Sanitary Survey - Review

Burry Inlet – 2021

Document No. – *J0591/20/06/18*

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Document QA and Approval

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Initial Consultation

Consultee	Date of consultation	Date of response
Carmarthenshire County Council	18/06/2020	16/07/2020
Swansea City & County Council	18/06/2020	16/07/2020
Welsh Water	25/06/2020	28/07/2020

Secondary Consultation

Consultee	Date of consultation	Date of response
Carmarthenshire County Council	09/11/2020	10/12/2020
Swansea City & County Council	09/11/2020	10/12/2020
Natural Resources Wales	09/11/2020	10/12/2020

A sanitary survey relevant to the bivalve mollusc beds in Burry Inlet BMPA was undertaken in 2012 under EC Regulation 854/2004 (now superseded by retained EU Law Regulation (EC) 2019/627). This provided appropriate hygiene classification zoning and monitoring plan based on the 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 ifrequired. Carcinus Ltd (Carcinus) undertook this work on behalf of the FSA. Carcinus 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, Carmarthenshire Council, Swansea Council The report is publicly available via the Carcinus Ltd website.

Recommended Bibliographic Citation:

Carcinus Ltd (Carcinus), 2021. Review of the Burry Inlet 2012 Sanitary Survey. Carcinus reports on behalf of the Food Standards Agency, to demonstrate compliance with the requirements for classification of bivalve mollusc production areas in England and Wales under retained EU Law Regulation (EC) Regulation 2019/627.

Contents

List of figures

List of tables

1 Introduction

1.1 Background

In line with the EU Good Practice Guide (European Commission, 2017) and Article 58 of retained EU Law Regulation (EC) 2019/627, Carcinus is contracted to undertake reviews of sanitary surveys on behalf of the Food Standards Agency. The FSA undertake targeted sanitary survey reviews to ensure public health protection measures continue to be appropriate.

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 complexity and risk. The desktop assessment is completed through analysis and interpretation of publicly available information, in addition to consultation with stakeholders.

1.2 Burry Inlet Review

This report reviews information and makes recommendations for a revised sampling plan where identified as required for existing Cockle (*Cerastoderma edule*) and Mussel (*Mytilus spp.*) classification zones in the Burry Inlet (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 the Local Authorities (LAs) and Welsh Water responsible for the production area was undertaken in June 2020. 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 the LAs and Local Action Group (LAG) members including Natural Resources Wales was undertaken in November 2020. 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. Subsequent discussions with LA officers took place in April 2021 before the review was finalised. The draft report is reviewed and finalised taking into account the feedback received.

The review updates the assessment originally conducted in 2012 and sampling plan as necessary and the report should be read 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.

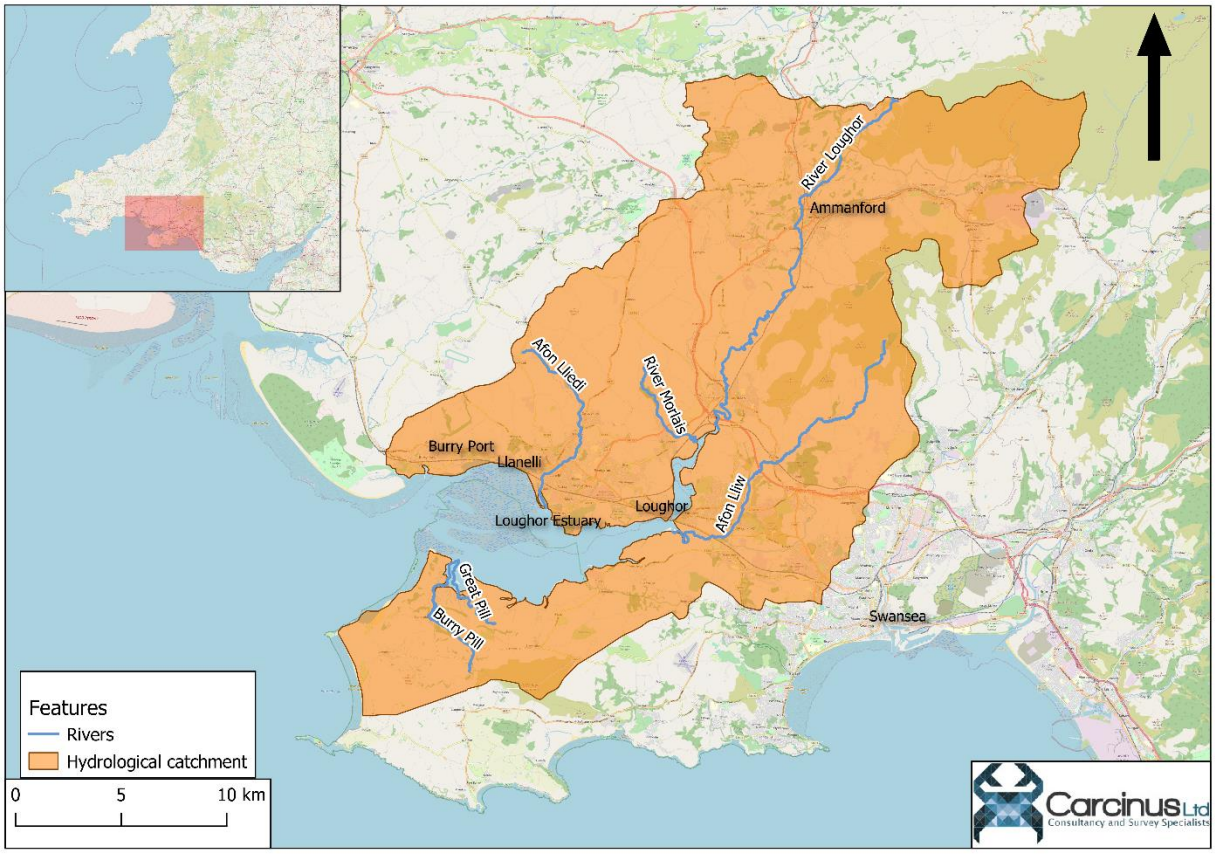

Figure 1.1 Location of Burry Inlet

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 Natural Resources Wales;
- The findings of this report are based on information and data sources up to and including June 2020 (excluding Official Control Monitoring Data (see below));
- Only information that may impact on the microbial contamination was considered for this review; and
- Official Control monitoring data has been taken at directly from the Cefas data hub[1] with no additional verification. Results up to and including March 2021 have been used within this study. Any subsequent samples have not been included.

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

2 Shellfisheries

2.1 Description of Shellfishery

Burry Inlet has supported a fishery of the naturally occurring cockle beds for more than 100 years. The fishery is formally regulated under the *Burry Inlet Cockle Fishery Order 1965* and is currently managed by Natural Resources Wales (NRW). The most recent update to the management plan for this fishery was issued in 2013 (Natural Resources Wales, 2013). Since the turn of the Millennium, chronic annual mass-mortalities of cockles within the inlet have occurred, negatively affecting the populations of wading birds such as oystercatchers (*Haematopus ostralegus*) and inflicting heavy financial losses (up to £3m per year) on the fishery itself. The mortalities are suspected to have been caused by untreated effluent from nearby shellfish processing factories which contains parasites such as *Minchinia tapetis*, *M. mercenariae*, and *Haplosporidium edule* (Longshaw, 2015). The most recent stock assessment conducted by NRW in April 2020 (Smith, 2020) reported a total count of 4.94 Billion (4.94×10^9) and a biomass of 5,947 tonnes, a decline of 14.5% and 49.9% on the Summer 2019 survey values respectively. Approximately 70% of the count was comprised of Year 1 cockles, though the count of Year 2 cockles had increased by ~340% from the Summer 2019 survey. The densest areas of cockle aggregations in the Spring 2020 survey were in the middle of the inlet, the northern waters near Pwll and in the south near the saltmarsh off Cheriton (Figure 2.1).

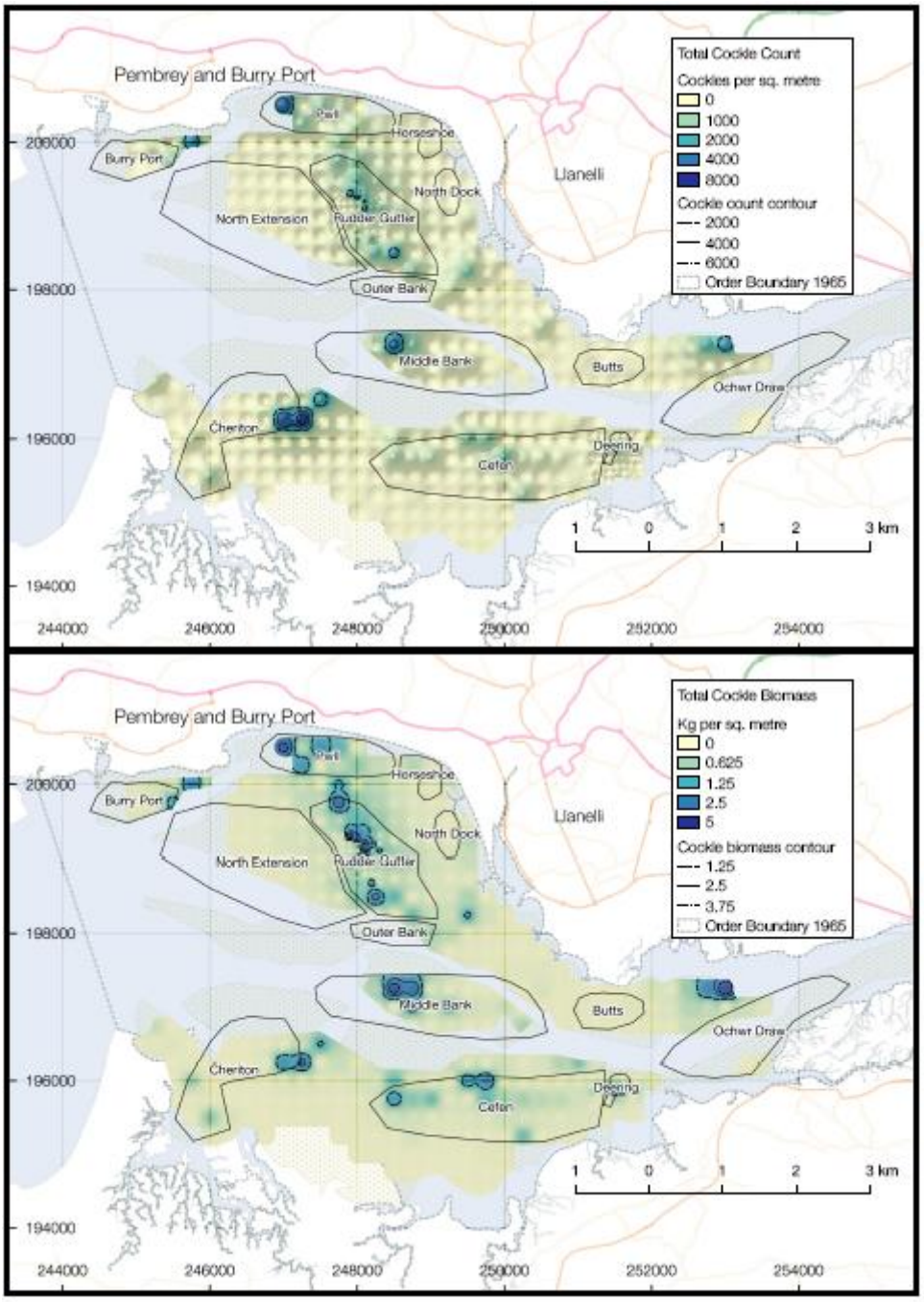

Figure 2.1 Representation of cockle count and biomass (Inverse Distance Weighted) in the Burry Inlet April 2020. Reproduced from Smith (2020).

The management plan sets a minimum landing size of 19 mm and estimates that the Total Allowable Catch (TAC) of cockles in the inlet will vary from 500 to 2500 tonnes, with 36 licences for 70 tonnes per person issued annually. Where NRW considers the fishery to be able to support additional landings, it may issue temporary licences. Consultation with the Local Authorities indicated that current gathering efforts are focussed on Whitford Sands and the Burry Inlet South beds.

There is a fishery of naturally occurring mussels in addition to the cockle fishery within Burry Inlet. The distribution of mussels throughout the Inlet is far more limited and patchier than the

distribution of cockles, and commercial efforts are focussed on Whitford Sands. No information was available on the current landings from this fishery.

The original sanitary survey made mention of an application to harvest soft shell clams (*Mya arenaria*) in the waters off Pwll. No current commercial fishery is present at this location and no monitoring of this species occurs.

No changes to harvesting methods were reported by the Local Authorities. All harvesting within the inlet is done by hand when the bivalves are exposed at low tide.

2.2 Classification History

The original sanitary survey divided the inlet into six Classification Zones (CZs), three on the south of the estuary and three on the north side of the estuary, all with single RMPs for each zone. Five of these RMPs were for both cockles and mussels. Some changes to CZs within the inlet have occurred since the original sanitary survey. Figure 2.2 presents the boundary and classification status of current CZs within Burry Inlet. The whole south side of the estuary is currently classified, though the Burry South (West) CZ has been renamed Whiteford Point (with the eastern boundary moved slightly westwards), the Burry South (Central) and Burry South (East) CZs have been adapted slightly to now comprise the South Mid, Southside: South East 4 and Dalton's Point CZs. The CZs on the north side of the inlet have changed more significantly; the Burry North (West) and Burry North (East) CZs are no longer classified, and the Burry North (Central) CZ has been renamed the Northside: West CZ with its eastern boundary moved slightly westwards. The Pwll classification zone, proposed to be contained within the Burry North (Central) classification zone, remains a separate zone.

