Flooding Survey June 1990

Lower Trent Catchment

NRA
National Rivers Authority
Severn-Trent Region

RIVER CATCHMENT AREAS

Severn-Trent Region Boundary

Catchment Boundaries

Adjacent NRA Regions

1. Upper Severn **2.** Lower Severn **3.** Avon **4.** Soar
5. Lower Trent **6.** Derwent **7.** Upper Trent **8.** Tame

NRA

National Rivers Authority
Severn-Trent Region

FLOODING SURVEY

JUNE 1990

SECTION 136(1) WATER ACT 1989

(Supersedes Section 24(5) Water Act 1973

Land Drainage Survey dated January 1986)

LOWER TRENT CATCHMENT

AND NOTTINGHAMSHIRE

FLOOD DEFENCE DEPARTMENT
NATIONAL RIVERS AUTHORITY
SEVERN-TRENT REGION
SAPPHIRE EAST
550 STREETSBROOK ROAD
SOLIHULL
W MIDLANDS B91 1QT

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REFERENCES

1 "Interim Report - Section 24(5) Survey" - Published by Severn-Trent Water Authority, July 1978.

2 "Flood Studies Report" Vols I-V, Natural Environmental Research Council (1975).

3 "The Benefits of Flood Alleviation" - E C Penning- Rowsell and J B Chatterton, published by Saxon House, Teakfield Ltd.

4 "Medway Letter" - Ministry of Agriculture and Fisheries (1933). Available in Wisdom's "Land Drainage", Sweet and Maxwell, London (1966).

5 DoE Circular 17/82 - "Development in Flood Risk Areas - Liaison between Planning Authorities and Water Authorities" published in 1982.

GLOSSARY OF TERMS

ADAS	- Agricultural Development and Advisory Service: part of the Ministry of Agriculture, Fisheries and Food (MAFF).
Arterial drainage	- The drainage channels conveying surface water run-off, effluent, etc. (excluding farm ditches, underdrainage and sewers) to the estuaries.
Benefit	- The return from investment in flood alleviation and land drainage improvement schemes.
Benefit area	- The geographical area in which direct benefit is obtained, usually either the maximum extent of flooding in an urban area or the land below the 'Medway Letter Line' in an agricultural area.
Catchment	- The geographical area from which rainfall will drain, by gravity, to a particular river and its tributaries.
Design flood	- The maximum flood for which the flood alleviation works will provide protection.
Discount rate	- The rate for converting all current and future benefits to present values.
Flood Q (T)	- The flood with a recurrence interval or return period of T years.
Floodplain	- The area of land adjacent to a watercourse which is inundated when the flow in the watercourse exceeds the capacity of the channel. The outer limit is usually the maximum extent of past recorded floods.
Freeboard	- See section 2.6.3.
Gross margin	- The gross output of an agricultural enterprise less the variable costs.
Intangible benefits	- The benefits that result indirectly from flood alleviation works, but which are not normally financially quantifiable. These can include freedom from anxiety, potential loss of life, cost of emergency services, etc.
Land potential	- An indication of soil profile characteristics such as structure, texture, depth, stoniness, etc which determines the ability of a soil to produce crop growth.
Main river	- The watercourses shown on the statutory 'main river maps' held by the National Rivers Authority and the Ministry of Agriculture, Fisheries and Food. The NRA has permissive powers to carry out works of maintenance and improvement on these rivers.
Mean annual flood Q	- The arithmetic average of annual maximum floods.
Normal water level	- The water level under average flow conditions.
Return Period	- The average length of time separating flood events of the same magnitude.
Underdrainage	- The drainage required in fields to ensure that the whole area drains satisfactorily to farm ditches or arterial watercourses. This may be tile drains, mole drains or subsoiling.
Variable costs	- Costs incurred in producing a crop, excluding fixed costs such as rent, rates and permanent labours. Variable costs include costs of seed, fertiliser, concentrates, vetinary costs, sprays and casual labour.

PREFACE

THE NATIONAL RIVERS AUTHORITY

The National Rivers Authority was established in September 1989 to be responsible for protecting and improving the water environment. It is an independent public body responsible for the regulatory functions formerly carried out by the water authorities, along with other important statutory duties. Its main tasks are:

- flood defence
- water quality and pollution control
- water resource management
- fisheries, conservation and recreation
- navigation

The NRA is a national body with a small central policy unit. Most of the employees work for the ten regional units which undertake day-to-day operations.

The NRA has a chairman, who along with other members is appointed by the Government - 12 by the Department of the Environment, 2 by the Ministry of Agriculture, Fisheries and Food and one by the Welsh Office. The MAFF appointees have a special responsibility for representing land drainage and fisheries interests.

SEVERN-TRENT REGION

The Severn-Trent Region is the second largest of the 10 regional units of the NRA both in size and population. It covers a diverse area of more than 8,000 square miles (21,600 sq km) and includes nearly 4,000 miles of rivers and watercourses.

The region is based upon the catchments of the Rivers Severn and Trent. The borders stretch from the Bristol Channel in the south to the Humber Estuary in the north, from Mid-Wales to the East Midlands.

The NRA is not responsible for navigation in the Severn-Trent Region. This is the responsibility of the British Waterways Board and a number of navigation trusts.

The headquarters of the NRA Severn-Trent Region is in Solihull, West Midlands. The Area organisation is catchment based with four areas of roughly equal size, achieved by dividing the Severn catchment at the confluence of the Severn and Teme and the Trent catchment at the Trent-Dove confluence. These areas are called Upper Severn, Lower Severn, Upper Trent and Lower Trent, with area offices at Shrewsbury, Tewkesbury, Burton-on-Trent and Nottingham. Within each area there are smaller sub-offices and depots.

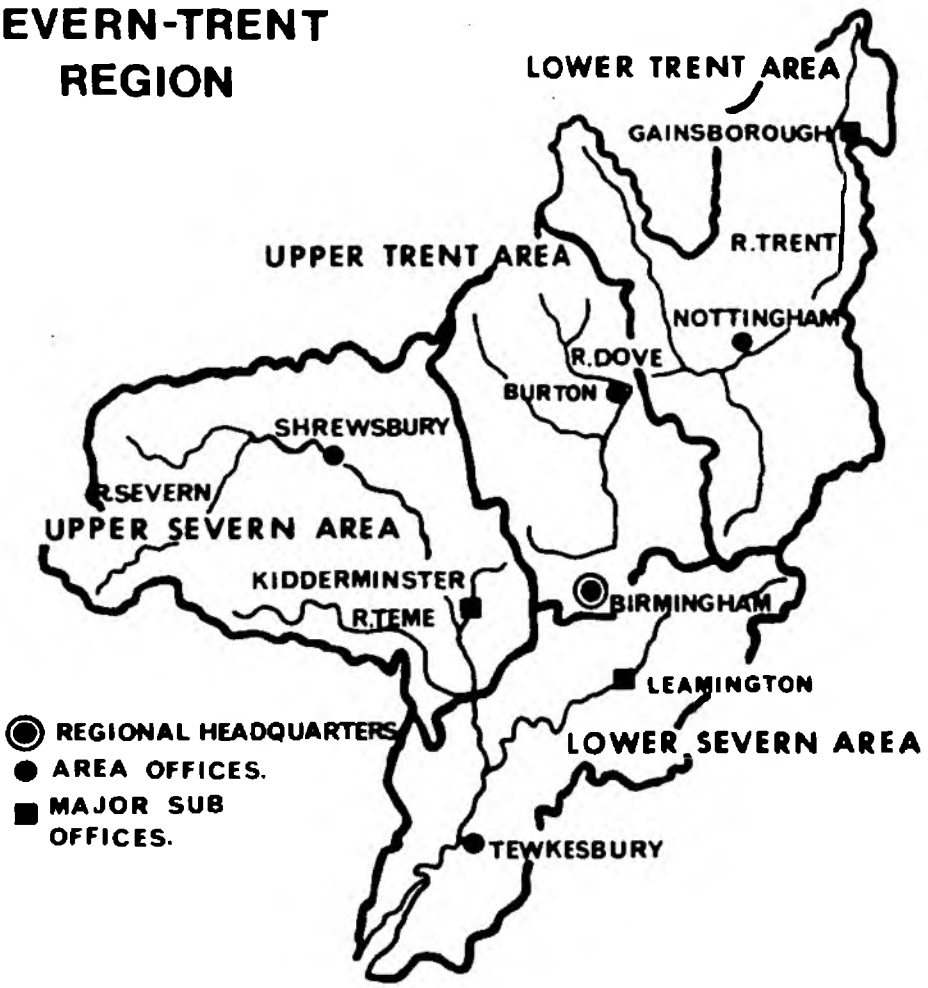
The NRA in the region works with three statutory committees which meet in public three or four times a year:-

Flood Defence Committee - This committee has 21 members appointed by the NRA, MAFF and local authorities. The committee has executive powers to discharge the NRA's flood defence and land drainage functions.

Rivers Advisory Committee - This committee is appointed by the NRA to advise on the broad framework of river basin management. It consists of representatives of local authorities, leisure groups, conservation interests, industry and agriculture and other interested parties.

Fisheries Advisory Committee - This committee has 15 members and advises the NRA on the discharge of statutory duties to maintain, develop and improve fisheries.

NRA SEVERN-TRENT REGION



Regional Headquarters
Sapphire East
550 Streetsbrook Road
Solihull B91 1QT
Tel: 021 711 2324

Upper Severn Area Office
Hafren House
Welshpool Road
Shelton
Shrewsbury SY3 8BB
Tel: (0743) 272828

Lower Severn Area Office
Southwick Park
Gloucester Road
Tewkesbury GL20 7DG
Tel: (0684) 850951

Upper Trent Area Office
The Poplars
21 Rolleston Road
Burton-on-Trent
DE13 0AY
Tel: (0283) 37191

Lower Trent Area Office
Trentside
Scarrington Road
Off Ladybay Bridge
West Bridgford
Nottingham NG2 5FA
Tel: (0602) 455722

CHAPTER 1

SUMMARY

1.0 SUMMARY

1.1 Introduction

1.1.1 This updated survey is one of eight surveys on the major river catchments in the Severn-Trent Region. Each survey provides information appertaining principally to a major catchment, extended to include the whole of the major County associated with it.

1.1.2 The primary purpose of the surveys is the identification and evaluation of flooding and land drainage problems and this summary provides information to facilitate rapid assimilation and comparison of costs, benefit/cost ratios and priority categories of these problems.

1.1.3 This survey supersedes the 1980 survey and the 1982 and 1986 revisions

1.2 Coding System

1.2.1 Every problem identified has been given a code number. The code numbers appropriate to each problem were originally classified in the "Interim Report of Survey"[1] of July 1978. That original classification remains unchanged for this Report but numbers have been added where new problems have been identified since the publication of the Interim Report. The codes applicable to catchments and County and District Councils are shown in Appendix A4 and the format of the code is as follows:

	x	xx	xxx	xx
	Catchment	County	District	Number
eg	1	83	310	27
	Upper Severn	Salop	Oswestry	Problem No.

1.3 Priority Categories

1.3.1 In order to establish a range of priorities to which an individual improvement scheme can relate, all improvement schemes have been categorised on the basis of:

(i) the size of the benefit/cost ratio
(ii) the cost of the arterial part of the improvement works (ie. excluding field drainage and ditching costs).

These categories are shown below.

Category by Benefit/Cost Ratio

CATEGORY	BENEFIT/COST RATIO	
	GREATER THAN	LESS THAN
1	2.0	
2	1.0	2.0
3		1.0

Category by Arterial Costs

CATEGORY	ARTERIAL COST (£'000)	
	GREATER THAN	LESS THAN
A	1000	
B	500	1000
C	100	500
D	50	100
E	10	50
F		10

1.4 Summary of Problem Evaluations

1.4.1 The problem evaluations which are shown in detail in Appendix A1 are summarised in Table 1. This Table shows costs, benefit/cost ratios and priority categories for every problem identified, and enables District Councils and County Councils to assimilate rapidly the total extent of improvements required in their areas and the priorities of the individual requirements within that total.

1.4.2 The page number within Appendix A1 of the evaluation of every identified problem is shown adjacent to the problem number in column 2 of Table 1.

1.4.3 It should be noted that the costs and benefits are to a December 1989 price base and that the watercourses marked * are main river or partly main river.

1.4.4 In some cases a single solution covers a number of identified problems. In these cases, the solution is detailed under the first problem number and all other relevant problem numbers are referred to it.

1.5 Summary by Priority Category

1.5.1 Tables 2 and 3 summarise, for both main river and non-main river, the numbers of problems in each category and the total cost of their associated improvement works. This summary includes only those problems in the catchment area and has been prepared primarily to provide the Ministry of Agriculture, Fisheries and Food with an overall appraisal of the total cost of improvements required throughout the Region. The total cost includes anticipated capital expenditure on current main river schemes and therefore represents a global summary of ongoing and future capital expenditure.

1.6 Identification of problems and their evaluation

1.6.1 The primary purpose of this Survey is to enable rapid identification of problems and the improvement works required to these problems. This can be done using the following system:

i) EITHER
Identify on the 1:25,000 scale maps, which accompanied the 1980 Report, the area of interest and note the code number of the benefit area or point source shown.
OR
Knowing the District or County Council in which the interest lies identify the relevant code number (see Section 1.2 of this Report and Appendix A4).

ii) Refer to the "Summary of Problem Evaluations" in Table 1 for brief details of costs, benefit/cost ratios and priority categories for the requisite watercourses in that District. All costs and benefits are at a December 1989 price base.

iii) Further information on individual schemes will be found in the detailed reports in Appendix A1. The relevant page is shown in the "Summary of Problem Evaluations".

1.6.2 The sheet numbers on the 1:25,000 scale maps in the 1980 album can be located by reference to the grid system shown on the rainfall map at the front of that album. The following diagram shows, as an example, the method for locating sheet number SK 46.

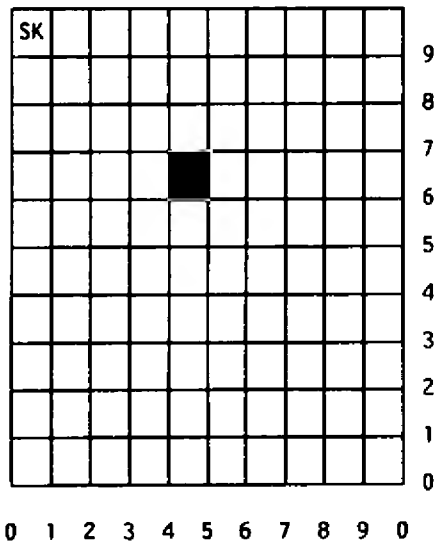


TABLE 1

SUMMARY OF PROBLEM EVALUATIONS

Note: All costs and benefits are to December 1989 price base
* Main River
# New problems since 1986 revision

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
CHARNWOOD BOROUGH COUNCIL						
4-93-310-5	1	*River Soar	SK 493 309			
MELTON BOROUGH COUNCIL						
5-93-610-1)						
5-93-610-2)	2	*River Devon	SK 807 392			
5-93-610-3)						
5-93-610-4)						
5-93-610-5	-	Winterbeck	SK 807 430	Problem alleviated		
5-93-610-6)	3	Dalby Brook	SK 676 237			
5-93-610-7)						
5-93-610-8	-	The Pingle	SK 725 275	Problem alleviated		
5-93-610-9	4	Un-named	SK 720 270			
5-93-610-10	5	Un-named	SK 773 309			
ASHFIELD DISTRICT COUNCIL						
5-94-110-1	-	*River Erewash	SK 519 335	Scheme completed		
5-94-110-2	6	Brinsley Brook	SK 468 497			
5-94-110-3	7	Bagthorpe Brook	SK 445 508			
5-94-110-4	9	Jacksdale Brook	SK 446 516			
5-94-110-5	10	Upper Erewash	SK 485 548	144	0.9	3C
5-94-110-6	11	Kirkby Park Brook	SK 465 546	6	0	3F
5-94-110-7	12	Cuttail Brook	SK 508 528	404	0	3C
5-94-110-8	14	Tributary of River Erewash	SK 498 554			
5-94-110-9	15	Maghold Brook/The Dumbles	SK 465 548	115	4.0	1C
5-94-110-10	17	Meadow Farm Brook	SK 481 564			
5-94-110-11	18	Castle Hill Brook	SK 492 569			
5-94-110-12	-	River Maun and Tributary	SK 506 577	Problem alleviated		
5-94-110-13	-	River Idle	SK 509 590	Problem alleviated		
5-94-110-14)	19	Upper Meden Tributaries	SK 493 619	216	1.4	2C
5-94-110-15)						
5-94-110-16	21	Baker Lane Brook	SK 550 485	432	1.2	2C
5-94-110-17	23	Farleys Brook	SK 546 472	86		
5-94-110-18	-	Tributary of River Erewash	SK 447 562	Problem alleviated		
5-94-110-19	25	Wilfred Brook	SK 485 548	58	0.6	3D
5-94-110-20	-	Tributary of Baker Lane Bk	SK 539 490	Problem alleviated		

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
BASSETLAW DISTRICT COUNCIL						
5-94-210-1	–	*River Trent	SK 806 902	Scheme completed		
5-94-210-2	26	*River Trent	SK 804 893			
5-94-210-3	27	*River Trent	SK 784 940			
5-94-210-4	28	*River Trent	SK 781 932			
5-94-210-6	29	*River Trent	SK 814 766			
5-94-210-7	30	*River Trent	SK 811 703	35	0.6	3E
5-94-210-8	–	*River Trent	SK 789 947	Scheme completed		
5-94-210-9	–	*River Trent	SK 815 714	Scheme completed		
5-94-210-10	31	*River Trent	SK 815 715			
5-94-210-11	–	Moor Drain	SK 770 923	Problem alleviated		
5-94-210-12	32	Wheatley Beck	SK 762 857	46	0.3	3E
5-94-210-13	33	Un-named	SK 788 839	40	0	3E
5-94-210-14	–	Dumps Beck	SK 786 823	Problem alleviated		
5-94-210-15	–	Village Drain	SK 784 809	Problem alleviated		
5-94-210-16	34	Leverton Station Drain	SK 785 816	29	1.1	3E
5-94-210-17	35	Harold Stream	SK 736 731	121	0.8	3C
5-94-210-18	–	Fledborough Beck	SK 814 722	Problem alleviated		
5-94-210-19	–	Un-named	SK 805 696	Problem alleviated		
5-94-210-20	36	*River Idle	SK 689 896			
5-94-210-21	–	*River Idle	SK 789 947	Scheme completed		
5-94-210-22	–	Watercourses in Idle & Ryton IDB	SK 682 942	Problem alleviated		
5-94-210-23)	–	*River Idle	included with 5-94-210-21			
5-94-210-24)						
5-94-210-25)						
5-94-210-26)	–	*River Idle	included with 5-94-210-20			
5-94-210-27)						
5-94-210-28	–	*River Idle	SK 665 936	Scheme completed		
5-94-210-29	–	Main Drain	SK 659 910	Problem alleviated		
5-94-210-30	–	Meadow Drain	SK 731 879	Problem alleviated		
5-94-210-31	37	The Beck	SK 716 810			
5-94-210-32	–	Un-named	SK 668 932	Problem alleviated		
5-94-210-33	38	None	SK 728 846	Highway problem		
5-94-210-34	–	Watercourses in Idle & Ryton IDB	included with 5-94-210-22			
5-94-210-35)	39	Idle & Ryton IDB	SK 711 894			
5-94-210-36)						
5-94-210-37)	–	*River Ryton	SK 655 910	Scheme completed		
5-94-210-38)						
5-94-210-39	40	River Ryton	SK 580 793			
5-94-210-40)	41	Owlands Wood Dyke	SK 595 845	222	1.0	3C
5-94-210-41)						
5-94-210-42)	–	*River Poulter	SK 701 754	Scheme completed		
5-94-210-43)						
5-94-210-44)						
5-94-210-45)	42	River Poulter	SK 647 755			
5-94-210-46)						
5-94-210-47	–	Owlands Wood Dyke	included with 5-94-210-40			

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
5-94-210-48)						
5-94-210-49)	44	*River Maun	SK 702 751			
5-94-210-50)						
5-94-210-52)	46	*River Meden	SK 703 751			
5-94-210-53)						
5-94-210-54	-	*River Trent	SK 827 805	Scheme completed		
5-94-210-55	47	Misterton Drain	SK 785 940	29	2.0	1E
5-94-210-56	-	Marsh Road Drain	SK 784 926	Problem alleviated		
5-94-210-57	48	Saundby Beck	SK 783 883			
5-94-210-58	49	Un-named	SK 733 833			
5-94-210-59	50	Un-named	SK 778 901			
5-94-210-60	51	None	SK 618 910			
BROXTOWE DISTRICT COUNCIL						
5-94-310-1	52	*River Trent	SK 520 340			
5-94-310-2	54	Un-named	SK 514 344	55	0.7	3D
5-94-310-3	55	Outfall to River Trent	SK 525 355	29	7.6	1E
5-94-310-4	-	None	SK 515 352	Problem alleviated		
5-94-310-5)	-	*River Erewash	included with 5-94-110-1			
5-94-310-6)						
5-94-310-7	-	None	SK 487 385	Problem alleviated		
5-94-310-8	56	Bishops Dyke	SK 484 395	26	0.9	3E
5-94-310-9	57	Gilt Brook	SK 483 447	1	5.2	1F
5-94-310-10	-	Nethergreen Brook	SK 455 474	Problem alleviated		
5-94-310-11	-	Beauvale Brook	SK 460 475	Problem alleviated		
5-94-310-12	58	Un-named	SK 535 355			
5-94-310-13	59	None	SK 516 348	349	1.2	2C
5-94-310-14	-	Daisy Farm Brook	SK 478 458	Problem alleviated		
5-94-310-15	-	*River Erewash	included with 5-94-110-1			
5-94-310-16	-	Brinsley Brook	SK 468 497	Problem alleviated		
GEDLING BOROUGH COUNCIL						
5-94-410-1	61	*River Trent	SK 648 421			
5-94-410-2	62	*River Trent	SK 459 309			
5-94-410-3	63	Crock Dumble/Vicarage Drain	SK 646 436	288	0.6	3C
5-94-410-4	65	None	SK 643 434	Sewerage problem		
5-94-410-5	66	Ouse Dyke	SK 622 425	213	0.5	3C
5-94-410-6	68	Tributary of River Trent	SK 628 424			
5-94-410-7	69	Un-named	SK 616 406	686	0.1	3B
5-94-410-8	-	Un-named British Rail Drain	SK 620 408	Problem alleviated		
5-94-410-9	71	Un-named	SK 535 510			
5-94-410-10	-	Day Brook	SK 562 435	Problem alleviated		
5-94-410-11	72	Un-named	SK 633 478			
5-94-410-12	74	Cocker Beck	SK 630 452			
5-94-410-13	75	Tributary of River Leen	SK 531 537			

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
MANSFIELD DISTRICT COUNCIL						
5-94-510-1)						
5-94-510-2)						
5-94-510-3)	-	*River Meden	included with 5-94-210-52			
5-94-510-4)						
5-94-510-5	-	*Lees Brook	SK 555 673	Scheme completed		
5-94-510-6	76	Sookholme Brook	SK 554 679	314	1.6	2C
5-94-510-7)	-	*River Maun	SK 541 608	Scheme completed		
5-94-510-8)						
NEWARK AND SHERWOOD DISTRICT COUNCIL						
5-94-610-1	-	Tributary of River Trent	SK 801 646	Problem alleviated		
5-94-610-2	78	*River Trent & Tributaries	SK 798 636	139	0.5	3C
5-94-610-3)						
5-94-610-4)						
5-94-610-5)						
5-94-610-6)	-	*River Trent	included with 5-94-210-10			
5-94-610-7)						
5-94-610-8)						
5-94-610-9)						
5-94-610-10)						
5-94-610-11)						
5-94-610-12	-	Holme Drain	SK 806 590	Problem alleviated		
5-94-610-13	-	Scaffold Drain	SK 838 620	Problem alleviated		
5-94-610-14	-	Crofts Drain	SK 820 675	Problem alleviated		
5-94-610-15	-	*River Trent	included with 5-94-210-10			
5-94-610-16	-	*River Trent	SK 800 655	Scheme completed		
5-94-610-17	79	Cuckstool Dyke and *River Trent	SK 802 659			
5-94-610-18	80	Cromwell Moor Drain	SK 795 627	193	1.6	2C
5-94-610-19)						
5-94-610-20)	81	Caunton Beck	SK 745 601	265	1.3	2C
5-94-610-21)						
5-94-610-22	82	*River Trent	SK 798 582	29	0.3	3E
5-94-610-23	-	*River Trent	SK 791 572	Scheme completed		
5-94-610-24)						
5-94-610-25)	-	*River Trent	included with 5-94-410-2			
5-94-610-26)						
5-94-610-27)						
5-94-610-28	83	*River Trent	SK 802 554	29	0.6	3E
5-94-610-29	85	*River Trent	SK 802 558			
5-94-610-30	86	*River Trent	SK 793 544			
5-94-610-31	-	*River Trent	SK 776 559	Problem alleviated		
5-94-610-32	-	*River Trent	SK 803 563	Problem alleviated		
5-94-610-33	-	*River Trent	included with 5-94-410-2			
5-94-610-34	87	*River Trent	SK 793 539			
5-94-610-35	88	Un-named	SK 780 526			
5-94-610-36	89	*River Trent	SK 769 521			

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
5-94-610-37	90	*River Trent	SK 765 510	130	0.3	3C
5-94-610-38	91	*River Trent	SK 723 488	153	0.1	3C
5-94-610-39	92	*River Trent	SK 700 465	242	0.3	3C
5-94-610-40)						
5-94-610-41)	93	*River Trent	SK 676 447	1011	0.1	3A
5-94-610-42)						
5-94-610-43	-	*River Trent	included with 5-94-410-2			
5-94-610-45	94	*Rivers Devon and Trent	SK 789 534			
5-94-610-46)	-	*River Devon	SK 788 531	Scheme completed		
5-94-610-47)						
5-94-610-48	95	*River Devon	SK 789 530			
5-94-610-49)						
5-94-610-50)						
5-94-610-51)	-	*River Devon	included with 5-94-610-46			
5-94-610-52)						
5-94-610-53)						
5-94-610-54)						
5-94-610-55	-	Sodbridge Drain	SK 825 529	Scheme completed		
5-94-610-56)	-	Middle Beck and Hawton	SK 819 509	Problem alleviated		
5-94-610-57)		Grange				
5-94-610-58)						
5-94-610-59	96	Thorpe Drain	SK 760 495	274	0	3C
5-94-610-60)						
5-94-610-61)						
5-94-610-62)						
5-94-610-63)	-	*River Maun	included with 5-94-210-48			
5-94-610-64)						
5-94-610-65)						
5-94-610-66	97	Bevercotes Beck	SK 702 732	519	2.1	1B
5-94-610-67	99	Rainworth Water	SK 651 672	784	1.2	2B
5-94-610-68	101	Vicar Water	SK 580 624	392	1.1	2C
5-94-610-69	-	Un-named	SK 778 592	Problem alleviated		
5-94-610-70	103	Brammersack Drain	SK 777 573			
5-94-610-71	-	Old Trent Dyke	SK 782 540	Problem alleviated		
5-94-610-72	104	Un-named	SK 760 523			
5-94-610-73	105	*River Greet	SK 743 515			
5-94-610-74	106	Un-named	SK 696 543	12	1.5	2E
5-94-610-75	107	Thurgaton Beck	SK 696 491			
5-94-610-76	-	Un-named	SK 682 473	Problem alleviated		
5-94-610-77	108	Tributary of Crifton Dyke	SK 662 443	95	0.3	3D
5-94-610-78	110	Potwell Dyke	SK 711 541	37	1.2	2E
5-94-610-79	-	Halam Beck	SK 676 547	Problem alleviated		
5-94-610-80	111	Un-named	SK 652 597	9	1.3	2F
5-94-610-81	-	Halloughton Dumble	SK 723 526	Problem alleviated		
5-94-610-82	-	*River Trent	included with 5-94-610-32			
5-94-610-83	-	Oxton Dumble	SK 630 513	Problem alleviated		
5-94-610-85	112	*River Trent	SK 688 455			
5-94-610-86	113	Highway Drain	SK 632 518			
5-94-610-87	114	Highway Drain	SK 638 517			

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
5-94-610-88	-	None	SK 816 522	Problem alleviated		
5-94-610-89	115	None	SK 652 485	Highway problem		
5-94-610-90	116	Un-named dykes	SK 820 518			
5-94-610-91	117	None	SK 654 599			
5-94-610-92	118	Un-named dyke	SK 648 562	Highway problem		
NOTTINGHAM CITY COUNCIL						
5-94-710-1	-	Day Brook	included with 5-94-410-10			
5-94-710-2)	119	Surface Water Outfalls to	SK 567 368			
5-94-710-3)		River Trent				
5-94-710-4	-	*Nethergate Stream	SK 565 345	Problem alleviated		
5-94-710-5	-	Tottle Brook	SK 521 387	Problem alleviated		
5-94-710-6	-	Un-named	SK 526 402	Problem alleviated		
5-94-710-7	-	Un-named	SK 542 463	Problem alleviated		
RUSHCLIFFE BOROUGH COUNCIL						
4-94-810-1)						
4-94-810-2)	-	*River Soar	included with 4-93-310-5			
4-94-810-3)						
4-94-810-4	-	None	SK 558 269	Problem alleviated		
4-94-810-5)						
4-94-810-6)	-	*River Soar	included with 4-93-310-5			
4-94-810-7)						
4-94-810-8	120	Tributary of Kingston Brook	SK 575 264			
4-94-810-9)	-	*River Soar	included with 4-93-310-5			
4-94-810-10)						
4-94-810-11	121	Tributary of River Soar	SK 508 248			
4-94-810-12	-	*River Soar	included with 4-93-310-5			
4-94-810-13)	122	Kingston Brook	SK 505 276	340	1.6	2C
4-94-810-14)						
4-94-810-15	123	Sheepwash Brook	SK 552 262	13	0.4	3E
4-94-810-16	-	Kingston Brook	included with 4-94-810-13			
4-94-810-18	124	Kingston Brook	SK 602 269			
4-94-810-19	125	Kingston Brook	SK 606 266			
4-94-810-20	126	Tributary of Kingston Brook	SK 604 257			
4-94-810-21	-	*River Soar	included with 4-93-310-5			
4-94-810-22	-	Kingston Brook	included with 4-94-810-13			
4-94-810-23	127	Ratcliffe Brook	SK 497 286	95	2.7	1D
5-94-810-1	-	*River Trent	SK 655 425	Scheme completed		
5-94-810-2	-	*River Trent	SK 695 450	Problem alleviated		
5-94-810-3	128	*River Trent	SK 644 396			
5-94-810-4	129	*River Trent	SK 523 329			
5-94-810-5	130	*River Trent	SK 509 312	23	0.5	3E
5-94-810-6	-	River Smite	SK 785 440	Problem alleviated		

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
5-94-61· -7)						
5-94-810-8)						
5-94-810-9)						
5-94-810-10)	131	River Smite and Tributaries	SK 681 334			
5-94-810-11)						
5-94-810-12)						
5-94-810-13)						
5-94-810-14	–	Un-named	SK 659 299	Problem alleviated		
5-94-810-15	–	Tributary of River Devon	SK 754 435	Problem alleviated		
5-94-810-16	–	Back Drain	SK 762 418	Problem alleviated		
5-94-810-17)						
5-94-810-18)	–	Aslockton Drains	SK 743 404	Problem alleviated		
5-94-810-19)						
5-94-810-20)						
5-94-810-21	–	Un-named	SK 696 401	Problem alleviated		
5-94-810-22	–	Northing Drain	SK 768 420	Problem alleviated		
5-94-810-23)						
5-94-810-24)	–	Dalby Brook	included with 5-93-610-6			
5-94-810-25)						
5-94-810-26	132	River Whipling	SK 766 367	236	2.0	1C
5-94-810-27	–	Stroom Dyke	SK 718 341	Problem alleviated		
5-94-810-28	133	Rundle Beck	SK 755 345	43	1.8	2E
5-94-810-29	134	Shelford Drains	SK 671 432			
5-94-810-30	135	Un-named	SK 653 396			
5-94-810-31	–	Tributary of Spellow Farm Brook	SK 661 395	Problem alleviated		
5-94-810-32	–	Un-named	SK 638 388	Problem alleviated		
5-94-810-33	136	None	SK 638 394			
5-94-810-34)						
5-94-810-35)	137	Polser Brook	SK 621 334	735	1.1	2B
5-94-810-36)						
5-94-810-37)						
5-94-810-38)	139	Gamston & Adbolton Brooks	SK 600 343			
5-94-810-39)						
5-94-810-40	141	Bridgford Beck Tributary	SK 595 379			
5-94-810-41	–	Tributary of Greythorne Dyke	SK 576 374	Problem alleviated		
5-94-810-42	142	Packman Dyke	SK 563 340			
5-94-810-43	143	*Fairham Brook and Tributaries	SK 556 328			
5-94-810-44	144	None	SK 586 317	Highway problem		
5-94-810-45)	–	*Fairham Brook and	included with 5-94-810-43			
5-94-810-46)		Tributaries				
5-94-810-47	–	Un-named	SK 536 305	Problem alleviated		
5-94-810-48)	–	*Greythorne Dyke	SK 572 368	Problem alleviated		
5-94-810-49)						
5-94-810-50	–	Polser Brook	included with 5-94-810-34			
5-94-810-51	–	Tributary of Polser Brook	SK 639 381	Problem alleviated		
5-94-810-52	–	*River Trent	included with 5-94-410-2			
5-94-810-53	–	None	SK 614 379	Problem alleviated		

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
NORTH KESTEVEN DISTRICT COUNCIL						
5-95-110-1	-	None	SK 870 626	Problem alleviated		
5-95-110-2	145	Mill Dam Dyke and Besthorpe Moor Drain	SK 835 660	231	1.7	2C
WEST LINDSEY DISTRICT COUNCIL						
5-95-310-1	146	*River Trent	SK 814 887			
5-95-310-2	-	*River Trent	SK 823 875	Scheme completed		
5-95-310-3	148	*River Trent	SK 828 864	52		
5-95-310-4	149	*River Trent	SK 820 744			
5-95-310-5	-	Marton Drain	SK 834 815	Problem alleviated		
5-95-310-6	-	*River Trent	SK 823 780	Scheme completed		
5-95-310-8	150	*River Eau	SK 896 994			
5-95-310-9	151	Scotton Beck	SK 873 986	17	1.9	2E
5-95-310-10	152	Northorpe Beck	SK 877 972	25	2.5	1E
5-95-310-11	-	Watercourses in Gainsborough IDD	SK 850 980	Problem alleviated		
5-95-310-12	153	Hemswell Beck	SK 930 912			
5-95-310-13	-	None	SK 929 932	Problem alleviated		
5-95-310-14	-	Morton Warping Drain	SK 810 922	Problem alleviated		
5-95-310-15	154	Darnsyke	SK 860 764	107	1.3	2C
5-95-310-16	155	Laughton Highland Drain	SK 840 970	403	1.9	2C
5-95-310-17	-	Humble Carr Drain	SK 815 886	Problem alleviated		
BOOTHFERRY DISTRICT COUNCIL						
5-96-110-1	-	*River Trent	SE 820 010	Scheme completed		
5-96-110-2	-	*River Trent	SE 863 192	Scheme completed		
5-96-110-3	-	*River Trent	SE 843 132	Scheme completed		
5-96-110-4	-	*River Trent	SE 850 153	Scheme completed		
5-96-110-5	156	Trentside Drain	SE 859 140	10	0.2	3E
5-96-110-6	-	Un-named dyke	SE 832 110	Problem alleviated		
5-96-110-7	157	New Mere Drain	SE 836 175			
5-96-110-8	-	Moor Middle Drain	SE 760 140	Problem alleviated		
5-96-110-9	-	Folly Drain	SE 741 040	Problem alleviated		
5-96-110-10	158	Area to south of Wroot	SE 720 010	101	2.3	2C
5-96-110-11	-	Finningley & South Axholme IDB Drains	SK 730 970	Problem alleviated		
5-96-110-12	-	Keadby IDB	SE 833 113	Problem alleviated		
5-96-110-13	159	#Un-named	SK 749 996			
GLANFORD BOROUGH COUNCIL						
5-96-210-1	-	*River Trent	SE 859 145	Scheme completed		
5-96-210-2	-	*River Trent	SE 841 000	Scheme completed		
5-96-210-3	-	Un-named	SE 866 186	Problem alleviated		
5-96-210-4	-	Scunthorpe IDD	SE 850 120	Problem alleviated		
5-96-210-5	160	*Bottesford Beck	SE 838 061			
5-96-210-6	-	Emmanuel Beck	SE 926 072	Problem alleviated		

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
5-96-210-7	161	Un-named	SE 940 071	Highway problem		
5-96-210-8	-	Long Belt Drain	SE 918 030	Problem alleviated		
5-96-210-9	-	Messingham IDD Drains	SE 855 034	Problem alleviated		
5-96-210-10	-	*Bottesford Beck	included with 5-96-210-5			
5-96-210-11	162	#Un-named	SE 881 069			
DONCASTER METROPOLITAN BOROUGH COUNCIL						
5-97-110-1	-	Village & Whiphill Drains	SE 638 038	Problem alleviated		
5-97-110-2	163	*River Torne	SE 835 113			
5-97-110-3	164	St. Catherine's Well Stream	SK 585 982	231	1.4	2C
5-97-110-4	-	Mother Drain	SE 595 002	Problem alleviated		
5-97-110-5	166	Paper Mill Dyke	SK 590 929	17	0.3	3E
5-97-110-6	167	Ruddle Mill Dyke	SK 543 947	124	0.2	3C
5-97-110-7	-	Littleworth Lane Drain	SK 617 983	Problem alleviated		
5-97-110-8	168	Austerfield/Newington Road Drain	SK 663 939			
ROTHERHAM METROPOLITAN BOROUGH COUNCIL						
5-97-210-1) 5-97-210-2)	170	Anston Brook	SK 540 825	9	0	3F
5-97-210-3	-	None	SK 514 835	Problem alleviated		
5-97-210-4	-	Cramfit Brook	SK 522 861	Problem alleviated		
5-97-210-5	172	Eel Mires Dyke	SK 508 870	231	1.6	2C
5-97-210-6) 5-97-210-7) 5-97-210-8)	174	Bramley Brook	SK 488 927			
BOLSOVER DISTRICT COUNCIL						
5-98-110-1	175	None	SK 502 735	Highway problem		
5-98-110-2	176	Millwood Brook	SK 526 745			
5-98-110-3	-	River Poulter	included with 5-94-210-44			
5-98-110-4	178	Sookholme Brook	SK 533 675			
5-98-110-5	-	Sookholme Brook	SK 520 675	Problem alleviated		
5-98-110-6	-	*River Erewash	included with 5-94-110-1			
5-98-110-7	-	Common Brook	SK 445 549	Problem alleviated		
5-98-110-8	179	Suff Brook	SK 451 553	375	0.9	3C
5-98-110-9	-	*River Meden	included with 5-94-210-52			
5-98-110-10	181	Millwood Brook	SK 495 762			
EREWASH BOROUGH COUNCIL						
5-98-210-1	182	*River Trent	SK 470 308			
5-98-210-2	183	*River Trent	SK 490 312			
5-98-210-4	-	Cramfit Brook	SK 522 861	Problem alleviated		
5-98-210-6	184	Erewash Canal and Feeder Drain	SK 482 378			

Code Number	Appendix A1 Page No.	Watercourse	Location	Arterial Cost (£'000)	Benefit/ Cost	Priority Category
5-98-210-7)						
5-98-210-8)	-	*River Erewash	included with 5-94-110-1			
5-98-210-9)						
5-98-210-10	-	Un-named	SK 476 354	Problem alleviated		
5-98-210-11)	185	Golden Brook	SK 508 335			
5-98-210-12)						
5-98-210-13	186	Golden Brook and Golden Stream	SK 453 346			
5-98-210-14	188	None	SK 452 333			
5-98-210-15	-	Old Derby Canal	SK 470 344	Problem alleviated		
5-98-210-16	-	Golden Brook Tributary	SK 461 357	Problem alleviated		
5-98-210-17)						
5-98-210-18)	189	Nut Brook	SK 482 390			
5-98-210-19)						
5-98-210-20)	190	Sow Brook	SK 464 398	118	0.8	3C
5-98-210-21)						
5-98-210-22)	191	Stanley Brook	SK 452 411			
5-98-210-23)						
5-98-210-24	192	New Sawley Brook	SK 491 322			
AMBER VALLEY DISTRICT COUNCIL						
5-98-310-1	-	*River Erewash	included with 5-94-110-1			
5-98-310-2	-	*River Trent	included with 5-98-210-2			
5-98-310-3)						
5-98-310-4)	-	*River Erewash	included with 5-94-110-1			
5-98-310-5)						
5-98-310-6)	193	Bailey Brook	SK 425 478	447	2.2	1C
5-98-310-7)						
5-98-310-9	195	Birchwood Brook	SK 438 541			

TABLE 2

SUMMARY BY PRIORITY CATEGORY - LOWER TRENT CATCHMENT
NON-MAIN RIVER

	A		B		C		D		E		F	
	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEME	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)
1	-	-	1	519	3	798	-	-	3	83	1	1
2	-	-	2	1,519	13	3,465	-	-	4	109	1	9
3	-	-	1	686	10	2,283	3	208	6	168	2	15
TOTAL	-	-	4	2,724	26	6,546	3	208	13	360	4	25
										TOTAL	50	9,863

TABLE 3

SUMMARY BY PRIORITY CATEGORY - LOWER TRENT CATCHMENT
MAIN RIVER

	A		B		C		D		E		F	
	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)	NUMBER OF SCHEME	TOTAL COST (£000s)	NUMBER OF SCHEMES	TOTAL COST (£000s)
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	1	1,011	-	-	4	664	-	-	4	116	-	-
TOTAL	1	1,011	-	-	4	664	-	-	4	116	-	-
										TOTAL	9	1,791

CHAPTER 2

THE SURVEY

2.0 THE SURVEY

2.1 Introduction

2.1.1 The requirement for a Survey results from the Water Act 1989, which also created the National Rivers Authority. Under Section 136(1) of the above Act the National Rivers Authority has a duty to carry out from time to time, a survey of its area in relation to flood defence functions.

