Sanitary Survey - Review

Camel Estuary – 2023

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Document QA and Approval

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A review of a sanitary survey conducted in 2009 relevant to the bivalve mollusc beds in the Camel Estuary was undertaken in 2015 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, Cornwall Port Health Authorityl. The report is publicly available via the Carcinus Ltd. website.

Recommended Bibliographic Citation:

Carcinus Ltd., 2022. Review of the Camel Estuary 2015 Sanitary Survey. Carcinus report 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 (EU) 2019/627.

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1 Introduction

1.1 Background

The Food Standards Agency 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, 2021). 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 Food Standards Agency.

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 Camel Estuary Review

This report reviews information and makes recommendations for a revised sampling plan for existing mussel (*Mytilus* spp.) and Pacific oyster (*Crassostrea gigas*) Classification Zones (CZs) in the Camel Estuary (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 and their impact on the classified shellfishery. Data for this review was gathered through a desk-based study and consultation with stakeholders.

An **initial consultation** with Local Authorities (LAs), the Environment Agency (EA) and Cornwall Inshore Fishery and Conservation Authority (C-IFCA) responsible for the production area was undertaken in August and September 2022. 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 December 2022 and January 2023. It is recognised that dissemination and inclusion of this 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 assessment originally conducted in 2015 (which was itself a review of a 2009 survey) and sampling plan as necessary and the report should be read in conjunction with these previous surveys. **Throughout this report, 'original report/survey' refers to the 2015 review unless explicitly stated.**

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.

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 6.4 and recommendations for an updated sampling plan are described in section 8.

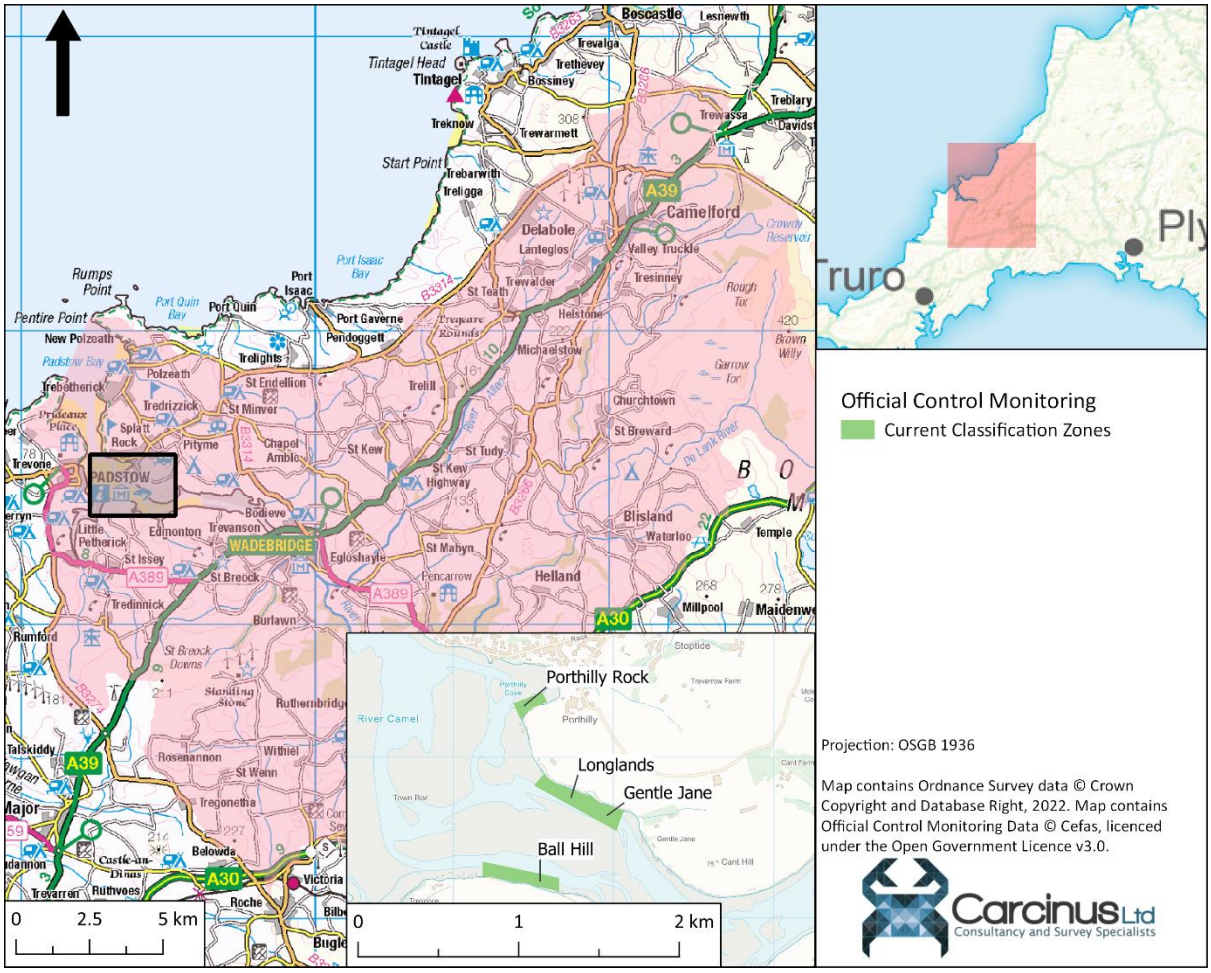


Figure 1.1 Location of the Camel Estuary in north Cornwall. Location of shellfish classification zones indicated by the black box

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 September 2022;
- 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 September 2022 have been used within this study. Any subsequent samples have not been included.

2 Shellfisheries

2.1 Description of Shellfishery

The Camel estuary is a small estuary located on the north coast of Cornwall (Figure 1.1). The boundaries of the Bivalve Mollusc Production Area[2] (BMPA) are considered to be the entire estuary from its mouth between Stepper Point to the south and Pentire Point to the north, up to its head at Wadebridge.

During initial consultations, Cornwall Inshore Fisheries and Conservation Authority (C-IFCA) indicated the only harvesting is that carried out under the River Camel Mussel and Oyster Fishery Order 2013 (SI 2013 No. 1978). This order confers rights of a several fishery for mussels and oysters for specific areas within the estuary for a period of 15 years (ending in 2028). There are four areas covered by this Order, one on the north bank of the estuary and three on the south bank (Figure 2.1). All are classified in accordance with regulatory requirements. The Local Enforcement Authority (LEA), responsible for this shellfishery in terms of food hygiene official controls purposes (including sampling) is Cornwall Port Health Authority.

[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/.
[2] Definition in retained (EU) Regulation 853/2004 – 'any sea, estuarine or lagoon area, containing either natural beds of bivalve molluscs or sites used for the cultivation of bivalve molluscs, and from which live bivalve molluscs are taken'

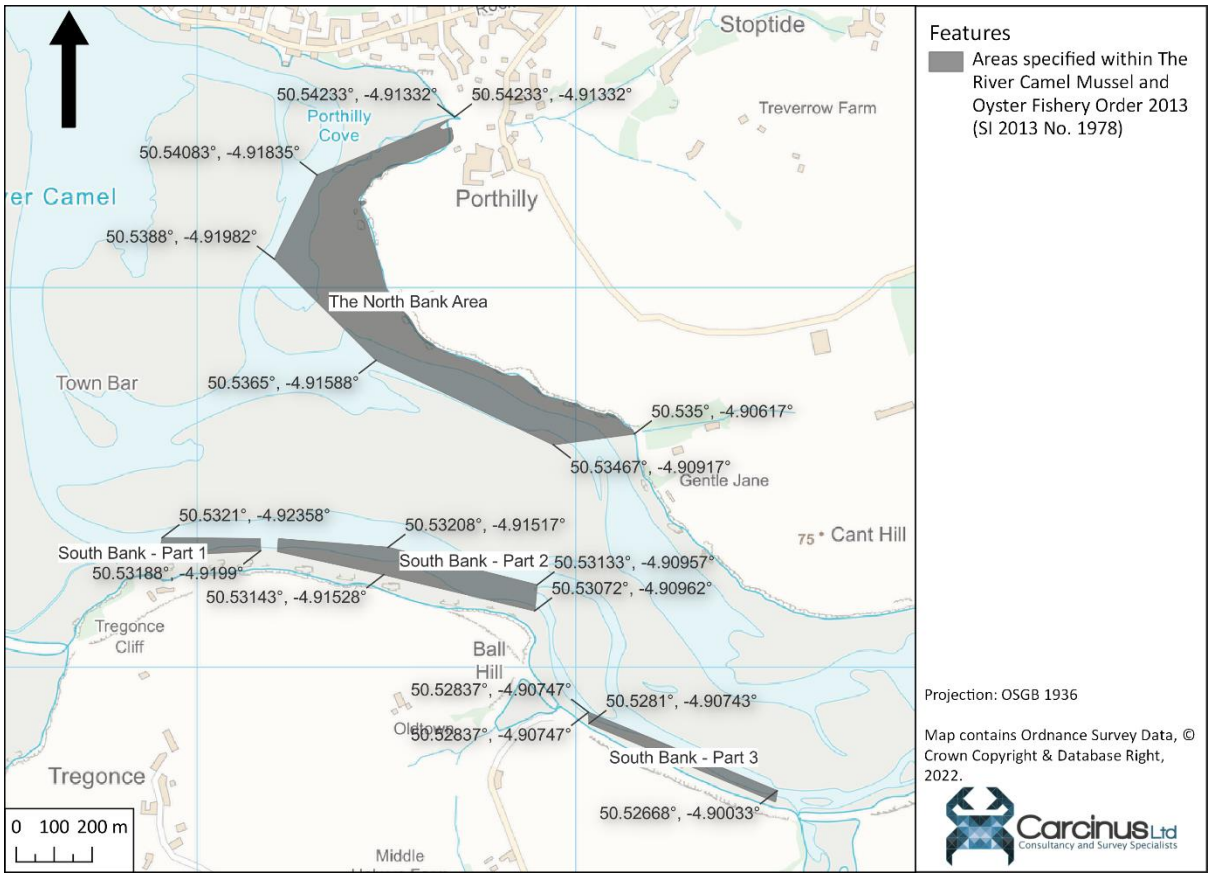


Figure 2.1 Areas covered by The River Camel Mussel and Oyster Fishery 2013.

A brief description of the status of the fishery for each of the species described in the original sanitary survey is provided below.

2.1.1 Mussels

The 2015 Sanitary Survey describes that mussels are cultivated in a combination of direct laying on the foreshore, as well as in bags on trestles, and that all harvesting is by hand. The report gave recommendations for four Classification Zones for this species, *Porthilley Cove*, *Gentle Jane*, *Ball Hill* and *Pinkson Creek*. Three of the four zones are currently active, with the *Pinkson Creek* zone being declassified in 2018. The LEA specified that all mussels in the estuary are subject to wild harvest. Figure 2.2 illustrates the location of the active mussel CZs from which commercial harvesting is permitted.

C-IFCA indicated during initial consultations that the only harvest of this species takes place under the rights of the Fishery Order, which has a Permanent Transport Authorisation in place. The LEA stated that between 01 October 2021 and 09 September 2022, 77.6 tonnes of mussels were removed from the *Ball Hill* zone, 6 tonnes from the *Porthilly Rock* zone and 8 tonnes from the *Gentle Jane* zone. No stock assessment was available to the authors of this review.

2.1.2 Pacific oysters

The 2015 review describes that Pacific oyster seed from Morecambe Bay are kept in floating racks at Longlands (opposite the *Ball Hill* CZ on the north bank of the estuary), before being transferred to racks within all other Classified areas Zones in the BMPA for on growing. The maturation process takes 2 to 3 years, after which time the oysters are harvested from the classified zones by hand. The 2015 review gave recommendations for the creation of four classification zones for this species: *Porthilley Rock*, *Longlands*, *Gentle Jane* and *Ball Hill*. All four CZs are still active Figure 2.2.

As for mussels, a Permanent Transport Authorisation is in place for the Camel oyster fishery. 394,027 oysters were harvested from the *Longlands* CZ between 01 October 2021 and 09 September 2022, and 305,260 oysters from the *Gentle Jane* CZ. Across both CZs this is approximately 70 tonnes harvested between 2021 and 2022.

2.1.3 Other Species

The 2015 sanitary survey mentions that the Camel has historically supported cockle (*Cerastoderma edule*) and Peppery furrow clams (*Scrobicularia plana*) fisheries. The cockle fishery closed in 2009 due to a lack of stock and the clam fishery was declassified in 2016. During secondary consultation, C-IFCA confirmed that there are reports of razor clams in the outer estuary around Doom Bar (around NGR SW918777), and that cockles used to occur on Town Bar (around NGR SW927747) but that a recent southern shift in the channel has eroded this sand bank displacing the cockle population.

2.2 Classification History

The original 2009 sanitary survey recommended the creation of nine classifications; four each for mussels and Pacific oyster, and one for clams. There are currently seven classification zones within the estuary, three for mussels and four for Pacific oysters. Classifications have been relatively stable since the original sanitary survey, with all zones awarded Long-Term B (LT-B) classifications for most of that time. In the first few months of 2022, all three mussel zones were changed from a B-LT to a Class B, but have since been changed back. In March 2022, *Gentle Jane* and *Ball Hill* mussel production sites were split to redesignate part of the production areas to relay areas. The production areas maintained class B-LT, and the relay sites were awarded class B. The relay areas have since reverted back to production areas, as requested by the LEA. This explains the changes in classification status. The Pacific oyster zones have remained B-LT. The location of all active classification zones, as well as all RMPs from which a sample has been collected in the last five years, are shown in Figure 2.2.

