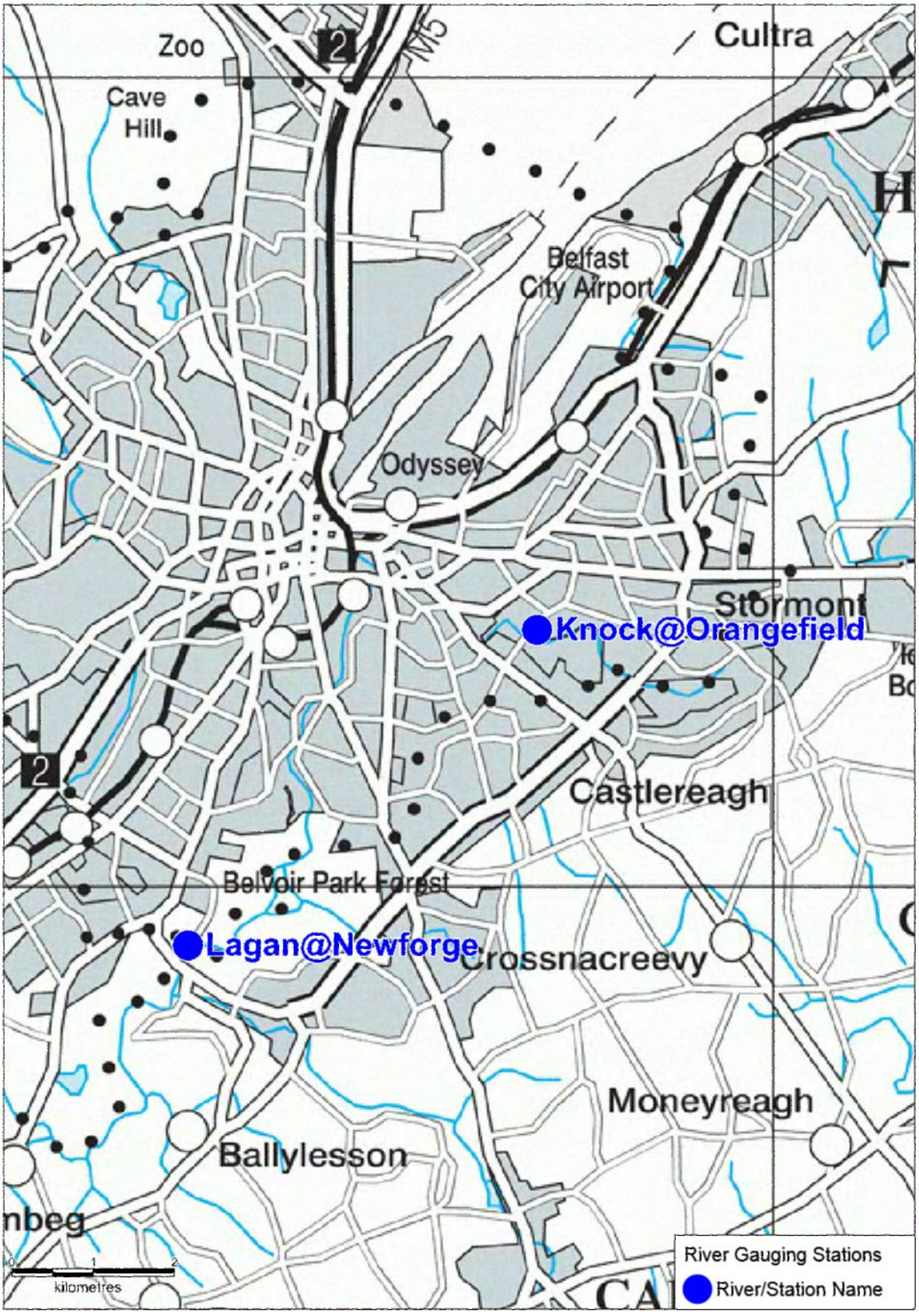


Figure 5.4 Location of river gauging stations

6. Meteorological data

Average monthly rainfall data from Newforge and Stormont weather stations for the 2000-2006 period was used in the 2008 report and have not been replicated for this review. They are available to view in the original 2008 AFBI report. For the purposes of this review, only Newforge weather station rainfall data has been purchased from the Meteorological Office. Newforge weather station lies approximately 12 km southwest of Belfast Lough, with rainfall considered representative of that within the catchment of Belfast Lough. Rainfall data was used for the period 01/01/2007 – 31/12/2012 and is recorded in total daily rainfall (mm). There were no missing records.

Wind roses were not included in the 2008 report. For the purposes of his review, wind roses have been purchased from the Meteorological Office for Orlock Head weather station, which lies approximately 10 km east of Belfast Lough. Wind roses for the period 2003-2007 and 2008-2012 have been purchased for comparison in this review, with the former displayed in Appendix 1.

6.1 Rainfall

Storm events and high rainfall levels are commonly associated with increased faecal contamination of coastal waters through surface water run-off from land where livestock or wild animals are present and through sewer and waste water treatment plant (WWTP) overflows (Mallin, et al., 2001; Lee & Morgan, 2003).

The Newforge weather station rainfall dataset for 2007-2012 is presented by year in Figure 6.1 and by month in Figure 6.2.

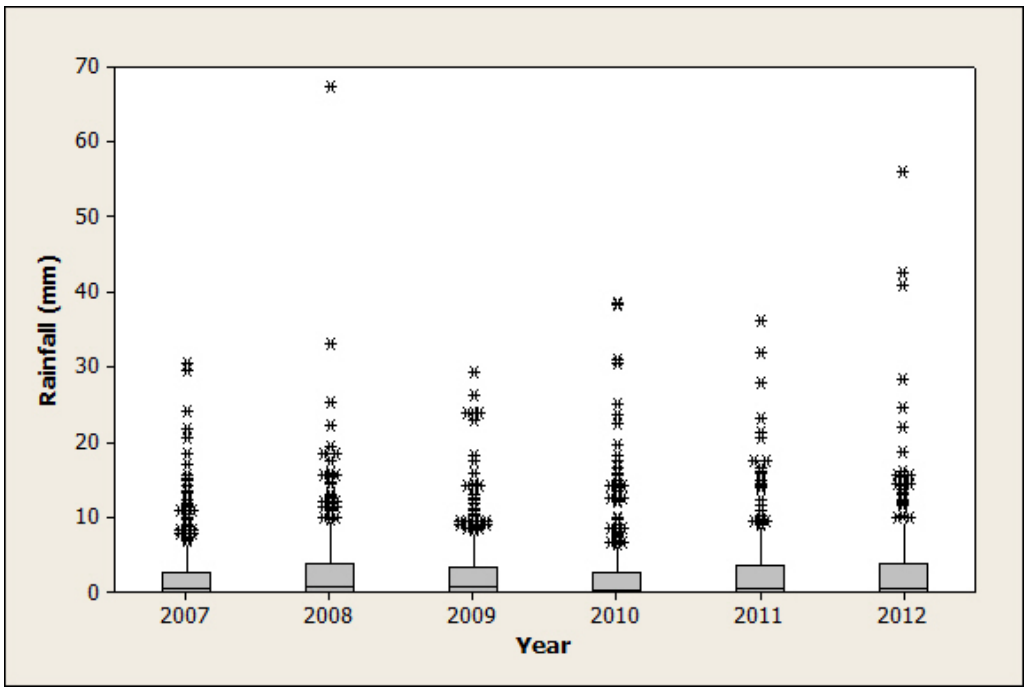


Figure 6.1 Boxplot of daily rainfall at Newforge by year (2007-2012)

The bulk of the observations were below 10 mm rainfall/day. The wettest years in the period were 2008 (1073 mm total rainfall) and 2012 (1051 mm). Rainfall events exceeding 30 mm/day occurred in all years except 2009, with two more extreme rainfall events of >50 mm/d occurring in 2008 and 2012.

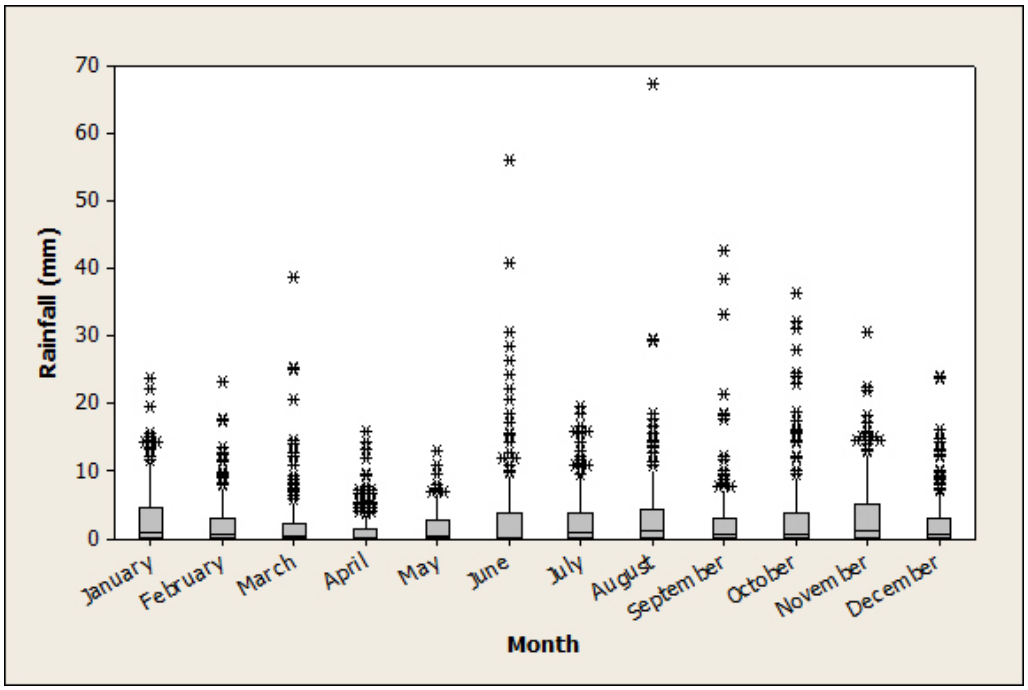


Figure 6.2 Boxplot of daily rainfall at Newforge by month (2007-2012)

The 2000-2006 dataset provided in the 2008 report indicated highest rainfall levels occurred from October to January, whilst lowest levels occurred from April to July.

There was not such a marked difference between months in the 2007-2012 dataset, although the driest months were April and May. The highest total monthly rainfall values occurred in January, June, August, October and November. The two extreme rainfall levels of >50 mm rain in one day occurred in June and August.

6.2 Wind

Wind speed and direction drive surface water and currents that play an integral part in particulate dispersal. Winds typically drive surface water at ca. 3% of the wind speed (Brown, 1991) so a gale force wind (a minimum of 34 knots/17.2 m/s) would drive a surface water current of about 1 knot or 0.5 m/s.

Figures 6.3 and 6.4 show seasonal wind roses for Orlock Head, at the mouth of Belfast Lough, for the periods 2003-2007 and 2008-2012 respectively.

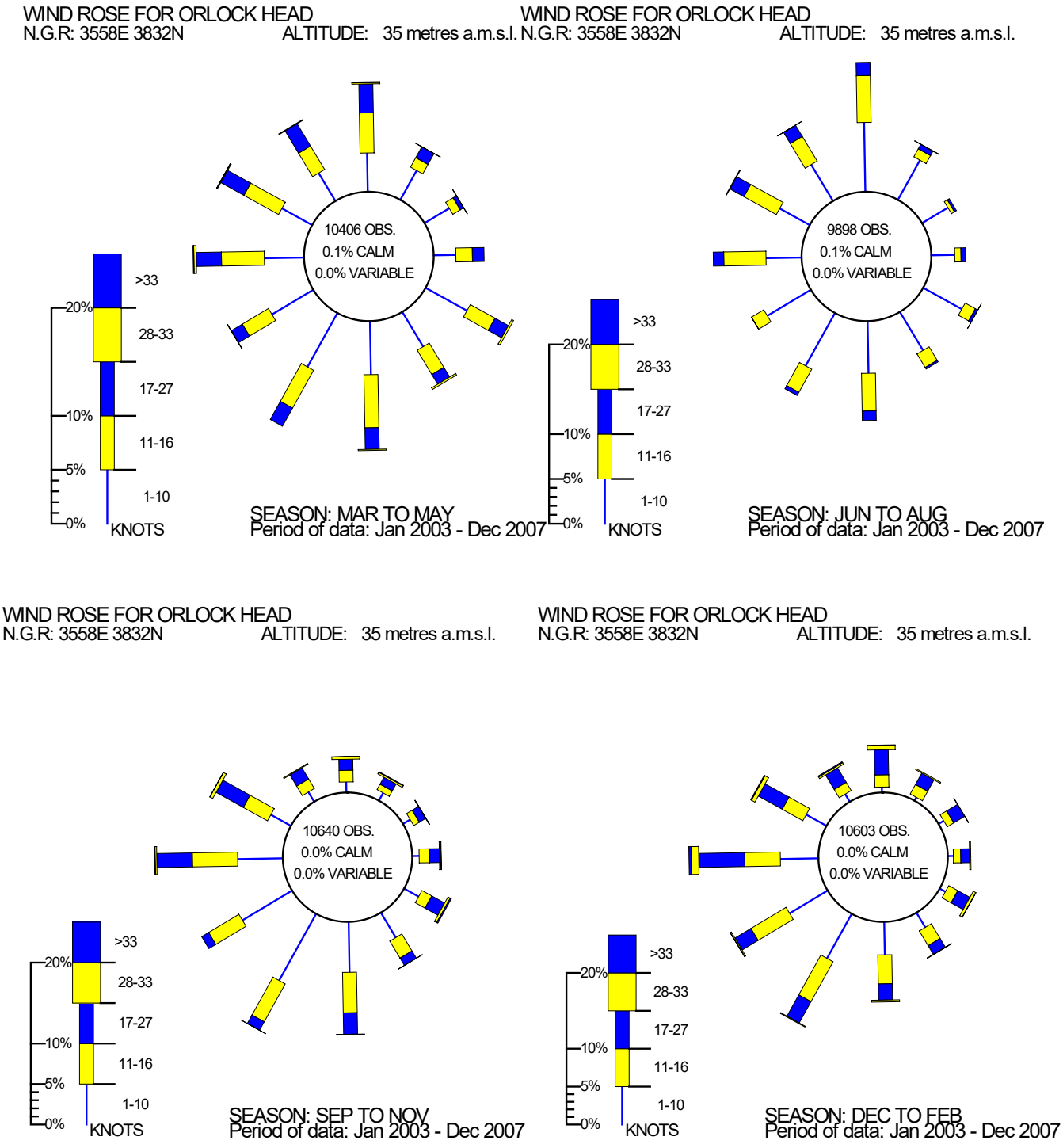


Figure 6.3 Seasonal wind roses for Orlock Head (2003-2007)

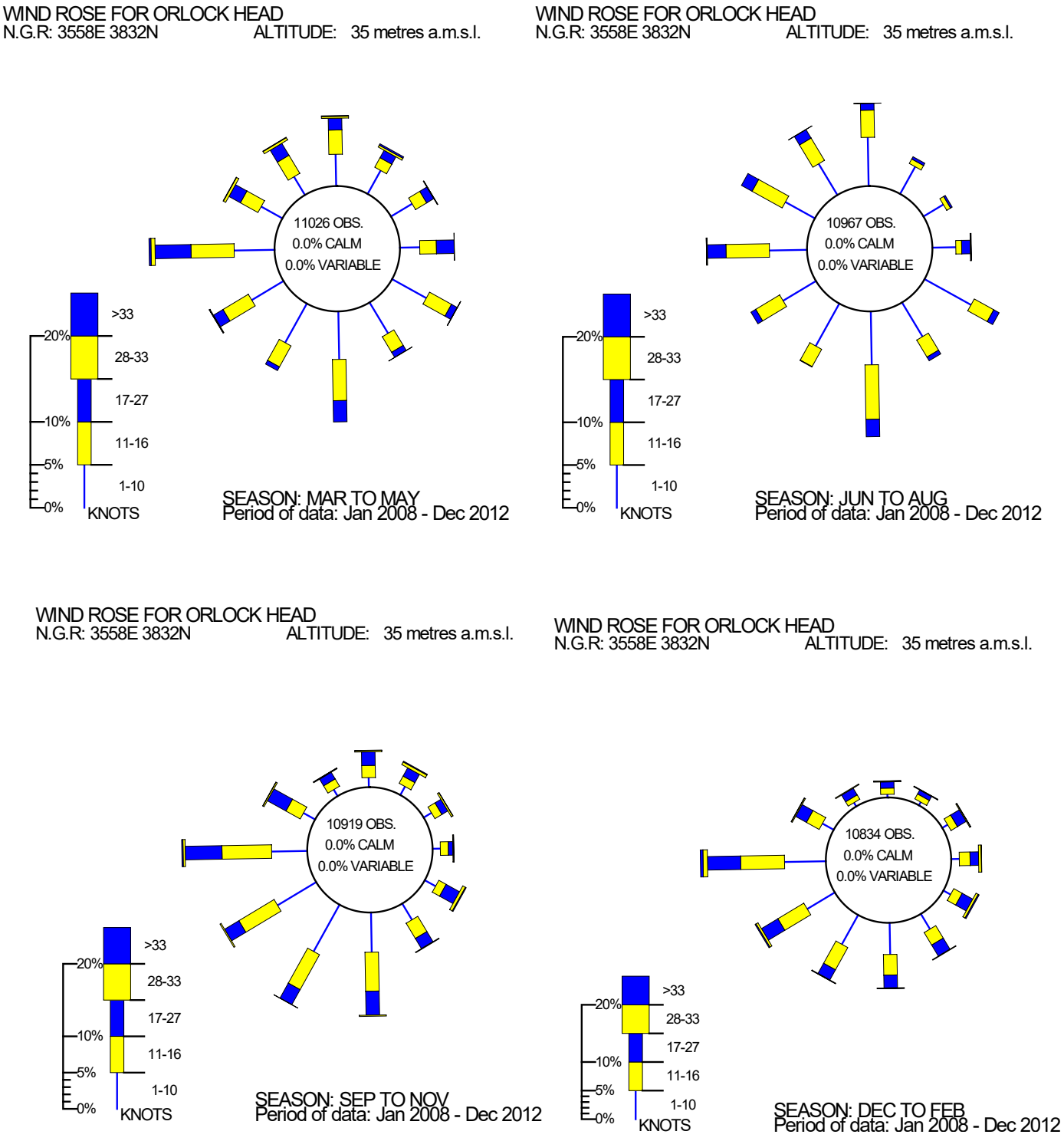


Figure 6.4 Seasonal wind roses for Orlock Head (2008-2012)

Prevailing winds throughout all four seasons appear to be south westerly. However, strong northerly westerly winds are also experienced in the spring and summer. This trend is seen in both 2003-2007 and 2008-2012 datasets. Figures 6.5 and 6.6 show the annual wind roses for the same periods.

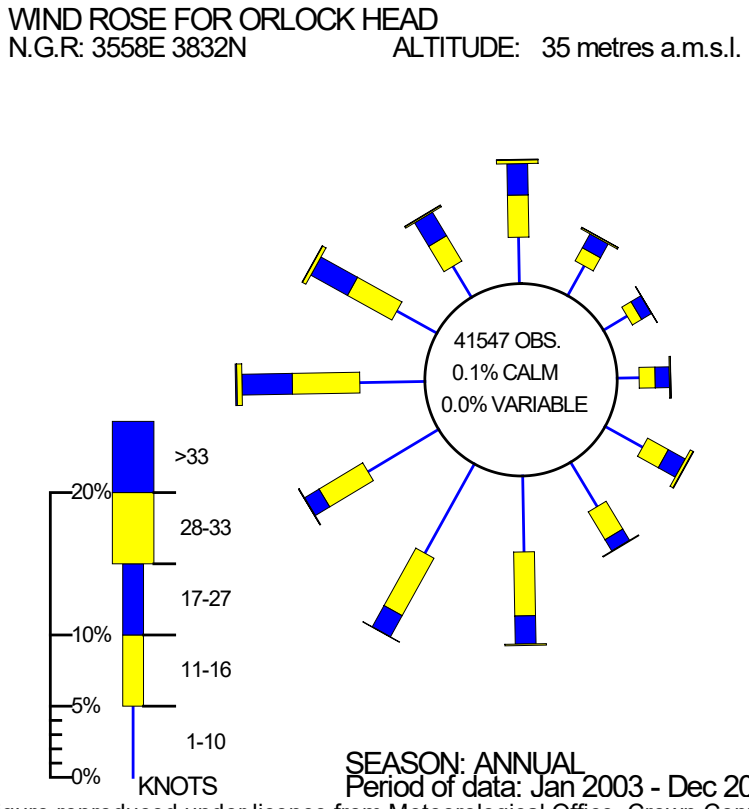


Figure 6.5 Annual wind rose for Orlock head (2003-2007)

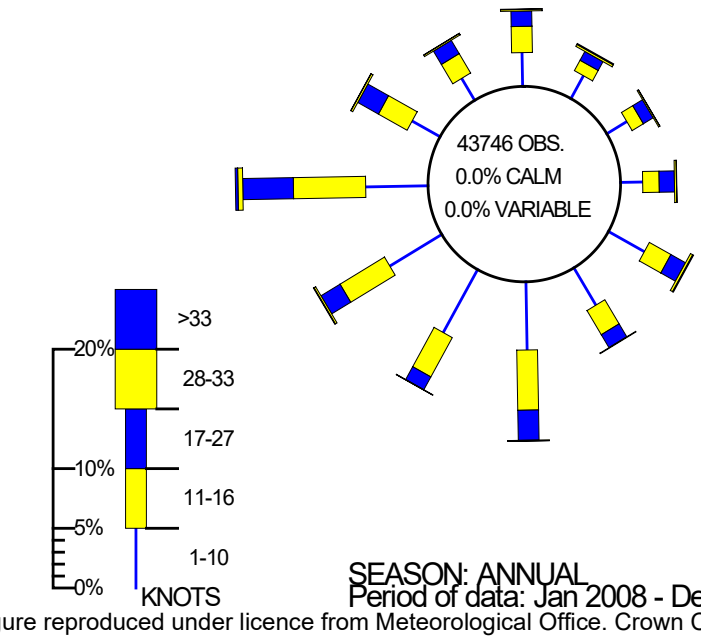


Figure 6.6 Annual wind rose for Orlock head (2008-2012)

Overall, the strongest winds range from westerly to southerly. In the earlier period, northerly to northwesterly winds were also significant.

7. Historical *E. coli* Data

No statistical analyses of Belfast Lough historical *E. coli* results were presented in the 2008 report. In this review, results for Belfast Lough sites Middlebank, Ross' Rock, Dougold, Urey, Dougold Carrick and Holywood South for the period between January 2007 and December 2013 were supplied by FSANI in February 2013. All *E. coli* results were reported as most probable number per 100 g of shellfish flesh and intravalvular fluid.

E. coli results reported as <20 were reassigned a value of 10 *E. coli* MPN/100 g for the purposes of statistical evaluation and graphical representation.

Summary of microbiological results

Summary results for all sites within Belfast Lough are displayed in Table 7.1.

Table 7.1 Sampling summary results for all RMPs in Belfast Lough 2007-2013

Sampling Summary						
Production area	Belfast Lough					
RMP	1	2	3	4	5	6
Bed name	Middlebank	Ross' Rock	Dougold	Urey	Dougold Carrickfergus	Holywood South
Species	Common mussels					
Nominal Location	54°.6446 N 5°.8809 W	54°.6669 N 5°.8934 W	54°.6625 N 5°.8819 W	54°.6765 N 5°.8593 W	54°.7038 N 5°.8274 W	54°.6658 N 5°.8807 W
Total no. of samples	116	143	145	143	135	103
2007	-	13	14	12	11	-
2008	-	12	12	12	8	-
2009	19	21	21	22	18	5
2010	24	24	25	24	24	24
2011	24	24	24	24	25	25
2012	24	24	24	24	24	24
2013	25	25	25	25	25	25
Results Summary						
Minimum	<20	<20	<20	<20	<20	<20
Maximum	16000	16000	24000	2400	5400	9200
Median	475	110	130	80	70	330
Geometric mean	418	126	136	79	93	292
90 Percentile	3500	2400	1300	790	794	3500
95 Percentile	9120	5180	2280	1640	1800	3500
No. Exceeding 230/100g	75 (65%)	51(36%)	52 (36%)	37 (26%)	45 (33%)	57 (55%)
No. Exceeding 1000/100g	36 (31%)	25 (17%)	19 (13%)	9 (6%)	12 (9%)	22 (21%)
No. Exceeding 4600/100g	9 (8%)	7 (5%)	5 (3%)	0	2 (1%)	4 (4%)
No. Exceeding 18000/100g	0	0	1	0	0	0

In general, prior to April 2009, samples were taken monthly and from then on, fortnightly from each RMP. The change in frequency coincided with the implementation of the recommendations of the 2008 sanitary survey. However, there were periods of time when samples were taken on a monthly basis and, occasionally, three samples were taken in one month. No samples were taken at Dougold Carrickfergus (RMP5) from September 2008 to March 2009 as there was no stock available for sampling and the site was confirmed as being inactive. Sampling only commenced for mussels at Middlebank (this was previously classified for cockles) and Holywood South in 2009.

All RMPs have, on occasions, yielded results of <20 *E. coli* MPN/100 g. The highest result of 24000 *E. coli* MPN/100g was seen at Dougold although both Middlebank and Ross' Rock both produced results of 16000 *E. coli* MPN/100 g.

Geographical patterns of results

A boxplot of results by site is presented in Figure 7.1. The box and whisker plots in Figures 9.1 and 9.2, present a summary of the distribution of individual daily rainfall values by year and by month. The grey box represents the middle 50% of the observations, with the median at the midline. The whiskers extend to the largest or smallest observations up to 1.5 times the box height above or below the box. Individual observations falling outside the box and whiskers are represented by the symbol *.

