ENVIRONMENT AGENCY

FEASIBILITY STUDY & APPRAISAL REPORT

PART 2 : ALTERNATIVE SCHEME OPTIONS

VOLUME 2 : Appendices D to I

STANMOOR BANK
G7655
MAY 1998

THE ENVIRONMENT AGENCY
SOUTH WEST REGION

STANMOOR BANK

Feasibility Study
& Appraisal Report

Project Reference G7655

PART 2 : ALTERNATIVE SCHEME OPTIONS

MAY 1998

PREPARED	CHECKED	APPROVED
D A Worth	P L Woods	I Haken
T Bonner	N Richardson	
Document Status:	FINAL	Dated: May 1998

POSFORD DUVIVIER
Consulting Engineers

Rightwell House
Bretton Centre
Peterborough
Cambridgeshire
PE3 8DW
Tel: 01733 334455
Fax: 01733 262243

1 Alba Court
Emperor Way
Exeter
Devon
EX1 3QS
Tel: 01392 447999
Fax: 01392 446148

THE ENVIRONMENT AGENCY
SOUTH WEST REGION

STANMOOR BANK
Feasibility Study & Appraisal Report

Project Reference G7655

PART 2 : ALTERNATIVE SCHEME OPTIONS

MAY 1998

CONTENTS OF VOLUME 2 – APPENDICES D-I

The Athelney Disaster of 1929, when Stanmoor Bank breached.

Evening World

FINAL EDN

MORE WEST OF ENGLAND NEWS THAN ANY OTHER PAPER

NO. 59 SATURDAY, DECEMBER 7, 1929 ONE PENNY

260 FLOOD REFUGEES IN SOMERSET

HUNDREDS FLEE THEIR HOMES

TWO VILLAGES SWEPT BY FLOOD TORRENTS

NIGHT OF TERROR

TRAGIC RETREAT FROM ATHELNEY

FROM

SIX BRISTOL BURGLARIES

THE AGA KHAN'S BRIDE

DRESS THAT COST £10,000

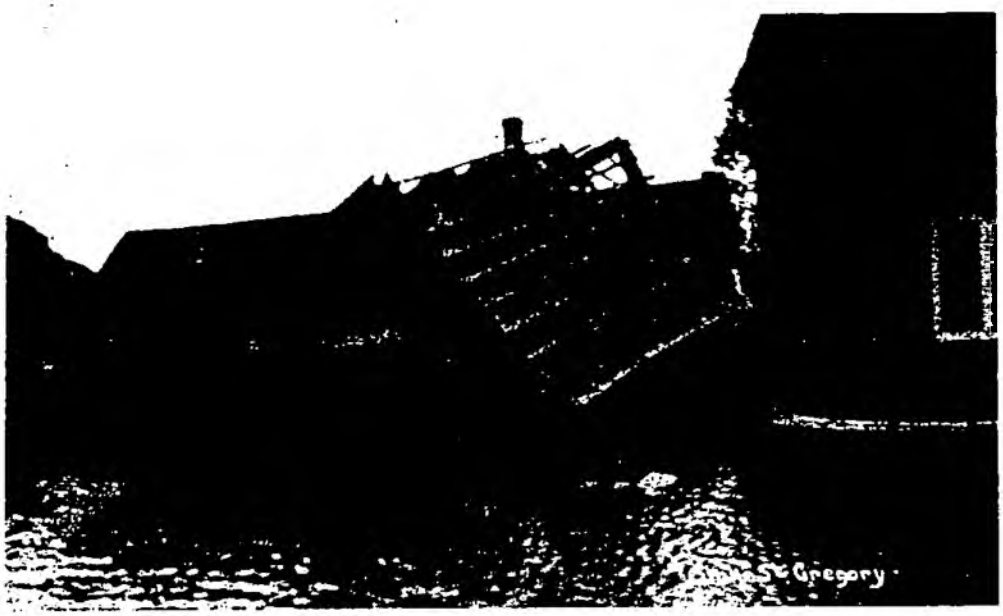
HOMES RAIDED WHILE OWNERS ARE ABSENT

BRISTOL STREET ESCAPE

WOMAN BLOWN INTO LAKE

Newspaper headline.

Water flowing across Stanmoor Road.



Building demolished by the flood.

Looking west from the railway line at Athelney.

APPENDIX E
HYDROLOGICAL AND HYDRAULIC ANALYSIS

APPENDIX E

HYDROLOGICAL AND HYDRAULIC ANALYSIS

1. BASIS OF THE ANALYSIS

The hydrological and hydraulic analysis has been used to derive flood water levels in the River Tone past Stan Moor Bank at a range of return periods. The water level profiles at each point along the river, as then used for design of the scheme and estimation of flood damages, are taken as the greatest of water levels arising from:

i) An event dominated by high fluvial flow
ii) An event dominated by extreme tide level
iii) An event in which extreme tide level is coincident with moderate fluvial flow.

Various combinations of fluvial flow and tidal condition, within joint probabilities in the range 1 in 2 years to 1 in 200 years, were used within a hydrodynamic computer model of the Rivers Tone and Parrett system to calculate the resulting flood water levels past Stan Moor Bank.

Modelling results were calibrated to accord with observed levels in the Rivers Tone/Parrett system. A plan showing the extent of rivers included in the model is given in *Figure E1*.

2. HYDROLOGICAL ANALYSIS

2.1 Inflow Points

The hydraulic modelling required estimation of inflows in the River Tone at New Bridge Sluice and in the River Parrett at Langport.

2.2 Flood Flows

Flood flows were estimated using Flood Studies Report rainfall/run-off procedures. Inflow hydrographs of flow vs time were generated from the catchment characteristics given in *Schedule E1*, at the end of this Appendix. Resulting peak flows are listed in *Table E2.2*. The flows apply to an equal storm duration and intensity on the catchments of the Rivers Tone and Parrett.

Table E2.2

Estimated Peak Flood Flows for the River Tone and River Parrett

Return Period (years)	Estimated Peak Flood Flows (cumecs)	
	River Tone to Upstream of Newbridge Sluice	River Parrett to Langport Bridge
2.33	85.2	126.8
5	127.0	186.8
10	150.9	221.1
20	174.5	254.8
50	208.3	303.0
100	235.0	340.9
200	266.5	385.8

2.3 Daily Flows

For joint probability with extreme tides a 1 in 1 day ("daily") fluvial discharge was required.

The appropriate flow in the Rivers Tone and Parrett was taken as equal to the gauged inflow during the tidal event of 10 March 1993. This event, which was gauged in some detail, was considered to be tidally dominated with only base river flow. Adopted "daily" flows were:

i) River Tone at New Bridge 2.4 cumecs
ii) River Parrett at Langport Bridge 2.7 cumecs

2.4 Monthly Flows

For joint probability with extreme tides in a combined fluvial/tidal event, a 10% exceedence ("monthly") fluvial discharge was required.

The appropriate flow in the River Tone at New Bridge was derived from Institute of Hydrology Water Archive data for Bishops Hull gauging station. This station is on the River Tone upstream of Taunton. From historic observations, the Agency have developed a relationship between flow at Bishops Hull and equivalent flow at Knapp Mill (a short distance upstream of New Bridge); the relationship accounts for the added flow from the catchment area downstream of Bishops Hull.

The estimation of "monthly" flow at New Bridge was:

i) 10% exceedence winter flow at Bishops Hull = 7.4 cumecs
ii) Agency factor for flow at Knapp Mill = 1.67
iii) Therefore, "monthly" flow at New Bridge = 7.4 x 1.67 = 12.35 cumecs.

The coincident equivalent flow into the River Parrett was estimated from the ratio of flows given in *Table E2.2* and taking account of comparative flows gauged during 1992. Flow in the River Parrett at Langport is estimated as being 1.46 x the flow in the River Tone at New Bridge. On this basis, the adopted "monthly" flow in the River Parrett was 18.0 cumecs.

3. TIDES

Still water tide levels at Bridgwater are given in *Table E3*. These were used as the downstream boundary condition in the hydrodynamic modelling, the corresponding shape of the tide curve (level vs time) being taken from tide observations at Bridgwater.

