Scottish Sanitary Survey Review

Sanitary Survey Review

Mid Yell Voe

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0.1	14/03/2014	All	Draft for external consultation
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Partner Organisation

The shoreline survey and its associated report were undertaken by SSQC, Shetland.

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APPENDICES

Review Specification and Introduction

Sanitary surveys are used to demonstrate compliance with the requirements stated in Annex II (Chapter II Paragraph 6) of Regulation (EC) 854/2004, whereby if the competent authority decides in principle to classify a production or relay area it must:

- make an inventory of pollution sources of human/animal origin likely to be a contamination source for the production areas;
- 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, wastewater treatment, etc.;
- determine the characteristics of the circulation of pollutants by virtue of current patterns, bathymetry and the tidal regime in the production area;
- 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.

As specified by the Food Standards Agency, this review is comprised of a brief desktop search of publicly available information together with a shoreline survey. No additional data requests are submitted to external bodies. The review is intended to identify significant changes in:

- Historic microbiological data.
- Sewage treatment and sewerage infrastructure.
- Housing and development.
- Harvester operations.

The output of the review is a report identifying any new information that has been obtained and/or whether major elements of the original sanitary survey can be regarded as essentially unchanged. That report includes an overall assessment as to whether the production area/classification zone boundaries and/or RMPs should be modified from those recommended in the original report and if so, a description of the revised boundaries and a revised sampling plan with the boundaries and RMP(s) locations.

In 2007, a Sanitary Survey was conducted for Mid Yell Voe to identify the location, extent and nature of the shellfishery, the potential sources of faecal contamination to the shellfishery, and to recommend boundaries and sampling plans for the production areas.

The output of the sanitary survey included a report and a recommended sampling plan for the fishery. The earlier sampling plan is identified alongside any recommended changes following findings from this review.

The present report constitutes a review of publicly available information in order to assess changes that have occurred since the 2007 sanitary survey report (see the Review Specification section for further detail). It is not intended to present detailed information relating to pollution sources that were identified in the previous report. This review should be read in conjunction with the 2007 sanitary survey report.

Sampling Plan – Mid Yell Voe

	2007 recommendations	2013 review	Changes
PRODUCTION AREA	Mid Yell Voe		No changes
SITE NAME	Seafield		
SIN	SI-216-432-08		
SPECIES	Common mussels		
TYPE OF FISHERY	Long line aquaculture		
NGR OF RMP	HU 5136 9195	HU 5137 9194	Move recommended RMP to lie on current Seafield farm
EAST	451360	451370	
NORTH	1191950	1191940	
TOLERANCE (M)	20	40	Amend for consistency with recent tolerances for longline farms
DEPTH (M)	1-3		No changes
METHOD OF SAMPLING	Hand		
FREQUENCY OF SAMPLING	Monthly		
LOCAL AUTHORITY	Shetland Island Council		
AUTHORISED SAMPLER(S)	Sean Williamson George Williamson Kathryn Winter Marion Slater	Sean Williamson Marion Anderson Agnes Smith Alan Harpin Vicki Smith	Change in staff
RECOMMENDED PRODUCTION AREA	Area bounded by lines drawn between HU 5060 9193 to HU 5060 9175 and from HU 5180 9195 to HU 5190 9098 to MHWS.	The area bounded by lines drawn from HU 5120 9222 to HU 5087 9207 to HU 5103 9163 to HU 5112 9163 to HU 5190 9175 to HU 5120 9222	Boundaries curtailed to exclude known discharges

1. Area Description

Mid Yell Voe is located on the island of Yell, north of mainland Shetland. It has a total length of 3.3 km, a maximum depth of 20 m and a total flushing time of two days (Edward and Sharples, 1986).

Figure 1.1 Location of Mid Yell Voe

2. Fishery

The current fishery at Mid Yell Voe consists of two common mussel farms, details of which are listed in Table 2.1.

Table 2.1 Current classified fishery at Mid Yell Voe

Production area	Site	SIN	Species	RMP
Mid Yell Voe	Camb	SI-216-430-08	Mussels	HU 5116 9190
	Seafield	SI-216-432-08	Mussels	

The current RMP identified by FSAS differs from that recommended in the 2007 sanitary survey report for Mid Yell Voe. The current RMP (given in Table 2.1) is located on the Camb site, approximately 200 m west of the recommended location on the Seafield site (HU 5136 9195). The sampling officer identified that the RMP had been moved due to a lack of mature stock on the Seafield site.

At the time of the 2007 shoreline survey, both the Camb and Seafield sites consisted of six, double-headed longlines.

At the time of the 2013 shoreline survey, six longlines remained at each site, with 8 m droppers on the Seafield site and 5 m droppers on the Camb site. The recorded extents of both sites was slightly smaller than that recorded in the 2007 survey (Figure 2.1), however this may be due to the 2007 extents being recorded at the anchor buoy rather than at the ends of the support floats.

The production area boundaries remain as recommended in the 2007 sampling plan. The production area boundaries and RMP recommended in the 2007 report are displayed in Figure 2.1, along with the Shetland Islands Council permit area, current RMP and extents of the mussel farms from both the 2007 and 2013 shoreline surveys.

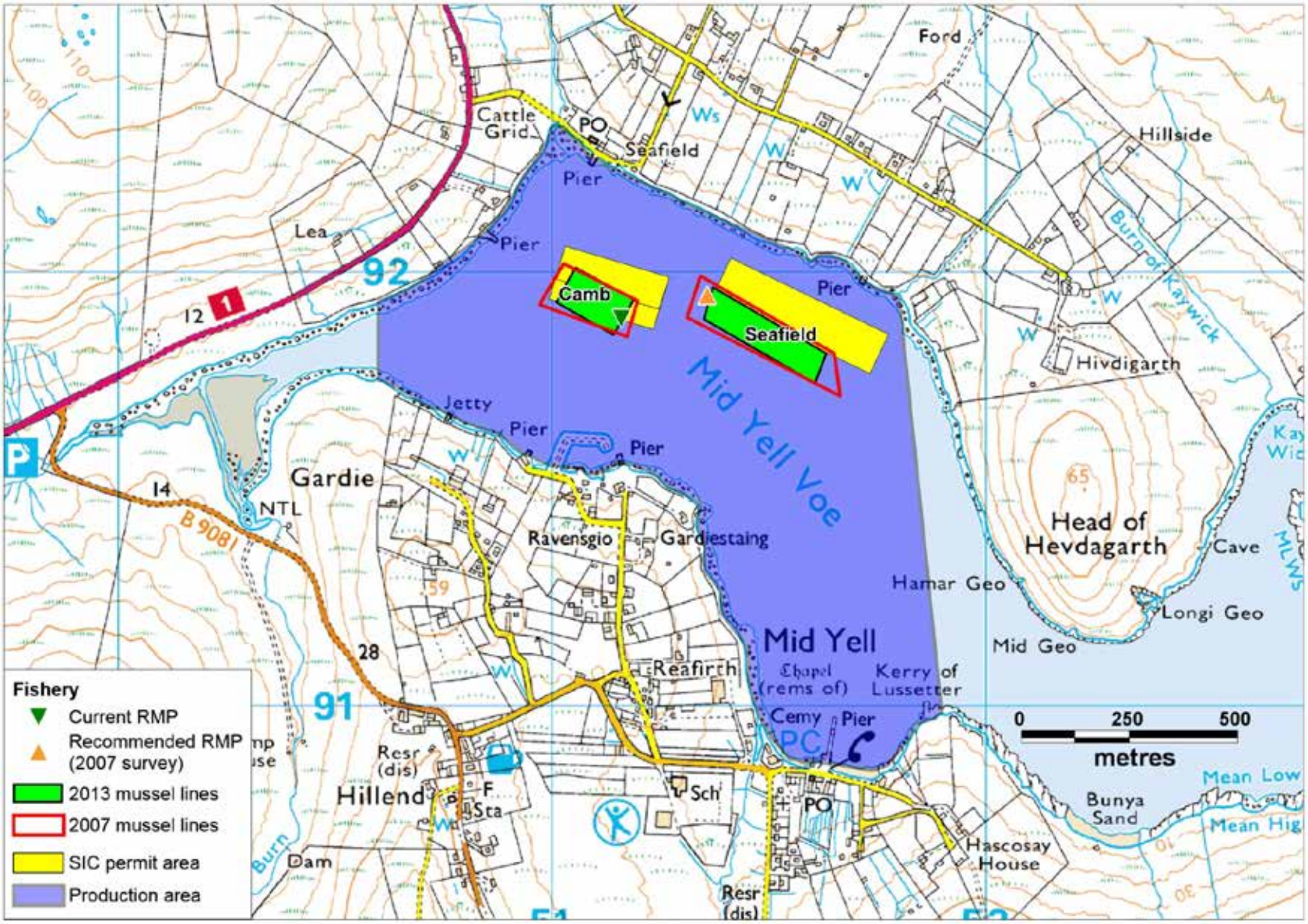

Figure 2.1 Current fishery production area and SIC leases, with current and historical farm boundaries at Mid Yell Voe

3. Population and Human Sewage Impacts

3.1 Population

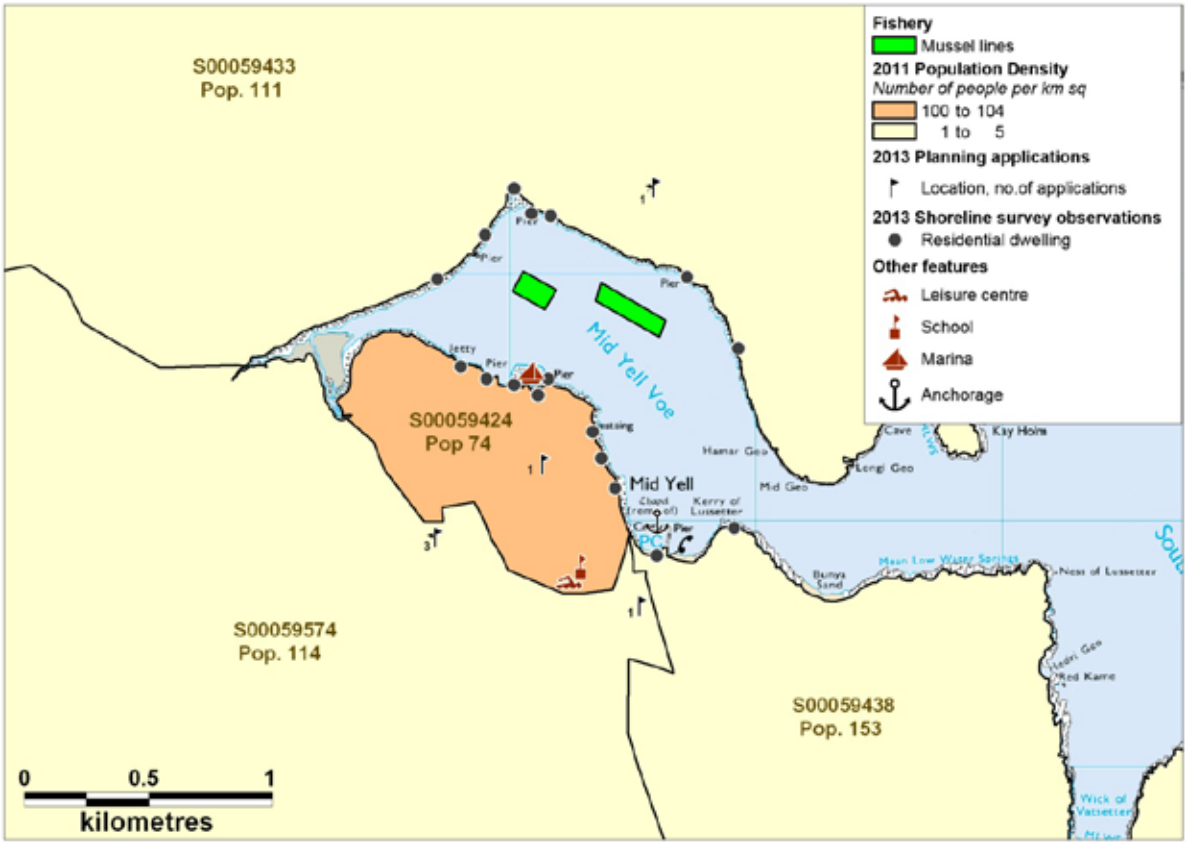

Figure 3.1 Map of human population distribution around Mid Yell Voe

The output areas have changed somewhat since the 2001 census data used in the sanitary survey report, with Mid Yell now making up a separate output area. Updated population census data for the Mid Yell Voe area indicated that overall, the population for the output areas around the voe has decreased slightly from a total of 477 to 452, a decline of about 5%.

By 2035, Shetland's population is projected to grow by about 0.6%, reaching 25534. Most of the increases are expected to occur in and around Lerwick, with other areas more likely to have stable or decreasing populations.

Since the 2007 report, seven planning applications were identified in the settlements of Camb (north) and Mid Yell (south) around Mid Yell Voe. These applications were downloaded from the Shetland Island Council Planning portal (http://pa.shetland.gov.uk/online-applications/) in July 2013, with full details presented in Appendix 1.

Most of the applications were associated with private dwellings, though there were three relating to other types of premises. One application related to a nursery, one

to a general purpose agricultural buidling, and one to a Scottish Water booster station. Four of the applications specified connection to mains sewerage, while the remaining three identified that discharges would go to soakaway.

Relatively little in the way of visitor accomodation was noted in the area, and therefore seasonal variation in the human population is not expected to be significant. Mid Yell is a centre for community services, including a leisure centre and pool, a nursing home, a health centre, and a school. Mid Yell junior high school has a total enrollment of 101 pupils and nursery places (http://www.midyell.shetland.sch.uk/school/, Accessed 5/3/2014).

A large number of boats were seen during the shoreline survey undertaken in June 2013 with many stored ashore at various locations, particularly close to the piers. The marina at Mid Yell contained 16 pleasure boats at the time of the survey. This was fewer than the 27 recorded in 2007, however this may be due to boats being ashore or away at sea during the survey. Meridian Salmon Farms Ltd operate a processing facility at Mid Yell and also own a marine cage fish farm site to the southeast of the Seafield mussel farm site. No other evidence was found to suggest that there had been a significant decline in boating activity.

3.2 Sewage Discharges

The 2007 sanitary survey report identified discharges associated with five Scottish Water owned community septic tanks around Mid Yell Voe. The locations of the assets as identified by Scottish Water are shown in Figure 3.2.

In addition to the Scottish Water septic tanks, there are consented discharges from a fish processing plant and a marine cage fish farm (SEPA, 2011). No location information was available for the processing plant discharge, and it is not known whether the discharged effluent includes sewage waste from staff facilities. The marine cage fish farm was located approximately 200 m southeast of the Seafield mussel farm, but has not been stocked since 2008 (http://aquaculture.scotland.gov.uk/data/fish_farms_monthly_biomass_and_treatment_reports.aspx?sepa_site_id=MYV1). Should this farm be reinstated, there would be an associated increase in boat traffic passing the mussel farms.

The requirement to register septic tanks in Scotland is relatively recent (2006) and some older homes that have not changed hands since then may still have unregistered tanks. A SEPA initiative in 2008 to offer free registration resulted in many applications and therefore there are likely to be more private septic tanks within the catchment area of the voe than were originally identified in the 2007 survey.

Sewage infrastructure observed during the 2013 shoreline surveys is listed in Table 3.1 , with locations mapped in Figure 3.2. Further details of the 2013 survey observations can be found in the Appendix 2.

All five Scottish Water septic tanks were recorded during the 2013 survey and correlated with the locations originally identified by Scottish Water. However, due to the high tidal state at the time of survey, the outfall pipe seen was that for the Ravensgeo ST.

Public toilets were observed at the end of Linkshouse Pier in both the 2007 and 2013 surveys. A seawater sample taken at the end of a pipe entering into the voe in 2013 returned a moderate result of 90 *E. coli* cfu/ 100 ml.

A broken pipe seen discharging to shore along the north shore of the voe in 2007 (No. 7, Table 3.1) was not seen in 2013 and is therefore presumed to have been removed.

A circular area of disturbed water 10 m offshore from the fish processing plant was observed during the 2013 survey. It reportedly had a brown colouration and gulls were noted to be feeding on the disturbed area. This is presumed to be the location of the final effluent discharge from the plant.