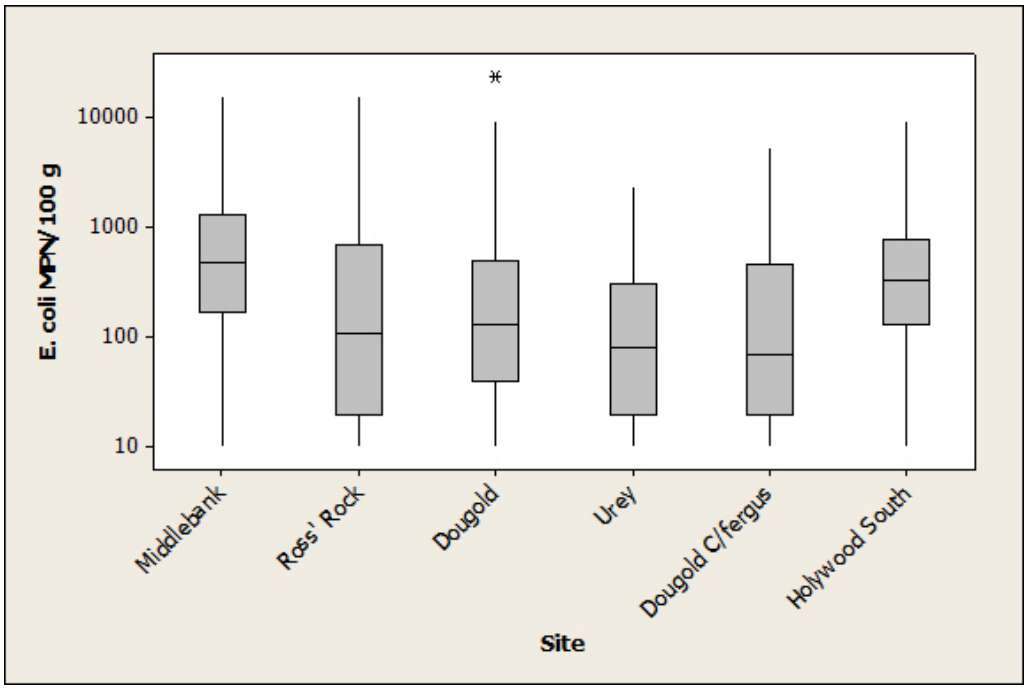


Figure 7.1 Boxplot of *E. coli* results by site

A very highly significant difference was found between *E. coli* results by site (one-way ANOVA, p = <0.001, Appendix 2), with geometric mean results at Middlebank and Holywood South being higher than those at the other sites. Figure 7.2 shows the

RMP locations with the symbols thematically mapped by the geometric mean *E. coli* values at each site.

Geographical locations were only available for the samples taken in 2013. However, apart from the January 2013 sampling run, all of the reported locations were identical and thus it was not possible to analyse the results for spatial relationships with respect to actual sampling location.

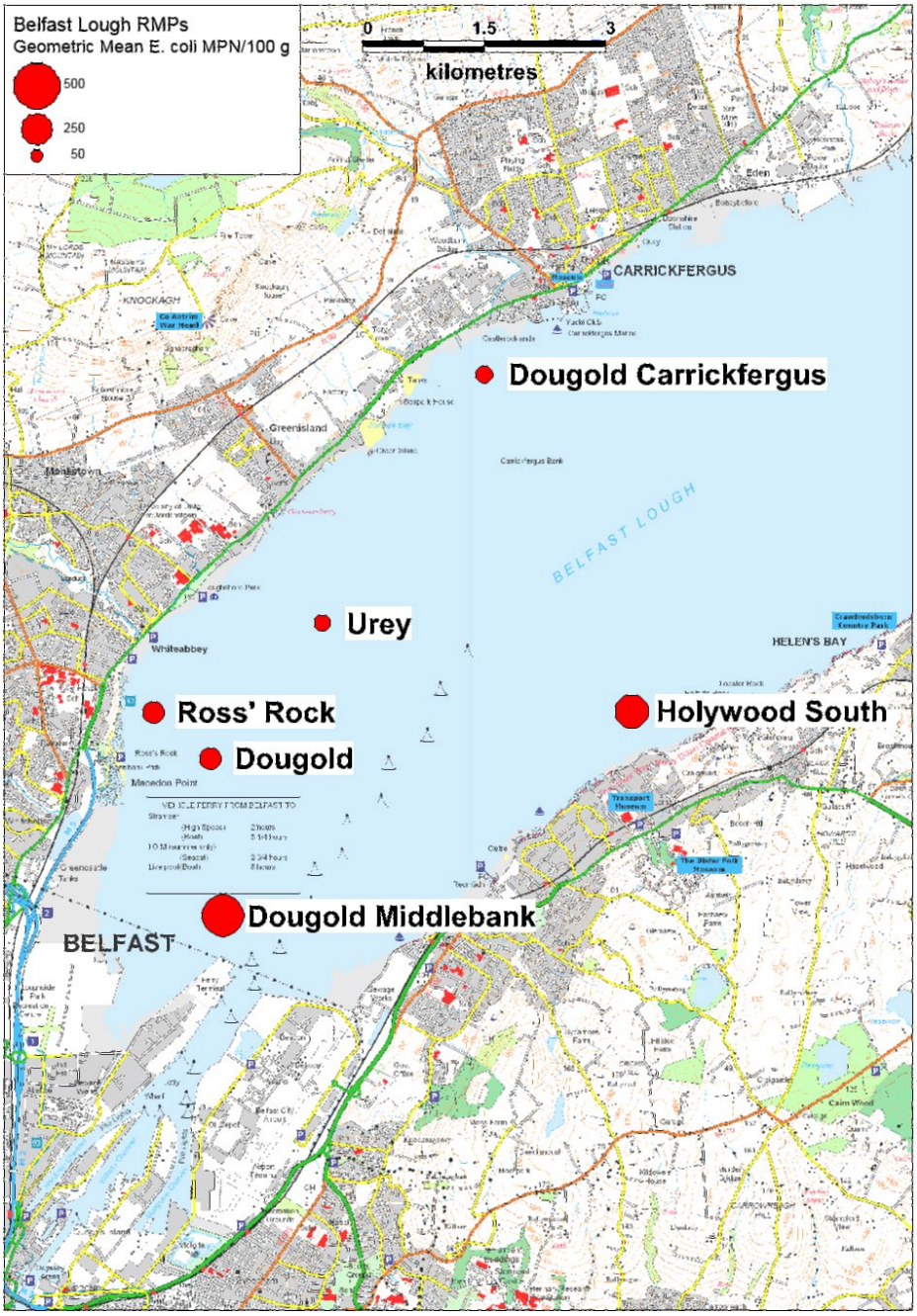


Figure 7.2 Variation in geometric mean *E. coli* by site

Temporal patterns of results

The trends in *E. coli* sampling results for all six RMPs in Belfast Lough have been analysed for the years between 2007 and 2013. Temporal trends for all six RMPs are displayed in Figures 7.1-7.7. The datasets are fitted with a lowess trend line. Lowess trendlines allow for locally weighted regression scatter plot smoothing. At each point in the dataset an estimated value is fitted to a subset of the data, using weighted least squares. The approach gives more weight to points near to the x-value where the estimate is being made and less weight to points further away. In terms of the monitoring data, this means that any point on the lowess line is influenced more by the data close to it (in time) and less by the data further away. A trend line helps to highlight any apparent underlying trends or cycles.

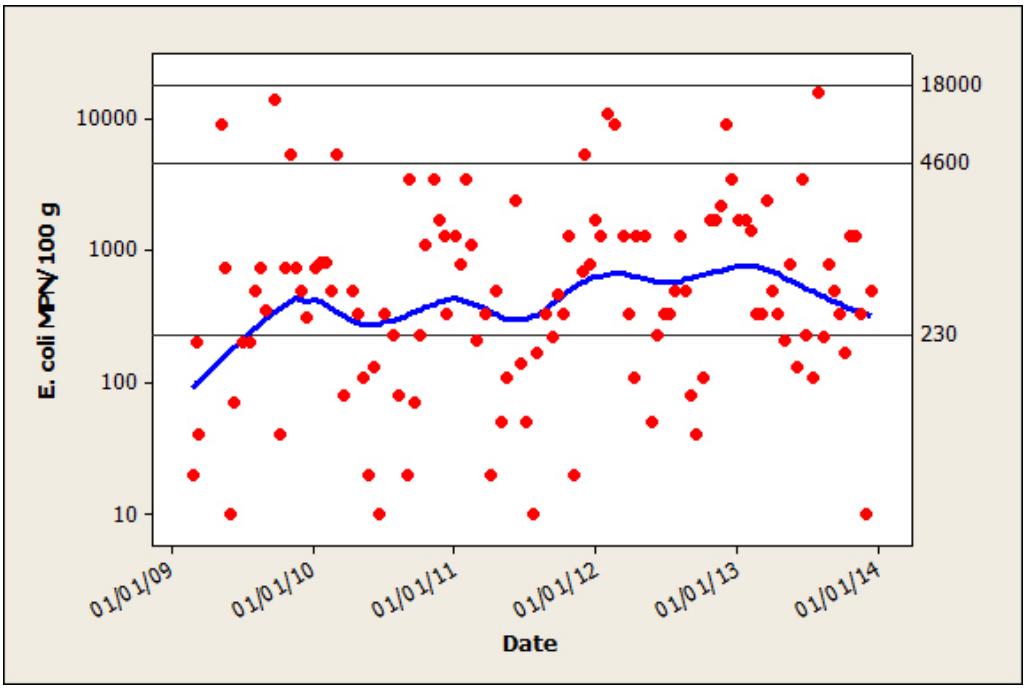


Figure 7.3 Scatterplot of Middlebank *E. coli* results by date (2009-2013

There has been a slight increase in contamination levels at Middlebank, as shown by the trend line. Superimposed on this general trend are peaks located approximately around the winter period.

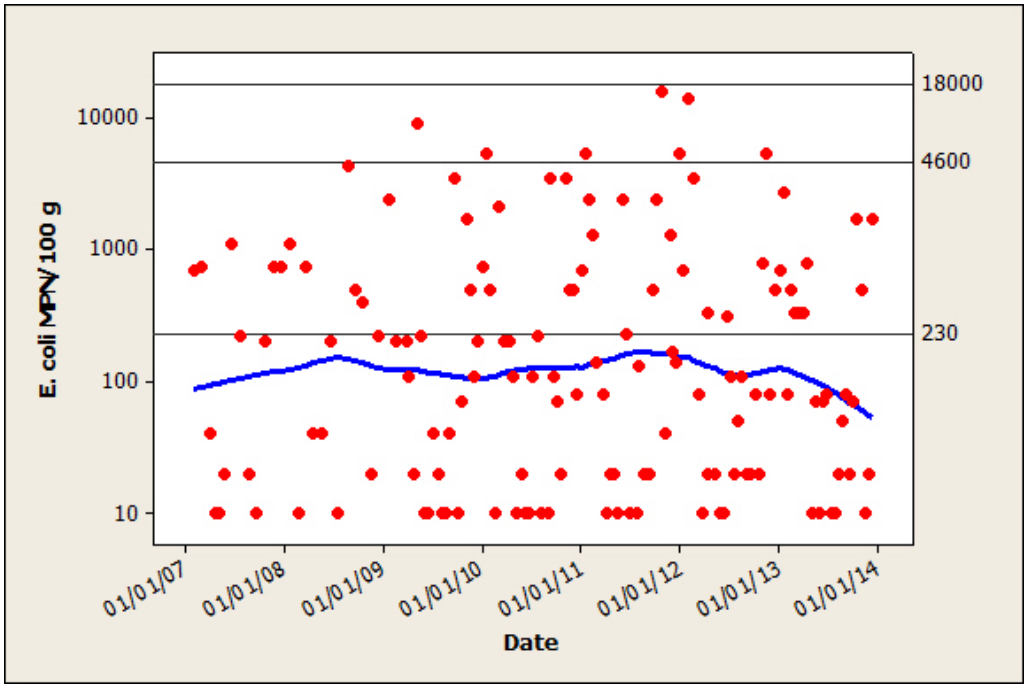


Figure 7.4 Scatterplot of Ross' Rock *E. coli* results by date (2007-2013)

Contamination levels have largely remained constant at Ross' Rock.

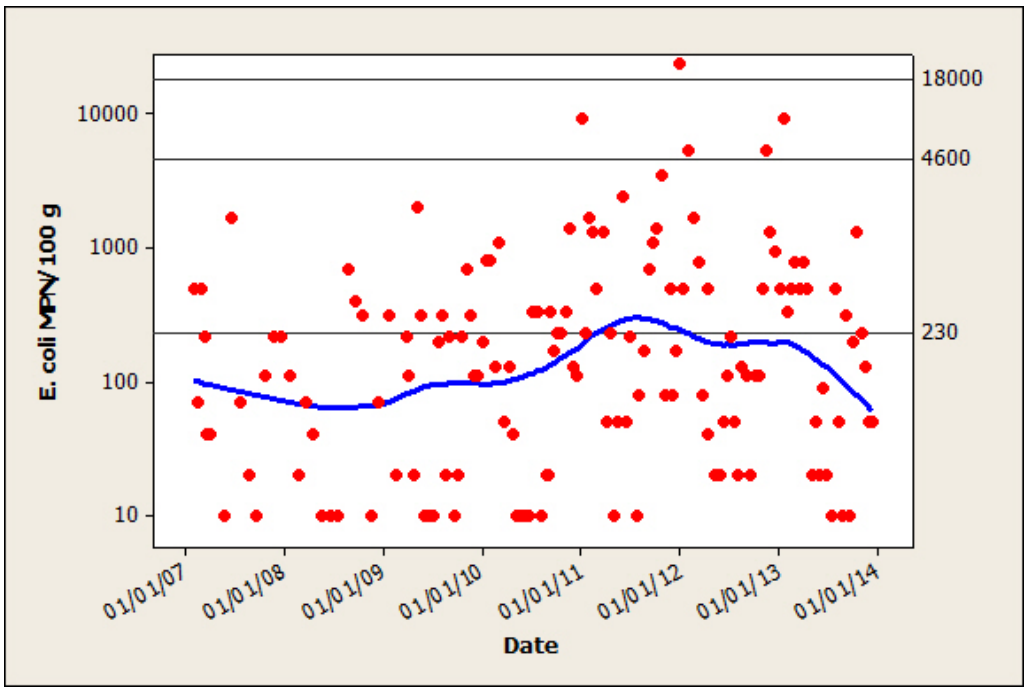


Figure 7.5 Scatterplot of Dougold *E. coli* results by date (2007-2013), with a lowess line

There has been a general increase in both the trend line and peak results over the sampling period.

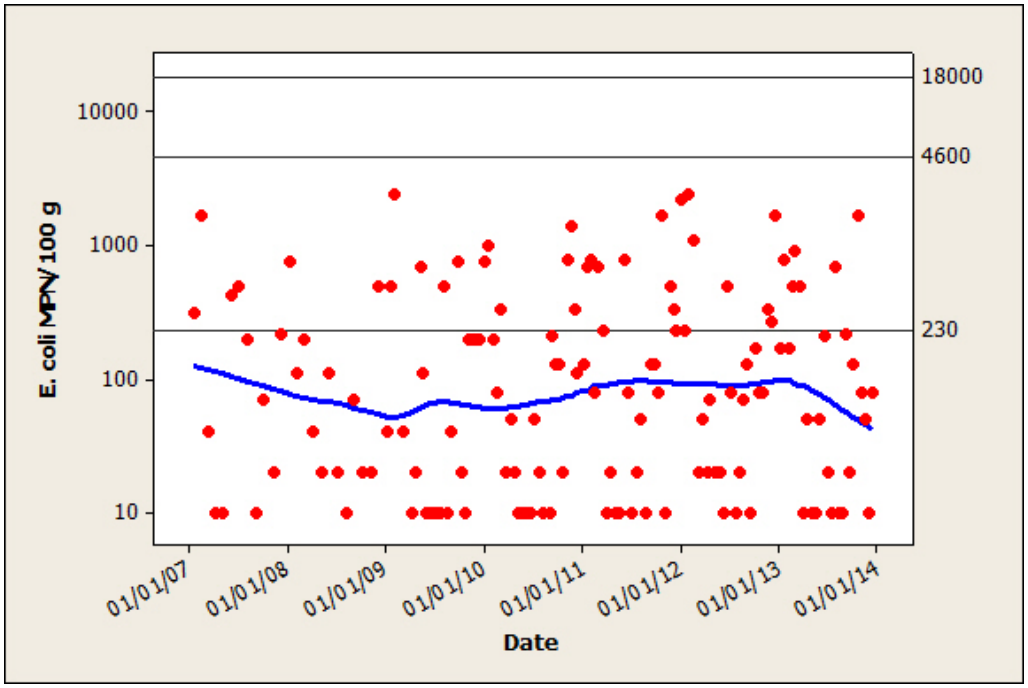


Figure 7.6 Scatterplot of Urey *E. coli* results by date (2007-2013)

Contamination levels at Urey have been generally constant over the period shown.

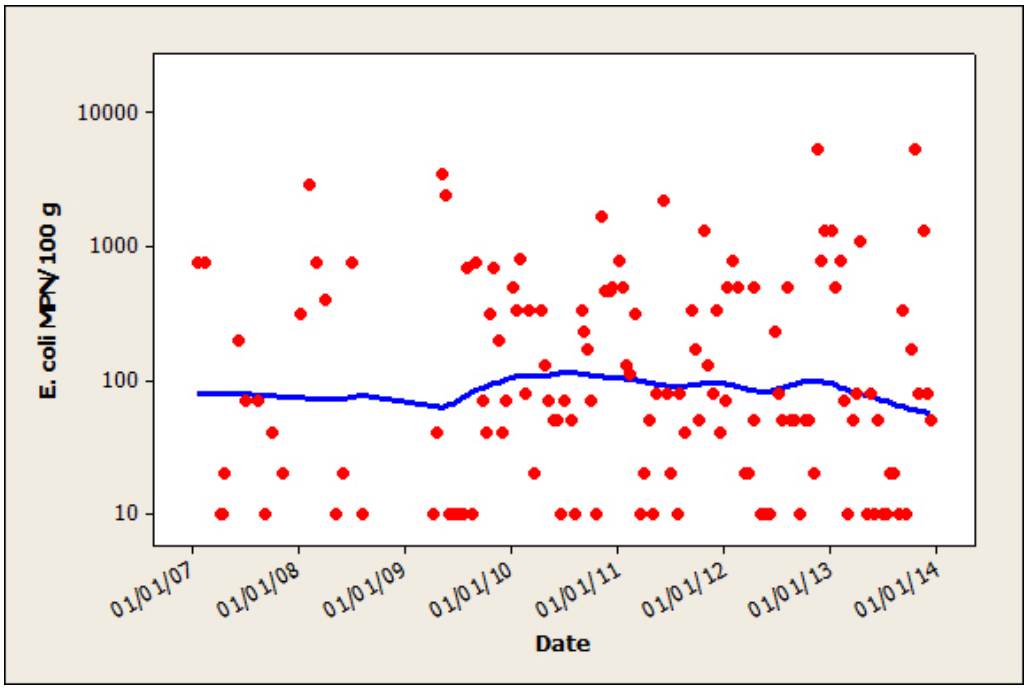


Figure 7.7 Scatterplot of Dougold Carrick *E. coli* results by date (2007-2013)

Contamination levels at Dougold Carrick have been generally constant over the period shown.

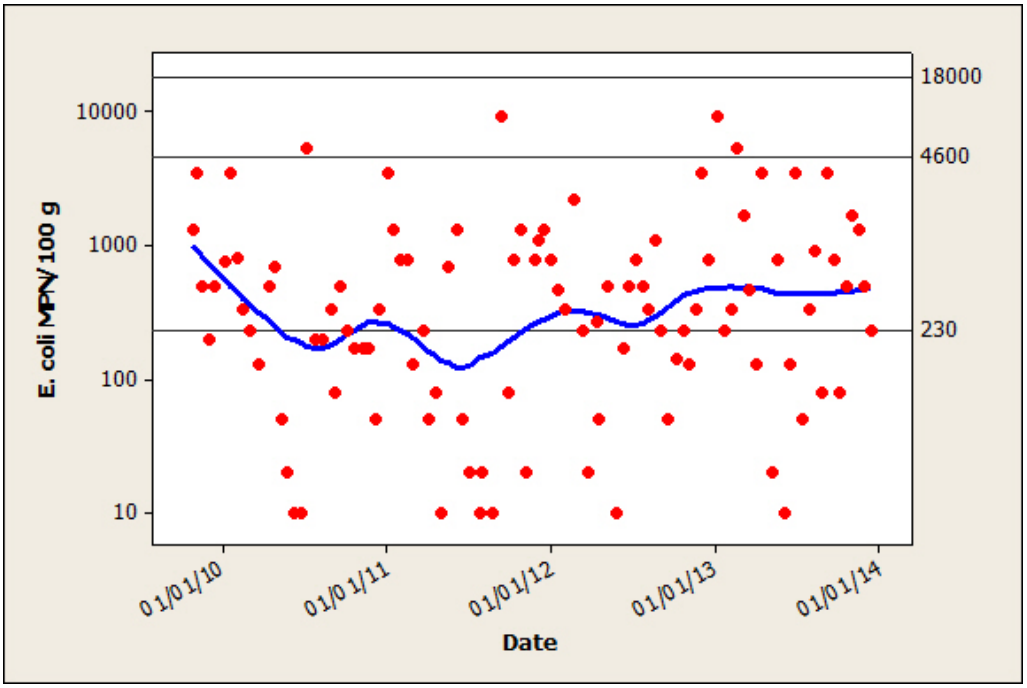


Figure 7.8 Scatterplot of Holywood South *E. coli* results by date (2009-2013), with a lowess line

Overall, there does not appear to have been a marked change in the level of *E. coli* contamination over the period. However, there are a series of small peaks in the trend line. These are located around the winter of each year.

Conclusions

On the basis of the historical data analysed for this review, the RMPs fall into three groups:

Group 1. Middlebank (RMP 1) and Holywood South (RMP 6). These showed markedly higher average results than the other four RMPs. They also yielded relatively high maximum *E. coli* results (16000 and 9200 *E. coli* MPN/100 g respectively) and the trend lines showed some evidence of seasonal effects.

Group 2. Ross' Rock (RMP 2) and Dougold (RMP 3). These yielded average *E. coli* levels that were intermediate between those shown by the other two groups (although significantly lower than those of Group 1) and relatively high maximum results (16000 and 24000 *E. coli* MPN/100 g respectively. No seasonal trend was apparent in the scatterplot for either RMP. However, that for Ross' Rock showed an increased level of contamination over time, which was not evident at Dougold.

Group 3. Urey (RMP 4) and Dougold Carrickfergus (RMP5). These yielded the lowest average *E. coli* levels and the lowest maximum results (2400 and 5400 *E. coli* MPN/100 g, respectively). No trends were apparent in the scatterplots at either site.

8. Movement of contaminants

The 2008 report used data from the SMILE programme (Ferreira, et al., 2007), which drew conclusions from data computed by hydrodynamic models such as Delft 3D and Ecowin. These were as follows:

- stratification is insignificant during summer months, with much of the area well mixed owing to little difference between the density at the surface and the bottom water. Freshwater input is most significant during winter months
- total freshwater runoff calculated at 1022 million m^3 y^{-1}
- water residence time is 10-20 days, with the longest residence times at the head of the lough, where the majority of shellfish farms are located
- residence times are longer in summer owing to the reduced influx of freshwater

No data on current speeds or estimates of particle transport distance were given in the 2008 sanitary survey report. There are no UKHO tidal stream predictions for the Inner Lough and no current data for the area was available from the British Oceanographic Data Centre. It is known that current data has been gathered as part of an EU-funded project, SPRES, but no data was given on the project website (http://spres.ihcantabria.com/). Reference was made to modelling from the SMILE project within the sanitary survey report (Ferreira, et al., 2007). Simulations from that modelling indicate current speeds of up to approximately 0.4 m/s within the Inner Lough, ignoring any effects of wind (Sustainable Mariculture in Northern Irish Lough Ecosystems, 1995). At a maximum current speed of 0.4 m/s, the maximum transport distance over a single ebb or flood tide would be expected to be approximately 5.8 km. The distance would be markedly less on neap tides. The actual distance of impact would also depend on the degree of dilution and dispersion. Currents within Inner Belfast Lough tend to be bidirectional.

9. Overall Assessment

This assessment considers the information obtained since the 2008 report and the potential changes in extent and location of faecal contamination.

Human sewage impacts

The primary impact on the beds at the southwestern end of the lough (towards the head of the lough) will be from the three continuous discharges from Belfast WWTW, Whitehouse WWTW and Kinnegar WWTW, and their associated CSOs, together with the continuous and intermittent discharges entering the River Lagan. These will impact on the western ends of the beds located towards the harbour area. For the beds located towards the northeastern end of the inner lough, the primary impact will be from the continuous discharges, and associated CSOs at Greenisland WWTW and Carrickfergus (on the north shore) and Seahill WWTW (on the south shore). The Greenisland discharge will impact mainly on the western end of the Dougold Carrickfergus bed while the Seahill discharge will mainly impact on the eastern end of the Holywood South bed.

In addition, during and after rainfall events, operation of other CSOs discharging either to watercourses or direct to the marine environment will have at least localised effects on the microbiological quality at the beds located closer to the shore.

Agricultural impacts

Despite the urban nature of the land immediately adjacent to Belfast Lough, there are a significant number of farm animals in the broader area. It is not possible to directly compare the data presented in this review with that presented in the original sanitary survey report and so it is not possible to determine whether the number of farm animals has changed. In addition, the spatial definition of the publicly available data is not sufficient to determine the relative abundance of farm animals within the lough catchments. It is expected that contamination from farm animals, and associated slurry, will contribute to observed *E. coli* concentrations in watercourses entering Belfast Lough, and the resulting estimated loadings thereof.

Wildlife Impacts

The primary impact associated with wildlife will be from birds. Although these occur in significant numbers around the intertidal areas of the lough, there will be some tendency for greater populations towards the head of the lough, in the vicinity of the reserve, park, and broad intertidal area.

Seasonal Variation

Human and animal populations are expected to be greatest during the summer months. However, the two RMPs that showed some evidence of a seasonal trend

showed higher levels during the winter period. This is not likely to be due to rainfall effects as there was no marked tendency towards higher rainfall, or the occurrence of unusual rainfall events, in the winter.

Watercourses

In general, the greatest impact from watercourses relates to those located at the head of the lough, predominantly the River Lagan, which receives significant amounts of human and waste. It is also likely to receive input from diffuse agricultural sources in the catchment. This is reflected in the historical microbiological data that showed the highest geometric mean result at the RMP located closest to the main channel at the head of the lough. Estimates for loadings of other watercourses located on the north and south shore indicate that some will potentially contribute localised contamination to specific beds or groups of beds.