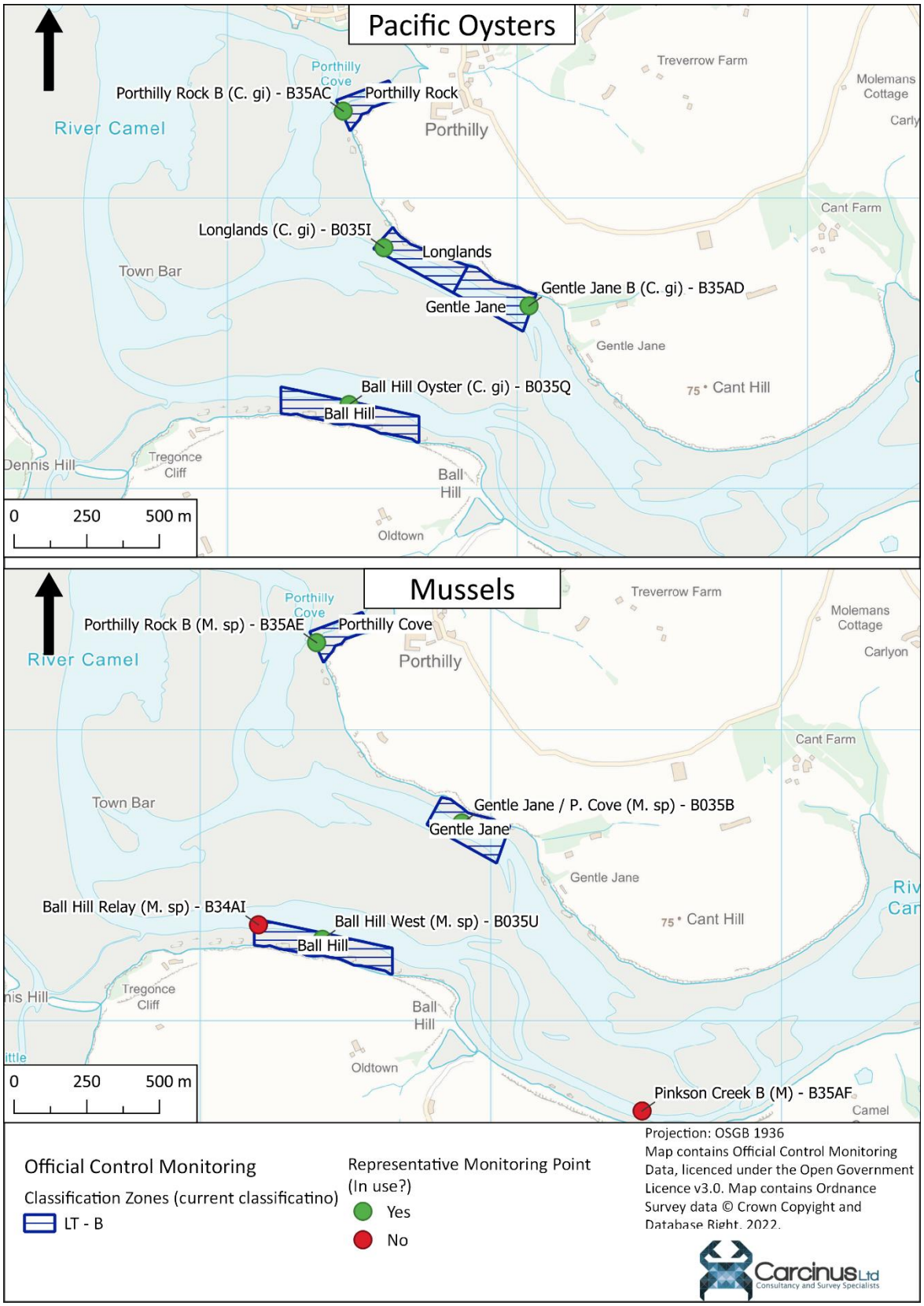


Figure 2.2 Current Classification Zones and associated Representative Monitoring Points in the Camel Estuary BMPA. See Figure 1.1 for the position of these zones within the wider catchment.

3 Pollution sources

3.1 Human Population

The 2015 review of the Camel estuary cites population data from the 2011 Census of the United Kingdom, which had become available since the original report was published in 2009. A subsequent census of the UK was conducted in March 2021, although as this data has not yet been made available, no comparison of census-derived population changes can be made. The total population within the catchment at the 2011 census was estimated to be 59,579 (a decrease of 1% on the 2001 census). The UK government provides periodic estimates of national population change and estimates that the total UK population will increase by 6.79% between 2011 and 2022 (www.ons.gov.uk; 2022). An increase of this proportion would see the approximate population living in the catchment increase to just over 64,000 people.

The 2015 survey review identified that the main population centres within the catchment continued to be the towns of Wadebridge at the head of the estuary, Bodmin and Camelford in the upper reaches of the catchment and Padstow and Rock at the mouth of the estuary. *Figure 3.1* shows how land cover has changed in the Camel catchment between 2012 and 2018. It suggests that the extent of these settlements have remained broadly similar, although there is slightly more urban-associated land use in the upper reaches of the catchment.

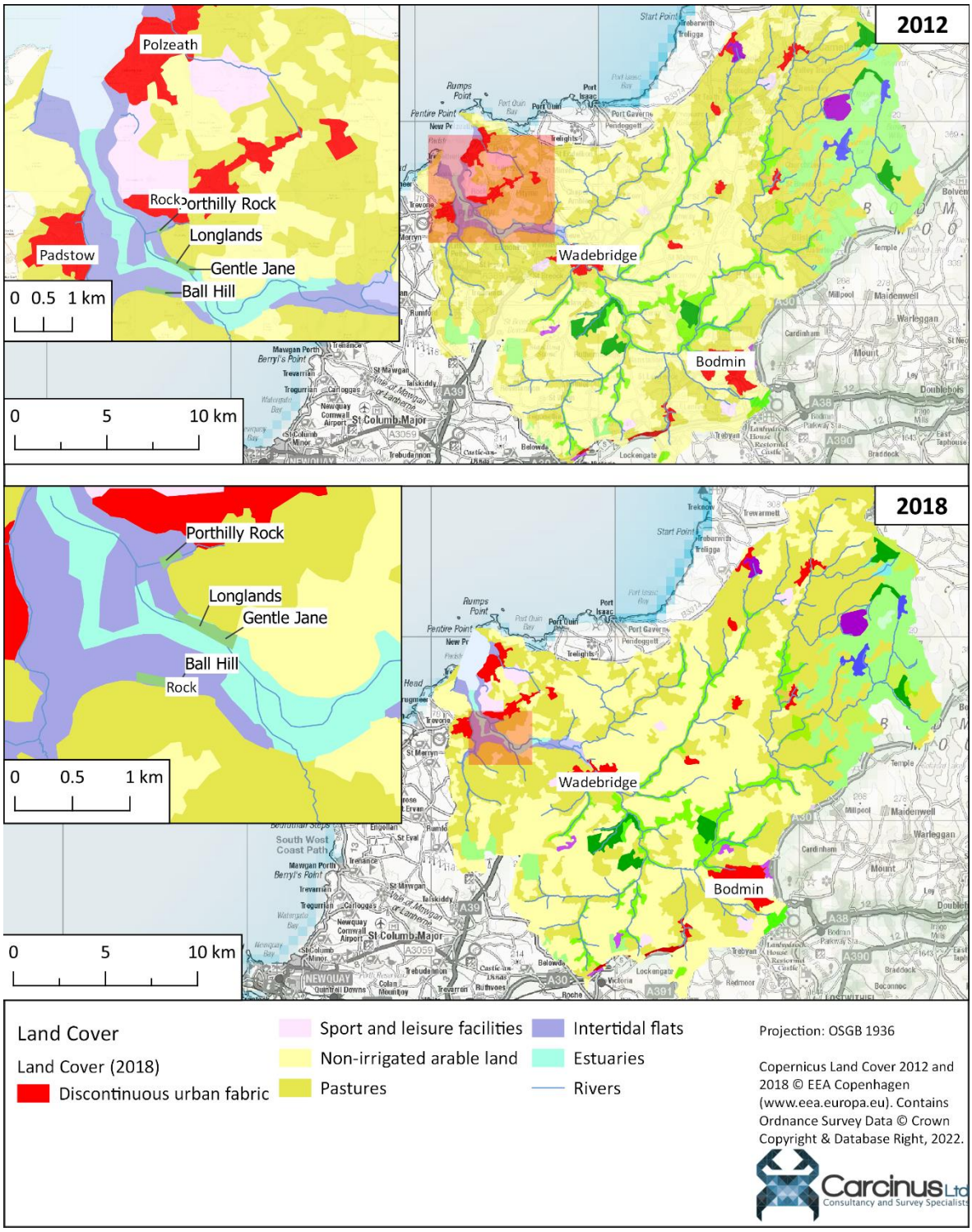


Figure 3.1 Change in the land cover of the Camel catchment between 2012 and 2018. Note – land cover items in the legend are focussed on those in the inset map.

Initial consultation with the LEA did not indicate any significant housing developments since the previous sanitary surveys were published. Furthermore, a Natural England letter dated 15 April 2022 has stated that development within the River Camel Special Area of Conservation (SAC) is subject to an embargo due to concerns over Phosphate levels and

eutrophication (Smyth, 2022). The SAC does not cover any waters with classified shellfish beds, but does cover the upper reaches of the catchment (JNCC, 2015). During secondary consultation, the LEA indicated that there have been some housing developments around Wadebridge, such as the Bradfords Quay redevelopment, which saw 83 townhouses and apartments constructed on the north bank of the Camel. Several areas within Wadebridge and the surrounding villages and hamlets have also been outlined as potential housing development spaces in the Local Plans for these areas. The EA also stated that there has been significant housing constructed in Bodmin. Any increase in population would almost certainly lead to an increase in loading to the wastewater treatment network (WWTN) which, without upgrades to assets on the network, would in turn increase faecal loading to coastal waters. Changes to the wastewater treatment network are discussed in the next section. The greatest potential for urban runoff to the Camel estuary remains the towns of Rock and Padstow at the mouth of the estuary, and Wadebridge at the head. Whilst the towns of Bodmin and Camelford will see some run-off, this is likely to have minimal impact on the bacteriological health of the BMPA given the positions of these settlements in the upper reaches of the catchment.

The original sanitary survey did not comment on seasonal tourism within the catchment although noted seasonal fluctuations to the population would increase the volume of expected sewage discharges in the spring and summer months.

Cornwall continues to be a popular tourist destination. The town of Padstow at the mouth of the estuary sees its population double from 2,500 to 5,500 during summer months and receives 500,000 day visitors each year (Padstow Town Council, 2022). In addition to a general seasonal increase over summer months, the LEA advised during secondary consultation that there are events such as the Royal Cornwall Show that attract 100,000s visitors over a few days. The authors of this review understand that sewage from these events is tankered to existing water treatment works such as Wadebridge STW, and so no additional contamination is likely. The EA stated during secondary consultation that the vast number of visitors to the area does put the wastewater infrastructure under pressure but did not go as far as stating that the capacity is insufficient. Similar tourism statistics were not available for other towns nearby, although it is likely that they will also see a significant population increase in summer months.

No updated census data are available to the authors of this report, although it is likely that the resident and seasonal population of the catchment has increased since the original sanitary survey and its review were published. However, the physical extent of the main urban centres has not increased significantly since the original sanitary survey and review and as such the sampling recommendations made in the original sanitary survey to capture the risk of contamination from urban runoff remain valid.

3.2 Sewage

Details of all consented discharges within the Camel BMPA catchment were taken from the most recent update to the Environment Agency's national permit database at the time of

this report (October 2022). The locations of these discharges within the BMPA and near the mussel and oyster RMPs in each classification zone are shown in Figure 3.2.

