

**DEVON AREA
INTERNAL REPORT**



**ENVIRONMENT
AGENCY**

**HOPE COVE: NON-COMPLIANCE
IN 1998 WITH THE EUROPEAN
COMMUNITY BATHING WATER
DIRECTIVE (76/160/EEC)**

**February 2001
DEV/EP/01/01
(CATCHMENT 08A)**

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**HOPE COVE: NON-COMPLIANCE IN 1998 WITH THE EUROPEAN
COMMUNITY BATHING WATER DIRECTIVE (76/160/EEC)**

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HOPE COVE: NON-COMPLIANCE IN 1998 WITH THE EUROPEAN COMMUNITY BATHING WATER DIRECTIVE (76/160/EEC)

1.0 INTRODUCTION

Hope Cove is a designated European Community Bathing Water (ECBW). In 1998 bathing water quality failed to comply with the European Community Bathing Water Directive (**Appendix 1.**) as a result of two elevated bacteria (faecal coliform) samples taken on 8/6/98 and 8/9/98. Devon Area Investigations Team (DAIT) were requested by the Agency's Regional Tidal Water Quality section to establish the cause of this failure.

This report follows on from an interim document released in February 2000.

2.0 SITE DESCRIPTION

Hope Cove is enclosed by a promontory to the north (the Shippen) and to the south by the land mass that runs out to Bolt Tail. A breakwater connects the northern side of the cove with Barney Bank rocks, providing shelter for fishing vessels (**Map 1.**).

The village is divided into Outer Hope to the north and Inner Hope to the south. The area is served by Galmpton Waste Water Treatment Works (WWTW) situated some 800m inland. Crude sewage is delivered to the WWTW via a rising main from a pumping station at Outer Hope (National Grid Reference (NGR) SX 6750 4000). A second pumping station transfers sewage from the Inner Hope area to the Outer Hope site. Both pumping station influent lines have a storm overflow capacity: storm flows from the influent line to Outer Hope pumping station are discharged via a screen to the final effluent line, while those from the influent line to Inner Hope pumping station are discharged, unscreened, to a point (NGR SX 6743 3976) some 125m offshore.

In addition to flows from Hope Cove, Galmpton WWTW treats sewage from Galmpton village. This arrives by gravity feed via a separate influent line.

Treatment comprises screening and sedimentation. Effluent is discharged to Hope Cove on the seaward side of the breakwater at NGR SX 6739 4001.

Map 2. is a reproduction of South West Water Limited (SWWL) plans showing sewerage detail for the area.

Improvements to the works are required under both the Urban Waste Water Treatment Directive and the Bathing Water Directive, and it is likely that future treatment will include ultra-violet (UV) disinfection. The Agency is in discussion with SWWL about the timing of these improvements.

There are two principal freshwater inputs to Hope Cove: the Bolberry Stream at Inner Hope which joins the southern end of the beach via a culvert, and an unnamed stream (Stream A) at Outer Hope which is piped to the northern end of the beach. The latter stream is forced towards the centre of the beach by the breakwater.

Bathing water quality is assessed from samples taken at the southern end of the beach and on a line that runs through the NGR points SX 6743 3979 and SX 6754 3973. The exact location of any one sample will be determined by the tide state at the time of sampling.

3.0 METHODS

- (i) Analyse historic water quality data
- (ii) Undertake a physical survey of the area
- (iii) Undertake a catchment based water quality survey
- (iv) Consider sewerage infrastructure
- (v) Liase with the Agency's Environment Protection Officer for the Hope Cove area
- (vi) Remove samples from specific locations identified from (iii)
- (v) Conduct dye and tracer studies where necessary

4.0 RESULTS AND DISCUSSION

This section is arranged as follows:

4.1 Historic Data

4.2 Initial Fieldwork

- 4.2.1 Physical Examination (30/06/99)
- 4.2.2 Dry Weather Survey (16/07/99)
- 4.2.3 Wet Weather Survey (14/12/99)

4.3 Further Fieldwork

- 4.3.1 Galmpton WWTW
- 4.3.2 Bolberry Stream
- 4.3.3 Inner Hope EO

4.4 Other Fieldwork/Considerations

4.1 Historic Data

The investigation has considered all data since 1990 and particularly those samples taken on 08/06/98 and 08/09/98 that failed to comply with the Directive. Whilst Hope Cove ECBW was compliant in 1999 a sample with elevated total and faecal coliform concentrations was obtained on 14/08/99. Consideration will also be given to this sample in what follows.

A total of 204 samples were taken at Hope Cove between 1990-2000 for the bathing beach programme (**Table 1.**).

Plots were made for all samples from 1990 for faecal coliform concentrations and the times that samples were taken against the times of high water. No trends were evident. The same data were tested against wind direction; an enhancement in bacteria concentrations when the wind was between south-west and north was evident (this will include on-shore winds) with lowest concentrations when the wind was between north-east and south east (**Chart 1**).

Comparisons were made of faecal coliform concentrations with rainfall¹ (1990-1999 excluding 1996 where rainfall data was unreliable). There was a general increase in faecal coliform concentrations with increasing rainfall, including a peak at 5mm, but above 12mm bacteria concentrations tended to reduce. The same test for faecal coliforms in the Bolberry Stream and rainfall gave similar results. The decline in bacteria concentrations at the higher rainfall values probably takes place because contaminants have already been effectively flushed.

Data for 1998 were compared with rainfall (Scobbiscombe rain gauge at NGR SX 631 470). This showed that the two poor samples taken in 1998 coincided with the highest rainfall on any day for which samples were taken that year (**Chart 2.**). Both poor samples would appear to be rain related, therefore. The relationship between the sample taken on 14/08/99 and wet weather is less clear (rainfall was 0.3mm on 14/08/99 and 4.7mm on 13/08/99).

All data for the period 1991-2000² were tested against a standard mathematical model that uses comparative salinities to determine the influence of freshwater inputs on bathing beach samples (**Chart 3.**). The model showed that the Bolberry Stream, which historically has high coliform counts, was the most frequent influence on faecal coliform concentrations at the ECBW site but that other sources of contamination were present.

More specifically the model indicated that the samples taken on 08/06/98 and 14/08/99 were influenced by faecal coliform concentrations in the Bolberry Stream, whilst the sample taken on 08/09/98 was contaminated by bacteria from another source. A note was made by the Agency Officer at the time of sampling on 08/09/98 that the Bolberry Stream was entering the sea at the sample point (similar notes were made for samples taken on 07/05/98 and 05/09/98). Although the cause of the poor sample on this date is not believed to be the Bolberry Stream, the proximity of the stream to the sample point is an important consideration.

¹ accumulative rainfall for both the day of sampling and the previous day

² excluding 1990 where salinity data were unreliable.

Samples were taken for the Bathing Beach Programme on both 08/06/98, 08/09/98 and 14/08/99 at the nearby beaches of Thurlestone South, Thurlestone North, Bigbury on Sea South, Bigbury on Sea North, Challaborough and Bantham. None contained total or faecal coliform concentrations that exceeded the Imperative standard.

In response to the poor sample at Hope Cove on 14/08/99 an Agency Environment Protection Officer revisited the site the following day and took samples at the ECBW sample point and from standing water on the landward side the breakwater fed by Stream A (Table 2). The bacteria concentrations of the ECBW sample were low but somewhat raised for the standing water sample. This sample was taken after it had flowed through rotting seaweed and whilst it may have reflected poor water quality in the stream it could also have resulted from contamination the previous day.

Follow-up samples were also taken on 09/09/98 in response to the poor sample obtained the day before. Samples were taken at the ECBW site, from the Bolberry and Galmpton Streams and at Mouthwell Sands (Table 3.). Neither of the beach samples exceeded the Imperative standard and the Bolberry Stream sample had bacteria concentrations that were consistent with previous routine samples. Concentrations in the Galmpton Stream were raised, however, possibly as a result of rainfall.

None of the bathing beach samples taken at Hope Cove during the 2000 season exceeded the Imperative standard.

Faecal coliform concentrations that exceeded the Imperative standard were also obtained at Mouthwell Sands³ on 08/06/98 and 08/09/98. Like Hope Cove, Mouthwell Sands maybe at risk of failing in wet weather and possibly as a result of contamination by the Galmpton Stream (no comparative samples were taken from the Galmpton Stream on 08/06/98 or 08/09/98).

A sample was taken at Mouthwell Sands on 14/08/99 which also had elevated bacteria values (for all three determinands) but, again, no associated stream sample was taken.

In summary the historic data shows that:

- (i) there was no relation between poor water quality at Hope Cove and tide state
- (ii) faecal coliform concentrations were higher when the wind direction was between south-west and north
- (iii) there was an increase in faecal coliform concentrations at Hope Cove and in the Bolberry Stream with rainfall
- (iv) the poor samples of 08/06/98 and 14/08/99 probably arose from high bacteria concentrations in the Bolberry Stream
- (v) the sample of 08/09/98 was probably contaminated by a source other than the Bolberry Stream

³ although Mouthwell Sands is not a designated bathing beach for the purposes of the Directive, water quality is monitored for operational reasons

4.2 Initial Fieldwork

4.2.1 Physical Examination (30/06/99)

An inspection of the general area was undertaken. It was noted that there is unfettered cattle access to the Bolberry Stream (to within 250m of the ECBW sample point) and to the Galmpton Stream (to within 300m of Mouthwell Sands sample point). Extensive pig ranching in the Bolberry stream upper catchment was also noted.

4.2.2 Dry weather survey (16/07/99)

The sample sites are shown in **Map 3** and the results given in **Table 4**.

Samples taken from the Bolberry Stream showed that total coliforms concentrations were almost doubling in the Bolberry area with a slight increase in faecal coliform concentrations. However these values had significantly decreased lower in the catchment. Both faecal coliforms and faecal streps were being enhanced in the Inner Hope area.

4.2.3 Wet weather survey (14/12/99)

The sample sites are shown in **Map 4** and the results given in **Table 5**.

Bacterial enhancement was again evident in the Inner Hope area (between sites 6 and 7) and may result from septic tanks serving properties that are not connected to the main sewer. Typical septic odours were noted at the time of sampling.

The bacterial enhancement in the Bolberry area that had been observed from samples taken on 16/07/99 was repeated (between Sites 1 and 2) and may also derive from septic tanks. Although total and faecal coliform concentrations in the Bolberry Stream at the beach site (Site 7) were high they were not reflected in concentrations at the ECBW site that would have caused a failure of the Imperative standard.

4.2.4 Samples taken from Galmpton Stream and adjacent discharge to top of beach at Mouthwell Sands.

These samples, taken on 01/10/99 during showery weather, contained bacteria concentrations that were sufficiently low that little impact on water quality at Mouthwell Sands beach was likely.

The results are given in **Table 6**.

4.2.5 Samples taken from unnamed stream (Stream A) at Outer Hope and from a piped discharge to beach approx. 20m north of ECBW line.

The sample from the unnamed stream (Map 1.) at Outer Hope had comparatively low bacterial concentrations. The small discharge (believed to be freshwater) near to the bathing water sampling line had very low concentrations for all three bacteria groups. The samples were taken on 20/01/00.

The results are given in Table 7.

4.2.6 Inspection of private sewage treatment systems

On 15/09/99 the sewage treatment systems at Hope Barton Farm, Karrageen Caravan Park and Bolberry House Farm Campsite were inspected with particular reference to the poor sample taken from the Bolberry Stream for the Bathing Beach Programme on 14/08/99. This sample was collected at the end of the solar eclipse week during which the area had been subject to a considerable increase in population together with extensive off-site camping.

Hope Barton Farm is consented to discharge via partial soakaway to the Bolberry Stream. There was no evidence that any recent discharge had occurred. The other sites utilise soakaways which are sufficiently far from the watercourse that no impact is likely under normal circumstances.

A number of temporary latrine pits had been constructed throughout the area during eclipse week – it was not possible assess their impact on the Bolberry Stream catchment.

The emptying of sewage effluent tanks at Hope Barton Farm is carried out by contractors. Accidental spillages when servicing is undertaken could result in contamination of the Bolberry Stream. Subsequent to the visit on 15/09/99 the Agency requested servicing records for both 1998 and 1999. No servicing was undertaken that coincided with any dates on which samples with elevated bacteria concentrations were obtained from the Bolberry Stream.

4.3 Further Fieldwork

4.3.1 Galmpton WWTW

Dye-tracing of the storm overflow facility at Galmpton WWTW on 30/06/99 confirmed that storm flows run to the Galmpton Stream immediately adjacent to the works. Storm flows are screened with Copa Sacs and, with adequate maintenance, sewage debris should not enter the stream. During operation of the storm overflow substantial contamination of the Galmpton Stream at Mouthwell Sands beach is possible.

On 09/09/99 a dye survey was undertaken to establish the behaviour of the effluent plume from Galmpton WWTW. The survey was carried out over a full spring tide cycle and under conditions believed to provide maximum impact at the ECBW site (north or north-west winds). Predicted high water at Salcombe was 0634 BST.

Discreet doses of Rhodamine and Fluoresceine dye were introduced to the final effluent line at Galmpton WWTW. Observations of plume dispersion on the seaward side of the breakwater were made from a number of vantage points.

The rate of dye dispersion was low with the plume tending to 'pond' around the outfall. There was no visible impact at the ECBW site.

