Sanitary Survey- Review

Liverpool Bay – 2022

Document No. – *J0591/21/12/03*

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1.0	19 January 2022	Draft for FSA review
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Document QA and Approval

	Name	Role	Date
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Initial Consultation

Consultee	Date of consultation
Mersey Port Health Authority	02 November 2021
Wirral Metropolitan Borough Council	02 November 2021
Environment Agency	02 November 2021

Consultation on draft report

Consultee	Date of consultation
Environment Agency	02 March 2022
Mersey Port Health Authority	02 March 2022
Wirral Metropolitan Borough Council	02 March 2022

A sanitary survey relevant to the bivalve mollusc beds in Liverpool Bay was undertaken in 2013 in accordance with Regulation (EC) 854/2004 (which was replaced by retained EU Law Regulation (EU) 2017/625, with sanitary survey requirements now specified in retained EU Law Regulation (EU) 2019/627). This provided appropriate hygiene classification zoning and monitoring plan based on the best available information with detailed supporting evidence. In line with regulatory and EU guidance the Food Standards Agency undertake targeted sanitary survey reviews to ensure public health protection measures continue to be appropriate. This report provides a review of information and recommendations for a revised sampling plan if required. Carcinus Ltd. (Carcinus) undertook this work on behalf of the FSA. Carcinus Ltd accepts no liability for any costs, losses or liabilities arising from the reliance upon or use of the contents of this report other than by its client.

Dissemination

Food Standards Agency, Mersey Port Health Authority, Wirral Metropolitan Borough Council. The report is publicly available via the Carcinus Ltd. website.

Recommended Bibliographic Citation:

Carcinus Ltd., 2022. Review of the Liverpool Bay 2013 Sanitary Survey. Carcinus report on behalf of the Food Standards Agency, to demonstrate compliance with the requirements for

classification of bivalve mollusc production areas (BMPA) in England and Wales under retained EU Law Regulation (EU) 2019/627.

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1 Introduction

1.1 Background

The Food Standards Agency (FSA) is responsible for carrying out sanitary surveys in classified production and relay areas in accordance with Article 58 of retained (EU) Regulation 2019/627 and the EU Good Practice Guide (European Commission, 2017). In line with these requirements, sanitary surveys must be reviewed to ensure public health protection measures continue to be appropriate. Carcinus is contracted to undertake reviews on behalf of the FSA.

The report considers changes to bacterial contamination sources (primarily from faecal origin) and the associated loads of the faecal indicator organism *Escherichia coli* (*E. coli*) that may have taken place since the original sanitary survey was undertaken. It does not assess chemical contamination, or the risks associated with biotoxins. The assessment also determines the necessity and extent of a shoreline survey based on the outcome of the desktop report and identified risks. The desktop assessment is completed through analysis and interpretation of publicly available information, in addition to consultation with stakeholders.

1.2 Liverpool Bay Review

This report reviews information and makes recommendations for a revised sampling plan for existing cockle (*Cerastoderma edule*) classification zones in Liverpool Bay (Figure 1.1). This review explores any changes to the main microbiological contamination sources that have taken place since the original sanitary survey was conducted. Data for this review was gathered through a desk-based study and consultation with stakeholders.

An **initial consultation** with Local Authorities (LAs) and the Environment Agency (EA) responsible for the production area was undertaken in November 2021. This supporting local intelligence is valuable to assist with the review and was incorporated in the assessment process.

Following production of a draft report, a wider **external second round of consultation** with LAs and Local Action Group (LAG) members was undertaken in March and April 2022. It is recognised that dissemination and inclusion of a wider stakeholder group, including local industry, is essential to sense-check findings and strengthen available evidence. The draft report is reviewed taking into account the feedback received.

The review updates the sanitary survey assessment originally conducted in 2013 (Cefas, 2013) (which was itself a review of a 2011 survey (Cefas, 2011)) and sampling plan as necessary and the report should read be in conjunction with the previous survey.

Specifically, this review considers:
(a) Changes to the shellfishery (if any);
(b) Changes in microbiological monitoring results;

(c) Changes in sources of pollution impacting the production area or new evidence relating to the actual or potential impact of sources;

(d) Changes in land use of the area; and

(e) Change in environmental conditions.

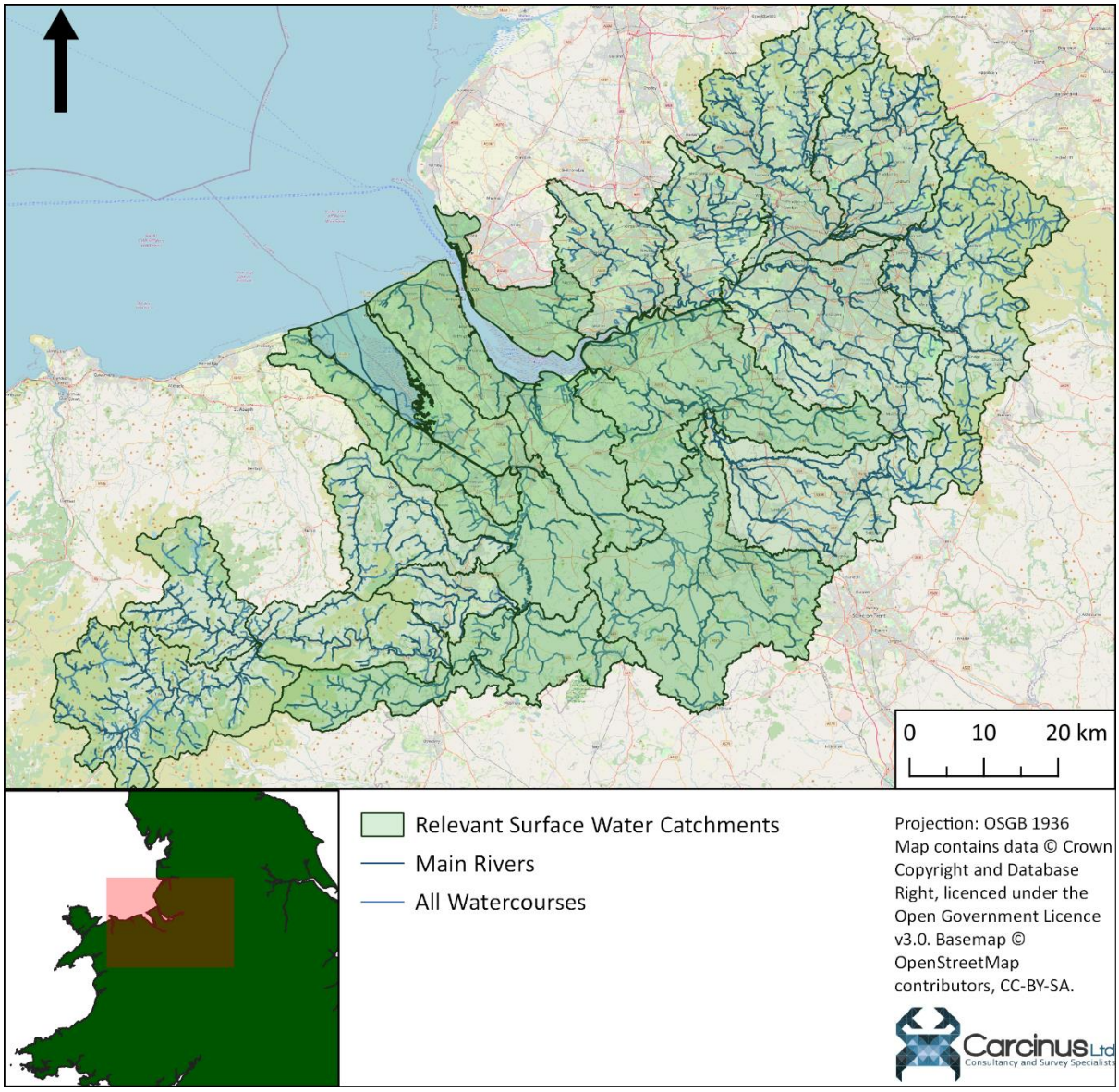

Figure 1.1 Location of Liverpool Bay in the northwest of England.

Sections 2 - 6 detail the changes that have occurred to the shellfishery, environmental conditions and pollution sources within the catchment since the publication of the original sanitary survey. A summary of the changes is presented in section 7 and recommendations for an updated sampling plan are described in section 8.

1.3 Assumptions and limitations

This desktop assessment is subject to certain limitations and has been made based on several assumptions, namely:

- Accuracy of local intelligence provided by the Local Authorities and Environment Agency;
- The findings of this report are based on information and data sources up to and including November 2021;
- Only information that may impact on the microbial contamination was considered for this review; and
- Official Control monitoring data have been taken directly from the Cefas data hub[1], with no additional verification of the data undertaken. Results up to and including November 2021 have been used within this study. Any subsequent samples have not been included.

2 Shellfisheries

2.1 Description of Shellfishery

The boundaries of the Liverpool Bay Bivalve Mollusc Production Area (BMPA) are hard to define, as there are Classification Zones (CZs) to both the east and west that are assigned to different BMPAs, Mersey and Dee respectively. For the purposes of this review, the BMPA is defined as the area off the Wirral peninsula between the northern shore of the Dee estuary and the southern shore of the Mersey estuary. The Mersey is a much more urbanised estuary than the Dee, with Liverpool on its northern side, Birkenhead on its southern side and Warrington at its head (as well as Greater Manchester farther inland).

Harvesting of shellfish off the Wirral peninsula is regulated by the North-West Inshore Fisheries and Conservation Authority (NW-IFCA) and is under the jurisdiction of Mersey Port Health Authority (the Local Enforcement Authority (LEA)) for food hygiene purposes. The main fishery in the area has historically been hand gathering of cockles from the intertidal areas, and the IFCA set out minimum landing sizes, whereby no person can remove cockles that pass through a gauge scare with an internal width of 20 mm on each side (NW-IFCA, 2018). Harvesting methods are also restricted to hand or using hand-held rakes. There is a closed season between 1st May and 31st August inclusive for cockle harvesting. The 2013 Liverpool Bay review describes that the cockle beds were all subject to managed closures under Byelaw 13a, which empowers the IFCA to close a cockle or mussel (*Mytilus edulis*) bed for the purposes of fishery management or controlling the rate of exploitation (NW-IFCA, 2021). During initial consultation, the LEA stated that the beds are subject to a temporary closure under the same byelaw until at least 31st April 2022. The LEA were also unable to provide recent landing statistics as the beds have been closed since the 2019/20 season. They did however state that significant volumes of spat have been identified within mature

[1] Cefas shellfish bacteriological monitoring data hub. Available at: https://www.cefas.co.uk/data-and-publications/shellfish-classification-and-microbiological-monitoring/england-and-wales/.

cockle beds, and it is hoped that a commercial cockle fishery may be viable from September 2022 and so continued classification for cockles is necessary. The 2013 survey recommended retaining two cockle zones in the BMPA, *Leasowe & New Brighton* and *Hoylake*. The *Hoylake* zone was declassified in 2016, and currently the *Leasowe and New Brighton* is the only classified zone for cockles in this BMPA.

The 2013 review was prompted by an application to classify a subtidal clam (including *Spisula solida*, *Tapes* spp., *Lutraria lutraria*, *Ensis* spp. and *Pharus legumen*) bed north of Hoyle Bank. The LEA advised that this application was unsuccessful due to issues in reliably obtaining samples for classification. No other species are currently classified in the Liverpool Bay BMPA; mussels were last classified in 2010.

2.2 Classification History

The original sanitary survey review recommended the creation of four classified zones, two each for clams and cockles. The two clam zones were never awarded formal classification and the *Hoylake* zone was declassified in 2016. There is now only one Classification Zone within the Liverpool BMPA, which holds a 'B' classification. The location of this zone off the Wirral Peninsula is shown in Figure 2.1.

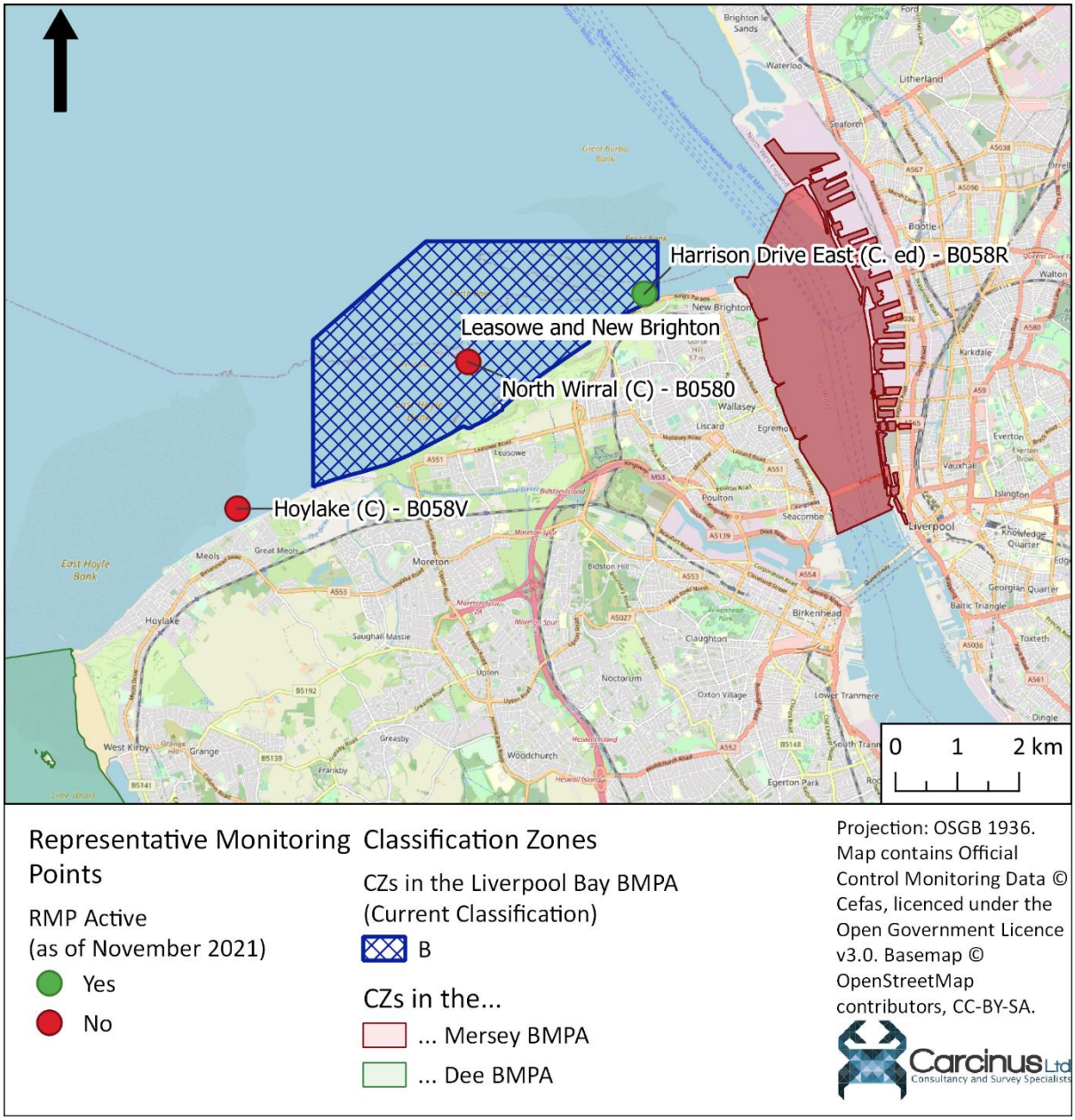

Figure 2.1 Current Classification Zones and associated Representative Monitoring Points in the Liverpool Bay BMPA.