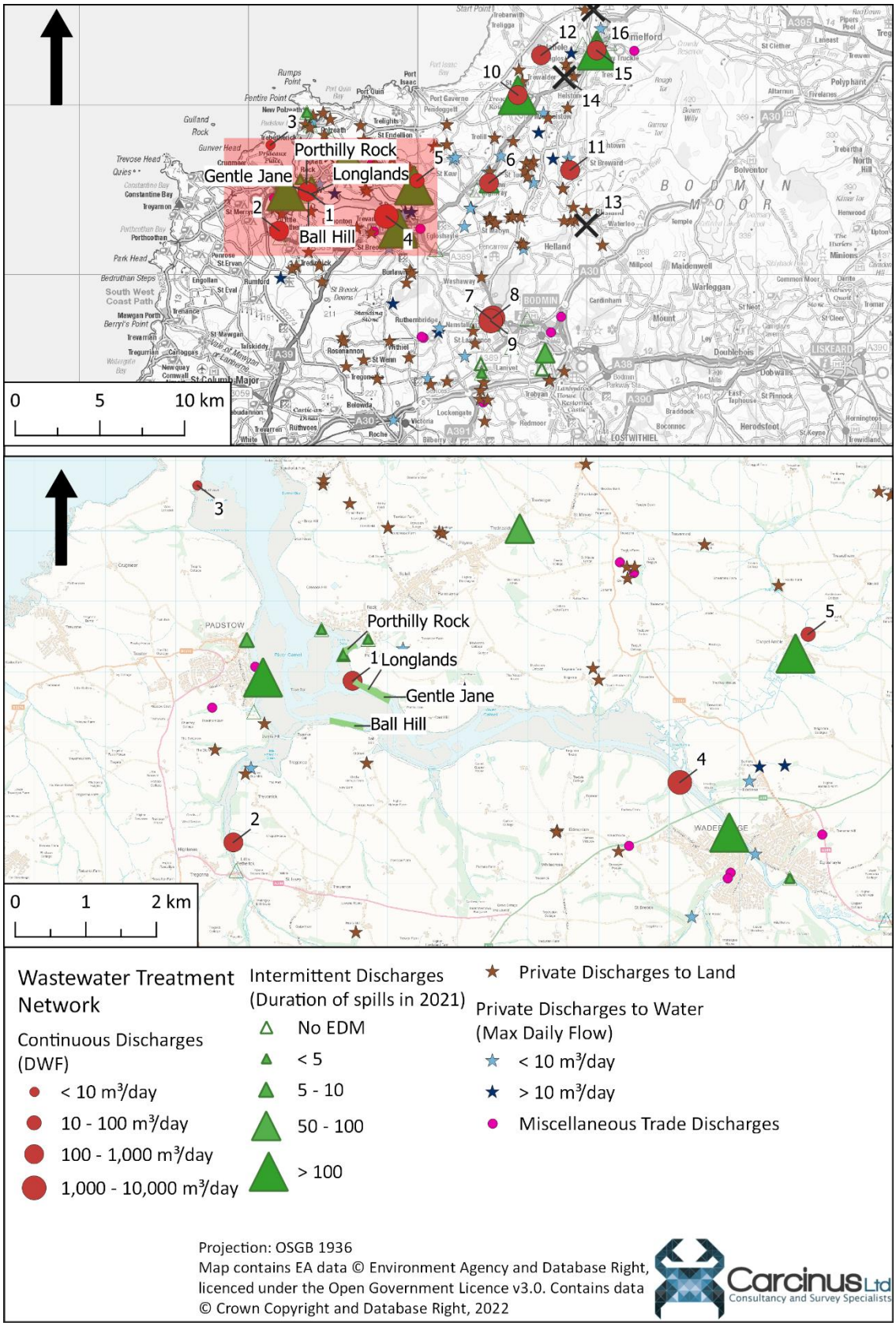


Figure 3.2 Locations of all consented discharges within the Camel catchment. Labels refer to continuous discharges, details of which can be found in Table 3.1.

Table 3.1 Details of continuous discharges in the Camel catchment.

ID	Site Name	Permit Number	NGR	Treatment	DWF	Distance to CZ (km)
1	PORTHILLY SEWAGE TREATMENT WORKS	304544	SW9351 074870	UV DISINFECTION	968	0.18
2	LITTLE PETHERICK WWTW	NRA-SW-3676	SW9182 072580	UV DISINFECTION	187	2.32
3	HAWKERS COVE STW	303021	SW9131 077640	BIOLOGICAL FILTRATION	8	3.18
4	WADEBRIDGE STW	302997	SW9815 073430	UV DISINFECTION	3370	4.40
5	CHAPEL AMBLE WWTW	EPRCP3528XH	SW9997 075530	REEDBED	20	6.11
6	ST MABYN WWTW	NRA-SW-0414	SX04220 75400	BIOLOGICAL FILTRATION	281.5	10.32
7	BODMIN NANSTALLON WWTW	NRA-SW-6959	SX04332 67349	CHEMICAL - PHOSPHATE STRIPPING	3588	12.72
8	BODMIN SCARLETTS WELL STW	NRA-SW-4018	SX04450 67430	UV DISINFECTION	1270	12.77
9	BODMIN NANSTALLON WWTW	NRA-SW-6959	SX04321 67244	UV DISINFECTION	3588	12.77
10	ST TEATH WASTEWATER TREATMENT WORKS	302142	SX05920 80590	BIOLOGICAL FILTRATION	126	13.38
11	ST BREWARD STW	NRA-SW-6746	SX09010 76150	BIOLOGICAL FILTRATION	308	15.16
12	DELABOLE WASTEWATER TREATMENT WORKS	NRA-SW-4934	SX07290 82940	CHEMICAL - PHOSPHATE STRIPPING	240	15.73
13	BLISLAND STW	NRA-SW-0077	SX09980 72890	BIOLOGICAL FILTRATION	Unspecified	16.15
14	HELSTONE STW	NRA-SW-0049	SX08680 81640	BIOLOGICAL FILTRATION	Unspecified	16.33
15	CAMELFORD WWTW	SWWA 573	SX10580 83230	CHEMICAL - PHOSPHATE STRIPPING	338	18.73

ID	Site Name	Permit Number	NGR	Treatment	DWF	Distance to CZ (km)
16	CAMELFORD STATION (COTTAGES)STW	SWWA 57	SX10390 85630	BIOLOGICAL FILTRATION	Unspecified	19.79

The 2015 review noted the presence of 17 continuous discharges in the vicinity of the Camel BMPA. One of these, Dwellings at Wadebridge Road (CD9 in the 2015 report) is no longer listed in the discharge database, suggesting it is likely a private discharge. The 2015 review noted that the highest Dry Weather Flow (DWF) at any water company continuous discharge was at Bodmin Nanstallon Sewage Treatment Works (ID 7). The Dry Weather Flow at this discharge is unchanged, and the EA stated during initial consultation that UV disinfection was installed during Asset Management Plan (AMP) 5 (2011 – 2015), meaning that the overall risk it causes remains very similar. No further detail of the timing of this installation was provided. No changes to the continuous discharges in the Camel catchment have occurred since the 2015 review was published. Little Petherick WWTW (ID 2) and Porthilly STW (ID 1) are the most likely to contribute contamination to the CZs, given their proximity (<3 km) to the shellfish beds. No changes to either of these discharges has occurred since the 2015 review was published.

In addition to the continuous discharges, the original sanitary survey identified a total of 40 intermittent discharges in the catchment. Intermittent discharges comprise Combined Storm Overflows (CSOs), Storm Tank Overflows (STOs) and Pumping Station Emergency Overflows (PSs). During AMP6 and AMP7, Event Duration Monitoring (EDM) was installed at several of the discharges within the catchment Summary data for 2020 and 2021 was published by the Environment Agency in March 2021 and in March 2022, respectively (Environment Agency, 2022). Details of the EDM data from 2021 for those discharges in the Camel catchment are presented in Appendix I.

The 2015 sanitary survey presented some EDM data, and so a limited comparison with that report is possible, though 30 of these discharges now possess telemetry capability. The intermittent discharge of primary relevance to the shellfishery is the Padstow Foreshore Pumping Station, given its proximity to the shellfish beds (1.3 km) and the fact it spilled 23 times for 151 hours in 2021, and 18 times for 139 hrs in 2020, notably more than many of the other discharges in the area. This is a higher frequency than that reported in the 2015 review, spilling 11 times in 2012, 14 times in 2013 but only twice in 2014. Other intermittent discharges that spilled less frequently, but are still relevant due to their proximity (< 1 km) to a shellfish classification zone are those around Porthilly Beach (Figure 3.2).

During initial consultations, the EA also indicated that evidence of non-compliance was found at five water company owned assets, Delabole WWTW, St Teath WWTW, Camelford WWTW, Wadebridge STW and Chapel Amble STW. Of these, the Wadebridge (ID 4) and Chapel Amble (ID 5) STWs are of primary concern given their position at the head of the estuary, although the Little Petherick and Porthilly STWs (ID 1 & 2) are far closer and therefore more relevant. The EA were unable to provide more details of the specific nature of these non-compliances, beyond stating that a 'spill non-compliance' occurs when a specific permit condition is breached for a given consented discharge.

In addition to the water company owned discharges, the authors of the original sanitary survey identified 44 private discharges within the catchment. The report concluded most were small (with consented DWFs of < 10 m^3/day) and discharged to watercourses upstream of the catchment. Many such discharges remain active, although those in the direct vicinity of the CZs continue to be small and so do not require additional consideration within the sampling plan since the water company owned discharges will have a greater impact on contamination levels (due to their proximity and discharge volumes). Limited information about the specific details of private discharges can be provided due to amended data protection requirements since the last review. Figure 3.2displays the location and summary spill information related to these discharges. It should be noted however that non-compliance was recorded at a significant number of these private discharges during EA investigations in 2021, although no further information can be provided.

No upgrades to water company owned assets have occurred in the Camel catchment since the 2015 review was published, and no changes to the consented discharge volumes of those discharges closest to the CZs have occurred. Limited comparison of EDM data was possible, although there remain a cluster of intermittent discharges off Padstow and Porthilly Beach, in the near vicinity of the CZs that should be taken into account in any updated sampling plan.

3.3 Agricultural Sources

The 2015 sanitary survey review presents livestock data for the Camel catchment based on adjusted livestock data from 2013 for the North Cornwall, Restormel and Caradon districts. Livestock data for these areas was not freely available to the authors of this review, and so a data request was made to the Farming Statistics office of the Department for Environment, Food and Rural Affairs (DEFRA) for livestock populations within the catchment area presented in Figure 1.1.

This data was made available under the Open Government Licence v3.0. Table 3.2 presents the changes in livestock populations within the catchment between 2013 and 2021, as well as changes in the area of pasture and arable farmland in the catchment between 2012 and 2018.

Table 3.2 Change in livestock populations between 2013 and 2021, and land cover between 2012 and 2018. Livestock census data based on June Agricultural Census data, provided by Defra.

		2013	2021	% Change
Livestock Populations	Cattle	47,562	46,882	-1.43%
	Pigs	889	2,618	+194.44%
	Sheep	79,263	82,143	+3.63%
	Poultry	17,584	268,232	+1,425.43%
	Total	**145,298**	**399,875**	**+175.21%**
Land Use (2012 and 2018)	Pasture	27,392.54	27,392.07	-0.0017%
	Arable	23,990.17	24,064.42	+0.31%

The June Agricultural Census data shows that the area of pasture within the catchment has remained very similar since the 2015 review, as has the area of arable farmland. However, there has been a significant increase in livestock populations, with all groups except for cattle showing an increase in population size. The overall livestock population showed a nearly 3-fold increase, and the poultry population went up by nearly 1500%. It should be noted that the June survey represents a snapshot of livestock populations in a single day, but populations will vary throughout the year, with highest numbers in spring and lowest in autumn and winter when animals are sent to market. An increase in livestock populations would potentially lead to increased run-off, due to the additional faecal deposits the larger population would cause.

The principal route of contamination of coastal waters by livestock is surface runoff carrying faecal matter. The land cover map presented in *Figure 3.1*suggests that all Classification Zones within the BMPA are backed by areas of pasture, which would mean that runoff is a potentially significant source of contamination to this shellfishery. However, there has been no change in the area of these pastures, and so the risk is considered to have remained similar to the original sanitary survey.

Another potential route of contamination from livestock-associated factors is slurry spreading. During initial consultations, the Environment Agency advised that the spreading of slurry to fields is controlled under the Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018, known as the Farming Rules for Water (FRfW), which came into force in April 2018. This legislation lays out a set of rules that require good farming practice, so that farmers manage their land both to avoid water pollution and benefit their business. Rules include requiring farmers to judge when it is best to apply fertilisers, where to store manures and how to avoid pollution from soil erosion. Furthermore, silage and slurry storage for agricultural purposes is subject to The Water Resources (Silage, Slurry and Agricultural Fuel Oil) (England) Regulations 2010 (SSAFO). All farmers must comply with the SSAFO regulations when building new slurry stores, or substantially altering (e.g. enlarging) existing ones. All stores must be built at least 10m

from any watercourse, including field drains or ditches, and be built or altered to last for at least 20 years with proper maintenance. All new and amended stores may be subject to planning requirements. Farmers should contact their local authority planning department before commencing building and alteration works.

Since 2021, the EA now has ART (Agricultural Regulatory Taskforce) Officers that have all been assigned a catchment and will engage, inspect, advise and if necessary, enforce the Silage, Slurry and Agricultural Fuel Oil regulations and the new (2018) Farming Rules for Water. These legislative changes are intended to improve water quality around farms and other slurry storage locations. ART officers in the Camel have inspected more than 40 high priority dairy and beef farms in the catchment and have found many non-compliances in relation to slurry storage and land management. During secondary consultation the EA stated that ART officers have not found any direct impacts from farming practices to shellfish in the Camel, but did acknowledge that agriculture contributes to diffuse pollution in this catchment. The EA was unable to provide specific names and locations of farms, but of the approximately 50 farms inspected in 2022, mostly in the Allen, St Lawrence and Polmorla catchments, about two-thirds were noncompliant with either the SSAFO or FRfW. These non-compliances commonly involved having insufficient slurry storage volume, inadequate infrastructure or lack of sampling/record keeping. All farms found to be non-compliant have been given deadlines to make plans to come into compliance.

There is no indication that the farmland immediately adjacent to the shellfish beds are non-compliant with the SSAFO and FRfW legislation. As livestock and agriculture are considered to be a significant source of diffuse pollution in this catchment, consideration should be given to farmland immediately adjacent to shellfish beds in any updated sampling plan, particularly given the increases in livestock population across the catchment.

3.4 Wildlife

The Camel estuary contains a large variety of intertidal and subtidal habitats that support a significant diversity of flora and fauna. The group of animals most likely to contribute notable levels of faecal contamination to the shellfishery is overwintering waterbirds (both wildfowl and waders), as they tend to forage (and therefore defecate) directly on intertidal shellfish beds.