Table E3

Still Water Tidal Levels at Bridgwater

Return Period (years)	Still Water Level at Bridgwater (m OD)
MHWS	6.10
5% exceedence	6.60
HAT	7.28
5	7.78
10	7.90
20	8.00
50	8.14
100	8.31
200	8.55

Tide levels in 50 years time, allowing for sea level rise, were taken as being 293mm higher than those in *Table E3*. This rise was calculated in accordance with agreed Agency/MAFF predictions.

4. HYDRODYNAMIC MODEL

4.1 Model Schematisation

The hydrodynamic computer model used for hydraulic analysis in this feasibility study included the River Parrett, from downstream of Bridgwater to Langport Bridge, and the River Tone, from its confluence with the Parrett to the tidal limit at New Bridge sluice. A plan showing the extent of rivers included in the model is given in *Figure E1*. Reference chainages along the River Tone, together with some other associated detail, are shown in *Figure E2*.

The model includes representation of Hook Bridge spillway, discharging from the River Tone to Curry Moor, together with corresponding filling of Curry Moor. Discharge from the River Parrett over Beazley and Allermoor Spillways and to the River Sowy via Monks Leaze Clyce is also included. Out of channel flow other than at these designated diversion points is not represented.

4.2 Model Construction

The model is constructed in ISIS, the HR Wallingford/Halcrow river modelling software. It was created from an existing Agency ONDA model, which also included Kings Sedgemoor Drain, the River Sowy, plus short lengths of the Rivers Isle, Yeo and Cary.

Cross-section data from the ONDA model was revised to take account of 1995 survey data along the River Tone from Hook Bridge to Stan Moor Bridge. Other cross-section data, and the modelled arrangement of structures, remains as constructed in the ODNA model.

Adopted channel roughnesses are:

▪	River Parrett,	upstream of Oath Lock (non-tidal)	n = 0.035
▪		Oath Lock - Northmoor PS (tidal)	n = 0.018
▪		Northmoor - Somerset Br. (tidal)	n = 0.017
▪		Somerset Br - Bridgwater (tidal)	n = 0.015
▪	River Tone,	New Bridge - River Parrett (tidal)	n = 0.035

Model boundary conditions are:

- Fluvial inflow in River Parrett at Longport Bridge, upstream limit of model.
- Fluvial inflow in River Tone at New Bridge, upstream limit of model.
- Tide curve in River Parrett downstream of Bridgwater, downstream limit of model.

4.3 Model Calibration

The ISIS model was calibrated against the tidally dominated event of 10 March 1993. The same event had been used to calibrate the earlier ONDA model. Detailed observations of river levels had been taken by NRA staff during the event. Peak water levels attained were as overleaf.

▪	River Parrett,	Bridgwater West Quay	7.42m OD
▪	River Tone,	Stan Moor Bridge	6.77m OD
▪		Currymoor PS	6.41m OD

Calibration plots of water level vs time at the above three locations for the March 1993 event are given in *Figure E3*.

Model results for water levels in the River Tone past Stan Moor Bank were further calibrated against recorded levels in the river at Currymoor pumping station outfall. The records used encompassed a period of 5 years, although with some data gaps, and included the flood event of early 1995 which is considered to be of about 1 in 25 years return period. A plot of water level vs. return period is given in *Figure E4*. It is seen that there is a relatively small rise in water level with increasing return period beyond events of 1 in 1 year frequency. This effect is due to the controlling influence of the spillways in the river system over which floodwater in excess of near bank-full capacity is diverted to storage on the Moors. Model results for the Rivers as existing (which can be seen in *Table E10)* were calibrated to accord with the observations at low return period (1 in 5 years) and high return period (1 in 200 years).

5. HYDRAULIC ANALYSIS

5.1 Model Runs

The hydraulic analysis used the calibrated hydrodynamic computer model with tidal and fluvial inputs at boundaries as described earlier in this Appendix. It was assumed that all sluices, eg. at Oath Lock on the River Parrett, were fully open. From a sensitivity analysis on the synchronisation of tide curve with fluvial hydrograph it was found that peak levels in the River Tone arose if the time of peak tide is coincident with the time of peak fluvial discharge; all model runs assumed this "worst" case.

Three types of flood event were considered, from which the envelope of peak water level at each point past Stan Moor Bank could be created. The types of event were:

i) Fluvially dominated - extreme fluvial flow taken with a 5% exceedence tide.
ii) Tidally dominated - "daily" fluvial flow taken with an extreme tide.
iii) Combined - "monthly" fluvial flow taken with an extreme tide.

Events of joint probability in the range 2-200 years were analysed.

Three cases were considered:

a) River system as exiting.
b) River system with Hook Bridge spillway restored to its original design level.
c) River system with Hook Bridge spillway restored to its original design level, and with peak tide levels increased to allow for predicted sea level rise over the next 50 years. No allowance was made for other changes to the river system which may take place over the 50 year period.

5.2 Results

The results are listed in *Tables E1 - E9*. The envelopes of peak levels past Stanmoor Bank for each return period are listed in *Tables E10 - E12*. A reference guide to the Tables is given below.

Table	Description
E1	Existing river. Fluvial events
E2	Existing river. Tidal events
E3	Existing river. Combined events
E4	Hook Bridge Spillway restored. Fluvial events
E5	Hook Bridge Spillway restored. Tidal events
E6	Hook Bridge Spillway restored. Combined events
E7	Spillway restored, 50 years sea level rise. Fluvial events
E8	Spillway restored, 50 years sea level rise. Tidal events
E9	Spillway restored, 50 years sea level rise. Combined events
E10	Existing river. Envelope of peak levels
E11	Hook Bridge Spillway restored. Envelope of peak levels
E12	Spillway restored, 50 years sea level rise. Envelope of peak levels

Schedule E1

Catchment Characteristics for the River Tone and River Parrett

Parameter	Catchment	
	River Tone to Upstream of Newbridge Sluice	**River Parrett to Langport Bridge**
AREA	400km^2	760km^2
MSL	36km	60.4km
S1085	4.05m/km	1.31m/km
SAAR	900mm	847mm
M5-2D	60mm	57.7mm
r	0.3	0.34
URBAN	0.02	0.04
smdbar	9.7mm	8.1mm
Soil 1	0.15	0.08
Soil 2	0.32	0.00
Soil 3	0.00	0.54
Soil 4	0.53	0.38
Soil 5	0.00	0.00
SOIL	0.36	0.40

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.1

Prepared PLW
Checked DAW

Fluvial flows with a 5% exceedence tide, Hook Bridge spillway at existing level

Location	Chainage (m)	Existing Crest Level (mOD)	Fluvial Input / Tidal Cond'ns / Spillway Level / Return Period	2yr 5% Exce' Existing 2	5yr 5% Exce' Existing 5	10yr 5% Exce' Existing 10	20yr 5% Exce' Existing 20	50yr 5% Exce' Existing 50	100yr 5% Exce' Existing 100	200yr 5% Exce' Existing 200
Confluence	0			7.49	7.51	7.52	7.53	7.54	7.54	7.54
Stanmoor Bridge	20			7.49	7.51	7.52	7.53	7.54	7.54	7.54
	30	7.72		7.50	7.52	7.53	7.53	7.54	7.54	7.55
	80	7.78		7.50	7.52	7.53	7.54	7.54	7.54	7.55
	180	7.77		7.51	7.53	7.53	7.54	7.55	7.55	7.55
	380	8.27		7.52	7.52	7.54	7.55	7.56	7.56	7.56
	480	7.93		7.53	7.55	7.55	7.56	7.57	7.57	7.57
	680	7.68		7.54	7.56	7.57	7.57	7.58	7.58	7.58
	880	7.89		7.55	7.57	7.58	7.58	7.58	7.58	7.58
	1080	7.93		7.57	7.59	7.59	7.60	7.60	7.60	7.60
	1280	8.06		7.59	7.60	7.61	7.62	7.62	7.62	7.62
	1480	7.83		7.61	7.62	7.63	7.63	7.63	7.63	7.63
	1580	7.68		7.62	7.63	7.63	7.64	7.64	7.64	7.64
Athelney Bridge (road)	1620	8.09		7.64	7.64	7.64	7.64	7.64	7.64	7.64
	1630	8.09		7.65	7.65	7.65	7.65	7.65	7.65	
	1790	8.01		7.66	7.66	7.66	7.66	7.66	7.66	7.66
	1930	8.09		7.66	7.66	7.66	7.66	7.66	7.66	7.66
Currymoor Pump Stn	2030	7.90		7.67	7.67	7.67	7.67	7.67	7.67	7.67
Railway Bridge	2180	7.85		7.68	7.68	7.68	7.68	7.68	7.68	7.68
	2190	7.96		7.68	7.68	7.68	7.68	7.68	7.68	7.68
	2330	7.96		7.69	7.69	7.69	7.69	7.69	7.69	7.69
	2530	8.04		7.70	7.70	7.70	7.70	7.70	7.70	7.70
	2730	8.19		7.72	7.72	7.72	7.72	7.72	7.72	7.72
	2880	7.99		7.73	7.73	7.73	7.73	7.73	7.73	7.73
	3020	8.02		7.74	7.74	7.74	7.74	7.74	7.74	7.74
	3030	8.02		7.74	7.74	7.74	7.74	7.74	7.74	7.74
	3110			7.74	7.74	7.74	7.74	7.74	7.74	7.74
Hook Bridge	3280			7.75	7.75	7.75	7.75	7.75	7.75	7.75
Hook Bridge Spillway	3290			7.75	7.75	7.75	7.75	7.75	7.75	7.75