2.1.2 The Ministry of Agriculture, Fisheries and Food issued Guidance Notes for Water Authorities in carrying out the original Survey and, wherever possible, suggested procedures were adopted and information incorporated within the reports.

2.1.3 In carrying out the Survey the Authority was required to:

1 Consult every local authority whose area is wholly or partially included in the area of the Water Authority.

2 Have regard to structure plans and local plans under the Town and Country Planning Act 1971.

2.2 Purposes of the Survey

2.2.1 The primary purpose of the Survey is to identify and evaluate flooding problems, both for existing problems and for potential problems which may occur as a result of increased run-off from development. Information is provided which summarises the principal solutions, costs, benefits and priorities.

2.2.2 The Surveys are required by the Ministry of Agriculture, Fisheries and Food to provide a comprehensive and logical basis for long-term planning of drainage improvements and flood alleviation.

2.2.3 The Survey will be used by this Authority to ensure rational phasing of improvements on main river, and will provide a firm basis for the supervisory role exercised by the Authority over all matters relating to its flood defence functions on all watercourses throughout the region.

2.2.4 The Survey provides comprehensive information on both main river and non-main river and can, therefore, be used by all drainage authorities and drainage bodies (local authorities) for determining capital works programmes of watercourse improvements in conjunction with the Authority's own programme of works.

2.2.5 The Authority will make use of the survey in considering any changes to the main river network.

2.3 Extent of the Survey

2.3.1 The Authority exercises a general supervisory role over all matters relating to land drainage. The Survey, therefore, identifies and examines not only problems on main river but also on other watercourses having existing or potential land drainage and flood alleviation problems.

2.3.2 No limit has been fixed by the Ministry of Agriculture, Fisheries and Food for a lower order of problems which should be considered by the Survey, but it has been indicated that a "broad brush" approach is preferable to detailed investigations of a minority of large problems. This accords with the Authority's view of its own requirements and thus the lower limit has been fixed as flooding affecting a single property or inadequate arterial conditions affecting twenty hectares of agricultural land. However, where specific requests have been made to investigate problems of lesser order these have been included wherever possible.

2.3.3 The Survey has investigated those watercourses which are currently in a satisfactory condition but where future development could necessitate improvements. This has been limited to those developments which have planning permission or have been identified in Structure and Local Plans and are likely to proceed in the near future.

2.3.4 The Survey covers only those drainage inadequacies which occur on arterial watercourses. Where drainage inadequacies on agricultural land can be resolved by underdrainage alone, these have not been included within the Survey.

2.4 Procedure

2.4.1 Of the information on drainage deficiencies required for this Survey, a considerable proportion was available within this Authority. This is particularly so of the problems on main river but also applies to major problems on non-main river. There are, however, many kilometres of non-main river on which this Authority had no information and which have, in many cases, had little or no maintenance work carried out on them. In order to ensure comprehensive coverage on such watercourses, in addition to main river, all bodies having land drainage interests were asked to provide information on drainage deficiencies. These include:

1 Ministry of Agriculture, Fisheries and Food.

2 Internal Drainage Boards.

3 County Councils.

4 District Councils.

5 Parish Councils.

6 British Waterways Board.

7 National Farmers' Union.

8 Country Landowners Association.

9 British Coal.

2.4.2 In July 1978, an 'Interim Report' was circulated to local authorities and many other organisations and bodies as part of the Authority's statutory duty under Section 24 of the Water Act 1973. This Report identified all drainage deficiencies which had been notified to the Authority and provided brief details of location and type of problem.

2.4.3 The primary purpose of the Interim Report was to seek views and comments on the identified problems so that these could be taken into account in determining solutions. Provision was also made to incorporate additional problem areas in subsequent Reports to ensure their comprehensiveness. All relevant comments have, therefore, been incorporated in the problem evaluations in Appendix A1 including those of the Nature Conservancy Council, County Conservation Trusts, Countryside Commission and fisheries, navigation and many other interests, in addition to those scheduled in Section 2.4.1. Wherever possible, the costs identified for the improvement works have included the cost of making provision for all interests which have been notified.

2.4.4 Every problem identified in the Interim Report and those notified since its publication have been investigated by visiting the site and carrying out land surveys as necessary. The extent of the investigation has largely been determined by the extent of the problems and the benefits which will result. Many minor problems have, therefore, not been examined in detail because of the high cost of providing the necessary improvement works. There are also many cases where flooding cannot be attributed to inadequacies in the arterial watercourse drainage system. In these situations, the solutions to the problems are outside the scope of this Survey and have not been determined. However, an indication is given, in each case, of the cause of the problem and these have been brought to the attention of the appropriate authority (eg. Highway Authority, British Coal, etc).

2.5 Hydrological Criteria

2.5.1 The mean annual flow for all sites of major importance, for which flow records are available, have been calculated using the appropriate method formulated in the "Flood Studies Report"[2].

2.5.2 For sites of minor importance and sites having no available flow records, the mean annual flood has been calculated from catchment characteristics using the "Flood Studies Report" six parameter equation.

2.5.3 In all cases, the relationship between Q(T) (the flood of return period T) and $\bar{Q}$ (the mean annual flood) has been derived from the "Flood Studies Report" regional growth curves.

2.6 Hydraulic Criteria

2.6.1 Urban flood alleviation schemes have been designed, wherever possible, to contain the 1 in 100 years flood. It is recognised that, in the final analysis, the design frequency chosen will be that which maximises the excess of benefit over cost but, within the scope of this Survey, this has not been possible other than in schemes of the very highest priority.

2.6.2 Culverts have generally been designed for the following flood return frequencies. (These standards have varied dependent upon economic or physical constraints):

1 Flooding of property and urban areas in general - 1 in 100 years.

2 All areas of high agricultural value including horticultural areas - 1 in 100 years.

3 Other agricultural areas - 1 in 25 years.

4 A combination of flooding transport systems and agricultural areas may justify a standard of up to 1 in 50 years.

2.6.3 For the Survey purposes the following criteria have been adopted:

1 In agricultural areas the pipe outfalls for field drainage systems are designed to be 150mm above normal water level. Where there is no field drainage system an average freeboard of 1,500mm between normal water level and ground level has been used. The freeboard requirements for under-drainage purposes may result in larger channel capacities than those required purely for flood alleviation purposes.

2 For the construction of floodbanks freeboard is dependent on the confidence limits of data used for design purposes, and for major floodbanks is normally 500mm. Small freeboards have been considered in appropriate cases. In all other cases, channel capacity is the design flood discharge with no additional freeboard.

2.7 Land Potential Category

2.7.1 The successful growth of crops depends on a suitable soil environment for germination, root anchorage and plant growth. Cropping systems are dependent on soil potential and similarly drainage standards can be linked to soil profile characteristics such as structure, texture, depth, stoniness and wetness. The Ministry of Agriculture, Fisheries and Food has assessed standards for field drainage and flood protection based upon the relationship between cropping and soil or land potential as indicated in Table 4. In providing these individual assessments the Ministry has pointed out that they are subjective and will need to be verified by detailed in-field investigations before any scheme can be agreed for grant aid purposes.

Table 4 Land Potential Categories

a	Land potential low (Normally pasture land)	1 in 2 years
a5	Land potential low/medium (Normally low grade arable land)	1 in 5 years
b	Land potential medium/high (Normally high grade arable land)	1 in 5/10 years
c	Land potential very high (Very high grade arable and horticultural land)	1 in 25/100 years

2.8 Improvement Costs

2.8.1 Costs of improvement schemes have been estimated on a standard unit cost basis wherever possible and appropriate in order to ensure uniformity and comparability of all schemes. The unit cost approach has been adopted for excavation of new channels, construction of floodbanks, bridges, pumping stations, culverts, revetment work, etc. It has not been possible to use unit costing for regrading and remodelling of existing channels or for channel clearance of undergrowth and trees as these are items which vary from watercourse to watercourse.

2.8.2 All costs include for design and supervision which on average is approximately 10% of the cost of the improvement works.

2.8.3 All costs are at a price base of December 1989.

2.8.4 The cost of field drainage for existing problems has been assessed by the Ministry of Agriculture, Fisheries and Food and has been included within the total cost of the improvement works. Field drainage costs for new problems have been assessed using a nomograph produced by Silsoe College for the Authority in 1984. Ditching costs have not been included unless this constitutes a significant proportion of the overall cost.

2.8.5 Wherever possible, the total cost of the improvement works includes the cost of making provision for navigation, fisheries, conservation and other interests of which the Authority has been notified.

2.9 Benefit Assessment

2.9.1 Benefit areas for urban problems have been determined largely from local knowledge of the extent and depth of past floods. These have been extrapolated where necessary to estimate the extent of floods with return periods in excess of recorded events. The stage/damage estimates and subsequent evaluation of annual average benefits have been derived from methods formulated in the manual entitled "The Benefits of Flood Alleviation: A Manual of Assessment Techniques"[3].

2.9.2 The areas which are likely to benefit in both agricultural and urban areas are shown on the overlays to the maps in the 1980 album. The locations of small areas of urban flooding and miscellaneous minor flooding problems are shown with a dot enclosed in a circle and identified with the appropriate code number. In the case of large urban flooding problems and agricultural drainage problems, the areas shown on the overlays and identified by code numbers are the areas which will benefit from drainage improvements.

2.9.3 Areas of inland agricultural land which will derive benefit from drainage operations have been defined, for the purpose of this Survey, as follows:

i) Land within an area bounded by a line 2.4m above the highest recorded flood level as defined in the "Medway Letter"[4].

ii) Where no flooding has occurred but normal water levels restrict outfall conditions for field drains, the benefit area is the area bounded by a line 2.4m above bank top level.

2.9.4 Annual average benefits for agricultural areas have been assessed by the Ministry of Agriculture, Fisheries and Food from the land potential (see Table 4) and from the potential change in gross margin which will result from improved drainage. These assessments will require verification by detailed studies if schemes are incorporated in capital programmes.

2.9.5 The maximum benefits from most agricultural improvement schemes can be achieved only if the individual farmers carry out ditching and install field drainage following the improvement to the receiving watercourses. In practise the benefits will, therefore, be phased in as field drainage is installed and due account will be taken of this phasing when individual detailed schemes are prepared.

2.9.6 If the improvement of a watercourse is an essential pre-requisite of planning permission for any housing or industrial development, such that without the improvement planning permission would not be approved, then the benefits attributable to future development by the off-site improvement of watercourse have been assessed as a proportion of the increase in the value of the land after planning permission is granted.

2.9.7 The benefits have been assessed, for both urban and agricultural problems, using a base date of December 1989. It should be appreciated that benefits, particularly in agricultural schemes, may not follow normal inflationary trends.

2.10 Test Discount Rate

2.10.1 The test discount rate which has been used for the assessment of the net present value of future costs and benefits is the Government's recommended current rate for public investment of 6%. The life of improvement schemes, other than those involving pumping stations, has been assumed as 50 years for the purpose of the net present value analysis.

2.10.2 Maintenance costs after improvements have been carried out are assumed, on average, to be of a similar order to those before. In some cases, maintenance costs will be lower whereas in others, particularly where maintenance has been neglected in the past, costs will be higher.

2.11 Benefit/Cost Ratios

2.11.1 The comparison of benefit with cost enables an assessment to be made of the worthwhileness of any proposed improvement. For the purpose of this Survey a scheme is considered as being possibly viable if the benefit to cost ratio is greater than unity. However, if an improvement scheme progresses to a capital programme it may be necessary to compare it with benefit/cost ratios for other competing schemes to enable a choice to be made.

2.11.2 The greater the excess of benefit over cost the higher the return for capital employed and, therefore, in purely economic terms, a scheme having a high benefit/cost ratio would have a higher priority than a scheme having a lower value. However, due weight must also be given to other factors such as risk to human life, amenity and environmental considerations. These factors are intangible and require a subjective assessment, in conjunction with economic factors, to determine the overall priorities of schemes.

2.12 Priority Category

2.12.1 The Survey has made no attempt to determine priorities which take into account intangible benefits; schemes have been categorised solely on the basis of tangible benefits which can be assessed in purely economic terms. It will be the responsibility of the promoting authority to determine the weight to be given to intangible benefits and, therefore, the overall priorities to be attached to schemes in its area.

2.13 Inflation Factors

2.13.1 Costs and Benefits for problems contained in the 1986 revision have been updated to a December 1989 price base as follows:

Arterial Costs - Baxter (Regional) Index

Underdrainage Costs - Retail Price Index

Agricultural Benefit - Using information supplied by Silsoe College based on changes in weighted gross margins

Urban and Road Benefits - Retail Price Index.

CHAPTER 3

GENERAL DESCRIPTION

3.0 GENERAL DESCRIPTION

3.1 Description of the Region

3.1.1 The boundary of the Severn-Trent Region of the National Rivers Authority is formed by the watersheds of the River Trent and the River Severn. The area of 21,600 sq. km extends from the Humber estuary in the north to the Severn estuary in the south, and is bounded by the Anglian, Yorkshire, North West, Welsh, Wessex and Thames Regions of the NRA. The Severn-Trent Region is divided into eight catchments the boundaries of which are the watersheds of the major sub-catchments of the River Severn and the River Trent. These catchments and the location of the region is shown in Fig.1.

3.1.2 The Severn-Trent Region of the National Rivers Authority is responsible for the two major tidal estuaries of the River Severn and the River Trent but other than these areas it has no coast line. The River Trent is tidal as far as Cromwell Lock, about eight kilometres downstream of Newark, and the River Severn is tidal as far as Gloucester.

3.1.3 The highest part of the Trent region is the Pennines in the north west where the River Derwent rises at an altitude of 630 metres. Altitude decreases across the Trent basin to the River Trent itself and then rises in the east to a height of between 60 metres and 120 metres. In the central region the catchments of the Rivers Severn and Trent are separated at the headwaters of the River Tame and the River Stour by a ridge of between 200 metres and 270 metres high.

3.1.4 The topography of the Severn basin is dominated by the Welsh Hills in the west at a maximum elevation of 830 metres and the Cotswold Hills in the south-east at an elevation of 330 metres. A prominent feature in the south-west is the Malvern Hills which rise to a height of 430 metres.

3.1.5 The average annual rainfall over the whole of the region is 775mm and this ranges from a maximum of over 2,000mm in the Welsh Hills to approximately 600mm in the Trent Valley in the rain shadow of the Pennines. The variation is largely associated with altitude. The lowlands generally have little seasonal variation but upland areas are wetter in winter than in summer. Similarly, in the upland areas, snowfall is a significant form of precipitation.

3.1.6 The geology of the region varies from the resistant Pre-Cambrian and Palaeozoic rocks in west Shropshire to the softer clays, shales and limestone bands of the Lower Lias in east Leicestershire and Warwickshire. The Pre-Cambrian and Palaeozoic rocks are characterised by the rugged landscape of Wales, the Border Counties and the carboniferous limestone formations in Derbyshire, while the more recent formations in the east have weathered to form the rolling scarps and vales typical of Leicestershire.

3.1.7 The total population of the Region is 8.3 million people with some 2.5 million in the Severn catchment and 5.8 millions in the Trent. Approximately 2.6 million people live in the West Midlands conurbation which straddles both catchments. The other major centres of population are Nottingham (280,000), Leicester (282,000), Stoke-on-Trent (250,000) and Derby (215,000). Many of these conurbations, and particularly that of the Black Country area, are situated in the vicinity of the headwaters of major rivers and have a significant effect on the river flows throughout their lengths.

3.1.8 The National Rivers Authority assumes a direct responsibility for 3,573 km of main river on which capital improvements and maintenance are carried out as necessary. Areas which have been protected from flooding, to various standards, on this length of main river total over 1,000 sq. km. Much of this area is protected by floodbanks of which the total length is 820 km, all of which is maintained on a regular basis by the Authority.

3.2 Description of the Lower Trent Basin

3.2.1 The Lower Trent Basin comprises the catchment area of the River Trent below the Derwent confluence with the exclusion of the River Soar catchment and drains an area of approximately 3,450 sq.km. The main tributaries are the River Devon, Erewash, Leen, Idle and Torne.

3.2.2 Most of the Trent Valley is composed of Keuper Marl through which the river has cut a channel and created a series of gravel terraces along the valley flanks. The River falls over 30 metres between the Derwent confluence and the Humber. The relief of the area rises to the west to a maximum of about 200m AOD and the strata becomes predominantly Bunter Sandstone. There are also outcrops of coal measures in the west, in the Nottingham and Doncaster areas, and the mining of these results in widespread subsidence and drainage difficulties.

3.2.3 The basin is situated in the rainshadow of the Pennines and receives relatively low average annual rainfall. Further, the run-off from the other rivers in the basin tends to be small in comparison with the flow in the Trent itself which emanates from rainfall in the upstream basins and is sustained in dry weather by effluents.

3.2.4 In the upper part of the basin, flooding is caused by fluvial conditions but, from Cromwell Lock to the estuary, maximum water levels are caused by a combination of fluvial floods and high tides. The frequent inundation of the low riverside land from fluvial and/or tidal flood waters has been reduced progressively over the years by extensive drainage and flood defence works. The lower tidal Trent and some of its tributaries now flow in embanked channels and large areas of land depend on pumped drainage.

3.2.5 Agricultural land accounts for about three-quarters of the basin area and much of this is above average quality with a result that arable farming predominates. The tidal reach flood protection scheme on the Trent, which is now complete, has provided protection to 1 in 3 years standard to washlands in the upper reaches and enabled these areas to change gradually from grazing to arable farming.

3.2.6 Over 26km on the lower reach of the River Idle between West Stockwith and Mattersey the river has a very flat gradient and 9,900 hectares of high value agricultural land are at risk from flooding, when the Idle cannot discharge to the Trent because of high water levels in the Trent. Comprehensive improvements include the construction of a 35 cumecs pumping station at West Stockwith and river improvements to Retford which are now complete. Improvements through Retford are due for completion in 1992.

3.2.7 Approximately 30% of the Trent basin is drained by rivers, watercourses and drains which, where they are not designated as 'main river', are the responsibility of 24 Internal Drainage Boards. The Boards generally administer the areas which, historically have been low-lying and prone to widespread flooding and, as such, have required extensive works to reduce the incidence of flooding. Large parts of these areas rely on pumped drainage and the Internal Drainage Boards operate over 40 pumping stations.

3.2.8 The extent of areas likely to be affected by mining subsidence have been shown on the maps. These areas are estimated and the effects and amounts of subsidence will vary across the areas delineated.

3.2.9 In 1983 the Authority completed a feasibility study on improvements to 22 km of the River Torne between Pilfrey Bridge and Auckley Bridge. This reach of river is a highland carrier which flows through an extremely flat, high grade agricultural lowland area. An improvement scheme comprising regrading of the river and associated flood defences commenced in 1984 and is due for completion in 1990/91.

CHAPTER 4

THE NATIONAL RIVERS AUTHORITY'S SUPERVISORY ROLE

4.0 THE NATIONAL RIVERS AUTHORITY'S SUPERVISORY ROLE

4.1 Introduction

4.1.1 Section 136(1) of the Water Act 1989 states that the National Rivers Authority shall exercise a general supervision over all matters relating to flood defence. This general supervision includes all watercourses, both main and non-main, and is exercised in part by consenting to works on or in watercourses, by the enforcement of bye-laws and by liaison with Planning Authorities responsible for development control.

4.2 Land Drainage Bye-laws

4.2.1 Section 34 of the Land Drainage Act 1976 (as amended by the Water Act 1989) allows Drainage Authorities to "make such bye-laws as they consider necessary for securing the efficient working of the drainage system in their area". Consent is required in compliance with particular bye-laws covering control of certain operations in or adjacent to rivers or the floodplain of rivers (generally confined to main rivers). Such operations include erection of fences, tree planting, disposal of rubbish, excavation affecting the bed and banks of rivers, erection of jetties or walls, etc.

4.2.2 In order to eliminate minor inconsistencies in the bye-laws inherited from the Severn and Trent River Authorities, the Severn Trent Water Authority made new bye-laws which were confirmed by the Ministry of Agriculture, Fisheries and Food on the 26 April 1979. By the provisions of the Water Act 1989 these Byelaws are now enforced by the National Rivers Authority, Severn-Trent Region. All references to Severn Trent Water Authority, STWA or Water Authority should now read National Rivers Authority.

4.3 Statutory Consents

4.3.1 It is essential that a rational and consistent approach is adopted for standards not only on main rivers but also on non-main rivers, where alterations to existing conditions can seriously affect the main river system downstream. The maximum benefits can be achieved only if all works which require consent are identified, so that a consistent standard can be attained throughout the region.

4.3.2 The issue of a Land Drainage Consent implies that, if the work is carried out in accordance with the drawings and documents submitted, there will be no detriment to land drainage operations or consequential flooding. Prior to issue of a consent Local Authorities, Internal Drainage Boards, Navigation Authorities and others are consulted as necessary.

4.3.3 A Consenting Manual has been produced for the Authority's internal use which details principles to be adopted and formalises the Authority's policy on various types of development so that consistent advice can be given to planners.

4.4 Planning Liaison and Development Control

4.4.1 In addition to exercising control over drainage works by consenting procedures, the Authority also seeks to control operations likely to adversely affect drainage interests through its planning consultation with Local Authorities. The Town & Country Planning General Development Order 1988 obliges local planning authorities to consult the NRA before determining planning applications. The majority of new developments which require land drainage improvements are identified in this way and advice is given to the planners about the effects of the proposals in relation to flooding and land drainage.

4.4.2 The Department of the Environment Circular 17/82[5] issued in 1982 emphasised the need for Planning Authorities to consult the Water Authorities in respect of development and caravan and camping sites in flood risk areas, and the effects of run-off from new developments. The National Rivers Authority must now be consulted on such matters.

4.4.3 The major floodplain areas are identified on the maps which accompanied the 1980 report. In general, the areas shown envelop those areas which have been flooded by past recorded events. They do not, therefore, relate to a particular frequency flood event.

4.4.4 Many areas within floodplains have been protected by improvement schemes which will, in general terms, consist of either channel improvements or flood embankments. These areas are also identified on the maps and the level of protection is indicated.

4.4.5 In particular, Local Authorities are advised that, for developments which are likely to increase the risk of flooding, the developer should be informed that works will be required to watercourses to remedy the situation. If these works are outside the area of the application, the developer is required to show that provision has been made to carry out the works, as conditions applicable to such works cannot be applied to planning permissions. If the developer does not make arrangements for the watercourse improvement the Planning Authority can refuse the application.

4.4.6 Where works are required to a non-main watercourse to accommodate the additional run-off from developments, the developer may carry out the work, by agreement with the riparian owners, at his own expense. If agreement is not possible he may request the Local Authority to carry out the works and reimburse the authority accordingly. In the case of main river, works will normally be carried out by the National Rivers Authority with an appropriate contribution from the developer.

4.4.7 At the present time, negotiations take place between the developer(s) and the National Rivers Authority or Local Authority into the proportion of the improvement cost of the off-site watercourse which is to be met by the developer(s).

CHAPTER 5

MAIN RIVER SYSTEM

5.0 MAIN RIVER SYSTEM

5.1 Statutory Provisions

5.1.1 The main river system is the system of watercourses identified on the statutory set of main river maps held by the National Rivers Authority and the Ministry of Agriculture, Fisheries and Food (MAFF). Main river powers extend to any structure in the bed or bank of the watercourse which controls the flow of water into or out of the watercourse. Powers for carrying out work on main river are exercisable by the National Rivers Authority and by others with the Authority's consent.

5.1.2 The main river map may be altered by the Ministry of Agriculture, Fisheries and Food at the request of the National Rivers Authority. Before doing so, the Minister must give notice of his intention and this is usually carried out by advertising in local newspapers. All objections to the proposals will be considered by the Minister.

5.1.3 In relation to watercourses which are not designated as main river the Authority has certain regulatory powers but has no powers to carry out work using Flood Defence finance.

5.1.4 A 1:250,000 scale map showing the main river system within the Severn-Trent Region as at January 1990 is available.

5.2 Principles for Main River Extension

5.2.1 The following criteria are used by the National Rivers Authority, Severn-Trent Region in deciding whether to make an application to MAFF for changing the status of a watercourse from non-main to main river.

1 Main River shall be continuous from the estuary to a suitable point (eg a bridge or other structure) where:-

(a) the population in the remainder of the upstream catchment is less than 10,000

or

(b) the average width of flood plain in the remainder of the upstream catchment is less than 300 metres per kilometre of watercourse

or

(c) there is no single community greater than 3,000 persons further upstream.

Whichever is the furthest point upstream.

2 Main river shall also extend upstream to the point of discharge of:-

(a) outfalls from sewage works with an average daily flow greater than 5 megalitres

(b) untreated water reservoirs that impound more than 1,000 megalitres

(c) the downstream outfall of an internal drainage board.

3 Where balancing storage is provided as an essential part of the system of surface water drainage, consideration should be given to extending main river up to the point of intake of such balancing storage.

4 However, a flexible approach will be adopted and consideration may also be given to extension of main river in particular circumstances (eg to receive the surface water drainage from a motorway, an embanked watercourse or to be the upstream boundary of urban areas for development control and byelaw purposes).

5.3 Local Authority Improvements

5.3.1 Where non-main watercourses accord with the above policy, and improvements are carried out by Local Authorities to standards approved by this Authority, the Authority may recommend to the Ministry of Agriculture, Fisheries and Food that the watercourses should be included as part of the main river system.

CHAPTER 6

THE LAND DRAINAGE ROLE OF LOCAL AUTHORITIES

6.0 THE LAND DRAINAGE ROLE OF LOCAL AUTHORITIES

6.1 Interaction with the National Rivers Authority's role

6.1.1 The powers available to Local Authorities (both District and County Councils) under the Land Drainage Act 1976 (as amended by the Water Act 1989) for carrying out works of maintenance and improvement on non-main rivers are complementary to those of the National Rivers Authority on main river. In almost all cases the powers are permissive, but most Councils now accept the responsibility that this implies and are prepared to carry out improvement schemes in conjunction with those of the National Rivers Authority on main river. In this way, many serious impediments to the overall drainage system are gradually being eliminated.

6.2 Powers of District Councils

6.2.1 District and Metropolitan District Councils have powers under Section 98 of the Land Drainage Act 1976 (as amended by the Water Act 1989) to carry out works on non-main river for the purpose of preventing flooding or remedying or mitigating any damage caused by flooding.

6.3 Powers of County Councils

6.3.1 County Councils have powers under Section 99 of the Land Drainage Act 1976 (as amended by the Water Act 1989) to execute land drainage schemes, at the request of owners and occupiers who will benefit from the schemes.

6.3.2 Section 100 of the Land Drainage Act 1976 (as amended by the Water Act 1989) enables County Councils to execute land drainage works compulsorily for the improvement of agricultural land, and apportion any expenses among the beneficiaries.

6.3.3 County Councils may exercise Section 98 powers by agreement with, or by default of, a District Council.

6.4 Maintenance of the Flow of Watercourses

6.4.1 Where the proper flow of water in a non-main river is impeded, both District and County Councils may, under Section 18, of the Land Drainage Act 1976 (as amended by the Water Act 1989), serve notice on the person concerned to remedy the situation.

CHAPTER 7

INTERNAL DRAINAGE BOARDS

7.0 INTERNAL DRAINAGE BOARDS

7.1 Constitution

7.1.1 Many Internal Drainage Boards were first constituted in the nineteenth century by individual Acts of Parliament. However, all Internal Drainage Boards are today constituted, or continued in being, in accordance with the provisions of the Land Drainage Act 1976 (as amended by the Water Act 1989) which defines Internal Drainage Districts as such areas as will derive benefit or avoid danger as a result of drainage operations. These areas are generally located in lowland regions where special drainage problems exist and where collective benefit will be derived from drainage operations.

7.1.2 Within the Region there are 32 Internal Districts of which 24 are in the Trent catchment and eight are in the Severn catchment. In most cases a District is administered by a Board consisting of elected members but the Sow and Penk District is administered directly by this Authority.

7.1.3 The basis for the determination of Internal Drainage District boundaries was laid down by the Minister of Agriculture and Fisheries in 1933 in a decision letter known as the "Medway Letter" [4]. This letter, which is now regarded as the authoritative pronouncement for all cases which have arisen since then, identified the area of benefit or avoidance of danger by reason of drainage operations by reference to flood contours (in relation to freshwater drainage) or tide levels (in relation to sea defence and salt water inundations).

7.2 Income

7.2.1 The income of Internal Drainage Boards is derived in the main from:

i) Drainage rates levied on land and buildings within the Drainage District.
ii) Ministry of Agriculture, Fisheries and Food grant aid for capital schemes undertaken by the Boards.
iii) Contributions, in appropriate cases, from the National Rivers Authority towards the cost incurred by the Boards in handling water flowing through the District from upland areas.

7.3 Designated Watercourses

7.3.1 The Boards are empowered under Section 6 of the Land Drainage Act 1976 (as amended by the Water Act 1989) to exercise a general supervision over all matters relating to the drainage of land within their Districts, and are empowered by Section 17 of that Act to carry out work on all non-main river watercourses within their area. In practice, most Boards designate certain watercourses in their area on which they carry out regular maintenance and other minor watercourses are left to riparian owners to maintain or improve.

7.4 Maintenance of the Flow of Watercourses

7.4.1 Where the proper flow of water is impeded, an Internal Drainage Board may serve notice under Section 18, Land Drainage Act 1976 (as amended by the Water Act 1989), on the person concerned to remedy the situation. This applies to all watercourses in the Drainage District other than main river on which notice would normally be served by the National Rivers Authority.

CHAPTER 8

FLOOD DEFENCE MAINTENANCE

8.0 FLOOD DEFENCE MAINTENANCE

8.1 Objectives

The main objectives for flood defence maintenance can be summarised as follows:

- to preserve the stability, continuity and integrity of flood defences

- to ensure the satisfactory operation of pumping stations, outfalls, sluices and other flood defence structures.

- to ensure that the river systems (channels, floodplain and washland) are capable of containing and transmitting flood waters and tidal surges up to the appropriate target return period.

- in carrying out its operations to preserve and 'further' the river environment.

8.2 Responsibility for Maintenance

The Authority is given powers under Section 17, Land Drainage Act 1976 (as amended by the Water Act 1989) to maintain watercourses designated as main river. It does not have similar powers for the maintenance of non-main rivers which are normally considered the responsibility of the riparian owners although Internal Drainage Boards, District Councils and, in certain cases County Councils have permissive powers on these watercourses.

8.3 Maintenance Programmes

An Asset Management Plan is being developed which will identify maintenance expenditure profiles which will ensure an appropriate Level of Service (LOS) for Flood Defence.

This Level of Service is expressed in terms of a target flood capacity which is calculated from an analysis of the land use benefiting from flood protection.

A major survey of Flood Defence Assets will be carried-out as part of this Asset Management Plan. Many of these assets are approaching the end of their original design life, therefore, this survey will confirm whether the current maintenance practices are adequate or not.

The Asset Management Plan will determine:-

- the target Level of Service

- the existing Level of Service

- the gap or shortfall between the target and existing Level of Service

- objective maintenance programmes appraised by cost benefit techniques. These will be further refined, following full consultation, to ensure that balanced programmes are produced which accommodate environmental interests.

The Region has recently commissioned a new Rivers Information and Maintenance System (RIMS) which assists this development of objective maintenance programmes.

In addition the Region carries out Best Operational Practice Reviews to ensure that full benefit is taken of any new developments in the industry; the resultant cost savings enable our operations to extend over more of the main river network.

Furthermore, post project appraisals are carried-out to ensure that the various models and techniques which have been developed and used are valid.

The Region also funds an annual environmental enhancement programme.

CHAPTER 9

FLOOD DEFENCE AND CONSERVATION

9.0 FLOOD DEFENCE AND CONSERVATION

9.1 Introduction

9.1.1 When carrying out improvements to watercourses due regard is taken of other interests which may be affected by such improvements. Other functions of the NRA are consulted during the detailed design phase of schemes. However, in the past, conservation interests relating to watercourses have not always received their due regard and for this reason particular emphasis has been given in this Survey to these aspects. Therefore, the problem evaluations in Appendix A1 give specific information on conservation and environmental interests where these may be affected by the suggested improvements. In addition, statutory conservation sites and County Trust Reserves are delineated on the maps which accompanied the 1980 report and scheduled in Appendix A3.

9.2 Statutory Provisions for Nature Conservation

9.2.1 Section 8(1) of the Water Act 1989 states that the National Rivers Authority has a duty to "further the conservation and enhancement of natural beauty and the conservation of flora, fauna and geological and physiographical features of special interest".

9.2.2 Guidance notes on land drainage and conservation have been circulated jointly by the Department of the Environment, MAFF and the Welsh Offices to all Water Authorities and Internal Drainage Boards in relation to duties under previous legislation. These guidelines are currently being updated to take into account the Water Act 1989.

9.2.3 The relevant functions of the Nature Conservancy Council and the Countryside Commission are given in Appendix A6.

9.2.4 The Authority's standard land drainage consent form has been amended to inform applicants of the need to comply with any duties or responsibilities for the conservation or protection of the environment (including flora and fauna).

9.3 Liaison with Conservation Interests

9.3.1 The Authority attaches great importance to liaison with conservation interests for all land drainage proposals which affect watercourses. These may be summarised as:

i) Improvement schemes identified in the 5 year capital programme for flood defence.

ii) Maintenance work on watercourses.

iii) Proposals for main river variations.

iv) Water Act 1989, Section 136(1) Flooding Survey.

9.3.2 The Authority's area staff have been issued with guidelines on the consultation which is necessary between area staff and conservation/recreation staff where works involve improvement or maintenance of rivers and watercourses.

9.3.3 The principal links between the area offices and conservation and amenity bodies are the Area Conservation and Recreation Officers.

CHAPTER 10

FLOOD WARNING SYSTEM

10.0 FLOOD WARNING SYSTEM

10.1 Investigations have shown that within the Severn-Trent Region of the National Rivers Authority considerable public benefit can accrue from accurate, reliable and well disseminated flood forecasts which provide the general public with adequate warning of flood events. The warnings can provide time for items to be moved from ground floors of residential and commercial properties, for boat owners to secure their crafts, campers and caravanners to evacuate sites, etc.

10.2 The National Rivers Authority has powers to provide and operate a flood warning system by Section 32 of the Land Drainage Act, 1976 (as amended by the Water Act 1989). The main provisions of the system which operates throughout the Region are:

i) To monitor weather conditions and flows and levels in rivers and to forecast future water levels.
ii) To provide warnings of potential floods in areas likely to be affected.
iii) To provide an advice and information service to the general public.
iv) To deploy area staff and equipment as necessary.
v) To liaise with other emergency services.

10.3 The procedure for issuing warnings is normally initiated by the Meteorological Office providing forecasts of rainfall or snowmelt. This information, together with the continual assessment of the detailed catchment situation by the interrogation of the network of rainfall and river flow and level recorders, enables the Authority to forecast and monitor the progression of floods through the river basins.

10.4 When danger areas have been assessed this information has to be passed to the public in those areas. This service is normally provided by the Police who advise the public by loudspeaker, local radio broadcasts and other appropriate methods. This system, however, cannot operate in some areas where localised storms can outpace the forecasting and warning procedure. Therefore, the service is limited to those areas where more than 4 hours warning can be given.

10.5 It is particularly difficult to provide warnings for transient groups of people such as caravanners, campers and boaters. When sites for caravans and camping are being considered the Authority will always advise planning authorities against their location in areas which are subject to periodic inundation. The protection of such sites from flooding is normally difficult, expensive and contrary to Authority policy regarding the use and management of floodplains. The joint DoE/MAFF/WO Circular 17/82 highlights this special risk problem.

10.6 Although major benefits can be attributed to a reliable flood warning system, such a system cannot, in itself, be considered as a satisfactory alternative to structural improvements which will reduce the risk of flooding. The Authority's policy is to continue to provide increased flood alleviation measures, at the same time as providing an effective flood forecasting service, which will give early warning of flooding in unprotected areas and also in the event that flood defences are likely to be overtopped.

CHAPTER 11

PROGRAMMING OF FUTURE WORK

11.0 PROGRAMMING OF FUTURE WORK

11.1 This Survey has identified and evaluated a wide range of flood defence problems throughout the Region. The responsibility for resolving the problems and financing the improvement works falls initially upon the riparian owner although drainage authorities have permissive powers to undertake works.

11.2 In many cases, the necessity for improvement is often due to increased channel flows resulting from developments in the upstream catchment, which, in recent years, have been approved by planning departments of Local Authorities. Where improvements due to development are required on main river, responsibility is normally accepted by this Authority, whereas on non-main river the responsibility is normally that of the District Council in urban areas, and the County Council in agricultural areas (other than in Drainage Districts where the Internal Drainage Board has a responsibility).

11.3 Improvement works on watercourses in individual catchments need to be co-ordinated to ensure that works in one area are compatible with those in another. This Authority is the body responsible for the co-ordination and supervision of flood defence throughout the area, and publishes annually its 5 year programme. The co-ordinating role can be carried out effectively only if all drainage bodies produce programmes of work which satisfactorily integrate to provide the maximum benefit to flood defence. This Survey provides the basis for the determination of such programmes of work.

11.4 Financing of flood defence works varies, dependent on the drainage body promoting the work. Most improvements, other than those needed as a requirement of future development, are eligible for grant aid from the Ministry of Agriculture, Fisheries and Food providing the improvement can be shown to have a satisfactory benefit/cost ratio (see Section 2.11). The sources of finance generally available to drainage bodies are indicated in Appendix A5.

11.5 In the future, the Survey will be updated at intervals of approximately three years. In order to ensure this operation is kept to a minimum in terms of manpower and financial resources, the Authority wishes to be kept informed of all improvement schemes which have been completed and of any additional problems which may be identified from time to time.

APPENDIX A1

PROBLEM DESCRIPTIONS

AND EVALUATIONS

IDENTIFICATION

Problem code number(s):	4-93-310-5/7/8/9/10/13/25/26/29/30/31/32/34/35/38/39/43/44,4-93-510-10,4-93-710-12,4-94-810-1/2/3/5/6/7/9/10/12/21
Watercourse:	River Soar (main river)
Location:	Leicester to Redhill (Rushcliffe and Charnwood Borough Councils, North-West Leicestershire District Council and Leicester City Council)
OS Map reference:	SK 493 309 to SK 594 130

NATURE OF PROBLEM

Flooding in the Soar Valley occurs regularly two or three times a year and inundation can last for up to 4 days. Inadequate drainage of agricultural land involving 2,700 ha is affected together with flooding of roads, houses and caravan parks. The problem is particularly complex because the river is navigable and navigable depths must be maintained in any improvement. The need to maintain water levels at certain mills also complicates the solution.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 10 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			b

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

Following mathematical modelling of the River Soar on this floodplain, an improvement scheme was formulated. As the proposals included lowering of navigation levels, the scheme had to be approved by Parliament. The Severn-Trent Water Authority Act was passed in December 1983. Following this, the proposals are being implemented over an 8-10 year period depending on availability of resources.

Work has been completed on the downstream sections between Redhill and Kegworth to give protection from flooding to a 1 in 10 year standard along the river, and a 1 in 100 year standard to adjacent, previously at risk, villages. Works are currently in progress between Zouch & Quorn where the scheme will be terminated. These works are due to be completed during 1991.

CONSERVATION

Cotes Grassland is an SSSI within the benefit area and is a grassland of botanical interest. Within this area, is also a site of natural history interest.

IDENTIFICATION

Problem code number(s):	5-93-610-1/2/3/4
Watercourse:	River Devon (main river)
Location:	Bottesford-Woolsthorpe-Knipton (Melton Borough Council)
OS Map reference:	SK 807 392 to SK 825 320

NATURE OF PROBLEM

In February 1977 and August 1980 minor flooding problems occurred along the Devon from Bottesford to Knipton. At Easthorpe Mill one house has flooded and other properties have been threatened. A capital scheme is required to resolve the problem at this site.

A problem also occurs at the Bottesford/Normanton Road which was originally a ford, but has been "bridged" by 11 small diameter pipes. It is unlikely that with alternative routes available, the County Council would consider constructing a proper bridge.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

FISHERIES

This is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-93-610-6/7 and 5-94-810-23/24/25
Watercourse:	Dalby Brook (non-main river)
Location:	Old Dalby to Hickling (Melton and Rushcliffe Borough Councils)
OS Map reference:	SK 676 237 to SK 694 295

NATURE OF PROBLEM

Increased run-off from the REME base at Old Dalby, and general lack of maintenance on the watercourse and its tributaries, has resulted in inadequate capacity to deal with 1 in 5 years flood flow. Flooding is not extensive, but deepening of the watercourse in certain areas could improve land drainage. Elsewhere cleaning out only is necessary. Some 1.8 km of the Brook between Hickling Lane and the Grantham Canal lie in the Newark IDB area and the Board has completed work effecting improvement to both land drainage and capacity.

Urban flooding problems at Hickling have been identified as being due to inadequate surface water drainage. Improvements to the Brook have assisted in alleviating these problems.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in ___ years
	(ii)	Structures	1 in ___ years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 5 years
(c) **Land potential category**			a5

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£____

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

Regrading 2 km of the watercourse and cleaning out on a further 5.35 km is required. Several access and footbridges will need to be replaced or enlarged on the regraded length, which includes the lower reach of the tributary draining the REME base, and a reach of the main stream south of the A606 where the existing freeboard is inadequate.

For the remainder of the watercourse only tree clearance and silt removal is necessary as the existing cross-section appears satisfactory. In view of the IDB Scheme no further works are proposed downstream of Hickling Lane.

The total catchment area to the Grantham Canal is 15.3 sq km and is predominantly rural. The 5 year design flow is estimated at about 6 cumecs at the outfall. The sub-catchment to the tributary draining the REME base will produce a flow of about 3 cumecs from an area of 3.6 sq km, the base occupying some 22% of the area.

Rushcliffe Borough Council are investigating the surface water drainage problem.

BENEFITS

The agricultural benefit is somewhat less than the MAFF estimate as the latter includes the IDB area, for which the majority of the benefits deriving from arterial works will have been realised as a result of the Board's Scheme.

