DEVON AREA
INTERNAL REPORT

ENVIRONMENT AGENCY

Investigation into the 1999 Failure of the European Community Bathing Waters Directive at Teignmouth Town Beach

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(CATCHMENT 06A)

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EXECUTIVE SUMMARY

Teignmouth Town Beach failed to reach the imperative standards for faecal coliforms (FC) in 1999. Guideline standards for FCs have not been achieved between 1990 and 2000.

Analysis of historic European Community Bathing Waters Directive (ECBWD) data shows no significant correlation between rainfall and tide with the failures. The data does show a trend towards increased FC counts during onshore winds. The salinity of the samples were quite high indicating only a small portion of the samples was from a freshwater source.

Holcombe Stream is the freshwater input that is associated with Teignmouth on the sampling programme. The Teign Estuary and Holcombe outfall may also have potential to impact upon the beach. Field studies and the historical data showed these are unlikely to have caused the failures. Holcombe outfall has been decommissioned, now Dawlish Waste Water Treatment Works is operational.

Catchment investigation highlighted a contaminated pipe discharge approximately 450m to the east of the sampling line. Further investigation revealed this flow originated from an abandoned surface water siphon that was found to be still operating; we have located one domestic sewage misconnection into this pipeline. The pipeline discharges to the inter-tidal zone. This contamination could have contributed to the 1999 failure and could potentially lead to further bathing water failures at Teignmouth.

The source of the siphon pipe was traced to the head of the Brimley Brook outfall tunnel situated at Haldon Avenue. A blockage at Haldon Avenue resulting from a collapsed culvert may be contributing to flow in the siphon pipe. We recommend:

- the siphon pipe discharge flow and any misconnection to it should be investigated by SWWL and stopped
- restricting cattle entry to Holcombe Stream
- any untreated sewage discharges at Combeinteignhead to be stopped
- the surcharging manhole at Glengariff should be made secure
- sampling of the siphon pipe discharge (if still flowing) prior to the 2001 ECBW season

Investigation into the 1999 Failure of the European Community Bathing Waters Directive at Teignmouth Town Beach

1.0 Catchment Description

Teignmouth Town beach (sample point no. 70614633) is designated under the European Community Bathing Waters Directive (ECBWD) number 76/160/EEC, see Appendix 1 for standards. In the proximity of Teignmouth Town Beach there are a number of freshwater inputs (see Figure 1):

- The River Teign estuary; to the west of the town beach
- Brimley Brook discharges via an outfall pipe approximately 70m offshore of Eastcliff to the east of the town beach
- Holcombe Stream discharges on Holcombe beach at NGR SX 9566 7463 also to the east of the town beach

Two investigations have taken place on discharges into the lower Teign these are kept on file, report numbers: DEV/E/11/95 & DEV/E/15/96. There have been no previous investigations conducted on Teignmouth Town Beach bathing water quality.

There is a continuous discharge to the inter-tidal zone via a pipe approximately 450 metres to the east of the bathing water sampling line. For the purpose of the investigation this discharge will be referred to as the siphon pipe discharge, see figure 2; plates 1 & 2.
Two storm overflow discharge pipes are located approximately 325 metres east of the sampling point, see figure 2; plates 3 & 4 for photos showing location, the photographs were taken shortly after a storm event. These two discharges result from storm flows in the siphon pipe and a Combined Sewer Overflow (CSO) situated in the Railway Station carpark, see figure 3.

The ECBWD samples are collected during the bathing season: 1st May to 30th September. On the same day (as Teignmouth ECBW is sampled) a sample is taken from Holcombe Stream (sample point no.70515603). Samples are also taken from the mouth of the River Teign (sample point no.70610159); however, these are not taken on the same day as the ECBWD samples.

1.1 Objectives

Teignmouth Town Beach failed to meet the Imperative standard for faecal coliforms (FC) for the 1999 season, see table 1. Concerns have been raised that the Holcombe outfall, River Teign, Brimley Brook outfall and North Teignmouth CSO all have potential to impact upon the water quality of the bathing beach.

The purpose of this investigation is:

- to determine the probable cause of the 1999 ECBWD failure at Teignmouth Town Beach
- to identify any areas of concern that may contribute to poor water quality at the beach and recommend actions to improve the water quality.

1.2 Project Team

Project Manager – Trevor Cronin
Project Leader & Author – Stuart Hunter

2.0 Catchment History

Prior to 1993 the Brimley Brook flowed through the town centre (culverted for much of its length), discharging partly into the lower estuary at the fish quay and over the beach via a siphon.

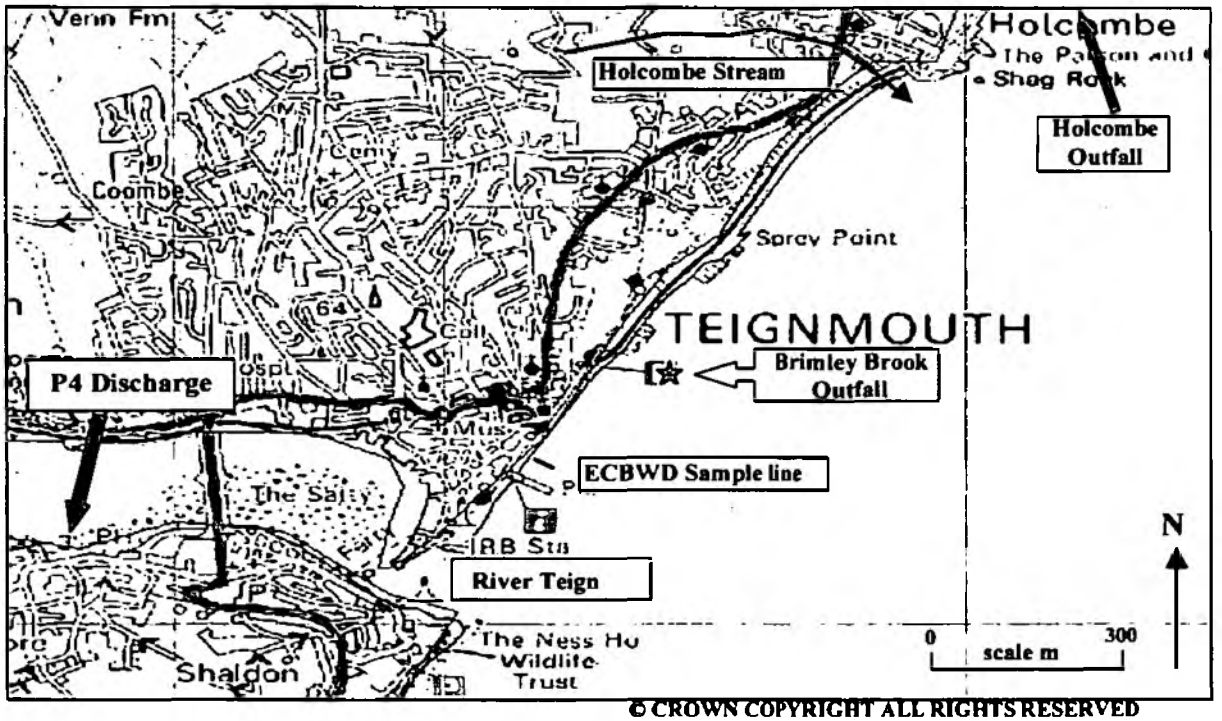
During the 1991 pre-scheme water-quality investigations for the Teignmouth long sea outfall the Brimley Brook was identified as being highly contaminated with discharge from numerous CSO's. A decision was made to remove the impact of the stream water by diverting the flow into a tunnel above the siphon and discharging to sea via a sea outfall.

