

**DEVON AREA
INTERNAL REPORT**



**ENVIRONMENT
AGENCY**

**INVESTIGATION INTO
POTENTIAL INPUTS TO COMBE
STREAM, S. DEVON**

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(CATCHMENT 08A)**

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INVESTIGATION INTO POTENTIAL INPUTS TO COMBE STREAM, S. DEVON

1. INTRODUCTION AND TERMS OF REFERENCE

The Rivers Avon and Erme Local Environment Agency Plan (LEAP) Consultation Report highlighted Salcombe South Sands as failing to comply with the EC Bathing Waters Directive (ECBWD) in 1986, 1988, 1993 and 1996. The cause of each failure was designated as a combination of Marlborough Sewage Treatment Works (STW) and the stream.

Malborough STW was recently upgraded and at the end of April 1997 the ultraviolet disinfection unit was commissioned. The sewage passing through now receives secondary treatment with UV disinfection before being discharged into the estuary.

A request was received from Devon Area Environment Planning to investigate potential inputs into Combe Stream.

2. CATCHMENT DESCRIPTION AND BACKGROUND

The two headwaters of the Combe Stream rise at NGR SX 7082 3931 and SX 7062 3899 south of Marlborough. The stream flows in a southeasterly direction for approximately 3km through mainly agricultural land, finally discharging onto South Sands Beach, see Figure 1.

The stream is not routinely monitored for Biological or River Ecosystem Classification and therefore has no River Quality Objective assigned to it.

The watercourse is sampled at NGR SX 7284 3769 (ECBR0330 on Figure 1), at the same time as the EC Bathing Waters Directive beach site at South Sands Beach.

3. PROJECT TEAM

T. Cronin (Project Leader)
J. Bartlett (Project Manager)

4. METHOD

- 4.1 Analysis of historical routine water quality data to establish any trends and/or relationships between water quality and other factors such as rainfall and dry weather conditions.
- 4.2 Talk to the Environment Protection Officer (EPO) and interrogate the Pollution Incident Logging System (PILS) for the catchment to identify areas of potential concern.
- 4.3 Carry out an appraisal of the watercourse during both wet and dry weather conditions using visual, chemical and bacteriological methods.
- 4.4 Carry out a further chemical/bacteriological survey of the stream when peak populations of tourists are present.



5. RESULTS

5.1 HISTORIC DATA - ECB0330 (Bathing waters site)

Sampling for the EC Bathing Waters Directive runs from May to September inclusive. The historic data collected from 7 May 1992 to 29 September 1997 showed two failures which occurred in 1993 and 1996. The failure in 1993 was caused by 5 exceedances, (2 for total coliforms; on the 10 June and 20 September, and 3 for faecal coliforms; on 10 June, 6 August and 20 September). The failure in 1996 was caused by 2 exceedances, (both for faecal coliforms), on the 23 May and 28 August.

Levels of total and faecal coliforms in Combe Stream samples (ECBR0330), are not consistently proportional to the exceeded values found in the saline samples (ECB0330). The actual log faecal coliform numbers are the values recorded in the seawater, the estimated values are derived from the calculation which estimates how many of the faecal coliforms in the sample may have originated from the stream by calculating the percentage of freshwater in the saline sample.

When the dilution factor of the freshwater in the beach sample is taken into account, the estimated faecal and total coliform contribution to the beach sample from the stream could account for 1 of the exceeded values for total coliforms (10 June 1993), and four of the exceeded values recorded for faecal coliforms, (see Tables 1 and 2).

Associated rainfall data (obtained from Devon Area Hydrometric Section), was gathered from the nearest rainfall gauging station at Southpool Gullet Farm, situated approximately 5km from the watercourse.