Whiteford Point at the mouth of the estuary currently holds a B classification for mussels and a long-term B classification for cockles. Dalton's Point at the eastern end of the inlet has periodically been classified over the last 20 years and has always held a C classification during those periods. It currently holds a preliminary C classification and will be sampled South East 4 (B038I) moving forward. The Northside: West (cockles) zone is not currently monitored from an RMP that falls within it, but it holds hold a long-term B classification based on monitoring data its RMP at Burry Port (B38AI). The South Mid and Southside South-East classification zones both hold a C classification and are classified based on samples from the South East 4 (B038I) RMP. The small Pwll zone on the north side of the inlet currently holds a LT-B classification and is classified using samples from the Pwll (B038G) RMP.

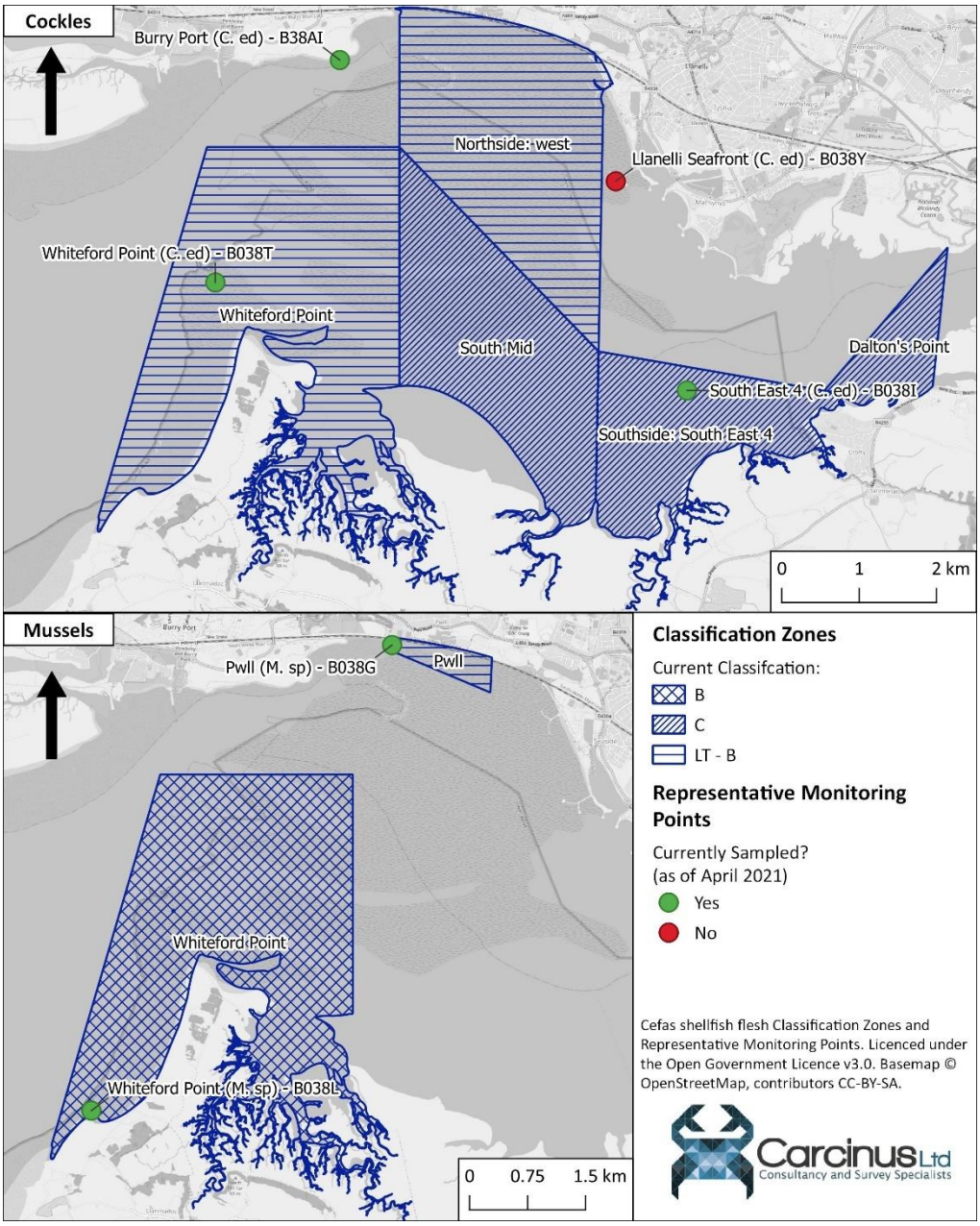

Figure 2.2 Current shellfish Classification Zones and associated Representative Monitoring Points in Burry Inlet.

3 Pollution sources

3.1 Human Population

The most recently available population data to the authors of the original Sanitary Survey of Burry Inlet was that of the 2001 census. The data collected during the subsequent census of 2011 has been made available since the publication of the original report, and changes in the human population within the catchment between the two censuses are discussed here as no further population data are freely available.

Figure 3.1 shows population densities in census Output Areas within or partially within the Burry Inlet hydrological catchment. In general, population increased across the whole catchment, particularly in and around the built-up areas of the catchment; the north-west parts of Swansea

south east of the estuary, Llanelli along the north shore and the areas surrounding Ammanford in the north of the catchment. Much of the catchment remains fairy rural and sparsely populated, particularly in the far north.

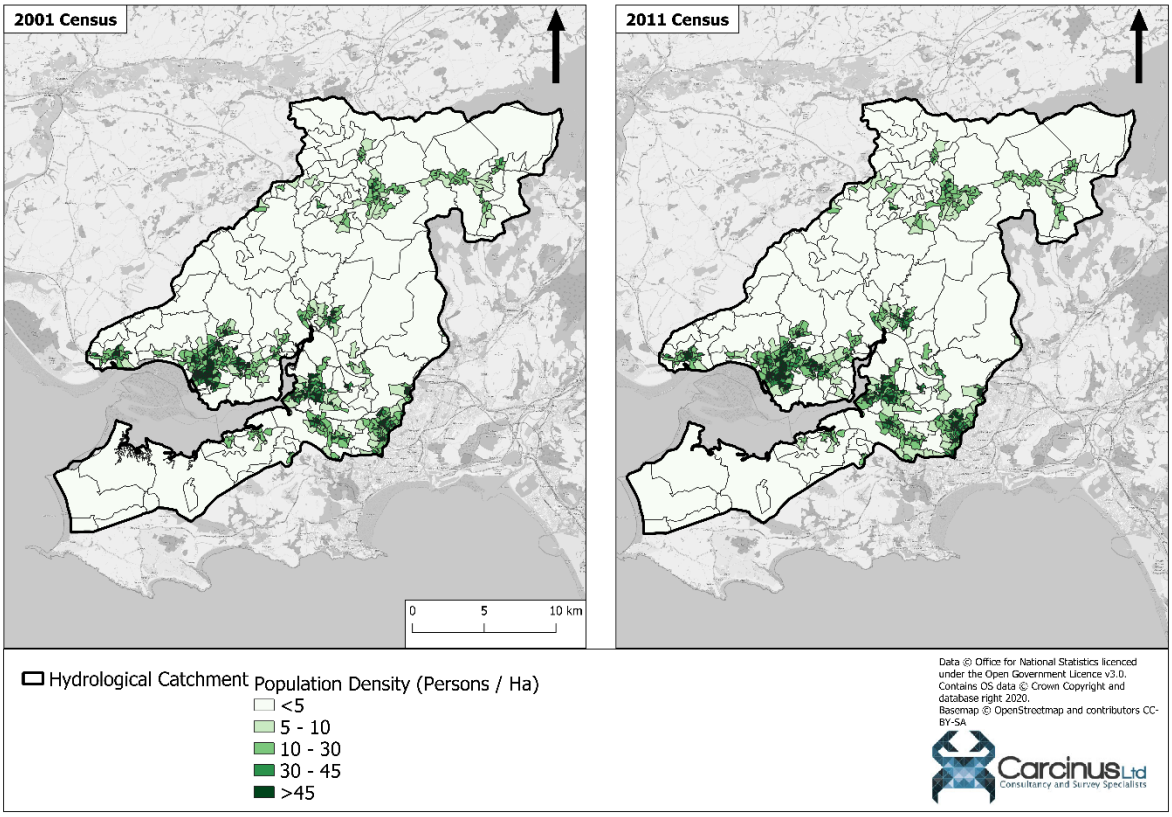

Figure 3.1. Population density of Lower Super Output Areas partially or wholly contained within the Burry Inlet catchment at the 2001 and 2011 censuses.

The total usual resident population within or partially within the catchment at the 2001 census was 168,969, which had increased to 181,763 by the 2011 census, which is a 7.57% increase. It should be noted, however, that the 2011 census data was collected whilst the original sanitary survey was being drafted and so is perhaps more relevant to that document. The next full census of the United Kingdom (UK) is scheduled to take place in 2021, and the UK government estimates that the population will increase by approximately 6.6% between 2011 and 2021 (Office for National Statistics, 2018). An increase of 6.6% in the Burry Inlet population would be 193,759 residents. Figure 3.2 indicates the population change of Electoral Wards within or partially within the Burry Inlet hydrological catchment. A full breakdown of the change within each Ward is presented in Appendix I. The population of most wards has remained stable. Areas that have seen the most significant population increases are the portions of the catchment within the city of Swansea, upstream of all classification zones, and the town of Llanelli, located on the northern shore of the estuary.

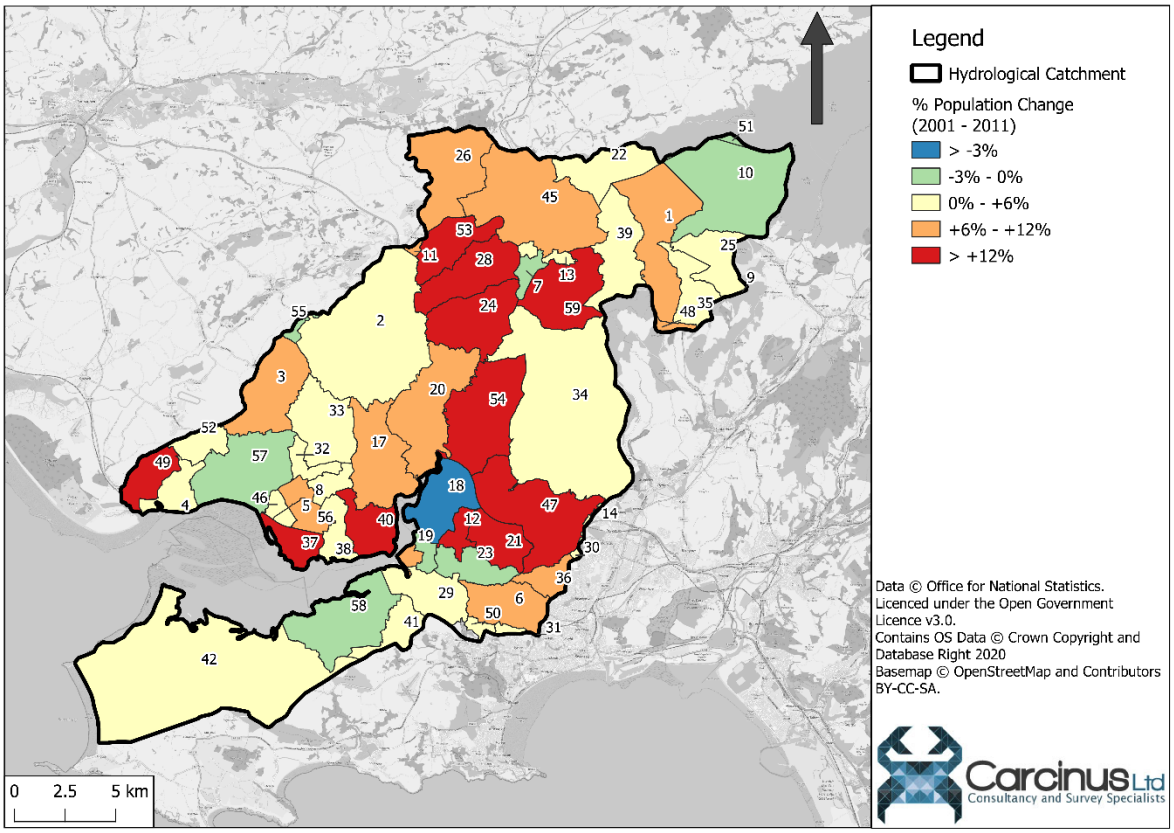

Figure 3.2 Population change of Wards and Electoral Divisions (2011 Census) within or partially within the Burry Inlet hydrological catchment between the 2001 and 2011 Censuses of the United Kingdom. 2001 Census data have been transposed to 2011 Wards using the UK Data Service's GeoConvert tool (UK Data Service, 2020) to facilitate comparison. Numbers within wards are identifiers that can be used in combination with Table III.0.1 to provide more detail.

Whilst there is no recently available population data for the estuary, it is likely that the population will have increased since the last sanitary survey. However, the distribution of the main population centres in the catchment have not changed, and thus the recommendations for positions of RMPs outlined in the original sanitary survey are still valid.

3.2 Sewage

Details of all consented discharges within the Burry Inlet catchment were taken from the most recent update to the NRW's national permit database (Natural Resources Wales, 2020). The locations of these discharges are shown in Figure 3.3. Details of all continuous discharges are presented in Table 3.1.

