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West Brownsea Island Relay Area Cockles and *Tapes spp*.

Provisional RMP Assessment

3rd August 2016

Cefas Document Control

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Approvals

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An application was received to reclassify part of an existing classification zone (class B-LT for cockles, mussels, *Tapes* spp., Pacific and native oysters) as a relay area for cockles and *Tapes* spp. Currently, this zone is classified on the basis of mussel monitoring results from the Hamworthy RMP. The proposed relay area covers a rectangular plot measuring 118 x 185m. It falls within an area which is leased to one operator by the Southern IFCA, who are the grantees of a Several Order which covers most of Poole Harbour.

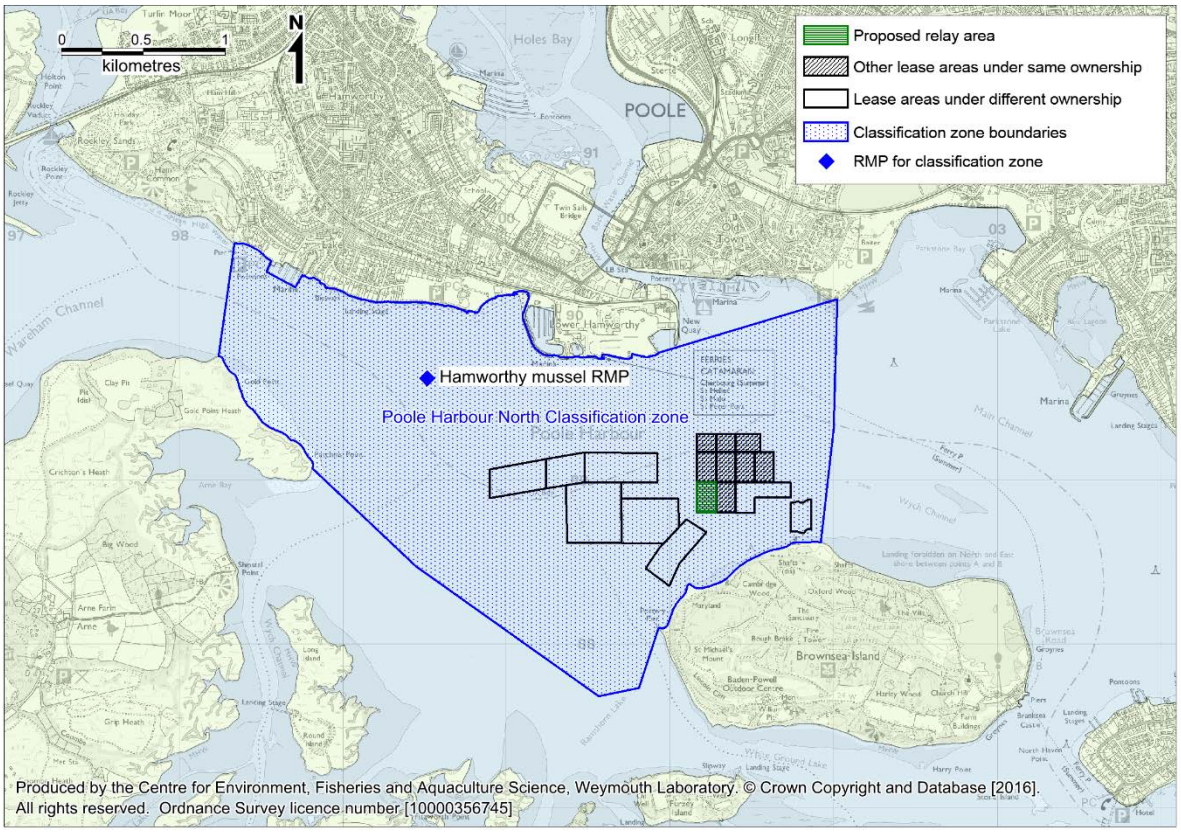

Figure 1: Location of proposed relay area

The application indicates that the wild cockles and clams of a marketable size will be taken by dredge from the Wareham Channel, which was recently downgraded to class C, and relayed for a period of at least two months before they are harvested. A maximum of 10 tonnes is projected to pass through the site on an annual basis. As the transplanted stocks are wild and captured by dredge it is likely that they will be deposited within the relay area in a series of small batches. The applicant indicated that the shellfish would be relayed on the seabed and after relay they would be collected by dredge. The harvester intends to deposit small batches during the dredging season, then wait two months after the last batch is deposited before harvesting to avoid the need for keeping batches separate.

There are seasonal restrictions on the use of dredges for the capture of wild shellfish within Poole Harbour. Their use is only permitted from the 25th May to the 25th December each year, and in some conservation sensitive areas there are extensions to the closed season or a complete ban. This will limit the supply of stocks to the relay area to periods within which

dredges may be used for the capture of wild stocks. However, there are no seasonal restrictions on the recovery of relayed shellfish within the lease area so a year round classification will be required.

There are no disease related restrictions for relaying clams and cockles taken from within Poole Harbour. If in future the applicant decides to use the relay area for stocks originating from outside of Poole Harbour, the Fish Health Inspectorate at Cefas should be consulted beforehand.