Table 1. Exceeded values of total coliforms (TC)

Date	ECB0330 TC pres no/100ml	ECBR0330 TC pres no/100ml	Proportion of freshwater in saline sample ECB0330 (%)	Estimated number of TC from stream in ECB0330 sample no/100ml	Associated rainfall (mm)
10/06/93	14 000	58 000	20.29	11 768	0.6
20/09/93	19 000	44 000	17.14	7 541	5.6

Table 2. Exceeded values of faecal coliforms (FC)

Date	ECB0330 FC pres no/100ml	ECBR0330 FC pres no/100ml	Proportion of freshwater in saline sample ECB0330 (%)	Estimated number of FC from stream in ECB0330 sample no/100ml	Associated rainfall (mm)
10/06/93	4 700	32 000	20.29	6 493	0.6
06/08/93	2 300	61 000	2.86	1 745	0.0
20/09/93	2 300	20 000	17.14	3 428	5.6
23/05/96	3 800	10 000	39.71	3 971	10.1
28/08/96	2 730	57 000	1.71	975	6.0

The estimated numbers of total and faecal coliforms are merely estimates and should not be regarded as absolutes.

Regional Tidal Water Quality

Regional Tidal Water Quality has analysed data from the bathing waters programme between 1986 and 1997, this is presented in Figures 5 and 6. The results indicate that Combe Stream is partially responsible for some of the Bathing Beach failures. Figure 5 indicates positive correlation between reduced salinity and increased log faecal coliform counts, the reduced salinity implies a freshwater input (i.e. the stream). Figure 6 illustrates the close relationship between actual log faecal coliform numbers and estimated log faecal coliform numbers.

The old sewer pipe line (see Figure 1) has historically presented problems caused by leaking and blockages, this may also have contributed to some of the bathing beach failures.

5.2 INVESTIGATION RESULTS

A site visit was undertaken and initially 15 sites were identified for sampling. Following high bacteria levels being found at the top site (Site 15) on the first run, 2 additional sites further upstream were incorporated into the sampling program.

The sampling sites are shown in Figure 2.

The initial appraisal of the watercourse showed no visual signs of pollution although sites 5 and 6, (situated in the caravan park at Southern Mill), had a strong sewage odour. Tourists at the caravan park complained of sewage and sewage litter they had seen several weeks previously in the stream which passes through the park (pers. comm.)

Three sampling runs were undertaken on 25 August, 25 September and 25 November. The chemical and bacteriological results from these runs are presented in Figures 3 and 4.

Samples were analysed for both total and faecal coliforms and faecal streptococci. These analyses not only show bacterial input, but can also give an indication as to the origin of the contaminating material.

Total coliforms is a collective term which includes not only faecal coliforms but also a range of other groups and species, some of which are found on certain types of vegetable matter and in some soils.

Faecal coliforms refers to a subgroup of thermo-tolerant organisms capable of living in warm blooded animals including man.

Faecal Streptococci denotes a group which not only includes enteritic species generally associated with human faecal matter (eg *Streptococcus faecalis*, *S. faecium* and *S. durans*) but also non-human based species (eg *S. bovis*, *S. equinus* and *S. avium*). However it must be stressed that the human based species can be associated with other warm blooded animals and visa versa.

The bacteriological levels indicated in Figure 3 show the stream in relation to the ECBWD standards, this information is included to aid in interpreting the results. However it should be remembered that the stream samples are in no way formally assessed with respect to ECBWD standards, and values are shown for comparative purposes only.

Associated rainfall data (obtained from Devon Area Hydrometric Section), is the accumulative rainfall data for the 22nd to the 27th day (inclusive) of each month of sampling. It was gathered from the nearest rainfall gauging station at Southpool Gullet Farm.

6. DISCUSSION

6.1 HISTORICAL DATA

The historical data from Routine Monitoring indicates Combe stream may have been responsible for 2 out of the 7 Bathing Beach failures between 1992 and 1997.

The data from Regional Tidal Water Quality shows that when there is a large freshwater input (ie the stream), faecal coliform numbers in the Bathing Beach sample are increased.

The data also indicates a strong positive correlation between the estimated and actual faecal coliform numbers. This therefore confirms that the calculations in Tables 1 and 2, provide accurate estimations for the number of bacteria originating from the freshwater sample, This in turn supports the indication that the Combe Stream may be responsible for some of the Bathing Beach failures.

The two sets of historic data indicate a definite need to identify sources of bacterial contamination to the Combe Stream to assist in improving bathing water quality post SWWSL's re sewerage programme in Marlborough and Salcombe.