The Camel estuary contains the largest aggregation of waterbirds of any estuary in Cornwall. In the five winters to 2014/2015, the average count of overwintering birds in the estuary was 14,158 (Frost *et al.*, 2016). In the five winters to 2019/2020 (the most recent for which data are available, the average count was 13,555 (a decrease of 4.26%). Despite this decrease, the estuary still contains nationally significant populations of Ruff, Green Sandpiper, Greenshank and Mediterranean Gull. As concluded in both the 2009 survey and 2015 review, waterbirds are likely to be a source of contamination to shellfish beds, predominantly in the winter months when migratory birds are present. However, due to the diffuse and spatially unpredictable nature of contamination from birds it is difficult to select specific RMP locations to capture this.

The 2015 review reported on the findings of the Special Committee on Seals (SCOS) 2013 report, noting that the closest identified haul out site is Gulland Rock offshore of the Camel mouth. The 2021 Special Committee on Seals SCOS report (SCOS, 2022) identifies that the main haul out sites for grey seals are the Isles of Scilly and Lundy Island (120 and 70 km from the Camel respectively). It is probable that grey seals use the waters of the estuary for foraging from time to time, and may reach the shellfish CZs at high tide. However, this species forages over a wide area and so any faecal contamination will be highly spatially and temporally variable and would have a very minor influence on the bacteriological health of the BMPA, requiring no additional consideration in any updated sampling plan.

No other wildlife species of significance are noted.

3.5 Boats and Marinas

The discharge of sewage from boats in the vicinity of the Camel Estuary BMPA is a potentially significant source of contamination. 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 reports. Their geographical positions are presented in Figure 3.3.

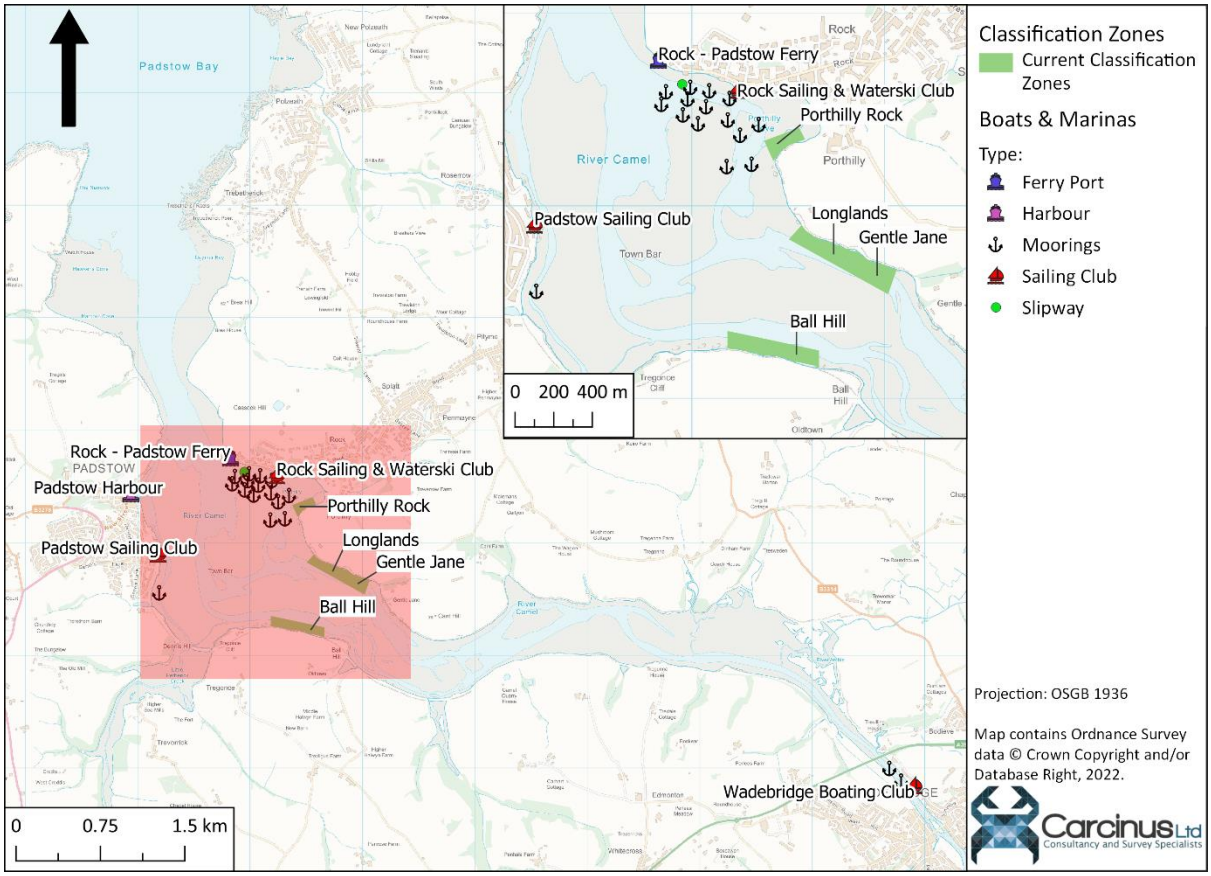


Figure 3.3 Locations of moorings, marinas and other boating activities in the vicinity of the Camel Estuary BMPA.

The 2015 review does not comment on the boating activities that take place in the Camel estuary, and so boating activities in the area have been compared to that of the 2009 Sanitary Survey.

The 2009 report describes that Padstow Harbour is a small but active harbour that can receive vessels of up to 2,000 tonnes. This capacity has not changed (Padstow Harbour Commissioners, 2021), and the port accommodates bulk cargoes such as sand and roadstone. The legislation governing the discharge of sewage from boats has not changed since the original sanitary survey was published, and contamination from commercial vessels is not expected to be a factor as they are prohibited from making overboard discharges within 3 nm of land.

The main risk of bacteriological contamination therefore exists from potential overboard releases from recreational vessels of a sufficient size to contain on board toilets. The original sanitary survey describes that there are nearly 350 moorings within the Camel Estuary, including within 10 m of the *Porthilly Rock* CZ. Updated numbers of moorings are not available, although Padstow Harbour Commissioners advise that they had 3,500 visiting yacht nights in 2020/21. Some overboard discharges are expected from those boats on moorings in the main channel, and these are likely to be most frequent in the summer months. Without more specific information as to the exact timing, frequency, nature and extent of the discharges however it is impossible to define RMPs that will reliably capture the pollution. That being said, as described in the 2009 sanitary survey, this source of pollution is likely to be relatively minor compared to other discharges described elsewhere in this report.

3.6 Other Sources of Contamination

The urban fabric in the vicinity of the Camel BMPA forms the town of Wadebridge at the head of the estuary, approximately 6 km from the nearest CZ (*Gentle Jane*), and the towns of Padstow and Rock which are within 200 m of (*Porthilly Rock*). Contamination from urban runoff may impact the zone, although its effect is considered to be minor due to the relatively small size of these towns and no change from the situation described in the original sanitary surveys. It is also likely that dog walking takes place along the shoreline of the estuary, and so some minor diffuse impact from dog waste is anticipated.

Overall, the risk from these sources of contamination is considered to be similar to that described in the original sanitary survey and its review and no update to the sampling plan is required on this basis.

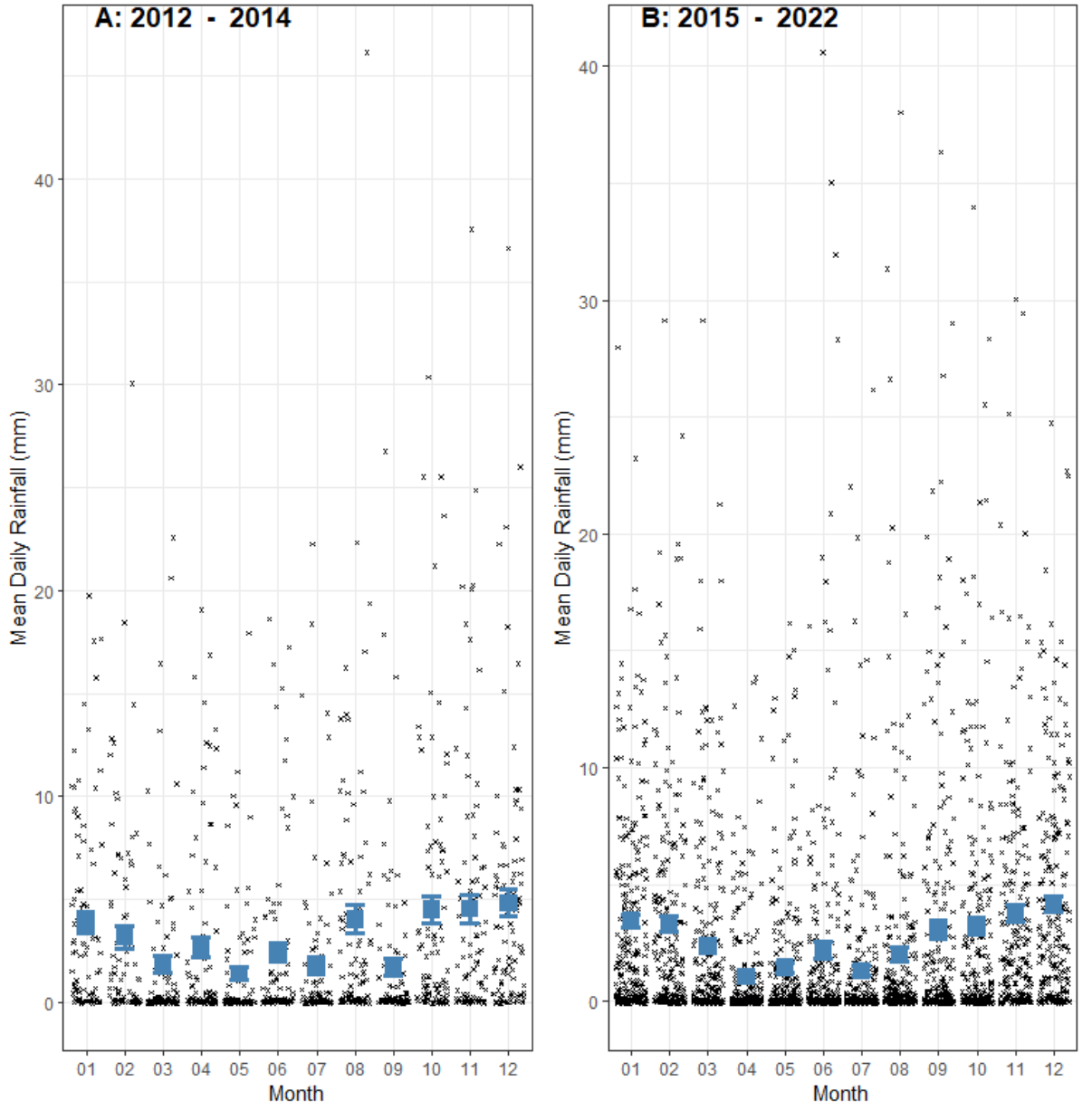
4 Hydrodynamics/Water Circulation

The Classification Zones within the Camel BMPA are situated in the intertidal , and the charts presented in the original reports specify that sandbanks within the estuary shift frequently. The 2015 review notes that some minor changes to depth had occurred since 2009, although these were unlikely to significantly affect the hydrodynamics of the BMPA.

Contamination from upriver sources will be carried in a westerly direction during the ebbing tide, and contamination from sources downstream of the CZs (i.e. from the mouth of the river or the towns of Padstow/Rock) will be carried over the CZ during the flooding tide. On balance, it is likely that greater contamination will be carried on the ebbing tide, as this will bring water from up-catchment sources. There is no evidence that these circulation patterns have changed since the original sanitary survey and review and as such the recommendations made in the original reports to account for the hydrodynamics of the area remain valid.

5 Rainfall

Rainfall data for the Port Isaac Tipping Bucket Rainguage (TBR) monitoring station (ID: 285441) (NGR: SW 99796 80376) were requested from the Environment Agency for the period 2012 – Present. This station was chosen as it is the geographically closest monitoring station to the BMPA, situated 8 km away on the north Cornwall coast. These data were subdivided into 2012 – 2014 (pre sanitary survey review) and 2015 – 2022 (post sanitary survey review) 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 review was published. Figure 5.1 shows the average daily rainfall totals per month at this monitoring station, and the results are summarised in Table 5.1.



Archive Daily Rainfall from the Port Isaac TBR monitoring station (#285441) (NGR: SW 99796 80376)
Data provided by the Environment Agency, licenced under the Open Government Licence v3.0

Figure 5.1 Mean daily rainfall per month for the Port Isaac TBR monitoring station (NGR: SW 99796 80376) for the periods (A) 2012 - 2014 and (B) 2015 - 2022.

Table 5.1 Summary statistics for rainfall for the period preceding and following the original sanitary survey, from the Port Isaac TBR monitoring station.

Period	Mean Annual Rainfall (mm)	Percentage Dry Days	Percentage Days Exceeding 10 mm	Percentage Days Exceeding 20 mm
2012 - 2014	1112.2	38.77737	35.76642	22.62774
2015 - 2022	902	38.66714	32.64433	20.13542

The data suggest that the level of rainfall the area receives has fallen, with the mean annual rainfall and days with heavy (>10 mm) rainfall all falling. However, the percentage of dry days has also fallen slightly. Two-sample t-tests indicated that there was no significant difference ($p>0.05$) in the mean daily rainfall per month for the 2012 – 2014 and 2015 – 2022 periods.