3 Pollution sources

3.1 Human Population

The 2013 Sanitary Survey Review of Liverpool Bay assessed changes in human population by comparing the population sizes as reported in the 2001 and 2011 censuses and found that the population increased by 0.12% in that time. No updated census information was available to the authors of this review, as the results of the March 2021 census had not been published at the time of writing (December 2021). However, the UK government estimates that the national population will have increased by approximately 6.6% between

2011 and 2021 (ons.gov.uk, 2021). An increase of this proportion would see the population reported in the 2013 survey (5,057,604) increase to over 5.3 million people (~8% of the total UK population).

The original sanitary survey identified that the main population centres in the catchment were around Greater Manchester, Liverpool, Chester and Wrexham. Figure 3.1 shows how land cover has changed within the catchment between and 2012 and 2018. It suggests that these population centres have not changed in size significantly, and that most of the urban fabric is in the northern part of the catchment, whilst the southern part is far more rural. Because of this, the sewage discharges to the Mersey will be greater than those to the Dee. Consultation with the LEA did not indicate any major developments on the Wirral that would be likely to significantly impact the bacteriological health of the BMPA. Despite this, it remains likely that the population size in the catchment will have increased to a certain degree, and any increase in population size would almost certainly have led to an increase in bacteriological contamination from utility misconnections or dog fouling. The towns on the coastline of the Wirral, New Brighton, Leasowe and Hoylake are likely to represent the greatest risk to the health of the shellfishery given their proximity. Direct impacts from sewage discharges will depend on the specific nature, volumes and extent of these discharges, changes to which are discussed in the next section.

The 2013 review does not comment on the volume of tourism received, but the 2011 survey provides data indicating that the population of the area increases during summer months with tourists visiting the many cities and coastal attractions throughout the catchment. Recent statistics show that the Wirral's visitor economy increased by 6.9% from 2018 – 2019, with over 9 million visitors (an increase of 28% since 2013) (WirralView.com, 2019). Seasonal increases in population size bring increased loading to the sewerage network, although it is assumed that the existing network has sufficient capacity to handle this increase. However, increases from tourism at certain times of year might impact on seasonality of contamination levels.

Whilst there is no recently available population data for the catchment, it is likely that the population will have increased since the 2013 review was published. However, the distribution of the main population centres in the catchment has not changed, and therefore the recommendations made in that document to account for this source of pollution in choosing RMP locations remains valid.

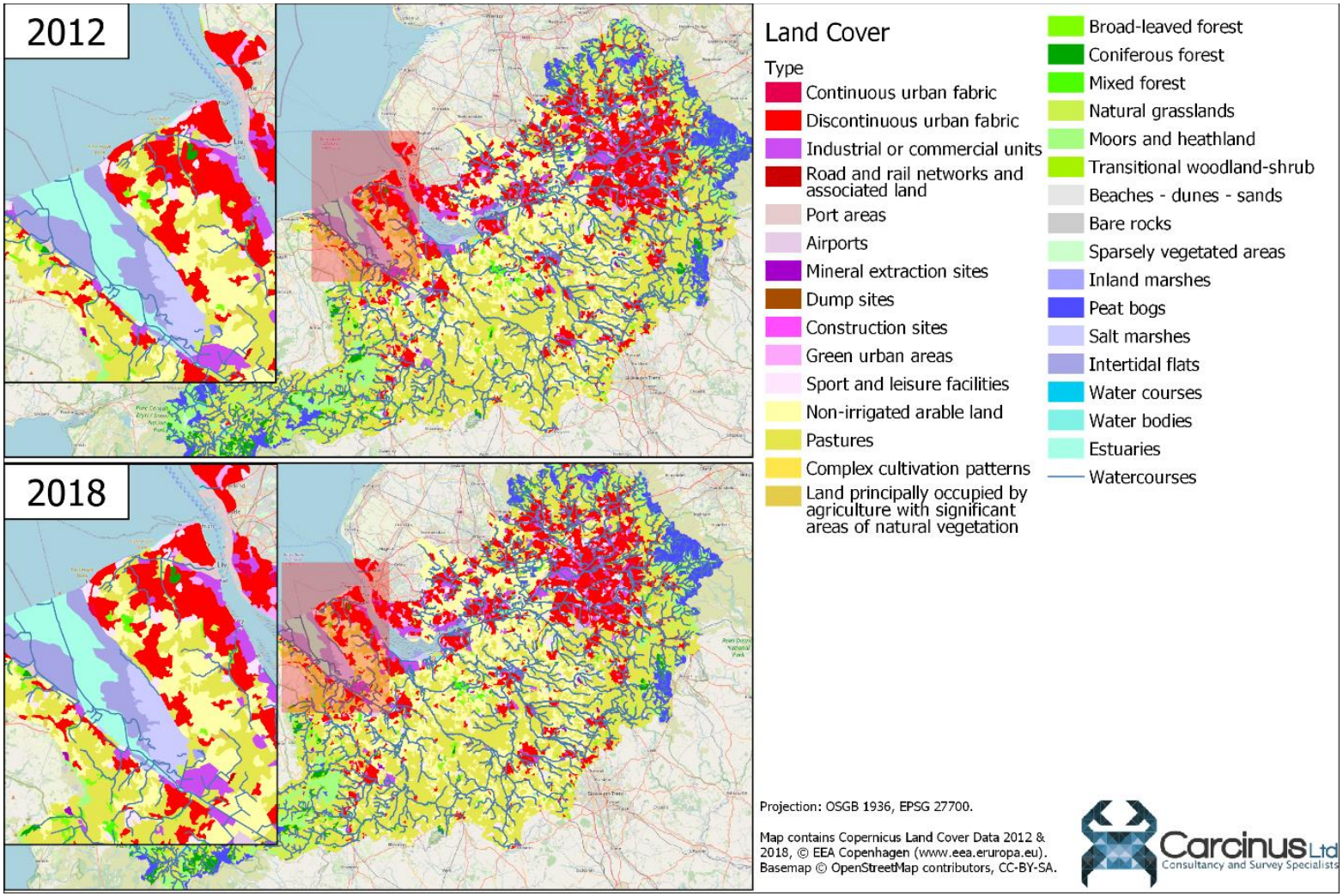

Figure 3.1 Land cover change in the Liverpool Bay catchment between 2012 and 2018.

3.2 Sewage

The catchment of the Liverpool Bay BMPA contains discharges that are owned and operated by United Utilities and Dwr Cymru (Welsh Water). Details of those discharges in England were taken from the most recent update to the Environment Agency (EA's) national permit database at the time of this report (December 2021). Details of those discharges in Wales were taken from the most recent update to Natural Resources Wales (NRW's) consented discharge database at the time of this report (October 2021). Both the 2013 review and 2011 survey have principally considered those discharges of greatest significance to the bacteriological health of the BMPA, which are those nearest to the Mersey and Dee Estuaries, and those on the Wirral Peninsula. The 2013 review also provided details of all consented discharges in the Dee and Mersey catchments with a dry weather flow (DWF) above 2,000 m^3/day (in the case of water company owned discharges) or 50 m^3/day (in the case of privately owned discharges), although these extra discharges are in the upper catchment, and will be of far less significance to the bacteriological health of the BMPA. The locations of all current consented discharges in the Liverpool Bay catchment are shown in Figure 3.2, though this figure also highlights those discharges around the Mersey and Dee Estuaries as well as those on the Wirral, as these will be of greater significance to the bacteriological health of the shellfishery.

A total of 296 continuous discharges were identified in the Liverpool Bay catchment, however the majority are located in the upper reaches of the catchment and so will be of limited influence compared to those in the near vicinity of the Dee and Mersey estuaries, as well as those on the Wirral. Details of these discharges are presented in Table 3.1. The 2013 review identified that the total volume of DWF draining to the Mersey had remained similar relative to 2011, but the volume draining to the Dee had increased, with most of the increase occurring at Flint STW, Connahs Quay STW and Queensferry STW. The consented discharge volume or treatment methodology employed at these discharges has not changed since 2013, and so the risk they pose has remained similar. A 2017 report on behalf of United Utilities (United Utilities, 2017) found that the most significant continuous discharge in terms of bacterial loading to the Mersey was the Sandon Dock Wastewater Treatment Works (WwTW) (ID: 125) and Birkenhead WwTW (ID: 27). During initial consultation, the EA stated that the outfall at Liverpool WwTW was extended in December 2013, to improve dilution and dispersion. In addition, secondary treatment was improved in 2016 which may have further reduced the bacterial load. This change will be incorporated into the decision making process for any updated sampling plan.

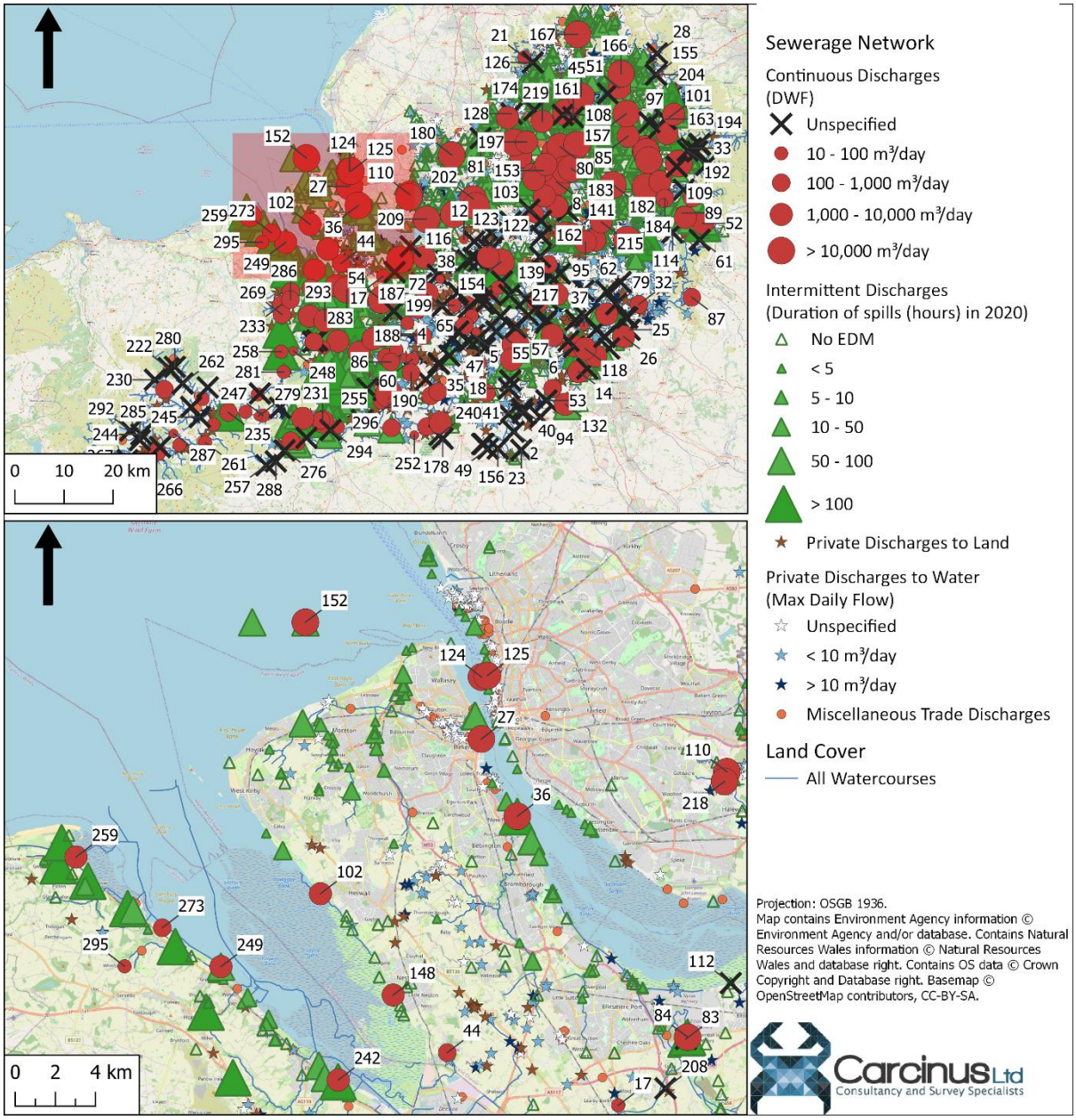

Figure 3.2 Locations of all consented discharges within the Liverpool Bay catchment and those of most relevance to the shellfishery. Labels refer to continuous discharges, details those continuous discharges most relevant to the BMPA can be found in Table 3.1.

Table 3.1 Details of selected continuous discharges within the Liverpool Bay catchment that are of most relevance to the bacteriological health of the BMPA.

ID	Water Company	Sewage Treatment Works	NGR	Treatment	DWF (m^3/day)
17	United Utilities	BACKFORD WASTEWATER	SJ3973871253	BIOLOGICAL FILTRATION	28

ID	Water Company	Sewage Treatment Works	NGR	Treatment	DWF (m^3/day)
		TREATMENT WORKS			
27	United Utilities	BIRKENHEAD WWTW BIRKE	SJ3292089490	BIOLOGICAL FILTRATION	55200
36	United Utilities	BROMBOROUGH WWTW	SJ3471085640	BIOLOGICAL FILTRATION	25100
44	United Utilities	BURTON WASTEWATER TREATMENT WORKS	SJ3122073880	BIOLOGICAL FILTRATION	105
83	United Utilities	ELLESMERE PORT WWTW	SJ4312074560	PRIMARY SETTLEMENT	UNSPECIFIED
84	United Utilities	ELLESMERE PORT WWTW	SJ4320074650	BIOLOGICAL FILTRATION	29500
102	United Utilities	HESWALL SEWAGE TREATMENT WORKS	SJ2490081791	UV DISINFECTION	2562
110	United Utilities	HUYTON WASTEWATER TREATMENT WORKS	SJ4516087860	BIOLOGICAL FILTRATION	15660
112	United Utilities	INCE STW	SJ4535077340	BIOLOGICAL FILTRATION	UNSPECIFIED
124	United Utilities	LIVERPOOL WWTW	SJ3292792578	BIOLOGICAL FILTRATION	234000
125	United Utilities	LIVERPOOL WWTW	SJ3321592641	BIOLOGICAL FILTRATION	234000
148	United Utilities	NESTON WWTW	SJ2852476748	UV DISINFECTION	4074
152	United Utilities	NORTH WIRRAL WWTW	SJ2415095300	UV DISINFECTION	16638
208	United Utilities	WERVIN STW	SJ4210072100	BIOLOGICAL FILTRATION	UNSPECIFIED
209	United Utilities	WESTERN AREA SEWER	SJ4860082850	SCREENING	9829
214	United Utilities	WIDNES WWTW	SJ4859482809	BIOLOGICAL FILTRATION	28000
218	United Utilities	WOOLTON STW	SJ4504187379	BIOLOGICAL FILTRATION	11710

ID	Water Company	Sewage Treatment Works	NGR	Treatment	DWF (m^3/day)
234	Dwr Cymru	CONNAHS QUAY STW	SJ 30240 69380	01: BIOLOGICAL FILTRATION	3898.3
242	Dwr Cymru	FLINT WWTW	SJ 25788 72517	22: UV DISINFECTION	3902.7
249	Dwr Cymru	GREENFIELD WWTW (STW) GREENFIELD	SJ 19940 78160	01: BIOLOGICAL FILTRATION	3891
259	Dwr Cymru	LLANASA WWTW COLLIERY ROAD TANLAN	SJ 12715 83618	22: UV DISINFECTION	8061
273	Dwr Cymru	MOSTYN WWTW	SJ 17017 80096	01: BIOLOGICAL FILTRATION	966
283	Dwr Cymru	QUEENSFERRY WWTW	SJ 32379 68522	22: UV DISINFECTION	11067.9
295	Dwr Cymru	WHITFORD STW	SJ 15140 78180	01: BIOLOGICAL FILTRATION	38

In addition to the continuous discharges, the original sanitary survey identified a total of five intermittent discharges with the potential to impact the BMPA. Intermittent discharges comprise Combined Storm Overflows (CSOs), Storm Tank Overflows (STOs) and Pumping Station Emergency Overflows (PSs). During Action Management Plan (AMP) 6 and AMP7, Event Duration Monitoring (EDM) was installed at several of the discharges within the catchment, and summary data for 2020 was published by the Environment Agency in March 2021 for those discharges in England (Environment Agency, 2021). Data for those discharges in Wales was accessed from the Rivers Trust, who obtained the data from Welsh Water (Rivers Trust, 2022). Details of these data for those discharges in the vicinity of the BMPA are presented in Appendix I (note – only those discharges in the vicinity of the BMPA have been presented because there are more than 1,000 discharges fitted with EDM capacity). The single datapoint for each discharge was joined to the main discharge database using the permit number. Beyond the data manipulation described above, the data have been taken at face value, and some locations in the consented discharge database may be erroneous, meaning that the point appears in the wrong location. Some EDM returns had multiple meters on a single discharge activity, in this case we have presented all reported spill counts as individual values, unless the comment indicated that the meters were not working properly in which case the values were nulled. The EDM returns 'Activity Reference' field did not reliably distinguish between emergency overflows and storm overflows, therefore we have included all of these in the intermittent discharge category.