6.2 INVESTIGATION RESULTS

The first appraisal carried out on 25 August 1997 (Bank Holiday Weekend) was intended to coincide with peak tourist numbers when the caravan park at Southern Mill should be full. This highlighted three areas which were impacting on the stream; the caravan park (Sites 5-7), the cottages at Combe (Site 9), and Portlemouth Barton Riding Stables at West Portlemouth (Site 15). Levels of total and faecal coliforms were high downstream of all these sites (see Figure 4). The site downstream of Combe cottages (Site 9) also recorded levels of 11000 /100ml for faecal streptococci.

The second sampling run on 25 September 1997 during a period of dry weather again highlighted the caravan park and Combe cottages as impacting on the stream. During this sampling run total coliform levels of up to 51000 /100ml and faecal coliforms up to 17000 /100ml were found, (Figure 3). The faecal streptococci levels were all 1000 /100ml and below.

The third sampling run on 25 November 1997 during a period of wet weather found only down stream of Portlemouth Barton (Site 15) was having a significant impact on the stream with faecal streptococci levels of 15000 /100ml, all other bacteriological levels were below the mandatory EC Bathing Water standards. It is possible that the high concentrations of faecal streptococci

which are indicative of both human and non human based faecal material originated from the horses in the fields adjoining the watercourse. Although the manure heap was seen to be over 10m away from the stream, the horses have access to the watercourse and it is possible that the animals contribute to the contamination of the stream. At the time of the third sampling run, the stables also had a number of ducks and geese living in a pond situated between sites 15 and 17, these are a further possible source of the high faecal streptococci count.

The results shown in Figure 3 indicate that during each of the three sampling runs the samples taken at ECB0330 (Site 1), were all below the imperative standards for the EC Bathing Waters Directive, this indicates that on these occasions the stream was not having a bacteriological impact on the bathing water.

The chemical analysis of the samples taken (Figure 3), showed some sampling sites recording values noticeably distinct from the run average. These exceptional results do not present themselves in any pattern and cannot be pinpointed into a specific area or to any particular site. This leads to the conclusion that the sources of bacteriological input are diffuse within the catchment and cannot be pinpointed to a specific source.

7. CONCLUSIONS

1. Salcombe South Sands ECB0330 passed the EC Bathing Waters Directive standards for 1997.
2. Inputs from Southern Mill, the cottages at Combe, and Portlemouth Barton are causing a bacteriological impact on the stream, although this does not appear to be at a level that is currently causing the bathing beach to fail.

8. RECOMMENDATIONS

1. The Environment Protection Officer to be made aware that, Southern Mill, the consented discharge at Combe, Portlemouth Barton and the known storm discharges into the stream, could all be potential sources of contamination.

