ENVIRONMENT AGENCY

KILLIOW STREAM POLLUTION BIOLOGICAL IMPACT ASSESSMENT

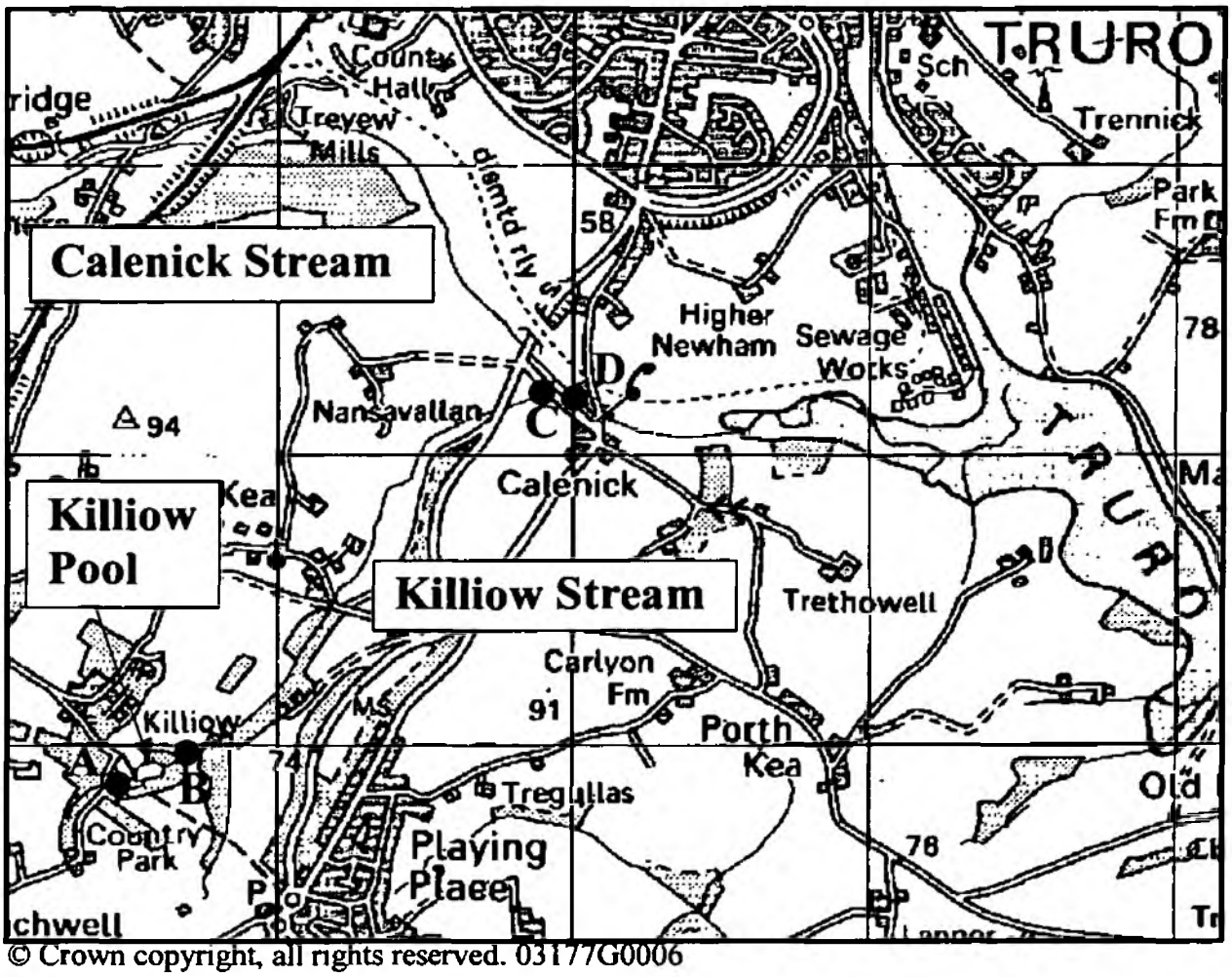
TIM GEATCHES
DECEMBER 1999

KILLIOW STREAM POLLUTION BIOLOGICAL IMPACT ASSESSMENT

1. INTRODUCTION

Environment Protection (West) requested a biological impact assessment of Killiow Pool. The pool was being drained and dredged by the owners. This caused severe aesthetic impact from silt of the Killiow Stream and Calenick Stream (see figure 1). Many pollution complaints were received and the investigation by Environment Protection (West) led to the issue of a Works Notice on the owners to cease operations.