The 2013 review did not provide any EDM data so comparison is impossible. The 2020 data suggest that the North Wirral WwTW storm overflow is likely to be the most significant in terms of the contamination it discharges, as it only employs primary screening and discharged 194 times for a total of 63 hours in 2020. Consultation with the Environment

Agency did not suggest any upgrades to intermittent discharges in the area would have resulted in a decrease in loading, however the United Utilities report mentioned above did show that several discharges farther up the Mersey have received additional storage capacity, which should have reduced the overall loading. The spill events from intermittent discharges in the immediate vicinity of the catchment remain a potentially significant source of contamination as they frequently spill untreated sewage. Consideration should therefore be given to them in any updated sampling plan.

In addition to the Water Company owned discharges, there are also a large number of private discharges throughout the catchment. However, there are few in the near vicinity of the BMPA and so the impact of these discharges is likely to be much less than the water company owned continuous and intermittent discharges, and so does not require consideration in any updated sampling plan.

No upgrades to the treatment methodologies have taken place at those continuous discharges in the near vicinity of the catchment, and those of greatest significance remain those in and around the River Mersey. The Meols WwTW off the Wirral has the greatest hydraulic connectivity to the BMPA, although the impacts are likely to be less than of those in the Mersey because of the UV Disinfection employed at this discharge. There remain a large number of intermittent discharges, although no comparison of EDM data was possible. Overall, the main hotspots of contamination from this source remain similar, and so the recommendations made in the 2013 review remain valid.

3.3 Agricultural Sources

Figure 3.1 shows that a significant proportion of the catchment is land reserved for pasture. Figure 3.3 and Table 3.2 show the changes in livestock populations wholly or partially contained within the Liverpool Bay catchment from 2013 to 2016 (no more recent data are available) (Defra, 2018). As only a small proportion of some of the districts fall within the catchment, the livestock data have been adjusted to reflect the proportion of each district that is contained within the catchment. This assumes that the livestock are distributed uniformly within each district and therefore some inaccuracies may be present. The percentage change in total livestock for each district is shown in Figure 3.3. Changes in livestock population data for each district, broken down by livestock group, are shown in Table 3.2.

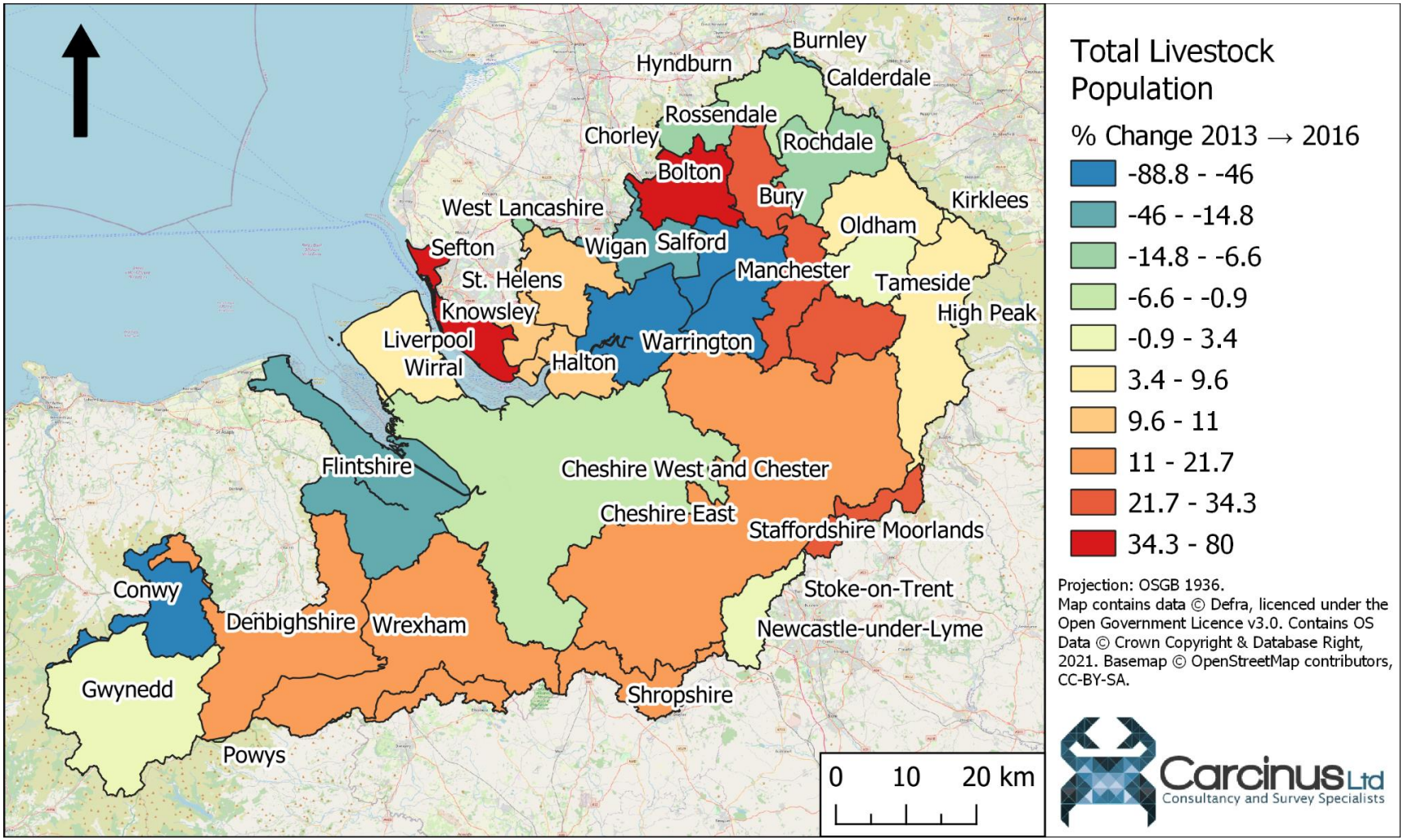

Figure 3.3 Livestock population change in Local Authority Districts (2016 Boundaries) within or partially within the Liverpool Bay catchment.

Table 3.2 Changes in livestock populations for Local Authority Districts wholly or partially contained within the Liverpool Bay BMPA catchment.

					Cattle			Sheep			Pigs			Poultry		
LAD NAME	**Area (Ha)**	**A w/in Ha**	**% Within Catchment**	**% of Catchment**	**2013**	**2016**	**% Change**	**2013**	**2016**	**% Change**	**2013**	**2016**	**% Change**	**2013**	**2016**	**% Change**
Barnsley	32939	281.39	0.90%	0.05%	148	146	-1.50%	316	408	28.98%	164	111	-32.53%	486	521	7.16%
Blackburn with Darwen	13716	5460.24	39.80%	1.01%	1,624	1,591	-2.04%	5,606	6,106	8.92%	95	193	102.40%	2,825	1,225	-56.64%
Bolton	13990	12692.84	90.70%	2.35%	3,154	3,377	7.05%	4,612	5,374	16.52%	1,326	1,149	-13.36%	148,319	225,640	52.13%
Burnley	11078	781.84	7.10%	0.14%	198	197	-0.55%	1,856	1,472	-20.69%	5	0	-100.00%	210	215	2.20%
Bury	9954	9954.15	100.00%	1.84%	3,016	2,797	-7.26%	4,755	6,363	33.82%	113	366	223.26%	258,709	325,933	25.98%
Calderdale	36428	49.51	0.10%	0.01%	10	11	3.30%	64	60	-6.91%	1	3	154.71%	35	15	-57.47%
Cheshire East	116726	116725.3	100.00%	21.57%	132,515	127,725	-3.61%	139,423	142,492	2.20%	11,526	8,081	-29.88%	1,476,497	1,855,696	25.68%
Cheshire West and Chester	91733	91709.74	100.00%	16.95%	99,427	98,984	-0.45%	42,997	42,444	-1.29%	20,721	21,750	4.96%	546,401	508,024	-7.02%
Chorley	20289	22.53	0.10%	0.00%	11	12	6.53%	28	33	20.03%	1	1	1.48%	619	525	-15.20%

					Cattle			Sheep			Pigs			Poultry		
LAD NAME	Area (Ha)	A w/in Ha	% Within Catchment	% of Catchment	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change
Conwy	113081	13914.12	12.30%	2.57%	5,589	6,218	11.26%	954,653	97,180	-89.82%	50	39	-21.43%	12,384	5,419	-56.25%
Denbighshire	83904	37214.63	44.40%	6.88%	22,051	22,342	1.32%	208,055	219,686	5.59%	228	109	-52.05%	65,921	108,918	65.23%
Flintshire	43778	35197.53	80.40%	6.50%	27,424	27,655	0.84%	83,539	86,920	4.05%	1,272	1,155	-9.17%	455,813	197,229	-56.73%
Gwynedd	254913	37283.65	14.60%	6.89%	11,417	12,183	6.70%	171,940	177,845	3.43%	259	300	15.48%	3,238	2,788	-13.90%
Halton*	7917	7886.9	99.60%	1.46%	2,597	2,358	-9.24%	10,547	9,460	-10.30%	1,441	1,062	-26.34%	3,777	7,496	98.44%
High Peak	54066	27349.76	50.60%	5.05%	9,346	9,142	-2.18%	67,106	66,491	-0.92%	4,019	3,812	-5.16%	7,604	11,643	53.11%
Hyndburn	7306	4.08	0.10%	0.00%	3	3	-6.06%	15	15	1.00%	0	2	0.00%	164	265	61.71%
Kirklees	40882	322.89	0.80%	0.06%	183	191	4.20%	278	284	2.19%	60	36	-40.07%	2,553	2,537	-0.62%
Knowsley*	8660	4560.67	52.70%	0.84%	1,374	1,247	-9.24%	5,581	5,006	-10.30%	763	562	-26.34%	1,999	3,966	98.44%
Liverpool**	11190	6736.36	60.20%	1.24%	193	220	13.87%	713	574	-19.47%	1,060	1,501	41.57%	599	2,324	287.65%

					Cattle			Sheep			Pigs			Poultry		
LAD NAME	Area (Ha)	A w/in Ha	% Within Catchment	% of Catchment	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change
Manchester****	11569	11568.74	100.00%	2.14%	2,758	2,746	-0.43%	9,280	11,136	20.01%	473	504	6.53%	7,963	10,920	37.13%
Newcastle-under-Lyme	21113	8337.91	39.50%	1.54%	9,648	9,597	-0.53%	5,821	5,075	-12.82%	3,824	1,231	-67.79%	9,091	12,364	36.01%
Oldham	14246	14209.71	99.70%	2.63%	2,269	2,632	15.99%	14,495	13,170	-9.14%	1,043	1,547	48.29%	3,061	5,451	78.06%
Powys	519837	192.33	0.00%	0.04%	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	0	0.00%
Rochdale	15829	15499.85	97.90%	2.86%	3,668	3,932	7.19%	13,453	14,860	10.46%	1,573	2,500	58.98%	17,806	11,758	-33.97%
Rossendale	13813	13245.32	95.90%	2.45%	3,840	3,992	3.97%	36,794	40,349	9.66%	63	154	143.48%	12,874	6,515	-49.39%
Salford*****	9723	9723.45	100.00%	1.80%	1,732	2,053	18.56%	1,342	1,205	-10.22%	642	677	5.52%	128,546	29,764	-76.85%
Sefton**	15505	1945.21	12.50%	0.36%	40	46	13.87%	148	119	-19.47%	220	312	41.57%	124	482	287.65%
Sheffield	36815	4.22	0.00%	0.00%	0	0	0.00%	0	0	0.00%	0	0	0.00%	0	0	0.00%
Shropshire	319965	16237.74	5.10%	3.00%	12,282	11,994	-2.35%	37,616	37,861	0.65%	2,842	2,149	-24.38%	280,872	318,818	13.51%
St. Helens*	13651	13327.2	97.60%	2.46%	2,545	2,310	-9.24%	10,335	9,270	-10.30%	1,412	1,040	-26.34%	3,701	7,345	98.44%

					Cattle			Sheep			Pigs			Poultry		
LAD NAME	Area (Ha)	A w/in Ha	% Within Catchment	% of Catchment	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change
Staffordshire Moorlands	57628	5774.18	10.00%	1.07%	6,265	6,126	-2.22%	10,187	10,627	4.32%	1,438	1,412	-1.81%	12,598	22,259	76.68%
Stockport***	12615	12614.86	100.00%	2.33%	2,758	2,746	-0.43%	9,280	11,136	20.01%	473	504	6.53%	7,963	10,920	37.13%
Stoke-on-Trent	9349	13.88	0.10%	0.00%	1	1	7.13%	1	1	34.97%	0	1	298.03%	20	22	7.46%
Tameside	10325	10324.78	100.00%	1.91%	2,431	2,152	-11.49%	3,357	3,524	4.98%	0	0	0.00%	440	624	42.01%
Trafford****	10611	10610.61	100.00%	1.96%	1,732	2,053	18.56%	1,342	1,205	-10.22%	642	677	5.52%	128,546	29,764	-76.85%
Warrington	18075	18040.65	99.80%	3.33%	3,248	2,617	-19.44%	2,226	1,295	-41.83%	2,163	1,037	-52.04%	135,746	58,284	-57.06%
West Lancashire	34700	800.67	2.30%	0.15%	168	184	9.51%	289	310	7.14%	171	73	-57.41%	9,597	8,204	-14.52%
Wigan	18831	10789.95	57.30%	1.99%	2,380	2,297	-3.51%	1,062	1,373	29.33%	1,781	2,338	31.30%	20,725	15,385	-25.76%
Wirral	15717	15656.52	99.60%	2.89%	4,349	3,913	-10.01%	992	1,756	76.94%	33	220	571.54%	13,668	13,886	1.60%
Wrexham	50403	48459	96.10%	8.95%	40,388	40,814	1.05%	118,610	120,058	1.22%	390	469	20.20%	425,696	489,709	15.04%

					Cattle			Sheep			Pigs			Poultry		
LAD NAME	Area (Ha)	A w/in Ha	% Within Catchment	% of Catchment	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change	2013	2016	% Change
Total	2054533	541167.5	26.34%	100.00%	422,783	418,602	-0.99%	1,978,713	1,152,543	-41.75%	62,289	57,078	-8.37%	4,207,191	4,312,855	2.51%

Livestock statistics as *Knowsley, St Helens & Halton ** Liverpool and Sefton *** Manchester and Stockport **** Salford & Trafford

The 2013 review stated that livestock populations were not significantly different from those reported in the 2011 sanitary survey, however the data suggest that the total (adjusted) livestock population fell by almost 11% between 2013 and 2016. Much of this fall was driven by sheep populations, which were the second most numerous (after poultry) but fell by more than 41% over the time period considered. The district with the largest (adjusted) livestock population is Cheshire East, although 87% of the livestock in this district are poultry.