Movement of contaminants

An approximate estimate of maximum transport distance over an ebb or flood tide is 5.8 km. This means that the shellfish beds may be impacted by several of the identified sources of contamination around the lough with the degree of impact depending on the degree of dilution and dispersion that takes place. Transport distance will be greatest at spring tide but the degree of dilution will be least at low spring tides and on neap tides. Due to the bidirectional nature of the predicted currents in the inner lough, sources will tend to impact on the beds located on the same side of the lough. The discharges located in the vicinity of the main channel, and contamination associated with the River Lagan, will impact mainly on the beds located towards the channel.

Analysis of Results

Historical *E. coli* results

On the basis of the historical data analysed for this review, the present RMPs fell into three groups on the basis of average and maximum *E. coli* levels and presence or absence of a seasonal trend. The groups were as follows:

Group 1. Middlebank (RMP 1) and Holywood South (RMP 6).

Group 2. Ross' Rock (RMP 2) and Dougold (RMP 3).

Group 3. Urey (RMP 4) and Dougold Carrickfergus (RMP5).

Apart from Ross' Rock and Dougold, the members of the groups are not located near each other and thus, although they exhibit common characteristics, are likely influenced by different sources of contamination.

Shoreline Survey results

No mussel samples were taken from the commercial beds during the shoreline survey. Six samples of mussels were taken from the intertidal areas. These yielded results ranging from 940 to >18000 *E. coli* MPN/100 g. The latter sample was taken at Whiteabbey on the north shore.

Twelve seawater samples were taken during the shoreline survey. The results ranged from 8 to 7200 *E. coli* cfu/100 ml. The two very high results were as follows:

- 7200 *E. coli*/100 ml: taken off Seapark House, near Jointure Bay
- 7100 *E. coli*/100 ml: taken off the recreation ground at Holywood

Conclusions

The principal sources of contamination of the mussel fisheries in Belfast Lough are the continuous and intermittent sewage discharges, both those that discharge directly to the lough and those that contribute to contamination within watercourses. Of the latter, the most significant is the River Lagan and this can essentially be considered as an additional point source. In addition to the major discharges, there are a large number of other intermittent and private continuous discharges in the area. Some of these discharge to the marine environment while others discharge to the watercourses, principally the Lagan and its tributaries. In addition, faecal contamination from agricultural sources will contribute to microbiological loadings of watercourses entering the lough. There are thus major sources affecting broad areas of the lough and smaller sources having more localised impacts. The large number of birds using the intertidal areas of the lough will also contribute to the microbiological status of the waters, with the greatest contribution expected towards the head of the lough.

10. Recommendations

Classification zones

In broad terms, it is recommended that the zones that were given in the original sanitary survey report should be kept. The exception is that it is recommended that Whitehouse Roads, C. Fresh and Steele be transferred to the Lower Inner zone to be represented by RMP1. This is because those four beds are all potentially impacted by contamination arising from Belfast WWTW, Kinnegar WWTW and the River Lagan. The beds are all well within the predicted maximum transport distance (5.8 km) of the sources (actual distances are between 1 and 3 km) and generally lie in the path that will be taken by contamination arising from Belfast WWTW and the River Lagan over a falling tide. The southeastern extents of the beds are also in close proximity (approximately 1 km) to the Kinnegar outfall and will be potentially impacted from that source around slack tides.

RMPs

It is recommended that the locations for RMPs 1, 2, 4 and 6 be maintained essentially as at present. It is recommended that the location of RMP 3 be moved to the southwest end of the bed to better reflect contamination arising from the Whitehouse WWTW. It is also recommended that the location for RMP 5 be moved to the southwest to better reflect contamination arising from Greenisland WWTW. The locations are given in Table 10.1 to 10 m accuracy in Irish National Grid eastings and northings and also in WGS84 latitude/longitude format.

The recommended RMPs and the zones they are recommended to represent are as follows:

Table 10.1 Recommended RMP locations for Belfast Lough

Zone	RMP	Site Name	Associated sites	RMP Location			
				Easting[1]	Northing[1]	Lat[2]	Long[2]
Lower Inner	RMP1	Middle Bank	Whitehouse Roads C. Fresh Steele	336,930	379,440	54°.6445N	5°.8797W
Inner 1	RMP2	Ross' Rock	Gallagher McLaughlin The Moorings	336,070	381,980	54°.6675N	5°.8918W
Inner 2	RMP3	Dougold	Henning	336,300	380,650	54°.6555N	5°.8889W
Middle	RMP4	Urey	Folly Roads	338,150	383,070	54°.6768N	5°.8591W
Outer	RMP5	Dougold Carrickfergus		339,800	386,000	54°.7026N	5°.8321W
Holywood South	RMP6	Holywood South		341,980	381,980	54°.6659N	5°.8003W

Notes: [1]Irish National Grid [2]Latitude/Longitude WGS84

Tolerance

It is recommended that a 100 m tolerance is applied to allow for the fact that these are dredged fisheries, i.e. a sample may be taken within 100 m of the recommended RMP location. It is recommended that the actual sampling locations be recorded, to 10 m accuracy, with that location being the approximate midpoint of the dredging that yields the sample. In the event of no stock being available within the specified tolerance of the RMP, consideration should be given to placing bagged mussels at the RMP location for the purposes of sampling. In that case, the mussels should be *in situ* for at least two weeks prior to sampling.

Frequency

The sanitary survey report recommended that sampling be undertaken fortnightly to provide sufficient data for a risk assessment. The data obtained through that sampling regime has been assessed in this review with respect to spatial and temporal trends. Further assessment for the purposes of classification and sampling plan review should not require such intensive monitoring and it is therefore proposed that the sampling frequency be reduced to monthly, as the normal frequency recommended in community guidance (European Comission, 2014).

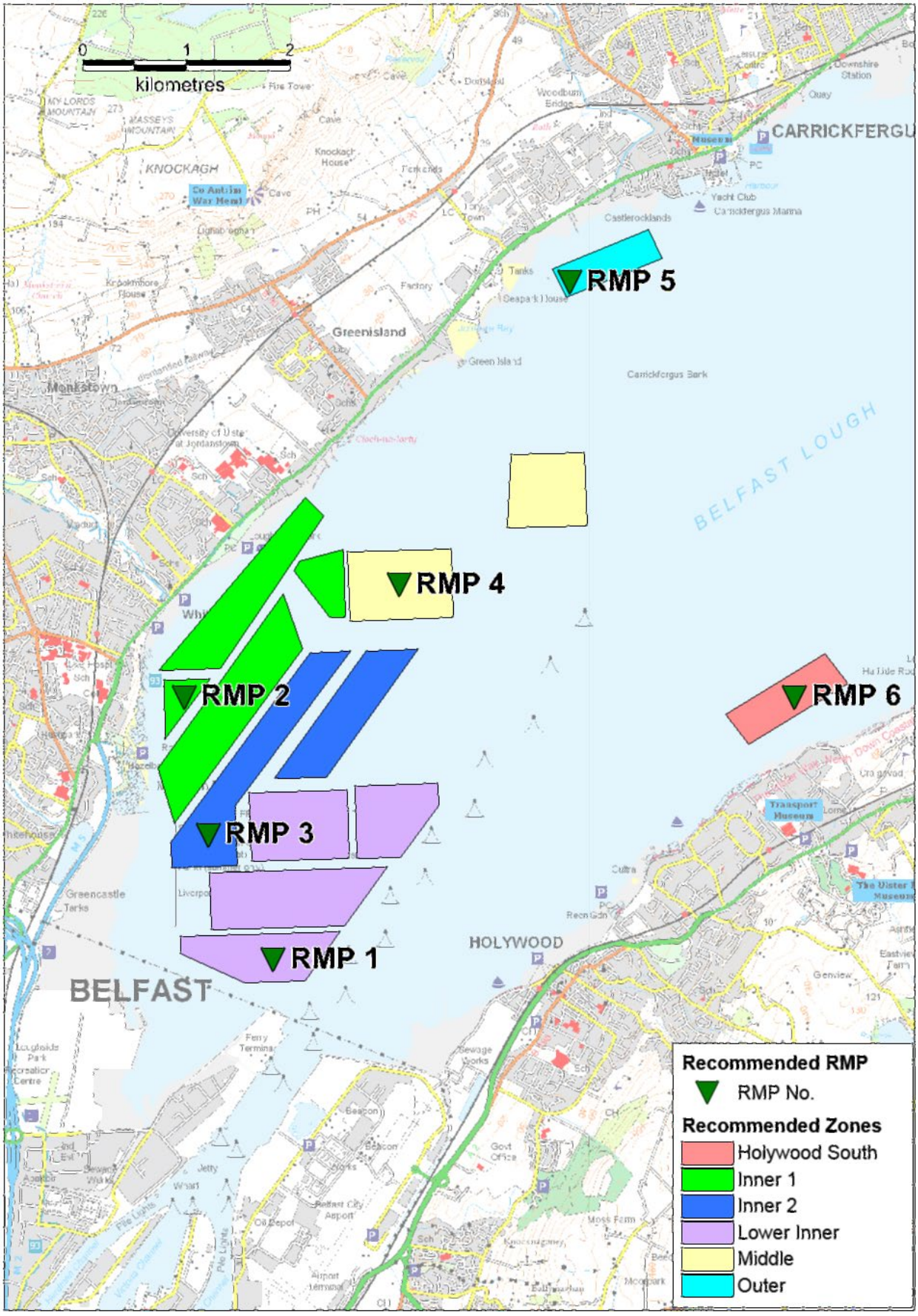


Figure 10.1 Map of Belfast Lough recommendations

Sampling Plan – Belfast Lough

Species	Zone	RMP	Site Name	DARD Code No.	Associated sites	DARD Code No.	RMP Location				Tolerance	Frequency
							Easting[1]	Northing[1]	Lat[2]	Long[2]		
Common mussels (*Mytilus edulis*)	Lower Inner	RMP 1	Middle Bank	B1	Whitehouse Roads C. Fresh Steele	B2 B4 B5	336,930	379,440	54°.6445 N	5°.8797 W	100 m	Monthly
	Inner 1	RMP 2	Ross' Rock	B6	Gallagher McLaughlin The Moorings	B7 B10 B11	336,070	381,980	54°.6675 N	5°.8918 W		
	Inner 2	RMP 3	Dougold	B3	Henning	B8	336,300	380,650	54°.6555 N	5°.8889 W		
	Middle	RMP 4	Urey	B12	Folly Roads	B14	338,150	383,070	54°.6768 N	5°.8591 W		
	Outer	RMP 5	Dougold Carrickfergus	B20			339,800	386,000	54°.7026 N	5°.8321 W		
	Holywood South	RMP 6	Holywood South	B24			341,980	381,980	54°.6659 N	5°.8003 W		

Notes: [1]Irish National Grid [2]Latitude/Longitude WGS84

11. References

AFBI, 2013. *Intertidal Hervesting in Northern Ireland,* Belfast: Agri-food and Biosciences Institute.

Austin, G. R. W. C. N. M. H. M. A. S. W. H. R. S. D. W. S. a. H. C., 2014. *Waterbirds in the UK 2011/12: The Wetland Bird Survey,* Thetford: BTO/RSPB/JNCC.

Belfast City Council, 2013. *Belfast Tourism Monitor2012.* [Online] [Accessed 28 02 2014].

Belfast Harbour, 2012. *Belfast Harbour, Annual Report & Accounts 2012.* [Online] Available at: https://www.belfast-harbour.co.uk/uploads/pdf/1372325686--BHC-Annual-Report-2012-13.pdf
[Accessed 03 02 2014].

Belfast Harbour, 2014a. *Cruise Schedule.* [Online] Available at: https://www.belfast-harbour.co.uk/port/cruise-schedule
[Accessed 04 02 2014].

Belfast Harbour, 2014b. *Belfast Harbour Welcomes Leisure Craft.* [Online] Available at: https://www.belfast-harbour.co.uk/port/marina
[Accessed 04 02 2014].

Brown, J., 1991. The final Voyage of Rapaiti: A measure of surface drift velocity in relation to the surface wind. *Marine Pollution Bulletin,* 22(1), pp. 37-40.

Centre for Ecology & Hydrology, 2014. *National River Flow Archive.* [Online] Available at: http://www.ceh.ac.uk/data/nrfa/data/search.html
[Accessed 05 03 2014].

Civil Aviation Authority, 2012. *Summary of Activity at Reporting Airports 2012.* [Online]
Available at: http://www.caa.co.uk/docs/80/airport_data/2012Annual/Table_02_2_Summary_Of_Activity_at_UK_Airports_2012.pdf
[Accessed 04 02 2014].

County Down Spectator and Ulster Standard, 2014. *Council urged to get 'wuff' with Seapark fouling dogs.* [Online]
Available at: http://countydownspectator.com/news/general-news/council-urged-to-get-wuff-with-seapark-fouling-dogs.html
[Accessed 04 02 2014].

Department for Regional Development Northern Ireland, 2007. *A2 Shore Road Greenisland Envrionmental Statement 11 Ecology and nature Conservation.* [Online] Available at: http://www.drdni.gov.uk/a2_chapter_11_-_ecology_and_nature_conservation.pdf
[Accessed 13 03 2014].

Department of the Environment Northern Ireland, 2014. *Planning Application Search.* [Online]
Available at: http://epicpublic.planningni.gov.uk/PublicAccess/zd/zdApplication/application_searchform.aspx
[Accessed 04 02 2014].

Duck, C., 2006. *Results of the thermal image survey of seals around the coast of Northern Ireland No. 06/09,* Belfast: Environment and Heritage Service Research and Development Series.

Duck, C. D., Morris, C. D. & Thompson, D., 2012. *The status of Bristish harbour seal populations in 2011,* Fife: NERC Sea Mammals Research Unit.

European Comission, 2014. *Community Guide to the Principles of Good Practice for the Microbiological Classification and Monitoring of Bivalve Mollusc Production and Relaying Areas with regard to Regulation 854/2004. European Commission DG Health and Consumers. Issue 2.,* Brussels: European Commission.

Ferreira, J. G. et al., 2007. *SMILE - Sustainable Mariculture in Northen Irish Lough Ecosystems - Assessment of Carrying Capacity for Environmentally Sustainable Shellfish Culture in Carlingfor Lough, Strangford Lough, Bellfast Lough, Larne Lough and Lough Foyle,* Ireland: IMAR Institute of Marine Research.

Geopii, 2014. *Listing of planning applications.* [Online] Available at: http://www.geopii.com/planning/ [Accessed 04 02 2014].

iNorthernIreland.co.uk, 2014. *Northern Ireland Dairy Farmers.* [Online] Available at: http://www.inorthernireland.co.uk/local/dairy-farmers/ [Accessed 04 02 2014].

Irish Cruising Club, 2008. *East and North Coasts of Ireland; Sailing Directions.* Eleventh ed. Dublin: Irish Cruising Club Publications Ltd..

Lee, R. J. & Morgan, O. C., 2003. Envrionmental factors influencing the microbial contamination of commercially harvested shellfish.. *Water Science and Technology,* Issue 47, pp. 65-70.

Mallin, M. A. et al., 2001. Demographics, landscape and meterological factors controlling the microbial pollution of coastal waters. *Hydrobiologica,* Issue 460, pp. 185-193.

Newtonabbey Borough Council, 2012. *Local Residents Help Stamp Out Dog Fouling!.* [Online] Available at: http://www.newtownabbey.gov.uk/news/displayarticle.asp?article=1867 [Accessed 04 02 2014].

NIEA, 2011. *Review of Sensitive Areas in Northern Ireland under the Urban Waste Water Treatment Directive 2006-2009. ,* Belfast: Northern Ireland Environment Agency.

NISRA, 2013. *Northern Ireland Tourism Statistics April 2012 to March 2013.* [Online] Available at: http://www.detini.gov.uk/publication_quarter_1_2013.pdf [Accessed 05 03 2014].

Office for National Statistics, 2012. *Country Profiles: Key Statistics - Northern Ireland, August 2012.* [Online] Available at: http://www.ons.gov.uk/ons/rel/regional-trends/region-and-country-profiles/key-statistics-and-profiles---august-2012/key-statistics---northern-ireland--august-2012.html [Accessed 2014 03 2014].

Parker, J. G., Damoglu, A. P. & Stewart, D. A., 1979. The distribution of faecal bacteria in the estuary of the River Lagan U.K.. *Records of Agriculture Resources (Belfast),* Volume 27, pp. 43-52.

RSPB, 2014. *Belfast Lough.* [Online] Available at: http://www.rspb.org.uk/reserves/guide/b/belfastlough/index.aspx [Accessed 04 02 2014].

Sea Watch Foundation, 2012. *Cetaceans of Northern Ireland.* [Online] Available at: http://seawatchfoundation.org.uk/wp-content/uploads/2012/07/NorthernIreland.pdf [Accessed 04 02 2014].

Sustainable Mariculture in Northern Irish Lough Ecosystems, 1995. *Animations.* [Online] Available at: http://www.ecowin.org/smile/A3.htm [Accessed 13 03 2014].

Titanic-Quarter, 2014. *Titanic Quarter, Belfast, Northern Ireland - Future Projects.* [Online] Available at: http://www.titanic-quarter.com/tq-life/futureprojectslife [Accessed 04 02 2014].

12. List of Figures and Tables

Appendices

1. Continuous Public Sewage Discharges (NIW)
2. Consented Public intermittent discharges (NIW) - Redacted
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5. Descriptive Statistics
6. Shoreline survey Report 2014

Appendix 1. NIW Public Septic Tanks and their associated population equivalents (PE). Data provided by NIW.

CARID	Name	Ownership	Installation Type	Treatment Level	Actual PE	Con-sented DWF
WW002063565	Movilla Road 136-140 ST	NI Water	Septic Tank	Primary	9	2.4
WW002063571	Ballymiscaw Road 33-37 ST	NI Water	Septic Tank	Secondary	9	2.6
WW002063575	Windmill Road 71-73 ST	NI Water	Septic Tank	Primary	6	2
WW002063579	Glen Cottages 1-6 ST	NI Water	Septic Tank	Primary	17	2
WW002063580	Craigdarragh Road 85-87 ST	NI Water	Septic Tank	Primary	8	2
WW002063581	Killaughey Road 252-254 ST	NI Water	Septic Tank	Primary	6	1.6
WW002063582	Ballykeel Cottages ST	NI Water	Septic Tank	Primary	13	3
WW002063583	Ballycrochan Road ST	NI Water	Septic Tank	Primary	6	2
WW002063954	Old Holywood Road 190-196 ST	NI Water	Septic Tank	Primary	12	3.2
WW002064168	Moneyreagh Road 51-55 ST	NI Water	Septic Tank	Primary	9	2.4
WW002063947	Ballybarnes Road ST	NI Water	Septic Tank	Primary	3	0.8
WW002064186	Gransha Road 26-28 ST	NI Water	Septic Tank	Primary	3	0.8
WW002064246	Dorisland ST	NI Water	Septic Tank	Primary	3	1
WW002064170	Upper Malone Road ST	NI Water	Septic Tank	Primary	24	6.4
WW002063573	Murdocks Lane 1-6 ST	NI Water	Septic Tank	Secondary	17	5
WW002063963	Middle Braniel Road ST	NI Water	Septic Tank	Primary	18	5

Appendix 2. Consent number and location information for Consented public intermittent discharges (CSO and ERO). Data provided by NIW.

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
Gilnahirk Road CSO	CSO	Consented		Stream
Knock Road CSO	CSO	Consented	5047/2007	River
Orby Drive CSO	CSO	Consented	5047/2007	Culvert
Houston Park Marina CSO	CSO	Consented	5047/2007	Culvert
Orangefield Avenue Sandhill CSO	CSO	Consented	5047/2007	River
Abbey Park Bangor CSO	CSO	Unconsented		Stream
Abbey Park Barnetts CSO	CSO	Consented	5047/2007	Stream
Abbey Park East CSO	CSO	Unconsented		River
Abbeydale Parade CSO	CSO	Consented	5019/2007	Culvert
Abetta Parade CSO	CSO	Consented	5047/2007	Stream
Abetta Parade Linden Gardens CSO	CSO	Consented	5047/2007	Stream
Agnes Street CSO	CSO	Consented	5022/2007	Culvert
Albany WwPS	ERO	Consented	5022/2007	River
Alexander Loop CSO	CSO	Unconsented		River
Altmore Green CSO	CSO	Consented	5102/2007	Stream
Andersonstown Park CSO	CSO	Consented	5019/2007	Culvert
Annadale Crescent WwPS	ERO	Consented	5019/2007	River
Antrim Road Alexandra CSO	CSO	Consented	5019/2007	Culvert
Antrim Street Carrick CSO	CSO	Consented	5022/2007	Sea
Ardmore Avenue CSO	CSO	Consented	5019/2007	Culvert
Ardmore Ballykeel CSO	CSO	Consented	5047/2007	Stream
Ards Drive Viaduct CSO	CSO	Consented	5102/2007	River
Avonlea Park CSO	CSO	Consented	5018/2007	Culvert
Balfour Avenue CSO	CSO	Consented	5101/2007	Sea
Ballybarnes Meadow CSO	CSO	Consented	5015/2007	Stream
Ballyclare Road Newtownabbey CSO	CSO	Consented	5102/2007	Culvert
Ballycrochan Drive WwPS	ERO	Unconsented		Stream
Ballycrochan Linear Park CSO	CSO	Pending		Stream
Ballygomartin Forth CSO	CSO	Consented	5019/2007	River
Ballygomartin Presbyterian CSO	CSO	Consented	5019/2007	River
Ballyhanwood Ballybeen WwPS	CSO & ERO	Consented	5047/2007	Stream
Ballylesson Giants Ring WwPS	ERO	Consented	5080/2007	Stream
Ballymurphy Road CSO	CSO	Consented	5019/2007	Culvert
Ballyrobert Bangor WwPS	CSO & ERO	Pending		Stream
Ballyrobert Road CSO	CSO	Pending		Stream
Ballyrogan Park CSO	CSO	Consented	5015/2007	River
Ballysillan Road Glenside CSO	CSO	Consented	5019/2007	Culvert
Ballywilliam WwPS	CSO & ERO	Consented	5038/2007	Sea

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
Balmoral Avenue CSO	CSO	Consented	5019/2007	Culvert
Balmoral Court CSO	CSO	Consented	5019/2007	Culvert
Bangor Abbey Parochial CSO	CSO	Unconsented		Culvert
Bangor Road Newtownards CSO	CSO	Consented	5015/2007	Culvert
Bangor Road Old Quay CSO	CSO	Consented	5047/2007	Culvert
Bangor Road Seapark CSO	CSO	Consented	5047/2007	Culvert
Beechmount Avenue Ardnaclowney CSO	CSO	Consented	5019/2007	Culvert
Beechmount Avenue Logan CSO	CSO	Consented	5019/2007	Stream
Belfast Road Carrickfergus CSO	CSO	Unknown		River
Belfast Road Palace Barracks CSO	CSO	Consented	5047/2007	River
Belfast Tunnel TPS	CSO & ERO	Unconsented		Sea
Bells Roundabout Belfast CSO	CSO	Consented	5047/2007	Culvert
Belvoir Park CSO	CSO	Consented	5080/2007	Stream
Ben Vista Holywood WwPS	CSO & ERO	Consented	5093/2007	Unknown
Blacks Road Trenchard CSO	CSO	Consented	5019/2007	Culvert
Blackwood Crescent CSO	CSO	Consented	5093/2007	Stream
Bloomfield Court WwPS	ERO	Consented	5047/2007	River
Bradshaws Brae WwPS	CSO & ERO	Consented	5015/2007	Stream
Braeside Newtownards WwPS	ERO	Consented	5015/2007	Culvert
Breckenridge WwPS	ERO	Consented	5038/2007	Sea
Bridge Street Fountain CSO	CSO	Consented	5018/2007	Sea
Briggs Rock PS	CSO		2032/06	
Brompton Park CSO	CSO	Consented	5019/2007	River
Brompton Road WwPS	CSO & ERO	Consented	5018/2007	Sea
Brook Meadow Gilnahirk WwPS	ERO	Consented	5047/2007	Stream
Brook Street Holywood CSO	CSO	Consented	5047/2007	Stream
Brooklands Avenue CSO	CSO	Consented	5047/2007	Culvert
Brooklands Crescent CSO	CSO	Consented	5047/2007	Culvert
Camross Park 2 CSO	CSO	Unconsented		River
Carnalea Golf Club CSO	CSO	Consented	5018/2007	Lough
Carnlea Clinic CSO	CSO	Unconsented		Stream
Carolhill Gardens CSO	CSO	Consented	5047/2007	Culvert
Carrickfergus Rodgers Quay WwPS	ERO	Consented	5022/2007	Estuary
Carrington Street WwPS	CSO & ERO	Consented	5019/2007	River
Carrs Glen Park CSO	CSO	Consented	5019/2007	Stream
Casaeldona Road Belfast CSO	CSO	Unconsented		Culvert
Castlehill Road CSO	CSO	Unconsented		Culvert
Castlehill Stormont WwPS	CSO & ERO	Consented	5047/2007	Stream

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
Cherrymount Bangor WwPS	CSO & ERO	Consented	5018/2007	River
Cherryvalley CSO	CSO	Unconsented		River
Chester Avenue Marine CSO	CSO	Consented	5101/2007	Sea
Chimera Wood WwPS	ERO	Pending		Sea
Church Road Knockbreda CSO	CSO	Consented	5080/2007	Stream
Clanbrassil WwPS	CSO & ERO	Pending		Sea
Clarawood Park Belfast CSO	CSO	Consented	5047/2007	River
Clarehill Mews WwPS	CSO & ERO	Consented	5047/2007	Stream
Coastguard Lane WwPS	CSO & ERO	Unconsented		
Coastguard Row WwPS	CSO & ERO	Consented	5102/2007	Estuary
Collinward Elmfield CSO	CSO	Consented	5102/2007	Stream
Comber Road Dundonald WwPS	CSO & ERO	Consented	5047/2007	Stream
Comber Road Enler CSO	CSO	Unconsented		Stream
Comber Road Shop Centre CSO	CSO	Unconsented		Stream
Commons Donaghadee WwPS	CSO & ERO	Consented	5038/2007	Sea
Connsbrook Avenue CSO	CSO	Consented	5047/2007	River
Connswater Street Severn CSO	CSO	Consented	5019/2007	Stream
Conway Street CSO	CSO	Consented	5019/2007	Culvert
Cottown WwPS	CSO & ERO	Unconsented		Unknown
Craigantlet North WwPS	CSO & ERO	Unconsented		Unknown
Craigantlet South WwPS	CSO & ERO	Consented	5015/2007	Culvert
Craigavad WwPS	CSO & ERO	Pending		Sea
Cranmore Park Osbourne CSO	CSO	Consented	5019/2007	Culvert
Crawfordsburn Helens Bay WwPS	CSO & ERO	Pending		Stream
Crawfordsburn Road Glenview CSO	CSO	Unconsented		Culvert
Crawsfordsburn Road Newtownards CSO	CSO	Unconsented		Culvert
Cregagh Park CSO	CSO	Consented	5047/2007	Culvert
Croft Burn CSO	CSO	Unconsented		Stream
Croft Road Woodcroft CSO	CSO	Consented	5047/2007	Culvert
Crossnacreevy WwPS	CSO & ERO	Consented	5047/2007	Stream
Crumlin Road Everton CSO	CSO	Consented	5019/2007	Culvert
Crumlin Road Glenbank CSO	CSO	Consented	5019/2007	River
Crumlin Road Wheatfield CSO	CSO	Consented	5019/2007	Culvert
Cultra Avenue CSO	CSO	Pending		Estuary
Cumberland Road CSO	CSO	Consented	5047/2007	Stream