Rainfall leads to increased faecal loading through two factors, elevated levels of surface runoff and spill events from intermittent discharges, particularly during periods of heavy (>10 mm/day) or extremely heavy (>20 mm/day) rain. Rainfall levels during both periods were greatest in winter months (November – February), and so the levels of runoff etc. would be expected to be greatest during this time. 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

Mean Official Control monitoring results for *E. coli* concentrations at all RMPs sampled since the 2015 sanitary survey review are presented in Figure 6.1 and summary statistics are presented in Table 6.1.

The data presented above have been taken directly from the Cefas datahub[1] and have been taken at face value. The datahub presents data from RMPs where a sample has been taken in the last five years.

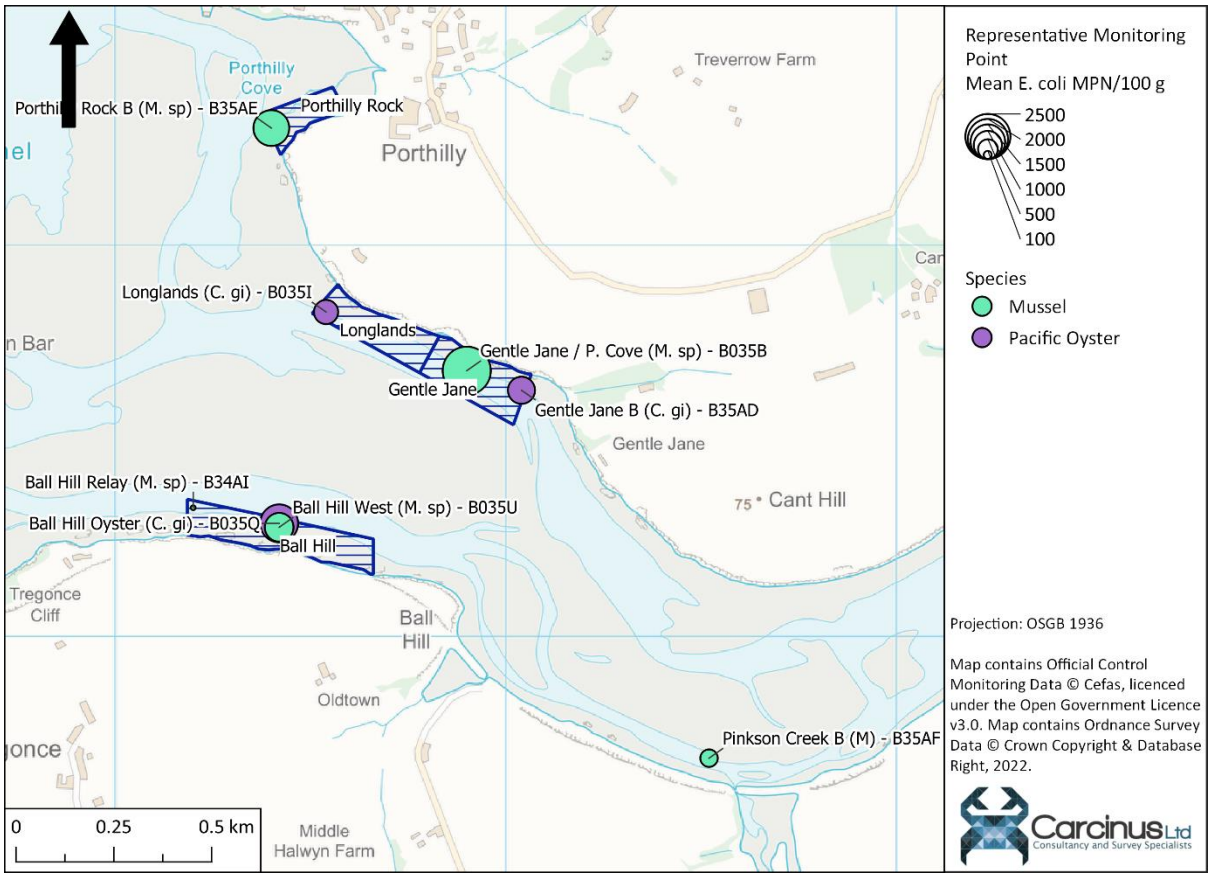


Figure 6.1 Mean E. coli results from Official Control Monitoring at RMPs within the Camel BMPA.

Table 6.1 Summary statistics of Official Control monitoring (E. coli MPN/100 g) at RMPs sampled since 2011 in the Camel BMPA. Data has been cut off at September 2022.

RMP (Species)	Species	No.	First Sample	Last Sample	Mean	Min Value	Max Value	% > 230	% > 4,600	% > 46,000
Gentle Jane / P. Cove (M. sp) - B035B	Mussel	168	20/01/2011	08/09/2022	2836.94	18	180000.00	82.14	9.52	0.60
Longlands (C. gi) - B035I	Pacific Oyster	141	20/01/2011	08/09/2022	746.93	18	13000.00	53.19	3.55	0.00
Ball Hill Oyster (C. gi) - B035Q	Pacific Oyster	139	20/01/2011	08/09/2022	1789.99	18	180000.00	34.53	1.44	0.72
Ball Hill West (M. sp) - B035U	Mussel	140	20/01/2011	08/09/2022	1044.85	18	17000.00	44.29	7.14	0.00
Porthilly Rock B (C. gi) - B35AC	Pacific Oyster	85	14/07/2015	08/09/2022	715.86	18	7900.00	42.35	3.53	0.00
Gentle Jane B (C. gi) - B35AD	Pacific Oyster	91	13/10/2015	08/09/2022	932.82	20	13000.00	64.84	3.30	0.00
Porthilly Rock B (M. sp) - B35AE	Mussel	90	09/09/2015	08/09/2022	1604.47	20	35000.00	65.56	5.56	0.00
Pinkson Creek B (M) - B35AF	Mussel	27	09/09/2015	18/12/2017	392.52	18	3300.00	33.33	0.00	0.00
Ball Hill Relay (M. sp) - B34AI	Mussel	4	12/04/2022	14/06/2022	72.50	20	230.00	0.00	0.00	0.00

Since 2015, Official Control monitoring samples have been taken from nine RMPs within the Camel BMPA. Three of these RMPs (B035B, B035I & B035Q) were sampled prior, sampling at a further five began in Summer/Autumn 2015 and a single RMP (B34AI) was sampled from April to June 2022. Sampling at the Pinkson Creek B (B35AF) RMP was stopped in December 2017 following the declassification of that area, and sampling at the Ball Hill Relay (B34AI) RMP stopped in June 2022. All other RMPs in the BMPA are currently in use (Table 6.1).

There are two instances of species being collocated and monitored by separate RMPs for each. The mean result of the oyster RMP at Porthilly Rock (B35AC) is almost half that of the mussel RMP (B35AE). Similarly, the oyster RMP at Ball Hill (B035Q) has returned a higher mean result than the mussel RMP (B035U), although the difference is less stark. Comparing the patterns in *E. coli* concentrations with respect to their geographic position, there does not appear to be a notable difference from one side of the estuary to the other, although the mean results from the Gentle Jane / P. Cove (B035B) mussel RMP are the highest of all other RMPs.

Figure 6.2 and Figure 6.3 present boxplots of *E. coli* monitoring results from the various mussel and oyster RMPs, respectively. One-way analyses of variance (ANOVA) tests were performed on the data to investigate the statistical significance of any differences between the monitoring results from the various RMPs. Comparisons are only appropriate between RMPs using the same species due to the differences in *E. coli* uptake between different species. Significance has been taken at the 0.05 level. All statistical analysis described in this section was undertaken in R ((R Core Team, 2021).

The median *E. coli* concentration at the Gentle Jane / P. Cove (B035B) RMP is the highest of all mussel RMPs, and the Ball Hill Relay (B35AI) (monitored for a limited period between April - June 2022) is the lowest (Figure 6.2). However, no significant differences were found in the mussel data ($p > 0.05$).

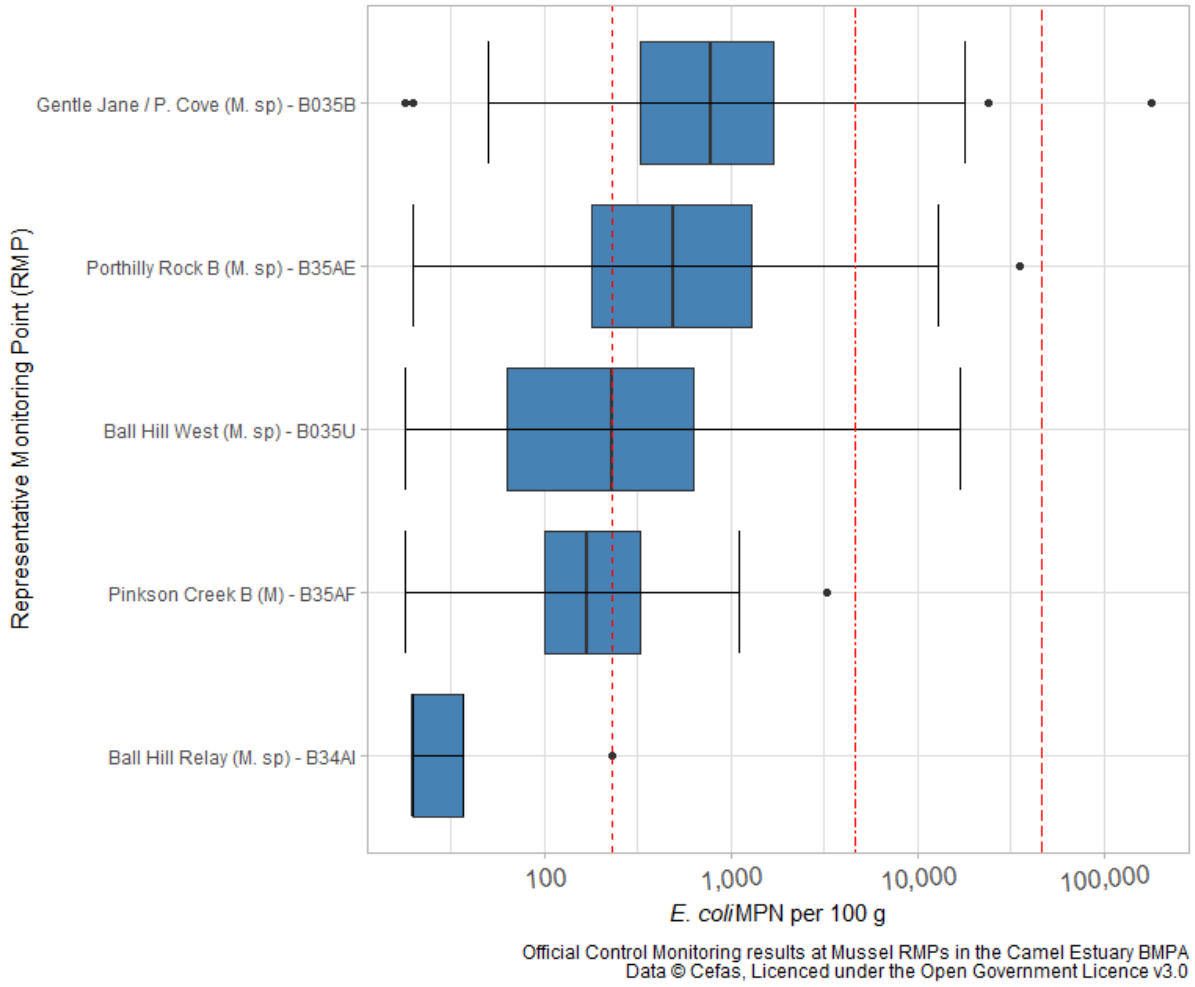


Figure 6.2 Boxplots of E. coli concentrations at mussel RMPs in the Camel Estuary BMPA since 2011. Central line indicates median value, box indicates lower-upper quartile range and whisker indicates minimum/maximum values, excluding outliers (points >1.5 x the interquartile range). Vertical dashed lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

The median value at the Gentle Jane B (B35AD) RMP is the highest of all Pacific oyster RMPs (Figure 6.3), although no significant differences ($p > 0.05$) were found in the data.