Existing crest levels are only given along Stanmoor Bank
Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.2

Prepared PLW

Checked DAW

Daily fluvial flows (2.4 cumecs) +tide, Hook Bridge spillway at existing level

Location	Chainage (m)	Existing Crest Level (mOD)	Fluvial Input Tidal Cond'ns Spillway Level Return Period	Daily 5 Existing 5	Daily 10 Existing 10	Daily 20 Existing 20	Daily 50 Existing 50	Daily 100 Existing 100	Daily 200 Existing 200
Confluence	0			7.29	7.39	7.47	7.57	7.70	7.92
Stanmoor Bridge	20			7.29	7.39	7.47	7.57	7.70	7.92
	30	7.72		7.29	7.39	7.46	7.57	7.69	7.92
	80	7.78		7.28	7.38	7.46	7.56	7.69	7.91
	180	7.77		7.27	7.37	7.44	7.55	7.68	7.91
	380	8.27		7.24	7.34	7.42	7.53	7.67	7.90
	480	7.93		7.23	7.33	7.41	7.53	7.67	7.90
	680	7.68		7.21	7.31	7.39	7.51	7.65	7.88
	880	7.89		7.19	7.29	7.38	7.50	7.64	7.87
	1080	7.93		7.18	7.28	7.36	7.48	7.63	7.86
	1280	8.06		7.16	7.26	7.35	7.47	7.62	7.84
	1480	7.83		7.15	7.25	7.34	7.46	7.62	7.83
	1580	7.68		7.14	7.24	7.33	7.46	7.62	7.83
Athelney Bridge (road)	1620	8.09		7.14	7.24	7.33	7.46	7.62	7.82
	1630	8.09		7.14	7.24	7.33	7.46	7.61	7.82
	1790	8.01		7.13	7.24	7.33	7.46	7.62	7.81
	1930	8.09		7.13	7.23	7.33	7.46	7.61	7.81
Currymoor Pump Stn	2030	7.90		7.13	7.23	7.33	7.46	7.61	7.80
Railway Bridge	2180	7.85		7.13	7.23	7.33	7.46	7.61	7.79
	2190	7.96		7.13	7.23	7.33	7.46	7.61	7.79
	2330	7.96		7.13	7.23	7.33	7.46	7.61	7.78
	2530	8.04		7.13	7.24	7.33	7.47	7.61	7.76
	2730	8.19		7.14	7.25	7.34	7.48	7.61	7.74
	2880	7.99		7.14	7.25	7.35	7.48	7.62	7.73
	3020	8.02		7.15	7.26	7.35	7.49	7.62	7.72
	3030	8.02		7.15	7.26	7.35	7.49	7.62	7.72
	3110			7.15	7.26	7.36	7.49	7.62	7.72
Hook Bridge	3280			7.16	7.27	7.36	7.50	7.62	7.70
Hook Bridge Spillway	3290			7.16	7.27	7.36	7.50	7.62	7.70

Existing crest levels are only given along Stanmoor Bank

Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.3

Prepared: PLW
Checked: DAW

Monthly fluvial flows (12 cumecs) +tide, Hook Bridge spillway at existing level

Location	Chainage (m)	Existing Crest Level (mOD)	Fluvial Input Tidal Cond'ns Spillway Level Return Period	Monthly 5 Existing 50	Monthly 10 Existing 100	Monthly 20 Existing 200
Confluence	0			7.63	7.70	7.77
Stanmoor Bridge	20			7.63	7.70	7.77
	30	7.72		7.63	7.70	7.77
	80	7.78		7.63	7.70	7.77
	180	7.77		7.63	7.70	7.77
	380	8.27		7.63	7.70	7.76
	480	7.93		7.63	7.70	7.76
	680	7.68		7.63	7.70	7.76
	880	7.89		7.63	7.70	7.76
	1080	7.93		7.63	7.70	7.75
	1280	8.06		7.63	7.70	7.75
	1480	7.83		7.63	7.70	7.74
	1580	7.68		7.63	7.69	7.74
Athelney Bridge (road)	1620	8.09		7.63	7.69	7.74
	1630	8.09		7.63	7.69	7.74
	1790	8.01		7.63	7.69	7.74
	1930	8.09		7.63	7.69	7.73
Currymoor Pump Stn	2030	7.90		7.63	7.69	7.73
Railway Bridge	2180	7.85		7.63	7.69	7.73
	2190	7.96		7.63	7.69	7.73
	2330	7.96		7.63	7.68	7.72
	2530	8.04		7.64	7.68	7.72
	2730	8.19		7.64	7.68	7.71
	2880	7.99		7.65	7.68	7.70
	3020	8.02		7.65	7.68	7.70
	3030	8.02		7.65	7.68	7.70
	3110			7.65	7.68	7.70
Hook Bridge	3280			7.65	7.68	7.69
Hook Bridge Spillway	3290			7.65	7.68	7.69

Existing crest levels are only given along Stanmoor Bank
Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.4

Prepared: PLW
Checked: DAW

Fluvial flows with a 5% exceedence tide, Hook Bridge spillway at original design level

Location	Chainage (m)	Existing Crest Level (mOD)	Fluvial Input Tidal Cond'ns Spillway Level Return Period	2yr 5% Exce' Original 2	5yr 5% Exce' Original 5	10yr 5% Exce' Original 10	20yr 5% Exce' Original 20	50yr 5% Exce' Original 50	100yr 5% Exce' Original 100	200yr 5% Exce' Original 200
Confluence	0			7.54	7.57	7.58	7.58	7.59	7.60	7.61
Stanmoor Bridge	20			7.54	7.57	7.58	7.58	7.59	7.60	7.61
	30	7.72		7.55	7.57	7.58	7.59	7.59	7.60	7.61
	80	7.78		7.55	7.58	7.59	7.59	7.59	7.60	7.61
	180	7.77		7.56	7.59	7.60	7.60	7.60	7.61	7.62
	380	8.27		7.58	7.61	7.62	7.62	7.62	7.63	7.64
	480	7.93		7.59	7.62	7.63	7.63	7.63	7.64	7.65
	680	7.68		7.61	7.63	7.64	7.64	7.64	7.65	7.66
	880	7.89		7.63	7.66	7.67	7.67	7.67	7.67	7.68
	1080	7.93		7.66	7.68	7.69	7.69	7.69	7.69	7.70
	1280	8.06		7.72	7.72	7.72	7.72	7.72	7.72	7.72
	1480	7.83		7.74	7.74	7.74	7.74	7.74	7.74	7.74
	1580	7.68		7.75	7.75	7.75	7.75	7.75	7.75	7.75
Athelney Bridge (road)	1620	8.09		7.75	7.75	7.75	7.75	7.75	7.75	7.75
	1630	8.09		7.76	7.76	7.76	7.76	7.76	7.76	7.76
	1790	8.01		7.78	7.78	7.78	7.78	7.78	7.78	7.78
	1930	8.09		7.79	7.79	7.79	7.79	7.79	7.79	7.79
Currymoor Pump Stn	2030	7.90		7.80	7.80	7.80	7.80	7.80	7.80	7.80
Railway Bridge	2180	7.85		7.81	7.81	7.81	7.81	7.81	7.81	7.81
	2190	7.96		7.81	7.81	7.81	7.81	7.81	7.81	7.81
	2330	7.96		7.83	7.83	7.83	7.83	7.83	7.83	7.83
	2530	8.04		7.85	7.85	7.85	7.85	7.85	7.85	7.85
	2730	8.19		7.87	7.87	7.87	7.87	7.87	7.87	7.87
	2880	7.99		7.89	7.89	7.89	7.89	7.89	7.89	7.89
	3020	8.02		7.90	7.90	7.90	7.90	7.90	7.90	7.90
	3030	8.02		7.90	7.90	7.90	7.90	7.90	7.90	7.90
	3110			7.91	7.91	7.91	7.91	7.91	7.91	7.91
Hook Bridge	3280			7.92	7.92	7.92	7.92	7.92	7.92	7.92
Hook Bridge Spillway	3290			7.92	7.92	7.92	7.92	7.92	7.92	7.92

