



ENVIRONMENTAL PROTECTION NRA

*National Rivers Authority
South West Region*

AN INVESTIGATION TO DETERMINE
THE SOURCE OF HIGH LEVELS
OF GAMMA-HCH
IN THE NEWLYN RIVER
DURING SUMMER 1989

DECEMBER 1989

FWI/89/003

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AN INVESTIGATION TO DETERMINE THE SOURCE OF HIGH LEVELS
OF GAMMA-HCH IN THE NEWLYN RIVER DURING SUMMER 1989.

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SUMMARY

Routine river quality sampling for pesticides in the Newlyn River on 30 August 1989 revealed 2600 ng/l of gamma-HCH at Newlyn Bridge monitoring point.

A special investigation involving four surveys isolated the source of gamma-HCH to a 3m stretch of river. It is considered that a vessel containing gamma-HCH was disposed of into the river which became trapped in a trash dam and subsequently contaminated river sediments approximately 300m upstream of the routine monitoring point at Newlyn Bridge.

Concentrations of gamma-HCH at the Newlyn Bridge monitoring point have declined since the initial pollution event and comply with the Environmental Quality Standard (100 ng/l) for this substance.

It is recommended that no remedial action is required to remove gamma-HCH in the sediments since winter flows are likely to flush the contamination from the river system. A repeat survey to analyse river sediments will be carried out in 1990 to ensure flushing of gamma-HCH.

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1. INTRODUCTION.

Routine river sampling for pesticides on the River Newlyn on 30 August 1989 revealed a high concentration (2600 ng/l) of gamma-HCH at Newlyn Bridge monitoring point (SW 462290). This concentration was much higher than the environmental quality standard (EQS) for this organo-chlorine pesticide (100 ng/l) and therefore prompted an investigation to locate the source.

The Pollution Control Section sampled the River Newlyn at 200m intervals on the 6 September 1989 between Stable Hobba Bridge (SW 454293) and Newlyn Bridge revealing that gamma-HCH was entering the river downstream of Zimmerman Cottage (SW 459293) (site 3 - Fig. 1). Gamma-HCH concentrations at each sampling location are shown in Table 1.

TABLE 1. Gamma-HCH concentrations in river water samples from seven sites on the Newlyn River on 6 September 1989.

Site	Gamma-HCH concentration (ng/l)
1. Newlyn Bridge	290
2. Fish Factory	310
3. Zimmerman Cottage	<10
4. D/S ploughed field	<10
5. Trieta Lodge D/S industrial estate	<10
6. Discharge from pipe at industrial estate	<10
7. Stable Hobba	<10

It was thought that cabbage stumps, which had been dumped in the river 100m downstream of the cottage, were a possible source of gamma-HCH if these had been treated with this compound. Gamma-HCH concentrations on the cabbages were found to be below the limit of detection.

It was decided that the Freshwater Investigation Team should carry out more detailed surveys to identify the cause and point of entry of gamma-HCH and this report describes the results of the work.