The results of this survey are shown pictorially in **Figures 1-4**.

A similar survey was then conducted on neap tides. This survey took place on 20/09/99 and again there was no visible impact at the ECBW site. Predicted high water at Salcombe was 1421 BST. The results are shown in **Figures 9-13**.

At high water on 20/09/99 waves were observed breaching the breakwater. A sample was taken from inside the breakwater at NGR 6746 4003 to assess the potential effect of this process on water quality at the ECBW site. Results are shown in **Table 8**. Both total and faecal coliform concentrations exceeded the Imperative standard. Breaching of the breakwater may well be contributing to reduced water quality in those samples from the ECBW site that were collected at or just prior to high water, or during the period following high tide when water is ebbing from this part of the beach (see also Section 3.4.3).

Neither of these surveys indicated that effluent was carried around the breakwater to the beach when wind conditions were expected to produce maximum impact. The wind direction on 08/06/98, 08/09/98 and 14/08/99 when poor samples were obtained was, respectively, south-west, south-west and west. In order to emulate these conditions a further dye survey was undertaken in south-west winds on 14/06/00. Predicted high water at Salcombe was 0457 BST. South-west winds tend to swing in around Bolt Tail to produce an on-shore wind at Inner Hope and it was felt that this might more effectively transport effluent to the ECBW site. Such behaviour was not observed, however, and the plume tended to travel more towards the beach at Mouthwell Sands (**Photograph 1**). Five dye drops were made between 0745 and 1832 BST. Dye transport was apparent following the first two dye drops and the results are shown in **Figures 14-15**. Dye patches from subsequent drops remained in the vicinity of the outfall. During this survey waves were again seen breaching the breakwater (**Photograph 2**).

Misconnections in the final effluent line were found by SWWL on 26/11/99 when responding to an incident (a blockage in the final effluent line from Galmpton WWTW was causing effluent to back up through a manhole outside the Post Office at Outer Hope). The misconnections are believed to involve a building extension to the Hope and Anchor public house as well as other properties. This may explain some of the instances of crude sewage debris on the beach (although the more likely cause is operation of the emergency overflow facility at Inner Hope (Section 3.3.3)).

The outfall is sited above low water springs so that at low water on a spring tide there is little effluent dispersion. An examination of the outfall was made on 09/03/00 under these conditions when pools of contaminated water were observed (**Photograph 3**).

The final effluent pipe is buried beneath the beach and there has been speculation about the existence of a fracture in this pipe adjacent to the inside of the breakwater. There was no evidence during the dye studies of any leakage.

SWWL were asked for details of telemetry alarms/mechanical failures at the Outer Hope pumping station for 1998/9. There were no instances of these for 08/06/98, 08/09/98 or 14/08/99.

4.3.2 Bolberry Stream

Surveys carried out on 16/07/99 and 14/12/99 showed that bacterial enhancement was occurring in the Bolberry and Inner Hope areas. This is likely to derive from septic tank inputs.

Whilst bacteria concentrations downstream of Bolberry appear to reduce sufficiently by the time they reach the beach that little impact at the ECBW site is likely, contamination in the Inner Hope area has the potential to compromise water quality at the bathing beach.

On 28/03/00 discharges from a pipe to the stream at Inner Hope were seen. A sample taken from the stream at the beach site, downstream of the discharge, had elevated total and faecal coliform concentrations (**Table 12**). This pipe may be related to septic tanks adjacent to the watercourse but subsequent dye work by the Environment Protection Officer failed to confirm this.

Background bacterial concentrations in the Bolberry and Galmpton Streams are probably being augmented where there is unfettered livestock access. A faecal coliform to faecal streptococci ratio of ≤ 0.8 may result from a livestock source (**Reference 1** and **APPENDIX 2**). The ratio in the case of a sample taken from the Galmpton Stream on 14/06/00 was 0.34 indicating that contamination from livestock was occurring. A model (**APPENDIX 3**) was used to see if the provision of livestock fencing to the lower catchment would protect the ECBW site from contamination that would cause exceedance of the Imperative Standard. The model showed that such protection could only be achieved if fencing was installed along the entire course of the stream. This finding also applies to the Galmpton Stream.

In practice (on 16/07/99, for example) we found that bacteria concentrations were reducing at a greater rate than was predicted by the model. This probably results from dilution by runoff.

At any time between half ebb and half flood the ECBW sample point is liable to be coincident with the stream as it disperses across the beach. On such occasions the beach sample is vulnerable to poor water quality in the Bolberry Stream. It has already been noted that this was the case on 08/09/98 (section 4.1).

4.3.3 Inner Hope EO

The influent line to the pumping station at Inner Hope incorporates an emergency overflow chamber situated at the top of the slipway. Following some doubt as to the exact position of the outfall for this facility fluoresceine dye was introduced to the overflow chamber on 02/08/99. This showed that the position of the outfall was accurately given on plans supplied by SWWL. (**Map 2**).

The position of the outfall is close to the ECBW sampling line and so has the potential to influence water quality samples. In order to quantify this potential impact dye was introduced to the overflow chamber on 09/09/99. Discharge flows were simulated by pumping water into the emergency overflow chamber from the adjacent Bolberry Stream. The survey showed substantial impact at the ECBW site at low water. The results are shown in **Figures 5-8** and **Photograph 4**. Dye also remained in rock pools as the tide ebbed (**Photograph 5**).

On 26/10/99 a flow logger was installed in the overflow chamber (**Photographs 6-8**) to assess the frequency with which emergency discharges were occurring. The equipment was removed on 19/09/00. A number of events were recorded and these are shown in **Table 9**.

The most significant continuous discharges were as follows:

<i>Date</i>	<i>Duration</i>
16/02/00	16 hours 30 mins
07-08/03/00	18 hours 00 mins
24-25/04/00	17 hours 25 mins
29/04-02/05/00	64 hours 05 mins
17/06/00	17 hours 50 mins

The events between 22-26/12/99 were markedly coincident with the times of high water: spring tides were particularly high during this period. The dynamics of flow/surcharging in the outfall pipe and chamber are unknown and it maybe that seawater was entering the chamber. It was not possible to resite the logger to prevent this but subsequent logged discharge events did not show a tendency to coincide with high spring tides.

On a number of occasions the overflow was seen to be operating (**Photograph 9**.) and samples of the discharge were taken together with comparative samples from the Bolberry Stream and the ECBW site (**Tables 10-14**). From **Table 11** it would appear that discharges on 9/3/00 were causing samples at the ECBW site to exceed faecal coliform Imperative standards; faecal coliform concentrations in the Bolberry Stream were not high enough to have been responsible.

Consideration was given to prosecuting SWWL as a result of discharges that took place on 14/06/00 when an investigation sample from the ECBW site exceeded Imperative faecal coliform values. However, the emergency overflow sample on this date (**Table 13**) showed unexpectedly low coliform concentrations. The sample was re-analysed and again concentrations were low. It was thought that bleach may have been the cause. The sample was further analysed for chlorine (which would have been present had the sample contained bleach) but none was detected. Because coliform concentrations in a contemporaneous sample from the Bolberry Stream were high it could have been argued that the poor ECBW sample resulted not from operation of the emergency overflow but from water quality in the Bolberry Stream. Following legal advice the case did not proceed to prosecution.

Nothing is known of the frequency of overflow discharges or their duration prior to installation of the logger. Because SWWL seem to have been unaware of the discharge events that are shown in **Table 9** until they were notified by the Agency, past discharges may have continued for considerable periods before they were detected.

The pumping station is fitted with an audible fault alarm. It appears that this is routinely muted.

SWWL had no records of faults at the pumping station for 08/06/98, 08/09/98 or 14/08/99.

Examination of the outfall pipe at low water on 09/03/00 revealed a fracture some 20m short of the designed discharge position. The emergency overflow was operating on this date and crude sewage was observed issuing from the fracture (**Photographs 10 and 11**). Faecal debris was noted in nearby rock pools.

4.4 Other Fieldwork/Considerations

4.4.1 Sewage debris on beach

Sewage debris is frequently found on the beach. Because the final effluent and storm discharges from Galmpton WWTW are screened, debris is unlikely to originate from this site on a regular basis. Misconnections to the final effluent line recently discovered at Outer Hope are a possible cause. In the light of this investigation's findings with regard to the emergency outfall at Inner Hope these discharges are the most probable cause.

4.4.2 Decomposition of seaweed inside the breakwater

Deposits of rotting seaweed on the inside of the breakwater (**Photograph 12**) have led to a number of complaints (often described as sewage). The deposits give rise to a dark liquid that leaches along the base of the breakwater, which may contribute to total coliform concentrations at the ECBW site. The process is unlikely to influence faecal coliform concentrations.

4.4.3 Sewage fungus inside the breakwater

Grey coloured growths have been observed on the substrate of residual pools inside the breakwater (**Photograph 13**). Photographs of these growths were inspected by Agency biologists who concluded that they depicted sewage fungus. The growths were absent on some occasions and so it seems less likely that they are associated with the decomposition of seaweed – which is invariably present – than contamination from effluent carried over the breakwater or poor water quality in Stream A.

4.4.4 Discharges from crab tanks

During the investigation it was reported that the old lifeboat station adjacent to the slipway at Inner Hope was used for the storage of live crabs and that sporadic discharges from the crab tanks were made to the beach. Samples taken by the Agency from crab tanks at an unrelated site showed low concentrations of total and faecal coliforms and faecal streptococci. For this reason such discharges are thought unlikely to affect water quality at the ECBW site.

4.4.5 Discharges from boats

The extent to which boats discharge untreated sewage to Hope Cove is unknown. Most of the vessels are small pleasure boats and the incidence of such discharges is believed to be low.

On occasion waste animal matter from crab pots has been noted to the north end of the cove. This may enhance total coliform concentrations but is thought unlikely to increase concentrations of faecal coliforms.

4.4.6 Detergents in the Bolberry Stream

Foam was reported in the Bolberry Stream on 16/08/98. Analysis of samples taken by the Agency found the cause to be non-ionic synthetic detergents. The source was believed to be water used for vehicle washing.

4.4.7 Abstraction from the Bolberry Stream

During the investigation it was noted that abstraction was occurring from the Bolberry Stream to a private pond at Inner Hope. Details were given to the Agency's Abstraction Licensing section.

5.0 CONCLUSION

5.1

The principal bacterial inputs to Hope Cove are believed to be Galmpton WWTW, the Bolberry and Galmpton Streams and Inner Hope EO. The Bolberry Stream probably caused two of the three exceedences under scrutiny and Inner Hope EO may have caused the other. These are considered the two most important influences on bathing water quality at the ECBW site.

5.2

Poor water quality in the Bolberry Stream is probably the result of both septic tank inputs at Inner Hope and of runoff during wet weather from livestock pasture.

5.3

Operation of the Inner Hope emergency outfall is likely to represent a frequent source of contamination to the bathing water.

5.4

A fracture in the Inner Hope emergency outfall pipe is compromising effective dispersal of discharges.

5.5

Improvements to Galmpton WWTW under AMP3 will substantially reduce the concentration of bacteria in the final effluent and, as a consequence, there should be an improvement in bacterial contribution to the bathing water. The extent of this improvement is unknown.

5.6

The Galmpton Stream is unlikely to affect the ECBW site but has potential to compromise water quality at Mouthwell Sands.

6.0 RECOMMENDATIONS

6.1

Further work is undertaken on septic tank inputs to the Bolberry Stream at Inner Hope to enable remedial work by the Environment Protection Officer.

ACTION: DEVON AREA INVESTIGATIONS TEAM

6.2

Consideration is given to the provision of fencing and other measures to prevent livestock entering the Bolberry Stream.

**ACTION: ENVIRONMENT PROTECTION OFFICER
(NATIONAL TRUST)**

6.3

Telemetry is installed at the Inner Hope pumping station so that faults can be immediately attended to.

**ACTION: ENVIRONMENT PROTECTION OFFICER
(SOUTH WEST WATER LTD)**

6.4

The Inner Hope emergency overflow discharge chamber is inspected should there be a suspicion of sewage pollution at the time that routine bathing beach samples are being taken.

ACTION: MONITORING TEAM

6.5

The fracture in the Inner Hope emergency outfall pipe is repaired.

**ACTION: ENVIRONMENT PROTECTION OFFICER
(SOUTH WEST WATER)**

6.6

Misconnections to Galmpton WWTW final effluent line at Outer Hope are rectified.

**ACTION: ENVIRONMENT PROTECTION OFFICER
(SOUTH WEST WATER)**

6.7

Warning notices are provided at Mouthwell Sands with regard to the possible contamination of the Galmpton Stream.

**ACTION: ENVIRONMENT PROTECTION OFFICER
(SOUTH HAMS DISTRICT COUNCIL)**

6.8

Planned improvements to Galmpton WWTW incorporate measures to prevent discharges of storm water to the Galmpton Stream.

**ACTION: REGIONAL TIDAL WATER QUALITY
(SOUTH WEST WATER)**

The above Actions will be reviewed in 4 months time (prior to the 2001 bathing beach sampling programme) and pursued where necessary (APPENDIX 4.).

7.0 ADDENDUM

The following information has been received subsequent to the draft of this document.

Telemetry has now been installed at Inner Hope pump station. This should prevent most of the emergency discharges of the kind found by this investigation. However, there is a small risk of future emergency discharges going undetected as a result of blockages in the influent line.