Teignbridge District Council informed us that the siphon had been capped and abandoned when the tunnel and outfall were created. A portion of Brimley Brook continues to flow as a stream as far as the Station Business Park, from here it is culverted and flows to discharge at the Fish Quay. See Figure 4.

2.1 Location

A site map of the area showing relative positions of Teignmouth Town Beach to Holcombe , Stream and the River Teign is presented in Figure 1. More detailed maps showing the CSO and more of the drainage infrastructure are shown in Figures 4 & 5.

Figure 1. Map of the area around Teignmouth town Beach



2.2 Compliance

The compliance history of Teignmouth Town Beach with the bathing water directive for the period 1990 to 2000 is given below in **Table 1**.

Table 1. Compliance history of Teignmouth Town Beach

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Compliance	I	I	I	I	I	I	I	I	I	F	I
No. of samples	21	20	21	20	20	20	20	20	20	20	20
No. fail FC 'I'	0	0	1	1	1	0	1	1	1	2	0
No. fail TC 'I'	0	0	0	0	0	0	0	0	0	0	0
No. fail FC 'G'	7	10	8	8	7	5	5	9	5	5	10
No. fail TC 'G'	1	4	3	3	3	1	2	4	2	3	0
No. fail FS 'G'	0	4	3	5	5	3	3	6	3	6	6
FC Geomean	60.9	93.5	78.4	74.0	70.7	45.7	69.0	91.5	53.4	93.2	89.0

Compliance to: I = imperative, G = Guideline, F = Fail
FC= Faecal Coliforms, TC = Total Coliforms, FS = Faecal Streptococci
NB Geomean calculated data sets: all results less than 10 taken as 10 to take variable lower detection limit of samples into account

2.3 Regional Bathing Water Database

This database identifies: compliance history; factors affecting water quality; actions already taken to improve water quality; planned investigations; planned investment and predicted changes in water quality. The information relating to Teignmouth Town Beach is presented in Appendix 2.

3.0 Method

The investigation has been split into several parts:

- a biodiversity search of the area
- a risk assessment
- historic data analysis
- survey work to collect field data

3.1 Biodiversity

A map of the investigation area and a description of the nature of the investigation were supplied to the Conservation Team. They determine if our actions raise any biodiversity issues, and inform us of sites designated with conservation interest status.

3.2 Risk Assessment

The site was inspected and a risk appraisal form completed for subsequent work (see Appendix 3).

3.3 Historic Data Analysis

Data collected during the period 1990 – 1999 from the Teignmouth Town Beach ECBWD site was analysed in order to reveal any trends. Correlation between failed samples with: wind

direction; state of tide; rainfall and samples from associated freshwater inputs were all investigated.

3.4 Field Work

The field surveys firstly looked at possible impacts to water quality highlighted in previous investigations. Secondly the discharges and areas of concerns highlighted at the start of this investigation. Finally any areas of concern found during the investigation.

3.4.1 Discharge at P4

The two previous investigations highlighted a pipe discharge referred to as "P4", discharging opposite Ringmore in Shaldon, as a potential source of contamination to the lower Teign Estuary. Three samples were taken of the discharge from P4 the results of these samples can be seen in table 5. See figure 2 plates 5 & 6.

3.4.2 Samples from Pollution Incident on 5th July 2000

Two samples were taken on the 5th July 2000. One sample from P4 and one from the siphon pipe discharge (table 6). This was during a pollution incident (NIRS no.SW55382) where a number of properties in Shaldon were flooded after a period of heavy rain.

3.4.3 Dye Tracing Survey 20th June 2000

Fluoresceine dye was added to the siphon manhole at the Eastcliff Hotel. Two samples were taken in the manhole prior to addition of the dye, the first from the high-level discharge pipe and the second in the pond at the base of the chamber. When the dye formed a plume on the beach a sample was taken from it and a background beach sample was taken. The results from these samples can be seen in table 8.

3.4.4 Tracing the origin of flow to the siphon pipe discharge

Drainage plans of Teignmouth were obtained from SWWL, the discharge pipe on the beach was found to be absent from these drawings. As the link between the discharge and a manhole adjacent to Eastcliff Hotel (figure 2 plate 7) had been established, an attempt was made to trace the flow back from there. Numerous manholes were lifted but no flow could be found.

We visited the Teignmouth Town Clerk on Thursday 7th Sep 2000, in an attempt to ascertain the details of the discharge across the beach. He was unsure about the origin of the discharge, and directed us to Peter Howells, a Drainage Engineer at Teignbridge District Council. Through conversation with Peter we were informed that a sealed siphon pipe exists (this explains why there were no manholes on the system). The siphon was intended to receive flow from the Brimley Brook at a point in Haldon Avenue. It then flowed down Lower Brimley Road and up to the bottom of Barnpark Road (Figure 4). The siphon was supposedly capped and abandoned in 1993 when the Brimley Brook diversion was completed.

The drainage plan also showed a surface-water drain entering the siphon from Barnpark Road. On lifting a manhole adjacent to number 16 the small amount of flow appeared to be foul. A survey was planned for the 4th October in an attempt to test whether any flow from this surface

water drain was entering the siphon and if a misconnection on Barnpark Road was contaminating this potential flow.

3.4.5 Dye Tracing and Sampling survey on the 4th October 2000

On the 4th October 2000 a catchment and dye tracing survey was undertaken. The aims of this survey were to:

- establish the location and photograph the Brimley Brook sea outfall
- establish if the siphon pipe was redundant or still flowing
- trace and sample the flow in the manhole at 16 Barnpark Road that was believed to be foul

Initially a sample was taken at Haldon Avenue from the culverted Brimley Brook at the start of the tunnel to the sea outfall. Three litres of fluoresceine were then added to the stream.

A sample was taken from the manhole at 16 Barnpark Road 1 litre of rhodamine, followed by 25 litres of water were added. A manhole known to be on the sewer line approximately 50m down Barnpark Road was then lifted to see if any connection could be established.

Further sampling in the upper town catchment of the visible Brimley Brook took place. Samples were taken at Glengariff House (in the garden) and upstream of Keswick in an area of undeveloped land. An attempt was made to sample the Brimley Brook, in the sea outfall tunnel at Woodway Road. The beach was observed for evidence of dye discharge.

4.0 Results

4.1 Biodiversity

The Conservation Team raised no concerns over our activities in and around Teignmouth. No areas of conservation interest would be at risk during our work.

4.2 Risk Assessment

An on site risk assessment was carried out. No specific issues other than those normally associated with fieldwork of this nature were raised (see Appendix 3).

4.3 Historic Data Analysis

A summary of data associated with the failed bathing water samples is presented in **Table 2**.