IDENTIFICATION

Problem code number(s):	5-93-610-9
Watercourse:	Un-named (non-main river)
Location:	Claxton Rise, Long Clawson (Melton Borough Council)
OS Map reference:	SK 720 270

NATURE OF PROBLEM

The watercourse, which is a tributary of the River Smite, was culverted across one plot and under the highway as part of the development of a small residential estate. The culverts are inadequate with surcharging causing flooding to one property and the highway.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-93-610-10
Watercourse:	Un-named (non-main river)
Location:	The Gote, Stathern (Melton Borough Council)
OS Map reference:	SK 773 309

NATURE OF PROBLEM

Flooding of a highway and one property occurs following the surcharging of a culverted section of the watercourse. In addition to the problems caused by blockages in the culvert, it is considered that the culvert may be of inadequate size.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The culvert is an old brick culvert with poor line and level as well as being hydraulically inadquate. The culvert requires replacing in order to alleviate the flooding problems.

IDENTIFICATION

Problem code number(s):	5-94-110-2
Watercourse:	Brinsley Brook (non-main river)
Location:	Brinsley (Ashfield District Council)
OS Map reference:	SK 468 497

NATURE OF PROBLEM

Surface water flooding of two properties situated in a low area occurred in 1977. Since then, improvements to the road drainage have been carried out which may have alleviated the problem appreciably. However, the location of the properties makes complete elimination of the flood risk impossible. The Brook runs to the east of Cordy Lane and is culverted for a length of 105 m in the vicinity of the above properties. The culvert is inadequate, but as no properties are likely to be affected by flooding it is considered uneconomic to effect improvements.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

A very small improvement has been made at the head of the brook where willow trees have obstructed the channel. The closure of the colliery at Underwood has reduced the dry weather flow in the streams upper reaches, all the water removed from the colliery along with the pit-head surface water delivered into the brook, this no longer happens and any redevelopment will drain via the brook's tributory which runs alongside Winter Close.

IDENTIFICATION

Problem code number(s):	5-94-110-3
Watercourse:	Bagthorpe Brook (non-main river)
Location:	Westwood (Ashfield District Council)
OS Map reference:	SK 445 508, SK 476 518, SK 463 524

NATURE OF PROBLEM

The Brook drains a fairly steep catchment in a mainly rural area, which is fringed by villages in which additional development has taken place in recent years.

Flooding of 'B' class roads occurs and some property is also affected in the lower reaches.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 10 years
	(ii)	Structures	1 in 10/25 years
(c) **Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£_____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	
	(iv)	Development	£	£_____
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

The downstream reach will be affected by backwater influence in the River Erewash to some degree.

Increased capacity of the Bagthorpe Brook channel must be provided, particularly in the lower reaches at Westwood where three or four properties were flooded in February 1977, and at least some seven properties would require protection against a flood of 100 years return period. Improvement in these reaches for a length of about 2 km would be expected to include channel regrading, enlargement and some realignment. A constriction is formed in the channel by a garden wall and this should be removed.

Upstream of Westwood, 4 to 5 km of the channel also needs improving by removal of obstructions in bed and banks, partial regrading, tree clearing and improvements to bridges and culverts. There is less risk of property flooding in those reaches and improvements should aim at the provision of a satisfactory channel to pass the necessary flows including those from future development. It is possible that partial improvement could be carried out at a lesser cost.

The catchment area is 7 sq km, of which 20% is urbanised, and the 100 years flow is 13 cumecs.

Improvements have been made to the channel behind the bungalows in Westwood increasing the capacity and removing the constriction formed in the channel by a garden wall. Riparian owners have made some improvements to the earth channels in both increasing the capacity and gradient downstream of Westwood Village. The confluence with the River Erewash has been improved to direct the flow into the main river.

The above works have not yet been tested by rainfall of sufficient intensity as to be able to draw a conclusion on the improvement achieved.

Nottinghamshire County Council have replaced two road bridges where the brook crossed, with box culverts of increased capacity.

DEVELOPMENT

Some 7.33 ha of residental development are proposed in the Selston/Selston Common area. This has been accounted for in both the improvement works and in the benefit assessment.

COMMENT

There are proposals for open-cast mining in the Erewash Valley which could affect the outfall of Bagthorpe Brook.

IDENTIFICATION

Problem code number(s):	5-94-110-4
Watercourse:	Jacksdale Brook (*non-main river*)
Location:	Jacksdale (Ashfield District Council)
OS Map reference:	SK 446 516

NATURE OF PROBLEM

The Brook is in a poorly maintained condition and flows through an urban area of Jacksdale. The channel is of inadequate capacity as are the culverts at Main Road and Selston Road. In February 1977 flooding affected about 15 properties, and flooding previously occurred in 1973. Further flooding occurred on several occasions from February 1977 to May 1986. The worst case recorded being May 1986 which affected 31 properties.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£_____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£_____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

The following improvement works have been undertaken.

1) Stage 1 completed in March 1986 which involved the re-grading of the brook from Main Road downstream to its conjunction with the River Erewash together with the replacement of the existing culvert under Main Road.

2) Stage 2 completed in August 1989 which involved the culverting of the watercourse to the rear of the properties fronting Selston road, a new channel section and a triple box culvert section under Selston Road.

The above improvement works were designed for a theoretical discharge for the 1 in 100 year flood of 6.53 cumecs. These works have not been tested by rainfall of sufficient intensity to be able to draw any conclusions on their performance as a whole.

CONSERVATION

The Nottinghamshire Trust for Nature Conservation has designated this a high grade County Site of Natural History Interest.

COMMENT

Ashfield District Council and British Coal are liasing regarding a proposed open-cast mining scheme for possibly balancing peak run-off.

IDENTIFICATION

Problem code number(s):	5-94-110-5
Watercourse:	Upper Erewash (non-main river)
Location:	Kirkby-in-Ashfield (Ashfield District Council)
OS Map reference:	SK 485 548 to SK 498 557

NATURE OF PROBLEM

Between Kirkby-in-Ashfield and the head of main river much of the watercourse is culverted through collieries and railway embankments.

It receives surface run-off from urban and industrial areas and the open channel section is in poor condition due to obstructions, tree growth, erosion and siltation. Flooding of a'B' road also occurs from a tributary which is programmed for improvement under a culvert reconstruction scheme by British Rail.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in years
(b) **Agricultural**	(i)	Channel	1 in 2 years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	144,150	
	(ii)	Field drainage	£		£144,150
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		
	(iv)	New development	£	140,120	£140,120
(c) **Benefit/cost ratio**					0.9
(d) **Priority category**					3C

IMPROVEMENT WORKS

Discharge in the river will be controlled to some degree by the capacity of the surface water drainage system and balancing effects upstream. The open channel sections are in need of improvement for a length of about 1 km and this would comprise regrading, removal of obstructions and cleaning of culverts. Further investigation would be required to determine the extent of any major enlargements or other drainage works needed.

BENEFITS

Whilst there would be some benefit to agricultural land, its area and economic value would probably be marginal. The benefit in this report has therefore been related only to the value of development assumed as 14 ha.

CONSERVATION

There is a designated site at the upstream end of this reach (SK 498 553) and the Nature Conservancy Council also have an interest in a small tributary on the right bank. Any channel improvements will need to take these factors into account.

MINING SUBSIDENCE

The watercourse is in an area, part of which may be affected by future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-110-6
Watercourse:	Kirkby Park Brook (non-main river)
Location:	Kirkby Park (Ashfield District Council)
OS Map reference:	SK 465 546

NATURE OF PROBLEM

This is a small watercourse which causes minor flooding of agricultural land.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	5,770	
		(ii)	Field drainage	£		£5,770
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£
(c)	**Benefit/cost ratio**					0
(d)	**Priority category**					3F

IMPROVEMENT WORKS

Whilst there are no reported problems of significance on this watercourse, there may be a need to carry out some improvement at the downstream end following the major improvement scheme on the River Erewash. For that reason, a provisional sum of £5,770 has been allowed for expenditure on a length of about 150 m.

BENEFITS

Initial assessment indicates that benefits are small and may be neglected.

IDENTIFICATION

Problem code number(s):	5-94-110-7
Watercourse:	Cuttail Brook (non-main river)
Location:	Annesley (Ashfield District Council)
OS Map reference:	SK 508 528 to SK 485 549

NATURE OF PROBLEM

A high degree of industrial development in the upper reaches of the watercourse will necessitate channel improvement works to be carried out. The total development is expected to take 20 years and to include expenditure by the developer on stormwater disposal works including balancing facilities.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 25 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 10 years
	(ii)	Structures	1 in 10 years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	403,610	
	(ii)	Field drainage	£		£403,610
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£not estimated
(c) **Benefit/cost ratio**					0
(d) **Priority category**					3C

IMPROVEMENT WORKS

Investigations have shown that the Brook channel is hydraulically inadequate and should be enlarged and regraded over a distance of 1.21 km downstream of Salmon Lane at an estimated cost of £45,400. In addition, the Local Authority has long term proposals for improvement upstream of Kodak and a provisional sum of £272,400 is allocated for this length. It is not expected that any works will be necessary to culverts or bridges. The 1 in 100 years flood discharge is estimated at 7 cumecs from a total catchment of 7.8 sq km.

The Cuttail Brook has been improved as it passes under Salmon Lane where Nottinghamshire County Council have replaced the highway culvert.

DEVELOPMENT

Future development in the Cuttail Brook catchment proposed within the Structure Plan amounts to 90 ha and has been taken into account in the design.

Surface water drainage from the new development by Eastman Kodak Ltd has been accounted for by the use of flow balancing lakes. These lakes will only effectively deal with up to a 1 in 10 year flood flow, and their effect has been progressively reduced in the design for the higher return period and the resulting benefits adjusted accordingly.

BENEFITS

Evaluation of benefit is complicated by the fact that works in connection with most of the development are being undertaken privately by Kodak Ltd. Development benefits have been taken into account in justifying the current work on the balancing lakes.

The agricultural areas which are pasture are not expected to benefit from these improvements. There is, however, a small area of arable land affected at the upstream end which would benefit by reduced flooding, but this has not been estimated.

RECREATION, FISHERIES AND AMENITY

There is a private coarse fishery which it is understood is now within the ownership of the developer.

MINING SUBSIDENCE

The watercourse is in an area, part of which may be affected by future mining subsidence.

CONSERVATION

This is a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	5-94-110-8
Watercourse:	Tributary of the Erewash (non-main river)
Location:	Kirkby-in-Ashfield (Ashfield District Council)
OS Map reference:	SK 498 554

NATURE OF PROBLEM

This watercourse was identified in the Local Authority's programme as affected by run-off from development in the Mansfield and Alfreton areas. However, a designated site of scientific interest exists at SK 498 553. It is understood that the designated area may be extended in the future. The extent of any improvement to the condition of the watercourse would therefore have to be agreed with the Nature Conservancy Council.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The tributary is culverted under an access road in Portland Park and British Rail's Pye Bridge to Shirebrook line. The former was replaced in 1987 after damage by British Coal's underground workings giving a one in 100 year storm frequency design.

MINING SUBSIDENCE

The watercourse is in an area, part of which may be affected by future mining subsidence.

CONSERVATION

Along this stretch of the watercourse is an SSSI known as Kirkby Grives.

IDENTIFICATION

Problem code number(s):	5-94-110-9
Watercourse:	Maghold Brook/The Dumbles (non-main river)
Location:	Pinxton/Sutton-in-Ashfield (Ashfield District Council)
OS Map reference:	SK 465 548

NATURE OF PROBLEM

The watercourse could be affected by new development planned in the catchment and is in need of improved maintenance.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 10 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	115,320	
	(ii)	Field drainage	£		£115,320
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		
	(iv)	Development	£	470,390	£470,390
(c) **Benefit/cost ratio**					4.0
(d) **Priority category**					1C

IMPROVEMENT WORKS

To ensure that future development does not lead to any worsening of land drainage in the area served by the Brook or give rise to deterioration in its condition, some work would be required on about 4.2 km of the channel. In the lower reach this would call for cleaning out and possible regrading. In the higher reaches (The Dumbles), where the channel is more deeply incised and heavily tree-lined, the requirements could probably be met by sufficient clearing and removal of tree growth and debris to provide a clear channel.

The catchment area is 4.2 sq km, and the flow estimated by flood studies method is 5.6 cumecs for the 1 in 100 year design flood.

The Mayhold Brook/The Dumbles has been spanned by the recently completed Sutton-in-Ashfield by-pass (A38) where in addition to culverting the watercourse under the highway a short length of downstream channel improvement was carried out to the existing pond, approximately 360 metres.

DEVELOPMENT

The County Draft Structure Plan envisages new development amounting to 47 ha. This has been allowed for in the run-off calculations.

BENEFITS

Adjacent agricultural land is devoted to cereals, mainly spring barley, and no increases in productivity are expected following drainage improvements. The allowance for benefit is based solely on that which may be attributable to new development. For that reason the benefit/cost ratio may be disproportionately high.

RECREATION, FISHERIES AND AMENITY

The improvements envisaged would not adversley affect these facilities, tree removal being restricted to a minimum.

MINING SUBSIDENCE

The watercourse is in an area, part of which may be affected by future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-110-10
Watercourse:	Meadow Farm Brook (non-main river)
Location:	Kirkby-in-Ashfield (Ashfield District Council)
OS Map reference:	SK 481 564 to SK 480 549

NATURE OF PROBLEM

This is a very minor tributary draining steep agricultural land. MAFF have indicated no agricultural benefit and the County Structure Plan does not indicate development in the catchment area. It is considered that channel improvements should be dealt with by improved maintenance.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£
(c) **Benefit/cost ratio**				
(d) **Priority category**				

CONSERVATION

This is a County Site of Natural History Interest as designated by the Nottinghamshire Trust for Nature Conservation.

IDENTIFICATION

Problem code number(s):	5-94-110-11
Watercourse:	Castle Hill Brook (non-main river)
Location:	Kirkby-in-Ashfield (Ashfield District Council)
OS Map reference:	SK 492 569 to SK 495 552

NATURE OF PROBLEM

This is a very minor tributary draining a section of Kirkby-in-Ashfield.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Preliminary investigations suggest that the watercourse should be improved by channel enlargement and partial regrading over a length of 1 km. It will not be necessary to rebuild any structure or culverts but they will require cleaning out and desilting. It is recommended that this work be carried out as a maintenance operation and the Local Authority have made allowance for this in their programme.

BENEFITS

No areas of agriculture are expected by MAFF to benefit from any improvements of the watercourse.

CONSERVATION

This is the site of Kirkby Grives SSSI.

MINING SUBSIDENCE

The watercourse is in an area, part of which may be affected by future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-110-14/15
Watercourse:	Upper Meden Tributaries (non-main river)
Location:	Pleasley, Stanton Hill, Skegby (Ashfield District Council)
OS Map reference:	SK 493 619, SK 496 634, SK 463 603

NATURE OF PROBLEM

The upper Meden tributaries drain the periphery of urban areas to the north-west of Sutton-in-Ashfield. Gradual development has resulted in increased run-off and, hence, enhanced the peak discharges occurring in these watercourses, including the Stanton and Skegby Brooks and the Meden. Inadequate maintenance has contributed to the present unsatisfactory condition of the watercourse channels over much of the length.

Some further development is planned in the catchment which falls within the Mansfield-Alfreton Growth Zone. Whilst agricultural benefit in the area may not be large, an improved standard of maintenance is desirable to prevent further deterioration in the arterial drainage.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 50 years
	(ii)	Structures	1 in 50 years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			a5

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	216,220	
	(ii)	Field drainage	£		£216,220
(b) **Present value of benefits**	(i)	Agriculture	£	30,560	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		
	(iv)	New development	£	270,230	£300,790
(c) **Benefit/cost ratio**					1.4
(d) **Priority category**					2C

IMPROVEMENT WORKS

Improvements were carried out by STWA on the Skegby Brook adjacent to the water reclamation works, and some improvement to flow at the B6014 road bridges has been made by works carried out by the Local Authority.

The extent of necessary improvements would need to be related to a more detailed appraisal of benefits, but the aim should be to ensure the river channel is restored to, and maintained in, a satisfactory condition to deal with present and future flows.

At this stage it is estimated that channel improvements on Skegby Brook should be continued to include the reach of approximately 3 km downstream to Newbound Mill Bridge (present head of main river). Regrading and/or channel clearance should be carried out on the Meden arm, upstream of the Skegby Brook confluence for an estimated length of 2 km, and for about 700 m on Stanton Brook.

Total catchment area to Newbound Mill Bridge is 20.5 sq km and the 5 year discharge is estimated as 5.7 cumecs.

DEVELOPMENT

The run-off calculations allow for 27 ha of future development.

BENEFITS

Following drainage improvements and the provision of satisfactory freeboard conditions, agricultural benefits were assessed by MAFF on 102 ha of agricultural land.

Urban benefits are purely the result of development potential.

SUBSIDENCE

The watercourses are in an area, part of which may be affected by future mining subsidence.

CONSERVATION

5-94-110-14 is the site of Terversal Pastures SSSI.

FISHERIES

A minor coarse fishery exists upstream of Sookholme Brook.

IDENTIFICATION

Problem code number(s):	5-94-110-16
Watercourse:	Baker Lane Brook (non-main river)
Location:	Hucknall (Ashfield District Council)
OS Map reference:	SK 550 485 to SK 523 497/SK 524 503

NATURE OF PROBLEM

Flooding of an urban area at Hucknall occurs from the Brook which has been culverted for much of its length through the town centre. Development in the past has restricted the natural flood capacity of the watercourse, and the present condition leads to the inevitable inundation of built-up areas such as occurred during February 1977, when some 20 properties were affected.

There is also cause for concern about the condition of the mill dam upstream.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	432,440	
	(ii)	Field drainage	£		£432,440
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	487,910	
	(iii)	Roads/Railways	£	50,040	£537,950
(c) **Benefit/cost ratio**					1.2
(d) **Priority category**					2C

IMPROVEMENT WORKS

To pass the necessary flood flow, the size of the channel and culverted sections of the Brook would have to be increased considerably resulting in an expensive scheme. The most economic solution would appear to be the construction of flood storage facilities upstream to reduce the size of the flood peaks passing through the town.

The Hucknall road by-pass Phase I is due to commence in 1990, Phase II is the section benefiting the brook and could be implemented in the same year.

Improvement of a 3.5 km length of watercourse will still be necessary, but this would generally entail works of a less extensive nature such as cleaning out of culverts rather than major reconstruction.

The catchment area of the Brook is 7.6 sq km with an urban factor of 25%.

SUBSIDENCE

The Brook and the suggested flood reservoir sites are within an area which could possibly be affected by mining subsidence.

BENEFITS

The benefit evaluation has been based entirely on the reduction of flood damage in the urban area and it is estimated that some 42 properties could be at risk from a 100 years flood.

CONSERVATION

This a County Site of Natural History Interest as designated by the Nottinghamshire Trust for Nature Conservation.

IDENTIFICATION

Problem code number(s):	5-94-110-17
Watercourse:	Farleys Brook (non-main river)
Location:	Hucknall Lane, Bulwell (Ashfield District Council)
OS Map reference:	SK 546 472

NATURE OF PROBLEM

Farleys Brook appears to have been diverted along its lower reaches at some time in the past to run alongside a now disused railway. Owing to inadequate channel and culvert capacity, flooding occurs with a frequency of several times a year along the old course of the Brook on a field used for recreational purposes and under more severe conditions on the A611 (Hucknall Lane). Some remedial works have been carried out by the Local Authority.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	86,490	
	(ii)	Field drainage	£		£86,490
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£not estimated
(c) **Benefit/cost ratio**					
(d) **Priority category**					

IMPROVEMENT WORKS

The anticipated Hucknall by-pass, Phase I, will include an improvement to the brook. The design of this has been approved by the National Rivers Authority after submissions by Nottinghamshire County Council. The start date for Phase I has been set at August 1990.

As a consequence of Nottinghamshire County Council's proposed road scheme, the Brook will need to be diverted over a length of about 520 m from its confluence with the River Leen. In order to protect the road against flooding, larger culverts will be required beneath the A611 and the Nottingham-Hucknall railway. In addition, the watercourse for a length of about 470 m upstream of the realigned reach is in need of regrading.

The catchment area of the Brook (including Common Brook at the head of the catchment) is 4.35 sq km. A preliminary assessment indicates that the 100 year flow from this area would be about 3.5 cumecs.

DEVELOPMENT

The present urban area is 1.04 sq km with a further 0.24 sq km proposed in the Common Farm area. The increased run-off resulting from this development will be balanced in storage lagoons. The only other area of development is the by-pass itself which will contribute flows from 2 ha within the catchment.

BENEFITS

Benefits will include the alleviation of flooding of the A611 road and reduction of threat of flooding to nearby properties. As the improvements would form an integral part of the road improvement scheme, it is not considered practicable to separate land drainage benefits at this stage.

Apart from the benefit attached to the development of the new road, which is not readily assessable, there are no other benefits to be derived from improvements to the Brook.

CONSERVATION

This is a high grade site of natural history interest.

MINING SUBSIDENCE

The watercourse is in an area, part of which may be affected by future mining subsidence.

FISHERIES

Parts of the brookcourse contain coarse fish.

IDENTIFICATION

Problem code number(s):	5-94-110-19
Watercourse:	Wilfred Brook (non-main river)
Location:	Kirkby-in-Ashfield (Ashfield District Council)
OS Map reference:	SK 485 548 to SK 487 567

NATURE OF PROBLEM

This is a badly maintained watercourse which, combined with an inadequate channel, causes flooding of adjoining land.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 10 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	57,660	
	(ii)	Field drainage	£		£57,660
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		
	(iv)	Development	£	32,530	£32,530
(c) **Benefit/cost ratio**					0.6
(d) **Priority category**					3D

IMPROVEMENT WORKS

Preliminary investigations show that the watercourse should be improved by channel enlarging and regrading. This includes some work on several road and rail bridges to increase discharge capacities. The 100 years flood discharge is estimated at 5 cumecs from a catchment area of 2.0 sq km.

DEVELOPMENTS

Proposals for future development in the present Structure Plan include an area of only 3.2 ha. This has been taken into account in design flow calculations.

MINING SUBSIDENCE

The watercourse is in an area, part of which may be affected by future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-210-2
Watercourse:	River Trent (main river)
Location:	Gainsborough (Bassetlaw District Council)
OS Map reference:	SK 804 893

NATURE OF PROBLEM

Under major flood conditions the Ramper Road, which crosses the Trent washlands, floods and this results in its closure with consequent diversion via Keadby. Estimates indicate that the cost of raising the road and providing flood openings would be very large and could not be considered economically practicable.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£ ____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£ ____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

COMMENT

A 1 in 15 year return period flood closes Ramper Road. In 1989, the highway authority renovated the flood arches under the road.

IDENTIFICATION

Problem code number(s):	5-94-210-3
Watercourse:	River Trent (main river)
Location:	Beckingham Marshes (Bassetlaw District Council)
OS Map reference:	SK 784 940 to SK 807 881

NATURE OF PROBLEM

Beckingham Marshes is an area of land which accommodates overspill from the River Trent under major flood conditions, such as occurred in 1947 and 1977. The area is protected by flood banks up to a 1 in 15/20 year flood and these are designed to overtop for floods in excess of this. Any increase in the height of these defences will enhance flood levels and endanger urban areas including Gainsborough. No flood alleviation measures are, therefore, possible.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-94-210-4
Watercourse:	River Trent - Tidal Reach (main river)
Location:	Walkeringham (Bassetlaw District Council)
OS Map reference:	SK 781 932, SK 781 923, SK 798 916

NATURE OF PROBLEM

These properties are situated in the River Trent washlands. Whilst it may be possible to provide some individual protection, the property and residents would be totally isolated in a flood and it is considered that the Authority would not be justified in adopting a policy of protection for these areas.

The properties will continue to be included in the Authority's flood warning system so that danger to life and property can be minimised.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£ ____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£ ____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-94-210-6
Watercourse:	River Trent - Tidal Reach (main river)
Location:	Church Laneham (Bassetlaw District Council)
OS Map reference:	SK 814 766

NATURE OF PROBLEM

Two properties were reported to be affected by flooding in February 1977. However, the houses were not actually flooded and, whilst the minor road serving them was flooded to a depth of more than 1 m, there is alternative foot access above flood level. There will be only minor benefits from an improvement scheme and no recommendation can, therefore, be made.

The properties are included in the authority's flood warning system.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

CONSERVATION

This is a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	5-94-210-7
Watercourse:	River Trent (main river)
Location:	High Marnham (Bassetlaw District Council)
OS Map reference:	SK 811 703

NATURE OF PROBLEM

Flooding from the River Trent affects two cottages, a public house and caravan site at Hollowgate Lane, High Marnham.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	34,590	
		(ii)	Field drainage	£		£34,590
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£	21,270	
		(iii)	Roads/Railways	£		£21,270
(c)	**Benefit/cost ratio**					0.6
(d)	**Priority category**					3E

IMPROVEMENT WORKS

Of the properties subject to flooding it is considered that only the two cottages could, in practice, be provided with an effective flood defence, and this has been allowed for in the estimate. The protection could be provided by raising the height and standard of the existing minor floodbank, and raising the level of Hollowgate Lane.

BENEFITS

In the flood of February 1977, the cottages were flooded to a depth of 1.0 m and benefit has been evaluated on the basis of an annual damage cost of £1,176.

CONSERVATION

This is a site of known natural history interest.

IDENTIFICATION

Problem code number(s):	5-94-210-10, 5-94-610-3/4/5/6/7/8/9/10/11/15
Watercourse:	River Trent (main river)
Location:	Newark & Sherwood District Council and Bassetlaw District Council areas
OS Map reference:	SK 87 & SK 86

NATURE OF PROBLEM

1 Improvements required to sluices at Cromwell, Girton and Carlton Ferry.
2 Minor flood defences are required for the protection of agricultural land at Grassthorpe, North Clifton, South Clifton and Carlton (South).
3 Major defences are required to alleviate flooding at Girton.
4 Flood protection to four properties in Collingham and Marnham Hall.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Problem 1 - Improvements have been carried out.
Problem 2 - Banks at North and South Clifton, Grassthorpe and Carlton (South) have been raised.
Problems 3 & 4 The problem still remains.

IDENTIFICATION

Problem code number(s):	5-94-210-12
Watercourse:	Wheatley Beck (non-main river)
Location:	North Wheatley (Bassetlaw District Council)
OS Map reference:	SK 762 857

NATURE OF PROBLEM

A small area of agricultural land and an unclassified road are subject to flooding. This is known to have occurred in February 1977 and December 1978.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 10 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	46,130	
	(ii)	Field drainage	£		£46,130
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£	15,010	£15,010
(c) **Benefit/cost ratio**					0.3
(d) **Priority category**					3E

IMPROVEMENT WORKS

Since the flooding of 1977 some channel improvement work has been carried out. However, the watercourse is restricted at the road culvert which requires enlargement. The estimate assumes a new box culvert being provided and improvements at the approach and exit. The catchment area is 6.1 sq km and the 25 year design discharge is estimated as 3.65 cumecs (100 year, 5.02 cumecs).

DEVELOPMENT

Only infill development is proposed within the catchment area.

BENEFITS

The main benefit relates to the reduction of flooding of the road and benefit has been assessed on the basis of 800 vehicles per day.

IDENTIFICATION

Problem code number(s):	5-94-210-13
Watercourse:	Un-named (non-main river)
Location:	Sturton-le-Steeple (Bassetlaw District Council)
OS Map reference:	SK 788 839

NATURE OF PROBLEM

It would appear that agricultural land to the east of Sturton-le-Steeple has flooded because the River Trent has overflowed. No evidence of flooding from the watercourse that runs through the village has been recorded. Calculations have shown that two culverts on the watercourse are adequate for storms in excess of a return period of 1 in 10 years, but a storm of 1 in 50 years might flood the car park of a public house, the garden of one property and a small length of Holland Lane.

The problem is, therefore, considered to be of a minor nature and whilst an estimate of possible improvements is indicated there is little economic justification for such works.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	40,360	
	(ii)	Field drainage	£		£40,360
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£
(c) **Benefit/cost ratio**					0
(d) **Priority category**					3E

IMPROVEMENT WORKS

The replacement of both culverts by larger culverts would resolve any possibility of flooding. The design discharge is 2.69 cumecs for a 1 in 100 year storm and 2.31 cumecs for a 1 in 50 year storm. The catchment area is 2.40 sq km.

Sturton-le-Steeple Parish Council has, with the sanction of the former Water Authority and I.D.B. completed a scheme to create a village "pond" on the watercourse between Cross Street and Reindeer Inn.

The overflow level of the weir has been raised to a level such that the normal water level in the culvert under Cross Street may effectively reduce the hydraulic capacity of the culvert in extreme conditions.

IDENTIFICATION

Problem code number(s):	5-94-210-16
Watercourse:	Leverton Station Drain (non-main river)
Location:	South Leverton (Bassetlaw District Council)
OS Map reference:	SK 785 816

NATURE OF PROBLEM

A large area of agricultural land is poorly drained. The watercourse is overgrown with vegetation and the flow is impeded with obstructions between Retford Road and South Gore Road. Two culverts under South Gore Road are obstructed with debris.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 5 years
		(ii)	Structures	1 in 5 years
(c)	**Land potential category**			a5

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	28,830	
		(ii)	Field drainage	£	152,630	£181,460
(b)	**Present value of benefits**	(i)	Agriculture	£	200,040	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£200,040
(c)	**Benefit/cost ratio**					1.1
(d)	**Priority category**					3E

IMPROVEMENT WORKS

Tree clearing, regrading and removal of silt, debris and vegetation over about 1.5 km of watercourse and the clearing out of both culverts (105 m) is required. The improvements would also reduce the risk of debris being carried downstream into Laneham Internal Drainage Board pumped drainage system. The 5 year discharge is estimated as 0.55 cumec from a catchment area of 1.65 sq km.

BENEFITS

Benefit was calculated from an estimated increase in gross margins on 87 ha of arable land. No increase in gross margin is likely on the remaining 77 ha of grass, previously assessed as being within the area of benefit.

The benefits have been assessed on the land being mainly arable with cereals, oilseed rape and temporary grass rotation such as wheat, oilseed rape, wheat, barley, ley. The benefits are based on this rotation on 65% of the area, the remaining 35% being permanent grass.

CONSERVATION

The Nottinghamshire Trust for Nature Conservation and the RSPB have designated this area as a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	5-94-210-17
Watercourse:	Harold Stream (non-main river)
Location:	East Markham (Bassetlaw District Council)
OS Map reference:	SK 736 731

NATURE OF PROBLEM

Flooding occurs to property in East Markham Village and there is inadequate drainage of agricultural land. Residential property is known to have flooded in December 1975, February 1976 and December 1978 and would also have been affected in February 1977. A recent new development has taken place on land which is understood to have flooded in the past.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 2 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	121,080	
	(ii)	Field drainage	£		£121,080
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	100,080	
	(iii)	Roads/Railways	£		£100,080
(c) **Benefit/cost ratio**					0.8
(d) **Priority category**					3C

IMPROVEMENT WORKS

Replacement culverting for a length of approximately 250 m is required, together with improvements to the open channel section and 700 metres of regrading to the confluence with the main stream. These improvements provide for a design flow of 2.2 cumecs (100 year standard) for a catchment area of 1.26 sq km.

DEVELOPMENT

Only infill development is proposed in the Village of East Markham.

BENEFITS

It has been assumed that the improvements will not provide agricultural benefit as much of the drainage improvement will occur by cleaning out the watercourse. This will provide a satisfactory outfall for farm ditches and enable existing tile drains to function properly. Little underdrainage work is likely to be carried out in this area. More detailed investigation may identify some agricultural benefit.

Urban benefits have been estimated on the basis of approximately ten properties being at risk from flooding, some of the property having been known to have flooded 3/4 times in the past 5 years.

IDENTIFICATION

Problem code number(s):	5-94-210-20/25/26/27
Watercourse:	River Idle (main river)
Location:	Mattersey to West Drayton (Bassetlaw District Council)
OS Map reference:	SK 689 896 to SK 702 751

NATURE OF PROBLEM

Major floods have occurred 13 times between 1910 and 1979 affecting property, roads and agricultural land. The duration of the flooding has been up to 2 weeks where property and roads have been involved, and up to 4 weeks in the case of agricultural land. The area is within the Idle and Ryton Internal Drainage District, part of which at West Drayton is adversely affected by mining subsidence.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 10 years
	(ii)	Structures	1 in years
(c) **Land potential category**			b

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

The former STWA carried out the following improvement schemes:-

Eaton - W. Drayton in 1981/82.
Mattersey - Bolham in 1983/85.
Retford Part 1 in 1985/86.

Retford Part 2 has been completed to upstream of Albert Bridge. The extent of Part 3 of the scheme is to be reviewed.

BENEFITS

The area of agricultural benefit is estimated to be 3,024 ha. The following properties would benefit from the scheme: 340 houses; 25 shops, commercial garages and public houses; 3 factories; 20 agricultural buildings.

CONSERVATION

Sites 5-94-210-20 and 26 are County Sites of Natural History Interest.

MINING SUBSIDENCE

The areas of watercourse in the 5-94-210-20 and 27 region are in an area, part of which may be affected by future mining subsidence.

FISHERIES

The Idle is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-210-31
Watercourse:	The Beck (non-main river)
Location:	Retford (Bassetlaw District Council)
OS Map reference:	SK 716 810, SK 713 811

NATURE OF PROBLEM

There is a risk of flooding to approximately 15 properties and agricultural land in the Grove Lane/Blackstops Lane area, together with other areas of flooding in the St. Helens Road/Grove Coach Road/Bracken Lane area.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 5 years
(c) **Land potential category**			a - 28 ha
			b - 104 ha

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£_____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£_____

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

The first phase of re-culverting between the river and Wesley Road has been completed in conjunction with the Inner Relief Road.

Bassetlaw District Council have recently approved in principle a scheme prepared by Grantham, Brundell and Farran to alleviate flooding upstream of the first phase.

In conjunction with housing development, for which approval was granted upon appeal, the culverts under Grove Coach Road and Brackett Lane have been enlarged which may reduce the frequency of flooding in the Grove Coal Road/Bracken Lane/St. Helen's Road area but the risk of flooding elsewhere remains.

IDENTIFICATION

Problem code number(s):	5-94-210-33
Watercourse:	None
Location:	Hayton (Bassetlaw District Council)
OS Map reference:	SK 728 846

NATURE OF PROBLEM

Flooding occurred in 1965, 1968 and 1977 to 1 house and a 'B' road. The flooding is due to inadequacies in the highway drainage system and the solution is, therefore, outside the scope of this Survey.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

It is understood that Nottinghamshire County Council are to carry out improvements to their highway drainage in the near future.

IDENTIFICATION

Problem code number(s):	5-94-210-35/36
Watercourse:	Idle and Ryton IDD (Sub-district B)
Location:	Wiseton (Bassetlaw District Council)
OS Map reference:	SK 711 894

NATURE OF PROBLEM

There is a risk of flooding of about one in two years on approximately 60 ha of agricultural land in that part of the IDD which drains to Wiseton Pumping Station. Flood flows are enhanced by the overspill from 3 weirs on the Chesterfield Canal.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in 30	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The capacity of the existing pumping station has been increased from 3.54 cumecs to 6.30 cumecs.

The IDD are investigating the need to carry out further improvements to the drains.

DEVELOPMENT

Only infill development is proposed within the catchment.

IDENTIFICATION

Problem code number(s):	5-94-210-39
Watercourse:	River Ryton (non-main river)
Location:	Worksop (Bassetlaw District Council)
OS Map reference:	SK 580 793 to SK 589 791

NATURE OF PROBLEM

Flooding occurs in the area of Worksop. Under minor flood conditions this is confined mainly to areas designated as washland and includes public parks, gardens and a car park. On the basis of past events, there is a risk, under more severe flood conditions, to properties in the town centre where some flooding was recorded in December 1960. More serious flooding occurred in 1947 and 1931.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in 2	years
	(ii)	Structures	1 in	years
(c) **Land potential category**			a	

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£_____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£_____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

A feasibility study was carried out by Sheffield Polytechnic in 1989, on behalf of Bassetlaw District Council.

Bassetlaw District Council are progressing a scheme to clean out the River Ryton to its 1978 profiles and gradients between Stubbin Lane and Bracebridge. Upon completion, the NRA has agreed to consider maining the river.

AMENITY

The River has some amenity value in the reach in Worksop Town known as the Canch and this would be preserved eg. by provision of automatic water level control.

CONSERVATION

This site has been designated a County Site of Natural History Interest by the Nottinghamshire Conservation Trust.

MINING SUBSIDENCE

The watercourse is in an area, part of which may be affected by future mining subsidence.

FISHERIES

The Ryton is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-210-40/41/47
Watercourse:	Owlands Wood Dyke (non-main river)
Location:	North Carlton/Woodsetts (Bassetlaw District Council)
OS Map reference:	SK 595 845, SK 558 832

NATURE OF PROBLEM

Roads and seventeen properties in North Carlton were reported to have flooded in 1958, 1960 and 1967 since when some improvements are understood to have been made. Further improvements are still required to bring the watercourse to a suitable standard.

There is a history of flooding at the Old Corn Mill, Wallingwells, where one property and farmyard were flooded to a depth of 450 mm in 1977.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 10 years
(c) **Land potential category**			b

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	221,980	
	(ii)	Field drainage	£	47,540	£269,520
(b) **Present value of benefits**	(i)	Agriculture	£	247,270	
	(ii)	Buildings	£	15,010	
	(iii)	Roads/Railways	£		£262,280
(c) **Benefit/cost ratio**					1.0
(d) **Priority category**					3C

IMPROVEMENT WORKS

Improvements are required at bridges in Carlton Village and at the mill at Wallingwells. It is estimated that approximately 4 km of channel will need improving but the scope for regrading may be limited above Carlton Mill due to the retained water level. 100 year discharge has been estimated as 14.0 cumecs and the catchment area is 16.96 sq km.

DEVELOPMENT

The only proposed development within the catchment area is 4.5 ha of housing at Woodsetts and this has been taken into account in the calculation of design discharge.

BENEFITS

The benefit evaluation is based on increased gross margins for 99 ha. There would be no increased benefit on the area of 182 ha downstream of North Carlton because of considerable areas of "sandland" and large areas already satisfactorily underdrained.

Urban flood alleviation benefits have been related to property at Wallingwells and North Carlton.

CONSERVATION

This problem is adjacent to a site of natural history interest.

IDENTIFICATION

Problem code number(s):	5-94-210-44/45/46, 5-98-110-3
Watercourse:	River Poulter (non-main river)
Location:	Hardwick Grange/Nether Langwith (Bassetlaw and Bolsover District Councils)
OS Map reference:	SK 647 755 and SK 528 703

NATURE OF PROBLEM

There was risk of flooding to property in the Village of Nether Langwith in February 1977. The River Poulter is in an area liable to some effects of mining subsidence.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Whilst a certain amount of flooding occurs in the locality of Nether Langwith no reports of serious flooding of property have been received.

There could be some risk under conditions more severe than 1977, but it is considered that this could be alleviated by improved maintenance of the watercourse rather than needing extensive works. There are, however, areas of poor drainage upstream (5-98-110-3).

DEVELOPMENT

Future development in the catchment is not expected to have any significant effect on river flows.

BENEFITS

The urban benefits are small and the agricultural benefits negligible.

SUBSIDENCE

This reach of the River Poulter flows through an area which is indicated as being liable to future subsidence.

CONSERVATION

5-94-210-44/46 are known sites of natural history interest.

FISHERIES

Parts of the Poulter can be considered a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-210-48/49/50, 5-94-610-60/61/62/63/64/65
Watercourse:	River Maun (main river)
Location:	West Drayton to Kings Mill Reservoir (Nr Sutton-in-Ashfield) (Bassetlaw and Newark District Councils)
OS Map reference:	SK 702 751 to SK 519 598

NATURE OF PROBLEM

Except for urbanisation in Mansfield, Edwinstowe and Ollerton the areas adjacent to the river are generally used for agricultural purposes. Efficient drainage of many of these areas is impeded by high river levels, mainly due to the presence of weirs and water mills or the effects of coal mining subsidence which is seriously affecting almost the whole length of river. Serious flooding of the urban area of Mansfield has occurred in the past and a flood protection scheme to deal with this problem was completed in 1978. Under major flood conditions some roads in Ollerton and approximately 16 houses in Edwinstowe could possibly be affected by flooding.

The existing problems are currently being worsened by the increased flows from urban development in the Mansfield area.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 2/10 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			b

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£____
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

STWA have completed a capital scheme from Haughton Mill to downstream of Ollerton and Mansfield Woodhouse to Kings Mill Reservoir.

The section from Edwinstowe to Mansfield Woodhouse has been removed from the capital programme.

The total catchment area draining to the River Maun is approximately 189.5 sq km and the maximum estimated flood discharge is 34 cumecs.

DEVELOPMENT

In calculating flows for design of improvement works due allowance has been made for future urban development in the Mansfield area.

BENEFITS

i) Urban

The protection against flooding of roads in Ollerton and approximately 5 houses in Edwinstowe.

ii) Agriculture

Each reach is very variable in current agricultural production. Much land floods or has high water tables, but many fields of winter corn grow well right up to the bankside. Gross margins included are reduced to take account of the fact that some land in each reach will be improved from grass to arable. River improvement is needed to enable existing underdrainage systems to function satisfactorily. Limited additional field drainage work is required.

iii) Future Development

It is estimated that 200 ha of development is likely in the future.

RECREATION, FISHERIES AND AMENITY

Fishing interests, the Nature Conservancy Council and the Nottinghamshire Trust for Nature Conservation are being consulted regarding the proposed improvements.

A NTNC reserve is proposed at SK 570 635 (Garibaldi Pond and Plantation). A site of natural history interest is within the benefit area.