Misconnections to Galmpton WWTW final effluent line have now been rectified by SWWL.

8.0 REFERENCES

1. Gerardi, M.H., et al. 1990. Wastewater Biology: The Microlife. Water Pollution Control Federation.

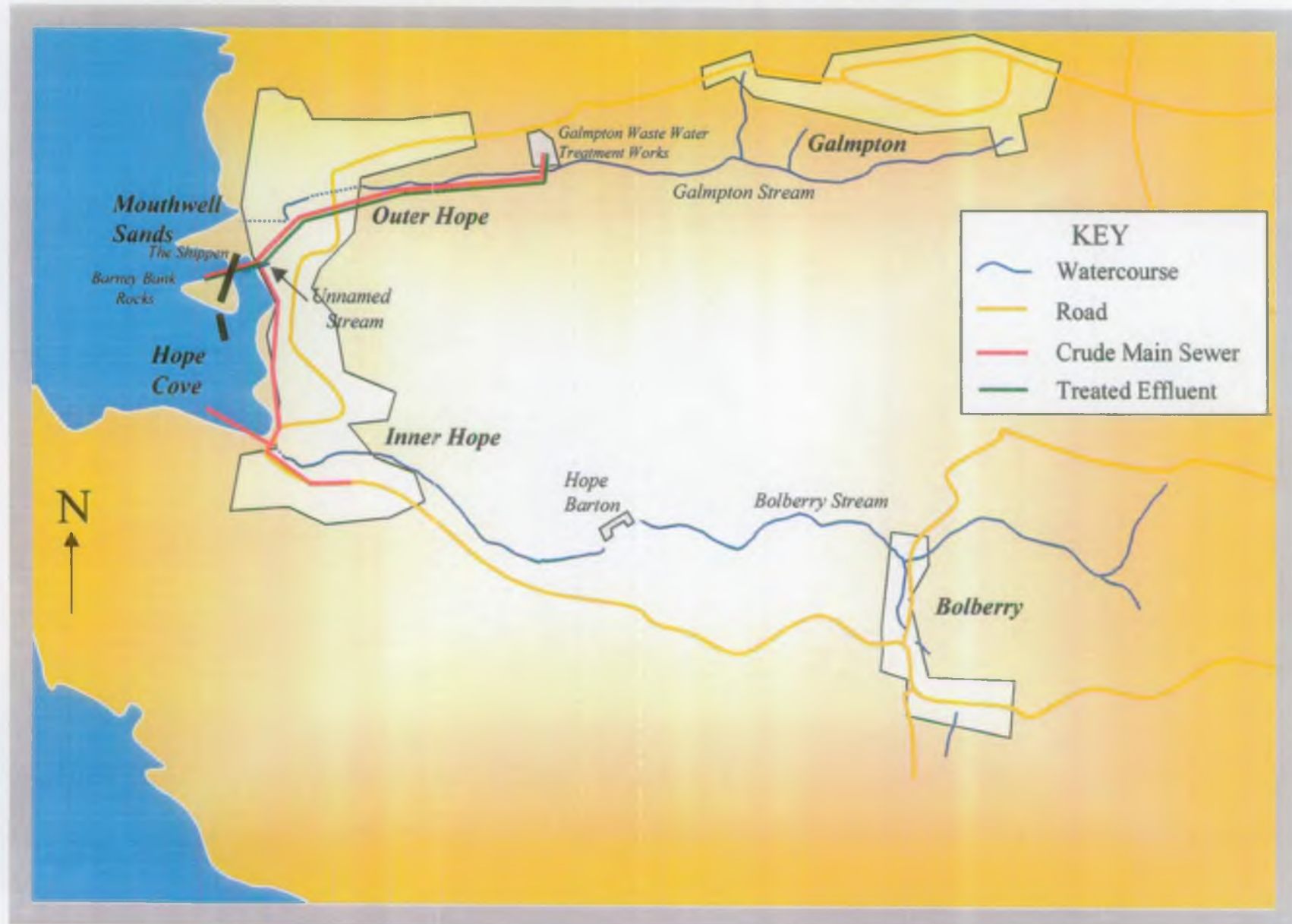
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DEVON AREA INVESTIGATIONS TEAM

DECEMBER 2000

JANUARY 2002 *with revisions*

MAP 1. DIAGRAMMATIC MAP OF THE HOPE COVE AREA



This map is diagrammatic and is not to scale

GALMPTON WWTW CATCH

Public Sewer	Private Sewer	Pumping Man
Full	Full	Full
Surface	Highway	Elevated Sewer
Combined	Treatment Works	Unverified
Treated	Abandoned Sewer	Syphon

Mon May 10 14:17:10 1999



The highlighted SO's were not true overflows but chambers containing open channels for gravity flow to the pumping station and treated flow to the outfall separated by the rising main. Works were carried out in 1997 to seal alternate channels in each manhole to ensure no cross flow could occur.

MAP 2. SWWL PLANS OF SEWERAGE FOR THE HOPE COVE AREA.

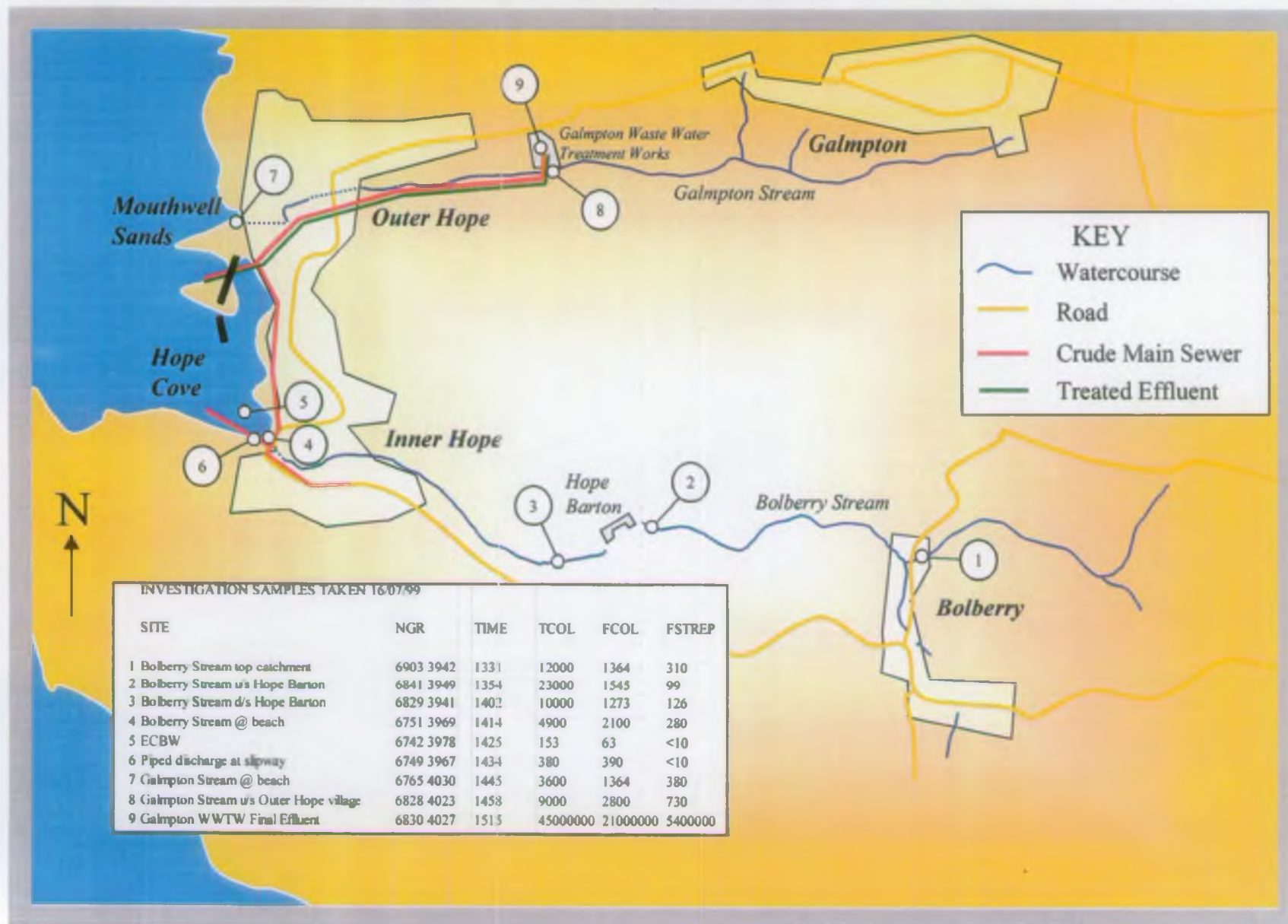
267342 mE 39494 mN

The information contained on this plan is provided only as a guide and no assurance as to the accuracy is given or implied. The Company accepts no liability whatsoever for any error or omission in the information. It should be noted that all manholes, pipes and other apparatus of the Company in the area of the plan are shown.

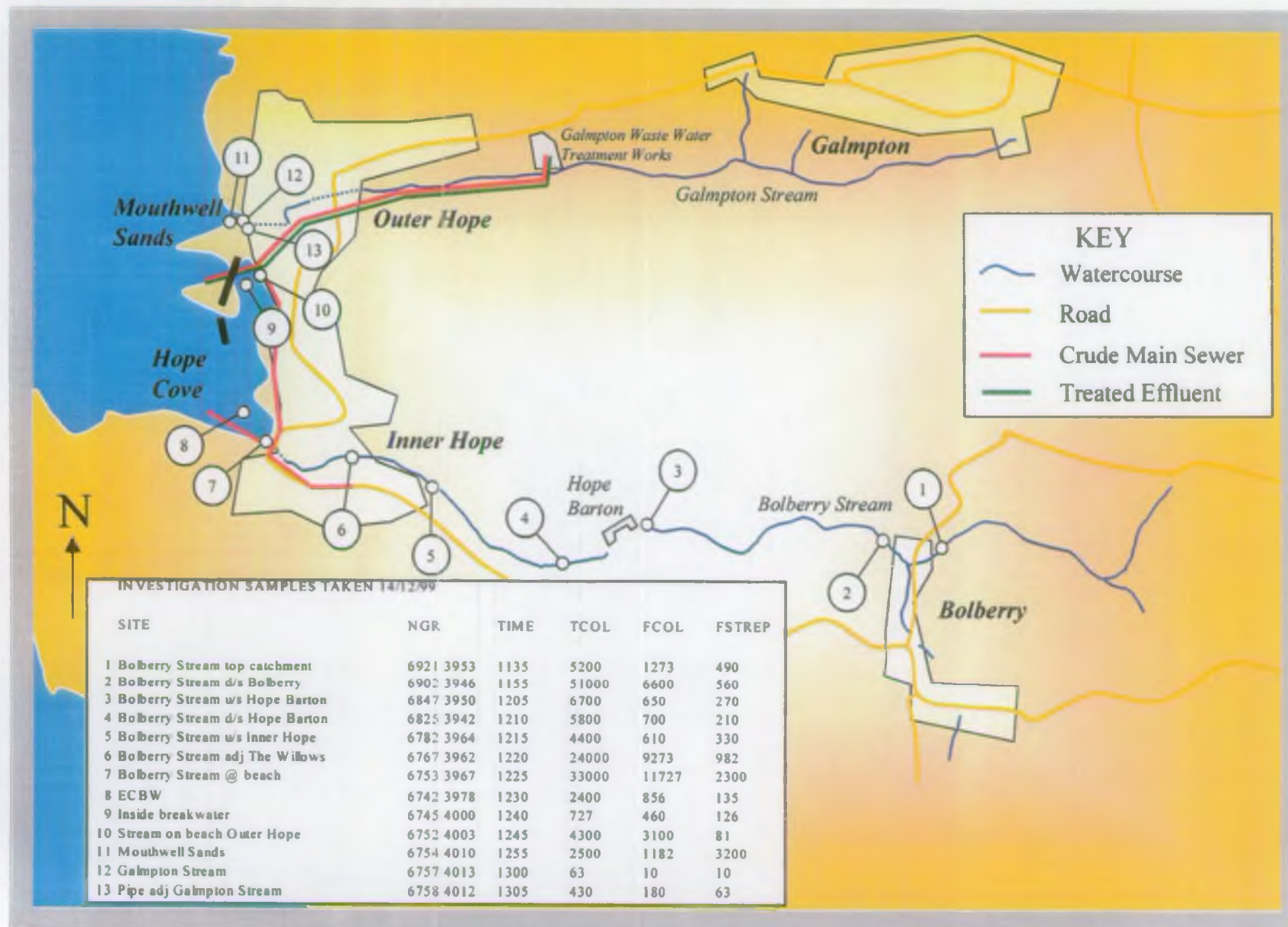
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Scale: 1:2500