Table 2. Summary of the ECBWD samples which exceeded the Imperative standard

Date	Time of Sample	FC no/100ml	Wind speed	Wind dir.	Rainfall at time of sample				State of tide	Sal g/kg
					-3 days	-2 days	-1 day	On day		
12-Aug-92	12:00	**3120**	-	E	0.2	2.1	5.5	17.2	+5.2	32.4
14-Sep-93	11:35	**2700**	3	SW	0.4	48.3	9.1	0	+5.6	31.3
31-Aug-94	13:05	**3000**	5	E	0	2	9.2	11.4	-0.9	34.6
28-Jun-96	12:20	**2700**	3	SW	0	0	0	0.8	-4.7	34.2
08-Aug-97	12:25	**2610**	3	W	21.9	6.5	6.7	0	+2.2	30.1
07-Aug-98	15:05	**2400**	3	SW	0	0	0	0	-4.1	34.1
18-Aug-99	10:18	**2200**	3	SW	6.2	2.6	5.8	9.1	-1.2	34.9
08-Sep-99	12:46	**3300**	4	S	0	0	0	2	-5.1	34

4.3.1 Rainfall

All the results for FC counts over the period 1990 – 1999 were correlated against rainfall on the day of the sample and the previous 3 days. No consistent patterns were detected. Both high and low microbiological numbers occurred on days of high rainfall over the 4-day period, but high and low counts also occurred with little or no rainfall.

Of the samples exceeding the Imperative standards (see table 2) some of the samples were associated with rainfall on the day of the sample, others with rainfall on the 2nd or 3rd day before the sample, whist others with very little or no rainfall on any of the 4 days.

The rainfall day used by the Environment Agency begins at 0900 and runs to 0900 the following day. The samples which failed were taken early in the day (see table 2), thus rainfall recorded on the day of the sample has a high probability of falling after the sample was collected.

4.3.2 Wind direction

At the time the samples that failed were taken wind directions were from the south, west, south-west and east. Wind speeds ranged from 3 to 5 on the Beaufort scale. On the date of the most contaminated sample (3300 FC per 100ml on 08 September 1999) the wind direction was south with a wind speed of 4. A chart showing log FC numbers from 1990 to 1999 plotted against wind direction can be seen in figure 6.

4.3.3 State of tide

Of the eight failures five were within 2 hours of low water, two were within 1.2 hours of high water and one was 2.2 hours after high water. Of the five near low water two were during the ebb tide and three during the flood tide. Tidal stream charts were used to assess an estimate of the tidal stream for Teignmouth (reference 6).

4.3.4 Salinity

The samples that failed had salinity concentrations between 30.1 and 34.9g/kg. The samples from the 1999 season were 34 and 34.9g/kg, this would suggest the sample is almost 100% seawater (Atlantic seawater has a salinity of 35 g/kg). If a fresh water source caused the failure it would need to have a high level of faecal contamination.

4.3.5 Associated Freshwater inputs

When bathing water samples are taken samples are also taken from associated freshwater inputs. In the case of Teignmouth this is Holcombe Stream. The River Teign Estuary also discharges near to the bathing waters; this is not sampled with the bathing waters. The Monitoring Team has recently (1999) started sampling the estuary mouth when they sample the estuary. The results of these samples can be seen in table 3.

Table 3. Samples taken in the mouth of the Teign Estuary (70610159) during the ECBW season.

Sample Date	Sample Time	Feacal Coliforms No. per 100ml	Salinity g/kg
02 Aug 1999	14:10	18	34.6
14 Sep 1999	13:40	<10	34.5
10 May 2000	13:10	<10	33.8
22 May 2000	09:55	<10	34.9
09 Jun 2000	13:18	<10	34.4
26 Jul 2000	12:25	<10	35.0
11 Sep 2000	13:47	27	33.5
25 Sep 2000	13:15	18	34.3

All the samples have low numbers of faecal coliform bacteria. The salinity levels in all samples are high indicating that the samples are mostly seawater.

4.3.6 Comparison with Holcombe and Shaldon Bathing Waters

Of the two associated watercourses (Holcombe Stream and the River Teign), Holcombe Stream would appear to impact more on Holcombe Bathing Water and the River Teign on Shaldon Bathing Waters than on Teignmouth Town Beach. Table 4 shows a comparison between Teignmouth Town bathing water samples and these other sites.

Table 4. Imperative FC failures at Teignmouth Town Beach compared to samples at Holcombe and Shaldon ECBW's and associated freshwater inputs

	Faecal Coliforms No. per 100ml			
Sample Date	Teignmouth Town ECBW	Shaldon ECBW	Holcombe ECBW	Holcombe Stream
12-Aug-92	**3,120**	560	**30,400**	220,000
14-Sep-93	**2,700**	500	**16,100**	23,000
31-Aug-94	**3,000**	333	**2,790**	93,000
28-Jun-96	**2,700**	27	18	55,000
08-Aug-97	**2,610**	900	**16,800**	8,727
07-Aug-98	**2,400**	<10	15	2,100
18-Aug-99	**2,200**	<10	36	1,040
08-Sep-99	**3,300**	280	280	4,800

ECBWD failures in bold

Table 4 shows that on a number of days when Teignmouth Town Beach failed Holcombe beach also failed. No failures at Shaldon have coincided with Teignmouth.
On the two days in 1999 when Teignmouth failed both Holcombe and Shaldon passed.
Indicating the probable cause of failure in 1999 was not Holcombe Stream or the River Teign.

4.4 Field Surveys

A number of samples were taken throughout the investigation, figures 2 & 3 are maps with all sample points highlighted.

4.4.1 P4 Discharge

Three samples were taken from P4 pipe discharge. The samples on the 5th July 2000 were taken after very heavy rainfall and localised flooding, it was considerably more polluted than the two previous samples. The flow from P4 was traced, using fluoresceine dye, back to a secured manhole at the top of the beach see figure 2 plate 5.

Table 5. Samples from P4 pipe discharge at Ringmore in the Teign Estuary

Date of Sample	Time of Sample	Location of Sample	T. Coliforms no. per 100ml	F. Coliforms no. per 100ml	F. Streps no. per 100ml
14/06/00	11:00	P4	4600	2000	2700
15/06/00	12:15	P4	3300	2200	3500
05/07/00	16:20	P4	140000	60000	78000

4.4.2 Siphon pipe discharge & manhole at Eastcliff Hotel

The siphon pipe discharge was traced using dye back to a manhole opposite the Eastcliff Hotel on Den Promenade. Samples taken from the manhole and discharge on the beach from the siphon pipe are shown in table 6. A number of the results were >100,000 for total and faecal coliforms. All samples show high numbers of pollution indicator bacteria.

Table 6. Samples from Manhole at Eastcliff Hotel and Siphon pipe discharge

Date of Sample	Time of Sample	Location of Sample	T. Coliforms no. per 100ml	F. Coliforms no. per 100ml	F. Streps no. per 100ml
15/06/00	13:31	Siphon Pipe Discharge	81000	12000	1909
20/06/00	14:05	Siphon Pipe Discharge	>100000	>100000	22000
05/07/00	16:50	Siphon Pipe Discharge	80000	36000	120000
29/08/00	14:58	Siphon Pipe Discharge	>100000	65000	26000
20/06/00	11:41	EastCliff MH Waterfall	>100000	>100000	22000
20/06/00	11:43	EastCliff MH in pond	>100000	>100000	24000
20/06/00	14:35	EastCliff MH	>100000	>100000	108000
04/10/00	11:37	EastCliff MH	820000	51000	28000

4.4.3 Samples from the Brimley Brook

Samples from the Brimley Brook were taken on a number of occasions, the results from these samples can be seen in table 7. The most contaminated sample was from the quay where the stream discharges into the Teign Estuary. The samples from Haldon Avenue and the quay were taken from culverts the other samples were taken from open stream channels. The samples from Keswick and Glengariff House were taken just upstream of where the two streams merge; the Keswick sample had the highest number of pollution indicating bacteria.