Table 3.1 Sewage discharge-related observations around Mid Yell Voe from the 2013 shoreline survey reports

No.	Year	NGR	Description of potential sewage discharge
1	2013	HU 5182 9197	North a Voe Septic Tank
2	2013	HU 5117 9224	Old clay pipe observed next to the house a small clear discharge coming from the end of the pipe most likely land drainage.
3	2013	HU 5106 9231	Seafield Septic Tank
4	2013	HU 5102 9235	Two large pipes observed above the burn most likely leading to the Seafield Septic Tank. Freshwater sample: 50 *E. coli* cfu/ 100 ml.
5	2013	HU 5112 9151	Ravensgio Septic Tank and pipe. Seawater sample: 60 *E. coli* cfu/ 100 ml.
6	2013	HU 5143 9113	Meridian Salmon Farms, salmon processing factory. Area 10m out from the shore where water was disturbed creating a circular zone. Possibly discharge from a pipe from the factory where approximately thirty gulls were feeding. No visible pipe could be seen coming from the shore.
7	2013	HU 5148 9093	Pipe above the watercourse most likely associated with the Cemetery septic tank. Freshwater sample: 50 *E. coli* cfu/ 100 ml
8	2013	HU 5145 9092	Cemetery Septic Tank
9	2013	HU 5165 9097	Public toilets at head of Linkshouse pier. Old pipe leading to the water at the head of the pier may be associated with the toilets, possibly disused. Seawater sample: 90 *E. coli* cfu/ 100 ml
10	2013	HU 5160 9086	Linkshouse Septic Tank

Neither of the samples taken from pipes indicated significant levels of faecal content. The seawater samples taken near sewage-related observations showed the presence of some, but not marked contamination.

Overall, the input of faecal contamination from sewage is expected to be largely unchanged based on the main community and larger private discharges remaining the same. However, there are likely to be additional private septic tank discharges that have not been identified in the data here. It is not known what proportion of these might discharge to watercourses, however even those discharging to soakaway may pose a risk of diffuse contamination should the soakaway fields be inappropriately sited or poorly maintained.

Subsequent to consultation on the draft of this review report, SEPA operations identified that they intended to carry out an evaluation of discharges identified as of potential risk at Mid Yell Voe.

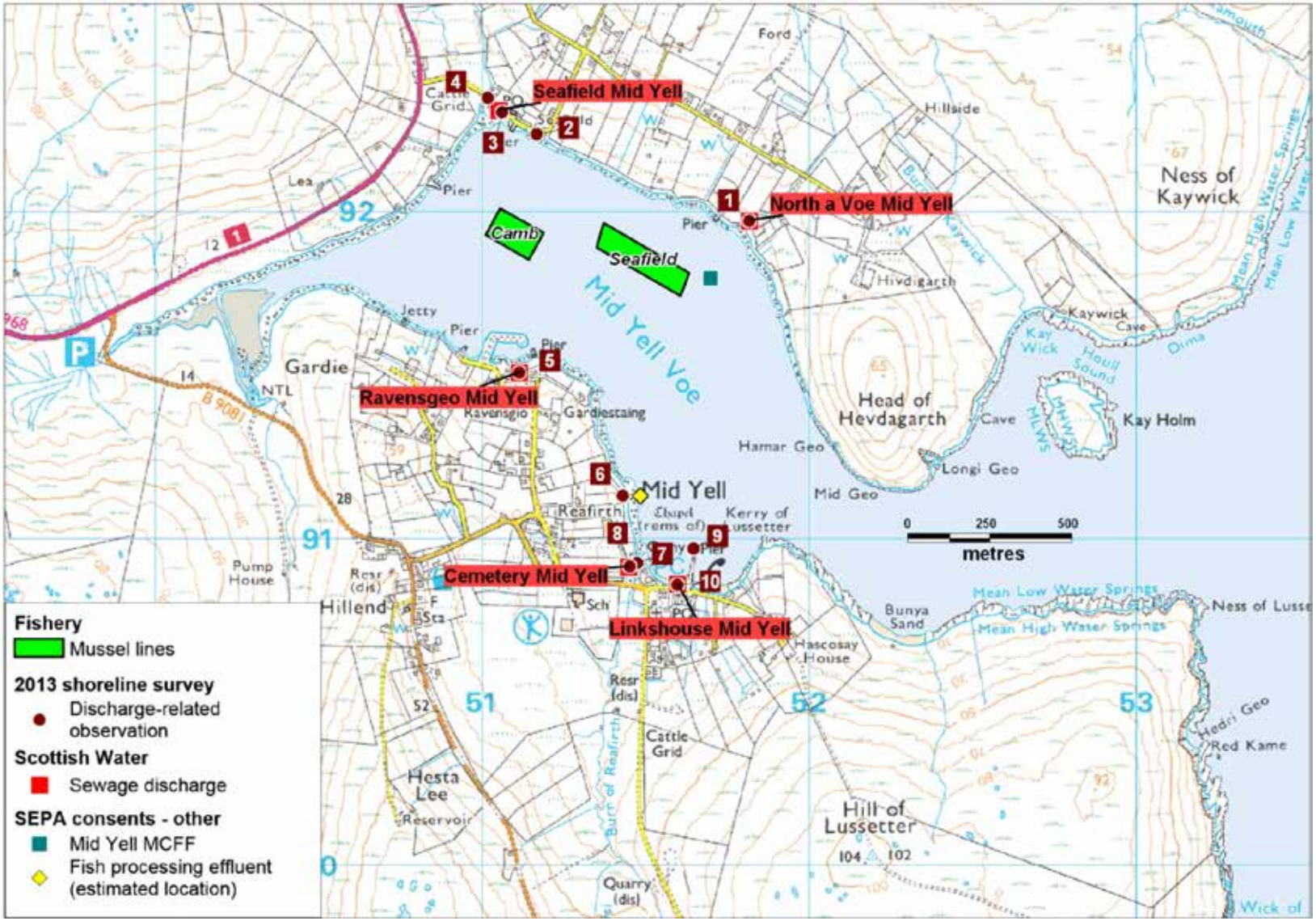

Figure 3.2 Map of sewage discharges and associated shoreline survey observations

4. Farm Animal Population and Agricultural Impacts

The 2007 report assessed farm animal populations based on data from the Agricultural Census and the shoreline survey. A recent desk-based search undertaken for this review returned no additional information on farming practices in the Mid Yell Voe area. The following data presented for 2013 therefore only relates to the shoreline survey carried out on the 26th June 2013. Locations of animals observed during the 2013 survey are displayed in Figure 4.1. For reference, the 2007 shoreline survey was undertaken 4-5 September, 2007.

In 2007, a modest number of livestock were observed along the northern and southern shorelines. In total, 183 sheep, seven cows and five chickens were observed. The largest number of sheep were seen along the north side of the voe, between Seafield and Camb, and along the southern shore between Hillend, Ravensgio, and Gardie. Sheep droppings were found along the southern shoreline. Local information (Shetland Agricultural Centre, *pers. comm*.) indicated numbers of sheep in the period May to September was approximately double that in other periods. Any contamination from sheep is therefore likely to be increased during that period.

In the 2013 survey, a total of 271 sheep were observed grazing along the northern and southern shorelines. For the most part, sheep were found to be kept in fenced crofts with no access to the shore. However, one flock of 30 sheep was seen on the shoreline near the Seafield site. Open grazing was also noted at the head and southeast areas of the voe, though shore access along the southeast is likely to be prevented by the presence of steep escarpments. Sheep faeces were noted in most grazing areas and two areas outside fenced crofts along the north shore. This suggests that sheep escape the fenced areas and access the shoreline from time to time. No cattle were seen in 2013, though a small number of ponies was recorded.

Three agricultural buildings were noted along the northern shoreline. It was not clear whether the buildings were used to store equipment, livestock or feed. It is therefore unclear whether they represent a potential contamination sources to the mussel farms.

Conclusions

Overall, a larger number of livestock animals was recorded during the 2013 survey, the majority of which were seen along the southern shore of the voe. However, it is not clear whether this represents a change in the number of animals kept in the area or is merely due to differences in timing or viewpoint during the two surveys. The greatest impact to the fishery is likely to occur where animals have access to the shoreline or to watercourses, and where the mussel farms most closely approach the shore. Therefore, the greatest potential impact at the mussel farms is to the north side of the Seafield site.

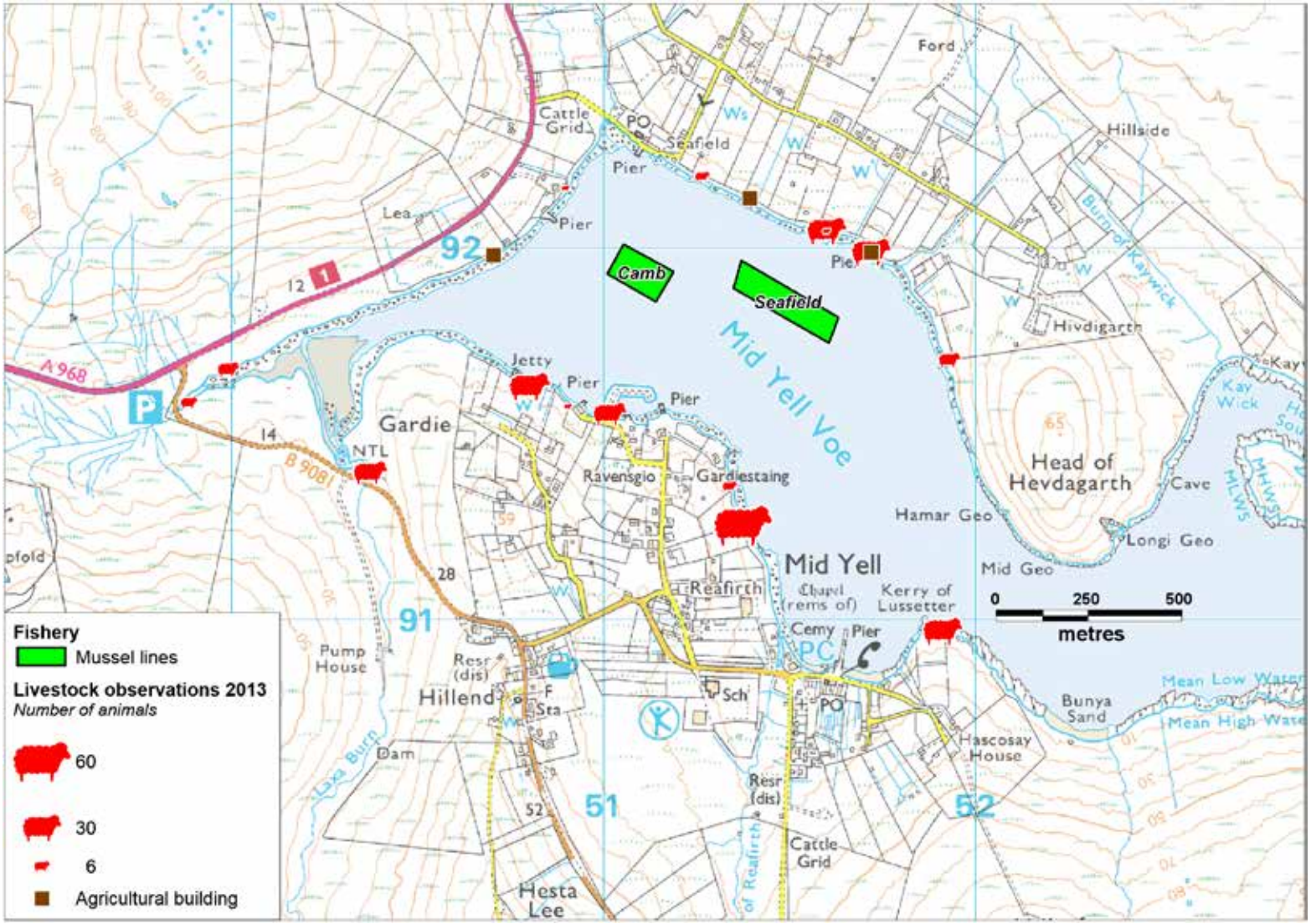

Figure 4.1 Map of farm animals and associated observations made during the 2013 shoreline survey

5. Wildlife

Information on potential pollution related to wildlife sources was obtained through the shoreline surveys conducted in 2007 and 2013, and through a desk-based internet search undertaken for this review. No wildlife was recorded during the 2007 shoreline survey, therefore observation information only relates to the time of the review survey undertaken on the 26th June 2013. Wildlife observations are displayed in Figure 5.1.

Seals

Since the 2007 Sanitary Survey Report, a series of population counts for the common/harbour (*Phoca vitulina*) seal and the grey seal (*Halichoerus grypus*) have been carried out in Shetland. The Special Committee on Seals (SCOS, 2012) report showed a dramatic decline in harbour seals since 2001 is now starting to slow, with population counts for the period 2007-2011 at 3039 seals. Grey seal populations by contrast have been growing. Grey seal pup production alone was 3300 in 2010 (SCOS, 2012).

Mid Yell Voe itself is not recognised as an important habitat for seals, although the Marine Spatial Plan for Shetland identified an area of seal habitat north of Hascosay island, approximately 3 km northeast of the Seafield mussel farm (NAFC, 2012). Seals are likely to be present in Mid Yell Voe from time to time, though it is not anticipated that they will have a significant impact on the fisheries. No seals were seen during the 2013 shoreline survey.

Cetaceans

Cetacean sightings for Shetland were presented in the 2007 report. No cetaceans were seen during the 2013 shoreline survey. Cetacean impacts in Mid Yell Voe are expected to be insignificant.

Seabirds

Seabird 2000 data for Shetland, in general, was presented in the 2007 report. Table 5.1 lists species found within a 5 km radius of Mid Yell Voe specifically, which are also displayed in Figure 5.1.

Table 5.1 Seabird 2000 census data for the 5 km area of Mid Yell Voe

Common name	Species	Count*	Method
Black Guillemot	*Cepphus grylle*	65	Individuals on land
Common gull	*Larus canus*	93	Individuals on land and Occupied nests
European Herring gull	*Larus argentatus*	16	Occupied nests
Great Black-backed gull	*Larus marinus*	4	Occupied territory
European Storm Petrel	*Hydrobates pelagicus*	184	Occupied sites
Northern fulmar	*Fulmarus glacialis*	550	Occupied sites
Great skua	*Stercorarius skua*	4	Occupied territory
Arctic tern	*Sterna paradisaea*	41	Individuals on land

*Adjusted count data used. (Mitchell *et al*., 2004)

It should be noted that Seabird 2000 sightings are recorded to the nearest 1 km and therefore some of the records may pertain to areas well outside the voe. Not all of the records included in Table 5.1 lie within the mapped area shown in Figure 5.1. Information on bird habitat from the Shetland Marine Spatial Plan (NAFC 2012) has also been included in Figure 5.1.

This data shows much of the voe is used by ducks and seabirds. Eider ducks are noted as present in winter. Seabird nesting areas located to the southeast of the fishery host relatively modest numbers of birds. Breeding seabirds are most likely to be present in these areas between April and August. Some species, such as some gulls and cormorants, will be present in the area throughout the year and were observed resting on the mussel floats during the 2013 shoreline survey. However, without more specific information on seasonal counts of birds in the area it is not possible to ascertain any clear seasonal variation in the contribution of faecal indicator bacteria to the fishery waters.

During the 2013 survey, birds were the most observed wildlife, with gulls the most commonly observed species. Birds and bird droppings were also noted on the mussel floats at the time of the survey, and therefore there is likely to be some direct deposition of droppings to the mussel farms. However, there is no information to suggest that any one part of the farms would be more impacted than another. Observations from the shoreline survey are shown in Figure 5.1. Labels are shown in the figure for any observations of greater than 5 individuals.

Otters

One otter was observed during the 2013 shoreline survey. The NAFC Marine and Spatial Plan Report indicates the presence of suitable otter habitat to the east of Mid Yell Voe, on the island of Hascosay approximately 3 km from the Seafield site. Overall contamination impacts from otters is anticipated to be low, and mainly confined to areas around water courses where they establish latrines.