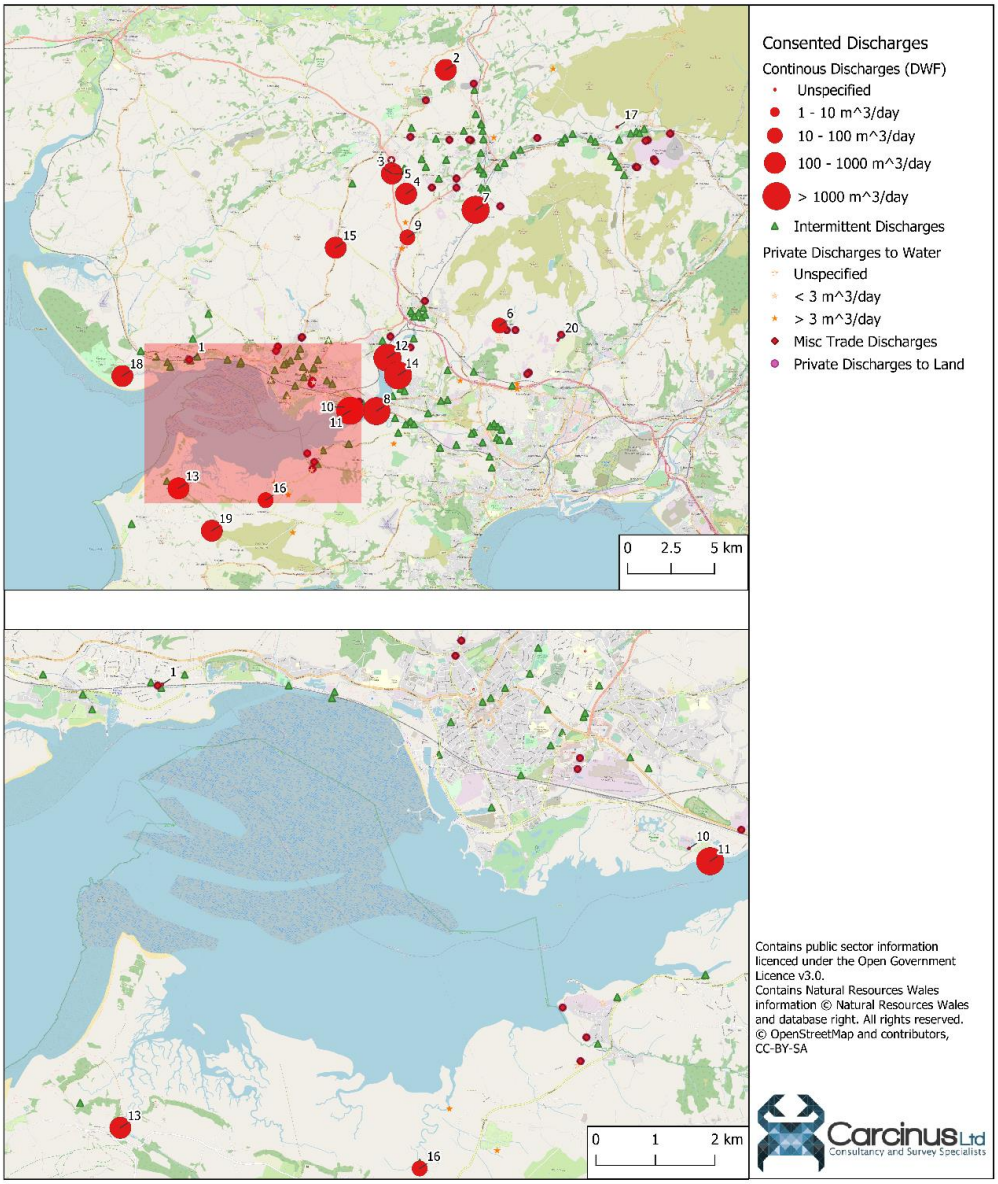

Figure 3.3. Locations of all consented discharges within the Burry Inlet catchment.

The 2012 sanitary survey identified 19 continuous discharges contained within the Burry Inlet catchment (p 57, Figure VII.1 & p 58, Table VII.1), four of which discharge directly to Burry Inlet itself and employed UV disinfection which would dramatically reduce the bacterial loading caused by the outfalls. These discharges are all located up-estuary of the CZs, and so any contamination would affect the most easterly CZs more significantly. There is a single additional continuous discharge present that was not active at the time of the original sanitary survey (Figure 3.3; Table 3.2); Bryn Avenue Combined Storm Overflow (CSO) (discharge No. 1) is located on the northern shore of the estuary. The Dry Weather Flow (DWF) from this discharge is unspecified and it only employs screening as a treatment method. It is believed that this is a mistake in the consented discharge database as it would appear to be an intermittent discharge based on its description, however, it has been plotted as a continuous discharge to reflect its categorisation within the database as being final treated effluent. A continuous discharge that only employs primary screening would result in a significant input of faecal indicator organisms to the estuary.

Table 3.1. Continuous discharges within the Burry Inlet Catchment. Additional discharges not identified in the original sanitary survey are highlighted in yellow.

No.	Continuous Discharge	NGR	DWF (m^3/day)	Treatment
1	Bryn Avenue CSO	SN4538300826	Unspecified	SCREENING
2	CARMEL WWTW CARMEL	SN6008517490	100.1	BIOLOGICAL FILTRATION
3	CROSSHANDS WWTW	SN5698011520	882	TERTIARY BIOLOGICAL
4	CWMGWILI WWTW CWMGWILI NR AMMANFORD	SN5780210355	378	BIOLOGICAL FILTRATION
5	CWMTAWEL WWTW OFF A48 S CROSS HANDS	SN5710911509	23	BIOLOGICAL FILTRATION
6	FELINDRE STW FELINDRE SWANSEA	SN6318002760	77	BIOLOGICAL FILTRATION
7	GARNSWLLT STW LONGELIN AMMANFORD	SN6180509433	17385.5	HIGH RATE BIOLOGICAL
8	GOWERTON WwTW	SS5608797833	22978	UV DISINFECTION
9	LLANEDI WWTW	SN5787507839	72	BIOLOGICAL FILTRATION
10	LLANELLI STW	SS5422098070	Unspecified	UV DISINFECTION
11	LLANELLI WWTW BERWICK ROAD BYNEA	SS5457697854	25920	UV DISINFECTION
12	Llangennech Wastewater Treatment Works	SN5672100904	1678	BIOLOGICAL FILTRATION
13	LLANMADOC WWTW BRITANIA INN LLANMAD	SS4467493383	282	BIOLOGICAL FILTRATION
14	LLANNANT WWTW LLANNANT ROAD SWANSEA	SS5733699894	4314	UV DISINFECTION
15	LLANNON STW LLANNON LLANELLI	SN5374007250	460	BIOLOGICAL FILTRATION
16	LLANRHIDIAN STW LLANRHIDIAN	SS4970092700	61	BIOLOGICAL FILTRATION
17	NANTGWINEU STW UPPER BRYNAMMAN	SN6997014200	Unspecified	Unspecified
18	PEMBREY WASTEWATER TREATMENT WORKS	SS4143899855	499.4	BIOLOGICAL FILTRATION
19	REYNOLDSTON WASTEWATER TREATMENT WK	SS4659690941	299	TERTIARY BIOLOGICAL
20	RHYDYPANDY STW	SN6655001930	Unspecified	Unspecified

A total of 63 intermittent discharge locations were identified at the time of the original sanitary survey, most which were situated on the northern shore and upstream of Loughor Bridge. The most recent permit database indicates that some intermittent discharges on the northern shore are no longer active, but that some additional locations inland are now permitted. No updated spill event monitoring was available for the intermittent discharges, however, for the seven years prior to the original sanitary survey, most spills were <12 hours. The Local Authorities indicated that 10 of the intermittent discharges had been included in the National Environment Programme for improvement in the 2015-2020 investment period (Table 3.2). These upgrades are due to be completed by the end of 2020. These upgrades will reduce the frequency and magnitude of spills from these sites.

Table 3.2. List of CSOs improvements included in the National Environment Programme for the 2015 - 2020 investment period.

Catchment	Name of Discharge	Permit Number
Llanelli	CAMBRIAN STREET P.S. SSO	BF0083605
Gowerton	HOLYTHORNE CROFTY B SEWAGE PS CROFT	BP0246301
Llanelli	BURRY PORT PS (STORM/EMERG) BURRY P	BP0252701
Llanelli	BURRY PORT	BW2205701
Llanelli	PWLL PS (STORM/EMERGENCY) PWLL LLA	BP0252802
Gowerton	NEW CROFTY C SEWAGE PS CROFTY GOWER	BW4100301
Llanelli	CSO behind sea wall	BW2203501
Llanelli	NORTHUMBERLAND PS (STORM/EMER)	BP0252902
Gowerton	GOWERTON WWTW VICTORIA ROAD GOWER	BW2304001
Llanelli	Llanelli STW Storm	BP0252602

For discharges that have not received any upgrades, it is likely that the patterns of spills have remained similar given that the rainfall patterns have not changed significantly since the publication of the original survey (see Section 5). The most at-risk areas to storm overflows remain the most up-estuary CZs and those on the northern shore where several intermittent discharges are still located.

The 2012 sanitary survey did not identify any private discharges to water. Based on the most recent permit database, there are several discharges throughout the catchment. The discharges most likely to impact the production area that are those close to the northern shore of the estuary in Llanelli, as well as those that drain into the marshes on the southern shore.

Overall, the changes to the sewage network within the Burry Inlet catchment that have occurred since the publication of the original sanitary survey are minor, and as such the recommendations made in the original survey for RMP position remain valid.

3.3 Agricultural Sources

Most of the Burry Inlet catchment is rural in nature, particularly on the southern shore of the inlet and in the northern reaches of the catchment. Figure 3.4 and Table 3.3 show the changes in livestock populations within Local Authorities wholly or partially contained within the Burry Inlet catchment from 2012 to 2017 (no more recent data are available) (StatsWales, 2020). As only a proportion of each district falls within the catchment, the livestock data have been adjusted to reflect the proportion of each district that is within the catchment. This assumes that livestock are distributed uniformly throughout each district and, therefore, some inaccuracies in the data may be present.

The total livestock population within the catchment decreased by more than 54% between 2012 and 2017. However, the population of poultry in the Swansea district decreased by more than 98% between 2012 and 2017. If this groups' data is removed, the overall change is a 10% increase. Pig populations also decreased significantly (-22%), though cattle populations remained stable (+0.2%) and sheep populations increased by 13.7%. Carmarthenshire saw the biggest increase in livestock populations (+10.59%) and Swansea the biggest decrease (-80.22%), though much of the decrease in Swansea population numbers are attributable to the drop in poultry numbers. Livestock population densities have dropped by half, though remain high at on average more than 116 animals / km^2 (in 2017).

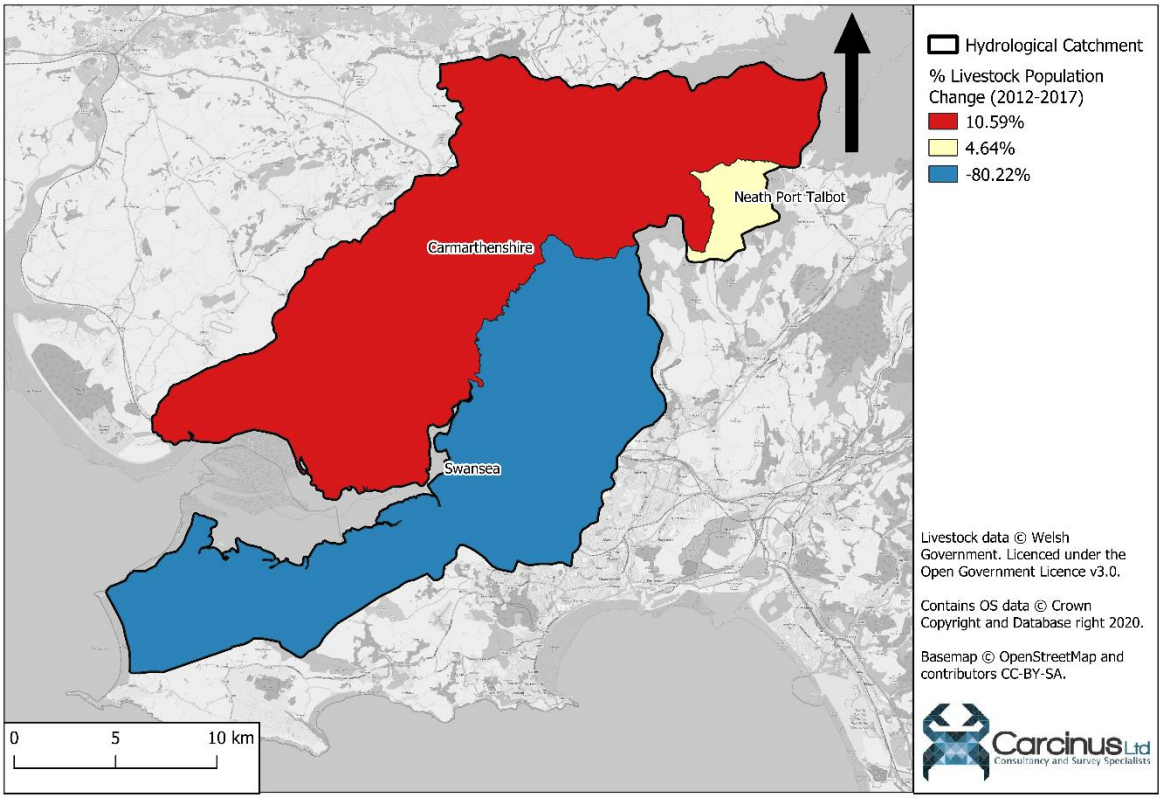

Figure 3.4 Change in the livestock populations of Local Authority districts wholly or partially within the Burry Inlet hydrological catchment (2012 - 2017).