Sources of Faecal Contamination

Figure 2 shows the location of potentially significant sources of contamination to the application area. This includes sewage discharges within 5km of Poole Harbour obtained from the Environment Agency permitted discharge database (November 2015). Details of water company sewage works and private discharges consented to discharge more than 10 m^3/day to water are presented in Table 1.

Table 1: Water company owned continuous sewage discharges and private discharges to water consented to discharge more than 10 m^3/day.

Name	Type	Treatment type	Consented flow (m^3/day)	NGR	Receiving environment
Blackheath STW	Water company	Biological filtration & Lagoon settlement	1200	SY9092092600	Sherford River
Harmans Cross STW	Water company	Tertiary Biological	75	SY9747080790	Corfe River tributary
Studland STW	Water company	Biological filtration	227	SZ0235084540	Unnamed stream
Corfe Castle STW	Water company	Biological filtration	285	SY9609683153	Corfe River
Wareham STW	Water company	UV Disinfection	2502	SY9364088630	River Piddle (tidal)
Poole E STW	Water company	UV Disinfection	47700	SZ0071093560	Unnamed stream
Lytchett Minster STW	Water company	UV Disinfection	1600	SY9685092300	Lytchett Bay
Brownsea Island Sewage Works	Private (A)	Biological Filtration	190	SZ0270087840	Unnamed stream
Burnbake Camp Site (Wareham)	Private (B)	UV Disinfection	18	SY9967783579	Burnbake stream
Magna Nursing Home	Private (C)	Package Treatment Plant	27.5	SZ0220297080	Arrowsmith Stream
Organford Manor Caravan Park	Private (D)	Package Treatment Plant	41	SY9435892367	Sherford river trib.
Pine Springs Development	Private (E)	Maceration	24	SY9956095020	Poole Harbour
Silent Woman Inn	Private (F)	Biological Filtration	15.9	SY9030089700	Unnamed stream

Data from Environment Agency
Consented volumes are for dry weather flow (water company) or maximum flow (private)
STW=sewage treatment works, UV=ultra violet