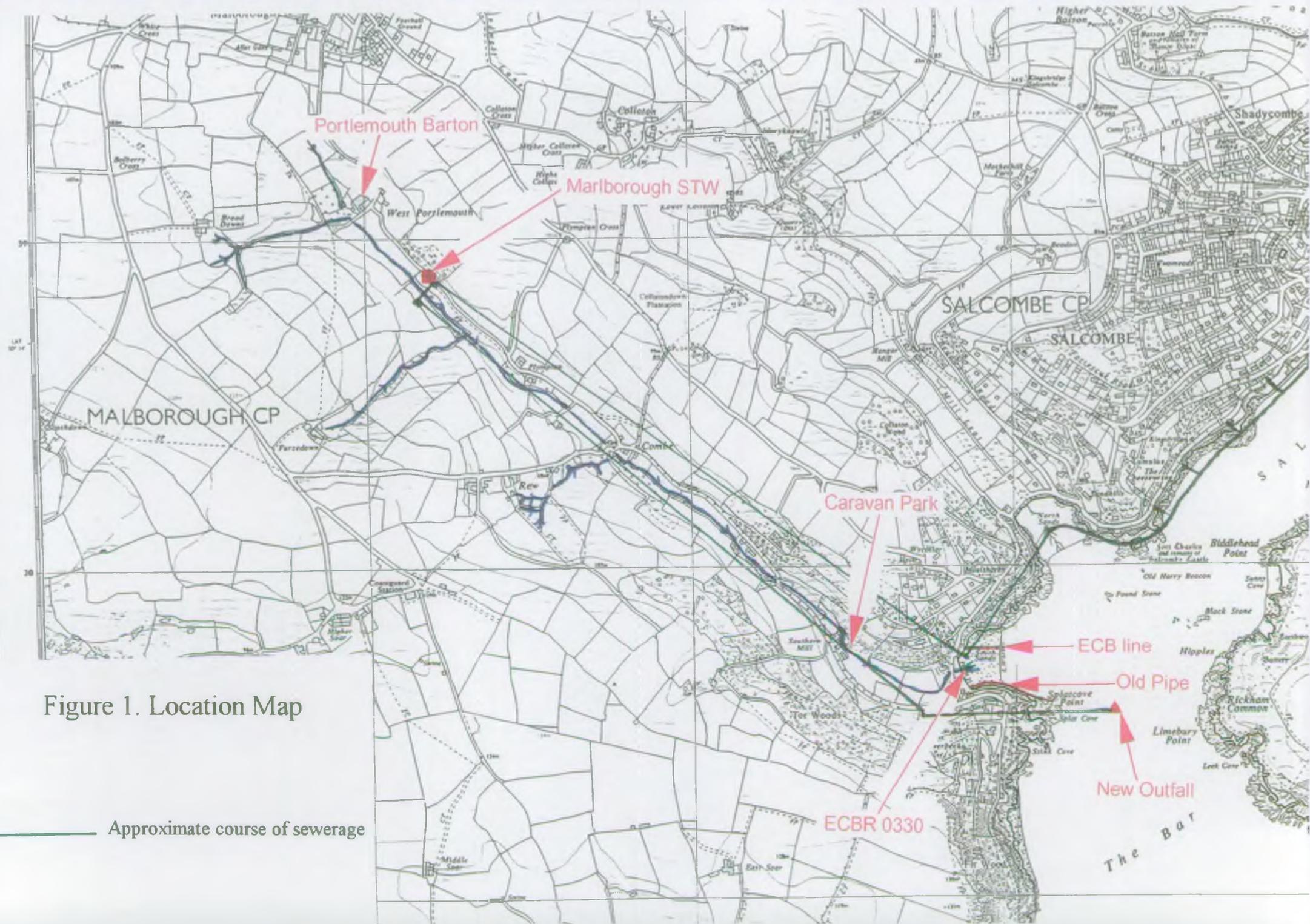


Figure 1. Location Map

— Approximate course of sewerage

Figure 3 Results from Combe Stream Survey

25 August

AR = 38.3 mm

Site	pH	DO (% sat)	BOD	T.NH3	NH3 non	SS 105	F. Strep	F. Colif	T. Colif
1	-	-	-	-	-	-	330	1 000	1 364
2	-	99	1.3	0.04	-	5.3	1 727	8 000	29 000
3	8.15	96	<1.0	0.05	0.002	8.4	4 200	10 727	30 000
4	8.20	73	1.5	0.08	0.0037	4.1	1 818	8 818	40 000
5	8.30	90	1.1	0.11	0.0063	<3.0	3 000	35 000	79 000
6	8.30	92	1.7	0.103	0.0059	4.8	2 700	25 000	59 000
7	8.35	101	1.0	<0.03	0.0019	4.3	1 818	2 400	5 200
8	8.20	90	1.3	0.05	0.0022	6.0	5 700	8 818	23 000
9	8.05	88	1.6	0.35	0.011	6.5	11 000	38 000	73 000
10	8.25	89	1.2	<0.03	0.0016	13.0	793	928	4 000
11	8.10	105	1.4	<0.03	0.0011	<3.0	800	1 045	3 600
12	8.00	76	<1.0	0.104	0.0031	8.8	1 838	3 600	6 000
13	8.05	103	1.1	<0.03	0.0009	8.6	83	72	230
14	8.05	94	1.2	0.181	0.0054	8.1	1 727	4 400	7 600
15	7.90	73	2.0	0.597	0.0158	9.9	5 300	26 000	58 000

maximum
minimum
average

8.35	105	2.0	0.597	0.0158	13.0
7.90	73	<1.0	<0.03	0.0009	<3.0
8.15	91	1.2	0.119	0.0047	6.3