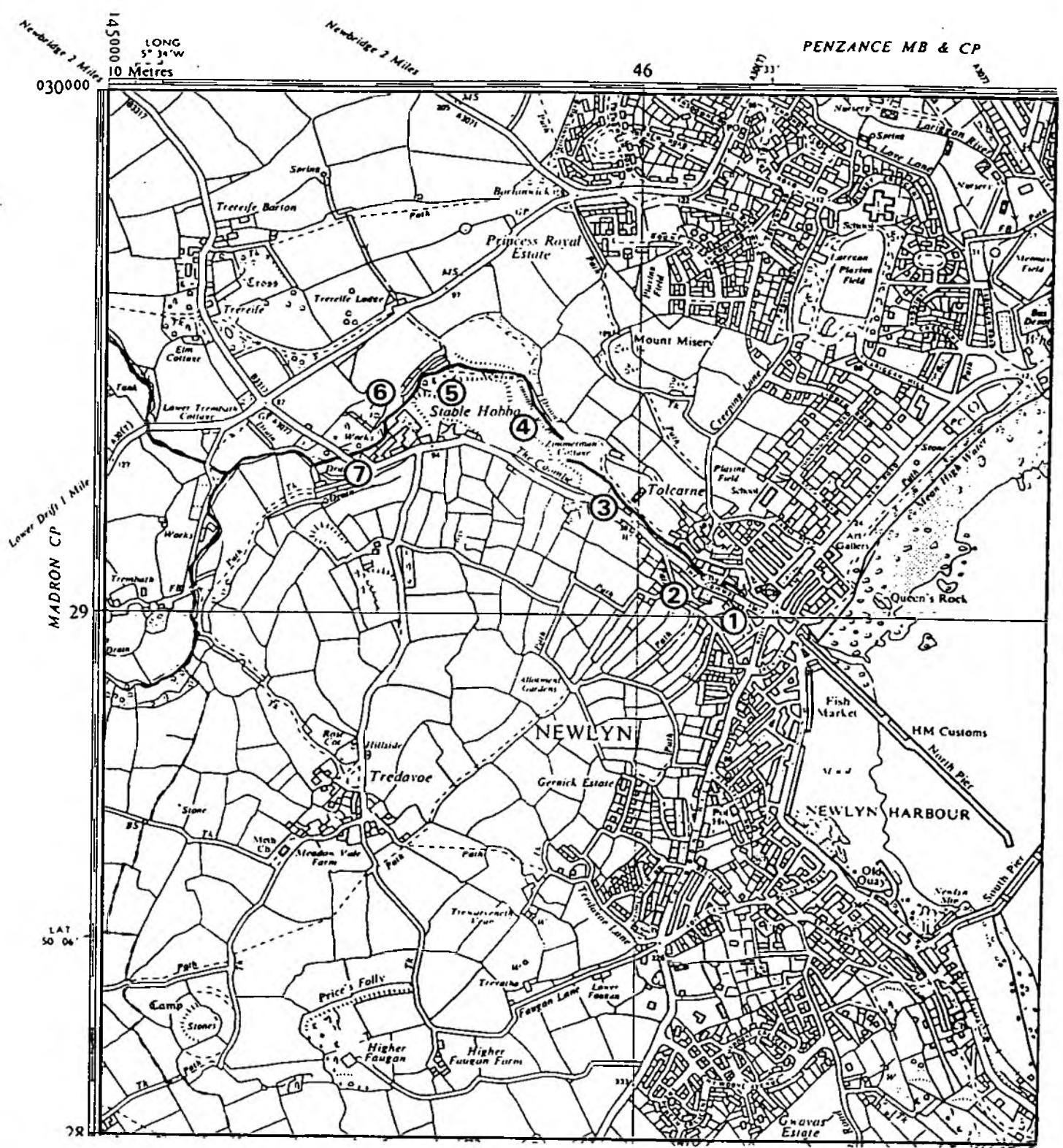
2. THE SURVEY AREA.

The River Newlyn rises 190m above sea level at Men-an-Col (SW 430350) and flows in a southerly direction on the Lands End peninsula. The river is impounded at Drift Reservoir 8km downstream and is used as a potable supply for Newlyn. Downstream of the reservoir the river flows for a further 4km before reaching the sea at Newlyn.

2.1 Land-use.

The upper reaches of the river lie on acidic granite while the lower stretches are on Devonian Mylor slates. In both areas land is mainly used

Fig. 1. Map of the River Newlyn indicating sampling locations between Newlyn Bridge and Stable Hobba Bridge.



for grazing, bulb growing and some cereal production. Newlyn is the major town in the area and there is a small industrial estate at Stable Hobba.

2.2 River-Use.

The River Newlyn has the following designated uses:

- * Protection of Aesthetic Quality
- * Protection of Salmonid Fish
- * Protection of Other Aquatic Life & Dependent Organisms
- * Protection for Livestock Watering
- * Protection for Irrigation of Crops

The River Quality Objectives (RQO's) of the river are shown in Table 1 together with the annual classification according to the National Water Council (NWC) classification system.

TABLE 2. Annual NWC classification of the Newlyn River.