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
Cupar Street Lower North CSO	CSO	Consented	5019/2007	Culvert
Cupar Street Lower South CSO	CSO	Consented	5019/2007	Culvert
Cupar Way CSO	CSO	Consented	5019/2007	Culvert
Dermont Lane WwPS	ERO	Consented	5102/2007	Stream
Distillery Street Syphon CSO	CSO	Consented	5019/2007	Culvert
Divis Street CSO	CSO	Consented	5019/2007	Culvert
Donaghadee PS	CSO		2033/06	
Donegall Place Royal Avenue CSO	CSO	Consented	5019/2007	Culvert
Dundonald Cemetery CSO	CSO	Not Required		Stream
Dunlambert Park CSO	CSO	Consented	5019/2007	Culvert
Dunmurry Glenburn WwPS	ERO	Unconsented		Stream
Dunotter Park WwPS	CSO & ERO	Consented	5038/2007	Sea
Dunraven Avenue Dunraven CSO	CSO	Consented	5047/2007	Stream
East Street Castle CSO	CSO	Consented	5038/2007	Sea
Edenderry Mill CSO	CSO	Consented	5019/2007	Stream
Elgin Street Baroda CSO	CSO	Consented	5019/2007	River
Errigal CSO	CSO	Consented	5019/2007	Culvert
Falls Bus Depot CSO	CSO	Consented	5019/2007	Stream
Falls Park CSO	CSO	Consented	5019/2007	Stream
Falls Road Beechview CSO	CSO	Consented	5019/2007	Culvert
Falls Road Donegall CSO	CSO	Consented	5019/2007	Culvert
Falls Road Rockmount CSO	CSO	Consented	5019/2007	Culvert
Fallswater CSO	CSO	Consented	5019/2007	Stream
Fane Street CSO	CSO	Consented	5019/2007	Culvert
Fane Street Primary School CSO	CSO	Consented	5019/2007	Culvert
Fane Street Ulsterville CSO	CSO	Consented	5019/2007	Culvert
Farm Lodge WwPS	ERO	Unconsented		Culvert
Fernagh CSO	CSO	Consented	5102/2007	Stream
First Street CSO	CSO	Consented	5019/2007	Culvert
Forfar Street CSO	CSO	Consented	5019/2007	Culvert
Fort Road WwPS	CSO & ERO	Pending		Sea
Fort Street CSO	CSO	Consented	5019/2007	Culvert
Fortwilliam Oakmount WwPS	CSO & ERO	Not Required		Culvert
Fortwilliam Park Dunlambert CSO	CSO	Consented	5019/2007	Culvert
Fortwilliam Park Grange CSO	CSO	Consented	5019/2007	Culvert
Garland Heights WwPS	ERO	Consented	5080/2007	Unknown
Gilnahirk Park CSO	CSO	Unconsented		
Glasvey Drive CSO	CSO	Unconsented		Culvert
Glen Brae WwPS	ERO	Consented	5047/2007	Stream
Glen Road Craigavad CSO	CSO	Consented	5093/2007	Stream

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
Glen Road CSO	CSO	Consented	5019/2007	Stream
Glenabbey Crescent CSO	CSO	Consented	5102/2007	River
Glenburn Ford WwPS	ERO	Unconsented		Stream
Glencairn Street CSO	CSO	Consented	5019/2007	River
Glencraig WwPS	CSO & ERO	Pending		Culvert
Glendarragh WwPS	ERO	Consented	5047/2007	Culvert
Glenford Way WwPS	ERO	Consented	5015/2007	Culvert
Glengall Street CSO	CSO	Consented	5019/2007	Culvert
Gortfin Street Beechmount CSO	CSO	Unconsented		Culvert
Grand Prix Mews CSO	CSO	Consented	5047/2007	River
Grange Crescent CSO	CSO	Unconsented		Stream
Gransha Bangor WwPS	CSO & ERO	Unconsented		Stream
Gransha Comber WwPS	ERO	Pending		
Graymount Road CSO	CSO	Consented	5019/2007	Culvert
Great Northern Street CSO	CSO	Consented	5019/2007	River
Greencastle Belfast WwPS	CSO & ERO	Consented	5019/2007	Culvert
Greenisland Four WwPS	CSO & ERO	Consented	5055/2007	Stream
Greenisland One WwPS	CSO & ERO	Consented	5102/2007	Estuary
Greenisland Three WwPS	CSO & ERO	Pending		
Greenisland Two WwPS	CSO & ERO	Consented	5055/2007	Lough
Groomsport Point WwPS	CSO & ERO	Unconsented		Stream
Hampton Park CSO	CSO	Consented	5080/2007	Stream
Harbour Road Groomsport WwPS	CSO & ERO	Unconsented		Sea
Hartford Link Glenford CSO	CSO	Unconsented		Culvert
Helens Bay Grey Point WwPS	CSO & ERO	Consented	5093/2007	Sea
Hibernia Street CSO	CSO	Consented	5047/2007	Sea
High Bangor Road WwPS	CSO & ERO	Unconsented		Stream
High Street Hunters CSO	CSO	Consented	5038/2007	Sea
High Street Townhall CSO	CSO	Consented	5038/2007	Sea
Hollywood Road CSO	CSO	Consented	5047/2007	River
Holywood Road CSO	CSO	Unconsented		River
Holywood Road Marmont CSO	CSO	Consented	5047/2007	Stream
Holywood Road Station CSO	CSO	Consented	5047/2007	Stream
Holywood Road Tillysburn CSO	CSO	Consented	5047/2007	Stream
Hughes Court CSO	CSO	Consented	5047/2007	Stream
Hydepark One WwPS	ERO	Consented	5102/2007	Culvert

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
Hydepark Two WwPS	ERO	Consented	5102/2007	River
Ingledale Park CSO	CSO	Consented	5019/2007	Culvert
Inverary Drive CSO	CSO	Consented	5047/2007	Stream
Irish Quarter South CSO	CSO	Consented	5022/2007	Estuary
Island Road Lower CSO	CSO	Consented	5006/2007	Stream
Jacksons Road CSO	CSO	Pending		
Jordanstown Road Glenkeen CSO	CSO	Unconsented		Stream
Joymount Carrickfergus CSO	CSO	Consented	5022/2007	Culvert
Keadyville CSO	CSO	Consented	5019/2007	Culvert
Kensington Manor WwPS	ERO	Consented	5047/2007	Stream
Kensington Road CSO	CSO	Consented	5047/2007	River
Killaire WwPS	CSO & ERO	Consented	5018/2007	Sea
Killaney Bangor WwPS	CSO & ERO	Consented	5018/2007	Stream
Killysuggan CSO	CSO	Consented	5015/2007	Stream
Kinnegar Avenue WwPS	CSO & ERO	Pending		Lough
Kinnegar Road CSO	CSO	Consented	5019/2007	Culvert
Knock Laburnum CSO	CSO	Unconsented		Culvert
Knockbreda Park Knockbreda CSO	CSO	Consented	5047/2007	Culvert
Knockbreda Road Rosetta CSO	CSO	Consented	5047/2007	Stream
Knocknagney Drive CSO	CSO	Consented	5047/2007	Culvert
Knocknagoney Dale CSO	CSO	Unconsented		Culvert
Knocknagoney Park CSO	CSO	Pending		Culvert
Knocknagoney Richmond WwPS	ERO	Consented	5047/2007	Stream
La Salle Drive CSO	CSO	Unconsented		Culvert
Ladas Drive CSO	CSO	Unconsented		Culvert
Ladybrook Crescent CSO	CSO	Consented	5019/2007	Culvert
Lansdowne Road CSO	CSO	Consented	5019/2007	Culvert
Lawnbrook Avenue Centurion CSO	CSO	Consented	5019/2007	Culvert
Leathem Square WwPS	ERO	Unconsented		Unknown
Ligoniel WwPS	ERO	Consented	5019/2007	River
Limestone North Queen CSO	CSO	Consented	5019/2007	Culvert
Limestone Road Camberwell CSO	CSO	Consented	5019/2007	Culvert
Limestone Road Oceanic CSO	CSO	Consented	5019/2007	Culvert
Limpey WwPS	ERO	Pending		
Linen Mill Grove WwPS	ERO	Consented	0201/2012	River
Linfield Road CSO	CSO	Consented	5019/2007	Stream
Lisburn Road Cranmore CSO	CSO	Consented	5019/2007	Culvert
Lisburn Road Golf Club CSO	CSO	Consented	5019/2007	Culvert
Lisburn Road Lislea CSO	CSO	Consented	5019/2007	Stream
Lislea Drive One WwPS	ERO	Consented	5019/2007	Stream

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
Lisleen WwPS	ERO	Pending		
Lockview Road Weir CSO	CSO	Consented	5019/2007	River
Long Acre WwPS	CSO & ERO	Consented	5080/2007	N/A
Loop Bridge Castlereagh CSO	CSO	Consented	5047/2007	Stream
Lord Wardens WwPS	ERO	Unconsented		Stream
Loughview Terrace WwPS	ERO	Unconsented		Culvert
Lower Woodburn WwPS	CSO & ERO	Consented	5055/2007	Lough
Lowwood CSO	CSO	Consented	5054/2007	River
Lukes Point WwPS	CSO & ERO	Consented	5018/2007	Lough
Magheramorne Shore Road WwPS	CSO & ERO	Pending		
Main Street Old Mill Close CSO	CSO	Pending		Stream
Main Street Old Mill House CSO	CSO	Consented	5093/2007	Stream
Manor Park Bangor WwPS	ERO	Unconsented		Unknown
Manor Wood WwPS	ERO			
Marine Avenue CSO	CSO	Consented	5101/2007	Sea
Marine Court Hotel CSO	CSO	Pending		Sea
Marine Drive Donaghadee CSO	CSO	Consented	5038/2007	Sea
Marine Drive Harbour CSO	CSO	Consented	5038/2007	Sea
Marine Highway CSO	CSO	Consented	5022/2007	Sea
Marine Parade CSO	CSO	Consented	5101/2007	Sea
Marine Parade Holywood CSO	CSO	Consented	5047/2007	Sea
Marine Parade Yacht Club CSO	CSO	Consented	5101/2007	Sea
Market Place CSO	CSO	Consented	5022/2007	Sea
Maxwell Road Downshire CSO	CSO	Consented	5018/2007	Sea
Meadowbridge Surgery WwPS	ERO	Consented	5101/2007	Stream
Merok Crescent Belfast CSO	CSO	Consented	5047/2007	Stream
Merville Mews 1 CSO	CSO	Unconsented		River
Methodist College CSO	CSO	Consented	5019/2007	Culvert
Milewater CSO	CSO	Consented	5019/2007	Stream
Mill Road Newtownabbey CSO	CSO	Consented	5102/2007	River
Mill Road West CSO	CSO	Consented	5080/2007	Unknown
Millars Lane WwPS	CSO & ERO	Consented	5047/2007	River
Millisle Road CSO	CSO	Consented	5038/2007	Sea
Minorca Drive South CSO	CSO	Consented	5022/2007	Stream
Minorca Drive WwPS	ERO	Consented	5022/2007	Stream
Minorca Place CSO	CSO	Consented	5022/2007	Estuary
Moat Park Upper Newnards Road CSO	CSO	Consented	5047/2007	Stream
Moat Street East CSO	CSO	Consented	5038/2007	Sea
Moat Street Moat Farm CSO	CSO	Consented	5038/2007	Sea

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
Moonstone Street CSO	CSO	Consented	5019/2007	Culvert
Mornington Place CSO	CSO	Consented	5080/2007	Stream
Mount Vernon CSO	CSO	Consented	5054/2007	Culvert
Mountainview Park CSO	CSO	Consented	5019/2007	Culvert
New Barnsley Park CSO	CSO	Consented	5019/2007	Culvert
Newforge Lane CSO	CSO	Consented	5019/2007	River
Newforge Lower CSO	CSO	Consented	5019/2007	River
Newpark Shore WwPS	CSO & ERO	Consented	5065/2007	Lough
North Howard Street CSO	CSO	Consented	5019/2007	Culvert
North Queen Street Cultra CSO	CSO	Consented	5019/2007	Culvert
Northland CSO	CSO	Consented	5022/2007	River
Old Inn WwPS	CSO & ERO	Pending		Stream
Old Quay Court WwPS	ERO	Pending		Stream
Old Shore Road CSO	CSO	Unknown		River
Oldcastle Road CSO	CSO	Consented	5101/2007	Culvert
Oldpark Road CSO	CSO	Consented	5019/2007	Stream
ONeill Road WwPS	ERO	Consented	5102/2007	River
Orangefield Orby Drive CSO	CSO	Consented	5047/2007	Culvert
Orangefield Orby Mews CSO	CSO	Unconsented		Culvert
Orchardville WwPS	CSO & ERO	Consented	5019/2007	Stream
Orlock Briggs Rock WwPS	CSO & ERO	Not Required	6378/2007	Sea
Orlock Lane WwPS	CSO & ERO	Consented	5018/2007	Lough
Orlock Sandeel WwPS	CSO & ERO	Unconsented		Sea
Orlock Seahaven WwPS	CSO & ERO	Not Required	5018/2007	
Ormeau Avenue CSO	CSO	Consented	5019/2007	Culvert
Ormeau Avenue Linenhall CSO	CSO	Consented	5019/2007	Culvert
Ormeau Park North CSO	CSO	Consented	5019/2007	River
Palmerston Road CSO	CSO	Consented	5047/2007	River
Parade Townhall CSO	CSO	Consented	5038/2007	Sea
Park Manor WwPS	CSO & ERO	Consented	5102/2007	River
Park Royal CSO	CSO	Consented	5019/2007	Culvert
Parkgate Avenue CSO	CSO	Consented	5047/2007	River
Parkway CSO	CSO	Consented	5047/2007	Stream
Parliament CSO	CSO	Unconsented		Culvert
Percy Street CSO	CSO	Consented	5019/2007	Culvert
Premier Drive CSO	CSO	Consented	5019/2007	Culvert
Princess Gardens Holywood CSO	CSO	Consented	5047/2007	Culvert
Priory Park CSO	CSO	Consented	5019/2007	Culvert

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
Purdys Lane CSO	CSO	Consented	5080/2007	Stream
Queens Bridge CSO	CSO	Consented	5019/2007	River
Queens Parade Somerset CSO	CSO	Consented	5018/2007	Sea
Queens Parade Southwell CSO	CSO	Unconsented		Sea
Queens PE Centre CSO	CSO	Consented	5019/2007	Stream
Railway Street Donaghadee CSO	CSO	Consented	5038/2007	Sea
Railway Street Dunmurry CSO	CSO	Unconsented		River
Ramada WwPS	ERO	Consented	5080/2007	River
Rathgael Road WwPS	CSO & ERO	Consented	5018/2007	Stream
Ravenhill Reach WwPS	ERO	Consented	5019/2007	River
Ravenhill Road BP Station CSO	CSO	Consented	5019/2007	River
Rhanbouy Park Seahill CSO	CSO	Pending		Estuary
Riverdale Park South CSO	CSO	Consented	5019/2007	Stream
Riverside Road Bangor CSO	CSO	Consented	5018/2007	River
Roden Street WwPS	ERO	Consented	5019/2007	Stream
Rosemary Crescent CSO	CSO	Consented	5018/2007	Culvert
Ryan Park WwPS	ERO	Consented	5047/2007	Stream
Sanddown Road Kingsleigh CSO	CSO	Consented	5047/2007	Stream
Sanddown Road Knockvale CSO	CSO	Consented	5047/2007	Culvert
Sandhurst WwPS	CSO & ERO	Consented	5018/2007	River
Sandy Row WwPS	CSO & ERO	Consented	5019/2007	River
Sandyknowes WwPS	ERO	Consented	5102/2007	Culvert
School Road CSO	CSO	Consented	5080/2007	Culvert
Seacliff Road Playground CSO	CSO	Unconsented		Sea
Seacourt WwPS	CSO & ERO	Pending		Sea
Seapark Holywood CSO	CSO	Consented	5047/2007	Stream
Shaftesbury Road WwPS	ERO	Unconsented		Stream
Shankill Rest Garden CSO	CSO	Consented	5019/2007	Stream
Shankill Road Lanark CSO	CSO	Consented	5019/2007	Stream
Sharman CSO	CSO	Consented	5019/2007	River
Sheridan Drive Helens Bay CSO	CSO	Pending		Estuary
Shore Road Fortwilliam CSO	CSO	Consented	5019/2007	Culvert
Shore Road Holywood CSO	CSO	Consented	5047/2007	Sea
Shore Road Jordanstown CSO	CSO	Consented	5102/2007	Estuary
Shore Road Whiteabbey CSO	CSO	Consented	5102/2007	Culvert
Shore Road Whitehouse CSO	CSO	Consented	5102/2007	River
Shore Road Whitewell CSO	CSO	Consented	5019/2007	Culvert
Shore Road York CSO	CSO	Consented	5019/2007	Culvert
Shore Street Bridge CSO	CSO	Consented	5038/2007	Sea
Shore Street Moat CSO	CSO	Consented	5038/2007	Sea

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
Shore Street Union CSO	CSO	Consented	5038/2007	Sea
Springfield Parade CSO	CSO	Consented	5019/2007	River
Springfield Park Owenvale CSO	CSO	Consented	5019/2007	Culvert
Springfield Road Owenvale CSO	CSO	Consented	5019/2007	Culvert
Springfield Road Workman CSO	CSO	Consented	5019/2007	River
St Agnes CSO	CSO	Consented	5019/2007	Culvert
Station Road Cultra CSO	CSO	Consented	5093/2007	Sea
Station Street CSO	CSO	Consented	5019/2007	Stream
Stewart Place CSO	CSO	Consented	5047/2007	Culvert
Stonebridge Gardens WwPS	ERO	Unconsented		Unknown
Stranmillis College CSO	CSO	Consented	5019/2007	River
Stranmillis Embankment CSO	CSO	Consented	5019/2007	Culvert
Strathearn Court CSO	CSO	Consented	5047/2007	Stream
Stricklands Glen WwPS	CSO & ERO	Consented	5018/2007	Lough
Summerhill WwPS	CSO & ERO	Unconsented		River
Sunningdale Gardens CSO	CSO	Consented	5019/2007	Stream
Sunnyside Street Annadale WwPS	CSO & ERO	Unconsented		River
Swifts Quay WwPS	ERO	Consented	5022/2007	Sea
Sydenham Park Avenue TPS	CSO & ERO	Consented	5047/2007	River
Taylors Avenue CSO	CSO	Consented	5022/2007	Culvert
Tennyson CSO	CSO	Unconsented		Sea
The Coaches WwPS	ERO	Unconsented		Unknown
The Green Lisburn CSO	CSO	Not Required		
Torgrange Hollywood CSO	CSO	Consented	5047/2007	Stream
Townsend Street Shankill CSO	CSO	Consented	5019/2007	Culvert
Twaddell Avenue CSO	CSO	Consented	5019/2007	Culvert
Upper Falls Boucher CSO	CSO	Consented	5019/2007	Unknown
Upton Park Finaghy CSO	CSO	Consented	5019/2007	Culvert
Victoria Road CSO	CSO	Consented	5047/2007	Stream
Warren Avenue WwPS	CSO & ERO	Consented	5038/2007	Sea
Warren Road East CSO	CSO	Consented	5038/2007	Sea
Warren Road Four WwPS	CSO & ERO	Consented	5038/2007	Sea
Warren Road One WwPS	CSO & ERO	Consented	5038/2007	Culvert
Warren Road Shore CSO	CSO	Consented	5038/2007	Sea
Warren Road Three WwPS	ERO	Consented	5038/2007	Sea
Warren Road Two WwPS	CSO & ERO	Consented	5038/2007	Sea
Waverley CSO	CSO	Unconsented		

Name	Overflow Sub-Type	Consent Status	NIEA Consent ID	Outfall Sub-Type
West Park WwPS	CSO & ERO	Consented	5022/2007	Sea
Westburn Crescent CSO	CSO	Unconsented		Stream
Westlink Busway CSO	CSO	Consented	5019/2007	Culvert
Westway Gardens Lyndhurst CSO	CSO	Consented	5019/2007	River
Whinnyhill Wood CSO	CSO	Consented	5080/2007	Stream
Whiteabbey Shore Road WwPS	CSO & ERO	Consented	5102/2007	River
Whitehead Old Castle WwPS	None			
Whiterock Road CSO	CSO	Consented	5019/2007	Stream
Whiterock Road Rockmount CSO	CSO	Consented	5019/2007	Culvert
Whitewell St Ninians CSO	CSO	Consented	5054/2007	Culvert
Whitewell Upper CSO	CSO	Consented	5102/2007	Culvert
Woodburn Road Killaloe CSO	CSO	Consented	5022/2007	Culvert
Woodburn Road Whinfield CSO	CSO	Consented	5022/2007	Culvert
Woodcroft Lane WwPS	ERO	Not Required		Stream
Woodcroft Park CSO	CSO	Consented	5047/2007	Culvert

Appendix 3. Consented private (domestic and industrial) sewage discharges. Data provided by NIEA

Consent No.	IGR of discharge	Treatment level
0214/11	J3689077640	Private Sewage Emergency Overflow
10006/75	J2630085300	Private Sewage Unspecified
10284/06	J2947084450	Private Sewage Unspecified
2080/12	J2644485002	Private Sewage Domestic
2293/12	J2816280757	Private Sewage Domestic
86/12	J2627085350	Private Sewage Unspecified
2444/12	J2868881482	Private Sewage Domestic
2442/12	J2556484665	Private Sewage Domestic
2711/12	J2557479176	Private Sewage Domestic
2712/12	J2558684558	Private Sewage Domestic
2811/12	J2556384704	Private Sewage Domestic
2852/12	J2829384671	Private Sewage Domestic
2912/12	J2660984774	Private Sewage Domestic
0502/13	J3012981461	Private Sewage Domestic
248/13	J3095681309	Private Sewage Unspecified
517/13	J2581974977	Private Sewage Domestic
12121/99	J3770069800	Private Sewage Unspecified
117/02	J3412671200	Private Sewage Emergency Overflow
13/98	J3488073840	Private Sewage Emergency Overflow
10197/04	J3732071120	Private Sewage Unspecified
296/05	J3116072640	Private Sewage Unspecified
275/07	J2873075160	Private Sewage Unspecified
408/08	J3118075240	Private Sewage Emergency Overflow
0215/11	J3660177171	Private Sewage Emergency Overflow
2457/12	J4067676027	Private Sewage Domestic
134/12	J3784070880	Private Sewage Unspecified
10904/81	J3040068200	Private Sewage Unspecified
19/03	J3713065440	Private Sewage Unspecified
183/03	J3263066820	Private Sewage Unspecified
20/04	J3041066210	Private Sewage Emergency Overflow
10045/04	J3213066220	Private Sewage Unspecified
175/04	J3679066940	Private Sewage Unspecified
32/05	J3173067840	Private Sewage Emergency Overflow
54/05	J2959068420	Private Sewage Emergency Overflow
407/08	J2633069330	Private Sewage Emergency Overflow
251/08	J2792072270	Private Sewage Unspecified
252/08	J2770072250	Private Sewage Unspecified
156/09	J2560070340	Private Sewage Unspecified
147/09	J2942766519	Private Sewage Unspecified
262/09	J2694071100	Private Sewage Unspecified
18/10	J2653068330	Private Sewage Unspecified

Consent No.	IGR of discharge	Treatment level
90/10	J3248068270	Private Sewage Unspecified
113/10	J2717074320	Private Sewage Unspecified
180/10	J3556066290	Private Sewage Unspecified
181/10	J2990068500	Private Sewage Unspecified
444/10	J3122068550	Private Sewage Emergency Overflow
32/11	J3480469954	Private Sewage Unspecified
2099/12	J3159167923	Private Sewage Domestic
2251/12	J3285968556	Private Sewage Domestic
2245/12	J3144068330	Private Sewage Domestic
0462/13	J3452966356	Private Sewage Domestic
0751/13	J3116168121	Private Sewage Domestic
912/13	J3099965540	Private Sewage Domestic
1043/13	J3666266770	Private Sewage Domestic
2328/12	J3762866569	Private Sewage Domestic
1964/91	J4410073700	Private Sewage Unspecified
10129/76	J4420076700	Private Sewage Unspecified
20427/76	J4430076700	Private Sewage Unspecified
3308/79	J4130068900	Private Sewage Unspecified
46/02	J4472076250	Private Sewage Unspecified
3401/05	J4219069030	Private Sewage Unspecified
3399/05	J4207069040	Private Sewage Unspecified
188/07	J4199073260	Private Sewage Emergency Overflow
404/08	J4074073440	Private Sewage Emergency Overflow
109/08	J3984071020	Private Sewage Unspecified
146/08	J4340070880	Private Sewage Unspecified
10033/09	J4060071480	Private Sewage Unspecified
298/09	J3759069170	Private Sewage Unspecified
81/10	J4453071870	Private Sewage Unspecified
222/11	J3838070348	Private Sewage Emergency Overflow
2203/12	J4218971095	Private Sewage Domestic
2389/12	J4285768667	Private Sewage Domestic
2502/12	J4037270377	Private Sewage Domestic
2589/12	J4069971442	Private Sewage Domestic
2627/12	J4310869372	Private Sewage Domestic
2916/12	J4184670915	Private Sewage Domestic
2777/12	J4485676088	Private Sewage Unspecified
2985/12	J4449070320	Private Sewage Domestic
0463/13	J4051268817	Private Sewage Domestic
1080/13	J4190575063	Private Sewage Domestic
1134/13	J4476771338	Private Sewage Domestic
300/05	J3073084710	Private Sewage Unspecified
420/09	J3542082940	Private Sewage Emergency Overflow
2506/12	J3401883436	Private Sewage Domestic