Conclusions

Overall, the main species of wildlife likely to be present in the vicinity of Mid Yell Voe have not changed since the 2007 report. The spatial impact from seabirds has been re-assessed in the light of data from the specific area, and is considered to be higher than assumed in the 2007 report. Faecal contamination from birds is likely to impact both mussel farms, with birds noted on the mussel lines during the survey. Areas identified as suitable wildlife habitat are located south and east of the mussel farms, with most of it located in the outer voe and beyond. Birds were observed both on the mussel farms and along the shore to the north and west , however the largest concentrations of birds were seen south of the farms, within the identified habitat areas. The greatest impact on faecal contamination at the fishery is likely to be that from birds directly resting or feeding on the mussel farms, where faecal deposits are likely to directly contaminate the water in which the mussels feed. Based on the number of recorded seabirds and the distance of their breeding areas from the mussel farms, any impacts from these sources are likely to be diffuse in nature and may contribute to background levels of faecal contamination, particularly in the outer voe.

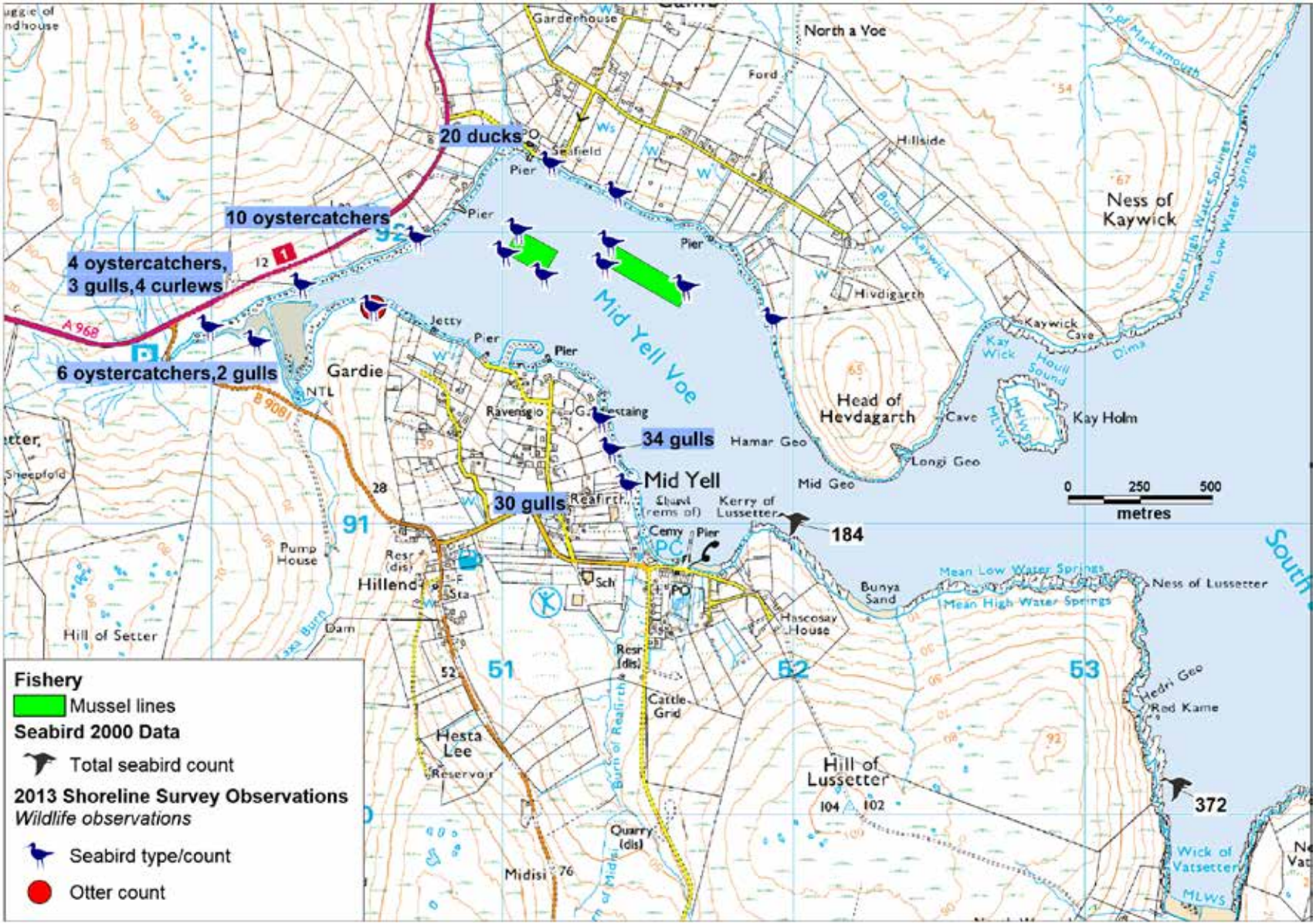

Figure 5.1 Map of wildlife around Mid Yell Voe, including observations made during the 2013 shoreline survey

6. Watercourses

There are no gauging stations on watercourses that flow into Mid Yell Voe. The Scottish Sea Loch Catalogue identified estimated runoff to be 17.8 Mm^3/yr (Edward and Sharples, 1986). The resulting estimated salinity reduction of the voe is 0.3 ppt, which suggests some freshwater influence in the voe. Data for 7 CTD/STD casts taken by FRS Marine Laboratory in the outer voe between 1998 and 2007 were obtained from the British Oceanographic Data Centre (BODC): these all showed near-surface salinities that were <0.2 ppt different from those seen at depth. The salinity profiles taken at the mussel sites during the 2013 shoreline survey did not show any reduction, within the variability of the instrument that was used. The minimum salinity recorded from spot samples taken during that survey was 33.99 ppt, showing soem freshwater influence. This was from a location at Mid Yell, near the location of a watercourse.

Prevailing weather conditions during the shoreline surveys were as follows: September 2007: showers on the survey day and in the 48 hrs prior to the survey, 26th June 2013: dry and sunny, with some rain over the 48 hrs prior to the survey.

Table 6.1 shows a comparison of watercourse loadings estimated on the basis of the 2007 and 2013 shoreline survey measurements and *E. coli* concentrations. A full list of recorded flow measurements and sample results from the 2013 shoreline survey can be found in Appendix 2.

Two watercourses enter into Mid Yell Voe along the northern shoreline. The Burn of Houll enters Mid Yell Voe <500 m from the northwest corner of the Camb mussel farm. The Burn of Uttrabister enters Mid Yell Voe <200 m from the northeast corner of the Seafield mussel farm. Two of the other watercourses are located at the head of the voe and the fifth is located on the southern shore, at Mid Yell. These three watercourses are each approximately 1 km from the nearest mussel farm.

Table 6.1 Watercourse loadings to Mid Yell Voe, 2007 and 2013 surveys

No.	Description	NGR (2013 survey)	2007 loading (*E. coli* /day)	2013 number & loading (*E. coli* /day)
1	Burn of Uttrabister	HU 5180 9196	$3.0x10^{11}$	$2.7x10^{10}$
2	Burn of Houll	HU 5102 9235	$7.0x10^{10}$	$1.9x10^{9}$
3	Watercourse at the head of the voe	HU 4989 9159	-	$1.1x10^{9}$
4	Laxa Burn	HU 5037 9140	$2.0x10^{10}$	$3.2x10^{9}$
5	Burn of Reafirth	HU 5148 9093	-	$1.1x10^{9}$

Estimated *E. coli* loadings were calculated for three out of the five major freshwater inputs into Mid Yell Voe in 2007. The estimated loadings were higher in 2007 than in 2013 for all three of these major watercourses, which may have been due to the slightly wetter conditions during the earlier survey. The highest loading estimated

from measurements made during both shoreline surveys was from the Burn of Uttrabister.

The impact from freshwater-borne contamination is anticipated to be greatest around the northeast end of the Seafield site, which lies nearest the outlet of the Burn of Uttrabister. The Camb site is also likely to receive freshwater input from watercourses to the north and southwest of it, however the combined estimated loading carried by these watercourses was lower than that observed at Burn of Uttrabister. The likely impact from these watercourses will depend on the predicted movement of contaminants and the potential for dilution.

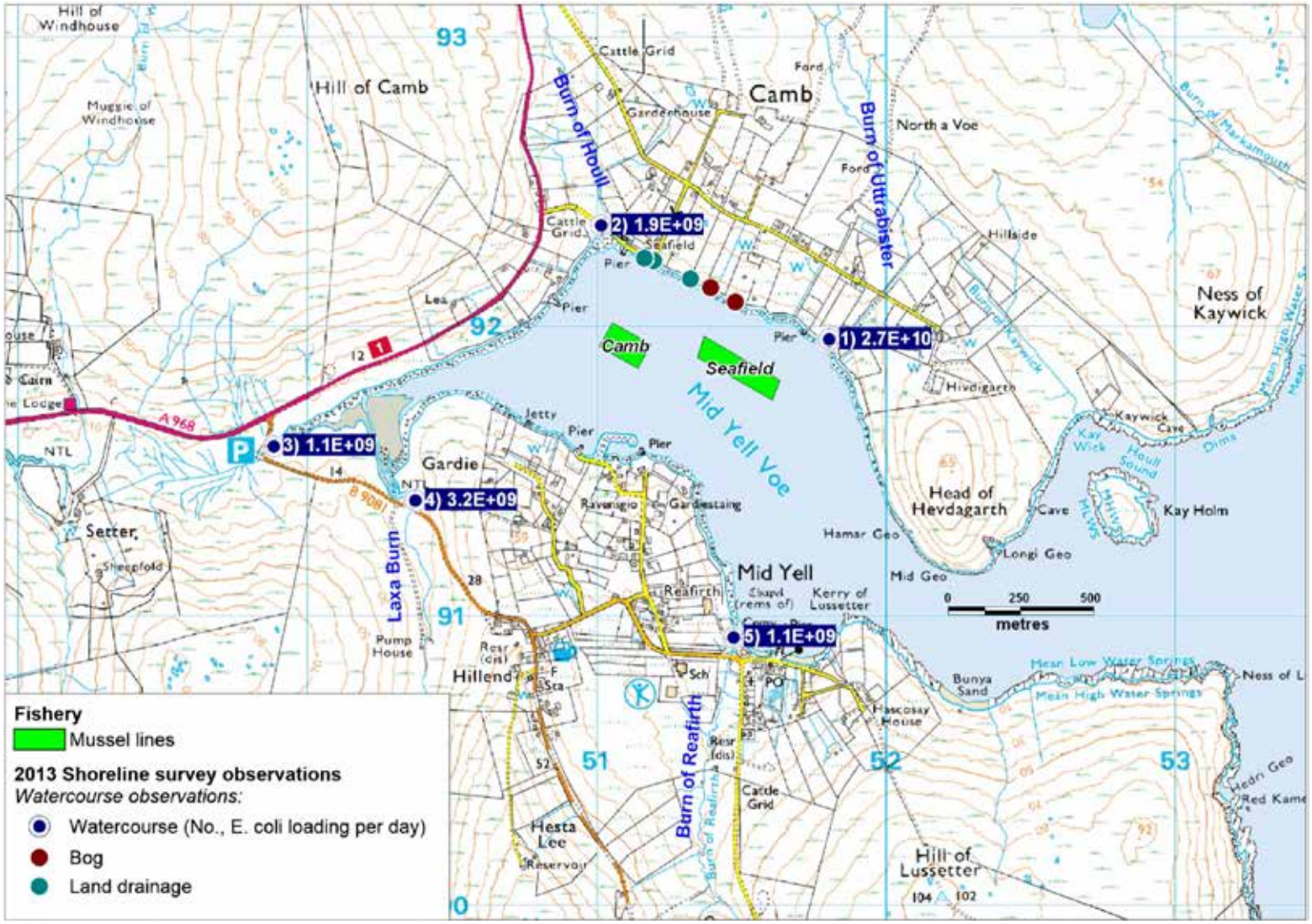

Figure 6.1 Watercourse loadings into Mid Yell Voe, estimated from measurements made during the 2013 shoreline survey

Where the bacterial loading is labelled on the map, the scientific notation is written in digital format, as this is the only format recognised by the mapping software. So, where normal scientific notation for 1000 is $1x10^3$, in digital format it is written as 1E+03.

7. Meteorological data

Meteorological data had been purchased from the UK Meteorological Office for the survey period 01/01/2003 - 31/12/2006 for the analyses undertaken for the 2007 Mid Yell Voe Sanitary Survey Report. Rainfall boxplots and wind roses for 2003-2006 period are presented in that report and have not been reproduced here. Rainfall was recorded in total daily rainfall (mm) from Baltasound weather station, which lies approximately 19 km northeast of the Mid Yell Voe production area. Wind roses were taken from the Lerwick weather station, which lies approximately 50 km south of the Mid Yell Voe production area. Meteorological data for this review was purchased in April 2013 for the period 01/01/2007 – 31/12/2012.

7.1 Rainfall

Storm events and high rainfall levels are commonly associated with increased faecal contamination of coastal waters through surface water run-off from land where livestock or wild animals are present and through sewer and waste water treatment plant (WWTP) overflows (Mallin *et al*, 2001: Lee and Morgan, 2003).

The Baltasound weather station rainfall dataset for 2007-2012 is presented by year in Figure 7.1 and by month in Figure 7.2.

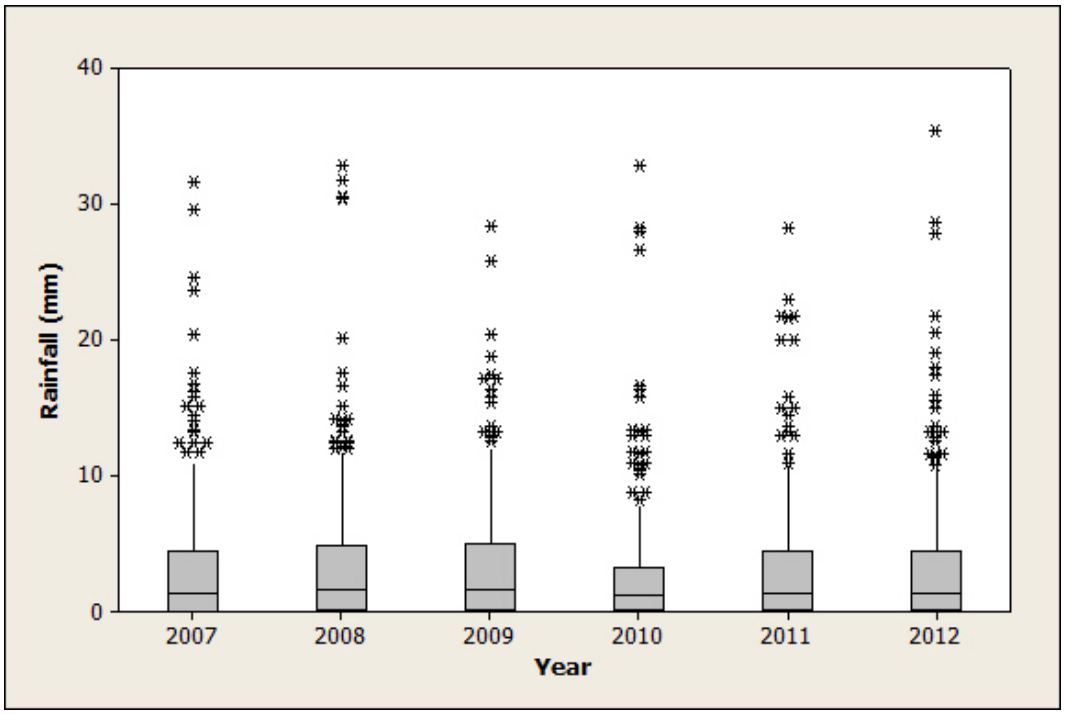

Figure 7.1 Boxplot of daily rainfall at Baltasound by year (2007-2012)

In both periods, the majority of observations were below 5 mm rainfall/day. Rainfall events exceeding 30 mm/day occurred in all years except for 2009 and 2011 (and in 2003 and 2004 in the previous dataset). There were no rainfall events exceeding 40

mm/d in either dataset. Therefore, overall daily rainfall does not appear to have changed significantly across the assessed years.

