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Medina Estuary Sanitary Survey

Review

March 2014

Food Standards Agency

Cover photo: Entrance to the Medina Estuary (looking south west)

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Statement of use

Under EC Regulation 854/2004 which lays down specific rules for official controls on products of animal origin intended for human consumption a sanitary survey relevant to bivalve mollusc beds in Medina Estuary was undertaken in 2008. This provided an appropriate hygiene classification zoning and monitoring plan based on the best available information with detailed supporting evidence. The FSA is committed to reviewing sanitary surveys every six years or sooner if significant changes in pollution sources or the fishery have occurred that may require revision of the sampling plan. This report provides six year review of information and recommendations for a revised sampling plan. The Centre for Environment, Fisheries & Aquaculture Science (Cefas) undertook this work on behalf of the Food Standards Agency (FSA).

Revision history

Version	Details	Approved by	Approval date
1	Draft for internal review	David Walker	18/03/2014
2	Draft for external review	Simon Kershaw	27/03/2014
Final	Final report post consultation	Simon Kershaw	10/07/2014

Consultation

Consultee	Date of consultation	Date of response
Environment Agency	31/03/2014	30/04/2014
Defra	31/03/2014	No response
Isle of Wight Council	31/03/2014	07/05/2014
Natural England	31/03/2014	17/04/2014
Shellfish Association of Great Britain	31/03/2014	No response
Southern IFCA	31/03/2014	No response
Southern Water	31/03/2014	23/04/2014

Dissemination

Food Standards Agency, Isle of Wight Council. The report is available publicly via the Cefas website.

Recommended Bibliographic Reference

Cefas, 2014. Review of the Medina Estuary 2008 Sanitary Survey. Cefas 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 EC Regulation No. 854/2004.

Contents

1. Introduction

1.1. Background

The Centre for Environment, Fisheries & Aquaculture Science (Cefas) is performing sanitary surveys for new bivalve mollusc production areas (BMPAs) in England and Wales, on behalf of the Food Standards Agency (FSA). The purposes of the sanitary surveys are to demonstrate compliance with the requirements stated in Annex II (Chapter II paragraph 6) of EC Regulation 854/2004, whereby 'if the competent authority decides in principle to classify a production or relay area it must:

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

In line with the EURL Good Practice Guide Cefas is contracted to undertake reviews of sanitary surveys on behalf of the Food Standards Agency. Reviews are to be undertaken six yearly intervals after the original sanitary survey or sooner and where there are changes to the type and locations of the shellfisheries or significant changes in sources of pollution.

1.2. Medina Estuary Review

This report reviews information and makes recommendations for a revised sampling plan for existing *Ostrea edulis* (native oyster) classification zones in the Medina Estuary (Figure 1.1). This review identifies changes to the information presented in the sanitary survey through a desk based study and shoreline survey. The assessment and sampling plan have been updated as necessary.

Specifically, the review considers:

(a) changes to the shellfishery
(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 in the area
(e) change in environmental conditions

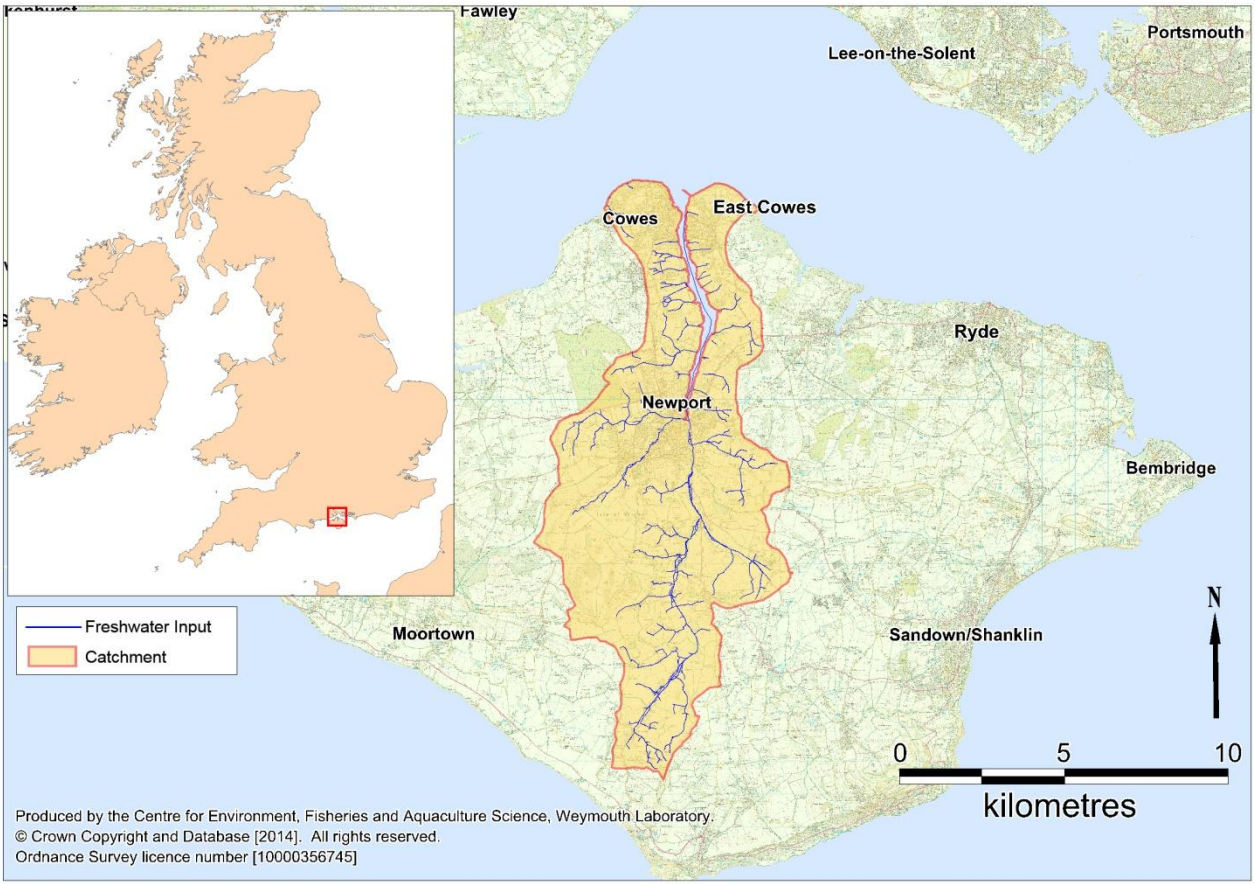

Figure 1.1: Location of the Medina Estuary

2. Shellfisheries

2.1. Description of shellfishery

Figure 2.1 shows the current and historic classification zones in the Medina Estuary. At present no shellfish beds are being harvested within the Medina Estuary. This is due to a temporary closure of all of the shellfish beds in the Solent (which includes the outer Medina estuary). The closure has been in place since 1st November 2013 due to severely depleted stock (Southern IFCA, 2013). However, the Squadron and Castle Point native oyster beds are temporarily declassified with quarterly monitoring. The oyster beds may reopen on 31st October 2014.

Medina Wharf, received a variety of classifications since September 2003 (class C and prohibited) and was declassified in September 2011 due to a lack of commercially available stock.

Dodnor shellfish bed has been prohibited for all species since the initial bacteriological study in the sanitary survey. Consequently no commercial dredging of *Tapes* clams, cockle or hard clam has taken place since that time.

The hard clam (*Mercenaria mercenaria*) handpicked fishery between North Fairlee and Kingston has not been classified since classification of hard clams was requested in 2008. This is due to insufficient stock to support a commercially viable fishery for this species in the Medina.

There is anecdotal evidence (mentioned by members of the public) that there is some degree of illegal commercial harvesting of shellfish in the Dodnor beds especially offshore of the Medina Valley Centre.

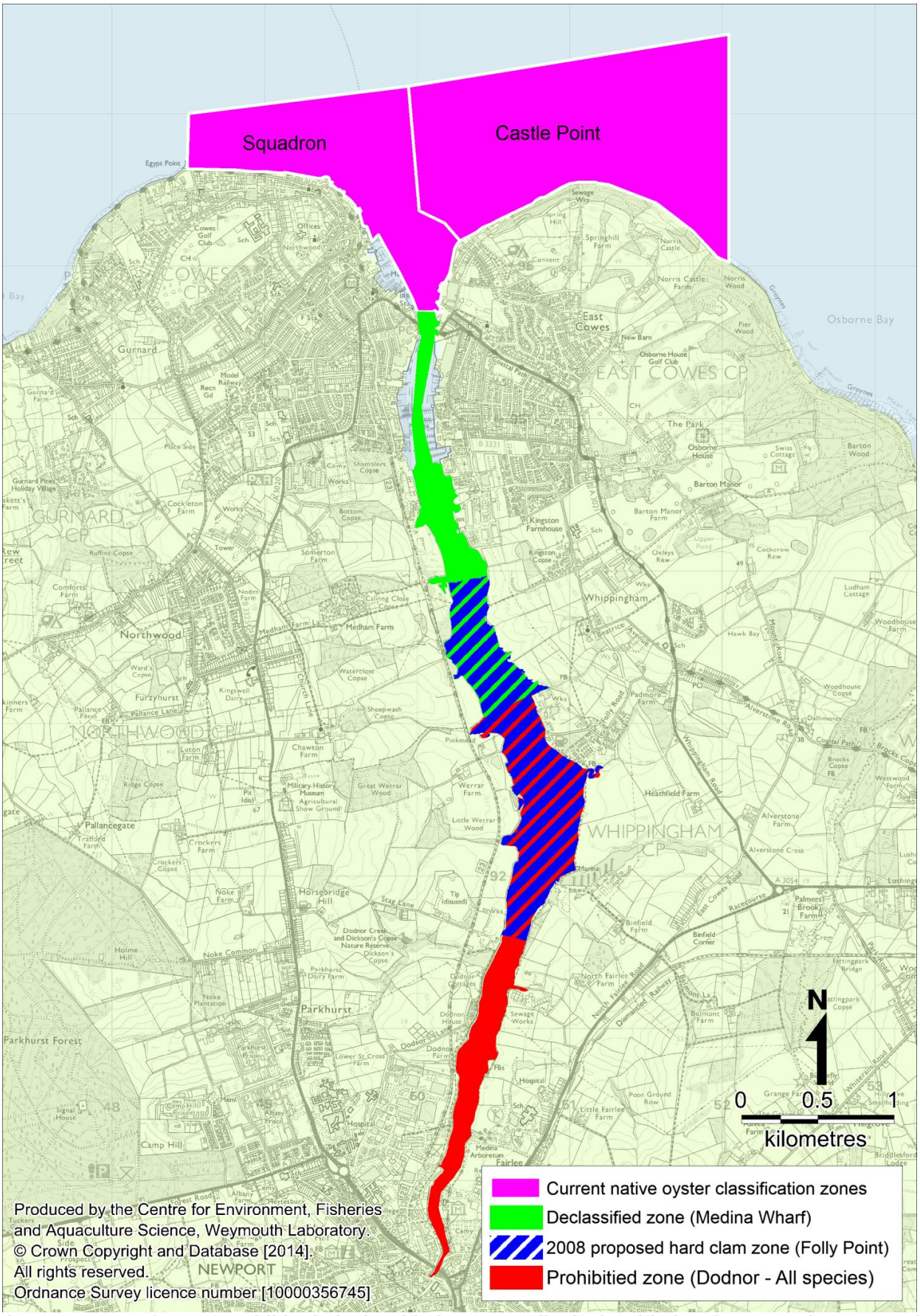

Figure 2.1: Locations of prohibited, declassified, temporarily declassified and proposed zones, and current RMPs Hygiene Classification.

N.B. Prohibited and declassified zones partially overlap the proposed hard clam zone (hatched regions)

Table 2.1 lists all of the classifications within the Medina Estuary since 2003 and Figure 2.1 shows the locations of the classification zones. Medina Wharf had a C classification until 2006 when it was prohibited. It remained prohibited until 2008 when it reclassified as C before being declassified in 2011. Both Castle Point and Squadron have maintained B classifications since the sanitary survey.

Table 2.1: Classification history for the Medina Estuary

Bed name	RMP	Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Medina Wharf	Medina Wharf		C	C	C	P	P	C	C	B	DC	-	-
Castle Point	Castle Point	*O. edulis*	-	-	-	B	B	B	B	B-LT	B-LT	B-LT	B-LT
Squadron	Squadron		-	-	-	C	B	B	B	B	B	B	B
Dodnor	Fairlee STW Outfall	All species	-	-	-	-	-	-	P	P	P	P	P

LT denotes long term classification; P denotes prohibited; DC denotes declassification

3. Overall Assessment

Since the sanitary survey, the fishery within the Medina estuary has declined. At the time of the survey, there were three pre-existing classification zones; Squadron, Castle Point and Medina Wharf. Two additional applications were made for a handpicked hard clam (*Mercenaria mercenaria*) fishery between North Fairlee and Kingston Wharf which was dropped due to a lack of commercially available stock. Another application for dredged *Tapes* clams, cockle and hard clam fisheries between Newport and Folly Road received prohibited results in the initial monitoring programme and has remained prohibited since.

There are no active shellfish beds within the estuary at present. The Medina Wharf zone was declassified in 2011 due to a lack of commercially available stock. Castle Point and Squadron have been temporarily declassified until 31st October 2014, also due to a lack of commercially available native oyster stocks. However, according to the Isle of Wight Council, there is interest in harvesting oysters from these beds once they are reopened.

The human population within the catchment has increased by approximately 2.2% between the 2001 to 2011 census data reports. However, the volume of sewage discharged to the Medina estuary will have decreased in this period due to the transfer of the Fairlee sewage treatment works (STW) continuous discharge out of the catchment to Sandown, in 2010.

Five additional water company continuous discharges which flow into the Medina upstream of Newport were identified as a potential source of microbiological pollution to the Dodnor classification zone.

A cluster of intermittent discharges situated west of Cowes outside the mouth of the Medina has also been identified as a potential source of contamination to the Squadron and Castle Point Beds on a flood tide. Dodnor Lane and Prior Crescent CSOs which discharge to the Medina in a similar location could represent a significant contamination source towards the north end of the Dodnor classification zone. There were a large number of long duration spills in late 2010/early 2011. However, this does not appear to have been reflected in the level of *E. coli* in shellfish samples taken around the time. Intermittent discharges create issues in management of shellfish hygiene however infrequently they spill. Their impacts are not usually captured during a year's worth of monthly monitoring from which the classification is derived as they only operate occasionally. Therefore when they do have a significant spill, heavily contaminated shellfish may be harvested under a better classification than the levels of *E. coli* within them may merit. A reactive system alerting relevant parties to spill events in real time could convey better public health protection information.

The Medina Leisure Park private discharge is still considered a significant source of microbiological contamination to the mid estuary with a maximum consented daily discharge of 100 m^3/day. It is expected that this discharge will fluctuate seasonally with highest discharge rates during the spring and summer months.

Overall numbers of livestock reported in the Isle of Wight decreased between 2007 and 2010. Freely available data were not available after 2010, therefore it is difficult to assess changes in livestock numbers since 2010. The livestock data reported for the Isle of Wight may not be representative of the Medina catchment as the Isle of Wight covers a wider area. Livestock appears to be widely spread throughout the catchment, and so will not influence the positioning of the monitoring points.

Bird populations within the Medina have remained fairly constant since the sanitary survey, with the exception of the Black-headed gull population, which has doubled. On the shoreline survey, birds were observed throughout the estuary. There were no large aggregations in any specific locations within the estuary and therefore this increase in birds is unlikely to influence the location of the RMPs. Seals were also assessed in this review but due to their small population size and large spatial and temporal variability their presence will not influence the sampling plan.

There have been no significant changes to the bathymetry since the sanitary survey. The Medina Breakwater Project is expected to commence in March 2014 which includes the construction of a new 350 m breakwater in the entrance to Cowes Harbour; an extension to the existing Shrape Breakwater by 58 m; the dredging of a new eastern channel and a marina with 400 berths in the lee of the Shrape breakwater. These structures will affect flows within the outer estuary and will divert the flood and ebb flows around the new breakwater through the western and newly dredged eastern channels. They are unlikely to influence contamination in the shellfish. The new marina will increase the number of leisure craft within Cowes and there may be some microbiological pollution associated with this increase. However, it is an offence under harbour byelaw to discharge sewage into the estuary when moored or alongside marina facilities with direct pedestrian access.

Before the sanitary survey, there were significant differences in *E. coli* levels between the three native oyster RMPs (Medina Wharf, Squadron and Castle Point). However, since then Medina Wharf is no longer sampled and the two outer estuary RMPs, Castle Point and Squadron do not differ significantly. In addition, *E. coli* levels at all native oyster RMPs are generally higher during the flood tide than other states of tide. This pattern was not seen before the sanitary survey. This suggests that there have been changes in the sources of contamination at the RMPs. However, no effect from moving the Fairlee STW outfall was evident.

The increased *E. coli* levels during the flood tide indicate that the source of contamination is to the west of the RMPs. However, the only significant sources of contamination west of the RMPs are intermittent water company discharges. There were a large number of spills recorded in late 2010 and early 2011, which may partially account for the change. However, no spill data were available for late 2011 which means that it is not possible to say with certainty if this was the main driver for the change.

4. Sampling Plan

4.1. Recommendations

Native oysters (*O. edulis*)

All native oyster beds in the Medina are temporarily closed until 31st October 2014. Both native oyster classification zones appear to share contamination sources and are affected by fluctuations in *E. coli* levels in a similar way. Both classification zones have received B classifications since 2007. For this reason it is recommended that the two native oyster classification zones are combined into a single classification zone with a single RMP.

Medina Mouth – This zone represents all of the native oysters around the mouth of the Medina estuary. The main source of contamination for the native oyster is likely to be the Medina. The historical microbiological data for native oysters also suggest that there is a significant source of contamination to the west, outside the estuary. This is likely to be a result of the high concentration of intermittent discharges to the west of the Medina. The RMP should therefore be located just outside the Medina Estuary mouth near the main channel. This will account for contamination from the Medina Estuary on the ebb tide and contamination from discharges to the west on the flood tide. The RMP should also be located to take into account the new breakwater which will alter the flow of water to some extent.

Clams (*Tapes* spp)

The Dodnor beds in the upper Medina estuary have been prohibited since 2009. It is likely that this is due in part to the Fairlee STW discharge. However, this discharge has since been moved, and so it is possible that resampling of this area could now return results showing lower *E. coli* levels.

Dodnor – This area represents the *Tapes* clams. in the upper Medina estuary. Contamination sources to this area include several discharges, as well as the Medina River and the wider catchment. The current location of the RMP accounts for the discharge from the Fairlee STW. While this discharge has been moved, there are still several intermittent discharges in the area including two of the largest in the catchment (Dodnor Lane CSO and Prior Crescent CSO). For this reason, it is recommended that the current position of the RMP is maintained. This will also allow for contamination from the Medina River.

4.2. General information

Location Reference

Production area	Medina Estuary
Cefas main site reference	M063
Ordnance survey 1:25,000 map	Explorer OL29 (Isle of Wight)
Admiralty chart	No 2793

Shellfishery

Species/culture	Native oysters (*Ostrea edulis*)	Wild
	Clams (*Tapes* spp.)	Wild
Seasonality of harvest	Year round	

Local Enforcement Authority

Name	Isle of Wight Council
Environmental health officer	Rachel Briscoe
Telephone number ☎	01983 823000
Fax number 🖷	01983 823158
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Requirement for review

The Guide to Good Practice for the Microbiological Monitoring of Bivalve Mollusc Harvesting Areas (EU Working Group on the Microbiological Monitoring of Bivalve Mollusc Harvesting Ares, 2010) indicates that sanitary assessments should be fully reviewed every six years. This assessment is therefore due for formal review in 2020. The assessment may require review in the interim should any significant changes in sources of contamination come to light.

Table 4.1: Number and location of representative monitoring points (RMPs) and frequency of sampling for classification zones within the Medina estuary

Classification zone	RMP*	RMP name	NGR	Latitude & Longitude (WGS84)	Species	Growing method	Harvesting technique	Sampling method	Tolerance	Frequency	Comments
Medina Mouth	TBA	Cowes Breakwater	SZ49659666	50°46.04'N 01°17.84'W	Native oysters (*O. edulis*)	Wild	Dredged	Dredged	100 m	Monthly	n/a
Dodnor	TBA	Fairlee**	SZ50499116	50°43.07'N 01°17.17'W	Clams *(Tapes* spp).	Wild	Dredged	Dredged	100 m	Monthly	n/a

**RMP codes will be generated once the report has been agreed and finalised.*
***Bed currently prohibited on basis of historic sampling results, however following subsequent water quality improvements local authority sampling may recommence where commercial interest exists.*

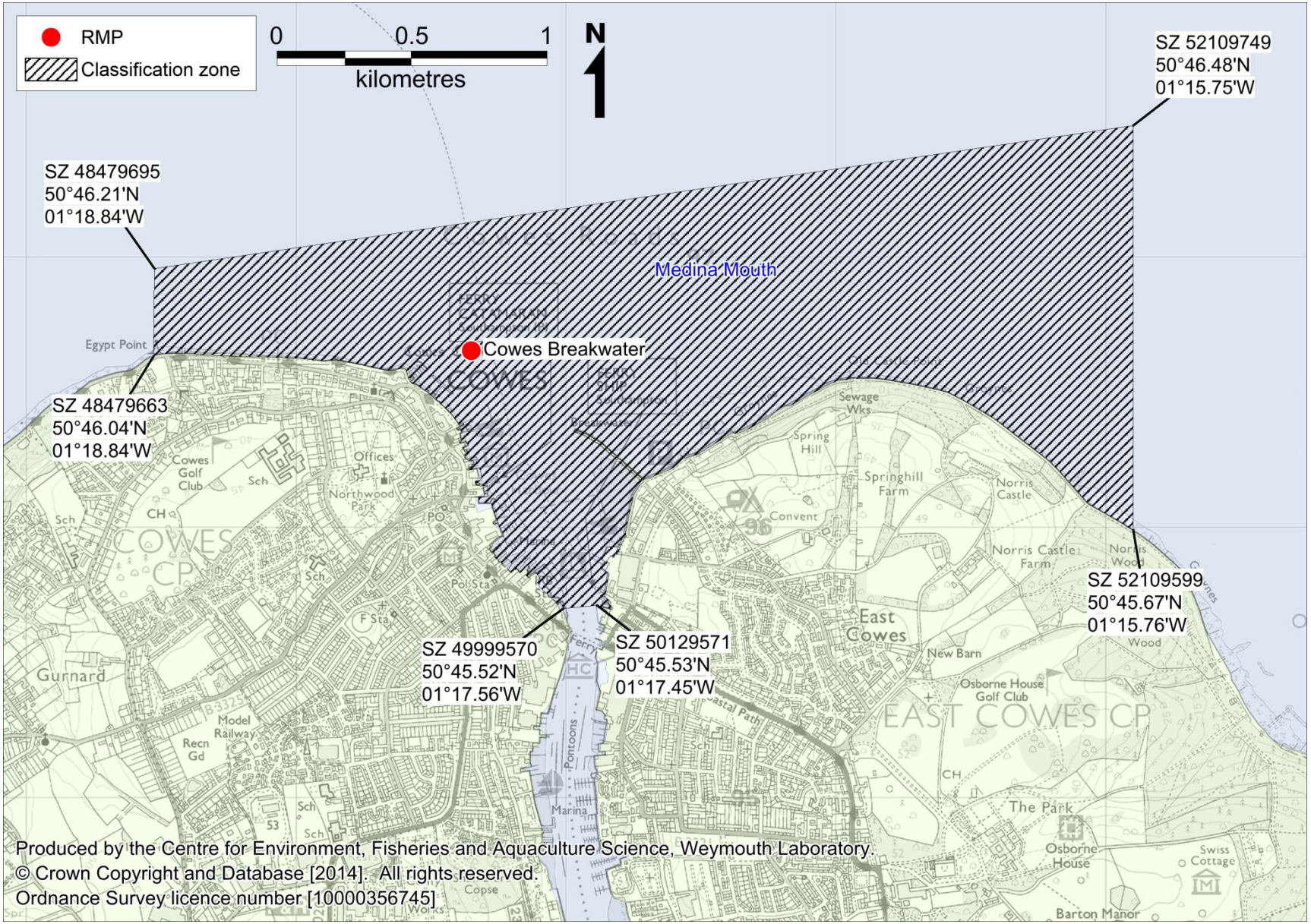

Figure 4.1: Recommended zoning and monitoring arrangements - native oysters (*O. edulis*)

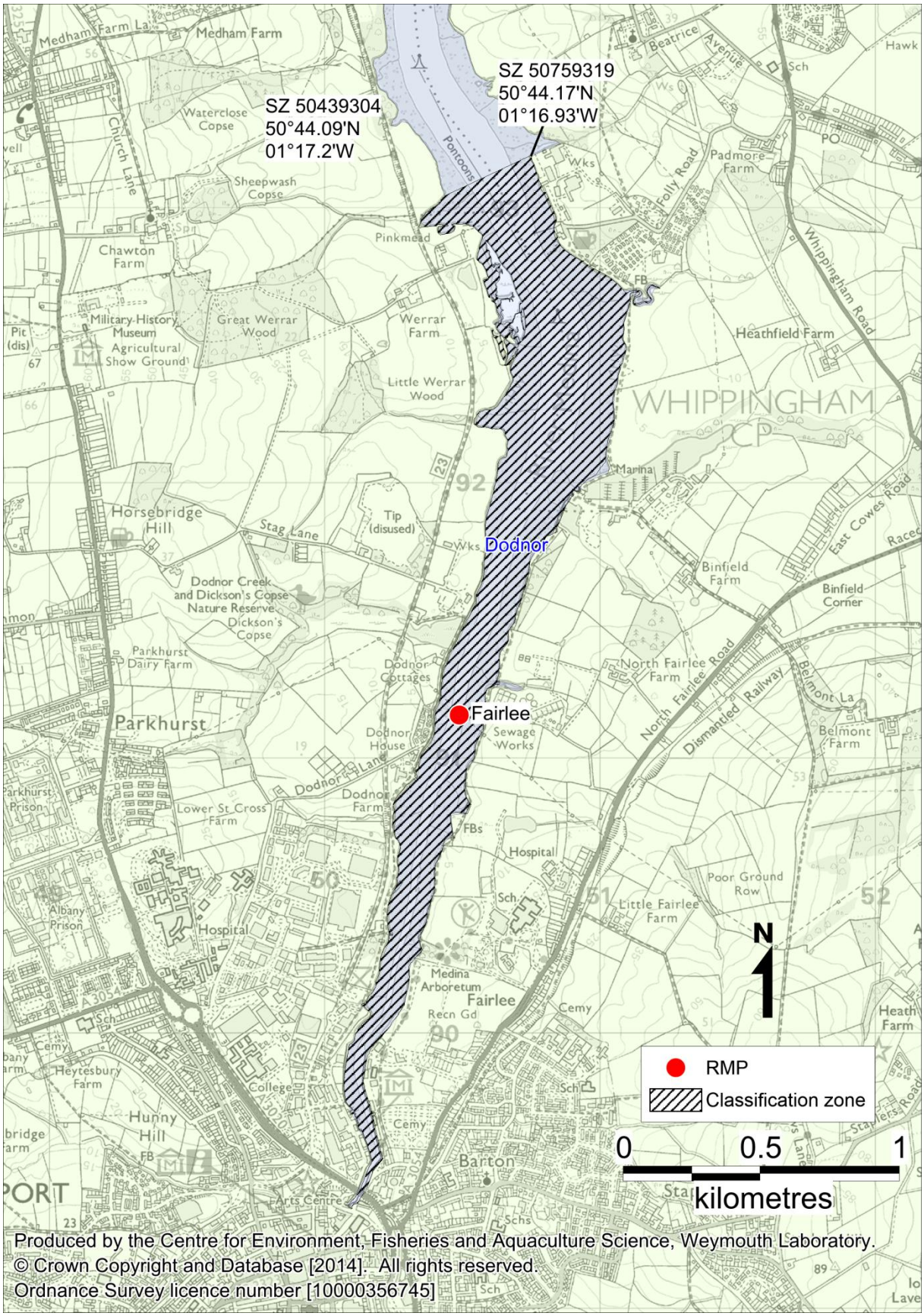

Figure 4.2: Recommended zoning and monitoring arrangements - clams (*Tapes* spp.)

Figure 4.3: Current and recommended RMPs.

5. Pollution sources

5.1. Population

In the original sanitary survey, only the populations for Newport and Cowes/Northwood were presented (22,957 and 19,110 respectively according to the 2001 census). Figure 5.1 shows population densities in census output areas within or partially within the Medina catchment area, derived from data collected from the 2011 census.

The total population in the catchment area increased from 49,600 to 50,600 (2.2% increase) between 2001 and 2011.

The Isle of Wight (IoW) attracts around 2.5 million tourists each year (IoW Tourism Monitor, 2012). Many of these tourists will visit for the Isle of Wight Festival (Seaclose Park, Newport) in June and Cowes week in August. Both of these events are held within the Medina catchment.

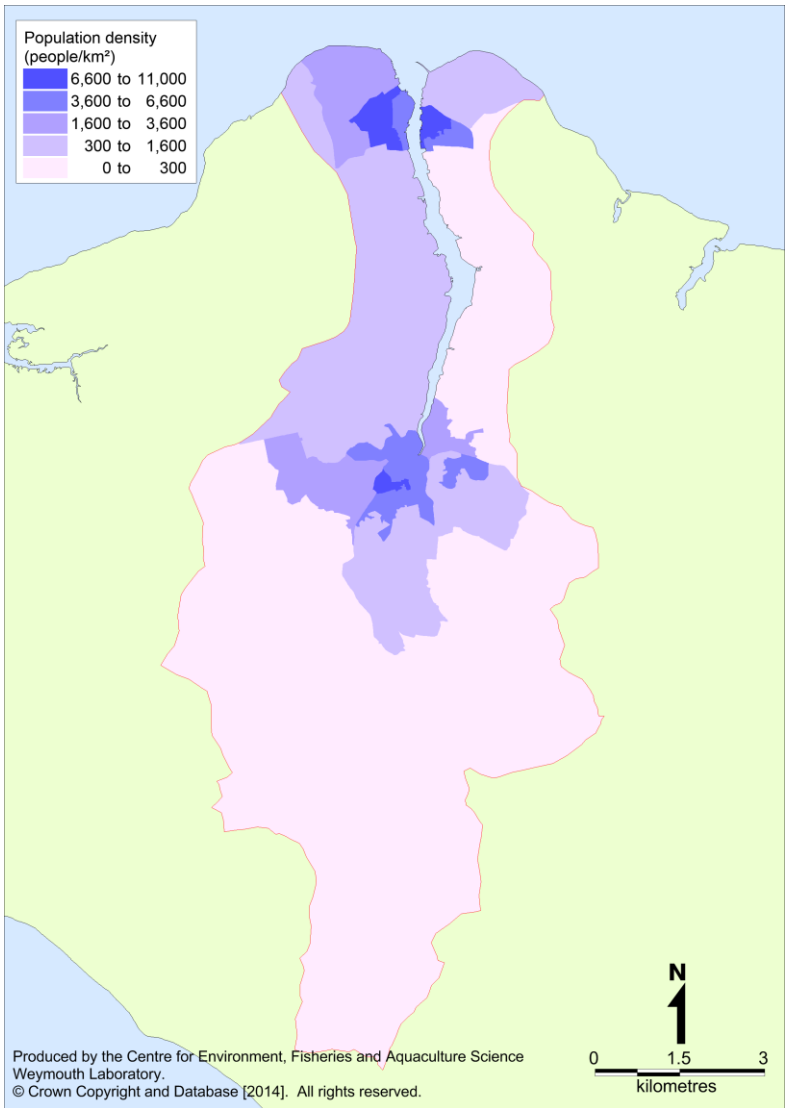

Figure 5.1: Human population density in census areas in the Medina catchment.

