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# Scottish Sanitary Survey Project



## Restricted Sanitary Survey Report

Arisaig: Morar Sands

HL 005 204 16

December 2009



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## Report Distribution – Arisaig: Morar Sands

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\* Distribution of both draft and final reports to relevant agency personnel is undertaken by FSAS.

\*\* Distribution of draft and final reports to harvesters is undertaken by the relevant local authority.

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## 1. Area Overview

Arisaig: Morar Sands lies outside Morar Bay on the western coast of Scotland, southeast of the Isle of Skye. Morar Sands lies at the mouth of the River Morar and is 2 km in length, 0.5 km wide at the mouth and 1 km wide at its widest point. The depth of Morar Bay varies from 0 to 10 m and it is exposed to the West. The shellfish bed is situated south of the town of Mallaig.



Figure 1.1 Location of Arisaig: Morar Sands

## 1.1 Land Cover

The majority of Morar Bay is composed of littoral sediment. The land cover adjacent to Morar Bay on the southern end is a mixture of heath land, neutral grassland, calcareous grassland and some improved grassland inland. The land cover north of Morar Bay is predominantly neutral grassland, heath land and coniferous woodland. Inland to the east of Morar Bay there are patches of bracken, heath land and coniferous woodland. The areas of improved grassland on the southern side of Morar Bay would be expected to contribute significant amounts of contaminated runoff after heavy rainfall. Information on landcover was obtained from LCM2000 data.

## 1.2 Human Population

Census information obtained from the General Register Office for Scotland identifies there are two census output areas directly adjacent to Arisaig: Morar Sands production area, plus an additional 7 associated with Mallaig further to the north. These are shown in Figure 1.2. The census output area to the south of the estuary has a population of 173 and the area to the north has a population of 105. The main settlements are Mallaig, 2.7 km to the north, and Morar on the east coast of the estuary. Mallaig has a population of 797, while Morar has 257 (2001 UK census). Mallaig harbour is a busy fishing port. A ferry service also runs from Mallaig to Skye, the Small Isles and the Knoydart peninsula. Contamination of the northern end of the fishery may arise from Mallaig. However, the more direct impacts from human faecal contamination to the fishery would be expected to be into the River Morar.

Some seasonal increase in population is expected during the summer months as there is a campground located near the southern end of the production area.



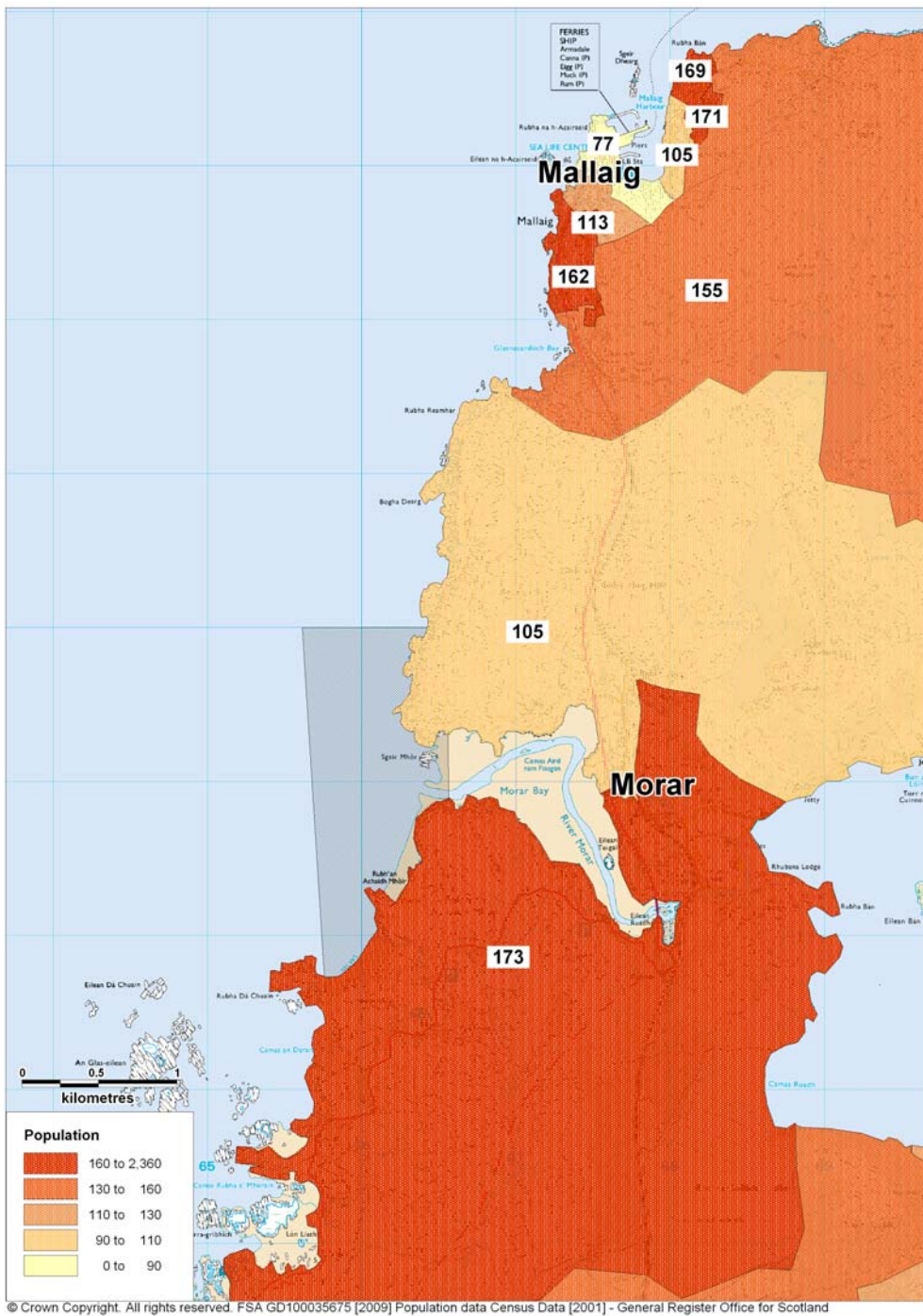


Figure 1.2 Population of Arisaig: Morar Sands

## 2. Fishery

The fishery at Arisaig: Morar Sands is comprised of a wild razor clam (*Ensis spp.*) bed within the Arisaig: Morar Sands (SIN HL 005 204 16) production area.

The production area boundaries are given as the area bounded by lines drawn between NM 6646 9400, NM 6561 9400 and NM 6576 9163 and between NM 6656 9288 and NM 6656 9331 extending to MHWs.

There is currently no RMP assigned to this area. The razor bed at Morar Sands does not lie within designated shellfish waters.

The razor beds lie within the production area, although the exact boundaries are not known. Harvesting of razors is by diving and takes place throughout the year.



Figure 2.1 Arisaig: Morar Sands fishery



### 3. Sewage Discharges

Community septic tanks and sewage discharges were identified by Scottish Water for the area surrounding Arisaig: Morar Sands. They are detailed in Table 3.1 and mapped in Figure 3.1.

Table 3.1 Discharges identified by Scottish Water

Discharge Name	SEPA Ref No.	NGR of discharge	Discharge Type	Level of Treatment	Consented flow m <sup>3</sup> /day	Consented/design pop
Morar	CAR/L/1002008	NM 673933	Continuous	Septic tank	70	300
Morar (Bracora)	68/78	NM 684923	Continuous	Septic tank	15	50
Mallaig STW	CAR/L/1001647	NM 67349675	Continuous	Secondary	1728	2000
Mallaig STW EO	CAR/L/1002115	NM 67349675	Intermittent	6mm screening, EO	Not stated	Not stated
Mallaig P/S No1 Cameron Ave	T/B 10/65/91(00)	NM 682977	Intermittent	EO only	Not stated	Not stated
Mallaig P/S No2 East Bay	T/B 10/66/91(00)	NM 680969	Intermittent	EO only	Not stated	Not stated
Mallaig P/S No3 Public Toilets	T/B 10/67/91(00)	NM 677969	Intermittent	EO only	Not stated	Not stated
Mallaig P/S No4 West Bay	T/B 10/68/91(00)	NM 674971	Intermittent	EO only	Not stated	Not stated
Mallaig P/S No5 St Elmo	T/B 10/69/91(00)	NM 674968	Intermittent	EO only	Not stated	Not stated
Mallaig P/S No6 Harbour	NA	Unknown	Intermittent	EO only	Not stated	Not stated
Mallaig Fank Brae ST	T/B 10/131/88	NM 673958	Continuous	Septic tank	18	Not stated
Mallaig Playing Fields ST	T/12/88	NM 672963	Continuous	Septic tank	19	167

No sanitary or microbiological data were available for these discharges.

A number of discharge consents were issued by SEPA for the area of Arisaig: Morar Sands. These are listed in Table 3.2 and mapped in Figure 3.1. At the time of writing this report, details for all the additional SEPA consents referenced in the above table were not available.