Livestock-borne pollution causes contamination of shellfish waters principally through runoff. Runoff from areas of pasture in the north of the catchment will drain into watercourses up-stream of the main estuary, so higher levels of faecal indicator organisms will likely be seen in the upper-estuary.

Peak concentrations of these bacteria will be found in watercourses receiving substantial run-off, particularly when significant rain follows a dry period. In addition to the pasture in the north of the catchment, the saltmarsh that covers the southern shore of the inlet is used by grazing livestock, particularly sheep. The 2012 sanitary survey indicated that this grazing activity (and associated faecal contamination) occurs year-round, with peak levels April – October with 4000-6000 animals. Updated data for this area of saltmarsh is not freely available, though the overall population of sheep within the Swansea district increased by 15% between 2012 and 2017. This area remains therefore a potentially significant source of faecal contamination, as run-off and tidal inundation carries faecal matter into the water column. Contamination will continue to vary seasonally, with populations (and associated contamination) likely to be highest in Spring when new animals are born, and lowest in Autumn when animals are sent to market. Overall, the timing, high-risk locations and extent of contamination from livestock have remained similar to that described in the 2012 sanitary survey. Since the publication of the original sanitary survey, no significant changes to the livestock populations (and associated faecal loading to the estuary) have taken place. Accordingly, the recommendations made in the original sanitary survey to capture this source of contamination remain valid.

Table 3.3 Livestock data for Local Authority Districts wholly or partially contained within the Burry Inlet catchment in 2012 and 2017.

Local Authority	Area Within Catch-ment km²	% of LA within catch-ment	% of total catch-ment area	Livestock Numbers (Adjusted)											
				Cattle			Pigs			Sheep			Poultry		
				2012	2017	% change	2012	2017	% change	2012	2017	% change	2012	2017	% change
Carmarthenshire	699.35	10.93%	56.43%	20631	21095	2.3%	197	166	-15.6%	78998	89423	13.2%	5141	5404	5.1%
Neath Port Talbot	34.123	2.91%	2.75%	180	161	-10.4%	5	6	26.5%	2244	2444	9.0%	122	57	-53.5%
Swansea	505.87	46.34%	40.82%	6689	6303	-5.8%	551	415	-24.7%	36291	41754	15.1%	223574	4369	-98.1%
Totals	**1239.35**		**100.00%**	**27500**	**27559**	**0.2%**	**752**	**587**	**-22.0%**	**117533**	**133621**	**13.7%**	**228838**	**9830**	**-95.7%**

3.4 Wildlife

Burry inlet contains a diverse range of habitats that support several important species. The entire estuary is a constituent part of the Carmarthen Bay Special Area of Conservation (SAC), as well as being designated a Special Protection Area (SPA), a Ramsar site and containing several Sites of Special Scientific Interest (SSSI). Part of the Whiteford Burrows National Nature Reserve is located at the mouth of the Inlet. The inlet also contains the largest continuous area of saltmarsh in Wales. This, along with the presence of other key habitats such as intertidal mudflats, makes it a popular overwintering location for wading birds. In the five years leading up to the 2012 sanitary survey, the average total count of waterbirds was 41,518. The five-year moving average based on the most recent survey (2018/2019) (Frost *et al.*, 2020) is 51,316 (an increase of 23.6%).

Several of the overwintering species present in Burry Inlet are dependent on bivalve molluscs as a food source. The birds will therefore forage (and defecate) on mollusc beds within the inlet over the winter months, representing a significant diffuse source of microbiological contamination. The most-affected locations within the inlet will vary year-on-year as the distributions will vary depending on the areas that have the optimal food resource. As identified within the original sanitary survey, contamination will likely be greater in winter months when populations are higher, but specifying the location of specific RMPs to capture the contamination from these sources is not possible due to the spatial and temporal variability of contamination (diffuse and variable by season).

West Wales is home to a strong population of grey seals (Langley *et al.*, 2020). The closest colony to Burry Inlet is at Caldey Island, approximately 30 km west of the Inlet. Grey seals forage over wide areas but return to the same locations to breed each year, therefore it is likely that animals still use the Inlet for foraging. No up-to-date population estimates for either the colony itself or the inlet are available but given the probable low numbers and large spatio-temporal variability, the impact of seals does not need to be factored into the sampling plan.

Whilst there has been a significant increase in the bird populations of the estuary since the original sanitary survey, their unpredictable spatial distribution makes it challenging to choose RMP locations that will consistently capture this source of pollution. No other wildlife species are likely to represent a significant source of contamination and, as such, the recommendations for RMP location made in the original sanitary survey are still valid.

3.5 Boats and Marinas

The discharge of sewage from boats is a potentially significant source of bacterial contamination of shellfisheries within Burry Inlet. Boating activities in the area have been derived through analysis of satellite imagery and various internet sources and compared to that described in the original sanitary survey.

Boating activity within the Inlet is restricted by the fact that much of the estuary is very shallow or intertidal. Whatever boating activity is present, is likely centred around Burry Port Marina (SN446001). The marina has 450 berths which can accommodate vessels from 6 m to 10 m in length (The Marine Group, 2020). The marina has a variety of services, though no pump out facilities are present at the marina (the closest pump out facilities are 20 km (as the crow flies) in Swansea marina (The Green Blue, 2020)). The marina is only accessible for two hours either side of High-Water, and traffic to and from the marina will follow the same routes, mainly down the central

channel (The Marine Group, 2020). It is unlikely that vessels will travel further up the estuary. Boat traffic is likely to be highest in summer months.

There have been no changes to the legislation governing overboard discharges from vessels, with restrictions placed on commercial vessels against overboard discharges within three nautical miles of land and guidance given to pleasure craft to follow the same advice (RYA, 2020). Private vessels of a sufficient size may still make occasional overboard discharges, either when moored / anchored overnight or when navigating through the calm of the estuary. The areas of the BMPA most at risk of contamination from boat-borne pollution remain the navigation routes through the estuary to and from the marina, as well as within the marina itself. Peak activity levels will continue to be during summer months and so associated impacts will occur seasonally as well. The original sanitary survey did not make specific recommendations for the sampling plan to be based on this source of contamination due to the uncertainty about the extent and precise locations of any discharges. The same is true for the updated sampling plan as part of this report.

Boating activity is considered unlikely to have changed significantly since the publication of the original sanitary survey, due to the restrictive topography / bathymetry of the estuary. As such, the recommendations for RMP location made in the original survey to capture this source of pollution are still valid.

3.6 Other Sources of Contamination

Urban fabric within the catchment remains centred around the town of Ammanford in the north of the catchment and the north west limits of Swansea, as well as the towns of Llanelli, Burry Port and Loughor on the banks of the estuary. Settlements near waterbodies represent a potential source of diffuse pollution via utility misconnections.

Some dog walking may well take place around the coastline, particularly on the north shore where the Millennium Coastal Path follows the coastline. Dog fouling may represent a potential diffuse source of pollution to the near-shore coastal zone, but the locations and extents have likely remained the same as at the time of the original sanitary survey.

No evidence of significant changes to these sources of contamination exists. Therefore, it can be assumed that the RMP location recommendations made in the original sanitary survey will still capture the influence of these sources.

4 Hydrodynamics/Water Circulation

The fundamental structure of Burry Inlet has not changed since the original sanitary survey was completed in 2012. The estuary remains a macro-tidal estuary, with a main river channel flanked on both sides by shallow mudflats that dry out at low tide. Peak tidal velocities occur at the estuary mouth, where a spit at Whiteford Point reduces the estuary width to 3 km from 6km beyond the spit. Flood velocities are 1.6 ms^{-1} and ebb velocities are 1.9 ms^{-1} (Robins, 2009). The north bank of the estuary is flanked with hard coastal defences, whereas the southern shores comprise an extensive saltmarsh. Drainage channels flow through the intertidal areas which may carry contamination from the land and diffuse pollution from feeding waterbirds. The original sanitary survey cited the modelling work done by Robins (2009), no updated modelling has been completed and it is assumed that patterns of tidal flow remain similar.

It is unlikely that any minor changes to the hydrodynamics of the Loughor estuary since the original sanitary survey will have significantly affected the circulation of contamination in the estuary; most contamination will still be carried from the main rivers into the main body of the estuary, particularly during ebbing tides. Therefore, no changes to the RMPs are recommended.

5 Rainfall

Rainfall data from the Loughor monitoring station (NGR: SN623126) from 2002 – 2010 (pre sanitary survey) and 2011-2017 (post sanitary survey) were used to determine whether any changes in rainfall patters have occurred since the original Burry Inlet sanitary survey. Figure 5.1 shows the average daily rainfall totals each month and Table 5.1 shows the annual summaries for the pre- and post- sanitary survey periods at the Loughor monitoring station. Whilst rainfall has been slightly lower since the publication of the original sanitary survey, two sample t-tests revealed that there was no significant difference in mean daily rainfall per month ($p = 0.88$) between the 2002 – 2010 and 2011 – 2017 periods.

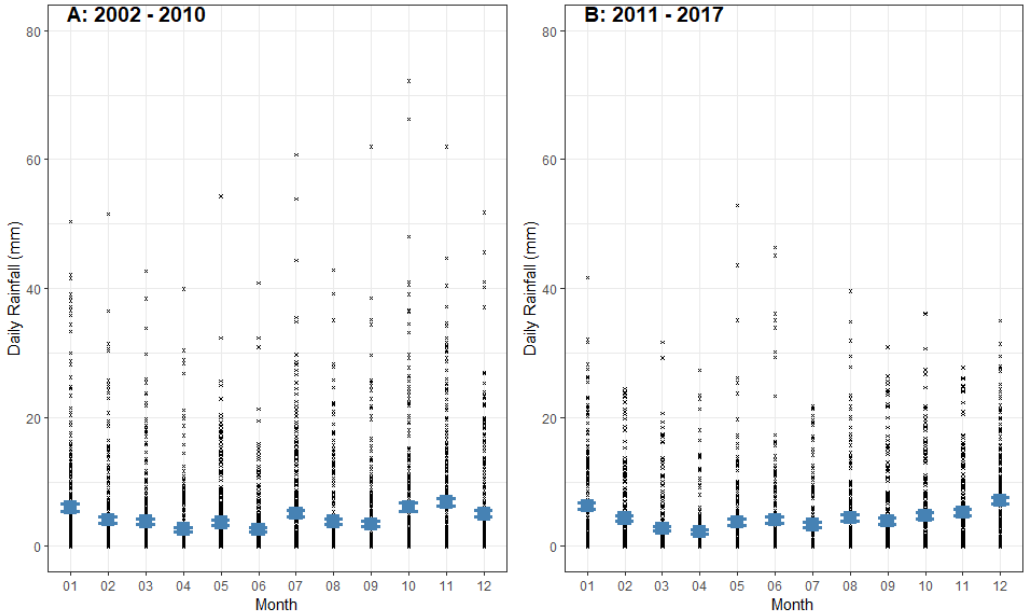

Figure 5.1 Average daily rainfall for a given month at the Loughor monitoring station (NGR: SN623126) for the period prior to and following the 2012 sanitary survey.

Table 5.1. Summary statistics for rainfall before and after the 2012 sanitary survey.

Period	Mean Annual Rainfall (mm)	% Dry Days	% Days > 10 mm rainfall	% Days > 20 mm rainfall
2002 - 2010	1618.29	31.03	39.12	23.49
2011 - 2017	1586.19	25.19	42.75	26.16

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 consistent across the two time periods, significantly increased bacterial loading due to these factors are 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

Official Control Monitoring data from Representative Monitoring Points within the Burry Inlet were taken directly from the Cefas data hub[1]. At the time of analysis, a total of six RMPs had been sampled within the Burry Inlet since the original sanitary survey was published[2]. Two of these are for mussels (*Mytilus* sp.) and four are for cockles (*Cerastoderma edule*). Sampling at only two of these stared after the original sanitary was published; Llanelli seafront (B038Y) was sampled from May 2013 until December 2018, after which sampling began at Burry Port (B38AI) to classify the *Northside: West* Classification Zone (CZ). The original sanitary survey gave recommendations for several RMPs for both mussels and cockles, few of which are currently sampled. The geometric mean results of shellfish flesh monitoring from all RMPs sampled since the original sanitary survey are presented in Figure 6.1. Table 6.1 shows the summary statistics for all RMPs sampled within the Burry Inlet since 2003.