Consent No.	IGR of discharge	Treatment level
268/92	J3490077700	Private Sewage Unspecified
2/02	J3332082080	Private Sewage Unspecified
2063/85	J3344082100	Private Sewage Unspecified
126/03	J3488077920	Private Sewage Unspecified
53/06	J3315080360	Private Sewage Unspecified
0526/13	J3315880486	Private Sewage Domestic
95/01	J4224066540	Private Sewage Unspecified
879/99	J3868078480	Private Sewage Unspecified
58/03	J4097078910	Private Sewage Emergency Overflow
10169/07	J4123078730	Private Sewage Unspecified
94/10	J4330081580	Private Sewage Unspecified
145/10	J4176066010	Private Sewage Unspecified
126/11	J4466079780	Private Sewage Unspecified
12151/12	J4402669390	Private Sewage Domestic
2211/12	J4139177325	Private Sewage Domestic
2266/12	J4159177199	Private Sewage Domestic
2323/12	J4252679485	Private Sewage Domestic
2797/12	J4063478554	Private Sewage Domestic
2995/12	J4307267280	Private Sewage Domestic
2994/12	J4282980515	Private Sewage Domestic
0794/13	J4088965576	Private Sewage Domestic
827/13	J4349177171	Private Sewage Domestic
956/13	J4159466005	Private Sewage Domestic
985/13	J4221666020	Private Sewage Domestic
1181/13	J4219778644	Private Sewage Domestic
0214/11	J3689077640	Private Sewage Emergency Overflow
20707/91	J2950085800	Private Sewage Unspecified
10284/06	J2947084450	Private Sewage Unspecified
168/08	J3139089390	Private Sewage Unspecified
10196/09	J2897986743	Private Sewage Unspecified
9/10	J3052088830	Private Sewage Unspecified
27/10	J3090088850	Private Sewage Unspecified
2112/12	J3003489044	Private Sewage Domestic
2293/12	J2816280757	Private Sewage Domestic
2432/12	J2991287782	Private Sewage Domestic
2444/12	J2868881482	Private Sewage Domestic
2852/12	J2829384671	Private Sewage Domestic
124/12	J3096088173	Private Sewage Unspecified
2973/12	J3396389082	Private Sewage Domestic
13062/12	J2927286119	Private Sewage Domestic
0502/13	J3012981461	Private Sewage Domestic
233/13	J3417688193	Private Sewage Unspecified
248/13	J3095681309	Private Sewage Unspecified

Consent No.	IGR of discharge	Treatment level
1071/13	J3048388957	Private Sewage Domestic
1132/13	J3091987780	Private Sewage Domestic
12121/99	J3770069800	Private Sewage Unspecified
117/02	J3412671200	Private Sewage Emergency Overflow
13/98	J3488073840	Private Sewage Emergency Overflow
10197/04	J3732071120	Private Sewage Unspecified
296/05	J3116072640	Private Sewage Unspecified
275/07	J2873075160	Private Sewage Unspecified
408/08	J3118075240	Private Sewage Emergency Overflow
0215/11	J3660177171	Private Sewage Emergency Overflow
2457/12	J4067676027	Private Sewage Domestic
134/12	J3784070880	Private Sewage Unspecified
251/08	J2792072270	Private Sewage Unspecified
252/08	J2770072250	Private Sewage Unspecified
32/11	J3480469954	Private Sewage Unspecified
2043/12	J4702073789	Private Sewage Domestic
1964/91	J4410073700	Private Sewage Unspecified
10129/76	J4420076700	Private Sewage Unspecified
20427/76	J4430076700	Private Sewage Unspecified
46/02	J4472076250	Private Sewage Unspecified
20166/04	J4560069890	Private Sewage Unspecified
108/05	J4540076100	Private Sewage Unspecified
188/07	J4199073260	Private Sewage Emergency Overflow
404/08	J4074073440	Private Sewage Emergency Overflow
109/08	J3984071020	Private Sewage Unspecified
146/08	J4340070880	Private Sewage Unspecified
10033/09	J4060071480	Private Sewage Unspecified
81/10	J4453071870	Private Sewage Unspecified
222/11	J3838070348	Private Sewage Emergency Overflow
2178/12	J4493771924	Private Sewage Domestic
2203/12	J4218971095	Private Sewage Domestic
2502/12	J4037270377	Private Sewage Domestic
2589/12	J4069971442	Private Sewage Domestic
2916/12	J4184670915	Private Sewage Domestic
2777/12	J4485676088	Private Sewage Unspecified
2985/12	J4449070320	Private Sewage Domestic
0532/13	J4506771542	Private Sewage Domestic
1080/13	J4190575063	Private Sewage Domestic
1134/13	J4476771338	Private Sewage Domestic
2901/04	J3860089150	Private Sewage Unspecified
15/05	J4062087490	Private Sewage Emergency Overflow
2386/12	J3923388924	Private Sewage Domestic
1449/97	J3330085400	Private Sewage Unspecified

Consent No.	IGR of discharge	Treatment level
300/05	J3073084710	Private Sewage Unspecified
420/09	J3542082940	Private Sewage Emergency Overflow
2120/12	J3100186129	Private Sewage Domestic
2506/12	J3401883436	Private Sewage Domestic
2641/12	J3420385817	Private Sewage Domestic
2643/12	J3274386304	Private Sewage Domestic
3025/12	J3156786972	Private Sewage Domestic
11685/88	J4400088500	Private Sewage Unspecified
268/92	J3490077700	Private Sewage Unspecified
2/02	J3332082080	Private Sewage Unspecified
896/99	J4118086910	Private Sewage Emergency Overflow
2063/85	J3344082100	Private Sewage Unspecified
126/03	J3488077920	Private Sewage Unspecified
64/05	J4514088850	Private Sewage Unspecified
281/05	J3679085470	Private Sewage Emergency Overflow
53/06	J3315080360	Private Sewage Unspecified
290/06	J4199087970	Private Sewage Emergency Overflow
288/07	J3664085570	Private Sewage Emergency Overflow
2148/12	J3876786996	Private Sewage Domestic
0526/13	J3315880486	Private Sewage Domestic
879/99	J3868078480	Private Sewage Unspecified
58/03	J4097078910	Private Sewage Emergency Overflow
10036/06	J4701071180	Private Sewage Unspecified
36/06	J4701071180	Private Sewage Unspecified
37/06	J4701071190	Private Sewage Unspecified
10169/07	J4123078730	Private Sewage Unspecified
135/09	J4682080100	Private Sewage Unspecified
94/10	J4330081580	Private Sewage Unspecified
126/11	J4466079780	Private Sewage Unspecified
26/12	J4496082260	Private Sewage Unspecified
2211/12	J4139177325	Private Sewage Domestic
2266/12	J4159177199	Private Sewage Domestic
2323/12	J4252679485	Private Sewage Domestic
2483/12	J4750474069	Private Sewage Domestic
2797/12	J4063478554	Private Sewage Domestic
2994/12	J4282980515	Private Sewage Domestic
0670/13	J4679280863	Private Sewage Domestic
827/13	J4349177171	Private Sewage Domestic
1074/13	J4635777181	Private Sewage Domestic
1113/13	J4738074914	Private Sewage Domestic
1181/13	J4219778644	Private Sewage Domestic
0214/11	J3689077640	Private Sewage Emergency Overflow
168/08	J3139089390	Private Sewage Unspecified

Consent No.	IGR of discharge	Treatment level
9/10	J3052088830	Private Sewage Unspecified
27/10	J3090088850	Private Sewage Unspecified
2025/12	J3431089887	Private Sewage Domestic
124/12	J3096088173	Private Sewage Unspecified
2973/12	J3396389082	Private Sewage Domestic
233/13	J3417688193	Private Sewage Unspecified
248/13	J3095681309	Private Sewage Unspecified
1071/13	J3048388957	Private Sewage Domestic
1132/13	J3091987780	Private Sewage Domestic
13/98	J3488073840	Private Sewage Emergency Overflow
408/08	J3118075240	Private Sewage Emergency Overflow
0215/11	J3660177171	Private Sewage Emergency Overflow
2457/12	J4067676027	Private Sewage Domestic
2043/12	J4702073789	Private Sewage Domestic
1964/91	J4410073700	Private Sewage Unspecified
10129/76	J4420076700	Private Sewage Unspecified
20427/76	J4430076700	Private Sewage Unspecified
46/02	J4472076250	Private Sewage Unspecified
108/05	J4540076100	Private Sewage Unspecified
188/07	J4199073260	Private Sewage Emergency Overflow
404/08	J4074073440	Private Sewage Emergency Overflow
2777/12	J4485676088	Private Sewage Unspecified
1080/13	J4190575063	Private Sewage Domestic
2901/04	J3860089150	Private Sewage Unspecified
15/05	J4062087490	Private Sewage Emergency Overflow
2145/12	J3962691597	Private Sewage Domestic
2198/12	J3937390652	Private Sewage Domestic
2386/12	J3923388924	Private Sewage Domestic
2448/12	J3833790558	Private Sewage Domestic
2709/12	J3907490402	Private Sewage Domestic
1449/97	J3330085400	Private Sewage Unspecified
300/05	J3073084710	Private Sewage Unspecified
420/09	J3542082940	Private Sewage Emergency Overflow
2120/12	J3100186129	Private Sewage Domestic
2506/12	J3401883436	Private Sewage Domestic
2641/12	J3420385817	Private Sewage Domestic
2643/12	J3274386304	Private Sewage Domestic
3025/12	J3156786972	Private Sewage Domestic
11685/88	J4400088500	Private Sewage Unspecified
268/92	J3490077700	Private Sewage Unspecified
102/01	J4692090611	Private Sewage Unspecified
12285/75	J4650090200	Private Sewage Unspecified
2/02	J3332082080	Private Sewage Unspecified

Consent No.	IGR of discharge	Treatment level
896/99	J4118086910	Private Sewage Emergency Overflow
2063/85	J3344082100	Private Sewage Unspecified
126/03	J3488077920	Private Sewage Unspecified
18/04	J4713092370	Private Sewage Emergency Overflow
64/05	J4514088850	Private Sewage Unspecified
281/05	J3679085470	Private Sewage Emergency Overflow
53/06	J3315080360	Private Sewage Unspecified
290/06	J4199087970	Private Sewage Emergency Overflow
58/07	J4714092740	Private Sewage Emergency Overflow
288/07	J3664085570	Private Sewage Emergency Overflow
20071/09	J4641891836	Private Sewage Unspecified
2148/12	J3876786996	Private Sewage Domestic
2146/12	J3975891596	Private Sewage Domestic
12897/12	J4718090901	Private Sewage Domestic
2957/12	J4795992637	Private Sewage Domestic
0526/13	J3315880486	Private Sewage Domestic
10616/93	J4984076490	Private Sewage Unspecified
77/02	J4902081060	Private Sewage Emergency Overflow
879/99	J3868078480	Private Sewage Unspecified
58/03	J4097078910	Private Sewage Emergency Overflow
10169/07	J4123078730	Private Sewage Unspecified
403/09	J4787073470	Private Sewage Emergency Overflow
135/09	J4682080100	Private Sewage Unspecified
65/10	J5003076230	Private Sewage Unspecified
94/10	J4330081580	Private Sewage Unspecified
126/11	J4466079780	Private Sewage Unspecified
26/12	J4496082260	Private Sewage Unspecified
2030/12	J4996477019	Private Sewage Domestic
2211/12	J4139177325	Private Sewage Domestic
2266/12	J4159177199	Private Sewage Domestic
2323/12	J4252679485	Private Sewage Domestic
2483/12	J4750474069	Private Sewage Domestic
2612/12	J4814975449	Private Sewage Domestic
2797/12	J4063478554	Private Sewage Domestic
2994/12	J4282980515	Private Sewage Domestic
0670/13	J4679280863	Private Sewage Domestic
827/13	J4349177171	Private Sewage Domestic
1074/13	J4635777181	Private Sewage Domestic
1113/13	J4738074914	Private Sewage Domestic
1181/13	J4219778644	Private Sewage Domestic
0214/11	J3689077640	Private Sewage Emergency Overflow
2025/12	J3431089887	Private Sewage Domestic
2528/12	J3470093390	Private Sewage Domestic

Consent No.	IGR of discharge	Treatment level
0215/11	J3660177171	Private Sewage Emergency Overflow
2457/12	J4067676027	Private Sewage Domestic
10129/76	J4420076700	Private Sewage Unspecified
20427/76	J4430076700	Private Sewage Unspecified
46/02	J4472076250	Private Sewage Unspecified
108/05	J4540076100	Private Sewage Unspecified
2777/12	J4485676088	Private Sewage Unspecified
2635/12	J3832395038	Private Sewage Domestic
2806/12	J3702994396	Private Sewage Domestic
2901/04	J3860089150	Private Sewage Unspecified
15/05	J4062087490	Private Sewage Emergency Overflow
2145/12	J3962691597	Private Sewage Domestic
2198/12	J3937390652	Private Sewage Domestic
2386/12	J3923388924	Private Sewage Domestic
2448/12	J3833790558	Private Sewage Domestic
2709/12	J3907490402	Private Sewage Domestic
420/09	J3542082940	Private Sewage Emergency Overflow
11685/88	J4400088500	Private Sewage Unspecified
268/92	J3490077700	Private Sewage Unspecified
102/01	J4692090611	Private Sewage Unspecified
12285/75	J4650090200	Private Sewage Unspecified
896/99	J4118086910	Private Sewage Emergency Overflow
126/03	J3488077920	Private Sewage Unspecified
18/04	J4713092370	Private Sewage Emergency Overflow
64/05	J4514088850	Private Sewage Unspecified
127/05	J4756095690	Private Sewage Unspecified
281/05	J3679085470	Private Sewage Emergency Overflow
231/06	J4770093300	Private Sewage Unspecified
290/06	J4199087970	Private Sewage Emergency Overflow
58/07	J4714092740	Private Sewage Emergency Overflow
288/07	J3664085570	Private Sewage Emergency Overflow
20071/09	J4641891836	Private Sewage Unspecified
2148/12	J3876786996	Private Sewage Domestic
2146/12	J3975891596	Private Sewage Domestic
2176/12	J4832693139	Private Sewage Domestic
2622/12	J4402193798	Private Sewage Domestic
2842/12	J4720993123	Private Sewage Domestic
12897/12	J4718090901	Private Sewage Domestic
2957/12	J4795992637	Private Sewage Domestic
10616/93	J4984076490	Private Sewage Unspecified
780/00	J5217080900	Private Sewage Unspecified
77/02	J4902081060	Private Sewage Emergency Overflow
879/99	J3868078480	Private Sewage Unspecified

Consent No.	IGR of discharge	Treatment level
1/02	J5362079810	Private Sewage Emergency Overflow
58/03	J4097078910	Private Sewage Emergency Overflow
179/04	J5102078330	Private Sewage Emergency Overflow
10169/07	J4123078730	Private Sewage Unspecified
172/07	J5228078730	Private Sewage Unspecified
424/08	J5093081700	Private Sewage Emergency Overflow
135/09	J4682080100	Private Sewage Unspecified
406/10	J5256081540	Private Sewage Emergency Overflow
65/10	J5003076230	Private Sewage Unspecified
94/10	J4330081580	Private Sewage Unspecified
126/11	J4466079780	Private Sewage Unspecified
26/12	J4496082260	Private Sewage Unspecified
2030/12	J4996477019	Private Sewage Domestic
2211/12	J4139177325	Private Sewage Domestic
2266/12	J4159177199	Private Sewage Domestic
2323/12	J4252679485	Private Sewage Domestic
85/12	J5325077550	Private Sewage Domestic
2797/12	J4063478554	Private Sewage Domestic
2994/12	J4282980515	Private Sewage Domestic
0670/13	J4679280863	Private Sewage Domestic
827/13	J4349177171	Private Sewage Domestic
1074/13	J4635777181	Private Sewage Domestic
1181/13	J4219778644	Private Sewage Domestic
2037/12	J3815196334	Private Sewage Domestic
2319/12	J3821996465	Private Sewage Domestic
2635/12	J3832395038	Private Sewage Domestic
2806/12	J3702994396	Private Sewage Domestic
2901/12	J3793997934	Private Sewage Domestic
2884/12	J4028796337	Private Sewage Domestic
683/13	J3825596300	Private Sewage Domestic
2901/04	J3860089150	Private Sewage Unspecified
15/05	J4062087490	Private Sewage Emergency Overflow
2145/12	J3962691597	Private Sewage Domestic
2198/12	J3937390652	Private Sewage Domestic
2386/12	J3923388924	Private Sewage Domestic
2448/12	J3833790558	Private Sewage Domestic
2709/12	J3907490402	Private Sewage Domestic
11685/88	J4400088500	Private Sewage Unspecified
102/01	J4692090611	Private Sewage Unspecified
12285/75	J4650090200	Private Sewage Unspecified
896/99	J4118086910	Private Sewage Emergency Overflow
18/04	J4713092370	Private Sewage Emergency Overflow
64/05	J4514088850	Private Sewage Unspecified

Consent No.	IGR of discharge	Treatment level
127/05	J4756095690	Private Sewage Unspecified
33343/05	J4287697861	Private Sewage Unspecified
231/06	J4770093300	Private Sewage Unspecified
290/06	J4199087970	Private Sewage Emergency Overflow
58/07	J4714092740	Private Sewage Emergency Overflow
20071/09	J4641891836	Private Sewage Unspecified
2148/12	J3876786996	Private Sewage Domestic
2146/12	J3975891596	Private Sewage Domestic
2176/12	J4832693139	Private Sewage Domestic
2381/12	J4344496251	Private Sewage Domestic
2622/12	J4402193798	Private Sewage Domestic
2842/12	J4720993123	Private Sewage Domestic
2896/12	J4191596831	Private Sewage Domestic
12897/12	J4718090901	Private Sewage Domestic
2957/12	J4795992637	Private Sewage Domestic
3058/12	J4179496579	Private Sewage Domestic
980/13	J4259096170	Private Sewage Domestic
780/00	J5217080900	Private Sewage Unspecified
77/02	J4902081060	Private Sewage Emergency Overflow
18/03	J5488079180	Private Sewage Unspecified
1/02	J5362079810	Private Sewage Emergency Overflow
58/03	J4097078910	Private Sewage Emergency Overflow
10158/04	J5585082870	Private Sewage Unspecified
254/06	J5450080710	Private Sewage Unspecified
424/08	J5093081700	Private Sewage Emergency Overflow
275/08	J5610082030	Private Sewage Unspecified
135/09	J4682080100	Private Sewage Unspecified
406/10	J5256081540	Private Sewage Emergency Overflow
94/10	J4330081580	Private Sewage Unspecified
126/11	J4466079780	Private Sewage Unspecified
168/11	J5606981278	Private Sewage Unspecified
26/12	J4496082260	Private Sewage Unspecified
2323/12	J4252679485	Private Sewage Domestic
12756/12	J5536379291	Private Sewage Domestic
2994/12	J4282980515	Private Sewage Domestic
0670/13	J4679280863	Private Sewage Domestic
0792/13	J5436779252	Private Sewage Domestic
2037/12	J3815196334	Private Sewage Domestic
2319/12	J3821996465	Private Sewage Domestic
2635/12	J3832395038	Private Sewage Domestic
2806/12	J3702994396	Private Sewage Domestic
2901/12	J3793997934	Private Sewage Domestic
2884/12	J4028796337	Private Sewage Domestic

Consent No.	IGR of discharge	Treatment level
683/13	J3825596300	Private Sewage Domestic
2901/04	J3860089150	Private Sewage Unspecified
15/05	J4062087490	Private Sewage Emergency Overflow
2145/12	J3962691597	Private Sewage Domestic
2198/12	J3937390652	Private Sewage Domestic
2386/12	J3923388924	Private Sewage Domestic
2448/12	J3833790558	Private Sewage Domestic
2709/12	J3907490402	Private Sewage Domestic
11685/88	J4400088500	Private Sewage Unspecified
102/01	J4692090611	Private Sewage Unspecified
12285/75	J4650090200	Private Sewage Unspecified
896/99	J4118086910	Private Sewage Emergency Overflow
18/04	J4713092370	Private Sewage Emergency Overflow
64/05	J4514088850	Private Sewage Unspecified
127/05	J4756095690	Private Sewage Unspecified
33343/05	J4287697861	Private Sewage Unspecified
231/06	J4770093300	Private Sewage Unspecified
290/06	J4199087970	Private Sewage Emergency Overflow
58/07	J4714092740	Private Sewage Emergency Overflow
20071/09	J4641891836	Private Sewage Unspecified
2148/12	J3876786996	Private Sewage Domestic
2146/12	J3975891596	Private Sewage Domestic
2176/12	J4832693139	Private Sewage Domestic
2381/12	J4344496251	Private Sewage Domestic
2622/12	J4402193798	Private Sewage Domestic
2842/12	J4720993123	Private Sewage Domestic
2896/12	J4191596831	Private Sewage Domestic
12897/12	J4718090901	Private Sewage Domestic
2957/12	J4795992637	Private Sewage Domestic
3058/12	J4179496579	Private Sewage Domestic
980/13	J4259096170	Private Sewage Domestic
780/00	J5217080900	Private Sewage Unspecified
77/02	J4902081060	Private Sewage Emergency Overflow
18/03	J5488079180	Private Sewage Unspecified
1/02	J5362079810	Private Sewage Emergency Overflow
58/03	J4097078910	Private Sewage Emergency Overflow
10158/04	J5585082870	Private Sewage Unspecified
254/06	J5450080710	Private Sewage Unspecified
424/08	J5093081700	Private Sewage Emergency Overflow
275/08	J5610082030	Private Sewage Unspecified
135/09	J4682080100	Private Sewage Unspecified
406/10	J5256081540	Private Sewage Emergency Overflow
94/10	J4330081580	Private Sewage Unspecified

Consent No.	IGR of discharge	Treatment level
126/11	J4466079780	Private Sewage Unspecified
168/11	J5606981278	Private Sewage Unspecified
26/12	J4496082260	Private Sewage Unspecified
2323/12	J4252679485	Private Sewage Domestic
12756/12	J5536379291	Private Sewage Domestic
2994/12	J4282980515	Private Sewage Domestic
0670/13	J4679280863	Private Sewage Domestic
0792/13	J5436779252	Private Sewage Domestic
2457/12	J4067676027	Private Sewage Domestic
10129/76	J4420076700	Private Sewage Unspecified
20427/76	J4430076700	Private Sewage Unspecified
46/02	J4472076250	Private Sewage Unspecified
108/05	J4540076100	Private Sewage Unspecified
2777/12	J4485676088	Private Sewage Unspecified
1080/13	J4190575063	Private Sewage Domestic
2901/04	J3860089150	Private Sewage Unspecified
15/05	J4062087490	Private Sewage Emergency Overflow
2145/12	J3962691597	Private Sewage Domestic
2198/12	J3937390652	Private Sewage Domestic
2386/12	J3923388924	Private Sewage Domestic
2448/12	J3833790558	Private Sewage Domestic
2709/12	J3907490402	Private Sewage Domestic
11685/88	J4400088500	Private Sewage Unspecified
102/01	J4692090611	Private Sewage Unspecified
12285/75	J4650090200	Private Sewage Unspecified
896/99	J4118086910	Private Sewage Emergency Overflow
18/04	J4713092370	Private Sewage Emergency Overflow
64/05	J4514088850	Private Sewage Unspecified
231/06	J4770093300	Private Sewage Unspecified
290/06	J4199087970	Private Sewage Emergency Overflow
58/07	J4714092740	Private Sewage Emergency Overflow
20071/09	J4641891836	Private Sewage Unspecified
2148/12	J3876786996	Private Sewage Domestic
2146/12	J3975891596	Private Sewage Domestic
2176/12	J4832693139	Private Sewage Domestic
2622/12	J4402193798	Private Sewage Domestic
2842/12	J4720993123	Private Sewage Domestic
12897/12	J4718090901	Private Sewage Domestic
2957/12	J4795992637	Private Sewage Domestic
10616/93	J4984076490	Private Sewage Unspecified
10616/93	J4984076490	Private Sewage Unspecified
780/00	J5217080900	Private Sewage Unspecified
77/02	J4902081060	Private Sewage Emergency Overflow

Consent No.	IGR of discharge	Treatment level
879/99	J3868078480	Private Sewage Unspecified
18/03	J5488079180	Private Sewage Unspecified
1/02	J5362079810	Private Sewage Emergency Overflow
58/03	J4097078910	Private Sewage Emergency Overflow
10158/04	J5585082870	Private Sewage Unspecified
155/04	J5735080000	Private Sewage Unspecified
179/04	J5102078330	Private Sewage Emergency Overflow
238/06	J5322075110	Private Sewage Unspecified
254/06	J5450080710	Private Sewage Unspecified
10169/07	J4123078730	Private Sewage Unspecified
172/07	J5228078730	Private Sewage Unspecified
424/08	J5093081700	Private Sewage Emergency Overflow
275/08	J5610082030	Private Sewage Unspecified
207/09	J5625077220	Private Sewage Unspecified
166/09	J5737676322	Private Sewage Unspecified
155/09	J5733876338	Private Sewage Unspecified
135/09	J4682080100	Private Sewage Unspecified
10312/09	J5613075580	Private Sewage Unspecified
406/10	J5256081540	Private Sewage Emergency Overflow
65/10	J5003076230	Private Sewage Unspecified
94/10	J4330081580	Private Sewage Unspecified
126/11	J4466079780	Private Sewage Unspecified
168/11	J5606981278	Private Sewage Unspecified
26/12	J4496082260	Private Sewage Unspecified
2030/12	J4996477019	Private Sewage Domestic
12114/12	J5726579398	Private Sewage Domestic
2211/12	J4139177325	Private Sewage Domestic
2266/12	J4159177199	Private Sewage Domestic
2323/12	J4252679485	Private Sewage Domestic
2330/12	J5339674509	Private Sewage Domestic
85/12	J5325077550	Private Sewage Domestic
2612/12	J4814975449	Private Sewage Domestic
2797/12	J4063478554	Private Sewage Domestic
12756/12	J5536379291	Private Sewage Domestic
2994/12	J4282980515	Private Sewage Domestic
0670/13	J4679280863	Private Sewage Domestic
231/13	J5711076276	Private Sewage Unspecified
0792/13	J5436779252	Private Sewage Domestic
827/13	J4349177171	Private Sewage Domestic
1100/13	J5713779837	Private Sewage Domestic
1074/13	J4635777181	Private Sewage Domestic
1113/13	J4738074914	Private Sewage Domestic
1181/13	J4219778644	Private Sewage Domestic

Appendix 4. Public Intermittent Discharges. Data provided by NIEA.