Table 3.2 SEPA discharge consents

Ref No.	NGR of discharge	Discharge Type	PE	Discharge Vol m <sup>3</sup> per day	Discharge to:
CAR/L/1001647	NM 6726 9685	Treated sewage (Mallaig STW)	2000	1728	Sound of Sleat
CAR/R/1023783	NM 6748 9578	Domestic	5	-	Land (via soakaway)
CAR/R/1025259	NM 6659 9165	Domestic	8	-	Land (via soakaway)

Septic tanks and outfall pipes were also observed during the shoreline survey and these are listed in Table 3.3. Their locations have been included in the mapped discharges in Figure 3.1. Further details can be found in the shoreline survey report in the appendix.

Table 3.3 Observations of potential sewage discharges

No.	Date	NGR	Description of potential sewage discharge
1	10/12/2008	NM67373 93494	Dripping overflow from septic tank
2	10/12/2008	NM67374 93479	Seepage from septic tank overflow
3	10/12/2008	NM66427 91941	Old campsite toilets
4	10/12/2008	NM68466 92419	Morar Bracora septic tank



Figure 3.1 Sewage discharges at Arisaig: Morar Sands

The input from the Morar and Morar (Bracora) community septic tanks and the potential discharges listed in Table 3.3 would be expected to have a more direct effect on the microbiological quality of the razor clams than would the discharges in the Mallaig area.

## 4. Animals

### 4.1 Livestock

During the shoreline survey, 35 sheep were observed on the shoreline on the north side of Morar Bay. A single cow was spotted on the southern side of the bay (see Figure 4.1).

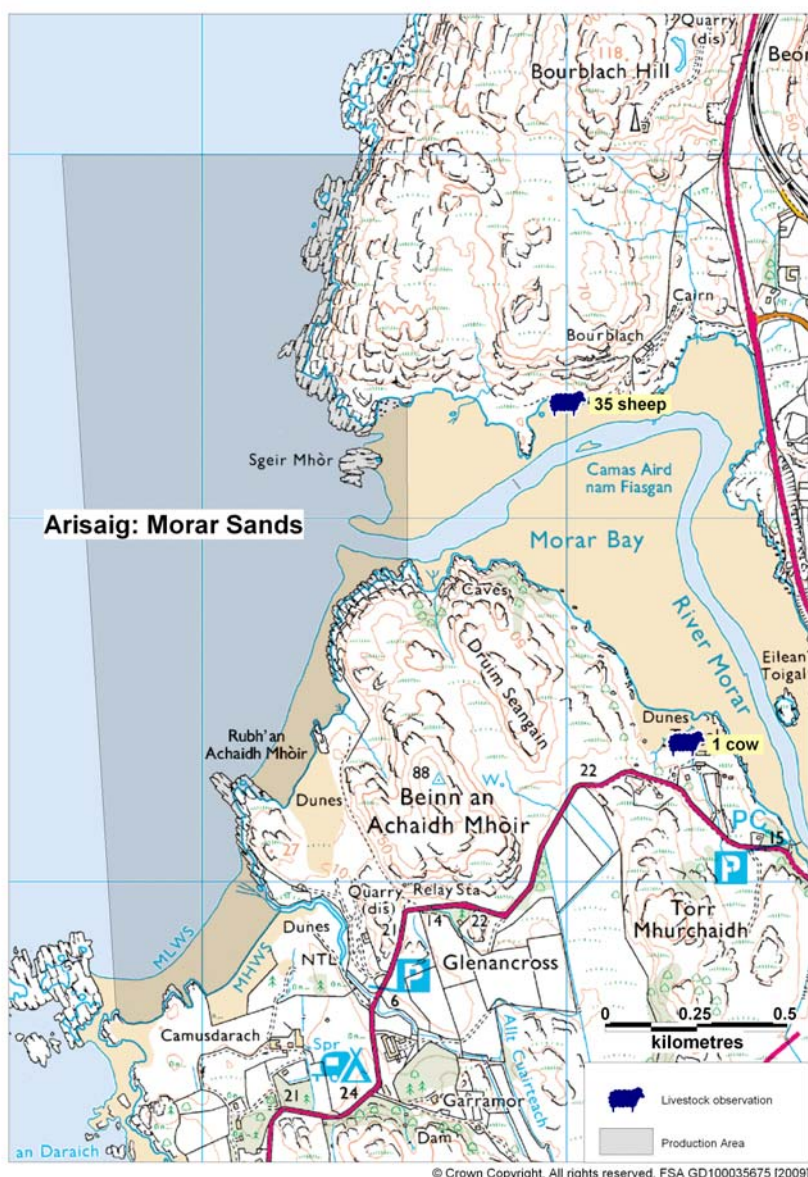


Figure 4.1 Livestock observations at Arisaig: Morar Sands

Livestock will be presumed to be present in relatively small numbers year round. Sheep may graze throughout the more hilly regions. A few small farms or crofts appear to be marked out on the map; however these are relatively few due to the rugged terrain. Livestock will not, therefore, be considered a significant source of faecal contaminants to the fishery, particularly when compared to the numbers of human sewage inputs.

## 4.2 Wildlife

During the shoreline survey no wildlife was observed. Species common to the area include seals and otters in Morar Bay and a variety of seabirds and waders including cormorants/shags, various ducks., gulls, hooded crows, grey heron, oyster catchers, curlew, turnstone, snipe, and plovers. Contamination from seabirds and shorebirds is most likely to impact the fishery at its eastern boundary, where it meets the Morar estuary.

According to the local authority, dolphins and whales are occasionally spotted in the area though faecal contamination from these animals is likely to be limited in duration and area and unpredictable in terms of timing. Deer are likely to be present in the area, and any impact from deer faeces is likely to occur via streams.

The Sea Mammal Research Unit recorded the number of common seals in sub regions of Scotland in 2000. A total of 597 common seals were recorded within the Arisaig sub region. The Arisaig sub region boundaries stretch from Mallaig north, 2.7 km north of the Morar Sands production area to Smirisary, 15 km south of the production area. Exact haul out sites for the seals are not known.



## 5. Rainfall

The nearest weather station is located at Rhubana, approximately 2.4 km east of the production area. However rainfall data was only available for three years and was incomplete. The Inverailort weather station is located 14 km south east of Morar Sands. Rainfall data was supplied for the period 01/01/2003 to 12/12/2007 (total daily rainfall in mm). Data was available for the whole period of 1826 days and was either covered by total daily rainfall data or total monthly rainfall data. Even though the Inverailort station is further away, as its records are complete it will be presumed that rainfall recorded there is indicative of what was likely to have fallen within the catchment area for Morar Sands.

High rainfall and storm events are commonly associated with increased faecal contamination of coastal waters through surface water run-off from land where livestock or other animals are present, and through sewer and wastewater treatment plant overflows (e.g. Mallin et al, 2001; Lee & Morgan, 2003).

### 5.1 Rainfall at Inverailort

As the rainfall records from Inverailort are complete, total annual rainfall and mean monthly rainfall can be calculated, and are presented in Figures 5.1 and 5.2.

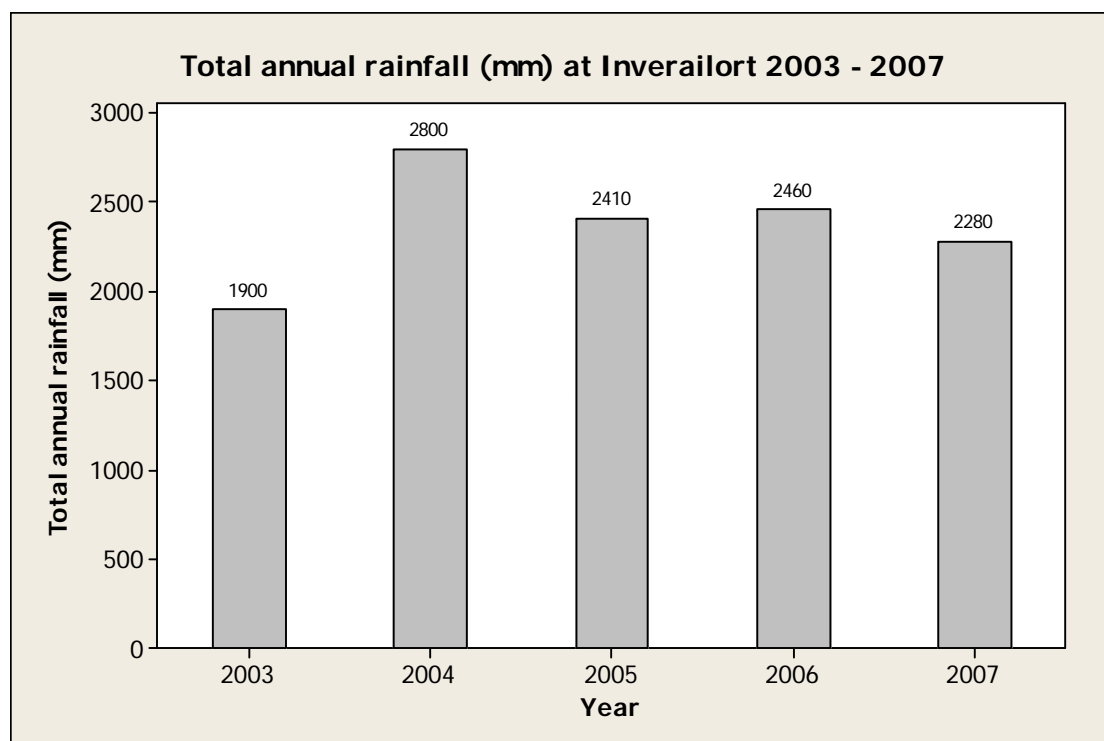


Figure 5.1 Total annual rainfall at Inverailort 2003 – 2007

The total rainfall varied significantly from year to year with 2003 being drier than average and 2004 wetter than average.