Existing crest levels are only given along Stanmoor Bank
Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.5

Prepared PLW

Checked DAW

Daily fluvial flows (2.4 cumecs) +tide. Hook Bridge spillway at original design level

Location	Chainage (m)	Existing Crest Level (mOD)	Fluvial Input / Tidal Cond'ns / Spillway Level / Return Period	Daily 5 Original 5	Daily 10 Original 10	Daily 20 Original 20	Daily 50 Original 50	Daily 100 Original 100	Daily 200 Original 200
Confluence	0			7.29	7.39	7.47	7.57	7.70	7.92
Stanmoor Bridge	20			7.29	7.39	7.47	7.57	7.70	7.92
	30	7.72		7.29	7.39	7.46	7.57	7.69	7.91
	80	7.78		7.28	7.38	7.46	7.56	7.69	7.91
	180	7.77		7.27	7.37	7.44	7.55	7.68	7.91
	380	8.27		7.24	7.34	7.42	7.53	7.67	7.90
	480	7.93		7.23	7.33	7.41	7.53	7.67	7.90
	680	7.68		7.21	7.31	7.39	7.51	7.65	7.88
	880	7.89		7.19	7.29	7.38	7.49	7.63	7.87
	1080	7.93		7.17	7.27	7.36	7.48	7.63	7.87
	1280	8.06		7.16	7.26	7.35	7.47	7.62	7.87
	1480	7.83		7.15	7.25	7.34	7.46	7.62	7.86
	1580	7.68		7.14	7.24	7.33	7.46	7.61	7.86
Athelney Bridge (road)	1620	8.09		7.14	7.24	7.33	7.46	7.61	7.86
	1630	8.09		7.14	7.24	7.33	7.45	7.61	7.86
	1790	8.01		7.13	7.23	7.32	7.45	7.61	7.86
	1930	8.09		7.13	7.23	7.32	7.46	7.62	7.86
Currymoor Pump Stn	2030	7.90		7.13	7.23	7.33	7.46	7.62	7.86
Railway Bridge	2180	7.85		7.13	7.23	7.33	7.46	7.62	7.86
	2190	7.96		7.13	7.23	7.33	7.46	7.62	7.86
	2330	7.96		7.13	7.23	7.33	7.46	7.62	7.86
	2530	8.04		7.13	7.24	7.33	7.46	7.62	7.86
	2730	8.19		7.13	7.24	7.34	7.47	7.64	7.86
	2880	7.99		7.14	7.25	7.35	7.48	7.64	7.86
	3020	8.02		7.15	7.26	7.35	7.49	7.65	7.86
	3030	8.02		7.15	7.26	7.35	7.49	7.65	7.86
	3110			7.15	7.26	7.36	7.49	7.65	7.86
Hook Bridge	3280			7.16	7.27	7.36	7.50	7.66	7.86
Hook Bridge Spillway	3290			7.16	7.27	7.36	7.50	7.66	7.86

Existing crest levels are only given along Stanmoor Bank

Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.6

Prepared PLW
Checked DAW

Monthly fluvial flows (12 cumecs) +tide, Hook Bridge spillway at original design level

Location	Chainage (m)	Existing Crest Level (mOD)	Fluvial Input Tidal Cond'ns Spillway Level Return Period	Monthly 5 Original 50	Monthly 10 Original 100	Monthly 20 Original 200
Confluence	0			7.64	7.74	7.82
Stanmoor Bridge	20			7.64	7.74	7.82
	30	7.72		7.64	7.74	7.82
	80	7.78		7.64	7.74	7.82
	180	7.77		7.64	7.74	7.82
	380	8.27		7.64	7.74	7.82
	480	7.93		7.65	7.74	7.82
	680	7.68		7.65	7.75	7.82
	880	7.89		7.65	7.75	7.83
	1080	7.93		7.66	7.75	7.83
	1280	8.06		7.67	7.76	7.83
	1480	7.83		7.68	7.76	7.83
	1580	7.68		7.68	7.77	7.83
Athelney Bridge (road)	1620	8.09		7.68	7.77	7.83
	1630	8.09		7.68	7.77	7.83
	1790	8.01		7.69	7.78	7.83
	1930	8.09		7.69	7.78	7.83
Currymoor Pump Stn	2030	7.90		7.70	7.78	7.83
Railway Bridge	2180	7.85		7.71	7.79	7.84
	2190	7.96		7.71	7.79	7.84
	2330	7.96		7.71	7.79	7.84
	2530	8.04		7.72	7.80	7.85
	2730	8.19		7.73	7.81	7.85
	2880	7.99		7.74	7.81	7.86
	3020	8.02		7.74	7.82	7.86
	3030	8.02		7.74	7.82	7.86
	3110			7.74	7.82	7.86
Hook Bridge	3280			7.75	7.82	7.86
Hook Bridge Spillway	3290			7.75	7.82	7.86

Existing crest levels are only given along Stanmoor Bank
Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.7

Prepared: PLW
Checked: DAW

Fluvial flows with a 5% exceedence tide, Hook Bridge spillway at original design level and 50 years sea level rise

Location	Chainage (m)	Existing Crest Level (mOD)	Fluvial Input / Tidal Cond'ns / Spillway Level / Return Period	2yr 5% Exce' Original 2	5yr 5% Exce' Original 5	10yr 5% Exce' Original 10	20yr 5% Exce' Original 20	50yr 5% Exce' Original 50	100yr 5% Exce' Original 100	200yr 5% Exce' Original 200
Confluence	0			7.73	7.73	7.73	7.73	7.73	7.73	7.73
Stanmoor Bridge	20			7.73	7.73	7.73	7.73	7.73	7.73	7.73
	30	7.72		7.73	7.73	7.73	7.73	7.73	7.73	7.73
	80	7.78		7.73	7.73	7.73	7.73	7.73	7.73	7.73
	180	7.77		7.73	7.73	7.73	7.73	7.73	7.73	7.73
	380	8.27		7.73	7.73	7.73	7.73	7.73	7.73	7.73
	480	7.93		7.74	7.74	7.74	7.74	7.74	7.74	7.74
	680	7.68		7.74	7.74	7.74	7.74	7.74	7.74	7.74
	880	7.89		7.76	7.76	7.76	7.76	7.76	7.76	7.76
	1080	7.93		7.78	7.78	7.78	7.78	7.78	7.78	7.78
	1280	8.06		7.79	7.79	7.79	7.79	7.79	7.79	7.79
	1480	7.83		7.80	7.80	7.80	7.80	7.80	7.80	7.80
	1580	7.68		7.81	7.81	7.81	7.81	7.81	7.81	7.81
Athelney Bridge (road)	1620	8.09		7.81	7.81	7.81	7.81	7.81	7.81	7.81
	1630	8.09		7.82	7.82	7.82	7.82	7.82	7.82	7.82
	1790	8.01		7.83	7.83	7.83	7.83	7.83	7.83	7.83
	1930	8.09		7.84	7.84	7.84	7.84	7.84	7.84	7.84
Currymoor Pump Stn	2030	7.90		7.85	7.85	7.85	7.85	7.85	7.85	7.85
Railway Bridge	2180	7.85		7.86	7.86	7.86	7.86	7.86	7.86	7.86
	2190	7.96		7.86	7.86	7.86	7.86	7.86	7.86	7.86
	2330	7.96		7.87	7.87	7.87	7.87	7.87	7.87	7.87
	2530	8.04		7.88	7.88	7.88	7.88	7.88	7.88	7.88
	2730	8.19		7.90	7.90	7.90	7.90	7.90	7.90	7.90
	2880	7.99		7.91	7.91	7.91	7.91	7.91	7.91	7.91
	3020	8.02		7.92	7.92	7.92	7.92	7.92	7.92	7.92
	3030	8.02		7.92	7.92	7.92	7.92	7.92	7.92	7.92
	3110			7.93	7.93	7.93	7.93	7.93	7.93	7.93
Hook Bridge	3280			7.94	7.94	7.94	7.94	7.94	7.94	7.94
Hook Bridge Spillway	3290			7.94	7.94	7.94	7.94	7.94	7.94	7.94