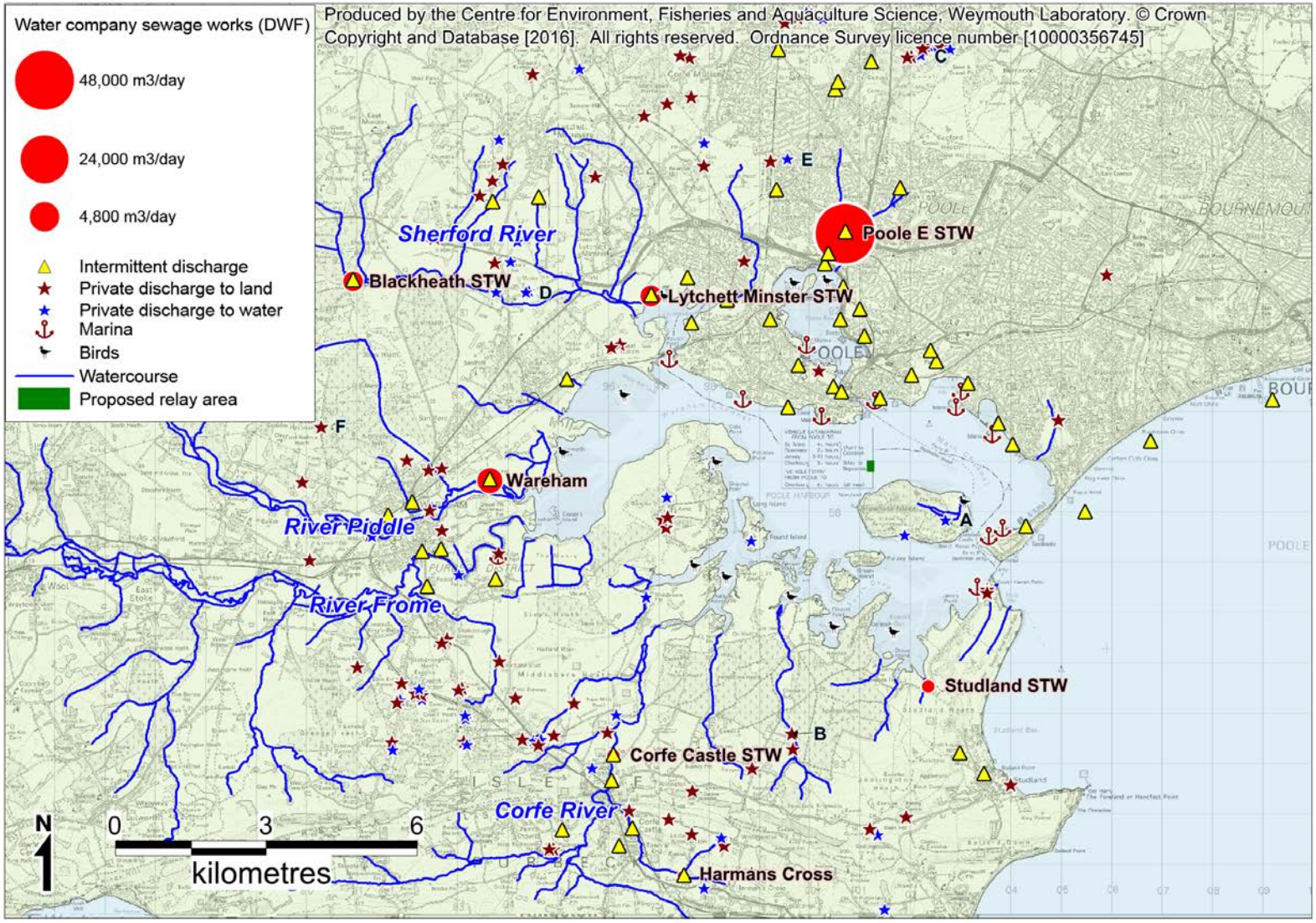

Figure 2: Potential sources of contamination to the application area

The three larger sewage works owned by water companies (Poole E, Wareham and Lytchett Minster) that discharge either directly or in close proximity to Poole Harbour all provide UV disinfection. The total bacterial loading they generate should therefore be very small assuming they are functioning correctly. Corfe Castle and Harmans Cross STWs do not provide disinfection so will contribute to the bacterial loading delivered to the harbour via the Corfe River, as will Blackheath STW and Studland STW. Perhaps the most significant sewage discharge for the proposed relay area is Brownsea Island sewage works (A). This is a private discharge receiving secondary treatment that discharges to a small watercourse which in turn drains to the north east corner of Brownsea Island. None of the other private sewage discharges are likely to significantly impact the proposed relay area. As well as the continuous discharges, there are numerous intermittent (overflow) discharges associated with the water company sewerage networks. The main cluster is around Poole, particularly around Holes Bay. There are also several discharging to the Sherford River, the tidal Piddle and Frome, and the Corfe River.

The two main rivers draining to Poole Harbour are the Piddle and Frome, both of which discharge to the western end of the harbour. The catchment area of these rivers is approximately 900 km^2 and largely rural, with urban area making up only 2% of the total catchment (EA, 2012). The main urban areas in the catchment are Poole, Wareham, Swanage, and Dorchester. The largest of these urban areas is Poole, which occupies much of the shore to the north of the proposed relay area. These rivers will deliver significant bacterial loadings from both urban and agricultural sources to Poole Harbour, particularly at times of elevated flow. There are also several smaller watercourses, the largest of which are the Sherford and Corfe Rivers. The small stream draining to the north east corner of Brownsea Island may be of minor local significance to the proposed relay area.

Poole Harbour experiences heavy boat traffic. This includes commercial vessels of a variety of sizes (fishing vessels, ferries, tour boats etc) and a large number of recreational craft. There are about 2500 swinging moorings and 2300 marina berths within the harbour (Poole Harbour Steering Group, 2006). Marinas and port facilities are mainly concentrated along the north shore around Poole, but mooring and anchoring areas are found in most places where there is sufficient depth of water. The main navigation channel runs from the harbour entrance to Poole, passing to the north of the proposed relay area. Of potential relevance to the fishery, there is an area of moorings in the Wych Channel, which runs along the north shore of Brownsea Island, immediately to the south of the proposed relay area. Merchant ships may not make overboard discharges within 3 nautical miles of land[1] so should not contribute faecal contaminants to the area. Although there are local byelaws prohibiting overboard discharges into the harbour and sewage pump out facilities are available at Poole. However, there is no requirement for boats to fit holding tanks for black waste (sewage) and many yachts lack these, discharging directly overboard either with maceration or maceration and disinfection. Therefore, is highly likely that overboard discharges occur from yachts in the harbour. Boats in overnight occupation on swinging moorings may have higher tendency to do so due to lack of easy access to shore-based facilities. Boat traffic, particularly for recreational vessels, will be considerably higher during the summer months and therefore the risk of contamination from overboard discharges will be higher during these months.

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

Poole Harbour supports significant bird populations. During the winter it regularly supports around 20,000 overwintering waterbirds (waders and windfowl) with peak counts of 25,160 in the winter of 2015/6 (Frost *et al*, 2016). There are also significant populations of seabirds with peak counts of 6,806 gulls and terns recorded in 2015. Birds will represent a diffuse source of contamination to intertidal areas, and their impacts may be more concentrated in the vicinity of any nesting or roosting sites. It is uncertain whether there are any such areas in the vicinity of the proposed relay area. Peak impacts will occur in the winter when populations are much larger.

Classification and monitoring history

The classification history for bivalves in Poole Harbour is shown in Table 2. There were major revisions to the zoning and monitoring arrangements in 2012 following completion of the sanitary survey.