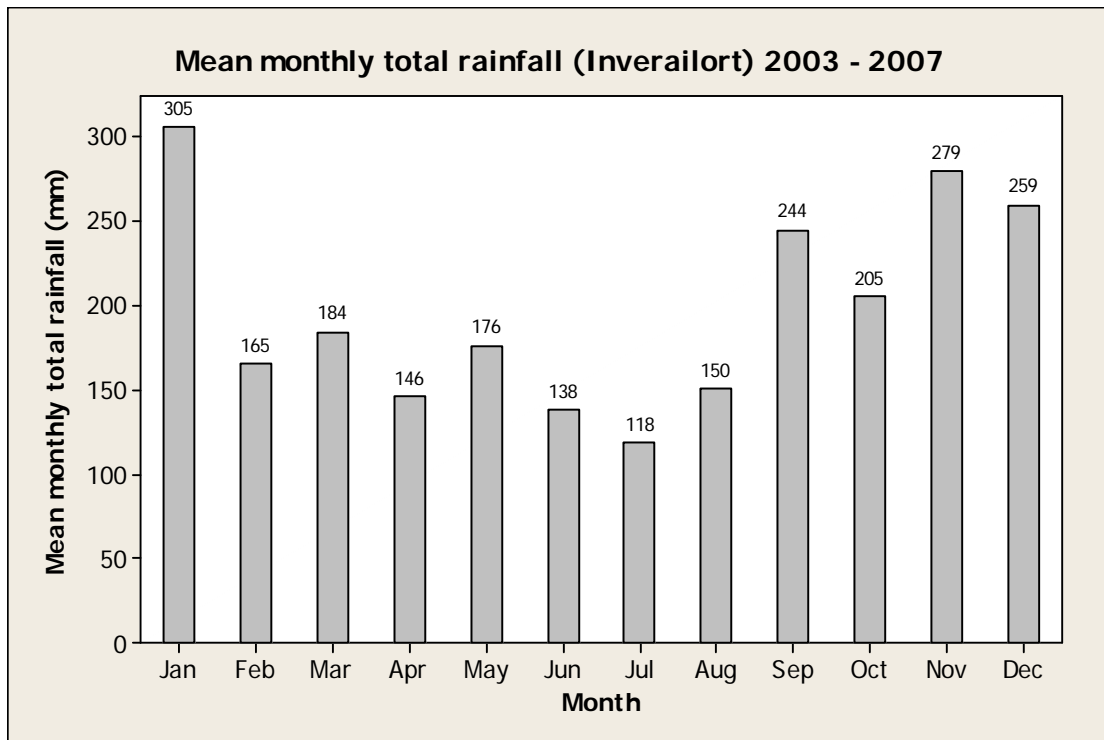


Figure 5.2 Mean total monthly rainfall at Inverailort 2003 – 2007

January was by far the wettest month, though mean rainfall was elevated from September to January, inclusive. There appears to be a seasonal pattern to the rainfall with a relatively dry period occurring from February to August, inclusive with the remainder of the year significantly wetter. Daily rainfall figures could not be calculated for Inverailort during this period as some of the rainfall data is only provided in monthly totals.

Periods of increased rainfall are generally associated with higher levels of contaminated surface water runoff. However, the catchment area for the bay and its streams is small and contamination via these sources may be present at any time of year after a rainfall.

Increased land run-off may occur when rainfall occurs after dry weather. In this area this is most likely to occur in September.

Faecal contaminants from other sources may be independent of rainfall and so episodes of contamination may occur outside identified periods of higher rainfall, for example when livestock are present on the shoreline.

## 6. River Flow

There is no river gauging station in the vicinity of Arisaig: Morar Sands.

The River Morar goes through Morar Bay and drains into Morar Sands. There are also several other burns discharging into the Arisaig Morar Bay and Morar Sands area, see Figure 6.1. The following rivers, streams and burns were sampled during the shoreline survey. These represented the largest freshwater inputs to Arisaig: Morar Sands.

The streams sampled at the time of the shoreline survey contained between <100 and 3300 cfu *E. coli*/100 ml. Calculated loadings are based on the flows and dimensions observed during the shoreline survey only.

Of the two streams with counts >100 *E. coli* per 100ml, and for which loadings could be calculated, one was located at the south side of Morar Bay and one on the coast south of the bay. Although the *E. coli* concentration of the River Morar was low on the day of sampling the volume of the river means that it is likely to contribute significantly to the *E. coli* loading to the bay.

The two inputs with the highest loadings discharged to the south side of Morar Bay and to the southern end of the production area respectively. The former would be expected to be diluted significantly before reaching the fishery whereas the latter will impact directly in the fishery in the near vicinity.

Table 6.1 Streams and loadings – Arisaig: Morar Sands

No	Grid Ref	Description	Width (m)	Depth (m)	Measured Flow (m/s)	Flow in m <sup>3</sup> /day	<i>E. coli</i> (cfu/100ml)	Loading ( <i>E. coli</i> per day)
1	NM66782 93331	Stream	0.20	0.10	0.042		<100	^
2	NM67016 93330	Stream	*	*	*	*	<100	^
3	NM67366 93511	Stream	1.00	0.15	0.220		<100	^
4	NM67568 93498	Burn	1.30	0.30	0.288		<100	^
5	NM68122 92228	River Morar	24.00	0.50	1.305		<100	^
6	NM67743 91970	Burn	1.00	0.20	0.116		<100	^
7	NM67330 92382	Stream	0.80	0.10	0.049		1800	3.9 x 10 <sup>4</sup>
8	NM66439 92463	Stream	0.10	0.05	*	*	<100	^
9	NM66241 91914	Burn	1.30	0.15	0.482		3300	6.3 x 10 <sup>5</sup>

\*Too small to measure

^ Loadings not calculated for streams with *E. coli* concentrations of <100/100ml.

Where the bacterial loading is labelled as 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 1 x 10<sup>3</sup>, in this case it would be written as 1E+3.



Figure 6.1 Location of stream flows and loadings at Arisaig: Morar Sands



## 7. Bathymetry and Hydrodynamics

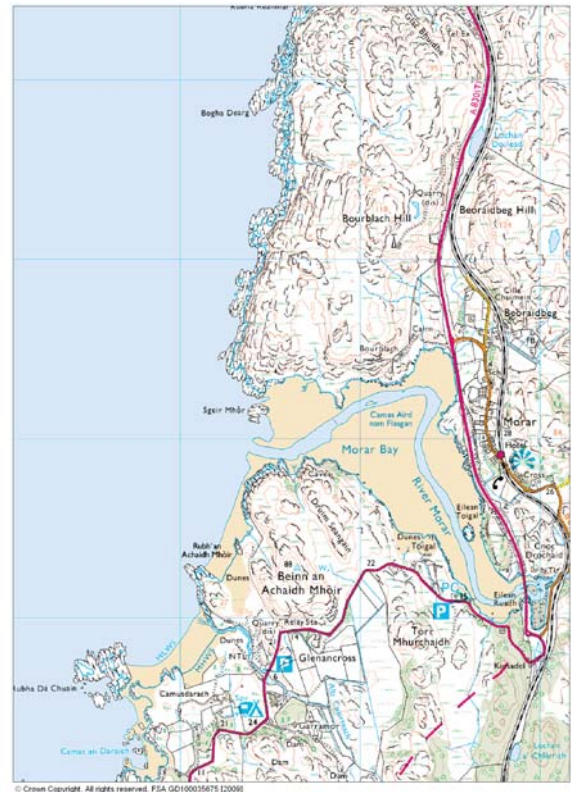
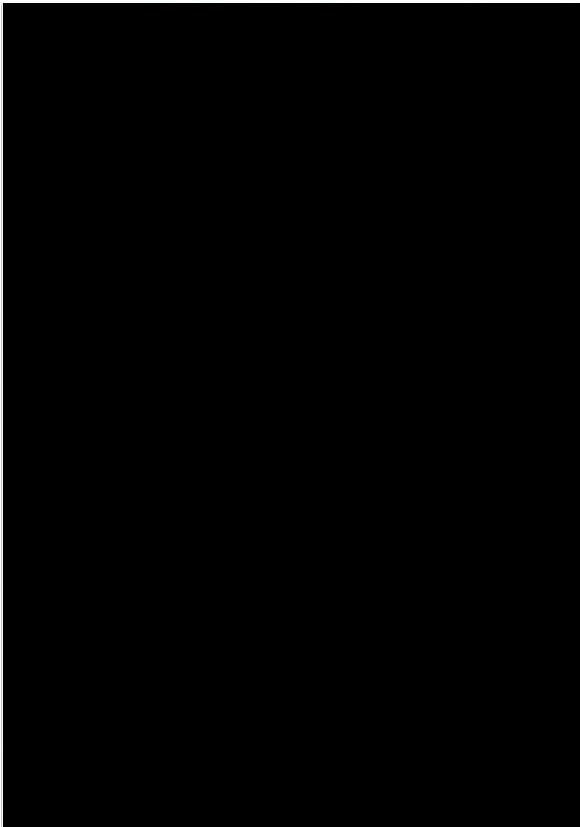


Figure 7.1 Arisaig: Morar Sands Bathymetry  
Figure 7.2 Arisaig: Morar Sands

The bathymetry chart above shows that the mouth of the River Morar and a small band of the coastline is a drying area. After the drying areas the depth then rapidly increases with distance from the coastline from 0 to over 50 m.