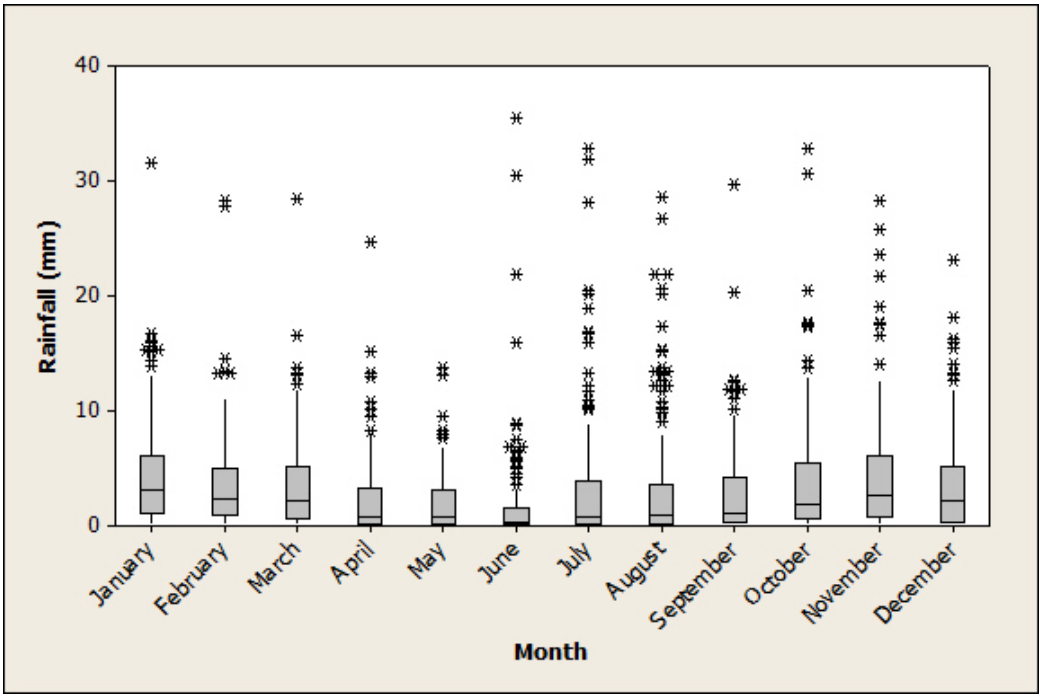

Figure 7.2 Boxplot of daily rainfall at Baltasound by month (2007-2012)

Figure 7.2 presents a boxplot of daily rainfall values by month for the 2007-2012 dataset. The period 2003-2006 had shown September to January to be the wetter months, and April to August drier. A similar trend was seen in data from the period 2007-2012, though July and August appeared to be comparatively wetter during 2007-2012 than during 2003-2006.

7.2 Wind

Wind speed and direction drive surface water and currents that play an integral part in particulate dispersal. Winds typically drive surface water at ca. 3% of the wind speed (Brown, 1991) so a gale force wind (a minimum of 34 knots/17.2 m/s) would drive a surface water current of about 1 knot or 0.5 m/s.

Figure 7.3 shows seasonal wind roses for Lerwick for the period 2002-2011. The local topography at Mid Yell Voe may result in differing wind patterns to those shown in the wind roses.

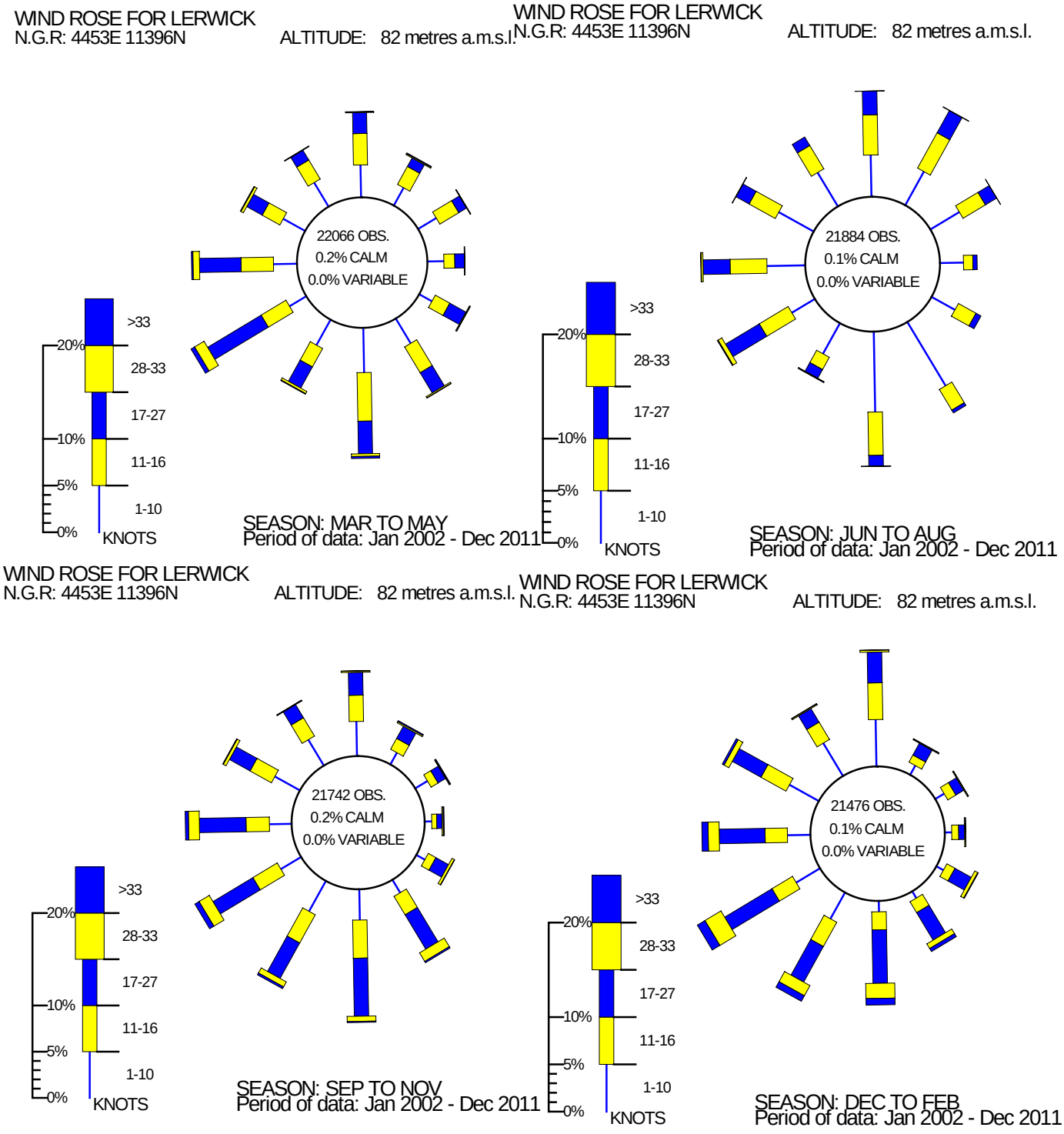

Figure 7.3 Seasonal wind roses for Lerwick (2002-2011)

Prevailing winds are south to south westerly, particularly in autumn and winter when the strongest winds come from this direction. However, strong north easterly and north westerly winds also occurred in summer, whilst spring winds were highest to the south-west. This is trend is seen in both datasets from 1996-2006 and 2007-2011. There are slight variations between years and seasons.

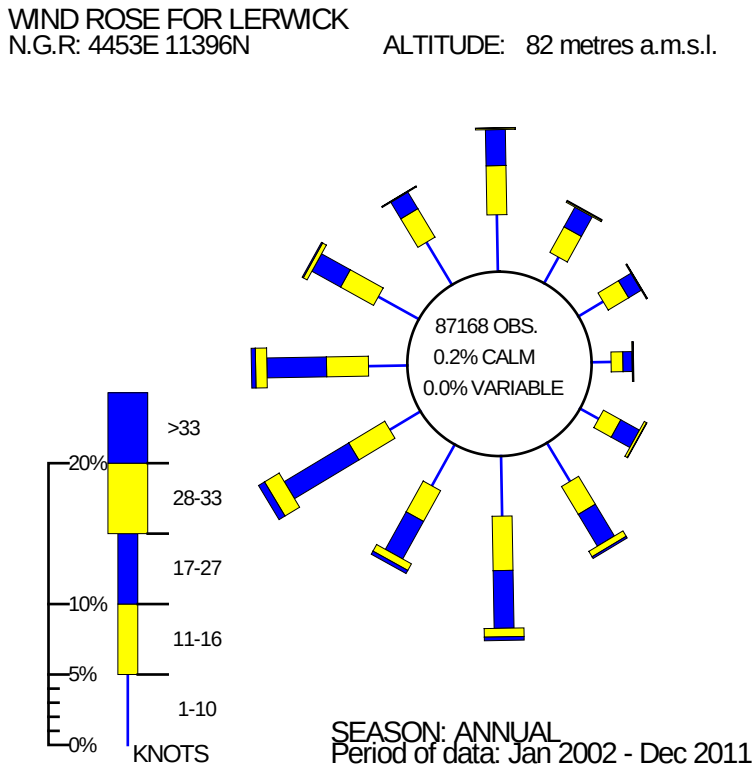

Figure 7.4 Annual wind rose at Lerwick (2002-2011)

The wind rose in Figure 7.4 shows that the overall prevailing annual wind direction is from the south and west. Winds are generally lighter during the summer months and strongest in the winter. Mid Yell Voe faces east and is sheltered from the open sea to some extent by the island of Hascosay.

8. Historical *E.* coli Data

Results for all samples assigned against Mid Yell Voe for the period 01/01/2007 to 7/03/2014 were extracted from the FSAS database and validated according to the criteria described in the standard protocol for validation of historical *E. coli* data. The data was extracted from the database in July 2013 and on 7/3/2014. Historical *E. coli* data used in the 2007 report had already been extracted and validated. For the purposes of this report, samples pre-dating 2001 were omitted from analysis. All *E. coli* results were reported as most probable number (MPN) *E. coli* per 100 g of shellfish flesh and intravalvular fluid.

E. coli results reported as <19 or <20 were reassigned a value of 10 *E. coli* MPN/100 g for the purposes of statistical evaluation and graphical representation.

Seafield site

Only four samples were attributed to the Seafield site. All of the samples were recorded on the database as valid, and were all received at the laboratory within the 24 hours of collection.

Camb site

A total of 75 samples were attributed to the Camb site. One sample [S02305-07-W] was recorded on the database as 'rejected' and was omitted from the analyses. One sample [SSQC_2008_195] did not have a result recorded and therefore could not be included in the analyses. Two samples on the database had incorrect laboratory receipt dates, which were amended to those stated on the original paper sample forms. All remaining samples were received at the laboratory within the 24 hours of collection.

8.1 Summary of microbiological results

The summary of sampling results between sampling periods 2001-2006 and 2007-2014 is given in Table 8.1.

Table 8.1 Sampling summary results for Mid Yell Voe common mussel fishery, 2001-2013

Sampling Summary								
Production area	Mid Yell Voe							
Site	Seafield				Camb			
Species	Common mussels							
SIN	SI-216-432-08				SI-216-430-08			
Location	Shetland Islands							
Years	2002-2006		2007-2013		2002-2006		2007-2013	
Total no. of samples	20		4		59		75	
	No. 2001	-	No. 2007	4	No. 2001	9	No. 2007	9
	No. 2002	-	No. 2008	-	No. 2002	10	No. 2008	8
	No. 2003	1	No. 2009	-	No. 2003	11	No. 2009	9
	No. 2004	3	No. 2010	-	No. 2004	9	No. 2010	12
	No. 2005	9	No. 2011	-	No. 2005	9	No. 2011	11
	No. 2006	8	No. 2012	-	No. 2006	10	No. 2012	12
			No. 2013	-			No. 2013	12
			No. 2014	-			No. 2014	2
Results Summary								
Minimum	<20		<20		<20		<20	
Maximum	2200		200		3500		9200	
Median	220		70		135		110	
Geometric mean	133		63		127		115	
90 Percentile	1620		200		785		1220	
95 Percentile	2150		200		1300		1700	
No. exceeding 230/100g	9 (45%)		0		17 (29%)		23 (31%)	
No. exceeding 1000/100g	4 (20%)		0		5 (8%)		9 (12%)	
No. exceeding 4600/100g	0		0		0		2 (3%)	
No. exceeding 18000/100g	0		0		0		0	

Sampling has varied between sites over the two sampling periods. The majority of samples were recorded against the Camb site in both the 2002-2006 and 2007-2013 sampling periods.

Table 8.2 Classification history for Mid Yell Voe common mussel fishery between 2001 and 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	B	B	B	B	A	A	A	B	B	B	B	B
2002	A	A	A	A	A	A	A	A	B	B	A	A
2003	A	B	B	B	B	B	B	B	B	B	B	A
2004	A	A	A	A	A	A	A	B	B	B	A	A
2005	A	A	A	A	A	A	A	A	A	A	A	A
2006	B	B	B	A	A	B	B	B	B	B	B	B
2007	B	B	B	A	A	B	B	B	B	B	B	B
2008	B	A	A	A	A	A	A	A	B	B	B	B
2009	B	B	A	A	A	A	A	A	B	B	B	B
2010	B	A	A	A	A	A	A	B	B	B	A	A
2011	A	A	A	B	B	B	B	B	B	B	A	A
2012	A	A	A	A	A	A	A	A	A	A	B	B
2013	A	A	A	A	A	A	A	A	A	A	B	B
2014	A	A	A									

In almost all years, Mid Yell Voe has had a seasonal A/B classification, except for 2005 when it received class A year round. No one month has been consistently A or B throughout the period assessed, though April and May have been predominantly class A September and October have been predominantly class B.

8.2 Geographical patterns of results

The location of the historical and current RMPs and shellfish sampling locations for both sites over the sampling period 01/01/2007–7/03/2014 are displayed in Figure 8.1. One sample [CEFAS_2913] was identified as unverified and had no associated location information, and is therefore not included in the figure. The size of the symbols are graduated in proportion to the magnitude of the *E. coli* result.

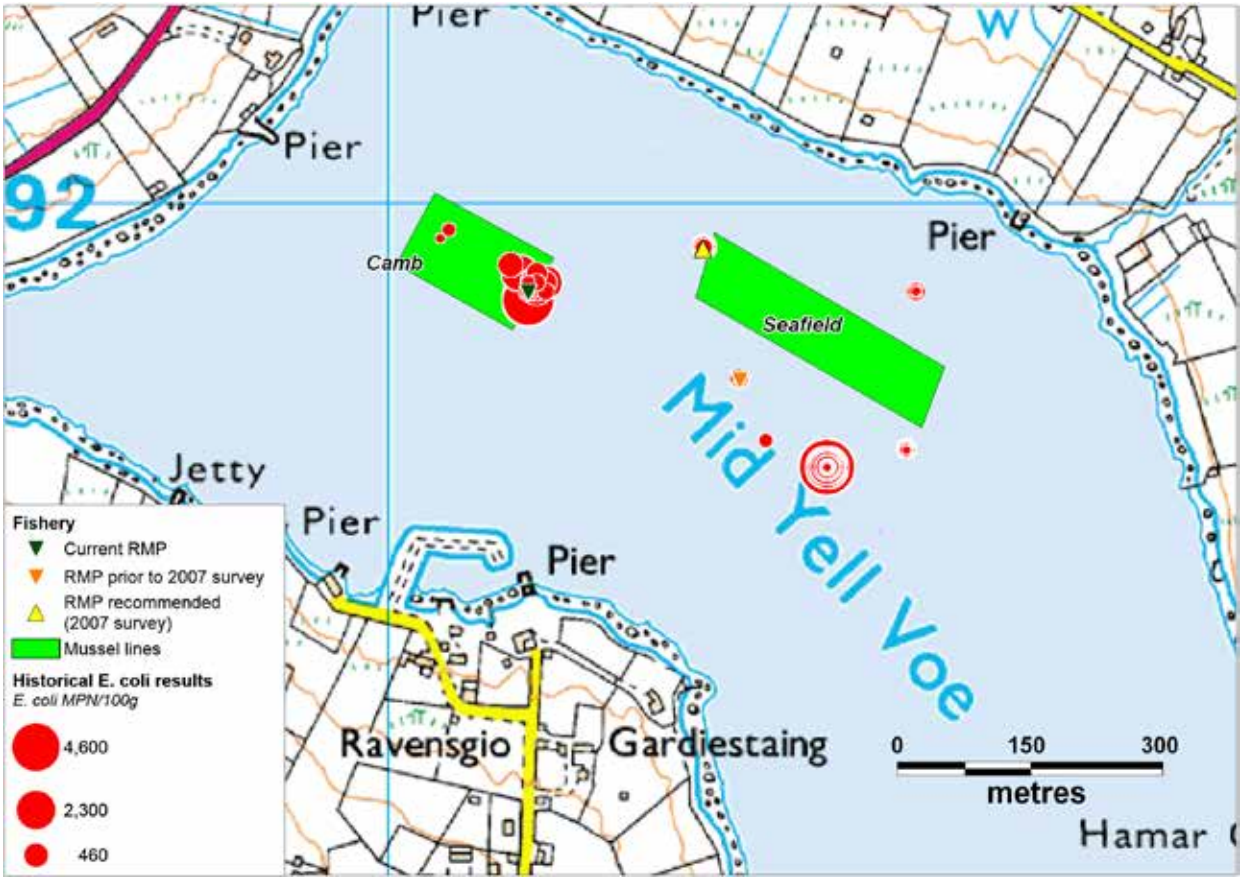

Figure 8.1 Mussel sampling locations and magnitude of results at Mid Yell Voe

The actual locations recorded for samples at Mid Yell Voe have not necessarily reflected the sites to which results were assigned. The majority of samples were recorded as having been taken near the Seafield site. This includes samples taken up to May 2012. From October 2012 onward, all samples plot in the vicinity of the RMP at Camb. Discrepancies with regard to reported sampling locations were also identified in the sanitary survey report.