25 September

AR = 0mm

Site	pH	DO (% sat)	BOD	T.NH3	NH3 non	SS 105	F. Strep	F. Colif	T. Colif
1	-	-	-	-	-	-	< 10	45	90
2	-	101	<1	<0.03	-	6.0	0	1 727	9 000
3	8.25	113	1.2	<0.03	0.0013	9.7	690	3 100	12 000
4	8.15	105	<1	0.038	0.0013	<3.0	290	4 200	30 000
5	8.25	106	1.4	0.062	0.0028	<3.0	865	17 000	51 000
6	8.30	107	1.9	<0.03	0.0015	16.9	710	3 900	27 000
7	8.30	109	<1	<0.03	0.0015	3.8	280	2 400	4 000
8	8.20	99	<1	<0.03	0.0012	4.8	320	1 072	3 300
9	8.10	99	<1	0.074	0.0023	<3.0	780	12 000	21 000
10	8.10	98	1.6	<0.03	0.0009	5.7	430	640	1 727
11	8.00	98	<1	0.032	0.0008	5.5	480	510	1 909
12	8.05	97	1.1	<0.03	0.0008	12.1	320	500	636
13	8.05	101	<1	<0.03	0.0009	14.6	90	901	1 091
14	8.10	99	<1	<0.03	0.0009	10.8	450	480	1 273
15	8.00	96	<1	0.08	0.0021	12.3	1 000	2 600	5 300
16	8.15	104	1.5	0.094	0.0034	25.5	480	2 300	3 100
17	7.65	97	<1	<0.03	0.0003	<3.0	83	45	270

maximum
minimum
average

8.30	113	1.9	0.094	0.0034	25.5
7.65	96	<1	<0.03	0.0003	<3
8.11	102	0.8	0.025	0.0015	8.1