Name	Private or public	Discharge Type	Discharge from
Seahill WWTW Discharge B	Public	Intermittent	CSO
Kinnegar WWTW Discharge B	Public	Intermittent	CSO
Greenisland WWTW Discharge B	Public	Intermittent	CSO
Greenisland WWTW Discharge C	Public	Intermittent	CSO
Greenisland WWTW Discharge D	Public	Intermittent	CSO
Carrickfergus WWTW Discharge B	Public	Intermittent	CSO
Carrickfergus WWTW Discharge C	Public	Intermittent	CSO
Belfast WWTW Discharge B	Public	Intermittent	CSO
Belfast WWTW Discharge C	Public	Intermittent	CSO
Abbeta Parade CSO	Public	Intermittent	CSO
Abbey Park Bangor CSO	Public	Intermittent	CSO
Abbeydale Parade CSO	Public	Intermittent	CSO
Agnes Street CSO	Public	Intermittent	CSO
Altmore Green CSO	Public	Intermittent	CSO
Annadale Flats CSO	Public	Intermittent	CSO
Antrim Road Alexandra CSO	Public	Intermittent	CSO
Antrim Street Carrick CSO	Public	Intermittent	CSO
Ardmore Road Croft CSO	Public	Intermittent	CSO
Ards Drive Viaduct CSO	Public	Intermittent	CSO
Avonlea Park CSO	Public	Intermittent	CSO
Ballycrochan Linear Park CSO	Public	Intermittent	CSO
Ballygomartin Forth CSO	Public	Intermittent	CSO
Ballygomartin Presbyterian CSO	Public	Intermittent	CSO
Ballymurphy Road CSO	Public	Intermittent	CSO
Ballyrobert Road CSO	Public	Intermittent	CSO
Ballysillan Oldpark CSO	Public	Intermittent	CSO
Ballysillan Road Glenside CSO	Public	Intermittent	CSO
Bangor Road Salvation Army CSO	Public	Intermittent	CSO
Bangor Road Seapark CSO	Public	Intermittent	CSO
Beechmount Avenue Logan CSO	Public	Intermittent	CSO
Belfast Road Carrickfergus CSO	Public	Intermittent	CSO
Bells Roundabout Belfast CSO	Public	Intermittent	CSO
Berwick Road CSO	Public	Intermittent	CSO
Bridge Street Fountain CSO	Public	Intermittent	CSO
Broadway CSO	Public	Intermittent	CSO
Brompton Park CSO	Public	Intermittent	CSO
Brook Street Exchange CSO	Public	Intermittent	CSO
Camross Park CSO	Public	Intermittent	CSO
Carnalea Golf Club CSO	Public	Intermittent	CSO

Name	Private or public	Discharge Type	Discharge from
Carnamena Avenue CSO	Public	Intermittent	CSO
Carnlea Clinic CSO	Public	Intermittent	CSO
Carolhill Gardens CSO	Public	Intermittent	CSO
Carrs Glen Park CSO	Public	Intermittent	CSO
Casaeldona Road Belfast CSO	Public	Intermittent	CSO
Castle Place PO CSO	Public	Intermittent	CSO
Castlehill Road CSO	Public	Intermittent	CSO
Cherryvalley CSO	Public	Intermittent	CSO
Chester Avenue Marine CSO	Public	Intermittent	CSO
Clarawood Park Belfast CSO	Public	Intermittent	CSO
Clonduff Drive CSO	Public	Intermittent	CSO
Connsbrook Avenue CSO	Public	Intermittent	CSO
Connswater Street Severn CSO	Public	Intermittent	CSO
Conway Street CSO	Public	Intermittent	CSO
Cranmore Park Osbourne CSO	Public	Intermittent	CSO
Cregagh Park CSO	Public	Intermittent	CSO
Croft Road Woodcroft CSO	Public	Intermittent	CSO
Crumlin Road Everton CSO	Public	Intermittent	CSO
Crumlin Road Glenbank CSO	Public	Intermittent	CSO
Crumlin Road Wheatfield CSO	Public	Intermittent	CSO
Cultra Avenue CSO	Public	Intermittent	CSO
Cupar Street Lower North CSO	Public	Intermittent	CSO
Cupar Street Lower South CSO	Public	Intermittent	CSO
Cupar Way CSO	Public	Intermittent	CSO
Distillery Street CSO	Public	Intermittent	CSO
Distillery Street Syphon CSO	Public	Intermittent	CSO
Divis Street CSO	Public	Intermittent	CSO
Donegall Place Royal Avenue CSO	Public	Intermittent	CSO
Drumglass Park CSO	Public	Intermittent	CSO
Dublin Road Bankmore CSO	Public	Intermittent	CSO
Duffins Yard Montgomery CSO	Public	Intermittent	CSO
Duncrue Street CSO	Public	Intermittent	CSO
Dunlambert Park CSO	Public	Intermittent	CSO
Dunraven Avenue Dunraven CSO	Public	Intermittent	CSO
Edenderry Mill CSO	Public	Intermittent	CSO
Elgin Street Baroda CSO	Public	Intermittent	CSO
Falls Bus Depot CSO	Public	Intermittent	CSO
Falls Park CSO	Public	Intermittent	CSO
Falls Road Beechview CSO	Public	Intermittent	CSO
Falls Road Donegall CSO	Public	Intermittent	CSO
Falls Road Rockmount CSO	Public	Intermittent	CSO

Name	Private or public	Discharge Type	Discharge from
Fallswater CSO	Public	Intermittent	CSO
Fane Street CSO	Public	Intermittent	CSO
Fane Street Primary School CSO	Public	Intermittent	CSO
Fane Street Ulsterville CSO	Public	Intermittent	CSO
Fernagh CSO	Public	Intermittent	CSO
First Street CSO	Public	Intermittent	CSO
Forfar Street CSO	Public	Intermittent	CSO
Fort Street Forest CSO	Public	Intermittent	CSO
Fortwilliam Park Dunlambert CSO	Public	Intermittent	CSO
Fortwilliam Park Grange CSO	Public	Intermittent	CSO
Fredrick Street North Queen CSO	Public	Intermittent	CSO
Gilnahirk Road CSO	Public	Intermittent	CSO
Glenabbey CSO	Public	Intermittent	CSO
Glencairn Street CSO	Public	Intermittent	CSO
Glengall Street CSO	Public	Intermittent	CSO
Glenmachan Place CSO	Public	Intermittent	CSO
Glenmachan Street CSO	Public	Intermittent	CSO
Gortfin Street CSO	Public	Intermittent	CSO
Gransha Road Bloomfield CSO	Public	Intermittent	CSO
Graymount Road CSO	Public	Intermittent	CSO
Great Nothern Street CSO	Public	Intermittent	CSO
Hampton Park CSO	Public	Intermittent	CSO
Hibernia Street CSO	Public	Intermittent	CSO
Hollywood Road CSO	Public	Intermittent	CSO
Holywood Road Marmont CSO	Public	Intermittent	CSO
Holywood Road Parkgate CSO	Public	Intermittent	CSO
Holywood Road Station CSO	Public	Intermittent	CSO
Holywood Road Tillysburn CSO	Public	Intermittent	CSO
Houston Park Marina CSO	Public	Intermittent	CSO
Hughes Court CSO	Public	Intermittent	CSO
Ingledale Park CSO	Public	Intermittent	CSO
Inverary Drive CSO	Public	Intermittent	CSO
Irish Quarter South CSO	Public	Intermittent	CSO
Jacksons Road CSO	Public	Intermittent	CSO
Joymount Carrickfergus CSO	Public	Intermittent	CSO
Keadyville CSO	Public	Intermittent	CSO
Kensington Road CSO	Public	Intermittent	CSO
Knock Laburnum CSO	Public	Intermittent	CSO
Knock Road CSO	Public	Intermittent	CSO
Knockbreda Park Knockbreda CSO	Public	Intermittent	CSO
Knockbreda Road Rosetta CSO	Public	Intermittent	CSO
Knocknagney Drive CSO	Public	Intermittent	CSO

Name	Private or public	Discharge Type	Discharge from
Knocknagoney Dale CSO	Public	Intermittent	CSO
Knocknagoney Park CSO	Public	Intermittent	CSO
La Salle CSO	Public	Intermittent	CSO
Ladas Drive CSO	Public	Intermittent	CSO
Lansdowne Road CSO	Public	Intermittent	CSO
Lawnbrook Avenue Centurion CSO	Public	Intermittent	CSO
Limestone North Queen CSO	Public	Intermittent	CSO
Limestone Road Camberwell CSO	Public	Intermittent	CSO
Limestone Road Oceanic CSO	Public	Intermittent	CSO
Linen Gardens Belfast CSO	Public	Intermittent	CSO
Linfield Road CSO	Public	Intermittent	CSO
Lisburn Road Cranmore CSO	Public	Intermittent	CSO
Lockview Road Weir CSO	Public	Intermittent	CSO
Loop Bridge CSO	Public	Intermittent	CSO
Lowwood CSO	Public	Intermittent	CSO
Main Street Old Mill Close CSO	Public	Intermittent	CSO
Main Street Old Mill House CSO	Public	Intermittent	CSO
Marine Avenue CSO	Public	Intermittent	CSO
Marine Court Hotel CSO	Public	Intermittent	CSO
Marine Highway CSO	Public	Intermittent	CSO
Marine Parade CSO	Public	Intermittent	CSO
Marine Parade Holywood CSO	Public	Intermittent	CSO
Marine Parade Yacht Club CSO	Public	Intermittent	CSO
Market Place CSO	Public	Intermittent	CSO
Maxwell Road Downshire CSO	Public	Intermittent	CSO
Merok Crescent Belfast CSO	Public	Intermittent	CSO
Merville Mews CSO	Public	Intermittent	CSO
Methodist College CSO	Public	Intermittent	CSO
Milewater CSO	Public	Intermittent	CSO
Mill Road Newtownabbey CSO	Public	Intermittent	CSO
Minorca Drive South CSO	Public	Intermittent	CSO
Minorca Place CSO	Public	Intermittent	CSO
Moonstone Street CSO	Public	Intermittent	CSO
Mornington Place CSO	Public	Intermittent	CSO
Mount Vernon CSO	Public	Intermittent	CSO
Mountainview Park CSO	Public	Intermittent	CSO
New Barnsley Park CSO	Public	Intermittent	CSO
North Howard Street CSO	Public	Intermittent	CSO
North Queen Street Cultra CSO	Public	Intermittent	CSO
North Queen Street Fredrick CSO	Public	Intermittent	CSO
Northland CSO	Public	Intermittent	CSO
Old Shore Road CSO	Public	Intermittent	CSO
Oldcastle Road CSO	Public	Intermittent	CSO

Name	Private or public	Discharge Type	Discharge from
Oldpark Road CSO	Public	Intermittent	CSO
Orangefield Avenue Belfast CSO	Public	Intermittent	CSO
Orangefield Orby Drive CSO	Public	Intermittent	CSO
Orangefield Orby Mews CSO	Public	Intermittent	CSO
Orby Drive CSO	Public	Intermittent	CSO
Ormeau Avenue CSO	Public	Intermittent	CSO
Ormeau Avenue Linenhall CSO	Public	Intermittent	CSO
Ormeau Park CSO	Public	Intermittent	CSO
Ormeau Park North	Public	Intermittent	CSO
Oxford Street Courts CSO	Public	Intermittent	CSO
Oxford Street WwPS	Public	Intermittent	CSO
Palace Barracks CSO	Public	Intermittent	CSO
Palmerston Road Loughfield CSO	Public	Intermittent	CSO
Parkgate Avenue CSO	Public	Intermittent	CSO
Parkmount Pass CSO	Public	Intermittent	CSO
Parkway Garnerville CSO	Public	Intermittent	CSO
Parliament CSO	Public	Intermittent	CSO
Percy Street CSO	Public	Intermittent	CSO
Premier Drive CSO	Public	Intermittent	CSO
Princess Gardens Holywood CSO	Public	Intermittent	CSO
Queens Parade Somerset CSO	Public	Intermittent	CSO
Queens PE Centre CSO	Public	Intermittent	CSO
Ravenhill Avenue Imperial CSO	Public	Intermittent	CSO
Ravenhill Road BP Station CSO	Public	Intermittent	CSO
Ravenhill Road Delaware CSO	Public	Intermittent	CSO
Ravenhill Road Florida CSO	Public	Intermittent	CSO
Rhanbouy Park Seahill CSO	Public	Intermittent	CSO
River Terrace CSO	Public	Intermittent	CSO
Riverside Road Bangor CSO	Public	Intermittent	CSO
Rosemary Crescent CSO	Public	Intermittent	CSO
Rotterdam CSO	Public	Intermittent	CSO
Sanddown Road Kingsleigh CSO	Public	Intermittent	CSO
Sanddown Road Knockvale CSO	Public	Intermittent	CSO
Seacliff Road CSO	Public	Intermittent	CSO
Seapark CSO	Public	Intermittent	CSO
Shankill Road Cambrai CSO	Public	Intermittent	CSO
Shankill Road Lanark CSO	Public	Intermittent	CSO
Sharman CSO	Public	Intermittent	CSO
Sheridan Drive Helens Bay CSO	Public	Intermittent	CSO
Shore Road Fortwilliam CSO	Public	Intermittent	CSO
Shore Road Holywood CSO	Public	Intermittent	CSO
Shore Road Jordanstown CSO	Public	Intermittent	CSO
Shore Road Whiteabbey CSO	Public	Intermittent	CSO
Shore Road Whitewell CSO	Public	Intermittent	CSO

Name	Private or public	Discharge Type	Discharge from
Shore Road York CSO	Public	Intermittent	CSO
Springfield Parade CSO	Public	Intermittent	CSO
Springfield Park Owenvale CSO	Public	Intermittent	CSO
Springfield Road Workman CSO	Public	Intermittent	CSO
Station Street CSO	Public	Intermittent	CSO
Stewarts Place Holywood CSO	Public	Intermittent	CSO
Stranmillis College CSO	Public	Intermittent	CSO
Stranmillis Embankment CSO	Public	Intermittent	CSO
Strathearn Court CSO	Public	Intermittent	CSO
Sunningdale Gardens CSO	Public	Intermittent	CSO
Sunnyside Street CSO	Public	Intermittent	CSO
Taylors Avenue CSO	Public	Intermittent	CSO
Torgrange Hollywood CSO	Public	Intermittent	CSO
Townsend Street Shankill CSO	Public	Intermittent	CSO
Twaddell Avenue CSO	Public	Intermittent	CSO
Victoria Road Croft CSO	Public	Intermittent	CSO
Westburn Crescent CSO	Public	Intermittent	CSO
Westlink Busway CSO	Public	Intermittent	CSO
Westway Gardens Lyndhurst CSO	Public	Intermittent	CSO
Whiterock Road CSO	Public	Intermittent	CSO
Whiterock Road Rockmount CSO	Public	Intermittent	CSO
Whitewell St Ninians CSO	Public	Intermittent	CSO
Whitewell Upper CSO	Public	Intermittent	CSO
Woodburn Road CSO	Public	Intermittent	CSO
Woodburn Road Killaloe CSO	Public	Intermittent	CSO
Woodburn Road Whinfield CSO	Public	Intermittent	CSO
Woodcroft Park CSO	Public	Intermittent	CSO
Ashley Park WwPS	Public	Intermittent	CSO & ERO
Ballyrobert Bangor WwPS	Public	Intermittent	CSO & ERO
Ben Vista WwPS	Public	Intermittent	CSO & ERO
Bromton Road WwPS	Public	Intermittent	CSO & ERO
Carrickfergus Harbour Flyte WwPS	Public	Intermittent	CSO & ERO
Carrington Street WwPS	Public	Intermittent	CSO & ERO
Castlehill Stormount WwPS	Public	Intermittent	CSO & ERO
Cherrymount WwPS	Public	Intermittent	CSO & ERO
Clarehill Mews WwPS	Public	Intermittent	CSO & ERO
Coastguard Row WwPS	Public	Intermittent	CSO & ERO
Craigantlet South WwPS	Public	Intermittent	CSO & ERO
Crawsfordsburn WwPS	Public	Intermittent	CSO & ERO
Distillary Street WwPS	Public	Intermittent	CSO & ERO
Farmhill Road WwPS	Public	Intermittent	CSO & ERO
Fort Road WwPS	Public	Intermittent	CSO & ERO
Glencraig WwPS	Public	Intermittent	CSO & ERO

Name	Private or public	Discharge Type	Discharge from
Glenmachan Street WwPS	Public	Intermittent	CSO & ERO
Gransha Bangor WwPS	Public	Intermittent	CSO & ERO
Greencastle Belfast WwPS	Public	Intermittent	CSO & ERO
Greenisland (1)	Public	Intermittent	CSO & ERO
Greenisland (2)	Public	Intermittent	CSO & ERO
Greenisland (3)	Public	Intermittent	CSO & ERO
Greenisland (4)	Public	Intermittent	CSO & ERO
Groomsport Point WwPS	Public	Intermittent	CSO & ERO
Harbour Road Groomsport WwPS	Public	Intermittent	CSO & ERO
Helens Bay WwPS	Public	Intermittent	CSO & ERO
Holywood A WwPS	Public	Intermittent	CSO & ERO
Killaire WwPS	Public	Intermittent	CSO & ERO
Kinnegar Avenue WwPS	Public	Intermittent	CSO & ERO
Long Acre WwPS	Public	Intermittent	CSO & ERO
Lower Woodburn WwPS	Public	Intermittent	CSO & ERO
Lukes Point WwPS	Public	Intermittent	CSO & ERO
Old Belfast Road WwPS	Public	Intermittent	CSO & ERO
Queens Bridge WwPS	Public	Intermittent	CSO & ERO
Rathgael Road WwPS	Public	Intermittent	CSO & ERO
River Terrace WwPS	Public	Intermittent	CSO & ERO
Sandhurst WwPS	Public	Intermittent	CSO & ERO
Sandy Row WwPS	Public	Intermittent	CSO & ERO
Seacourt WwPS	Public	Intermittent	CSO & ERO
Shaftsbury WwPS	Public	Intermittent	CSO & ERO
Strand Avenue Holywood WwPS	Public	Intermittent	CSO & ERO
Stricklands Glen WwPS	Public	Intermittent	CSO & ERO
Sunnyside Street WwPS	Public	Intermittent	CSO & ERO
Sydenham WwPS	Public	Intermittent	CSO & ERO
West Park WwPS	Public	Intermittent	CSO & ERO
Whiteabbey WwPS	Public	Intermittent	CSO & ERO
Carrickfergus WWTW Discharge D	Public	Intermittent	ERO
Carrickfergus WWTW Discharge E	Public	Intermittent	ERO
Carrickfergus WWTW Discharge F	Public	Intermittent	ERO
Carrickfergus WWTW Discharge G	Public	Intermittent	ERO
Albany WwPS	Public	Intermittent	ERO
Annadale Crescent WwPS	Public	Intermittent	ERO
Annadale WwPS	Public	Intermittent	ERO
Bloomfield WwPS	Public	Intermittent	ERO
Carrickfergus Harbour WwPS	Public	Intermittent	ERO

Name	Private or public	Discharge Type	Discharge from
Farm Lodge WwPS	Public	Intermittent	ERO
Glen Brae WwPS	Public	Intermittent	ERO
Glendarragh WwPS	Public	Intermittent	ERO
Kensington Manor WwPS	Public	Intermittent	ERO
Knocknagoney WwPS	Public	Intermittent	ERO
Lord Wardens WwPS	Public	Intermittent	ERO
Minorca Drive WwPS	Public	Intermittent	ERO
Old Quay Court WwPS	Public	Intermittent	ERO
Ravenhill Reach WwPS	Public	Intermittent	ERO
Roden Street WwPS	Public	Intermittent	ERO
Shaftesbury Road WwPS	Public	Intermittent	ERO
Swifts Quay WwPS	Public	Intermittent	ERO
Belfast WWTW	Public	Intermittent	CSO
Carrickfergus WWTW	Public	Intermittent	CSO & ERO
Greenisland WWTW	Public	Intermittent	CSO
Kinnegar WWTW	Public	Intermittent	CSO
Seahill WWTW	Public	Intermittent	CSO

N.B. Emergency Relief Overflow (ERO) is the same as an Emergency Overflow (EO).

Appendix 5 – Descriptive Statistics

One-way ANOVA: LogEC versus Site

```
Source DF SS MS F P
Site 5 49.463 9.893 16.74 0.000
Error 779 460.434 0.591
Total 784 509.898

S = 0.7688 R-Sq = 9.70% R-Sq(adj) = 9.12%


 Individual 95% CIs For Mean Based on
 Pooled StDev
Level N Mean StDev ---------+---------+---------+---------+
1 116 2.6215 0.7194 (-----*----)
2 143 2.1016 0.8857 (----*----)
3 145 2.1349 0.7653 (----*----)
4 143 1.8990 0.7256 (----*----)
5 135 1.9688 0.7540 (----*----)
6 103 2.4656 0.7294 (-----*-----)
 ---------+---------+---------+---------+
 2.00 2.25 2.50 2.75

Pooled StDev = 0.7688


Grouping Information Using Tukey Method

Site N Mean Grouping
1 116 2.6215 A
6 103 2.4656 A
3 145 2.1349 B
2 143 2.1016 B
5 135 1.9688 B
4 143 1.8990 B

Means that do not share a letter are significantly different.


Tukey 95% Simultaneous Confidence Intervals
All Pairwise Comparisons among Levels of Site

Individual confidence level = 99.55%


Site = 1 subtracted from:

Site Lower Center Upper +---------+---------+---------+---------
2 -0.7937 -0.5199 -0.2462 (-----*----)
3 -0.7596 -0.4867 -0.2137 (----*-----)
4 -0.9963 -0.7225 -0.4488 (-----*----)
5 -0.9301 -0.6527 -0.3754 (-----*----)
6 -0.4525 -0.1559 0.1407 (-----*-----)
 +---------+---------+---------+---------
 -1.00 -0.50 0.00 0.50


Site = 2 subtracted from:

Site Lower Center Upper +---------+---------+---------+---------
3 -0.2249 0.0333 0.2915 (----*----)
4 -0.4617 -0.2026 0.0565 (----*----)
5 -0.3957 -0.1328 0.1301 (----*-----)
6 0.0809 0.3641 0.6472 (----*-----)
 +---------+---------+---------+---------
```

```
 -1.00 -0.50 0.00 0.50


Site = 3 subtracted from:

Site Lower Center Upper +---------+---------+---------+---------
4 -0.4941 -0.2359 0.0223 (----*----)
5 -0.4281 -0.1661 0.0959 (-----*----)
6 0.0484 0.3308 0.6131 (-----*----)
 +---------+---------+---------+---------
 -1.00 -0.50 0.00 0.50


Site = 4 subtracted from:

Site Lower Center Upper +---------+---------+---------+---------
5 -0.1931 0.0698 0.3327 (----*-----)
6 0.2835 0.5666 0.8498 (----*-----)
 +---------+---------+---------+---------
 -1.00 -0.50 0.00 0.50


Site = 5 subtracted from:

Site Lower Center Upper +---------+---------+---------+---------
6 0.2102 0.4968 0.7835 (-----*-----)
 +---------+---------+---------+---------
 -1.00 -0.50 0.00 0.50
```

Appendix 6 - Shoreline Survey Report

Production area:	Belfast Lough
Site name:	
Species:	*Mytilus* sp.
Harvester:	Various
Local Authority:	
Status:	Sanitary Survey Review
Dates Surveyed:	10-11/09/2013
Surveyed by:	Jessica Larkham, Liefy Hendrikz, Frank Cox, Ron Lee
Existing RMPs:	
Area Surveyed:	The survey was nominally split into North Shore (Carrickfergus to Hazelbank Park) and South Shore (Helen's Bay to Kinnegar) with separate teams undertaking each. The South Shore team also undertook a small number of observations at Whitehouse and in East Belfast.

Weather

Heavy rain (21 mm) had fallen on the Saturday (7/09/13) and light rain on the Sunday (2 mm; 8/09/13) and Monday (3 mm; 9/09/13) prior to the survey (http://www.accuweather.com/en/gb/belfast/bt1-1/month/326934?view=table; accessed 29/09/13). No rain fell on the first day of the survey and light showers occurred on the second day during the period of the survey.

Fishery

As the licensed fisheries are subtidal, the locations could not be recorded during the shoreline survey. Beds of wild mussels were widespread on much of the intertidal substrate and adjacent structures (such as concrete enclosed pipes and construction platforms) around much of the north and south shores. Significant concentrations of cockles and winkles were also noted, along with moderate numbers of clam shells in some areas. Some native oyster (*Ostrea edulis*) shells were also seen.

Sewage Sources

The location of NIW sewage treatment works in the area identified during the survey were recorded using GPS. Many of the actual discharge locations could not be directly observed. Where possible, samples were taken from the discharges; otherwise, seawater samples were taken in the near vicinity. Several large pipes enter the intertidal area of the lough. It was not clear whether these were associated with the sewerage system or were from culverted watercourses. Where possible, flows were measured and sampled: otherwise, seawater samples were taken in the near vicinity.

Seasonal Population

Several hotels were observed, but not specifically recorded during the shoreline survey. A small caravan park was observed at Loughshore Park at

Green Island on the northern shoreline. There is a large marina at Carrickfergus.

Boats/Shipping

Belfast Harbour occupies a large area at the head of the lough. Due to access and safety issues, it was not possible to survey the harbour area. Several ships and ferries were observed leaving and entering the harbour/lough during the course of the survey (these are not all specifically recorded in the tables of observations). There is a harbour and marina for smaller boats at Carrickfergus on the northern shore and small numbers of sailing yachts and motor boats were observed moored off the southern shore.