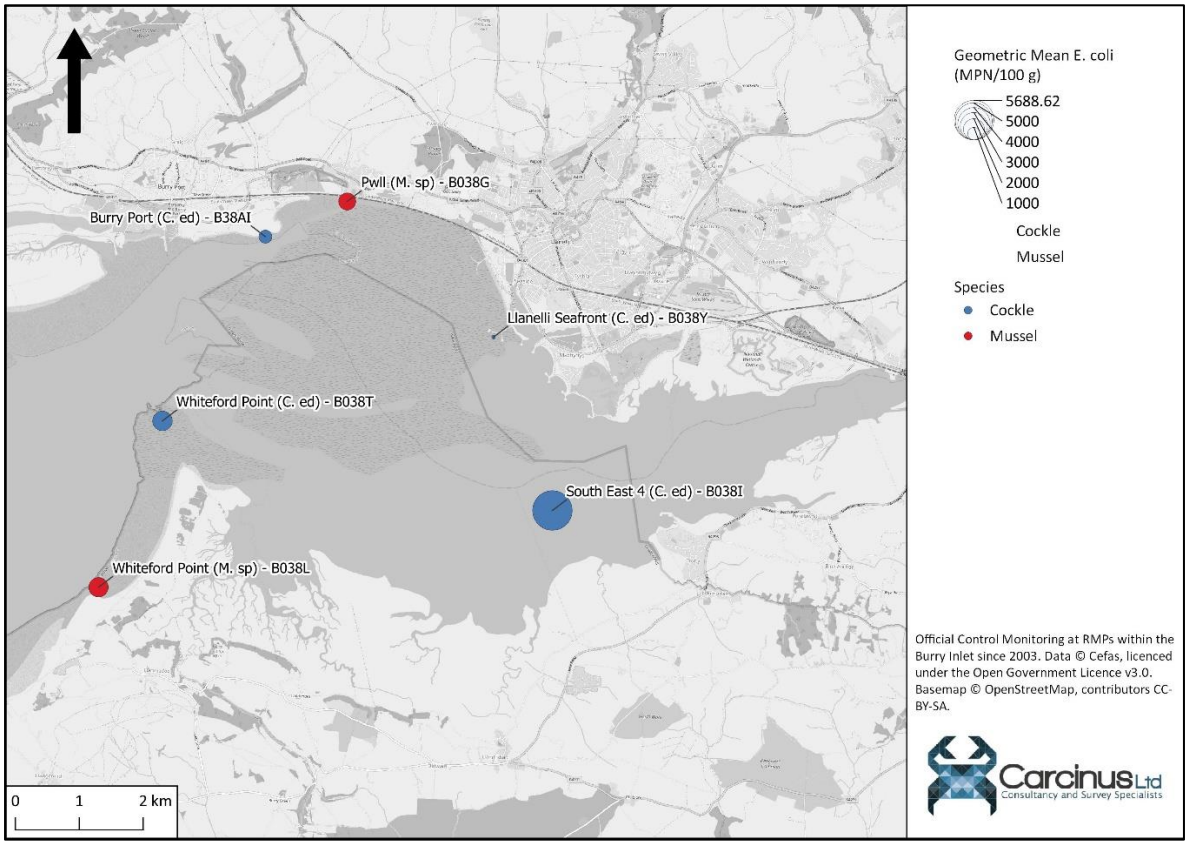

Figure 6.1 Bivalve RMPs active since 2003, with geometric mean E. coli (MPN/100g) values.

E. coli levels exceeded 4,600 MPN / 100g in more than 10% of samples at two RMPs within the Burry Inlet; South East 4 (B038I) and Whiteford Point (B038T). South East 4 (B038I) is also one of only two RMPs where *E. coli* results have exceeded 46,000 MPN/100 g. There does not appear to be a difference in *E. coli* levels between samples from different species. In general, *E. coli* results from the south side of the estuary are greater than those from the northern side, perhaps reflecting greater connectivity between waters on the southern shores and the land-borne pollution.

[2] Note, the Cefas data hub does not hold the data of RMPs where sampling stopped more than 6 years ago.

Table 6.1 Summary Statistics of E. coli results (MPN / 100g) from RMPs sampled from 2003 onwards. Where raw data reported values of < LoD, these have been taken at face value..

Site (Species)	NGR	Species	No.	First Sample	Last Sample	*E. coli* MPN/100 g					
						Geometric Mean	Min Value	Max Value	% > 230	% > 4,600	% > 46,000
Pwll (M. sp) - B038G	SN47290073	Mussel	202	06/01/2003	15/03/2021	1,495.77	18	24000	67.33	7.43	0.00
South East 4 (C. ed) - B038I	SS50509590	Cockle	189	07/01/2003	17/03/2021	5,688.62	20	180000	80.95	27.51	2.12
Whiteford Point (M. sp) - B038L	SS43409470	Mussel	193	07/01/2003	15/03/2021	1,778.93	18	54000	52.33	7.77	0.52
Whiteford Point (C. ed) - B038T	SS44409730	Cockle	167	05/04/2004	15/03/2021	1,810.30	18	18000	47.31	10.78	0.00
Llanelli Seafront (C. ed) - B038Y	SS49589861	Cockle	62	20/05/2013	10/12/2018	593.73	18	5400	59.68	1.61	0.00
Burry Port (C. ed) - B38AI	SN46010018	Cockle	22	07/01/2019	15/03/2021	1,066.27	20	4900	68.18	4.55	0.00

Box plots of *E.* coli monitoring results for RMPs sampled for mussels and cockles in the Burry Inlet since 2003 are presented in Figure 6.2 and Figure 6.3 respectively. The highest geometric mean *E. coli* level in mussel RMPs was found at the Whiteford Point (B038L) RMP, 1,778.93 MPN/100g. However, one-way analysis of variance (ANOVA) testing revealed no significant differences between any of the mussel RMPs (p = 0.54).

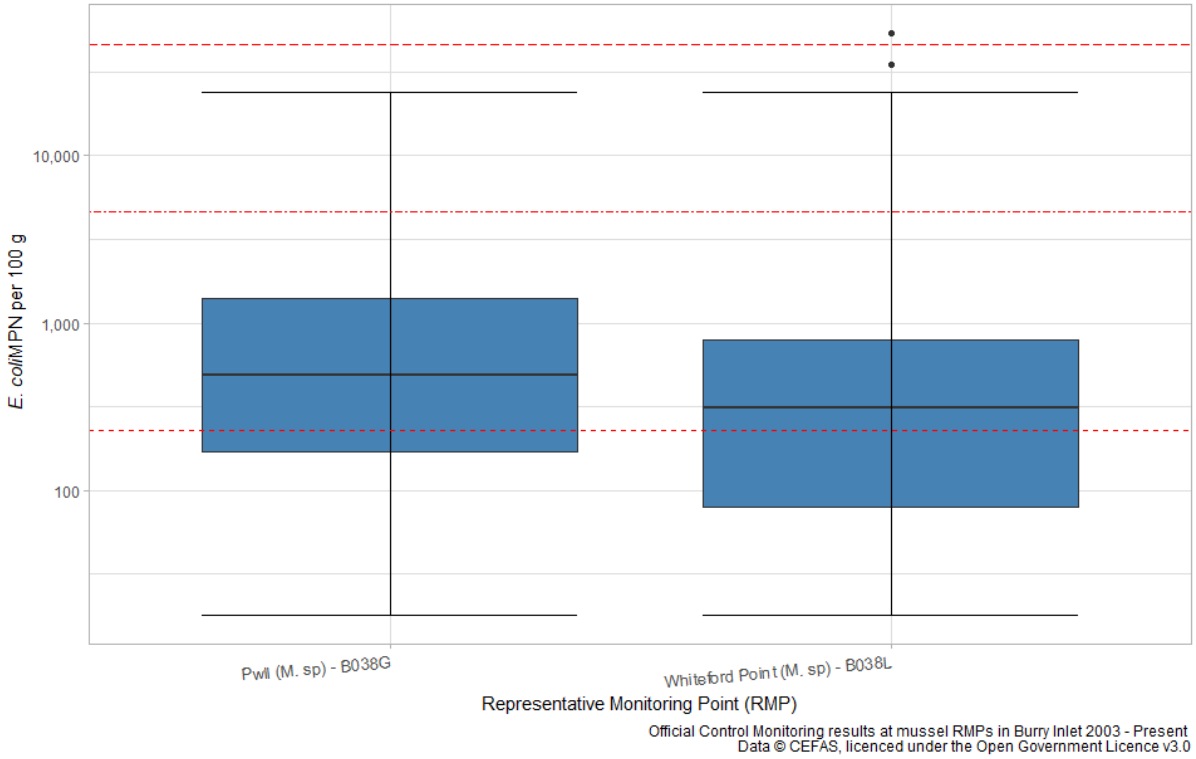

Figure 6.2 Boxplots of E. coli levels at Mussel RMPs sampled within Burry Inlet 2003 – Present. Central line indicates median value, box indicates lower – upper quartile range and whisker indicates minimum/maximum value, excluding (> 1.5 x interquartile range).

The highest geometric mean *E. coli* level in cockle RMPs was found at South East 4 (B038I) (Figure 6.3), 5688.62 MPN/100g, where the mean result was more than double that of the other cockle RMPs in the inlet. More than 26% of the samples from this RMP were greater than the 4,600 MPN/100g required for Class B, and a further 2.12% were greater than 46,000 MPN/100g. One-way ANOVA tests indicated that the *E. coli* results from this RMP were significantly greater than the results from Llanelli Seafront (B038Y) (p = 0.0052) and Whiteford Point (B038T) (p = 0.0030). No other significant differences were found in the data.

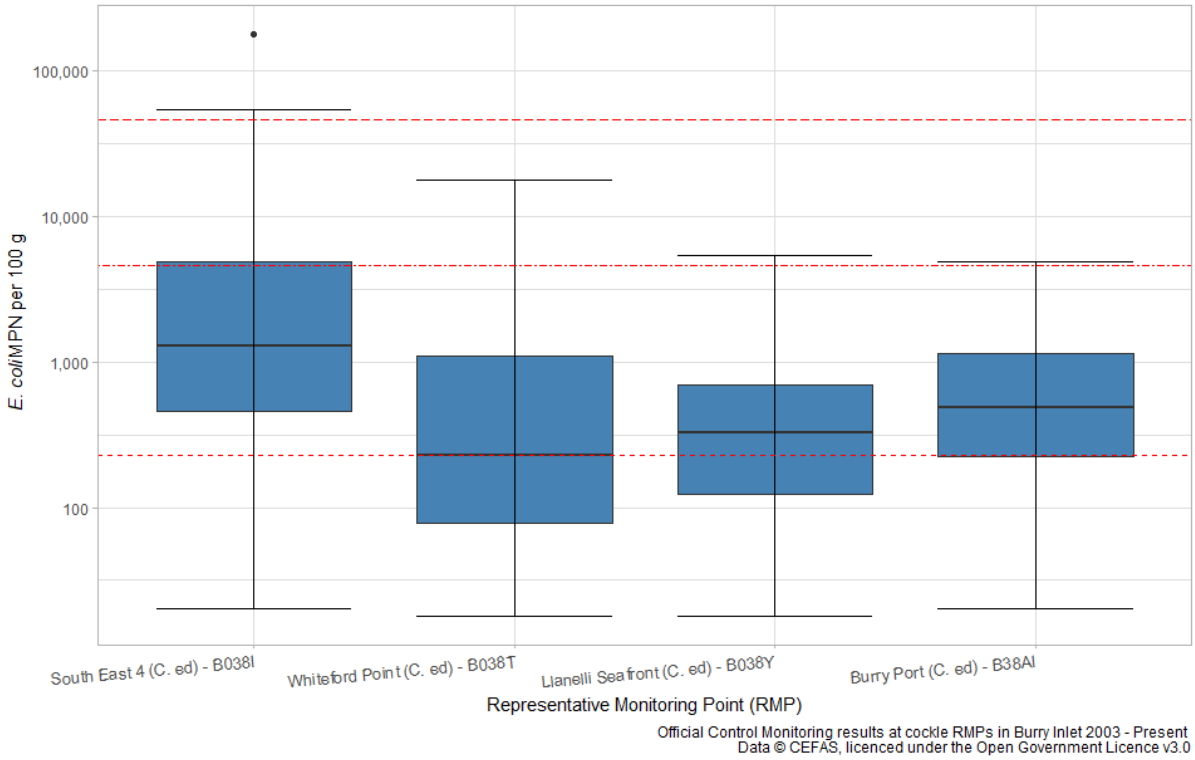

Figure 6.3 Boxplot of E. coli levels at Cockle RMPs within Burry Inlet 2003-Present.

6.2 Overall temporal pattern in results

The overall temporal pattern in shellfish flesh monitoring data for mussel and cockle RMPs within the Burry Inlet are presented in Figure 6.4 and Figure 6.5 respectively. Both RMPs were sampled prior to the publication of the original sanitary survey. Monitoring results from Whiteford Point (B038L) increased until approximately 2010, where they remained relatively stable until 2017, after which they have shown a trend of decreasing *E. coli* levels. Monitoring results at the Pwll (B038G) have shown the opposite trend, falling from 2003 – 2013 and then increasing until the present. However, there is a wise scatter in the results and the trend lines generally fall between the lower (230 MPN/100 g) and middle (4,600 MPN/100 g) thresholds.

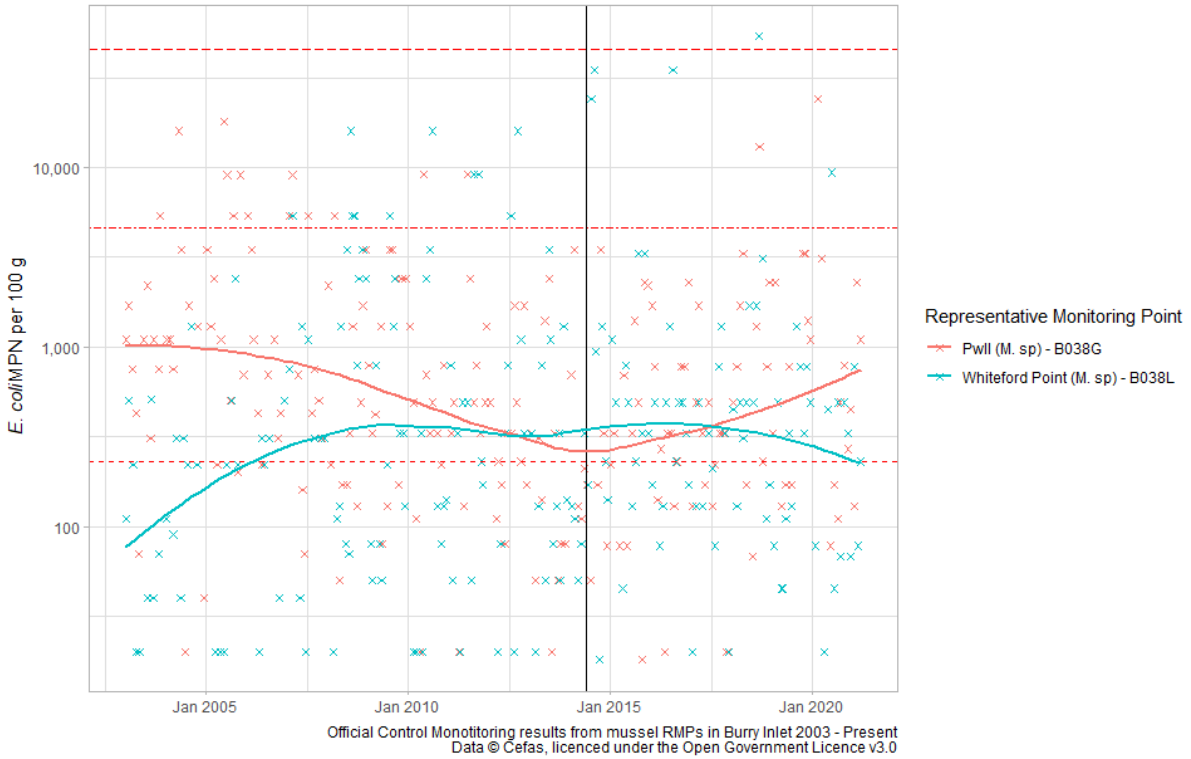

Figure 6.4 Timeseries of E. coli levels at mussel RMPs sampled within Burry Inlet 2003 – Present. Scatter is overlaid with Loess model fitted to data.