### 7.1 Tidal curve and description

The two tidal curves below are for the port of Mallaig, the nearest secondary port– they have been output from UKHO TotalTide. The first is for seven days beginning 00.00 GMT on 14<sup>th</sup> April 2008. The second is for seven days beginning 00.00 GMT on 22<sup>nd</sup> April 2008. Together they show the predicted tidal heights over high/low water for a full neap/spring tidal cycle.

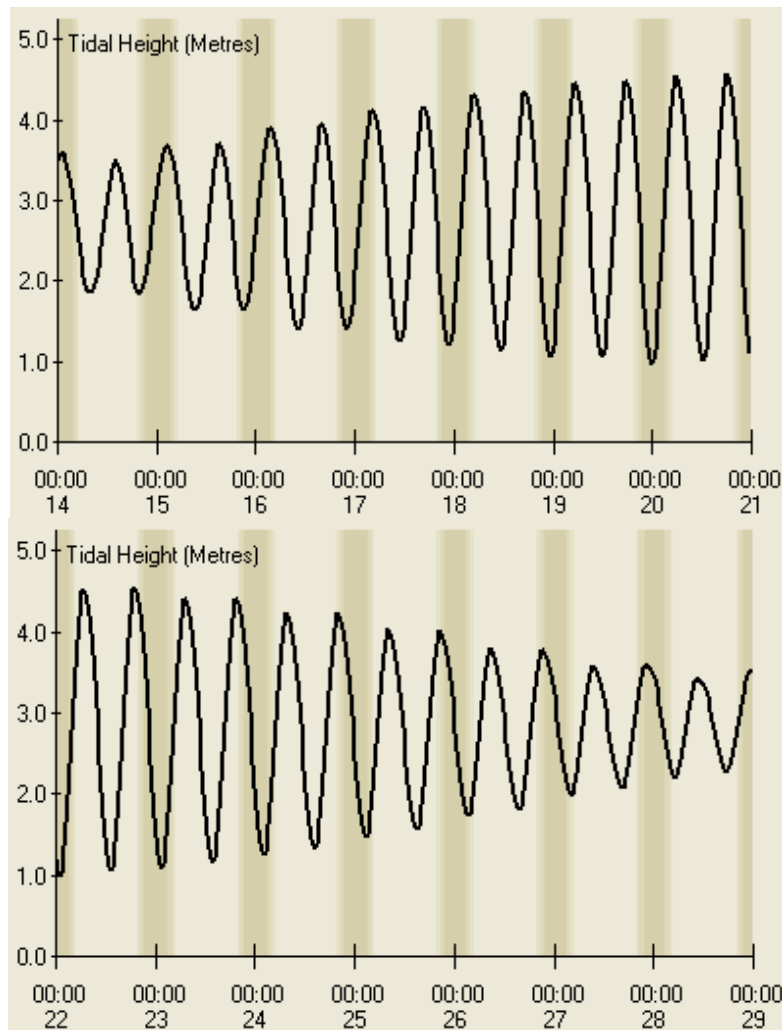


Figure 7.3 Tidal curves for Mallaig

The following is the UKHO summary description for Mallaig:  
The tide type is Semi-Diurnal.

MHWS	5.0 m
MHWN	3.6 m
MLWN	2.1 m
MLWS	0.8 m

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Predicted heights are in metres above chart datum. The tidal range at spring tide is therefore approximately 4.2 m and at neap tide 1.5 m.

### Currents

No tidal stream information is available for Arisaig: Morar Sands (no tidal diamonds are within a 10 km range of the site).

Tidal flows between Ardnamurchan and Mallaig are generally no more than 0.5 m/s except where they run along the eastern side of the small islands of Much and Eigg (Clyde Cruising Club 2006).

### Conclusions

The relatively slow tidal flows combined with the depth reduce the likely impact to the fishery of sewage discharges to the north at Mallaig. However, it should be noted that under some wind conditions, surface flows could carry contaminants further south along the shoreline than might happen under prevailing conditions.

Contamination arising within Morar Bay will be taken out over the fishery as the tide ebbs and then south towards Rubh 'an Achaid.

## 8. Historical *E. coli* Monitoring Data

### 8.1 Validation

The *E. coli* results of all the shellfish samples taken from Arisaig: Morar Sands from the middle of 2004 up to the most recent samples taken in 2008 were extracted from the database and validated according to the criteria described in the standard protocol for validation of historical *E. coli* data.

No samples were rejected on the basis of sampling date discrepancies.

All *E. coli* results are reported in most probable number per 100 g of shellfish flesh and intravalvular fluid.

### 8.2 Summary of sampling and results by species/monitoring point

A summary of the number of samples and the *E. coli* results is presented in Table 8.1.

Table 8.1 Summary of historical results from Arisaig: Morar Sands

<b>Sampling Summary</b>	
<b>Production area</b>	<b>Arisaig: Morar Sands</b>
<b>Site</b>	Morar Sands
<b>Species</b>	Razor fish
<b>SIN</b>	HL 005 204 16
<b>Location</b>	All (13)
<b>Total no of samples</b>	28
<b>n 2004</b>	10
<b>n 2005</b>	4
<b>n 2006</b>	3
<b>n 2007</b>	6
<b>n 2008</b>	5
<b>Results Summary</b>	
<b>Minimum</b>	10
<b>Maximum</b>	500
<b>Median</b>	20
<b>Geometric mean</b>	33
<b>90 percentile</b>	19
<b>95 percentile</b>	62.5
<b>n exceeding 230/100g</b>	1 (3.57%)
<b>n exceeding 1000/100g</b>	0 (0%)
<b>n exceeding 4600/100g</b>	0 (0%)
<b>n exceeding 18000/100g</b>	0 (0%)



### 8.3 Temporal pattern of results

Figure 8.1 presents a scatterplot of the individual log *E. coli* results against date for all razor clam samples taken from Arisaig: Morar Sands.

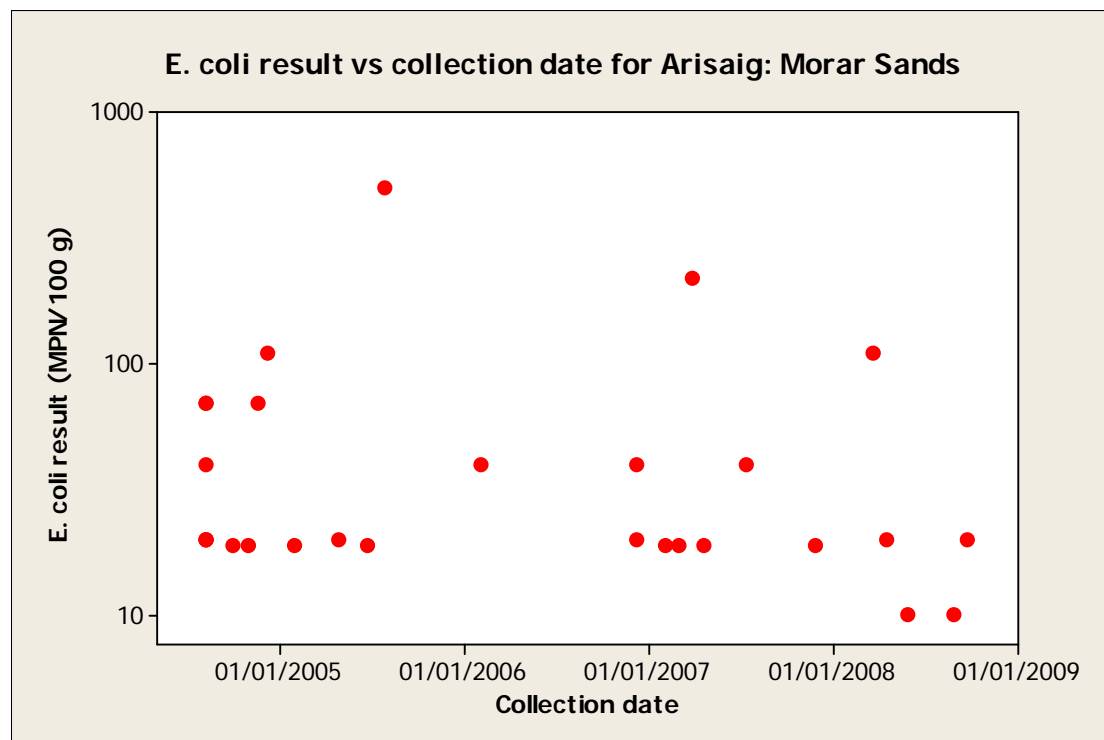


Figure 8.1 Scatterplot of *E. coli* result (MPN/100 g) for razor fish vs collection date on log scale

No overall trends are apparent from Figure 8.1. There is a gap in sampling with only three samples submitted in 2006.