Farming and Livestock

No livestock were noted during the course of the survey. A large number of dogs were being walked on the shore. Although bins for dog waste were provided at several points, dog faeces were observed on the shore.

Land Use and Land Cover

Much of the land around the lough is urban or suburban, or occupied by the docks and surrounding industrial units. There are a number of parks and other grassed and/or wooded areas in the suburbs. The area is surrounded by hills that appeared to be predominantly covered by a mixture of woodland and grass.

Watercourses

A large number of watercourses were observed around the lough and, where possible, these were measured and sampled. The larger watercourses recorded during the survey tended to be located on the north shore although one moderate-sized river was recorded in East Belfast. The River Lagan, the largest watercourse in the area, was not measured or sampled due to difficulties with access.

Wildlife/Birds

Sea birds in small to medium sized groups were seen at several points around the shoreline. Seagulls predominated with oystercatchers also being fairly frequent.

Figure 1. Belfast Lough Waypoints

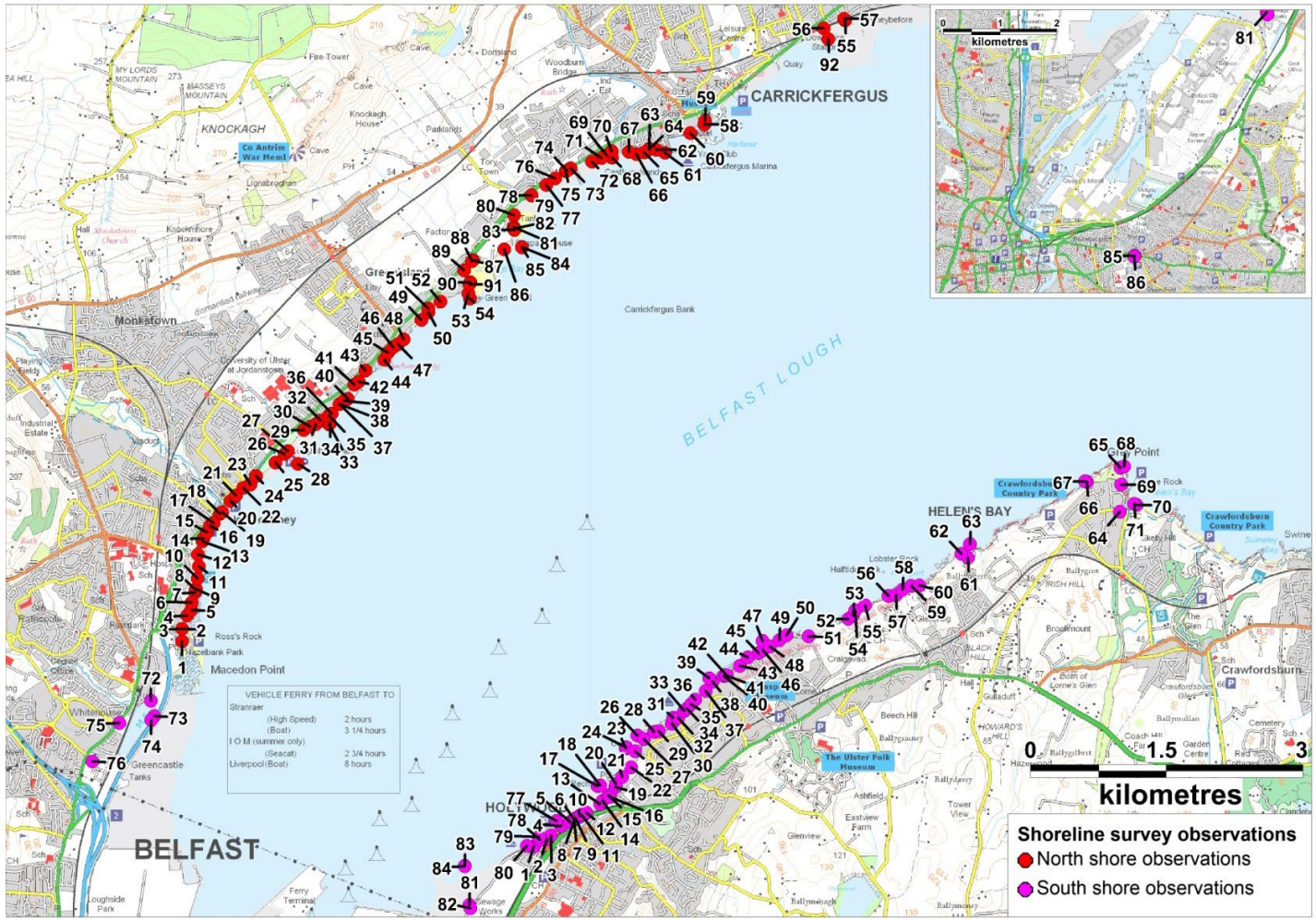

Figure 2. Belfast Lough Sample Locations

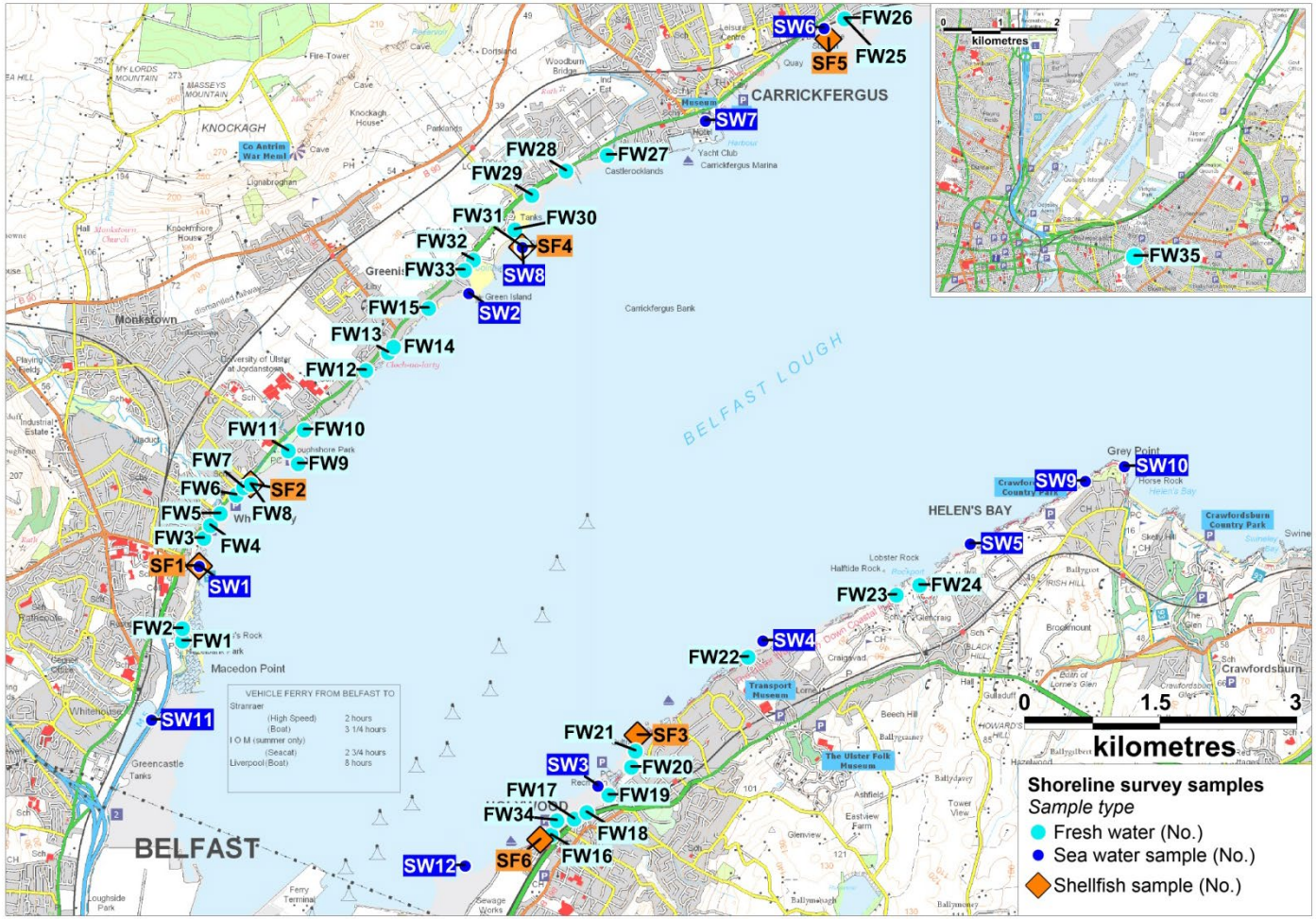
SW6
FW26
FW25
SF5
CARRICKFERGUS
SW7
FW28
FW27
FW29
FW31
FW30
FW32
SF4
FW33
SW8
SW2
FW15
FW13
FW14
FW12
FW11
FW10
FW9
FW7
FW6
SF2
FW5
FW8
FW3
FW4
SF1
SW1
FW2
FW1
Macedon Point
SW11
BELFAST
SW12
SF6
FW16
FW34
FW17
FW18
SW3
FW21
SF3
FW20
FW19
FW22
SW4
FW23
FW24
SW5
HELEN'S BAY
SW9
SW10
FW35
BELFAST LOUGH
Carrickfergus Bank
Monkstown
KNOCKAGH
Greencastle
VEHICLE FERRY FROM BELFAST TO
Stranraer
(High Speed) 2 hours
(Boat) 3 1/4 hours
I O M (summer only)
(Seacat) 2 3/4 hours
Liverpool (Boat) 8 hours
0
1.5
3
kilometres
Shoreline survey samples
Sample type
Fresh water (No.)
Sea water sample (No.)
Shellfish sample (No.)

Table 1 Shoreline Observations – North Shore

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
1	10/09/13	6:13	IJ 35500 81415	335500	381415			50 seabirds
2	10/09/13	6:19	IJ 35499 81556	335499	381556	Fig. 3	BLNS1	Small watercourse running through channel in sea defences, no odour or signs of sewage. Water sample BLNS1, W 0.15, D 0.03, F +0.417 m/s, SD 0.018
3	10/09/13	6:19	IJ 35500 81556	335500	381556			Concrete pipe, no flow, signs of recent flow
4	10/09/13	6:33	IJ 35555 81698	335555	381698			No associated observation
5	10/09/13	6:35	IJ 35601 81761	335601	381761			50 seabirds, slipway with gates
6	10/09/13	6:39	IJ 35603 81843	335603	381843	Fig. 4	BLNS2	Large pipe with grate, small flow - not enough to measure. Water sample BLNS2
7	10/09/13	6:44	IJ 35644 81954	335644	381954			1 heron, 8 gulls
8	10/09/13	6:45	IJ 35648 81987	335648	381987			Two concrete pipes next to each other, very small flow - not enough to measure or sample. 1 oystercatcher, 1 crow
9	10/09/13	6:46	IJ 35652 81992	335652	381992			Two concrete pipes next to each other, very small flow - not enough to measure or sample. 2 oystercatchers
10	10/09/13	6:50	IJ 35669 82109	335669	382109			Pipe small flow - not enough to measure or sample, no houses behind, assumed drainage. 2 herring gulls, 1 common gull, 1 pigeon, 1 curlew
11	10/09/13	6:53	IJ 35685 82243	335685	382243		BLNSM1 & BLNS3	Private slipway. Wild mussel sample BLNSM1 taken from rock outcrops, sea water sample BLNS3
12	10/09/13	7:08	IJ 35673 82373	335673	382373			Private slipway
13	10/09/13	7:10	IJ 35723 82519	335723	382519			3 areas of land drainage through rocks on to shoreline
14	10/09/13	7:10	IJ 35736 82551	335736	382551	Fig. 5	BLNS4	Outfall and slipway next to houses. Sample BLNS4 from outfall. W 0.40, D 0.03, F +0.024 m/s, SD 0.002
15	10/09/13	7:18	IJ 35775 82618	335775	382618			Slipway, 30 pigeons

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
16	10/09/13	7:21	IJ 35809 82691	335809	382691	Fig. 6	BLNS5	1 duck. Outfall pipe - signs of flow. Watercourse under road, location of sample BLNS5 W 0.45, D 0.12, F +0.118 m/s, SD 0.17. Large amount of sanitary debris (also present in 20 m radius from the pipe). Sound of heavy water flow behind. 20 gulls
17	10/09/13	7:34	IJ 35847 82720	335847	382720			Slipway
18	10/09/13	7:37	IJ 35918 82823	335918	382823	Figs. 7 & 8	BLNS6	Large watercourse, location of BLNS6, Smells of sewage Total width 4.10 m 1) 1m in, D 0.13, F +0.336 m/s, SD 0.030, 2) 2 m in, D 0.17, F +0.407 m/s, SD 0.075, 3) 3 m in D 0.11, F +0.456 m/s, SD 0.005
19	10/09/13	7:50	IJ 35941 82843	335941	382843			Evidence of lots of birds - tracks in sand
20	10/09/13	7:52	IJ 36032 82964	336032	382964			Outfall in concrete block under road, very small discharge - not enough to measure or sample. 25 seabirds
21	10/09/13	7:55	IJ 36094 83027	336094	383027		BLNS7	Outfall in concrete block, strong smell of sewage/chemical toilets, small flow - not enough to measure. Sample BLNS7
22	10/09/13	8:03	IJ 36173 83109	336173	383109		BLNS8	Outfall in concrete block, small flow, location of sample BLNS8, Wetted area W 0.20, Pipe diameter 0.35, D 0.03, F +0.013 m/s, SD 0.033
23	10/09/13	8:14	IJ 36253 83147	336253	383147	Fig. 9	BLNS9, BLNSM2	Outfall pipe with flow, water sample BLNS9 and mussel sample BNLSM2, Wetted area W 0.05, Pipe diameter 0.18, D 0.03, Jug Flow 2 litres/5 seconds
24	10/09/13	8:30	IJ 36315 83239	336315	383239			Outfall pipe, no flow, debris, edge of park
25	10/09/13	8:36	IJ 36530 83390	336530	383390			Outfall pipe, small flow - not enough to measure or sample, runs down from Loughshore park
26	10/09/13	8:45	IJ 36630 83483	336630	383483			Loughshore Park and caravan park
27	10/09/13	8:46	IJ 36667 83517	336667	383517			Long outfall next to shorter outfall, no recent signs of flow
28	10/09/13	8:50	IJ 36776 83373	336776	383373	Fig. 10	BLNS10	End of long outfall pipe, small flow - not enough to measure, sample BLNS10
29	10/09/13	9:03	IJ 36841 83748	336841	383748	Fig. 11	BLNS11	Watercourse at edge of park, location of BLNS11, Total width 2.0 m, 1) D 0.11, F +0.036 m/s, SD 0.004, 2) D 0.12, F +0.047 m/s, SD 0.006. 10 Seabirds

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
30	10/09/13	9:14	IJ 36913 83783	336913	383783			Pipe next to slipway, no flow. Start of expensive houses that back on to the shoreline.
31	10/09/13	9:15	IJ 36976 83812	336976	383812			Two pipes leading down from houses (10 m apart), no flow
32	10/09/13	9:17	IJ 37025 83853	337025	383853			Pipe, no flow, next to slipway
33	10/09/13	9:19	IJ 37121 83810	337121	383810			Sea defences. Wildlife: 1 oyster catcher, 2 gulls, 2 seals, 6 ducks
34	10/09/13	9:22	IJ 37132 83821	337132	383821			Outfall pipe, no flow. Wildlife: 10 seabirds, 7 ducks
35	10/09/13	9:24	IJ 37121 83908	337121	383908			Pipe next to slipway, no flow. 1 heron
36	10/09/13	9:25	IJ 37150 83930	337150	383930			Slipway
37	10/09/13	9:28	IJ 37236 84033	337236	384033	Fig. 12	BLNS12	Watercourse, location of water sample BLNS12, W 0.40, D 0.03, F + 0.5 m/s, SD 0.013
38	10/09/13	9:28	IJ 37237 84034	337237	384034			No associated observation
39	10/09/13	9:34	IJ 37281 84070	337281	384070			Pipe, no flow
40	10/09/13	9:35	IJ 37328 84093	337328	384093			Slipway
41	10/09/13	9:38	IJ 37399 84247	337399	384247			Pipe, small flow - not enough to measure or sample, slipway
42	10/09/13	9:40	IJ 37445 84281	337445	384281			Pipe, no flow, slipway
43	10/09/13	9:43	IJ 37523 84405	337523	384405	Fig. 13	BLNS13	Culvert under road, location of BLNS13, W 0.53, D 0.05, F +0.399 m/s, SD 0.094. 3 gulls
44	10/09/13	9:53	IJ 37727 84523	337727	384523	Fig. 14		2 pipes (1 long), no flow. 2 oyster catchers, 1 hooded crow. 2 people harvesting mussels.
45	10/09/13	9:57	IJ 37767 84598	337767	384598		BLNS14	Watercourse through culvert, smell of silage, location of water sample BLNS14, W 0.25, D 0.05, F +0.350 m/s, SD 0.10. 1 Cormorant
46	10/09/13	10:07	IJ 37828 84659	337828	384659	Fig. 15	BLNS15	Watercourse through culvert, location of BLNS15 W 0.75, D 0.06, F +0.041 m/s, SD 0.014
47	10/09/13	10:17	IJ 37881 84694	337881	384694			Slipway
48	10/09/13	10:18	IJ 37942 84746	337942	384746			60 ducks

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
49	10/09/13	10:22	IJ 38139 84963	338139	384963			Slipway
50	10/09/13	10:23	IJ 38215 85044	338215	385044			Oyster and razor clam shells, 12 oyster catchers
51	10/09/13	10:25	IJ 38216 85087	338216	385087	Fig. 16	BLNS16	Watercourse location of water sample BLNS16, W 0.30, D 0.04, F +0.074 m/s, SD 0.009
52	10/09/13	10:32	IJ 38347 85163	338347	385163			Private slipway
53	10/09/13	10:37	IJ 38655 85256	338655	385256	Fig. 17	BLNS17	Outfall pipe, sea water BLNS17 taken at end of outfall pipe, tide partially in so end half covered and unable to tell if there was any flow. 35 Cormorants
54	10/09/13	10:41	IJ 38673 85197	338673	385197			No associated observation
55	11/09/13	6:19	IJ 42810 88267	342810	388267			80 seabirds
56	11/09/13	6:24	IJ 42575 88181	342575	388181	Fig. 18	BLNS20	Long and short outfall pipe, sea water sample BLNS20 taken from the end of the long outfall. High water so unable to tell if it was flowing or not, but when we returned later to collect the shellfish sample, there was a small flow.
57	11/09/13	6:39	IJ 42800 88284	342800	388284	Fig. 19	BLNS18, BLNS19	Two watercourses run along aside to each other under the railway line, down to the sea. East watercourse, location of water sample BLNS18, W 0.43, D 0.10, F +0.002 m/s, SD 0.007. West watercourse, location of water sample BLNS19, W 0.35, D 0.04, F +0.064 m/s, SD 0.011
58	11/09/13	7:04	IJ 41260 87117	341260	387117			Harbour, 2 slipways, 35 vessels (fishing and leisure) and 100 starlings
59	11/09/13	7:05	IJ 41265 87157	341265	387157	Fig. 20	BLNS21	Harbour sea water sample BLNS21
60	11/09/13	7:14	IJ 41102 87023	341102	387023	Fig. 21		Carrickfergus Marina, very busy, est. 200 boats (leisure)
61	11/09/13	7:21	IJ 40823 86805	340823	386805			2 gulls
62	11/09/13	7:25	IJ 40728 86839	340728	386839			1 curlew, 2 gulls, 3 whimbrels
63	11/09/13	7:27	IJ 40649 86850	340649	386850			Outfall pipe with cover in concrete block. No evidence of recent flow. 1 black backed gull
64	11/09/13	7:29	IJ 40646 86842	340646	386842			Outfall pipe with blue cover, semi-open, no evidence of recent flow

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
65	11/09/13	7:31	IJ 40596 86811	340596	386811			14 gulls
66	11/09/13	7:32	IJ 40507 86792	340507	386792			Boat shed and slipway. 1 oystercatcher and 1 gull
67	11/09/13	7:37	IJ 40425 86817	340425	386817			Two outfall pipes, 10 m apart. 1 broken, no flow but evidence of flow - green seaweed growth, 2nd pipe broken, no flow, filled with sand
68	11/09/13	7:42	IJ 40241 86752	340241	386752			Orange plastic pipe, no flow
69	11/09/13	7:44	IJ 40182 86777	340182	386777	Fig. 22	BLN22	Large watercourse with lots of mussel shells in, location of water sample BLNS22. Total width 7.80 m, at 1) 1 m in F +0.168 m/s, SD 0.017, D 0.14, 2) 2 m in F +0.238 m/s, SD 0.015, D 0.19, 3) 3 m in F +0.221 m/s, SD 0.016, D 0.11, 4) 4 m in F +0.121 m/s, SD 0.025, D 0.09, 5) 5 m in F +0.09 m/s, SD 0.003, D 0.055
70	11/09/13	7:57	IJ 40238 86826	340238	386826			Small black pipe, no flow
71	11/09/13	8:01	IJ 40124 86749	340124	386749			Pipe in concrete block, no flow
72	11/09/13	8:04	IJ 40019 86709	340019	386709			Orange outfall pipe in concrete block, very little flow, not enough to sample or measure
73	11/09/13	8:10	IJ 39783 86636	339783	386636			Outfall coming out of road, no flow but evidence of flow - green seaweed growth
74	11/09/13	8:11	IJ 39742 86609	339742	386609	Fig. 23		Large concrete structure with three openings/outfalls, two blocked up. No flow, although some green seaweed growth
75	11/09/13	8:13	IJ 39731 86604	339731	386604	Fig. 24	BLNS23	Watercourse through culvert under road (gravel in bottom of culvert), location of water sample BLNS23, Diameter of culvert 0.93, Wetted W 0.42, D 0.07, F +0.798 m/s, SD 0.007
76	11/09/13	8:24	IJ 39613 86524	339613	386524			Outfall coming out of wall, no flow but evidence of flow - green seaweed growth. 20 gulls, 1 oystercatcher
77	11/09/13	8:29	IJ 39516 86450	339516	386450			Pipe coming under road, no flow, although signs of recent flow
78	11/09/13	8:32	IJ 39351 86337	339351	386337	Fig. 25	BLNS24	Watercourse running through culvert under the road, location of BLNS24, W 0.75, D 0.11, F +0.274 m/s, SD 0.017. Rock outcrop with 20 cormorants, 20 gulls on
79	11/09/13	8:33	IJ 39351 86338	339351	386338			Tidal pool with slight spring feed in, stagnant

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
80	11/09/13	8:45	IJ 39159 86117	339159	386117	Fig. 26		Green Island STW, fenced off. Two discharge pipes, one on the left with sludge in front of it, both coming from STW.
81	11/09/13	8:49	IJ 39155 85988	339155	385988			Culvert/outfall from STW, no flow, although evidence of recent flow - green seaweed growth
82	11/09/13	8:51	IJ 39159 85968	339159	385968			Orange pipe from STW, no flow
83	11/09/13	8:52	IJ 39164 85953	339164	385953		BLNS25	Pipe coming from STW, small flow, not enough to measure, location of water sample BLNS25
84	11/09/13	8:59	IJ 39247 85766	339247	385766	Fig. 27	BLNS26	End of outfall from STW, location of fresh water sample BLNS26, Diameter of outfall 0.45, Wetted W 0.40, D 0.15, F + 1.190 m/s, SD 0.011. 30 Eider ducks, 2 cormorants, 8 gulls, 6 oystercatchers
85	11/09/13	9:10	IJ 39248 85764	339248	385764		BLNS27 & BLNSM3	Outfall pipe, seawater sample BLNS27 taken at end of outfall, wild mussel sample taken next to outfall pipe
86	11/09/13	9:23	IJ 39053 85740	339053	385740			End of outfall, no flow, suspected to belong to large house behind
87	11/09/13	9:35	IJ 38706 85623	338706	385623		BLNS28	Small watercourse flowing into the bay , location of water sample BLNS28, W 0.25, D 0.08, F +0419 m/s, SD 0.040
88	11/09/13	9:39	IJ 38696 85612	338696	385612			Metal outfall pipe, no flow
89	11/09/13	9:42	IJ 38611 85508	338611	385508		BLNS29	Small watercourse, location of water sample BLNS29, W 1.0, D 0.09, F +0.401 m/s, SD 0.009. Septic tank next to the house and watercourse. Three pipes next to watercourse, no flow.
90	11/09/13	9:48	IJ 38679 85378	338679	385378			Green electricity wire/telephone exchange housing
91	11/09/13	9:50	IJ 38666 85355	338666	385355			Old metal pipe, no flow
92	11/09/13	10:50	IJ 42625 88062	342625	388062		BLNSM4	Location of wild mussel sample BLNSM4, at the end of outfall pipe where seawater sample BLNS20 was collected

Table 2 Shoreline Observations – South Shore

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
1	10/09/13	06:27	IJ 39377 79152	339377	379152			Holywood Yacht Club. Large numbers of cockle shells and moderate numbers of mussel shells on beach.
2	10/09/13	06:33	IJ 39526 79233	339526	379233			Approximately 20 gulls and oystercatchers at tideline. Several items of sanitary debris. Some razor shells.
3	10/09/13	06:37	IJ 39566 79273	339566	379273	Fig. 28	BLS FW01	Outfall –flowing. Width 20 cm, depth 2 cm, flow, +0.643 m/s (SD=0.250). Sanitary debris. Shore mussels around outfall. Large numbers of cockle shells and moderate numbers of mussel shells.
4	10/09/13	06:56	IJ 39681 79375	339681	379375			Approximately 30 gulls, 10 crows, 6 oystercatchers. Mussels on rocks. Large numbers of cockle and mussel shells.
5	10/09/13	06:59	IJ 39779 79422	339779	379422			Pipe opening through sea wall. No flow.
6	10/09/13	07:04	IJ 39820 79453	339820	379453			Water coming through small hole in sea wall (approximately 1 cm diameter). Not measured or sampled.
7	10/09/13	07:05	IJ 39821 79451	339821	379451		BLS FW02	Water coming through hole in sea wall (approx 3 cm diameter). 200 ml in 1 sec.
8	10/09/13	07:07	IJ 39829 79458	339829	379458			Water coming through holes in sea wall at 3 separate points. Not measured or sampled.
9	10/09/13	07:08	IJ 39838 79462	339838	379462			Pipe. Internal diameter approximately 40 x 34 cm. Just seeping. Lots more water coming out through holes in sea wall over a 100 m stretch beyond the pipe.
10	10/09/13	07:11	IJ 39880 79490	339880	379490			Small pipe outlet in sea wall. No flow.
11	10/09/13	07:13	IJ 39905 79503	339905	379503			Small pipe outlet in sea wall. No flow but seepage under pipe.
12	10/09/13	07:14	IJ 39958 79525	339958	379525	Fig. 29	BLS FW03	Culverted stream. Width 27 cm, depth 6 cm, flow +0.104 m/s (SD=0.179). 3 dogs on beach,

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
13	10/09/13	07:25	IJ 40109 79618	340109	379618			Two pieces sanitary debris on beach. Cockle and mussel shells.
14	10/09/13	07:28	IJ 40137 79655	340137	379655			20 gulls and 2 crows. Flat oyster shell.
15	10/09/13	07:30	IJ 40199 79718	340199	379718	Fig. 30	BLS FW05	Blind water course – flow seeps through shore. Measured at constriction: width 59 cm, depth 3 cm, flow +0.177 m/s (SD=0.013).
16	10/09/13	07:37	IJ 40218 79697	340218	379697			Dog faeces on shore. Dog on beach.
17	10/09/13	07:41	IJ 40080 79818	340080	379818		BLS SW01	End of pipe. ID=30 cm. Smelly. No obvious flow. Mussel beds cover sand banks. Seawater sample from pool in front of pipe.
18	10/09/13	07:47	IJ 40109 79825	340109	379825	Fig. 31		Mussel beds
19	10/09/13	07:50	IJ 40275 79808	340275	379808			Pipe outlet in sea wall. Approximate ID=30 cm. Dog in act of defaecating on beach but owner picked it up.
20	10/09/13	07:52	IJ 40284 79839	340284	379839			Dog on beach.
21	10/09/13	07:54	IJ 40354 79918	340354	379918			Pipe outlet in sea wall. ID=15 cm. No flow. Approximately 10 crows and 50 gulls on mussel beds.
22	10/09/13	07:58	IJ 40451 80024	340451	380024	Fig. 32	BLS FW06	Culverted watercourse. Width 73 cm, depth 3 cm, flow 0.340 m/s (SD=0.016).
23	10/09/13	08:09	IJ 40394 80235	340394	380235			End of concrete encased pipe. ID=70 x 65cm. No flow. Mussel beds on sand banks. Some clam and cockle shells.
24	10/09/13	08:12	IJ 40395 80246	340395	380246			End of concrete encased pipe, approximately 20 cm ID. Broken flap valve. Pipe broken at various places along length.
25	10/09/13	08:17	IJ 40494 80204	340494	380204		BLS FW07	Flow from broken pipe (above). Unable to measure flow. Large numbers of winkles.
26	10/09/13	08:27	IJ 40521 80376	340521	380376		BLS SF01	Mussel sample. 3 cormorants, 3 oystercatchers, 3 gulls.
27	10/09/13	08:33	IJ 40593 80337	340593	380337			Pipe outlet in sea wall. No flow. ID approximately 33 x 30 cm.