As is reported in the original sanitary surveys, the districts with the highest densities of livestock population ultimately drain into the Dee estuary. The Mersey catchment is much more urban and livestock densities are lower. The principal route of contamination of coastal waters by livestock is surface runoff carrying faecal matter. Based on 2018 land cover data (Figure 3.3), there is a small area of pasture lying immediately adjacent to the Wirral peninsula headland, as well as a few more areas along the shoreline of the Dee, on both the English and Welsh coasts. These areas represent the most significant risk to the bacteriological health of the BMPA.

Livestock density in the area remains relatively low, at 8 animals per hectare. However, within this overall statistic are several districts with densities of over 20 animals per hectare. There may be some impact of faecal runoff, but as the geographical extent of pasture areas has not changed significantly, the recommendations made in the original surveys to account for this source of contamination remain valid.

3.4 Wildlife

Liverpool Bay, including the Dee and Mersey estuaries, contain a variety of habitats and support a large range of wildlife. Consequently, they have been awarded various statutory and non-statutory designations, including as a Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar Site, Site of Special Scientific Interest (SSSI) and National Nature Reserve.

These designations are due, in part, to internationally significant populations of overwintering waterbirds that utilise the extensive saltmarsh and mudflat in the region. The 2013 review cites the results of the 2010/11 Wetland Bird Survey (WeBS) and reported an increase of approximately 10,000 waterbirds on the year previous. The average count of waterbirds in the Dee and Mersey estuaries in the five years to 2012/2013 was 117,115 (Holt *et al.*, 2012). In the five years to 2019/2020 (the most recent for which data are available), the average count of waterbirds was 284,518 (an increase of >140%) (Frost *et al.*, 2021) Within this population are internationally significant populations of Shelduck, Dunlin, Redshank and other species, as well as nationally significant populations of many more. As concluded in both the 2011 Sanitary Survey and 2013 review of the same, birds are likely to be a significant source of pollution, particularly in winter months when the migratory species are present. Contamination from these animals in the form of faecal deposition will

directly affect shellfish beds, although as its spatial and precise temporal distribution is very hard to quantify, it remains impossible to reliably account for it in the positioning of RMPs.

Both previous sanitary surveys stated that there is a small but active population of grey seals that haul out off the Wirral. Seals are known to still haul out here, but the current size of the population is unknown. Around the UK, seal populations are increasing (SMRU, 2021) and so it is probable that the same is true here, although the wide foraging ranges of this species mean that it most likely does not represent a significant source of contamination of the shellfish beds, and so does not require additional consideration within any updated sampling plan.

No other wildlife species of significance are noted, and it remains impossible to account for the contamination that faeces from these species may cause due to the unpredictable nature of the contamination.

3.5 Boats and Marinas

The discharge of sewage from boats is a potentially significant source of bacteriological contamination of the shellfish beds in the Liverpool Bay BMPA. Boating activities in the area have been derived through analysis of satellite imagery and other internet sources. Their geographic positions are presented in Figure 3.4.

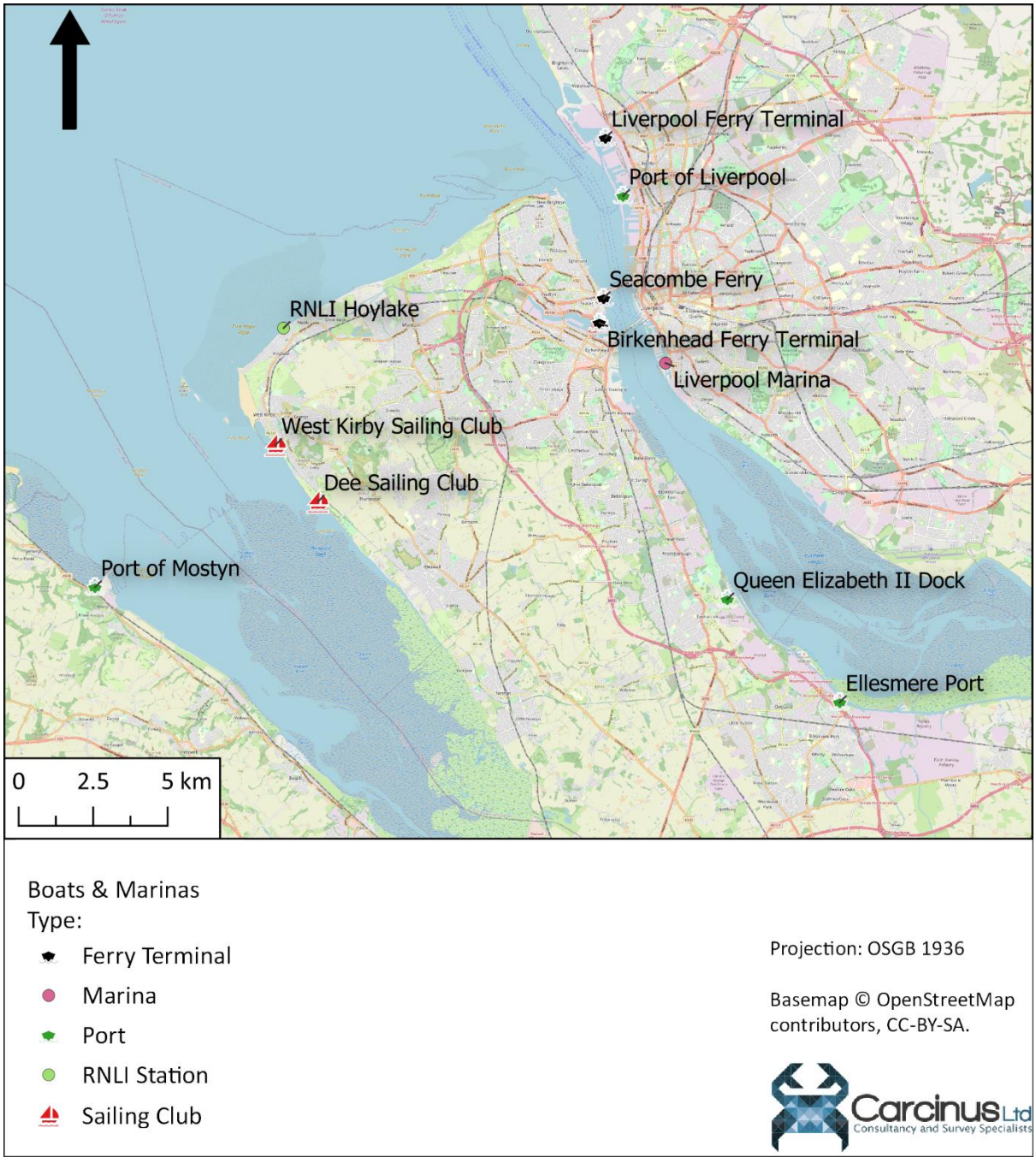

Figure 3.4 Locations of moorings, marinas and other boating activities within the Liverpool Bay area.

The 2013 review does not comment on any boating activities within the area. However, the 2011 sanitary survey notes that there are several commercial ports and ferry terminals, including the Port of Liverpool, Port of Mostyn, Ellesmere Port and the 12 Quays Ferry Terminal. All are still in use, and the LEA indicated during secondary consultation that the Port of Liverpool has recently commissioned the opening of an additional berth for large, containerised freight. However, although the regulations governing the overboard

discharges from commercial vessels[2] have not changed since the original sanitary survey was published and so the risk of contamination is considered to have remained similar.

In addition to the commercial shipping traffic, there are several marinas and sailing clubs distributed throughout the survey area. The closest pump-out facilities to the area are at Conwy Marina (approximately 50 km away), and so vessels of a sufficient size to contain onboard toilets are liable to make overboard discharges from time to time. This is most likely to occur when transiting through the main navigational channels or when moored overnight outside of marinas, as it is generally considered antisocial to discharge waste in a marina setting. Peak pleasure craft activity (and therefore the greatest risk of pollution from this source) will occur during the summer months.

There is no evidence that the level of recreational boat use in the area has increased, although occasional overboard discharges from sufficiently large pleasure craft remains possible. The 2011 sanitary survey concluded that boats and shipping had no material influence on the sampling plan, and the same is true for this review.

3.6 Other Sources of Contamination

As is discussed in Section 3.1, the area of urban fabric that is most likely to contribute diffuse microbiological contamination of the shellfisheries through utility misconnections and dog fouling are the towns of New Brighton, Leasowe and Hoylake at the edge of the Wirral Peninsula. Consultation with the LEA did not indicate any significant development in this area, and so the impacts of misconnections are not likely to have increased significantly since the original sanitary surveys.

The 2013 sanitary survey identified that dog walking was popular on the North Wirral shore, and the shoreline survey conducted as part of this assessment in 2013 revealed large amounts of dog faeces. None of the beaches on the coastline have dog bans in force at any time of year (TheBeachGuide.co.uk, 2021), and as a result there lies the potential for some contamination from dog fouling. However, the extent of this pollution source is not assessed to have increased significantly since the original sanitary survey and does not require additional consideration in any updated sampling plan.

4 Hydrodynamics/Water Circulation

The 2013 sanitary survey review notes that the hydrography in the area is largely driven by tidal circulation interacting with shallow subtidal sandbanks and dredged channels. As a result of this, it considers that slight changes to the bathymetry and tidal patterns are common. The report also notes that an application for an expansion of the Burbo Bank windfarm was in process. This expansion has since been completed and has been

[2] The Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008.

operational since 2017 (Ørsted, 2019), and will have resulted in localised changes to wave patterns, though the residual impact on the shellfish beds is likely to be minimal.

Tidal circulation will bring clean sea water across Liverpool Bay and into the Dee and Mersey estuaries on the flooding tide. The reverse will occur on the ebb, and it is likely that the eastern side of the north Wirral shore will receive greater contamination due to the increased level pollution affecting the Mersey estuary relative to that of the Dee.

5 Rainfall

Rainfall data for the Moreton TEL rainfall monitoring station (NGR: SJ260908) were requested from the Environment Agency for the period 2010 – present. These data were then subdivided into 2006 – 2013 (pre sanitary survey) and 2014 – 2021 (post sanitary survey) and processed in R (R Core Team, 2021). These data were used to determine whether any changes in rainfall patterns had occurred since the original sanitary survey was undertaken. Figure 5.1 shows the average daily rainfall totals per month at the Moreton TEL monitoring station. The monitoring results are summarised in Figure 5.1.

Table 5.1 Summary statistics for rainfall for the period preceding and following the original sanitary survey, taken from the Moreton TEL monitoring station.

Period	Mean Annual Rainfall (mm)	Percentage Dry Days	Percentage Days Exceeding 10 mm	Percentage Days Exceeding 20 mm
2006 - 2013	700.82	46.4	27.5	17.1
2014 - 2021	743.93	47.31	28.81	17.98

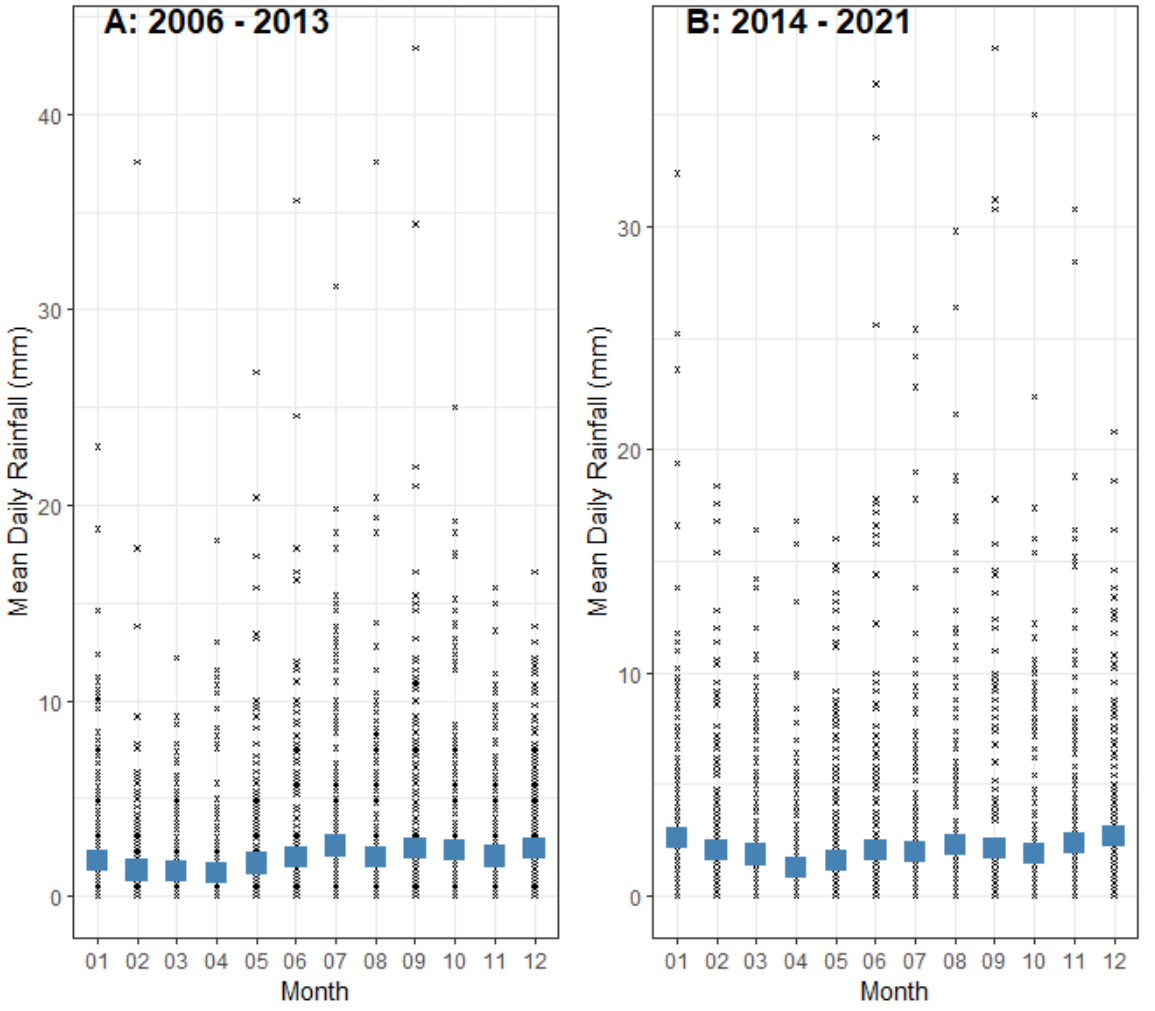

Figure 5.1 Mean daily rainfall per month for the Moreton TEL monitoring station (NGR: SJ260908) for the periods (A) 2006 – 2013 and (B) 2014 – 2021.

Annual rainfall was found to have increased in the period following the 2013 review compared to that of the period preceding it, as have the percentage of days with heavy rainfall (days with more than 10 mm of rain). However, two-sample t-tests indicated that there was no significant difference in the mean daily rainfall per month between the 2010 – 2013 and 2014 – 2021 periods (p=0.232).