IDENTIFICATION

Problem code number(s):	5-94-210-52/53, 5-94-510-1/2/3/4, 5-98-110-9
Watercourse:	River Meden (main river)
Location:	West Drayton/Pleasley (Bassetlaw, Mansfield and Bolsover District Councils)
OS Map reference:	SK 703 751, SK 496 633

NATURE OF PROBLEM

The lower reaches of the River Meden were improved in 1964, but other than some pioneer improvement work, minor channel improvement at Gleadthorpe and subsidence remedial works, no substantial improvements have been carried out on the upper reaches. Eight properties have been reported as affected by flooding at Pleasley and some at Warsop. Apart from these areas the River Meden flows mainly through a rural valley where the problems are lack of freeboard, and surface water drainage problems resulting from mining subsidence. In addition the structural stability of the Mill Dam at Pleasley is suspect.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in years
(b) **Agricultural**	(i)	Channel	1 in 2 years
	(ii)	Structures	1 in 10/25 years
(c) **Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£_____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£_____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

STWA carried out a capital scheme from Church Warsop to Hind Carr Wood and a small scheme at Pleasley Vale. The section from Thoresby Lake to Budby along with improvements at Pleasley was not improved due to insufficient benefits. Both schemes were rechargeable to British Coal.

CONSERVATION

Officially designated SSSI's exist at Warsop Vale (Hills, Holes & Sookholme Brook, SK 555 678) and Thoresby (SK 630 703). Consultations will take place prior to any scheme design with the Nature Conservancy Council and any other interested bodies, on the possible effects of drainage work.

A County Site of Natural History Interest is located at SK 544 660 (Oxpasture Subsidence). A site of natural history interest is located within the benefit area.

SUBSIDENCE

The Meden is liable to the effects of future mining subsidence.

FISHERIES

Thoresby Lake is a good trout fishery. From Warsop downstream the Meden is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-210-55
Watercourse:	Misterton Drain (non-main river)
Location:	Misterton (Bassetlaw District Council)
OS Map reference:	SK 785 940 to SK 779 939

NATURE OF PROBLEM

Flooding took place at Newell's Corner in July 1973, the extent of which is not known although the road adjacent to Newell's Works, part of the works and the adjacent garage were affected. This is in the district of Laneham Internal Drainage Board.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	28,830	
	(ii)	Field drainage	£		£28,830
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		
	(iv)	Development	£	60,050	£60,050
(c) **Benefit/cost ratio**					2.0
(d) **Priority category**					1E

IMPROVEMENT WORKS

This problem has been discussed with the Consulting Engineers to Laneham Internal Drainage Board. It would appear that it may be possible for some flow to be diverted into the Board's system draining to Weir Dyke Pumping Station by the provision of an overflow pipe (approx. 475 m diameter), and the regrading of some 130 m of watercourse with associated enlargement at several field crossings.

DEVELOPMENT

Approximately 6 ha are scheduled for development within the catchment.

BENEFITS

The new development will require improvements to the watercourse and hence benefits have been based on 6 ha of development.

IDENTIFICATION

Problem code number(s):	5-94-210-57
Watercourse:	Saundby Beck (non-main river)
Location:	A620, Saundby (Bassetlaw District Council)
OS Map reference:	SK 784 883

NATURE OF PROBLEM

Flooding of the A620 and one dwelling occurred in June 1983 as a result of the surcharging of the culvert under the A620.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Nottinghamshire County Council has carried out improvements in the vicinity of this culvert.

IDENTIFICATION

Problem code number(s):	5-94-210-58
Watercourse:	Un-named (non-main river)
Location:	Church Lane/Main Street, Clarborough (Bassetlaw District Council)
OS Map reference:	SK 733 833/SK 732 835

NATURE OF PROBLEM

Flooding of Church Street and Main Street and two dwellings occurred in May and June 1983 and on previous occasions. The problem is caused by insufficient watercourse and access culvert capacity, together with a lack of maintenance and the effect of the syphon under the Chesterfield Canal.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IDENTIFICATION

Problem code number(s):	5-94-210-59
Watercourse:	Un-named (non-main river)
Location:	A631, Ravencroft Lane, High Street, Rectory Gardens, Low Street, Beckingham (Bassetlaw District Council)
OS Map reference:	SK 778 901

NATURE OF PROBLEM

The A631 Beckingham By-Pass cuts across the catchment of two watercourses. Flooding occurred in May and June 1983 following heavy rain. Run-off from the two catchment areas collected to the west of the by-pass before flooding across the highway and surcharging the village watercourses and surface water sewerage system. Highways within the village together with gardens and properties were affected.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

A new 375mm diameter relief sewer was constructed along High Street by Bassetlaw District Council as agents for Severn Trent Water in 1988.

IDENTIFICATION

Problem code number(s):	5-94-210-60
Watercourse:	None
Location:	Blyth Road, Harworth (Bassetlaw District Council)
OS Map reference:	SK 618 910

NATURE OF PROBLEM

Severe flooding to Blyth Road, agricultural land and Harworth Engineering Limited recurred in May and June 1983.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-94-310-1
Watercourse:	River Trent (main river)
Location:	Attenborough (Broxtowe District Council)
OS Map reference:	SK 520 340 and SK 520 350

NATURE OF PROBLEM

Attenborough is within the floodplain of the River Trent and is surrounded on three sides by water filled gravel pits. Flooding to the village perimeter takes place regularly when the village green and the road known as The Strand are inundated. Two properties were flooded in 1977, but a scheme carried out in May 1979 now ensures that all property within the village is defended against river flooding of the same magnitude as 1947 (ie. 1 in 50 years return period).

In the areas of Chilwell, Beeston and Beeston Rylands, which adjoins the northernmost gravel pits (now a Nature Reserve) flooding occurs to gardens, allotments, rugby pitches and to a golf course. These areas are drained by minor watercourses which discharge into the northern gravel pits. High water levels in these ponds during flood conditions affect the discharge of these watercourses and must contribute towards the flooding.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in 50 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				See below

IMPROVEMENT WORKS

Both the flooding problems referred to would be improved if the present interconnection between the Trent, the Erewash and the gravel pits was to be closed. However, this will not be possible until Trent Gravels Limited complete gravel extraction in the area near Long Eaton. They estimate that this might take another 10/12 years.

A bund has been constructed by Trent Gravels Limited which separates the northern part of the pits from the areas open to barge traffic. The bund, together with improvements to the existing outfall and construction of a new dewatering outfall at SK 519 335, has helped to alleviate the problem.

BENEFITS

The benefits of the above works are very difficult to qualify. Nevertheless, the deteriorating flooding and drainage problems of the area do warrant some remedial action.

CONSERVATION

Attenborough Gravel Pits is a statutory SSSI. The Nature Conservancy Council has been consulted and has requested that nothing should be done to increase the quantity of Erewash water in the gravel pits.

IDENTIFICATION

Problem code number(s):	5-94-310-2
Watercourse:	Un-named (non-main river)
Location:	Attenborough (Broxtowe District Council)
OS Map reference:	SK 514 344

NATURE OF PROBLEM

Flooding occurs to two factories and adjoining land at the junction of the A453 road and Barratt Lane, Attenborough. The flooding occurred in February 1977 and is estimated to have a frequency of 1 in 15 or 20 years. The area drains to the Trent via two 2.5 m culverts beneath the Nottingham to Derby railway line. Adjacent properties are built at a higher level.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	54,780	
	(ii)	Field drainage	£		£54,780
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	40,030	
	(iii)	Roads/Railways	£		£40,030
(c) **Benefit/cost ratio**					0.7
(d) **Priority category**					3D

IMPROVEMENT WORKS

Further investigation is needed to establish the extent to which flooding is attributable to the Trent. It is possible that this may be due to direct back flow through the inadequately sealed old railway culverts. Alternatively, the flooding may be due to surface water unable to discharge because of high Trent levels. In this case the solution indicated would be some arrangement of pumping facility, which would appear to be unjustified on economic grounds. A provisional estimate has been made, therefore, on the assumption that works would consist of improvements in the sealing of the old culverts by cut-off walls, penstock chambers and fitting of flap valves.

Broxtowe District Council has programmed a scheme for 1992/93.

DEVELOPMENT

The catchment area of about 1.6 sq km is already extensively developed and only minor infilling is likely in the future.

BENEFITS

The benefits assessed result entirely from alleviation of flooding to the two factories.

CONSERVATION

The Attenborough Nature Reserve is immediately downstream of the railway but the works envisaged should have no effect on the area.

IDENTIFICATION

Problem code number(s):	5-94-310-3
Watercourse:	Outfall to River Trent (non-main river)
Location:	Attenborough (Broxtowe District Council)
OS Map reference:	SK 525 355

NATURE OF PROBLEM

The Nottingham-Derby railway line embankment acts as the major Trent flood defence. A stream passes through the embankment in a culvert with a penstock on the downstream end to form the flood control when the Trent level is high. When the penstock is closed, high flood levels in the stream have caused flooding, in 1977 to floor level of a 5 ha residential development to the east of Meadow Lane.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in 100	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	28,830	
	(ii)	Field drainage	£		£28,830
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	217,680	
	(iii)	Roads/Railways	£		£217,680
(c) **Benefit/cost ratio**					7.6
(d) **Priority category**					1E

IMPROVEMENT WORKS

It is not considered feasible to improve the discharge capacity of the culvert under the railway. Similarly, a pumping station to deal with the whole of the 100 year flow from the catchment (referred to in problem 5-94-310-13) would result in costs out of proportion to the amount of benefit. In common with other areas built on the Trent Valley gravel beds, enhancement of groundwater levels is a possibility under sustained high river levels.

A valuable improvement would be the construction of a manhole chamber, with flap valve at the downstream end, to enclose the existing penstock. This will allow automatic control of the tributary stream outfall and at the same time save manpower flood operating conditons. The existing penstock would remain to act as a second line of defence in the event of the flap valve failing to make the necessary seal.

BENEFITS

It is estimated that some 70 properties could be at risk under 100 year conditions and on this basis benefit has been assessed at £217,680.

CONSERVATION

This is the site of Attenborough Nature Reserve and is known to be of natural history interest.

IDENTIFICATION

Problem code number(s):	5-94-310-8
Watercourse:	Bishops Dyke (non-main river)
Location:	Trowell (Broxtowe District Council)
OS Map reference:	SK 484 395 and SK 483 397

NATURE OF PROBLEM

At Nottingham Road, 4 bungalows were affected in 1967 and 1977 by flooding upstream of the road culvert. The watercourse has been affected by erosion of the bed and banks which has resulted in a slip in the motorway embankment and bank stabilisation is required.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	25,950	
	(ii)	Field drainage	£		£25,950
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	22,520	
	(iii)	Roads/Railways	£		£22,520
(c) **Benefit/cost ratio**					0.9
(d) **Priority category**					3E

IMPROVEMENT WORKS

The Brook requires regrading for a length of 340 m and further protection can be given to the properties by the construction of a small floodbank along the rear boundaries. The existing grille on the upstream side of the Nottingham Road culvert is inadequate and will require replacing. In addition, some modification of the outlet works downstream of the motorway culvert is likely to be of advantage.

Houses and gardens of properties on Stapleford Road have been affected by flooding but, since improvements were carried out by the District Council, it is now clear that the existing flooding results from the sewerage system and the solution is, therefore, outside the scope of this Survey.

A floodbank with a flapped outfall was constructed in 1980 to the rear of properties on Nottingham Road.

IDENTIFICATION

Problem code number(s):	5-94-310-9
Watercourse:	Gilt Brook (non-main river)
Location:	Awsworth (Broxtowe District Council)
OS Map reference:	SK 483 447

NATURE OF PROBLEM

A factory (precast concrete units) flooded in February 1977 (a 1 in 15 years event). The factory is sited near the confluence of the Gilt Brook with a major tributary draining from Kimberley and flooding occurred as a result of an oil drum becoming lodged in a culvert on this tributary.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in 100	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	1,440	
	(ii)	Field drainage	£		£1,440
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	7,510	
	(iii)	Roads/Railways	£		£7,510
(c) **Benefit/cost ratio**					5.2
(d) **Priority category**					1F

IMPROVEMENT WORKS

Since February 1977 a regrading scheme has been carried out on the channel by the District Council and the channel is now considered to be of adequate capacity.

Broxtowe District Council have fitted a new grille at the entrance to the culvert but the degree of alleviation has not yet been assessed.

IDENTIFICATION

Problem code number(s):	5-94-310-12
Watercourse:	Un-named (non-main river)
Location:	Beeston Rylands (Broxtowe District Council)
OS Map reference:	SK 535 355

NATURE OF PROBLEM

Flooding and waterlogging occurs on allotments on the upstream side of the Trent floodbank. The watercourse discharges through the bank via a 1.2 m diameter pipe fitted with a flap valve. There is also a hand operated penstock. When the Trent is high, water cannot discharge and ponds up behind the bank causing flooding to the adjacent allotments. There is very little freeboard available immediately upstream of the bank, so that flooding tends to occur frequently and parts of the gardens are waterlogged for much of the winter.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	2 years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

It is not possible to improve the drainage of the site by regrading as this would involve lowering the culvert in the floodbank, the cost of which would be prohibitive. The alternatives would be to raise the area or provide pumping, but again these would be very expensive. Therefore, in order to provide some measure of flood alleviation to the allotments without causing problems upstream, it would be possible to construct a low floodbank (say 1 m high) along the eastern bank of the watercourse for a distance of some 100 m immediately upstream of the main floodbank. This would have the effect of reducing the frequency of the flooding from 1 in 1 year to 1 in 2 years (approximately). The watercourse should also be cleaned out over this length. It would be necessary to ensure that flood levels upstream were not enhanced by a floodbank. Although Broxtowe District Council completed improvements in 1982, the problem still remains when the River Trent is in flood.

RECREATION

The affected area provides recreational facilities for 16 or 17 plot holders which could be lost owing to the flooding.

CONSERVATION

This is the site of an SSSI and a County Trust Reserve.

IDENTIFICATION

Problem code number(s):	5-94-310-13
Watercourse:	None
Location:	Crofton Road, Attenborough (Broxtowe District Council)
OS Map reference:	SK 516 348

NATURE OF PROBLEM

The surface water sewer serving the development at Crofton Road appears to be of inadequate capacity and is set too low to allow free drainage from its outfall. In February 1977, 30 properties were affected by flooding to a maximum depth of 350 mm and it is likely that a much larger number could be affected by a more serious flood (greater than the 1 in 20 years event). The sewer discharges to an open watercourse and from there via a 200 m concrete box culvert under Meadow Lane to the Trent. A penstock on the downstream end of the culvert prevents Trent water from backing up the watercourse. During high Trent levels the penstock may be closed, allowing the Brook to back up, thus exacerbating the problem.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	348,830	
	(ii)	Field drainage	£		£348,830
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	435,370	
	(iii)	Roads/Railways	£		£435,370
(c) **Benefit/cost ratio**					1.2
(d) **Priority category**					2C

IMPROVEMENT WORKS

It is suggested that the existing surface water sewer is replaced with one of 900 mm diameter which would be adequate to take surface water run-off. Because of the restrictions on levels imposed by an ornamental pond at the Chilwell Comprehensive School and the culvert under Meadow Lane, it seems unlikely that improvements to the watercourses downstream of the pond could be effected. An alternative could be to construct a headwall and flap in the watercourse upstream of the pond and provide a pumping station of approximately 0.5 cumec capacity. This would operate when the pond level, influenced by the Trent, was high enough to close the flap valve. An associated flap valve from Long Lane to the School would have a top level at 0.6 m above the level of the 1947 flood (28.2 m).

An alternative to the above scheme (see 5-94-310-3) would be to provide pumping capacity for the whole catchment to the Meadow Lane culvert. Although protecting many more properties, the cost of installation is considered prohibitive.

Further investigation is required to determine whether a pumping scheme would satisfactorily cope with any percolation through gravels under flood conditions.

No works are currently programmed.

HYDROLOGY

TRRL Road Note 35 was used to estimate discharges from the sewer under flood conditions having approximately a 1 in 100 years return period (0.5 cumecs).

BENEFITS

Approximately 100 houses may be affected by a 100 year flood.

CONSERVATION

This location is adjacent to a County Trust Reserve and an SSSI.

IDENTIFICATION

Problem code number(s):	5-94-410-1
Watercourse:	River Trent (main river)
Location:	Stoke Bardolph (Gedling Borough Council)
OS Map reference:	SK 648 421

NATURE OF PROBLEM

A public house is subject to flooding. This property is within the River Trent floodplain and in this location flooding is inevitable.

For practical purposes, alleviation is best dealt with by adequate flood warning to minimise damage. Flood proofing of the property could also be considered but it is unlikely to be cost effective.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

CONSERVATION

The problem is adjacent to a site of natural history interest.

IDENTIFICATION

Problem code number(s):	5-94-410-2, 5-94-610-24/25/26/27/33/43, 5-94-810-52
Watercourse:	River Trent (main river)
Location:	River Derwent confluence to Cromwell Weir (Gedling and Rushcliffe Borough and Newark District Councils)
OS Map reference:	SK 459 309 to SK 809 611

NATURE OF PROBLEM

All problem areas are located in the floodplain of the River Trent and are representative of areas affected by minor floods. Such areas occur throughout the entire length of the fluvial reach from the Derwent confluence to Cromwell Weir. In many places the land is protected to some degree by floodbanks formed many years ago, the condition of which now varies and which, in some cases, have been affected by erosion of the river channel (eg. Newark Cut).

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Periodic flooding of this agricultural land in the floodplain is essential in order to protect urban areas downstream. Whilst such areas must of necessity be retained as floodplain, there would be some benefit in the reduction of the frequency of inundation. However, this requires more extensive investigation than can be carried out within the limits of this Survey.

CONSERVATION

5-94-410-2, 5-94-610-43 and 5-94-610-27 are sites of natural history interest.

SUBSIDENCE

5-94-610-2 - area of watercourse which may be affected by future mining subsidence.

FISHERIES

The Trent is a good coarse fishery upstream of Gainsborough.

IDENTIFICATION

Problem code number(s):	5-94-410-3
Watercourse:	Crock Dumble/Vicarage Drain (non-main river)
Location:	Burton Joyce (Gedling Borough Council)
OS Map reference:	SK 646 436

NATURE OF PROBLEM

The Crock Dumble and its tributary Vicarage Drain flow through Burton Joyce to discharge into the River Trent. The area has been affected to some degree by subsidence. The natural channels of both watercourses have been restricted by culverting and inadequate maintenance. When the River Trent is in flood the outfall discharge of the stream is impeded, leading to high levels with consequent flooding and drainage difficulties in the lower part of the village. In the past, flooding has also been partly due to the direct effect of the Trent. This has now been alleviated by construction of a major defence at the outfall of the stream. It is estimated that 22 properties were at risk in February 1977 from the Crock Dumble and Vicarage Drains alone. On that occasion flooding was averted by emergency pumping at the outfall.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	288,290	
	(ii)	Field drainage	£		£288,290
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	175,150	
	(iii)	Roads/Railways	£		£175,150
(c) **Benefit/cost ratio**					0.6
(d) **Priority category**					3C

IMPROVEMENT WORKS

Whilst some improvement in the capacity of the watercourses could be obtained by regrading and enlargement of culverts, the major threat of flooding now arises from the inability of the stream to discharge against Trent flood levels. Provision of some pumping facility at the outfall would overcome that problem. The catchment area is 2.25 sq km and a satisfactory standard of protection could probably be achieved by pumps capable of dealing with a 10 year flow estimated at 1.3 cumecs. The channel may require to provide for a larger flow.

More investigation and survey would be necessary to determine the full extent of improvement works required.

Allowance has been made in this estimate for improvement of some 1.5 km of the Crock Dumble, together with some provision on the Vicarage Drain.

BENEFITS

Benefit assessment is based on an estimated number of properties at risk under more severe conditions than those in February 1977. These include an old people's home which in 1977 was evacuated, and which is reported to be subject to fairly frequent drainage difficulties in wet weather.

SUBSIDENCE

The watercourses are in an area liable to mining subsidence.

AMENITY

In the higher parts of the village, whilst the stream is in need of improvement, the extent of this may be influenced by a need to balance amenity value against flood risks.

CONSERVATION

Crock Dumble is a site of known natural history interest.

IDENTIFICATION

Problem code number(s):	5-94-410-4
Watercourse:	None
Location:	Burton Joyce (Gedling Borough Council)
OS Map reference:	SK 643 434

NATURE OF PROBLEM

Flooding of gardens to some properties which occurred in February 1977 was due to surcharging of a surface water sewer. As no watercourse is involved the problem is outside the scope of this Survey.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-94-410-5
Watercourse:	Ouse Dyke (non-main river)
Location:	Gedling (Gedling Borough Council)
OS Map reference:	SK 622 425

NATURE OF PROBLEM

The catchment consists of a fairly steep sided valley which is 80% developed, giving rapid and intense run-off. The existing bridges and watercourse are capable of accepting the 10 year storm flows, but the 100 year condition will not be contained. Flooding at Jessops Lane is caused by an inadequate stream culvert system, as is the case at Chandos Street, Willow Lane, Conway Road and an access road upstream of Main Road, Gedling.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	213,330	
	(ii)	Field drainage	£		£213,330
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	17,510	
	(iii)	Roads/Railways	£		
	(iv)	New development	£	100,080	£117,590
(c) **Benefit/cost ratio**					0.5
(d) **Priority category**					3C

IMPROVEMENT WORKS

The Ouse Dyke should be improved generally throughout the section of open channel to a 1 in 100 year standard as the area is highly urbanised. There is one road culvert at Jessops Lane which is undersized, causing flooding and which must be reconstructed.

The discharge has been calculated based upon the capacity of the surface water sewers, and the 100 year flow is estimated at 10 cumecs at Burton Road from a catchment area of approximately 11 sq km.

The Colwick Loop Road construction included some improvements from Conway Road to Chandos Street. Flooding in May 1989 was caused by blocked screens on the Colwick Loop Road culverts. These are being removed and fencing is being erected instead.

DEVELOPMENT

A possible 10 to 15 ha of development may take place and this has been allowed for in calculating the design discharge.

BENEFITS

An approximate estimate of benefits has been obtained from the investigation into the possible flooding of properties adjacent to the watercourse. Some future development is allowed for also. The benefits are sufficient to give a cost/benefit ratio of only 0.5, but it may be possible for partial improvement to be more readily justified, at lower cost.

SUBSIDENCE

The watercourse is in an area, part of which may be affected by future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-410-6
Watercourse:	Un-named Trent Tributary (non-main river)
Location:	Gedling (Gedling Borough Council)
OS Map reference:	SK 628 424

NATURE OF PROBLEM

There are six properties which are affected by sub-floor flooding in this area of Newark Internal Drainage District. In addition, frequent flooding of pasture land occurs and affects 7.7 ha of land.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	5 years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

These require the regrading of approximately 1.0 km of the main channel and improvements to 11.1 km of field drains.

Some of the pasture land has been developed for residential purposes and improvements have been carried out to the watercourse.

The sub-floor flooding is inevitable when the River Trent is in flood due to the gravel sub-strata.

BENEFITS

It is estimated that 16 properties may be affected up to floor level in a flood of 100 year magnitude. Additional benefit may be derived by the improvement of drainage to 7.7 ha of pasture land. It is possible that a change to arable could result in greater benefit.

SUBSIDENCE

The last active working in that area was in the 1950's. The area does, however, fall within the region designated for possible future extraction.

IDENTIFICATION

Problem code number(s):	5-94-410-7
Watercourse:	Un-named (non-main river)
Location:	Colwick Vale (Gedling Borough Council)
OS Map reference:	SK 616 406

NATURE OF PROBLEM

Flooding of an urban area occurs from a watercourse which crosses Vale Road and the Colwick Industrial Estate to outfall to the River Trent. As part of the Trent major flood defence the outfall is controlled by a penstock and flap valve. Under major flood conditions discharge from the watercourse is impeded by high Trent levels. In February 1977 this condition resulted in flooding on Vale Road, which affected terrace houses and two factories. Restriction on the capacity of the drainage system is imposed by urban encroachment, past development and the general condition of the stream.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	686,130	
	(ii)	Field drainage	£		£686,130
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	72,560	
	(iii)	Roads/Railways	£		£72,560
(c) **Benefit/cost ratio**					0.1
(d) **Priority category**					3B

IMPROVEMENT WORKS

Improvements would probably be directed towards pumping flows from the watercourse to the Trent under adverse conditions of gravity discharge. In 1975 a report, by a firm of Consulting Engineers, recommended the construction of a pumping station based on a minimum capacity of 5.4 cumecs, estimated at that time to have a return period of 1 in 2 years.

Following the flood of February 1977, the Local Authority installed a pumping unit at the outfall to the Trent as a temporary measure. This pump is still maintained and is understood to have provided some benefit to the drainage system, but no conditions of severity approaching those of 1977 have occurred since then. The capacity of this pump is given as 1 cumec.

A detailed investigation would be required to determine the optimum size of pumps and necessary channel works. Such an investigation should also study the effects of sustained high Trent levels on the water table. For the purpose of this Survey Report, a permanent pumping capacity of 3.5 cumecs has been assumed together with cleaning out of culverts and channel.

DEVELOPMENT

The catchment is fully developed and only minor infilling is likely in the future. Colwick Loop Road crosses the stream and allowance has been made for additional run-off.

BENEFITS

In 1977 approximately 25 properties were affected by sub-floor flooding. It is estimated that, in the event of a 100 year flood, the depth would be significantly greater and will be above floor level in certain cases. The resultant benefits are low as flooding is infrequent.

IDENTIFICATION

Problem code number(s):	5-94-410-9
Watercourse:	Un-named (non-main river)
Location:	Linby (Gedling Borough Council)
OS Map reference:	SK 535 510

NATURE OF PROBLEM

Two small open watercourses flow into Linby Main Street, where they are separately culverted in old masonry structures and run parallel for some 120 m, thereafter joining in a single culvert. The total length of culverts to the confluence is 170 m, with a further 170 m downstream. On the upstream length the culverts are broken by lengths of open watercourse. The sizes of the culverts are inadequate to deal with higher flows (ie. in excess of 20 year return periods) and water then flows down the road, by-passing the culverts, to rejoin the open stream east of the village. However, no flooding to property occurs and, as this is likely to be the case during the 100 year event, it is considered that improvements to the watercourse are not appropriate in view of the negligible benefits.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

CONSERVATION

This is a site of known natural history interest.

SUBSIDENCE

The watercourse is in an area, part of which may be affected by future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-410-11
Watercourse:	Un-named (non-main river)
Location:	Woodborough (Gedling Borough Council)
OS Map reference:	SK 633 478

NATURE OF PROBLEM

In 1977, blockage in culverts beneath Main Road, Woodborough, caused water to overtop the banks of the watercourse and flow down Main Road; two semi-detached cottages were also flooded. Because of development encroachment and culverting of the watercourse, flooding in the village is inevitable. However, based on past information, damage is limited in extent and thus major improvements are difficult to justify. Gedling Borough Council have undertaken some improvement works to the inlets to the culverts following the flooding, and it is essential that the Brook should be efficiently maintained to mitigate any adverse effects of flooding.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 25 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

In order to reduce flooding from lower frequency flows and to provide a measure of protection against blockage at the culvert inlet, it may be possible for a dwarf wall to be constructed on the north side of the Brook adjacent to the flooded property. Care should be taken to ensure that conditions are not made worse in the event of the wall being overtopped. In addition, it is suggested that the masonry boundary wall above the inlet be replaced with an open fence so that flood flows in excess of the culvert's capacity can pass freely onto the road. It is thought unlikely that conditions downstream (ie. along the road) will be worsened significantly. A first estimate of the 100 year flood gives a flow of about 4 cumecs from a rural catchment of 6.2 sq km. Gedling Borough Council have carried out some improvements to mitigate the effect of flooding in Main Street.

A scheme to attenuate flood flows by on-line storage in the steam has been abandoned due to objections by the landowner and the Parish Council.

BENEFITS

The benefits are small because the flooded property is affected only by the lower frequency events, except in cases when blockage occurs.

CONSERVATION

Woodborough Village is a conservation area.

SUBSIDENCE

The watercourse is in an area of which part might be subject to future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-410-12
Watercourse:	Cocker Beck (non-main river)
Location:	Lambley (Gedling Borough Council)
OS Map reference:	SK 630 452

NATURE OF PROBLEM

Owing to inadequate watercourse and culvert capacity during times of high run-off, flooding occurs along Main Street through overtopping. Flooding is confined to the road which, together with the Beck, is in the bottom of a fairly steep sided valley. Surrounding property is elevated above the likely 100 year flood level. The road is of local importance only and it is considered that improvement works are not appropriate since any benefits would be minimal.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Improvements and partial culverting downstream of Church Street were completed in 1989. This is expected to improve the flow through the village.

CONSERVATION

This is a County Site of Natural History Interest as designated by the Nottinghamshire Trust for Nature Conservation.

SUBSIDENCE

The watercourse is in an area of which part may be affected by future mining subsidence.

FISHERIES

Some of the watercourse is fished.

COMMENT

The main cause of flooding in the past has been lack of maintenance of the roadside stream. Some maintenance has been carried out and will be continued.

IDENTIFICATION

Problem code number(s):	5-94-410-13
Watercourse:	Tributary of River Leen (non-main river)
Location:	Newstead (Gedling Borough Council)
OS Map reference:	SK 531 537

NATURE OF PROBLEM

Flooding of woodland is due to past subsidence. Very little agricultural land is affected.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Improvements can be made but, as there is little or no benefit to be gained, no scheme would be cost effective. Although the land is unlikely to be drained, it may be desirable to provide a more adequate culvert through the access road.

SUBSIDENCE

This is still an area of active coal mining subsidence.

CONSERVATION

This is a known site of natural history interest.

FISHERIES

This is a coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-510-6
Watercourse:	Sookholme Brook (non-main river)
Location:	Sookholme (Mansfield District Council)
OS Map reference:	SK 554 679 to SK 541 665

NATURE OF PROBLEM

52 ha of agricultural land from downstream of Shirebrook Water Reclamation Works to the confluence with the River Meden suffer from inadequate arterial drainage.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	2 years
		(ii)	Structures	1 in	25 years
(c)	**Land potential category**				a

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	314,240	
		(ii)	Field drainage	£		£314,240
(b)	**Present value of benefits**	(i)	Agriculture	£	513,990	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£513,990
(c)	**Benefit/cost ratio**					1.6
(d)	**Priority category**					2C

IMPROVEMENT WORKS

The recommended solution includes the regrading of Sookholme Brook from Shirebrook Water Reclamation Works to the confluence with the River Meden and the replacement of Sookholme Lane road bridge.

To provide an adequate outfall, the River Meden should also be regraded from just upstream of the Meden/Sookholme Brook confluence to the lake area in Warsop.

Some 3.4 km of Sookholme Brook would be regraded to carry the 2 year flow of 3 cumecs, and allow satisfactory freeboard for field drainage under normal flow conditions.

DEVELOPMENT

There are 16.3 ha of development underway or proposed in Shirebrook which would discharge into the Sookholme Brook, but the proposed improvements, although they are designed to take this additional flow, would not be significantly affected by the run-off from the development sites.

BENEFITS

The land is largely used for dairy cattle and other grazing stock. The lowering of the water level should provide drainage benefit with little or no need for field drainage.

CONSERVATION

An area of the Sookholme Brook - River Meden confluence could be affected and the Nature Conservancy Council will be consulted. Whilst this is not designated an SSSI, the watercourse is of considerable value, and is fished.

SUBSIDENCE

The watercourse has been affected by subsidence and the area may be affected by future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-610-2
Watercourse:	River Trent and tributaries (main river)
Location:	Carlton-on-Trent (Newark and Sherwood District Council)
OS Map reference:	SK 798 636

NATURE OF PROBLEM

The Village is situated at the edge of the River Trent Washland, and is subject to flooding from the river and from tributary watercourses which are unable to discharge when the river level is high. In February 1977 six properties were flooded, with the flood water reaching floor level at a further six properties.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in 100 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	138,780	
		(ii)	Field drainage	£		£138,780
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£	75,060	
		(iii)	Roads/Railways	£		£75,060
(c)	**Benefit/cost ratio**					0.5
(d)	**Priority category**					3C

IMPROVEMENT WORKS

Work would consist of:

i) The provision of some 2,300 m of floodbank to the rear of Great North Road, around Beck Cottage and along the watercourse which passes under the A1 trunk road.
ii) Raising the road level at Ferry Lane for approximately 150 m.
iii) Provision of flap valves to all outfalls.

BENEFITS

The benefit has been evaluated using an estimted 30 properties and 1 pumping station which are liable to be affected during a 100 year flood event.

DEVELOPMENT

Some 2.4 ha of residential development have been programmed for the Carlton-on-Trent area. This has not been included in any of the calculations as there would be no significant effect on the drainage system.

CONSERVATION

This is a site of known natural history interest.

FISHERIES

The Trent is a good coarse fishery upstream of Gainsborough.

IDENTIFICATION

Problem code number(s):	5-94-610-17
Watercourse:	Cuckstool Dyke (non-main) and River Trent (main river)
Location:	Sutton-on-Trent (Newark and Sherwood District Council)
OS Map reference:	SK 802 659

NATURE OF PROBLEM

Flooding of 16 properties occurred in February 1977, probably due to a combination of seepage under the River Trent major floodbank and flooding from Cuckstool Dyke, which was unable to discharge due to the high water level in the Trent.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in 100 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£		
		(ii)	Field drainage	£		£see below
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£	121,350	
		(iii)	Roads/Railways	£	500	£121,850
(c)	**Benefit/cost ratio**					
(d)	**Priority category**					

IMPROVEMENT WORKS

To discharge the flow from the Cuckstool Dyke under Trent flood conditions would entail pumping. Newark IDB have already purchased 3 portable pumps which will be made available at the Sutton-on-Trent outfall in times of flood. It is, however, considered improbable that flooding can be prevented by pumping alone, as most of the water is believed to be due to seepage from the River Trent. A more detailed investigation of the sub-strata is necessary to estimate the depth and size of cut-off required. Therefore a cost cannot be calculated until such a survey is carried out. It is likely that the cost would be prohibitive in comparison with the economic benefits.

The flow in the Cuckstool Dyke is estimated to be in the order of 1.0 cumec for a 1 in 10 year event.

The effects of minor floods on the River Trent have been limited by the raising of the minor floodbank and the Grassthorpe Beck banks. The mobile pumps are now required much less frequently.

BENEFITS

Benefits have been evaluated assuming an estimated 33 properties and one pumping station are affected during a 1 in 100 year magnitude flood event.

IDENTIFICATION

Problem code number(s):	5-94-610-18
Watercourse:	Cromwell Moor Drain (non-main river)
Location:	Cromwell (Newark and Sherwood District Council)
OS Map reference:	SK 795 627

NATURE OF PROBLEM

Flooding of approximately 20 ha of agricultural land at the downstream end of the drain is due to the combined effects of Carlton Beck and the River Trent.

At the upstream end approximately 45 ha suffer from insufficient freeboard and a high water table.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	10 years
	(ii)	Structures	1 in	10 years
(c) **Land potential category**			a	

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	193,150	
	(ii)	Field drainage	£	17,510	£210,660
(b) **Present value of benefits**	(i)	Agriculture	£	336,170	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£336,170
(c) **Benefit/cost ratio**					1.6
(d) **Priority category**					2C

IMPROVEMENT WORKS

Any improvement would probably take the form of a regrading scheme and pumping into the Carlton Beck. A pumping station in the order of 0.2 cumec would be necessary together with channel improvements on a length of about 2.4 km with bridge improvements.

The catchment area is approximately 81 ha.

BENEFITS

Following drainage improvements, an increase in gross margin on 67 ha of agricultural land would be expected as a result of the improvement in root cropping ability.

IDENTIFICATION

Problem code number(s):	5-94-610-19/20/21
Watercourse:	Caunton Beck (non-main river)
Location:	Caunton/Maplebeck (Newark and Sherwood District Council)
OS Map reference:	SK 745 601 to SK 694 628

NATURE OF PROBLEM

183 ha of agricultural land bordering the Beck suffer from inadequate drainage, and occasional flooding affects highways in Caunton Village.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	10 years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	265,230	
	(ii)	Field drainage	£	100,080	£365,310
(b) **Present value of benefits**	(i)	Agriculture	£	458,420	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£458,420
(c) **Benefit/cost ratio**					1.3
(d) **Priority category**					2C

IMPROVEMENT WORKS

General regrading and realignment of the watercourse for a length of 11.2 km is required, including improvement at a number of access bridges.

The catchment area is 56.5 sq km and the design discharge 16 cumecs, with satisfactory freeboard for field drainage under normal flow conditions.

Pioneering works have been carried out between SK 745 601 and SK 713 618, and additional culvert capacity at SK 729 602 following consultation with conservation interests.

BENEFITS

Following improvement works, an increase in gross margin is expected. The present cereals/grass cropping system could be improved with greater emphasis on arable farming.

FISHERIES

Account should be taken of fisheries interests.

CONSERVATION

There is a natural history interest (Nottinghamshire Trust) from SK 713 618 to SK 694 628. A Tree Preservation Order applies to the length from SK 729 602 to SK 713 618.

IDENTIFICATION

Problem code number(s):	5-94-610-22
Watercourse:	River Trent (main river)
Location:	North Muskham (Newark and Sherwood District Council)
OS Map reference:	SK 798 582

NATURE OF PROBLEM

The Village of North Muskham generally escapes flooding, most of the properties being above flood level or protected by a ridge of high ground. At the southern end, however, some isolated buildings are vulnerable under major flood conditions as are a few of the new properties in the Village.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in 100 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	28,830	
		(ii)	Field drainage	£		£28,830
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£	10,010	
		(iii)	Roads/Railways	£		£10,010
(c)	**Benefit/cost ratio**					0.3
(d)	**Priority category**					3E

IMPROVEMENT WORKS

Protection to 3 properties and farm buildings at the southern end of the Village would entail construction of a flood defence. Without levels, it is estimated that a 500 m long earth floodbank of marginal height, ie. about 0.6 m, would be necessary. Detailed levelling would be required to establish a suitable route and defence height.

The newer properties would need a low defence building through the rear gardens. However, having regard to the degree of flood risk and the situation in February 1977, no allowance has been made in this estimate for such work. An effective flood warning service would operate under major flood conditions.

CONSERVATION

This is a Country Site of Natural History Interest as designated by the Nottinghamshire Trust for Nature Conservation and the Royal Society for the Protection of Birds.

FISHERIES

Upstream of Gainsborough the Trent is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-610-28
Watercourse:	River Trent (main river)
Location:	Newark (Newark and Sherwood District Council)
OS Map reference:	SK 802 554

NATURE OF PROBLEM

Flooding of a glue factory occurs from the Navigation Arm of the River Trent. The premises, which are situated behind a main line railway embankment, are at risk under major flood conditions. This is due to flood water gaining access through an opening in the embankment, the last occasion being in February 1977.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in 100	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	28,830	
	(ii)	Field drainage	£		£28,830
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	17,510	
	(iii)	Roads/Railways	£		£17,510
(c) **Benefit/cost ratio**					0.6
(d) **Priority category**					3E

IMPROVEMENT WORKS

The opening in the railway embankment is used by the Glue Company for access purposes between units of the works. To allow this use to continue in all but major flood conditions, the property behind the railway could be protected by some kind of stop-log arrangement. This would be operated in conjunction with flood warning. Such an arrangement would obviously require agreement with the Company and would not protect that property on the river side of the railway line.

The need for measures to protect against any risk of flooding from the watercourse on the adjoining land, would have to be considered.

No levels or survey have been carried out for the purpose of this report but a provisional sum of £28,830 has been included as the estimated cost.

DEVELOPMENT

The defence works would need to take into account any effects of the proposed A46 by-pass road and this is still under investigation.

BENEFITS

The Company are aware of the flood risks and have taken steps to minimise damage. A very approximate evaluation has been made based on the effects of the 1977 flood. This occurred during the weekend and it is possible that damage resulting from other events could be greater.

IDENTIFICATION

Problem code number(s):	5-94-610-29
Watercourse:	River Trent (main river)
Location:	Newark (Newark and Sherwood District Council)
OS Map reference:	SK 802 558

NATURE OF PROBLEM

Flooding of the Water Reclamation Works area occurs under major Trent flood conditions. However, the operation of the Works is not adversely affected, the main units having been built above flood level. Flooding occurs from the drain on the east side of the railway, and alleviation of this problem is being investigated in connection with access and A46 Relief Road proposals. In general, the effects of flooding on the Works are not considered sufficiently serious to justify expenditure on protection works.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-94-610-30
Watercourse:	River Trent (main river)
Location:	Newark (Kelham Road) (Newark and Sherwood District Council)
OS Map reference:	SK 793 544

NATURE OF PROBLEM

25 houses are at risk from flooding due to their location in the River Trent floodplain.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The properties are to be protected as part of the current A46 Newark By-Pass Scheme by the construction of an earth floodbank around their western perimeter.

BENEFITS

These have been evaluated from known flood depths and extrapolated to 100 years conditions using information from Hydraulics Research Station tests in connection with the by-pass road.

FISHERIES

Upstream of Gainsborough the Trent is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-610-34
Watercourse:	River Trent (main river)
Location:	Newark (Tolney Lane) (Newark and Sherwood District Council)
OS Map reference:	SK 793 539

NATURE OF PROBLEM

Permanent caravan sites located in the floodplain of the River Trent are affected by major floods. The site receives a warning of potential flooding and this enables caravans to be moved to higher ground. No protection works can be recommended.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£____

(c) **Benefit/cost ratio**

(d) **Priority category**

COMMENT

The Local Authority is understood to be considering the possibility of re-siting the caravan sites out of the floodplain. NRA have consistently objected to the siting of any caravans within the floodplain.

IDENTIFICATION

Problem code number(s):	5-94-610-35
Watercourse:	Un-named (non-main river)
Location:	Crees Lane, Farndon (Newark and Sherwood District Council)
OS Map reference:	SK 780 526

NATURE OF PROBLEM

A 7 ha smallholding bordering the Trent suffers from poor drainage due to the gravel sub-strata. The A46 Newark By-pass will cross the area centrally and the drainage of the immediate area will be radically affected as a consequence.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

As part of the Newark By-pass Scheme, the banks along the River Trent are to be raised to the 1 in 100 year standard.

IDENTIFICATION

Problem code number(s):	5-94-610-36
Watercourse:	River Trent (main river)
Location:	Farndon (Newark and Sherwood District Council)
OS Map reference:	SK 769 521

NATURE OF PROBLEM

The effect of flooding on property in the Farndon Ferry area is marginal and associated with the location of the development at the edge of the River Trent floodplain.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

CONSERVATION

This is a County Site of Natural History Interest as designated by the Nottinghamshire Trust for Nature Conservation.