25 November

AR = 61.5 mm

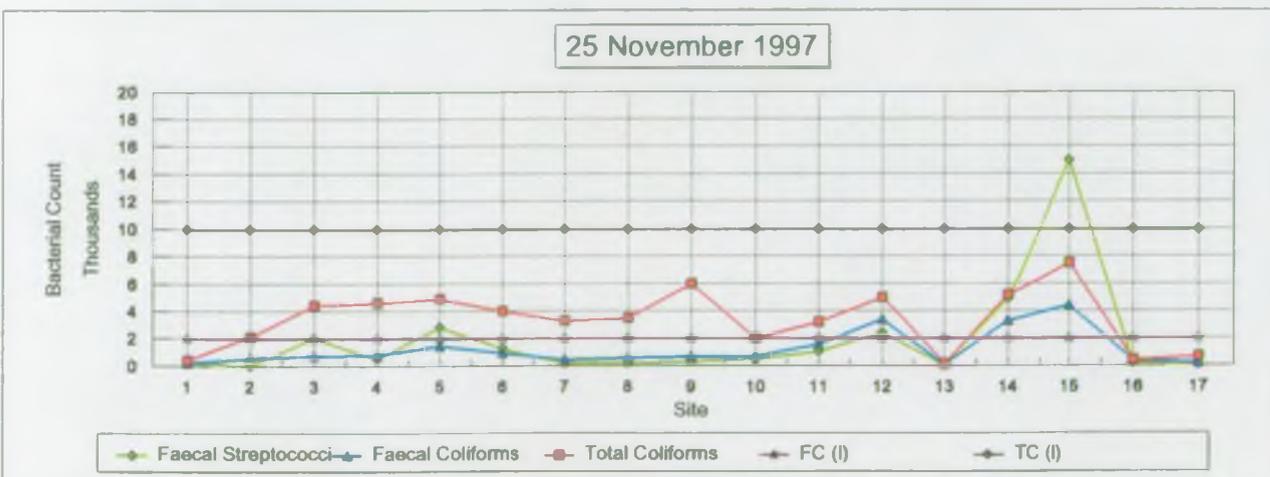
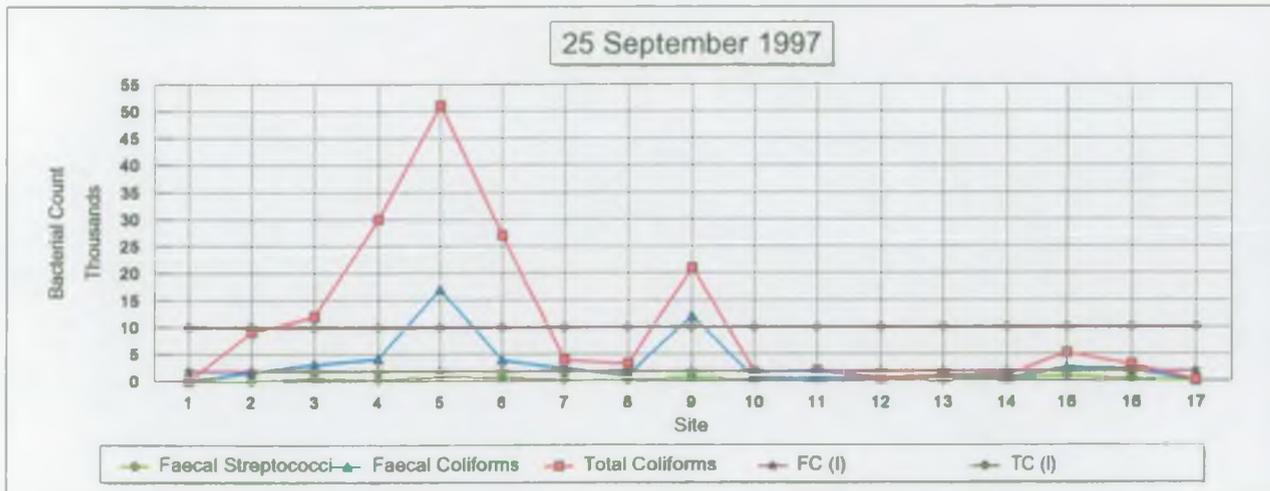
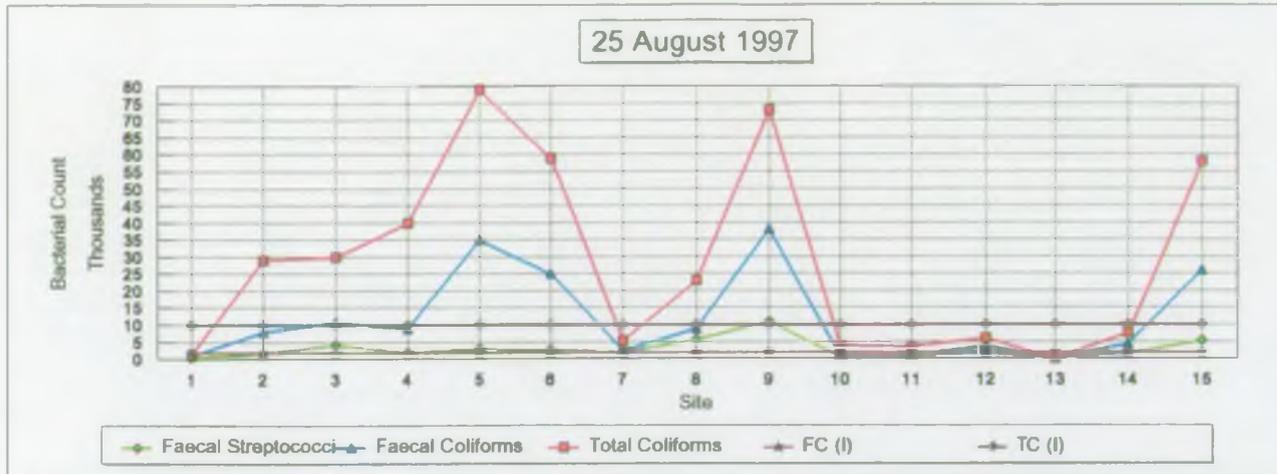
Site	pH	DO (% sat)	BOD	T.NH3	NH3 non	SS 105	F. Strep	F. Colif	T. Colif
1	-	-	-	-	-	-	182	250	408
2	-	101	<1	0.035	-	15.3	0	550	2 100
3	8.10	100	<1	0.058	0.0014	10.5	2 000	730	4 400
4	8.00	100	<1	0.037	0.0008	11.1	530	780	4 600
5	8.10	100	<1	0.045	0.0012	10.1	2 800	1 455	4 900
6	8.10	101	1.1	0.043	0.0012	11.3	1 273	937	4 000
7	8.15	101	<1	<0.03	0.0009	11.8	189	450	3 300
8	8.10	101	1.0	0.035	0.0009	10.9	162	620	3 500
9	8.00	99	1.1	0.049	0.0011	8.2	340	690	6 000
10	7.95	99	1.2	0.044	0.0008	29.7	480	700	2 000
11	7.90	97	1.3	0.048	0.0008	19.7	1 018	1 545	3 200
12	7.85	97	1.2	0.045	0.0009	63.3	2 400	3 400	5 000
13	7.85	100	1.1	<0.03	0.0005	22.2	45	81	153
14	7.95	98	1.0	0.045	0.0009	33.9	4 900	3 300	5 200
15	7.85	98	1.4	0.065	0.001	103.0	15 000	4 400	7 500
16	7.90	99	<1	<0.03	0.0005	31.4	180	420	440
17	7.55	93	1.7	<0.03	0.0002	108.0	27	200	640