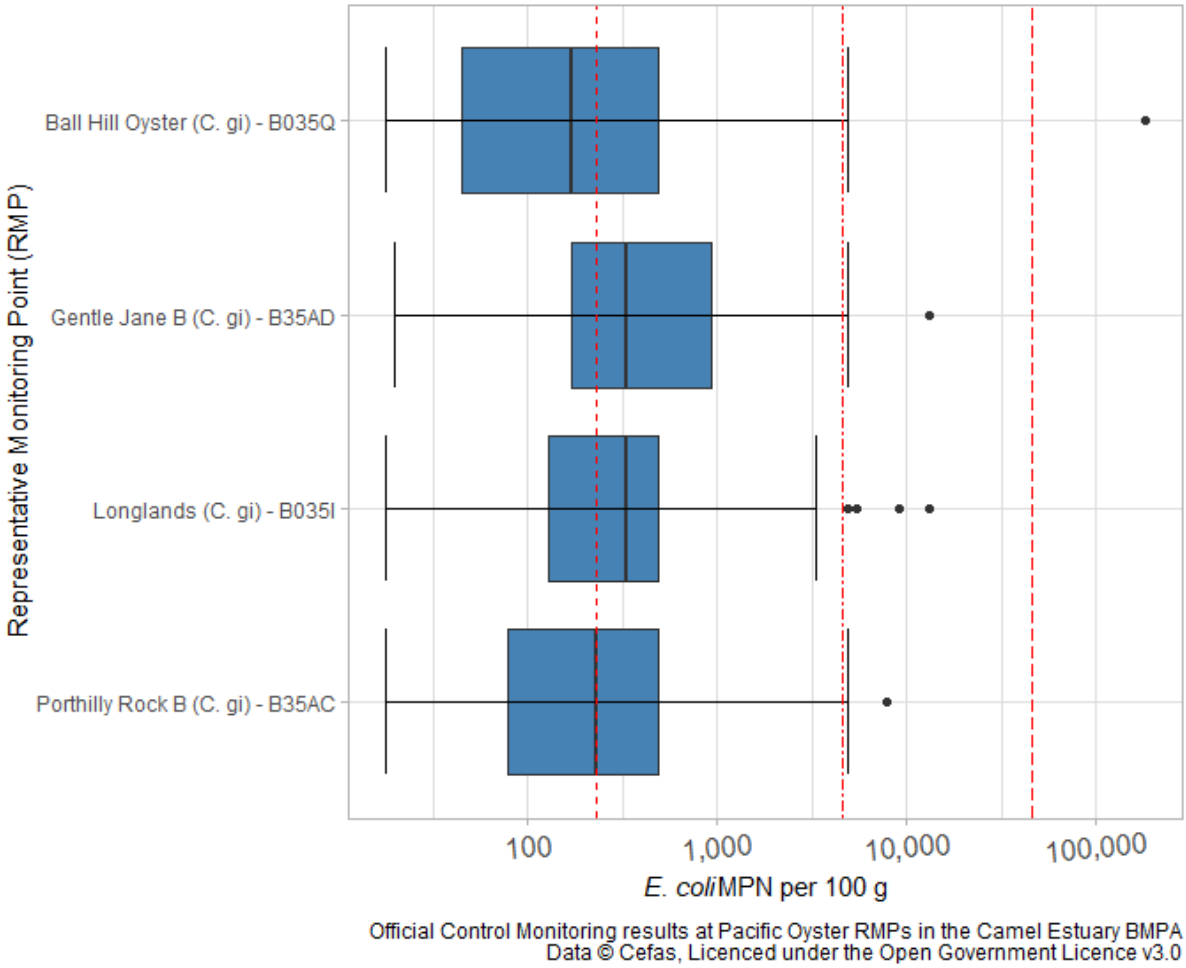


Figure 6.3 Boxplots of E. coli concentrations at Pacific oyster RMPs in the Camel Estuary BMPA since 2011. Vertical dashed lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

6.2 Overall temporal pattern in results

The overall temporal pattern in shellfish flesh monitoring results for RMPs sampled within the Camel BMPA are shown in Figure 6.4 for mussels, and Figure 6.5 for Pacific oysters.

The monitoring results from mussel RMPs (Figure 6.4) suggest that the level of contamination at the Gentle Jane / P. Cove (B035B) and Ball Hill West (B035U) RMPs have been broadly stable, although there is a slight improvement in shellfish flesh monitoring results and decline at the latter since 2019, to the point where the loess models fitted to the data now converge. There has also been a marked decline in shellfish flesh monitoring results at the Porthilly Rock (B35AE) RMP in recent years. Rock beach (near the Porthilly Rock RMPs) was de-designated as a bathing water in 2016 due to concerns over public safety and low usage. Intermittent discharge data suggest that the frequency of spills from intermittent discharges in the area has remained broadly consistent. The RMP is in the vicinity of a significant number of moorings, but the LEA advised during secondary

consultation that the number had not increased. No real temporal trend from the Ball Hill Relay (B35AI) RMP can be drawn, as only 4 samples were collected.

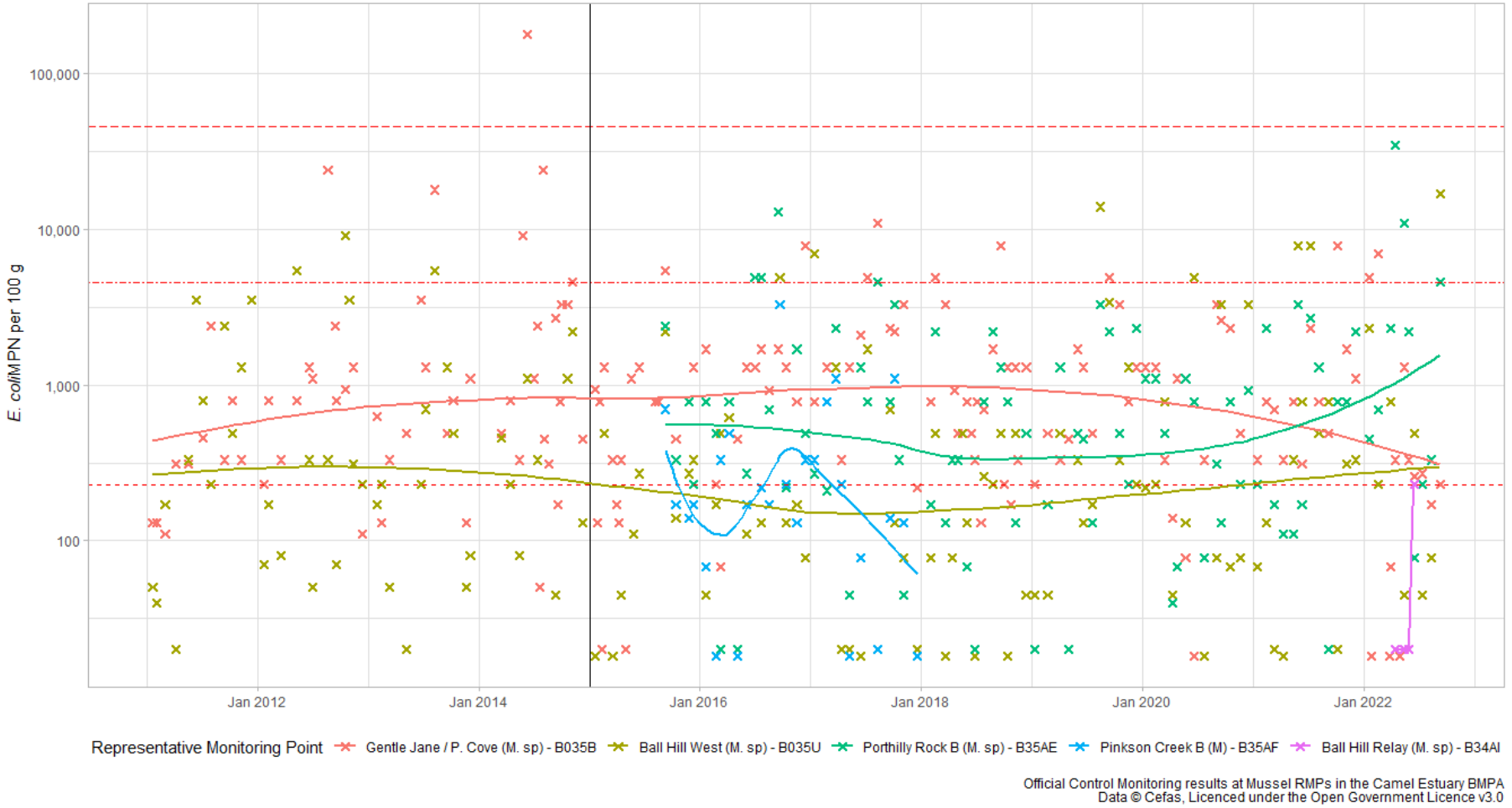


Figure 6.4 Timeseries of E. coli levels at mussel RMPs sampled in the Camel BMPA since 2011. Scatter plots are overlaid with a loess model fitted to the data. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

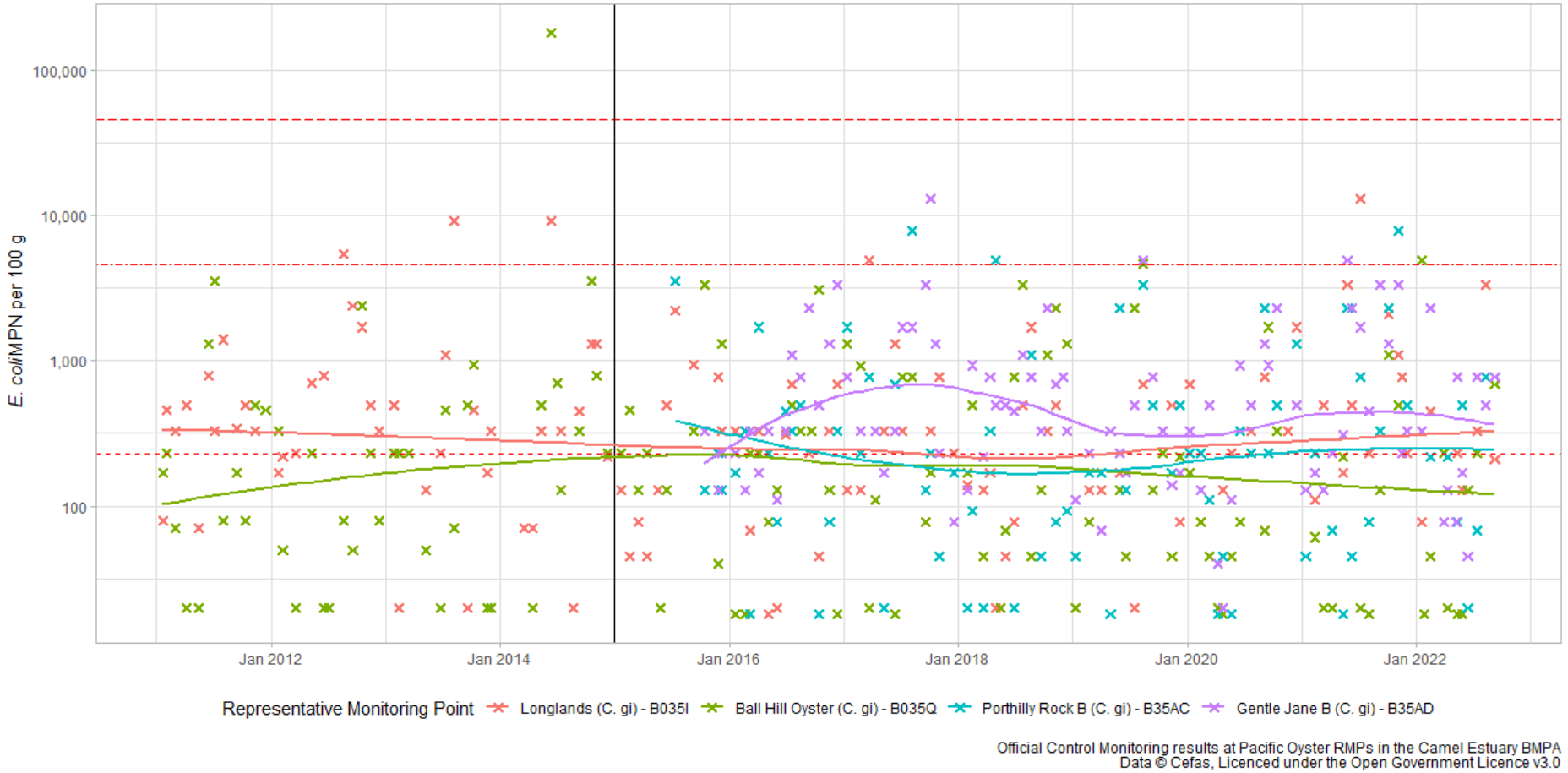


Figure 6.5 Timeseries of E. coli levels at Pacific oyster RMPs sampled in the Camel BMPA since 2011. Scatter plots are overlaid with a loess model fitted to the data. Horizontal lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

Monitoring results from the Longlands (B035I) and Ball Hill Oyster (B035Q) have also been relatively consistent, with the trend lines located at or around the 230 MPN/100 g threshold (Figure 6.5). Interestingly, despite the two RMPs being co-located, the increase seen at the Porthilly Rock mussel RMP in Figure 6.4 is not replicated in the Pacific oyster RMP, where the trend line is much more consistent. It is clear from the loess models that the contamination in the vicinity of the Gentle Jane (B35AD) RMP is higher than other areas.

6.3 Seasonal patterns of results

The seasonal patterns of *E. coli* levels at the various RMPs within the Camel BMPA were investigated and are shown for mussels in Figure 6.6 and for oysters in Figure 6.7. The data for each year were averaged into the four seasons, with winter comprising data from January to 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 (if there is more than one RMP for a given species) as independent factors (i.e., pooling the data across season and RMP respectively), as well as the interaction between them (i.e., exploring seasonal differences within the results for a given RMP). Significance was taken at the 0.05 level.

Figure 6.6 and Figure 6.7 suggest that monitoring results from summer months are higher than those from other times of the year, and that results from winter months are the lowest. This pattern could be explained by the population increase that the area receives in the summer due to tourism. Despite the visual differences, no significant differences ($p > 0.05$) were found in the data, either when the data for an individual RMP was considered, or when the data was pooled across RMP for either species.