IDENTIFICATION

Problem code number(s):	5-94-610-37
Watercourse:	River Trent (main river)
Location:	Farndon (Newark and Sherwood District Council)
OS Map reference:	SK 765 510

NATURE OF PROBLEM

Flooding occurs to a filling station, one house and the A46 trunk road which are located on the edge of the floodplain of the River Trent. This occurs only in floods of about 15-20 year magnitude and greater.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in 100 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	129,730	
		(ii)	Field drainage	£		£129,730
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£	5,000	
		(iii)	Roads/Railways	£	32,530	£37,530
(c)	**Benefit/cost ratio**					0.3
(d)	**Priority category**					3C

IMPROVEMENT WORKS

A floodbank would be necessary to protect the area and this would be in the order of 1.6 km long. Any further investigation at this stage, would not be justified due to the apparent lack of economic viability of a protection scheme. The most practical means of alleviation would be by a flood warning system such as is already in operation.

If protection of the house alone was considered necessary, the cost would of course be much less but because of the relatively small risk, benefit would be proportionately low.

BENEFITS

The major benefit results from flooding of the A46 road which carries a weekday average traffic flow of 16,568 vehicles per day. After the 1977 flood the filling station became disused and benefit was not, therefore, attributed to this property. However, the filling station has now been rebuilt.

IDENTIFICATION

Problem code number(s):	5-94-610-38
Watercourse:	River Trent (main river)
Location:	Gibsmere (Newark and Sherwood District Council)
OS Map reference:	SK 723 488

NATURE OF PROBLEM

The Village is situated in the River Trent floodplain. Major floods surround the Village and although no property was flooded above floor level in 1977, floods of greater magnitude have directly flooded older properties in the Village. Indirect flooding through floor seepage has also occurred.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in 50	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	152,790	
	(ii)	Field drainage	£		£152,790
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	10,010	
	(iii)	Roads/Railways	£		£10,010
(c) **Benefit/cost ratio**					0.1
(d) **Priority category**					3C

IMPROVEMENT WORKS

Protection of the properties would entail construction of a ring floodbank around the perimeter of the Village. Such a proposal would have to be preceded by ground investigations in view of the seepage problem.

The length of bank would be about 1.1 km and would also necessitate construction of road ramps on the Village road.

BENEFITS

These have been based on an estimated 6 properties and a caravan park, which could be affected in events greater than 20 years. At least 6 properties were flooded in 1947. In view of the high cost of recommended works relative to the benefits, a protection scheme would not be economically viable.

CONSERVATION

This is a known site of natural history interest.

IDENTIFICATION

Problem code number(s):	5-94-610-39
Watercourse:	River Trent (main river)
Location:	Hoveringham (Newark and Sherwood District Council)
OS Map reference:	SK 700 465

NATURE OF PROBLEM

Hoveringham Village is situated on a gravel terrace in the floodplain of the River Trent. Under major flood conditions the Village is surrounded by water and there is a risk of flooding to some properties and roads. These have been affected by major floods in 1947, 1960 and 1977.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	50	years
	(ii)	Structures	1 in		years
(b) **Agricultural**	(i)	Channel	1 in		years
	(ii)	Structures	1 in		years
(c) **Land potential category**					

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	242,160	
	(ii)	Field drainage	£		£242,160
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	67,560	
	(iii)	Roads/Railways	£		£67,560
(c) **Benefit/cost ratio**					0.3
(d) **Priority category**					3C

IMPROVEMENT WORKS

Protection of the Village would be a relatively costly undertaking. For the purpose of this Survey, an estimate has been based on the construction of some 1,150 linear metres of earth floodbank together with road ramps.

These floodbanks will provide protection against the 1 in 50 years flood event (1,130 cumecs).

FLOOD WARNING

Effective flood warning arrangements are essential.

FISHERIES

Upstream of Gainsborough the Trent is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-610-40/41/42
Watercourse:	River Trent (main river)
Location:	Gunthorpe (Newark and Sherwood District Council)
OS Map reference:	SK 676 447, SK 678 443 and SK 683 438

NATURE OF PROBLEM

The 1977 flood, which was estimated to be a 1 in 20 year event, inundated parts of the Village on the east side of the A6097 road and flooded roads, gardens, a caravan site and the cellar of a public house. Following this, Newark Internal Drainage Board carried out improvements to minor watercourses. It is essential that the floodplain should continue to pass major floods unobstructed and thus there are limitations on the extent of possible flood protection works.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 50 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	1,010,510	
	(ii)	Field drainage	£		£1,010,510
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	146,370	
	(iii)	Roads/Railways	£		£146,370
(c) **Benefit/cost ratio**					0.1
(d) **Priority category**					3A

IMPROVEMENT WORKS

The cost of the protection works includes raising the A6097 road for 600 m and constructing flood defences alongside the River Trent to the south of the village. Protection has also been included to properties on Cottage Pasture Lane.

BENEFITS

Benefits have been assessed based on a 100 year flood affecting some 80 properties including 2 service garages. Road traffic disruption benefits have not been allowed for as flood water must always cross the A6097 road to the north of Gunthorpe to relieve upstream flood levels.

FISHERIES

Upstream of Gainsborough the Trent is a good coarse fishery.

CONSERVATION

Sites of natural history interest are adjacent to 5-94-610-40 and 5-94-610-41.

IDENTIFICATION

Problem code number(s):	5-94-610-45
Watercourse:	River Devon/River Trent (main river)
Location:	Newark (Newark and Sherwood District Council)
OS Map reference:	SK 789 534 to SK 788 531

NATURE OF PROBLEM

Newark Rowing Club and Newark Marina lie on opposite sides of the River Devon just upstream from the confluence with the River Trent. They are within the floodplain of both rivers and flood protection works cannot, therefore, be recommended. The A46(T) was flooded during February 1977 but was not impassable.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

FISHERIES

The Devon is a very good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-610-48
Watercourse:	River Devon (main river)
Location:	Newark (Newark and Sherwood District Council)
OS Map reference:	SK 789 530

NATURE OF PROBLEM

One isolated property situated in Devon Park is subject to flooding from the River Devon. It is not considered feasible to carry out any extensive works to protect this property from inundation in a major flood.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

FISHERIES

The Devon is a very good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-610-59
Watercourse:	Thorpe Drain* (non-main river)
Location:	Thorpe/East Stoke (Newark and Sherwood District Council)
OS Map reference:	SK 760 495

NATURE OF PROBLEM

Inadequate drainage of agricultural land occurs due to lack of channel gradient. In addition, flood conditions in the River Devon cause backing up in this watercourse.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 10 years
		(ii)	Structures	1 in 25 years
(c)	**Land potential category**			a5

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	273,880	
		(ii)	Field drainage	£	10,010	£283,890
(b)	**Present value of benefits**	(i)	Agriculture	£	negligible	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£negligible
(c)	**Benefit/cost ratio**					0
(d)	**Priority category**					3C

*In the Interim Report it is listed as the East Stoke Sewer.

IMPROVEMENT WORKS

These would entail construction of a pumping station of approximatly 0.9 cumecs capacity and regrading of the watercourse for a length of 5.3 km, including improvement at one road bridge. The drainage area amounts to 1.2 sq km.

BENEFITS

No increase in gross margin is anticipated as existing cropping is good. However, there may be some minor benefits through reduction in flooding over a very limited area.

IDENTIFICATION

Problem code number(s):	5-94-610-66
Watercourse:	Bevercotes Beck (non-main river)
Location:	Bevercotes/Boughton (Newark and Sherwood District Council)
OS Map reference:	SK 702 732 to SK 678 675

NATURE OF PROBLEM

There is inadequate arterial drainage affecting some 160 ha of agricultural land.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 5 years
		(ii)	Structures	1 in 10/15 years
(c)	**Land potential category**			a5

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	518,920	
		(ii)	Field drainage	£	137,620	£656,540
(b)	**Present value of benefits**	(i)	Agriculture	£	1,100,210	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		
		(iv)	Development	£	250,210	£1,350,420
(c)	**Benefit/cost ratio**					2.1
(d)	**Priority category**					1B

IMPROVEMENT WORKS

The works required would consist of channel regrading from the confluence of the Bevercotes Beck with the River Maun, upstream to the culvert adjoining Boughton Water Reclamation Works. The length of regrading involved is 8.3 km and footbridges and many farm access bridges would probably have to be replaced. Road and rail bridges would need cleaning out to provide for 10/25 year flows. A preliminary allowance has been made for this in the estimate but no detailed investigation of structures has been carried out.

The 5 year design discharge is estimated to be 5.1 cumecs from the total catchment of 21 sq km. Improved maintenance is required on the watercourse upstream of Boughton Water Reclamation Works as far as Wellow Village.

DEVELOPMENT

The County Structure Plan indicates land in the Ollerton/Boughton area of 230 ha for residential and industrial development, of this it is estimated that 100 ha would drain to Bevercotes Beck.

BENEFITS

The major benefit of an Improvement Scheme would be agricultural, and benefit has been evaluated on 220 ha of arable and pasture land. No agricultural benefit has been allowed for upstream of Tuxford Road (A6075).

Any Improvement Scheme would have to take into account future development in the catchment, and it is therefore considered reasonable to add to the agricultural benefit assessment some allowance to reflect the value of the new development.

SUBSIDENCE

Part of the Bevercotes Beck is within an area which could be affected by subsidence.

IDENTIFICATION

Problem code number(s):	5-94-610-67
Watercourse:	Rainworth Water (non-main river)
Location:	Ollerton to Rainworth (Newark and Sherwood District Council)
OS Map reference:	SK 651 672 to SK 582 579/SK 578 583

NATURE OF PROBLEM

The Rainworth Water flows through residential, agricultural, woodland and park areas.

The drainage of 195 ha of agricultural land served by the watercourse would benefit by improvement. Any such improvement work should, however, have regard to the nature of the watercourse which crosses the influent Bunter Sandstone Aquifer from which abstractions are made for water supply purposes.

Flooding affects property in May Lodge Drive, Rufford Park partly due to mining subsidence.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 5/10 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			a - 27 ha
			a5 - 140 ha
			b - 28 ha

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	784,150	
	(ii)	Field drainage	£	130,110	£914,260
(b) **Present value of benefits**	(i)	Agriculture	£	658,460	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		
	(iv)	Development	£	400,340	£1,058,800
(c) **Benefit/cost ratio**					1.2
(d) **Priority category**					2B

IMPROVEMENT WORKS

The Rainworth Water should be improved by regrading the existing channel so as to provide, through the agricultural areas, a 5 year channel design with satisfactory freeboard. This would entail work in the length of approximately 11.5 km on the watercourse, between its confluence with the River Manu at Ollerton and its upper reaches at Rainworth Village. New development in the higher part of the catchment will increase run-off. In order to deal with the resulting enhancement in flows and protect urban areas to an adequate standard, further provision against a 100 year flood may be needed on the Rainworth Water. For that purpose it has been assumed that the existing lake upstream of Rainworth Village can be utilised by modification to act as a balancing reservoir. Such a scheme would, however, require detailed feasibility investigation. In the absence of survey and level information an approximate estimate has been made of the extent of improvement works required.

The catchment areas are 20 and 61 sq kms at Rainworth and Rufford respectively. Peak flows may, however, be reduced by the influent nature of the watercourse. This, together with other factors, increases the complexity of this problem and will necessitate further investigation.

Several minor improvements have been carried out to improve the flow in Rainworth Water. Adjacent to Mickeldale Close, Bilsthorpe, the District Council has provided flood banks to the stream. Also, immediately north of the adjacent railway line, the riparian owner has carried out improvement works. Further downstream at Rufford Park, the County Council has carried out some works.

DEVELOPMENT

The watercourse will be affected by future developments envisaged within the Mansfield and Alfreton areas and these have been taken into account. An area of 40 ha or more could be involved and the effect on flows should be considered at planning consultation stage.

BENEFITS

The assessment allows for change to arable on part of the area and no change but increased production on the remainder. Future development has been allowed for on 40 ha.

RECREATION, FISHERIES AND AMENITY

The Nottinghamshire County Council Country Park and lake at Rufford would not be affected by the proposals. Consideration must be given to the existing fishery.

SUBSIDENCE

The Rainworth Water is in an area which could be affected by future subsidence.

CONSERVATION

A site of natural history interest is within the benefit area.

IDENTIFICATION

Problem code number(s):	5-94-610-68
Watercourse:	Vicar Water (non-main river)
Location:	Mansfield/Clipstone (Mansfield/Newark and Sherwood District Councils)
OS Map reference:	SK 580 624, SK 605 652

NATURE OF PROBLEM

The Vicar Water flows through an area containing active collieries and industry. Considerable interference has taken place to the natural channel which has been affected by colliery tips, culverting, the formation of lakes and subsidence. In its lower reaches there is agricultural land bordering the stream which could be improved.

Substantial new development in the higher parts of the catchment will generate greater run-off and the watercourse is in need of improved maintenance.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			b

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	392,070	
	(ii)	Field drainage	£	17,510	£409,580
(b) **Present value of benefits**	(i)	Agriculture	£	216,710	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		
	(iv)	New development	£	250,210	£466,920
(c) **Benefit/cost ratio**					1.1
(d) **Priority category**					2C

IMPROVEMENT WORKS

Through the farmland in the lower reaches, the watercourse could be realigned and regraded for a length of 1.8 km with advantage to the land drainage of the area. The solution is less straightforward further upstream where the works would be more expensive and survey and more detailed investigation would be needed. This would include an evaluation of various alternative schemes taking into account relevant factors such as costs, risks and future land use. It is possible that the existing system of lakes could be utilised for flow balancing purposes and any study should include an examination of their natural balancing capacity together with works needed to ensure the safety of the dam structures under present and future flood flows. The largest of the 3 lakes is Vicar Pond where some strengthening and protective works are needed. To provide for improvement of present wasteland at Newlands Farm, allowance has been made for regrading 0.8 km of channel in that area. Improvement of the Vicar Water will require a co-ordinated approach with the various Authorities and consideration should be given to amenity improvements.

The total catchment to River Maun confluence is 15.5 sq km (Urban 41%) and size of flows will depend on the balancing effects upstream. For the purpose of this study it is assumed that 100 year flows will be passed to Vicar Pond, agricultural land being protected to a 5 year standard.

The improvement of the upper reaches of the watercourse upstream of Vicar Pond is controlled by the continuing effects of coal mining subsidence. Improvements to the balancing effects of the existing ponds and the general environment would be expected from any scheme.

DEVELOPMENT

Vicar Water is affected by development in the Mansfield and Alfreton areas and account has been taken of this in the calculations for design discharge and economic assessment.

BENEFITS

Agricultural benefit has been assessed on the basis of increased gross margins on an area of 194 ha. These figures assume wasteland can be brought into agricultural production.

Planned new development (residential and industrial) amounts to 104 ha. As this is roughly 75% complete, benefit evaluation has been based on 25 ha. The development proceeded in advance of watercourse improvements because of temporary subsidence effects which required land drainage works to be postponed.

FISHERIES

The lakes referred to above are used for fishing and any improvements should have regard to their effect on that facility.

SUBSIDENCE

The area is liable to mining subsidence effects, which are expected to continue for several years.

IDENTIFICATION

Problem code number(s):	5-94-610-70
Watercourse:	Brammersack Drain (non-main river)
Location:	Little Carlton (Newark and Sherwood District Council)
OS Map reference:	SK 777 573

NATURE OF PROBLEM

Flooding and inadequate drainage affects 61 ha of agricultural land and a smallholding in Newark IDD who maintain this drain to Bathley.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in 10	years
	(ii)	Structures	1 in 25	years
(c) **Land potential category**			b	

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

3.24 km of channel improvement would be required. This would take the form of regrading, reshaping of banks and provision of a non-return flap valve at Kelham Lane as protection against minor flooding and is not considered worthwhile. The protection works for the smallholding have been constructed as part of the A46 Newark Relief Road.

The catchment area is 1.02 sq km and the design discharge is estimated at 0.85 cumecs.

IDENTIFICATION

Problem code number(s):	5-94-610-72
Watercourse:	Un-named (non-main river)
Location:	Rolleston (Newark and Sherwood District Council)
OS Map reference:	SK 760 523

NATURE OF PROBLEM

Minor flooding and drainage problems occur in this area of Newark Internal Drainage District. The problem can be alleviated by improving the standard of maintenance of the unadopted watercourses and providing satisfactory field drainage.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Several drains in this area were subjected to extensive maintenance works in October 1984 by Newark IDB.

CONSERVATION

The Nottinghamshire Trust for Nature Conservation has designated this area as a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	5-94-610-73
Watercourse:	River Greet (main river)
Location:	Fiskerton/Southwell (Newark and Sherwood District Council)
OS Map reference:	SK 743 515 to SK 705 547

NATURE OF PROBLEM

In 1978 the River Greet became main river from its confluence with the Trent for a length of 6.8 km to the surface water outfall at Kirklington Road, Southwell. Some road flooding occurs and one property was affected in February 1977. There are four mills situated on this length of the river which is embanked for some distance. Inadequate freeboard has resulted in poor drainage of agricultural land upstream of Southwell Mill, and regular flooding of land occurs. Flooding may affect a recently developed industrial estate.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in 10	years
	(ii)	Structures	1 in	years
(c) **Land potential category**			b	

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

Improvement in flow and water level controls at the mill and regrading of the River Greet will improve the drainage of the area. The catchment area to Southwell is 46 sq km and the design flow is estimated to be 11 cumecs.

BENEFITS

The majority of the benefits are obtained from estimated increased gross margins of £140/ha per annum on 241 ha. The area is currently mainly under grass and cereals. Some extension of root cropping could be expected in limited areas.

FISHERIES

The River Greet is a maintained "put and take" trout fishery.

CONSERVATION

The benefit area includes a site of natural history interest.

IDENTIFICATION

Problem code number(s):	5-94-610-74
Watercourse:	Un-named (non-main river)
Location:	Southwell, Glenfields (Newark and Sherwood District Council)
OS Map reference:	SK 696 543

NATURE OF PROBLEM

A natural watercourse has been culverted and incorporated in the surface water drainage system serving a residential estate. In February 1977 four houses were flooded. It is understood that the flooding on that occasion was due to rubble and debris forming a blockage in the culverted section and causing a manhole to surcharge. The flood water finds its way down Glenfields Avenue. Flooding has occurred subsequently.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	11,530	
	(ii)	Field drainage	£		£11,530
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	17,510	
	(iii)	Roads/Railways	£		£17,510
(c) **Benefit/cost ratio**					1.5
(d) **Priority category**					2E

IMPROVEMENT WORKS

Since enlargement of the culvert is not a viable option for mitigating the risk of recurrent flooding, the entrance conditions to the culvert should be radically improved. An effective grille arrangement should be provided and regularly maintained. A floodbank constructed to the rear of properties in Glenfields, including some pensioners' bungalows, would provide added protection as would temporary storage of flood water, the provision of which requires further investigation. The estimated discharge at this entrance to the 0.6 m diameter culvert is 0.8 cumecs.

BENEFITS

The benefits were calculated by evaluating damage to 14 properties estimated to be at risk under a 1 in 100 years flood event.

IDENTIFICATION

Problem code number(s):	5-94-610-75
Watercourse:	Thurgaton Beck (non-main river)
Location:	Thurgaton (Newark and Sherwood District Council)
OS Map reference:	SK 696 491

NATURE OF PROBLEM

The downstream reach of the Thurgaton Beck to Causeway Dyke has been regraded and improved since 1977 when flooding occurred in the Village. The work was done by Newark Internal Drainage Board which has proposals for extending the improvement upstream to the A612 road. Because of the situation of the properties adjoining the Brook, that improvement will be limited in extent but combined with the work already carried out, should provide some significant measure of flood relief within practical and economic limitations.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Limited improvements have been carried out on the section along the Village Street and no further work is considered by Newark Internal Drainage Board to be practical.

Newark IDB have carried out further regrading works downstream of the village and bank protection works within the village. It is not considered economically viable to provide flood protection within the village but the works described above should considerably improve the situation.

FISHERIES

Parts of this brookcourse are fished and provide fish spawning areas.

IDENTIFICATION

Problem code number(s):	5-94-610-77
Watercourse:	Tributary of the Criftin Dyke (Bulcote Spinney) (non-main river)
Location:	Bulcote Farm (Newark and Sherwood District Council)
OS Map reference:	SK 662 443

NATURE OF PROBLEM

Housing development has taken place in an area of poor drainage. In February 1977, 4 properties were affected at sub-floor level being saved from flooding only by emergency measures. The properties have been at risk on several other occasions.

The Newark IDB maintains the Criftin Dyke and the Bulcote Farm feeder to the railway. The watercourse draining the Bulcote Spinney development is not maintained by the Board.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	95,140	
	(ii)	Field drainage	£		£95,140
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	10,010	
	(iii)	Roads/Railways	£		
	(iv)	Development	£	15,010	£25,020
(c) **Benefit/cost ratio**					0.3
(d) **Priority category**					3D

IMPROVEMENT WORKS

A drainage ditch taking surface water from the development site to the Criftin Dyke tributary passes through a railway embankment by means of a brick culvert. The invert to this culvert is some 0.6 m higher than the bed level of the dyke at the upstream end in the housing area. The problem is enhanced by the lack of fall from the railway culvert to the outfall into the Criftin Dyke tributary, through which section the draining ditch is culverted. In February 1977, the Criftin Dyke tributary submerged the outfall of the ditch causing greater amounts of water to back up into the development area.

A remedy to this problem would be to regrade some 770 m of the Criftin Dyke tributary to improve the conditions at the outfall of the drainage ditch, and replace the existing culvert downstream of the railway with an open channel about 360 m long. Lowering of the railway culvert invert would also be necessary, together with regrading of the existing channel for a length of about 490 m. Provision of a flap valve at the Bulcote Farm/Criftin Dyke confluence should also be considered, together with realignment.

DEVELOPMENT

The remainder of the Bulcote Spinney site was developed in 1987 and certain measures are in hand to improve drainage at the edge of the development on the IDB's boundary. These works are to be carried out by the Developer and the IDB in consultation with the National Rivers Authority. The effects of a major flood such as in 1977 on the area will remain unchanged as far as the IDB is aware.

BENEFITS

The benefits shown were evaluated on an estimated 14 properties being affected in a flood of 100 year magnitude.

SUBSIDENCE

The area could be liable to the effects of future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-610-78
Watercourse:	Potwell Dyke (non-main river)
Location:	Southwell (Newark and Sherwood District Council)
OS Map reference:	SK 711 541 to SK 699 534

NATURE OF PROBLEM

Flooding of the A612 Nottingham Road occurs with a reported frequency of about once or twice a year. Flooding of a School occurred in February 1977 but improvements in that area have been carried out since then. Minor flooding also took place in 1977 on Halloughton Road.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£ 37,480		
	(ii)	Field drainage	£		£37,480
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£ 45,040		£45,040
(c) **Benefit/cost ratio**					1.2
(d) **Priority category**					2E

IMPROVEMENT WORKS

Flooding of the School area which occurred in 1977 was due to surface water run-off. Since that time a cut-off ditch has been formed to the rear of the School and this should reduce the incidence of flooding from that source.

Flooding of Halloughton Road, could be alleviate by regular maintenance and cleaning out of road gullies.

At the A612, the existing road culvert should be replaced by a new one providing not less than 1.8 x 1.0 m cross sectional opening. A limited amount of regrading would need to be carried out in conjunction with the new culvert and, for the purpose of this Survey, the length has been taken as about 260 m either side. The outfall pipe to an existing open highway drain would require replacing. Elsewhere, the channel is in need of improved maintenance.

The catchment area is 4.53 sq km and the 100 year design discharge is estimated to be 3.6 cumecs.

BENEFITS

Benefits have been evaluated on the basis of costs attributable to traffic affected by the flooding of the A612 road.

CONSERVATION

This is a site of known natural history interest.

IDENTIFICATION

Problem code number(s):	5-94-610-80
Watercourse:	Un-named (non-main river)
Location:	Bilsthorpe (Newark and Sherwood District Council)
OS Map reference:	SK 652 597

NATURE OF PROBLEM

Residential development is affected by flood water running off agricultural land in an area of difficult drainage. Water collects to the rear of several properties and in February 1977 three houses were affected.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	8,650	
	(ii)	Field drainage	£		£8,650
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	11,260	
	(iii)	Roads/Railways	£		£11,260
(c) **Benefit/cost ratio**					1.3
(d) **Priority category**					2F

IMPROVEMENT WORKS

The area is situated in a low pocket which may have been formed as the result of past subsidence. No levels have been taken in connection with this Survey, but it would appear that a solution based on improved drainage of flood water would be expensive and difficult to justify on economic grounds. As a less costly alternative, an earth floodbank protection to the properties could be considered. The estimate assumes a bank about 200 m long formed from a re-excavated drain to the rear of the properties.

BENEFITS

Benefit was evaluated on the basis of avoidance of flood damage to 10 properties in a 100 year event.

IDENTIFICATION

Problem code number(s):	5-94-610-85
Watercourse:	River Trent (main river)
Location:	Caythorpe and Brackenhill (Newark and Sherwood District Council)
OS Map reference:	SK 688 455/SK 693 457

NATURE OF PROBLEM

These areas are located at the edge of the River Trent floodplain. A few properties are at risk under major flood conditions although the last occasion on which any properties were actually flooded was December 1960. Because of the location of the properties, any defence scheme would be difficult to construct and justify. The most practical means of alleviation is through a satisfactory flood warning arrangement and such a system is currently in operation. This area may be subject to future mining subsidence.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-94-610-86
Watercourse:	Highway Drain (non-main river)
Location:	Oxton (Newark and Sherwood District Council)
OS Map reference:	SK 632 518

NATURE OF PROBLEM

Surface water from fields adjacent to Honey Knab Lane is unable to discharge into a surface water sewer as the sewer entrance is unprotected and has blocked and silted up. Water flows onto the road but is accepted by roadside gullies. Upstream of the sewer entrance, the drain is in the form of a shallow open ditch. A field access of earth fill has been placed across this ditch and only a poorly placed 100 mm pipe has been allowed for the passage of water through this access. Water therefore overtops and runs down the road again, discharging into the gullies.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

It is recommended that the field access should be reconstructed as a bridge and the ditch should be deepened. A small grille should be erected at the entrance to the surface water sewer to prevent pipe blockages, and this will require regular maintenance.

SUBSIDENCE

This area may be subject to future mining subsidence.

IDENTIFICATION

Problem code number(s): 5-94-610-87
Watercourse: Highway Drain (non-main river)
Location: Oxton Hill (Newark and Sherwood District Council)
OS Map reference: SK 638 517

NATURE OF PROBLEM

A once open roadside ditch has been culverted by the County Council. Surface water run-off from the field adjacent to Birkhouse Wood and from Oxton Hill, in the past, has been unable to discharge into this culvert, therefore, ponding occurs. The County Council have recently installed road gullies which should deal with the road top water. The field, however, is still unable to adequately discharge its top water into the system and this affects the drainage of 2 ha of arable land.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The recommended solution is to install perforated pipes and connect these directly into the highway culvert.

SUBSIDENCE

This area may be subject to future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-610-89
Watercourse:	None (non-main river)
Location:	Hagg Lane, Epperstone (Newark and Sherwood District Council)
OS Map reference:	SK 652 485

NATURE OF PROBLEM

Occasional flood problems occur at the junction of Hagg Lane and Main Street due to water running off the fields into Hagg Lane. The highway drainage in this area has insufficient capacity.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£_____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£_____
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

As this is a highway problem, the solution is outside the scope of this Survey.

IDENTIFICATION

Problem code number(s):	5-94-610-90
Watercourse:	Un-named dykes (non-main river)
Location:	Bullpit Lane, Balderton (Newark and Sherwood District Council)
OS Map reference:	SK 820 518

NATURE OF PROBLEM

Recent flooding has occurred due to the inadequate capacity of adjacent dykes.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The partially open dyke between Bullpit Lane and London Road, Balderton has been re-graded and culverted, thereby eliminating previous problems which arose due to silting up, and blockages downstream. The small size of the older piped section downstream of London Road still imposes restrictions on the overall capacity, although the situation in the vicinity of Main Street and Bullpit Lane, Balderton has been greatly improved.

IDENTIFICATION

Problem code number(s):	5-94-610-91
Watercourse:	None (non-main river)
Location:	Bilsthorpe (Newark and Sherwood District Council)
OS Map reference:	SK 654 599 and SK 649 599

NATURE OF PROBLEM

Run-off from fields has given rise to problems at the top of Cheyne Drive (SK 654 599). Flooding has also occurred to the rear of Oak Tree Drive (SK 649 599).

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

At SK 654 599, the problem has been partially solved by the co-operation of the farmer who has improved his land drainage works. A further section, however, which is under different ownership, still requires improvement. The District Council is pursuing the matter.

At SK 649 599, it is hoped that improvements made by riparian owners will have resolved the problem.

IDENTIFICATION

Problem code number(s):	5-94-610-92
Watercourse:	Un-named dyke (non-main river)
Location:	Farnsfield (Newark and Sherwood District Council)
OS Map reference:	SK 648 562

NATURE OF PROBLEM

In May 1983, 4 houses flooded in addition to the highway. Improvements to the dyke by riparian owners have reduced the liability of flooding, although recent events have shown that the susceptability of road drainage and grillages to blocking have not eliminated the problems entirely.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The seriousness of flooding under normal to heavy rain storms has very much been reduced, and the susceptibility to flooding of houses has been substantially reduced as the result of improvements works already carried out. A new development off Back Lane known as Nairn Close and Church Side, is liable to flooding, and has had flood water over the site on several occasions, although not into the houses. This has arisen due to the expansion of Farnsfield as a whole, without regard to the effect of the additional surface water run off on the existing surface water sewers. The Council are currently carrying out a survey to determine the size of the problem with a view to producing a scheme for up-sizing the culvert between Main Street and Beck Lane.

IDENTIFICATION

Problem code number(s):	5-94-710-2/3
Watercourse:	Surface Water Outfalls to River Trent (non-main river)
Location:	Wilford (Nottingham City Council)
OS Map reference:	SK 567 368 and SK 566 374

NATURE OF PROBLEM

Flooding occurs in an urban area behind the Trent major flood defences and affects roads and some property. The flooding results when the River Trent is in a major flood condition preventing discharge from surface water outfall systems. In recent years the flooding is known to have occurred in December 1960, February 1977 and possibly December 1965. The outfalls are controlled by flap valves and penstocks which have to be closed against Trent flows. Minor flooding occurred again on 1 January 1987 affecting two gardens in Maplestead Avenue and part of Wilford Lane.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

CONSERVATION

These are sites of known natural history interest.

IDENTIFICATION

Problem code number(s):	4-94-810-8
Watercourse:	Tributary of Kingston Brook (non-main river)
Location:	Costock (Rushcliffe Borough Council)
OS Map reference:	SK 575 264

NATURE OF PROBLEM

Flooding occured in February 1977 to 5 houses in Chapel Lane, Church Lane and Main Street, Costock. Flooding in Chapel and Church Lane is from the Kingston Brook and floodbank protection for these properties can be incorporated in the Kingston Brook Improvement (4-94-810-22). The land to the south of Main Street is drained by a series of ditches which are culverted under the road and some properties as well. Inadequate maintenance to these ditches and culverts causes the flooding of Main Street and threatens to flood properties.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£
(c) **Benefit/cost ratio**				
(d) **Priority category**				

IMPROVEMENT WORKS

It is recommended that maintenance is carried out regularly on the ditches and culverts to ensure that they can operate at maximum capacity. In addition, minor flood banking at the entrance to the culverts may increase their capacity assuming blockage does not occur.

Some dyke regrading has been carried out downstream of the surface water culvert outfall to the north of Church Lane.

No further works have been carried out on the ditches and culverts, but the public foul sewer through Costock has been replaced. During the sewer relaying works some highway drainage deficiencies were remedied, and, in addition, the sewer improvements will have provided a better flow arrangement at the Main Street/Chapel Lane junction of the foul sewers, reducing the risk of sewer surcharge on Chapel Lane.

CONSERVATION

This is a County site of National History Interest.

IDENTIFICATION

Problem code number(s):	4-94-810-11
Watercourse:	Tributary of River Soar (non-main river)
Location:	Sutton Bonington (Rushcliffe Borough Council)
OS Map reference:	SK 508 248

NATURE OF PROBLEM

Flooding occurs to Main Street and several houses when water backs up the road gullies. This is due to silting up of the culvert on this tributary where it passes under the railway and Main Street.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in 100 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Improvements have been completed to the ditch and culvert both upstream and downstream of the railway culvert on Hungary Lane. In addition, at the Borough Council's instigation, certain watercourses downstream of Main Street have been cleaned out by the respective responsible parties, i.e. Nottingham County Council, riparian land owners and British Waterways. There is still one highway culvert at the Main Street/Hungary Lane junction requiring attention, and the County Council is currently considering replacing the old culvert with pipes.

Improvements have also been made to the River Soar, and flood defences have been constructed by the National Rivers Authority.

IDENTIFICATION

Problem code number(s):	4-94-810-13/14/16/22
	4-94-810-8 (part)
Watercourse:	Kingston Brook (non-main river)
Location:	Rushcliffe (Rushcliffe Borough Council)
OS Map reference:	SK 505 276 to SK 577 266

NATURE OF PROBLEM

Flooding of agricultural land in Kingston Brook Internal Drainage Board takes place regularly and drainage is affected over an area of 340 ha. Flooding also occurs to 5 houses and roads at Chapel Lane and Church Lane in Costock. In 1964 Trent River Authority prepared a scheme at the request of Kingston Brook Internal Drainage Board to improve the Brook from the A60 at Costock to a point near Kingston Pool, 1.6 km downstream of West Leake, a total length of 9 km. The scheme was designed to a 1 in 4/5 year standard (13 cumecs). Only minor works have been carried out since flooding of Main Street is caused by inadequate culvert capacity during flood flows.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	340,180	
		(ii)	Field drainage	£	407,840	£748,020
(b)	**Present value of benefits**	(i)	Agriculture	£	1,208,560	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£1,208,560
(c)	**Benefit/cost ratio**					1.6
(d)	**Priority category**					2C

IMPROVEMENT WORKS

The River Authority scheme has been updated and involves some regrading and resectioning, channel clearance and tree clearance and the improvement of the road bridge at West Leake. In addition, embankment work would protect the properties in Chapel and Church Lanes. The cost of replacing culverts in the Main Street area would be high in relation to the limited benefits, therefore regular maintenance to ensure operation at their maximum capacity is recommended.

BENEFITS

This is prime agricultural land and following drainage improvements an increase in gross margin is expected with the production of cash crops including sugar beet and potatoes.

CONSERVATION

4-94-820-13/14/16/22.

These areas are County sites at National History Interest.

IDENTIFICATION

Problem code number(s):	4-94-810-15
Watercourse:	Sheepwash Brook (non-main river)
Location:	East Leake (Rushcliffe Borough Council)
OS Map reference:	SK 552 262

NATURE OF PROBLEM

The Sheepwash Brook flows through the Village of East Leake and floods two houses and the adjacent road on occasions of heavy rainfall, the last being March 1977. Flooding can last for up to 6 hours. The cause of the problem is the inadequacy of culverts at the south end of the village and this is aggravated by trapped debris.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	10 years
	(ii)	Structures	1 in	10 years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	12,970	
	(ii)	Field drainage	£		£12,970
(b) **Present value of benefits**	(i)	Agriculture	£	5,000	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£5,000
(c) **Benefit/cost ratio**					0.4
(d) **Priority category**					3E

IMPROVEMENT WORKS

The smallest culverts near Burton Walk are capable of carrying a 1 in 5 years flow and it is proposed to increase these to 1 in 10 years (1.6 cumecs). To increase the standard of protection beyond 1 in 10 years would require the replacement of many culverts. This will result in greatly increased cost for very little additional benefit and a detailed assessment has not, therefore, been made.

The Borough Council completed some improvement works in 1982.

BENEFITS

No benefits are attributable to road flooding as the road has never been closed to traffic.

CONSERVATION

This is a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	4-94-810-18
Watercourse:	Kingston Brook (non-main river)
Location:	Wysall (Rushcliffe Borough Council)
OS Map reference:	Sk 602 269

NATURE OF PROBLEM

The road from Wysall to Costock crosses the floodplain of the Kingston Brook and, although the channel and bridge openings have reasonable capacity, the road floods to a sufficient depth to make it impassable for traffic.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The flooding of the road occurs for normal floodplain inundation. The problem can be alleviated by raising the road for approximately 100 m and providing adequate culvert capacity to maintain floodplain flows without afflux. As this is only one of five access routes to Wysall and traffic flow is low, the works cannot be justified. There is some evidence also at this point of inadequacies in the highway drainage system.

CONSERVATION

This is a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	4-94-810-19
Watercourse:	Kingston Brook (non-main river)
Location:	Wysall (Rushcliffe Borough Council)
OS Map reference:	SK 606 266

NATURE OF PROBLEM

The road from Wysall to Thorpe in the Glebe crosses the floodplain of the Kingston Brook and, although the channel and culvert have reasonable capacities, the road floods when out of bank flows build up above road level (600 mm above ground level).

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Flooding can be alleviated by constructing flood banks for a distance of about 100 m or raising the road level. Sufficient culvert capacity will need to be provided to allow for the flow across the floodplain. In neither case can the cost be justified because the traffic flow is so low.

CONSERVATION

This is a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	4-94-810-20
Watercourse:	Tributary of Kingston Brook (non-main river)
Location:	Thorpe in the Glebe (Rushcliffe Borough Council)
OS Map reference:	SK 604 257

NATURE OF PROBLEM

The minor road between Wymeswold and Wysall floods at Thorpe in the Glebe from a tributary of the Kingston Brook which passes under the road at this point in a 600 mm diameter culvert.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The watercourse is not maintained adequately so its capacity is reduced and the road culvert blocks easily. Proper maintenance of the watercourse, and particularly the culvert during flood periods, will alleviate the problem.

CONSERVATION

This is a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	4-94-810-23
Watercourse:	Ratcliffe Brook (non-main river)
Location:	Ratcliffe (Rushcliffe Borough Council)
OS Map reference:	SK 497 286 to SK 523 295

NATURE OF PROBLEM

The Brook has inadequate capacity to contain the 1 in 5 years flood and there is insufficient freeboard for optimum land drainage of 306 ha of agricultural land.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in 5	years
	(ii)	Structures	1 in	years
(c) **Land potential category**			a5	

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£ 95,140		
	(ii)	Field drainage	£ 312,760	£407,900	
(b) **Present value of benefits**	(i)	Agriculture	£ 1,086,320		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£	£1,086,320	
(c) **Benefit/cost ratio**				2.7	
(d) **Priority category**				10	

IMPROVEMENT WORKS

The recommended solution involves regrading the Brook to improve freeboard conditions and provide for a design flow of 2 cumecs. This will necessitate lowering the culvert under Kegworth Road and lowering the invert of the railway bridge.

BENEFITS

This area is prime agricultural land, cropped with cereals, potatoes and peas and the benefits have proved difficult to quantify in monetary terms.

FISHERIES

Consultation is required before any works are commenced.

IDENTIFICATION

Problem code number(s):	5-94-810-3
Watercourse:	River Trent (main river)
Location:	Radcliffe-on-Trent (Rushcliffe Borough Council)
OS Map reference:	SK 644 396

NATURE OF PROBLEM

This site was originally developed for caravans which have since been largely replaced by prefabricated bungalows. Although the site was established in Trent washland and is unprotected, the ground levels are now such that most of the site is above flood level. To give complete and permanent protection to the area is not considered to be viable and the risk of flooding is best dealt with by means of flood warning arrangements.

It should be noted that this area may be subject to future mining subsidence.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-94-810-4
Watercourse:	River Trent (main river)
Location:	Barton-in-Fabis (Rushcliffe Borough Council)
OS Map reference:	SK 523 329

NATURE OF PROBLEM

The village of Barton-in-Fabis is protected by a major floodbank. When the River Trent is in flood, water inevitably ponds behind the defences to some extent, being impeded from discharging via the normal drain outfalls. The extent of flooding is understood to be confined to a relatively small area of agricultural land and no complaints have been received. The Local Authority have carried out some recent improvements to the watercourse system in the village and it is unlikely that further works are necessary or can be justified.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

CONSERVATION

The Nottinghamshire Trust for Nature Conservation recognises this area as a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	5-94-810-5
Watercourse:	River Trent (main river)
Location:	Thrumpton (Rushcliffe Borough Council)
OS Map reference:	SK 509 312

NATURE OF PROBLEM

The Village of Thrumpton lies on the south bank of the River Trent. Part of the village is built in the floodplain of the Trent. In the December 1960 flood, 6 properties were flooded and a further 6 properties were completely isolated by floodwaters. In the February 1977 flood, 3 properties were flooded and a further 8 properties were surrounded by floodwaters. The village is unprotected.

Minor flood protection of the washland area downstream of the village is included in 5-94-810-52.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in 50 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	23,060	
		(ii)	Field drainage	£		£23,060
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£	10,260	
		(iii)	Roads/Railways	£	1,250	£11,510
(c)	**Benefit/cost ratio**					0.5
(d)	**Priority category**					3E

IMPROVEMENT WORKS

The flooding can be alleviated by raising 130 m of unmetalled road by an average of 0.5 m to act as a floodbank to the north of Schoolhouse and Gatehouse. In addition, road ramps should be constructed across Church Lane just north of Elm Cottage and Old Post Office. At this stage it is assumed that such works would not be detrimental to the unprotected properties.

The proposals assume a defence level of 29.25 m AOD. This would give protection to all but two of the properties in the village against a repeat of either the 1947, 1960 or 1977 floods.

The 2 properties nearest to the river are Ferry Farmhouse and Ferry Farm Cottage. These properties are so close to th· river it is difficult to see any viable method of protecting them.

CONSERVATION

The Nottinghamshire Trust for Nature Conservation considers this area to be a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	5-94-810-7/8/9/10/11/12/13
Watercourse:	River Smite and Tributaries (non-main river)
Location:	Colston Bassett (Rushcliffe Borough Council)
OS Map reference:	SK 681 334, SK 703 342

NATURE OF PROBLEM

Inadequate drainage and flooding of agricultural land occurs and highways are also affected. Flooding of certain village roads has been recorded but only under more severe conditions. The area is in Newark Internal Drainage District.