Figure 1. Sampling sites



2. METHODS

2.1. Macroinvertebrate samples were taken on 15 October 1999 according to standard Environment Agency methodology (see reference 7.1.). A three minute kick sample was taken at each site using a pond net (see figure 1). This technique is semi-quantitative by using relative abundance in terms of percentage. The sample was examined on site to assess any macroinvertebrate mortalities. A one minute search was then conducted to look for any additional taxa. None were found in this survey.

2.2. Samples were preserved in Industrial Methylated Spirit (95%) and Glycerol (5%) for further examination in the laboratory. Site features were also recorded as per Environment Agency methods.

2.3. In the laboratory the sample was sieved and sorted according to standard Environment Agency methods. Taxa were enumerated and identified to the lowest practical level.

3. RESULTS

3.1. The taxa list is shown in appendix 1.

4. DISCUSSION

4.1. On site assessment

No macroinvertebrate mortalities were observed in any of the samples. However, it was clear that a comparison of sites upstream and downstream of the pool showed a major change in dominant macroinvertebrate taxa.

Upstream of the pool (site A) the substrate was clean and a wide variety of clean water taxa was observed. Downstream of the pool (site B) the substrate was covered in a fine layer of silt and was dominated by a few macroinvertebrate taxa tolerant of organically polluted conditions. Photographs of site A and B for comparison are shown in appendix 2 and appendix 3 respectively.

Further downstream, prior to the Calenick Stream (site C), the substrate was clean and clean water taxa were more evident. There was substantial growth (30% cover) of the filamentous alga *Cladophora glomerata*, indicating nutrient rich conditions.

In the Calenick Stream at Calenick (site D), taxa indicated metalliferous conditions. It was clear that the Killiow Stream was not impacting the Calenick Stream and therefore the Calenick Stream upstream of Killiow Stream was not sampled. The Calenick Stream at Calenick is a routine biological site (NR06.1938) so it was possible to compare historic data (see section 4.2.).

4.2. Laboratory assessment – biotic scores

The on site assessment indicated no acute impact from the pool operations. However, there was clear evidence of a chronic impact downstrcam of the pool. Using standard Environment Agency biotic scores (see reference 7.1.) there was a clear drop in BMWP and ASPT scores downstream of the pool (see table 1). There is partial recovery further downstream at site C.

Table 1. Biotic scores – 15 October 1999

	Killiow Stream upstream Killiow Pond (Site A)	Killiow Stream downstream Killiow Pond (Site B)	Killiow Stream prior to Calenick Stream (Site C)	Calenick Stream at Calenick (Site D)
BMWP families	27	19	27	15
BMWP score	175	101	157	88
ASPT score	6.48	5.32	5.81	5.87

The Calenick Stream at Calenick (site D) had poor BMWP and ASPT scores due to metalliferous pollution and not as a consequence of the Killiow Stream. Comparison with previous years is shown in table 2. This indicates there has been no recent deterioration in biological quality in the Calenick Stream.

Table 2. Autumn biotic scores - Calenick Stream at Calenick (site D, NR06.1938)

	20 September 1990	23 September 1993	17 October 1995	15 October 1999
BMWP families	4	11	5	15
BMWP score	23	70	32	88
ASPT score	5.75	6.36	6.40	5.87