MAP 3. INVESTIGATION SAMPLE SITES 16/07/99



MAP 4. INVESTIGATION SAMPLE SITES 14/12/99



This map is diagrammatic and is not to scale

Note: In following Tables no correction to BST has been applied

TABLE 1. HOPE COVE ECBW: HISTORIC DATA 1990-2000

DATE	TIME	TOTAL COLIFORMS 100ml*	FAECAL COLIFORMS 100ml*	FAECAL STREPTOCOCCI 100ml*	DATE	TIME	TOTAL COLIFORMS 100ml*	FAECAL COLIFORMS 100ml*	FAECAL STREPTOCOCCI 100ml*
1990					1993				
04-May-90	10:05	90	80	30	06-May-93	11:15	10	10	10
14-May-90	10:45	520	170	38	15-May-93	10:50	70	120	8
23-May-90	13:15	29	2	1	24-May-93	12:25	650	960	600
30-May-90	13:25	120	26	21	03-Jun-93	11:15	530	392	100
02-Jun-90	13:40	280	170	29	10-Jun-93	12:55	100	34	12
11-Jun-90	10:00	470	240	19	19-Jun-93	12:30	270	170	25
20-Jun-90	13:00	50	47	7	23-Jun-93	12:40	400	10	20
29-Jun-90	10:00	11	5	3	28-Jun-93	11:10	10	10	10
08-Jul-90	10:00	204	200	33	05-Jul-93	13:30	30	40	320
17-Jul-90	10:00	190	142	60	14-Jul-93	10:55	224	92	10
23-Jul-90	13:50	61	14	11	21-Jul-93	12:50	30	70	10
26-Jul-90	14:00	7	5	2	30-Jul-93	11:00	360	340	20
04-Aug-90	10:05	91	73	7	06-Aug-93	12:30	10	30	30
13-Aug-90	10:35	29	15	14	09-Aug-93	12:55	387	160	10
22-Aug-90	13:20	360	220	78	16-Aug-93	13:55	20	20	10
29-Aug-90	13:10	280	80	25	24-Aug-93	11:05	10	10	10
03-Sep-90	13:45	300	310	28	03-Sep-93	13:45	70	128	10
10-Sep-90	10:10	1050	830	38	10-Sep-93	11:00	2100	1100	70
19-Sep-90	09:55	1200	930	149	20-Sep-93	11:50	900	333	450
28-Sep-90	10:35	7	3	1	28-Sep-93	11:10	297	168	10
max		1200	930	149	max		2100	1100	600
min		7	2	1	min		10	10	8
geo mean		114.00	58.01	15.07	geo mean		109.14	81.64	25.83
stdev		332.16	257.62	34.49	stdev		486.57	304.56	167.17
1991					1994				
07-May-91	14:20	210	80	10	05-May-94	12:15	1260	810	100
14-May-91	14:25	10	10	10	14-May-94	11:30	20	35	22
23-May-91	14:55	90	90	10	23-May-94	13:30	90	100	30
02-Jun-91	10:00	10	10	10	02-Jun-94	11:50	100	160	12
06-Jun-91	10:00	500	190	10	09-Jun-94	11:25	30	8	6
11-Jun-91	10:05	1500	640	40	18-Jun-94	12:25	30	30	32
18-Jun-91	12:05	480	140	60	22-Jun-94	11:45	120	153	130
27-Jun-91	11:30	530	220	10	27-Jun-94	12:30	14	3	3
04-Jul-91	11:40	20	10	10	04-Jul-94	11:15	162	66	160
13-Jul-91	11:20	700	330	170	13-Jul-94	11:30	20	5	4
22-Jul-91	11:35	10	10	10	20-Jul-94	13:35	17	17	22
29-Jul-91	11:30	100	70	10	29-Jul-94	11:00	200	250	330
02-Aug-91	10:25	80	50	10	05-Aug-94	11:45	84	61	18
07-Aug-91	11:35	230	100	10	08-Aug-94	12:10	50	40	10
14-Aug-91	11:00	110	20	10	15-Aug-94	11:40	50	8	3
23-Aug-91	11:50	3400	2300	420	23-Aug-94	12:30	176	105	35
02-Sep-91	11:20	20	20	40	02-Sep-94	12:25	108	5	19
11-Sep-91	12:25	70	70	10	09-Sep-94	12:45	6300	3510	1600
18-Sep-91	12:05	130	130	30	19-Sep-94	12:10	800	340	150
27-Sep-91	11:40	280	170	100	27-Sep-94	11:40	4000	900	390
max		3400	2300	420	max		6300	3510	1600
min		10	10	10	min		14	3	3
geo mean		129.54	76.27	20.68	geo mean		118.62	62.28	35.35
stdev		784.75	508.38	96.05	stdev		1602.17	790.22	357.48
1992					1995				
07-May-92	13:40	6	2	1	05-May-95	10:55	40	8	4
14-May-92	14:00	198	93	6	11-May-95	11:10	70	36	6
26-May-92	13:40	200	73	22	17-May-95	11:00	1260	740	270
02-Jun-92	12:25	13	9	1	25-May-95	11:45	270	280	70
11-Jun-92	11:25	42	27	6	05-Jun-95	10:55	70	36	18
18-Jun-92	14:20	25	19	4	15-Jun-95	11:15	60	44	8
24-Jun-92	13:03	27	21	2	23-Jun-95	11:50	10	2	1
27-Jun-92	11:00	1	3	1	29-Jun-95	11:45	20	10	10
06-Jul-92	14:40	13	11	24	03-Jul-95	14:40	42	33	66
13-Jul-92	13:05	3240	2480	91	13-Jul-95	10:55	50	70	70
22-Jul-92	13:40	6	1	1	21-Jul-95	11:10	500	180	35
29-Jul-92	13:50	3	1	1	27-Jul-95	12:55	500	272	65
07-Aug-92	11:50	9	1	2	31-Jul-95	10:35	650	600	36
14-Aug-92	11:45	132	57	6	10-Aug-95	12:05	34	21	9
21-Aug-92	10:30	12	7	4	18-Aug-95	12:30	25	12	11
23-Aug-92	11:30	62	86	2	24-Aug-95	11:50	150	77	12
27-Aug-92	11:25	730	630	103	30-Aug-95	12:00	8	7	4
02-Sep-92	12:05	950	744	69	04-Sep-95	12:15	180	120	16
09-Sep-92	11:48	876	1010	136	19-Sep-95	14:30	60	33	25
18-Sep-92	14:20	486	96	19	27-Sep-95	10:55	2400	1400	450
25-Sep-92	13:50	37	38	9					
30-Sep-92	11:20	950	469	460					
max		3240	2480	460	max		2400	1400	450
min		1	1	1	min		8	2	1
geo mean		57.93	33.24	8.11	geo mean		98.38	56.14	20.71
stdev		737.83	580.25	102.64	stdev		579.28	347.37	109.49

exceeds Imperative standard

TABLE 1(Cont.). HOPE COVE ECBW: HISTORIC DATA 1990-2000

DATE	TIME	TOTAL COLIFORMS 100ml*	FAECAL COLIFORMS 100ml*	FAECAL STREPTOCOCCI 100ml*
1996				
03-May-96	10:55	37	58	14
15-May-96	12:00	2	1	1
23-May-96	12:48	2430	1620	440
03-Jun-96	11:15	200	44	28
07-Jun-96	14:00	70	46	21
16-Jun-96	12:55	308	182	210
21-Jun-96	11:00	82	18	5
01-Jul-96	11:40	136	136	24
11-Jul-96	11:00	19	18	1
15-Jul-96	12:55	8	11	2
19-Jul-96	10:50	19	10	4
29-Jul-96	12:35	63	44	29
08-Aug-96	11:10	68	15	4
16-Aug-96	10:50	18	5	1
21-Aug-96	16:55	222	118	22
28-Aug-96	17:20	900	600	991
05-Sep-96	11:05	53	15	10
11-Sep-96	10:55	45	31	7
15-Sep-96	11:15	81	18	36
25-Sep-96	12:10	76	52	14
max		2430	1620	991
min		2	1	1
geo mean		68.80	36.44	13.83
stdev		551.91	370.06	233.20

DATE	TIME	TOTAL COLIFORMS 100ml*	FAECAL COLIFORMS 100ml*	FAECAL STREPTOCOCCI 100ml*
1999				
07-May-99	10:40	105	36	10
10-May-99	09:10	440	130	10
14-May-99	15:10	198	162	153
23-May-99	09:35	351	216	10
01-Jun-99	14:30	9	10	10
09-Jun-99	13:55	68	27	117
14-Jun-99	09:00	63	36	18
18-Jun-99	14:30	36	18	10
25-Jun-99	10:40	10	10	10
04-Jul-99	09:18	54	45	10
13-Jul-99	14:20	54	10	10
20-Jul-99	09:00	189	113	18
29-Jul-99	10:12	63	10	10
05-Aug-99	13:10	265	36	36
14-Aug-99	09:15	70000	5040	2800
17-Aug-99	09:00	396	252	108
23-Aug-99	14:22	840	108	90
02-Sep-99	10:00	54	10	10
13-Sep-99	17:45	89	90	99
20-Sep-99	10:30	982	675	300
max		70000	5040	2800
min		9	10	10
geo mean		152.30	60.54	32.46
stdev		15604.39	1113.95	618.26

DATE	TIME	TOTAL COLIFORMS 100ml*	FAECAL COLIFORMS 100ml*	FAECAL STREPTOCOCCI 100ml*
1997				
03-May-97	11:05	34	25	5
15-May-97	10:55	1	1	1
23-May-97	11:15	25	16	5
03-Jun-97	11:05	900	47	80
09-Jun-97	11:30	28	13	4
16-Jun-97	14:50	15	7	1
23-Jun-97	11:05	340	168	30
01-Jul-97	10:55	14	6	5
11-Jul-97	11:25	7	2	1
15-Jul-97	11:45	66	73	33
21-Jul-97	11:45	6	6	5
29-Jul-97	15:30	6	4	6
08-Aug-97	12:55	22	4	10
18-Aug-97	11:45	1	70	14
21-Aug-97	11:55	27	34	27
28-Aug-97	11:55	1228	603	54
04-Sep-97	11:10	225	74	41
11-Sep-97	12:40	54	38	126
15-Sep-97	12:50	320	220	23
25-Sep-97	10:50	89	130	9
29-Sep-97	11:50	155	77	4
max		1228	603	126
min		1	1	1
geo mean		37.27	24.93	10.02
stdev		318.25	134.19	31.24

DATE	TIME	TOTAL COLIFORMS 100ml*	FAECAL COLIFORMS 100ml*	FAECAL STREPTOCOCCI 100ml*
2000				
03-May-00	09:10	92	10	18
16-May-00	17:20	174	115	72
23-May-00	16:30	827	288	81
02-Jun-00	09:10	225	76	99
09-Jun-00	09:30	120	79	36
19-Jun-00	12:38	154	122	27
22-Jun-00	11:25	370	351	45
27-Jun-00	11:25	72	45	10
04-Jul-00	09:00	81	36	54
13-Jul-00	09:05	750	480	162
20-Jul-00	09:00	126	81	99
25-Jul-00	09:10	54	27	10
07-Aug-00	09:12	36	18	54
15-Aug-00	09:45	324	189	27
23-Aug-00	09:00	270	155	10
01-Sep-00	11:10	432	207	36
06-Sep-00	09:25	510	380	171
11-Sep-00	09:00	240	144	10
14-Sep-00	13:40	250	105	54
15-Sep-00	11:15	670	580	520
max		827	580	520
min		36	10	10
geo mean		204.83	108.66	44.65
stdev		237.04	161.34	113.69

DATE	TIME	TOTAL COLIFORMS 100ml*	FAECAL COLIFORMS 100ml*	FAECAL STREPTOCOCCI 100ml*
1998				
07-May-98	13:40	13	13	3
14-May-98	16:40	10	10	10
26-May-98	14:30	1	8	18
02-Jun-98	10:45	1000	855	210
08-Jun-98	14:25	2800	2600	6400
11-Jun-98	13:10	2250	909	54
18-Jun-98	10:30	54	45	36
22-Jun-98	12:40	10	27	9
27-Jun-98	12:35	151	162	18
06-Jul-98	14:15	1545	1182	16000
13-Jul-98	11:30	680	380	90
22-Jul-98	10:35	72	45	18
29-Jul-98	14:35	63	36	18
07-Aug-98	11:25	97	54	9
14-Aug-98	11:50	162	18	27
01-Sep-98	13:55	180	171	108
05-Sep-98	10:30	1145	700	460
08-Sep-98	12:40	3600	2200	135
14-Sep-98	10:30	1310	910	36
17-Sep-98	12:10	135	63	9
24-Sep-98	10:40	454	261	153
max		3600	2600	16000
min		1	8	3
geo mean		182.25	139.89	57.64
stdev		1031.53	753.28	3675.78

exceeds Imperative standard

TABLE 2.
SAMPLES TAKEN 15/08/99 (HIGH WATER 0922 BST)

SITE	NGR	TIME	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
ECBW	6742 3978		455	180	18
Spring on beach Outer Hope	6747 4002		13000	4100	1909

TABLE 3.
SAMPLES TAKEN 09/09/98 (HIGH WATER 2008 BST)

SITE	NGR	TIME	SALINITY	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
Mouthwell Sands	6755 4014	1403	33.4	2000	1727	36
Galmpton Stream at Beach	6765 4030	1407		27000	10455	7200
Hope Cove ECBW	6742 3978	1418	34.2	1636	1182	135
Bolberry Stream at Beach	6751 3969	1421		12000	5200	3500

TABLE 4.
INVESTIGATION SAMPLES TAKEN 16/07/99 (HIGH WATER 0917 BST) DURING DRY WEATHER (See Map 3)