Table 2: Classification history of the area from 2006 to present

BED NAME	Species	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Harbour (except Wareham Channel)	Pacific oyster	B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	-		-	-	-
Harbour (except Wareham Channel)	Native oyster	B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	-	-	-	-	-
Harbour (except Wareham Channel)	*Tapes* spp.	B	B	B	B	B-LT	B-LT	-	-	-	-	-
Harbour (except Wareham Channel)	Cockle	B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	-	-	-	-	-
Harbour (except Wareham Channel)	Mussel	B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	-	-	-	-	-
Harbour (Lake Road)	Cockle	-	-	-	-	-	-	-	-	-	-	-
Hamworthy	Mussel	-	-	-	-	-	-	-	-	-	-	-
North Wych	Mussel	-	-	-	-	-	-	-	-	-	-	-
Lytchett Bay	All species	P	P	P	P	P	P	-	P	P	P	P
Wareham Channel East	*Tapes* spp	B	B	B	B	B	B	-	-	-	-	-
Wareham Channel East	Cockle	-	B	B	B	B	B	-	-	-	-	-
Wareham Channel East	Mussel	-	B	B	B	B	B	-	-	-	-	-
Wareham Channel West	*Tapes* spp	P	P	C	-	C	C	-	-	-	-	-
Poole bay	Native oyster	B-LT	B-LT	B-LT	B-LT	B-LT	DC	-	-	-	-	-
Poole bay	Pacific oyster	-	-	-	-	-	-	-	-	-	-	-
Poole bay	Clams	-	-	-	-	-	-	-	-	-	-	-
Poole bay	Mussel	-	-	-	-	-	-	-	-	-	-	-
Poole bay	Surf clam	B-LT	B-LT	B-LT	B-LT	B-LT	DC	-	-	-	-	-
Poole bay	Razor clam	B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	DC	DC	DC	-	-
West Brownsea	*Tapes* spp	B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	-	-	-	-	-
West Brownsea	Cockle	-	-	-	-	-	-	-	-	-	-	-
South Deep Relay	Native oyster	B-LT	B-LT	B-LT	B-LT	B-LT	B-LT	-	-	-	-	-
Wareham Channel	*Tapes* spp	-	-	-	-	-	-	C	C	C	B	C
Wareham Channel	Cockle	-	-	-	-	-	-	C	C	C	B	C
Wareham Channel	Mussel	-	-	-	-	-	-	-	-	-	-	C
Rockley	Cockle	-	-	-	-	-	-	B	B-LT	B-LT	B-LT	B-LT
Rockley	Mussel	-	-	-	-	-	-	B	B-LT	B-LT	B-LT	B-LT
Rockley	*Tapes* spp	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
Poole Harbour North	Cockle	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
Poole Harbour North	Mussel	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
Poole Harbour North	*Tapes* spp	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
Poole Harbour North	Pacific oyster	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
Poole Harbour North	Native oyster	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
Whitley lake	Cockle	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
Wych lake	Cockle	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
Wych lake	*Tapes* spp	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
SW Brownsea Island	*Tapes* spp	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
SW Brownsea Island	Pacific oyster	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
SW Brownsea Island	Native oyster	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
SW Brownsea Island	Cockle	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
Brands Bay	Cockle	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT
Brands Bay	*Tapes* spp	-	-	-	-	-	-	B-LT	B-LT	B-LT	B-LT	B-LT

P denotes Prohibited, DC denotes temporarily declassified. All species denotes the area is classified for Pacific and native oysters, mussels, cockles and *Tapes* spp.

At present, the majority of Poole Harbour is classified B-LT for a variety of species. One area (Wareham Channel) where the influence of the Rivers Piddle and Frome is the greatest is currently classified as C for the species harvested from there. The majority of these classifications (including all classifications for *Tapes* spp. and cockles) are based on the results of mussel samples taken from deployment bags. Whilst this may be a historically accepted practice in Poole Harbour, there is growing evidence from other areas (e.g. Langstone Harbour) that *Tapes* spp. accumulate *E. coli* to a much higher level compared to mussels (Lewis Coates, pers. comm). This has had major consequences for other shellfisheries in such areas (eg. native oyster sampling may return a B classification whereas sampling of *Tapes* spp. may return prohibited level results.) This implies that *Tapes* spp. should be sampled in preference to mussels, although it is understood that there may be practical challenges in doing so.

Table 3 shows the summary statistics for the shellfish flesh monitoring results for Poole Harbour since 2006, and Figure 3 shows the locations of the sampling sites.

Table 3: Summary statistics for *E. coli* classification monitoring results (MPN/100g) by RMP – 2011 to 2016