### 8.4 Geographical pattern of results

Figure 8.2 shows a thematic map with the *E. coli* results plotted at the sampling locations of razor clams at Arisaig: Morar Sands. Monitoring results were higher in the northern half of the production area. It is also clear that the production area as currently drawn does not cover the entire shellfish bed as a number of samples fell outside the northern production area boundary. However, lower results were observed to the south.

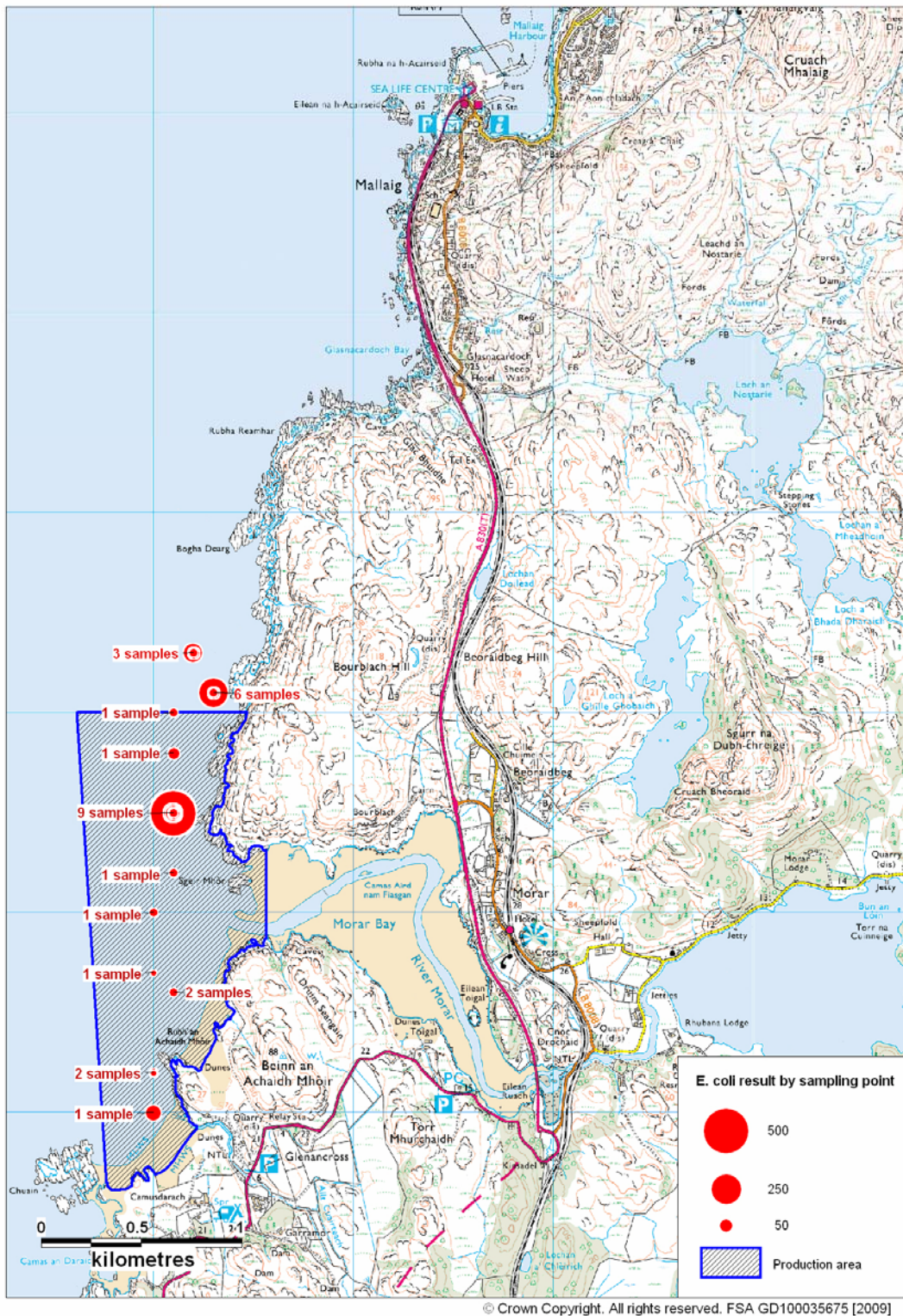


Figure 8.2 *E. coli* result (MPN/100 g) by sampling location for razor fish at Arisaig: Morar Sands

## 9. Shoreline Survey Overview

A restricted shoreline survey of the Arisaig: Morar Sands area was undertaken by staff from Highland Lochaber Council on 10<sup>th</sup> December 2008 and 10<sup>th</sup> February 2009.

A number of septic tanks and overflow from septic tanks were recorded during the shoreline survey.

There is some small boating activity especially in the summer in Morar Bay. Mallaig 3 km north of the production area is a busy fishing port. A ferry service also runs from Mallaig to Skye, the Small Isles and the Knoydart peninsula.

Both freshwater and seawater samples were collected from around the survey area. One freshwater sample was found to be heavily contaminated. Seawater sample results ranged from 1 to 540 *E. coli* CFU/100 ml with highest result seen at the far southern end of the production area. Freshwater sample results ranged from <100 to >100000 *E. coli* CFU/100 ml, the most contaminated of which was taken from discharge pipe in Morar Bay

Razor samples were collected at three points along the production area. Samples taken from the north end and centre of the site had low results of <20 *E. coli* (MPN/100 g). The sample collected at the southern end of the site had a higher result of 170 *E. coli* (MPN/100 g).

Figure 9.1 shows the relative locations of the most significant findings. Only fresh water samples with an *E. coli* result >100 CFU/100 ml have been labelled.

In summary, identified sources of most significant contamination are:

- Dripping overflow from Morar septic tank
- Sewage and septic tank overflows
- Livestock present on the shoreline



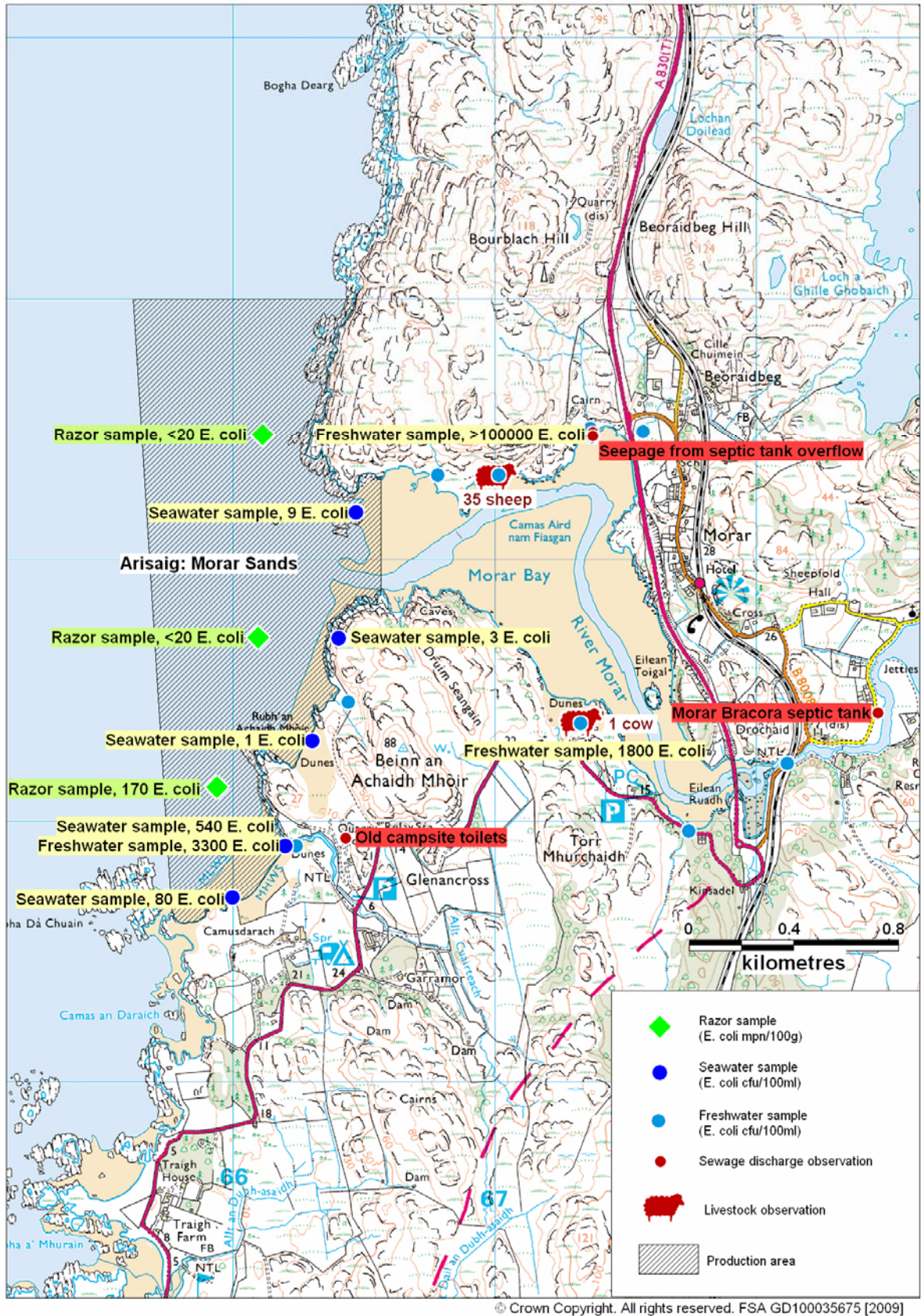


Figure 9.1 Summary of shoreline observations

## 10. Overall Assessment

### Human sewage inputs

The settlement of Morar is located on the eastern side of Morar Bay, 1 km from the Arisaig: Morar Sands production area. Morar has a population of 257 (2001 UK census). There are two community septic tanks serving this area. The Morar (Bracora) septic tank at the western end of Morar Bay and furthest from the production area discharges a lower volume than the Morar septic tank which is located closer to shellfish bed. At the time of the shoreline survey, the Morar septic tank overflow was producing seepage which tested at >100000 *E. coli* CFU per 100 ml.