Existing crest levels are only given along Stanmoor Bank
Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.8

Prepared: PLW

Checked: DAW

Daily fluvial flows (2.4 cumecs) +tide, Hook Bridge spillway at original design level + 50 years sea level rise

Location	Chainage (m)	Existing Crest Level (mOD)	Fluvial Input / Tidal Cond'ns / Spillway Level / Return Period	Daily 50 Original 50	Daily 100 Original 100	Daily 200 Original 200
Confluence	0				7.94	8.15
Stanmoor Bridge	20				7.94	8.15
	30	7.72		7.80	7.93	8.15
	80	7.78		7.80	7.93	8.15
	180	7.77		7.79	7.93	8.14
	380	8.27		7.78	7.92	8.14
	480	7.93		7.78	7.91	8.13
	680	7.68		7.77	7.90	8.12
	880	7.89		7.76	7.88	8.11
	1080	7.93		7.76	7.89	8.09
	1280	8.06		7.75	7.89	8.08
	1480	7.83		7.74	7.89	8.07
	1580	7.68		7.74	7.89	8.06
Athelney Bridge (road)	1620	8.09		7.74	7.89	8.06
	1630	8.09		7.74	7.88	8.05
	1790	8.01		7.74	7.88	8.05
	1930	8.09		7.74	7.88	8.04
Currymoor Pump Stn	2030	7.90		7.74	7.88	8.03
Railway Bridge	2180	7.85		7.74	7.88	8.03
	2190	7.96		7.74	7.88	8.02
	2330	7.96		7.74	7.88	8.02
	2530	8.04		7.75	7.87	8.00
	2730	8.19		7.75	7.87	7.98
	2880	7.99		7.76	7.87	7.97
	3020	8.02		7.76	7.86	7.96
	3030	8.02		7.76	7.86	7.96
	3110			7.76	7.86	7.95
Hook Bridge	3280				7.86	7.94
Hook Bridge Spillway	3290				7.86	7.94

Existing crest levels are only given along Stanmoor Bank

Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.9

Prepared: PLW
Checked: DAW

Monthly fluvial flows (12 cumecs) +tide, Hook Bridge spillway at original design level + 50 years sea level rise

Location	Chainage (m)	Existing Crest Level (mOD)	Fluvial Input Tidal Cond'ns Spillway Level Return Period	Monthly 5 Original 50	Monthly 10 Original 100	Monthly 20 Original 200
Confluence	0				7.92	7.98
Stanmoor Bridge	20				7.92	7.98
	30	7.72		7.78	7.92	7.98
	80	7.78		7.78	7.92	7.98
	180	7.77		7.78	7.92	7.97
	380	8.27		7.79	7.92	7.97
	480	7.93		7.79	7.92	7.97
	680	7.68		7.79	7.92	7.97
	880	7.89		7.79	7.92	7.96
	1080	7.93		7.79	7.91	7.95
	1280	8.06		7.80	7.91	7.96
	1480	7.83		7.80	7.91	7.95
	1580	7.68		7.80	7.91	7.95
Athelney Bridge (road)	1620	8.09		7.80	7.91	7.95
	1630	8.09		7.80	7.91	7.95
	1790	8.01		7.81	7.91	7.95
	1930	8.09		7.81	7.91	7.95
Currymoor Pump Stn	2030	7.90		7.81	7.91	7.95
Railway Bridge	2180	7.85		7.82	7.91	7.94
	2190	7.96		7.82	7.91	7.94
	2330	7.96		7.82	7.91	7.94
	2530	8.04		7.83	7.91	7.94
	2730	8.19		7.83	7.91	7.93
	2880	7.99		7.84	7.91	7.93
	3020	8.02		7.84	7.91	7.93
	3030	8.02		7.84	7.91	7.93
	3110			7.84	7.91	7.93
Hook Bridge	3280				7.91	7.93
Hook Bridge Spillway	3290				7.91	7.93

Existing crest levels are only given along Stanmoor Bank
Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.10

Prepared PLW
Checked DAW

Envelope of 1:5, 1:20, 1:50, 1:100 and 1:200 year water levels with Hook Bridge spillway at existing level

Envelope of 1:85 year water levels gives bank full conditions first reached at the two locations highlighted

Location	Chainage (m)	Existing Crest Level (mOD)	Envelope of Water Levels					
			5 (years)	20 (years)	50 (years)	85 (years)	100 (years)	200 (years)
Confluence	0		7.51	7.53	7.63	7.68	7.70	7.92
Stanmoor Bridge	20		7.51	7.53	7.63	7.68	7.70	7.92
	30	7.72	7.52	7.53	7.63	7.68	7.70	7.92
	80	7.78	7.52	7.54	7.63	7.68	7.70	7.91
	180	7.77	7.53	7.54	7.63	7.68	7.70	7.91
	380	8.27	7.52	7.55	7.63	7.68	7.70	7.90
	480	7.93	7.55	7.56	7.63	7.68	7.70	7.90
	680	7.68	7.56	7.57	7.63	7.68	7.70	7.88
	880	7.89	7.57	7.58	7.63	7.68	7.70	7.87
	1080	7.93	7.59	7.60	7.63	7.68	7.70	7.86
	1280	8.06	7.60	7.62	7.63	7.68	7.70	7.84
	1480	7.83	7.62	7.63	7.63	7.68	7.70	7.83
	1580	7.68	7.63	7.64	7.64	7.68	7.69	7.83
Athelney Bridge (road)	1620	8.09	7.64	7.64	7.64	7.68	7.69	7.82
	1630	8.09	7.65	7.65	7.65	7.68	7.69	7.82
	1790	8.01	7.66	7.66	7.66	7.68	7.69	7.81
	1930	8.09	7.66	7.66	7.66	7.68	7.69	7.81
Currymoor Pump Stn	2030	7.90	7.67	7.67	7.67	7.68	7.69	7.80
Railway Bridge	2180	7.85	7.68	7.68	7.68	7.68	7.69	7.79
	2190	7.96	7.68	7.68	7.68	7.68	7.69	7.79
	2330	7.96	7.69	7.69	7.69	7.69	7.69	7.78
	2530	8.04	7.70	7.70	7.70	7.70	7.70	7.76
	2730	8.19	7.72	7.72	7.72	7.72	7.72	7.74
	2880	7.99	7.73	7.73	7.73	7.73	7.73	7.73
	3020	8.02	7.74	7.74	7.74	7.74	7.74	7.74
	3030	8.02	7.74	7.74	7.74	7.74	7.74	7.74
	3110		7.74	7.74	7.74	7.74	7.74	7.74
Hook Bridge	3280		7.75	7.75	7.75	7.75	7.75	7.75
Hook Bridge Spillway	3290		7.75	7.75	7.75	7.75	7.75	7.75

Existing crest levels are only given along Stanmoor Bank

Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

Table E.11

Prepared PLW
Checked DAW

Envelope of 1:50, 1:100 and 1:200 year water levels with Hook Bridge spillway at original design level

Location	Chainage (m)	Existing Crest Level (mOD)	Envelope of Water Levels 50 (years)	100 (years)	200 (years)
Confluence	0		7.64	7.74	7.92
Stanmoor Bridge	20		7.64	7.74	7.92
	30	7.72	7.64	7.74	7.91
	80	7.78	7.64	7.74	7.91
	180	7.77	7.64	7.74	7.91
	380	8.27	7.64	7.74	7.90
	480	7.93	7.65	7.74	7.90
	680	7.68	7.65	7.75	7.88
	880	7.89	7.67	7.75	7.87
	1080	7.93	7.69	7.75	7.87
	1280	8.06	7.72	7.76	7.87
	1480	7.83	7.74	7.76	7.86
	1580	7.68	7.75	7.77	7.86
Athelney Bridge (road)	1620	8.09	7.75	7.77	7.86
	1630	8.09	7.76	7.77	7.86
	1790	8.01	7.78	7.78	7.86
	1930	8.09	7.79	7.79	7.86
Currymoor Pump Stn	2030	7.90	7.80	7.80	7.86
Railway Bridge	2180	7.85	7.81	7.81	7.86
	2190	7.96	7.81	7.81	7.86
	2330	7.96	7.83	7.83	7.86
	2530	8.04	7.85	7.85	7.86
	2730	8.19	7.87	7.87	7.87
	2880	7.99	7.89	7.89	7.89
	3020	8.02	7.90	7.90	7.90
	3030	8.02	7.90	7.90	7.90
	3110		7.91	7.91	7.91
Hook Bridge	3280		7.92	7.92	7.92
Hook Bridge Spillway	3290		7.92	7.92	7.92