4.3. Laboratory assessment – taxa

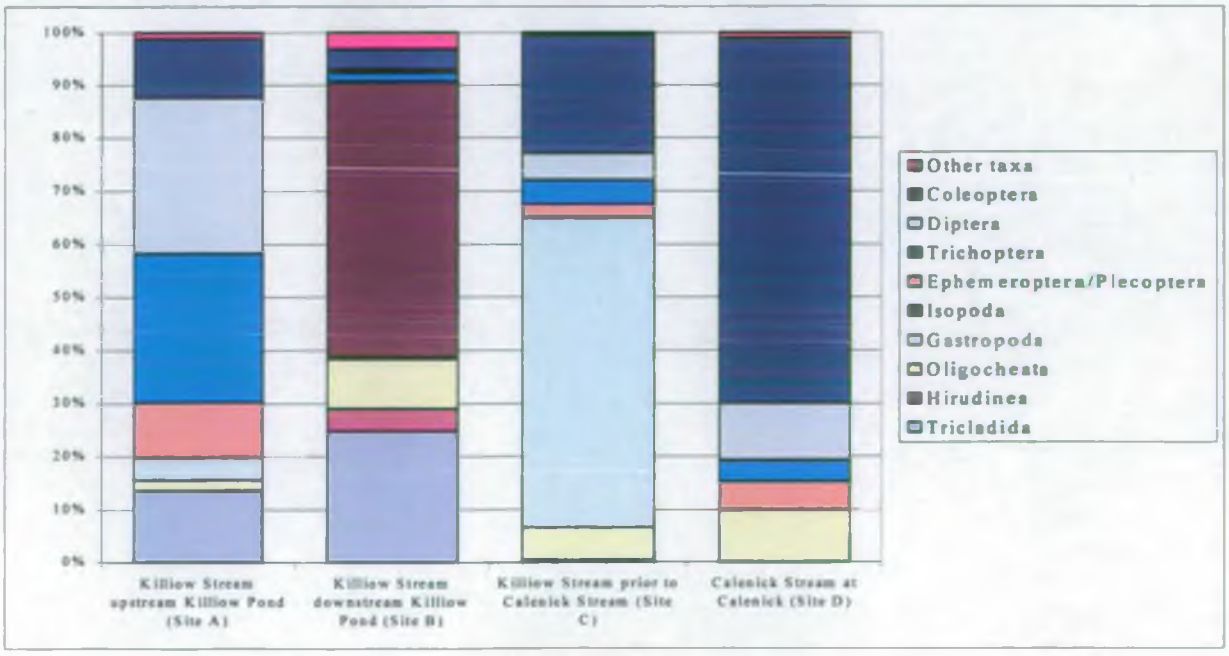
The Killiow Stream upstream of Killiow Pool (site A) contained a wide variety of species typical of clean water. *Rhithrogena semicolorata* (Ephemeroptera), *Siphonoperla torrentium* (Plecoptera), *Odontocerum albicorne* and *Philopotamus montanus* (Trichoptera) are all species requiring good quality water. No one species was dominant.

In comparison, the Killiow Stream downstream of Killiow Pool (site B) was dominated by one species, *Asellus aquaticus* (Isopoda), not recorded at site A. *Asellus aquaticus* is a detritivore tolerant of organically polluted conditions. Ephemeroptera and Plecoptera were absent, and Trichoptera were poorly represented. Hirudinea and Tricladida, major predators of *Asellus aquaticus*, were also common and are known to be tolerant of organically polluted conditions.

The deterioration of site B was probably due to the silting up of Killiow Pool. This process would lead to an accumulation of organic matter within the pool and its release to the Killiow Stream below. This would lead to the observed change to species tolerant of organically rich conditions.

Comparison between the key groups is shown in figure 2.

Figure 2. Key groups relative abundance



The Killiow Stream prior to the Calenick Stream (site C) shows another shift in dominance to *Potamopyrgus antipodarum*. *Asellus aquaticus* was absent. Ephemeroptera and Plecoptera were recorded but species diversity and relative abundance had not returned to levels recorded at site A. The taxa, together with substantial *Cladophora glomerata* growth (see section 4.1.), indicated nutrient-rich conditions typical of the recovery zone from organically polluted conditions at site B.

The Calenick Stream at Calenick (site D) was dominated by *Limnius volckmari* (Coleoptera). There was a reduced number of species compared to the Killiow Stream and taxa were typical of metalliferous conditions. No indication of nutrient enrichment was evident.

5. CONCLUSIONS

5.1. The Killiow Stream upstream of Killiow Pool contains macroinvertebrate taxa indicative of good water quality.

5.2. The Killiow Stream downstream of Killiow Pool contains macroinvertebrate taxa indicative of organically polluted conditions.

5.3. There is no evidence of an acute impact from the dredging operations of Killiow Pool.

6. RECOMMENDATIONS

6.1. The Killiow Stream to be diverted around Killiow Pool to maintain high water quality.

7. REFERENCES

7.1. Murray-Bligh J, Jones F and Seager J (1997) Procedures for collecting and analysing macroinvertebrate samples. BT001.