### Agricultural inputs

The land surrounding the Morar Bay coastline is primarily used for arable agriculture. During the shoreline survey 35 sheep were observed grazing on the northern shoreline of Morar Bay, 0.5 km away from the production area. A single cow was also observed on the southern shoreline of Morar Bay.

### Wildlife inputs

Wildlife such as cetaceans, water birds and seals are likely to be resident in or visit the area, but not in large numbers. During the shoreline survey no wildlife was observed. Overall, the wildlife impacts to the shellfish bed at Arisaig Morar Sands are likely to be localized, minor and unpredictable and will therefore not be explicitly taken into account in determining the sampling plan.

### Seasonal variation

The historical monitoring dataset was analysed and a scatter plot showed there are no patterns in seasonal variation. As little is known about the livestock husbandry of the area, it was not possible to assess seasonal variation in livestock numbers. There is likely to be an increase in human population during the spring and summer months when tourists stay in the area. Pleasure boat traffic is likely to be seasonal with activity highest in summer.

### Rivers and streams

The mouth of the River Morar discharges directly into the Morar Sands production area. A water sample taken further up the River Morar near the bridge during the shoreline survey contained a low concentration of *E. coli* (<100 *E. coli* CFU/100 ml).

In addition to streams, a fresh water discharge from the Morar septic tank overflow was also sampled and had a high result of >100,000 *E. coli* CFU/100 ml.



## Rainfall

Rainfall patterns at Inverailort show rainfall levels are higher between September and January than during the remainder of the year. An increase in rainfall, especially early in this period and after the dry summer months, may be expected to wash a flush of bacteria from the surrounding land into the production area. The impact of this is likely to be most acute nearest where the streams enter the sea.

## Hydrography

In general contamination arising from coastal sources would be expected to follow the coastline with tidal currents. Contamination arising inside Morar Bay would impact the fishery on the ebbing tide.

## Analysis of results

During the shoreline survey, seawater samples were taken from four points along the shore, stretching from north to south, with results ranging from 1 to 540 *E. coli* (CFU/100 ml), all consistent with an equivalent Class B standard. The two seawater samples taken from the southern end of the bay were more contaminated than samples taken at the northern end of the bay. Freshwater samples taken during the shoreline survey from watercourses and discharges showed in some areas highly contaminated water was entering the production area. One freshwater sample taken from an outfall pipe was found to be heavily contaminated with a result of >100000 *E. coli* (CFU/100 ml). The remaining freshwater sample results ranged from <100 to 3300 *E. coli* (CFU/100 ml).

Razor clam (*Ensis spp.*) samples were collected at three points along the production area. Samples taken from the north end and centre of the site had low results of <20 *E. coli* (MPN/100 g). The sample collected at the southern end of the site had a slightly higher result of 170 *E. coli* (MPN/100 g), this coincides with the sea water results which were also higher at the southern end of the production area.

Historic shellfish hygiene monitoring results for razor clams (*Ensis spp.*) were available from the middle of 2004 up to September 2008 (28 samples were taken in total). Results were generally low, ranging from 10 to 500 *E. coli* (MPN/100 g). The highest results were seen north of Sgier Mhor and were sampled in July 2007 (500 *E. coli* MPN/100 g) and March 2007 (220 *E. coli* MPN/100 g).

## Summary

In general, most contamination of the fishery from both animal and human sources is likely to arise from within Morar Bay and to impact on the outgoing tide. At the time of the shoreline survey, significant contamination was detected in a stream on the coast to the south of the bay and a seawater and a razor clam sample taken near to that location gave the highest results for

those samples taken during the survey. Contamination arising from the Mallaig area could impact the northern end of the fishery under certain conditions.

## 11. Recommendations

Although the highest historical result was seen in a sample taken to the north of the mouth of Morar Bay, it is expected that contamination arising from inside the Bay will, in general, impact on the fishery at the mouth and immediately to the south of this. It is therefore recommended that the RMP be located at NM 6620 9280 with a tolerance of 150 m (see Figure 11.1). Frequency of monitoring should be monthly until an assessment of stability can be made.

In order to cover the area from which samples have been obtained in the past, and which has therefore presumably been fished, it is proposed that the production area be extended northwards. However, this extension is limited to that proposed below as to avoid significantly increasing the risk of contamination arising from the Mallaig area. The proposed area is therefore the area bounded by lines drawn between NM 6655 9455, NM 6559 9455 and NM 6576 9163 and between NM 6656 9288 and NM 6656 9331 extending to MHWS (see Figure 11.1).

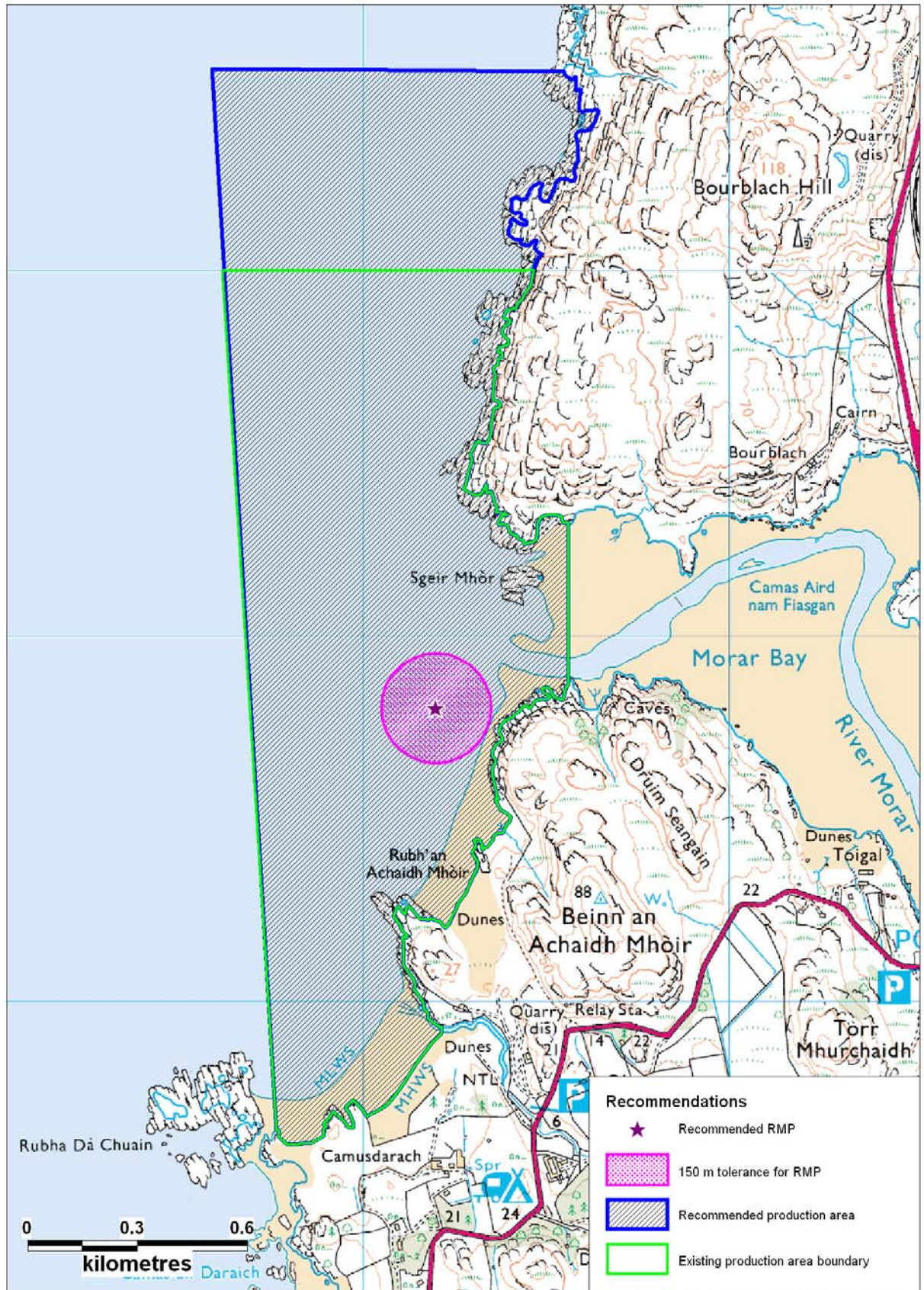


Figure 11.1 Recommendations for Arisaig: Morar Sands

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# Appendices

1. **Summary Sampling Plan**
2. **Table of Proposed Boundaries and RMPs**
3. **Shoreline Survey Report**