Rainfall leads to increased faecal loading through two factors: elevated levels of surface runoff and spill events from intermittent discharges. However, as the rainfall patterns have remained (statistically) similar across the two time periods, significantly altered bacterial loading due to these factors is unlikely and as such RMP recommendations made in the original sanitary survey to capture the influence of runoff and spill events remain valid.

6 Microbial Monitoring Results

6.1 Summary Statistics and geographical variation

A total of three RMPs have been sampled within the Liverpool Bay estuary since the original sanitary survey (and subsequent review) was published, all of which involve the sampling of cockles. Of these, only one (North Wirral, B058O) was sampled prior, although it should be noted that this RMP has been subject to intermittent sampling over the time period considered here, with no sampling between June 2010 and October 2016 (4 samples were collected in this month), and then nothing until April 2017. The most recent sample from this RMP was collected in June 2017. Additional discussions with a sampling officer from Mersey PHA (*pers. comm.*, February 2022) revealed that this RMP was initially sampled, but was replaced by the Harrison Drive East (B058R) RMP as this point returned elevated samples. Initial samples were then collected in 2016 when it was thought that stock had returned, but the B058R RMP was retained moving forward. The 2011 sanitary survey recommended the creation of a Hoylake (B058T) RMP in 2011 at SJ 2205 9056. However, the only RMP in the vicinity is listed on the Cefas datahub[1] as Hoylake (B058V) at SJ 2295 9078. It was initially thought that sufficient volumes existed in the area around the B058T point, but this was found during subsequent investigations not to be the case, and the most representative location with sufficient stock for sampling was around the B058V point. It is assumed that the Hoylake (B058V) point was used to classify the *Hoylake cockles* zone until its declassification in 2016. The only RMP currently sampled is the Harrison Drive East (B058R) RMP, which was recommended in the 2011 sanitary survey. Figure 6.1 shows the geometric mean results of Official Control Monitoring at these RMPs, and summary statistics are presented in Table 6.1. All data have been taken directly from the Cefas datahub[1] and have been taken at face value. The datahub only presents the data of RMPs where a sample has been collected in the last five years so it is possible that monitoring data for other positions exists, but is not considered within this report.

There is a clear geographical trend in the three RMPs for which monitoring data exists. The two RMPs nearest the mouths of the estuaries have returned the highest mean monitoring results, with the RMP nearest the Mersey returning the highest of all three. More than 70% of the results from this point (Harrison Drive East, B058R) have been above 230 MPN/100 g (the threshold required for Class A) and nearly 10% of results have exceeded 4,600 MPN/100 g (the threshold required for Class B). None of the RMPs ever returned a result of more than 46,000 MPN/100 g (the Class C threshold) and two of the RMPs have a mean result of <1,000 MPN/100 g.

Figure 6.2 presents boxplots of *E. coli* monitoring results from the three cockle RMPs sampled within the Liverpool Bay BMPA. One-way analyses of variance (ANOVA) tests were used to investigate the statistical significance of any differences between monitoring results from RMPs. All statistical analysis described in this section was undertaken in R (R Core Team, 2021). Significance has been taken at the 0.05 level.

Despite some visual differences in the three boxplots, and a marked difference in the geometric mean result, ANOVA testing indicated no significant difference between the monitoring results from the three RMPs ($p > 0.05$).

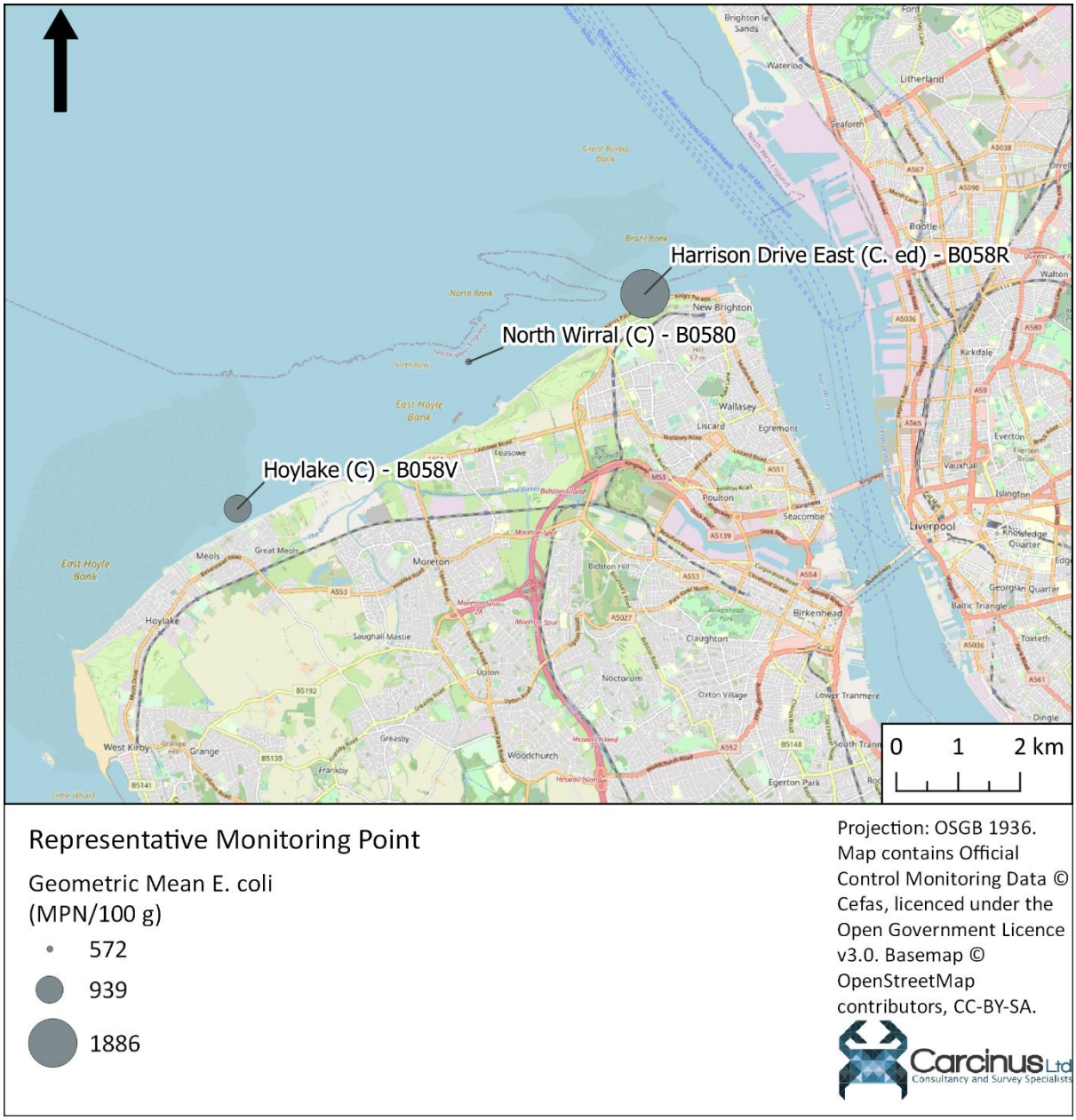

Figure 6.1 Geometric mean E. coli monitoring results from Official Control Monitoring at bivalve RMPs within the Liverpool Bay BMPA.

Table 6.1 Summary statistics of E. coli (MPN/100 g) from RMPs sampled in the Liverpool Bay. Data cut off at November 2021.

RMP (Species)	NGR	Species	No.	First Sample	Last Sample	Geometric Mean	Min Value	Max Value	% > 230	% > 4,600	% > 46,000
North Wirral (C) - B058O	SJ26689315	Cockle	8	22/02/2010	13/06/2017	571.75	20	3300	37.50	0.00	0.00
Harrison Drive East (C. ed) - B058R	SJ29539425	Cockle	86	23/02/2011	09/11/2021	1885.70	20	35000	72.09	9.30	0.00
Hoylake (C) - B058V	SJ22959078	Cockle	21	16/01/2012	16/03/2016	939.05	40	9200	71.43	4.76	0.00

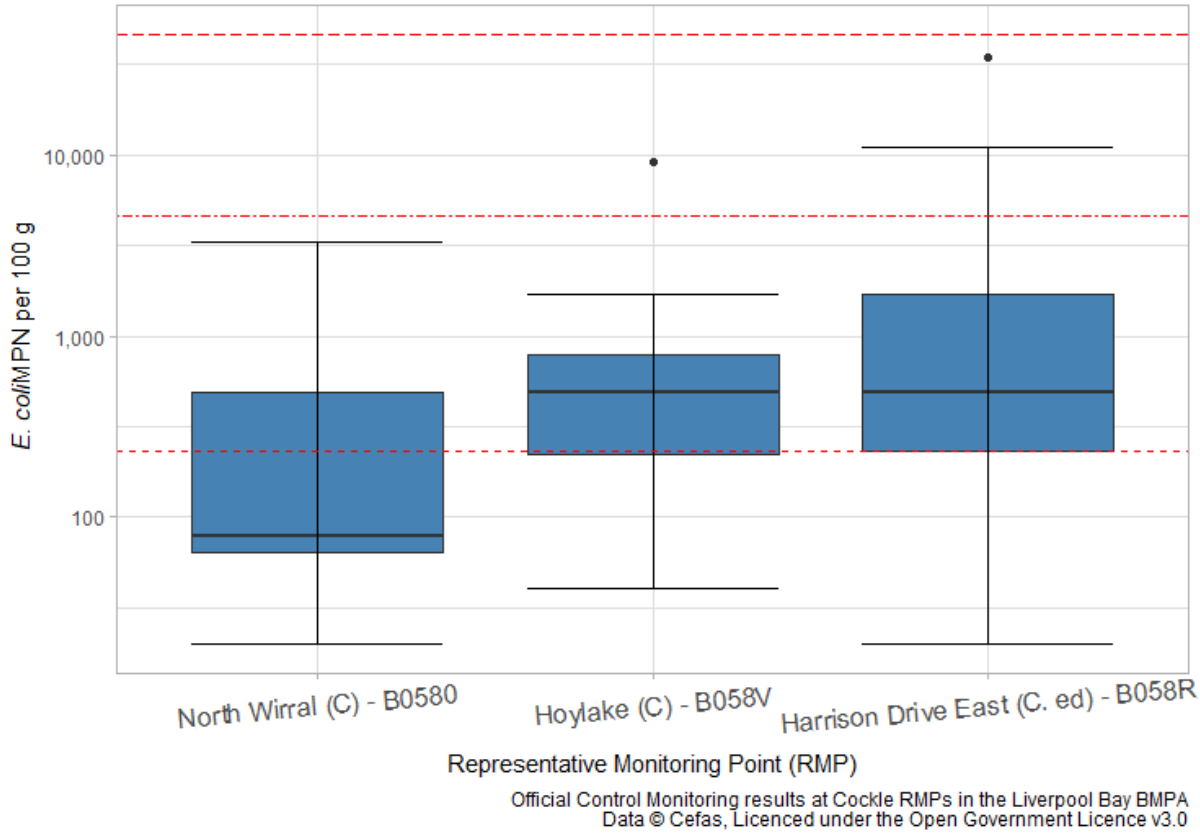

Figure 6.2 Boxplots of E. coli levels at cockle RMPs sampled within the Liverpool Bay BMPA. Central line indicates the median value, box indicates the lower-upper quartile range and whisker indicates minimum/maximum values excluding outliers (points >1.5x the interquartile range). Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

6.2 Overall temporal pattern in results

The overall temporal pattern in shellfish flesh monitoring results from the three RMPs sampled within the Liverpool Bay BMPA are shown in Figure 6.3.

The loess model fitted to the results from Hoylake (B058V) indicate that generally water quality was improving over the period that this RMP was sampled, although the loess model was still above the lowest threshold of 230 MPN/100 g. No trend is visible in the data collected at North Wirral (B058O) because of the lack of consistency in sampling at this point. The loess model fitted to the data from Harrison Drive East (B058R) indicates an improvement in water quality between 2011 and late 2014, followed by a decline until 2020, at which point the loess model has stabilised and indicates consistently average results (midway between the lower and middle thresholds of 230 and 4,600 MPN/100 g respectively, on a log scale).

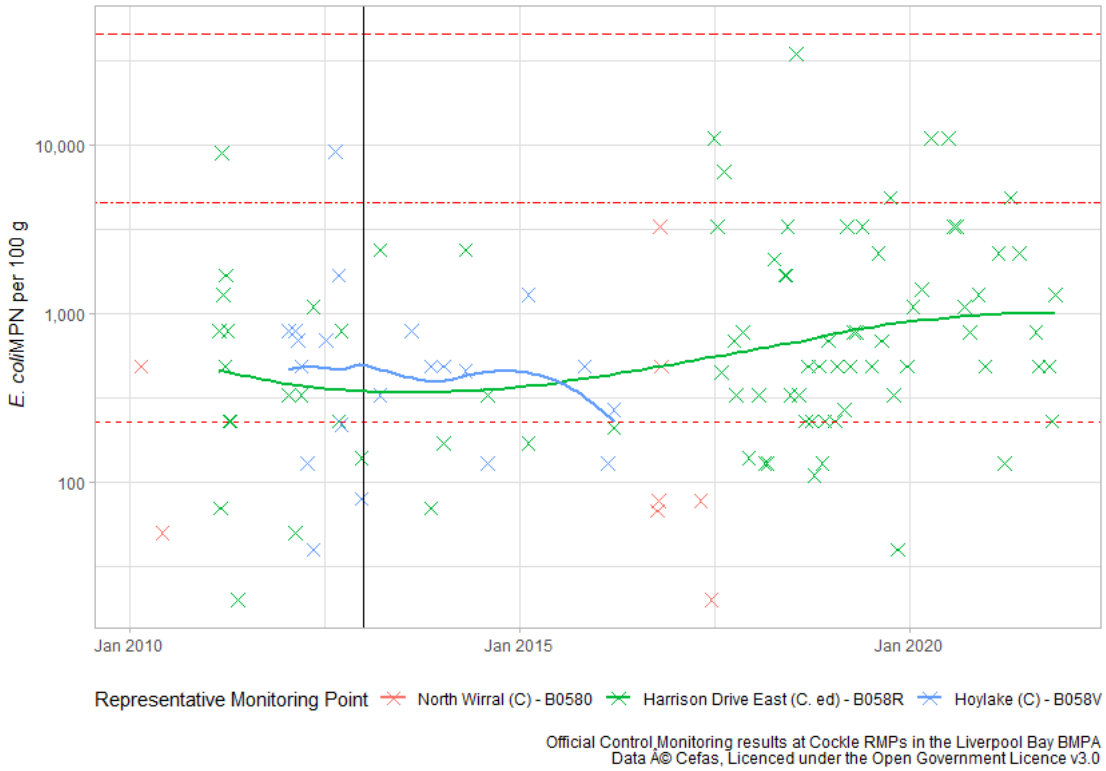

Figure 6.3 Timeseries of E. coli levels at cockle RMPs sampled in the Liverpool Bay BMPA. Scatter plots are overlaid with a loess model fitted to the data. Note – no loess model was fitted to the North Wirral (B058O) data as the irregularity of sampling at this point renders the loess model useless. Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

6.3 Seasonal patterns of results

The seasonal pattern in *E. coli* levels at the various RMPs sampled within the Liverpool Bay BMPA were investigated and are presented in Figure 6.4. The data for each year were averaged into the four seasons, with Winter comprising data from January – March, Spring from April – June, Summer from July – September and Autumn from October – December. Two-way ANOVA testing was used to look for significant differences in the data, using both season and RMP as independent factors (i.e., pooling the database across RMP and season respectively), as well as the interaction between them (i.e., exploring seasonal differences within a given RMP). Significance was taken at the 0.05 level.