5.2. Sewage

Figure 5.2 shows the locations of all of the current discharges identified in the Environment Agency (EA) national permit database (October 2013) which fall within the Medina Estuary catchment.

Since the 2008 sanitary survey, the Fairlee STW discharge has been moved to Sandown and so the discharge from this is no longer in the Medina. However, five other water company owned continuous discharges exist in the catchment which were not reported in the sanitary survey (Table 5.1). All five of these discharges flow ultimately to the Medina River at Newport.

The Medham Farm SPS was previously reported erroneously as a water company asset. However, corrections to the EA national permit database show this discharge to be a private discharge. Additionally the Newport SPS which was reported in the original sanitary survey report (Sanitary Survey Table 4.3, page 20) is not known by Southern Water and so is assumed to be erroneous. There are a total of 31 water company owned, intermittent sewage discharges within the Medina catchment, including those just off the coast (Table 5.2). There is a particularly high concentration of these discharges situated west of Cowes which flow directly into the Squadron and Castle Point classification zones on a flood tide. There is also a high concentration of intermittent discharges towards the upper estuary around Newport including Dodnor Lane CSO and Prior Crescent CSO, both of which enter the Medina at a similar location.

Table 5.4 and Figure 5.3 show the spills from intermittent discharges for which data were available in the Medina catchment. There were a large number of long duration spills in late 2010 and early 2011 as shown in Figure 5.3. Of particular note are the Egypt Point PS and Woodvale/Gurnard Headworks WPS, which both spilled frequently and for long periods.

There are also nine private discharges in the Medina catchment with consented DWFs equal to or greater than 5 m^3/day (Table 5.3). Four of these, including the largest (Medina Leisure Park, 100 m^3/day), discharge mid-estuary, while the other five discharge to watercourses in the upper catchment.

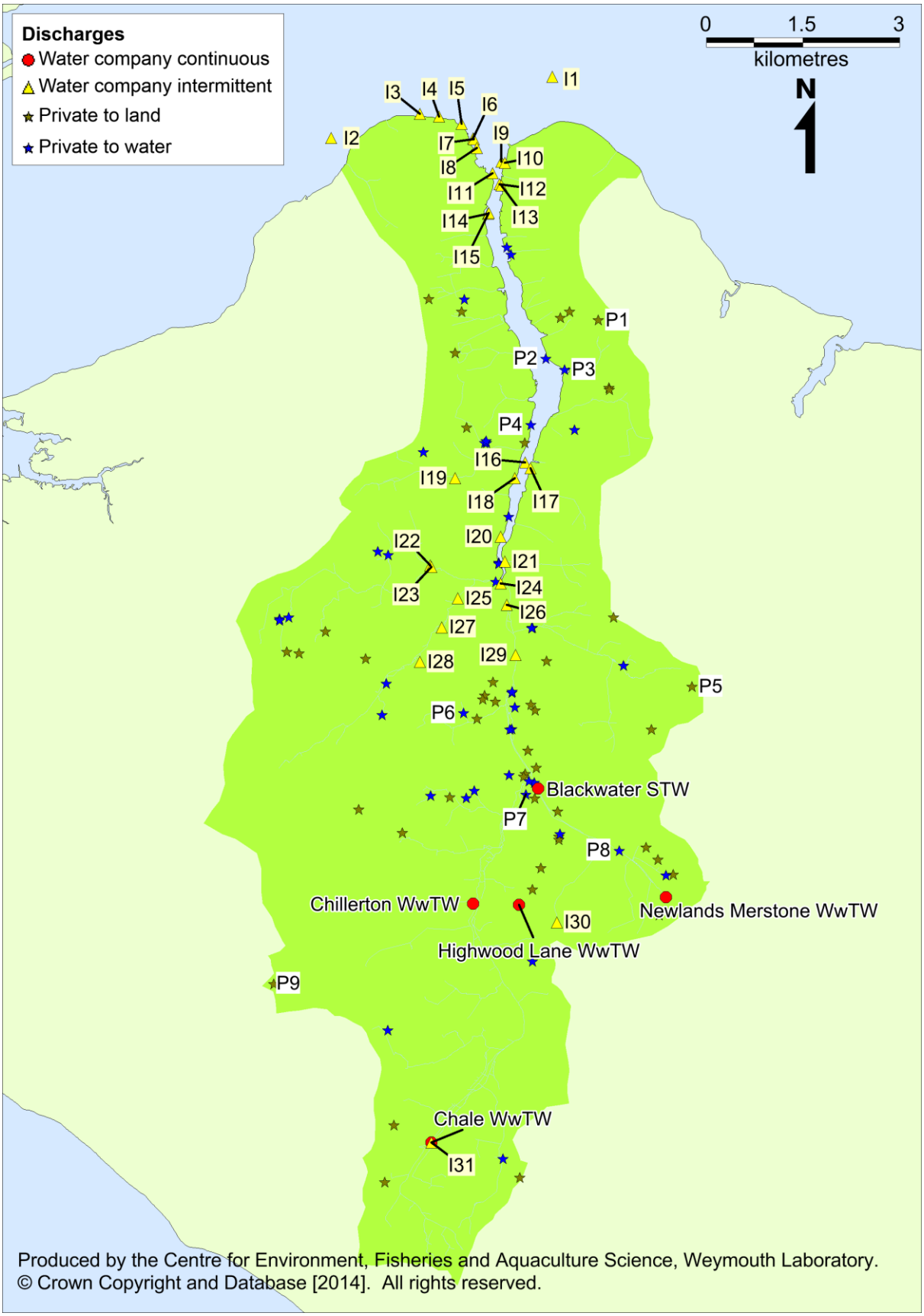

Figure 5.2: Discharges in the Medina catchment (Table 5.1, Table 5.2, and Table 5.3 for details)
Data from Environment Agency

Table 5.1: Continuous water company discharges within the Medina catchment.

Name	NGR	Treatment	Dry weather flow (m³/day)	Receiving environment	Fluvial distance to nearest CZ (km)
Blackwater STW	SZ5071086180	2° (biological filtration/reed bed)	Not reported	Merstone stream	3.5
Chale WwTW	SZ4905080680	2° (oxidation ditch)	117	River Medina	10.5
Chillerton WwTW	SZ4970084390	2° (SAFF)	220	Sheat stream	5.9
Highwood Lane WwTW	SZ5041084371	2° (SAFF)	16	Tributary of the River Medina	6.2
Newlands Merstone WwTW	SZ5270084490	2° (biological filtration)	12	Tributary of Merstone Stream	6.2

Data from Environment Agency
SAFF = Submerged aerobic fixed film

Table 5.2: Intermittent water company discharges within the Medina catchment. Grey cells indicate discharges used in Figure 5.3.

Number on map	Name in current database	Name in 2008 sanitary survey	NGR	Reported in 2008 sanitary survey?	Receiving environment
I1	Cowes (Springhill) Headworks WPS	Cowes (Springhill) Transfer SPS	SZ5093097250	Yes	Saline Estuary
I2	Woodvale/Gurnard Headworks WPS		SZ4749096300	No	Saline Estuary
I3	Egypt Point PS	Egypt Point SPS	SZ4887096670	Yes	Saline Estuary
I4	Esplanade Cowes CEO	Esplanade SPS	SZ4917096630	Yes	Saline Estuary
I5	The Parade PS	The Parade SPS	SZ4952096520	Yes	Saline Estuary
I6	Market Hill Cowes CSO	Market Hill SPS	SZ4970096290	Yes	Saline Estuary
I7	Harbour Lights WPS		SZ4971096280	No	Saline Estuary
I8	Terminus Road Cowes CSO	Terminus Road CSO	SZ4976096140	Yes	Saline Estuary
I9	Albany Pumping Station		SZ5014095930	No	Saline Estuary
I10	Castle Street Cowes CSO	Castle Street CSO	SZ5019095910	Yes	Saline Estuary
I11	High Street Cowes CEO	High Street SPS	SZ4971096280	Yes	Saline Estuary
I12	Albany Road PS	Albany Road CSO	SZ5011095580	Yes	Saline Estuary
I13	Floating Bridge Cowes CSO	Floating Bridge CSO	SZ5014095560	Yes	Saline Estuary
I14	Whitegates PS	Arctic Road CSO	SZ4993095120	Yes	Saline Estuary
I15	Whitegates Storm Water Overflow		SZ4994095130	No	Saline Estuary
I16	Fairlee Combined Sewer Overflow		SZ5051091250	No	Saline Estuary
I17	Fairlee Intermediate WPS	Fairlee Transfer SPS	SZ5059091160	Yes	Saline Estuary
I18	Dodnor Lane CSO	Dodnor Lane CSO	SZ5013090100	Yes	Freshwater river

I19	Prior Crescent CSO	Prior Crescent CSO	SZ4942091010	Yes	Saline Estuary
I20	Dodnor CEO	Dodnor SPS	SZ5035091010	Yes	Saline Estuary
I21	Fairlee Road Newport O/S 62 CSO	Fairlee Road CSO	SZ5019089710	Yes	Saline Estuary
I22	Heytesbury Pumping Station	Heytebury Road SPS	SZ4903089650	Yes	Freshwater river
I23	Heytesbury WPS		SZ4905089630	No	Freshwater river
I24	The Quay Newport CEO	The Quay SPS	SZ5012889373	Yes	Saline Estuary
I25	Westminster Mill CSO	Westminster Mill SPS	SZ4946089140	Yes	Freshwater river
I26	East Street/Furrlongs CSO	South Street CSO	SZ5022089040	Yes	Saline Estuary
I27	Recreation Ground Road	Recreation Ground CSO	SZ4921088690	Yes	Freshwater river
I28	Carisbrooke Storm Overflow		SZ4887088150	No	Freshwater river
I29	Shide Path Newport No.1 CSO	Shide Path CSO	SZ5036088260	Yes	Freshwater river
I30	Rookley PS		SZ5100084100	No	Freshwater river
I31	Chale WwTW		SZ4905080680	No	Freshwater river

Data from Environment Agency
NR = Not Reported

Table 5.3: Private discharges within the Medina catchment with maximum daily flows above 5 m³.

Number on map	Name	NGR	Reported in 2008 sanitary survey?	Maximum daily flow (m³)	Receiving environment
P1	Priory School septic tank	SZ5164793469	No	8	Land
P2	Folly Inn	SZ5083092870	Yes	12	Water
P3	Medina Leisure Park	SZ5112092700	Yes	100	Water
P4	Hare and Hounds Pub	SZ5310087770	No	18	Land
P4	Office Block	SZ5059891843	No	39	Water
P6	Newclose Farm Cottages	SZ4955087360	No	5	Water
P7	Blackwater Mill retirement home	SZ5052286094	No	17.5	Water
P8	Merston Manor Farm	SZ5197085220	No	5	Water
P9	Newbarn Farm	SZ4660083150	No	8.2	Land

Data from Environment Agency

Table 5.4: Spills from intermittent discharges in the Medina catchment.

Discharge	Number of spills						% time spilling					
	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
Albany Road PS	NDP				10	28	NDP				0.91	2.67
Chale WwTW	NDP				5	8	NDP				0.09	0.73
Cowes (Springhill) Headworks WPS	2	39	75	NDA			0.01	0.46	2.01	NDP		
Dodnor CEO	71	23	36	23	6	NDP	4.74	1.03	1.41	1.65	0.31	NDP
Dodnor Lane CSO	NDP				11	19	NDP				0.85	0.99
Dodnor WPS	NDP				18	32	NDP				1.23	4.11
Egypt Point PS	142	87	107	132	47	43	3.07	1.71	3.97	23.58	7.79	8.17
Esplanade Cowes CEO	NDP		10	NDP		1	NDP		0.94	NDP		0.01
Fairlee Intermediate WPS	NDP				18	6	NDP				1.11	0.26
High Street Cowes CEO	14	NDP		15	15	23	0.07	NDP		1.15	1.79	1.26
Market Hill Cowes CSO	78	28	54	49	16	5	2.20	0.37	0.95	5.83	1.02	0.76
Norton Transfer Iow WPS	30	30	38	25	9	22	0.76	0.70	1.34	1.62	0.81	3.86
Prior Crescent CSO	28	48	45	37	22	31	0.80	1.34	2.39	3.79	3.32	3.07
Shide Path Newport No.1 CSO	3	NDP			7	3	<0.01	NDP			0.01	0.01
Terminus Road Cowes CSO	65	44	49	72	32	3	2.26	0.44	2.73	10.77	5.59	0.22
The Parade PS	NDP	1	4	31	1	NDP	NDP	0.01	0.01	7.97	0.00	NDP
Whitegates PS	NDP	45	53	43	13	NDP	NDP	1.07	1.07	2.94	1.13	NDP
Woodvale/Gurnard Headworks WPS	NDP			62	69	98	NDP			13.71	16.91	20.48

Data from Environment Agency
NDP = No data provided
Missing data in 2011, 2012 and 2013 - not available at time of writing
Spills assessment derived using EA 12/24 hour block counting method
Figures highlighted are spills ≥ 3% time in the year indicated

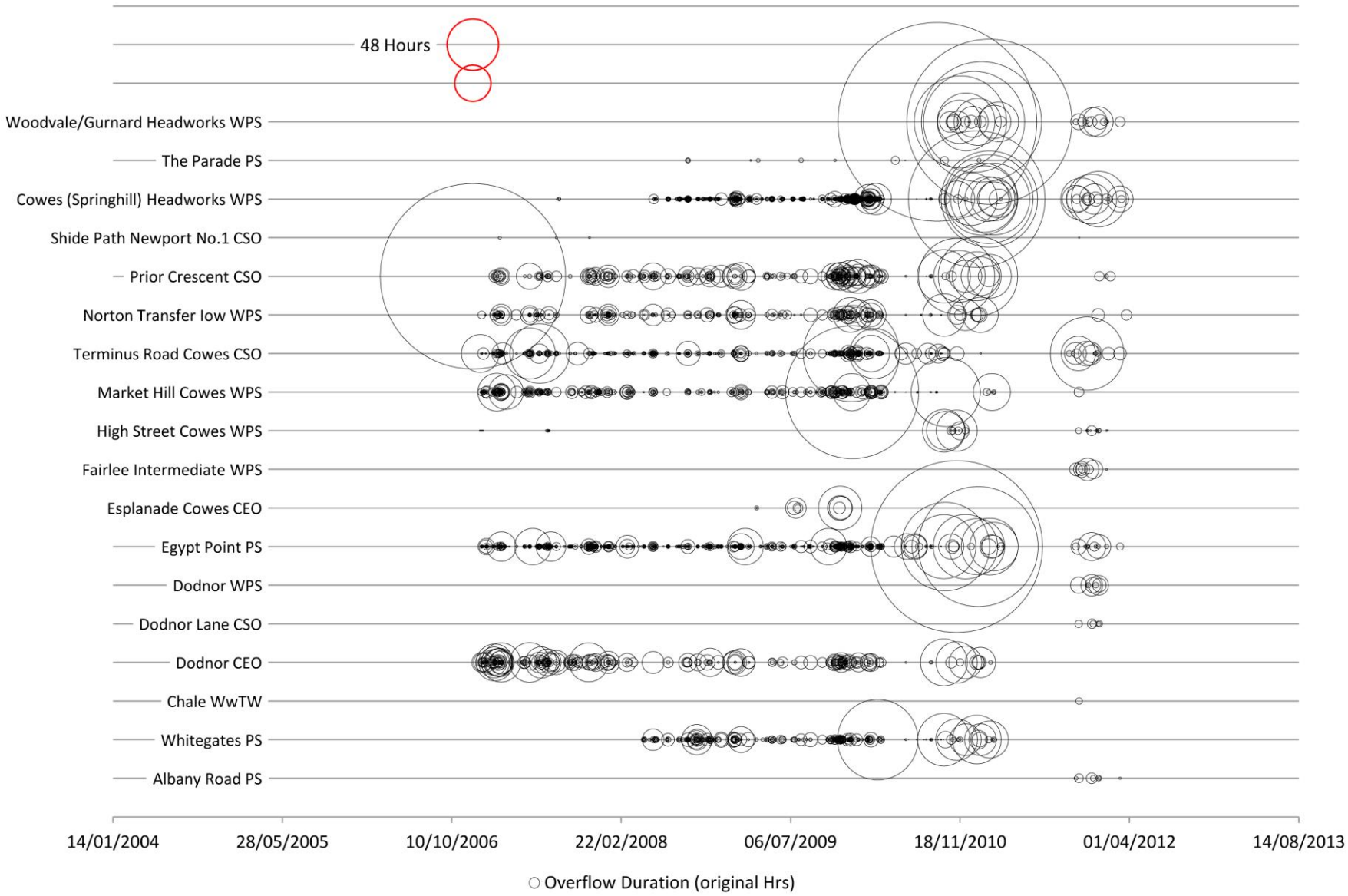

Figure 5.3: Bubble plot of spills from intermittent discharges in the Medina catchment.
Missing data in 2011, 2012 and 2013 - not available at time of writing

5.3. Agriculture

There was a slight increase in the number of cattle, sheep and pigs on the Isle of Wight between 2006 and 2010 with the largest increase being pigs. Conversely there has been a significant decline in the number of chickens (46% decrease). The Medina catchment makes up around 20% of the total area of the Isle of Wight. Therefore the changes in livestock numbers shown in Table 5.5 may not be truly representative of the Medina catchment. No catchment specific data were freely available for the Medina estuary at the time of writing.

Table 5.5: Livestock data for the Isle of Wight in 2006 and 2010.

	2006	2010	% difference
Cattle	14,800	14,866	+0.4
Sheep	35,700	36,730	+2.9
Pigs	800	887	+10.9
Chickens	75,900	40,980	-46.0

Data from 2008 Sanitary Survey and Defra (2010)

5.4. Wildlife

Since the 2008 sanitary survey the number of birds residing in the estuary has remained fairly constant, with the exception of the Black-headed Gull population, which has doubled in size (Austin *et. al*, 2014). In order to make a direct comparison, the average counts for the same species were assessed. An average of 998 waders and wildfowl were recorded for the five winters up to 2006/2007 (Marston, 2007) compared to an average of 893 waders and wildfowl over the five winters running up to 2011/2012. For the gulls and other species the average count increased from 944 to 1,974 (Austin *et. al*, 2014). Including all additional species recorded an average count of 1,147 waders and wildfowl and 1,996 gulls, terns and other species was reported over the five winters up to 2010/11 (Austin *et. al*, 2014).

Seals were not assessed as a source of microbiological contamination to the shellfish beds in the 2008 survey. A seal tagging study undertaken by the South East Wildlife Trust in 2008 confirms that a colony of harbour seals, between 23 and 25 and a couple of grey seals exist within the Solent. The seals forage in the Eastern Solent and occasionally make foraging trips over to the Isle of Wight. The moulting and pupping season is between June and August for harbour seals and September to December for grey seals. In these months they will spend more time at their haul out sites. No haul out sites have been identified within the Medina estuary (Wildlife Trusts' South East Marine Programme, 2010). Consequently, the highest microbiological input to the Medina from seals will be between January and May. Seals may enter the outer reaches of the Medina estuary from time to time but only in small numbers and their presence will be unpredictable both spatially and temporally. Consequently the presence of seals will not influence the sampling plan.

5.5. Boats

The number of berths and moorings (for both residents and visitors) in the Medina estuary has increased slightly since the 2008 sanitary survey (Table 5.6). The total number of moorings within the Main Harbour, Whitegates and Folly Reach has remained the same since 2007 (565 plus an additional 350 moorings during Cowes week) (CHC, 2011). In addition to this there are several houseboats which were observed on the shoreline survey and appeared to be occupied all year round. These could represent an additional source of microbiological pollution to the head of the estuary. However as stated in the 2008 survey it is an offence to discharge sewage into the estuary when moored or alongside marina facilities with direct pedestrian access to the shore. Shepherds Wharf Marina is still the only marina within the estuary which provides sewage pump out facilities (The Green Blue, 2010).

Table 5.6: Marina berths and moorings within the Medina estuary in 2007 and 2014

	Total berths/*moorings		
Site	**2007**	**2014**	**Source**
Cowes Yacht Haven	235	260	Cowes Yacht Haven website
Shepherds Wharf Marina	130	165	Shepherds Wharf website
East Cowes Marina	330	340	East Cowes Marina website
Island Harbour Marina	240	200	Island Harbour Marina website
Odessa Boatyard	80	80	Reeds Almanac, 2012
UK Sailing Academy	10	5	Reeds Almanac, 2012
Newport Harbour	50*	50*	Reeds Almanac, 2012
Total	**1,075**	**1,100**	

As mentioned in the previous sanitary survey report the development of a new marina with up to 400 berths in the lee of the Shrape breakwater in the mouth of the estuary is set to go ahead at the end of 2014 (Cowes Harbour Commission, 2014b). The increased number of leisure craft within Cowes may result in some increase in microbiological pollution. However, it is an offence to discharge sewage into the estuary when moored or alongside marina facilities with direct pedestrian access.

6. Hydrodynamics

The bathymetry within the Medina estuary has remained largely unchanged since the sanitary survey. Comparisons of the March 2008 and September 2013 editions of Admiralty Chart No. 2793 show there have been minor changes to the depths throughout the estuary. New pontoons have been added at Britannia Wharf, the UK Sailing Academy, Clarence Yard, East Cowes SC and the pontoon at Venture Quays has been removed.

Cowes Breakwater Project is expected to commence in the spring of 2014 and be completed during the spring of 2015. The 350 m breakwater will be positioned with a west to east orientation and will create a sheltered harbour protecting marine craft on moorings and the shoreline business and premises against strong winds and tides. This project will also include the dredging of a new eastern approach channel into the estuary and the extension of Shrape Breakwater by 58 m (Cowes Harbour Commission, 2014a). In addition to this Homes and Communities Agency is searching for financial support for East Cowes Regeneration Project which could see the development of a new marina with up to 400 berths, 100 new homes, a 60 bed hotel and restaurant (Cowes Harbour Commission, 2014b).

This large scale project will cause minor morphological changes, modify surface currents and change the distribution of estuarine sediments in the outer estuary to some extent. The largest effect will be the tidal flows will be at its mouth will be diverted around the breakwater and split into two separate flows. On an ebb tide the modified tidal vectors will flow in a northerly direction out of the main harbour channel and to the north east through the newly constructed eastern channel, the opposite will occur on the ebb tide. (ABPmer 2009). It is unlikely to cause any significant changes in flow in the upper estuary.

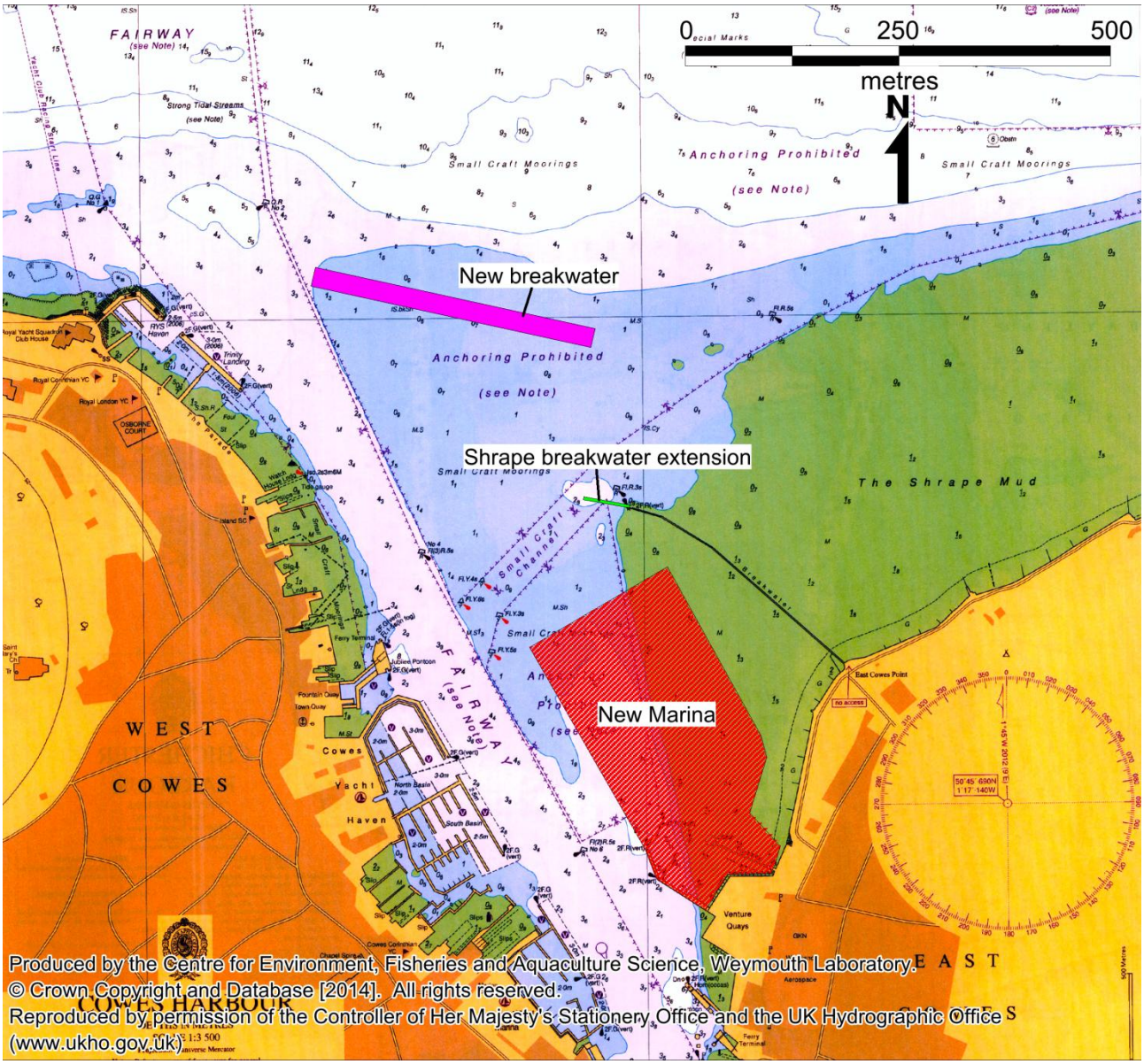

Figure 6.1: Layout of the Medina Estuary mouth after construction of the new breakwater and marina.

7. Rainfall

No freely available sources of rainfall data could be found that were published after the sanitary survey.

8. Microbial Monitoring Results

8.1. Summary statistics and geographical variation

Between January 2002 and January 2014, there have been a total of five recommended monitoring points (RMPs) for bivalve shellfish in the Medina Estuary. Four of these RMPs were for native oysters, one of which (Medina River) was only sampled on one occasion (12/12/2005). The other three native oyster RMPs are current, but Medina Wharf has not been sampled since March 2011.

A single *Tapes* clam RMP at Fairlee Station Outfall was sampled on three occasions from May to July 2009.

In addition to the Squadron, Castle Point, Medina Wharf and Fairlee Station RMPs, another RMP at Folly Point was recommended by the sanitary survey for the classification of hard clams. However, no samples have been taken from this RMP.

The *E. coli* data for bivalve samples are presented in Figure 8.1. The Medina Wharf, Squadron and Castle Point native oyster RMPs have been split into three time periods representing samples taken before the sanitary survey (January 2003 – November 2007), after the sanitary survey but before redirection of sewage to the Sandown outfall (December 2007 – March 2010) and after redirection of sewage to the Sandown outfall (April 2010 – March 2014).

Summary statistics are presented in Table 8.1 and boxplots for are shown in Figure 8.2. Medina River, Fairlee Station Outfall and Medina Wharf (2010-2013) were sampled on fewer than 10 occasions and so will not be considered further.

Table 8.1: Summary statistics for *E. coli* results (MPN/100 g) from bivalve RMPs in the Medina Estuary from 2002 to 2014.