TIM GEATCHES
BIOLOGIST
DECEMBER 1999

Appendix 1. Taxa list

TAXA	A	B	C	D
Platyhelminthes				
Tricladida				
Dugeslidae				
Dugesia tigrana		14		
Planariidae				
Polycelis felina	209		11	
Polycelis sp.		700		
Annelida				
Hirudinea				
Erpodellidae				
Erpobdella octoculata		61		
Erpobdella sp.		12	6	
Glossiphonidae				
Glossiphonia complanata		38		
Glossiphonia sp.		5	1	
Helobdella stagnalis	1	4		
Oligocheata	29	268	246	66
Mollusca				
Bivalvia				
Sphaeriidae				
Pisidium sp.	4	9	1	1
Gastropoda				
Ancylidae				
Ancylus fluviatilis			479	
Hydrobiidae		13		
Potamopyrgus antipodarum	66		1864	
Chelicerata				
Acari				
Hydracarina		2	1	1
Oribatei	2			
Crustacea				
Ostracoda		39		
Malacostraca				
Amphipoda				
Crangonyctidae				
Crangonyx pseudogracilis		43	15	
Gammaridae				
Gammarus sp.				4
Isopoda				
Asellidae				
Asellus aquaticus		1495		

TAXA	A	B	C	D
Uniramia				
Collembola	1			
Ephemeroptera				
Baetidae				
Baetis muticus	8			
Baetis rhodani	51		51	15
Heptageniidae				
Rhithrogena semicolorata	5		1	
Odonata				
Cordulegasteridae				
Cordulegaster boltoni	9	1		
Plecoptera				
Chloroperlidae				
Siphonoperla torrentium	9			
Leuctridae				
Leuctra fusca	33		18	9
Leuctra hippopus	41			2
Leuctra nigra	1		2	5
Leuctra sp.			2	3
Nemouridae				
Amphinemoura sp.	5			
Nemoura avicularis			1	
Nemoura sp.				1
Nemurella picteti	1			
Protonemoura meyeri	4		24	1
Perlodidae				
Isoperla grammatica	1			
Trichoptera				
Beraeidae				
Beraea maurus	1			
Goeridae				
Silo pallipes			26	7
Hydropsychidae				
Diplectrona felix	101			
Hydropsyche siltalai	12	4	67	9
Lepidostomatidae	1			
Leptoceridae		1		
Limnephilidae	28	12	1	
Chaetopteryx villosa			1	
Micropterna sp.	1			
Potamophylax sp.	1			
Odontoceridae				
Odontocerum albicorne	11	1	14	3
Philopotamidae				
Philopotamus montanus	188		1	
Wormaldia sp.	20			
Polycentropidae	2			
Plectrocnemia geniculata	4		1	
Plectrocnemia sp.			2	
Rhyacophilidae				
Rhyacophila dorsalis	5	8	3	
Rhyacophila sp.	2	1	4	
Sericostomatidae				
Sericostoma personatum	56	23	66	8

TAXA	A	B	C	D
Uniramia (continued)				
Diptera				
Ceratopogonidae	2	4	2	5
Chironomidae	314	6	139	60
Dixidae				
Dixa dilatata		1		
Dixa nubilipennis	12			
Dixa puberula	6		2	
Empididae		1		
Chelifera group			2	
Hemerodromia group			2	1
Wiedmannia group			1	
Psychodidae	7	1		
Ptychopteridae				
Ptychoptera sp.		3		
Simuliidae				
Simulium sp.	93		41	2
Tipulidae				
Dicranota sp.	9		11	
Limnophila (Elaeophila) sp.	4			3
Pedicia sp.	4			
Coleoptera				
Elmidae				
Elmis aenea	4	106	764	82
Limnius volckmari			105	353
Ouliminius tuberculatus				16
Ouliminius sp.				8
Gyrinidae				
Orectochilus villosus			26	
Hydraenidae				
Hydraena gracilis	9		7	4
Hydraena riparia		1	1	
Hydraena sp.	2		1	
Scirtidae				
Helodes sp.	161	4	1	

Appendix 2. Killiow Stream upstream Killiow Pool (site A)

Appendix 3. Killiow Stream downstream Killiow Pool (site B)