There is insufficient data to facilitate a reliable seasonal comparison with the data from North Wirral (B058O), and two-way ANOVA tests revealed that there were no significant differences in the monitoring results for any species, either when the data was pooled across RMP or when the data for a single RMP was considered ($p > 0.05$).

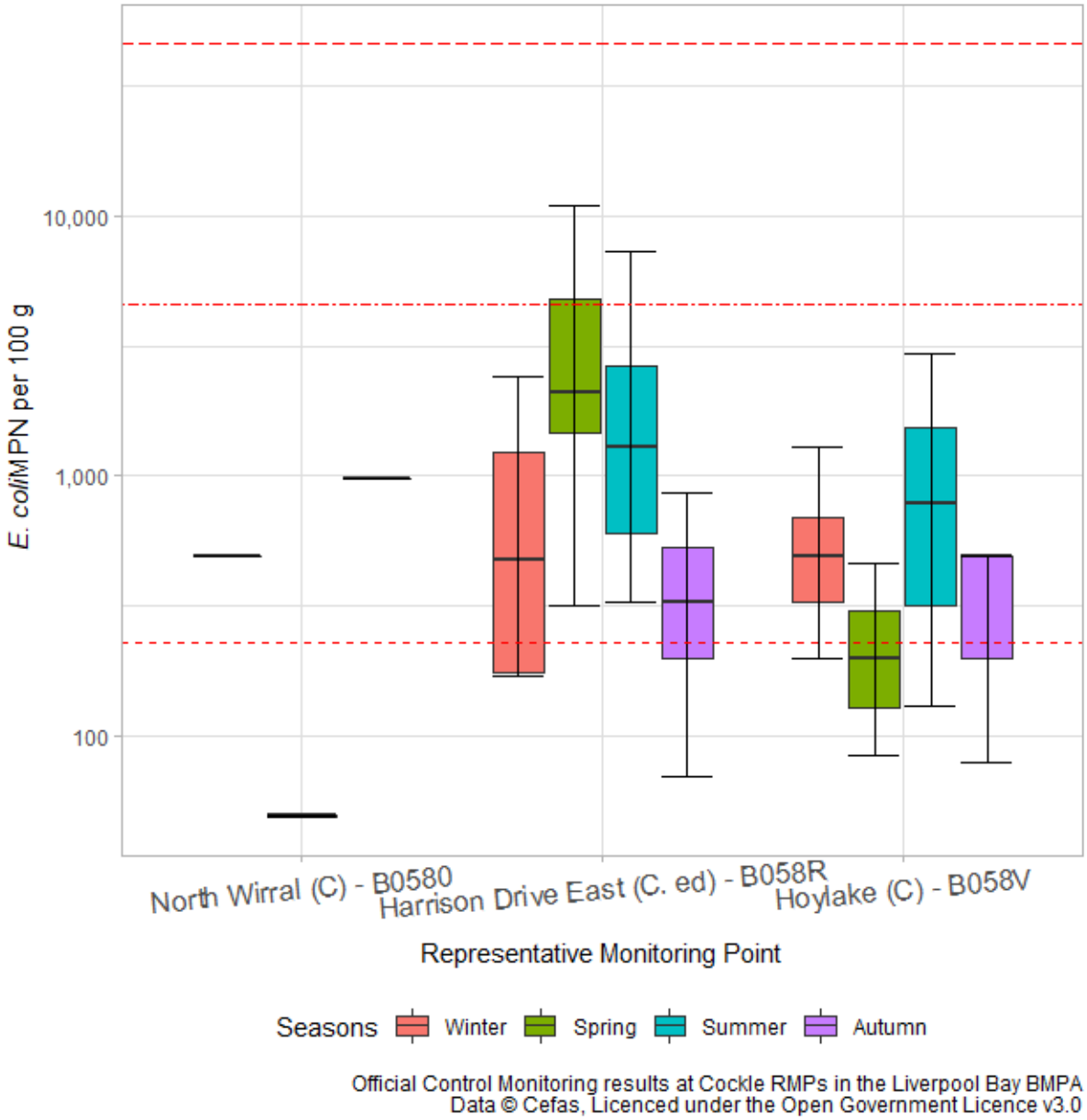

Figure 6.4 Boxplots of E. coli levels per season at cockle RMPs sampled in the Liverpool Bay BMPA. Horizontal red lines indicate classification thresholds of 230, 4,600 and 46,000 MPN/100 g.

7 Conclusion and overall assessment

Liverpool Bay is an embayment in the northwest of England, close to the border with Wales and is fed by two major watercourses, the Rivers Dee and Mersey, both of which contain their own Classification Zones. Contamination sources affecting the shellfisheries within Liverpool Bay have been subject to two separate assessments within recent years, a Sanitary Survey conducted in 2011 and a subsequent review in 2013. There is currently only one CZ in the BMPA, *Leasowe & New Brighton* classified for cockles, another cockle CZ was

declassified in 2016, and previous applications to classify clam CZs have been unsuccessful. Furthermore, during initial consultations, the LEA notified the authors that at present the cockle fishery is closed until at least April 2022 under an NW-IFCA byelaw to promote the recovery of the cockle beds. We understand that significant spatfall has been identified and it is hoped that the cockle fishery could reopen from September 2022. As such, continued classification is required.

No updated human population data was available to the authors of this review beyond that cited in the 2013 review, as the results of the March 2021 census have not yet been published. The UK government estimate that the national population will have increased by 6.6% over the time period, which would see the estimated population within the catchment increase to over 5.3 million people (~8% of the total UK population). Land cover maps indicate that the geographic extent of the main settlements have not changed significantly between 2012 and 2018, but any increase in population size would see an associated increase in loading to the wastewater treatment network. Furthermore, recent tourism statistics indicate that the volume of tourism that the Wirral receives has increased significantly, with 28% more visitors than in 2013. The peak rise in human population is likely to occur during summer months, although it is assumed that the current sewerage network has sufficient capacity to handle this increase.

The 2013 review identified that the total loading (dry weather flow) to the Mersey had remained similar, but that the loading to the Dee had increased compared to 2011. Based on consented discharge information for 2021, loading will have remained similar, as no significant upgrades to treatment methodologies have occurred. There remain several intermittent discharges of concern due to their proximity to the BMPA, although overall the hotspots of contamination from this source remain similar. As such the recommendations made in the 2013 review to account for this source of pollution remain valid.

Land cover maps indicate that the southern part of the catchment is far more rural than the northern part and contains a significant proportion of land reserved for pasture. Livestock data from 2013 and 2016 (no more recently collected data are available) show that in that period, the total livestock population within the catchment fell by more than 11%. The principal route of contamination of shellfisheries by livestock is runoff carrying faecal matter into coastal waters. The land cover maps presented in Figure 3.1 show that most of the pasture is located in the upper reaches of the catchment, with only small areas immediately adjacent to the shellfisheries. As a result of this, contamination from agricultural sources is likely to be relatively minimal in comparison to contamination from other sources.

Liverpool Bay contains extensive areas of intertidal mudflat and saltmarsh that are known to support significant populations of overwintering waterbirds. The average count of overwintering and waterbird species using the Dee and Mersey estuaries in the five years to 2019/2020 (the most recent for which data are available) increased by more than 140% on the five years to 2012/2013. Within this population are internationally and nationally

significant populations of many species. These animals are likely to represent a potentially significant source of contamination, particularly during winter months when the migratory species are present. However, it is impossible to reliably account for this source of pollution in any updated sampling plan due to the spatial and temporal variability in their distributions. There also remains a small but significant population of seals that haul out off the north Wirral coast. These animals show wide foraging ranges and so whilst they may contribute some diffuse contamination, they do not require additional consideration within any updated sampling plan.

There are two main commercial ports within the survey area, in the form of the Port of Liverpool and the Port of Mostyn. Commercial vessels are prohibited from making overboard discharges within three nautical miles of land and so do not have any bearing on the sampling plan as they should not contribute any contamination. There are no pump-out facilities in the vicinity of the BMPA, and so pleasure craft of a sufficient size may make overboard discharges from time to time, particularly when transiting through the main navigational channels. However, these channels are all located some distance from the shellfish beds and so bear limited consequence for the bacteriological health of the shellfishery.

A total of three RMPs have been sampled in the BMPA since the original sanitary survey was published. The RMP nearest the mouth of the Mersey, Harrison Drive East (B058R) has returned the highest mean result, most likely due to the increased faecal loading within the Mersey, although no significant differences between the data from the three RMPs was found. There was also no seasonal pattern in the shellfish monitoring results.

Based on the information available, there do not appear to have been any significant changes to the main sources of contamination to this BMPA since the original sanitary survey was published. The authors of this review have not identified any knowledge gaps that would justify a full shoreline survey.

Having reviewed and compared the desk based study with the findings of the previous sanitary survey review in 2013, the FSA are also content that an updated shoreline assessment is not required.

8 Recommendations

Despite the fact that the fishery is currently closed, and has been closed for several years due to a lack of sufficient stock for commercial operation, we understand that significant spatfall has occurred and it is hoped that the fishery will be reopened in the coming months and so continued classification is required. Recommendations for an updated sampling plan are given below and summarised in Table 8.1.

New Brighton and Leasowe Cockles

This zone was recommended in the 2011 sanitary survey, to cover the eastern part of the North Wirral foreshore. It currently covers an area of 13.3 km², extending from the New Brighton Breakwater westwards till the breakwater and Parkfields. The original sanitary survey recommended placing the RMP for this zone at the closest point to the eastern boundary, so as to capture contamination originating from the Mersey. The 2013 sanitary survey noted that the RMP sampling position had been moved slightly closer to shore (SJ 2953, 9425) and recommended retaining the RMP. On balance, the current position will still be representative of the main contamination sources affecting this zone and should be retained. As the harvesting season is consistently restricted, a revised sampling frequency to take into account of the seasonality of harvesting can be agreed. The minimum number of samples still apply.

8.1 General Information

8.1.1 Location Reference

Production Area	Liverpool Bay
Cefas Main Site Reference	M058
Ordnance survey 1:25,000	OS Explorer 266
Admiralty Chart	Admiralty 1978

8.1.2 Shellfishery

Species	Culture Method	Seasonality of Harvest
Cockles (*Cerastoderma edule*)	Wild	Closed season 1st May 31st August

8.1.3 Local Enforcement Authority(s)

Name	Mersey Port Health Authority Victoria House Derby Road Liverpool L20 1AB
Website	https://www.mersey-pha.gov.uk/port-health-controls/shellfish/
Telephone number	0151 233 2583/4
E-mail address	porthealth@liverpool.gov.uk

*Table 8.1 Proposed sampling plan for the Liverpool Bay BMPA. Suggested changes are given in **bold red** type.*

Classification Zone	RMP	RMP Name	NGR (OSGB 1936)	Lat / Lon (WGS 1984)	Species Represented	Harvesting Technique	Sampling Method	Sampling Species	Tolerance	Frequency
Leasowe & New Brighton (cockles)	B058R	Harrison Drive East	SJ 2953 9425	53° 26.42'N, 03° 03.74'W	*C. edule*	Hand (rake)	Hand (rake)	Cockles	100 m	**Monthly**

9 References

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Appendices

Appendix I. Event Duration Monitoring Data Summary for 2020

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	BIRKENHEAD WWTW BIRKE	RIVER MERSEY ESTUARY/R.BIRKET	SJ3277089490	SCREENING	6.835	241	100.00%
UNITED UTILITIES	BIRKENHEAD WWTW BIRKE	RIVER MERSEY ESTUARY/R.BIRKET	SJ3282089400	SCREENING	6.835	241	100.00%
UNITED UTILITIES	BIRKENHEAD WWTW BIRKE	RIVER MERSEY ESTUARY/R.BIRKET	SJ3292089490	SCREENING	6.835	241	100.00%
UNITED UTILITIES	LIVERPOOL WWTW	RIVER MERSEY ESTUARY	SJ3292792578	SCREENING	17.809	148	100.00%
UNITED UTILITIES	LIVERPOOL WWTW	RIVER MERSEY ESTUARY	SJ3321592641	SCREENING	17.809	148	100.00%
UNITED UTILITIES	WIDNES WWTW	RIVER MERSEY ESTUARY	SJ4859482809	PRIMARY SETTLEMENT	38.447	364	100.00%
UNITED UTILITIES	NORTH WIRRAL WWTW	LIVERPOOL BAY & RIVER BIRKET	SJ2150095300	SCREENING	62.992	194	99.91%
UNITED UTILITIES	NORTH WIRRAL WWTW	LIVERPOOL BAY & RIVER BIRKET	SJ2401090280	SCREENING	62.992	194	99.91%
UNITED UTILITIES	NORTH WIRRAL WWTW	LIVERPOOL BAY & RIVER BIRKET	SJ2415095300	SCREENING	62.992	194	99.91%
UNITED UTILITIES	BROMBOROUGH WWTW	RIVER MERSEY ESTUARY	SJ3471085640	SCREENING	131.355	208	99.63%
UNITED UTILITIES	3 PARK ROAD CSO	MANCHESTER SHIP CANAL	SJ3718080580	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	389 HOYLAKE ROAD CSO	ARROWE BROOK	SJ2549089490	NONE	7.84	48	98.60%
UNITED UTILITIES	5 DEE COTTAGES CSO	DEE ESTUARY	SJ2760178628	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	97 WOOD LANE CSO	ARROWE BROOK	SJ2556088180	NONE	UNSPECIFIED	UNSPECIFIED	

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	ACTON LANE COMBINED SEWER OVERFLOW	ARROWE BROOK	SJ2552089270	NONE	0.126	5	99.99%
UNITED UTILITIES	ALBERT DOCK PS	RIVER MERSEY ESTUARY	SJ3411089530	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	ARROWEBROOK LANE CSO	ARROWE BROOK TRIB RIVER BIRKET	SJ2645086910	SCREENING	11.171	94	68.68%
UNITED UTILITIES	BAILEYS LANE PS	MERSEY ESTUARY	SJ4448081410	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	BANKHALL CSO 99007 LIV0038	RIVER MERSEY	SJ3318093470	NONE	0.075	10	100.00%
UNITED UTILITIES	BANKHALL RELIEF CSO 99005	RIVER MERSEY ESTUARINE WATERS	SJ3308093950	NONE	2.666	56	100.00%
UNITED UTILITIES	BARNSTON STORM TANK 51070	PRENTON BROOK	SJ2855984282	NONE	2.4	23	100.00%
UNITED UTILITIES	BATTERY LANE CSO	MERSEY ESTUARY	SJ3328091950	NONE	0.045	7	100.00%
UNITED UTILITIES	BEBINGTON SEWAGE PUMPING STATION	TRIB OF PRENTON BROOK	SJ3051085320	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	BEECHWOOD AVENUE CSO	BIDSTON STREAM	SJ2905092100	NONE	0.011	3	99.84%
UNITED UTILITIES	BIDSTON BY-PASS CSO	THE RIVER BIRKETT	SJ2845090890	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	BIDSTON MOSS PS	THE BIRKET (TRIB RIVER MERSEY)	SJ2886091459	NONE	0.063	46	100.00%
UNITED UTILITIES	BLACK HORSE HILL CSO 511EV	NEWTON BROOK TRIB OF R.BIRKET	SJ2294087780	NONE	0	0	95.25%
UNITED UTILITIES	BOAT MUSEUM 1 PS (18035)	MANCHESTER SHIP CANAL	SJ4062077298	NONE	UNSPECIFIED	UNSPECIFIED	