Site	Species	No.	Date of first sample	Date of last sample	Geometric mean	Min.	Max.	% over 230	% over 4,600	% over 46,000
Medina River	Native oyster	1	12/12/2005	12/12/2005	750.0	750	750	100.0	0.0	0.0
Medina Wharf (2003-2007)		48	20/01/2003	26/11/2007	3,213.1	70	54,000	93.8	39.6	6.3
Medina Wharf (2007-2010)		24	07/01/2008	15/03/2010	943.4	40	24,000	79.2	8.3	0.0
Medina Wharf (2010-2014)		9	07/04/2010	08/03/2011	1,565.0	170	92,000	77.8	22.2	11.1
Squadron (2003-2007)		43	18/08/2003	26/11/2007	659.8	<20	35,000	72.1	14.0	0.0
Squadron (2007-2010)		21	07/01/2008	15/03/2010	279.5	20	13,000	57.1	4.8	0.0
Squadron (2010-2014)		27	13/10/2010	18/02/2014	234.2	40	2,400	48.1	0.0	0.0
Castle Point (2003-2007)		42	18/08/2003	26/11/2007	467.0	40	16,000	61.9	7.1	0.0
Castle Point (2007-2010)		21	07/01/2008	15/03/2010	228.2	20	2,400	57.1	0.0	0.0
Castle Point (2010-2014)		27	13/10/2010	18/02/2014	162.9	<20	1,300	37.0	0.0	0.0
Fairlee Station Outfall	*Tapes* clams	3	21/05/2009	27/07/2009	32,812.5	16,000	92,000	100.0	100.0	33.3

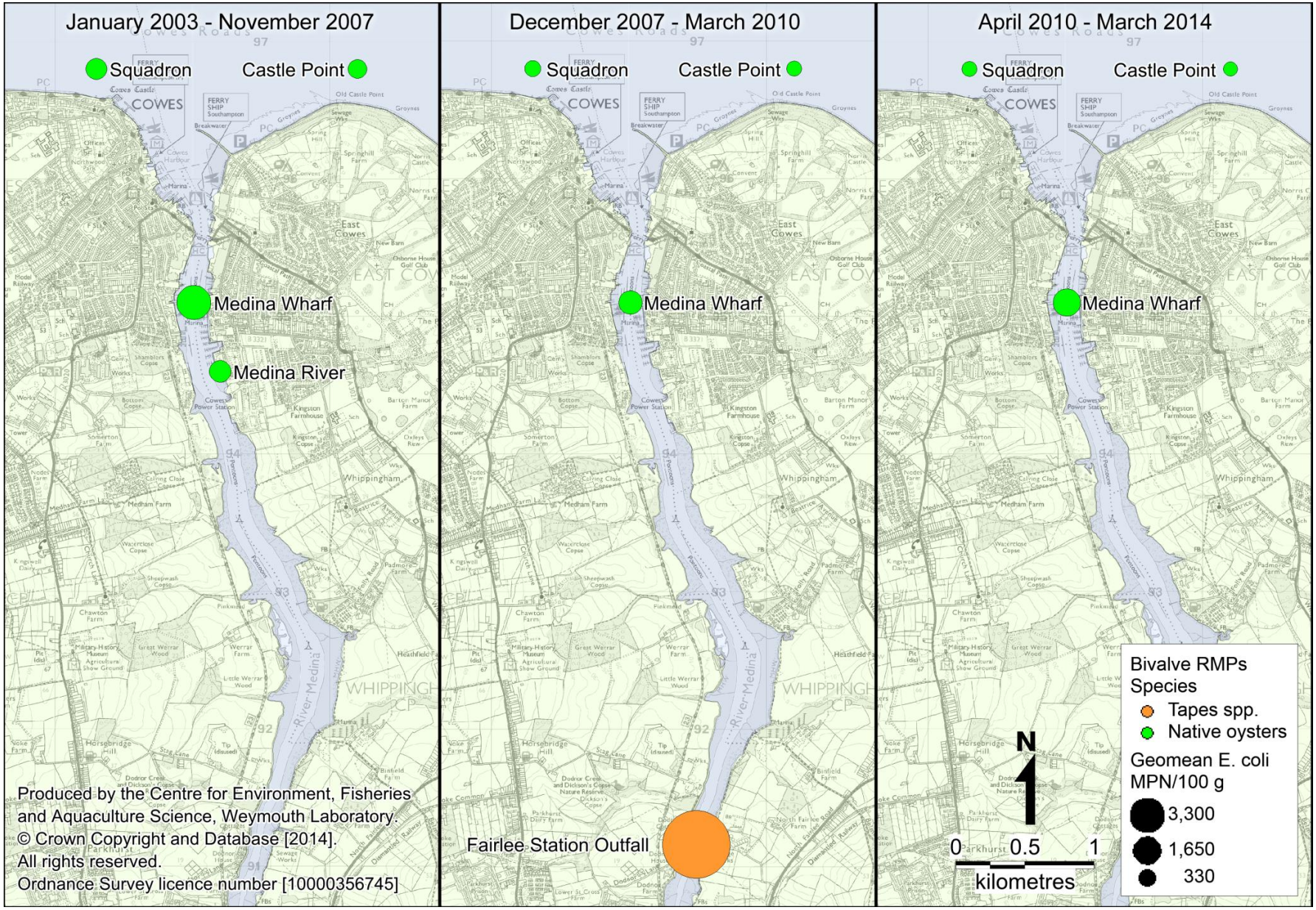

Figure 8.1: Current and historical native oysters and *Tapes* clams RMPs sampled since 2003.

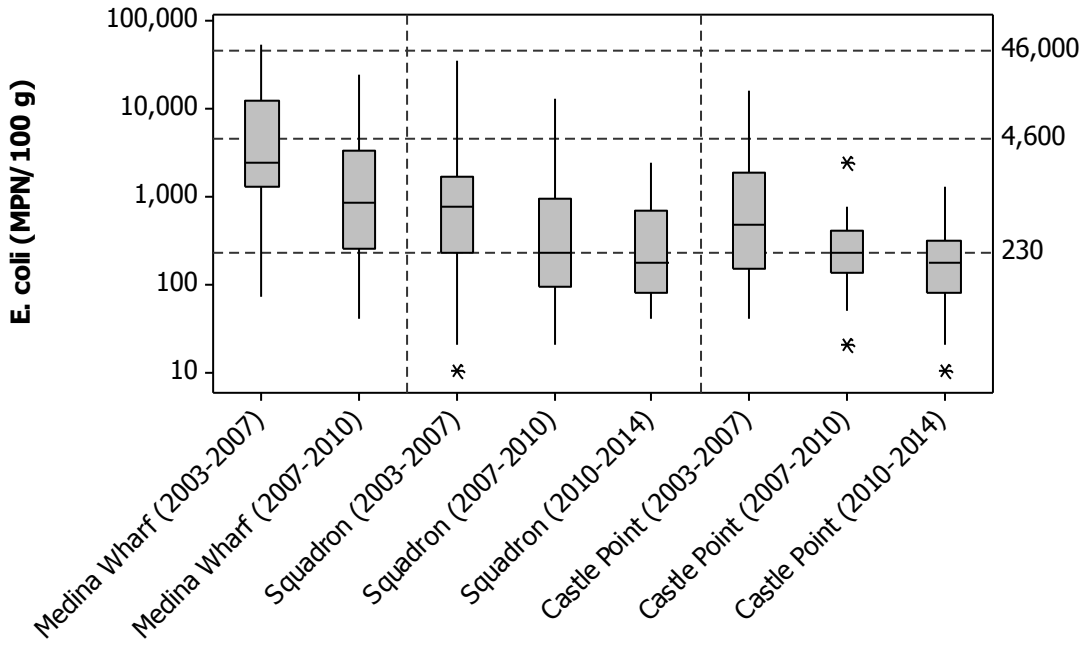

Figure 8.2: Boxplots of *E. coli* results from native oyster RMPs from 2003 onwards.

One-way ANOVA tests showed that there were significant differences in *E. coli* levels between sites for native oysters in the period 2003-2007 ($p<0.001$) and 2007-2010 ($p=0.003$), but not 2010-2014 ($p=0.262$). Post ANOVA Tukey tests showed that in both the periods 2003-2007 and 2007-2010, Medina Wharf had significantly higher *E. coli* levels than both Squadron and Castle Point, and Squadron had higher levels than Castle Point.

Comparisons of RMPs were carried out on a pair-wise basis by running correlations (Pearson's) between sites that shared sampling dates, and therefore environmental conditions, on at least 20 occasions. All sites compared for each period correlated significantly, indicating that they are likely to share contamination sources, or are affected by environmental conditions in a similar manner.

8.2. Overall temporal pattern in results

Figure 8.3 shows time series of *E. coli* results in native oyster samples taken from 2003 to 2014. In March 2010 the continuous discharge of sewage effluent from Fairlee STW was redirected from Medina Estuary to Sandown.

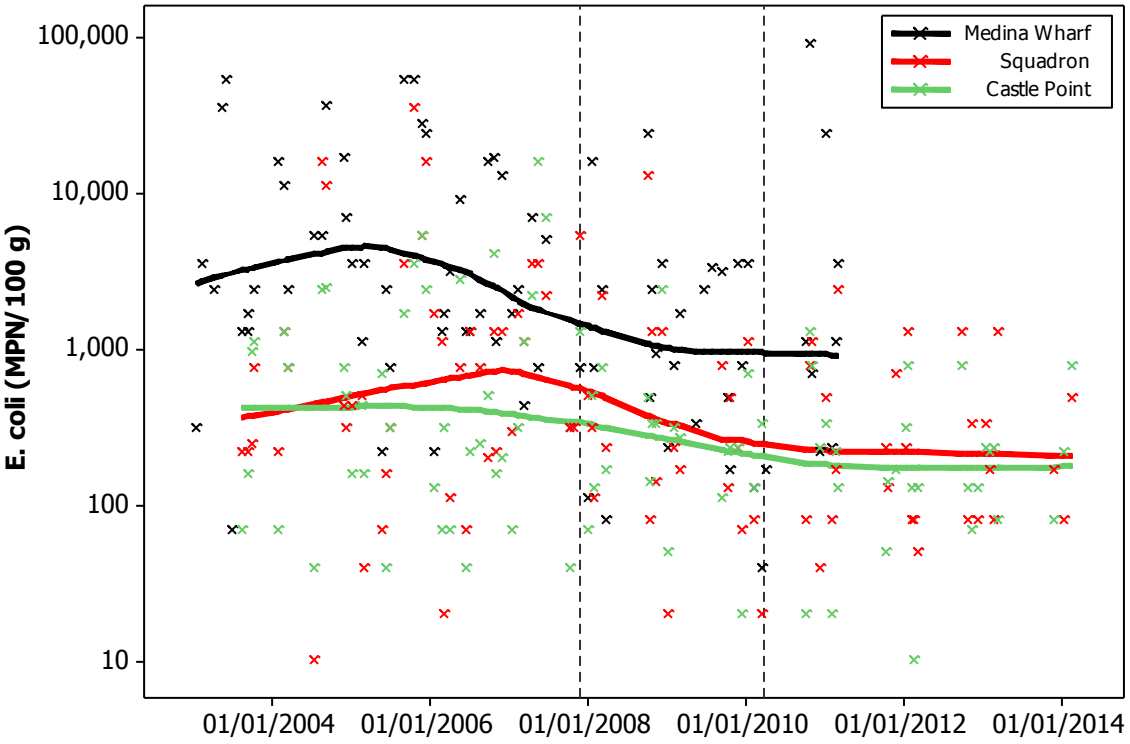

Figure 8.3: Scatterplot of *E. coli* results overlaid with loess lines.

There appears to have been a decline in *E. coli* levels at all three native oyster RMPs since the start of sampling in 2003. At Medina Wharf, there was a decline from 2005 to 2009, when *E. coli* levels remained stable until the end of sampling in 2011. At Squadron, *E. coli* levels started to decline in 2007 but like Castle Point, levels of *E. coli* have remained stable since 2010. There does not appear to have been an effect of removing the Fairlee STW discharge, as *E. coli* levels were already declining when that discharge was stopped. This is supported by ANOVAs comparing *E. coli* data at each site in the three time periods. At all three analysed native oyster sites, a significant difference was found between time periods (p=0.004-0.016), and post ANOVA Tukey tests showed that at all three sites, *E. coli* levels were significantly higher in the 2003-2007 period than the 2010-2014 period, but there were no differences in *E. coli* levels between the 2007-2010 periods with either of the other two periods.

Two sample T-tests were run to compare the level of *E. coli* in native oysters between the 2003-2007 (pre-sanitary survey) and 2007-2014 (post-sanitary survey) periods and each site. For all three analysed sites, there were significantly higher *E. coli* levels before the sanitary survey than after.

8.3. Seasonal Patterns of Results

Figure 8.4 shows the overall pattern in seasonal variation at the native oyster RMPs from 2003-2007 and 2007-2014.

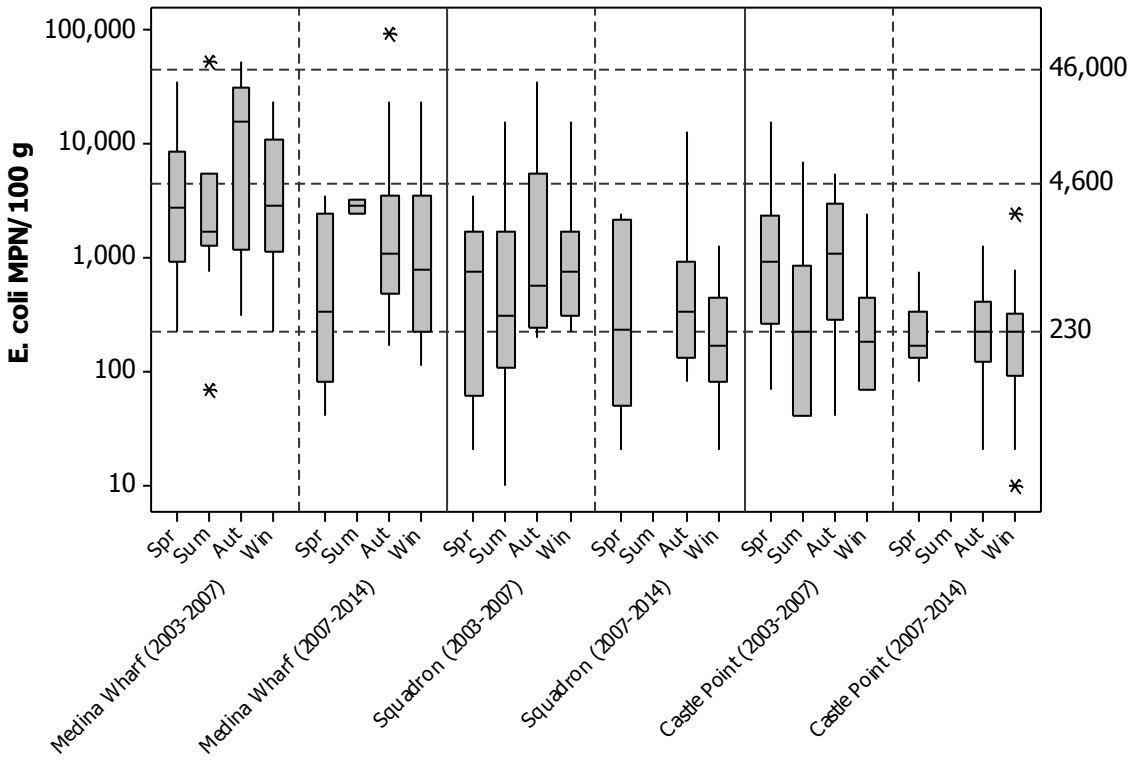

Figure 8.4: Boxplot of *E. coli* results in native oysters by RMP and season

One-way ANOVA tests showed that there was no significant variation in *E. coli* results between seasons at most of the native oyster RMPs (p=0.161 to 0.899). While a significant difference between seasons was found at Castle Point (2003-2007) (p=0.045), a post-ANOVA Tukey test did not reveal the source of the variation.

8.4. Influence of tide

To investigate the effects of tidal state on *E. coli* results, circular-linear correlations were carried out against the high/low and spring/neap tidal cycles for each RMP where more than 30 samples had been taken. Results of these correlations are summarised in Table 8.2, and significant results are highlighted in yellow.

Table 8.2: Circular linear correlation coefficients (r) and associated p values for *E. coli* results against the high/low and spring/neap tidal cycles

	High/low tides		Spring/neap tides	
Site Name	**r**	**p**	**r**	**p**
Medina Wharf (2003-2007)	0.153	0.347	0.189	0.199
Medina Wharf (2007-2014)	0.340	0.030	0.347	0.026
Squadron (2003-2007)	0.209	0.173	0.129	0.514
Squadron (2007-2014)	0.359	0.003	0.485	<0.001
Castle Point (2003-2007)	0.148	0.426	0.084	0.758
Castle Point (2007-2014)	0.363	0.003	0.404	0.001

At all three RMPs, no correlation between tidal state and *E. coli* level was found in the 2003-2007 period, but significant correlations were found for the 2007-2014 period.

Figure 8.5 presents polar plots of $\log_{10}$ *E. coli* results against tidal states on the high/low cycle for the correlations indicating a statistically significant effect. High water at Cowes is at 0° and low water is at 180°. Results of 230 *E. coli* MPN/100g or less are plotted in green, those from 231 to 4,600 are plotted in yellow, and those exceeding 4,600 are plotted in red.

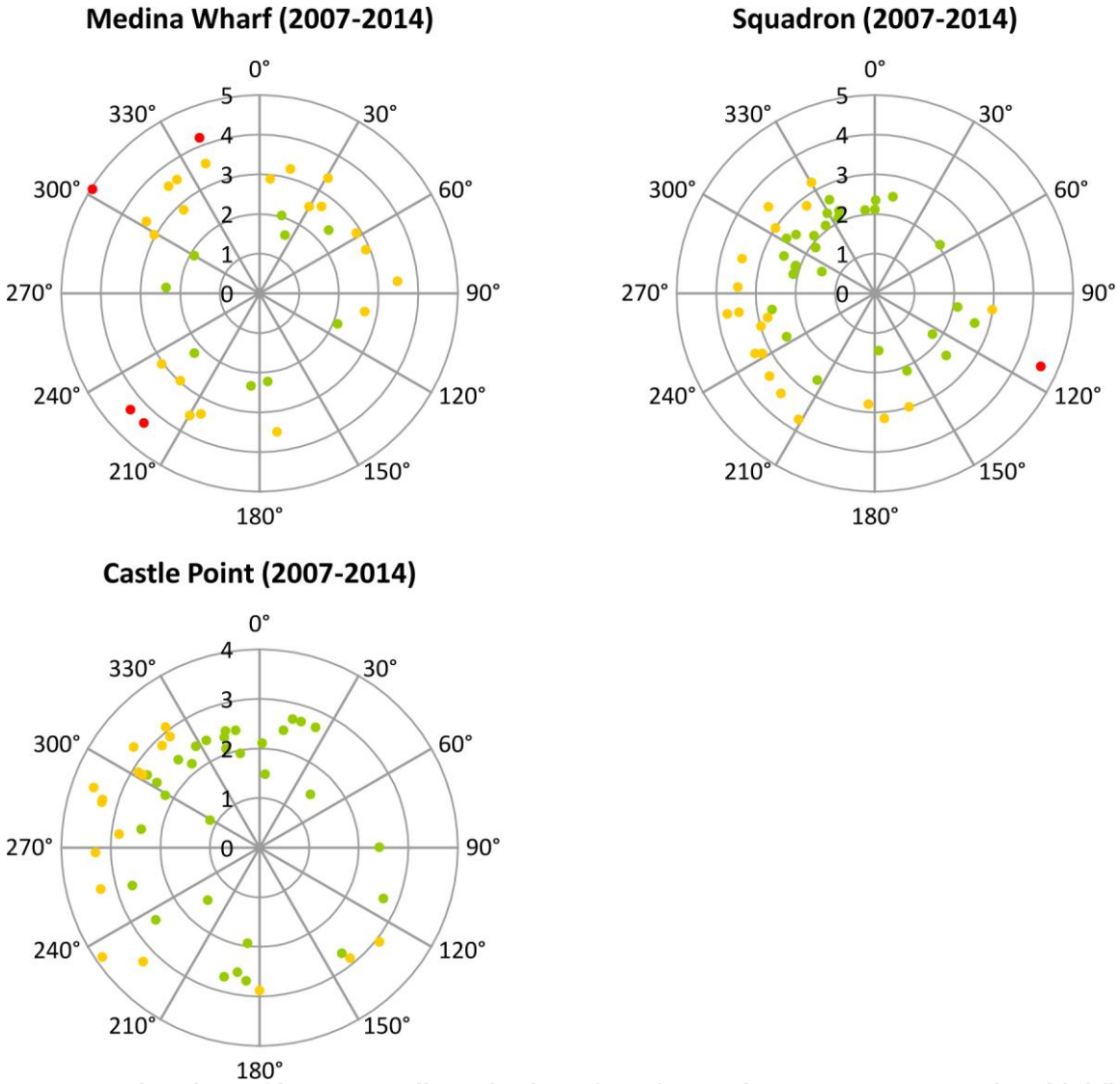

Figure 8.5: Polar plots of log10 *E. coli* results (MPN/100g) at native oyster RMPs against high/low tidal state

In the 2007-2014 period, higher *E. coli* levels tended to occur during the flood tide. This indicates that there is a source of contamination down tide of all three sites. This effect is most pronounced in Squadron and Castle Point, both of which are just outside the Medina Estuary.

Figure 8.6 presents polar plots of log10 *E. coli* results against the spring neap tidal cycle for each RMP. Full/new moons occur at 0º, and half moons occur at 180º, and the largest (spring) tides occur about 2 days after the full/new moon, or at about 45º, then decrease to the smallest (neap tides) at about 225º, then increase back to spring tides. Results of 230 *E. coli* MPN/100g or less are plotted in green, those from 231 to 4600 are plotted in yellow, and those exceeding 4600 are plotted in red.

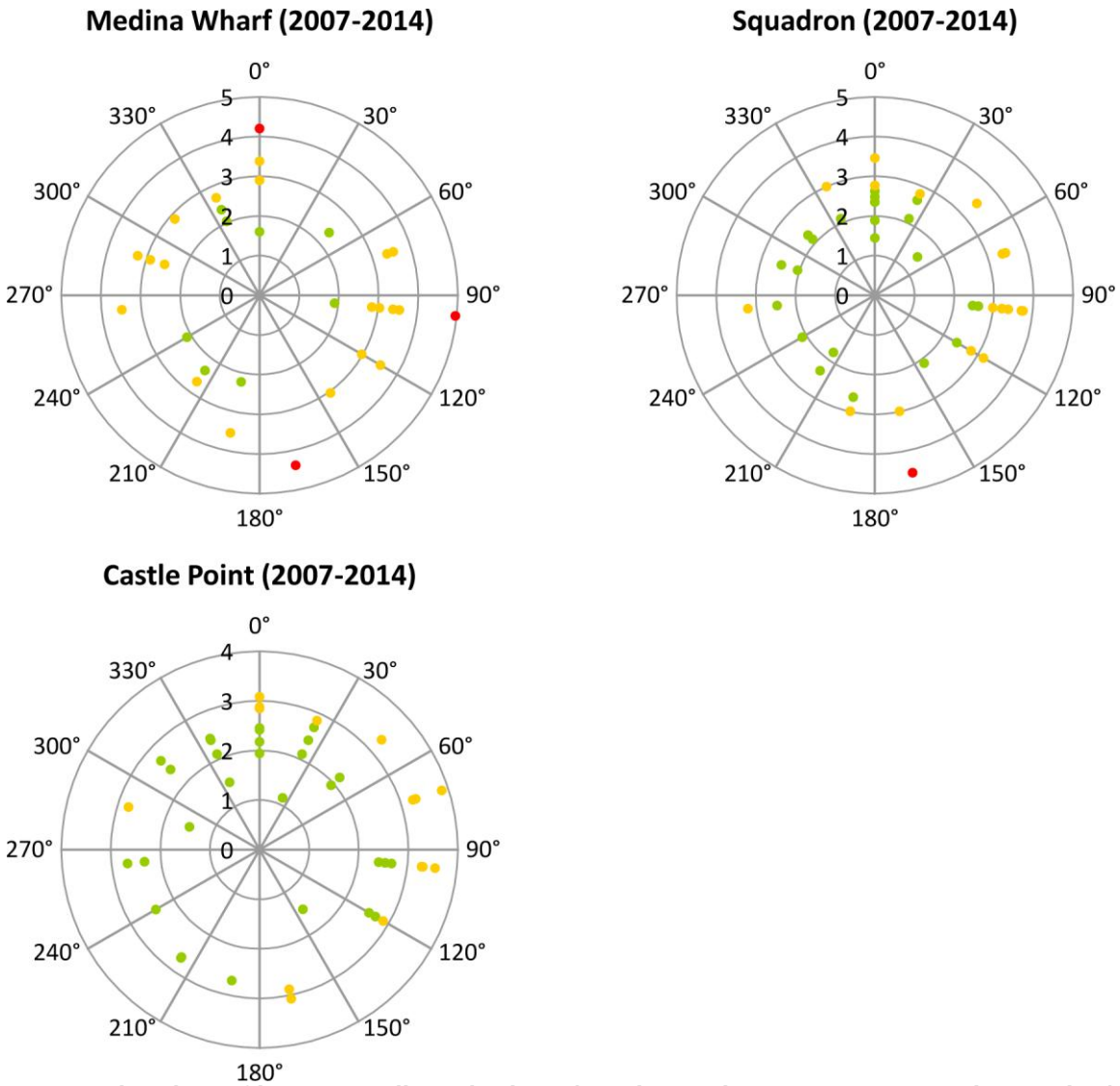

Figure 8.6: Polar plots of log10 *E. coli* results (MPN/100g) at native oyster RMPs against spring/neap tidal state

Despite the significant correlation between *E. coli* levels and spring/neap tidal state reported for Medina Wharf, there does not appear to be a significant pattern on the polar plot. At both Squadron and Castle Point, the level of *E. coli* tended to be higher around the spring tide, indicating that the most significant contamination sources were some distance from the RMPs.

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Appendices

Appendix I. Shoreline Survey

Date (time):
27/11/2013 (08:30 – 15:30)
28/11/2013 (08:30 – 15:30)

Cefas Officer:
Rachel Parks (27/11/2013 & 28/11/2013)
Simon Kershaw (28/11/2013)

Survey Partner:
Cathy Rushworth (Chelsea Technologies Ltd.) 27/11/2013
James Howe (Isle of Wight Council) 28/11/2013

Area surveyed:
Medina estuary — Boat survey, outer estuary: Cowes Castle along the western shore towards Dodnor Creek and north along the eastern shore to the breakwater at the mouth of the Medina.
Foot survey, upper estuary - Dodnor Creek along the shore to the Folly Lane, Whippingham.

Weather:
27 November 2013, overcast, 8.4°C, wind bearing 347° at 3.22 km/h
28 November 2013, overcast, 9.4°C, wind bearing 351° at 1.61 km/h

Tides:
Admiralty TotalTide© predictions for Cowes (50°46'N 1°18'W). All times in this report are GMT.

27/11/2013			28/11/2013		
High	06:00	3.7 m	High	07:08	3.7 m
High	18:26	3.5 m	High	19:35	3.6 m
Low	11:11	2.0 m	Low	12:21	1.8 m
Low	23:42	1.8 m			

Objectives:

The shoreline survey aimed to obtain samples of freshwater inputs to the area for bacteriological testing; confirm the location of previously identified sources of potential contamination; locate other potential sources of contamination that were previously unknown and find out more information about the fishery. A full list of recorded observations is presented in Table I.1 and Table I.2; and the locations of these observations are shown in Figure I.1 and Figure I.2.

I.1. Fishery

The Fairlee Station Outfall shellfishery was prohibited and the Squadron and Castle Point shellfisheries were temporarily declassified at the time of survey.

Illegal dredging of shellfish offshore from the Medina Valley Centre within the Donor classification area has been reported from an anecdotal source.

I.2. Sources of contamination

Sewage discharges

Two intermittent outfalls, Newport Intermittent (71) and Duck Bill discharge at Fairlee STW (80), were identified but were not discharging at the time of the survey, although sewage related debris were present in the vicinity of the Fairlee STW outfall. A large, valved pipe adjacent to Dodnor Pumping Station believed to be Dodnor CEO Outfall (47) was partially submerged and was not flowing at the time of the survey.

The Fairlee Road CSO was identified and sampled (67), it contained the highest *E. coli* concentration of 12,000 cfu/100 ml and a loading of 1.28 $x10^{10}$ cfu/day. A pipe from the Medina Caravan Park private package plant (88) had *E. coli* concentrations of 7,900 cfu/ 100 ml and a loading of 1.75 $x10^{9}$ cfu/day. On the western shore, three pipes discharge and combine to form a one combined flow into the estuary. This combined flow had an *E. coli* concentration of 11,000 cfu/100ml and a loading of 1.09 $x10^{10}$ cfu/day. It is assumed that the Dodnor Lane CSO discharges to one of these pipes, which would account for the high *E. coli* concentration. Sanitary debris were sighted at various locations in the upper estuary principally on the shoreline of the eastern shore, at observation 7, 81, 83, 87 and 86.

At observation 6 a water sample was taken adjacent to the old Fairlee continuous outfall which was relocated to Sandown in March 2010 (EA Southern Region Liaison Meeting, 2011). The *E. coli* concentration here (850 cfu/100 ml) was considerably low.

Around 6 houseboats were observed in the upper reaches of the estuary close to Odessa Boatyard (observation 58) and could be a potential source of sewage pollution to the estuary.

The *E. coli* concentration progressively increases from 20 cfu/100 ml at the mouth to 1,800 cfu/100 ml at Fairlee in the upper estuary.

Freshwater inputs

The majority of freshwater inputs observed during the survey were surface drainage, largely via pipes (observations 5, 27, 50, 72, 73, 74 and 76). *E. coli* concentrations were low (<440 cfu/100 ml), with the exception of observation 43, a 150mm pipe which had an *E. coli* concentration of 2,000 cfu/100 ml but a comparatively low loading of $1.05x10^{3}$

cfu/day. A pipe discharging to the eastern shore in the mouth of the estuary (21) located next to a Southern Water pumping station had an *E. coli* concentration of 2,000 cfu/100 ml and could represent sources of sewage contamination.

Two streams were observed in the upper estuary (observation 82 and 87) one of which was flowing at the time of the survey. The River Medina and the Lukely Brook (63 and 62) discharge to the head of the estuary and had low *E. coli* concentrations of 250 cfu/100 ml and 680 cfu/100 ml respectively. They were not accessible for flow measurements but were flowing rapidly at the time of the survey.

Livestock

No livestock was observed in close proximity to the Medina estuary, although 2 ponies were observed (44) in a field adjacent to the shore.

Wildlife

A range of bird species were observed throughout the survey area (observations 11, 12, 13, 16, 25, 49, 57, 61, 66, 69 & 85) including gulls, geese, ducks and pigeons. Bird aggregations were relatively small ranging from 15 at observation 25 to 60 at observation 49.

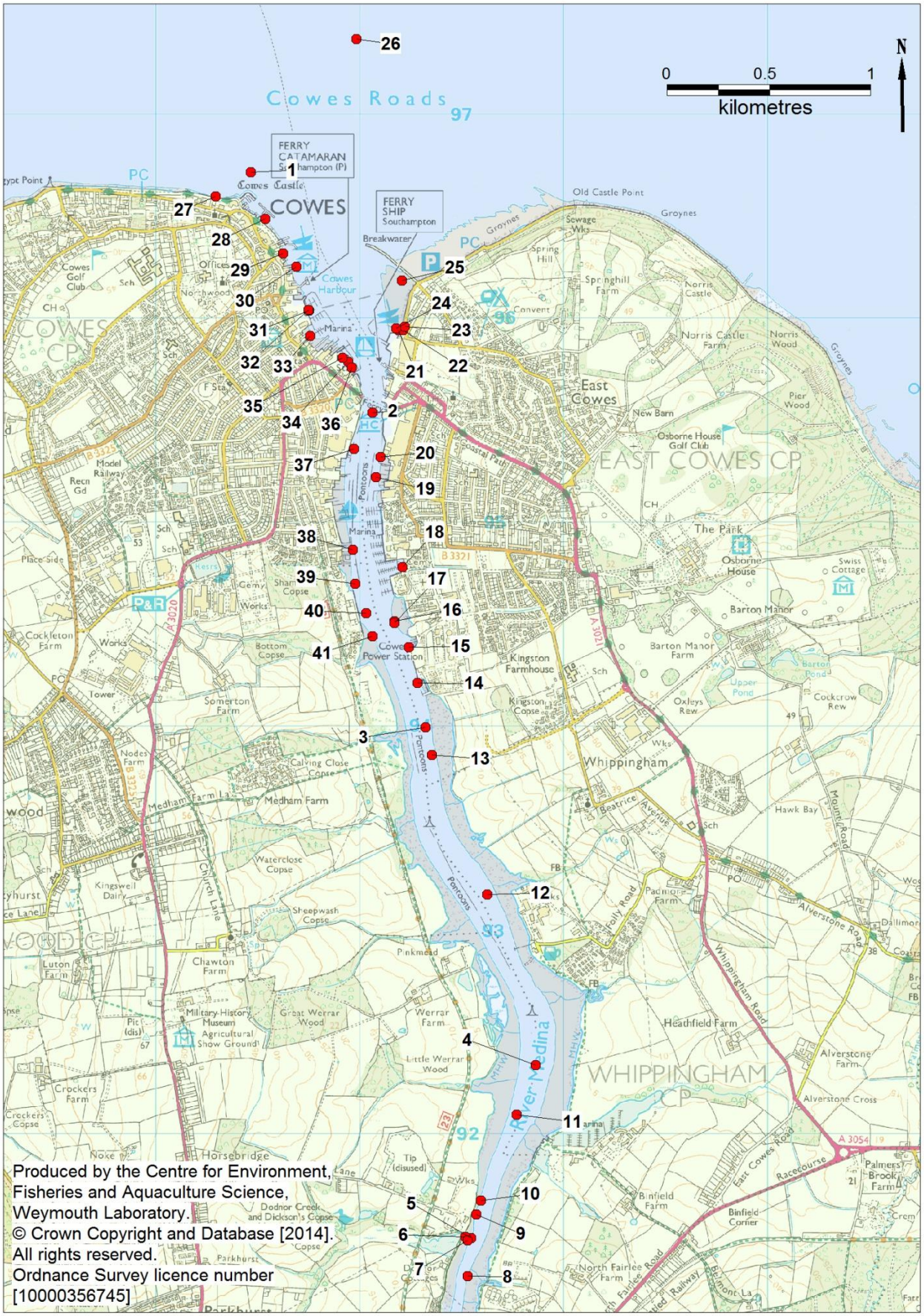

Figure I.1: Locations of boat shoreline survey observations (Table I.1 for details).