River Length	River Quality				RQO
	1985	1986	1987	1988	
Source to Skimmel Bridge	-	1B	1B	1B	1B
Skimmel Bridge to Buryas Bridge	1B	1B	1B	1B	1A
Buryas Bridge to Newlyn Bridge	2	1B	1B	1B	1B

2.3 Historic Gamma-HCH Pollution.

The Newlyn river has a history of pollution from gamma-HCH. During studies in the Newlyn Catchment in 1988, gamma-HCH was detected at Stable Hobba at a concentration of 110 ng/l on 14 December 1988 (see Report EP/WQ/89/3). It was also present in river sediments at 88 ug/kg (dried weight) and concentrations in five trout ranged from 50 to 86 ug/kg (wet weight).

The source of gamma-HCH recorded during these surveys is unknown. However, since trace concentrations of gamma-HCH were found at Buryas Bridge a likely source is the Trereife Stream where gamma-HCH was present in river sediments (<1-23 ug/kg dried weight).

2.4. Area of Investigation.

The study reach was approximately 400m of the Newlyn River between Zimmerman Cottage and Newlyn Bridge (see photograph and Fig. 2).

On the right hand-bank the river was bordered by a brick wall for approximately half the length. There were a number of surface-water drains in this wall. Immediately upstream was an old building which was part used as a garage with a small garden where vegetables and raspberries

Photograph 1. Aerial view of the study area.

- KEY: 1 = Zimmerman Cottage,
2 = Garage with garden,
3 = Harvey and Sons Fish Factory.
A = Source of contamination.