DESIGN STANDARDS

(a)	**Urban**	(i) Channel	1 in	years
		(ii) Structures	1 in	years
(b)	**Agricultural**	(i) Channel	1 in	10 years
		(ii) Structures	1 in	years
(c)	**Land potential category**			a5 - 72 ha
				b - 277 ha

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Improvement works would entail regrading of: (1) the River Smite from the weir downstream of China Bridge for a length of 3.4 km, (2) Church Drain for 1.1 km and (3) Willow Holt Drain for 1.7 km. Works would be needed on 3 road bridges, one of which is a 'listed' structure, together with a number of access bridges. (2) and (3) have been completed by Newark IDB up to the IDD boundary.

A surface water sewer/carrier on Bunnystone Lane (outside Newark IDD) caused flooding to the roads in 1977. A flap valve has since been fitted to the outfall by Newark IDB. Whilst this may help reduce the frequency of flooding to the roads, improvements may also be needed to the surface water drainage system and this should be investigated. The catchment area at the weir is 54.7 sq km and the 10 year design discharge is 14.2 cumecs.

CONSERVATION

The Village of Colston Bassett is a conservation area. The listed road bridge referred to above is in this area.

RECREATION, FISHERIES AND AMENITY

The Smite flows through parkland and for a length of approximately 2 km is a fishery. Provision has been made within the proposals for maintaining the existing facilities.

IDENTIFICATION

Problem code number(s):	5-94-810-26
Watercourse:	River Whipling (non-main river)
Location:	Redmile/Granby (Rushcliffe Borough Council)
OS Map reference:	SK 766 367

NATURE OF PROBLEM

Flooding and inadequate drainage of agricultural land occurs. Unstable bank conditions and seepage from the Grantham Canal aggravates the problem.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 10 years
		(ii)	Structures	1 in years
(c)	**Land potential category**			a(5)

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	236,400	
		(ii)	Field drainage	£	640,540	£876,940
(b)	**Present value of benefits**	(i)	Agriculture	£	1,783,670	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£1,783,670
(c)	**Benefit/cost ratio**					2.0
(d)	**Priority category**					1C

IMPROVEMENT WORKS

These would entail regrading and re-sectioning of the river channel for a length of 7.42 km upstream of Barnstone Road. Bank protection would be necessary for a substantial length. Improvements would also be required to 4 highway bridges and a number of access bridges. The total catchment area of the River Whipling is 4.91 sq km and the design discharge is estimated as 1.28 cumecs.

FISHERIES

Any improvement work to enlarge the brookcourse would ensure that this could be utilised as a fishery.

IDENTIFICATION

Problem code number(s):	5-94-810-28
Watercourse:	Rundle Beck (non-main river)
Location:	Granby (Rushcliffe Borough Council)
OS Map reference:	SK 755 345

NATURE OF PROBLEM

Normal water levels in the Rundle Beck are too high to enable adequate drainage of 142 ha of agricultural land. The problem is compounded by seepage through the banks of the Grantham Canal.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in years
(c) **Land potential category**			a(5)

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	43,240	
	(ii)	Field drainage	£	177,650	£220,890
(b) **Present value of benefits**	(i)	Agriculture	£	388,960	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£388,960
(c) **Benefit/cost ratio**					1.8
(d) **Priority category**					2E

IMPROVEMENT WORKS

These would consist of regrading the channel for a length of 2.53 km up to the Grantham Canal, including works on a number of access bridges. For a distance of 1.37 km upstream from the confluence with the River Whipling, improvement to the necessary standard has been completed by the Internal Drainage Board.

Seepage through the canal banks adds to the drainage problems but this is the responsibility of the British Waterways Board and is outside the scope of this Survey. The catchment area is 13.4 sq km and the design discharge is 3.5 cumecs.

DEVELOPMENT

No development proposals of significance are foreseen, though the area could be affected by coal mining proposals in the future.

FISHERIES

The Beck is a good coarse fishery and capable of supporting trout.

IDENTIFICATION

Problem code number(s):	5-94-810-29
Watercourse:	Shelford Drains (non-main river)
Location:	Shelford (Rushcliffe Borough Council)
OS Map reference:	SK 671 432

NATURE OF PROBLEM

These drains within Newark Internal Drainage District have been affected by colliery workings.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Most of the watercourses affected have now been restored, either by British Coal or Newark Internal Drainage Board.

This area is still affected by mining subsidence. Improvements in the Shelford Manor Area have been carried out by British Coal. The IDB carried out regrading on the Water Lane Drain in 1987 and 1988 to alleviate problems to the east of the village.

Hams Dyke Pumping Station is still operated by the IDB and funded by British coal. Improvements are required to the Station to avoid high maintenance costs. Meanwhile the IDB ensures the satisfactory operation of the pumping station and British Coal reimburse all costs.

IDENTIFICATION

Problem code number(s):	5-94-810-30
Watercourse:	Un-named (non-main river)
Location:	Radcliffe-on-Trent (Rushcliffe Borough Council)
OS Map reference:	SK 653 396

NATURE OF PROBLEM

Flooding of residential properties occurred in February 1977 as a result of the culvert entrance becoming blocked by debris. This was at a point where the watercourse enters a section of culverting under a residential area.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

Since the flooding in 1977, the Borough Council have installed a second grille at the entrance to the culvert and this should prevent recurrence of the blockage and enable the culvert to operate to its maximum capacity.

Further investigations may be necessary to establish the capacity of this watercourse and this may indicate that additional improvements are necessary to provide a higher standard of protection.

SUBSIDENCE

This area may be subject to future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-810-33
Watercourse:	None
Location:	Radcliffe-on-Trent (Rushcliffe Borough Council)
OS Map reference:	SK 638 394

NATURE OF PROBLEM

In February 1977, flooding occurred on the area of pasture land and minor roads behind the major flood defences. The exact reason for this has not been established and whilst it may be due to ponding of surface/field drainage, it is recommended that the situation be monitored in future.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

SUBSIDENCE

This is within an area of possible mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-810-34/35/36/37/50
Watercourse:	Polser Brook (non-main river)
Location:	Normanton-on-the-Wolds to Radcliffe (Rushcliffe Borough Council)
OS Map reference:	SK 621 334 to SK 632 393

NATURE OF PROBLEM

The major problem over this length of the Brook is a combination of inadequate channel capacity and lack of maintenance which results in inadequate drainage to 632 ha of agricultural land. Flooding has also occurred to several properties in Cotgrave Lane and to two houses and minor roads in Normanton.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 5 years
(c) **Land potential category**			a5

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	735,140	
	(ii)	Field drainage	£	302,750	£1,037,890
(b) **Present value of benefits**	(i)	Agriculture	£	1,152,990	
	(ii)	Buildings	£	5,000	
	(iii)	Roads/Railways	£		£1,157,990
(c) **Benefit/cost ratio**					1.1
(d) **Priority category**					2B

IMPROVEMENT WORKS

The major improvement required is the regrading of the Brook for 900 m upstream of Normanton-on-the-Wolds, and 650 m upstream of Nottingham Airport, to provide a design discharge varying from 7 to 12.5 cumecs. Upstream of the Grantham Canal the Thurbeck Dyke will be diverted into the Polser Brook. At the downstream end several bridges and culverts will need to be replaced and the effects of River Trent levels on this reach will have to be considered.

Flooding from the sewerage system at Normanton has been alleviated by Rushcliffe Borough Council.

Problem 5-94-810-35 has been alleviated following local regrading of the Brook by the National Coal Board.

COMMENT

The Borough Council has carried out improvements in the vicinity of Clipston Lane Bridge, involving the provision of a by-pass culvert at the Bridge to increase the system capacity at this point. In addition, a short section of the brook immediately upstream of the Bridge has been straightened to improve hydraulic operation, and localised obstructions have been removed from the Brook Course.

CONSERVATION

Tollerton Hall Lake affects the water levels for about a kilometre upstream and major alterations to the lake would be necessary to enable water levels to be lowered. As this is a valuable amenity, such proposals are unlikely to be acceptable and have not been considered within the overall scheme.

Skylarks Gravel Pit (SK 621 391) has been designated a County Trust Reserve.

FISHERIES

The Polser Brook is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-94-810-38/39
Watercourse:	Gamston and Adbolton Brooks (non-main river)
Location:	Gamston/West Bridgford (Rushcliffe Borough Council)
OS Map reference:	SK 600 343 to SK 613 387

NATURE OF PROBLEM

Owing to inadequate watercourse and culvert capacity, flooding occurs to agricultural land and gardens and threatens several properties adjacent to the A52 Nottingham-Grantham Road. The road has also been flooded, but not sufficiently to halt traffic. Increased run-off arising from future developments and the Gamston-Lings Bar Road will exacerbate an already unsatisfactory situation.

A detailed consultants' report has been prepared for the Borough Council in which the likely cost of improvement works has been estimated. The Authority has been consulted and has commented on this report.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 5 years
(c) **Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

The first phase improvements involved the enlargement of culverts beneath and adjacent to the A52, and dyke regrading works in the same vicinity. The second phase will not be possible until gravel extraction operations have been completed as the proposals require the utilisation of the excavated areas for balancing purposes.

The dyke regrading works upstream of the Grantham Canal have been carried out in conjunction with the road construction contract.

The County Council are looking at the required improvements North of the A52 as part of their development programme.

CONSERVATION

There is a conservation area at Meadow Covert, Edwalton.

SUBSIDENCE

The watercourses are in an area which may be subject to mining subsidence.

IDENTIFICATION

Problem code number(s):	5-94-810-40
Watercourse:	Bridgford Beck Tributary (non-main river)
Location:	Seymour Road, West Bridgford (Rushcliffe Borough Council)
OS Map reference:	SK 595 379

NATURE OF PROBLEM

A culverted watercourse runs across Gertrude Road, Julian Road and Seymour Road, picking up various surface water drains before discharging into an open watercourse. The capacity of the 225 mm diameter culvert is inadequate to deal with flood flows and in 1977 the culvert surcharged flooding gardens. The surface water loading of this culvert has been increased by development of the Oak Tree Close estate and the frequency of flooding is reported to have increased.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£____

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

Rushcliffe Borough Council have carried out localised minor improvements immediately downstream of the culvert outfall. The Council will monitor the situation before considering the need for any further works, but these are unlikely to be cost effective.

CONSERVATION

The Nottinghamshire Trust recognises this area as a County Site of Natural History Interest.

IDENTIFICATION

Problem code number(s):	5-94-810-42
Watercourse:	Packman Dyke (non-main river)
Location:	Ruddington (Rushcliffe Borough Council)
OS Map reference:	SK 563 340 to SK 576 338

NATURE OF PROBLEM

The Packman Dyke is a tributary of Fairham Brook and is within the Fairham Brook Internal Drainage District. The watercourse required improvement to cater for the run-off from new development and a scheme of channel regrading and new road culverting has now been carried out by the Borough Council.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The Borough Council propose further works to deal with the drainage problems in Ruddington and these could have some effect on the Packman Dyke. It is recommended that this situation be kept under review.

COMMENT

The Borough Council has carried out some localised improvements to the surface water drainage system in Wilford Road which outfalls into the Packman Dyke. An inspection in 1989 of the Packman Dyke to the west of the railway line confirmed the Dyke to be in good order, free from any major obstruction.

CONSERVATION

SK 563 339 is the location of a County Trust Nature Reserve.

IDENTIFICATION

Problem code number(s):	5-94-810-43/45/46
Watercourse:	Fairham Brook and Tributaries (main river (part))
Location:	Clifton (Rushcliffe Borough Council)
OS Map reference:	SK 556 328, SK 587 307, SK 652 283, SK 647 299

NATURE OF PROBLEM

Agricultural land is affected by flooding and high water levels in the Brook. The Ministry of Agriculture, Fisheries and Food have confirmed the agricultural importance of the area draining to the Fairham Brook and its major tributaries. Most of the area is within Fairham Brook IDD.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	5 years
	(ii)	Structures	1 in	25 years
(c) **Land potential category**				a5

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£		
	(ii)	Field drainage	£		£_____
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£_____

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

The Internal Drainage Board have completed Phases I and II of an Improvement Scheme as far as Bunny. Phase III, from Bunny to the IDD boundary is unlikely to be carried out due to conservation objections. In the higher reaches beyond the present IDD boundary, improvements would include removal of obstructions, trees, bushes and/or channel regrading, although the extent of such works may be more limited and aimed at improving the efficiency of the existing channel rather than considerable regrading.

CONSERVATION

There is a conservation area between Fairham Bridge and Clifton Pastures under the control of the School. 5-94-810-43 is the site of a County Trust Nature Reserve and a county site of known natural history interest is at SK 613 286.

FISHERIES

Fairham Brook is a good coarse fishery with trout in the upper reaches.

IDENTIFICATION

Problem code number(s):	5-94-810-44
Watercourse:	None
Location:	Bradmore (Rushcliffe Borough Council)
OS Map reference:	SK 586 317

NATURE OF PROBLEM

Minor flooding occurs to an unmetalled access road and no watercourse is involved. The problem is due to inadequate road drainage and is outside the scope of this Survey.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-95-110-2
Watercourse:	(1) Mill Dam Dyke (2) Besthorpe Moor Drain (non-main river)
Location:	Girton/Besthorpe/N.Scarle (North Kesteven District Council)
OS Map reference:	SK 835 660

NATURE OF PROBLEM

(1) Flooding of agricultural land due to overtopping of Mill Dam Dyke has occurred under major flood conditions in 1947, 1960 and 1977.

(2) Agricultural land suffers from lack of adequate freeboard and poor drainage due to low gradients.

This area is within the District of Newark Internal Drainage Board.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 5 years
		(ii)	Structures	1 in 10 years
(c)	**Land potential category**			(1) a
				(2) b

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	230,630	
		(ii)	Field drainage	£	127,610	£358,240
(b)	**Present value of benefits**	(i)	Agriculture	£	600,110	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£600,110
(c)	**Benefit/cost ratio**					1.7
(d)	**Priority category**					2C

IMPROVEMENT WORKS

(1) Overtopping of the Mill Dam Dyke is essential in order to provide flood relief for the village of North Scarle. The only means by which this could be avoided would be by replacing this existing gravity discharge with a major pumping station. As the flooding of the land only occurs under flood events in the order of 1 in 10/20 years such a proposal is not considered by the Internal Drainage Board to be a practical alternative in economic terms.

(2) Besthorpe Moor Drain and tributaries could be pumped into Mill Dam Dyke. This would be likely to require a pumping station in the order of 1 cumec to deal with floods of a 5 year return period. Channel enlargement would be necessary on a length of about 5.2 km but no bridge works are envisaged. The catchment area is approximately 685 ha.

IDENTIFICATION

Problem code number(s):	5-95-310-1
Watercourse:	River Trent (main river)
Location:	Gainsborough (West Lindsey District Council)
OS Map reference:	SK 814 887, SK 810 882

NATURE OF PROBLEM

Following the serious flooding in March 1947, with its very severe consequences for the residents of Gainsborough, a major flood protection scheme was carried out through the town. Over much of the length, buildings such as wharfs and warehouses abut the river and the flood protection scheme utilised those structures by incorporating the walls into the flood defence system. The age of those buildings and their continuing deterioration, together with the seepage which is known to occur, gives cause for concern about the stability and safety of the Gainsborough Flood Protection Scheme in future years.

Since the completion of the Gainsborough Flood Protection Scheme, the defences have been further heightened as part of the Trent Tidal Reach Improvement Scheme. The standard of protection this provided may be considered greater than that represented by 1947 conditions. Failure of the defences could therefore be extremely serious.

Prolonged high water levels due to combined fluvial and tidal floods would result in severe seepage which could cause extensive damage, for instance to materials stored in riverside wharfs and warehouses.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£_____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£_____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

Detailed engineering investigation will be necessary to determine the extent and nature of works required. It is, however, anticipated that these will include some form of cut-off walls and will be aimed at preventing seepage under and through the existing walls and ensuring the necessary structural stability.

The NRA will carry out a condition survey in 1990/91 which will identify specific remedial/new works.

BENEFITS

In 1947 an estimated 180 ha of Gainsborough was inundated affecting a very large number of residential, commercial, and industrial properties. Evaluation of economic benefit requires a more detailed investigation.

FISHERIES

Upstream of Gainsborough the Trent is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-95-310-3
Watercourse:	River Trent (main river)
Location:	Lea (Convent) (West Lindsey District Council)
OS Map reference:	SK 828 864

NATURE OF PROBLEM

There is some threat of flooding to this property under major flood conditions when, whilst not actually flooded, a property which houses old people is isolated.

The benefit value is mainly of an intangible nature.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	51,890	
		(ii)	Field drainage	d		£51,890
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£see above
(c)	**Benefit/cost ratio**					
(d)	**Priority category**					

CONSERVATION

Lea Marshes, mainly grazing marshes, is an important ornithological site.

IDENTIFICATION

Problem code number(s):	5-95-310-4
Watercourse:	River Trent (main river)
Location:	Dunham Bridge (West Lindsey District Council)
OS Map reference:	SK 820 744

NATURE OF PROBLEM

Flooding has occurred to a Toll Keeper's cottage in 1947, 1960 and 1977 to a depth of approximately 1 m. The cottage is within the floodplain of the River Trent and it would not be practical to provide flood protection.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-95-310-8
Watercourse:	River Eau (main river)
Location:	Scotton (West Lindsey District Council)
OS Map reference:	SK 896 994

NATURE OF PROBLEM

Farmland is at risk from flooding due to overtopping of a low bank adjoining a realigned reach of the river. Water under flood conditions flows along the old course. This is a comparatively minor problem which can be dealt with by raising the bank as part of maintenance. There may, however, be some benefit in regrading the River Eau upstream to Dunstall Beck and this would warrant further investigation.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

FISHERIES

The River Eau is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-95-310-9
Watercourse:	Scotton Beck (non-main river)
Location:	Scotton (West Lindsey District Council)
OS Map reference:	SK 873 986 to SK 895 997

NATURE OF PROBLEM

Agricultural land over the whole length of Scotton Beck floods almost annually. This flooding is caused by a total lack of maintenance.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 50 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 2 years
	(ii)	Structures	1 in 50 years
(c) **Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	17,300	
	(ii)	Field drainage	£	15,010	£32,310
(b) **Present value of benefits**	(i)	Agriculture	£	61,120	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£61,120
(c) **Benefit/cost ratio**					1.9
(d) **Priority category**					2E

IMPROVEMENT WORKS

The whole length of 3 km of the watercourse requires regrading and the removal of silt, debris and weed growth. The 2 year design discharge is estimated at 0.86 cumecs from a catchment of 5.18 sq km (100 year flow at Scotter Road Bridge 3.64 cumecs).

DEVELOPMENT

Only infill development is planned for Scotter Village.

BENEFITS

The watercourse has a substantial area already with infield drainage but its efficiency is reduced by poor freeboards when there are high water levels.

IDENTIFICATION

Problem code number(s):	5-95-310-10
Watercourse:	Northorpe Beck (non-main river)
Location:	Northorpe (West Lindsey District Council)
OS Map reference:	SK 877 972 to SK 903 982

NATURE OF PROBLEM

At least 40 ha of agricultural land floods annually due to lack of maintenance.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(b) **Agricultural**	(i)	Channel	1 in 2 years
	(ii)	Structures (Road Bridge)	1 in 100 years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	24,500	
	(ii)	Field drainage	£	62,550	£87,050
(b) **Present value of benefits**	(i)	Agriculture	£	213,930	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£213,930
(c) **Benefit/cost ratio**					2.5
(d) **Priority category**					1E

IMPROVEMENT WORKS

The watercourse requires regrading and silt, debris and weed growth removing for a length of about 5 km. The 2 year discharge is estimated at 1.5 cumecs from a catchment of 8.45 sq km (100 year 4.8 cumecs).

Gainsborough Internal Drainage Board agreed to adopt that part of this Beck within its boundary. A scheme involving improvement and regrading from the River Eau upstream to the Board's boundary, including the removal of two unused bridges and the provision of a new bridge, has not commenced due to lack of agreement with riparian owners over compensation for loss of land.

BENEFITS

The watercourse has a substantial area already with infield drainage but its efficiency is reduced by poor freeboards when there are high water levels.

IDENTIFICATION

Problem code number(s):	5-95-310-12
Watercourse:	Hemswell Beck (non-main river)
Location:	Hemswell (West Lindsey District Council)
OS Map reference:	SK 930 912

NATURE OF PROBLEM

The problem arose after Hemswell Beck was culverted by Gainsborough Rural District Council. During heavy rainfall the water backs up the road gullies in Brook Street. The pipes have become calcified as the source of the watercourse is a spring in a limestone quarry.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in 100 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The proposed solution is the replacement of the inadequate calcified culvert with a new culvert to provide the original flow capacity.

IDENTIFICATION

Problem code number(s):	5-95-310-15
Watercourse:	Darnsyke (non-main river)
Location:	Hardwick (West Lindsey District Council)
OS Map reference:	SK 860 764 to SK 860 743

NATURE OF PROBLEM

This drain is a tributary drain of the main Torksey pumping drain within Newark Internal Drainage District. The lack of fall from this area to the Internal Drainage Board pumping station, results in inadequate freeboard for under drainage of the land. There is also seepage from the Foss Dyke through the sandy sub-soil.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 10 years
		(ii)	Structures	1 in 10 years
(c)	**Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	106,670	
		(ii)	Field drainage	£	37,530	£144,200
(b)	**Present value of benefits**	(i)	Agriculture	£	180,590	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£180,590
(c)	**Benefit/cost ratio**					1.3
(d)	**Priority category**					2C

IMPROVEMENT WORKS

A booster pump is required on the Darnsyke. Channel improvements associated with these works would include regrading upstream and downstream to Torksey drain; a total length of approximately 4,000 m. The reconstruction of several access culverts would also be required. The design discharge is estimated at 0.3 cumec from a drainage area of 1.33 sq km.

BENEFITS

Agricultural benefit on 120 ha has been based on an estimated increase in annual gross margin assuming that one third of the area was in cash roots and the rest in cereals. A substantial area already has underdrains installed, but their efficiency is reduced by poor freeboards when there is high run-off.

IDENTIFICATION

Problem code number(s):	5-95-310-16
Watercourse:	Laughton Highland Drain (non-main river)
Location:	Laughton/Wildsworth (West Lindsey District Council)
OS Map reference:	SK 840 970

NATURE OF PROBLEM

An area of agricultural land, between Laughton and Wildsworth in Gainsborough Internal Drainage District, is affected by flooding due to inadequate discharge through the gravity outfall in wet weather under unfavourable tidal levels in the River Trent.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	5 years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	402,844	
	(ii)	Field drainage	£		£402,844
(b) **Present value of benefits**	(i)	Agriculture	£	746,750	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£746,750
(c) **Benefit/cost ratio**					1.9
(d) **Priority category**					2C

IMPROVEMENT WORKS

A feasibility study was completed by STWA in 1981.

In order to achieve the required standard of protection, floodbanks to both sides of a 1.5 km length of the drain through the flooded area is required, together with intermittent lengths of floodbank downstream. Drainage of the problem area would be effected by the installation of a small (0.28 m^3/s) pumping station to raise water from the regraded local drainage system into the Highland Drain.

Investigations are continuing regarding the availability of spoil for floodbanks. Costs and benefits have yet to be explained to, and agreed by, farmers.

A considerable maintenance programme has been undertaken by Gainsborough IDB and there has been no flooding in recent years. However, the underlying problem remains.

BENEFITS

The benefits have been estimated on the basis of improved yields from existing cropping patterns.

Following an Improvement Scheme some more profitable crops might be grown, but the additional benefits could well be off-set by the need for under drainage and they have not been included in the analysis.

IDENTIFICATION

Problem code number(s):	5-96-110-5
Watercourse:	Trentside Drain (non-main river)
Location:	Amcotts (Boothferry District Council)
OS Map reference:	SE 859 140

NATURE OF PROBLEM

The gardens of 8 houses are affected by flooding in times of heavy rainfall. The flooding is caused by access culverts to the houses being inadequately sized and laid to incorrect levels.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	10,090	
	(ii)	Field drainage	£		£10,090
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	2,500	
	(iii)	Roads/Railways	£		£2,500
(c) **Benefit/cost ratio**					0.2
(d) **Priority category**					3E

IMPROVEMENT WORKS

The existing access culverts, which are 100 mm to 225 mm diameter, need to be enlarged to at least 375 mm and 100 m of channel would require regrading. The catchment area of the watercourse is less than 20 ha.

BENEFITS

Benefit has been estimated on the relief of flooding to 8 gardens and has only a low value because there is no risk of flooding of the houses themselves.

IDENTIFICATION

Problem code number(s):	5-96-110-7
Watercourse:	New Mere Drain (non-main river)
Location:	Garthorpe (Boothferry District Council)
OS Map reference:	SE 836 175

NATURE OF PROBLEM

When storm conditions coincide with the tide lock period there is insufficient storage in the drains, with the result that the water rises, eventually reaching a level of 1.0 m above Ordnance Datum. This causes flooding and waterlogging of approximately 150 ha of agricultural land. The land is all within the District of Garthorpe Internal Drainage Board.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 10 years
		(ii)	Structures	1 in years
(c)	**Land potential category**			c

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

The Internal Drainage Board has constructed a second outfall pipe alongside the original Waterton Drain Outfall which has considerably improved the drainage to the east of Luddington. The scheme does not prevent flooding of this land but it should ensure very quick evacuation of floodwaters. No further works are proposed at this stage.

IDENTIFICATION

Problem code number(s):	5-96-110-10
Watercourse:	Area to South of Wroot (non-main river)
Location:	Bull Hassocks (Boothferry District Council)
OS Map reference:	SE 720 010

NATURE OF PROBLEM

Approximately 100 ha of arable land floods almost annually when high water levels are present in the South Idle Drain. The ground level at the centre of the affected area is lower than the flood water level in the Drain and so the field drainage system cannot work efficiently.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 20 years
		(ii)	Structures	1 in 20 years
(c)	**Land potential category**			c

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	100,900	
		(ii)	Field drainage	£	45,040	£145,940
(b)	**Present value of benefits**	(i)	Agriculture	£	330,620	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£330,620
(c)	**Benefit/cost ratio**					2.3
(d)	**Priority category**					2C

IMPROVEMENT WORKS

The alternative solutions are:

1 Lower the water level in the South Idle Drain by regrading.
2 Lower water level in the carrier drains by regrading them and pumping into the South Idle Drain.

The first alternative is not considered feasible as the South Idle Drain runs alongside the Idle Bank Road. Bed level is over 6 m below road level and any further lowering of bed level would structurally affect the road. Any works would necessitate piling of the works to maintain the structural integrity of the road.

A private pumping station is proposed by the Company which owns much of the affected land (approx. 80 ha). This would discharge into the South Idle Drain at Charity Farm.

The area in the catchment of Snell Drain would not be improved by the private pumping station and only a pump at the head of Snell Drain would resolve the situation for all the area.

Snell Drain itself should then be regraded for a length of approximately 2 km.

BENEFITS

This is an area of sand/peat with serious drainage problems.

IDENTIFICATION

Problem code number(s):	5-96-110-13
Watercourse:	Culvert along Doncaster Road draining to Monkham Drain
Location:	Westwoodside (Boothferry District Council)
OS Map reference:	SK 749 996

NATURE OF PROBLEM

Flooding occurs to properties and gardens and is believed to be due to obstructions/lack of capacity in the culvert. Further investigation is required to fully evaluate the problem and establish and identify potential contributors to possible works to alleviate the flooding.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£_____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£_____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-96-210-5/10
Watercourse:	Bottesford Beck (main river)
Location:	West Butterwick to Scunthorpe (Glanford Borough Council)
OS Map reference:	SE 838 061 to SE 925 084

NATURE OF PROBLEM

The Bottesford Beck is affected by run-off from urban areas at Scunthorpe. The outall to the River Trent consists of a gravity discharge structure through which flow is controlled by tidal conditions. Flooding and inadequate drainage of agricultural land occurs upstream of Scotter Road and there is a risk of breached flood defences along the downstream embanked portion of the watercourse. A partial scheme of floodbank reconstruction to a 50 year standard has somewhat alleviated this risk, and a feasibility study of further improvements has been completed.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

STWA completed a scheme downstream of Watermill Bridge. However, there are no proposals for improvements upstream of Watermill Bridge to Emmanuel Bridge. Flooding and inadequate drainage of agricultural land remains. It is doubtful whether the benefits would justify any further works.

IDENTIFICATION

Problem code number(s):	5-96-210-7
Watercourse:	Un-named (non-main river)
Location:	Holme (Glanford Borough Council)
OS Map reference:	SE 940 071

NATURE OF PROBLEM

The road junction between the B1398, Mortal Ash Hill and Holme Lane has flooded during periods of heavy rainfall and agricultural land floods between "Sweetinghthorns" and the road junction. The road junction floods because no provision has been made for the surface water run-off from the metalled road on Mortal Ash Hill. The flood water then flows down Holme Lane until it can reach the roadside drain. The agricultural land flooded because the culvert under the road junction was extended by approximately 15 m, blocking the outfalls to the land drains.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£____

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

A drainage channel should be constructed to cater for the surface water run-off from Mortal Ash Hill, this would discharge into the culvert that runs under the B1398. This is a highway drainage problem. The culvert blocking the land drain outfalls has been removed.

IDENTIFICATION

Problem code number(s):	5-96-210-11
Watercourse:	Un-named (non-main river)
Location:	Moorwell Road, Bottesford
OS Map reference:	SE 8806 0685 to SE 8758 0690

NATURE OF PROBLEM

An open stretch of watercourse on the north side of Moorwell Road, Bottesford is in need of improvement/culverting as may be appropriate for the urban environment. Part lies within the area of the Scunthorpe Internal Drainage Board and is accepted by them as their responsibility to maintain. Flooding does occur from time to time by overtopping causing very considerable inconvenience to business and commercial premises on land adjacent to an industrial estate. There are also problems of deposition of rubbish, complaints of safety, complaints about public health etc. The rubbish can tend to cause blockages within the culverted sections.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-97-110-2
Watercourse:	River Torne (main river)
Location:	Keadby/Auckley (Boothferry District Council and Doncaster Metropolitan Borough Council)
OS Map reference:	SE 835 113/SE 646 013

NATURE OF PROBLEM

The River Torne is a highland river flowing through what is largely a lowland area. The Torne outfalls at Keadby Pumping Station where discharge, when unable to gravitate, is pumped to the Trent. Concern has been felt for some time about the effect of increased run-off on the river's capacity and about the condition of the major floodbanks.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in 10	years
	(ii)	Structures	1 in 10	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

Works are being undertaken on the River Torne upstream of Pilfrey Bridge following the adoption of recommendations made in the feasibility report produced by STWA in 1983. The 22 km of river improvements and flood bank reconstruction are being carried out in 4 sections. Section 4, Candy Farm Pumping Station to upstream of Auckley Bridge is due for completion in 1990.

CONSERVATION

The dykes and meadows in this valley support a rich and rare flora and fauna. The Yorkshire Naturalists' Trust feel that this area is particularly at risk from drainage activities.

Hatfield Moor SSSI is adjacent to the River Torne.

SUBSIDENCE

The watercourse is in an area which may be subject to future mining subsidence.

FISHERIES

The River Torne is a good coarse fishery.

IDENTIFICATION

Problem code number(s):	5-97-110-3
Watercourse:	St. Catherine's Well Stream (non-main river)
Location:	Loversall (Part - Potteric Carr IDD) (Doncaster Metropolitan Borough Council)
OS Map reference:	SK 585 982

NATURE OF PROBLEM

Approximately 25 ha of agricultural land at Low Farm, Loversall flood almost annually. The flooding is caused by water backing up from the River Torne, and by the inadequacy of parts of the St. Catherine's Well Stream to accept the flood flows.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(b)	**Agricultural**	(i)	Channel	1 in 5 years
		(ii)	Structures	1 in years
(c)	**Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	230,630	
		(ii)	Field drainage	£	30,030	£260,660
(b)	**Present value of benefits**	(i)	Agriculture	£	361,180	
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£361,180
(c)	**Benefit/cost ratio**					1.4
(d)	**Priority category**					2C

IMPROVEMENT WORKS

The recommended solution consists of regrading and enlarging a length of approximately 5 km of St. Catherine's Well Stream and diverting some of the flow into the catchment of the Huxter Well Drain. The design discharge is 2.45 cumecs for a 1 in 5 year storm and the catchment area is 1,830 ha.

Doncaster Metropolitan Borough Council agreed to a comprehensive scheme but were unable to provide funds. The Metropolitan Borough Council now believe the flooding has moved upstream and that the situation requires reviewing.

DEVELOPMENT

40 ha of land is allocated for development (housing) and the additional run-off has been taken into account in arriving at the design discharge.

Further development is planned in the catchment as a result of redevelopment of the Yorkshire Main Colliery Site and on-site storage of peak run off is having to be provided in order to avoid worsening the situation.

BENEFITS

Improvement to the land situated between Washing Dyke Plantation and Monbrick Wood will depend on an improved outfall under the railway. The soils of the area are poorly drained clay soil, loamy soil and loamy weathered marl, and the type of farming is mixed with crops ranging from grass to barley.

SUBSIDENCE

The watercourse is affected by mining subsidence.

IDENTIFICATION

Problem code number(s):	5-97-110-5
Watercourse:	Paper Mill Dyke (non-main river)
Location:	Tickhill (Doncaster Metropolitan Borough Council)
OS Map reference:	SK 590 929

NATURE OF PROBLEM

The gardens of approximately 15 houses flooded in 1976 and 1977. The flooding was caused by an inadequate culvert carrying a footbridge (capacity 1 in 5 year storm), and a small length of retaining wall which requires improving from its present standard (1 in 75 years) up to the design standard. It is understood that obstructions have been formed in the channel in the past by riparian owners but the obstructions have since been removed.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	17,300	
	(ii)	Field drainage	£		£17,300
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	5,000	
	(iii)	Roads/Railways	£		£5,000
(c) **Benefit/cost ratio**					0.3
(d) **Priority category**					3E

IMPROVEMENT WORKS

These should include renewal of the footbridge and improvement of 50 m of stone retaining wall. The 1 in 100 year discharge is estimated as 9.82 cumecs from a catchment of 19 sq km.

An additional waterway has been provided at Rowlands Bridge in an attempt to improve the situation. However Rowlands Bridge will not meet the 1 in 100 year design standard and further improvements are constrained by the bridge being a listed building.

DEVELOPMENT

Only infill development is proposed within the catchment.

BENEFITS

Benefit assessment has been based on 7 properties, but these are estimated to be affected to ground floor level only.

CONSERVATION

The Nottinghamshire Conservation Trust considers this a high grade County Site of Natural History Interest. The Paper Mill at Rowlands Bridge is a listed building.

IDENTIFICATION

Problem code number(s):	5-97-110-6
Watercourse:	Ruddle Mill Dyke (non-main river)
Location:	Stainton (Doncaster Metropolitan Borough Council)
OS Map reference:	SK 543 947

NATURE OF PROBLEM

The flooding in Chapel Hole and Stainton is due to inadequate culverts and inadequate channel capacity. The problem is aggravated by a pumped discharge from a quarry.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 10 years
(c) **Land potential category**			b

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	123,960	
	(ii)	Field drainage	£		£123,960
(b) **Present value of benefits**	(i)	Agriculture	£	22,230	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£22,230
(c) **Benefit/cost ratio**					0.2
(d) **Priority category**					3C

IMPROVEMENT WORKS

i) Chapel Hole: replace 2 culverts and upgrade the watercourse over a length of 500 m to give additional freeboard;

ii) Stainton Village: replace 2 culverts and upgrade watercourse for 300 m and replace 4 house access culverts;

iii) Stainton Bottoms: replace 1 culvert, clean out one other and upgrade watercourse for a length of 100 m.

The discharge calculated for the 100 year design flow is 9.2 cumecs on a catchment area of 13.2 sq km.

Revision of pumping arrangements at the quarry may reduce complaints.

DEVELOPMENT

Only infill development is proposed within the catchment.

BENEFITS

The soil type is fine loamy river alluvium of the Trent Series, and fine loamy alluvium over dolomitic limestone of the Aberford Series. If the watercourse is cleared it is possible that very little, if any, underdrainage will be required because of the limestone sub-soil.

CONSERVATION

There is a small lake at SK 575 929 which has some naturalist interests, principally botanical, but this will not be affected by the works.

Ruddle Mill Dyke passes to the north of a large quarry and is separated from it by a limestone escarpment and woodland. This area, between the river and quarry, is of considerable natural history interest. The Nature Conservancy Council wish to see safeguards being taken to ensure the interest remains.

SUBSIDENCE

The watercourse is in an area which could be affected by future mining subsidence.

IDENTIFICATION

Problem code number(s):	5-97-110-8
Watercourse:	Austerfield/Newington Road Drain (non-main river)
Location:	Austerfield (Doncaster Metropolitan District Council)
OS Map reference:	SK 663 939

NATURE OF PROBLEM

Property floods, probably due to undersized culverts, one of which has already been enlarged. Mining subsidence has also affected part of the Austerfield land drainage system.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

CONSERVATION

This is quite an interesting site because of a diversity of relatively common plants. If the adjacent meadow floods in winter, it could be of importance to both migrant and wintering wader wildfowl.

IDENTIFICATION

Problem code number(s):	5-97-210-1/2
Watercourse:	Anston Brook (non-main river)
Location:	(1) Lindrick Dale
	(2) North Anston (Rotherham Metropolitan Borough Council)
OS Map reference:	SK 540 825 and SK 516 844

NATURE OF PROBLEM

(1) The gardens of houses in Lindrick Dale are inundated approximately every 5 years. The flooding is caused by insufficient freeboard at certain parts on the west bank of Anston Brook.

(2) Flooding of gardens and approximately 25 ha of agricultural (pasture) land occurs. The flooding is caused by lack of freeboard causing overspilling of banks, and railway and road culverts becoming obstructed with silt.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in 50/100 years
		(ii)	Structures	1 in 100 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	8,650	
		(ii)	Field drainage	£		£8,650
(b)	**Present value of benefits**	(i)	Agriculture	£		
		(ii)	Buildings	£		
		(iii)	Roads/Railways	£		£
(c)	**Benefit/cost ratio**					0
(d)	**Priority category**					3F

IMPROVEMENT WORKS

(1) The protection will involve the building up of banks at low spots (approx. 50 m) in landscaped gardens and it is doubtful whether such works can be justified.

(2) One railway culvert and one road bridge culvert require cleaning out and the banks require building up over short lengths to give adequate cross-sectional area. It would be appropriate for such works to be carried out as part of a maintenance programme.

Rotherham MBC are monitoring the situation.

DEVELOPMENT

There are 41 ha of development proposed within the catchment and these have been included in arriving at the recommended solution.

BENEFITS

It is unlikely that any substantial physical damage is caused.

CONSERVATION

There is an SSSI at Anston Stones Wood (SK 531 831) and a disused magnesian limestone quarry with a well developed marsh community at SK 540 825. Any bankside works if impinging on the SSSI should be sympathetic to the high ecological value.

IDENTIFICATION

Problem code number(s):	5-97-210-5
Watercourse:	Eel Mires Dyke (non-main river)
Location:	Dinnington (Rotherham Metropolitan Borough Council)
OS Map reference:	SK 508 870

NATURE OF PROBLEM

Approximately 10 ha of agricultural land on Laughton Common flood almost annually. The flooding is caused by inadequate culverts, culverts laid to incorrect levels and lack of maintenance.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 5 years
(c) **Land potential category**			b

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	230,630	
	(ii)	Field drainage	£	45,040	£275,670
(b) **Present value of benefits**	(i)	Agriculture	£	433,410	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		£433,410
(c) **Benefit/cost ratio**					1.6
(d) **Priority category**					2C

IMPROVEMENT WORKS

The inadequate culvert requires replacing by a larger culvert over a length of 220 m. The channel should be regraded to provide a design capacity of 2.26 cumecs for a 1 in 100 year storm and 1.03 cumecs for a 1 in 5 year storm.

Considerable efforts have been expended to encourage riparian owners to carry out maintenance works on sections of the watercourse upstream of the point where it crosses beneath the B6463 (Monksbridge Road). The Council has organised much of the clearance works on behalf of the riparian owners, but problems quickly recur due to the poor gradients available and illegal tipping that takes place. The land immediately upstream of Monksbridge Road is now partially disused and maintenance of the open watercourse in this section has proved problematical. The land is scheduled for redevelopment and culverting of the watercourse will be pursued as part of any development proposals.

BENEFITS

This small arterial watercourse drains a catchment of some 59 ha known as Laughton Common. The upper part of the catchment of approximately 27 ha extending to Laughton Common Road has already been drained and the watercourse improved. This is now cropped with grass and cereals in rotation. The lower catchment did not allow scope for underdrainage but some spring sowing is carried out.

The soil series is Dale, a clayey soil with moderate limitations that restrict choice of crops and demand careful management. The watercourse is in a fairly clean state but has a high water level and any improvements will have to come about by pumping. This land has medium potential with a design flood frequency of not less than 1 in 5 years. It is estimated that 29 ha will benefit from underdrainage if a satisfactory outfall is provided.

SUBSIDENCE

The area could be affected by mining subsidence.

IDENTIFICATION

Problem code number(s):	5-97-210-6/7/8
Watercourse:	Bramley Brook (non-main river)
Location:	Bramley/Hellaby (Rotherham Metropolitan Borough Council)
OS Map reference:	SK 488 927, SK 494 926, SK 501 926

NATURE OF PROBLEM

A small area of Brook Lane, Bramley becomes flooded after heavy rain. Considerable building development is taking place in the catchment.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in years
		(ii)	Structures	1 in 50 years
(b)	**Agricultural**	(i)	Channel	1 in years
		(ii)	Structures	1 in years
(c)	**Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	
		(iv)	Development	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

A flooding problem between Bramley and the M18 at the old Bramley Sewage works, (5-97-210-7) has been relieved by works carried out by Rotherham Metropolitan Borough Council. Residential development in the Bramley Brook catchment has continued over the last few years, with most of the catchment now fully developed. In conjunction with developers, the Highway Authority and Severn Trent Water, the Council has progressed a programme of culverting such that all the Brook in this area is now culverted in appropriately sized pipes. Additional capacity was built into these works to allow abandonment of the balancing reservoir, the site of which has also been redeveloped for housing purposes.