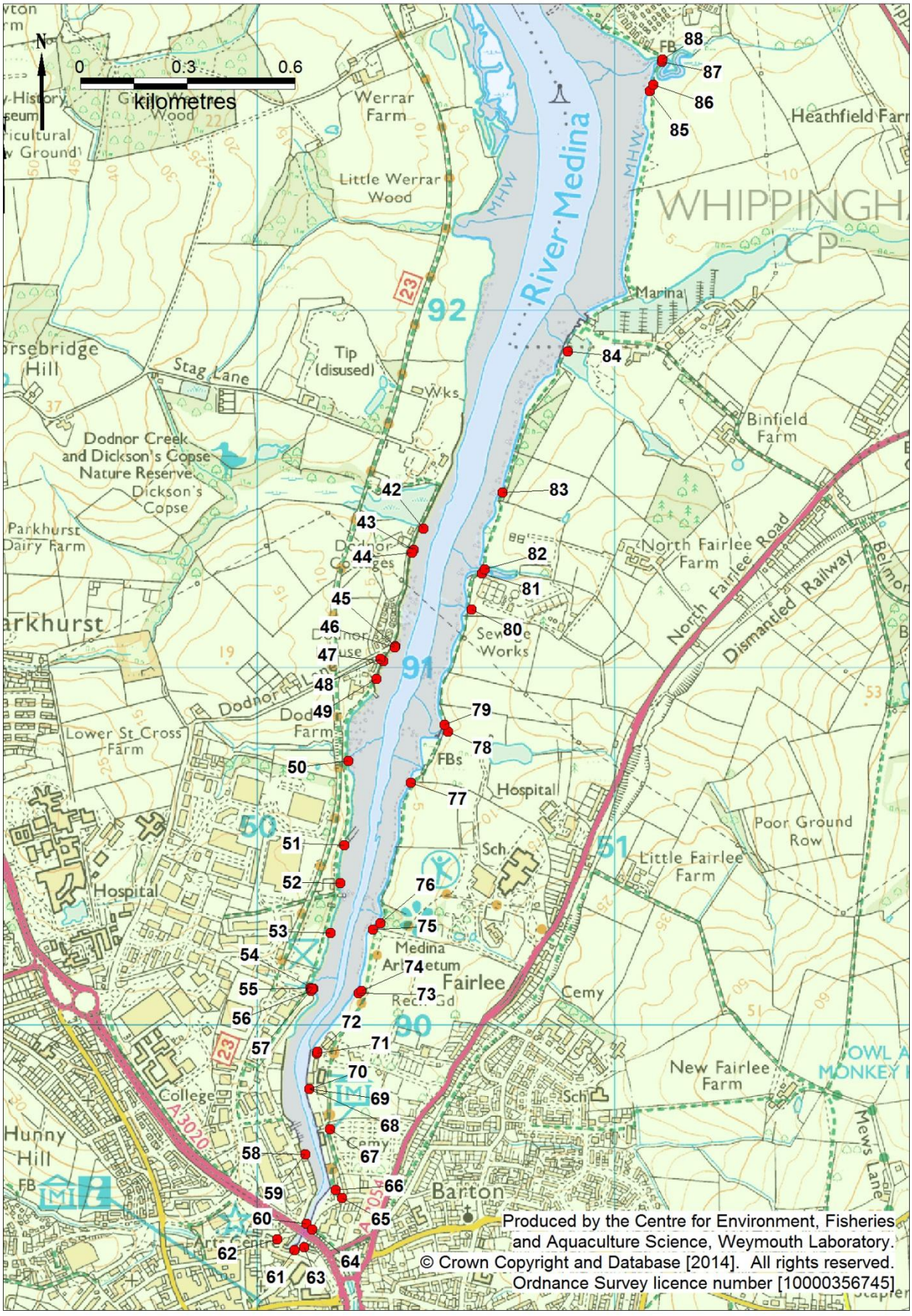

Figure I.2: Locations of foot shoreline survey observations (Table I.2 for details).

Table I.1: Details of Shoreline Observations from the boat survey

Observation no.	NGR	Date	Time	Description	Photo
1	SZ4946396716	27/11/2013	09:09:21	Water sample (MD01) & CTD Measurement	
2	SZ5006295535	27/11/2013	09:20:52	Water sample (MD02) & CTD Measurement	
3	SZ5032093992	27/11/2013	09:36:24	Water sample (MD03) & CTD Measurement	Figure I.10
4	SZ5086192334	27/11/2013	09:51:42	Water sample (MD04) & CTD Measurement	
5	SZ5054391487	27/11/2013	10:01:32	(MD05) sample taken in estuary adjacent to outputs through wall from pond with reed beds behind - next to Vestas	Figure I.11
6	SZ5051591492	27/11/2013	10:18:38	(MD06) Sample taken next to disused Fairlee Continuous Outfall	Figure I.12
7	SZ5052791476	27/11/2013	10:21:04	Sanitary debris on shore	
8	SZ5052691300	27/11/2013	10:28:28	(MD07) Water sample & CTD measurement	
9	SZ5057091604	27/11/2013	10:40:26	Pipe (375mm) with flap not flowing	
10	SZ5059391672	27/11/2013	10:43:08	2 surface drainage pipes not flowing	
11	SZ5076892091	27/11/2013	10:48:39	Flock of birds ~50	
12	SZ5062393172	27/11/2013	10:58:17	Flock of birds ~20	
13	SZ5035393855	27/11/2013	11:03:33	Flock of birds ~30	
14	SZ5028294211	27/11/2013	11:08:16	Outfall with grill. No flow	Figure I.13
15	SZ5023894384	27/11/2013	11:16:45	Submerged pipe under jetty	
16	SZ5016994511	27/11/2013	11:20:26	Birds ~40 and surface drainage pipe under works not flowing	
17	SZ5016794503	27/11/2013	11:22:47	Submerged pipe next to works	
18	SZ5020994779	27/11/2013	11:27:13	Pipe not flowing in corner of marina	
19	SZ5007995220	27/11/2013	11:41:08	Drainage pipe not flowing	
20	SZ5009995318	27/11/2013	11:43:21	2 pipes, 2 plastic drainage pipes, 1 flat valve not flowing CTD measurement	
21	SZ5018995940	27/11/2013	12:01:31	(MD08) Pipe next to Southern Water pumping station flowing - 6 seconds to fill bucket	Figure I.14
22	SZ5021095940	27/11/2013	12:03:34	Drainage pipes x 2 and pipe with grid not flowing	
23	SZ5021895956	27/11/2013	12:03:53	Pipe with grid not flowing	
24	SZ5017895950	27/11/2013	12:18:57	2 drainage pipes not flowing	
25	SZ5020496184	27/11/2013	12:24:05	15 gulls on the wall & pipe not flowing	
26	SZ4998397369	27/11/2013	12:31:20	CTD measurement	Figure I.15
27	SZ4929396597	27/11/2013	12:43:16	(MD09) Pipe flowing (similar to 618) and then decreased to dripping	Figure I.16
28	SZ4953696487	27/11/2013	12:49:46	Surface water drainage pipes not flowing	
29	SZ4962296317	27/11/2013	13:12:57	2 pipes with flaps not flowing not flowing	
30	SZ4968996250	27/11/2013	13:38:02	Pipe with u bend submerged under HSBC	
31	SZ4974996036	27/11/2013	13:43:21	Pipe with u bend submerged	

32	SZ4974796038	27/11/2013	13:44:09	Pipe not flowing
33	SZ4975695911	27/11/2013	13:49:16	3 Drainage pipes
34	SZ4994395784	27/11/2013	13:53:08	Small Pipe with flap (~150mm)
35	SZ4991395803	27/11/2013	13:54:15	Small Pipe with flap (~150mm)
36	SZ4995995756	27/11/2013	13:57:22	Small Pipe with flap (~150mm)
37	SZ4997095358	27/11/2013	14:02:34	Drainage pipe from Cowes Shipyard
38	SZ4996594862	27/11/2013	14:08:57	4 drainage pipes not flowing
39	SZ4997594696	27/11/2013	14:10:47	2 pipes one above the other not flowing
40	SZ5002994552	27/11/2013	14:12:44	2 drainage pipes not flowing
41	SZ5006094438	27/11/2013	14:13:40	2 drainage pipes not flowing

Table I.2: Details of Shoreline Observations from the foot survey

Observation no.	NGR	Date	Time	Description	Photo
42	SZ5046491390	28/11/2013	09:13:59	3 pipes not flowing from pond next to Vestas	
43	SZ5043691330	28/11/2013	09:17:37	(MD10) Pipe (150mm) flowing	Figure I.17
44	SZ5043291323	28/11/2013	09:24:04	2 ponies in field	
45	SZ5038591061	28/11/2013	09:28:41	Large pipe not flowing - surface drainage	
46	SZ5038491058	28/11/2013	09:29:28	Large pipe not flowing - surface drainage	
47	SZ5035191019	28/11/2013	09:35:18	Large pipe with flap not flowing and plastic pipe to the right, Dodnor CEO?	Figure I.18
48	SZ5034491025	28/11/2013	09:36:32	Southern Water Pumping Station	
49	SZ5033390969	28/11/2013	09:38:36	~60 birds	Figure I.19
50	SZ5025390740	28/11/2013	09:51:42	(MD11) Submerged Pipe with channel (to large and deep for flow reading) fast flow	Figure I.20
51	SZ5024390503	28/11/2013	09:59:27	Drainage pipes Vestas Blade runner behind	
52	SZ5023190398	28/11/2013	10:03:27	Surface drainage pipe not flowing	
53	SZ5020490259	28/11/2013	10:07:17	Pipe with u bend and man cover above not flowing	
54	SZ5015590102	28/11/2013	10:10:41	(MD12) 3 pipes combined output including Dodnor Lane CSO discharge; observation 653 & 654.	Figure I.21
55	SZ5014890104	28/11/2013	10:17:15	Pipe with pond behind dripping	
56	SZ5014990096	28/11/2013	10:22:48	Pipe not flowing	
57	SZ5015290103	28/11/2013	10:23:40	~30 birds on the opposite shore	
58	SZ5013389638	28/11/2013	10:38:18	Houseboats ~ 6 - shore pump out not always used	Figure I.22
59	SZ5013389639	28/11/2013	10:39:52	Pipe from meat processing plant (closed 18 months ago) building now empty.	Figure I.23
60	SZ5013689444	28/11/2013	10:48:47	Pipe with flap dripping - land drainage from under bridge (dual carriageway above)	
61	SZ5010389370	28/11/2013	10:53:59	Pigeons and ducks ~50	
62	SZ5005489401	28/11/2013	10:58:24	(MD13) Lukely Brook - not accessible for flow sample. Fast Flowing	Figure I.25
63	SZ5013089379	28/11/2013	11:06:18	(MD14) Sample from River Medina - not accessible for flow measurement. Fast flowing	
64	SZ5015289429	28/11/2013	11:09:28	Pipe with flap dripping	Figure I.24
65	SZ5023689517	28/11/2013	11:13:25	Southern Water Pumping Station- Site Reference No 101500	
66	SZ5021889539	28/11/2013	11:14:52	~30 gulls	
67	SZ5020289710	28/11/2013	11:19:03	(MD15) Fairlee Road Newport CSO via a concrete culverted stream	Figure I.26
68	SZ5014589821	28/11/2013	11:38:08	Flow from wall (couldn't see if there was a pipe) - not accessible	
69	SZ5014589821	28/11/2013	11:39:07	~30 gulls	
70	SZ5014589822	28/11/2013	11:39:58	Outfall from under aggregate works	
71	SZ5016689922	28/11/2013	11:43:11	Newport Intermittent Not flowing	Figure I.27
72	SZ5016789926	28/11/2013	11:44:09	(MD16) Pipe flowing	Figure I.28
73	SZ5028290089	28/11/2013	11:52:28	(MD17) 2 pipes flowing - combined flow reading	Figure I.29

74	SZ5029090096	28/11/2013	12:00:19	(MD18) Surface drainage	
75	SZ5032390268	28/11/2013	12:15:00	Dripping surface drainage from pipe and channel to estuary	
76	SZ5034390286	28/11/2013	12:17:46	(MD19) Pipe flowing no flap	Figure I.30
77	SZ5042990679	28/11/2013	12:31:20	2 large pipes no flaps (1 dripping)	
78	SZ5053390822	28/11/2013	12:38:57	(MD20) Large pipe flowing	Figure I.31
79	SZ5052490841	28/11/2013	12:50:41	Large drainage pipes through land	
80	SZ5059991164	28/11/2013	12:57:48	'Duck Bill' discharge at Fairlee STW - Not flowing. Sewage debris present.	Figure I.32
81	SZ5062891265	28/11/2013	13:02:23	Sewage debris	
82	SZ5063691276	28/11/2013	13:03:16	Stream not flowing and pipe not flowing	
83	SZ5068591491	28/11/2013	13:09:01	Cotton wool buds & sanitary items	
84	SZ5086891885	28/11/2013	13:17:00	(MD21) Drainage from marshes	Figure I.33
85	SZ5109792614	28/11/2013	13:37:25	Geese ~50	
86	SZ5110892632	28/11/2013	13:39:11	Cotton wool buds	
87	SZ5113192697	28/11/2013	13:40:49	(MD22) Stream & cotton wool buds	Figure I.34
88	SZ5113392703	28/11/2013	13:47:00	(MD23) Pipe from Medina Leisure Park with Pumping station behind (Package Plant)	Figure I.35

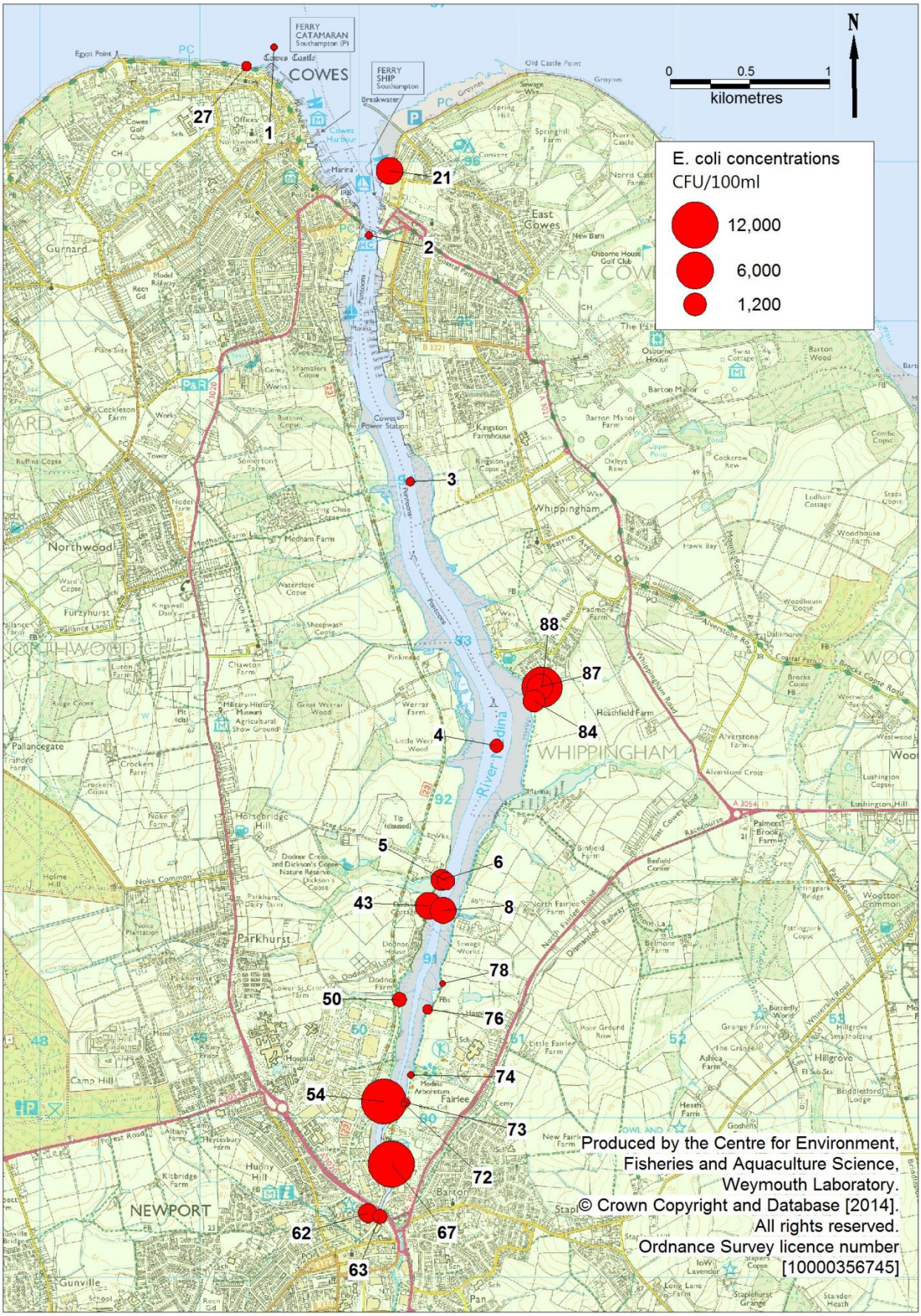

Figure I.3: Water sample results (Table I.3 for details)

Table I.3: *E. coli* results

Sample ID	Observation number	Water type	Description	*E. coli* concentration (cfu/100 ml)	Flow (m^3/s)	*E. coli* loading (cfu/day)
MD01	1	SW	Estuary water sample	20	n/a	
MD02	2	SW	Estuary water sample	30	n/a	
MD03	3	SW	Estuary water sample	40	n/a	
MD04	4	SW	Estuary water sample	200	n/a	
MD05	5	SW	Reed bed drainage	440	Flow too spread to measure	
MD06	6	FW	Close to disused Fairlee STW outfall	850	Flow too spread to measure	
MD07	8	SW	Estuary water sample	1,800	n/a	
MD08	21	FW	Pipe next to SW Water PS	2,000	0.001	2.00×10^{4}
MD09	27	FW	Pipe flowing then reduced to dripping	60	Similar to MD08	Estimated 5.18×10^{7}
MD10	43	FW	150 mm Pipe	2000	5.26×10^{-5}	1.05×10^{3}
MD11	50	FW	Submerged pipe	260	Too large and deep to measure	
MD12	54	FW	3 pipes combined output including Dodnor Lane CSO discharge	11,000	0.081	$1.09E \times 10^{10}$
MD13	62	FW	Lukely Brook	680	Too large and deep to measure	
MD14	63	FW	River Medina	250	Too large and deep to measure	
MD15	67	FW	Fairlee Road Newport CSO	12,000	0.001	1.28×10^{10}
MD16	72	FW	Pipe	10	0.001	8.64×10^{6}
MD17	73	FW	2 pipes – combined flow	50	0.058	6.26×10^{6}
MD18	74	FW	Surface drainage	20	3.60×10^{-5}	6.22×10^{5}
MD19	76	FW	Pipe no flap	60	0.049	6.40×10^{7}
MD20	78	FW	Large pipe	10	0.005	4.08×10^{7}
MD21	84	FW	Marsh drainage	1,000		
MD22	87	FW	Stream	1,800		
MD23	88	FW	Pipe from Medina caravan park with adjacent PS	7,900	2.56×10^{-4}	1.75×10^{9}

I.3. Conductivity Temperature Depth (CTD) Measurements

Conductivity (PSU), temperature (°C) and depth (m) [CTD] measurements were taken at six locations within the Medina (observations 1-4; 8 & 26), Figure I.1 illustrates their locations. Measurements were taken on an ebb tide and were taken from the mouth of the estuary towards its upper estuary observation 8 was taken 5.5 km up estuary. An exception to this is observation 26 which was taken offshore approximately 0.8 km from

the mouth, and on a flood tide. Temperature and salinity profiles for these locations are shown in Figure I.4 to Figure I.9.

In the mouth of the estuary and offshore the salinity and temperature is constant throughout the water column (above 33 PSU and above 8.5°C). As you move upstream there is more variation in the salinity and temperature between the surface waters and at depth, providing evidence of a freshwater plume. There is some stratification at observation 4 where the salinity increases from 13.8 PSU in the surface waters down to 32.3 PSU at 2.4 metres depth. There is a small temperature difference (1.7°C) throughout the water column. Observation 8 follows a similar trend increasing from 20.9 to 28.8 PSU in 1.2 metres.

Figure I.4: Temperature and salinity profiles for observation 1 (Medina mouth)

Figure I.5: Temperature and salinity profiles for observation 2 (South of chain ferry)

Figure I.6: Temperature and salinity profiles for observation 3 (Kingston Copse)

Figure I.7: Temperature and salinity profiles for observation 4 (Whippingham)

Figure I.8: Temperature and salinity profiles for observation 8 (Offshore from Fairlee Intermittent)

Figure I.9: Temperature and salinity profiles for observation 26

Figure I.10 Observation 3 (MD03)

Figure I.11 Observation 5 (MD05)

Figure I.12 Observation 6 (MD06)

Figure I.13 Observation 14

Figure I.14 Observation 21 (MD08)

Figure I.15 Observation 26

Figure I.16 Observation 27 (MD09)

Figure I.17 Observation 43 (MD10)

Figure I.18 Observation 47

Figure I.19 Observation 49

Figure I.20 Observation 50

Figure I.21 Observation 54 (MD12)

Figure I.22 Observation 58

Figure I.23 Observation 59

Figure I.24 Observation 64

Figure I.25 Observation 62 (MD13)

Figure I.26 Observation 67 (MD 15)

Figure I.27 Observation 71

Figure I.28 Observation 72 (MD16)

Figure I.29 Observation 73 (MD17)

Figure I.30 Observation 76 (MD 19)

Figure I.31 Observation 78 (MD 20)

Figure I.32 Observation 80

Figure I.33 Observation 84 (MD 21)

Figure I.34 Observation 87 (MD 22)

1

Figure I.35 Observation 88 (MD 23)

Appendix II. Medina Estuary Sanitary Survey Report 2008

Regulation (EC) No 854/2004

CLASSIFICATION OF BIVALVE MOLLUSC PRODUCTION AREAS IN ENGLAND AND WALES

SANITARY SURVEY REPORT

Medina Estuary - Isle of Wight

2008

Cover photo: River Medina at Dodnor.

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STATEMENT OF USE: This report provides information from a desk study evaluation of the information available relevant to perform a sanitary survey of bivalve mollusc production areas in the Medina Estuary. Its primary purpose is to demonstrate compliance with the requirements for classification of bivalve production areas, laid down in Regulation (EC) No 854/2004 of the European Parliament and of the Council. The Centre for Environment, Fisheries and Aquaculture Science (Cefas) undertook this work on behalf of the Food Standards Agency (FSA).

DISSEMINATION STATUS: Food Standards Agency, Isle of Wight Council, Environment Agency.

CONTENTS

EXECUTIVE SUMMARY

Under Regulation (EC) No 854/2004 there is a requirement for competent authorities intending to classify bivalve mollusc production and relaying areas (BMPAs) to undertake a number of tasks collectively known (in England and Wales) as 'sanitary surveys'. The main purpose of these surveys is to inform the sampling plans for the microbiological monitoring programme and classification of BMPAs. Other wider benefits of these surveys include the potential to improve identification of pollution events and the sources of those events such that in the future remedial action can be taken to the benefit of the fisheries.

This report documents the qualitative assessment made of the levels of microbiological contamination in bivalves from the Medina BMPA, Isle of Wight and presents the recommended sampling plan as a result of a sanitary survey undertaken by Cefas on behalf of the Food Standards Agency (FSA).

The assessment is supported by published relevant information for the Medina area and new information obtained from a shoreline survey performed in the estuary. In addition, statistical analysis of historical data from the Shellfish Hygiene monitoring programme was undertaken. The sampling plan presents information on the location of monitoring points and sampling frequency for new harvesting areas for manila clam, cockle and hard clam and for existing harvesting areas for native oysters.

The main sources of microbiological contamination in the Medina BMPA are the continuous effluent discharge from Fairlee sewage treatment works (STW) and intermittent sewage discharges in Cowes and Newport. The private sewage treatment plant at Medina Leisure Park may also be locally important. Other potential sources of contamination in the estuary include birds, dogs and sewage discharges from moored boats. Direct agricultural inputs to the estuary are not thought to be a significant source of contamination although diffuse agricultural inputs to the River Medina and its tributaries may be more important. Maintenance and capital dredging in the estuary may result in the release of sediment-bound faecal bacteria and viruses into the water column and subsequent uptake by shellfish.

Levels of faecal bacterial contamination in both water and shellfish increase following rainfall suggesting that rainfall related sources of contamination are important throughout the Medina BMPA. There is no evidence that levels of contamination increase during Cowes Week when large numbers of competitors and spectators visit the area.

The native oyster beds within the estuary are currently classified as 'prohibited' and levels of *E. coli* in Manila clams collected from near the outfall of Fairlee STW were above prohibited levels. It is therefore highly likely that the proposed new beds within the estuary will be prohibited for shellfish harvesting due to the impact of the effluent discharge from Fairlee STW. Fairlee STW is scheduled to be closed by March 2009. This should result in a reduction in levels of contamination in shellfisheries throughout the Medina BMPA. The sanitary survey and sampling plan should be reviewed on completion of this scheme and the monitoring results reviewed after a period of further sampling.

1. INTRODUCTION

1.1 Background

Filter-feeding bivalve shellfish can accumulate bacterial and viral pathogens from sewage-contaminated waters. The consumption of raw or insufficiently cooked shellfish harvested from such waters can cause illness (e.g. gastro-enteritis) and lead to outbreaks of infectious disease. In order to protect public health, under Regulation (EC) No 854/2004, shellfish harvesting and relaying areas are classified on the basis of monitoring of levels of faecal indicator organisms (*Escherichia coli* in the EU) in shellfish. This classification determines the level of treatment required (e.g. purification, relaying or cooking) before human consumption, or may prohibit harvesting.

Regulation (EC) No 854/2004, states that '*if the competent authority decides in principle to classify a production or relay area it must:*

i) make an inventory the sources of pollution of human or animal origin likely to be a source of contamination for the production areas;

ii) examine the quantities of organic pollutants released during the different periods of the year, according to the seasonal variations of both human and animal populations in the catchment area and environmental factors e.g. rainfall, river flow, level of waste-water treatment, etc.

iii) determine the characteristics of the circulation of pollutants by virtue of current patterns, bathymetry and the tidal regime in the production area; and

iv) establish a sampling programme of shellfish in the production area which is based on the examination of established data, and with a number of samples, a geographical distribution of the sampling points and a sampling frequency which must ensure that the results of the analysis are as representative as possible for the area considered'.

In England and Wales these activities are collectively known as a 'sanitary survey' (Cefas, 2007). The Centre for Environment Fisheries and Aquaculture Science (Cefas) is performing sanitary surveys for new bivalve mollusc production areas (BMPAs) in England and Wales on behalf of the Food Standards Agency (FSA). This report documents information arising from a sanitary survey relevant to BMPAs in the Medina Estuary, Isle of Wight. The sanitary survey was prompted by applications for monitoring and classification of wild Manila clam, American hard shell clam and cockle within the estuary. These are new operations being developed within an existing production area.

1.2 Site description

The Medina Estuary is situated on the north coast of the Isle of Wight, extending approximately 7 km from the tidal limit at Newport to the Solent at Cowes (Figure 1.1). The estuary is narrow (less than 0.5 km wide) relative to its length and shallow (less than 5 m deep). There are narrow intertidal mudflats on either side of the middle and upper estuary, which is bordered by agricultural land, hedgerows and woods. In contrast, the mouth of the estuary and its lower reaches are lined by docks, boatyards and marinas (Figure 1.2). Commercial and economic use of the estuary includes commercial shipping, ferry services, marine services, fishing and tourism (Isle of Wight Council, 2007). Major urban centres are located at Newport (population 22,957) and Cowes/Northwood (population 19,110) (2001 census figures, National Statistics, 2004).

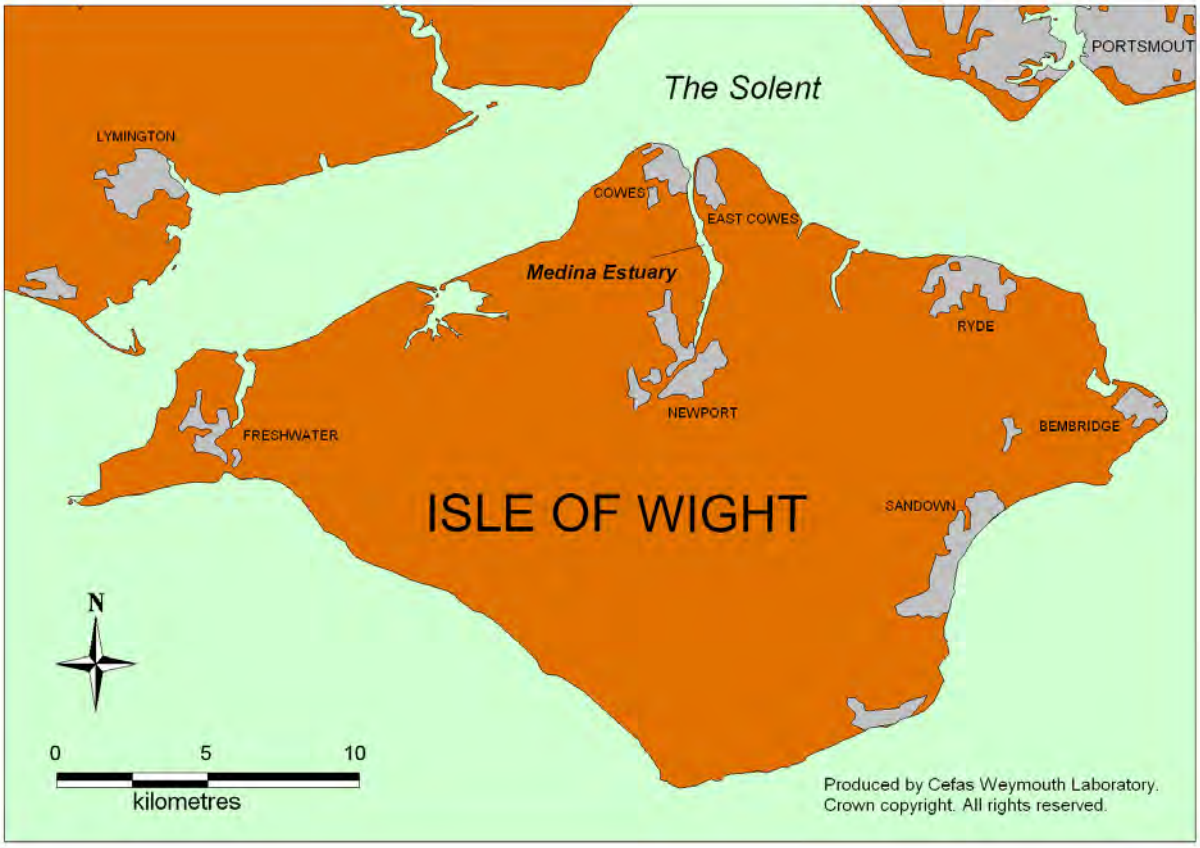


Figure 1.1: Location of the Medina Estuary, Isle of Wight

Cowes has an international reputation for yachting and yacht racing (a survey conducted by the Southern Tourist Board in 2000 concluded that over 710,000 yachtsmen visited Cowes in 2000 (Cowes Harbour Commission, 2007)). Cowes Week, held in the first week of August, is the largest yachting regatta of its type in the world. The event attracts around 8,500 competitors and in excess of 100,000 spectators each year (Skandia Cowes Week, 2008). The pressures created by this influx of visitors may result in a temporary increase in the risk of pollution to the estuary due to the increased demands on the local sewerage infrastructure and the potential discharge of sewage from boats.