Sampling Site	Species	No.	Date of first sample	Date of last sample	Geometric mean	Min.	Max.	% over 230	% over 4,600	% over 46,000
West Brownsea 1	Cockle	28	08/08/2006	14/10/2008	442.3	110	9,200	57.1	10.7	0.0
WH15	Mussel	5	02/12/2010	02/08/2011	436.6	110	2,400	40.0	0.0	0.0
Barrel O	Mussel	101	08/08/2006	19/07/2016	1,146.3	20	22,000	86.1	15.8	0.0
Rockley	Mussel	113	08/08/2006	05/07/2016	555.3	<20	16,000	72.6	6.2	0.0
Rockley East	Mussel	67	08/08/2006	06/03/2012	320.1	20	16,000	52.2	3.0	0.0
Hamworthy	Mussel	117	08/08/2006	05/07/2016	298.7	<18	24,000	53.0	1.7	0.0
Northwytch	Mussel	66	08/08/2006	06/03/2012	150.9	<20	3,500	37.9	0.0	0.0
Round Island	Mussel	118	08/08/2006	05/07/2016	340.9	<20	16,000	59.3	4.2	0.0
West Brownsea 2	Mussel	39	06/11/2008	06/03/2012	66.5	<20	1,800	10.3	0.0	0.0
West Brownsea West Cardinal	Mussel	49	04/04/2012	05/07/2016	164.4	<18	3,500	34.7	0.0	0.0
North Haven Alternative Site	Mussel	12	04/06/2015	05/07/2016	252.1	20	16,000	33.3	8.3	0.0
North Haven Pontoon	Mussel	55	04/04/2012	05/07/2016	936.7	130	17,000	80.0	14.5	0.0
Brands Bay	Mussel	47	16/05/2012	05/07/2016	179.2	<18	5,400	34.0	2.1	0.0
South Deep	Mussel	109	22/08/2006	05/07/2016	89.8	<18	9,200	21.1	2.8	0.0
Hook Sands	Mussel	41	19/09/2006	09/12/2010	52.8	<20	1,300	14.6	0.0	0.0
Bournemouth Pier	Mussel	41	22/08/2006	09/12/2010	57.9	<20	3,500	12.2	0.0	0.0
West Brownsea 1	Pacific oyster	122	08/08/2006	05/07/2016	171.3	<20	9,200	32.8	3.3	0.0
West Brownsea West Cardinal	Pacific oyster	51	04/04/2012	05/07/2016	164.9	<18	9,200	37.3	2.0	0.0
Barrel O	*Tapes* spp.	6	14/11/2006	06/10/2015	6,449.5	330	160,000	100.0	66.7	16.7
Rockley	*Tapes* spp.	5	14/11/2006	06/10/2010	1,587.6	490	3,500	100.0	0.0	0.0
West Brownsea 2	*Tapes* spp.	28	08/08/2006	14/10/2008	623.5	70	16,000	82.1	14.3	0.0

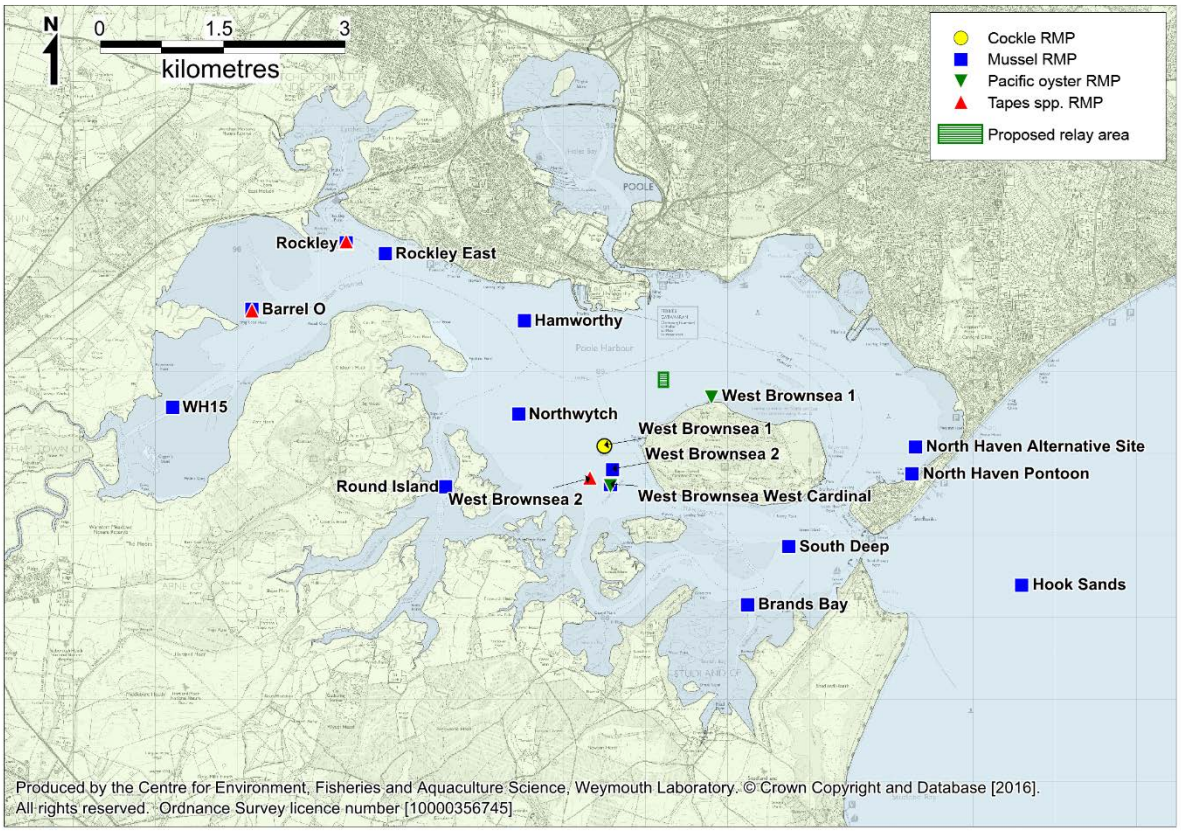

Figure 3: Locations of RMPs in Poole Harbour from 2006 to 2016.

These summary statistics show that the concentration of *E. coli* found in shellfish flesh is higher on average in the Wareham Channel (WH15 to Rockley). There also appears to be a more localised hotspot of contamination at the North Haven Pontoon. No marked spatial variation was apparent in the levels of contamination in shellfish in the north central part of the harbour, where the proposed relay area is located.