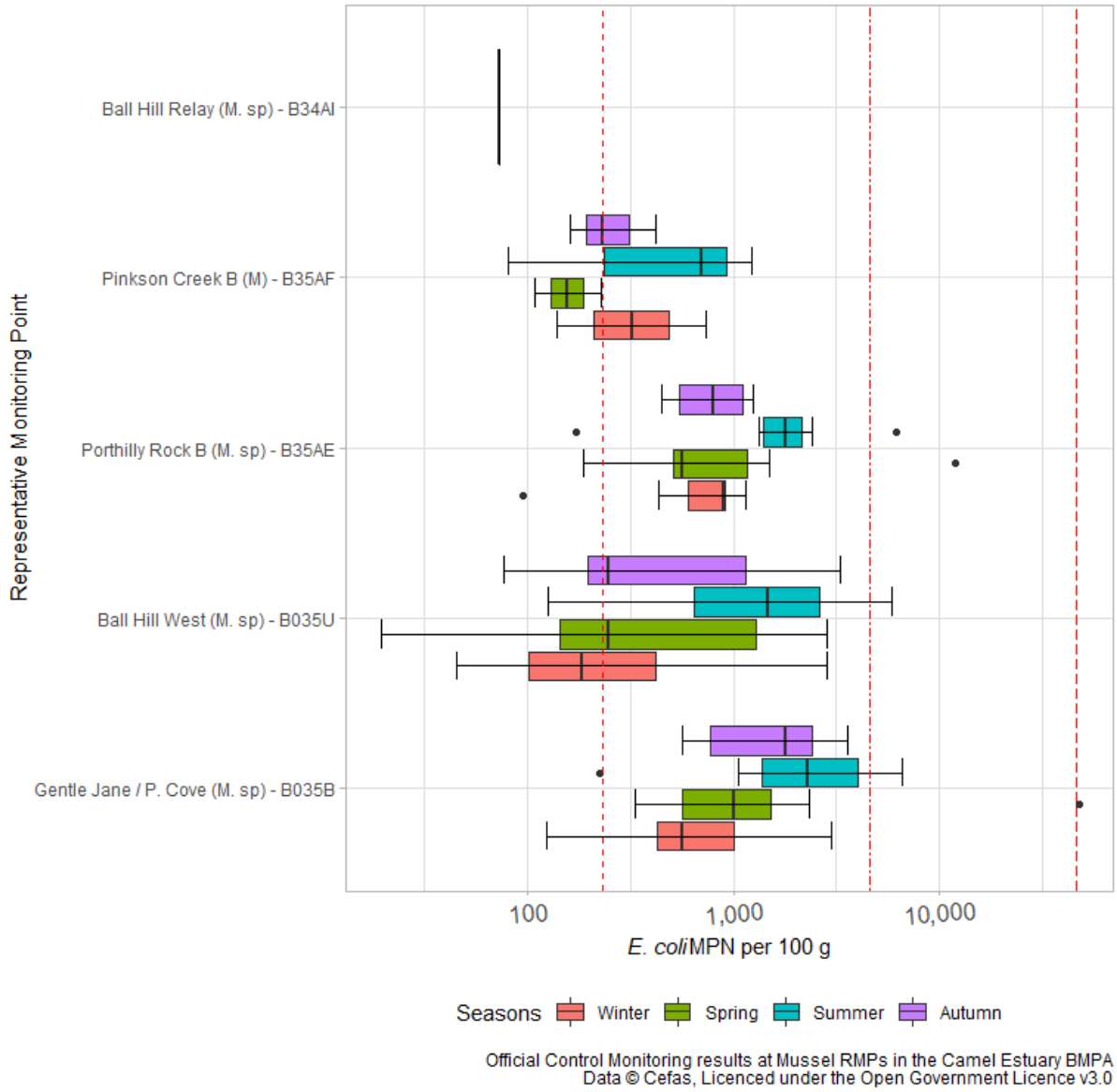


Figure 6.6 Boxplots of E. coli levels per season at mussel RMPs sampled within the Camel BMPA. Horizontal dashed lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

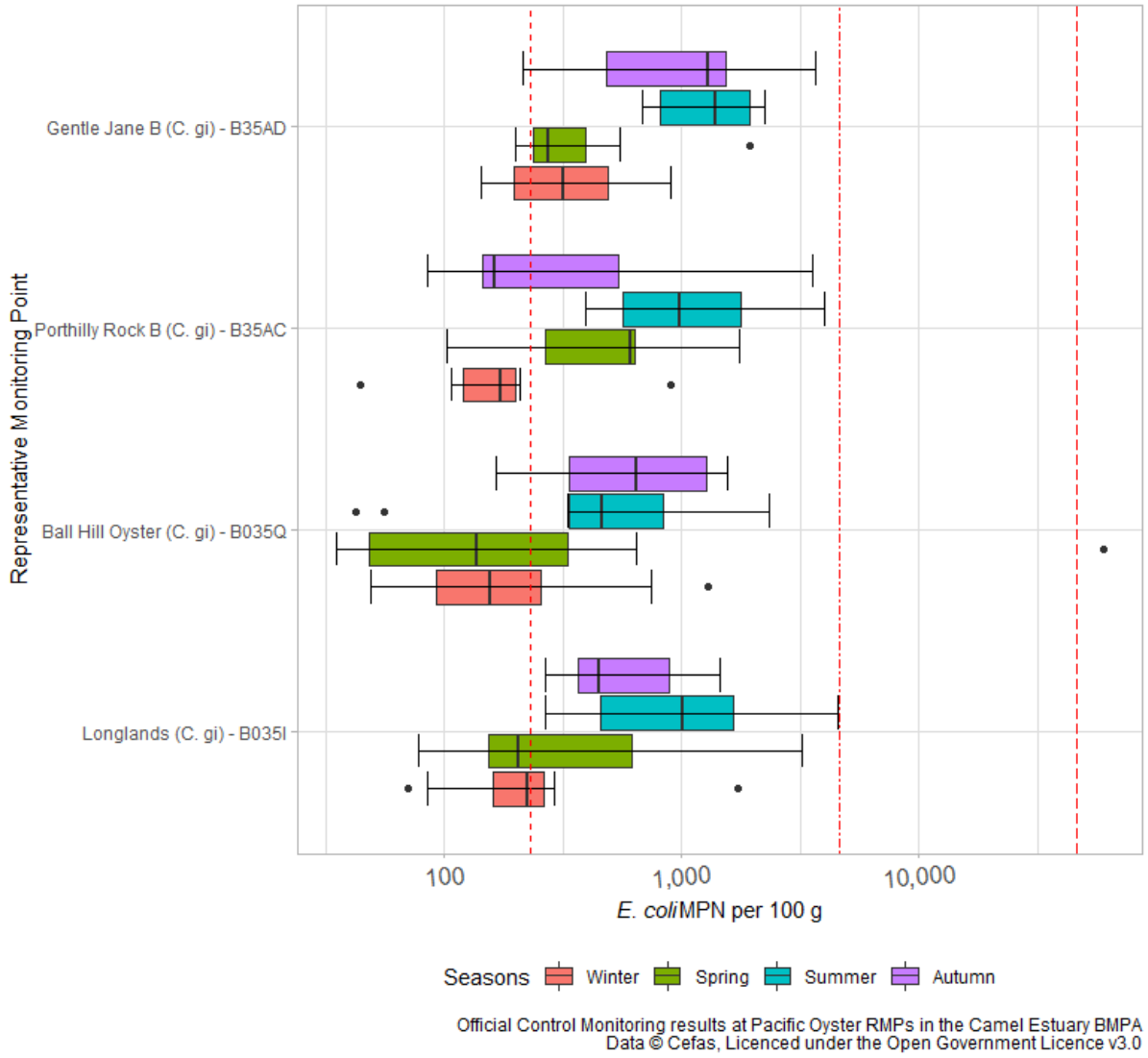


Figure 6.7 Boxplots of E. coli levels per season at Pacific oyster RMPs sampled within the Camel BMPA. Horizontal dashed lines indicate classification thresholds at 230, 4,600 and 46,000 MPN/100 g respectively.

6.4 Action States

Since the 2015 survey review, one result above the classification threshold has triggered an action state. This occurred on 12 April 2022 following a result of 35,000 *E. coli* MPN/100 g in *Mytilus* spp. at Porthilly Cove B35AE. Subsequent samples, collected 9 and 15 days after the initial result, returned concentrations of 45 and 20 *E. coli* MPN/100 g respectively. No pollution or extreme rainfall events were recorded in the days preceding the Action State result, and all sampling followed correct protocols meaning that there were no grounds to waive the result. Subsequent monthly sampling on 12 May 2022 returned a result of 11,000 *E. coli* MPN/100 g indicating a resurgence of elevated contamination. Other results above classification thresholds have been recorded in samples collected from RMPs in the Camel estuary but none of these exceeded the action state threshold (18,000 *E.coli* MPN/100 g).

This Action State result suggests that although very infrequently (only 1 event over 7 years), extremely high *E. coli* results are recorded at RMPs in the Camel BMPA. The fact that subsequent Action State sampling recorded very low results (<100 *E. coli* MPN/100 g) suggests that contamination is flushed quickly from shellfish beds in the BMPA. No conclusions on the placement of RMPs can be drawn from these results.

7 Conclusion and overall assessment

Classification Zones within the Camel BMPA are situated within the main body of the estuary, upstream of the main conurbations of Padstow and Rock. The BMPA includes a wild fishery for mussels and cultivated Pacific oysters. C-IFCA indicated during initial consultations that the only commercial harvest in the BMPA is on beds operated under the River Camel Mussel and Oyster Fishery Order 2013. In terms of landings (kg), the oyster fishery is much larger than the mussel fishery. Historically there have been cockle and Peppery furrow clam fisheries in the estuary, although these are not currently active due to a lack of stock and commercial interest.

There are currently seven classification zones within the estuary, three for mussels and four for Pacific oyster, a slight reduction on the nine zones recommended by the 2015 sanitary survey review.

The 2015 Sanitary Survey Review compared the results of the 2011 Census to that of the 2001 Census to give an indication of the changes in human population within the catchment. No further Census data are available as the results of the 2021 Census have not yet been published. However, if the Camel catchment matches the UK government's estimated population trend, the total population within the catchment will be approximately 64,000 people, based on the UK-wide estimate of an increase of 6.79% on the 59,579 at the 2011 census.

The main population centres of relevance to the bacteriological health of the BMPA are the towns of Rock and Padstow (< 1 km from all CZs in the BMPA), and Wadebridge at the head of the estuary (approximately 6km from the *Gentle Jane* CZ). The geographical extent of these conurbations has not increased significantly since the original sanitary survey, but population size is expected to have increased. This will have an impact on the loading to the sewage treatment network.

The area remains a popular tourist destination, and recent statistics suggest that numbers of visitors are increasing. It is likely that the main swelling in population size (and associated increase in loading to the WWTN) will occur during summer months, although no information has come forward during the desk assessment or initial consultation to suggest the existing capacity of the sewage network is insufficient to handle this increase.

No changes to either the treatment methodologies or the consented discharge volumes of those discharges closest to the BMPA have occurred. The most relevant discharges in terms of contamination impacting the shellfish CZs are the Little Petherick WWTW and Porthilly STW; it is worth noting there has been no change in discharge volumes or to these assets

since the 2015 review. Limited comparison of EDM data for intermittent discharges was possible, although there remain a cluster of intermittent discharges off Padstow and Porthilly Beach, within 1 km of the CZs that should be taken into account in any updated sampling plan.

Livestock populations within the catchment (based on the annual June Survey of Agriculture) were provided by DEFRA under the Open Government Licence v3.0 for 2013 and 2021 to give an indication of changes in livestock populations within the catchment. These data suggested that there was a significant increase in livestock populations, though this was mostly driven by drastic increases in poultry and pig populations. The area of the catchment covered by pasture or arable farmland remained very similar. There are several areas of pasture immediately adjacent to all CZs except *Porthilly Rock* and run-off from these areas could represent a significant source of contamination following heavy rainfall. The EA stated during initial consultations that there were some farms that had issues with the storage and application of slurry, although specific details were not provided and are not available due to data protection issues. Based on the information available to the authors from initial consultations and the desk based assessment, the areas most at risk, and the extent of that risk have not changed significantly since the original sanitary survey and therefore the sampling plan recommendations made in that document remain valid.

Land cover maps show that the Camel Estuary contains a variety of habitats that support a large diversity of wildlife. One of the groups of animals that is most likely to contribute significant levels of contamination to the BMPA are overwintering and water-birds. The annual counts by the Wetland Bird Survey suggest that the Camel Estuary contains the highest winter count of waterbirds of any estuary in Cornwall. Whilst the average count in the five winters to 2019/2020 was lower than in the five years to 2014/2015, the area still contains internationally significant populations of many species. Where a flock of waterbirds defecate directly on shellfish beds, significant pollution can occur. However it is impossible to define RMP locations that will reliably capture the pollution as the precise locations will vary from year to year with the shifting distributions of the birds' prey. Seals may forage in the area from time to time, although there is no significant seal colony in the area and any pollution is likely to be diffuse and intermittent. No other wildlife species of significance to the sampling plan were identified.

There is no commercial shipping traffic in the Camel Estuary as the shallow bathymetry prohibits access to large vessels. Recreational craft of a sufficient size to contain onboard toilets are liable to make occasional overboard discharges, either when moored overnight or when moving through the main navigational channels. The risk of this source of pollution is not assessed to have increased significantly, and it remains challenging to account for it in any updated sampling plan.

A total of nine RMPs have been sampled within the Camel BMPA since the 2015 sanitary survey review was published, of which two were sampled prior (since 2011). Two RMPs are no longer sampled: Ball Hill Relay (B35AI), from which only four samples were collected

between April and June 2022, and Pinkson Creek B (B35AF), which was sampled until 2017 when the CZ it was used to classify was declassified.

No significant differences were found in the monitoring results from these RMPs, although in instances where RMPs were co-located for different species, generally mussel RMPs returned higher 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 2015 sanitary survey review was published. At present some knowledge gaps exist although it is hoped additional information at secondary consultation will clarify these.

Having reviewed and compared the desk based study with the findings of the previous sanitary survey review in 2015, the FSA are content that an update shoreline assessment is not required.