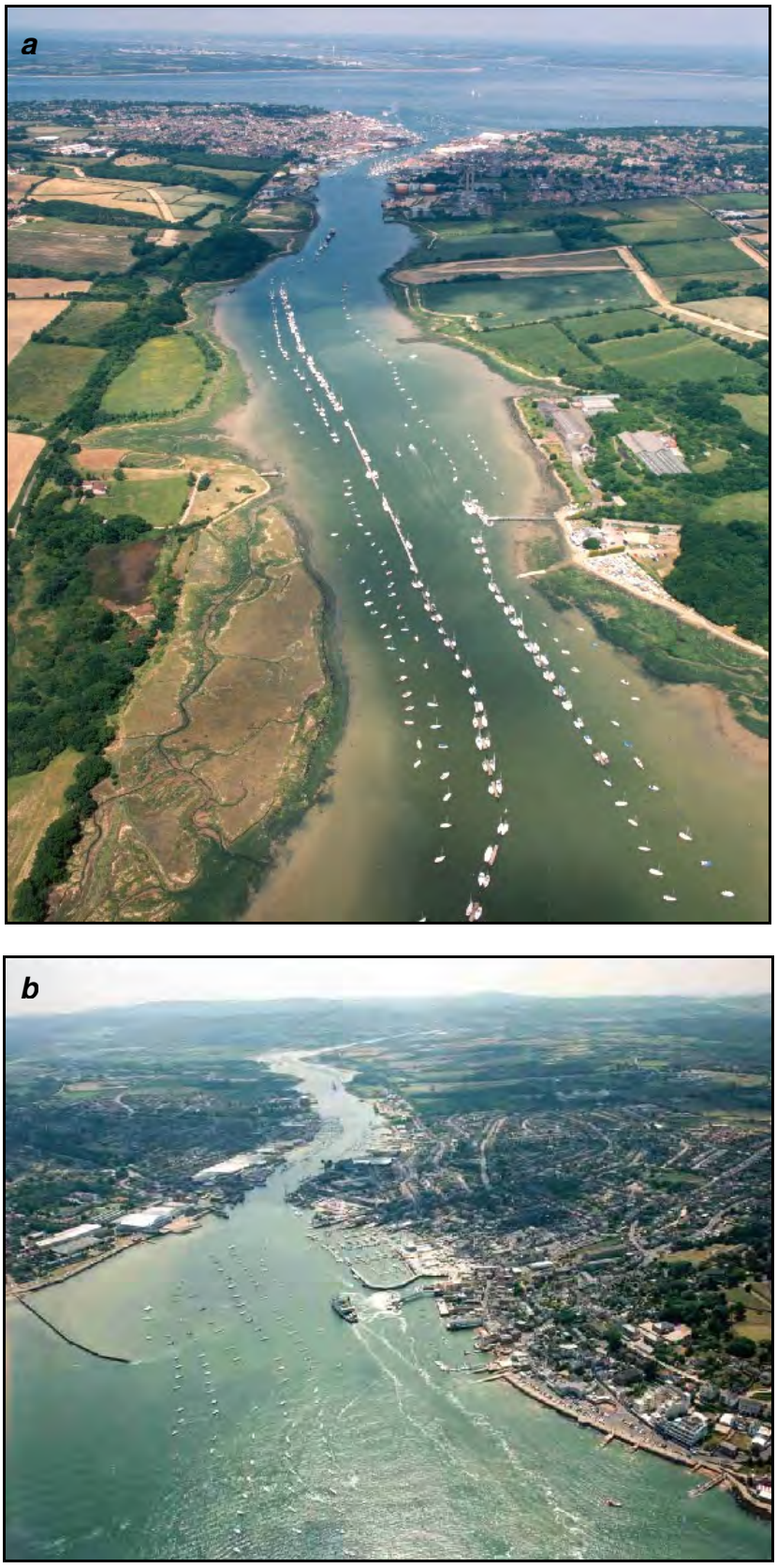


Figure 1.2: Aerial views of a) the Medina Estuary at Folly Reach looking north and b) Cowes Harbour looking south. Images © Isle of White Estuaries Project

Cowes Harbour is exposed to the wind and open sea conditions from the northwest to northeast quadrant. Cowes Harbour Commission (CHC) are proposing to build a detached breakwater in the outer harbour to make Cowes a truly sheltered harbour (Cowes Harbour Commission, 2007). The construction of a new 305-berth marina in the harbour is also planned. This development will complement the planned South East England Development Agency (SEEDA) project to regenerate East Cowes and Cowes Waterfront.

The estuary forms part of the Solent Maritime Special Area of Conservation (SAC), the Solent and Southampton Water Special Protection Area (SPA) and the Solent and Southampton Water Ramsar site. It is also a Site of Special Scientific Interest (SSSI). The lower estuary is designated as a Sensitive Area under the EC Shellfish Waters Directive (79/923/EEC) and the entire estuary has recently been designated as a Sensitive Area (Eutrophic) under the Urban Waste Water Treatment Directive (91/271/EEC).

2. SHELLFISHERIES

2.1 Existing native oyster fishery

The Medina Estuary has historically supported a small but economically important native oyster (*Ostrea edulis*) fishery. Annual production in the mid 1990s was estimated to be between 16 and 20 tonnes (Steins and Edwards, 1997). No information is available on current levels of production. The location and extent of the native oyster beds in the estuary is shown in Figure 2.1.

In the 1990s, CHC issued oyster-dredging licences to a limited number of fishermen that restricted dredging to certain times and areas (Steins and Edwards, 1997). Such licences are no longer issued and the only restrictions imposed on oyster dredging in the estuary are the navigational rules stipulated in the Cowes Harbour byelaws (Stuart McIntosh, Cowes Harbour Master, personal communication). Because the Medina Estuary is outside of the jurisdiction of Southern Sea Fisheries Committee (see Box 1) and is not covered by the Solent Oyster Fishery Regulating Order, there are no statutory restrictions on periods or times of dredging, gear restrictions, oyster size limits or quotas.

Box 1: Navigation and fisheries regulation in the Medina Estuary

Cowes Harbour Commissioners (CHC) and Newport Harbour Authority (NHA) have statutory responsibility for conservation and navigation within the estuary and have the powers to make byelaws for regulation purposes. CHC jurisdiction, as established by the Cowes Harbour Act 1897, extends on the northern boundary from Egypt Point to Prince Consort Buoy to Castle Point and thereafter on the foreshore at the high water mark throughout the estuary to an east-west boundary at the Folly Inn. South of this boundary the estuary is regulated by the Isle of Wight Council as Newport Harbour Authority, who own the riverbed south of the boundary. The Medina Estuary is outside of the jurisdiction of the Southern Sea Fisheries Committee (although part of the Medina BMPA is within SSFC jurisdiction), and the Environment Agency has regulatory authority over the fishery within the estuary. However, due to resource issues the Environment Agency does not wish to act as the regulating authority and currently has no involvement in regulating the fishery (Rob Waring, Environment Agency, Personal Communication).

The classification zone map for the native oyster beds in the Medina BMPA is given in Figure 2.2 and the classification history for these beds is given in Table 2.1. The oyster beds within the estuary (Medina Wharf bed) are currently classified as 'prohibited' for shellfish harvesting under the Shellfish Hygiene Regulations. The oyster beds outside of the estuary (Squadron and Castle Point) achieve a Class B classification.

Table 2.1: Classification history for native oyster beds in the Medina BMPA (data from Food Standards Agency, 2008)

Bed	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Wharf	C	C	C	Prohibit.	Prohibit.	Prohibit.
Castle Point	-	-	-	B	B	B
Squadron	-	-	-	C	C	B

2.2 Proposed new fisheries

Cefas have received applications for the classification of two new fisheries within the estuary. These relate to:

1. Harvesting of American hard shell clam (*Mercenaria mercenaria*) by handpicking in the intertidal between North Fairlee and Kingston (application from Trevor Towill, Red Squirrel Holidays)

2. Harvesting of *M. mercenaria*, cockle (*Cerastoderma edule*) and Manila clam (*Tapes phillippinarum*) by dredging between Newport and the Folly Inn (application from Eric McLeod, Viviers (UK) Ltd.)

The areas for which classification has been requested for these fisheries are shown on the map in Figure 2.1.

The above species are not currently commercially harvested for human consumption and very little information is available on stock status.

Mercenaria are collected from the intertidal by handpicking and sold as bait for bass longlines (Mike Towill, fisherman, personal communication). The species does not appear to be abundant in the estuary and only a single specimen was found in a dredge at North of Folly Reach in 2002 (Mallinson and Herbert, 2003). *Mercenaria* was not recorded in benthic surveys undertaken by Titan Environmental Surveys Ltd. in 2005 (2005), nor was it found during the bacteriological survey undertaken by Cefas in 2008 (See Appendix B).

Manila clams are present in the upper estuary in the vicinity of Dodnor (see Appendix B). Boats dredging illegally for this species have been apprehended in the Dodnor area (Mark Rowland, Isle of Wight Council, personal communication).

Cockles are present throughout the estuary (Mallinson and Herbert, 2003; Titan Environmental Surveys Ltd., 2005).

As noted above, commercial fisheries for these species within the estuary would not be subject to any quotas, gear restrictions, size limits or closed seasons as they are outside SSFC jurisdiction.

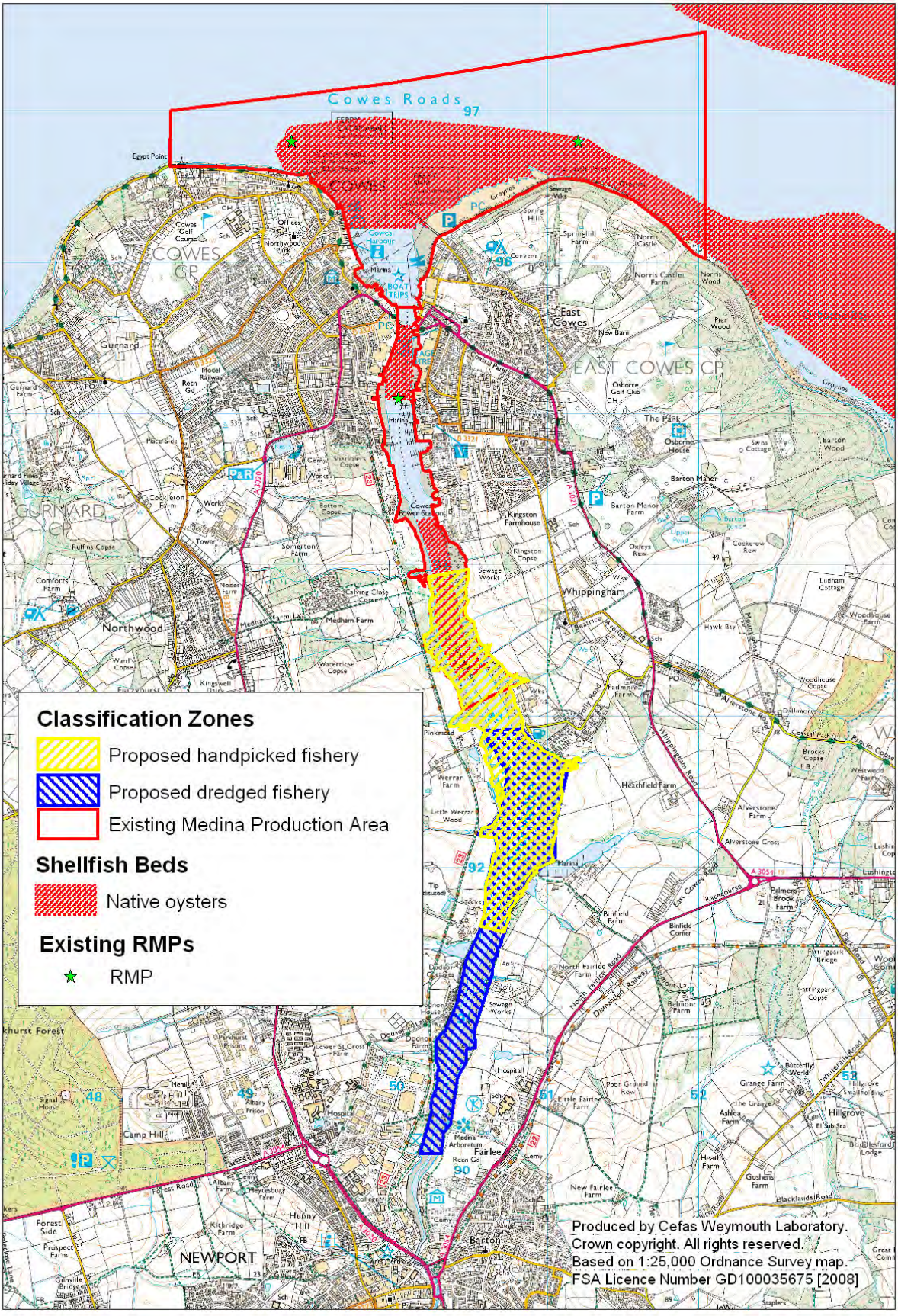
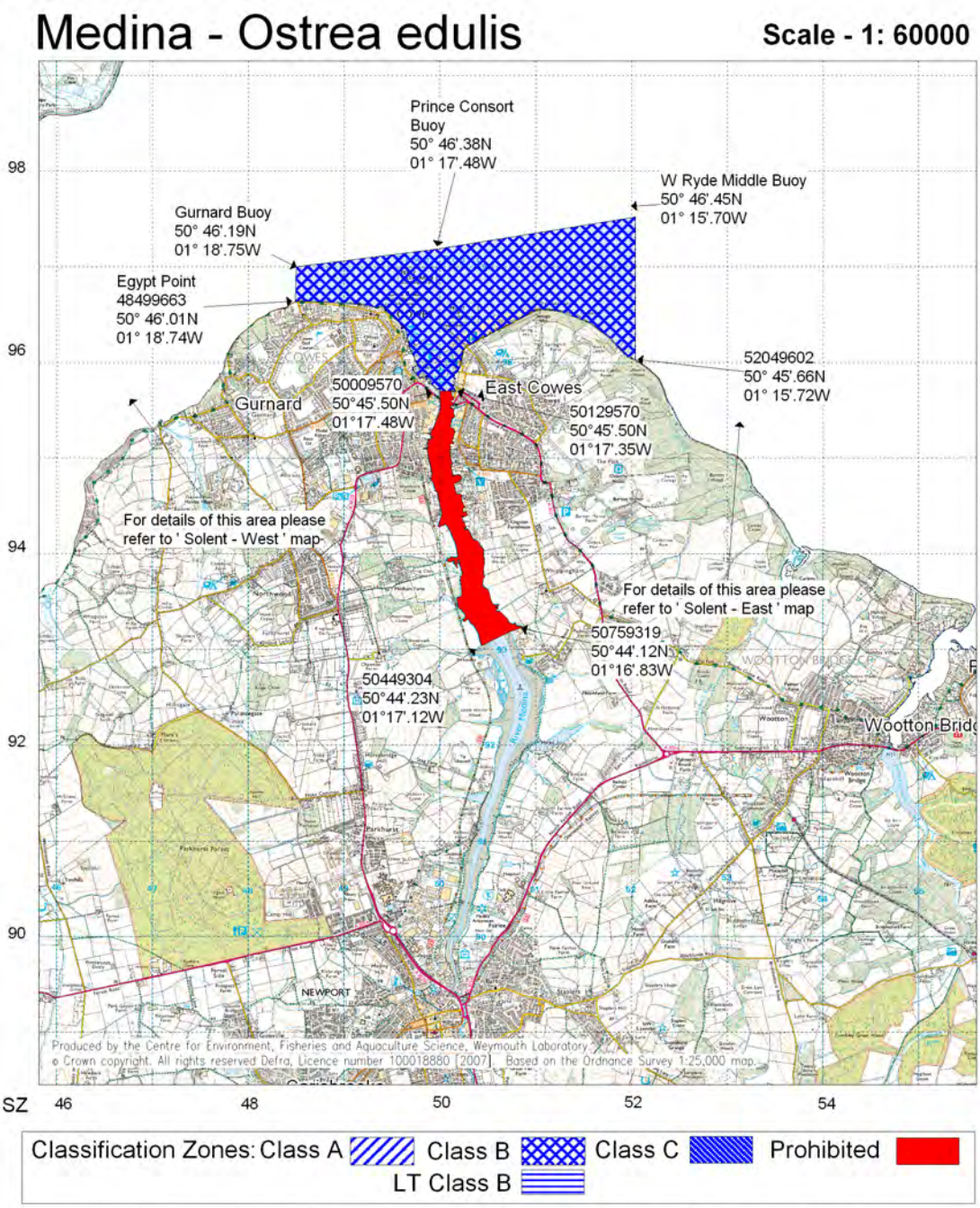


Figure 2.1: Shellfisheries in the Medina BMPA



Classification of Bivalve Mollusc Production Areas: Effective from 1 September 2007

The areas delineated above are those classified as bivalve mollusc production areas under EU Regulation 854/2004.

Further details on the classified species and the areas may be obtained from the responsible Food Authority. Enquiries regarding the maps should be directed to: Shellfish Microbiology, CEFAS Weymouth Laboratory, Barrack Road, The Nothe, Weymouth, Dorset DT4 8UB.
(Tel: 01305 206600 Fax: 01305 206601)

N.B. Lat/Longs quoted are OSGB 36

Food Authority: Isle of Wight Council

Figure 2.2 Classification map for Medina BMPA (Cefas)

3. HYDROGRAPHY AND HYDRODYNAMICS

3.1 Bathymetry

The Medina estuary is shallow and at low water the 3 km channel between Newport and Folly Reach dries. Elsewhere in the estuary the chart depths are typically < 5m below Chart Datum (LAT). In the Medina BMPA outside of the estuary chart depths range from 5 to 20 m. [Detailed bathymetry information for the Medina BMPA is given in Admiralty Chart No. 2793, Cowes Harbour and River Medina (UKHO, 2000).]

3.2 Tidal regime

The spring tidal range is 3.4 m at Cowes decreasing to 2.5 m at Newport (Table 3.1). In common with the other tidal inlets of the Solent the hydraulic regimes are ebb-dominant. That is, the tide falls faster than it rises so that ebb currents are shorter in duration, but more rapid than their flood tide counterparts (Bray *et al*., 2005). Double high waters occur at or near spring tides and on neap tides a stand occurs lasting up to two hours (Figure 3.1).

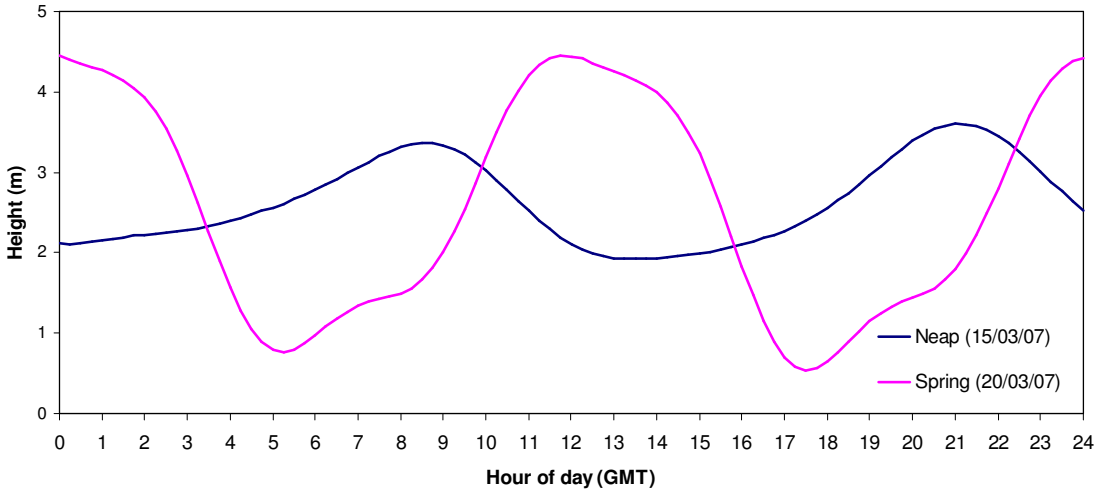


Figure 3.1: Selected spring and neap tidal elevation curves for the Medina Estuary at Cowes (predicted elevations from POLTIPS)

Table 3.1: Tidal ranges in the Medina Estuary (UKHO, 2000)

	Height (m) above chart datum			
	MHWS	MHWN	MLWN	MLWS
Cowes	4.2	3.5	1.8	0.8
Folly Inn	4.1	3.4	1.8	1.0
Newport	4.1	3.4	2.0	1.6

The hydraulic regime of the estuary may be regarded as substantially natural with local modifications due to waterfront development, the dredging of the main channel and the installation of protection structures such as the Shrape Breakwater (Isle of Wight Estuaries Project, 2000).
Recent measurements of tidal currents within the estuary indicate that currents within the main channel are relatively weak, with maximum speeds of around 0.5 m s^{-1} on the ebb (Titan Environmental Surveys Ltd., 2005). Tidal currents are much stronger

in Cowes Harbour and the wider Medina BMPA outside of the estuary. The hydraulic regime in this area is influenced by the high-energy conditions that result from coastal waves, wind driven currents and the strong tidal currents of the Solent. Measurement of tidal currents in the adjacent area of the central Solent indicate westward flow at and after high water (Table 3.2), thus ebb currents from the estuary are deflected westward at the harbour entrance (Bray *et al*., 2005; Cowes Harbour Commission, 2007; ABP MER, 2007). Consequently, contaminants originating from sources within the estuary are expected to have a greater impact on shellfish beds to the west rather than the east of the harbour entrance.

Table 3.2: Tidal streams in the Solent for the tidal diamond at 50° 46.5' N 1° 17.5' W in relation to time of high water at Portsmouth (Imray, 2005)

	Hours before HW							Hours after HW					
	6	5	4	3	2	1	HW	1	2	3	4	5	6
Direction°	84	90	91	90	96	259	267	268	269	269	275	83	84
Rate in Spring	2.5	2.7	2.7	2.2	0.9	0.7	2.8	3.8	3.0	1.8	0.5	0.8	2.0
Knots Neap	1.2	1.3	1.4	1.1	0.4	0.3	1.4	1.9	1.5	0.9	0.2	0.4	1.0

3.3 Freshwater inputs and salinity

In addition to being important potential sources of microbiological contamination of the estuary (see Section 4.2), freshwater flows will enhance gravitational circulation in the estuary and cause a net advective movement towards the estuary mouth. The main sources of freshwater to the estuary are the River Medina and its tributary the Lukely Brook. These rivers combine to form a mean discharge of only about 0.4 $m^3 s^{-1}$ at the head of the estuary (Table 4.5). Consequently saline water penetrates through most of the estuary, and it is likely to be well mixed.

Despite this low input of freshwater to the estuary a recognisable salinity gradient is evident (Table 3.3). The salinity data presented in Table 3.3 indicate that, assuming a surface salinity of the open sea of around 35, the maximum percentage of freshwater ranges from 52% at Island Harbour to 3 % at the Harbour Entrance. This suggests that the influence of freshwater inputs (including sewage effluents) on water quality will decrease towards the estuary mouth due to dilution by seawater.

Freshwater may have a much greater impact after heavy rainfall, when salinities of less than 5 have been recorded at high tide off the Medina Valley Centre, Dodnor (Riley and Herbert, 1998).

Measurements of the variations in salinity with depth confirm that the estuary is well mixed in its middle and lower reaches and there is little vertical stratification with respect to salinity (Titan Environmental Surveys Ltd., 2005). This indicates that levels of contaminants originating from freshwater sources will generally be distributed evenly throughout the water column and water quality at the estuary surface should be representative of that experienced by shellfish at the bed. However, differences between surface and near bed salinity can be marked near Newport in the upper estuary, with a layer of relatively freshwater overlying denser saltwater (Riley and Herbert, 1998). Observations of surface water quality will not be representative of that at the bed in this area.

Table 3.3: Summary of near-bed salinity data for the Medina Estuary, 18 February to 6 March 2005 (data from Titan Environmental Surveys Ltd., 2005)

	Medina Entrance	Medina Wharf	Medham Beacon	Island Harbour
NGR	SZ 4981 9672	SZ 4500 9469	SZ 5031 9364	SZ 5083 9229
Mean	34.4	33.7	31.6	30.5
SD	0.6	1.0	3.2	3.3
Median	34.4	34.0	33.0	31.8
10%ile	34.0	32.4	25.0	26.0
Maximum	34.7	34.8	33.0	31.8
Minimum	33.9	28.7	23.3	16.7

3.4 Wind pattern

Wind stress is likely to have an influence on water movement and contaminant transport within the estuary. The predominant wind direction at a weather station at the Medina Valley Centre near Newport is from the west or southwest and the strongest winds nearly always blow from this direction (Figure 3.2). The average wind speed is approximately 5 knots (2.6 m s^{-1}).

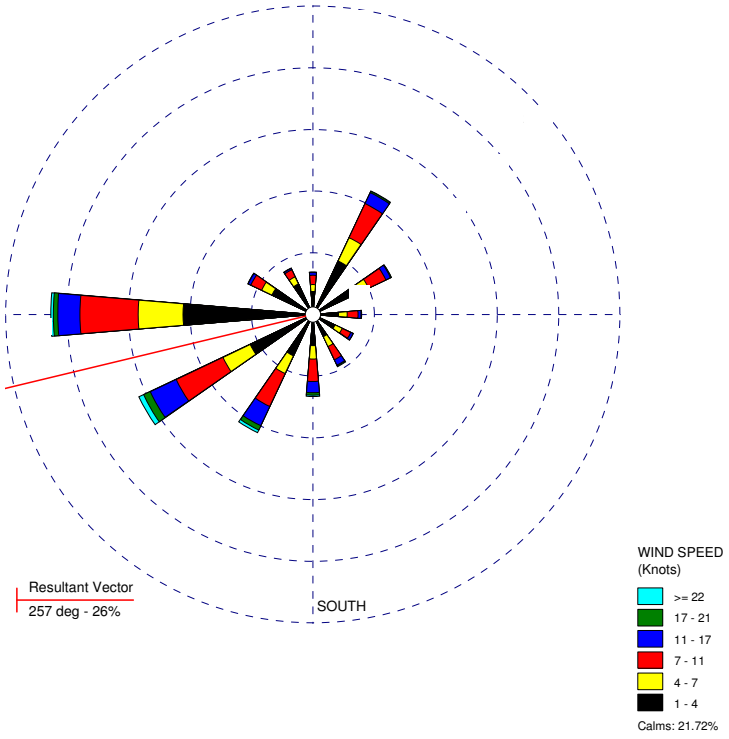


Figure 3.2: Wind rose for meteorological station at Medina Valley Centre, Newport (NGR SZ 5035 9110), 2005-2007 (Data from the Medina Valley Centre)

As noted above, the harbour entrance is very exposed to winds from the northwest to northeast quadrants. Under these conditions significant wind driven currents may be generated in the harbour entrance and wider BMPA that will affect the dispersion of contaminants leaving the estuary.

4. SOURCES OF MICROBIOLOGICAL POLLUTION

4.1 Sewage discharges

The locations of sewage discharges to the Medina BMPA in relation to the location of shellfish beds are shown in the map below (Figure 4.1).