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	BOAT MUSEUM 2 PS (18036)	MANCHESTER SHIP CANAL	SJ4046077330	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	BOOTLE NORTHERN OPC CSO 99102	RIVER MERSEY ESTUARY	SJ3213295576	NONE	0.178	17	
UNITED UTILITIES	BRISCOE DRIVE CSO 511G9	RIVER FENDER	SJ2761089730	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	BROMBOROUGH POOL VILLAGE PS 51026	MERSEY ESTUARY	SJ3541084410	NONE	1.547	8	99.99%
UNITED UTILITIES	COLLEGE ROAD ESHE ROAD CSO 38109	RIVER MERSEY ESTUARY	SJ3028098550	SCREENING	2.61	92	69.87%
UNITED UTILITIES	CORONATION RD PS OVERFLOW	RIVER MERSEY ESTUARY	SJ3028098860	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	COTTAGE LANE PUMPING STATION	THE DEE	SJ2650080000	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	CROFT DRV SHORE RD CSO CALDY 512RB	RIVER DEE ESTUARY	SJ2220084800	SCREENING	0.001	1	99.98%
UNITED UTILITIES	CSO AT WILLASTON MILL SPS	UNNAMED TRIB OF CLATTER BROOK	SJ3242078130		UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	DINGLE COMBINED SEWER OVERFLOW	RIVER MERSEY ESTUARY	SJ3570086860	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	DINGLE COMBINED SEWER OVERFLOW	MERSEY ESTUARY	SJ3578186866	NONE	2.91	51	
UNITED UTILITIES	DINNER LANE	DITCH TO MERSEY ESTUARY	SJ4631282342	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	DOCK ROAD SOUTH CSO	RIVER MERSEY ESTUARY	SJ3540884414	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	DOCK ROAD SOUTH CSO	RIVER MERSEY ESTUARY	SJ3541084410	NONE	58.493	142	100.00%

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	DUNGEON LANE PS	RIVER MERSEY ESTUARY	SJ4448081410	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	EARLE DRIVE - PARKGATE ROAD CSO	DEE ESTURARY	SJ2783477647	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	EASTHAM RAKE CSO	DIBBINSDALE BROOK	SJ3482179346	SCREENING	1.583	24	100.00%
UNITED UTILITIES	EASTHAM VILLAGE CSO	MERSEY ESTUARY (TIDAL)	SJ3648281797	NONE	29.25	68	96.16%
UNITED UTILITIES	ENNISDALE DRIVE CSO	NEWTON BROOK	SJ2293087780	NONE	0.033	7	100.00%
UNITED UTILITIES	FRANKBY CLOSE CSO 513MM	GREASBY BROOK	SJ2481087060	SCREENING	0.65	30	100.00%
UNITED UTILITIES	FULWOOD CSO	RIVER MERSEY ESTUARY	SJ3717085990	NONE	0.14	8	100.00%
UNITED UTILITIES	FULWOOD CSO	RIVER MERSEY ESTUARY	SJ3717085990	NONE	0.14	8	100.00%
UNITED UTILITIES	GARRICK AVENUE CSO	ARROWE BROOK	SJ2526089670	NONE	0.207	18	99.88%
UNITED UTILITIES	GARSTON CSO LIVERPOOL	MERSEY ESTUARY	SJ3959083420	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	GAYTON CEDARWAY PUMPING STATION	UNNAMED DITCH TO RIVER DEE	SJ2777080260	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	GAYTON PARKWAY CSO	TRIB OF RIVER DEE	SJ2826080436	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	GLADSTONE ROAD CSO	UNNAMED WATERCOURSE	SJ2940777342	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	GOWER ST/KINGS DOCK CSO	MERSEY ESTUARY	SJ3408589474	NONE	UNSPECIFIED	UNSPECIFIED	

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	GRASSENDALE COMBINED SEWER OVERFLOW	MERSEY ESTUARY	SJ3855084825	NONE	2.021	46	100.00%
UNITED UTILITIES	GREASBY ROAD/CORTSWAY CSO 511WQ	ARROWE BROOK	SJ2634088090	NONE	0.156	6	100.00%
UNITED UTILITIES	GREENFIELDS DRIVE CSO	DEE ESTUARY	SJ2905575755	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	HALE ROAD / DINNER LANE CSO	LADY POOL	SJ4630182364	NONE	0.551	11	66.26%
UNITED UTILITIES	HALE VILLAGE PUMPING STATION	RAM'S BROOK	SJ4747182930	NONE	0.416	8	100.00%
UNITED UTILITIES	HALE VILLAGE PUMPING STATION	RAM'S BROOK	SJ4747182930	SCREENING	0.416	8	100.00%
UNITED UTILITIES	HALEWOOD PUMPING STATION	THE MERSEY ESTAURY	SJ4860082800	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	HARBORD ROAD PS 99047	LIVERPOOL BAY	SJ3044497717	NONE	4.857	96	
UNITED UTILITIES	HARP INN CSO	DEE ESTUARY	SJ2892875942	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	HARRINGTON AVENUE CSO	TRIB CARR DRAIN (TO R. BIRKET)	SJ2236088970	SCREENING	3.674	38	50.25%
UNITED UTILITIES	HESWALL SEABANK ROAD	PIPE TO RIVER DEE	SJ2620080700	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	HESWALL STORAGE TANK CSO HESWALL	RIVER DEE ESTUARY	SJ2619080420	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	HESWALL WASTEWATER TREATMENT WORKS	DEE ESTUARY	SJ2497081795	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	HOOTON ROAD CSO 181ZR	DIBBINSDALE BROOK	SJ3547478442	SCREENING	15.119	70	100.00%

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	HOYLAKE ROAD/CHAPELHILL CSO	RIVER FENDER	SJ2764090350	SCREENING	3.25	40	96.72%
UNITED UTILITIES	JERICHO LANE CSO	MERSEY ESTUARY	SJ3740085831	NONE	0.053	6	100.00%
UNITED UTILITIES	KINGFISHER WAY CSO	ARROWE BROOK	SJ2554088920	NONE	0.007	1	100.00%
UNITED UTILITIES	LEASOWE ROAD CSO	BIDSTON STREAM	SJ2904092100	SCREENING	12.375	164	99.98%
UNITED UTILITIES	LONG HEY ROAD CSO	RIVER DEE (NORTH WALES)	SJ2302083940	SCREENING	42.733	60	100.00%
UNITED UTILITIES	MARSHLANDS ROAD PS	RIVER DEE ESTUARY	SJ2888076240	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	MARYLAND LANE CSO	ARROWE BROOK	SJ2477090370	SCREENING	0.029	3	100.00%
UNITED UTILITIES	MAYFIELD DRIVE PS1 CSO 512EZ	RIVER MERSEY ESTUARY	SJ3648281797	NONE	12.731	97	100.00%
UNITED UTILITIES	MAYFIELDS DRIVE WW NTWK PS	RIVER MERSEY	SJ3648281797	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	MEADOW LANE PS	MANCHESTER SHIP CANAL	SJ4097077100	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	MERSEY ROAD COMBINED SEWER OVERFLOW	MERSEY ESTUARY	SJ3808385255	NONE	1.79	36	100.00%
UNITED UTILITIES	MORETON SPUR PS	RIVER FENDER	SJ2764089330	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	NESTON PARKGATE PUMPING STATION	DEE ESTUARY	SJ2783477644	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	NESTON WWTW	EST WATERS OF STANNEY BROOK	SJ2870176792	SCREENING	UNSPECIFIED	UNSPECIFIED	

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	NEW BRIGHTON PUMPING STATION	TIDAL RIVER MERSEY	SJ3140094250	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	NOCTORUM AVENUE CSO 512IB	THE RIVER FENDER	SJ2807087940	NONE	6.16	110	99.66%
UNITED UTILITIES	NORTH ROAD WW NTWK PS	RIVACRE BROOK	SJ3868078700	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	O/S 107 LIVERPOOL ROAD CSO 382D3	RIVER MERSEY ESTUARY	SJ3028098550	SCREENING	1.375	31	100.00%
UNITED UTILITIES	O/S51 MOORLAND AVE CSO 382G6	RIVER MERSEY ESTUARY	SJ3028098550	SCREENING	12.735	123	99.46%
UNITED UTILITIES	OGLET PS	RIVER MERSEY ESTUARY	SJ4448081410	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	OPPOSITE 53 MOOR LANE CSO 382G6	RIVER MERSEY ESTUARY	SJ3028098550	SCREENING	22.021	170	94.90%
UNITED UTILITIES	OUTSIDE 16 CORONATION RD CSO 381PQ	RIVER MERSEY ESTUARY	SJ3028098550	SCREENING	0.365	20	100.00%
UNITED UTILITIES	OUTSIDE 81 WODLANE CSO 513OI	ARROWE BROOK	SJ2580088260	SCREENING	0.4	23	100.00%
UNITED UTILITIES	PARK STREET COMBINED SEWER OVERFLOW	RIVER MERSEY ESTUARY	SJ3471088000	NONE	0.132	19	100.00%
UNITED UTILITIES	PARTSIDE ONE PS	MANCHESTER SHIP CANAL	SJ4045077470	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	PORT CAUSEWAY/CROSSWAY CSO	BROMBOROUGH POOL	SJ3441083750	NONE	0	0	
UNITED UTILITIES	PORTSIDE TWO PS	MANCHESTER SHIP CANAL	SJ4019077720	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	POWERHOUSE ROAD PUMPING STATION	MANCHESTER SHIP CANAL	SJ3718080570	NONE	UNSPECIFIED	UNSPECIFIED	

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	REAR OF 25 WHEATFIELD CLOSE CSO	RIVER FENDER	SJ2761089730	SCREENING	17.278	82	96.49%
UNITED UTILITIES	REAR OF 65 FULTON AVE CSO 5130R	NEWTON BROOK	SJ2313087300	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	RIMROSE BROOK CSO	RIVER MERSEY ESTUARY	SJ3181695885	NONE	0.478	21	100.00%
UNITED UTILITIES	RIVACRE VALLEY PARK CSO	RIVACRE BROOK, TRIB MERSEY	SJ3798976928	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	RIVACRE VALLEY PARK CSO	RIVACRE BROOK	SJ3835877970	SCREENING	8.45	107	97.93%
UNITED UTILITIES	RIVACRE VALLEY PARK CSO	RIVACRE BROOK	SJ3853077990	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	SALTWORKS PUMPING STATION	MANCHESTER SHIP CANAL VIA SWS	SJ4949482071	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	SANDHILLS LANE CSO	MERSEY ESTUARY	SJ3320093120	NONE	0.762	24	100.00%
UNITED UTILITIES	SANDY LANE CSO	BIDSTON STREAM	SJ2862091660	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	SANDY LANE CSO	BIDSTON STREAM	SJ2904092100	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	SAUGHALL MASSIE RD/DEVONSHIRE RDCSO	ARROWE BROOK	SJ2540788540	NONE	1.119	18	100.00%
UNITED UTILITIES	SOUTH FERRY ISLAND PS	RIVER MERSEY	SJ3448088640	BIOLOGICAL FILTRATION	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	SOUTH PARADE CSO 202S2	WEAVER NAVIGATION	SJ4963081130	NONE	0.018	5	100.00%
UNITED UTILITIES	SOUTHERN RELIEF CSO	MERSEY ESTUARY	SJ3834585043	NONE	8.799	78	100.00%

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	SPS HERCULANEUM DOCK	RIVER MERSEY ESTUARY	SJ3940087200	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	ST JOSEPHS COLLEGE PUMPING STN	DIBBINSDALE BROOK	SJ3572076740	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	ST NICHOLAS STORM SEWER OVERFLOW	MERSEY ESTUARY	SJ3372090350	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	ST PAUL'S ROAD CSO	THE MERSEY ESTUARY	SJ3346087300	NONE	0.085	8	100.00%
UNITED UTILITIES	STANLEY AVENUE/GREEN LANE CSO	RIVER BIRKET	SJ2902092720	NONE	11.295	14	100.00%
UNITED UTILITIES	STANLEY ROAD PUMPING STATION	THE IRISH SEA	SJ2036088320	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	STANTON ROAD PS	BOARDMAN BROOK	SJ3244083410	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	STATION RD COMBINED SEWER OVERFLOW	BIDSTON STREAM	SJ2915091650	SCREENING	0.028	1	100.00%
UNITED UTILITIES	STRAND ROAD STORM SEWER OVERFLOW	RIVER MERSEY	SJ3259095110	NONE	19.22	6	100.00%
UNITED UTILITIES	TANKFIELDS CSO	STANNEY BROOK	SJ2920877160	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	THE BYPASS/LPOOL RD JUNCT CSO 382UR	RIVER MERSEY ESTUARY	SJ3028098550	SCREENING	0.636	32	100.00%
UNITED UTILITIES	THE DELL COMBINED SEWER OVERFLOW	THE MERSEY ESTUARY	SJ3417086380	NONE	12.405	147	99.54%
UNITED UTILITIES	THERMAL ROAD/PORT CAUSEWAY CSO	THE MERSEY ESTUARY	SJ3580083650	NONE	28.976	120	100.00%
UNITED UTILITIES	THORNTON HOUGH PUMPING STATION	THORNTON HOUGH,TRIB OF CLATTER	SJ3071080550	NONE	1.334	88	99.98%

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	TOWN PUMPING STATION	MANCHESTER SHIP CANAL	SJ4095777100	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	UPTON ROAD CSO 513N8	RIVER FENDER	SJ2761089730	SCREENING	1.51	37	100.00%
UNITED UTILITIES	UPTON STORM TANKS	RIVER FENDER	SJ2769089020	SCREENING	9.948	40	99.78%
UNITED UTILITIES	VALLEY DRIVE CSO	RIVACRE BROOK	SJ3795176567	SCREENING	0.12	13	100.00%
UNITED UTILITIES	WALLACRE ROAD CSO	MERSEY ESTUARY	SJ2914091650	SCREENING	1.521	31	100.00%
UNITED UTILITIES	WALLACRE ROAD/BEAUFORT DRIVE CSO	BIDSTON STREAM	SJ2914091650	NONE	0.047	3	100.00%
UNITED UTILITIES	WALLASEY COASTAL DRIVE 51052	RIVER MERSEY ESTUARY	SJ2918393900	NONE	0.042	4	99.99%
UNITED UTILITIES	WALLASEY COASTAL DRIVE 51052	RIVER MERSEY ESTUARY	SJ2947594048	NONE	0.042	4	99.99%
UNITED UTILITIES	WALLASEY WW PUMPING STATION	RIVER MERSEY ESTUARY	SJ3259090650	NONE	54.22	281	73.51%
UNITED UTILITIES	WALLASEY WW PUMPING STATION	RIVER MERSEY ESTUARY	SJ3262090640	SCREENING	54.22	281	73.51%
UNITED UTILITIES	WASTDALE DRIVE CSO	ARROWE BROOK	SJ2491090200	SCREENING	6.354	48	99.99%
UNITED UTILITIES	WEST KIRBY PUMPING STATION	UNNAMED TRIB OF RIVER BIRKET	SJ2178087720	SCREENING	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	WHITBY ROAD COMBINED SEWER OVERFLOW	MANCHESTER SHIP CANAL	SJ4096777096	NONE	0.029	14	100.00%
UNITED UTILITIES	WHITEBEAM WALK CSO 513PX	GREASBY BROOK TRIB ARROW BROOK	SJ2484086900	SCREENING	1.706	51	100.00%