### Sampling Plan for Arisaig: Morar Sands

PRODUCTION AREA	SITE NAME	SIN	SPECIES	TYPE OF FISHERY	NGR OF RMP	EAST	NORTH	TOLERANCE (M)	DEPTH (M)	METHOD OF SAMPLING	FREQ OF SAMPLING	LOCAL AUTHORITY	AUTHORISED SAMPLER(S)	LOCAL AUTHORITY LIAISON OFFICER
Arisaig: Morar Sands	Morar Sands	HL 005 204 16	Razors	Wild Harvest	NM 6620 9280	166200	792800	150	NA	Diving	Monthly	Highland Lochaber Council	Stephen Lewis	Stephen Lewis

**Table of Proposed Boundaries and RMPs – Arisaig: Morar Sands**

Production Area	Species	SIN	Existing Boundary	Existing RMP	New Boundary	New RMP	Comments
Arisaig: Morar Sands	Razor clams	HL 005 204 16	The area bounded by lines drawn between NM 6646 9400, NM 6561 9400 and NM 6576 9163 and between NM 6656 9288 and NM 6656 9331 extending to MHWS	NA	The area bounded by lines drawn between NM 6655 9455, NM 6559 9455 and NM 6576 9163 and between NM 6656 9288 and NM 6656 9331 extending to MHWS	NM 6620 9280	

# Shoreline Survey Report



Arisaig: Morar Sands  
HL 005

Scottish Sanitary Survey Project  **Cefas**



## Shoreline Survey Report

Production area: Arisaig: Morar Sands  
Site name: Morar Sands  
Species: Razors  
Harvester: Mr John Grieve (Loch Leven Shellfish)  
Local Authority: Highland Lochaber  
Status: New site

Date Surveyed: 10<sup>th</sup> December 2008 & 10<sup>th</sup> February 2009  
Surveyed by: Stephen Lewis Highland Lochaber Council  
Alan Macdonald Highland Lochaber Council

Existing RMP: N/A  
Area Surveyed: See Figure 1.

### Weather observations

10<sup>th</sup> December 2008: Sunny, clear, cold and breezy.

10<sup>th</sup> February 2009: Clear, calm, cold (2-3C), dry and little rainfall in the preceding 48 hours.

### Fishery

The Arisaig Morar Sands site is harvested for Razors (*Ensis spp*). The razors are hand gathered by divers within the boundaries of the classified production area. The razors are harvested all year round.

### Sewage/Faecal Sources

The area surveyed includes the settlement of Morar at the eastern end of Morar Bay. There are two community septic tanks serving this area. Further up the coastline is the town of Mallaig where there are further septic tanks and sewage outfall pipes.

### Seasonal Population

There are several campsites/caravan parks south of Morar along the coastline. These are mostly seasonal (March – September).

### Boats/Shipping

There is some small boating activity especially in the summer in Morar Bay. Mallaig 3 km north of the production area is a busy fishing port. A ferry service also runs from Mallaig to Skye, the Small Isles and the Knoydart peninsula.

### Land Use

The land use in the surrounding area is primarily grassland with some patches of heath and woodland.

### Wildlife/Birds

The fauna that can be spotted in and around Morar Bay includes common and grey seals, otters, seabirds: cormorants/shags, various duck spp., various gulls, hooded crows, grey heron, various waders: e.g. oyster catchers, curlew, turnstone, snipe, plovers and dolphins/porpoises and the occasional whale.

Observations made during the shoreline survey are mapped in Figure 1, with details of each observation listed in Table 1.

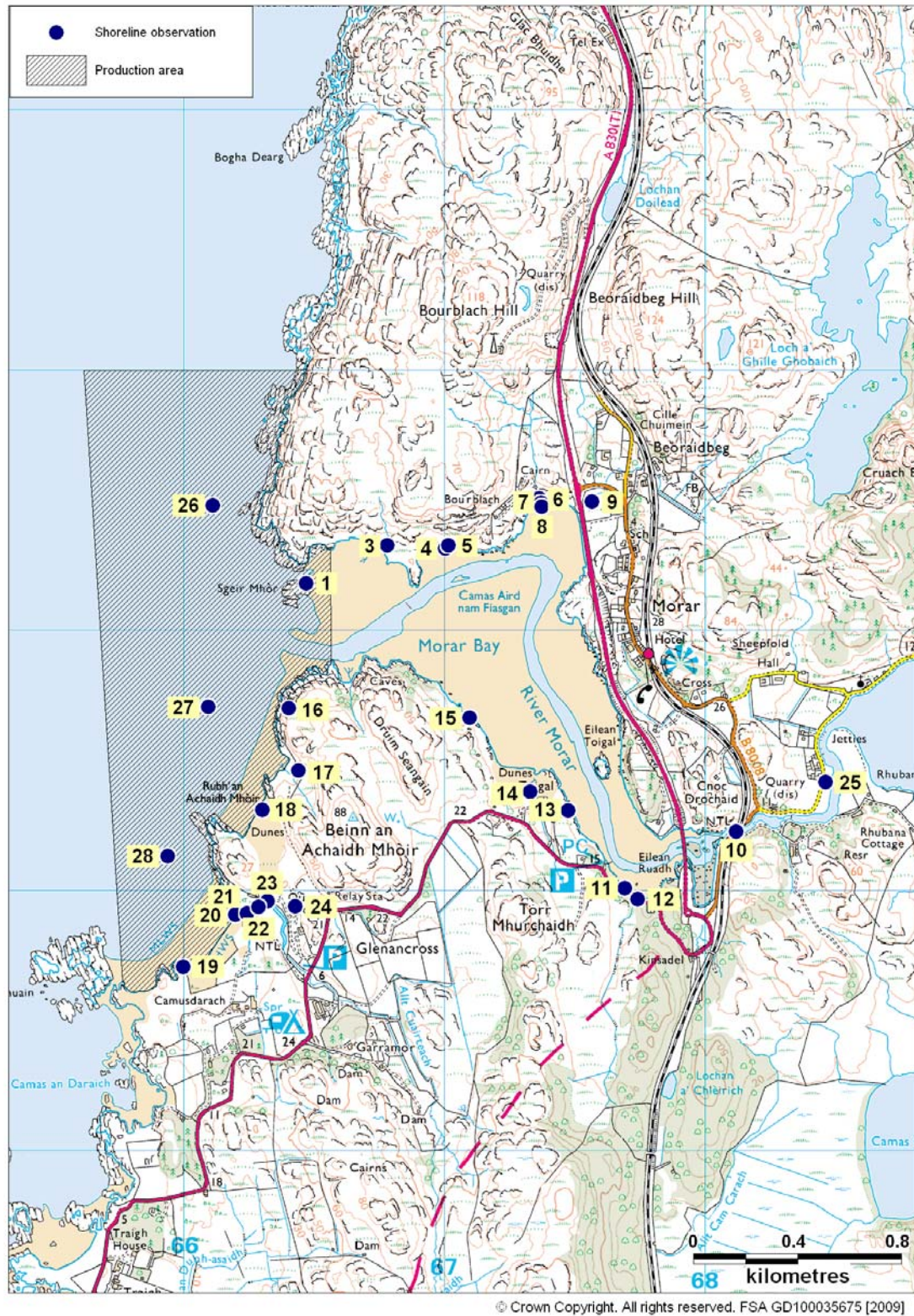


Figure 1. Shoreline survey observations

Table 1. Shoreline survey observations

No.	Date	Time	NGR	East	North	Associated photograph	Description
1	10/12/2008	09:15	NM66470 93185	166470	793185	Figure 4	Seawater sample 1, Salinity 33ppt
2	10/12/2008	09:25	N/A			Figure 5	Pictures of Morar Sands Production area
3	10/12/2008	09:45	NM66782 93331	166782	793331		Burn W 0.20, D 0.10, Flow 0.042 Freshwater sample 1
4	10/12/2008	09:55	NM67004 93318	167004	793318	Figures 6 & 7	35 sheep observed, some on shoreline
5	10/12/2008	10:00	NM67016 93330	167016	793330		Small burn, Freshwater sample 2
6	10/12/2008	10:30	NM67366 93511	167366	793511	Figure 8	Burn W 1.00, D 0.15, Flow 0.220 Freshwater sample 3
7	10/12/2008	10:40	NM67373 93494	167373	793494	Figure 9	Dripping overflow from Morar septic tank
8	10/12/2008	10:40	NM67374 93479	167374	793479		Seepage from Morar septic tank overflow, W 0.10, D <0.01 Freshwater sample 4
9	10/12/2008	10:55	NM67568 93498	167568	793498		Burn W 1.30, D 0.30, Flow 0.288, Freshwater sample 5
10	10/12/2008	11:20	NM68122 92228	168122	792228	Figure 10	River Morar, W 24.00, D 0.50*, Flow 1.305. *Estimated average from several readings. Freshwater sample 6
11	10/12/2008	11:45	NM67693 92012	167693	792012		Minor run-off from road
12	10/12/2008	11:50	NM67743 91970	167743	791970	Figure 11	Burn under road, W 1.00, D 0.20, Flow 0.116, Freshwater sample 7
13	10/12/2008	12:00	NM67476 92311	167476	792311		Minor seepage from nearby houses
14	10/12/2008	12:10	NM67330 92382	167330	792382	Figure 12	1 cow observed upstream. Burn, W 0.80, D 0.10, Flow 0.049, Freshwater sample 8
15	10/12/2008	12:15	NM67098 92666	167098	792666		Minor flow
16	10/12/2008	12:40	NM66403 92704	166403	792704	Figure 13	Seawater sample 2, Salinity 30ppt
17	10/12/2008	13:00	NM66439 92463	166439	792463		Burn W 0.10, D 0.05, Freshwater sample 9
18	10/12/2008	13:25	NM66302 92313	166302	792313		Seawater sample 3, Salinity 30
19	10/12/2008	13:50	NM65997 91710	165997	791710		Seawater sample 4, Salinity 30
20	10/12/2008	14:00	NM66197 91911	166197	791911		Seawater sample 5, Salinity 30
21	10/12/2008	14:05	NM66241 91914	166241	791914	Figure 14	Burn W 1.30, D 0.15, Flow 0.482, Freshwater sample 10
22	10/12/2008	14:10	NM66286 91939	166286	791939		Minor outflow below house
23	10/12/2008	14:10	NM66322 91963	166322	791963		Observation photograph
24	10/12/2008	14:10	NM66427 91941	166427	791941	Figure 15	Old campsite toilets
25	10/12/2008	15:10	NM68466 92419	168466	792419	Figures 16 & 17	Morar Bracora septic tank
26	10/02/2009	09:30	NM66111 93483	166111	793483	Figure 18	Seawater sample 6, Shellfish sample 1