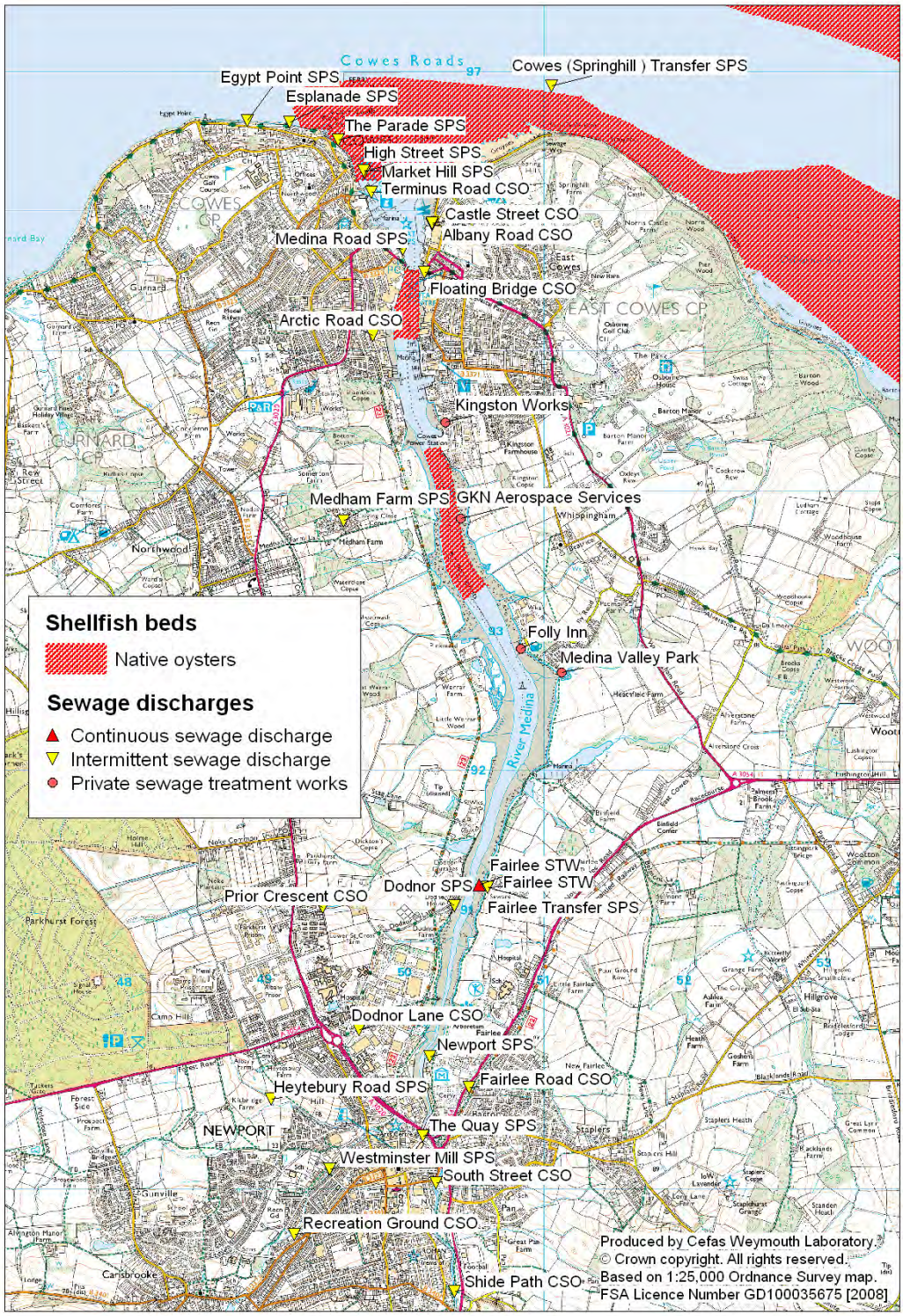


Figure 4.3: Sewage discharges to the Medina BMPA

4.1.1 Continuous (water company) sewage discharges

Wastewater flows from all major urban areas on the Isle of Wight (with the exception of Newport) are transferred by means of pumping stations and a network of transfer pipelines to Sandown Sewage Treatment Works (STW) for treatment (Southern Water Services Ltd., 2007). Fairlee STW, population equivalent (PE) 49,000, serves Newport and is the only major continuous sewage discharge to the Medina BMPA (Table 4.1). The STW discharges secondary treated effluent to an outfall in mid channel. There is no tidal phasing of the discharge.

Table 4.1: Continuous sewage discharges to the Medina Estuary

Name	Level of treatment	DWF (m^3/day)	NGR of discharge
Fairlee STW	Secondary	12,115	SZ 5053 9118

The STW discharge is directly into the proposed dredged fishery between Newport and Folly Reach. Given the volume and level of treatment, the discharge is highly likely to contribute to levels of microbiological contamination in this fishery and represents a significant risk to public health if shellfish are harvested in the vicinity of the outfall. Levels of *E. coli* in Manila clams collected from near the outfall were above prohibited levels (See Bacteriological survey report in Appendix B).

The discharge from Fairlee STW is potentially a significant source of microbiological contamination throughout the Medina estuary. The impact of the STW will decrease towards the estuary mouth as salinity increases and the effluent is diluted with seawater. Ideally, the level of dilution of the effluent at shellfisheries downstream of the outfall should be estimated in order to assess the potential impact on levels of contamination (see e.g. Sherwin, 2000). This has not yet been undertaken.

Monthly variation in inlet flows to Fairlee STW is shown in Figure 4.2. Whilst seasonal variation in inlet flows is not great, flows tend to be highest during the winter, probably due to increased surface water infiltration during periods of high rainfall. There is no evidence of an increase in flows to the STW during the summer holiday period.

It is proposed that wastewater flows from the Fairlee catchment will be transferred to Sandown STW for treatment in order to improve water quality in the estuary (Southern Water Services Ltd, 2007). Flows of up to 3DWF from the Fairlee catchment will be passed to Sandown STW via Fairlee Transfer SPS. Flows above 3DWF will be discharged to the estuary via a new Fairlee CSO. The existing Fairlee STW will then be closed. Although originally scheduled for completion by March 2008, the planned completion date for this scheme is now March 2009 (David Bone, Southern Water Services Ltd., personal communication).

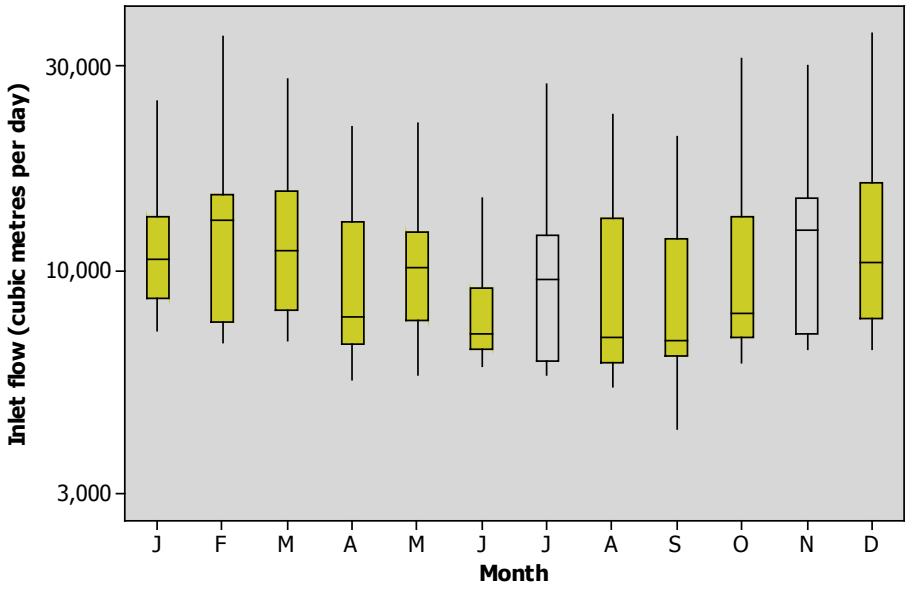


Figure 4.2: Monthly variation in daily total inlet flows (m^3 day^{-1}) to Fairlee STW, September 2005 to October 2007 (Data from Southern Water Services Ltd)

4.1.2 Private sewage discharges

In addition to Fairlee STW there are several small private treatment works that discharge secondary treated sewage effluent to the Medina Estuary (Table 4.2). The largest and most significant of these is at Medina Leisure Park which discharges to the Medina Estuary at Folly Reach (See Appendix B). This discharge may have a localised impact on levels of contamination in the proposed dredged and hand picked fisheries.

Table 4.2: Private sewage treatment works that discharge to the Medina Estuary

Discharge name	NGR of discharge	Level of treatment	Flow m^3 day^{-1}
Medina Leisure Park	SZ 5112 9270	Secondary	100[a]
GKN Aerospace Services	SZ 5040 9380	Secondary	22[b]
Folly Inn	SZ 5083 9287	Secondary	12[b]
Kingston Works	SZ 5029 9449	Secondary	1.4[a]

N.B. a Consented DWF, b Consented max. flow

4.1.2 Intermittent sewage discharges

Intermittent sewage discharges (combined sewer overflows and sewage pumping stations) that discharge to the Medina Estuary and nearby watercourses are listed in Table 4.3. These discharges are mainly located in the urban centres of Cowes and Newport (Figure 4.1) and discharge untreated sewage in the event of a storm or emergency spill. As noted above, a new CSO will be located at Fairlee on completion of the scheme to transfer wastewater flows from the Fairlee catchment to Sandown STW.

Table 4.3: Intermittent sewage discharges to the Medina Estuary. Data from Southern Water Services Ltd. (2006) except * (Cefas database)

Discharge name	Location	NGR
Cowes (Springhill) Transfer SPS	East Cowes	SZ 5093 9725
Egypt Point Cowes SPS	Cowes	SZ 4887 9667
Esplanade Cowes SPS	Cowes	SZ 4917 9663
The Parade Cowes SPS	Cowes	SZ 4952 9651
Market Hill Cowes SPS	Cowes	SZ 4970 9629
High Street Cowes SPS	Cowes	SZ 4971 9628
Terminus Road Cowes CSO	Cowes	SZ 4976 9614
Castle Street Cowes CSO	East Cowes	SZ 5019 9591
Albany Road Cowes SPS	East Cowes	SZ 5019 9590
Medina Road Cowes SPS	Cowes	SZ 4998 9572
Floating Bridge East Cowes CSO	East Cowes	SZ 5014 9556
Arctic Road Cowes CSO*	Cowes	SZ 4977 9511
Medham Farm Northwood SPS	Northwood	SZ 4955 9378
Fairlee Transfer SPS	Newport	SZ 5059 9116
Fairlee STW (storm/emergency)	Newport	SZ 5059 9116
Dodnor SPS	Newport	SZ 5035 9103
Prior Crescent Newport CSO	Newport	SZ 4941 9102
Dodnor Lane Newport CSO	Newport	SZ 4967 9014
Newport SPS*	Newport	SZ 5018 8995
Fairlee Road Newport CSO	Newport	SZ 5046 8973
Heytesbury Road Newport SPS	Newport	SZ 4904 8964
The Quay Newport SPS	Newport	SZ 5011 8938
Westminster Mill Newport CSO	Newport	SZ 4946 8914
South Street Newport CSO	Newport	SZ 5022 8904
Recreation Ground Road New CSO	Newport	SZ 4920 8867
Shide Path Newport No 1 CSO	Newport	SZ 5035 8827

N.B. CSO = Combined Sewer Overflow, SPS = Sewage Pumping station

A summary of recent spill information for intermittent discharges that are monitored by Southern Water is presented in Table 4.4 and Figure 4.3. Several of these discharges, notably the sewage pumping stations at Medina Road Cowes, High Street Cowes, Market Hill Cowes, Cowes Springhill Transfer and Dodnor appear to spill frequently. These discharges are directly into proposed or existing shellfisheries in the Medina BMPA and represent significant potential sources of contamination.

There is no evidence of any distinct seasonality to the incidence of discharges or of an increased tendency for discharges to occur during Cowes Week in early August.

Table 4.4: Summary of available spill data for intermittent discharges to the Medina Estuary (Data from Southern Water Services Ltd)

Discharge Name	Total spill duration (hours)	
	2005/2006	2006/2007
Arctic Road Cowes CSO	64	34
Castle Street Cowes CEO	11	0
Dodnor CEO	-	383
Egypt Point Cowes CEO	256	196
Esplanade Cowes CEO	-	0
Fairlee Transfer EMO	0	-
High Street Cowes CEO	1114	205
Market Hill Cowes EMO	-	165
Medham Farm Northwood EMO	21	2
Medham Farm Northwood WPS	11	-
Medina Road Cowes CEO	207	352
Off Forest Road Newport CEO	640	5
Prior Crescent Newport CSO	14	692
Shide Path Newport No 1 CSO	-	4
Cowes (Springhill) Transfer CEO	1810	135
The Parade Cowes CEO	-	3

N.B. CEO = Combined emergency overflow, CSO = Combined Sewer Overflow, SPS = Sewage Pumping station

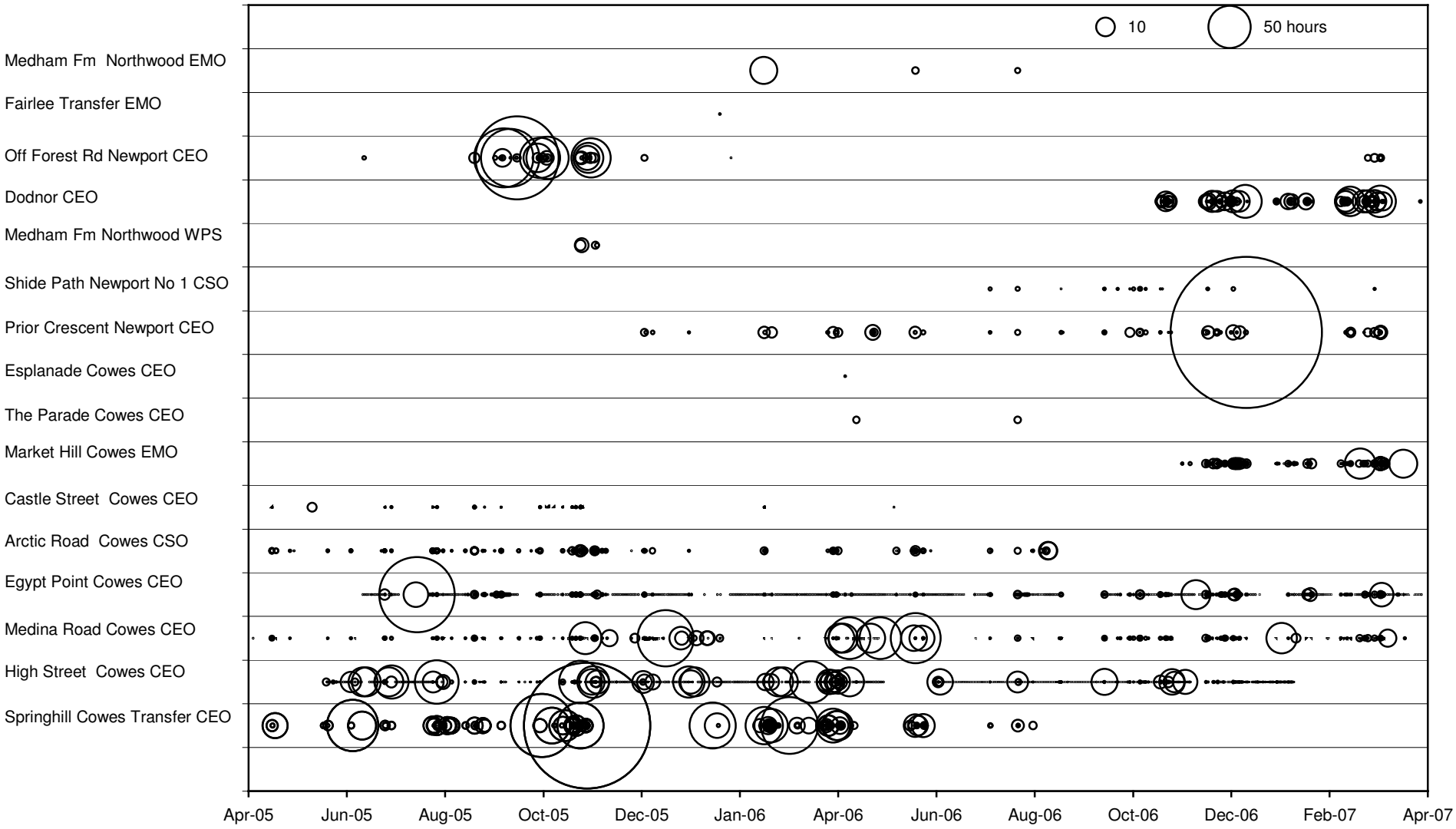


Figure 4.3: Intermittent discharges to the Medina BMPA, 2005-2007 (Data from Southern Water Services Ltd.)
N.B. Bubble area is proportional to spill duration.

4.2 Freshwater inputs

Rivers and streams receiving point or diffuse pollution sources from within their catchments are often important sources of microbiological contamination of shellfisheries. The major freshwater input to the Medina estuary is the River Medina (Figure 4.4). The river rises from chalk springs at St Catherine's Down on the south side of the island and flows due north, collecting the Merstone Stream at Blackwater before crossing the island ridge at Shide. The Medina's main tributary, the Lukely Brook, rises in the Bowcombe Valley and joins the tidal river at the head of the estuary in Newport (Environment Agency, 2001). The catchments of both streams are predominantly rural, the only significant urban area being in Newport. Both streams are gauged shortly upstream of their confluence. Summary flow statistics from the CEH river archive are presented in Table 4.5. The mean flow of the River Medina at Shide is approximately three times that of the Lukely Brook.

Whereas the Lukely Brook drains a chalk catchment, the River Medina drains some areas of clay and greensand that are less permeable than the chalk and consequently the Medina has a much more 'flashy' response to rainfall than the Lukely Brook (Figure 4.5). This suggests that rainfall generated run off from urban and agricultural land may be a more important source of microbiological contamination in the River Medina than in the Lukely Brook. This is supported by observations that the *E. coli* load in the River Medina increased by an order of magnitude following rainfall but remained relatively constant in the Lukely Brook (See Shoreline Survey Report in Appendix A).

Seasonal variation in flow in the River Medina is marked (Figure 4.6), although because much of this flow is derived from groundwater this does not necessarily imply that the impact of the river on levels of contamination at shellfisheries in the estuary varies in a similar pattern.

To summarise, although the River Medina is unlikely to be a significant source of contamination during baseflow conditions, it is potentially a very significant source of contamination during spate conditions following heavy rainfall. Rainfall tends to be heaviest in the late autumn and it is during this period when the River Medina is most likely to be significant sources of contamination. The impact of the river on water quality will be greatest in the upper estuary and will decrease towards the estuary mouth as salinity increases (Section 3.3).

In addition to the River Medina and Lukely Brook, there are a number of small streams (such as Dodnor Creek and Fairlee Hole Stream) that drain to the estuary along its east and west banks (Figure 4.4). These represent relatively minor sources of microbiological contamination that are likely to have only local significance.

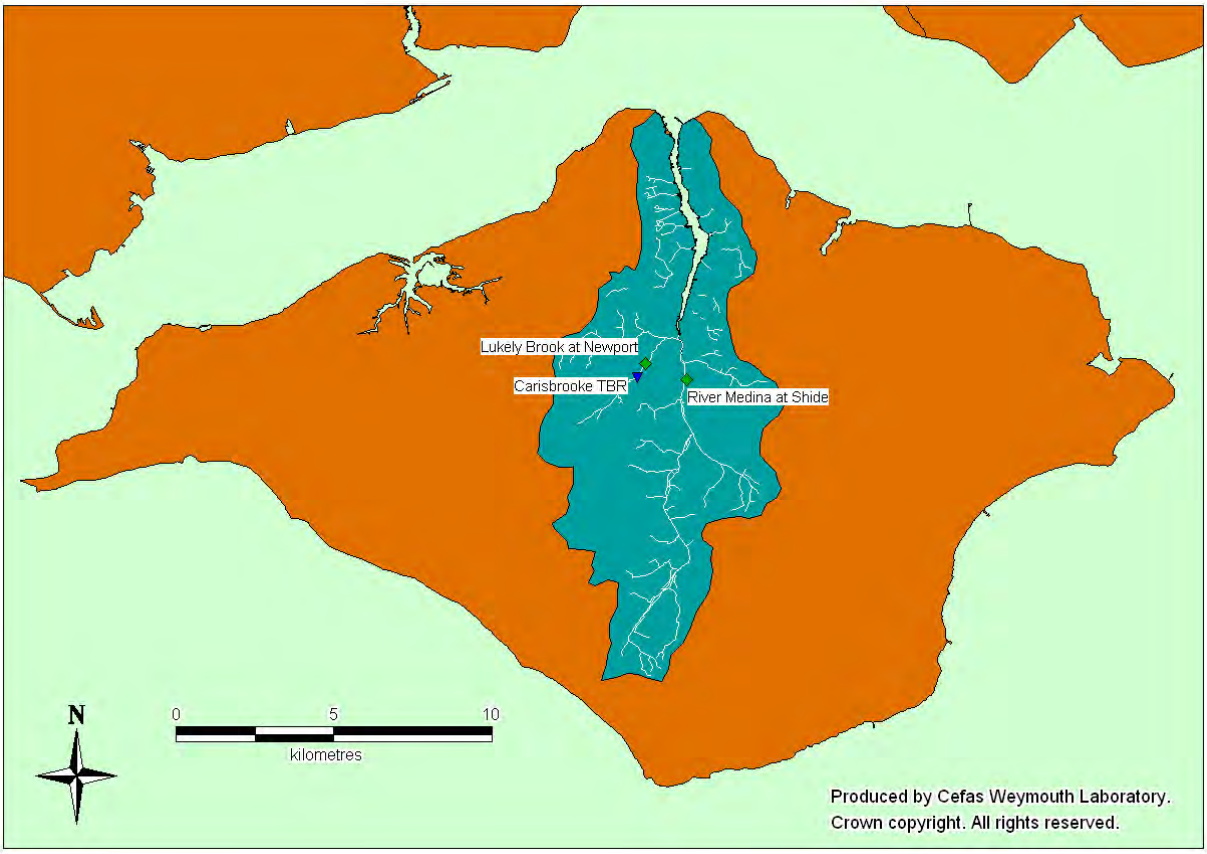


Figure 4.4: The Medina Estuary catchment showing locations of EA river flow gauging stations and raingauge at Carisbrooke.

Table 4.5: Summary statistics for EA flow gauging stations on River Medina and Lukely Brook (Centre for Ecology and Hydrology, 2007)

Station	River Medina at Shide	Lukely Brook at Newport
Grid Reference	SZ 504 881	SZ 491 886
Catchment Area (km^2)	29.8	16.2
Level of Station (mOD)	10.4	12.6
Max. catchment altitude (mOD)	167	214
Mean flow ($m^3 s^{-1}$)	0.29	0.10
95% exceedance (Q95) ($m^3 s^{-1}$)	0.085	0.005
10% exceedance (Q10) ($m^3 s^{-1}$)	0.539	0.252
61-90 average annual rainfall (mm)	839	862

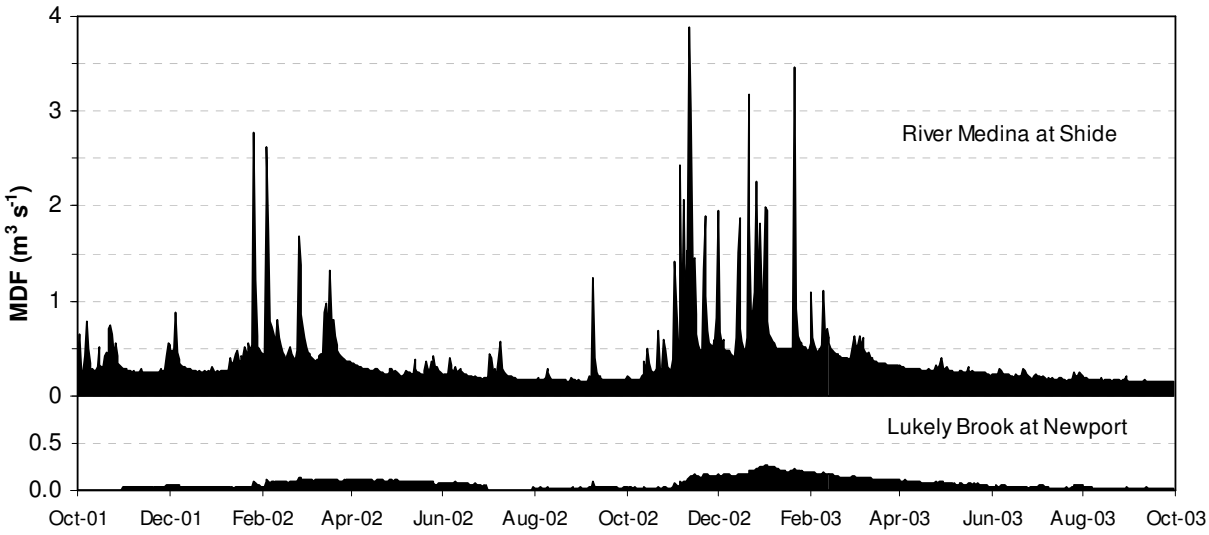
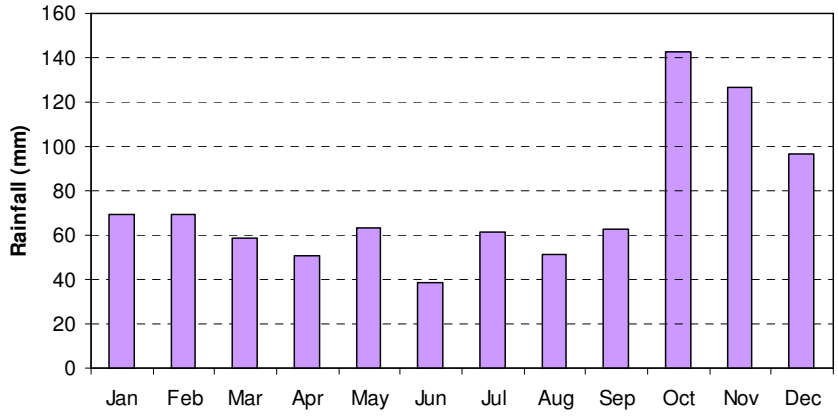
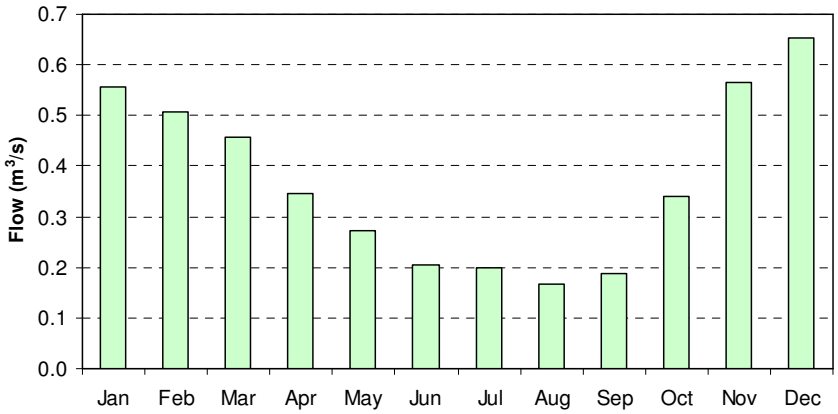


Figure 4.5: Exemplary hydrographs for the River Medina and Lukely Brook, October 2001-2003. Note flashy response of River Medina and more stable flow in Lukely Brook (Data from the Environment Agency)



a) Rainfall at Carisbrooke near Newport (NGR SZ 4885 8818)



b) Flow in the River Medina at Shide (NGR SZ 5040 8810)

Figure 4.6: Seasonal variation in a) mean monthly rainfall and b) mean monthly flow in the River Medina, 2002 to 2007 (Data from the Environment Agency)

4.3 Marinas and moorings

The locations of yacht marinas and moorings in the Medina Estuary in relation to the location of shellfish beds are shown in the map below (Figure 4.7).

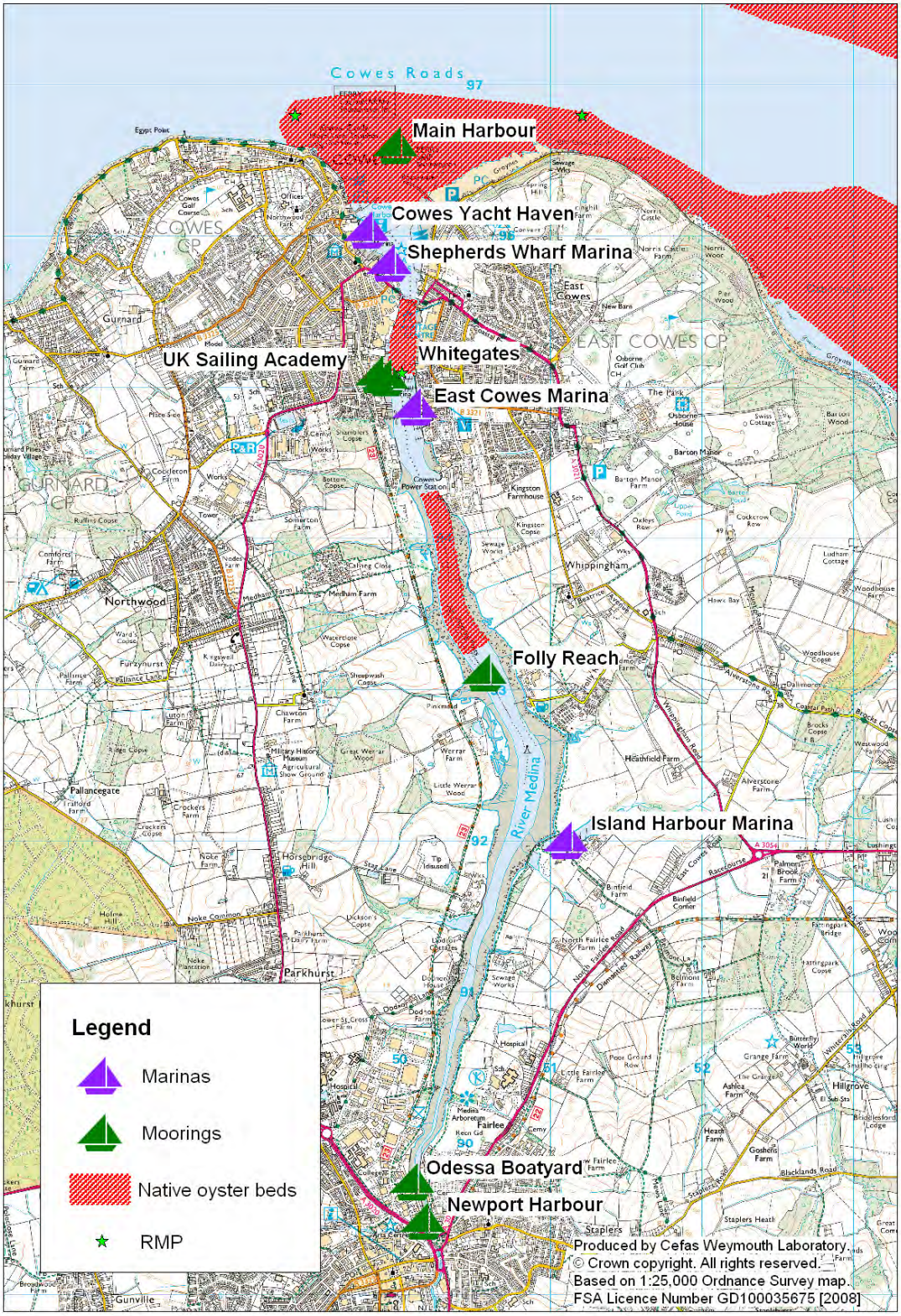


Figure 4.7 Marinas and moorings in the Medina Estuary

The discharge of sewage from boats is potentially a significant source of bacterial contamination of shellfisheries in the Medina estuary. The greatest risk of contamination is likely to be during the sailing season (i.e. April to October) and there may also be an increased risk of contamination during Cowes Week in early August. A Cowes harbour byelaw explicitly prohibits the discharge of sewage when moored within or alongside marina mooring facilities or alongside pontoon berths having direct pedestrian access to the shore (Cowes Harbour Commission, 2005).

The estuary is home to four large marinas, all of which have the capacity to accept visiting yachts (Table 4.6). Shepherds Wharf Marina at Cowes is currently the only marina in the estuary that has a sewage pump-out facility.

Table 4.6: Marinas in the Medina Estuary (Featherstone and Lambie, 2007)

Site	Permanent berths	Visitor berths/*moorings
Cowes Yacht Haven	35	200
Shepherds Wharf Marina	30	100
East Cowes Marina	200	130
Island Harbour Marina	120	120
Odessa Boatyard	75	5
UK Sailing Academy	-	10
Newport Harbour	-	50*

There are proposals to build a new 305-berth marina in the outer harbour as part of the redevelopment of this area (Cowes Harbour Commission, 2007).