maximum
minimum
average

8.15	101	1.7	0.065	0.0014	108.0
7.55	93	<1	<0.03	0.0002	8.2
7.96	99	0.8	0.034	0.0009	31.3

- DO (% sat) Dissolved Oxygen % saturation
- BOD: Biochemical Oxygen Demand
- T. NH3: Total ammonia mg/l
- NH3 non: Non-ionised ammonia
- SS105: Suspended solids at 105C
- F Strep: Faecal streptococci presumptive No/100ml
- F Colif: Faecal Coliforms presumptive No/100ml
- T Colif: Total Coliforms presumptive No/100ml
- AR: Associated Rainfall
- No Result
- 12000 Exceeds mandatory value of 10000 Total Coliforms / 100ml
- 3100 Exceeds mandatory value of 2000 Faecal Coliforms / 100ml
- 690 Exceeds guideline value of 100 Faecal Streptococci / 100ml

Figure 4 Combe Stream Bacteriological Survey Results



KEY: FC (I) Faecal Coliforms Imperative standards
 TC (I) Total Coliforms Imperative standards

Figure 5. Salcombe South Sands Beach and Combe Stream

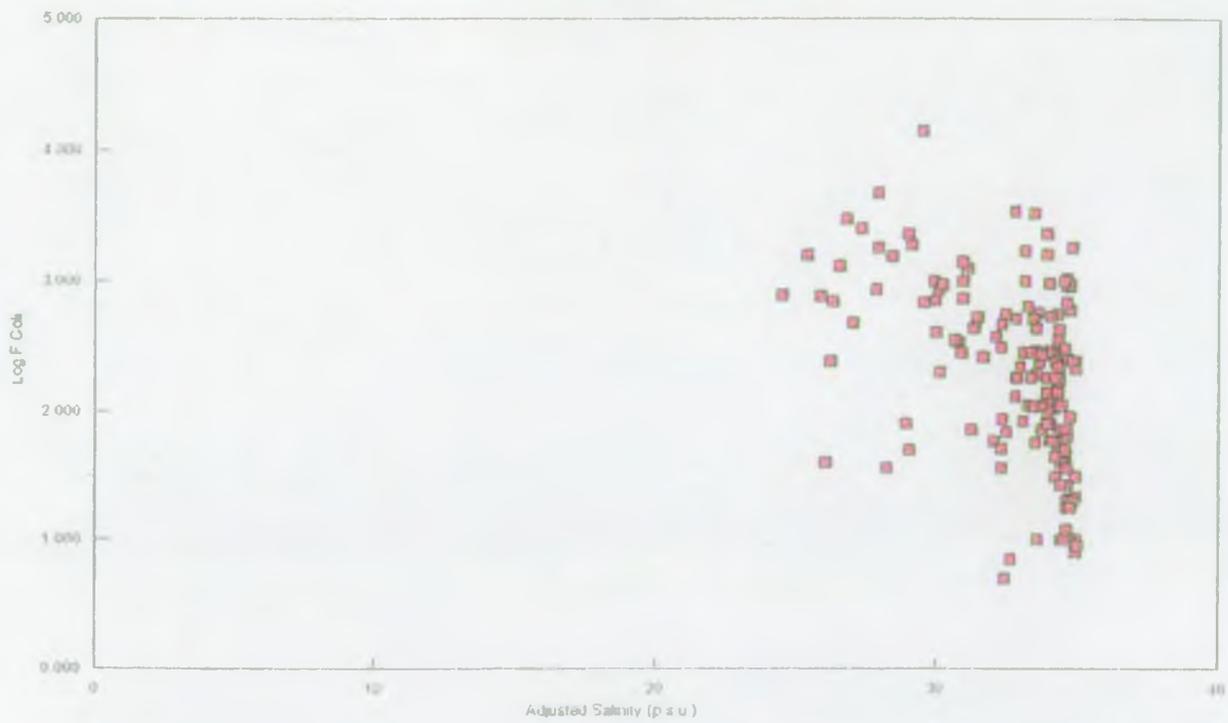


Figure 6. Salcombe South Sands Beach and Combe Stream

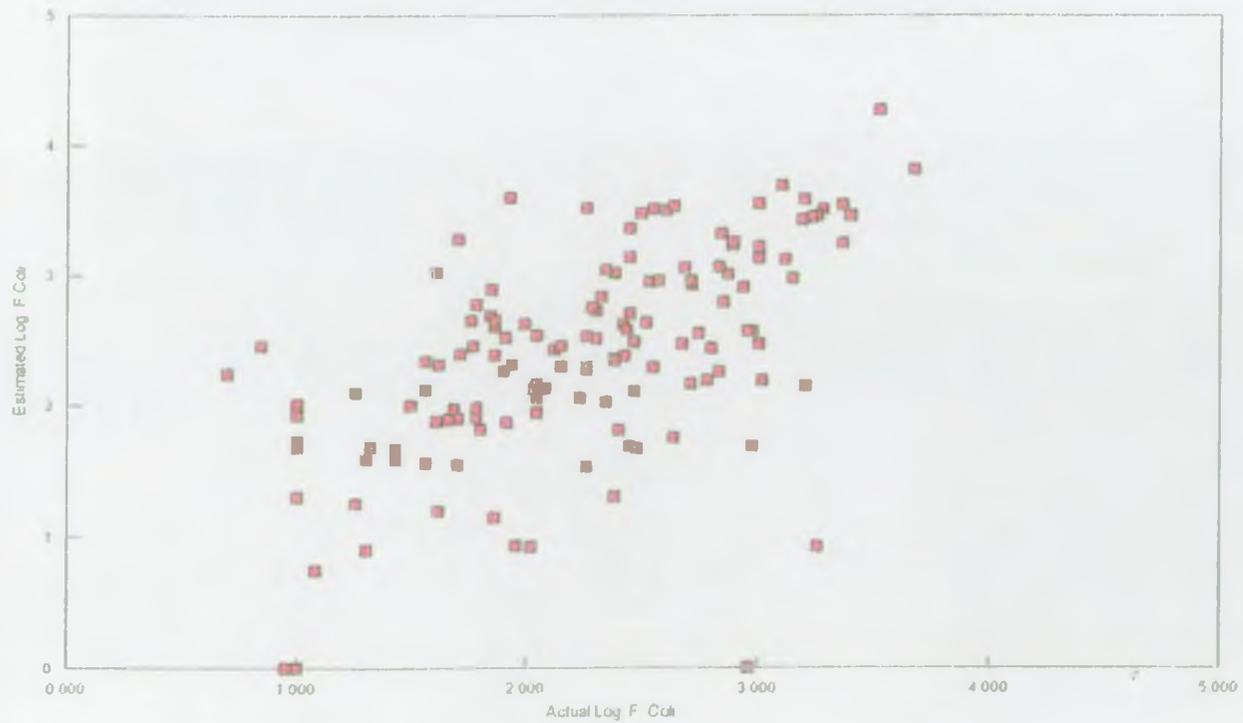


Figure 2. Sampling Point Locations on Combe Stream

3 → Sampling Point

Scale: Grid lines are at 1km intervals