Table 7. Samples taken from the Brimley Brook

Date of Sample	Time of Sample	Location of Sample	T. Coliforms no. per 100ml	F. Coliforms no. per 100ml	F. Streps no. per 100ml
25/05/00	15:15	Brimley @ Belgrave Hse	660	470	300
20/06/00	15:10	Brimley @ Quay	38000	24000	6400
26/06/00	11:00	Brimley @ Belgrave Hse	838	400	210
04/10/00	13:19	Brimley @ Keswick	38000	22000	450
04/10/00	13:40	Brimley @ Glengariff	2500	360	490
04/10/00	10:25	Brimley @ Haldon Ave.	8545	2400	460

4.4.4 Dye survey 20th June 2000

The results show high levels of contamination in the siphon pipe discharge and the impact of this discharge to the bathing waters. The background beach sample has very low bacteria numbers compared to the sample from within the dye patch.

Table 8. Samples taken on 20th June 2000

Date of Sample	Time of Sample	Location of Sample	T. Coliforms no. per 100ml	F. Coliforms no. per 100ml	F. Streps no. per 100ml
20/06/00	11:41	EastCliff MH Waterfall	>100000	>100000	22000
20/06/00	11:43	EastCliff MH in pond	>100000	>100000	24000
20/06/00	12:35	in dye patch	4800	1182	117
20/06/00	12:40	background beach	18	18	63
20/06/00	14:05	Siphon Pipe Discharge	>100000	>100000	22000
20/06/00	14:35	EastCliff MH	>100000	>100000	108000

4.4.5 Dye and Sampling survey on the 4th October 2000

At Haldon Avenue three litres of fluoresceine dye were added to the Brimley Brook at 10:30. Members of the Investigation Team remained on-site until 17:00 by which time no dye had been observed appearing from the outfall or in the Eastcliff Hotel manhole.
Colin Martin, the area EPO located the fluoresceine in the Eastcliff Hotel manhole on the morning of the 5th October, this manhole is located on the siphon pipeline.

The rhodamine dye was released in the manhole at 16 Barnpark Road at 10:50, the dye was not observed in the sewer manhole. The rhodamine was observed discharging from the siphon pipe on the beach at 13:58. The attempt to sample the Brimley Brook within the tunnel to the sea outfall via a lamphole was unsuccessful. Due to the construction of the lamphole, no sampling container could be lowered into the Brimley Brook outfall tunnel.

Table 9. Showing results from samples taken on the 4th October 2000

Date of Sample	Time of Sample	Location of Sample	T. Coliforms no. per 100ml	F. Coliforms no. per 100ml	F. Streps no. per 100ml
04/10/00	10:25	Haldon Avenue	8545	2400	460
04/10/00	10:47	MH @ 16 Bampark	47000000	14000000	380000
04/10/00	11:37	EastCliff MH	820000	51000	28000
04/10/00	13:19	Brimley @ Keswick	38000	22000	450
04/10/00	13:40	Brimley @ Glengariff	2500	360	490

5.0 Discussion

5.1 Historical data analysis

Between the period 1990 to 2000, Teignmouth Town Beach has failed to reach the imperative standards for FC only in 1999. It has failed to reach the guideline standards for FC every other year.

Analysis of historical data showed no significant correlation between exceeding sample dates and rainfall. There is a small positive correlation between increased FC results and increased rainfall, but not enough to link it directly with failures of the bathing water.

Wind direction does show a correlation with FC concentrations in samples. As figure 6 shows, winds from the west and south (180° to 270°) show higher average FC counts. These increased counts are attributed to the wetter weather associated with these winds. There is also an increase in FC in an east wind, it is possible this is due to the siphon pipe discharge being blown in a westerly direction to the sampling line.

Most of the bathing water samples are quite saline, indicating only a small proportion of the water is from freshwater inputs. If the contamination were from the freshwater portion of the sample the fresh water would have to be highly contaminated.

The state of the tide at the times when the failures occurred showed a slight correlation. Five samples, out of 8 that exceeded, were near to low water; with the tidal currents running east to west. Two were near high water with tidal currents east to west and one sample around mid tide also, east to west. The tidal currents were estimated from tidal stream charts, however fieldwork suggested that the very inshore water currents were more effected by wind direction.

5.2 Siphon pipe discharge

The siphon pipe was discharging on each occasion the site was visited. The flow was consistent during dry weather and increased during wet weather. All samples from the discharge were contaminated. The flow was clear and did not contain any visible solids, though there was occasionally a sewage odour present in the manhole at the Eastcliff Hotel. The flow in the pipe was traced back to Haldon Terrace; at the head of the Brimley Brook outfall tunnel. The siphon was supposedly abandoned and flow into it stopped. We are

unsure if the flow in the siphon is due or exacerbated by the blockage of the Brimley Brook outfall tunnel, or if SWWL's attempt to cap the pipe has failed.

One source of contamination to the siphon pipe was found during the investigation. The drainage plans showed a surface water drain serving road drains on Barnpark Road; a manhole was shown located in front of number 16. When this manhole was lifted we suspected the flow was foul. Our suspicion was confirmed when it was sampled, faecal coliforms were 14,000,000 per 100ml. The link between the manhole and the siphon pipe discharge was confirmed with rhodamine dye.

5.3 Brimley Brook outfall

Attempts to identify the exact location of the Brimley Brook outfall were unsuccessful. We concluded the most probable reason for this result is a blockage at the head of the Brimley Brook outfall tunnel. A clasped culvert caused the blockage, SWWL have been made aware of this and are scheduled to remove it as soon as possible. We have requested to be informed as to when this work will be undertaken, so that we can be present on site during the work.

5.4 Holcombe Stream & outfall

The Holcombe outfall discharging screened crude sewage from the sea wall at NGR SX 9605 7534 is being picked up in the 'Cleansweep for Dawlish' by SWWL. It stopped discharging as an outfall, and will only operate as a pumping station emergency overflow (PSEO) from December 2000. Dye studies undertaken for the Coryton's Cove Investigation (ref. 7), of Holcombe outfall indicated it is very unlikely to have impacted upon Teignmouth Town bathing water quality.

During the failures at Teignmouth in 1999 Holcombe Stream did not have high concentrations of faecal coliforms. The stream discharges approximately 2.2km from the bathing beach sampling line and is not thought to have been a contributing factor to the failure.

Holcombe Strcam has been investigated, by Devon Area Investigations, in connection with failure at Holcombe Bathing Beach. It was found that a cause of contamination was cattle access to the stream, a CSO that discharges onto Holcombe beach was also identified, and is a potential source of pollution. SWWL are planning to extend the CSO outfall to remove the impact from Holcombe Bathing Waters.

5.5 Teign Estuary

The River Teign Estuary discharges large quantities of freshwater into the sea at Teignmouth. Historically a considerable amount of work has been undertaken to improve water quality within the estuary. The samples taken in the lower estuary (Table 3) did not show any level of contamination to cause concern.

A potential problem raised in previous reports (DEV/E/11/95 & DEV/E/15/96), regarding a contaminated discharge on the salty named P4, appears to have been resolved. Samples of the discharge during this investigation did not show high levels of faecal contamination. The Brimley Brook has a discharge point in the Fishquay at NGR SX 9384 7276. This discharge was sampled once and was found be contaminated with faecal pollution.