All samples taken from 10/07/2007 to 09/11/2010 (30 samples) were reported against a location approximately 400 m southeast of the current RMP at HU 515 917. Only 6 samples were taken at the RMP recommended in the sanitary survey report: these were taken between November 2011 and April 2012.

Dual monitoring was undertaken at HU 5160 9190 and HU 5140 9180 from January to April 2007. These locations plot > 40 metres to the north and south of the Seafield site, respectively, though the samples from HU 5140 9180 were attributed to Camb.

A total of 20 samples were reported against locations within the Camb site boundaries (<200 m from the RMP) between 2012 and 2014, with results ranging from <20 to 5400 *E. coli* MPN/ 100 g.

Due to confusion regarding the site and locations to which the samples have been attributed, it is not possible to derive meaningful conclusions about the spatial variation in results. For the same reason, all results have been grouped together for the remaining analyses.

8.3 Temporal patterns of results

The trends of *E. coli* results for Mid Yell Voe have been analysed for the years between the previous sampling period (2002-2006) and the current sampling period (2007-2013).

To test for significant differences between results from samples taken at Mid Yell Voe over the two periods, the following statistical analyses were carried out for results:

- A two sample t-test (using $\log_{10}$ transformed *E. coli* data) to determine whether there was a statistically significant difference between *E. coli* results between the two sampling periods.

- A Chi squared test to test for the significant difference in the observed and expected *E. coli* results above critical levels (230 and 1000 *E. coli* MPN/ 100 g) from both sampling periods.

Temporal trends are displayed below in Figure 8.2, followed by results from the statistical analyses. Jittering was applied to results at 0.02 (x axis) and 0.001 (y axis) respectively.

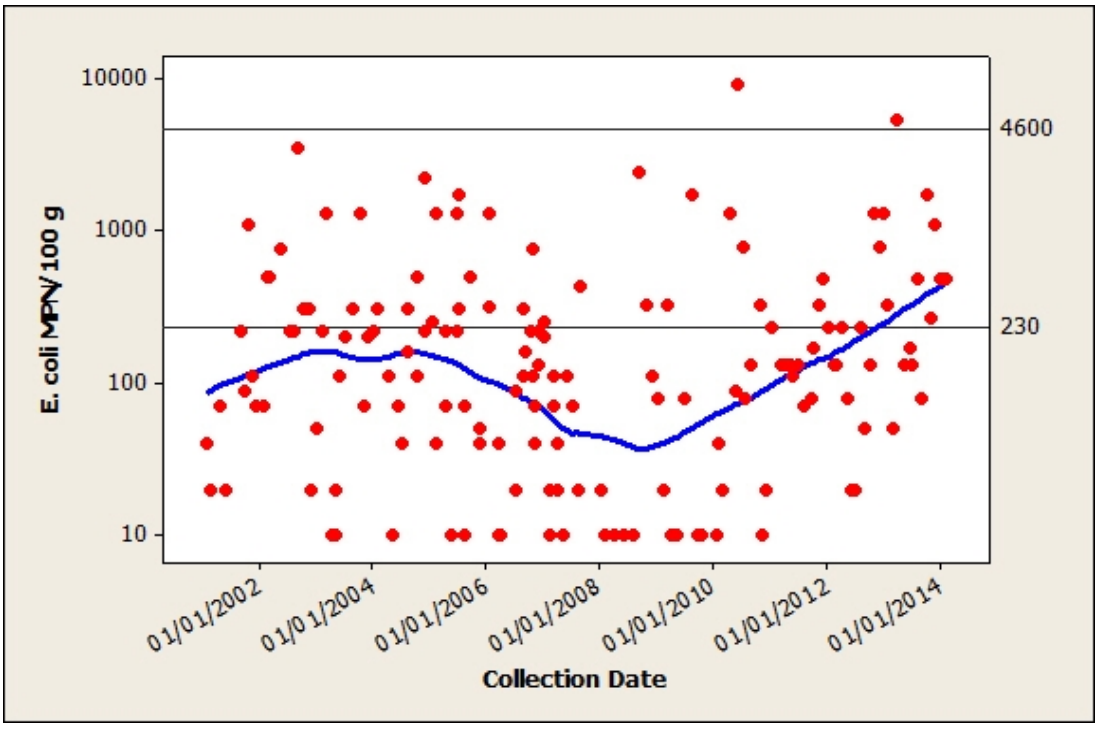

Figure 8.2 Scatterplot of Mid Yell Voe common mussel *E. coli* results by date (2001-2013), with a lowess line

The trend in *E. coli* results showed a dip between 2007 and 2009, after which results increased steadily. Since 2010, there have been two results greater than 4600 *E. coli* MPN/100 g and no results below the limit of detection (< 20 *E. coli* MPN/100 g). Of the results >4600, one occurred in 2010 and the other in 2013.

The difference in results between the two periods was not statistically significant, (Two sample t-test, t = 0.63, df = 154, p = 0.527).

Table 8.3 Chi-squared test results above and below 230 and 1000 *E. coli MPN*/100 g for Mid Yell Voe common mussel *E. coli* results

		E. coli MPN/100g			***E. coli MPN/100g***		
		≤230	>230	**Total**	≤1000	>1000	**Total**
2001-2006	Observed	53	26	79	70	9	79
2007-2014	Observed	56	23	79	70	9	79
Total		109	49	158	140	18	158

There was no statistically significant difference in the proportion of results ≤230 *E. coli* MPN/100 g and >230 *E. coli* MPN/100 g between the two sampling periods (Chi-square test, $X^2 = 0.266$, df = 1, p = 0.606).

There was no difference in the proportion of sampling results ≤1000 *E. coli* MPN/100 g and >1000 *E. coli* MPN/100 g between the two sampling periods. (Chi-square test, $X^2 = 0.0$, df = 1, p =1.0).

Conclusions

Overall there has not been a statistically significant change in *E. coli* results since 2007. However, the overall trend in results has shown a clear rise following a period of lower results in 2008-2009. The two results >4600 *E. coli* MPN/100 g were both recorded since 2010. This suggests a general deterioration in contamination levels at the fishery, however due to confusion regarding the recorded sampling locations, it is not possible to identify whether this was in part due to geographic variation.

9. Movement of contaminants

The main conclusions of the 2007 sanitary survey report with respect to movement of contaminants were as follows:

- Mid Yell Voe is shallow throughout its area, providing less potential for dilution of pollutants.
- Tidal effects are expected to be limited with respect to the dispersion of pollutants and dispersion will therefore be wind and density dependent.

There have been no recent assessments of the hydrography or bathymetry at Mid Yell Voe that could be used to assess changes in the movement of contaminants. No current data for the area was available from BODC. Satellite imagery courtesy of Bing maps (accessed 08/08/2013 at 11.35am) and hydrographic chart data maps indicate that there have been no significant apparent changes since the 2007 report. Therefore, the conclusions from the 2007 report are expected to remain valid.

10. Overall Assessment

This assessment considers the information obtained since the 2007 Report and the potential changes in extent and location of faecal contamination.

Human sewage Impacts

The human sewage impact remains largely the same; the resident population had decreased by approximately 5% between 2001 and 2011 and most of the planning applications for new dwelling houses identified planned connection to an existing/public septic tank. Two additional private septic tanks, one on the northern and one on the southern shoreline, are not expected to significantly impact the mussel farms due to their distance from the shoreline. The discharge from the fish processing plant, not noted in the previous report, was identified through the presence of an effluent boil at the sea surface approximately 600 m south of the Seafield site. The sewage content of this efflent is not known, however any faecal component to this discharge would be expected to contribute to overall contamination levels in the voe.

The number of visitors and the amount of boating activity in the voe are not anticipated to have increased significantly since the 2007 report.

Principal sources remain the community septic tanks spread around the voe. Due to the presence of community facilities such as schools and health centres, the area is expected to attract a relatively large proportion of resident visitors from around the island. This may serve to increase the risk of norovirus in the voe, particularly as there are both a nursery and a care home in Mid Yell.

Agricultural impacts

Large numbers of sheep continue to be kept around the voe, though most appeared to be kept fenced away from the shoreline. Sheep droppings were, however, noted along both sides of the voe and a small group of sheep were seen on the shoreline northeast of the Seafield site. Although a larger number of sheep were observed during the 2013 survey, it is not clear whether this was due to an actual increase in the number of sheep kept on land around the voe or due to chance variation in the number of animals visible to the surveyors.

Wildlife Impacts

A variety of seabirds, wading birds and ducks were observed during the 2013 survey. Gulls and cormorants were seen to be sitting on mussel floats, and these are likely to contribute significantly to faecal bacterial levels in the immediate vicinity of the mussel farms. Seals and otters are also likely to be present around the area, though they are not known to be present in large numbers. The outer parts of the voe, to the south and east of the mussel farms, are known to be habitat for both

visiting and resident ducks, seabirds, gulls. These are most likely to contribute to the levels of background faecal contamination found in the outer voe.

Seasonal Variation

There may be some seasonal variation in human population in Mid Yell as pupils will be present at the school during term time. No evidence was found of significant tourism to the area, though boating activity may be higher in summer due to the presence of the marina.

Seabirds are known to breed along the outer loch and islands, southeast of the fishery. However, the recorded numbers of breeding birds are relatively modest and therefore a minor contribution to background contamination levels in the outer voe is expected from these animals roughly from April to August. The outer voe south and east of the mussel farms is reported to be winter habitat for eider ducks, and therefore any impact from these animals is more likely in winter.

Seasonal variation in rainfall is expected in the area, with driest conditions occurring in summer and wetter weather occurring in winter. However, the variation is generally modest, and daily rainfall >30 mm was still found to occur in most months.

Watercourses

Freshwater sample results ranged from 30 to 3300 *E. coli* cfu/ 100 ml, though all but one was below 100 *E. coli* cfu/100 ml. The highest result came from the Burn of Uttrabister. As rainfall had been relatively low during the survey, this is likely to represent relatively dry conditions and therefore loadings may be higher in wetter weather.

Therefore, the Burn of Uttrabister was again found to contribute a higher loading of *E. coli* than the other main watercourses in the area. Contamination carried via this watercourse is expected to have the greatest impact on the Seafield site, which lies approximately 200 m southwest of the mouth of the burn. Burn of Houll discharges approximately 300 m north of the Camb site and contamination from this source may be carried southward across the mussel farm and may also impact the west end of the Seafield site.

Movement of contaminants

No information was obtained to suggest that the bathymetry and hydrodynamics have significantly changed since the 2007 sanitary survey report. As the water depths are shallow and tides relatively small, wind driven flow is likely to be an important mechanism of transport. Prevailing winds year round are from the southwest, however the direction of the wind at the mussel farms is likely to be heavily influenced by the topography around the voe. Discounting any effects of topography, a wind from the southwest may serve to push surface contaminants,

such as those that might be found in a surface layer of fresher water, toward the northwest. Under such conditions, contamination from the south shore where there are larger populations of both people and livestock, may be driven across the mussel farms.

Analysis of Results

Historical *E. coli* results

No significant difference was found in *E. coli* results between the survey and review sampling periods (2001-2006 and 2007-2014, respectively). Although the majority of samples were reported against the Camb site, the large majority (58 of 79) were reported against grid references that plotted in the vicinity of the Seafield site. Of the samples locations identified around the Seafield site, most did not correspond with the known location of the mussel farm.

Although there was no statistically significant difference between results from 2001-2006 and 2007-2014, the trend in results over time showed a dip in 2008-2009 followed by a steady increase until present. There is therefore some indication from the monitoring results that water quality has deteriorated since 2010.

Shoreline survey samples

Conditions were mainly dry during the shoreline survey, with winds ranging from northerly to westerly. Six mussel samples were taken at three different locations. Results were as follows:

- Camb (southwest corner): results of 50 and 40 *E. coli* MPN/100 g, for the top and bottom samples respectively.
- Seafield (southwest corner): results of 110 *E. coli* MPN/100 g for both top and bottom samples
- Seafield (northeast corner): results of 130 and 80 *E. coli* MPN/100 g for the top and bottom results respectively.

Seawater samples at all three mussel sample locations returned results of <1 *E. coli* cfu/100 ml with salinity not varying between top and bottom. Two other seawater samples were taken adjacent to discharge pipes at Mid Yell pier and Linkshouse pier returned results of 60 and 90 *E. coli* cfu/ 100 ml.

Conclusions

The conclusions from the 2007 report identified that the main sources of faecal contamination to the fisheries were human sewage from the septic tanks discharging to the voe, contamination carried via the Burn of Uttrabister, and diffuse

contamination from livestock kept within the catchment of the voe. These sources are not considered to have changed significantly since the sanitary survey.

The 2007 report recommended that the RMP be moved to HU 5136 9195, at the northwest corner of the Seafield site. This location was sampled on six occasions, from November 2011 to April 2012. There was a lack of clarity regarding sampling locations and their attributed sites, and a large number of samples were reported against locations that did not appear to correspond with the mussel farm locations.

11. Recommendations

There is no evidence to suggest that significant changes have occurred to the spatial distribution of contamination sources entering into Mid Yell Voe. The initial recommendations have been reviewed in light of current information and current approaches to establishing boundaries and tolerances, with amendments recommended as identified below. The recommended production area boundaries and RMP are shown in Figure 11.1.

Production area

The current approach is to exclude, where possible, all known point sources of sewage contamination from the production area boundaries. Therefore, it is recommended that the production area boundary be curtailed to exclude identified septic tank discharges and the marina. The recommended revised boundaries are the area bounded by lines drawn from HU 5120 9222 to HU 5087 9207 to HU 5103 9163 to HU 5112 9163 to HU 5190 9175 to HU 5120 9222.

RMP

Although there is no evidence to suggest contaminating sources have changed markedly, the locations of the mussel farms have shifted slightly, leaving the previously recommended RMP no longer on the recorded mussel farm area. Therefore it is recommended that the RMP be amended to HU 5137 9194, which lies near the northwest corner of the Seafield mussel farm. As there have been issues with availability of mature stock at this site, it is recommended that bagged mussels be placed at the RMP location for sampling purposes. Any bagged shellfish need to be placed on the site for at least a fortnight prior to sampling.

Tolerance

It is recommended that the sampling tolerance be extended to 40 m to be consistent with other mussel farms in allowing sufficient scope to accomodate movement of the long lines.

Depth

It is recommended that sampling be undertaken within the top 1 m of the lines to reflect contamination carried in freshwater near the surface.

Frequency

It is recommended that monitoring be retained at monthly.