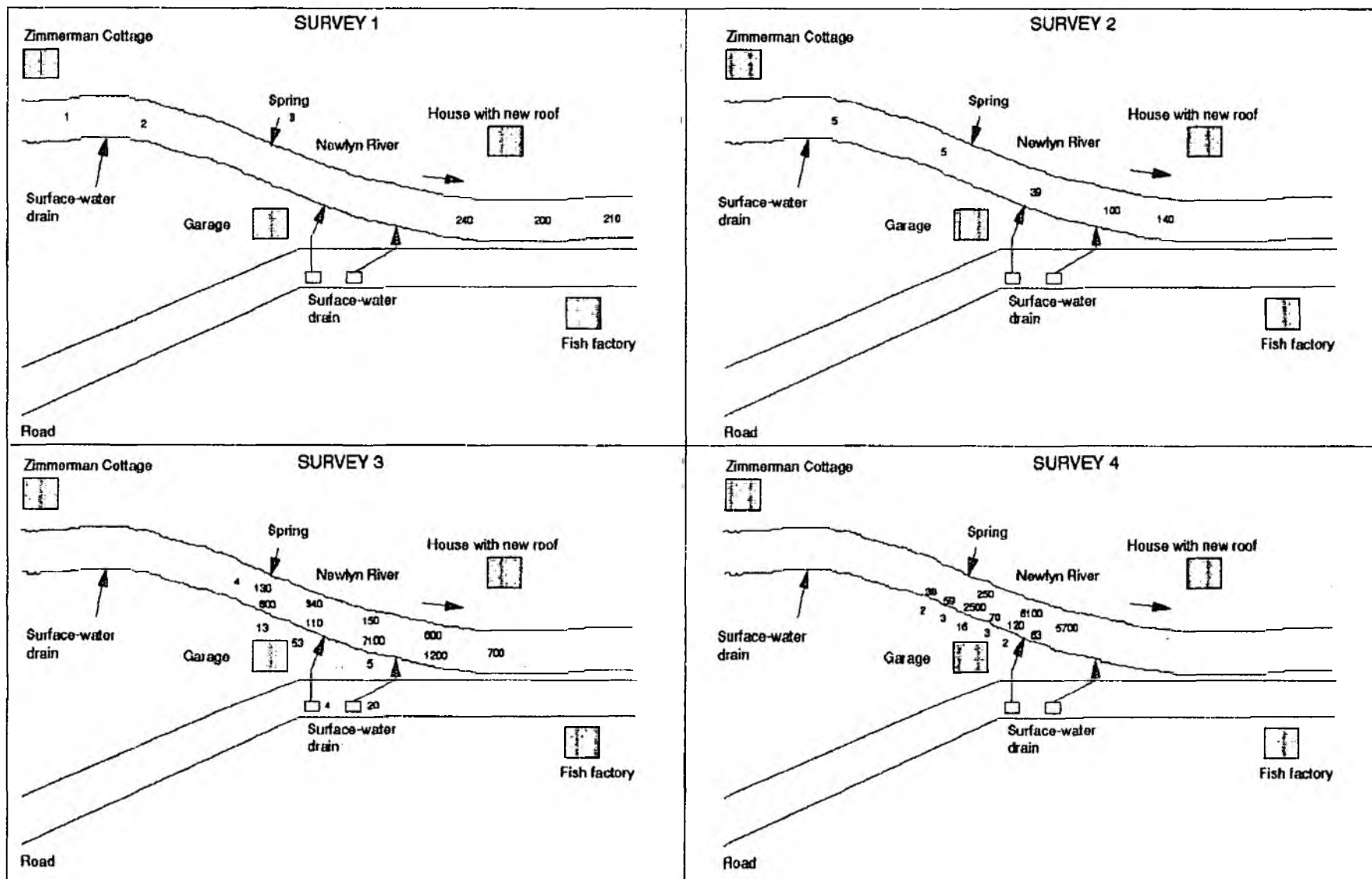


Fig. 2 Newlyn River indicating sampling locations and gamma-HCH concentrations

water samples (ng/l)

sediment samples (ug/kg dry wt)

soil samples (ug/kg dry wt)



were grown. Outside the garage there was a small rubbish-tip next to the river.

Along the left-hand-bank there were trees/shrubs bordering a track leading to Zimmerman Cottage. The river bed consisted of gravel, with silt accumulated in back-water areas.

Several potential sources of gamma-HCH were identified (Fig. 2). These included:

- a) A leachate from a fish factory (SW 461291);
- b) A broken sewer opposite the fish factory (SW 461291);
- c) A new roof which may have had treated timbers (SW 461292);
- d) Surface-water drains (SW 460292, SW 459293);
- e) A spring (SW 459292);

3. METHODS.

Samples were taken at various locations along the river in an attempt to isolate the point of entry of gamma-HCH. When the source was identified as being between two sampling locations, a repeat survey was carried out with samples taken within this stretch of river.

Four surveys were needed to narrow-down the point of origin. These were carried out on 11 September 1989, 17 September 1989, 29 September 1989 and 27 October 1989.

Spot samples of river water were taken during each survey. For the third survey, water samples were taken in transect; one on the right-hand bank and the other the left-hand-bank. Soil samples were also taken from road drains and from three locations on the river bank during this survey. During the fourth survey samples were taken from the river sediment and from river bank soil. However, on this occasion soil was taken at 5m intervals and within each 5m location samples were taken at random and bulked.

4. RESULTS.

The first two surveys narrowed down the point of entry of gamma-HCH to a 50m stretch of river between the garage and downstream of the surface-water drains (see Fig. 2).

Transect samples of river water from the third survey revealed that gamma-HCH was entering the river from the right-hand-bank although the obvious sources such as the surface-water drains were not the cause of pollution. Concentrations of gamma-HCH in river water were much higher than previously recorded.

Sediment samples collected during the fourth survey isolated the source of contamination to within a 3m stretch of river. A slack-water area behind a trash dam had very high gamma-HCH concentrations in the river sediment. Adjacent soil samples from the river bank were not contaminated with

gamma-HCH. Immediately downstream of the trash dam on the right-hand bank, water samples had similar levels of gamma-HCH to those found in the third survey at the same locations.

5. DISCUSSION.

5.1 General.

Owing to the insidious nature of the pollution and large number of potential inputs to the river it took four surveys to trace the source of gamma-HCH to within a 3m stretch of river. Within this small area there were no obvious points of entry such as a small tributary or discharge.