Existing crest levels are only given along Stanmoor Bank
Black Shading indicates overtopping

STANMOOR BANK - HYDRAULIC MODEL OUTPUTS

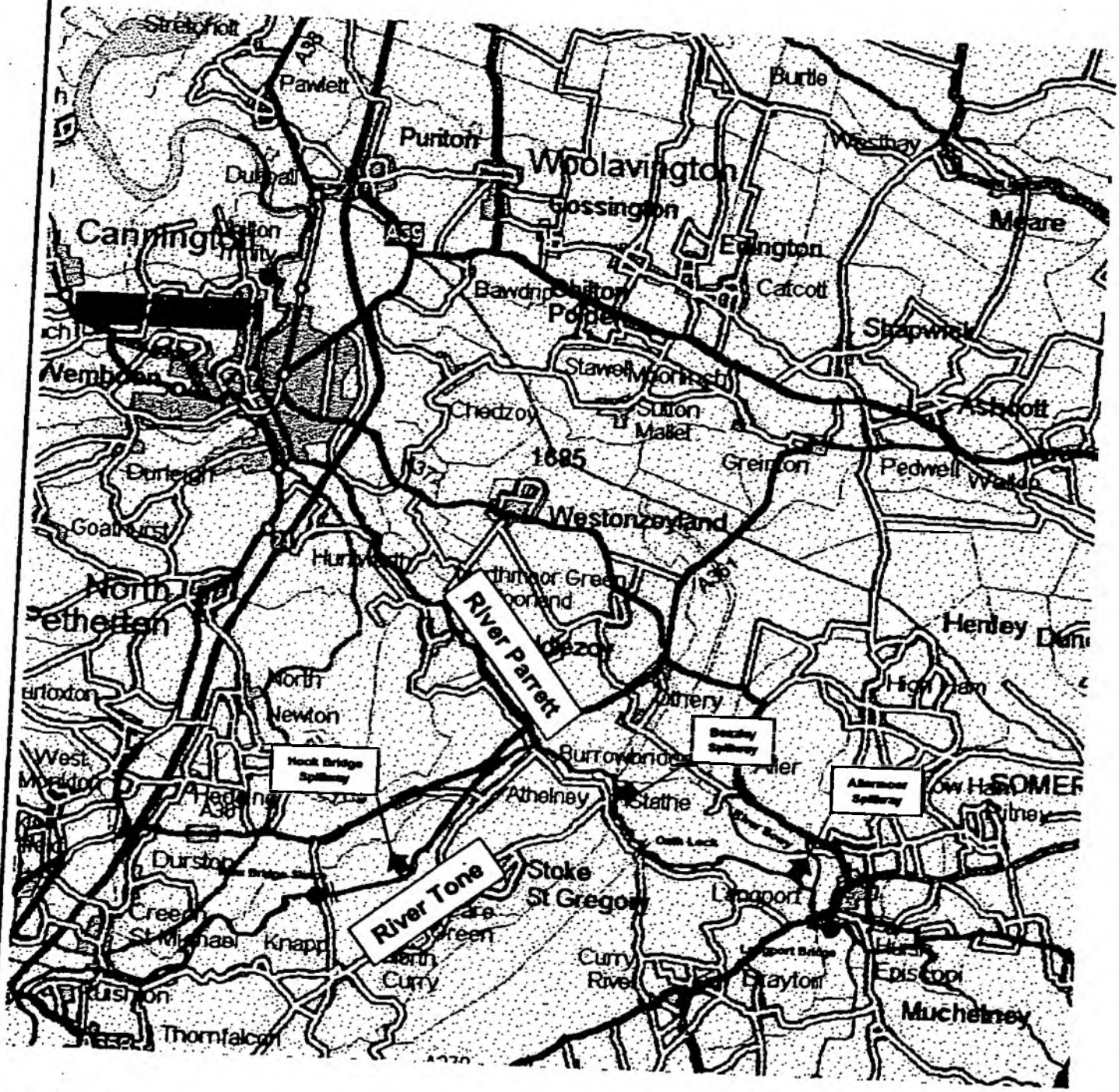
Table E.12

Prepared: PLW
Checked: DAW

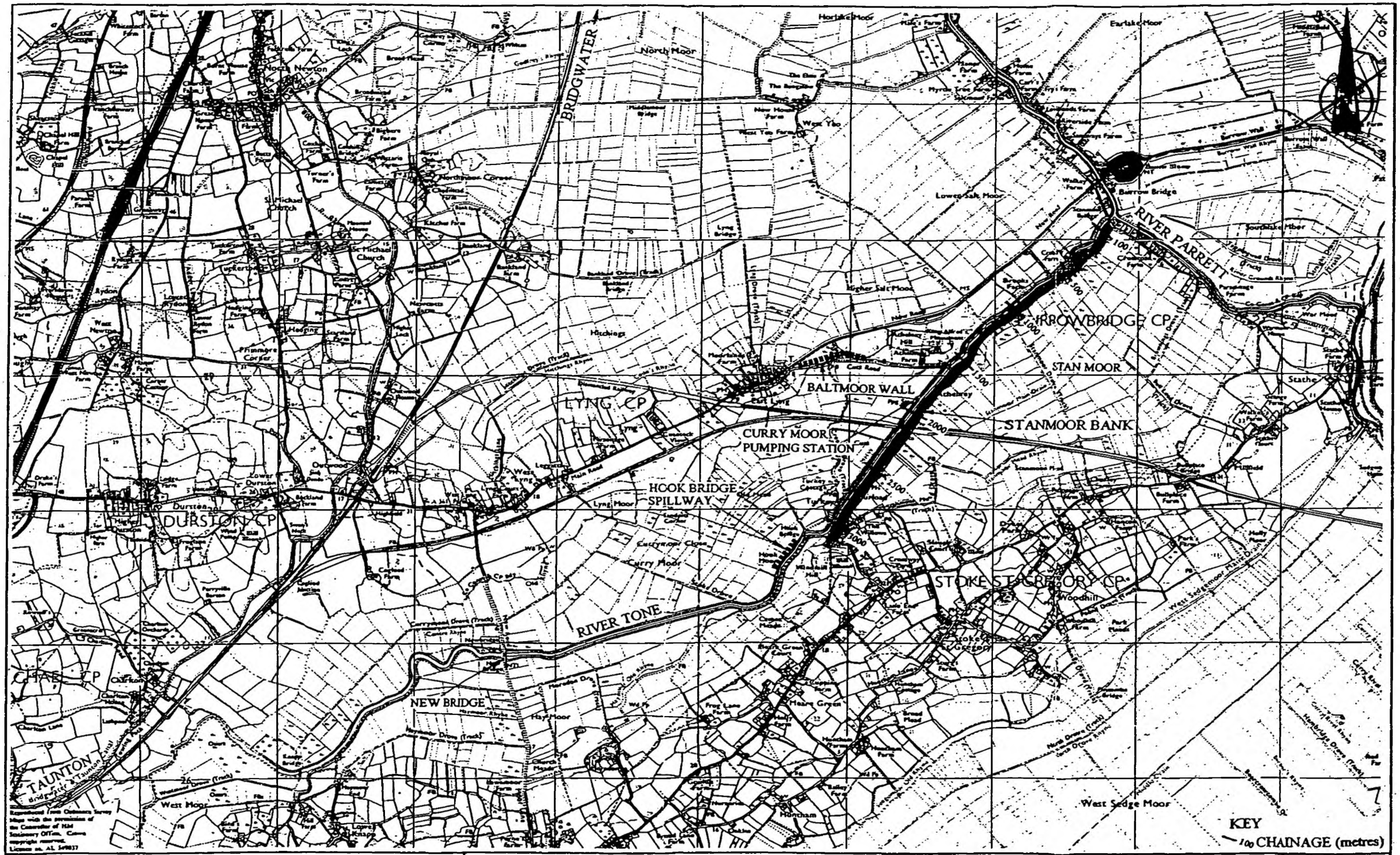
Envelope of 1:100 and 1:200 year water levels with Hook Bridge spillway at original design level and with 50 years sea level rise