5.6 Planned Improvements at Teignmouth

In Asset Management plan III (AMP III) 13 CSO's are to be improved in the Teignmouth Catchment (ref. 8). One of these discharges into the Brimley Brook and the remaining 12 discharge into the Teign Estuary. Table 10 lists these CSO's and shows the NGR of their outfalls.

Table 10. Shows CSO's in the Teignmouth catchment being improved in AMP III

CSO name	Receiving Water	Outfall Site NGR
Horns Park	Teign Estuary	SX 90449 73608
Church	Teign Estuary	SX 91061 73467
Mill Bottom Lane	Teign Estuary	SX 91471 70713
Laurel Lane	Teign Estuary	SX 92561 72102
R/o Orchard Close	Teign Estuary	SX 92564 72041
Park Hill, Alexandra Terrace	Teign Estuary	SX 93548 72962
Rugby Club	Teign Estuary	SX 93363 72985
Rugby Club	Teign Estuary	SX 93326 72078
Rugby Ground	Teign Estuary	SX 93352 72069
Headway Cross Road	Teign Estuary	SX 93197 73878
First Avenue (Fire Station)	Teign Estuary	SX 93275 73303
Rear of Village Hall, Oak Park	Teign Estuary	SX 90016 71742
Keswick off Ferndale Road	Brimley Brook	SX 93982 74058

The Brimley Brook at Keswick flows to Haldon Avenue where it should enter the outfall tunnel and discharge from the Brimley Brook Outfall. We found it discharges via the siphon pipe that closer to the bathing water sample point.

A scheme for Teignmouth was identified in the Asset Management Plan 1, under the Bathing Water Directive for Teignmouth (Town) and Shaldon Bathing Waters. This regional scheme collected sewage from the settlements of Newton Abbott, the Aller Valley, Milber, Stoke-in-Teignhead, Combe-in-Teignhead, Shaldon, Teignmouth, Bishopsteignton and Kingsteignton. Approximately 70% of the Dry Weather Flow sewage is treated to a secondary standard and then discharged through a 2km long sea outfall. The remainder is treated to a primary standard. The scheme was completed in 1993 before the start of the bathing season.

In Asset Management Plan 2, under the Urban Waste Water Treatment Directive, Teignmouth discharge is to receive full secondary treatment by the end of 2000.

5.7 Other Concerns

During the investigation other potential sources of pollution were identified.

During the survey on the 4th October the Brimley Brook was sampled in the garden of Glengariff, a residential property. Upon speaking to the owner we were informed a sewer line runs through the garden and underneath the stream. During periods of heavy rainfall a manhole, on the sewer next to the stream, blows and sewage flows from the sewer into the

Brimley Brook. He had informed SWWL who reset the manhole but this has not solved the problem.

An employee of SWWL also brought to our attention that raw sewage discharges into the Teign Estuary. The discharge is via a stream from properties at Combeinteignhead. This could potentially impact on the bathing waters of Teignmouth and Shaldon, and on the shellfishery. This discharge is identified in the River Teign Action Plan (ref. 3) and is being investigated by the area EPO.

During the investigation numerous dogs were seen on the beach in and around the bathing waters. Many owners were seen to clean up after their dogs, but dog faeces were still visible on the beach.

The under side of Teignmouth Pier is used as a roost by pigeons and gulls, also gulls are common along the foreshore of the bathing waters.

Both dog and bird faeces have the potential to contribute to bacterial loading in the bathing waters.

6.0 Conclusions

1. Holcombe outfall is unlikely to have been the cause of the ECBW failure. Flow to Holcombe outfall was redirected to Dawlish STW in December 2000, the outfall will now only operate as a PSEO.

2. Holcombe Stream could contribute to FC loading at Teignmouth Town bathing water. Due to the distance away from the sampling point (2.2km) it is unlikely to cause failure.

3. The River Teign could contribute to FC loading at Teignmouth Town bathing water. The sample results from the estuary mouth have not shown contamination. Work within the estuary for the shellfishery will benefit water quality at Teignmouth and Shaldon.

4. It is suspected the Brimley Brook outfall is blocked. This may be causing a flow in an old sewer, the siphon, which discharges more closely to the bathing water sample point.

5. The misconnection of foul water, to the surface water drain at Barnpark Road, which connects to the siphon pipe, could have a direct impact on the bathing water quality.

7.0 Recommendations

1. Cattle should be prevented from entering Holcombe Stream.
   Action: Environment Protection Officer

2. Any untreated discharges of sewage at Combeinteignhead should be investigated.
   Action: Environment Protection Officer

3. The blockage at the head of Brimley Brook outfall tunnel should be removed. This was arranged with SWWL during the investigation, they are to advise the area Environment Protection Officer when it is to take place.

4. The siphon pipe discharge flow and any misconnection to it should be investigated by SWWL and stopped.
Action: Environment Protection Officer

5. The manhole situated at Glengariff could be a possible source of contamination of the Brimley Brook and the bathing water. A more secure method of containment should be put in place to resolve this contamination.
Action: Environment Protection Officer

6. Samples should be taken from any discharge from the siphon pipe and from the Brimley Brook discharge in the Fish Quay. This should be done in advance of the 2001 ECBWD sampling programme, to allow time for remedial action if needed.
Action: D.A.I.T

8.0 References

1. A Loxton. *An Investigation into Discharges in the Lower Teign Estuary.* Devon Area Internal Report, DEV/E/11/95. March 1995.

2. A Loxton. *Further Investigations into Pipe Discharges in the Lower Teign Estuary.* Devon Area Internal Report, DEV/E/15/96. March 1996.

3. Environment Agency, 1998. *Local Environment Agency Plan, River Teign Action Plan January 1998.*

4. Environment Agency, 1999. *Local Environment Agency Plan, Teign & Torbay First Annual Review April 1999.*

5. Robin Pearson. *Investigation into the failure of Holcombe Bathing Waters 1998.* Working file.

6. Admiralty tidal stream atlas. The English and Bristol Channels. 1973 3rd edition. Hydrographic Office

7. R Pearson. *Coryton's Cove: Non-Compliance in 1999 with the European Community Bathing Water Directive (76/160/EEC).* Devon Area Internal Report, DEV/EP/02/01. January 2001.