8 Recommendations

Recommendations for the various Classification Zones within the Camel BMPA are described below and summarised in Table 8.1.

8.1 Mussels

8.1.1.1 Porthilly Cove

This CZ covers an area of 0.015 km² and is located adjacent to Brea Beach off Rock. The 2015 review recommended that the RMP be situated at the western extremity of the CZ to capture contamination from up-estuary sources such as Porthilly CSO and Harbour Lights CSO. The monitoring results from this RMP have indicated a decline in water quality in recent years (Figure 6.4), and it is recommended that the RMP position be retained as it continues to be representative of the worst-case contamination affecting this zone.

8.1.1.2 Gentle Jane

This zone covers an area of 0.031 km² and is located on the north bank of the estuary. The 2015 sanitary survey recommended retaining the existing RMP as it was representative of the main contamination sources due to its up-estuary location close to the main low water channel. This RMP is still in use, although the current boundaries of this zone extend farther up-estuary than the zone mapped in the 2015 report. It is not immediately clear whether the western or eastern end of the zone would receive greater levels of contamination. The western end will receive contamination on a flooding tide from the towns of Padstow and Rock, as well as from the sewage discharges in the estuary, whereas the eastern end would receive contamination on an ebbing tide, from up-estuary sources (run-off from Wadebridge and the upper catchment). We therefore recommend temporarily creating two RMPs within the zone, one at the up-estuary end and one at the down-estuary end (both on the mid-points). The RMPs should be concurrently sampled for a period of 8 – 10 samples, and whichever RMP returns higher results should be retained for Classification purposes moving forwards.

8.1.1.3 *Ball Hill*

This zone is located on the southern side of the estuary, covering an area of 0.04 km². The 2015 review recommended retaining the existing RMP as it was located on the eastern extremity of the zone and therefore representative of up-estuary sources of contamination. The current boundaries of the zone are further up estuary than accounted for in the original survey, and so the RMP should similarly be moved eastwards to reflect this.

8.2 Pacific Oysters

8.2.1.1 *Porthilly Rock*

The boundaries of this zone are the same as the mussel zone of the same name. It is recommended that the RMP be retained as it will still be representative of the contamination sources affecting this zone.

8.2.1.2 *Longlands*

This zone covers an area of 0.027 km² and is located immediately west of the *Gentle Jane* mussel and Pacific oyster CZ. The 2015 sanitary survey recommended retaining the existing RMP as it would still capture the contamination from the sewage discharges, including the Porthilly STW, in the near vicinity. It should be retained moving forward for the same reason, as these discharges continue to represent the most significant sources of contamination to this classification zone.

8.2.1.3 *Gentle Jane*

The 2015 sanitary survey recommended that a new RMP be created on the eastern end of the zone, as upstream sources including run-off from Wadebridge and the upper catchment) were identified as being most relevant to the contamination levels within this zone. The RMP should be retained moving forward, at least temporarily. However, if the concurrent monitoring to be undertaken for the Gentle Jane mussel zone (discussed above) indicates that a down-estuary location is a worse-case scenario, then the RMP should be moved to the same location as the new mussel RMP.

8.2.1.4 *Ball Hill*

This zone covers the same area as the mussel zone of the same name, and the RMP is co-located. As above, the RMP for this zone should be moved eastwards to the up-estuary extent of the zone at the mid point of the boundary, to adequately represent the contamination sources affecting the zone.

8.3 General Information

8.3.1 Location Reference

Production Area	**Camel Estuary**
Cefas Main Site Reference	M035
Ordnance survey 1:25,000	Explorer 106 (Newquay & Padstow)
Admiralty Chart	No. 1168

8.3.2 Shellfishery

Species	Culture Method	Seasonality of Harvest
Mussels (*Mytilus* spp.)	Wild	Year Round
Pacific oyster (*Crassostrea gigas*)	Cultivated	Year Round

8.3.3 Local Enforcement Authority(s)

Name	**Cornwall Port Health Authority** The Docks, Falmouth, Cornwall TR11 4NR
Website	https://www.cornwall.gov.uk/environment/cornwall-port-health-authority/
Telephone number	01872 323090
E-mail address	porthealth@cornwall.gov.uk

*Table 8.1 Proposed sampling plan for the Camel Estuary 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
Porthilly Rock (*Crassostrea gigas*)	B35AC	Porthilly Rock B	SW 9340 7530	50°32.45'N 04°55.03'W	*C. gigas*	Hand-picked (bags)	Hand picked	*C. gigas*	10 m	Monthly
Porthilly Cove (*Mytilus* spp.)	B35AE	Porthilly Rock B	SW 9340 7530	50°32.45'N 04°55.03'W	*Mytilus* spp.	Hand picked (wild)	Hand picked	*Mytilus* spp.	10 m	Monthly
Longlands	B035I	Longlands	SW 9354 7483	50°32.20'N 04°54.89'W	*C. gigas*	Hand-picked (bags)	Hand picked	*C. gigas*	10 m	Monthly
Gentle Jane (*C. gigas*)	B35AD	Gentle Jane B	SW 9404 7463	50°32.10'N 04°54.46'W	*C. gigas*	Hand-picked (bags)	Hand picked	*C. gigas*	10 m	Monthly
Gentle Jane (*Mytilus* spp.)	**TBC**	**TBC**	**SW 9382 7472**	**50°32.15'N, 04°54.65'" W**	*Mytilus* spp.	Hand picked (wild)	Hand picked	*Mytilus* spp.	10 m	Monthly
	TBC	**TBC**	**SW 9404 7463**	**50°32.10'N 04°54.46'W**						
Ball Hill (*C. gigas*)	**TBC**	**TBC**	**SW 9366 7424**	**50°31.88'N 04°54.77W**	*C. gigas*	Hand-picked (bags)	Hand picked	*C. gigas*	10 m	Monthly

Classification Zone	RMP	RMP Name	NGR (OSGB 1936)	Lat / Lon (WGS 1984)	Species Represented	Harvesting Technique	Sampling Method	Sampling Species	Tolerance	Frequency
Ball Hill (*Mytilus* spp.)	**TBC**	**TBC**	**SW 9366 7424**	**50°31.88'N 004°54.77 W**	*Mytilus* spp.	Hand picked (wild)	Hand picked	*Mytilus* spp.	10 m	Monthly

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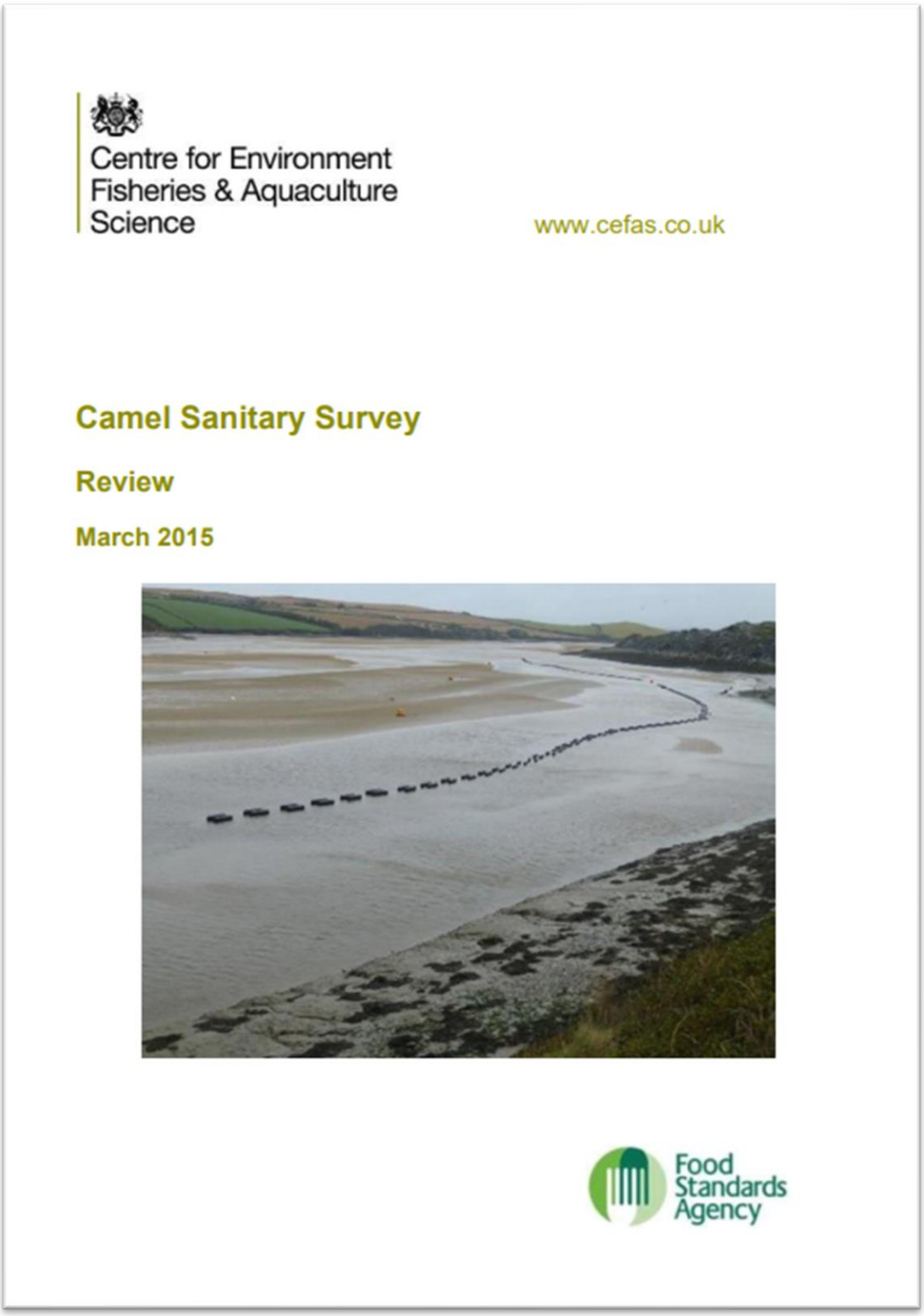
10 Appendices

Appendix I. 2021 EDM Return

Site Name	Permit Reference	NGR	Count of Spills in 2021	Duration of Spills (hrs) in 2021
MOYLE ROAD CSO	302975	SW9218074790	18	4.92
BLOWING HOUSE LANE CSO	301825	SX 0557 6570	125	1815.13
HARBOUR LIGHTS CSO	301863/CS/01	SW 9338 7524	0	0
BODMIN NSTALLON WWTW	NRA-SW-6959	SX 0433 6735	56	942.91
PADSTOW HARBOUR PUMPING STATION	302973	SW 9201 7545	13	8.1
PORTHILLY COVE PS	302972	SW 9373 7546	9	3.85
PORTHILLY COVE PS	302972	SW 9338 7524	9	3.85
TREDRIZZICK BRIDGE PUMPING STATION	034546/PC/01	SW 9588 7703	13	61.84
ST MABYN WWTW	NRA-SW-0414	SX 0422 7540	8	19.36
EGLOSHAYLE PUMPING STATION	302976	SW 9971 7207	9	1.69
ST TEATH WASTEWATER TREATMENT WORKS	302142	SX 0592 8059	112	101.94
WADEBRIDGE PS	302977	SW 9885 7272	24	204.59
METHODIST CHURCH CSO	301836/CS/01	SX 1063 8373	Unspecified /No EDM	Unspecified/ No EDM
BODMIN GOLF COURSE PSCSO/EO	302093/PC/01	SX0733464400	Unspecified /No EDM	Unspecified/ No EDM
ST BREWARD STW	NRA-SW-6746	SX0913076180	0	0
BODMIN NSTALLON WWTW	NRA-SW-6959	SX0449567023	Unspecified /No EDM	Unspecified/ No EDM
OLD COACH ROAD	301686/CS/01	SX0373464702	Unspecified /No EDM	Unspecified/ No EDM
OLD JAIL COMBINED SEWER OVERFLOW	301827	SX 0580 6743	116	2023.93
DRAGONS PIT COMBINED SEWER OVERFLOW	301826	SX 0754 6535	56	46.43
DELABOLE WASTEWATER TREATMENT WORKS	NRA-SW-4934	SX 0729 8294	134	2142.33

Site Name	Permit Reference	NGR	Count of Spills in 2021	Duration of Spills (hrs) in 2021
CAMELFORD WWTW	15/49/281/P/16	SX 1058 8323	34	358.5
CHAPEL AMBLE WWTW	EPR/CP3528XH	SW 9979 7526	28	341.37
DELABOLE WASTEWATER TREATMENT WORKS	NRA-SW-4934	SX 0729 8294	247	1719.1
MOYLE ROAD CSO	302975	SW 9225 7478	18	4.92
NEW POLZEATH PUMPING STATION	034547/PC/01	SW 9346 7957	1	4.42
LANIVET INN COMBINED SEWER OVERFLOW	302157	SX0379064170	3	0.79
LITTLE PETHERICK WWTW	NRA-SW-3676	SW 9182 7258	83	497.65
PADSTOW FORESHORE PUMPING STATION	302974	SW 9224 7492	23	151.74
ROCK PUMPING STATION	302971	SW 9307 7560	2	1.63
MARKET SQUARE CSO	301835/CS/01	SX 1063 8373	Unspecified /No EDM	Unspecified/ No EDM



Centre for Environment
Fisheries & Aquaculture
Science

www.cefas.co.uk

Camel Sanitary Survey

Review

March 2015

Follow hyperlink in image to view full report.

11 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.

12 Contact Us

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13 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.

14 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.

15 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*"