Since 2006, there were seven instances where both mussel and Tapes spp. were sampled from the same location on the same date. These individual results are listed in Table 4.

Table 4: Comparison of paired sample results (mussel vs Tapes spp., *E. coli* MPN/100g)

RMP	Date	Mussel result	*Tapes* spp. result
Barrel O	06/10/2015	1300	7900
Barrel O	07/04/2009	700	7900
Barrel O	04/12/2007	320	9100
Barrel O	14/11/2006	750	2400
Rockley	10/11/2009	220	700
Rockley	07/04/2009	460	490
Rockley	04/12/2007	500	2400

The number of samples considered is limited but illustrative of the potential weaknesses of using mussels to classify *Tapes* spp. On all these occasions *Tapes* spp returned a higher result than mussels, and on three occasions results for *Tapes* spp exceeded 4600 *E. coli* MPN/100g when the results for mussels were below this threshold. The difference was greater

at the Barrel O site than at Rockley, and on the only date that both sites were sampled for both species, there was very little difference between species at Rockley which suggests there may be site specific factors at play, as well.

Chemical contaminants

There are no immediately apparent potential sources of chemical contaminants within 5 km of the harbour according to the Environment Agency permitted discharge database (November 2015). Due to boating activity and urban use of the lower catchment, there is likely to be some level of contamination from hydrocarbons arising from motor vehicles and 2-stroke boat engines. Agricultural use of the upper catchment would suggest that river effluent will carry some pesticide residues but no specific information on the types of agricultural chemicals likely to be used in the area was obtained.

Water circulation

The proposed relay area lies to the north of Brownsea Island, in outer central Poole Harbour on a flat area of seabed at an elevation of 0.1m to -0.4m relative to chart datum. The Wych Channel (about 3-5m deep relative to chart datum) lies immediately to the south, and the main shipping channel to Poole (maintained at 7.5m deep relative to chard datum) lies 500m to the north. Both these channels have an approximately east-west orientation.

The tidal range within the harbour is 1.6m on spring tides and 0.5m on neap tides. The harbour experiences a double high water. The flood tide commences about an hour after low water with peak flood tidal currents occurring at about three hours after low water. The first high water occurs approximately six hours after low water and corresponds to virtually quiescent conditions. Tidal flows change direction at about seven hours after low water, but flow rates drop significantly at nine hours at the second high water. At ten hours after low water, a strong ebb flow has set in again, reaching peak current speeds at around low water (Halcrow Maritime, 1999).