SITE	NGR	TIME	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
1 Bolberry Stream at top catchment	6903 3942	1331	12000	1364	310
2 Bolberry Stream w/s Hope Barton	6841 3949	1354	23000	1545	99
3 Bolberry Stream d/s Hope Barton	6829 3941	1402	10000	1273	126
4 Bolberry Stream at beach	6751 3969	1414	4900	2100	280
5 Hope Cove ECBW	6742 3978	1425	153	63	<10
6 Piped discharge at slipway	6749 3967	1434	380	390	<10
7 Galmpton Stream at beach	6765 4030	1445	3600	1364	380
8 Galmpton Stream w/s Outer Hope village	6828 4023	1458	9000	2800	730
9 Galmpton WWTW final effluent	6830 4027	1515	4.5x10 ⁶	2.1x10 ⁶	5.4x10 ⁶

TABLE 5.
INVESTIGATION SAMPLES TAKEN 14/12/99 (HIGH WATER 0906 BST) DURING WET WEATHER (See Map 4)

SITE	NGR	TIME	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
1 Bolberry Stream at top catchment	6921 3953	1135	5200	1273	490
2 Bolberry Stream d/s Bolberry	6902 3946	1155	51000	6600	560
3 Bolberry Stream w/s Hope Barton	6847 3950	1205	6700	650	270
4 Bolberry Stream d/s Hope Barton	6825 3942	1210	5800	700	210
5 Bolberry Stream w/s Inner Hope	6782 3964	1215	4400	610	330
6 Bolberry Stream adjacent The Millers	6767 3962	1220	24000	9273	982
7 Bolberry Stream at beach	6753 3967	1225	33000	11727	2300
8 ECBW	6742 3978	1230	2400	856	135
9 Hope Cove inside breakwater	6745 4000	1240	727	460	126
10 Stream A at Outer Hope	6752 4003	1245	4300	3100	81
11 Mouthwell Sands	6754 4010	1255	2500	1182	3200
12 Galmpton Stream at beach	6757 4013	1300	63	10	10
13 Discharge from wall adjacent Galmpton Stream	6758 4012	1305	430	180	63

TABLE 6.
INVESTIGATION SAMPLES TAKEN 01/10/99 [HIGH WATER 1033 BST]

SITE	NGR	TIME	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
Discharge from wall adjacent Galmpton Stream	6765 4029	1236	1182	260	400
Galmpton Stream at beach	6765 4030	1239	3300	919	1135

TABLE 7.
INVESTIGATION SAMPLES TAKEN 20/01/00 [HIGH WATER 1821 BST]

SITE	NGR	TIME	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
Discharge to beach 20m N ECBW line	6975 3975	1315	<10	<10	<10
Stream A at manhole Outer Hope	6752 4003	1330	3700	320	36

TABLE 8.
INVESTIGATION SAMPLES TAKEN 20/09/99 [HIGH WATER 1421 BST]

SITE	NGR	TIME	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
Hope Cove inside breakwater	6745 4001	1345	6300	2300	600

TABLE 9
INNER HOPE EMERGENCY OUTFALL: LOGGED DISCHARGES 26/10/99 - 19/09/00

DISCHARGE START		DISCHARGE FINISH		OBSERVATIONS
DATE	TIME	DATE	TIME	
18/12/1999	19:00	18/12/1999	21:30	Site attended: discharge observed. SWWL informed. Problem is blockage in rising main.
24/12/1999	05:50	24/12/1999	07:45	
	16:40		20:45	
25/12/1999	01:05	25/12/1999	01:50	
	06:20		09:00	
26/12/1999	07:40	26/12/1999	08:10	
15/02/2000	23:30	15/02/2000	00:15	
16/02/2000	02:45	16/02/2000	04:30	
	07:15		23:45	
17/02/2000	07:15	17/02/2000	12:30	
25/02/2000	09:55		10:30	Site attended: discharge observed. SWWL informed. Both pumps failed. One pump only present which had failed.
	10:45		11:10	
	12:00		14:55	
26/02/2000	20:05		23:40	
27/02/2000	00:00		02:10	
	04:45		04:55	
06/03/2000	17:40		17:45	
	18:05	07/03/2000	00:20	
07/03/2000	06:40	08/03/2000	00:40	
08/03/2000	07:00	09/03/2000	01:30	
09/03/2000	05:00	09/03/2000	16:55	Site attended: discharge observed. SWWL informed. One pump only present which had failed.
28/03/2000	unknown	28/03/2000	unknown	
21/04/2000	22:30	21/04/2000	22:50	
24/04/2000	20:05	25/04/2000	13:30	
29/04/2000	21:00	02/05/2000	13:05	
12/06/2000	23:50	12/06/2000	00:30	
13/06/2000	04:10	13/06/2000	04:30	
	05:20		05:40	
	06:50		23:30	
14/06/2000	00:00	14/06/2000	00:30	
	06:10		18:50	Site attended: discharge observed. SWWL informed.
17/06/2000	07:20	18/06/2000	01:10	
18/06/2000	06:10	18/06/2000	22:10	
	23:00		00:10	
19/06/2000	07:10	19/06/2000	12:30	
	19:50		00:50	
20/06/2000	03:20	20/06/2000	03:40	
	04:10		13:40	
	14:50		15:00	
	16:30		00:30	
21/06/2000	02:00	21/06/2000	02:20	Site attended: discharge observed. SWWL informed.
	05:20		05:30	
	06:50		10:30	
23/06/2000	09:40	23/06/2000	unknown	

TABLE 10.
INVESTIGATION SAMPLES TAKEN 17/02/00 [HIGH WATER 1712 BST]

SITE	NGR	TIME	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
Discharge from Inner Hope EO	6751 3966	1215	2000000	2000000	430000
Bolberry Stream at Beach	6753 3967	1220	3400	580	300
ECBW	6742 3978	1225	1818	560	210

TABLE 11.
INVESTIGATION SAMPLES TAKEN 09/03/00 [HIGH WATER 0851 BST]

SITE	NGR	TIME	TEMP	SALINITY	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
Discharge from Inner Hope EO	6751 3966	1301	11.5	0.1	6000000	430000	69000
Bolberry Stream at Beach	6753 3967	1252	11.7	0	6600	780	390
ECBW	6742 3978	1249	10.5	32.5	4900	1636	135
Discharge from Inner Hope EO	6751 3966	1422	11.7	0	9600000	3500000	380000
Bolberry Stream at Beach	6753 3967	1427	12.4	0	3600	600	310
ECBW	6742 3978	1432	11	33.5	21000	4400	330

TABLE 12.
INVESTIGATION SAMPLES TAKEN 28/03/00 [HIGH WATER 1150 BST]

SITE	NGR	TIME	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
Discharge from Inner Hope EO	6751 3966	n/a	27x10 ⁴	11727273	410000
Bolberry Stream at Beach	6753 3967	n/a	18000	6500	198
ECBW	6742 3978	n/a	3000	946	27

TABLE 13.
INVESTIGATION SAMPLES TAKEN 14/06/00 [HIGH WATER 1625 BST]

SITE	NGR	TIME	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
Galmpton WWTW Final Effluent	6830 4027	1025	3.5x10 ⁷	1.7x10 ⁷	4.8x10 ⁶
Galmpton Stream at Beach	6757 4013	1030	4200	874	2600
Discharge from wall adjacent Galmpton Stream	6758 4012	1035	5100	2600	937
Mouthwell Sands Beach	6754 4010	1040	126	270	45
Bolberry Stream at Beach	6753 3967	1237	42000	32000	280
Hope Cove ECBW	6742 3978	1240	3900	2100	81
Discharge from Inner Hope EO	6751 3966	1242	99	<10	27

TABLE 14.
INVESTIGATION SAMPLES TAKEN 23/06/00 [HIGH WATER 1021BST]

SITE	NGR	TIME	TOTAL COLIFORMS 100ml ⁻¹	FAECAL COLIFORMS 100ml ⁻¹	FAECAL STREPS 100ml ⁻¹
Discharge from Inner Hope EO	6751 3966	1031	9x10 ⁷	2.7x10 ⁷	1279279
Bolberry Stream at Beach	6753 3967	1033	13000	5000	610
ECBW	6742 3978	1040	2100	530	81

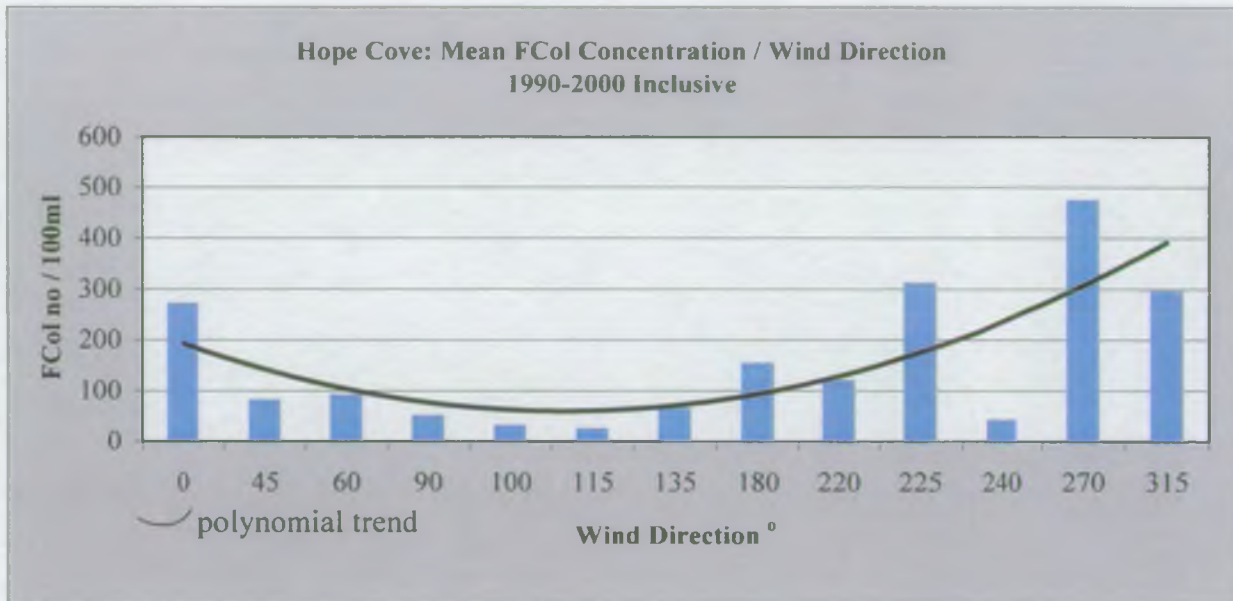


CHART 1. Faecal coliform concentrations at Hope Cove ECBW and wind direction

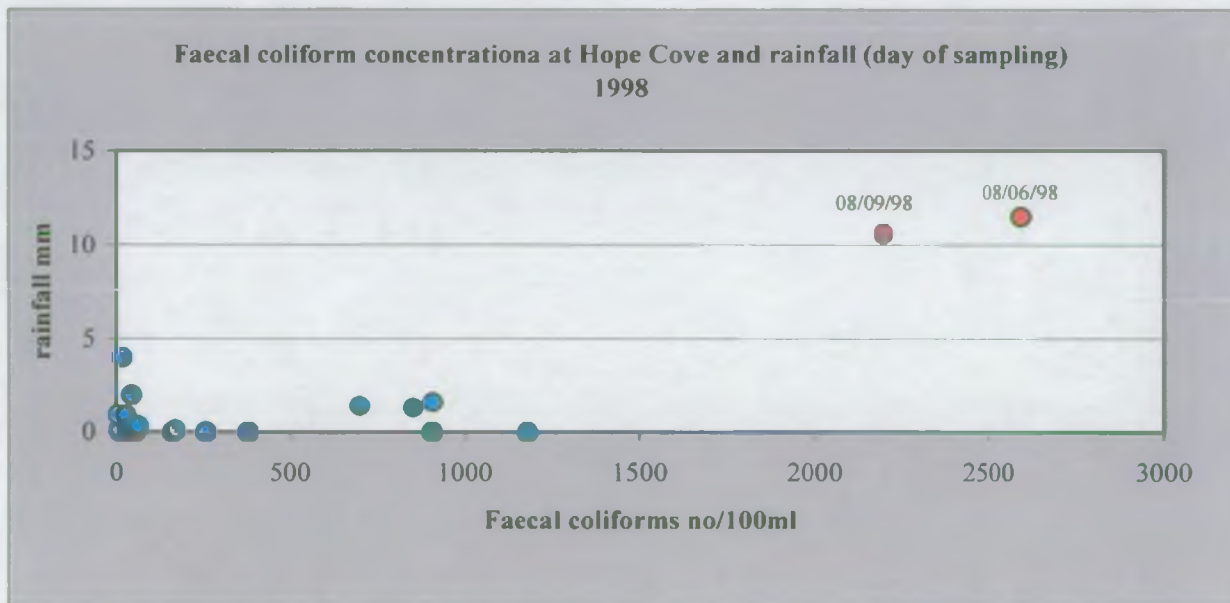


CHART 2. Faecal coliform concentrations at Hope Cove relative to same day rainfall 1998