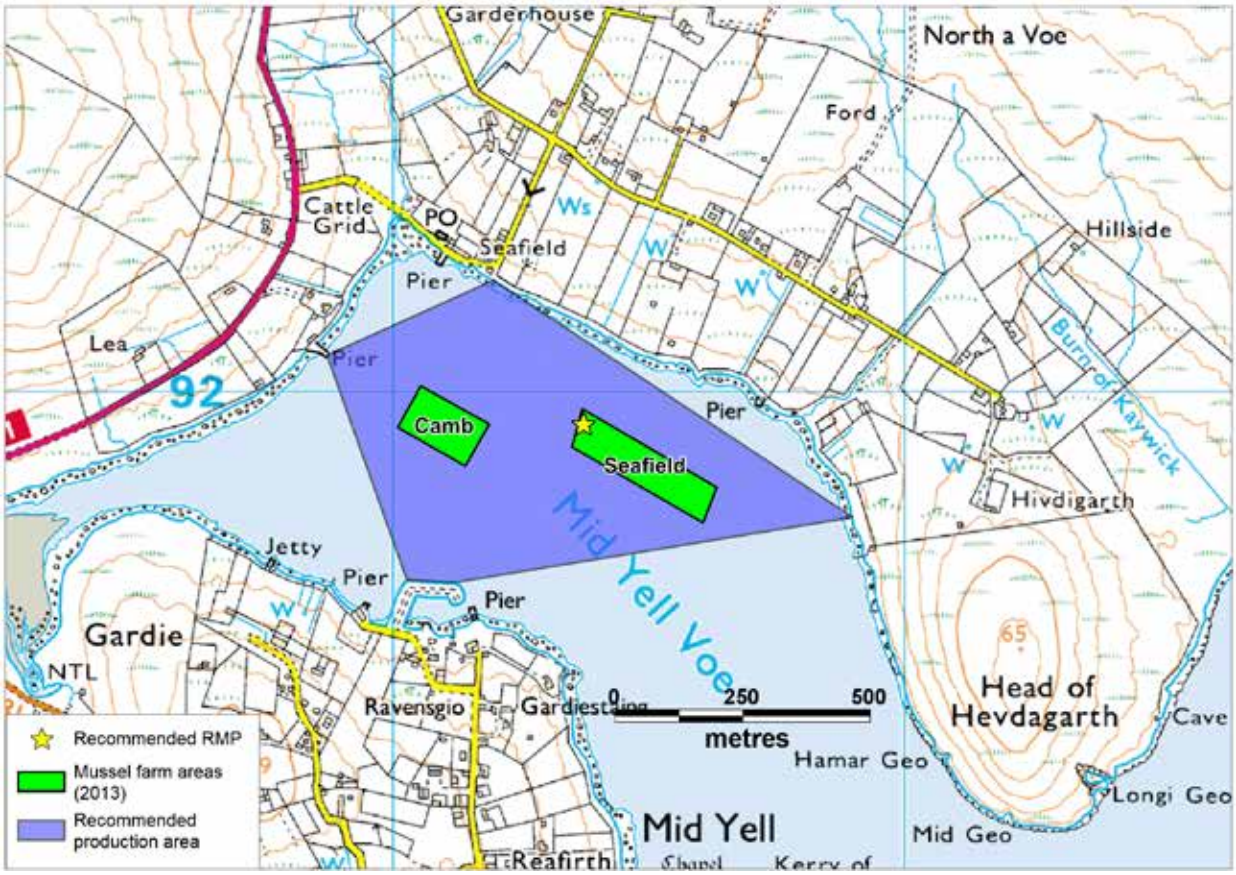

Figure 11.1 Recommended production area boundaries and RMP – Mid Yell Voe

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13. List of Figures and Tables

Appendices

1. List of planning applications

2. Shoreline Survey Report

Appendix 1. List of planning Applications

Planning applications expected to change the human population and overall faecal loading to Mid Yell Voe are listed in Table 1.

Table 1 List of planning applications to the Shetland Island Council, to land surrounding Mid Yell Voe

Date	Ref. No.	Description
May-11	2011/128/PCD	Demolition of croft house and erection of detached dwellinghouse, with sewage to public sewer and SDS
Jul-12	2012/253/PPF	Change of use of abandoned building to residential; renovate and install new septic tank and soakaway and provide access
Jan-12	2012/010/PPF	Erect 2 storey side extension, with toilet to existing septic tank
Dec-09	2009/361/PCD	Erect dwellinghouse, connecting to public drainage nextwork
Jul-09	2009/206/PCD	To erect childrens day nursery with access, parking and play area, to public sewer and SDS
Jul-09	2009/203/PCD	Erect dwellinghouse to public sewer and SDS
May-09	2009/158/PCD	Scottish Water to build a booster station and associated sites works, to new septic tank with soakaway and with surface water to other.
Apr-09	2009/112/PNA	To erect general purpose agricultural building, sewage to soakaway, SUDS

Appendix 2.

Shoreline Survey Report

Production Area:	Mid Yell Voe
Site Names:	Camb Seafield
SIN:	Camb: SI-216-430-08 Seafield: SI-216-432-08
Species:	Common Mussel
Harvesters:	C & S Mussels – Gilbert Clark and Erland Smith
Local Authority:	Shetland Islands Council
Status:	Existing area
Date surveyed:	26 June 2013
Surveyed by:	Sean Williamson (Hall Mark Meat Hygiene Ltd.) Vicki Smith (SSQC Ltd.) We are grateful to Erland Smith for providing assistance during the marine survey work.
Existing RMP:	Camb - HU 5116 9190
Area Surveyed:	See Figure 1

Specific observations made on site are mapped in Figure 1 and listed in Table 1. Water and shellfish samples were collected at the locations marked on Figures 2 and 3. Bacteriology results are given in Tables 2 and 3. Salinity profiles are presented in Table 4 with profile locations marked on Figure 2. Photographs are presented in Figures 4-16.

Weather

Wednesday 26 June 2013

Very calm conditions started the day before the wind built slightly going into the boat work with conditions sunny with scattered clouds and a light breeze (F2) coming from the north. The northerly wind increased slightly to a gentle F3 throughout the shoreline walk with the sunny conditions and partial cloud cover continuing throughout the afternoon.

Preceding the shoreline survey, Monday 24 June started with light rain showers persisting throughout the morning, before drying up moving into the afternoon. A gentle to moderate northerly breeze (F3/F4) accompanied the rain in the morning before moving north westerly into the afternoon and evening. Conditions remained cloudy for the majority of the day with a few brief light rain showers during the evening. Tuesday 25 June began with overcast conditions which cleared to partly cloudy as the day progressed. Tuesday was a dry day with wind building from a north westerly F2 in the morning to a westerly F4 in the afternoon before dying away into the evening.

Fishery

The location of the Seafield and Camb mussel lines are mapped in Figure 1. Both fisheries had stocked mussel lines on site at the time of the survey. Harvesting was not occurring at either of the fisheries at this time.

The Seafield fishery consisted of six mussel lines running parallel to the shoreline (Figure 4). All lines were double headed long lines with 8 metre droppers. Two mussel samples were collected near the south east corner of the site from the line closest to the shore taken from the top and bottom of a mussel line. Two mussel samples were also collected from the north west corner of the site from the line furthest from the shore, taken from the top and bottom of a mussel line.

The Camb fishery consisted of six mussel lines running parallel to the shoreline (Figure 5). All lines were double headed long lines with 5 metre droppers. Two mussel samples were collected from the north west corner of the site from the line furthest from the shore taken from the top and bottom of a mussel line.

Sewage/Faecal Sources

Human – On the northern shoreline of Mid Yell Voe, Seafield and Camb are the main dwelling areas, with approximately 30 occupied houses evenly spaced along the first half of the shoreline walk. The majority of the houses in this area are not close to the shore but are located near the road which is some distance from the shore. Two community septic tanks service this area with the North a Voe Septic Tank (Figure 6) at the east end of the dwelling area near the start of the shoreline walk and the Seafield Septic Tank found at the western end of the dwelling area. Occupied houses were not commonly found along the second part of the northern shoreline towards the head of the voe. On the southern shoreline from the head of the voe to the Meridian Salmon Farms shorebase in the Ravensgio area, there were very few houses. For the remainder of the southern shoreline walk dwelling houses were found in higher numbers in the village of Mid Yell, which is the largest settlement on the island of Yell. There are approximately 100 houses in the Mid Yell area with the majority of the houses found some distance from the shore. Three community septic tanks service this area which were all identified on the shoreline walk.

Of the five community septic tanks located around the shoreline of Mid Yell Voe only the pipe from the Ravensgio Septic Tank was observed entering the sea (Figure 7), this was most likely due to the tide height at the time of the shoreline walk with high water occurring during the walk at 12:44 (2.4m). Eight pipes were identified along the shoreline walk, three of which were associated with community septic tanks; the Ravensgio Septic Tank pipe leading to the water with the other pipes observed above watercourses near the Seafield and Cemetery Septic Tanks most likely associated with these septic tanks. Two pipes were identified on the northern shoreline associated with field drainage both with a low volume clear water discharge. A perforated pipe with a small discharge with a slight white colouration was present next to the Meridian Salmon Farms shorebase near Ravensgio. A zone of disturbance in the water approximately 10 metres out from the salmon processing factory also owned by Meridian near Reafirth was observed where gulls were feeding (Figure 8). This may have been associated with a discharge from the factory

however no pipe was observed on the shore leading to the sea. Public toilets were located on the Linkshouse Pier with a pipe noted entering the sea directly below the toilets (Figure 9), it was not known if this pipe was in use or whether the toilets were connected to the Linkshouse Septic Tank adjacent to the pier.

Sample analysis

Five freshwater samples were obtained from watercourses on the shoreline survey, all of which were outlined on the sampling plan. Another two freshwater samples were outlined in the plan on the northern shoreline but on approaching the locations outlined in the plan no watercourses were present, only areas of boggy ground but no water flowing. Of the five watercourses sampled, four were found to have *E.coli* levels between 30-80 cfu/100ml. The sample which was found to have an elevated *E.coli* count ($3.3x10^3$ cfu/100ml) was from a large watercourse (Figure 10) sampled at the start of the shoreline walk adjacent to the North a Voe community Septic Tank.

Three seawater samples were obtained on the shoreline walk, all of which were outlined on the survey plan. The *E.coli* counts of the three samples ranged from 12-90 cfu/100ml with the Linkshouse Pier seawater sample recording the highest *E.coli* count (90 cfu/100ml) which was near the Linkshouse community Septic Tank (Figure 11).

Four mussel samples were obtained from the Seafield fishery, two near the south east corner of the site and two from the north west corner of the site. The two samples collected near the south east corner were obtained from the top and bottom of a mussel line. The sample from the top of the mussel line returned a count of 130 *E.coli* MPN/100g with the bottom sample returning levels of 80 *E.coli* MPN/100g. The two samples collected from the north west corner again were collected from the top and bottom of a mussel line and both returned counts of 110 *E.coli* MPN/100g. Two mussel samples were obtained from the Camb fishery from the north west corner of the site. The samples were obtained from the top and bottom of a mussel line. The sample obtained from the top of the mussel line returned a count of 50 *E.coli* MPN/100g with the bottom sample returning levels of 40 *E.coli* MPN/100g.

E.coli levels in the mussel tissue were found to be greater in samples obtained from the Seafield fishery with generally the samples taken from the top of the mussel lines returning higher *E.coli* counts than the samples taken from depth however the top and bottom samples taken from the north west corner of the Seafield fishery returned identical *E.coli* counts (110 *E.coli* MPN/100g).

Salinity profiles were collected from the north and south ends of the Seafield fishery, the north end of the Camb fishery and the Linkshouse Pier. All profiles obtained with the exception of one showed <0.20 ppt change in salinity from 10 metres to the surface which is within the accuracy of the probe used (± 0.35 ppt). The salinity profile which showed the greatest difference (0.99 ppt) in salinity (outwith the accuracy of the probe) was recorded at the Linkshouse Pier which saw a decrease in salinity from 10m to the surface. Another two profiles outlined in the survey plan could not be recorded for the full 10m depth as the depth at the Seafield Pier and the Ravensgio Pier was only 1m and 2m respectively. Four of the six profiles showed a

slight increase with decreasing depth including the profile recorded at the Seafield Pier. The other two profiles recorded at the Ravensgio Pier and Linkshouse Pier showed decreases in salinity with decreasing depth.

Of the six temperature profiles recorded three showed an increase with decreasing depth and three showed a decrease with decreasing depth. The profiles that showed the greatest difference from 10 metres to the surface was the profile taken at the NW corner of the Camb site (difference 0.8°C) and the profile taken at the Linkshouse Pier which showed a 1.6°C difference between 10 m and the surface. The two temperature profiles recorded at the Seafield Pier and the Ravensgio Pier could not be recorded for the full 10m depth as the depth was only 1m and 2m respectively. Despite this the Ravensgio Pier profile showed quite a large difference in temperature from 2m to the surface with a difference of 0.8°C between the two readings.

Salinities of the seawater samples analysed at the laboratory showed salinities ranging from 33.99-35.17 PSU. The seawater sample collected at the Linkshouse Pier had the lowest salinity (33.99 PSU) with the sample collected from the NW corner of the Seafield fishery having the highest salinity (35.17 PSU) of the seawater samples.

Seasonal population

There are three known self-catering properties in the Mid Yell Voe area, two are situated in on the southern shoreline in Mid Yell, one some distance from the shore on the hillside behind the local school and one a short distance from the shore just east of the Linkshouse Pier. The other self-catering property is located near the Seafield Pier adjacent to a large watercourse. All properties sleep up to four people with two of the properties on the southern shore being available to rent all year round and the Seafield property only available to rent from March to October. No individual septic tanks were identified on the shoreline walk with all properties assumed to be connected to one of the five community septic tanks situated around the voe. Due to the large number of houses in the Mid Yell area these three self-catering properties are unlikely to have much effect on seasonal fluctuations. In Mid Yell there is also a school, care home, The Hilltop bar and restaurant, a shop, a health centre, a leisure centre with a swimming pool and a local community hall. The local amenities such as the bar and restaurant, shop and leisure centre will probably see an increase in visitors during the summer months but the school will be closed during these months so will therefore have a decrease in usage.

Boats/Shipping

Boat traffic in the Mid Yell Voe area is largely associated with mussel and salmon farming and also leisure boats. C&S Mussels who own both the Seafield and Camb fisheries berth a large workboat used to service their sites at the Linkshouse Pier, which was used to carry out the boat work for the survey and was on site at the Camb fishery during the shoreline walk. Creel fishermen are also known to use the Linkshouse Pier to land their catch. At the time of the survey no boats were berthed at the Linkshouse Pier. Meridian Salmon Farms Ltd. who own a number of salmon farms in the Yell and Unst area have a shorebase at Ravensgio (Figure 12) on the

south shore of Mid Yell Voe which they use to service their sites around Yell. At the shorebase a large workboat was berthed at the pier, but other workboats are known to work out of this shorebase. There was a marina (Figure 13) adjacent to the Meridian Salmon Farms shorebase which had sixteen boats berthed and two small boats lying on the walkways of the marina. Also two boats were on trailers beside the marina. All these boats looked to be used for leisure purposes. At the Seafield Pier there were three small rowing boats moored on the land above the pier and one boat was observed in a shed adjacent to the pier. Three small disused fishing boats were moored on the land next to a house near the Ravensgio Pier. Three sailing boats were observed on land near the Linkshouse Pier, two next to the Linkshouse Septic Tank and one on the beach east of the pier.

Farming and Livestock

The land on the shoreline survey was mostly rough grazing. Sheep were frequently observed grazing on both the northern and southern shorelines with a total of 271 animals observed. In the built up areas of Seafield, Camb and Mid Yell most sheep were observed in fenced areas below houses with no access to the shore. Open grazing where the animals had access to the shore was more frequent around the head of the voe and it was present again at the end of the survey near the Skerry of Lussetter, however these animals present at the end of the survey may have had difficulty accessing the shore due to the steep escarpments and rocky shoreline below. Approximately 30 animals were seen outside the fenced area on the shore in the Seafield area near the start of the survey (Figure 14). Sheep faeces were noted is most areas where animals were grazing however there were two occasions where sheep faeces were noted on the grassy verges outside the fenced areas where animals were grazing.