The initial high concentration of gamma-HCH was a one-off event and probably caused by someone discarding a vessel containing gamma-HCH or a gamma-HCH mixture. Two boulders in the river had snagged a large amount of debris including tin-cans and plastic bags and it is likely that one or more of these items had held gamma-HCH and subsequently contaminated the sediment in the vicinity.

Routine river sampling at Newlyn Bridge has shown a gradual decrease in gamma-HCH concentration following the initial event on 30 August 1989 (Fig. 3). The results in surveys 3 and 4 were higher than those recorded at the routine monitoring point and appear to contradict the results found in this study. However, this is probably due to disturbance of sediments during the surveys.

5.2 Remedial Actions.

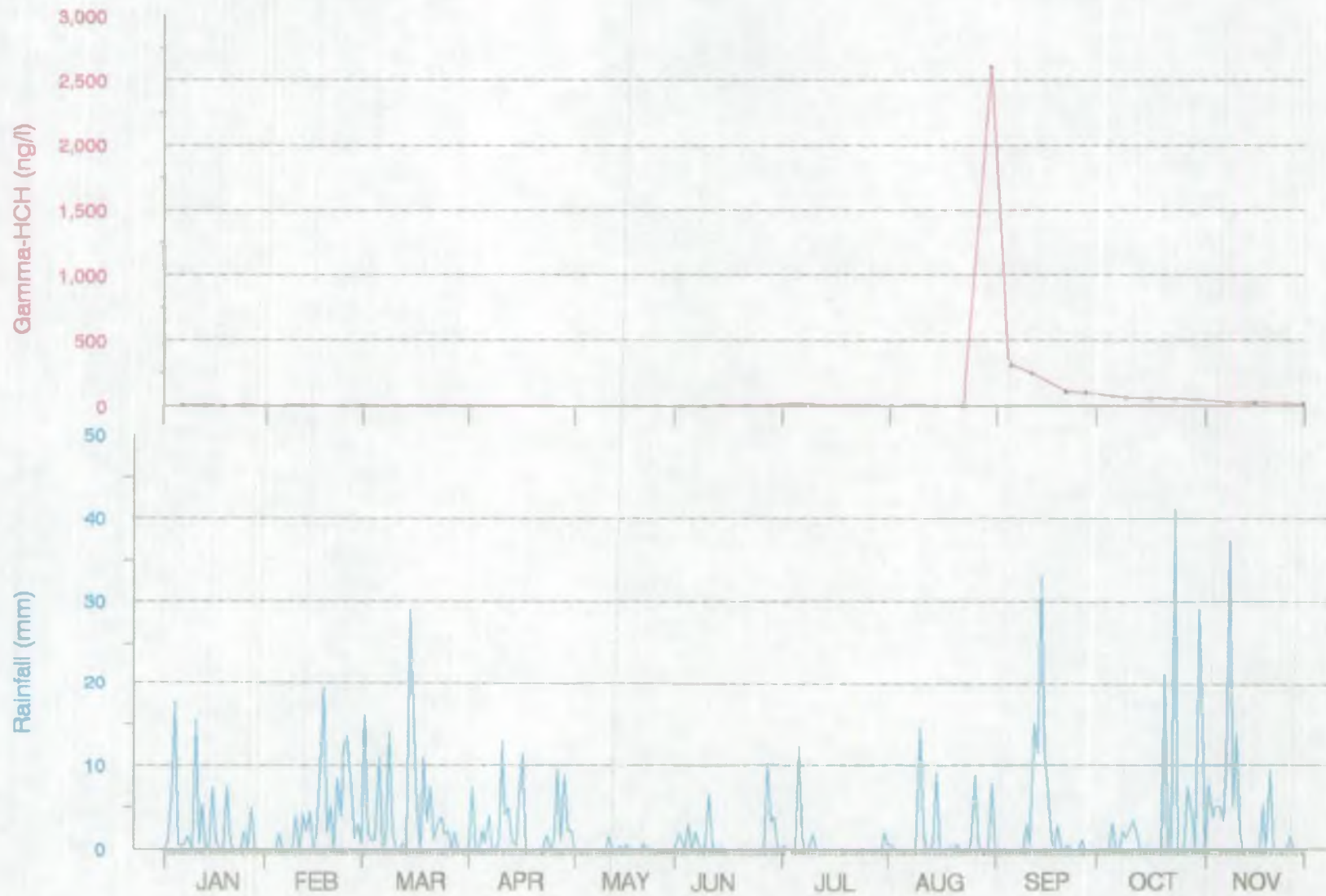
In order to remove the contaminated river sediment (approximately 1 cm thick) the following options could be adopted.