Cowes Harbour Commission (CHC) manages a total of 565 annual moorings in the Main Harbour, Whitegates and Folly Reach (Table 4.7). In addition, CHC manages visitor's swinging moorings off Cowes Green and in Cowes Roads, and visitor's pontoon moorings at Folly Reach, Venture Quay and Whitegates (Cowes Harbour Commission, 2007). There are also a small number of visitor moorings at Newport (Table 4.6).

Table 4.7: Number and type of annual moorings managed by Cowes Harbour Commission (Cowes Harbour Commission, 2007).

	Swinging	Pontoon	Pile	Total
Main Harbour	149	-	-	149
Whitegates	-	100	42	142
Folly Reach	89	160	25	274
Total	238	260	67	565

In excess of 350 additional moorings are laid by CHC in Cowes Harbour for Cowes Week (Cowes Harbour Commission, 2007).

4.4 Farms

Agriculture is the primary land use between Cowes and Newport with farms ranging from 35 to 1,700 acres in size (Isle of Wight Estuaries Project, 2000). There is a mix of both arable land (257 ha.) and grassland (305 ha.) on both sides of the valley (Marston (2007). An increased demand for housing in recent years has seen the conversion of agricultural land to urban areas and there are currently housing developments underway at Kingston and Island Harbour.

The locations of farms in close proximity to the Medina Estuary in relation to the location of shellfish beds are shown in the map in Figure 4.8. Details of current livestock densities in the Isle of Wight as a whole are presented in Table 4.8. No more detailed information is currently available on stock numbers at farms or seasonal variation in numbers of animals.

Table 4.8 Livestock numbers and densities in the Isle of Wight (Defra June 2006 Agricultural Survey)

	Cattle	Pigs	Sheep	Poultry
Number (000's)	14.8	0.8	35.7	75.9
Density (no per km^2)	39	2	94	200

There have been no reported farm pollution incidents with the potential to impact on shellfisheries in the Medina in recent years and agriculture is not currently though to have a serious impact on water quality in the estuary (Isle of Wight Estuaries Project, 2000; Victor Jennings, Environment Agency, personal communication).

Information on the location of registered slurry/sludge spreading and storage sites in close proximity to the Medina estuary has been requested from the EA but is not available at the time of writing.

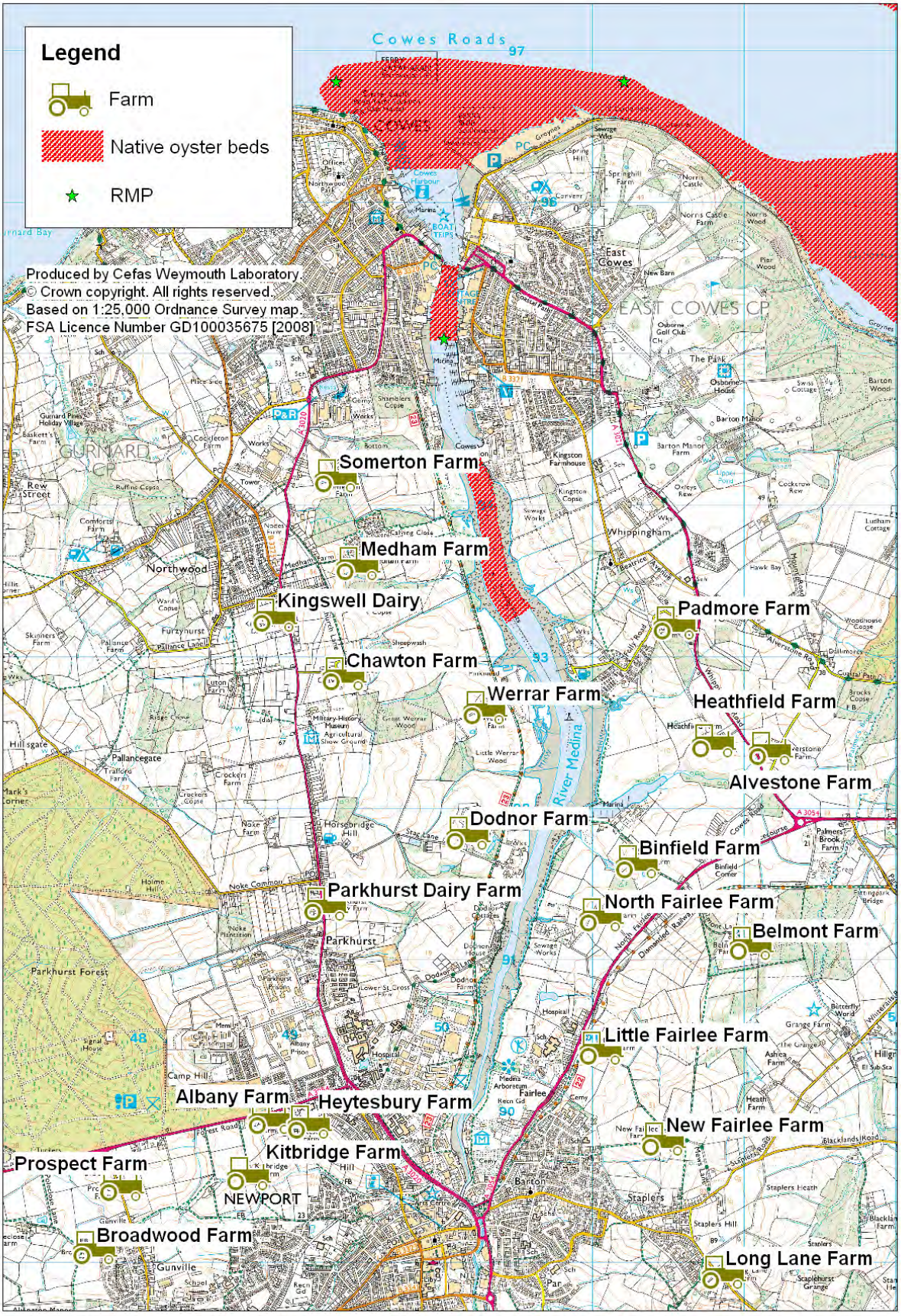


Figure 4.8: Farms in the Medina Valley. Names and locations taken from 1:25,000 scale Ordnance Survey map.

4.5 Birds

Large numbers of waders and wildfowl feed on the intertidal mudflats that line the middle and upper estuary and faeces from these birds may be a significant source of microbiological contamination of shellfisheries in the Medina BMPA. Peak winter counts for key bird species (from Marston, 2007) are given in Table 4.9. Black headed gulls are the most abundant species in the estuary; with peak winter counts sometimes exceeding 1000 individuals. In addition to the species listed in Table 4.8, large numbers of feral pigeons (up to 237 individuals) have been recorded at Cowes Grain Silos during the winter (Marston, 2005). Large flocks of Canada geese (up to 86 individuals) also visit the estuary, particularly during the autumn.

Monthly peak counts of waders, wildfowl and other species (mostly gulls) in the Medina Estuary are shown in Figure 4.9. Seasonal variation is marked and the greatest risk of microbiological contamination of shellfisheries due to birds is in the winter.

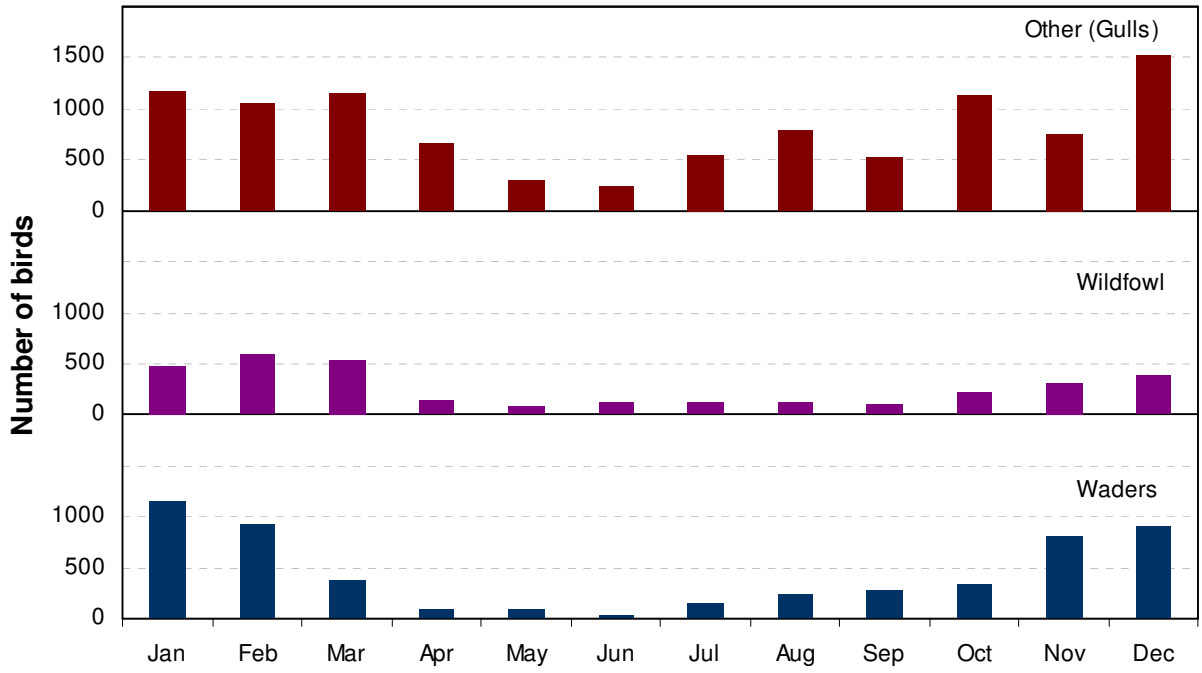


Figure 4.9: Mean maximum monthly counts (sum of peak species counts) of birds in the Medina Estuary, 1996-2006 (data from Marston, 2007)

Details of the location of high water roost sites along the estuary are given in Marston (2007). Waders and wildfowl use the area of saltmarsh on the west side of the estuary near Werrar Farm (see photo in Figure 1.2a) as a high water roost. This site is likely to be a source of relatively high levels of faecal contamination, particularly following tidal inundation of the saltmarsh at high waters springs. The mooring pontoons in Folly Lake and at the Medina Valley Centre are also important high water roost sites for gulls and waders.

Table 4.9: Peak counts of overwintering water birds along the Medina Estuary, 2001/02 to 2005/06 (from Marston, 2007)

	2001/2	2002/3	2003/4	2004/5	2005/6	Mean
Waders						
Black tailed godwit	45	32	29	20	18	29
Curlew	48	63	25	28	57	44
Common snipe	0	0	0	25	1	5
Dunlin	300	225	107	250	135	203
Grey plover	4	5	2	1	4	3
Lapwing	440	162	175	80	40	179
Oystercatcher	75	83	116	105	107	97
Redshank	82	44	65	63	42	59
Ringed plover	29	9	23	0	9	14
Turnstone	32	16	24	25	24	24
Wildfowl						
Brent Goose	93	36	28	59	279	99
Coot	24	46	46	45	41	40
Goldeneye	6	6	1	1	0	3
Little grebe	15	10	19	16	15	15
Mallard	40	59	74	64	96	67
Mute swan	29	37	48	47	44	41
Pochard	0	0	0	0	1	0
Red breasted merganser	19	14	2	7	4	9
Shelduck	8	12	8	14	36	16
Teal	0	10	3	28	13	11
Wigeon	44	47	36	37	36	40
Gulls and other species						
Black headed gull	480	925	935	1108	1017	893
Common gull	21	10	2	4	4	8
Cormorant	11	7	7	12	14	10
Great black backed gull	1	4	13	1	2	4
Grey heron	1	2	3	0	1	1
Herring gull	17	13	13	40	29	22
Little egret	6	8	6	6	6	6

4.6 Other sources

4.6.1 Dogs

Dog walkers use the footpaths bordering the banks of the estuary and dog faeces may be a sporadic source of microbiological contamination where there is access to the shoreline.

Dogs are banned from Cowes and East Cowes beaches between 1st May and 30th September and owners are required to clear up after their dogs at all other times (Isle of Wight Council, 2008).

4.6.2 Dredging

Whilst not a source in their own right, dredging operations within the estuary may result in the release of sediment-bound faecal bacteria and viruses to the overlying water column (see e.g. Grimes, 1975).

Maintenance dredging is undertaken in Cowes and Newport Harbours by the respective Harbour Authorities for navigation purposes and amounts to approximately 10,000 and 2,000 tonnes per annum respectively. Dredging of wharves and marinas also occurs depending upon need (Isle of Wight Estuaries Project, 2000). CHC undertook a capital dredge in Cowes Harbour in 2000 to improve the width and depth of the main fairway (CHC, 2007).

5. MICROBIOLOGICAL DATA

5.1 Water

The Medina Estuary is designated a Shellfish Water under the EC Shellfish Waters Directive 79/923/EEC codified 2006/113/EEC (Anon., 2006). Part of the Medina BMPA outside of the estuary forms part of the Cowes Shellfish Water. The locations of the shellfish waters monitoring points are shown in Figure 5.1. The monitoring point for the Cowes Shellfish Waters is in Cowes Roads, just outside of the Medina BMPA. The monitoring point for the Medina Shellfish Water is within the estuary near Cowes Power Station. The Environment Agency (EA) monitors levels of faecal coliforms at the water surface at these sites four times a year. Because the estuary is well mixed, concentrations of faecal coliforms at the water surface should be representative of levels of contamination at the bed (See section 3.3).

Faecal coliform data for the period 2003 to 2007 are summarised in Figure 5.2 and Table 5.1. Levels of faecal coliforms in the water column are higher in the Medina shellfish water than in the Cowes shellfish water indicating that levels of bacterial contamination within the estuary are higher than those outside. This is unsurprising given that the most significant sources of microbiological contamination are located within the estuary. In addition, freshwater sources of contamination (including the effluent discharge from Fairlee STW) will be diluted by seawater and dispersed by the strong tidal currents of the Solent.

Correlation coefficients between rainfall, river flow and salinity and faecal coliform levels in seawater at Shellfish Waters monitoring points are given in Table 5.1. Despite the relatively small data sets, both rainfall on the day prior to sampling and mean daily river flow on the day of sampling are significantly positively correlated with faecal coliform levels at both the Cowes and Medina Shellfish Waters monitoring points. This suggests that rainfall associated contamination is likely to be important throughout the Medina BMPA. In addition, there is a significant negative correlation between salinity and faecal coliform levels at the Medina Shellfish Waters monitoring point. As noted above (Section 3.3), surface salinities in the estuary are reduced following heavy rainfall. Levels of microbiological contamination in the estuary will vary both as a result of dilution of freshwater inputs by seawater and rainfall related variations in bacterial concentrations to these inputs.
Levels of faecal indicator organisms at the designated bathing water at Cowes are monitored throughout the bathing season (May to September) by the EA. Although outside of the estuary, this site is within the Medina BMPA (Figure 5.1). The beach has complied with the guideline standards of the EC Bathing Waters Directive (76/160/EEC, Anon, 1976) since 1999. Since 2003, only two samples from Cowes have exceeded the imperative faecal coliform standards set out in the Directive (Table 5.2). The cause of the exceedance in 2005 was a collapsed sewer that diverted foul sewage onto the beach via a surface water drain. The cause of the exceedance in 2007 is not known (Ian Dunhill, Technical Officer (Marine), Environment Agency, Personal Communication).

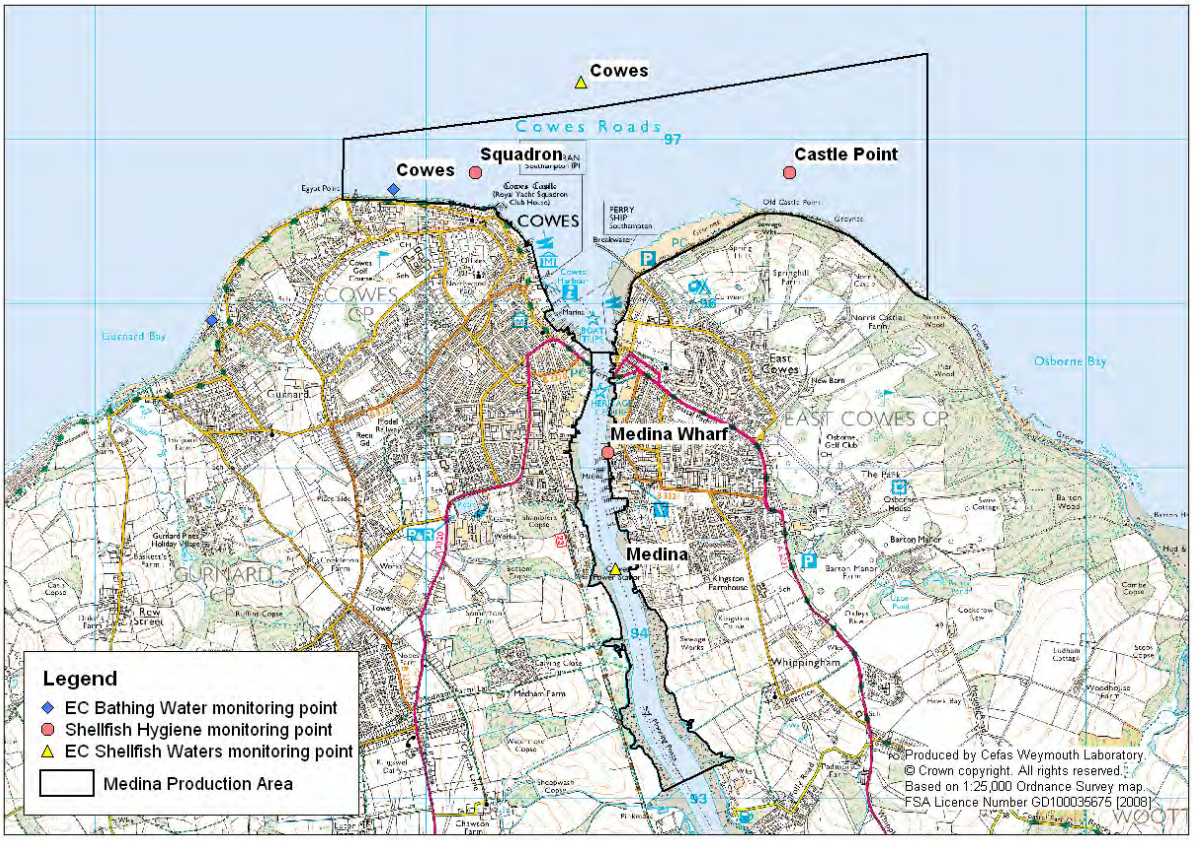


Figure 5.1: Microbiological monitoring points in the Medina BMPA

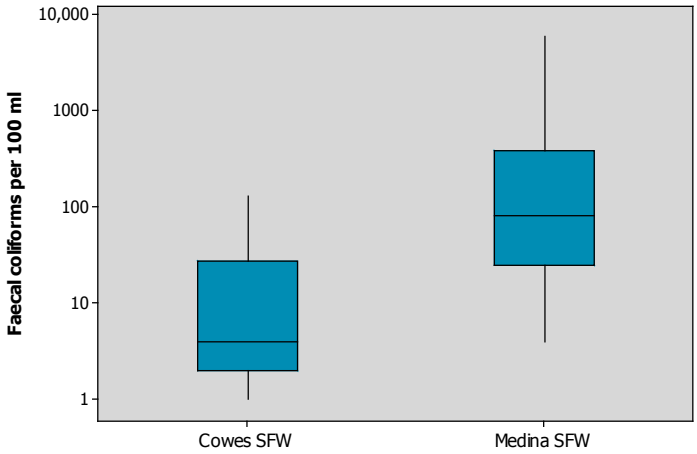


Figure 5.2: Faecal coliform concentrations in the Cowes and Medina Shellfish Waters, 2003 to 2007 (Data from the Environment Agency)

Table 5.1: Summary of faecal coliform data (no per 100 ml) for Cowes and Medina Shellfish Waters, 2003 to 2007 (data from EA)

	No. of samples	Geometric mean	Median	Maximum
Medina	18	110	82	6,000
Cowes	15	7	4	130

Table 5.1: Summary of Pearson correlation coefficients (r) between faecal coliform levels in seawater at Shellfish Waters monitoring sites and (i) rainfall at Carisbrooke, (ii) mean daily flow in the River Medina at Shide on the day of sampling (Day_0) and the day prior to sampling (Day_{-1}) and (iii) salinity at the time of sampling (Data from the Environment Agency).

	i) Rainfall in previous			ii) River flow			iii) Salinity	
	n	24 hrs	48 hrs	*n*	Day_0	Day_{-1}	*n*	
Medina	17	0.6860	0.5963	18	0.5402	-0.3313	18	-0.7041
Cowes	14	0.7328	0.4724	15	0.7527	0.1985	15	-0.4277

N.B. *Log_{10} transformations were applied to faecal coliform and river flow data.*
n = Number of samples.
Underlined values are significant at the P <0.05 level.

Table 5.2: Samples from Cowes Bathing Water that have exceed the imperative standards of the Bathing Water Directive, 2003-2007.

Date	Total coliforms (No/100 ml)	Faecal coliforms (No/100 ml)	Faecal streptococci (No/100 ml)
20 July 2005	3050	3497	269
29 August 2007	5200	4808	102

5.2 Shellfish flesh

Existing shellfish hygiene monitoring points in the Medina BMPA are located at Medina Wharf, within the estuary, and at Squadron and Castle Point, outside of the estuary (Figure 5.1). *E. coli* results for native oysters from these sites for the period 2004 to 2007 are summarised in Figure 5.5 and Table 5.3[1]. Levels of bacterial contamination in native oysters are higher within the estuary than outside of the estuary reflecting the differences in levels of contamination in sea water noted above.

Because the ebb current from the estuary (and associated microbiological contamination) is deflected westward at the estuary mouth by the Solent tides (Section 3.2), levels of contamination in native oysters at Squadron (to the west of the mouth) might be expected to be higher than those at Castle Point (to the east). However, although the geometric mean *E. coli* level is higher at Squadron than at Castle Point, this difference is not statistically significant (2 sample t-test, df = 64, T = -0.87, P = 0.386).

Time series of *E. coli* results for native oysters from the Medina BMPA for the period 2003 to 2007 are presented in Figure 5.6. There is no evidence of any distinct seasonal variation in levels of contamination at any of the sites, or of any tendency for levels of contamination to increase during Cowes Week in early August. Details of exceptional results since 2003 (>46,000 at Medina Wharf and >4,600 at Squadron and Castle Point) are presented in Table 5.4. Although several of these high results

[1] Analysis of shellfish hygiene data has been restricted to post March 2004, the completion date of sewerage improvement schemes in the estuary (Environment Agency, 2007).

can be attributed to heavy rainfall prior to sampling and associated sewage discharges, there are others that are clearly not rainfall related.

Correlation coefficients between rainfall and river flow and *E. coli* levels in shellfish at hygiene monitoring points in the Medina BMPA are given in Table 5.5. *E. coli* levels are significantly correlated with rainfall, the strongest correlations being observed with rainfall in the 24 hours prior to sampling. No significant correlation was evident between *E. coli* level and flow in the River Medina.

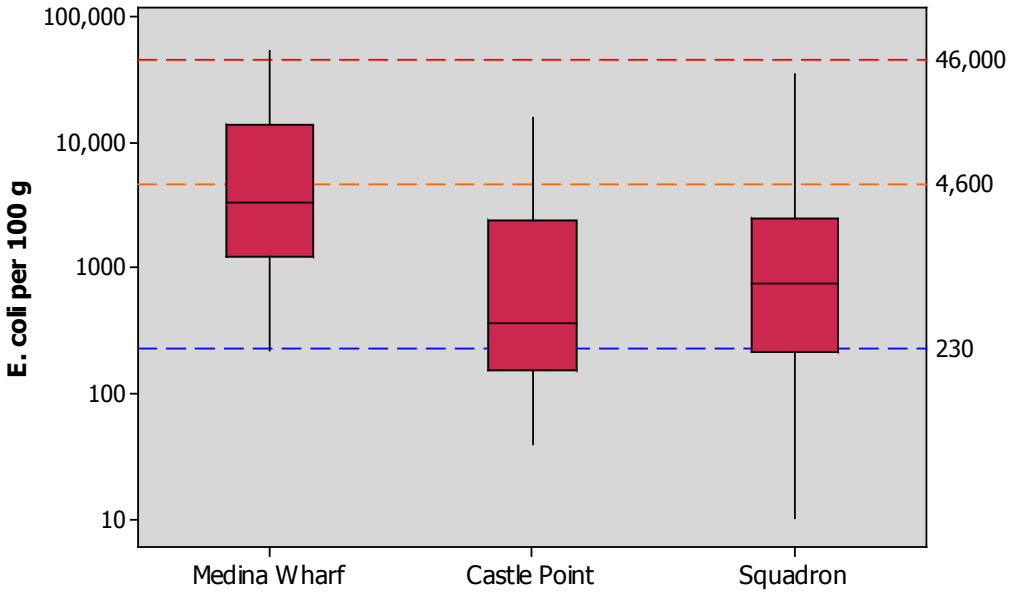


Figure 5.5:* E. coli *results for native oysters from shellfish hygiene monitoring sites in the Medina BMPA, April 2004 to November 2007

Table 5.3: Summary of* E. coli *data (MPN per 100 g) for native oysters from the Medina BMPA, April 2004 to November 2007

	No. of samples	Geometric mean	Median	Maximum
Medina Wharf	34	3,500	3,300	54,000
Castle Point	34	480	370	16,000
Squadron	34	700	750	35,000

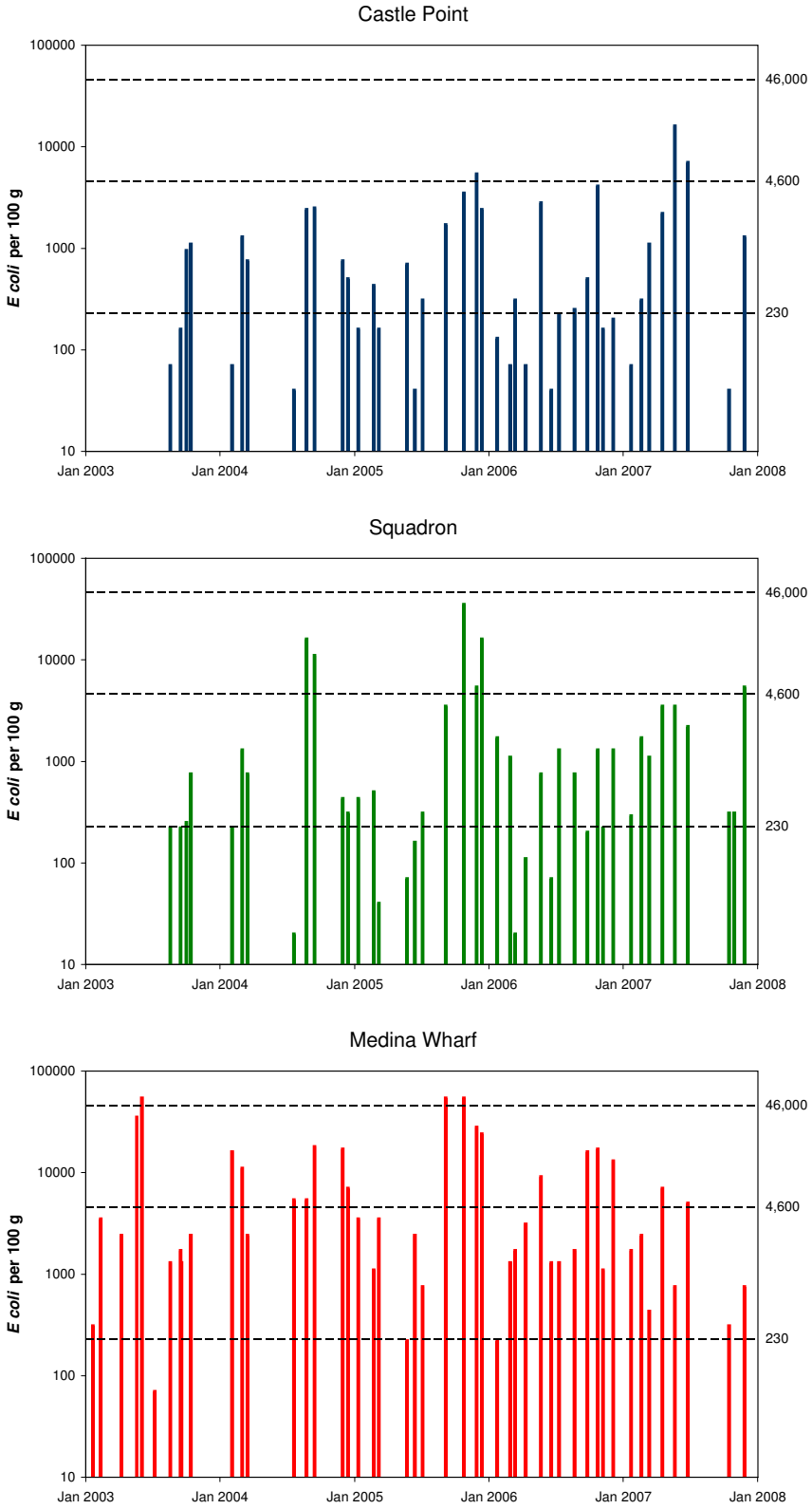


Figure 5.6: Time series of E. coli results for native oysters from the Medina BMPA, 2003 to 2007.

Table 5.4: Details of exceptional E. coli results (MPN per 100 g) for native oysters from the Medina BMPA since 2003

Bed	Date	Result	Notes
Castle Point	28/11/05	5,400	No rain
Castle Point	21/05/07	16,000	1.0 mm rain in preceding 24 hours
Castle Point	25/06/07	7,000	22.4 mm rain in preceding 24 hours
Medina Wharf	02/06/03	54,000	No rain
Medina Wharf	05/09/05	54,000	6.4 mm rain in preceding 24 hours. Pollution incident due to leak of raw sewage at HMP Camp Hill on 3-4/09/05
Medina Wharf	24/10/05	54,000	32.0 mm rain in preceding 24 hours (1 in 3 year rainfall event). Discharges from Cowes (Springhill) SPS, Arctic Road Cowes CSO and High Street Cowes CEO
Squadron	23/08/04	16,000	11.2 mm rain in preceding 24 hours
Squadron	13/09/04	11,000	15.8 mm rain in preceding 24 hours
Squadron	24/10/05	5,400	32.0 mm rain in preceding 24 hours (1 in 3 year rainfall event). Discharges from Cowes (Springhill) SPS Arctic Road Cowes CSO and High Street Cowes CEO.
Squadron	28/11/05	35,000	No rain
Squadron	12/12/05	16,000	No rain
Squadron	26/11/07	5,400	-

Table 5.5: Summary of Pearson correlation coefficients (r) between E. coli levels in native oysters and (i) rainfall at Carisbrooke in the previous 24 and 48 hours and (ii) mean daily flow in the River Medina at Shide on the day of sampling (Day_0) and the day prior to sampling (Day_{-1}).

	i) Rainfall in previous			ii) River flow		
	n	24 hrs	48 hrs	*n*	Day_0	Day_{-1}
Medina Wharf	33	0.4577	0.4507	33	0.2157	0.1831
Castle Point	33	0.4946	0.4389	33	0.2894	0.1945
Squadron	33	0.5080	0.4639	33	0.3364	0.1725

N.B. *Log_{10} transformations were applied to E. coli and river flow data.*
n = Number of samples
Underlined values are significant at the P <0.05 level.