Shetland ponies were observed on two occasions both on the northern shoreline in fenced areas below houses in the Seafield and Camb areas (Figure 15). The four animals noted did not have access to the shore.

Three agricultural sheds were noted on the northern shoreline in the Seafield and Camb areas adjacent to houses, however all were located some distance from the shore.

Land Use and Land Cover

Rough grassland dominated both northern and southern shorelines of the production area. Wet boggy areas were present near the start of the shoreline walk characterised with a yellow green moss and long stemmed green leaves, possibly yellow iris. Heather was present amongst the grassland on the southern shoreline near the head of the voe.

The northern shoreline was characterised by a slight escarpment leading to stony beaches below before levelling out as you moved towards the head of the voe. At the head of the voe lowland areas with small grassy verges led to stony beaches. Moving onto the southern shoreline and towards the Mid Yell area the lowland areas with stony beaches continued before heightening after the Ravensgio Septic Tank to areas of long grass on the verges and steep escarpments leading to small sandy beaches below. The shoreline levelled out again as you approached the more built

up area near the Linkshouse Pier before a final incline to the Skerry of Lussetter with a steep escarpment and rocky shoreline. Grazing varied between open and fenced areas, however in some areas where the animals were not fenced in the steep escarpments may have prevented the animals from accessing the shore.

There was some rainfall in the days preceding the shoreline walk with wet boggy areas noted on three occasions at the start of the shoreline walk, however two watercourses that were outlined on the survey plan to be sampled were not, as there was no areas of running water at these locations just wet boggy ground.

Watercourses

Five watercourses were sampled on the shoreline walk, all of which were on the sample plan. Two watercourses which were outlined in the plan on the northern shoreline were not sampled as there was no running water at the locations outlined in the plan. Flow rate was recorded at all five watercourses.

Wildlife/Birds

Artic terns, cormorants, gulls and eider dicks were observed on buoys or in the water around the fisheries during the boat work, with bird faeces present on the majority of the buoys at the fisheries (Figure 16). Other than two crows and one gull seen in flight and a group of 20 eider ducks near the Seafield Pier, birds were not commonly observed until reaching the head of the voe where a number of bird species were observed. Gulls, oystercatchers, curlews and sandpipers were seen in flight, in the water or feeding on the foreshore. On approaching the settlement of Mid Yell, approximately 34 gulls were seen in a field with grazing sheep. Also near the salmon processing factory, what looked to be a discharge to the sea attracted approximately 30 gulls to feed. Mussel shells were observed regularly on grassy verges or on stony beaches near the head of the voe to the Meridian Salmon shorebase. An otter was observed in the water on the southern shoreline near Gardie.

General observations

Recorded observations apply to the date of survey only. Animal numbers were recorded on the day from the observer's point of view. This does not necessarily equate to total numbers present as natural features may obscure individuals and small groups of animals from view.

Dimensions and flows of watercourses are estimated at the most convenient point of access and not necessarily at the point at which the watercourse enters the voe.

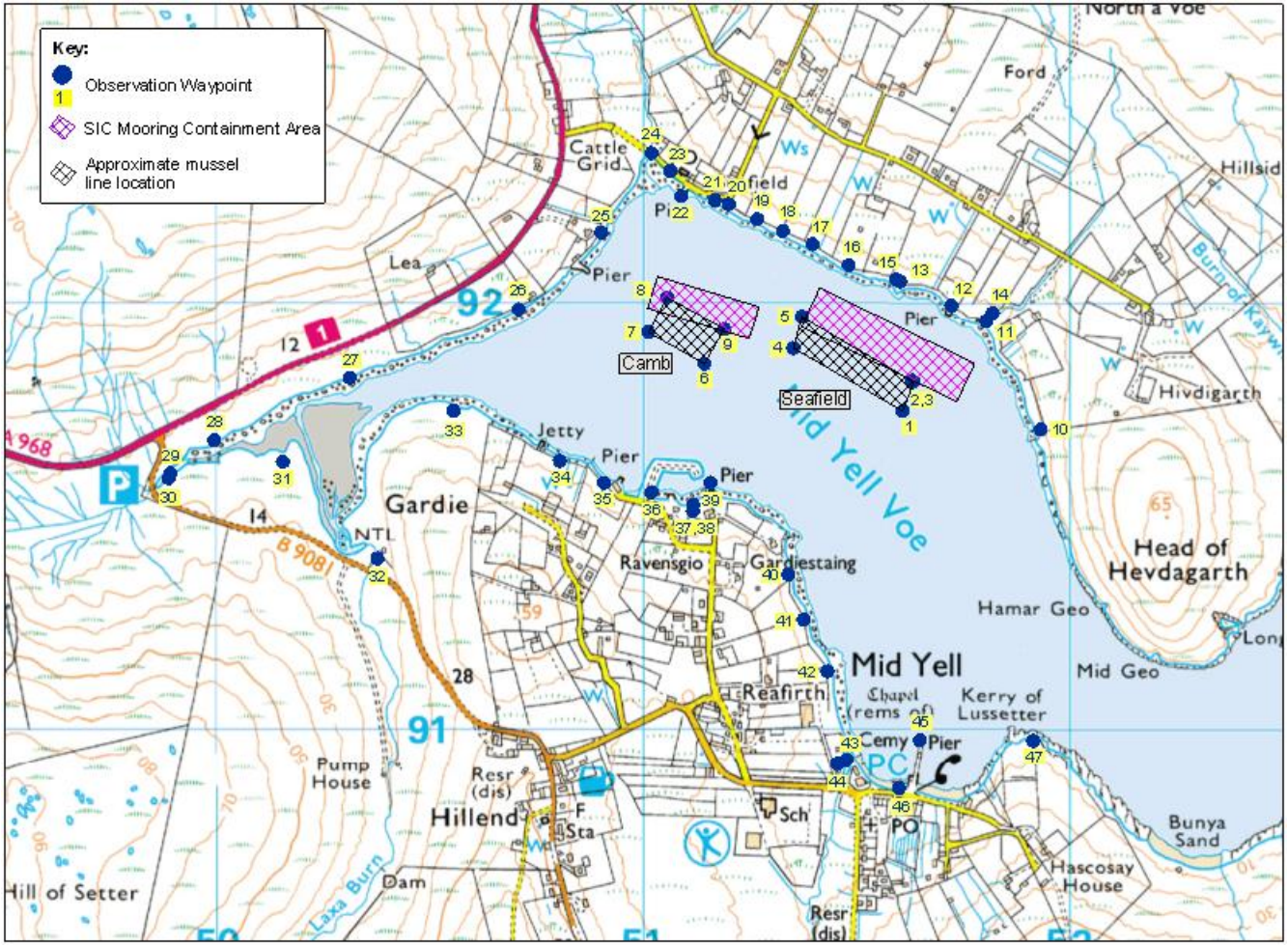

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Figure 1 Map of shoreline observations

Table 1 Shoreline Observations

No.	Date/Time (UT)	NGR	Easting	Northing	Associated Photograph	Associated Sample	Description
1	26/06/2013 07:49	HU 51607 91744	451607	1191744			Weather: Sunny, partly cloudy. Wind direction NNW (335°G), light breeze. Sea state small wavelets, not breaking, no white caps. SW corner of Seafield fishery. 6x double header long lines. Droppers 8m, mussels on site.
2	26/06/2013 07:52	HU 51633 91813	451633	1191813			SE corner of Seafield fishery. Two artic terns observed on buoys at the site.
3	26/06/2013 07:57	HU 51629 91816	451629	1191816		MYV-MUSS01 (Top), MYV-MUSS02 (Bottom), MYV-SW01	Salinity Profile 1 collected (ppt/°C): 10m 35.19/10.6, 5m 35.30/10.2, 3m 35.36/10.2, surface 35.35/10.5. Mussels collected from furthest east line just north of the SE corner buoy. Surface sample collected from the top of a mussel line, bottom sample collected from the bottom of a mussel line. Seawater sample collected. One cormorant on a buoy at the south end of the site.
4	26/06/2013 08:17	HU 51350 91892	451350	1191892		MYV-MUSS03 (Top), MYV-MUSS04 (Bottom), MYV-SW02	NW corner of the Seafield fishery. Salinity Profile 2 collected (ppt/°C): 10m 35.43/10.3, 5m 35.52/10.2, 3m 35.50/10.2, surface 35.43/10.4. Mussels collected from the furthest west line at the NW corner buoy. Surface sample collected from the top of a mussel line, bottom sample collected from the bottom of a mussel line. Seawater sample collected. One cormorant and one gull observed on buoys at the site. One eider duck swimming towards the site. Bird faeces observed on most of the buoys at the site.
5	26/06/2013 08:29	HU 51371 91966	451371	1191966			NE corner of the Seafield fishery. One cormorant observed on a buoy at the south end of the site.

6	26/06/2013 08:32	HU 51142 91855	451142	1191855			SW corner of the Camb fishery. 6x double header long lines. Droppers 5m, mussels on site. Bird faeces present on most of the buoys at the site.

7	26/06/2013 08:37	HU 51010 91930	451010	1191930		MYV-MUSS05 (Top), MYV-MUSS06 (Bottom), MYV-SW03	NW corner of the Camb fishery. Salinity Profile 3 collected (ppt/°C): 10m 35.20/11.2, 5m 35.37/10.4, 3m 35.39/10.4, surface 35.34/10.4. Mussels collected from the furthest west line at the NW corner buoy. Surface sample collected from the top of a mussel line, bottom sample collected from the bottom of a mussel line. Seawater sample collected. One gull observed on a buoy at the north of the site.
8	26/06/2013 08:52	HU 51054 92011	451054	1192011	Figure 16		NE corner of the Camb fishery. Three gulls observed on buoys at the site. Bird faeces observed on buoys at the site.
9	26/06/2013 08:59	HU 51189 91937	451189	1191937			SE corner of the Camb fishery.
10	26/06/2013 10:05	HU 51931 91701	451931	1191701			Start of the shoreline walk at Hivdigarth. Rough grassland, quite boggy. Approximately thirty occupied houses along the northern shoreline in the Camb/Seafield area. Ten sheep grazing in the field above the shore, fenced in, no access to the shore. Sheep droppings were present on the grassy verge outside the fenced area. Northern shoreline characterised with grassy verges slight escarpments leading to stony beaches. An unoccupied house was situated at the top of the field at the start of the survey. Two crows seen in flight.
11	26/06/2013 10:16	HU 51804 91955	451804	1191955	Figure 10	MYV-FW01	Large fast flowing watercourse leading to the shore. Dark brown peaty colouration. Freshwater sample taken (on survey plan) and flow rate

							measured; width 25 cm, depth 7 cm, flow 0.546 m/s, st. dev. 0.009 m/s. Derelict house observed a small distance up the hill.
12	26/06/2013 10:22	HU 51721 91991	451721	1191991			Thirty sheep observed on the shore outside the fenced area. House present some distance above the shore near the road. Agricultural shed noted next to a house.
13	26/06/2013 10:27	HU 51601 92048	451601	1192048			Thirty sheep and two Shetland ponies observed in a fenced field above the shore below houses located near the road, no access to the shore.
14	26/06/2013 10:39	HU 51819 91974	451819	1191974	Figure 6		North a Voe Septic Tank not noted at the start of the survey so tracked back to locate the septic tank. Located up the hill adjacent to the large watercourse mentioned in WP011.
15	26/06/2013 10:44	HU 51591 92053	451591	1192053	Figure 4		Seafield and Camb fisheries.
16	26/06/2013 10:47	HU 51481 92087	451481	1192087			Very wet boggy ground, no water flowing.
17	26/06/2013 10:50	HU 51395 92136	451395	1192136			Very wet boggy ground, no water flowing between Seafield and Camb fisheries. Long stemmed green leaves (possibly yellow iris) and yellow/green moss present. Agricultural shed observed above the road next to houses. One gull seen in flight.
18	26/06/2013 10:54	HU 51326 92167	451326	1192167			Black pipe most likely land drainage with small clear water discharge. Very little water flow down to shore.
19	26/06/2013 10:56	HU 51266 92195	451266	1192195			Five sheep in fenced area above the shore, no access to the shore.
20	26/06/2013 11:00	HU 51199 92230	451199	1192230			Field drain under the road, little water flow, two pools of stagnant water. Long stemmed green leaves present.

21	26/06/2013 11:04	HU 51167 92239	451167	1192239			Occupied house situated on the shore. Shed next to the house used to store peats and a boat. Old clay pipe observed next to the house a small clear discharge coming from the end of the pipe most likely land drainage. Twenty ducks observed in the sea close to the shore.
22	26/06/2013 11:08	HU 51088 92248	451088	1192248		MYV-SW04	Pier at Seafield, seawater sample obtained from the end of the pier, Salinity profile 4 - salinity and temperature measurements taken at 1m depth and the surface (ppt/°C): 1m 35.27/10.9, surface 35.42/10.8. Derelict house and out buildings just across the road from the pier near the shore. Three small rowing boats on land next to the pier. One occupied dwelling a small distance up the hill.
23	26/06/2013 11:16	HU 51062 92307	451062	1192307			Seafield Septic Tank.
24	26/06/2013 11:20	HU 51018 92350	451018	1192350		MYV-FW02	Large watercourse coming under the road leading to the shore. Dark brown peaty colouration. Freshwater sample taken (on survey plan) and flow rate measured; width 230 cm, depth 30 cm, flow 0.045 m/s, st. dev. 0.014 m/s. Occupied house above the road adjacent to the burn. Two large pipes observed above the burn most likely leading to the Seafield Septic Tank.
25	26/06/2013 11:33	HU 50900 92163	450900	1192163	Figure 5, Figure 14 & Figure 15		Two Shetland ponies observed in a fenced field below an occupied house and shed up from the shore, no access to the shore. Another house noted some distance from the shore above the road. Sheep on the shore, mentioned in WP012 moving towards the head of the voe.
26	26/06/2013 11:42	HU 50706 91983	450706	1191983			Rough grassland. Ten oystercatchers taking flight from the water. Two houses above the road and one associated agricultural shed.

27	26/06/2013 11:50	HU 50310 91822	450310	1191822			Birds more numerous in this area approaching the head of the voe. Four oystercatchers and two gulls observed in flight and one gull observed in the water. Four curlews in flight. Mussel shells observed in high numbers along the shore on the small stony beaches. Lowland area, small grassy verges and stony beaches.
28	26/06/2013 11:57	HU 49992 91675	449992	1191675			Three sandpipers observed feeding on the foreshore. Approximately ten sheep grazing in the fields above the shore, open grazing with access to the shore. Sheep droppings present on the shore. Long grass on low verges near the water's edge at the head of the voe.
29	26/06/2013 12:01	HU 49889 91598	449889	1191598			Sheep skeleton observed just up from the shore.

30	26/06/2013 12:05	HU 49885 91586	449885	1191586		MYV-FW03	Large watercourse at the head of the voe, coming under the road. Freshwater sample taken (on survey plan) and flow rate measured; width 110 cm, depth 40 cm, flow 0.095 m/s, st. dev. 0.014 m/s. Seven sheep observed, open grazing with access to the shore.
31	26/06/2013 12:15	HU 50153 91625	450153	1191625			Six oystercatchers and two gulls observed in flight. Mussel shells still present along the shore. Sheep droppings also present all along the shore. Heather present amongst the grassland.
32	26/06/2013 12:30	HU 50374 91398	450374	1191398		MYV-FW04	Large watercourse coming under the road. Freshwater sample taken (on survey plan) and flow rate measured; width 140 cm, depth 20 cm, flow 0.165 m/s, st. dev. 0.04 m/s. Twenty three sheep observed on the hill, open grazing with access to

							the shore.
33	26/06/2013 12:40	HU 50553 91745	450553	1191745			One otter observed in the water near the shore. Two gulls observed in flight. Lowland stony beach landscape.
34	26/06/2013 12:46	HU 50802 91627	450802	1191627			Thirty sheep in fenced area above the shore with no access to the shore. One sheep in a poor condition observed on the shore outside the fenced area. Sheep droppings and mussel shells present along the shoreline. Two occupied houses and one derelict house observed up the hill some distance from the shore.
35	26/06/2013 12:50	HU 50906 91576	450906	1191576			Outside the fenced area adjacent to the Meridian Salmon shorebase, small white perforated pipe with a very small discharge of water with a white colouration. Two sheep observed outside the fenced area on the shore.