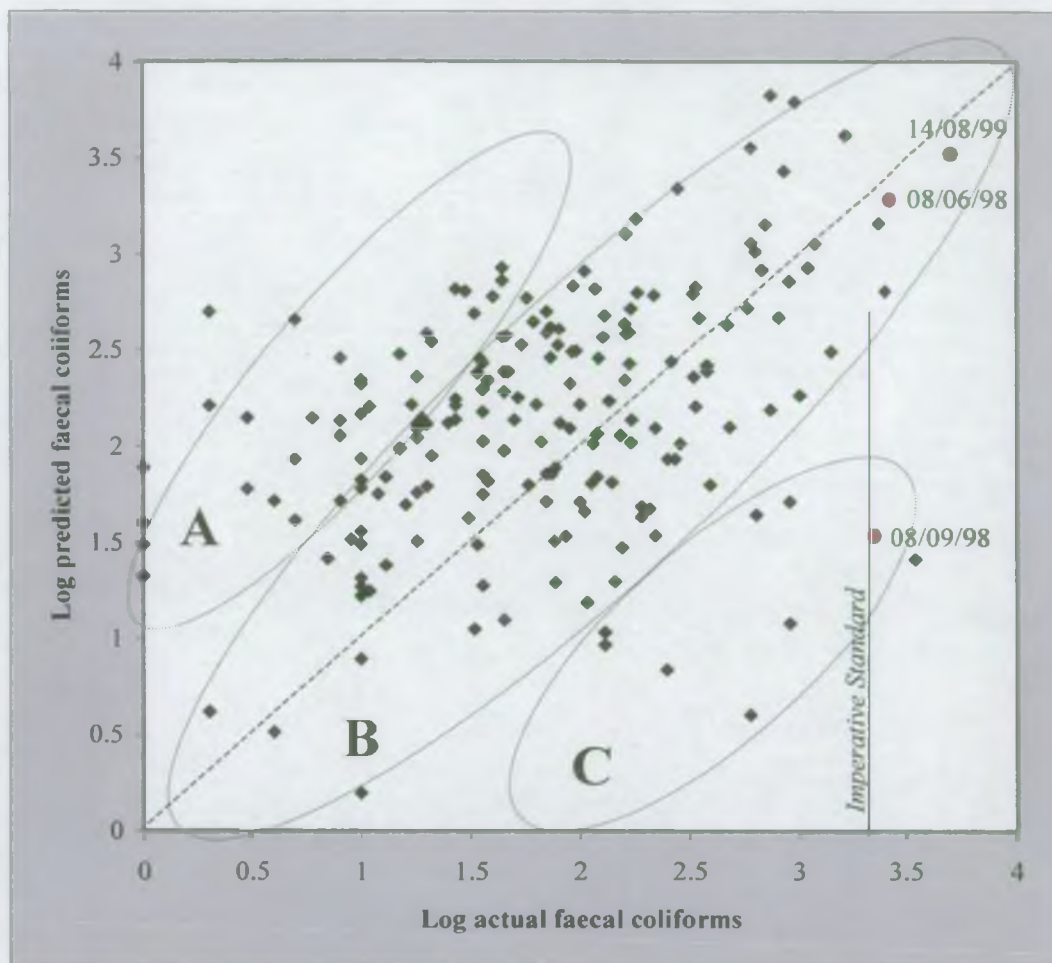


CHART 3. Predicted against actual faecal coliform concentrations at the ECBW site Hope Cove (1991-2000) based on faecal coliform concentrations in the Bolberry Stream.

Area A represents samples whose faecal coliform concentrations were substantially lower than we would have predicted and indicate that the Bolberry Stream is having little impact at the ECBW site.

Area B represents samples whose faecal coliform concentrations were of a similar order to those we would have predicted and indicate that the Bolberry Stream was determining water quality at the bathing beach site.

Area C represents samples whose faecal coliform concentrations were substantially higher than we would have predicted and indicate that other sources were responsible.

The plot uses relative salinities to obtain predicted concentrations and assumes the Bolberry Stream to be the only source of faecal coliforms.

**GALMPTON WWTW DYE STUDIES FINAL EFFLUENT 9/9/99
SPRING TIDES**



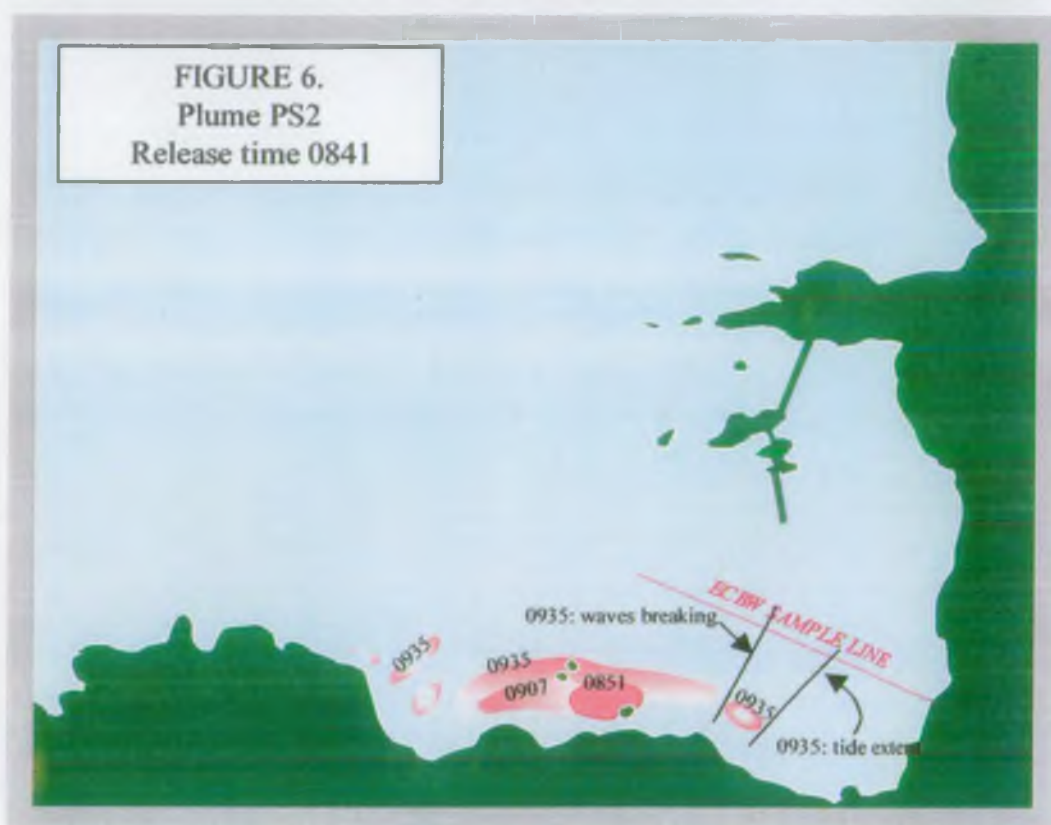
Figures are diagrammatic and not to scale

**GALMPTON WWTW FINAL EFFLUENT DYE STUDIES 9/9/99
SPRING TIDES**



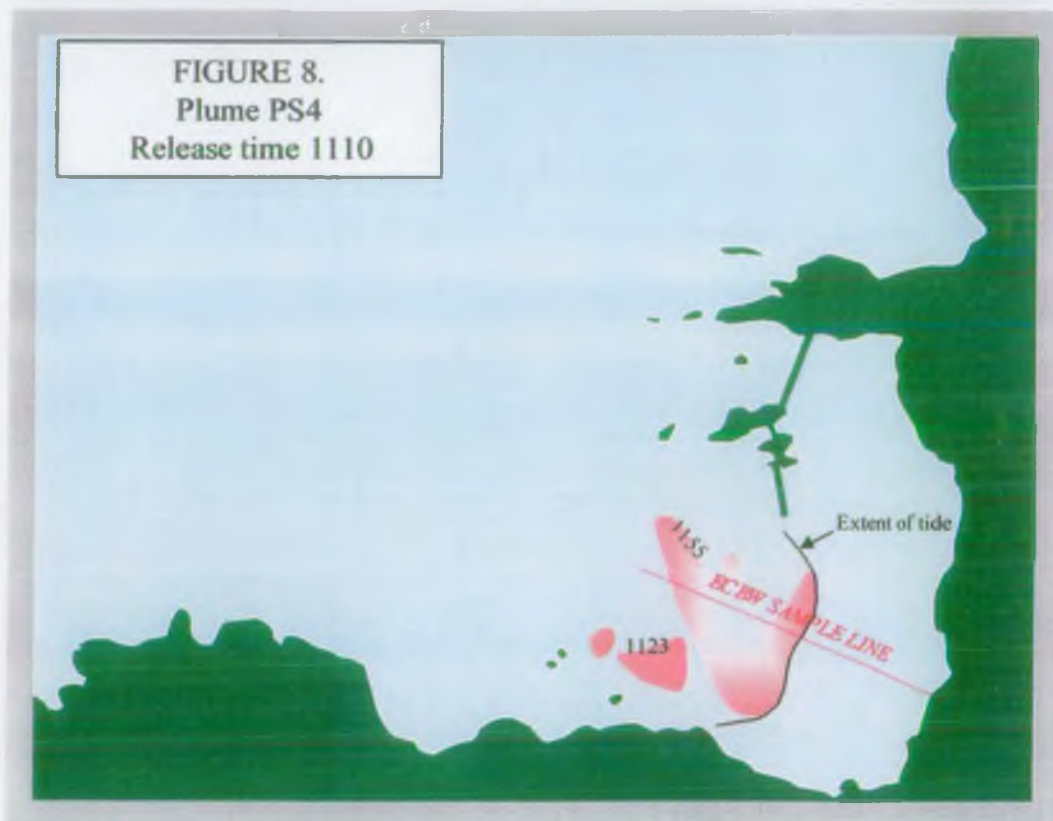
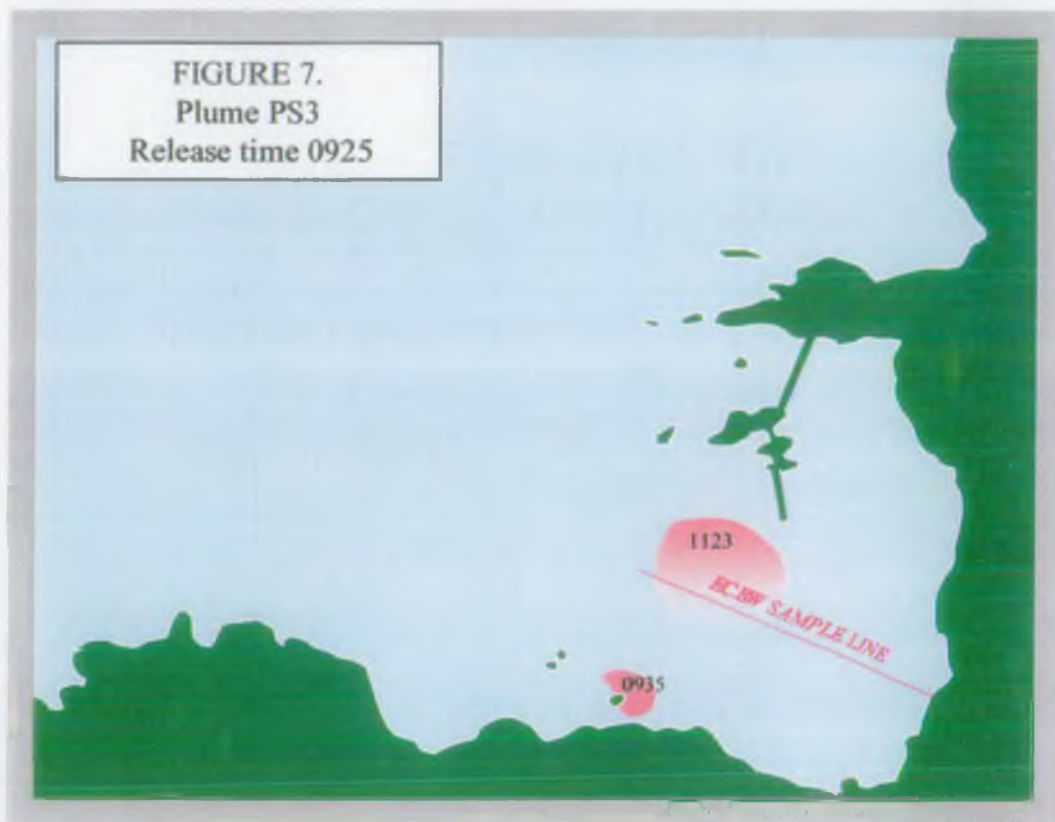
Figures are diagrammatic and not to scale