A problem still exists in the vicinity due to lack of capacity within the highway drain system in Brook Lane. Some palliative measures to prevent flooding from this source have already been taken in advance of a scheme to renew the drain incorporated into the current programme of highway drainage works to be implemented in the near future.

There have been no reported incidents of flooding since completion of the culverting works and implementation of the highway drainage scheme will reduce the risk of flooding even further.

CONSERVATION

Problem 5-97-210-8 involves a permanent marsh which Rotherham Metropolitan Borough Council's Keeper of Natural Sciences has requested be left in its natural state.

SUBSIDENCE

The area may be affected by mining subsidence.

IDENTIFICATION

Problem code number(s):	5-98-110-1
Watercourse:	None
Location:	Elmton (Bolsover District Council)
OS Map reference:	SK 502 735

NATURE OF PROBLEM

Flooding of an unclassified road and part of a field occurs on infrequent occasions. There is a satisfactory diversion and the benefits from improvements will not justify an improvement scheme. No watercourse is involved.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-98-110-2
Watercourse:	Millwood Brook (non-main river)
Location:	Creswell (Bolsover District Council)
OS Map reference:	SK 526 745

NATURE OF PROBLEM

Flooding of 14 properties along the A616 in Cresswell occurred in February 1977. The flooding is caused by a watercourse which passes through a series of inadequate and silted culverts. Water unable to pass through these culverts overflows onto the A616 and then into adjacent properties.

Further flooding occurred in April 1981 involving basements and threatening property upstream.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 10 years
	(ii)	Structures	1 in 10 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

The improvements considered would take the form of regrading of 1.86 km of channel, contruction of 320 m of floodbank, and the cleaning out and repair of existing culverts and bridges. The works would be carried out to protect against a 10 year event only, as the location and lengths of some of the existing culverts would appear to make it economically unsound to provide 100 year protection by channel improvements. It may, however, be possible to provide storage for flows above the 10 year magnitude at a site upstream of Creswell, the Hollinhill/Markland Grips area. From a visual inspection this site appears to be suitable but a detailed investigation of the potential of the area needs to be undertaken.

Flows were calculated using the unit hydrograph method. The design scheme costed above will provide for a capacity of 3.5 cumecs (100 year = 6.2 cumecs).

Bolsover District Council have cleaned out the existing culverts and regraded a length of channel which has reduced the extent and frequency of flooding. A scheme for the construction of floodbanks has been completed.

DEVELOPMENT

27 ha of residential development is proposed in the Creswell/Clowne area.

BENEFITS

Prior to improvements, 14 properties would have been affected by a 10 year flood and some 50 shops, commercial premises and dwellings might have suffered flood damage during a 100 year event.

SUBSIDENCE

The Millwood Brook is partly within an area which could be subject to mining subsidence, the area including Hollinhill/Markland Grips.

RECREATION, FISHERIES AND AMENITY

These facilities would not be affected by improvement works but if a flood storage scheme is adopted these may offer the possibility of some improvement in some amenity aspects.

CONSERVATION

A site of Special Scientific Interest is recorded at Hollinhill and Markland Grips. Cresswell Craggs is downstream of the length considered.

IDENTIFICATION

Problem code number(s):	5-98-110-4
Watercourse:	Sookholme Brook (non-main river)
Location:	Shirebrook (Bolsover District Council)
OS Map reference:	SK 533 675

NATURE OF PROBLEM

An inadequate culvert on this tributary of the River Meden caused flooding at a Water Reclamation Works and an industrial site. The Local Authority have carried out improvements to the culvert and a section of the watercourse. A further improvement in conditions may be achieved by improvements to Sookholme Brook downstream of the Reclamation Works (5-94-510-6).

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£____
(c) **Benefit/cost ratio**				
(d) **Priority category**				

CONSERVATION

The Nottinghamshire Trust for Nature Conservation has designated this area a high grade County Site for Natural History Interest.

SUBSIDENCE

The watercourse is in an area which might be subject to future mining subsidence.

FISHERIES

Part of the brook course is fished.

IDENTIFICATION

Problem code number(s):	5-98-110-8
Watercourse:	Suff Brook (non-main river)
Location:	Pinxton Wharf (Bolsover District Council)
OS Map reference:	SK 451 553 to SK 453 543

NATURE OF PROBLEM

At times of high flows in the River Erewash, the Suff Brook backs up through the railway embankment and frequently floods properties, gardens and roads. Some flooding can also be attributed to Erewash water being unable to drain due to blocked culverts. Past mining subsidence has also created low areas which pond flood water.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	374,780	
	(ii)	Field drainage	£		£374,780
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£	25,020	
	(iii)	Roads/Railways	£		
	(iv)	New Development	£	300,250	£325,270
(c) **Benefit/cost ratio**					0.9
(d) **Priority category**					3C

IMPROVEMENT WORKS

Investigations have shown that the existing channel is inadequate and should be enlarged and regraded for 0.9 km. This also includes several bridges which need to be rebuilt.

The culvert beneath the railway at Pinxton Wharf has subsided and is inadequate to accept the design flows. It should be reconstructed and two blocked off culverts within the adjacent scrap yard re-opened. Some regrading work is necessary immediately downstream of the railway embankment within the derelict canal which carries the watercourse through to the Erewash. The estimated flood discharge is 4.7 cumecs (100 year) from a catchment area of 1.2 sq km.

DEVELOPMENT

Development in the Suff Brook catchment as indicated in the Structure Plan has been taken into account in the proposals, although some of the development has already proceeded in anticipation of the improvement.

BENEFITS

The benefits have been calculated based upon an estimated eight properties which would flood in the 100 year event. The agricultural areas, which are permanent pasture, are not expected to benefit from these improvements.

RECREATION, FISHERIES AND AMENITY

The Pinxton Wharf site is part of the Nottinghamshire County Councils amenity development of the disused Pinxton Canal. Part of Suff Brook contains coarse fish.

IDENTIFICATION

Problem code number(s):	5-98-110-10
Watercourse:	Millwood Brook (non-main river)
Location:	Clowne (Bolsover District Council)
OS Map reference:	SK 495 762

NATURE OF PROBLEM

There are three interrelated land drainage problems at Clowne:

1) Flooding of Rotherham Road (A618) due to insufficient freeboard.
2) The retained high water level of Harlesthorpe Dam.
3) Flooding of Station Road, due mainly to inadequate culvert openings and channel capacity.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

Problem 1 Improvement works have been completed and appear successful.

Problem 2 A Panel 1 Engineer's Report has been prepared and it is understood that the owner has carried out some of the recommendations. The District Council is monitoring the situation.

Problem 3 Improvement works have been completed and appear successful.

FISHERIES

There is an active fishing lake at Harlesthorpe Dam which is privately owned.

IDENTIFICATION

Problem code number(s): 5-98-210-1
Watercourse: River Trent (main river)
Location: Sawley (Erewash Borough Council)
OS Map reference: SK 470 308

NATURE OF PROBLEM

The A453 trunk road is affected by major floods. This road is in the floodplain of the River Trent and the benefits from flood alleviation will not justify the extensive improvement works required.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IDENTIFICATION

Problem code number(s):	5-98-210-2 and 5-98-310-2
Watercourse:	River Trent (main river)
Location:	Sawley (Erewash Borough Council)
OS Map reference:	SK 490 312

NATURE OF PROBLEM

Several properties including public houses are situated in the River Trent floodplain at the junction of the Erewash Canal and the River Trent. The area has become a centre for water-based recreational activities and any flood risk to property is that which would reasonably be expected in view of its location.

For practical purposes any alleviation measures should be directed towards providing adequate flood warning in order to minimise damage.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

The former STWA completed a scheme for raising minor flood defences to a 1 in 10 year standard.

CONSERVATION

This site adjoins a small area of marsh which is of some local interest.

IDENTIFICATION

Problem code number(s):	5-98-210-6
Watercourse:	Erewash Canal and Feeder Drain (non-main river)
Location:	Sandiacre (Erewash Borough Council)
OS Map reference:	SK 482 378

NATURE OF PROBLEM

Poor drainage and some surface flooding affects approximately 4 ha of wasteland and 1 ha of pasture. Drainage improvements are considered both uneconomical and impractical as they would involve the lowering of the Erewash Canal water level and improvement to the downstream overflow arrangements.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

FISHERIES

The lower reaches of the canal are extensively fished.

IDENTIFICATION

Problem code number(s):	5-98-210-11/12
Watercourse:	Golden Brook (non-main river)
Location:	Long Eaton (Erewash Borough Council)
OS Map reference:	SK 508 335, SK 482 334

NATURE OF PROBLEM

Under major flood conditions extensive flooding occurs within the urban area of Long Eaton from the Golden Brook and its tributary the Harrington Drain. In February 1977 this affected some 60 properties, including a post-war residential estate which had been previously flooded in December 1960. The flooding is due to urban encroachment on the floodplain and watercourse resulting in inadequate capacity for flows, and these are further impeded at the outfall of the Brook when the River Erewash is also in flood.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in years
	(ii)	Structures	1 in years

(c) **Land potential category**

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	£

(c) **Benefit/cost ratio**

(d) **Priority category**

IMPROVEMENT WORKS

(a) Work completed: Automation of penstock control on Golden Brook at the canal. Major improvements in Oakley's Road area. Construction of a pumping station on the outfall to the floodplain. Improvements between the M1 and West Park. A new culvert under Wilsthorpe Road and the diversion of a sewer. Construction of floodbanks to the south of Golden Brook and on the north side of Harrington Drain.

(b) Work to be carried out: Improvements to Breaston lagoon. This should be completed in 1990/91. When completed, the level of protection will be in 100 years.

CONSERVATION

The existing flood storage lagoon at Breaston is now classified as a nature reserve.

FISHERIES

The Brook contains coarse fish.

IDENTIFICATION

Problem code number(s):	5-98-210-13
Watercourse:	Golden Brook, Golden Stream (non-main river)
Location:	Breaston (Erewash Borough Council)
OS Map reference:	SK 453 346 to SK 473 337

NATURE OF PROBLEM

The culverted crossings under Draycott Road, on both watercourses, are inadequate to deal with higher rates of run-off owing to the configurations of the culverts and their entries. Eleven properties were flooded above floor level in 1977, and about 30 suffered sub-floor flooding. These problems were the subject of a consultant's study and a report has been prepared for the Local Authority.

In addition, 60 ha of agricultural land are subject to flooding and poor drainage because of inadequate freeboard, both upstream and downstream of Draycott Road.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 5 years
(c) **Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£_____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	
	(iv)	Future development	£	£_____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

The following improvements were completed in 1989:

Golden Stream (Protection Level 1 in 30 years)

1) Regrading of field ditch to the south of Gregory Avenue
2) Construction of a bund north of Gregory Avenue
3) Streamlining of the confluence of agricultural drainage from east and west adjacent to Western Mare School
4) New channel part open cut, part culvert through Western Mare playing fields
5) New culverts under Draycott Road

Golden Brook (Protection Level 1 in 50 years)

1) Realignment of the Brook north of Draycott Road and streamlining of culvert entrance.
2) Bund to the west of the Brook, north of Draycott Road, and flood protection wall to the boundary of No 50 Draycott Road with a bund to the northern boundary at the same property
3) Concrete flood defence wall adjacent to Draycott Road (north side) to prevent overtopping of water onto the highway
4) Streamlining the outfall from Draycott Road culvert and widening and regrading downstream (adjacent to the "Crescent")
5) Reconstruction of accommodation bridge over the brook at the end of Marlborough Road

FISHERIES

The Brook contains coarse fish.

IDENTIFICATION

Problem code number(s):	5-98-210-14
Watercourse:	None
Location:	Draycott (Erewash Borough Council)
OS Map reference:	SK 452 333

NATURE OF PROBLEM

Flooding of the railway line in the cutting occurs on average two or three times a year, occasionally stopping services between Nottingham and Derby. The flooding is attributed to inadequate track drainage, but the problems have increased following the infilling of the Derby Canal.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

British Rail are investigating proposals to alleviate flooding as part of the future electrification of the line. The flood alleviation proposals will be promoted as part of the British Rail Bill through Parliament and are anticipated to cost a minimum of £0.5M. It is anticipated that the track side drainage and the run-off from the infilled Derby Canal will be discharged to a suitable outfall point in the Derwent Division.

IDENTIFICATION

Problem code number(s):	5-98-210-17/18/19
Watercourse:	Nut Brook (non-main river)
Location:	Stanton to Ilkeston (Erewash Borough Council)
OS Map reference:	SK 482 390 to SK 449 425

NATURE OF PROBLEM

The natural course of the Nut Brook is affected by the now disused Nut Brook Canal and by industrial development. Flooding of the Stanton Ironworks complex takes place under major flood conditions. The Stanton Ironworks site is vulnerable to flooding from events with an estimated recurrence interval of 15 years or greater. Areas of agricultural land served by the Brook are flooded. Some allotments have suffered frequent inundation in recent years and about 1 ha of land is more or less permanently flooded. Further urban development is planned and the upper part of the catchment is affected by opencast coal workings.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 2/10 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£____
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	
	(iv)	Future development	£	£____

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

A balancing scheme has been completed by Derbyshire County Council upstream, but problems still exist downstream.

Flood discharge estimated by Flood Studies Report methods is 3 cumecs (2 year) from a total catchment of 43 sq km.

DEVELOPMENT

Further development in the Nut Brook catchment will require additional flows to be balanced.

CONSERVATION

5-98-210-17 adjoins an area of species rich grassland.
5-98-210-19 had only recently become flooded, but in this relatively short time it has become a locally important ornithological site.

IDENTIFICATION

Problem code number(s):	5-98-210-20/21
Watercourse:	Sow Brook (non-main river)
Location:	Kirk Hallam (Erewash Borough Council)
OS Map reference:	SK 464 398 to SK 440 387

NATURE OF PROBLEM

The Sow Brook is a tributary of the Nut Brook and flows mainly through agricultural areas. The problem is mainly one of improvement of the arterial drainage and there is some flood risk to two properties at Dale and minor road flooding.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in 25 years
(c) **Land potential category**			

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	118,200	
	(ii)	Field drainage	£	25,020	£143,220
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings)	£		
	(iii)	Roads/Railways)	£	115,100	£115,100
(c) **Benefit/cost ratio**					0.8
(d) **Priority category**					3C

IMPROVEMENT WORKS

The watercourse will require regrading over a length of approximately 2 km and improved discharge capacity will be required at road crossings including Dale Ford. Works may also be necessary on the lake downstream of Sow Brook Lane.

CONSERVATION

5-98-210-21; Ponds near the Sow Brook at this location are of botanical interest and it is thought to be certain that work on the Sow Brook at this point would affect the eastern pond and possibly the others also.

5-98-210-20; This site is a wet, rush-dominated grassland, a habitat considered rare in such a locality, and one which has developed an ornithological interest.

FISHERIES

The Brook contains coarse fish.

IDENTIFICATION

Problem code number(s):	5-98-210-22/23
Watercourse:	Stanley Brook (non-main river)
Location:	Kirk Hallam/Stanley (Erewash Borough Council)
OS Map reference:	SK 452 411 to SK 409 408

NATURE OF PROBLEM

The Stanley Brook is in a poorly maintained condition, which has contributed to some flooding of property in its higher reaches at Stanley where agricultural drainage is also affected.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 100 years
	(ii)	Structures	1 in 100 years
(b) **Agricultural**	(i)	Channel	1 in 5 years
	(ii)	Structures	1 in years
(c) **Land potential category**			a5

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	
	(ii)	Field drainage	£	£
(b) **Present value of benefits**	(i)	Agriculture	£	
	(ii)	Buildings	£	
	(iii)	Roads/Railways	£	
	(iv)	New development	£	£

(c) **Benefit/cost ratio**
(d) **Priority category**

IMPROVEMENT WORKS

A drainage scheme to regrade the watercourse from SK 421 403 to SK 416 401 was completed by Derbyshire County Council in 1986. Works have been successful downstream of the road bridge. The field upstream of the bridge floods occasionally due to the brook overtopping its banks upstream of the improvement and flowing overland.

DEVELOPMENT

Further development in the Stanley Brook catchment as indicated in the latest structure plan amounts to 17 ha.

FISHERIES

The Brook contains coarse fish.

IDENTIFICATION

Problem code number(s):	5-98-210-24
Watercourse:	New Sawley Brook (non-main river)
Location:	New Sawley/Long Eaton (Erewash Borough Council)
OS Map reference:	SK 491 322

NATURE OF PROBLEM

The outfall of the Brook through the River Trent major floodbank is controlled by a penstock. During major flood conditions, the penstock is closed causing flooding of agricultural land in the Fields Farm area.

DESIGN STANDARDS

(a)	**Urban**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(b)	**Agricultural**	(i)	Channel	1 in	years
		(ii)	Structures	1 in	years
(c)	**Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a)	**Costs**	(i)	Arterial works	£	
		(ii)	Field drainage	£	£____
(b)	**Present value of benefits**	(i)	Agriculture	£	
		(ii)	Buildings	£	
		(iii)	Roads/Railways	£	£____
(c)	**Benefit/cost ratio**				
(d)	**Priority category**				

IMPROVEMENT WORKS

A pumping station has been constructed and is operational. The Penstock has also been removed. A study is being undertaken in order to improve the influx capacity of water to the pumping station through the existing railway culverts.

IDENTIFICATION

Problem code number(s):	5-98-310-6/7
Watercourse:	Bailey Brook (non-main river)
Location:	Loscoe to Langley Mill (Amber Valley District Council)
OS Map reference:	SK 425 478 to SK 456 463

NATURE OF PROBLEM

There is flooding at various points along the watercourse between Loscoe Dam and the River Erewash. The Trent bus garage on Station Road has been affected by flooding in the past. The main problems appear to be the result of inadequate channel and culvert capacity, owing in part to lack of maintenance and blockages. Also two properties adjacent to Loscoe Dam are threatened during severe floods because of the storage produced by inadequate flood weirage.

The Brook requires improvement to provide for development in the catchment and there is a need for co-ordination in the phasing of development and land drainage works.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in 10 years
	(ii)	Structures	1 in 25 years
(b) **Agricultural**	(i)	Channel	1 in 3 years
	(ii)	Structures	1 in years
(c) **Land potential category**			a

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£	446,850	
	(ii)	Field drainage	£	7,510	£454,360
(b) **Present value of benefits**	(i)	Agriculture	£	50,010	
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		
	(iv)	New Development	£	930,780	£980,790
(c) **Benefit/cost ratio**					2.2
(d) **Priority category**					1C

IMPROVEMENT WORKS

A scheme has been produced by Amber Valley District Council based on stated design flows of 1 in 25 years for structures and 1 in 10 years for open channel. The Council's calculations were based on the rational method of flood prediction, and give lower flows than those predicted by the Flood Studies Report. It is, however, important that the property should not flood in a 50 or 100 year event, although some out of banks flooding would be acceptable. The estimates derived from the Local Authority's preliminary report may be subject to some revision.

The Local Authority scheme comprises the regrading of 1,150 m of open channel together with culverting or re-culverting of 220 m of watercourse. British Coal will be carrying out improvement works immediately downstream of Loscoe Dam as part of its proposed opencast workings. It is proposed that consideration be given to replacement of the inadequate weir on Loscoe Dam with a larger open weir and spillway (subject to the requirements of the Inspecting Engineer under the Reservoirs Act). Some tree clearing and improved maintenance is necessary on open channel lengths.

The stated 1 in 25 year flood flow from the fully developed catchment of 13.6 sq km is 7.20 cumecs at the Erewash Confluence (1 in 10 year - Flood Studies Report).

Some channel improvements have been carried out downstream of the Trent bus garage on Station Road.

DEVELOPMENT

The catchment can conveniently be split into two parts, upstream of Loscoe Dam and downstream. Upstream, a total of 21.9 ha of future development are proposed comprising 21.5 ha residential and 0.4 ha industrial. Downstream, there are 66.5 ha of future residential and 4.7 ha of industrial development proposed. In the fully developed catchment the urban proportion will be 41.6%, the design flows allow for the future development.

BENEFITS

(i) Urban: The value of benefits attributable to buildings derives entirely from the betterment to future development within the catchment, assuming that the total proposed area (93.1 ha) is realised, at £10,010/ha.

(ii) Agricultural: It is difficult to assess an average gross margin as the area north-west of Mansfield Road is derelict, with little or no agricultural production, and part of the area east of the railway is similarly semi-derelict. The only agricultural land is the area around Lacey Fields Farm where drainage does not appear to be a serious limiting factor.

RECREATION AND AMENITY

Some of the flooded land is designated a recreation area by Amber Valley District Council.

CONSERVATION

The Derbyshire Naturalists Trust have expressed interest in maintaining the area between the Brook and Bailey Brook Drive as a nature reserve, though it is not officially designated as such at present. The Council's proposals will have no detrimental effect on the area from the Naturalists' viewpoint and it should be possible to provide an adequate drainage system on the Brook, compatible with other proposals for land use.

FISHERIES

The Brook contains coarse fish.

COMMENT

The District council are investigating a scheme for on-site balancing when opencast mining is completed.

IDENTIFICATION

Problem code number(s):	5-98-310-9
Watercourse:	Birchwood Brook (non-main river)
Location:	Somercotes (Amber Valley District Council)
OS Map reference:	SK 438 541 and SK 448 537

NATURE OF PROBLEM

The watercourse is affected by development in its upper reaches, the run-off from which is partially controlled by balancing ponds. The channel is in need of some improvement but the area is partly the subject of opencast mining proposals in the near future.

DESIGN STANDARDS

(a) **Urban**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(b) **Agricultural**	(i)	Channel	1 in	years
	(ii)	Structures	1 in	years
(c) **Land potential category**				

ECONOMIC EVALUATION (December 1989 price base)

(a) **Costs**	(i)	Arterial works	£		
	(ii)	Field drainage	£		£
(b) **Present value of benefits**	(i)	Agriculture	£		
	(ii)	Buildings	£		
	(iii)	Roads/Railways	£		
	(iv)	New development	£	267,720	£267,720
(c) **Benefit/cost ratio**					
(d) **Priority category**					

IMPROVEMENT WORKS

Preliminary investigations have shown that the existing channel is inadequate and should be enlarged and regraded. All structures would require some work to be carried out in order to accept appropriate design flows. The lower section of the watercourse, upstream of the Erewash confluence, is within an area designated for Open Cast Mining Development. The necessary standards for improvement of the watercourse should be considered in conjunction with restoration of that area. No estimate of cost has therefore been provided. The unbalanced flood discharge estimated by the Flood Studies Report methods is 9.2 cumecs (100 year) from a total catchment area of 4.3 sq km.

DEVELOPMENT

New development in the Birchwood Brook catchment, as indicated in the County Structure Plan, amounts to 145 ha. This development is currently taking place. The surface water run-off will be flow balanced.

BENEFITS

Flood damage to property is negligible and only the proposed development benefits have been taken into account. Future development benefits have been allowed at £10,010/ha and provide a benefit value of £267,720. The agricultural areas, which are permanent pasture, are not expected to benefit from these improvements.

APPENDIX A2

SCHEDULE OF MAIN RIVER

SCHEDULE OF MAIN RIVERS IN THE UPPER SEVERN AREA - JANUARY 1990

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
ACRE BROOK	R Severn confluence to upstream face of outfall structure	SJ 316 160	SJ 315 159	0.28	1
ADFORTON BROOK	Wigmore Main Drain confluence to a point upstream of Green Lane Bridge, Adforton	SO 420 706	SO 415 704	0.48	2
ALLCOCKS BROOK	Wigmore Main Drain confluence to Allcocks Bridge	SO 420 706	SO 425 693	1.45	2
BACK BROOK	R Roden confluence to Stang's Plantation	SJ 514 286	SJ 484 291	3.70	1
BAILEY BROOK	R Tern confluence to Hoarstone Lane Bridge	SJ 629 315	SJ 610 337	4.67	1
BELE BROOK	R Severn confluence to Wern Bridge	SJ 283 158	SJ 253 137	4.14	1
BLACK BROOK	Smestow Brook confluence to the A454 road bridge	SO 839 959	SO 836 967	1.00	2
BROMLEY BROOK	R Perry confluence to Bagley-Shade Oak road bridge	SJ 399 252	SJ 410 274	3.70	1
BUCKLEY FARM BROOK	R Severn confluence to upstream face of Buckley Farm outfall	SJ 363 166	SJ 364 167	0.20	1
RIVER CAMLAD	R Severn confluence to Snead Bridge	SJ 209 006	SO 320 918	29.23	1
RIVER CERIST	R Severn confluence to Van road bridge (B4518)	SO 025 915	SN 915 874	9.50	1
RIVER CLYWEDOG	R Severn confluence to Clywedog Dam	SN 954 848	SN 913 869	5.31	1
COMMISSION DRAIN	R Tern confluence to Kynnersley road bridge	SJ 615 149	SJ 650 176	5.25	1
RIVER CORVE	R Teme confluence to Beam Bridge	SO 506 750	SO 532 882	22.85	2
CRIGGION BROOK	R Severn confluence to upstream face of outfall structure	SJ 314 161	SJ 313 161	0.04	1
CRUCKTON BROOK	Rea Brook confluence to upstream of confluence with right bank tributary	SJ 432 098	SJ 428 102	0.70	1
DUNKETT BROOK	R Severn confluence to upstream face of Dunkett outfall	SJ 356 170	SJ 357 174	0.40	1
RIVER EIRTH	R Tanat confluence to 250m upstream of B4391 bridge at Llangynog	SJ 055 260	SJ 051 263	0.56	1
ELMBRIDGE BROOK	R Salwarpe confluence to road bridge near Cooksey Green	SO 885 629	SO 894 696	8.69	2
RIVER GARNO	R Severn confluence to Wig Bridge	SO 027 917	SO 017 926	1.50	1
GUILSFIELD BROOK	Bele Brook confluence to Lower Varchoel Farm	SJ 253 137	SJ 236 126	2.30	1
GWYFER BROOK	R Severn confluence to upstream face of outfall structure	SJ 292 166	SJ 291 166	0.07	1
HADLEY BROOK	R Salwarpe confluence to the B4192 road bridge	SO 869 620	SO 869 713	14.64	2
HEN AFON	R Vyrnwy confluence to outfall structure	SJ 155 127	SJ 153 128	0.26	1
HOO BROOK	R Stour confluence to A448	SO 829 746	SO 847 755	2.25	2
HURLEY BROOK	Commission Drain confluence to overflow structure on Northern Interceptor sewer	SJ 641 159	SJ 653 151	1.17	1
KYRE BROOK	R Tame confluence to confluence with a minor watercourse downstream of Splash Bridge	SO 599 685	SO 602 672	1.88	2
LAUGHERN BROOK	R Teme confluence to the Worcester - Martley road bridge near Kenswick Manor	SO 834 526	SO 796 580	12.71	2
LONCO BROOK	R Meese confluence to Whitleyford Bridge	SJ 737 217	SJ 746 238	4.83	1
RIVER MEESE	R Tern confluence to Aqualate Mere	SJ 638 208	SJ 765 208	22.60	1
RIVER MORDA	R Vyrnwy confluence to Newbridge road bridge	SJ 293 207	SJ 304 254	14.80	1
RIVER ONNY	R Teme confluence to confluence of Quinny Brook	SO 485 766	SO 436 843	12.34	2
OSWESTRY BROOK	R Morda confluence to the major surface water outfalls at Oswestry	SJ 316 238	(SJ 302 290) (SJ 300 284)	7.40	1

SCHEDULE OF MAIN RIVERS IN THE UPPER SEVERN AREA (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
PENTRE BROOK	R Vyrnwy confluence to downstream face of road culvert at Pentre	SJ 166 137	SJ 151 135	1.74	1
RIVER PERRY	R Severn confluence to Hillyards Plantation	SJ 440 166	SJ 315 334	30.09	1
POTFORD BROOK	R Tern confluence to the downstream face of A442 culvert	SJ 638 208	SJ 634 223	2.30	1
REA BROOK	R Severn confluence to Marton Pool	SJ 496 123	SJ 298 028	37.65	1
RIVER REA	R Teme confluence to the A4117 road bridge at Cleobury Mortimer	SO 636 686	SO 680 763	18.02	2
RIVER RED STRINE	R Strine confluence to Humber Brook confluence	SJ 644 174	SJ 685 165	5.31	1
RIVER RODEN	R Tern confluence to Blackhurstford Bridge	SJ 593 124	SJ 462 334	43.44	1
RIVER SALWARPE	R Severn confleunce to Upton Warren Bridge	SO 841 601	SO 933 674	23.01	2
RIVER SEVERN	R Teme confluence to R Clywedog confluence	SO 850 521	SN 954 848	218.00	1 + 2
SLEAP BROOK	R Roden confluence to bridge on minor road from Brandwood to Noneley	SJ 505 281	SJ 471 271	4.30	1
SMESTOW BROOK	R Stour confluence to the upstream face of the canal culvert	SO 863 855	SJ 898 006	25.27	2
SOULTON BROOK	R Roden confluence to Creamery Bridge	SJ 545 294	SJ 541 337	5.15	1
RIVER STOUR	R Severn confluence to the downstream end of Overend Tunnel, Cradley	SO 812 708	SO 949 851	41.79	2
STRINE BROOK	Soulton Brook confluence to road bridge at Steel Heath	SJ 550 308	SJ 554 363	6.35	1
RIVER STRINE	R Tern confluence to downstream face of canal culvert	SJ 629 176	SJ 752 200	15.00	1
RIVER TANAT	R Vyrnwy confluence to 300m downstream of Llangynog bridge	SJ 243 207	SJ 055 260	26.00	1
RIVER TEME	R Severn confluence to sewage works outfall at Knighton	SO 850 521	SO 301 724	107.07	2
RIVER TERN	R Severn confluence to Walkmill Bridge, Market Drayton	SJ 553 091	SJ 672 335	45.21	1
TETCHILL AND NEWNES BROOK	R Perry confluence to upstream face of culvert at Dudleston Heath	SJ 380 296	SJ 365 363	10.70	1
RIVER TRANNON	R Cerist confluence to the B4569 road bridge at Trefeglwys	SO 012 910	SN 969 903	5.52	1
RIVER VYRNWY	R Severn confluence to downstream end of the Vyrnwy dam spillway	SJ 328 159	SJ 019 192	66.06	1
WALL BROOK	R Strine confluence to syphon at junction of Kynnersley Drive and Shropshire Union Canal	SJ 675 181	SJ 687 165	2.14	1
WEIR BROOK	R Severn confluence to upstream face of outfall structure	SJ 345 169	SJ 344 169	0.05	1
WEIR BROOK (new cut)	R Severn confluence to upstream face of outfall structure	SJ 345 171	SJ 344 171	0.04	1
WERN-DDU BROOK	R Vyrnwy confluence to the Melverley IDB outfall on the B4398	SJ 283 202	SJ 282 206	0.56	1
WIGMORE MAIN DRAIN	R Teme confluence to the head of the drain	SO 431 717	SO 415 696	3.22	2
RIVER WORFE	R Severn confluence to Broad Bridge, Stapleford	SO 725 952	SO 762 982	15.14	1
WORTHEN BROOK	Rea brook confluence to the Ford at Worthen	SJ 334 042	SJ 327 045	0.80	1
TOTAL				960.83	

SCHEDULE OF MAIN RIVERS IN THE LOWER SEVERN AREA - JANUARY 1990

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
RIVER ALNE	R Arrow confluence to Botley Mill Farm Bridge	SP 093 573	SP 144 684	22.69	3
RIVER ARROW	R Avon confluence to Coventry Highway Bridge, Redditch	SP 083 507	SO 055 680	25.00	3
RIVER AVON	R Severn confluence to road bridge at Welford	SO 888 331	SP 645 808	180.94	3
BADSEY BROOK	R Avon confluence to A44 road bridge, Wickhamford	SP 050 454	SP 065 413	6.27	3
BIRDINGBURY BROOK	R Leam confluence to upstream face of culvert on Birdingbury-Offchurch Road	SP 418 685	SP 427 677	1.40	3
BOW BROOK	R Avon confluence to Shell Ford, Himbleton	SP 919 426	SO 951 596	25.90	3
BRETFORTON BROOK	Badsey Brook confluence to Stoneford Barn	SP 066 443	SP 097 426	4.32	3
RIVER CAM	Gloucester and Sharpness Canal to Lower Cam	SO 739 051	SO 752 002	7.15	2
CAPEHALL BROOK	Wicksters Brook confluence to upstream face of M5 Motorway culvert	SO 756 048	SO 762 038	1.45	2
CAREYS BROOK	R Severn confluence to upstream face of A4021 road bridge	SO 849 506	SO 834 507	2.50	2
CARRANT BROOK	R Avon confluence to Aston on Carrant road bridge	SO 895 334	(SO 940 349) (SO 940 348)	8.10	3
RIVER CHELT	R Severn confluence to railway bridge, Cheltenham	SO 848 262	SO 936 232	14.81	2
CLAYCOTON BROOK	R Avon confluence to unnamed tributary flowing from Elkington	SP 564 778	SP 607 754	8.20	3
CLIFTON BROOK	R Avon confluence to Clifton road bridge	SP 515 775	SP 521 759	0.90	3
COLLIERS BROOK	R Leadon confluence to upstream face of the A417 road bridge	SO 776 235	SO 799 260	4.00	2
DEAN BROOK	R Swilgate confluence to the A435 road bridge	SO 911 283	SO 955 286	4.83	2
DEERHURST PARISH DRAIN	R Severn confluence to the drain head	SO 846 264	SO 878 271	3.22	2
RIVER DENE	R Avon confluence to Wellesbourne Mill	SP 258 563	SP 284 544	4.83	3
DIMORE BROOK	R Severn confluence to upstream face of the A38 road bridge	SO 794 150	SO 807 131	2.94	2
DOVERTE BROOK	R Little Avon confluence to upstream face of the B4509 road bridge at Berkeley	ST 677 992	ST 684 990	0.84	2
ELL BROOK	R Leadon confluence to upstream face of Ell Bridge, Newent	SO 774 245	SO 721 264	6.80	2
RIVER FROME	R Severn confluence to bridge on Frampton Mansell - Trillis road	SO 751 106	SO 929 030	34.59	2
GLYNCH BROOK	R Leadon confluence to upstream face of Berry Bridge, Staunton	SO 771 275	SO 783 294	4.00	2
HASFIELD DRAIN	R Severn confluence to upstream face of B4213 road culvert	SO 844 270	SO 842 281	1.58	2
HATHERLEY BROOK	R Severn confluence to upstream face of Arle Bridge	SO 826 210	SO 914 218	11.53	2
HORSBERE BROOK	R Severn confluence to upstream face of Brockworth road bridge	SO 828 209	SO 892 169	9.84	2
RIVER ISBOURNE	R Avon confluence to Wormington Bridge	SP 031 431	SP 037 364	9.07	3
RIVER ITCHEN	R Leam confluence to R Stowe confluence	SP 406 690	SP 406 620	12.55	3
RIVER LEADON	R Severn confluence to England's Bridge near Bosbury	SO 817 199	SO 692 440	39.00	2
RIVER LEAM	R Avon confluence to road bridge on Grandborough-Woolscott road	SP 301 657	SP 495 672	39.09	3
LEIGH BROOK	R Chelt confluence to Knight's Bridge	SO 853 259	SO 893 268	5.40	2

SCHEDULE OF MAIN RIVERS IN THE LOWER SEVERN AREA - (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
LEIGH PARISH DRAIN	R Chelt confluence to approx 300m downstream of footbridge on Coombe Hill Canal (disused)	SO 851 261	SO 877 270	3.38	2
RIVER LITTLE AVON	R Severn confluence to upstream face of railway bridge	SO 661 006	ST 728 902	20.04	2
LITTLETON BROOK	Bretforton Brook confluence to tributary upstream of North Littleton	SP 073 443	SP 084 478	4.34	3
LONGDON BROOK	R Severn confluence to confluence with Berry Meadow Brook	SO 868 362	SO 810 335	9.87	2
MARCHFONT BROOK	R Avon confluence to Clifford Chambers - Long Marston road bridge	SP 159 521	SP 169 513	1.61	3
MILL AVON	R Severn confluence to downstream face of Abbey Mill sluice	SO 879 317	SO 892 330	1.80	2
MILLHOLME BROOK	R Leam confluence to downstream side of bridge on road running SW from Grandborough	SP 460 681	SP 483 659	4.02	3
MYTHE BROOK	R Severn confluence to upstream face of Bow Bridge	SO 886 342	SO 879 364	2.69	2
NOLEHAM BROOK	R Avon confluence to access bridge at Pitchell Farm, south of Broad Marston	SP 117 514	SP 145 454	9.81	3
NORMANS BROOK	Hatherley Brook confluence to railway bridge at Churchdown	SO 874 222	SO 895 204	3.38	2
PIDDLE BROOK	R Avon confluence to the A442 at Grafton Flyford	SO 954 465	SO 964 555	14.48	3
RED BROOK	R Leadon confluence to upstream face of road bridge at Taynton	SO 776 222	SO 751 231	4.12	2
RIVER SEVERN	Avonmouth (East bank) and Beachley Point (West Bank) to R Teme confluence	(ST 513 798) (ST 550 903)	SO 850 521	130.00	1 + 2
SHELL BROOK	Shell Ford to Brandon Brook confluence	SO 951 596	SO 006 602	6.40	3
RIVER SHERBOURNE	R Sowe confluence to Whitley Bridge	SP 346 757	SP 349 771	2.74	3
SHORN BROOK	Gloucester and Sharpness Canal to minor road at Hardwicke	SO 791 128	SO 794 125	0.40	2
SHOTTERY BROOK	R Avon confluence to upstream face of culvert under the Stratford-on-Avon canal	SP 184 535	SP 187 560	3.00	3
RIVER SOWE	R Avon confluence to Longford Bridge (A444)	SP 324 724	SP 349 832	24.94	3
STOCK GREEN BROOK	Shell Brook confluence to downstream face of road culvert in Stock Green	SO 956 599	SO 981 587	3.15	3
RIVER STOUR	R Avon confluence to Mitford Bridge	SP 183 534	SP 263 371	36.42	3
RIVER STOWE	R Itchen confluence to Daventry road bridge, Southam	SP 406 620	SP 423 619	2.48	3
STROUD WATER	R Frome confluence to Wall Bridge culvert, Stroud	SO 831 047	SO 848 051	1.77	2
RIVER SWIFT	R Avon confluence to Lutterworth water reclamation works outfall	SP 505 768	SP 541 835	11.50	3
RIVER SWILGATE	Mill Avon confluence to Stoke Orchard Bridge	SO 887 323	SO 914 281	7.00	2
TIBBERTON BROOK	Red Brook confluence to upstream face of Wynford Bridge	SO 756 231	SO 752 226	0.68	2
TIRLE BROOK	R Swilgate confluence to Aston Cross Bridge	SO 897 325	SO 942 336	5.95	2
WHADDON BROOK	Gloucester and Sharpness Canal to downstream end of culvert, Lower Tuffley	SO 815 157	SO 824 146	1.40	2
WHITSUN BROOK	Piddle Brook confluence to Bishampton - Abberton road bridge	SO 962 510	SO 991 522	4.40	3

SCHEDULE OF MAIN RIVERS IN THE LOWER SEVERN AREA – (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
WICKSTERS BROOK	R Cam confluence to upstream face of M5 Motorway culvert	SO 742 049	SO 766 049	2.85	2
WITHY BROOK	R Sowe confluence to B4029	SP 385 802	SP 410 827	4.00	3
WOTTON BROOK	Horsbere Brook confluence to Cole Bridge, Gloucester	SO 833 210	SO 847 191	2.57	2
TOTAL				834.93	

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SCHEDULE OF MAIN RIVERS IN THE UPPER TRENT AREA - JANUARY 1990

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
RIVER ANKER	R Tame confluence to Stretton Baskerville Brook confluence	SK 206 038	SP 403 909	38.34	8
BELL BROOK	R Penk confluence to Pillaton Bridge	SJ 923 145	SJ 940 130	2.41	7
BENTLEY (BRADBOURNE) BROOK	R Dove confluence to Woodeaves Mill Bridge	SK 160 462	SK 185 503	6.44	6
RIVER BLITHE	R Trent confluence to north of Blythe Bridge	SK 114 176	SJ 951 416	39.00	7
RIVER BLYTHE	R Tame confluence to Earlswood Reservoir	SP 212 916	SP 114 742	40.47	8
BOURNE BROOK	R Tame confluence to Footherley Brook confluence	(SK 210 017) (SK 209 016)	SK 108 051	18.83	8
RIVER BOURNE	R Tame confluence to Furnace End Bridge	SP 216 916	SP 248 912	4.10	8
BRAMCOTE BROOK	R Anker confluence to downstream face of M42 culverts	SK 264 040	(SK 276 056) (SK 279 061)	3.85	8
CHURCH EATON BROOK	R Penk confluence to Mitton Manor Farm	SJ 916 142	SJ 889 148	3.68	7
RIVER CHURNET	R Dove confluence to Tittesworth Reservoir	SK 102 375	SJ 994 586	40.50	6
RIVER COLE	R Blythe confluence to Cole Ford, near Shard End	SP 212 912	SP 143 885	14.11	8
COLESHILL HALL BROOK	R Cole confluence to the M42 outfall	SP 190 882	SP 195 877	1.00	8
COMBERFORD BROOK	R Tame confluence to field boundary upstream of footbridge north-west of Wigginton	SK 190 075	SK 204 072	1.80	8
CURBOROUGH BROOK	R Trent confluence to Curborough reclamation works outfall	SK 166 155	SK 127 129	5.70	7
DARLASTON BROOK	R Tame confluence to downstream face of Murdoch Road culvert	SO 981 982	SO 961 967	2.85	8
DOLEY BROOK	Church Eaton Brook confluence to Norbury Park, north-west of Gnossall	SJ 892 150	SJ 808 225	13.68	7
RIVER DOVE	R Trent confluence to Okeover Bridge	SK 280 261	SK 164 481	54.86	6
ENDON BROOK	R Churnet confluence to flood wall 40m above railway culvert	SJ 968 534	SJ 928 531	5.82	6
FEATHERSTONE BROOK	R Penk confluence to Cat and Kittens Lane, Featherstone	SJ 905 066	SJ 923 050	2.90	7
FOOTHERLEY BROOK	Bourne Brook confluence to Blake Street Culvert	SK 108 051	SK 105 008	5.95	8
FORS BROOK	R Blithe confleunce to downstream face of the footbridge, Forsbrook	SJ 960 406	SJ 965 417	1.36	7
FOSTON BROOK	R Dove confluence to Boylestone	SK 195 299	SK 179 359	8.45	6
GILWISKAW BROOK	R Meese confluence to near Nook Farm, Ashby-de-la-Zouch	SK 336 101	SK 359 155	6.91	7
GROVELAND BROOK	R Tame confluence to manhole 80m north of Tividale Road	SO 974 916	SO 964 908	1.50	8
HARROW BROOK	R Anker confluence to downstream face of Brodick Road Bridge	SP 389 911	SP 409 938	4.15	8
HATCHFORD BROOK	Kingshurst Brook confluence to the downstream face of Eastern Bridge	SP 167 860	SP 166 860	0.60	8
HENMORE BROOK	R Dove confluence to Carsington Reservoir	SK 160 447	SK 244 504	13.53	6
HILTON BROOK	R Dove confluence to Longford	SK 265 274	SK 219 369	13.52	6
HOLLYWELL BROOK	R Blythe confluence to M42 outfall	SP 214 839	SP 199 836	1.75	8
HORTON BROOK	Endon Brook confluence to A53 road bridge	SJ 936 540	SJ 934 541	0.41	6
KINGSHURST BROOK	R Cole confluence to Hatchford Brook confluence	SP 179 874	SP 167 860	1.50	8
KINGSTON BROOK	R Penk confluence to upstream face of A513 road bridge	SJ 946 229	SJ 939 242	1.45	7
LEASOW BROOK	R Tame confluence to Birmingham & Fazeley Canal	SK 189 082	SK 178 077	1.30	8