- (i) No action could be taken allowing natural spates to flush the contaminated sediment from the system.
- (ii) Pressure hoses or other mechanical action could be used to flush the sediment from the system.
- (iv) The river flow could be redirected by removing the boulders and allowing the natural flow to scour the sediment.

6. CONCLUSION.

1. The source of gamma-HCH contamination in the Newlyn River has been isolated to a 3m stretch (SW 459292).
2. There is no obvious point source discharge causing the contamination of gamma-HCH in the Newlyn River.
3. It is considered the most likely source of the gamma-HCH contamination in the Newlyn River is the result of a container or bag, containing gamma-HCH, becoming snagged amongst debris in a trash

Fig. 3 Gamma-HCH concentrations at Newlyn Bridge during 1989 and rainfall measured at Drift Reservoir.



dam. This has brought about the contamination of river sediments in the area.

4. Routine river sampling for pesticides at Newlyn Bridge has shown a gradual decline in the level of gamma-HCH in the river water samples following the initial event. Concentrations are now less than the EQS for this pesticide in river water.

7. RECOMMENDATIONS.

1. As the concentration of gamma-HCH routinely recorded at the Newlyn Bridge monitoring point have declined below the EQS it is recommended the river is left untreated, allowing natural spates to flush the contaminated sediment from the river system. However, to ensure removal is progressing as expected, a repeat survey will be carried out in spring 1990 at the source location.

8. REFERENCES.

Report EP/WQ/89/3. Water quality investigations in the Newlyn River Catchment.

Recovery of gamma-HCH contamination in the Newlyn River: 1990 Follow-up Survey.

1. Introduction.

It was recommended that river sediments from the Newlyn River are monitored in 1990 to assess if natural flushing had been successful in removing gamma-HCH contaminated sediment from the river.

A vessel containing gamma-HCH was considered to have been disposed of into the Newlyn River. The container is thought to have been trapped in a trash dam which subsequently contaminated river sediments in the immediate vicinity (see Report FWI/89/003).

2. Methods.

A follow-up survey was carried out on 14 June 1990 to determine levels of gamma-HCH in river sediments at the previously contaminated site. Samples were collected at the same sites used in previous surveys associated with the trash dam. River water samples were also taken to assess levels of gamma-HCH.

3. Results.

The structure of the trash dam and associated flow pattern had substantially changed since previous surveys. The bulk of rubbish had been removed presumably as a result of high winter flows.

Gamma-HCH concentrations in river sediments and river water had decreased at all sites associated with the trash dam (see Table 1). This is probably due to the combined action of flushing of sediments at times of high flow and the leaching of this water soluble pesticide from the sediment into the water column.

TABLE 1. Gamma-HCH concentrations in river sediments (ug/kg dried weight) and river water (ng/l) associated the trash dam in the Newlyn River.

	27.10.89	14.6.90
	<u>River sediment</u>	
2,500		34
70		24
120		8
	<u>River water</u>	
250		8
6,100		8
5,700		8

4. Discussion.

Concentrations of gamma-HCH in river sediments during the follow-up survey were low and similar to concentrations found at the Stable Hobba site (88 ug/kg dried weight) before the pollution event (see Report EP/WQ/89/3). It would appear that the river has recovered.

5. Conclusion.

1. The high winter flows have been successful in flushing sediment contaminated with gamma-HCH from the Newlyn River system.

6. Recommendations.

1. No further action.

7. References.

Report FWI/89/003. An investigation to determine the source of high levels of gamma-HCH in the Newlyn River during summer 1989.

Report EP/WQ/89/3. Water Quality Investigations of the Newlyn River Catchment.