**INNER HOPE PUMPING STATION OVERFLOW
DYE STUDIES 9/9/99 SPRING TIDES**



Figures are diagrammatic and not to scale

**INNER HOPE PUMPING STATION OVERFLOW
DYE STUDIES 9/9/99 SPRING TIDES**



Figures are diagrammatic and not to scale

**GALMPTON WWTW FINAL EFFLUENT DYE STUDIES 20/9/99
NEAP TIDES**



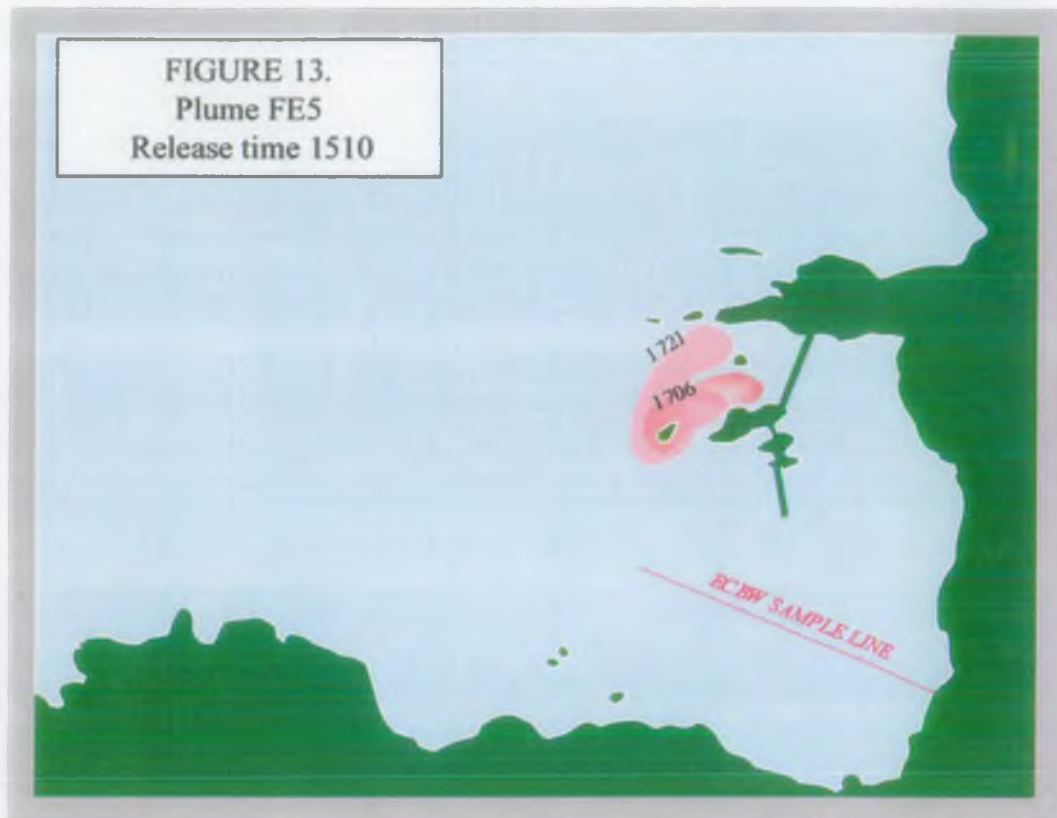
Figures are diagrammatic and not to scale

**GALMPTON WWTW FINAL EFFLUENT DYE STUDIES 20/9/99
NEAP TIDES**



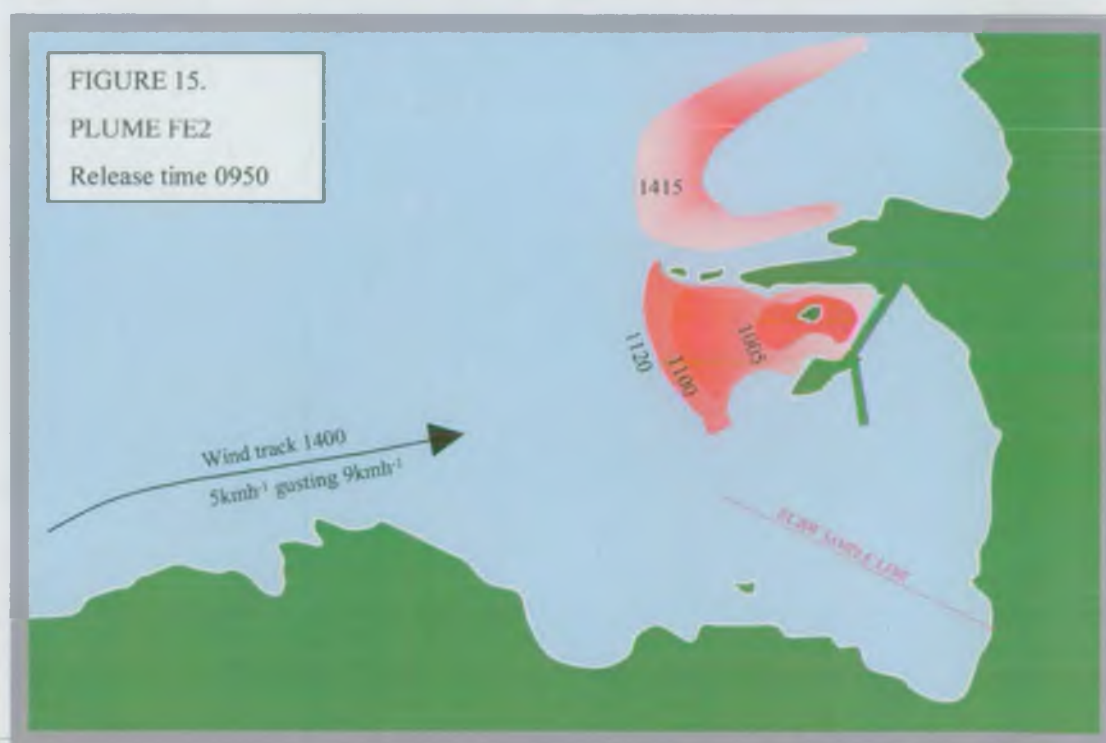
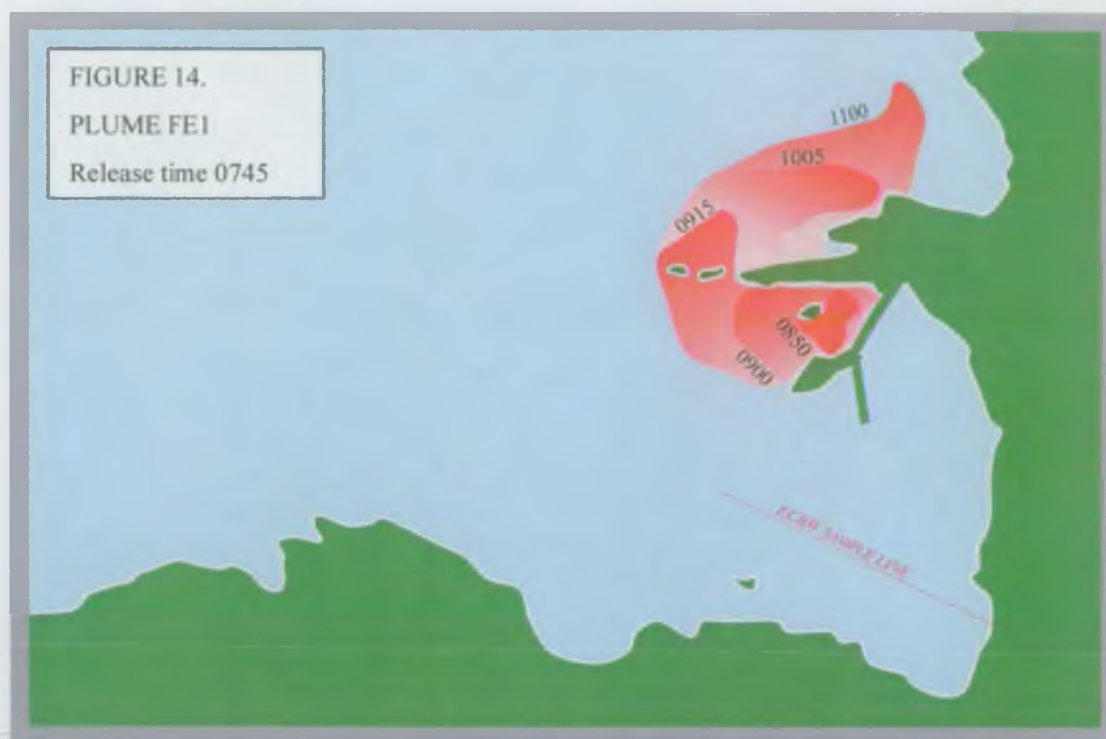
Figures are diagrammatic and not to scale

**GALMPTON STW FINAL EFFLUENT DYE STUDIES 20/9/99
NEAP TIDES**



Figures are diagrammatic and not to scale

GALMPTON STW FINAL EFFLUENT DYE STUDIES 14/06/00
INTERMEDIATE TIDE



Photograph 1.

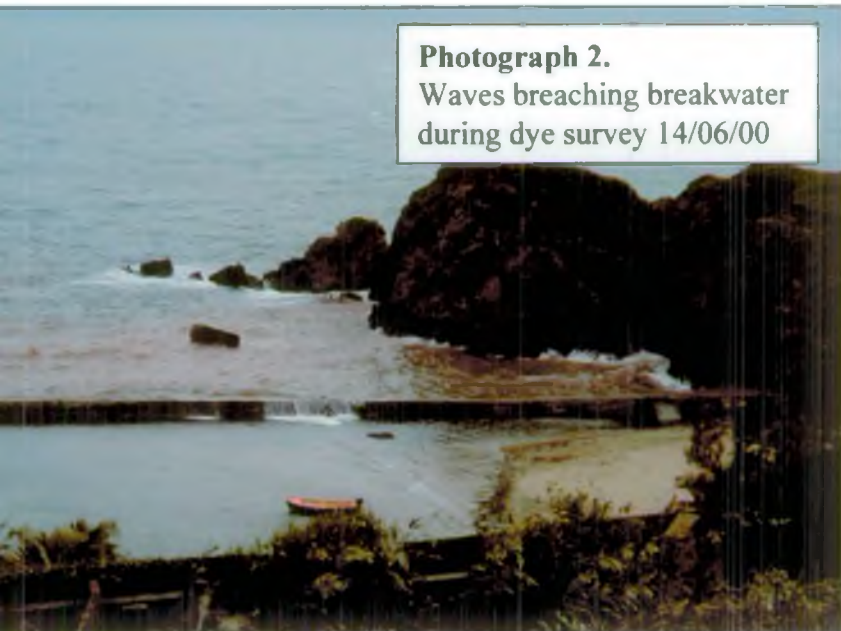
Potential impact of Galmpton
WWTW effluent dye plume at
Mouthwell Sands beach 14/06/00



Photograph 3.

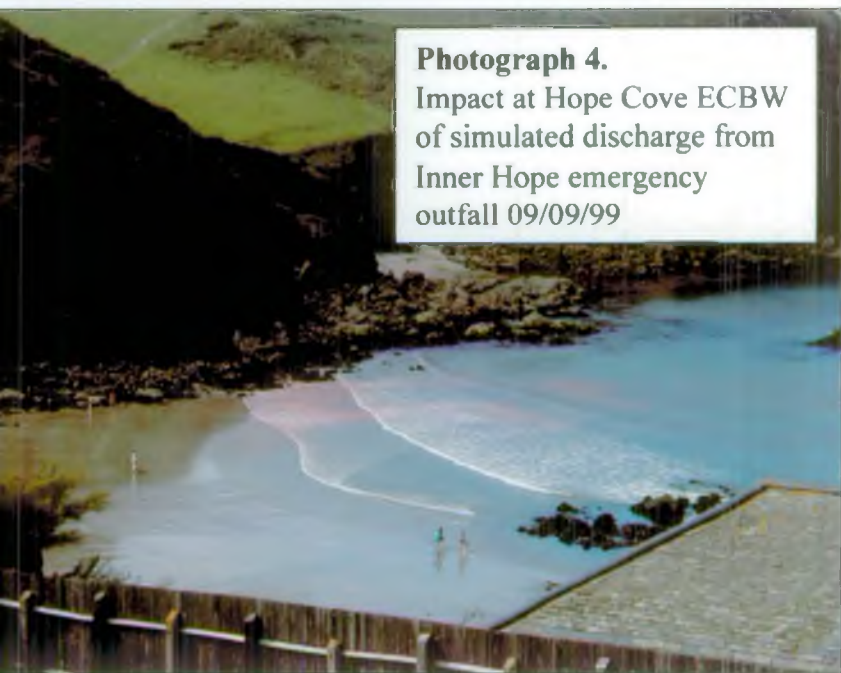
Poor effluent dispersion from
Galmpton WWTW outfall at
Low Water Springs 09/03/00





Photograph 2.

Waves breaching breakwater
during dye survey 14/06/00

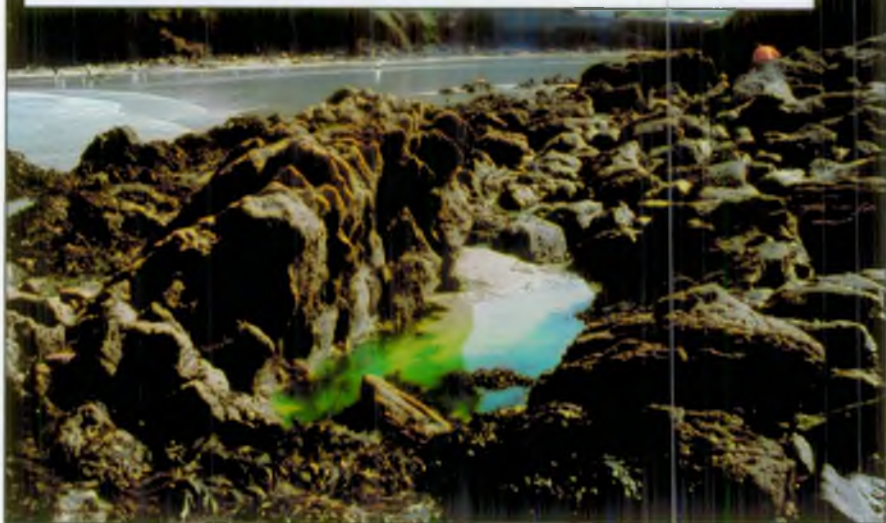


Photograph 4.