8. National Environment Programme version 3.3 as approved by the DETR on 19th April 2000.

Figure 2

Plate 1, siphon pipe discharge

Plate 2, siphon pipe discharge

Plate 3, Storm water overflow Teignmouth Town Beach

Plate 4, Storm water overflow Teignmouth Town Beach

Plate 5, secured manhole on P4 discharge line showing tidal flap

Plate 6, P4 pipe discharge, Teign Estuary

Plate 7, showing location of Eastcliff manhole in distance and manhole with weir to overflows on beach in foreground

Figure 3

Map of Teignmouth

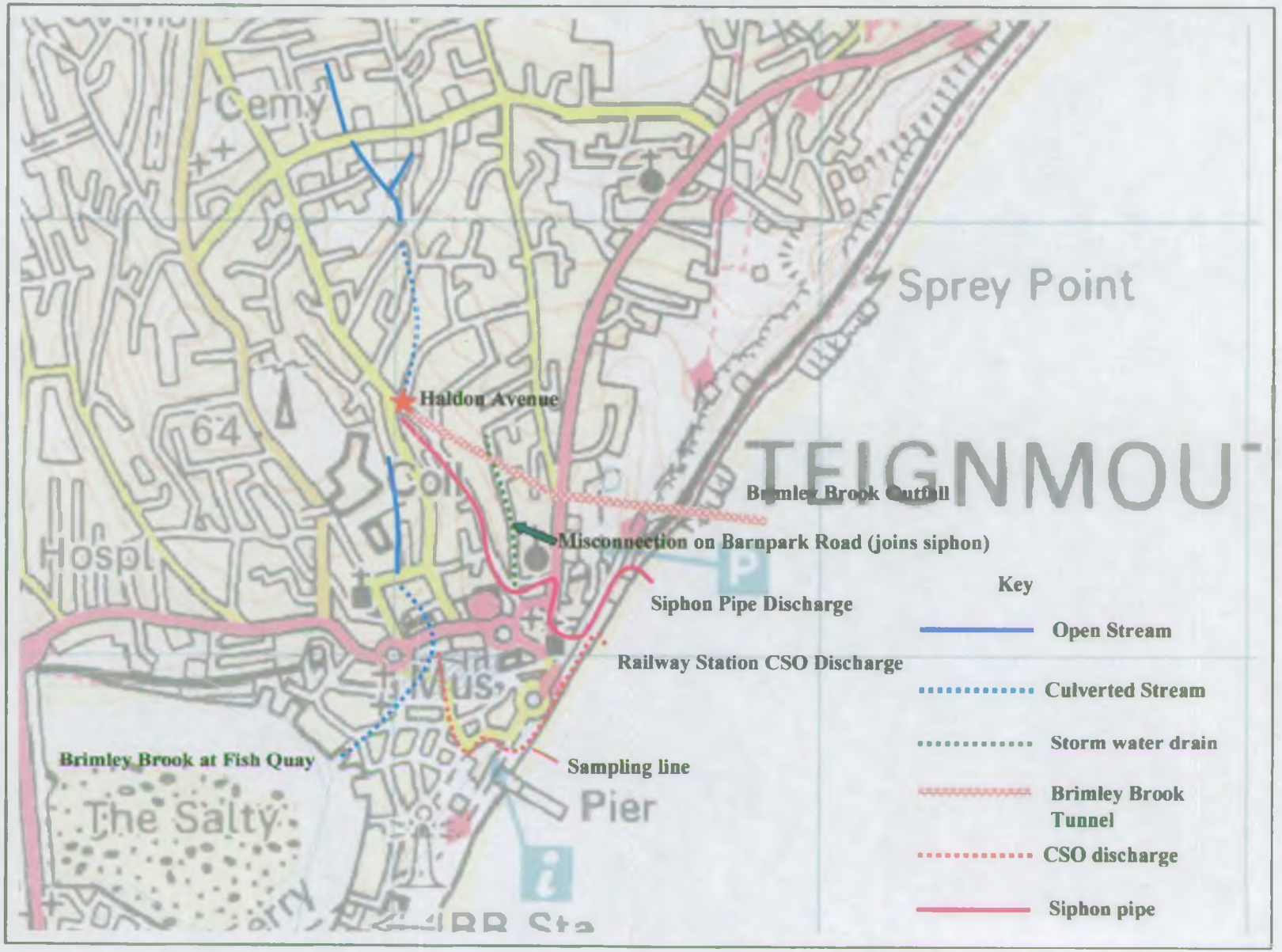


Figure 4

Teignmouth Plan Showing Brimley Brook Outfall, Siphon and CSO Discharge Point.

Figure 5

Map showing Sample Point Locations Teignmouth Bathing Beach Failure Investigation.