Two cockle RMPs were sampled prior to the publication of the original sanitary survey. South East 4 (B038I) consistently returned higher results than Whiteford Point (B038T), with an increase until approximately 2010 before remaining relatively consistent since then (Figure 6.5. Monitoring results from the Llanelli Seafront (B038Y) RMP remained relatively consistent for the five years it was sampled, with the trend line falling around the lower threshold of 230 MPN/100 g. The scatter of results from the Burry Port (B38AI) RMP (which replaced the Llanelli Seafront (B038Y) RMP) has been broadly similar, although the trend line is less stable as the RMP has only been sampled for two years. Whiteford Point (B038T) has returned broadly consistent results since sampling began at this RMP in April 2004.

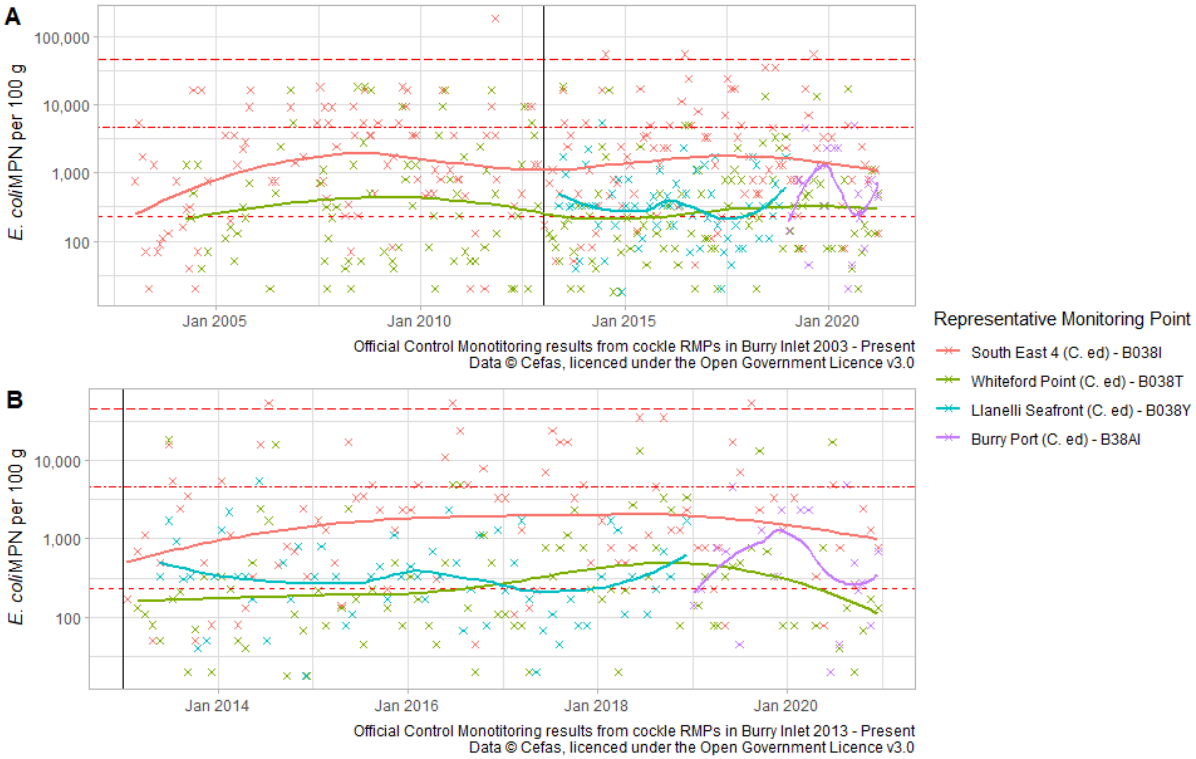

Figure 6.5 Timeseries of E. coli levels at Cockle RMPs sampled within Burry Inlet 2003 – Present (A) and 2013 – Present (B).

6.3 Seasonal patterns of results

The seasonal patterns of *E. coli* monitoring results from 2003 – present at each RMP were investigated. The data from mussel RMPs are presented in Figure 6.6 and for cockles in Figure 6.7. The data for each year was 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, considering firstly pooled data from all RMPs, and secondly looking for differences within RMP. Only significant results between seasons for the same RMP, or excluding RMP as a factor, have been reported. Significance has been taken at the 0.05 level.

When considered collectively, results from mussel RMP samples collected during summer months were significantly higher than those collected in spring ($p = 0.011$), autumn ($p = 0.006$) and winter ($p = 0.03$) months (Figure 6.6. The only differences between season for individual RMPs were found at Whiteford Point (B038L), where results collected in summer months were significantly greater than at all other times of year ($p = 0.00029$, $p = 0.00029$ & $p = 0.00011$) compared to, Spring, Autumn and Winter respectively). No other significant seasonal differences within individual RMPs were found.

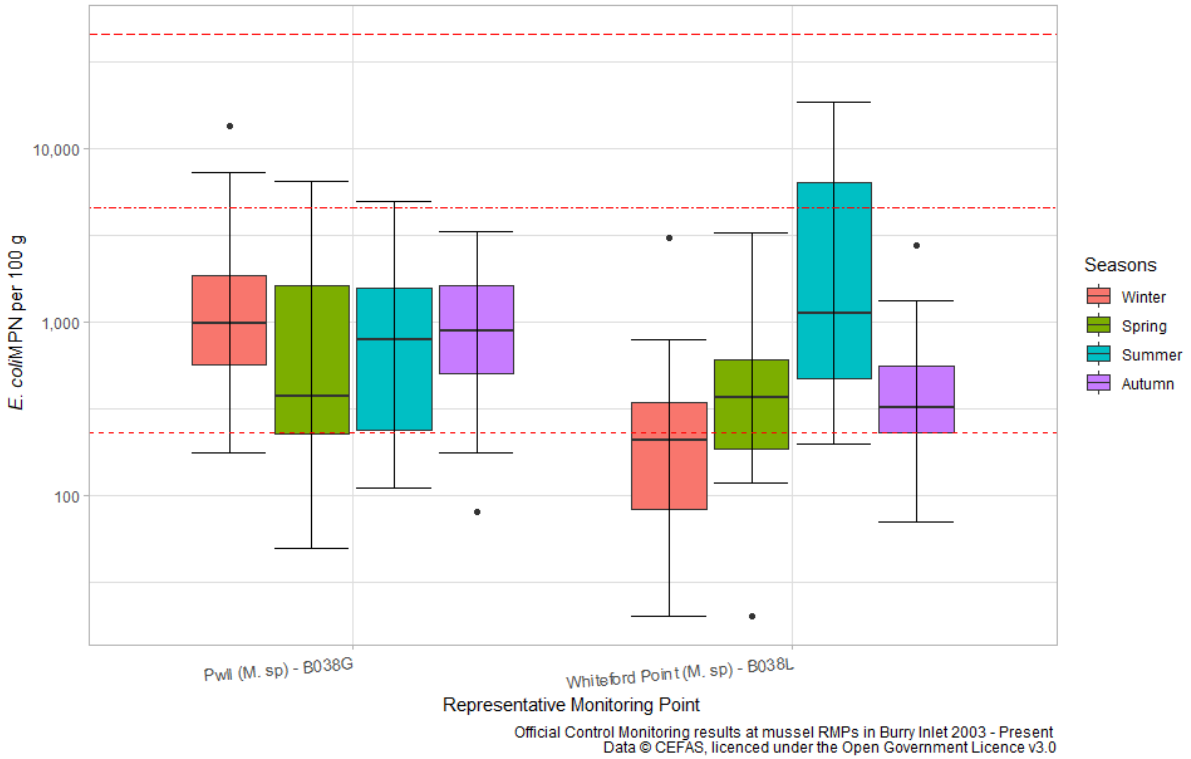

Figure 6.6 Seasonal variation in E. coli levels at Mussel RMPs sampled within Burry Inlet 2003-Present. Winter is the averaged value for the results from January – March, Spring: April – June, Summer: July – September and Autumn: October – December.

The results from cockle RMP samples collected during summer months were significantly greater than those collected during spring months (p = 0.0089) (Figure 6.7). No other significant differences between seasons were found when RMPs were pooled. When RMPs were considered individually, only samples collected from Southeast 4 (B038I) were significantly greater in one season than others. Samples collected in summer from this RMP were significantly greater than samples collected in winter (p = 0.011). No other significant differences were found.

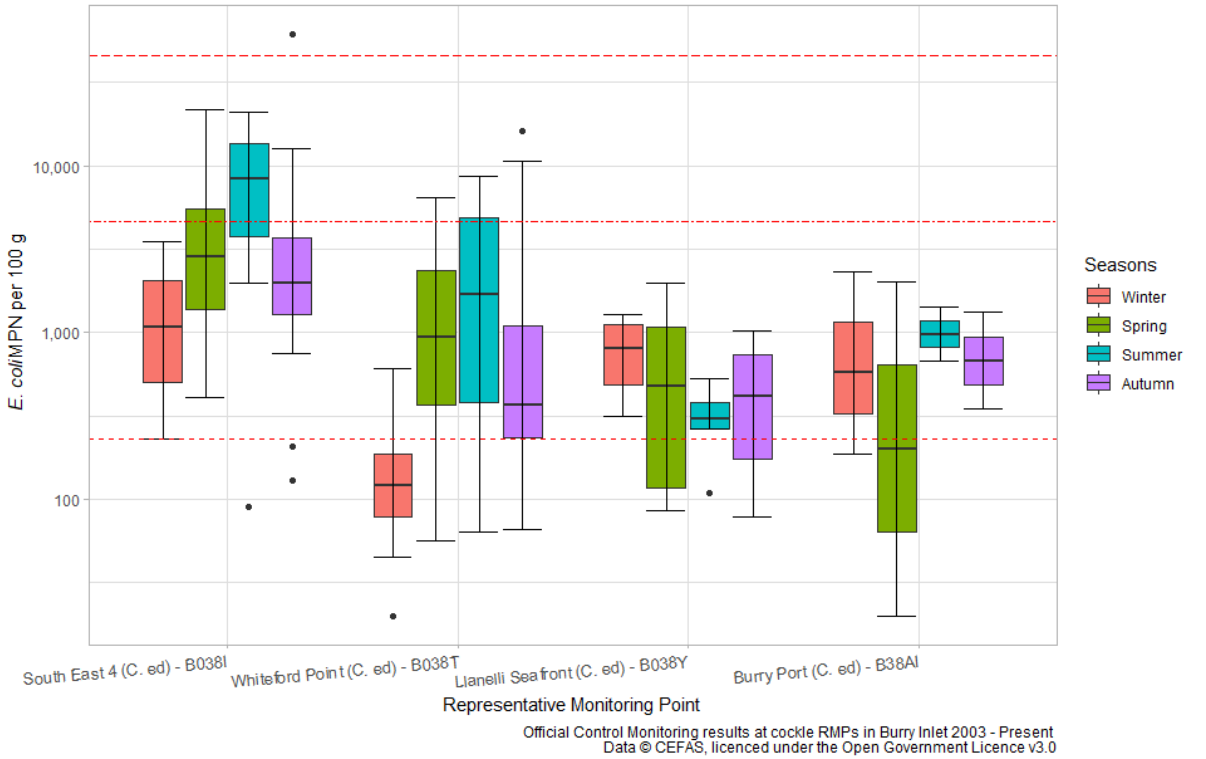

Figure 6.7 Seasonal variation in E. coli levels at Cockle RMPs sampled within Burry Inlet 2003-Present. Winter is the averaged value for the results from January – March, Spring: April – June, Summer: July – September and Autumn: October – December.

7 Conclusion and overall assessment

Annual mass-mortalities of the naturally occurring cockles within the estuary have occurred since the turn of the millennium, resulting in the population being mainly made up of Year 1 cockles. The fishery is managed by NRW, who conducts regular monitoring to set the Total Allowable Catch (TAC) for this species to the 36 licence holders operating in the fishery. In addition to the cockle fishery, there is a commercial mussel fishery operating around Whiteford Point. The CZs on the north side of the estuary and around Whiteford Point hold LT-B or B classifications. The remaining CZs, located within the inner estuary on the southern side of the estuary hold a C classification, which is preliminary for the Dalton's Point and South Mid zones. The original sanitary survey indicated plans to harvest soft shell clams in waters near to the northern shore of the estuary, though no current commercial activity is taking place with respect to this species.