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
28	10/09/13	08:37	IJ 40704 80417	340704	380417			Foreshore changed from sandy to largely rocky. Approximately 20 gulls.
29	10/09/13	08:38	IJ 40755 80424	340755	380424			11 small boats moored offshore.
30	10/09/13	08:42	IJ 40900 80507	340900	380507			Area of green algae on beach.
31	10/09/13	08:43	IJ 40916 80574	340916	380574			RNIYC. 2 slipways, one of them disused. 1 jetty.
32	10/09/13	08:46	IJ 40968 80573	340968	380573			Relatively large pipe outlet (ID=35 x 33 cm) and 6 small ones in sea wall. No flows.
33	10/09/13	08:47	IJ 41037 80648	341037	380648			5 gulls.
34	10/09/13	08:48	IJ 41068 80674	341068	380674	Fig. 33		Flap valve in sea wall OD=22 x 29 cm). Dripping. Lots of green weed below. Several pipe outlets in roadside wall (no flows).
35	10/09/13	08:53	IJ 41112 80720	341112	380720			Pipe outlet in sea wall (couldn't reach to estimate ID). Dripping. Green algae below. More pipe outlets through roadside wall (no flow).
36	10/09/13	08:56	IJ 41157 80772	341157	380772			3 gulls, Shore changed from rocky to pebbles.
37	10/09/13	08:59	IJ 41275 80868	341275	380868			Dog on beach. Pebbles at top of foreshore, rocks further down.
38	10/09/13	09:01	IJ 41350 80972	341350	380972			Broken concrete encased pipe. No flow.
39	10/09/13	09:02	IJ 41313 81006	341313	381006			End of iron pipe. ID= 20 cm. Dripping. Lots of small mussels and also winkles. Some Ulva on the shoreline. More pipe outlets at top of sea wall (no flow).
40	10/09/13	09:07	IJ 41471 81033	341471	381033			Area of green algae on shore. Cormorant and 10 gulls. Lower shore turned to horizontally stratified rock. Manhole cover visible above sea wall. More pipe outlets at top of sea wall (no flow).

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
41	10/09/13	09:09	IJ 41496 81038	341496	381038			Two large pipe outlets in sea wall. 1: ID=31 cm, no flow. 2: ID=30 cm, dripping, lots of green algae.
42	10/09/13	09:10	IJ 41506 81041	341506	381041			Iron pipe outlet in sea wall (ID=13 cm), no flow. Second iron pipe lower down (ID=12 cm), no flow.
43	10/09/13	09:14	IJ 41651 81145	341651	381145			End of sea wall. Upper shore now sand. Lots of green algae further down shore.
44	10/09/13	09:17	IJ 41738 81238	341738	381238	Fig. 34	BLS FW08	Concrete encased pipe (ID=20 cm), no flow. Water course alongside, measured at constriction. Width 129 cm, depth 6 cm, flow 0.524 m/s (SD=0.015).
45	10/09/13	09:24	IJ 41858 81285	341858	381285			Lots of green algae on shore. Winkles, some mussels.
46	10/09/13	09:25	IJ 41904 81318	341904	381318			Sanitary debris.
47	10/09/13	09:27	IJ 41901 81420	341901	381420	Fig. 35	BLS SW02	End of two concrete pipes in concrete outer. ID of both approximately 60 cm. Tide coming in and couldn't observe flow. Seawater sample.
48	10/09/13	09:33	IJ 41980 81359	341980	381359			End of slipway. Lots of mussel shell on shore. Several small pipe outlets in sea wall, no flow.
49	10/09/13	09:36	IJ 42086 81429	342086	381429	Fig. 36		Plastic pipe outlet with flap valve in sea wall (ID=18 cm).
50	10/09/13	09:41	IJ 42165 81483	342165	381483			5 gulls, 2 crows. Rocky lower foreshore.
51	10/09/13	09:44	IJ 42407 81472	342407	381472			Western edge of golf course including woodland. Dog on beach. 3 gulls.
52	10/09/13	10:03	IJ 42846 81663	342846	381663			Dog on beach.
53	10/09/13	10:04	IJ 42899 81699	342899	381699			8 oystercatchers, 5 gulls. Green algae on beach.
54	10/09/13	10:06	IJ 42922 81758	342922	381758			Mussel beds on banks. 5 gulls, 2 oystercatchers. Rocky outcrop and woodland at top of shore.
55	10/09/13	10:09	IJ 43032 81812	343032	381812			2 crows.

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
56	10/09/13	10:14	IJ 43287 81917	343287	381917			Sanitary debris. Approximately 30 gulls. Some Ulva on shore.
57	10/09/13	10:16	IJ 43372 81924	343372	381924	Fig. 37	BLS FW09	Culverted watercourse. Width 20 cm, depth 4 cm, flow 0.344 m/s (SD=0.004). 25 cormorants on rock offshore.
58	10/09/13	10:24	IJ 43443 81984	343443	381984			Land seepage. Rough grass and trees above shore.
59	10/09/13	10:28	IJ 43543 82027	343543	382027			14 gulls.
60	10/09/13	10:31	IJ 43631 82034	343631	382034	Fig. 38	BLS FW10	Watercourse. Width 53 cm, depth 9 cm, flow 0.031 m/s (SD=0.021).
61	10/09/13	10:48	[redacted]					Entrance to Seahill WWTW. Scrub and woodland in vicinity.
62	10/09/13	10:51	IJ 44094 82380	344094	382380	Fig. 39		Iron concrete-encased pipe with flap valve (ID=35 cm). No flow.
63	10/09/13	10:56	IJ 44189 82489	344189	382489	Figs. 40 & 41	BLS SW03	50 gulls, 1 curlew, 7 oystercatchers. Seawater sample taken from near end of Seahill main outfall.
64	11/09/13	06:25	IJ 45840 82845	345840	382845	Fig. 42		Probable sewage pumping station in building in Helen's Bay Beach Car Park. Telemetry.
65	11/09/13	06:41	IJ 45849 83332	345849	383332	Fig. 43		Pumping station with telemetry. Date of construction on plate, 2012.
66	11/09/13	06:49	IJ 45479 83175	345479	383175			Manhole cover above shore.
67	11/09/13	06:54	IJ 45455 83182	345455	383182		BLS SW04	Seawater sample. Sanitary debris on shore. Scrub, trees and houses above shore.
68	11/09/13	07:07	IJ 45889 83346	345889	383346		BLS SW05	Seawater sample. Pipe submerged in sea. Flow heard under lower manhole. 3 freighters offshore.
69	11/09/13	07:14	IJ 45854 83145	345854	383145			Photograph from Grey Point path (part of Ulster Way) of large diameter pipe running parallel to shore. Point covered in woodland.

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
70	11/09/13	07:19	IJ 46026 82920	346026	382920	Fig. 44		26 gulls on St Helen's Bay beach. Concrete pipe in wall above beach. Grill above outlet. Slight flow disappearing into sand. Some green algae.
71	11/09/13	07:22	IJ 45998 82932	345998	382932	Fig. 45		Photographs of water quality board. Advisory against swimming for 48 hours after heavy rainfall. Mention of stream, possibly related to observation 70.
72	11/09/13	08:00	IJ 35154 80761	335154	380761			Approximately 90 birds on lagoon (mainly gulls and oystercatchers).
73	11/09/13	08:13	IJ 35191 80589	335191	380589			Sanitary debris.
74	11/09/13	08:16	IJ 35160 80547	335160	380547	Fig. 46	BLS SW06	Sample from lagoon by westernmost of two sets of 3 large outlet pipes. Sanitary debris. Lots of mussels and mussel shells.
75	11/09/13	08:29	IJ 34806 80513	334806	380513			Possible P.S. next to traffic lights (switch box plus tank covers).
76	11/09/13	08:30	[redacted]					Entrance to Whitehouse WWTW and sludge thickening plant.
77	11/09/13	09:05	IJ 39629 79435	339629	379435		BLS FW11	End of concrete pipe. Some flow. ID=85 cm. Smell of urine. Flow 800 ml in 10 secs.
78	11/09/13	09:39	IJ 39448 79224	339448	379224		BLS SF02	Mussel sample from pilings of concrete encased pipe.
79	11/09/13	09:42	IJ 39437 79256	339437	379256	Fig. 47		Near end of concrete encased pipe. Water too deep to access end.
80	11/09/13	09:47	IJ 39301 79157	339301	379157			Small yacht moored just offshore.
81	11/09/13	10:08	IJ 38668 78507	338668	378507			Shore end of concrete line heading out NE.
82	11/09/13	10:09	[redacted]					Kinnegar WWTW.

No.	Date	Time	Irish Grid	Easting	Northing	Associated photograph	Associated sample	Description
83	11/09/13	10:18	IJ 38617 78936	338617	378936	Fig. 48	BLS SW07	Seawater sample on east side part way along concrete line given in observation 81. Lots of mussels along line. Approximately 200 gulls and oystercatchers on intertidal area towards the east. Looking towards shore: woodland on hills behind barracks.
84	11/09/13	10:19	IJ 38617 78935	338617	378935			Repeat waypoint of 83.
85	11/09/13	11:13	IJ 36345 74224	336345	374224	Fig. 49		Photograph of river in East Belfast
86	11/09/13	11:16	IJ 36336 74208	336336	374208		BLS FW12	Sample from river.

Photographs referenced in the table are included as Figures 3 – 49.

Sampling

Samples were collected at sites marked on the map shown in Figure 2. Samples were transported during the shoreline survey in back packs containing ice packs and then transferred to Biotherm insulated boxes with ice packs and posted to Glasgow Scientific Services (GSS) for *E. coli* analysis. All samples were posted on the day of collection and all of them were received and analysed the following day. The sample temperatures on arrival to the laboratory ranged between 2.3˚C and 4.2 ˚C for the samples from the first day and 9.6 to 12.1˚C for the samples on the second day (caused by ineffective freezing of ice packs). Although the receipt temperatures for the samples taken on the second day exceeded the target of 8˚C, they were within the range that the UK NRL has shown results in no significant change in *E. coli* concentration in shellfish at 24 hours. The results of all samples were therefore accepted as valid.

Seawater samples were tested for salinity by GSS and the results reported in mg Chloride per litre. These results have been converted to parts per thousand (ppt) using the following formula:

$$\text{Salinity (ppt)} = 0.0018066 \times Cl^{-}\,(\text{mg/L})$$

The results are shown in Tables 3 (freshwater samples), 4 (seawater samples) and 5 (shellfish samples).

Table 3. Freshwater Sample Results

No.	Date	Sample	Grid Ref	*E. coli* (cfu/100ml)
1	10/09/13	BLNS1	IJ 35500 81415	10000
2	10/09/13	BLNS2	IJ 35499 81556	1220
3	10/09/13	BLNS4	IJ 35736 82551	1920
4	10/09/13	BLNS5	IJ 35809 82691	15000
5	10/09/13	BLNS6	IJ 35918 82823	2000
6	10/09/13	BLNS7	IJ 36094 83027	208000
7	10/09/13	BLNS8	IJ 36173 83109	110000
8	10/09/13	BLNS9	IJ 36253 83147	30000
9	10/09/13	BLNS10	IJ 36776 83373	30
10	10/09/13	BLNS11	IJ 36841 83747	30000
11	10/09/13	BLNS12	IJ 36667 83517	1840
12	10/09/13	BLNS13	IJ 37523 84404	840

No.	Date	Sample	Grid Ref	*E. coli* (cfu/100ml)
13	10/09/13	BLNS14	IJ 37767 84598	20000
14	10/09/13	BLNS15	IJ 37828 84659	2160
15	10/09/13	BLNS16	IJ 38216 85087	20000
16	10/09/13	BLS FW01	IJ 39566 79273	2600000
17	10/09/13	BLS FW 02	IJ 39821 79451	50
18	10/09/13	BLS FW03	IJ 39958 79525	30000
19	10/09/13	BLS FW05	IJ 40199 79718	10000
20	10/09/13	BLS FW06	IJ 40451 80024	10000
21	10/09/13	BLS FW07	IJ 40494 80204	<10
22	10/09/13	BLS FW08	IJ 41738 81238	550
23	10/09/13	BLS FW09	IJ 43372 81924	340
24	10/09/13	BLS FW10	IJ 43631 82034	390
25	11/09/13	BLNS18	IJ 42800 88284	50000
26	11/09/13	BLNS19	IJ 42800 88284	240000
27	11/09/13	BLNS22	IJ 40182 86777	1060
28	11/09/13	BLNS23	IJ 39731 86603	20000
29	11/09/13	BLNS24	IJ 39351 86337	660
30	11/09/13	BLNS25	IJ 39164 85953	20000
31	11/09/13	BLNS26	IJ 39247 85766	27000
32	11/09/13	BLNS28	IJ 38706 85623	1140
33	11/09/13	BLNS29	IJ 38611 85508	780
34	11/09/13	BLS FW11	IJ 39629 79435	8000
35	11/09/13	BLS FW12	IJ 36336 74208	40000

Table 4. Seawater Sample Results

No.	Date	Sample	Grid Ref	*E. coli* (cfu/100ml)	Salinity (ppt)
1	10/09/13	BLNS3	IJ 35685 82243	36	35.0
2	10/09/13	BLNS17	IJ 38655 85255	1500	35.6
3	10/09/13	BLS SW01	IJ 40080 79818	7100	33.2
4	10/09/13	BLS SW02	IJ 41901 81420	34	34.0
5	10/09/13	BLS SW03	IJ 44189 82489	47	34.5
6	11/09/13	BLNS20	IJ 42575 88181	10	35.4
7	11/09/13	BLNS21	IJ 41265 87157	15	35.0
8	11/09/13	BLNS27	IJ 39248 85764	7200	20.2
9	11/09/13	BLS SW04	IJ 45455 83182	47	35.0
10	11/09/13	BLS SW05	IJ 45889 83346	8	35.4
11	11/09/13	BLS SW06	IJ 35160 80547	100	34.0
12	11/09/13	BLS SW07	IJ 38617 78936	66	34.1

Table 5. Shellfish Sample Results

No.	Date	Sample	Grid Ref	Type	*E. coli* (MPN/100 g)
1	10/09/13	BLNSM1	IJ 35685 82243	Mussels	940
2	10/09/13	BLNSM2	IJ 36253 83147	Mussels	>18000
3	10/09/13	BLS SF01	IJ 40521 80376	Mussels	3500
4	11/09/13	BLNSM3	IJ 39248 85764	Mussels	2400
5	11/09/13	BLNSM4	IJ 42625 88062	Mussels	3500
6	11/09/13	BLS SF02	IJ 39448 79224	Mussels	3500

Salinity Profiles

No salinity profiles were taken during this shoreline survey.

Photographs

Figure 3. Small watercourse running through channel in sea defences. Site of freshwater sample BLNS1.

Figure 4. Large pipe with grating. Site of freshwater sample BLNS2.

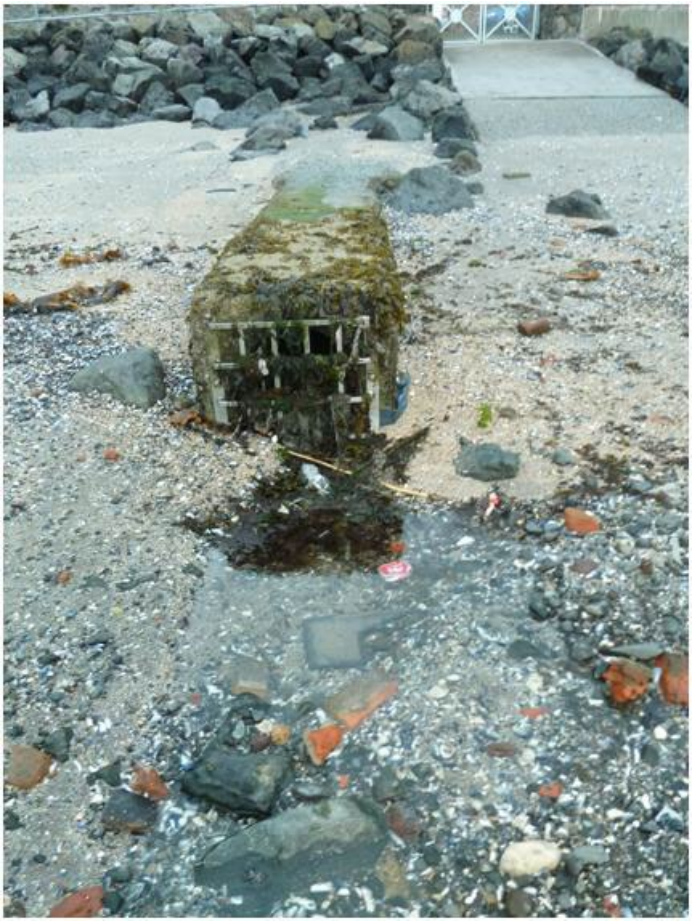

Figure 5. Outfall and slipway. Site of freshwater sample BLNS4

Figure 6. Outfall pipe and watercourse. Site of freshwater sample BLNS5.

Figure 7. Sanitary debris in the vicinity of Three Mile Water and Whiteabbey WWPS.

Figure 8. Watercourse. Site of freshwater sample BLNS6.

Figure 9. Outfall pipe. Site of freshwater sample BLNS9 and mussel sample BLNSM2.

Figure 10. End of long outfall pipe. Site of freshwater sample BLNS10.

Figure 11. Watercourse at edge of park. Site of freshwater sample BLNS11.

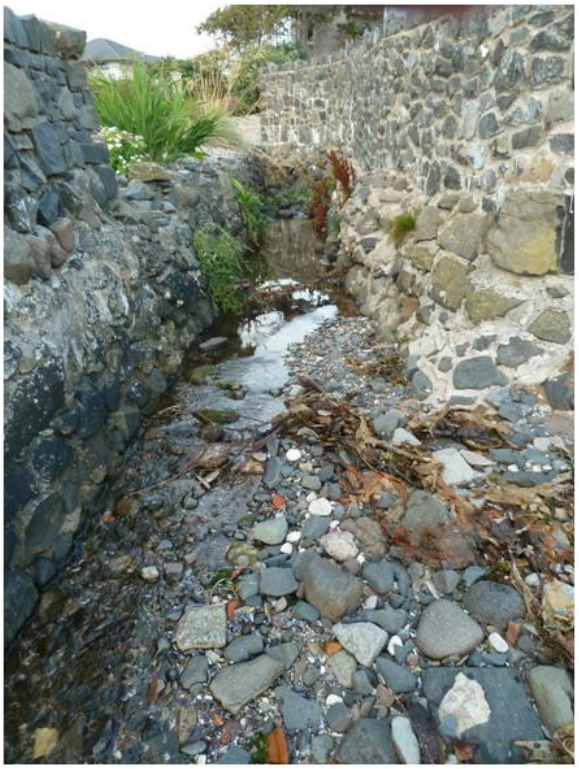

Figure 12. Watercourse. Site of freshwater sample BLNS12.

Figure 13. Culvert under road. Site of freshwater sample BLNS13.

Figure 14. Two pipes, neither with flow at time of survey.

Figure 15. Culverted watercourse. Site of freshwater sample BLNS15.

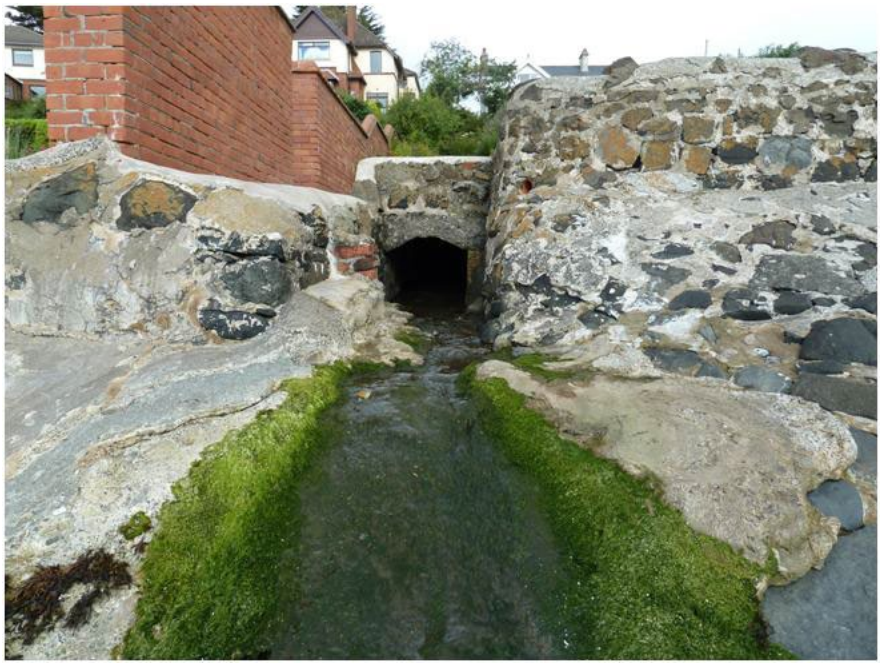

Figure 16. Culverted watercourse. Site of freshwater sample BLNS16.

Figure 17. Outfall pipe. Seawater sample BLNS17 taken at end of pipe.

Figure 18. Long and short outfall pipes with no evidence of flow. Seawater sample BLNS20 taken at end of long pipe.

[taken at 06:24: photograph lightened to make pipes visible]

Figure 19. Two watercourses in culvert under railway line. Site of freshwater sample BLNS18.

Figure 20. Carrickfergus Harbour. Site of seawater sample BLNS21.

Figure 21. Carrickfergus Marina.

Figure 22. Watercourse. Site of freshwater sample BLNS22.

Figure 23. Three openings in concrete structure, two blocked up. No flow.

Figure 24. Culverted watercourse. Site of freshwater sample BLNS23.

Figure 25. Culverted watercourse. Site of freshwater sample BLNS24.

Figure 26. Green Island STW.

Figure 27. Outfall from Green Island STW.

Figure 28. Outfall. Site of freshwater sample BLS FW01.

Figure 29. Culverted watercourse. Site of freshwater sample BLS FW03.

Figure 30. Blind watercourse. Site of freshwater sample BLS FW05.

Figure 31. One of the many wild mussel beds along the southern shore.

Figure 32. Culverted watercourse. Site of freshwater sample BLS FW06.

Figure 33. Flap valve with signs of recent flow.

Figure 34. Watercourse. Site of freshwater sample BLS FW08.

Figure 35. Ends of two pipes. Site of seawater sample BLS SW02.

Figure 36. Flap valve in sea wall.

Figure 37. Culverted watercourse. Site of freshwater sample BLS FW09.

Figure 38. Watercourse. Site of freshwater sample BLS FW10.

Figure 39. Flap valve on end of pipe. No flow at time of survey.

Figure 40. Seahill STW.

Figure 41. Seahill STW main outfall. Site of seawater sample BLS SW03.

Figure 42. Presumed sewage pumping station in Helen's Bay Beach car park.

Figure 43. Pumping station.

Figure 44. Watercourse on Helen's Bay Beach. Presumed location of CSO discharge point (via watercourse).

Figure 45. Helen's Bay Beach water quality information board. Includes post-rainfall bathing advisory.

Figure 46. One of two sets of three outlets from lagoon.

Figure 47. Possible outfall pipe.

Figure 48. Dense bank of mussels on concrete structure. Site of seawater sample BLS SW07.

Figure 49. River in East Belfast. Site of freshwater sample BLS FW12.