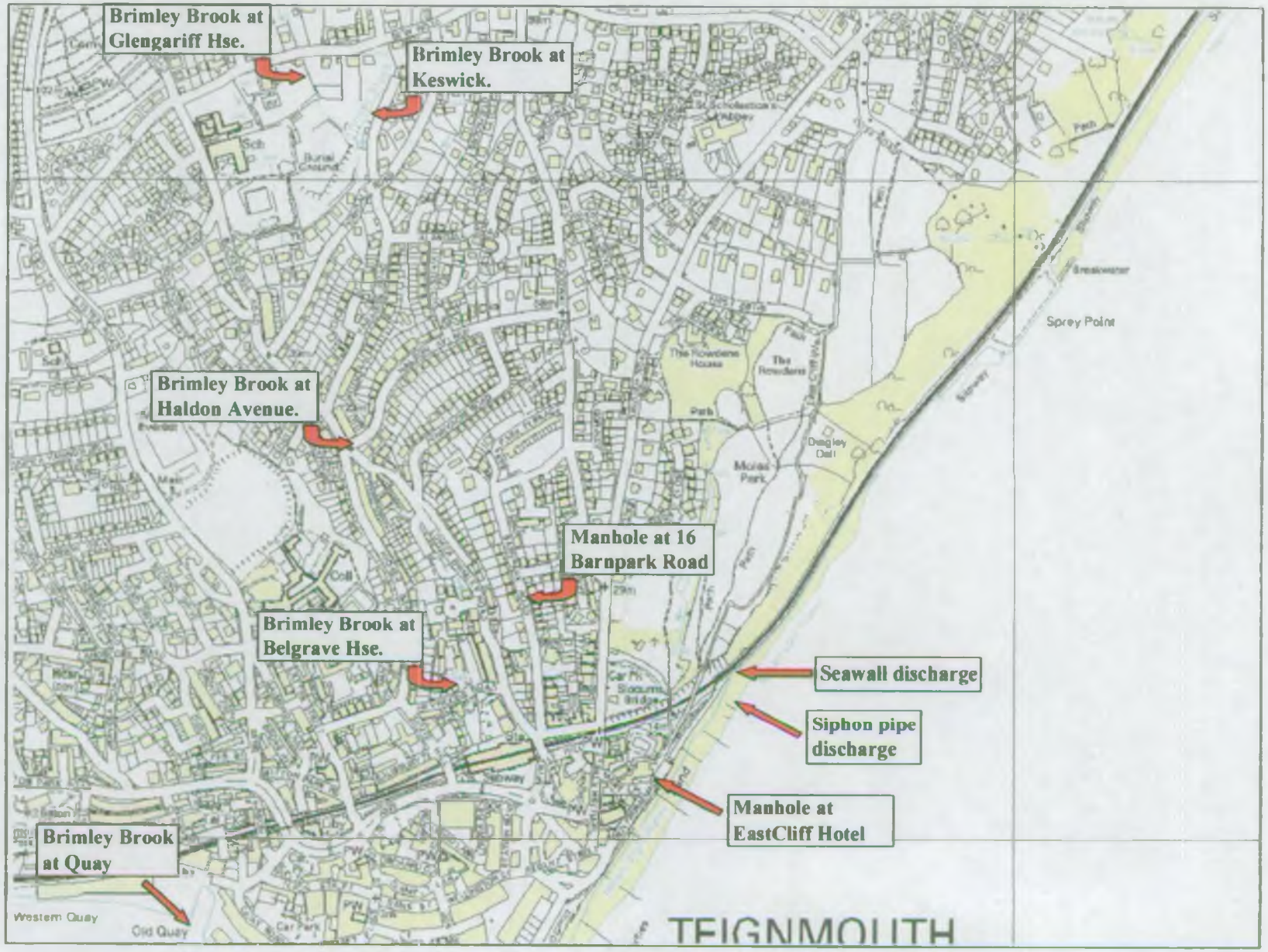
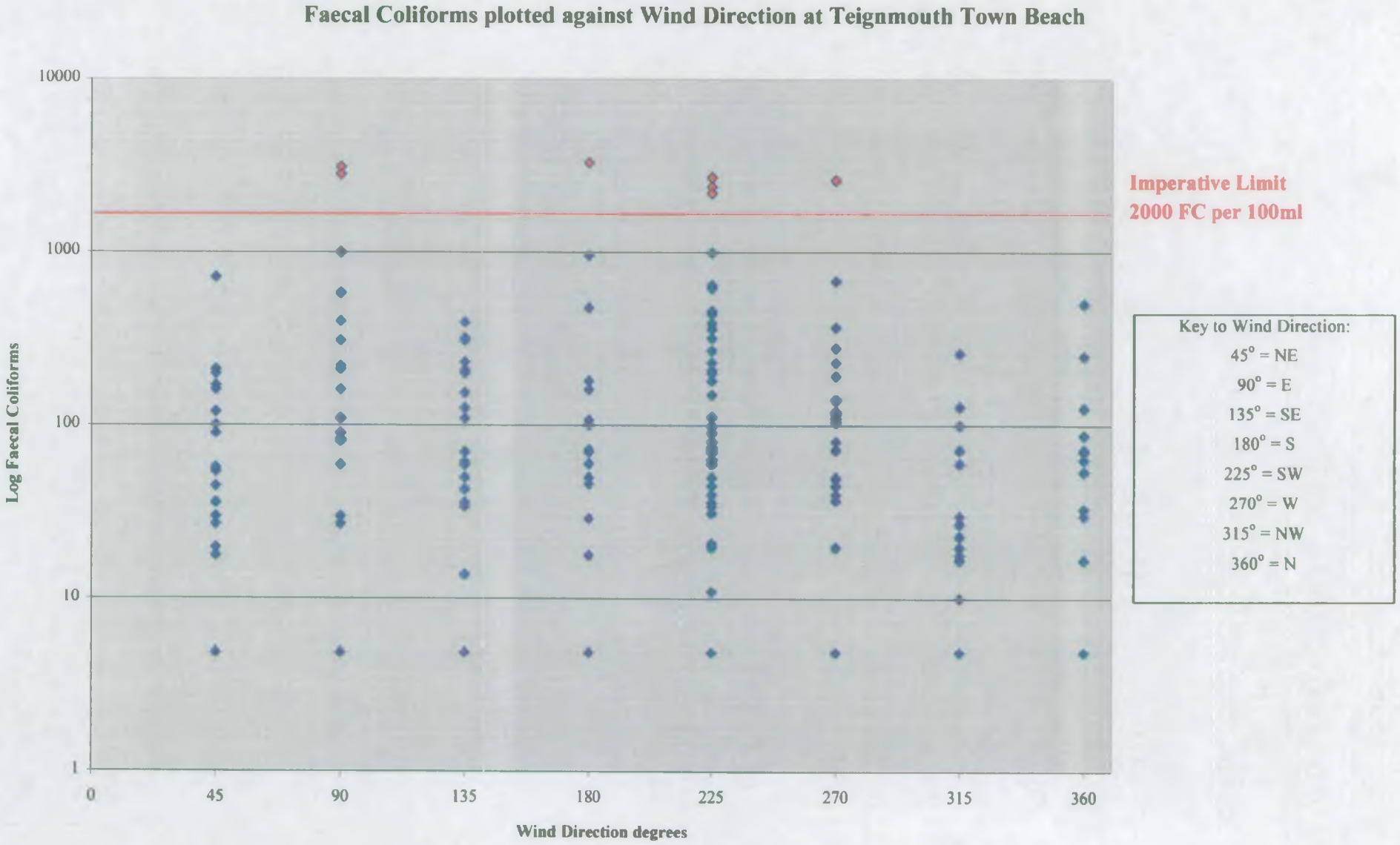


Figure 6


Faecal Coliforms plotted against Wind Direction at Teignmouth Town Beach
Log Faecal Coliforms
10000
1000
100
10
1
0
45
90
135
180
225
270
315
360
Wind Direction degrees
Imperative Limit
2000 FC per 100ml
Key to Wind Direction:
45° = NE
90° = E
135° = SE
180° = S
225° = SW
270° = W
315° = NW
360° = N

APPENDICES

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.

EC Bathing Waters Directive Summary of Standards

Compliance is generally assessed against the imperative (I) standards for the principal bacteriological parameters total and faecal coliforms. These standards are:

Total coliforms:	Max 10,000 per 100ml
Faecal coliforms:	Max 2,000 per 100ml

Bathing waters are allowed a five percent failure in any one year. This means that 19 samples in 20 have to meet the imperative standards for compliance to be achieved.

The principal guideline (G) standards, have to be achieved in 80 percent of samples i.e. 16/20 samples are:

Total coliforms:	Max 500 per 100ml
Faecal coliforms:	Max 100 per 100ml
Faecal streptococci:	Max 100 per 100ml (achieved in 90% of samples)

Environment Agency

Region South West (SW)

Sampling Point 22800 Teignmouth (Town) Beach **NGR** SX94287280 **Updated** 29 March 2000

Year of Identification 1987

Category **Pre AMP1/2** 6 **End of 1997** 4 **End of 1998** 4 **End of 1999** 6 **Post AMP2** 4 **Post AMP3** 4

Compliance Record and Water Quality Summary

The table below includes the following abbreviations - FC: Faecal Coliforms, TC: Total Coliforms, FS: Faecal Streptococci

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Compliance	Imperative	Imperative	Imperative	Imperative	Imperative	Imperative	Imperative	Imperative	Imperative	Fail
No. Samples	21	20	21	20	20	20	20	20	20	20
No. Fail FC Imperative	0	0	1	1	1	0	1	1	1	2
No. Fail TC Imperative	0	0	0	0	0	0	0	0	0	0
No. Fail FC Guideline	9	10	9	9	8	5	6	10	7	9
No. Fail TC Guideline	1	5	3	3	2	1	3	4	2	3
No. Fail FS Guideline	0	3	3	3	5	3	3	7	4	7
FC Geomean	67.16	96.37	78.35	75.72	73.39	46.26	69.97	93.19	55.4	95.78
TC Geomean	94.36	174.81	107.89	105.78	104.72	76.41	94.03	121.5	93.49	138.42
FS Geomean	14.24	31.62	42.88	38.15	36.65	36.46	34.88	52.52	39.38	59.06
FC Median	73	120	74	75	70	45	50	90	72	81
TC Median	83	150	122	135	126	55	95	190	98	149
FS Median	18	40	38	40	29	30	32	68	27	68

Risk of Future Non-Compliance with Imperative and Guideline Standards Based on Historical Data

Percentage Risk of Non-Compliance

	1990 to 1999 inclusive	1991 to 1999 inclusive	1992 to 1999 inclusive	1993 to 1999 inclusive	1994 to 1999 inclusive	1995 to 1999 inclusive	1996 to 1999 inclusive	1997 to 1999 inclusive
Imperative Faecal Coliforms						26.4		
Imperative Total Coliforms						0		

Risk Assessment Undertaken for Imperative Standards ☑

	1990 to 1999 inclusive	1991 to 1999 inclusive	1992 to 1999 inclusive	1993 to 1999 inclusive	1994 to 1999 inclusive	1995 to 1999 inclusive	1996 to 1999 inclusive	1997 to 1999 inclusive
Guideline Faecal Coliforms								
Guideline Total Coliforms								
Guideline Faecal Streptococci								

Risk Assessment Undertaken for Guideline Standards : ☐

Notes:

Actions Already Taken To Improve Water Quality

Before 1990 there were 'Imperative' Bathing Water failures in 1986 and 1987.