The human population resident in or near to the hydrological catchment increased by 7.57% between the 2001 and 2011 censuses. The increase generally occurred around the urban areas of the catchment, though much of the catchment remains very sparsely populated (<5 persons per hectare). Increases to population will almost certainly have led to an increase in sewage discharge volumes within the catchment, particularly via spill events if no major upgrades to the continuous discharges have occurred.

There have been few significant changes to the sewerage network in the Burry Inlet catchment. There is a single additional continuous discharge and some changes to the intermittent discharges on the northern shore. There have been some upgrades to the storm overflow network in these areas, which will mean that the frequency and extent of spill events are reduced, particularly as the

patterns of rainfall have remained similar. The original sanitary survey did not identify any private discharges, however there is a cluster in Llanelli on the northern side of the estuary and some that will drain through the marshes on the southern side of the estuary that may cause additional contamination.

Much of the catchment remains rural, with large areas of pasture in the north of the catchment and on the southern bank of the inlet. The total livestock population for districts within the catchment decreased 54% from 2012 and 2017, though most of this decrease can be attributed to a 98% decline in poultry in the Swansea district (without this data, livestock population increased 10%). The primary route of pollution from livestock will remain run-off from pasture in the north of the catchment into water courses affecting up-estuary areas. Additionally, grazing on the saltmarsh on the southern shore of the catchment may continue to lead to pollution through run-off and tidal inundation.

Burry Inlet holds the largest continuous area of saltmarsh in Wales, as well as a variety of other habitats that support internationally important populations of wading birds and other species. The five-year average count of wading birds in the estuary to 2019 was 51,316, an increase of 23% on the five-year average reported in the original sanitary survey. Hotspots of contamination from these species will remain similar to that previously assessed, as will the timing of the highest level of pollution and so are likely captured in the current sampling plan.

The hydrography of Burry Inlet restricts the navigation possible by boats. The size of the marina at Burry Port has remained the same, and no pump-out facilities have been added. No legislative changes to permitted discharges from recreational vessels have occurred, and occasional overboard discharges within the marina and the main navigational channels may still occur, as identified within the previous survey.

A total of six RMPs have been sampled in the Burry Inlet since the publication of the original sanitary survey (five were sampled prior). *E. coli* levels have generally remained stable, falling between the lowest threshold of 230 MPN/100g and the middle threshold of 4,600 MPN/100 g. There appears to be a slight trend of higher results from RMPs on the south side of the estuary, perhaps reflecting greater connectivity between land-borne pollution and the shellfish waters. Additionally, there appears to be a trend of higher *E. coli* results in summer months than at other times of year, though not to the extent that a seasonal classification would be appropriate for the classification zones in Burry Inlet.

Based on the information available, there does not appear to have been any significant changes to the sources of contamination into this estuary since the publication of the original sanitary survey. The authors of this review have not identified any knowledge gaps (other than that described in the subsequent section) that would justify a full shoreline survey. There are only minor recommendations made for an updated sampling plan, and results from a shoreline survey are unlikely to provide additional information that would be necessary to make the recommendations.

Having reviewed the recommendations of the 2020 report and compared with the findings of the 2012 sanitary survey review for the Burry Inlet, the FSA are content that the level of risk posed by the findings is low and does not warrant a further review of the existing shoreline assessment.

8 Sampling plan

8.1 Recommendations

8.1.1 Cockles (*Cerastoderma edule*)

Consultation with the Local Authorities indicated that commercial harvesting in the Inlet is focussed on the *Whiteford Point* and the classification zones on the southern side of the estuary, *South Mid and Southside: South East 4*. The wild cockle beds are temporally variable, particularly as most cockles are Year 1 and so not necessarily built upon existing stocks. Monitoring for classification continues therefore to allow for movement in high stock densities. Most of the inlet is governed by the Burry Inlet Cockle Fishery Order 1965. The original sanitary survey divided the inlet into six classification zones, three on the north side and three on the southside, to represent varying sources of pollution in relation to the large naturally occurring cockle fishery. The western and eastern CZs on the north side are no longer classified, and some changes to the boundaries proposed in the original sanitary survey have occurred.

The extents of the CZs for cockles should remain unchanged from the current sampling plan, with the exception of the *Whiteford Point* CZ. At present the zone covers an area both within the Estuary, subject to contamination sources from within the catchments of the Great Pill, and an area within the outer estuary. Recommendations for this, and other CZs are described in the following paragraphs.

Whiteford Point

This CZ represents the western edge of the inlet and is classified for both cockle and mussel harvesting. The current cockle RMP is currently located 750 m North-north west of the sand-spit that restricts the mouth of the estuary. The RMP proposed in the original sanitary survey was located at the mouth of the Burry Pill and Great Pill drainage channels, though consultation with the LAs indicated that this RMP was never used due to a lack of stock. We recommend dividing this zone into two, *Whiteford Point East & West (Cockles)* with the boundary a line drawn North from SS 44750 96633 (near Whiteford Point at the mouth of the estuary) (Figure 8.1). Recommendations for these zones are given below.

Whiteford Point West (Cockles)

This zone will represent the western half of the original *Whiteford Point* zone and covers the area on the outside of the main estuary. It is recommended that this zone inherit the classification from the original zone as the RMP should remain the same; Whiteford Point (B038T) (Figure 8.1) as this is likely to be representative of the main sources of contamination to this zone.

Whiteford Point East (Cockles)

This zone will represent the eastern half of the original *Whiteford Point* zone and covers the area on the inside of the main estuary. The 2020 cockle stock assessment indicates that limited stock exists in this area. If industry requires a classification for this zone, the RMP should be placed in the same location as recommended in the original sanitary survey, around SS 4601 9609, to capture contamination from the Burry Pill and Great Pill drainage channels (Figure 8.1).

South Mid

This CZ approximately matches the boundaries of the Burry South (Central) CZ proposed in the original sanitary survey. The RMP for this CZ does not currently fall within its boundaries, as both this CZ and the *Southside: South East 4* CZ are classified on data from the South East 4 RMP, which was

already sampled at the time of the original sanitary survey. The existing RMP is considered to be representative of the range of sources from the upper estuary along with the sources located to the south of the *Southside: South East 4* zone, including the Llanridian Pill drainage channel.

Southside: South East 4

This CZ approximately matches the Burry South (East) CZ as described in the original sanitary survey, though its boundaries have been moved slightly westwards and the *Dalton's Point* CZ is located to the east. It is currently classified using samples taken from the South East 4 RMP, the position of which is designed to capture contamination from the Llanridian Pill drainage channel. The existing RMP is considered to be representative of the range of sources from the upper estuary along with the sources located to the south of the Southside: South East 4 zone, including the Llanridian Pill drainage channel.

Dalton's Point

This CZ is the furthest east of any in the Burry Inlet. It has periodically been classified in the last 20 years, and currently holds a preliminary classification. The RMP from which monitoring samples are currently collected is the same as the *South Mid* and *Southside: South East 4* zones, South East 4 (B038I) This RMP is considered to be representative of the main contaminating influences on this zone.

Northside: West

This CZ approximately matches the Burry North (Central) CZ proposed in the original sanitary survey, with its eastern boundary moved slightly westwards. It is currently classified using samples from the Burry Port (B38AI) RMP, which replaced the Llanelli Seafront (B038Y) RMP, whose location was proposed in the original sanitary survey to capture contamination from Lleidi, Dafen and intermittent discharges from Llanelli Seafront. The existing RMP is representative of the highest risk sources of , draining from the northern shore of the inlet.

8.1.2 Mussels (Mytilus sp.)

Current industry focus on mussel harvesting in the Burry Inlet is centred around *Whiteford Point* CZ at the mouth of the Inlet. The six CZs proposed in the original sanitary survey (see Figure 2.2) were intended for classification of both wild cockle and mussel fisheries, though currently only Whiteford Point and Pwll are classified for mussel harvesting.

The extents of the CZs for mussels should remain unchanged from the current sampling plan, with the exception of the *Whiteford Point* CZ, at present the zone covers an area both within the Estuary, subject to contamination sources from within the catchments of the Great Pill and an area on within the outer estuary. Recommendations for both zones are discussed in the subsequent paragraphs.

Whiteford Point

The boundary of this CZ is the same as the zone classified for cockles. The RMP currently used to classify this bed is located at the southern end of Whiteford Sands. The original sanitary survey proposed the same RMP location for mussels as cockles, at the mouths of the Burry Pill and Great Pill drainage channels to capture contamination from the saltmarsh to the south of the estuary. The recommendation to divide the zone in two halves, with the boundary at a line drawn North from SS 44750 96633 (near Whiteford Point at the mouth of the estuary) (Figure 8.1), that has been given for cockle zones also applies to this zone. Recommendations for these new zones are given below.

Whiteford Point West (Mussels)

The boundaries of this zone should match those of the Cockle zone of the same name. This zone should inherit the classification awarded to the original zone as the RMP (Whiteford Point (B038L)), which should be retained, is likely representative of the main contaminating influences on this zone.

Whiteford Point East (Mussels)

The boundaries of this zone should match those of the Cockle zone of the same name. No mussel stock assessment is available for this estuary; however satellite imagery indicates that the substrates are generally unsuitable for mussel spat settlement. If industry requires a classification for this zone, the RMP should be placed in the same location as recommended in the original sanitary survey, around SS 4601 9609, to capture contamination from the Burry Pill and Great Pill drainage channels (Figure 8.1).

Pwll

This is the smallest CZ within the Burry Inlet and is located entirely within the *Northside: West* cockle CZ. This zone was not proposed in the original sanitary survey but has since been separated from the cockle zone. No current commercial activity is taking place within this zone and classification is based on samples taken from the Pwll (B038G) RMP. This RMP should be retained as it is representative of the main contaminating influences on this zone, which are likely to be shoreline dominated.

8.2 General Information

8.2.1 Location Reference

Production Area	Burry Inlet
Ordnance Survey 1:25,000 map	164 (Gower) 165 (Swansea) 178 (Llanelli & Ammanford)
Admiralty Chart	No. 1167 (Burry Inlet)

8.2.2 Shellfishery

Species / culture	Culture Method	Seasonality of Harvest
Cockles (*Cerastoderma edule*)	Wild (by hand)	No formal closed season
Mussels (*Mytilus sp.*)	Wild (by hand)	No formal closed season

8.2.3 Local Enforcement Authority

Name	Carmarthenshire County Council Ty Elwyn Town Hall Square Llanelli SA15 3AP
Website	https://www.carmarthenshire.gov.wales/home/council-services/environmental-health/
Telephone number	01267 234567
Email	direct@carmarthenshire.gov.uk

Name	Swansea Council Civic Centre Oystermouth Road Swansea SA1 3SN
Website	https://www.swansea.gov.uk/harvestingofshellfish
Telephone number	01792 635600
Email	foodandsafety@swansea.gov.uk

8.2.4 Requirement for review

The Guide to Good Practice for the Microbiological Monitoring of Bivalve Mollusc Harvesting Areas (European Commission, 2017) recommends that sanitary assessments should be fully reviewed every six years. This assessment is therefore due for formal review in 2026. The assessment may

require review in the interim should any significant changes in sources of contamination come to light or any significant changes to the shellfishery occur.

Where recommendations are made in relation to changes to existing monitoring arrangements, monitoring of results should be undertaken to identify any unexpected step changes and reviewed if such changes occur.

Table 8.1. Number and location of Representative Monitoring Points (RMPs) and frequency of sampling for classification zones in the Burry Inlet production area. Proposed changes are highlighted in red. Text that is ~~struck-through~~ indicates a zone to be entirely altered.

Classification Zone	RMP	RMP Name	NGR (OSGB 1936)	Latitude & Longitude (WGS 1984)	Species represented	Growing Method	Harvesting Technique	Sampling Method	Sampling Species	Tolerance	Frequency
~~**Whiteford Point**~~	~~B038T~~	~~Whiteford Point~~	~~SS 4440 9730~~	~~51°39.174'N 4°15.040'W~~	~~Cockles~~	~~Wild~~	~~Hand~~	~~Hand~~	~~Cockles~~	~~10m~~	~~Monthly~~
Whiteford Point West (Cockles)	B038T	Whiteford Point	SS 4440 9730	51° 39.174'N 04°15.040'W	Cockles	Wild	Hand	Hand	Cockles	10 m	Monthly
Whiteford Point East (Cockles)	TBC	TBC	SS 4601 9609	51°38'33"N, 004°13'37"W	Cockles	Wild	Hand	Hand	Cockles	10 m	Monthly
South Mid	B038I	South East 4	SS 5050 9590	51°38.518'N 4°9.717'W	Cockles	Wild	Hand	Hand	Cockles	10 m	Monthly
Southside: South East 4	B038I	South East 4	SS 5050 9590	51°38.518'N 4°9.717'W	Cockles	Wild	Hand	Hand	Cockles	10 m	Monthly
Dalton's Point	B38AB	Ochor Draw	SS 5367 9715	51°39.242'N 4°7.002'W	Cockles	Wild	Hand	Hand	Cockles	10 m	Monthly

Classification Zone	RMP	RMP Name	NGR (OSGB 1936)	Latitude & Longitude (WGS 1984)	Species represented	Growing Method	Harvesting Technique	Sampling Method	Sampling Species	Tolerance	Frequency
Northside: West	B038Y	Llanelli Seafront	SS 4958 9861	51°39.965'N 4°10.584'W	Cockles	Wild	Hand	Hand	Cockles	10m	Monthly
~~**Whiteford Point**~~	~~B038L~~	~~Whiteford Point~~	~~SS 4340 9470~~	~~51°37.756'N 4°15.836'W~~	~~Mussels~~	~~Wild~~	~~Hand~~	~~Hand~~	~~Mussels~~	~~10m~~	~~Monthly~~
Whiteford Point East (Mussels)	B038L	Whiteford Point	SS 4340 9470	51°37.756'N, 004°15.836'W	Mussels	Wild	Hand	Hand	Mussels	10 m	Monthly
Whiteford Point East (Mussels)	TBC	TBC	SS 4601 9609	51°38'33"N, 004°13'37"W	Mussels	Wild	Hand	Hand	Mussels	10 m	Monthly
Pwll	B038Z	Llanelli Seafront	SS 4958 9861	51°39.965'N 4°10.584'W	Mussels	Wild	Hand	Hand	Mussels	10m	Monthly