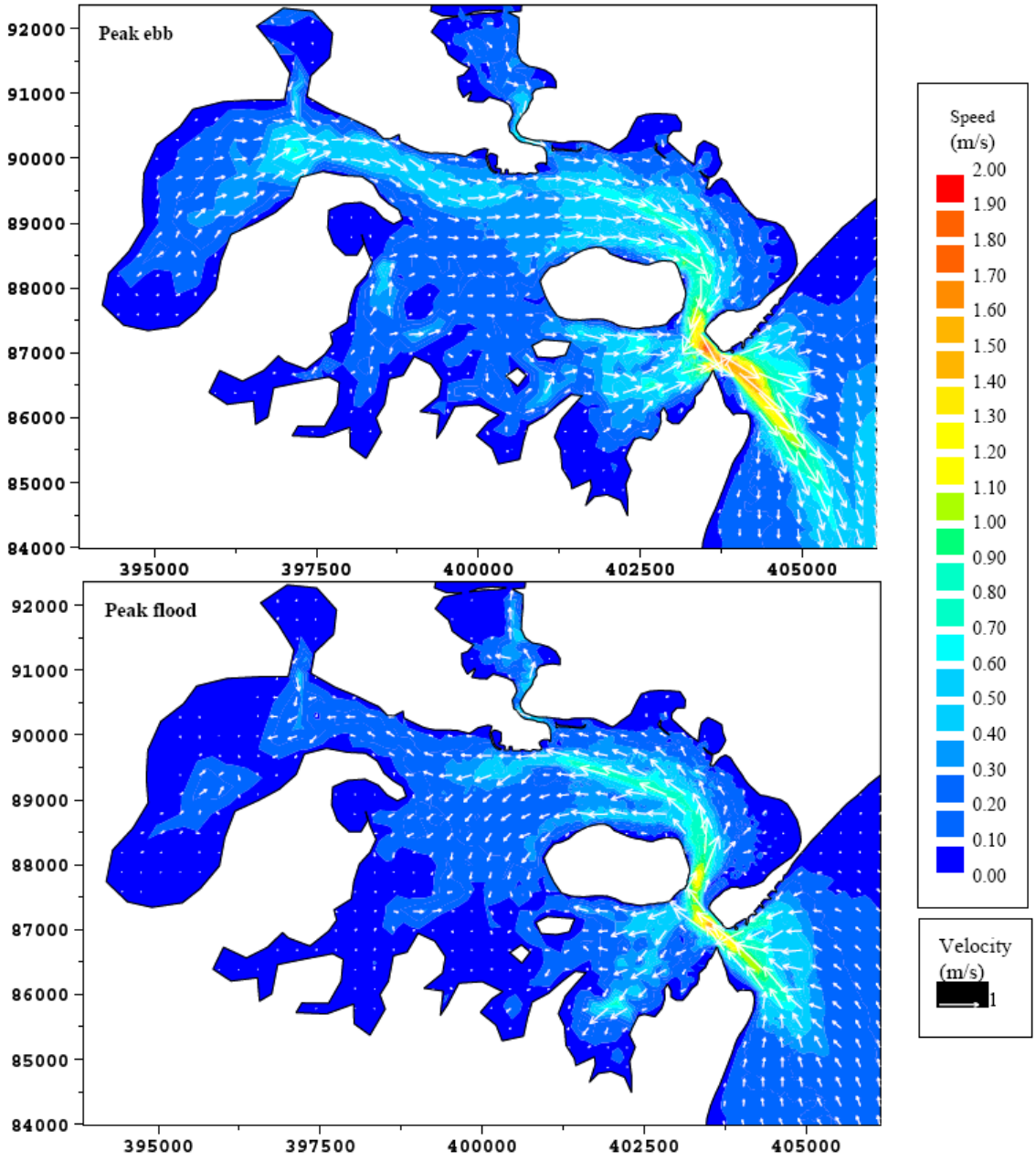

Figure 4: Peak spring ebb and flood flow tidal flow vectors for Poole Harbour (reproduced from Royal Haskoning, 2004)

Tidal streams within the harbour a bidirectional, moving into and up the harbour on the flood, with the revers occurring on the ebb. Peak flows in the vicinity of the proposed relay area are about 0.3-0.4 m/s and travel along the east-west axis. This means that sources to immediately to the east and west of the proposed relay area will be of most importance, and the areas immediately east and west of the relay area will be most susceptible to any contamination released by relayed shellfish as they purge themselves.

Although the regular and predictable tidal currents will be the main mode of contaminant transport under most conditions, wind and density effects may modify water circulation patterns. The main body of Poole Harbour is well mixed and more or less vertically homogenous with respect to salinity (Humphreys, 2005) so density effects are unlikely to be

of much significance. Winds may at times significantly alter circulation patterns within the harbour, but such effects will depend on wind strength and direction as well as tidal state at the time.

Buffer zone requirement

The legislation (EC Regulation 854/2004) states that there 'must be a minimum distance' between relay sites and other relay sites or production areas to prevent cross contamination, but gives no indication of what this distance should be. Taking the worst case in terms of potential contamination transfer by re-laid cockles and clams, 10 tonnes containing *E. coli* at 46,000 MPN/100g would contain about 9.2×10^8 *E.coli*, assuming a meat content of 20%. If deposited at a density of 10kg/m^2 the relaid shellfish would cover an area of 1000 m^2, or a square plot of about 30m x 30m. If this area was covered by 1m of water, with no circulation or bacterial die off, the concentration of *E. coli* in the overlying water would be raised by 92 *E. coli*/100ml.

However, a more realistic scenario is the gradual release over a period of 24 hours, and an average current speed of 0.05 m/s over the shellfish. This would result in the overlying water being exchanged 144 times per day. Under such conditions the *E. coli* concentration in water which has just passed over the shellfish would be raised by only about 0.7 *E. coli* cfu/100ml. The potential for cross contamination via the release of *E. coli* from relayed shellfish is therefore low under conditions approximating those within the proposed relay area, so only small buffer zones around the relay area and between batches of relayed shellfish are required. In this case buffer zones of 40m along the tidal direction and 20m across it should be adequately protective, assuming that it is possible to delineate the areas to a suitable degree of accuracy.

Recommendations regarding provisional RMP and production area

A buffer zone around the relay area is required to avoid cross contamination of neighbouring stocks. This should be formed by the outermost 40m of the eastern and western edges of the plot, and the outermost 20m of the northern and southern edges of the plot for which the relay classification was requested. This results in a smaller relay area but ensures the buffer zone does not encroach on the adjacent lease areas.

It is understood that the harvester intends to accumulate stock on the relay area throughout the clam harvesting season, and not extract any stock until at least two months have elapsed since the last batch was relayed.

There is little to suggest that local sources of contamination may result in significant spatial variation in levels of contamination across this small plot. The stream which discharges to the north east corner of Brownsea Island and carries sewage from the Brownsea Island private sewage discharge is the nearest identified point source of potential significance. There are also moorings for recreational craft immediately to the south of the plot in the Wych Channel. The nearest intertidal areas where birds are likely to forage are also immediately to the south.

Although there are major sources of contamination elsewhere in the harbour (e.g. Rivers Piddle and Frome) that will contribute to bacterial concentrations in the water column at the proposed relay area, they are too distant to result in noticeable spatial differences across the plot. It is therefore recommended that the RMP is located at the south eastern corner of the relay area as this lies nearest Brownsea island.

The relay area will form a separate classification zone from the existing Poole Harbour North zone so will require separate ongoing monitoring. The species sampled should be *Tapes* spp of a marketable size, which may be used to classify cockles as well. Sampling should be on a monthly, year round basis. As the relay area is only about 40m from east to west, a tolerance of 10m applies. If possible for this species, a sample bag or cage should be maintained, otherwise stocks will have to be sampled via dredge. Stocks should be held *in situ* for at least 2 weeks prior to sampling to allow them to equilibrate.