Location	Chainage (m)	Existing Crest Level (mOD)	Envelope of Water Levels 50 (years)	100 (years)	200 (years)
Confluence	0			7.94	8.15
Stanmoor Bridge	20			7.94	8.15
	30	7.72	7.80	7.93	8.15
	80	7.78	7.80	7.93	8.15
	180	7.77	7.79	7.93	8.14
	380	8.27	7.79	7.92	8.14
	480	7.93	7.79	7.92	8.13
	680	7.68	7.79	7.92	8.12
	880	7.89	7.79	7.92	8.11
	1080	7.93	7.79	7.91	8.09
	1280	8.06	7.80	7.91	8.08
	1480	7.83	7.80	7.91	8.07
	1580	7.68	7.81	7.91	8.06
Athelney Bridge (road)	1620	8.09	7.81	7.91	8.06
	1630	8.09	7.82	7.91	8.05
	1790	8.01	7.83	7.91	8.05
	1930	8.09	7.84	7.91	8.04
Currymoor Pump Stn	2030	7.90	7.85	7.91	8.03
Railway Bridge	2180	7.85	7.86	7.91	8.03
	2190	7.96	7.86	7.91	8.02
	2330	7.96	7.87	7.91	8.02
	2530	8.04	7.88	7.91	8.00
	2730	8.19	7.90	7.91	7.98
	2880	7.99	7.91	7.91	7.97
	3020	8.02	7.92	7.92	7.96
	3030	8.02	7.92	7.92	7.96
	3110			7.93	7.95
Hook Bridge	3280			7.94	7.94
Hook Bridge Spillway	3290			7.94	7.94

Existing crest levels are only given along Stanmoor Bank
Black Shading indicates overtopping



PROJECT	TITLE			
STANMOOR BANK FEASIBILITY STUDY AND APPRAISAL REPORT	EXTENT OF HYDRODYNAMIC COMPUTER MODEL	POSFORD DUVIVIER CONSULTING ENGINEERS	DATE MAR 98 / SCALE N.T.S.	
			DRAWN MJM / CHKD	
			FIGURE E1	



PROJECT

STANMOOR BANK
FEASIBILITY STUDY
AND APPRAISAL REPORT

TITLE

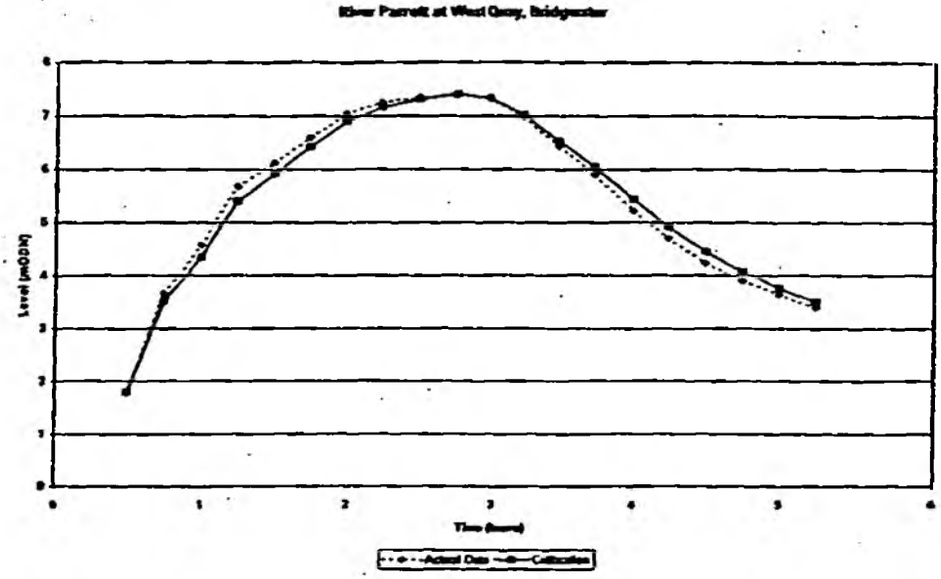
TIDAL RIVER TONE
REFERENCE POINTS IN COMPUTER MODEL

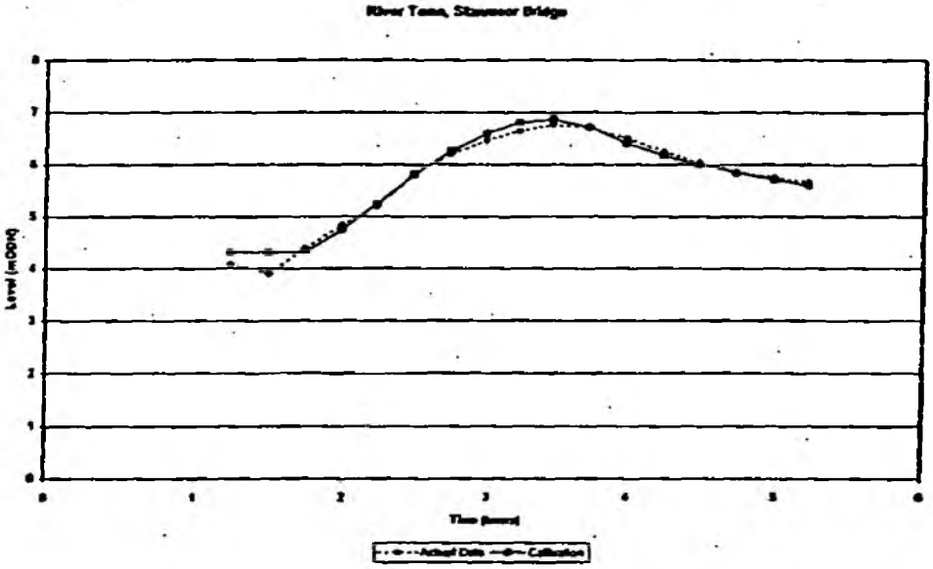
POSFORD DUVIVIER
CONSULTING ENGINEERS

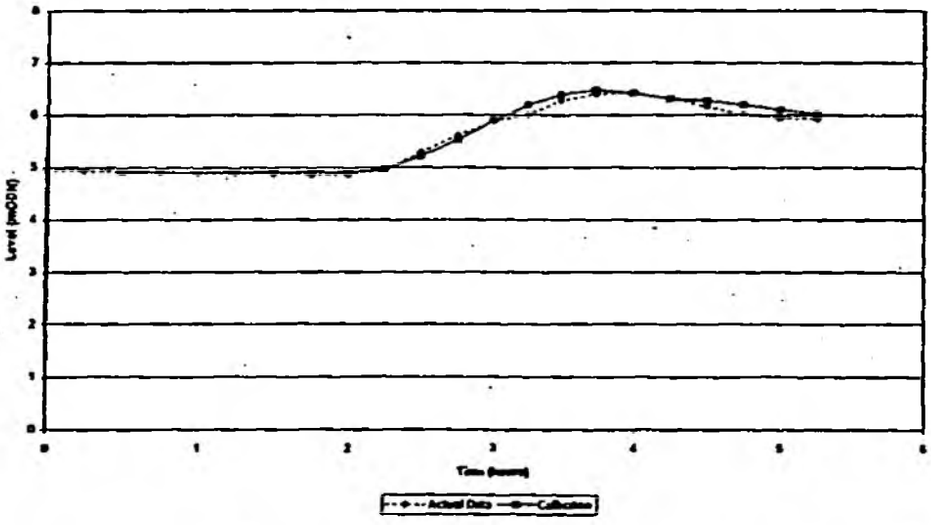
DATE MAR 98	SCALE 1:25,000
DRAWN MJM	CHKD