36	26/06/2013 12:55	HU 51018 91553	451018	1191553	Figure 12 & Figure 13		Twenty two sheep in a fenced area below four houses above the Meridian Salmon shorebase. One large workboat moored at the shorebase pier. Mid Yell marina, sixteen boats moored in the marina. Two boats out of the water on the walkway of the marina and one small fishing boat and one small rowing boat on land on trailers.
37	26/06/2013 12:59	HU 51115 91510	451115	1191510			Ravensgio Septic Tank. Fifteen occupied dwellings observed up from the shore.
38	26/06/2013 13:02	HU 51116 91524	451116	1191524	Figure 7	MYV-SW05	Seawater sample taken next to a pipe discharging to the shore below the Ravensgio Septic Tank.

39	26/06/2013 13:05	HU 51156 91576	451156	1191576			Salinity profile 5 - Salinity and temperature measurements taken at the end of the pier near the septic tank at 2m depth and the surface (ppt/°C): 2m 35.20/11.3, surface 35.05/12.1. Occupied house just up from the shore and three small disused fishing boats on land below the house.
40	26/06/2013 13:20	HU 51339 91361	451339	1191361			Landscape changes from stony beaches with seaweed to higher escarpments. Four houses observed some distance from the shore, one house located closer to the shore. Two oystercatchers in flight and five sheep observed in a fenced field with no access to the shore.
41	26/06/2013 13:23	HU 51375 91255	451375	1191255			Sixty six sheep in three fenced fields below houses, no access to the shore. Long grass on the verges at the shoreline, steep escarpments with small sandy beaches below. Thirty gulls observed in the field and four gulls in flight. Ten houses observed up from the shore.
42	26/06/2013 13:28	HU 51431 91133	451431	1191133	Figure 8		Meridian Salmon Farms, salmon processing factory. Area 10m out from the shore where water was disturbed creating a circular zone. Possibly discharge from a pipe from the factory where approximately thirty gulls were feeding. No visible pipe could be seen coming from the shore.

43	26/06/2013 13:43	HU 51475 90926	451475	1190926		MYV-FW05	Large watercourse coming under the road adjacent to the cemetery. Freshwater sample taken (on survey plan) and flow rate measured; width 140 cm, depth 35 cm, flow 0.05 m/s, st. dev. 0.002 m/s. Pipe above the watercourse most likely associated with the septic tank.

44	26/06/2013 13:46	HU 51453 90916	451453	1190916			Cemetery Septic Tank. Plant material overgrown on the top of the septic tank could hear water running.
45	26/06/2013 13:55	HU 51648 90971	451648	1190971	Figure 9	MYV-SW06	Linkshouse Pier, no boats moored here at present, seawater sample and salinity profile 6 collected (ppt/°C): 10m 35.50/11.2, 5m 35.27/11.0, 3m 35.22/11.3, surface 34.51/12.8. Public toilets located at the head of the pier. Old pipe leading to the water at the head of the pier, may be associated with the toilets, possibly disused.
46	26/06/2013 14:09	HU 51599 90859	451599	1190859	Figure 11		Linkshouse Septic Tank. Two sailing boats ashore next to the septic tank. Approximately twenty houses in the area south of the Linkshouse Pier, up the hill. Sandy beach to the east of the pier with one small sailing boat on the beach.
47	26/06/2013 14:17	HU 51914 90970	451914	1190970			Thirty sheep at the Skerry of Lussetter, open grazing with access to the shore however access may have been difficult as steep escarpments, rocky shoreline below. Upper Mid Yell another twenty three houses observed. End of the shoreline walk.

Sampling

Water and shellfish samples were collected at the locations indicated in Figures 2 and 3. Two freshwater samples outlined in the survey plan were not obtained due to there being no water flowing at the two locations outlined. All samples were transported initially by a cool backpack and then in a cool box to SSQC Ltd. for analysis within 24 hours of sample collection.

Bacteriology results are present in Table 2 and 3 and mapped in Figures 2 and 3.

Seawater samples were also tested for salinity at SSQC Ltd. In the field salinity profiles were collected using a YSI Professional Plus handheld meter and CT probe which had an accuracy of (± 0.35 ppt). Results are presented in Table 4 and locations of the profiles are mapped in Figure 2.

Table 2 Water sample *E.coli* results

No.	Sample Ref.	Date/Time (UT)	Position	Type	*E.coli* (cfu/100ml)	Salinity*
1	MYV-SW01	26/06/2013 07:57	HU 51629 91816	Sea Water	<1	34.99
2	MYV-SW02	26/06/2013 08:17	HU 51350 91892	Sea Water	<1	35.17
3	MYV-SW03	26/06/2013 08:37	HU 51010 91930	Sea Water	<1	34.99
4	MYV-FW01	26/06/2013 10:16	HU 51804 91955	Fresh Water	3300	-
5	MYV-SW04	26/06/2013 11:08	HU 51088 92248	Sea Water	12	34.77
6	MYV-FW02	26/06/2013 11:20	HU 51018 92350	Fresh Water	70	-
7	MYV-FW03	26/06/2013 12:05	HU 49885 91586	Fresh Water	30	-
8	MYV-FW04	26/06/2013 12:30	HU 50374 91398	Fresh Water	80	-
9	MYV-SW05	26/06/2013 13:02	HU 51116 91524	Sea Water	60	34.62
10	MYV-FW05	26/06/2013 13:43	HU 51475 90926	Fresh Water	50	-
11	MYV-SW06	26/06/2013 13:55	HU 51648 90971	Sea Water	90	33.99

*Practical Salinity Scale 1978 (PSS-78)

Table 3 Shellfish sample *E.coli* results

No.	Sample Ref.	Date/Time (UT)	Position	Type	Depth	*E.coli* (MPN/100g)
1	MYV-MUSS01	26/06/2013 07:57	HU 51629 91816	Common Mussel	Top	130
2	MYV-MUSS02	26/06/2013 07:57	HU 51629 91816	Common Mussel	Bottom	80
3	MYV-MUSS03	26/06/2013 08:17	HU 51350 91892	Common Mussel	Top	110
4	MYV-MUSS04	26/06/2013 08:17	HU 51350 91892	Common Mussel	Bottom	110
5	MYV-MUSS05	26/06/2013 08:37	HU 51010 91930	Common Mussel	Top	50
6	MYV-MUSS06	26/06/2013 08:37	HU 51010 91930	Common Mussel	Bottom	40

Table 4 Salinity profiles

Profile	Date/Time (UT)	Position	Depth (m)	Salinity (ppt) (± 0.35 ppt)	Temperature (°C)
1	26/06/2013 07:57	HU 51629 91816	surface	35.35	10.5
			3	35.36	10.2
			5	35.30	10.2
			10	35.19	10.6
2	26/06/2013 08:17	HU 51350 91892	surface	35.43	10.4
			3	35.50	10.2
			5	35.52	10.2
			10	35.43	10.3
3	26/06/2013 08:37	HU 51010 91930	surface	35.34	10.4
			3	35.39	10.4
			5	35.37	10.4
			10	35.20	11.2
4	26/06/2013 11:08	HU 51088 92248	surface	35.42	10.8
			1	35.27	10.9
5	26/06/2013 13:05	HU 51156 91576	surface	35.05	12.1
			2	35.20	11.3
6	26/06/2013 13:55	HU 51648 90971	surface	34.51	12.8
			3	35.22	11.3
			5	35.27	11.0
			10	35.50	11.2

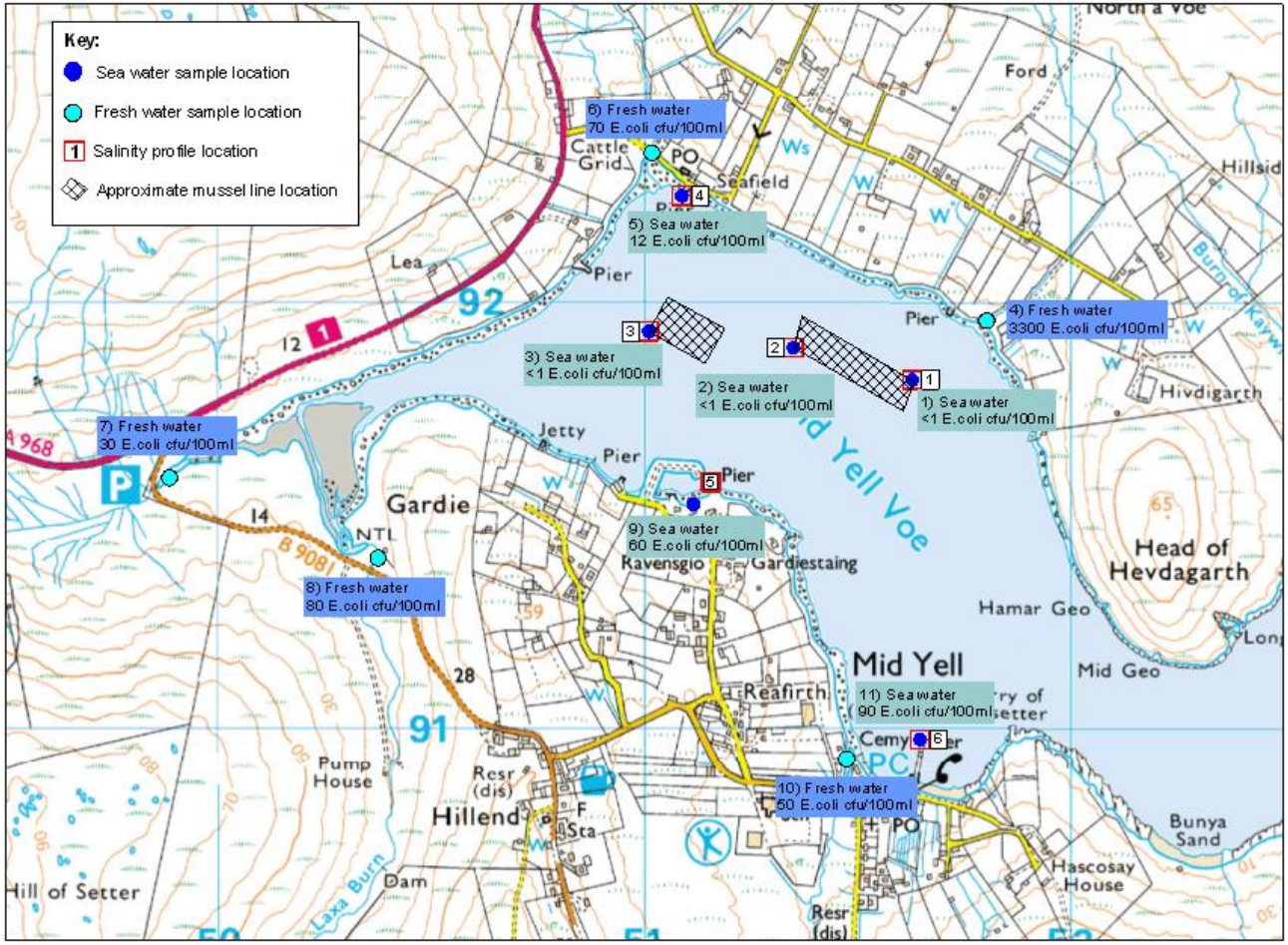

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Figure 2 Map of water sample results and salinity profile locations

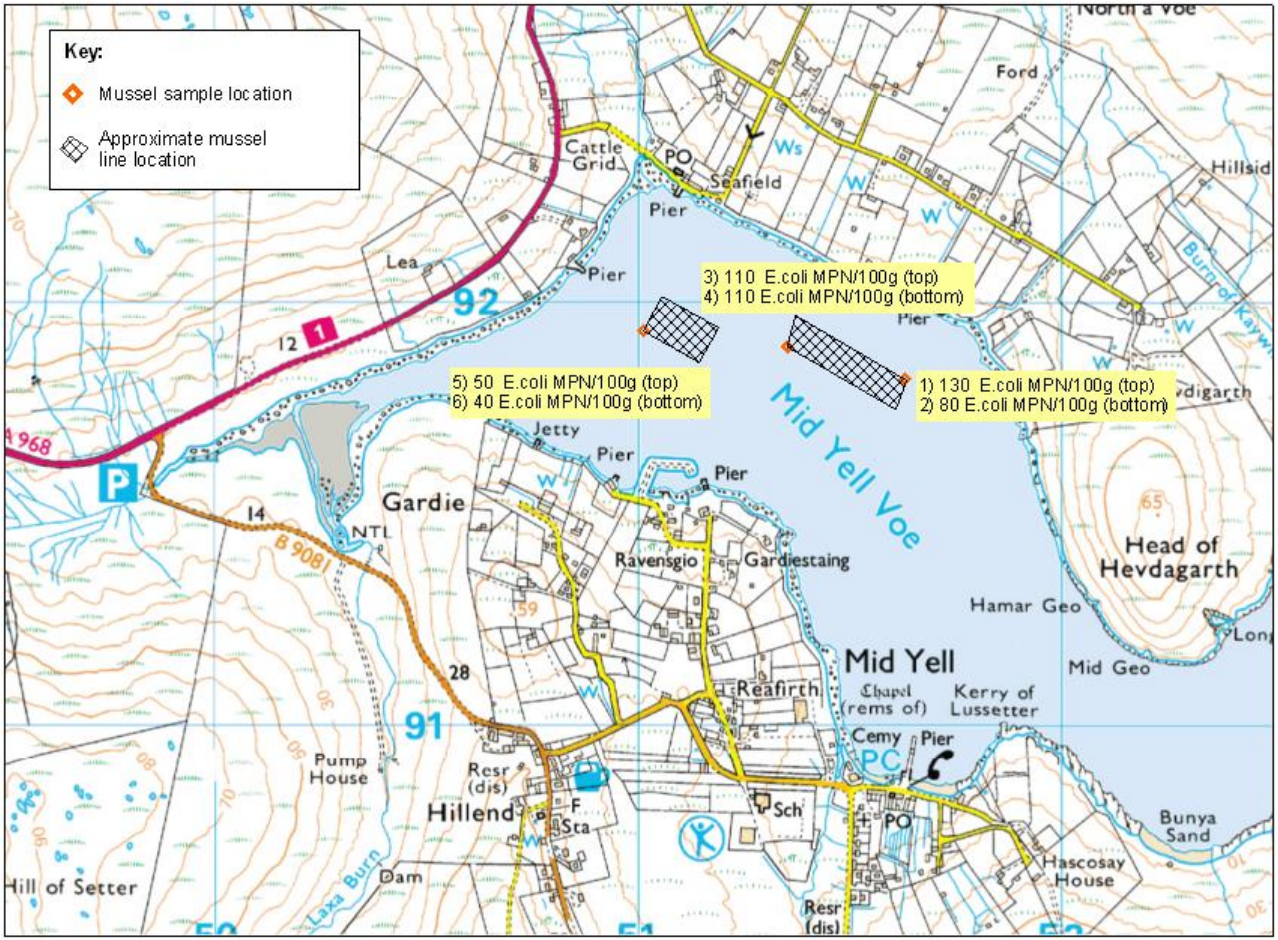

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Figure 3 Map of shellfish sample results

Photographs

Figure 4 – Mussel lines at the Seafield fishery looking south to Mid Yell.

Figure 5 – Mussel lines at the Camb fishery looking south to Mid Yell, with a workboat on site.

Figure 6 – North a Voe Septic Tank

Figure 7 – Sea water sample being obtained near the Ravensgio Septic Tank discharge pipe.

Figure 8 – Zone of disturbance in the water where gulls were feeding, possible discharge from the salmon processing factory at Reafirth.

Figure 9 – Public toilets at the Linkshouse Pier, pipe leading to the sea possibly associated with discharge from the toilets.

Figure 10 – Large watercourse sampled adjacent to the North a Voe Septic Tank.

Figure 11 – Linkshouse Septic Tank adjacent to the Linkshouse Pier.

Figure 12 – Meridian Salmon Farms shorebase at Ravensgio.

Figure 13 – Mid Yell marina at Ravensgio.

Figure 14 – Sheep with access to the shore near Seafield.

Figure 15 – Shetland ponies in a field below a house at Seafield.

Figure 16 – Bird faeces on a buoy at the Camb fishery.

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