No.	Date	Time	NGR	East	North	Associated photograph	Description
27	10/02/2009	10:00	NM66094 92708	166094	792708	Figure 19	Seawater sample 7, Shellfish sample 2
28	10/02/2009	10:30	NM65937 92135	165937	792135	Figure 20	Seawater sample 8, Shellfish sample 3

Photographs referenced in the table can be found attached as Figures 4 - 17.

## Sampling

Water samples were collected at sites marked on the map (Figure 2). Bacteriology results follow in Table 2. On the day of the survey at late notice the harvester was unable to go out on the boat and collect shellfish samples. Shellfish samples were collected at the next possible opportunity on 10<sup>th</sup> February 2009; results are shown in Table 3 and mapped in Figure 3.

Seawater samples were tested for salinity using a hand held refractometer. These readings are recorded in Table 1 as salinity in parts per thousand (ppt).

Samples were also tested for salinity by the laboratory using a salinity meter under more controlled conditions. These results are shown in Table 2, given in units of grams salt per litre of water. This is equivalent to ppt.

Table 2. Water sample results

No	Sample	Date	Grid Ref	Type	E. coli (cfu/100ml)	Salinity (g/L)
1	MSSW1	10/12/2008	NM66470 93185	Seawater	9	33
2	MSFW1	10/12/2008	NM66782 93331	Freshwater	<100	-
3	MSFW2	10/12/2008	NM67016 93330	Freshwater	<100	-
4	MSFW3	10/12/2008	NM67366 93511	Freshwater	<100	-
5	MSFW4	10/12/2008	NM67374 93479	Freshwater	>100000	-
6	MSFW5	10/12/2008	NM67568 93498	Freshwater	<100	-
7	MSFW6	10/12/2008	NM68122 92228	Freshwater	<100	-
8	MSFW7	10/12/2008	NM67743 91970	Freshwater	<100	-
9	MSFW8	10/12/2008	NM67330 92382	Freshwater	1800	-
10	MSSW2	10/12/2008	NM66403 92704	Seawater	3	31
11	MSFW9	10/12/2008	NM66439 92463	Freshwater	<100	-
12	MSSW3	10/12/2008	NM66302 92313	Seawater	1	30
13	MSSW4	10/12/2008	NM65997 91710	Seawater	80	30
14	MSSW5	10/12/2008	NM66197 91911	Seawater	540	30
15	MSFW10	10/12/2008	NM66241 91914	Freshwater	3300	-
16	MSSW6	10/02/2009	NM66111 93483	Seawater	0	30
17	MSSW7	10/02/2009	NM66094 92708	Seawater	0	32
18	MSSW8	10/02/2009	NM65937 92135	Seawater	30	

Table 3. Shellfish Sample Results

No.	Date	Sample	Grid Ref	Type	E. coli (mpn/100g)
1	10/02/2009	MSSF1	NM66111 93483	Razor clam	<20
2	10/02/2009	MSSF2	NM66094 92708	Razor clam	<20
3	10/02/2009	MSSF3	NM65937 92135	Razor clam	170





Figure 2. Water sample results





Figure 3. Shellfish sample results

Photographs



Figure 4. Location of water sample 1



Figure 5. Morar sands production area





Figure 6. Sheep observed on the shoreline



Figure 7. Sheep observed on the shoreline





Figure 8. Small burn, location of water sample 4



Figure 9. Dripping overflow from Morar septic tank





Figure 10. River Morar, location of water sample 7



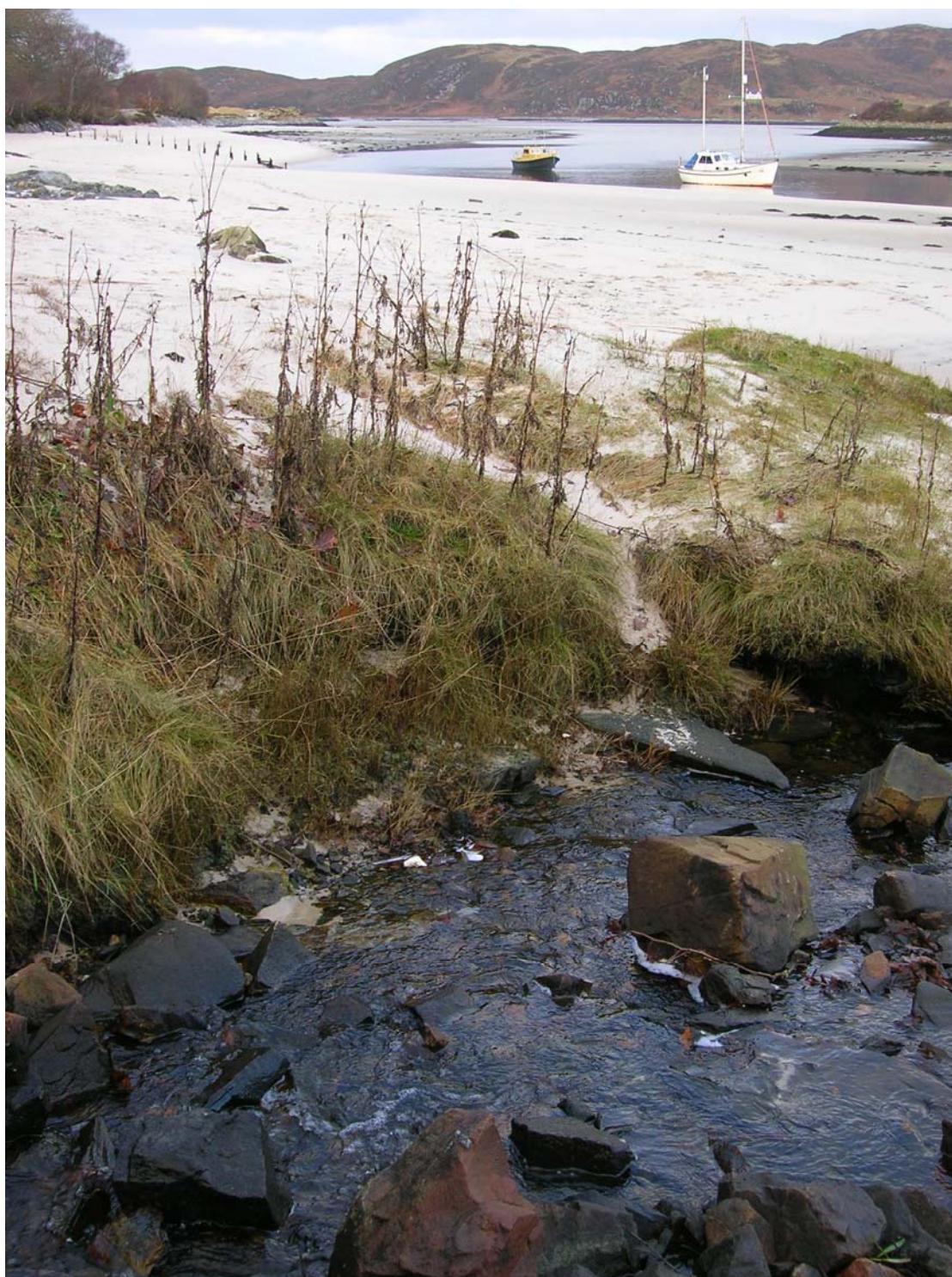


Figure 11. Small burn, location of water sample 8





Figure 12. Houses upstream. Small burn, location of freshwater sample 8



Figure 13. Location of water sample 10





Figure 14. Burn, location of water sample 15





Figure 15. Old campsite toilets





Figure 16. Signage for Morar Bracora septic tank





Figure 17. Morar/Bracora septic tank





Figure 18. Collection of Razor samples



Figure 19. Razor samples





Figure 20. Razor samples