Faecal coliform levels in native oysters from the Medina and Cowes Shellfish Waters are monitored four times of a year by the EA in order to assess compliance with the guideline standard in the Shellfish Waters Directive (the samples analysed are a

subset of those collected for shellfish hygiene monitoring). The Medina Shellfish Water has consistently failed to achieve the guideline faecal coliform standard of the Directive (<300 faecal coliforms per 100g flesh and intravalvular fluid in 75% of samples) since 2003 (Table 5.6).

Table 5.6: Compliance against the guideline faecal coliform standard of the Shellfish Waters Directive for the Cowes and Medina Shellfish Waters

	2003	**2004**	**2005**	**2006**	**2007**
Medina	Fail	Fail[a]	Fail[a]	Fail	Fail[a]
Cowes	NA[b]	NA[b]	Fail[a]	Pass	Fail

N.B. a=Only 3 samples collected but at least 2 exceeded standard
b=Insufficient samples collected to determine compliance.

6. OVERALL ASSESSMENT

There are several potentially significant sources of microbiological contamination in the Medina BMPA. These include:

- The treated effluent discharge from Fairlee STW (DWF 12,115 m^3/day) and the smaller but locally significant private discharge from Medina Leisure Park (DWF 100 m^3/day).

- Over 25 intermittent sewage discharges, predominantly in Cowes and Newport, that discharge in the event of a storm or emergency spill.

- Urban and agricultural run off to the River Medina, Lukely Brook and other minor freshwater inputs to the estuary.

- Four large yacht marinas (three near Cowes and one at Island Harbour) and numerous yacht moorings throughout the estuary.

- Large numbers of waders, wildfowl and gulls that feed on the intertidal mudflats within the estuary during the winter.

Within the Medina BMPA, levels of bacterial contamination in both water and shellfish are clearly higher in the estuary than immediately outside. This reflects both the location of the sources of contamination listed above and the high level of dispersion afforded by the strong tidal currents of the Solent. Levels of faecal bacteria in both water and shellfish increase following rainfall indicating that rainfall related sources of contamination (storm discharges and run off from urban and agricultural land) are important throughout the Medina BMPA.

On the basis of the information provided in the applications and our subsequent assessment a sampling plan detailing the location of representative monitoring points (RMPs) is detailed in Appendix C. However, prior to any further review of this sampling plan, further information should be sought by the local authority to evidence that the level of stocks of each of the species identified (Manila clam, cockle and *M. mercenaria*) is sufficient to allow sampling for classification purposes and support a viable commercial fishery.

A new RMP for Manila clams, cockles and hard clams is identified at Fairlee STW outfall in order to adequately monitor the impact from Fairlee STW, the intermittent sewage discharges in Newport and Dodnor and the freshwater inputs from the River Medina and Lukely Brook. The recommended maximum tolerance around these RMPs is 50 metres. It is considered that this tolerance minimises the effect of spatial variation in the extent of microbiological contamination whilst allows some latitude necessary around RMPs where sampling occurs by dredging, which often runs over hundreds of metres.

A new RMP for hard clams is also identified at Folly Reach in order to adequately monitor the potential impact from the discharge at Medina Leisure Park and the yacht moorings and associated bird roosts in Folly Reach. The recommended maximum tolerance around this RMP is 10 metres. It is considered that this tolerance minimises

the effect of spatial variation in the extent of microbiological contamination whilst preserving the fixed location concept.

The existing Medina Wharf RMP is well placed to monitor the impact of the intermittent sewage discharges to Cowes Harbour and any potential impact from Cowes Yacht Haven. The existing Squadron and Castle Point RMPs outside of the estuary are representative of the native oyster beds in this area and no changes to their locations are recommended. The recommended maximum tolerance around these RMPs is 50 metres and justification for this is mentioned above.

Cowes week sailing regatta attracts significant numbers of additional visitors to the estuary during early August. Dry weather sewage flows will therefore increase during this period and there may also be an increased risk of sewage discharges from moored boats. However, there is no evidence of a peak in levels of contamination of shellfish during this period and it is therefore considered unnecessary to increase sampling frequency at this time.

The native oyster beds within the estuary are currently classified as 'prohibited' and levels of *E. coli* in Manila clams collected from near the outfall of Fairlee STW in January 2008 were above prohibited levels (See Appendix B). It is therefore highly likely that the proposed new beds within the estuary will be prohibited for shellfish harvesting. Assuming this happens then this classification should be reviewed on completion of the scheme to transfer sewage flows from Fairlee STW to Sandown STW, currently scheduled for the end of March 2009.

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Glossary

Bathing Water	A body of water used for bathing by a significant number of people. Bathing waters may be classed as either EC designated or non-designated OR Those waters specified in section 104 of the Water Resources Act, 1991.
Bivalve mollusc	Any marine or freshwater mollusc of the class Pelecypoda (formerly Bivalvia or Lamellibranchia), having a laterally compressed body, a shell consisting of two hinged valves, and gills for respiration. The group includes clams, cockles, oysters and mussels.
Classification of bivalve mollusc production or relay areas	A system for grading harvesting areas based on levels of bacterial indicator organisms (usually E. coli or faecal coliforms) in shellfish (in European Union).
Coliform	Gram negative, facultatively anaerobic rod-shaped bacteria which ferment lactose to produce acid and gas at 37°C. Members of this group normally inhabit the intestine of warm-blooded animals but may also be found in the environment (e.g. on plant material and soil).
Combined Sewer Overflow	A system for allowing the discharge of sewage (usually dilute crude) from a sewer system following heavy rainfall. This diverts high flows away from the sewers or treatment works further down the sewerage system.
Discharge	Flow of effluent into the environment.
Dry Weather Flow (DWF)	The average daily flow to the treatment works during seven consecutive days without rain following seven days during which rainfall did not exceed 0.25 mm on any one day (excludes public or local holidays). With a significant industrial input the dry weather flow is based on the flows during five working days if production is limited to that period.
EC Directive	Community legislation as set out in Article 189 of the Treaty of Rome. Directives are binding but set out only the results to be achieved leaving the methods of implementation to Member States, although a Directive will specify a date by which formal implementation is required.
Emergency Overflow	A system for allowing the discharge of sewage (usually crude) from a sewer system or sewage treatment works in the case of equipment failure.
Escherichia coli (E. coli)	A species of bacterium that is a member of the faecal coliform group (see below). It is more specifically associated with the intestines of warm-blooded animals and birds than other members of the faecal coliform group.
Faecal Coliforms	A group of bacteria found in faeces and used as a parameter in the Hygiene Regulations, Shellfish and Bathing Water Directives, E. coli is the most common example of faecal coliform. Coliforms (see above) which can produce their characteristic reactions (e.g. production of acid from lactose) at 44°C as well as 37°C. Usually, but not exclusively, associated with the intestines of warm-blooded animals and birds.
Geometric Mean	The geometric mean of a series of N numbers is the Nth root of the product of those numbers. It is more usually calculated by obtaining the mean of the logarithms of the numbers and

	then taking the anti-log of that mean. It is often used to describe the typical values of a skewed data such as one following a lognormal distribution.
Guideline (G) values	Values set in European Directives that the Member States have to endeavour to achieve.
Hydrodynamic models	In this context numerical models that approximate the detail of real fluid flow i.e. velocities and water levels as functions of time and space. Output from these models can then be used together with a representation of the diffusive process in the water column to represent the fate and dispersion of bacteria.
Imperative (I) Value	Also known as Mandatory values. Values set in European Directives which have to be met in all cases.
Primary Treatment	Removal of gross sewage solids by settlement process.
Secondary Treatment	Treatment to applied to breakdown and reduce the amount of solids by helping bacteria and other microorganisms consume the organic material in the sewage. OR Further treatment of settled sewage, generally by biological oxidation.
Sewage	Sewage can be defined as liquid, of whatever quality that is or has been in a sewer. It consists of waterborne waste from domestic, trade and industrial sources together with rainfall from subsoil and surface water.
Sewage Treatment Works (STW)	Facility for treating the waste water from predominantly domestic and trade premises.
Sewer	A pipe for the transport of sewage.
Sewerage	A system of connected sewers, often incorporating inter-stage pumping stations and overflows.
Sludge	A solid waste fraction precipitated by a water treatment process.
Storm Water	Rainfall which runs off roofs, roads, gulleys, etc. In some areas storm water is collected and discharged to separate sewers, whilst in combined sewers it forms a dilutes sewage.
Tertiary Treatment	Treatment applied to the effluent from a secondary treatment process in order to further reduce a component or components of that effluent, e.g. pathogenic micro-organisms or nutrients.
Waste water	Any waste water but see also “sewage”.

List of Abbreviations

AOD	Above Ordnance Datum
ADCP	Acoustic Doppler Current Profiler
BOD	Biochemical Oxygen Demand
BMPA	Bivalve Mollusc Production Area
BST	British Summer Time
CD	Chart Datum
CHC	Cowes Harbour Commission.
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEO	Combined emergency overflow
CSO	Combined Sewer Overflow
DWF	Dry Weather Flow
EA	Environment Agency
E. coli	*Escherichia coli*
EC	European Community
EO	Emergency Overflow
FSA	Food Standards Agency
GMT	Greenwich Mean Time
HW	High Water
hr	Hour
km	Kilometre
LAT	Lowest Astronomical Tide
LW	Low Water
MDF	Mean daily flow
mg	Milligrams
ml	Millilitres
m^3 day^{-1}	Cubic metres per day
m^3 s^{-1}	Cubic metres per second
mm	Millimetres
mOD	Metres above Ordnance Datum
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWN	Mean Low Water Neap
MLWS	Mean Low Water Spring
MPN	Most Probable Number
NGR	National Grid Reference
NHA	Newport Harbour Authority
OS	Ordnance Survey
PE	Population Equivalent
POLTIPS	Proudman Oceanographic Laboratory Tidal Prediction Software
RMP	Representative Monitoring Point
SEEDA	South East England Development Agency
SPS	Sewage pumping station
SSFC	Southern Sea Fisheries Committee
SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works

APPENDIX A. Medina Estuary Shoreline Survey Report

A1. Objectives

The objectives of the survey were to confirm the presence of sources of microbiological contamination identified during the desk study and identify any additional sources of contamination that could impact on shellfisheries in the Medina BMPA.

A2. Survey

The shoreline survey was undertaken during dry weather on 26 September 2007. The survey was undertaken in conjunction with a member of staff from the local food authority (LFA), Isle of Wight Council (IOWC). The estuary was surveyed both on foot and using a small RIB hired from the Medina Valley Centre. The shoreline walk covered both sides of the estuary between Newport and Folly Works. The boat survey covered the entire estuary between Newport and Cowes. The survey was undertaken between 09:50 and 17:15. Times of high and low water in the estuary are shown in Table A1.

Table A1: Times and heights of high and low water at Cowes, 26 September 2007 (prediction from POLTIPS)

	LW	HW	LW	HW
Time (BST)	0454	1142	1716	2355
Height (mAOD)	1.25	4.42	1.25	4.44

Water samples were collected from selected locations (Figure A1) and returned to Cefas Weymouth laboratory for microbiological analysis. Additional samples were collected following heavy rainfall on 21 November 2007 by staff from IOWC.

A3. General observations

A3.1 Sewage discharges

Details of sewage discharges and other potential sources of microbiological contamination that were identified during the shoreline survey are listed in Table A2 and shown on the map in Figure A2.

A3.2 Birds

Gulls (50+), curlews (100), little egrets (10), cormorants, oystercatchers and mute swans were present on the high water roost site on the saltmarsh near Werrar Farm (NGR SZ 5061 9292). A large flock of curlews was present in the arable fields to the east of the estuary near Whippingham (NGR SZ 5051 9351). Mute swans (9) were present near the Medina Valley Centre (NGR SZ 5034 9100).

Table A2: Discharges identified during shoreline survey of the Medina

No	Location	NGR	Notes
1	Lukely Brook	SZ 50088 89384	Flap valve
2	Bargemans Rest	SZ 50139 89451	Flap valve in wall (Photo ii)
3	Newport Quay	SZ 50200 89540	Pumping station outfall. No discharge (Photo ii)
4	Seaclose Quay	SZ 50175 89718	Concrete culvert. No discharge. (Photo iii)
5	Newport	SZ 50164 89940	Outfall (Photo iv)
6	Medina Valley Centre	SZ 50340 91000	Pumping station near Medina Valley Centre, Dodnor Lane (Photo v)
7	Dodnor Cottages	SZ 50406 91059	Surface water outfall (Photo vi)
8	Fairlee STW	SZ 50536 91203	Yellow buoy marking in channel marking outfall from Fairlee STW. (Photo vii)
9	Fairlee STW	SZ 50536 91203	'Duck bill' discharge flap from headwall at Fairlee STW (Photo viii). No discharge.
10	Medina Leisure Park	SZ 51149 92710	Package plant at Medina Leisure Park near Folly Inn (Photo ix). Sanitary debris present.
11	Folly Point	SZ 50994 92774	Surface water outfall (Photo x)
12	Folly Point	SZ 50955 92783	Surface water outfall
13	Folly works	SZ 50787 93213	Pipe discharge from derelict works. Flowing (sampled)
14	Kingston	SZ 50463 93749	Pipeline. No flow. Disused STW?
15	Gas tank	SZ 50289 94222	Outfall with grill (Photo xi)
16	GKN building	SZ 50082 95400	Flowing discharge
17	Shepherds Wharf	SZ 49890 95850	Flowing outfall (Photo xii)

A3.3 Livestock

No livestock were observed in close proximity to the estuary.

A3.4 Sanitary debris

Sanitary debris was observed in the vicinity of the discharge from Medina Leisure Park STW near Folly Point (NGR SZ 5115 9271).

A3.4. Marinas and moorings

In addition to yachts moored in the marinas in East and West Cowes and Island Harbour, large numbers of yachts were noted to be moored in the river at Cowes, Folly Reach and Newport Harbour.

A4. Sampling results

E. coli results for the water samples are given in Table A3 and A4 below.

Table A3: Water sample results, 26 September 2007* (Dry weather)

No	Site	NGR	Time taken	*E. coli* / 100 ml
1	Stream near Bus Museum	SZ 50215 89710	10:00	79,500
2	Medina Leisure Park STW	SZ 51149 92710	11:30	25,350
3	Pipe at Folly Works	SZ 50787 93213	12:00	8,300
4	Stream near Folly Works	SZ 50875 93248	12:10	1,350
5	Stream near Dodnor Farm	SZ 50257 90856	15:11	2,025
6	Stream near Dodnor Farm	SZ 50247 90751	15:18	2,300
7	Stream near College, Newport	SZ 50137 90109	15:44	752
8	Ballast Quay (from boat)	SZ 50014 94536	16:37	<1
9	Newport PS outfall (from boat)	SZ 50164 89940	11:00	7,500
10	River Medina at Newport	SZ 50140 89392	17:00	3,300
11	Lukely Brook at Newport	SZ 50061 89399	17:05	3,350

*MDFs in River Medina and Lukely Brook were 0.17 and 0.07 m^3s^{-1} respectively.

Table A4: Water sample results, 21 November 2007* (Wet weather)

No	Site	NGR	Time taken	*E. coli* / 100 ml
1	Stream near Bus Museum	SZ 50215 89710	14:00	7,200
2	River Medina at Newport	SZ 50140 89392	14:10	7,300
3	Lukely Brook at Newport	SZ 50061 89399	14:15	5,150

*MDFs in River Medina and Lukely Brook were 1.13 and 0.09 m^3 s^{-1} respectively.

Dry weather *E. coli* levels in the Fairlee Hole Stream (sample 1) that drains to the estuary near Newport Bus Museum were high. The source of this contamination is not clear but the stream flows close to a farmyard and is then culverted through an urban area so there is potential for faecal contamination from both urban and agricultural sources. Dry weather *E. coli* levels in other stream inputs were moderate and indicative of relatively low levels of faecal contamination. *E. coli* concentrations in the River Medina and Lukely Brook were elevated following heavy rainfall but not markedly so. However, the increased flow in the River Medina suggests that the *E. coli* load to the estuary increased by at least an order of magnitude during wet weather

E. coli levels in the effluent from the private treatment plant at Medina Leisure Park were typical of those in secondary treated sewage effluent.

The elevated *E. coli* levels in the estuary at the outfall from Newport SPS at high water suggested that the outfall was a source of contamination, although no obvious sewage discharge was observed.

Salinity and temperature profiles were taken close to the outfall from Fairlee STW at high water (Table A5). There was a slight difference in salinity between the surface and the bed but no evidence of marked stratification at the time of measurement.

Table A5: Salinity and temperature profiles taken at Fairlee STW outfall

Depth (m)	Salinity (psu)	Temp. ℃
Surface	27.9	17.3
1	29.3	17.2
2	30.7	17.2
3	30.7	17.2

A5. Conclusions

The following potential sources of microbiological contamination were identified during the shoreline survey:

- Continuous sewage discharges at Fairlee STW and Medina Leisure Park
- Intermittent sewage discharges at Newport and Dodnor SPS
- Birds (notably on the saltmarsh near Werrar Farm)
- Moored boats (notably at Newport Harbour and Folly Reach)
- Freshwater inputs from the River Medina, Lukely Brook and other smaller streams (*E. coli* loads will increase following rainfall)

Figure A1: Locations of water samples (Numbers refer to samples in Table A3)

Figure A2: Locations of discharges (Numbers refer to Table A2)

Figure A3: Photos of: i) discharge at Bargemans Rest public house, ii) Newport Quay sewage pumping station, iii) culverted stream at Seaclose Quay, iv) outfall from Newport sewage pumping station outfall at high water, v) Fairlee STW outfall buoy, vi) Fairlee transfer outfall, vii) Dodnor sewage pumping station, viii) Dodnor cottages.

Figure A3 (continued): ix) Medina Leisure Park STW, x) surface water outfall at Folly Point, xi) outfall with grid near gas tanks, xii) discharge near Shepherds Wharf, Cowes.

APPENDIX B. Medina Estuary Bacteriological Survey Report

B1. Objectives

The objectives of the bacteriological survey were to determine levels of bacteriological contamination in shellfish in the upper Medina Estuary in order to identify suitable monitoring points for hygiene classification purposes.

B2. Survey

The survey was undertaken from 'Lisa Marie' on 23rd January 2008. Roger Downey skippered the boat. Richard Acornley (Cefas), Mark Rowland (Isle of Wight Council) and Mike Towill (Red Squirrel Holidays) were also onboard. Dredges were taken using a clam dredge in mid channel at three sites between Folly Inn and Newport (Figure B1).

High water at Cowes was at 11:32. Weather was dry, winds SW Force 3. Rain had been light prior to sampling (0 mm in previous 24 hours, 7 mm in previous 48 hours, Newport, Isle of Wight Weather Station).

Shellfish samples were returned to Cefas Weymouth laboratory for analysis.

B3. General observations

Site 1: South of Folly Inn (NGR SZ 50874 92590 to SZ 50892 92427)
A single clam of the genera *Tapes* or *Venerupis* was recovered in the dredge. Cockles were also recovered but not in sufficient quantity or size to sample. No hard clams (*M. mercenaria*) were found.

Site 2: Cement Works (NGR SZ 50637 91679 to SZ 50564 91475)
Manila clams were present in the dredge. Cockles were also present but not in sufficient quantity/size to sample. No *Mercenaria* were found.

Site 3: Fairlee STW outfall (NGR SZ 50501 91247 to SZ 50433 90932)
Manila clams were present in the dredge. No *Mercenaria* were found.

B4. Sample results

Microbiological results for the Manila clam samples are presented in Table B1. Levels of *E. coli* in the clam sample collected from near the outfall of Fairlee STW were above prohibited levels.

***Table B1:* E. coli *results for Manila clams from the Medina estuary*[2]**

Site	Time of collection	Salinity (PSU)	Temp. (°C)	*E. coli* per 100 g
2. Cement Works	10:30	NR	NR	35,000
3. Fairlee STW	10:45	28.5	9.2	54,000

[2] Samples were analysed outside of 24 hour test period

B5. Conclusions

- No hard clams (*M. mercenaria*) were found in the upper estuary.
- Cockles (*C. edule*) were present but not in sufficient densities to sample for microbiological analysis.
- Manila clams (*Tapes philippinarum*) were present between the Cement Works and the Medina Valley Centre.

Levels of *E. coli* in Manila clams from near the outfall of Fairlee STW were above prohibited levels (i.e. >46,000 per 100 g).

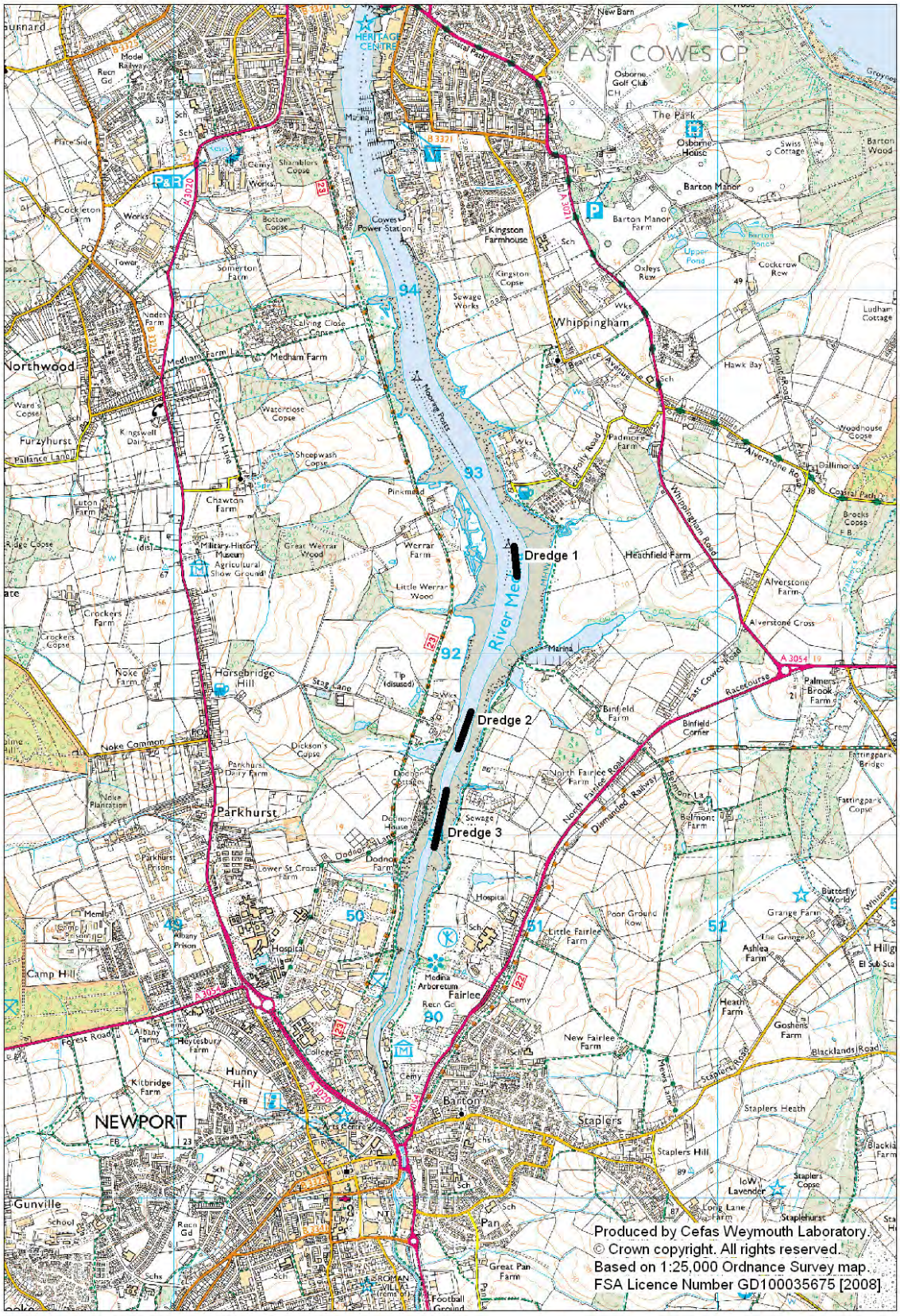

Figure B1: Bacteriological survey dredge locations

Cefas

Regulation (EC) No 854/2004

CLASSIFICATION OF BIVALVE MOLLUSC PRODUCTION AREAS IN ENGLAND AND WALES

SAMPLING PLAN

Medina Estuary - Isle of Wight

2008

APPENDIX C. Medina Estuary Sampling Plan

C1 General Information

Location Reference

Production Area	Medina
Cefas Main Site Reference	M063
Cefas Area Reference	FDR 2846
Ordnance Survey 1:25,000 map *Admiralty Chart*	Explorer OL 29 Isle of Wight No 2793 Cowes Harbour and River Medina

Shellfishery

Species/culture	Native oysters (*Ostrea edulis*) Cockle (*Cerastoderma edule*) Manila clam (*Tapes philippinarum*) Hard clam (*Mercenaria mercenaria*)	Wild Wild Wild Wild
Seasonality of harvest	Not applicable	

Local Food Authority

Local food authority	Isle of Wight Council
Address	Environmental Health Jubilee Stores The Quay Newport Isle of Wight PO30 2EH
E-mail	mark.rowland@iow.gov.uk
Telephone	01983 823000
Sampling Officer	Mark Rowland (Trainee Health Protection Officer)

C2 Monitoring points and frequency of sampling

See map and table below

C3 Requirement for review

The competent authority will review this sampling plan within six years or in light of any obvious known changes in sources of pollution of human or animal origin (e.g. following a sewerage improvement scheme).

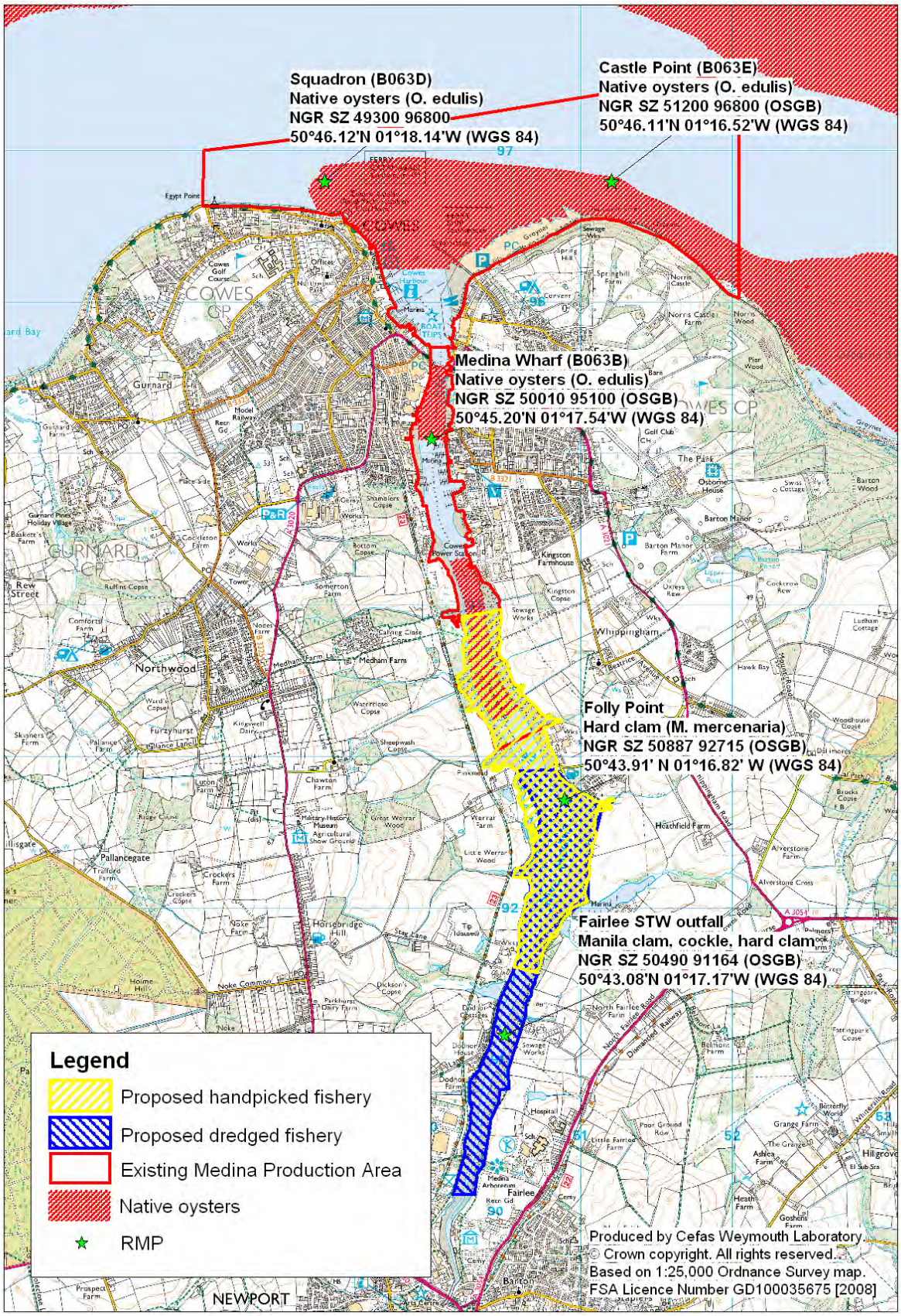

Figure C1: Representative Monitoring Points (RMPs) in the Medina BMPA

Table C1: Representative Monitoring Points (RMPs) and frequency of sampling for the Medina BMPA

RMP	Bed Name	Species	OSGB36		WGS84		Collection method	Sample Frequency
			Easting	Northing	Latitude	Longitude		
B063B	Medina Wharf	Native oyster	450010	95100	50° 45.20' N	01° 17.54' W	Dredge[2]	At least monthly
B063D	Squadron	Native oyster	449300	96800	50° 46.12' N	01° 18.14' W	Dredge[2]	At least monthly
B063E	Castle Point	Native oyster	451200	96800	50° 46.11' N	01° 16.52' W	Dredge[2]	At least monthly
B063?	Folly Point	Hard clam[1]	450887	92715	50° 43.91' N	01° 16.82' W	Hand picked[3]	At least monthly
B063?	Fairlee STW outfall	Manila clam	450490	91164	50° 43.08' N	01° 17.17' W	Dredge[2]	At least monthly
B063?	Fairlee STW outfall	Cockle[1]	450490	91164	50° 43.08' N	01° 17.17' W	Dredge[2]	At least monthly
B063?	Fairlee STW outfall	Hard clam[1]	450490	91164	50° 43.08' N	01° 17.17' W	Dredge[2]	At least monthly

Notes

1 Establishment of sampling point is dependent on presence of sufficient wild stock to support sampling
2 Tolerance around sampling point 50m
3 Tolerance around sampling point 10m