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
UNITED UTILITIES	WILLASTON RELIEF SEW TANK	TRIB DIBBINSDALE BROOK	SJ3409078950	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	WILLASTON RELIEF SEWER	TRIB DIBBINSDALE BROOK	SJ3412078180	UNSPECIFIED	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	WINDBOURNE CSO	RIVER MERSEY ESTUARY	SJ3678086230	NONE	0.879	11	100.00%
UNITED UTILITIES	WOOD LANE/GLENTREE CLOSE CSO	ARROWE BROOK TRIB R. BIRKETT	SJ2556188181	NONE	UNSPECIFIED	UNSPECIFIED	
UNITED UTILITIES	WOODSIDE CSO	MERSEY ESTUARY	SJ3298089260	NONE	UNSPECIFIED	UNSPECIFIED	
DWR CYMRU	ARGOED PS	GUTTER FAWR	SJ 11460 83560	99: NONE	36	9	98.48
DWR CYMRU	Ashgrove PS Shotton	River Dee	SJ 31231 69211	11: SCREENING	180.75	68	99.96
DWR CYMRU	BAGILLT EAST SPS	DEE ESTUARY	SJ 22310 75550	11: SCREENING	27.75	11	100
DWR CYMRU	BAGILLT EIRANFA PS EMERGENCY OVERFL	TRIB OF DEE ESTUARY	SJ 22400 75030	11: SCREENING	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	BAGILLT GREENACRE DRIVE - SSO	UNNAMED W/C	SJ 22662 74552	99: NONE	6.5	9	99.66
DWR CYMRU	BAGILLT STATION ROAD - SSO	UNNAMED W/C	SJ 22200 75300	99: NONE	5.25	10	99.72
DWR CYMRU	BAGILLT TYDDYN MESHAM LANE - SSO	UNNAMED W/C	SJ 22646 74517	99: NONE	0	0	100
DWR CYMRU	Bagillt verge off Manor Drive CSO	Unnamed Watercourse (drainage ditch)	SJ 23209 74332	99: NONE	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	BAGILLT WEST SPS BAGILLT	DEE ESTUARY	SJ 21270 76630	11: SCREENING	33	27	99.86

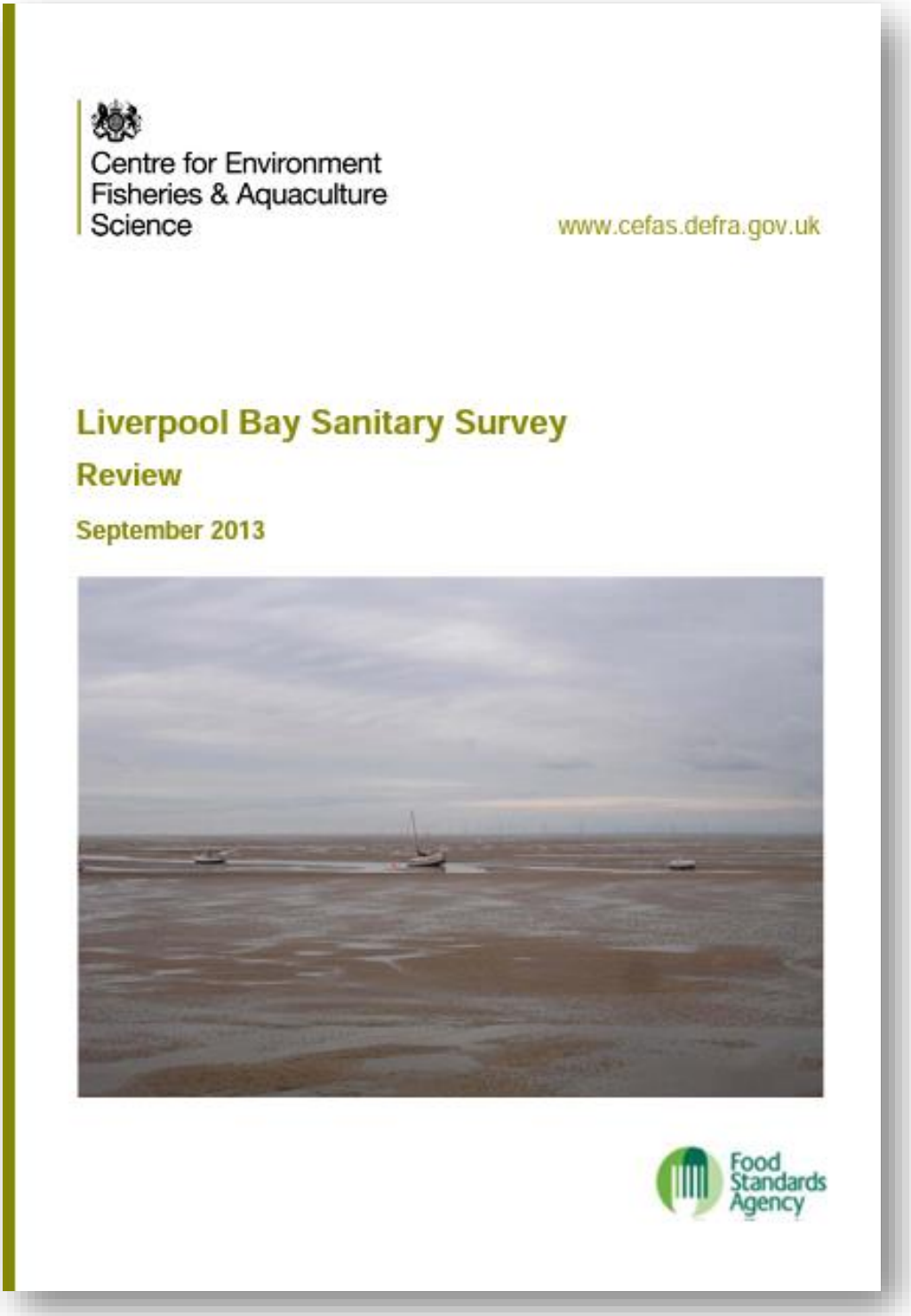
WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
DWR CYMRU	BOOT & SHIP PS , ,	STREAM TO R. DEE	SJ 20960 76300	11: SCREENING	0.25	1	100
DWR CYMRU	Cestrian St CSO	Unnamed watercourse flowing to the River Dee	SJ 29732 69585	99: NONE	3.75	3	99.76
DWR CYMRU	CONNAHS QUAY DEVA AVENUE - CSO	River Dee	SJ 28738 69434	99: NONE	0	0	70.75
DWR CYMRU	Connahs Quay Dock Road PS	River Dee	SJ 29506 69885	99: NONE	1	1	94.99
DWR CYMRU	Connahs Quay Dock Road PS	River Dee	SJ 29506 69885	99: NONE	1	1	94.99
DWR CYMRU	Connahs Quay Golftyn PS CSO/Storm	Golftyn Brook	SJ 28524 70377	11: SCREENING	136.75	28	100
DWR CYMRU	Connahs Quay Linden Avenue - CSO	River Dee	SJ 28800 69499	99: NONE	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	CONNAHS QUAY LOW LEVEL SPS STORM	WEPRE BROOK	SJ 30205 69260	11: SCREENING	0	0	100
DWR CYMRU	CONNAHS QUAY LOW LEVEL SPS STORM	WEPRE BROOK	SJ 30205 69260	11: SCREENING	0	0	100
DWR CYMRU	Connah's Quay Wepre PS	WEPRE BROOK	SJ 30409 69122	11: SCREENING	17.25	27	99.94
DWR CYMRU	CSO Adjacent A548 Road Bridge	Greenfield Valley (Holywell) Stream	SJ 19587 77662	11: SCREENING	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	CSO at Tanlan Bach Pumping Station	TAN LAN DRAINS	SJ 11836 83188	99: NONE	105.5	11	100
DWR CYMRU	DISCHARGE A 14 FFORDD DDYFRDWY	TRIB OF THE RIVER DEE ESTUARY	SJ 16303 80013	11: SCREENING	0.75	2	100
DWR CYMRU	Factory Road CSO, Sandycroft	SANDYCROFT DRAIN	SJ 33665 67353	ZZ: Unspecified	11.75	3	99.72

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
DWR CYMRU	FFYNNON WEST PS	FFYNNONGROEW DRAIN	SJ 13310 82420	99: NONE	308.25	23	100
DWR CYMRU	FLINT BARDYN PS , ,	DEE ESTUARY	SJ 24820 73230	11: SCREENING	89.5	38	100
DWR CYMRU	FLINT DEE COTTAGES PS	DEE	SJ 25000 72900	99: NONE	1.5	5	100
DWR CYMRU	FLINT IN GARDEN 102 MAES GWYN	UNNAMED W/C	SJ 25121 72628	99: NONE	51	54	95.61
DWR CYMRU	FLINT STW (THE MEADOWS) , ,	SWINCHIARD BROOK	SJ 23990 72770	11: SCREENING	0	0	100
DWR CYMRU	GARDEN CITY BRITISH LEGION - CSO	MANOR DRAIN	SJ 33126 69169	11: SCREENING	154	24	99.99
DWR CYMRU	GREENFIELD A548 NR ABBEY MILL	UNNAMED W/C	SJ 19590 77665	99: NONE	1	4	99.87
DWR CYMRU	GREENFIELD IND EST NO 1 HOLYWELL	RIVER DEE (TIDAL)	SJ 20060 77514	99: NONE	3	2	100
DWR CYMRU	GREENFIELD PARENT CSO HOLYWELL	HOLYWELL STREAM	SJ 19844 77831	11: SCREENING	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	GREENFIELD WWTW (STW) GREENFIELD	ESTUARIAL WATERS OF RIVER DEE	SJ 19940 78160	11: SCREENING	87.5	34	99.94
DWR CYMRU	GWESPYR OLD STW - SSO	UNNAMED W/C	SJ 11128 83454	99: NONE	0.5	1	100
DWR CYMRU	HOLYWELL PEN Y MAES RD/PEN Y M	UNNAMED W/C	SJ 19200 75900	11: SCREENING	376.25	61	92.85
DWR CYMRU	HOLYWELL STRAND WALK NR STRAND	UNNAMED W/C	SJ 18900 76700	11: SCREENING	0	0	100
DWR CYMRU	KELSTERTON PUMP STN. , ,	THE KELSTERTON BROOK	SJ 27900 70700	11: SCREENING	UNSPECIFIED	UNSPECIFIED	#N/A

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
DWR CYMRU	MANCOT LANE CSO	QUEENSFERRY DITCH	SJ 32130 67830	11: SCREENING	239	42	100
DWR CYMRU	MERLLYN LANE BAGILLT	Unnamed Watercourse	SJ 22020 75002	99: NONE	0	0	99.72
DWR CYMRU	MOSTYN ARMS PS MOSTYN	CULVERTED TRIB. OF DEE (TIDAL)	SJ 15290 81050	99: NONE	243.5	12	99.87
DWR CYMRU	MOSTYN DOCKS CAR PARK - SSO	CULVERTED TRIB. OF DEE (TIDAL)	SJ 15570 80960	99: NONE	84.25	10	100
DWR CYMRU	MOSTYN NEAR FUN SHIP - SSO	LLANERCHYMOR GUTTER	SJ 17662 79167	99: NONE	123.25	36	99.76
DWR CYMRU	MOSTYN WWTW - TRANSFER PS	DEE ESTUARY	SJ 17017 80097	01: BIOLOGICAL FILTRATION	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	Oakenholt Main SPS	Pentre Ffwrndan Drain	SJ 25678 72147	11: SCREENING	0	0	90.71
DWR CYMRU	Oakenholt Main SPS	Pentre Ffwrndan Drain	SJ 25678 72147	11: SCREENING	0	0	90.71
DWR CYMRU	PAPERMILL LANE PS	CULVERTED SECTION OF LEAD BROO	SJ 26280 71720	11: SCREENING	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	PEN Y FFORDD ADJ PEN Y FFORDD	UNNAMED W/C	SJ 13173 82161	99: NONE	15.25	9	99.95
DWR CYMRU	PEN Y MAES PUMPING STATION	UNNAMED TRIB OF RIVER DEE	SJ 19336 76370	11: SCREENING	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	PEN Y MAES PUMPING STATION	UNNAMED TRIB OF RIVER DEE	SJ 19336 76370	11: SCREENING	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	QUEENSFERRY PENTRE PUMPING STATION	QUEENSFERRY DITCH	SJ 32315 67663	11: SCREENING	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	QUEENSFERRY STW QUEENSFERRY ,	QUEENSFERRY DRAIN	SJ 32230 68420	99: NONE	UNSPECIFIED	UNSPECIFIED	#N/A

WATER COMPANY	DISCHARGE NAME	RECEIVING ENVIRONMENT	NGR	TREATMENT (IF ANY)	DURATION	COUNT	% OF REPORTING PERIOD OPERATIONAL
DWR CYMRU	QUEENSFERRY STW (SETTLED STORM)	Un-named watercourse	SJ 32380 68530	11: SCREENING	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	Sandycroft Phoenix Street CSO	BROUGHTON BROOK	SJ 33513 67123	11: SCREENING	2.5	1	91.72
DWR CYMRU	SEALAND PS	GARDEN CITY DRAIN	SJ 32920 69290	99: NONE	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	Settled Storm Sewage at Flint WwTW	River Dee Estuary	SJ 25780 72440	ZZ: Unspecified	387.75	51	83.86
DWR CYMRU	SHOTTON PS SHOTTON CHESTER	UNNAMED TRIB. OF WEPRE BROOK	SJ 30900 68950	99: NONE	UNSPECIFIED	UNSPECIFIED	#N/A
DWR CYMRU	STATION ROAD PS TALACRE	NEW DRAIN	SJ 12000 84330	99: NONE	130.75	17	99.13
DWR CYMRU	TAI TREVOR PS LLANNERCHYMOR	MARSIANDWR	SJ 18470 78690	99: NONE	0	0	91.04
DWR CYMRU	TALACRE STATION ROAD PS	MAESCOED DRAIN	SJ 12363 84693	99: NONE	0	0	0
DWR CYMRU	TANLAN PS	TANLAN DRAIN	SJ 12520 82780	99: NONE	UNSPECIFIED	UNSPECIFIED	#N/A

Appendix II. Liverpool Bay Sanitary Survey Report 2013



Follow hyperlink in image to view full report.

About Carcinus Ltd

Carcinus Ltd is a leading provider of aquatic environmental consultancy and survey services in the UK.

Carcinus was established in 2016 by its directors after over 30 years combined experience of working within the marine and freshwater environment sector. From our base in Southampton, we provide environmental consultancy advice and support as well as ecological, topographic and hydrographic survey services to clients throughout the UK and overseas.

Our clients operate in a range of industry sectors including civil engineering and construction, ports and harbours, new and existing nuclear power, renewable energy (including offshore wind, tidal energy and wave energy), public sector, government, NGOs, transport and water.

Our aim is to offer professional, high quality and robust solutions to our clients, using the latest techniques, innovation and recognised best practice.

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Environmental Consultancy

Carcinus provides environmental consultancy services for both freshwater and marine environments. Our freshwater and marine environmental consultants provide services that include scoping studies, Environmental Impact Assessment (EIA) for ecological and human receptors, Habitats Regulations Appraisal (HRA), Water Framework Directive (WFD) assessments, project management, licensing and consent support, pre-dredge sediment assessments and options appraisal, stakeholder and regulator engagement, survey design and management and site selection and feasibility studies.

Ecological and Geophysical Surveys

Carcinus delivers ecology surveys in both marine and freshwater environments. Our staff are experienced in the design and implementation of ecological surveys, including marine subtidal and intertidal fish ecology and benthic ecology, freshwater fisheries, macro invertebrate sampling, macrophytes, marine mammals, birds, habitat mapping, River Habitat Surveys (RHS), phase 1 habitat surveys, catchment studies, water quality and sediment sampling and analysis, ichthyoplankton, zooplankton and phytoplankton.

In addition, we provide aerial, topographic, bathymetric and laser scan surveys for nearshore, coastal and riverine environments.

Our Vision

"To be a dependable partner to our clients, providing robust and reliable environmental advice, services and support, enabling them to achieve project aims whilst taking due care of the sensitivity of the environment"