SCHEDULE OF MAIN RIVERS IN THE UPPER TRENT AREA – (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
LONGNOR BROOK	Wheaton Aston Brook confluence to Station Road, Wheaton Aston	SJ 869 141	SJ 855 124	2.05	7
LOW BROOK	Kingshurst Brook confluence to downstream face of railway culvert	SP 172 864	SP 179 846	2.00	8
MARE BROOK	R Tame confluence to upstream face of A38(T) road culvert	SK 174 115	SK 141 096	4.80	8
MARSTON BROOK	Wheaton Aston Brook confluence to Birchmoor Lane	SJ 845 141	SJ 827 143	1.98	7
RIVER MEASE	R Trent confluence to Gilwiskaw Brook confluence	SK 196 147	SK 336 101	25.57	7
MEECE BROOK	R Sow confluence to Swinchurch Brook confluence	SJ 874 282	SJ 823 363	16.94	7
MOAT BROOK	R Penk confluence to 200m above Wood Road, Codsall	SJ 890 037	SJ 859 037	4.30	7
MOTTY MEADOWS BROOK	Wheaton Aston Brook confluence to Wrestlers Wood	SJ 845 141	SJ 825 133	1.60	7
NUNEATON FLOOD RELIEF CHANNEL	R Anker confluence to inlet from the R Anker	SP 365 927	SP 379 917	1.80	8
OTHERTON BROOK	R Penk confluence to railway bridge near Lyne Hill	SJ 922 144	SJ 923 129	1.61	7
RIVER PENK	R Sow confluence to Pendeford Mill Lane bridge	SJ 946 229	SJ 891 036	26.87	7
PICKNALL BROOK	R Dove confluence to confluence 260m downstream of Loxley Lane	SJ 116 319	SK 066 326	6.31	6
RAVENSHAW BROOK	R Blythe confluence to M42 outfall	SP 178 792	SP 173 789	0.80	8
RISING BROOK	R Penk confluence to A449 culvert	SJ 936 212	SJ 920 214	2.60	7
ROLLESTON BROOK	Tutbury Mill Fleam confluence to 200m upstream of Bushton Bridge	SK 242 282	SK 206 262	4.41	6
SAREDON BROOK	R Penk confluence to Golly Brook confluence	SJ 903 075	SJ 972 087	8.35	7
SCOTCH BROOK	R Trent confluence to downstream face of canal culvert	SJ 902 334	SJ 902 337	0.26	7
SENCE BROOK	R Sence confluence to confluence of R Tweed and Stapleton Brook	SP 326 999	SP 409 989	12.47	8
RIVER SENCE	R Anker confluence to B591 at Heather	SP 315 991	SK 394 109	20.33	8
SHADOW BROOK	R Blythe confluence to M42 outfall	SP 216 825	SP 192 809	3.00	8
SKETCHLEY BROOK	Harrow Brook confluence to downstream face of Brookfield Road Bridge	SP 392 916	SP 421 928	3.50	8
RIVER SOW	R Trent confluence to Pershall	SJ 995 226	SJ 818 297	28.83	7
SWAN BROOK	Tipton Brook confluence to downstream face of manhole adjacent Birmingham New Road	SO 963 927	SO 947 918	3.00	8
RIVER TAME	R Trent confluence to Ashes Road, Oldbury and downstream face of James Bridge, Willenhall	SK 192 149	(SO 985 875) (SO 976 987)	87.72	8
TATENHILL BROOK	R Trent confluence to SK 220 203	SK 227 209	SK 220 203	1.00	7
RIVER TEAN	R Dove confluence to footbridge near Noah's Ark Farm	(SK 102 355) (SK 106 344)	SK 062 360	7.80	6
TIPTON BROOK	R Tame confluence to Swan Brook confluence	SO 979 935	SO 963 927	1.90	8
RIVER TRENT	R Dove confluence to footbridge at Stoke-on-Trent	SK 280 261	SJ 901 513	87.00	5 + 7
TUTBURY MILL FLEAM	R Dove confluence to sluice at Dove confluence	SK 249 284	SK 204 294	6.40	6
WHEATON ASTON BROOK	Church Eaton Brook confluence to Motty Meadows Brook confluence	SJ 889 148	SJ 845 141	4.30	7

SCHEDULE OF MAIN RIVERS IN THE UPPER TRENT AREA - (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
WITHERLEY BROOK	R Anker confluence to upstream face of Chapel Lane road bridge	SP 323 981	SP 328 976	0.80	8
WYRLEY BROOK	Golly Brook confluence to Charrington Drive	SJ 972 087	SJ 986 078	1.85	7
TOTAL				744.87	

SCHEDULE OF MAIN RIVERS IN THE LOWER TRENT AREA (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
RATCLIFFE-ON-SOAR POWER STATION DRAIN	R Soar confluence to upstream face of railway culvert	SK 491 298	SK 497 296	0.70	4
RATCLIFFE-ON-SOAR VILLAGE DRAIN	R Soar confluence to upstream face of railway culvert	SK 493 289	SK 497 285	1.29	4
REPTON BROOK	R Trent confluence to Lawn Bridge	SK 317 285	SK 313 252	4.50	7
ROTHLEY BROOK	R Soar confluence to the A50	SK 592 132	SK 542 070	11.26	4
RIVER RYTON	R Idle confluence to Bracebridge, Worksop	SK 658 921	SK 585 790	28.96	5
SAUNDBY BECK	R Trent confluence to Laneham IDD boundary	SK 807 881	SK 790 879	1.74	5
RIVER SENCE	R Soar confluence to Great Glen	SP 552 985	SP 656 981	19.31	4
SILEBY BROOK	R Soar confluence to Sileby Village	SK 591 148	SK 602 150	1.00	4
SNOW SEWER	R Trent confluence to Snow Sewer pumping station	SK 813 994	SK 731 986	9.01	5
RIVER SOAR	R Trent confluence to footbridge upstream of Sharnford	SK 494 309	SP 463 909	75.73	4
SODBRIDGE DRAIN	Middle Beck confluence to upstream face of railway culvert	SK 805 508	SK 816 528	2.53	5
SOUTH LEVEL ENGINE DRAIN	Keadby pumping station to Bull Hassocks pumping station	SE 835 113	SE 731 017	17.25	5
SOUTH LEVEL ENGINE SOAK DRAIN	South Idle Drain to north of Aucklands Farm	SE 735 040	SE 738 034	2.00	5
SOUTH SOAK DRAIN	Keadby pumping station to Thorne	SE 835 113	SE 681 132	16.57	5
RIVER TORNE	R Trent confluence to the A60 at Styrrup Carr	SE 836 113	SE 588 906	39.42	5
RIVER TORNE SOAK DRAIN (CANDY FARM)	Ring Drain confluence to Blaxton Banks	SE 704 037	SE 673 028	3.94	5
RIVER TORNE SOAK DRAIN (TUNNEL PITS)	Southern side of Syphon under R Torne into Tunnel Pits pumping station to Wroot Common	SE 735 040	SE 717 040	2.20	5
RIVER TRENT	R Humber confluence to R Dove confluence	SE 863 235	SK 280 261	193.00	5 + 7
TUNNEL PITS SUCTION DRAIN	Tunnel Pits pumping station to North Idle Drain at East Ring Drain	SE 735 040	SE 736 044	0.55	5
TWYFORD BROOK	Queniborough Brook confluence to the Dairy Farm	SK 643 131	SK 736 094	15.89	4
WATERTON DRAIN	Woodhouse Sewer confluence to Diggin Dyke confluence	SE 662 066	SE 662 064	0.21	5
WENSLEY BROOK	R Derwent confluence to upstream face of Oldfield Lane Bridge	SK 270 621	SK 269 619	0.13	6
WHETSTONE BROOK	R Soar confluence to Bottom End Bridge, Countesthorpe	SP 548 974	SP 558 969	1.34	4
WILNE DRAIN	R Derwent outfall to 230m north-east of Beech cottage	SK 452 314	SK 440 307	1.59	6
WOODCARR SUCTION DRAIN	Woodcarr pumping station to junction with Woodcarr Small Drain	SE 753 088	SE 754 088	0.06	5
WOODHOUSE SEWER	Hatfield Waste Drain to Green Lane, Waterton Carr	SE 685 082	SE 660 066	3.22	5
RIVER WREAKE	R Soar confluence to Stapleford Park	SK 596 127	SK 815 187	40.42	4
RIVER WYE	R Derwent confluence to the A6 upstream of Ashford-in-the-Water	SK 260 655	SK 179 698	17.29	6
TOTAL				1,032.40	

SCHEDULE OF MAIN RIVERS IN THE LOWER TRENT AREA - JANUARY 1990

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
ALFRETON BROOK	R Amber confluence to Fordbridge Lane	SK 387 564	SK 440 577	6.84	6
RIVER AMBER	R Derwent confluence to Ogston Reservoir	SK 347 515	SK 380 598	16.03	6
BAR BROOK	R Derwent confluence to tributary confluence 60m upstream of Derwent Valley Aqueduct, near Baslow	SK 256 712	SK 262 725	1.77	6
BARROW DRAIN	Main Drain confluence to SK 350 302	SK 368 303	SK 350 302	1.80	6
BENTLEY BROOK	R Derwent confluence to stilling pond south of Lumsdale	SK 300 598	SK 312 605	1.78	6
RIVER BIAM	Downstream confluence with R Soar to upstream confluence with R Soar	SK 579 028	SK 577 024	0.48	4
BLACK BROOK	R Soar confluence to Grace Dieu Brook	SK 521 220	SK 487 209	5.15	4
BOTTESFORD BECK	R Trent confluence to Emanuel Bridge	SE 837 061	SE 925 084	9.98	5
BOTTLE BROOK	R Derwent confluence to Smithy Houses (North) & Bottlebrook Houses (South)	SK 359 407	(SK 386 471) (SK 389 460)	9.00	6
BROUGHTON ASTLEY BROOK	R Soar confluence to surface water outlet from Harborough DC housing development	SP 520 963	SP 528 923	5.00	4
BURTON BROOK	R Sence confluence to Burton Overy	SP 654 974	SP 675 980	2.41	4
CANDY FARM SUCTION DRAIN	Candy Farm pumping station to Hatfield Chase IDB Boundary	SE 698 031	SE 698 037	0.60	5
CASTLE DONINGTON BROOK	R Trent confluence to outfall of surface water sewer	SK 455 300	(SK 449 284) (SK 448 277)	3.33	7
CHADDESDEN BROOK	R Derwent confluence to Lees Brook confluence	SK 375 358	SK 384 372	1.83	6
COSBY BROOK	R Soar confluence to Cambridge Road, Cosby	SP 536 970	SP 547 952	3.22	4
CUTTLE BROOK	R Trent confluence to Sinfin Moor	SK 377 281	SK 370 302	2.41	6
RIVER DERWENT	R Trent confluence to outfall from Ladybower Reservoir	SK 459 308	SK 199 853	88.78	6
RIVER DEVON	R Trent confluence to Knipton reservoir	SK 790 533	SK 818 309	32.94	5
DIGGIN DYKE	Waterton Drain confluence to balancing area	SE 662 064	SE 657 050	2.03	5
DOVER BECK	R Trent confluence to Lowdham Mill (downstream limit of control structures)	SK 695 451	(SK 666 474) (SK 666 473)	5.20	5
RIVER EAU	R Trent confluence to Dunstall Beck	SE 837 033	SK 891 940	16.41	5
RIVER ECCLESBOURNE	R Derwent confluence to weir upstream of Windley Bridge	SK 350 432	SK 319 447	5.28	6
EGGINTON BROOK	R Trent confluence to Radbourne Brook, Etwall	SK 285 269	SK 264 336	9.36	6
EMINSONS DYKE	R Eau confluence to Messingham Catchwater Drain confluence	SE 879 026	SE 884 027	0.50	5
RIVER EREWASH	R Trent confluence to downstream face of B6018 road bridge, Kirkby-in-Ashfield	SK 514 330	SK 485 548	39.66	5
FAIRHAM BROOK	R Trent confluence to surface water outfall from new development on left bank	SK 560 366	SK 556 328	4.60	5
FOSSE DYKE	R Trent confluence to Torksey road bridge	SK 834 781	SK 838 781	0.32	5
GRASSTHORPE BECK	R Trent confluence to downstream end of control structure at Grassthorpe Mill	SK 816 673	SK 792 676	3.12	5
GREAT CATCHWATER DRAIN	Ravensfleet pumping station to the A159 at Wharton	SK 800 960	SK 839 934	6.40	5
RIVER GREET	R Trent confluence to outfall at Lower Kirklington Road, Southwell	SK 743 515	SK 705 547	6.80	5
GREYTHORNE DYKE	R Trent confluence to upstream of Wilford Road	SK 575 375	SK 572 368	0.81	5
HALLOUGHTON DUMBLE DRAIN	Marlock Dyke confluence to Southwell reclamation works	SK 737 523	SK 726 526	1.37	5

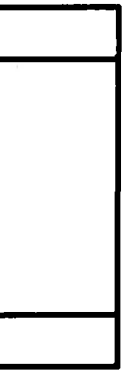
SCHEDULE OF MAIN RIVERS IN THE LOWER TRENT AREA - (CONTINUED)

WATERCOURSE	LOCATION	FROM NGR	TO NGR	LENGTH (KM)	CATCHMENT NO
HARWORTH DYKE	R Torne confluence to major surface water outfall from Harworth	SK 606 926	SK 614 916	1.50	5
HATFIELD WASTE DRAIN	Keadby pumping station to Woodhouse Sewer, Hatfield Woodhouse	SE 835 113	SE 685 082	17.70	5
HERMITAGE BROOK	R Soar confluence to railway and Moor Lane	SE 544 215	(SK 553 196) (SK 551 194)	3.30	4
RIVER IDLE	R Trent confluence to Twyford Bridge, Gamston	SK 790 947	SK 699 752	48.75	5
KILBY BROOK	R Sence confluence to downstream face of Kilby Road culvert	SP 616 963	SP 618 955	1.00	4
LANEHAM BECK	R Trent confluence to Askham Drain	SK 815 770	SK 774 740	5.60	5
LEAS BROOK	R Meden confluence to surface water outfall at Mansfield Woodhouse	SK 555 672	SK 547 642	3.60	5
RIVER LEEN	R Trent confluence to Linby Mill, Papplewick	SK 566 381	SK 546 510	17.52	5
LEES BROOK	Chaddesden Brook confluence to minor watercourse confluence	SK 384 372	SK 387 373	0.35	6
LOW BANK SUCTION) DRAIN/ANCHOR DRAIN)	Low Bank pumping station to the M180	SE 739 086	SE 729 090	1.06	5
LUBBESTHORPE BROOK	R Soar confluence to downstream face of Meridian Park culvert	SK 564 007	SK 552 008	1.43	4
MAIN DRAIN	Osmaston Drain confluence to outfall from balancing pond, Sinfin Moor	SJ 370 302	SK 348 309	2.30	6
MARLOCK DYKE	R Greet confluence to Halloughton Dumble Drain confluence	SK 741 518	SK 737 523	0.76	5
RIVER MAUN	R Idle confluence to King's Mill reservoir	SK 701 754	SK 519 597	32.61	5
MEADOW DRAIN	Osmaston Drain confluence to southern boundary of golf course, Sinfin	SK 363 312	SK 356 315	0.95	6
RIVER MEDEN	R Maun confluence to Newbound Mill Bridge, Pleasley	SK 703 751	SK 496 633	29.50	5
MESSINGHAM CATCHWATER DRAIN	Bottesford Beck confluence to the Messingham IDD boundary	SE 878 060	SE 884 027	3.50	5
MIDDLE BECK	R Devon confluence to upstream face of railway culvert	SK 785 514	SK 805 508	2.27	5
MILTON BROOK	R Trent confluence to overspill weir at Foremark reservoir	SK 340 273	SK 329 245	4.80	7
NETHERGATE BROOK	Fairham Brook confluence to downstream face of A453 culvert	SK 564 345	SK 548 348	1.70	5
NORTH ENGINE DRAIN	Keadby pumping station to Dirtness pumping station	SE 835 113	SE 747 096	9.01	5
NORTH SOAK DRAIN	Keadby pumping station to Wike Well Bridge, Thorne	SE 835 113	SE 696 121	13.68	5
OCK BROOK	R Derwent confluence to upstream face of Hawthorn Avenue bridge, Borrowash	SK 420 338	SK 422 349	1.44	6
OLDCOATES DYKE	R Ryton confluence to the A60 at Oldcoates	SK 630 872	(SK 588 885) (SK 588 884)	5.79	5
OSMASTON DRAIN	Cuttle brook confluence to culvert under disused railway line	SK 370 302	SK 364 316	1.66	6
OUSE DYKE	R Trent confluence to downstream end of Netherfield railway culvert	SK 648 420	SK 629 411	3.50	5
RIVER POULTER	R Idle confluence to weir upstream of the A614	SK 699 752	SK 646 754	7.24	5
QUENIBOROUGH BROOK	R Wreake confluence to St Mary's Church Bridge	SK 628 133	SK 653 120	3.56	4

SUMMARY OF MAIN RIVER - JANUARY 1990

AREA	LENGTH (KM)
Upper Severn	960.83
Lower Severn	834.93
Upper Trent	744.87
Lower Trent	1,032.40
TOTAL	3,573.03

SEC24/35



APPENDIX A3

CONSERVATION SITES

SSSI - Site of Special Scientific Interest
NNR - National Nature Reserve
LNR - Local Nature Reserve
CTR - County Trust Reserve

CONSERVATION SITES IN THE LOWER TRENT CATCHMENT AND NOTTINGHAMSHIRE AT APRIL 1990

SITE NAME	STATUS	NATIONAL GRID REFERENCE	DESCRIPTION
Annesley Woodhouse Quarry	SSSI	SK 489 534	A fine example of a calcareous grassland.
Anston Stones Wood	SSSI	SK 531 831	Limestone woods of ash and elm.
Ashton's Meadow	SSSI	SK 788 799	Species rich neutral grassland.
Attenborough Gravel Pits	SSSI/CTR	SK 522 341	Valuable wildfowl refuge.
Bagthorpe Meadows	SSSI	SK 469 519	Site of rich and varied botanical habitat.
Barnstone Railway Cutting	SSSI	SK 741 355	Important source of fossil vertebrate material.
Barrow Hills Sandpit	SSSI	SK 683 917	A species-rich grassland.
Belshaw	SSSI	SE 768 059	Site supports rare plant.
Bevercotes Park	SSSI	SK 701 709	A mixed ash wood.
Birklands and Bilhaugh	SSSI	SK 620 683	Last fragments of Sherwood Forest.
Bogs Farm Quarry	SSSI	SK 482 534	A former quarry in sands and clays of glacial origin.
Briery Wood Heronry	SSSI	SK 824 329	Largest heronry in Leicestershire.
Bulwell Wood	SSSI	SK 518 463	Ancient semi-natural woodland and unpolluted open water.
Castle Hill Wood	SSSI	SK 737 805	Secondary woodland with botanical and ecological interest.
Chesterfield Canal	SSSI	SK 664 829	Good examples of emergent and aquatic plant communities.
Clarborough Tunnel	SSSI/CTR	SK 749 826	Grassland with rich flora.
Clipstone Heath	SSSI	SK 594 625	Important dry acid lowland heath.
Clumber Park	SSSI	SK 643 773	An extensive area of mature woodland.
Colwick Cutting	SSSI	SK 602 397	Geological interest.
Crabtree Wood	SSSI	SK 490 785	A base rich flush.
Cresswell Crags	SSSI	SK 535 742	Series of caves and exposures of exceptional palaeo-biological and botanical interest.
Crowle Borrow Pits	SSSI	SE 790 105	Site containing a variety of habitats.
Croxton Park	SSSI	SK 823 279	Medieval parkland.
Dyscarr Wood	SSSI/CTR	SK 581 871	A fine example of calcareous ash-wych elm wood.
Eakring and Maplebeck Meadows	SSSI/CTR	SK 705 622	Species-rich neutral grassland on moist alluvial soils.
Eastoft Meadow	SSSI	SE 786 142	A small herb-rich hay meadow.
Edlington Wood	SSSI	SK 549 980	Wood dominated by ash and lime.
Epworth Turbary	SSSI/CTR	SE 755 040	Area of peat-loving vegetation.
Friezeland Grassland	SSSI	SK 476 506	Interesting range of habitat types.
Gamstone & Eaton Wood and Roadside Verges	SSSI	SK 727 767	Woodland and adjoining roadside verges with an exceptionally diverse flora.

SITE NAME	STATUS	NATIONAL GRID REFERENCE	DESCRIPTION
Ginny Spring	SSSI	SK 520 788	Small flush with some plant species rare in the region.
Gotham Hill Pasture	SSSI	SK 532 307	Species-rich grassland developed on limestone.
Grantham Canal	SSSI	SK 747 317	A diverse aquatic plant community.
Harby Hills Wood	SSSI	SK 762 284	Ash-sycamore woodland, grassland and spring-fed marshes.
Hatfield Moor	SSSI	SE 690 045	Remnant of once extensive lowland raised mire.
Haxey Grange Fen	SSSI	SK 737 937	Finest example of primary fen habitat in South Humberside.
Haxey Turbary	SSSI/CTR	SE 748 018	Area of peat-loving vegetation.
Hills Holes & Sookholme Brook	SSSI	SK 555 678	Limestone grassland and marsh site with great floral diversity.
Hollinhill and Markland Grips	SSSI	SK 510 750	Deep valleys with vertical cliff-like sides supporting rich flora.
Holme Pit	SSSI	SK 536 345	A valuable area of open water and marsh with diverse vegetation.
Holwell Mouth	SSSI	SK 725 245	Rich marsh flora.
Hoveringham Pastures	SSSI	SK 707 466	A grazed neutral grassland in the Trent floodplain.
Humber Flats and Marshes	SSSI	SE 835 238	Large intertidal mudflats and fringing saltmarsh.
Kimberley Railway Cutting	SSSI/CTR	SK 506 454	A valuable geological exposure.
Kinoulton Marsh and Canal	SSSI	SK 678 305	An area of open water and neutral marsh.
Kirkby Grives	SSSI	SK 498 554	Limestone grassland and woodland with an exceptionally diverse flora.
Kirton Wood	SSSI	SK 707 684	Woodland dominated by ash supporting typical flora and fauna.
Laxton Sykes	SSSI	SK 735 656	Traditionally managed hay meadow grasslands.
Linby Quarries	SSSI	SK 535 523	Recolonised limestone quarry.
Lindrick Golf Course	SSSI	SK 543 825	Former common land with natural flora.
Lord Stubbins Wood	SSSI	SK 537 688	An ash-wych elm wood.
Maltby Low Common	SSSI/CTR	SK 545 913	Botanically diverse and species-rich area of grassland.
Manton and Twigmoor	SSSI	SE 940 044	Mainly sand heath with ponds and marshy areas with a wide variety of breeding birds.
Martin's Pond	LNR	SK 526 402	Valuable refuge for wildlife in an urban area.
Mather Wood	SSSI	SK 724 593	An ash-oak-maple wood.
Mattersey Hill Marsh	SSSI	SK 672 874	A neutral marsh developed on the site of former gravel workings.
Messingham Heath	SSSI	SE 875 037	Wet and dry acid heathland habitats.
Messingham Sand Quarry	SSSI/CTR	SE 913 035	Important open water, wetland and woodland site.
Mission Line Bank	SSSI	SK 715 961	Diverse examples of wetland plant communities.
Muston Meadows	SSSI	SK 824 367	Four "ridge and furrow" hay fields.
New Edlington Brickpit	SSSI	SK 531 988	Geological interest.
Newhall Reservoir Meadows	SSSI	SK 662 546	Grassland supporting rare plant species.
Normanton Pastures	SSSI	SK 625 332	A series of neutral grasslands on well-drained clays.
Orston Plaster Pits	SSSI	SK 763 402	An example of calcareous grassland.

SITE NAME	STATUS	NATIONAL GRID REFERENCE	DESCRIPTION
Pleasley Vale	SSSI	SK 523 052	Geological site.
Pleasley Vale Railway	SSSI	SK 519 649	An example of calcareous grassland.
Potteric Carr	SSSI/CTR	SE 599 003	Areas of open water, reed bed and carr, and a wildlife reservoir.
Rainworth Heath	SSSI	SK 590 590	An example of a lowland wet heath plant community.
Rainworth Lakes	SSSI	SK 583 583	Contains fine examples of base-poor marsh and open water plant communities.
Redgate Woods and Mansey Common	SSSI	SK 677 598	Ash-elm woodland and a species-rich grassland.
Risby Warren	SSSI	SE 921 135	Largest surviving area of heathland on Lincolnshire limestone escarpment.
River Idle Washlands	SSSI	SK 660 935	Regularly flooded marshland providing a sanctuary for over-wintering wildfowl.
Robbinetts	SSSI	SK 492 421	Acidic grassland.
Roche Abbey Woodlands	SSSI	SK 542 899	Woodland with marshy & calcareous grassland.
Roe Wood	SSSI	SK 699 589	Ash-wych elm/Ash-oak-maple woods.
Rushcliffe Golf Course	SSSI	SK 544 281	Grassland supporting a rich variety of plants.
Rush Furlong	SSSI/CTR	SE 780 003	Hay meadow.
Sandall Beat	SSSI/LNR	SE 613 037	Woodland and fenland providing varied wildlife habitats.
Scotton and Laughton Forest Ponds	SSSI	SK 847 991	Peaty heathland pools associated with open acid grassland.
Scotton Beck Fields	SSSI	SK 877 988	Extensive area of acidic unimproved grassland.
Scotton Common	SSSI/CTR	SK 870 985	Lowland heath rich in species.
Sellers Wood	SSSI	SK 523 455	Ash-wych elm woodland.
Sherwood Forest Golf Course	SSSI	SK 587 617	Nationally rare habitat.
Sledder Wood Meadow	SSSI	SK 487 469	A species-rich grassland.
Spalford Warren	SSSI	SK 833 680	Fine example of grass heathland.
Stonish Hill	SSSI	SK 664 622	The only known exposure of definitely marine Triassic rocks in Britain.
Strawberry Hill Heaths	SSSI	SK 568 604	Dry acid lowland heathland.
Terrace Hills Pasture	SSSI	SK 795 309	Calcareous pasture.
Teversal Pastures	SSSI	SK 493 617	Fine examples of species-rich grassland.
Teversal-Pleasley Railway	SSSI	SK 486 633	Calcareous grassland.
Thoresby Lake	SSSI	SK 630 703	Well established man-made lake providing valuable sanctuary for wildfowl.
Thorne, Goole & Crowle Moors	SSSI/CTR	SE 730 160	Extensive raised mire with varied wildlife habitats.
Treswell Wood	SSSI/CTR	SK 761 794	Woodland supporting diverse ground flora.
Upper Humber	SSSI	SE 835 238	See Humber Flats and Marshes SSSI.
Welbeck Lake	SSSI	SK 580 729	Wide variety of breeding bird populations.
Wellow Park	SSSI	SK 683 671	Extensive secondary woodland.
White Quarry	SSSI	SK 534 600	Excellent geological exposure.
Wilford Clay Pits	SSSI	SK 571 355	Base-rich marsh and eutrophic mire plant communities.
Willwell Cutting	SSSI	SK 567 348	Species-rich grassland communities.
Wood Lee Quarry	SSSI	SK 533 915	Limestone outcrops, now weathered into crags.

APPENDIX A4

CODING SYSTEM

CODING SYSTEM

	x	xx	xxx	xx
	CATCHMENT	COUNTY	DISTRICT	NUMBER
eg	6	98	510	23
	Derwent	Derbyshire	High Peak	Problem No.

CATCHMENT	Code
UPPER SEVERN	1
LOWER SEVERN	2
AVON	3
SOAR	4
LOWER TRENT	5
DERWENT	6
UPPER TRENT	7
TAME	8

County/District Councils	County Code	District Code
AVON COUNTY COUNCIL		
Bristol	82	310
Northavon	82	410
SHROPSHIRE COUNTY COUNCIL		
Bridgnorth	83	110
North Shropshire	83	210
Oswestry	83	310
South Shropshire	83	410
Shrewsbury and Atcham	83	510
Telford Development Corporation	83	610
Wrekin	83	710
CLWYD COUNTY COUNCIL		
Glyndwr	84	110
Wrexham Maelor	84	210
GWYNEDD COUNTY COUNCIL		
Meirionnydd	85	110
POWYS COUNTY COUNCIL		
Mid Wales Development Corporation	86	110
Montgomery	86	210
Radnor	86	310

HEREFORD AND WORCESTER COUNTY COUNCIL		
Leominster	87	110
Bromsgrove	87	210
Malvern Hills	87	310
Redditch	87	410
Redditch Development Corporation	87	510
South Herefordshire	87	610
Worcester	87	710
Wychavon	87	810
Wyre Forest	87	910
GLOUCESTERSHIRE COUNTY COUNCIL		
Cheltenham	88	110
Forest of Dean	88	210
Gloucester	88	310
Stroud	88	410
Tewkesbury	88	510
Cotswold	88	610
OXFORDSHIRE COUNTY COUNCIL		
Cherwell	89	110
NORTHAMPTONSHIRE COUNTY COUNCIL		
Daventry	90	110
WARWICKSHIRE COUNTY COUNCIL		
Nuneaton & Bedworth	91	110
Rugby	91	210
Stratford-upon-Avon	91	310
Warwick	91	410
North Warwickshire	91	510
WEST MIDLANDS		
Coventry	92	110
Birmingham	92	210
Dudley	92	310
Sandwell	92	410
Solihull	92	510
Walsall	92	610
Wolverhampton	92	710
LEICESTERSHIRE COUNTY COUNCIL		
Blaby	93	110
Hinckley and Bosworth	93	210
Charnwood	93	310
Harborough	93	410
Leicester	93	510
Melton	93	610
North West Leicestershire	93	710
Oadby and Wigston	93	810
Rutland	93	910

NOTTINGHAMSHIRE COUNTY COUNCIL		
Ashfield	94	110
Bassetlaw	94	210
Broxtowe	94	310
Gedling	94	410
Mansfield	94	510
Newark and Sherwood	94	610
Nottingham	94	710
Rushcliffe	94	810
LINCOLNSHIRE COUNTY COUNCIL		
North Kesteven	95	110
South Kesteven	95	210
West Lindsey	95	310
HUMBERSIDE COUNTY COUNCIL		
Boothferry	96	110
Glanford	96	210
Scunthorpe	96	310
SOUTH YORKSHIRE		
Doncaster	97	110
Rotherham	97	210
Sheffield	97	310
DERBYSHIRE COUNTY COUNCIL		
Bolsover	98	110
Erewash	98	210
Amber Valley	98	310
Derby	98	410
High Peak	98	510
North East Derbyshire	98	610
Derbyshire Dales	98	710
South Derbyshire	98	810
Chesterfield	98	910
STAFFORDSHIRE COUNTY COUNCIL		
Staffordshire Moorlands	99	110
Cannock Chase	99	210
East Staffordshire	99	310
Lichfield	99	410
Newcastle under Lyme	99	510
South Staffordshire	99	610
Stafford	99	710
Stoke on Trent	99	810
Tamworth	99	910

APPENDIX A5

SOURCES OF FINANCE

1 Levy on County Councils, Metropolitan District Councils and Internal Drainage Boards

The Authority's flood defence and land drainage revenue income derives in the main from contributions from County Councils, Metropolitan District Councils and Internal Drainage Boards collected by a regional levy. The total amount required to be collected is apportioned between the Councils on the basis of relevant population (for Community Charge purposes) after taking into account the amounts to be raised from Internal Drainage Boards. The amount paid by Councils for flood defence levies is reimbursed in full by the Department of the Environment the following year through the revenue support grant for local authorities. Internal Drainage Boards' contributions to the National Rivers Authority expenditure are assessed on the basis of the benefit which the Boards derive as a result of the Authority's operations.

2 Loans

The Authority's flood defence capital expenditure is self-financed and loans will be sought in exceptional circumstances only, to deal with unforeseen emergencies.

3 General and Special Drainage Charges

General drainage charges are a means by which revenue, to meet land drainage expenditure, can be raised on agricultural land which lies outside Internal Drainage Districts. The Land Drainage Act (as amended by the Water Act 1989) prescribes a procedure designed to secure that the amount of the charge shall be as near as practicable equivalent to what would be paid in respect of the chargeable land if the land were rated.

Special drainage charges can be levied on specified areas outside Internal Drainage Districts where it appears to the Authority that drainage works on any watercourses in that area should be carried out in the interests of agriculture.

Because of the limits which are statutorily imposed, General and Special charges would provide only a small addition to current income. The Authority has, therefore, decided that, in view of the high adminstrative costs, such charges would not be justified at present.

4 Grant Aid to the National Rivers Authority

(a) Section 90 of the Land Drainage Act 1976 (as amended by the Water Act 1989) enables grants to be paid by the Ministry of Agriculture, Fisheries and Food in respect of approved land drainage schemes for the improvement of existing works or the construction of new works. In the Severn-Trent Region grant is currently paid at 15% of qualifying expenditure. A supplement of 20% may also be payable for tidal defence schemes.

(b) Grants are available under Section 92 of the Land Drainage Act 1976 (as amended by the Water Act 1989) for providing apparatus for carrying out engineering operations for the installation of flood warning systems.

5 Grant Aid to Local Authorities and Internal Drainage Boards

By virtue of Section 91, Land Drainage Act 1976 (as amended by the Water Act 1989) grants are payable by the Ministry of Agriculture, Fisheries and Food to Internal Drainage Boards and County, Metropolitan and District Councils in respect of expenditure incurred on drainage schemes carried out under Sections 17, 22, 98, 99

and 100 of the Land Drainage Act 1976 (as amended by the Water Act 1989). Such grants are available in respect of expenditure on approved land drainage schemes for the improvement of existing works and for the construction of new works, and, in the case of Internal Drainage Boards, on works (other than routine maintenance) on the rebuilding or repair of any bridge maintained by a Board.

The Authority must be consulted, as required by Section 98(8) of the Land Drainage Act 1976 (as amended by the Water Act 1989), before such schemes are submitted to the Ministry.

Grant aid is currently payable up to a maximum of 26% of the cost of the scheme for Internal Drainage Boards and Local Authorities. A supplement of 20% may also be payable for tidal defence schemes.

6 European Regional Development Fund

Certain areas within the region, principally the West Midlands, have been designated as intermediate areas and schemes which are designed to serve those areas by the provision of infrastructure for industry/commerce may be eligible for grant aid from the European Regional Development Fund.

APPENDIX A6

CONSERVATION

1 **CONSERVATION DUTIES UNDER THE WATER ACT 1989**

The following excerpts from the Water Act 1989 define the NRA's statutory conservation duties, as relating to flood defence/land drainage operations.

8. (1) It shall be the duty of each of the following, that is to say, the Secretary of State, the Minister, the Director and every relevant body, in formulating or considering any proposals relating to the functions of any relevant body or, as the case may be, that body:-

a) so far as may be consistent with the purposes of any enactment relating to the functions of that body and, in the case of the Secretary of State and the Director, with their duties under section 7 above, so to exercise any power conferred on him or it with respect to the proposals as to further the conservation and enhancement of natural beauty and the conservation of flora, fauna and geological and physiographical features of special interest;

b) to have regard to the desirability of protecting and conserving buildings, sites and objects of archaeological, architectural or historic interest; and

c) to take into account any effect which the proposals would have on the beauty or amenity of any rural or urban area or on any such flora, fauna, features, buildings, sites or objects.

(2) Subject to subsection (1) above, it shall be the duty of each of the following, that is to say, the Secretary of State, the Minister, the Director and every relevant body, in formulating or considering any proposals relating to the functions of a relevant body or, as the case may be, that body:-

a) to have regard to the desirability of preserving for the public any freedom of access to areas of woodland, mountains, moor, heath, down, cliff or foreshore and other places of natural beauty;

b) to have regard to the desirability of maintaining the availability to the public of any facility for visiting or inspecting any building, site or object of archaeological, architectural or historic interest; and

c) to take into account any effect which the proposals would have on any such freedom of access or on the availability of any such facility.

9. (1) Where the Nature Conservancy Council are of the opinion that any area of land:-

a) is of special interest by reason of its flora, fauna or geological or physiographical features; and

b) may at any time be affected by schemes, works, operations or activities of a relevant body or by an authorisation given by the Authority,

the Council shall notify the fact that the land is of special interest for that reason to every relevant body whose works, operations or activities may affect the land or, as the case may be, to the Authority.

(2) Where a National Park authority or the Broads Authority is of the opinion that any area of land in a National Park or in the Broads:-

a) is land in relation to which the matters for the purposes of which section 8 above has effect are of particular importance; and

b) may at any time be affected by schemes, works, operations or activities of a relevant body or by an authorisation given by the Authority, the National Park authority or Broads Authority shall notify the fact that land is such land, and the reasons why those matters are of particular importance in relation to the land, to every relevant body whose works, operations or activities may affect the land or, as the case may be, to the Authority.

(3) Where a relevant body has received a notification under subsection (1) or (2) above with respect to any land, that body shall consult the notifying body before carrying out, or (in the case of the Authority) carrying out or authorising, any works, operations or activities which appear to that relevant body to be likely:-

a) to destroy or damage any of the flora, fauna, or geological or physiographical features by reason of which the land is of special interest; or

b) significantly to prejudice anything the importance of which is one of the reasons why the matters mentioned in subsection (2) above are of particular importance in relation to that land.

(4) Subsection (3) above shall not apply in relation to anything done in an emergency where particulars of what is done and of the emergency are notified to the Nature Conservancy Council, the National Park authority in question or, as the case may be, the Broads Authority as soon as practicable after that thing is done.

2 RELEVANT FUNCTIONS OF THE NATURE CONSERVANCY COUNCIL

1 The Nature Conservancy Council was established by the Nature Conservancy Council Act 1973 for the purposes of nature conservation and fostering the understanding thereof. The major functions prescribed by the Act are:-

i) the establishment, maintenance and management of nature reserves in Great Britain;

ii) the provision of advice to Ministers on the development and implementation of policies for or affecting nature conservation in Great Britain;

iii) the provision of advice and dissemination of knowledge about nature conservation;

iv) the commissioning or support of relevant research.

2 The NCC also inherited a number of powers and duties formerly exercised by the Nature Conservancy among which are:-

i) a duty to notify land of special interest (SSSIs) to local planning authorities (Section 23 of the National Park and Access to the Countryside Act 1949 now superseded by Section 28 of the Wildlife and Countryside Act 1981 - see below);

ii) power to enter into agreements to conserve SSSIs (Section 15 of the Countryside Act 1968);

iii) powers of entry for survey in connection with acquisition of land (Section 108 of the 1949 Act).

3 The Town and Country Planning General Development Order 1977 obliges local planning authorities to consult the NCC before granting planning permission for development in an SSSI.

4 The Wildlife and Countryside Act 1981 placed a number of additional duties on the NCC, some of which replace similar duties in earlier legislation, including:

i) duty to notify internal drainage boards and the NRA of land of special interest and to advise those bodies when consulted on their proposals affecting such sites. (Section 48);

ii) duty to notify land of special interest (SSSIs) not only to local planning authorities but also to every owner or occupier and to the Secretary of State, specifying the nature of the scientific interest and any operations likely to damage the interest (Section 28);

iii) duty to offer a management agreement where the NCC has objected to a farm capital grant and it is subsequently refused by agriculture ministers on nature conservation grounds (Section 32).

3 RELEVANT FUNCTIONS OF COUNTRYSIDE COMMISSION

1 Under Section 2 of the Countryside Act 1968, the Countryside Commission has the statutory duty of keeping under review all matters relating to the provision and improvement of facilities for the enjoyment of the countryside, the conservation and enhancement of the natural beauty and amenity of the countryside, and the need to secure public access to the countryside for the purposes of open-air recreation. It is required to consult with such local planning authorities and other bodies as appear to the Commission to have an interest in those matters, and to encourage, assist, concert or promote the implementation of any proposals with respect to those matters made by any person or body, being proposals which the Commission consider to be suitable. The Commission is also required to advise any Minister having functions under the Countryside Act 1968, or any other Minister or any public body, on such matters relating to the countryside as he or they may refer to the Commission, or as the Commission may think fit.

2 Under Section 9 of the Local Government Act, 1974, the Commission, in accordance with arrangements approved by the Secretary of State and the Treasury, may give financial assistance by way of grant or loan, to any person in respect of expenditure incurred by him in doing anything which, in the opinion of the Commission, is conducive to the attainment of any of the purposes of the Countryside Act 1968 or the National Parks and Access to the Countryside Act 1949.

NRA

National Rivers Authority
Severn-Trent Region