The relay area, buffer zones and provisional RMP are shown in the map in Figure 5.

Table 5: Provisional Sampling Plan

Production Area	Poole Harbour
pRMP name	West Brownsea Island Relay Area
NGR	SZ 0123 8883
Latitude	50° 41.947'N
Longitude	01° 59.037'W
Species	*Tapes* spp. (also representing cockles in the same zone)
Collection method	Dredge or bagged
Sampling tolerance	10 m
Sampling frequency	Monthly
Recommended relay area boundary	Area bounded by lines drawn from 50° 42.017'N 01° 59.054'W to 50° 42.017'N 01° 59.028'W to 50° 41.941'N 01° 59.028'W to 50° 41.941'N to 01° 59.054'W back to 50° 42.017'N 01° 59.054'W
Recommended buffer zone boundary	Area bounded by line drawn from 50° 42.028'N 01° 59.088'W to 50° 42.028'N 01° 58.986'W to 50° 41.931'N 01° 58.986'W to 50° 41.931'N 01° 59.088'W back to 50° 42.028'N 01° 59.088'W excluding the relay area delineated above.

(Lat/Long datum WGS84)

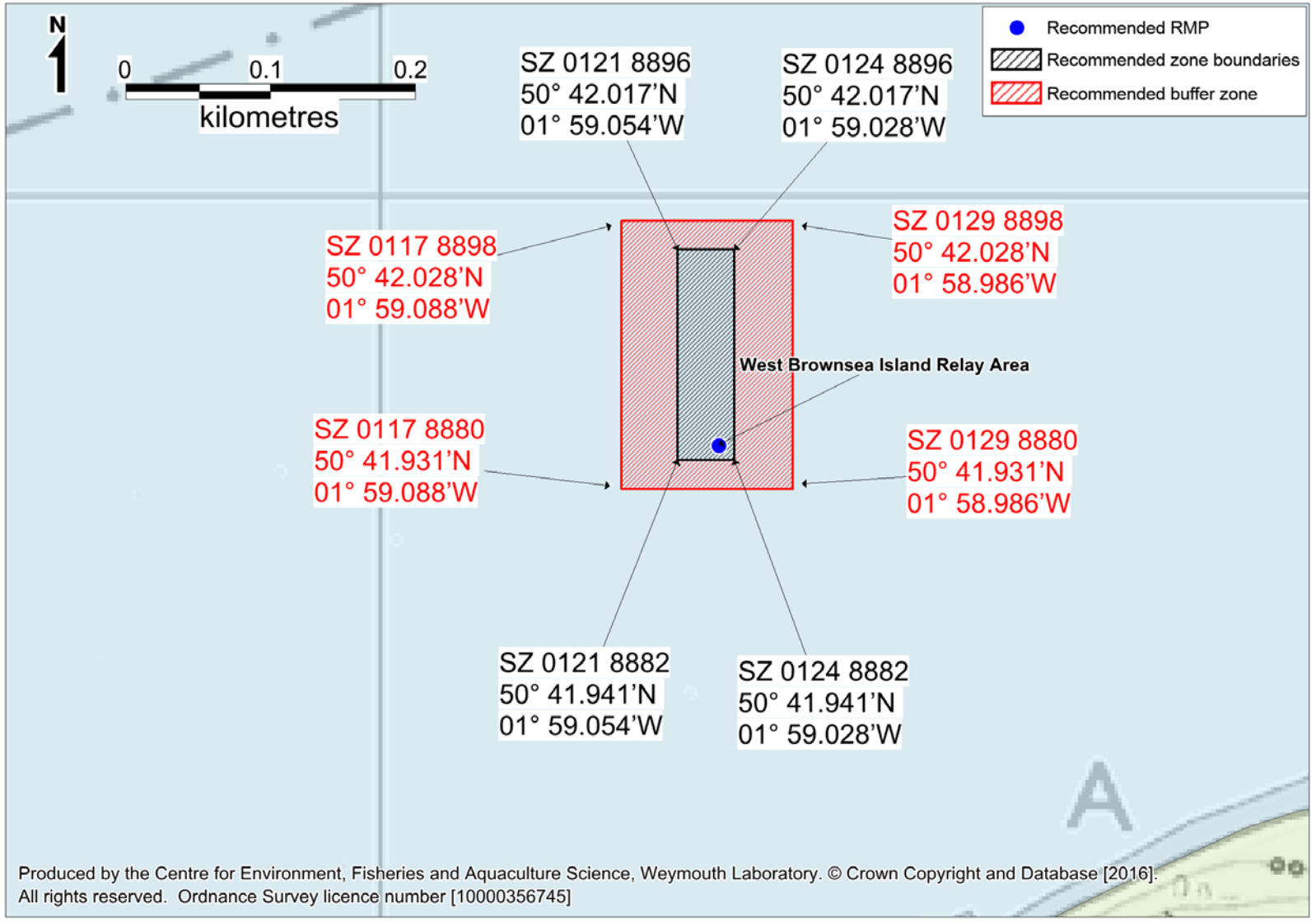

Figure 5: Recommended relay area, buffer zone and provisional RMP

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