Water Company Improvements
A scheme for Teignmouth was identified in the Asset Management Plan 1, under the Bathing Water Directive for Teignmouth (Town) and Shaldon Bathing Waters. This regional scheme collected sewage from the settlements of Newton Abbott, the Aller Valley, Milber, Stoke-in-Teignhead, Combe-in-Teignhead, Shaldon, Teignmouth, Bishopsteignton and Kingsteignton. Approximately 70% of the Dry Weather Flow sewage is treated to a secondary standard and then discharged through a 2km long sea outfall with a 10 port diffuser. The remainder is treated to a primary standard. The scheme was completed in 1993 before the start of the bathing season.

Other Actions
Numerous pre-scheme investigations into the sources of pollution and water movements, in the vicinity of the proposed outfall, led to a number of improvements being incorporated into the scheme. Subsequent investigations have shown that there is still some source of bacterial contamination in the lower estuary at Teignmouth and Shaldon. The nature of these sources has not yet been identified.

Investigations in 1996 into 'Imperative' exceedances did not identify a specific cause but suggested contamination from the Teign estuary and possibly large numbers of dogs and seabirds.

Investigations in 1997 found that 'Imperative' exceedances followed heavy rainfall.

22/3/00

Factors Affecting Water Quality

WSC/PD	Name	Discharge Location	Comments
SWW	Teignmouth Outfall	2 km off the Ness, Shaldon	
SWW	Teignmouth CSO	N Edge Town ECBW	
SWW/PDs	Numerous Inputs	River Teign/Teign Estuary	
	Brimley Brook	Through outfall to Town ECBW	

Before completion of the Teignmouth scheme there were eight crude outfalls in the lower Teign estuary as well as numerous Combined Storm Overflows and PDs. The pollution of the Teign affected this Bathing Water in particular as well as others south and north of the Teign estuary. Subsequently, these crude outfalls were removed from the estuary and treated sewage is now discharged from 2 km offshore. The background water quality of the coastal waters is affected by both Holcombe and Dawlish discharges. Although the cause of the failure to comply with'Imperative' standards in 1999 is not yet confirmed, it is thought that the discharge of screened sewage from Holcombe may have contributed to the failure.

Abbreviations:
CSO - Combined Storm Overflow, ECBW - EC identified Bathing Water, MLWS - Mean Low Water Springs, O'F - Outfall, PD - Private Discharge, PS - Pumping

Station, PSEO - PS Emergency Overflow, STW - Sewage Treatment Works, SWW - South West Water, WSC - Water Service Company, WxW - Wessex Water.

31/3/00

Planned Investigation

Further investigations are planned on the potential sources of contamination affecting the Bathing Water, resulting from the failure in 1999 .

22/3/00

Planned Investment

In Asset Management Plan 2, under the Urban Waste Water Treatment Directive Teignmouth discharge is to receive full secondary treatment by the end of 2000; at present only 70% receive this level of treatment.

Improvements to 57 Combined Storm Overflows in the Teign Estuary are identified under the Urban Waste Water Treatment Directive in Asset Management Plan 3, and due for completion in June 2003.

In Asset Management Plan 2, a scheme for Dawlish is identified with the provision of secondary treatment to the discharge (under the Urban Waste Water Treatment Directive), and improvements to the Combined Storm Overflows under the Bathing Water Directive. The scheme is scheduled for completion in 2000.

Treatment for the Holcombe catchment was identified in Asset Management Plan 2 under the Bathing Water Directive. Sewage from Holcombe is now to be transferred to Dawlish for treatment before the end of 2000. The Agency is currently determining whether UV disinfection is also required at Dawlish to protect Bathing Waters.

28/3/00

Predicted Changes in Water Quality

Removal of the Holcombe outfall and improvements to CSO's within the Teigh Estuary are expected to minimise the risk of further failures of the "Imperative" standards.

22/3/00

DEVON AREA INVESTIGATIONS TEAM ACTIVITY RISK ASSESSMENT

Date last modified 23/11/99
by (name) R Pearson

SITE: TEIGNMOUTH TOWN BEACH

CATCHMENT 06A

Date of Assessment 20-5-2000

Name of Officer S. HUNTER

CONSIDERATION	YES	NO	ACTIONS REQUIRED
(A) GENERAL			
1. Do you need to notify site manager/ landowner of Agency presence?		✓	
2. Do you need to be accompanied by site staff?		✓	
3. Does task require more than one person?	✓		Depending of nature of task.
4. Are you working outside daylight hours?		✓	
5. Is the site isolated		✓	
5. Do you need to employ Lone Worker procedures?		✓	
6. Is protective clothing required?	✓		Reflective jackets, Safety boots, bollards for lifting manholes. Gloves when sampling
7. Will seasonal factors affect site safety?	✓		Rough seas may pose risk.
8. Are there dangers from the following			
chemicals	✓		When using dye wear gloves/goggles.
biological hazard	✓		Contaminated Surface water
explosive gases		✓	
inhalation of fumes/dust/asbestos		✓	
moving vehicles	✓		When opening manholes on roads
machinery		✓	
falling objects		✓	
9. Are overhead power supplies present?		✓	
10. Is site secure for equipment installation?		✓	no equipment will be deployed for the investigation
(B) VEHICLE ACCESS			
1. Is there safe vehicle acces to site?	✓		
2. Can vehicles be parked/left safely?	✓		Many spaces near tickets along sea front.

(C) FOOT ACCESS

	YES	NO	
1. Is there safe foot access to the site?	✓		
2. Are there fences/ditches etc. to cross?		✓	

(D) BANK SITES

1. Are banks steep or slippery?	✓	} possibilities when sampling Brindles Brook.
2. Might banks be undercut?	✓	)
3. Is water deep/strong currents?	✓	

(E) CLIFF OR SIMILAR SITES

1. Are there dangers from falling?	✓	
2. Is the terrain steep/slippery?	✓	
3. Might the cliff be overhanging?	✓	
4. Are ropes required?	✓	

(F) CONFINED SPACES

1. Are confined spaces involved? IF *YES* YOU MUST COMPLETE THE CONFINED SPACE FORM HELD IN OFFICE	✓	

(G) BOAT WORK

1. Is boat work involved? IF *YES* YOU MUST COMPLETE THE BOAT WORK FORM HELD IN OFFICE	✓	

(H) MANHOLES

1. Is the area around the manhole safe?	✓	Yes if precautions taken with bollards/reflective jackets
2. Are bollards/cones required?	✓	
3. Can cover be lifted safely?	✓	
4. Are cover keys/other equipment needed?	✓	Keys and lifting machine needed as appropriate.

(I) AGGRESSIVE BEHAVIOUR

1. Are people likely to be aggressive?	✓	
2. Are guard dogs/farm dogs/other livestock a risk?	✓	

(J) OTHER