Impact at Hope Cove ECBW
of simulated discharge from
Inner Hope emergency
outfall 09/09/99

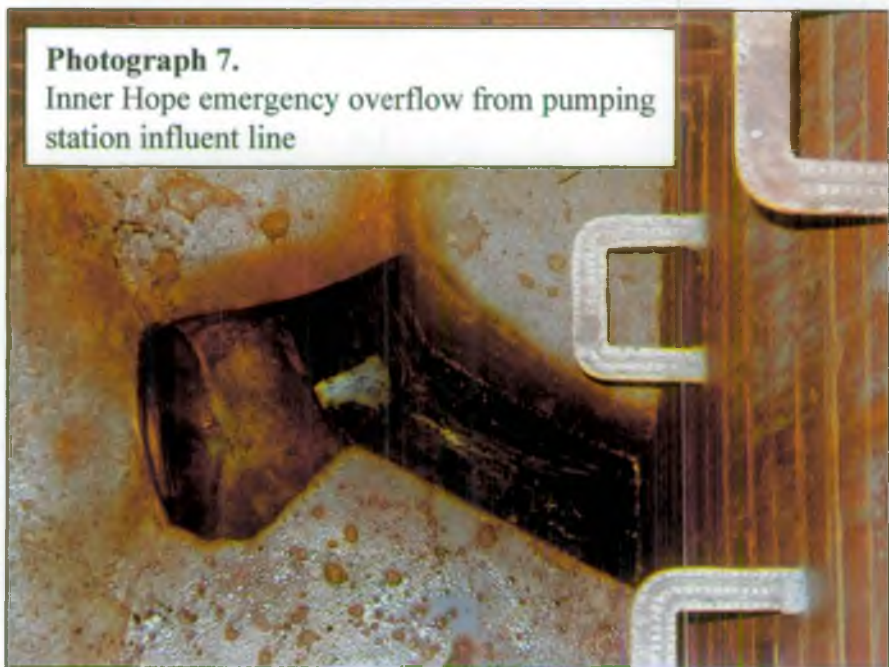
Photograph 5.

Residual dye in rock pools close to Inner Hope emergency outfall discharge point 09/09/09. ECBW in background.



Photograph 7.

Inner Hope emergency overflow from pumping station influent line



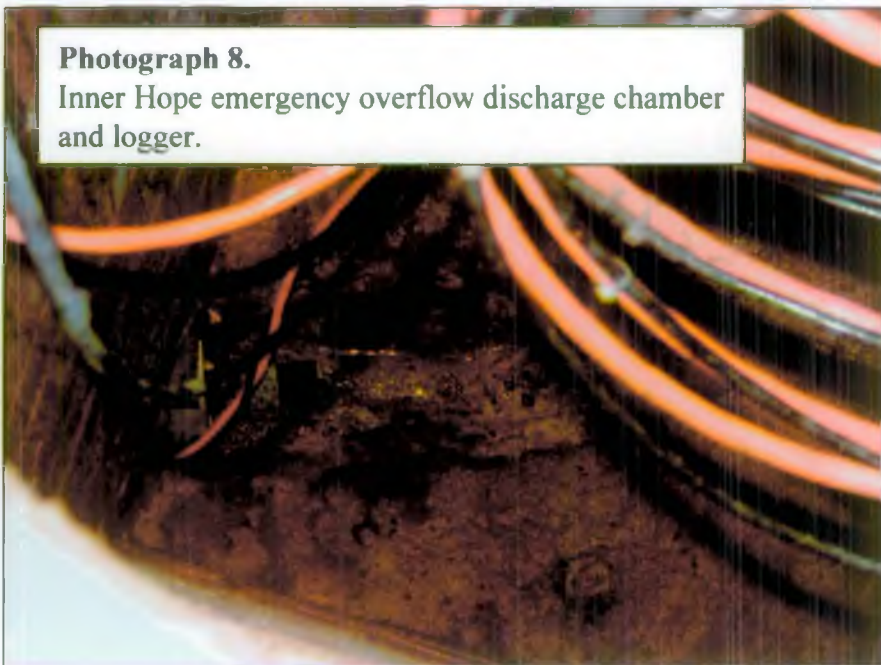
Photograph 6.

Inner Hope emergency overflow: triangular cover to influent line, circular cover to discharge chamber.



Photograph 8.

Inner Hope emergency overflow discharge chamber and logger.



Photograph 9.

Discharge from Inner Hope emergency overflow:
crude debris visible



Photograph 10.

Inner Hope emergency overflow: discharge of untreated
sewage from fracture in discharge pipe (arrowed) 09/03/00



Photograph 11.

Inner Hope emergency overflow:
discharge of untreated sewage
from fracture in discharge pipe
(arrowed) 09/03/00



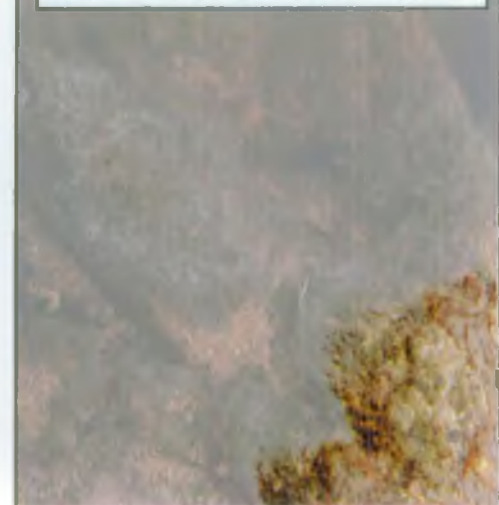
Photograph 12.

Deposits of decaying algae on landward side
of breakwater



Photograph 13.

Sewage fungus in rock pools on
landward side of breakwater



APPENDIX 1. THE BATHING WATER DIRECTIVE

INTRODUCTION

The Bathing Water Directive (76/160/EEC) concerns the quality of bathing waters for the purpose of protecting public health and for reasons of amenity. The **mandatory** requirements of this Directive have been translated into UK legislation under provisions of the Water Resources Act 1991.

The Directive requires the Agency to take samples and analyse bathing waters in accordance with the Directive and to report the results annually to the Department of Environment, Trade and Regions (DETR), who then forward the results to the European Commission. Results of analysis are also reported throughout the bathing season to local authorities and private beach owners who can then display them at or near beaches.

DESIGNATED BATHING WATERS

For the 1997 bathing season 448 designated bathing waters were monitored in England and Wales.

In the South West Region 180 designated bathing waters were monitored during 1997, of these 60 were within Devon.

MONITORING

The recognised bathing season in England and Wales runs from 15 May to 30 September. Sampling commences on 1 May with 20 samples being collected at each designated beach by 30 September.

Samples are collected at different times of the day and at different states of the tide to provide a broad spectrum of water quality.

Sampling commences at 10.00 am and samples must be transported to the laboratory in a refrigerated van or cool-box within 6 hours of collection to maintain the integrity of the sample.

QUALITY STANDARDS

The **mandatory** coliform standards given in the Directive and used by DETR to assess compliance require there to be no more than 10,000 total coliforms per 100ml sample and no more than 2,000 faecal coliforms per 100ml sample. In order for a bathing water to comply with these **mandatory** standards, 95% of samples (i.e. 19 out of 20) must meet these standards.

In addition to the **mandatory** standards the Directive includes guideline standards which the Agency is required to have regard to when seeking water quality improvements. These **guideline** standards are one of the parameters used by the Tidy Britain Group (TBG) to issue the coveted Blue Flag to beach owners. The **guideline** standards used by TBG to assess compliance require there to be no more than 500 total coliforms per 100ml sample, no more than 100 faecal coliforms per 100ml sample and no more than 100 faecal streptococci per 100ml sample. In order for the bathing water to be considered for a Blue Flag 80% of samples (i.e. 16 out of 20) must meet the total and faecal coliform standards and 90% of samples (i.e. 18 out of 20) must meet the faecal streptococci standards.

FAILURES OF MANDATORY STANDARDS

The day following sampling the Environment Agency Laboratory notifies Environment Protection staff of "presumptive" failures of the **mandatory** standards. This enables field staff to investigate the cause of failure. It should be noted that this investigation takes place two full tidal cycles after sampling and in some cases the cause can remain undetected.

APPENDIX 2.

Faecal coliform: faecal streptococci ratios of 4.4 or greater indicate a human origin, ratios of 0.7 or less indicate non-human sources and ratios between these values result from combined sources. Given in Gerardi, 1990.

APPENDIX 3.

Using the formula $TC = TC_0 \exp [-k_{tc} x/U_0]$ **

where	TC	= total coliform number at point x from discharge	MPN 100ml ⁻¹
	TC ₀	= initial coliform number	MPN 100ml ⁻¹
	k _{tc}	= total coliform decay coefficient	d ⁻¹
	x	= distance downstream from discharge point	m
	U ₀	= velocity of river	ms ⁻¹

$$k_{tc} = 1.0 + 0.02(T - 20) \text{ where } T = \text{temperature}$$

and $TC_0 = [(TC_{up})(Q_{up}) + (TC_e)(Q_e)] / (Q_{up} + Q_e)$

where	TC _{up}	= total coliform number upstream discharge	MPN 100ml ⁻¹
	Q _{up}	= flowrate stream upstream discharge	m ³ s ⁻¹
	TC _e	= total coliform number of effluent	MPN 100ml ⁻¹
	Q _e	= flowrate effluent	m ³ s ⁻¹

Using the above a theoretical livestock-derived total coliform concentration of 100000 100ml⁻¹ introduced to the Bolberry Stream at the extreme top of the catchment would have only attenuated to 88380 100ml⁻¹ at the beach site². Livestock contamination at any point on the Bolberry Stream is very likely to cause failure of the bathing water sample when the stream is coincident with the ECBW sample point.

* Open University, T303 Environmental Modelling, Monitoring and Control (Course Text), 1997. The Water Block. 171-3.

¹ from measurements made by DAIT during work on the Holcombe Stream, Teignmouth, Devon in 1998

² based on maximum stream length of 2 km and on profile measurements taken at Inner Hope (NGR 6782 3964) on 01/10/99

APPENDIX 4.

Record Sheet for Actions on Recommendations: (Current at January 2002)

<p>Recommendation 6.1:</p> <p>Further work is undertaken on septic tank inputs to the Bolberry Stream at Inner Hope to enable remedial work by the Environment Protection Officer.</p> <p>ACTION: DEVON AREA INVESTIGATIONS TEAM</p>	<p>Action taken:</p> <p>This work is ongoing</p>
<p>Recommendation 6.2:</p> <p>Consideration is given to the provision of fencing and other measures to prevent livestock entering the Bolberry Stream.</p> <p>ACTION: ENVIRONMENT PROTECTION OFFICER (NATIONAL TRUST)</p>	<p>Action taken:</p> <p>Not progressed</p>
<p>Recommendation 6.3:</p> <p>Telemetry is installed at the Inner Hope pumping station so that faults can be immediately attended to.</p> <p>ACTION: ENVIRONMENT PROTECTION OFFICER (SOUTH WEST WATER LTD)</p>	<p>Action taken:</p> <p>SWWL report that this was completed in early 2000</p>
<p>Recommendation 6.4:</p> <p>The Inner Hope emergency overflow discharge chamber is inspected should sewage pollution be suspected at the time that routine bathing beach samples are being taken.</p> <p>ACTION: MONITORING TEAM</p>	<p>Action taken:</p> <p>Not progressed</p>

<p>Recommendation 6.5:</p> <p>The fracture in the Inner Hope emergency outfall pipe is repaired.</p> <p>ACTION: ENVIRONMENT PROTECTION OFFICER (SOUTH WEST WATER LTD)</p>	<p>Action taken:</p> <p><i>Fracture marked with buoy November 2001 by DAIT. Buoy location and information passed to SWWL</i></p>
<p>Recommendation 6.6:</p> <p>Misconnections to Galmpton WWTW final effluent line at Outer Hope are rectified.</p> <p>ACTION: ENVIRONMENT PROTECTION OFFICER (SOUTH WEST WATER LTD)</p>	<p>Action taken:</p> <p>SWWL report that this was completed in Summer 2000</p>
<p>Recommendation 6.7:</p> <p>Warning notices are provided at Mouthwell Sands with regard to the possible contamination of the Galmpton Stream.</p> <p>ACTION: ENVIRONMENT PROTECTION OFFICER (SOUTH HAMS DISTRICT COUNCIL)</p>	<p>Action taken:</p> <p>Not progressed</p>
<p>Recommendation 6.8:</p> <p>Planned improvements to Galmpton WWTW incorporate measures to prevent discharges of storm water to the Galmpton Stream.</p> <p>ACTION: REGIONAL TIDAL WATER QUALITY (SOUTH WEST WATER LTD)</p>	<p>Action taken:</p> <p>RTWQ are progressing with SWWL</p>