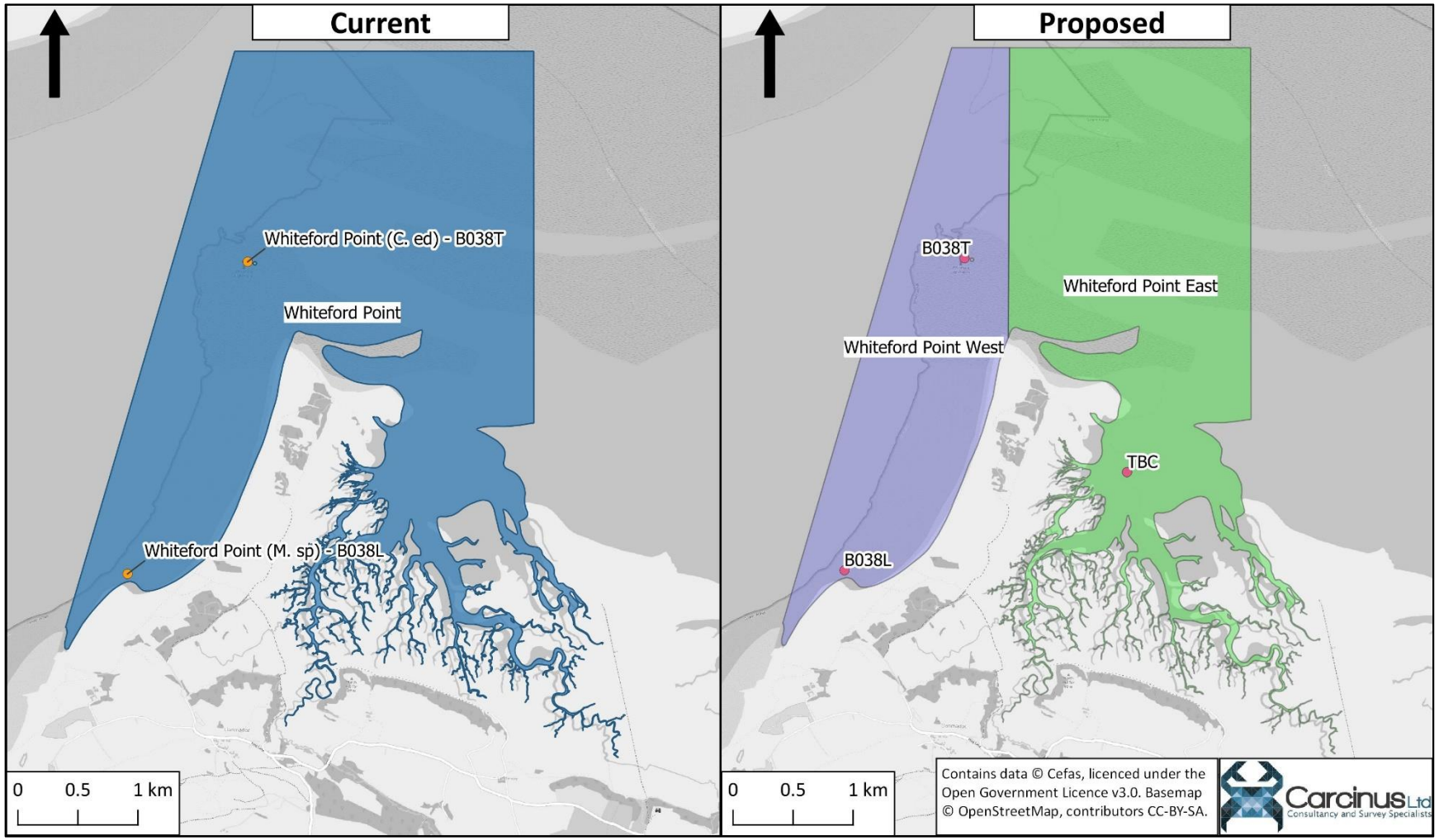

Figure 8.1. Proposed changes to the Whiteford Point Classification zone.

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Appendices

Appendix I. Breakdown of Population Change

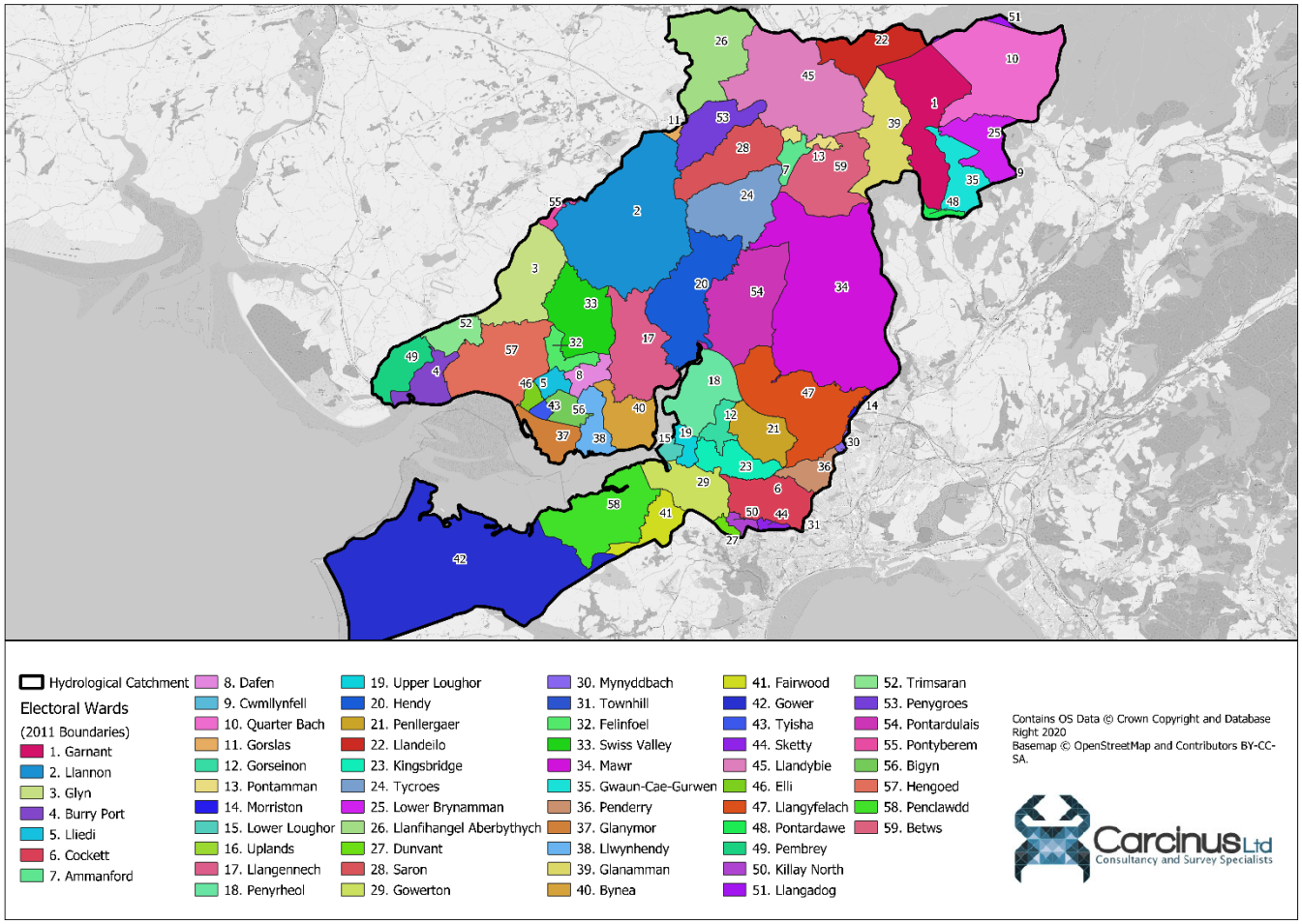

Figure III.0.1: Wards and electoral divisions within or partially within the Burry Inlet Hydrological Catchment (2011 Census).

Table III.0.1: Breakdown of population changes for Wards and Electoral Wards within or partially within the Burry Inlet catchment.

ID	Electoral Ward	Total Population			Population Density		
		2001 Census	2011 Census	% Change	2001 Census	2011 Census	Absolute Change
1	Garnant	1965	2139	8.85	1.29	1.40	0.11
2	Llannon	4999	5270	5.42	10.35	11.00	0.65
3	Glyn	2032	2155	6.05	0.87	0.90	0.03
4	Burry Port	4209	4246	0.88	61.38	62.50	1.12
5	Lliedi	5036	5457	8.36	98.90	106.50	7.60
6	Cockett	12586	13362	6.17	171.96	186.00	14.04
7	Ammanford	2664	2662	-0.08	29.99	30.00	0.01
8	Dafen	3433	3597	4.78	43.07	46.50	3.43
9	Cwmllynfell	1123	1172	4.36	1.21	1.30	0.09
10	Quarter Bach	2933	2921	-0.41	10.67	10.30	-0.37
11	Gorslas	3724	4066	9.18	4.58	5.00	0.42
12	Gorseinon	3275	4301	31.33	42.81	49.70	6.89
13	Pontamman	2629	2749	4.56	39.56	41.70	2.14
14	Morriston	16781	16928	0.88	342.01	343.70	1.69
15	Lower Loughor	2146	2355	9.74	21.76	22.60	0.84
16	Uplands	13355	15665	17.30	593.25	712.10	118.85
17	Llangennech	4510	4964	10.07	18.26	19.70	1.44
18	Penyrheol	5780	5523	-4.45	95.11	91.30	-3.81
19	Upper Loughor	2845	2771	-2.60	44.16	42.80	-1.36
20	Hendy	3039	3226	6.15	13.85	13.90	0.05
21	Penllergaer	2434	2868	17.83	8.30	9.60	1.30
22	Llandeilo	2937	2971	1.16	7.77	7.60	-0.17
23	Kingsbridge	4089	4008	-1.98	63.99	62.80	-1.19
24	Tycroes	2156	2438	13.08	1.92	2.20	0.28
25	Lower Brynamman	1307	1330	1.76	1.65	1.70	0.05
26	Llanfihangel Aberbythych	1716	1851	7.87	0.35	0.40	0.05
27	Dunvant	4679	4383	-6.33	74.27	69.30	-4.97

ID	Electoral Ward	Total Population			Population Density		
		2001 Census	2011 Census	% Change	2001 Census	2011 Census	Absolute Change
28	Saron	3467	4111	18.58	7.00	8.30	1.30
29	Gowerton	4928	5212	5.76	45.82	48.20	2.38
30	Mynyddbach	8756	8872	1.32	164.12	166.40	2.28
31	Townhill	8443	8696	3.00	289.81	293.50	3.69
32	Felinfoel	1948	2054	5.44	8.17	8.60	0.43
33	Swiss Valley	2434	2536	4.19	33.11	31.50	-1.61
34	Mawr	1800	1850	2.78	0.31	0.30	-0.01
35	Gwaun-Cae-Gurwen	2826	2910	2.97	11.65	12.00	0.35
36	Penderry	10981	12119	10.36	236.36	253.60	17.24
37	Glanymor	4888	5668	15.96	70.04	107.70	37.66
38	Llwynhendy	4276	4506	5.38	70.98	75.00	4.02
39	Glanamman	2261	2347	3.80	4.12	4.30	0.18
40	Bynea	3091	4207	36.10	14.36	19.20	4.84
41	Fairwood	2774	2914	5.05	4.23	4.40	0.17
42	Gower	3654	3696	1.15	0.64	0.70	0.06
43	Tyisha	3995	4079	2.10	198.72	202.40	3.68
44	Sketty	13799	14301	3.64	243.12	254.00	10.88
45	Llandybie	3738	3994	6.85	3.07	3.30	0.23
46	Elli	3156	3203	1.49	67.19	68.30	1.11
47	Llangyfelach	4426	5039	13.85	51.09	53.60	2.51
48	Pontardawe	5043	5421	7.50	39.14	43.80	4.66
49	Pembrey	3748	4301	14.75	2.60	2.80	0.20
50	Killay North	3436	3467	0.91	52.45	47.47	-4.98
51	Llangadog	1951	1929	-1.13	0.10	0.10	0.00
52	Trimsaran	2533	2541	0.32	10.06	10.00	-0.06
53	Penygroes	2429	2889	18.94	6.85	8.10	1.25
54	Pontardulais	5293	6281	18.67	43.15	48.10	4.95
55	Pontyberem	2829	2768	-2.16	7.51	7.30	-0.21
56	Bigyn	6347	6761	6.52	170.41	184.10	13.69
57	Hengoed	3829	3745	-2.19	18.63	13.60	-5.03

ID	Electoral Ward	Total Population			Population Density		
		2001 Census	2011 Census	% Change	2001 Census	2011 Census	Absolute Change
58	Penclawdd	3672	3635	-1.01	7.55	7.40	-0.15
59	Betws	1834	2175	18.59	1.64	1.90	0.26

Cefas

EC Regulation 854/2004

CLASSIFICATION OF BIVALVE MOLLUSC PRODUCTION AREAS IN ENGLAND AND WALES

SANITARY SURVEY REPORT

Burry Inlet

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