FIGURE E2

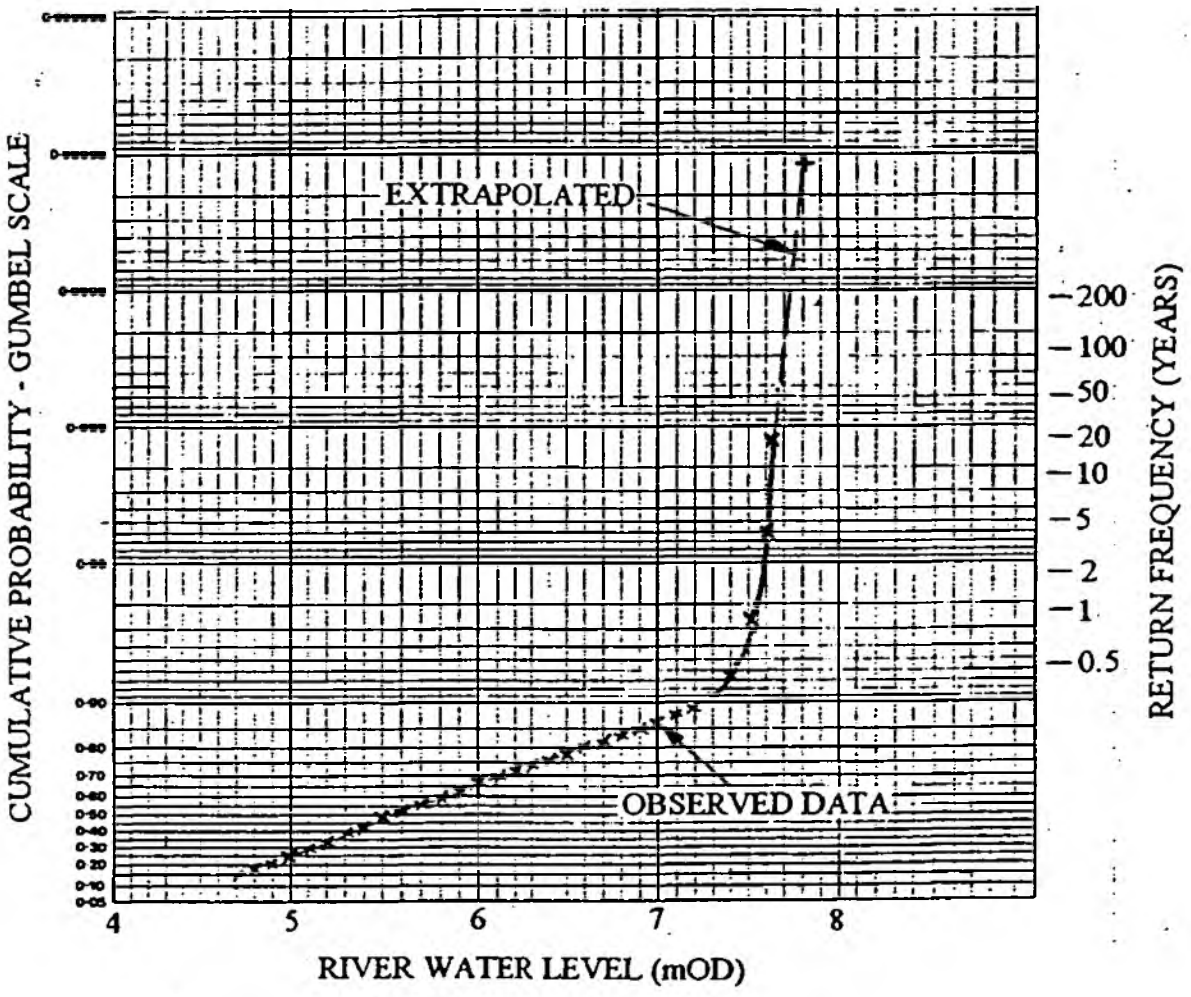
B0510







PROJECT	TITLE		DATE	SCALE
STANMOOR BANK FEASIBILITY STUDY AND APPRAISAL REPORT	MODELLING CALIBRATION PLOTS	POSFORD DUVIVIER CONSULTING ENGINEERS	MAR 98	
			DRAWN MJM	CHKD
			FIGURE E3	



FROM ENVIRONMENT AGENCY WATER LEVEL RECORDS, 1991 - 1996.

PROJECT	TITLE		DATE MAR 98	SCALE
STANMOOR BANK FEASIBILITY STUDY AND APPRAISAL REPORT	RIVER TONE AT CURRYMOOR P.S WATER LEVEL FREQUENCY	POSFORD DUVIVIER CONSULTING ENGINEERS	DRAWN MJM	CHKD DAW
			FIGURE E4	

APPENDIX F
BENEFIT ASSESSMENT

Schedule F1 - Properties at risk

Valuation bands are described at the end of this schedule.

Property	Valuation Band	Actual Known Value £	Best Assessed Value £K
Stanmoor Road, Stanmoor Bridge to railway			
Stanmoor Farm	E		90
Willow Factory	A		10
Sunnyside Cottage	E		90
Stanmoor Bakery			10
Walnut Cottage	D		70
Rose Cottage	D		70
St Elmo	E		90
Hill View Annexe	B		45
Hill View	D		70
Window House	D		70
The Firs	E		90
Barn	A		10
The Old Withey Barn	D	74950	70
Willow Cottage	E		90
Toneside	C		55
Lyndmere	C		55
Post Office House	D	132500	130
Bickleigh Cottage	C		55
Homelea	E		90
Morland	D		70
Dove Dale	B		45
Black Gate	C		55
The Cottage	E		90
Building	A		10
Fernlea	B		45
Woodbine Cottage	D		70
Quaine	C		55
Building	B		45
Drove House	C		55
Fern Cottage	C		55
Stanmoor Garage	*D		95
Rose Cottage & Garage	D		70
Kingsmere	D		70
Kingshead	C		55
Sunridge	C		55
Musgrave Cottage	E		90
Honeysuckle Cottage	C		55
Maybank	C		55
Cottage	B		45
Meadowside	E		90
Fairview Bungalow	E		90
Athelney Bungalow	D		70
Meadowbank	E		90
Brackenhurst	E	92000	90

Property	Valuation Band	Actual Known Value £	Best Assessed Value £K
West Point	B		45
Fernlea	E		90
Dragons	D		70
Rise Cottage	D		70
Laurel Cottage	D		70
The Poplars	C	74950	75
Myrtle Tree House	B		45
Calamus	E		90
Fairview	B		45
Riversleigh	C		55
The Old Store	B		45
Lorna Doone	C	54995	55
Athelney Cottage	A		10
Athelney House	C		55
Building	C		55
			3750
Stanmoor Road railway to Curload			
Old Station House	D		70
Birch House	B		45
Windy Willows	B		45
No.3	B		45
Willow Farm	C		55
Roys Riding Stables			20
Rose Cottage	A		10
Building	C		55
The Gables	C		55
Rose Cottage	A		10
McGuff	C		55
The Sheilings	C		55
Willow View	B		45
The Old Stores	D		70
The Pigeons Inn	*B		130
Moss Barn	D		70
Ivy Cottage	C		55
Lawn Cottage	C		55
Jessamine	B		45
Farthings	C		55
Middle Moor	E		90
Curload Cottage	C		55
The Poplars	E		90
Curload House	D		70
			1350

Property	Valuation Band	Actual Known Value £	Best Assessed Value £K
Curload			
The English Basket & Hurdle Centre	C x 5		275
Willow House	E		90
1 Riverside Cottage	C		55
2 Riverside Cottage	C		55
Chatsworth Cottage	D		70
Withy Grove House	E		90
Ivy House Farm	E		90
Currymoor	D		70
The Stack	E		90
Laurel Cottage	D		70
Curload Farm	F		130
Walnut Arbour	F		130
Old Barbers	E		90
Walford House	B		45
			1350
Stanmoor Mead Drove			
Sunnyside	B		45
The Willows	G		170
1 The Fieldways	B		45
2 The Fieldways	B		45
Cedron	B		45
			350

North or Southside	Property	Valuation Band	Actual Known Value £	Best Assessed Value £K
	Staithe Road			
S	Stoke Orchard Farm	F		130
N	Riverside Nursery			50
S	Grassendale	C		50
S	Ranelagh Cottage	F	139950	130
S	Parrett Cottage	E		90
S	Fairmead	D		70
S	Lilac Cottage	F		130
S	Parsonage Farm	E		90
S	The Old King William	D		70
S	Sheds,Farm			40
N	Building			10
N	Building			10
S	Pumping Station			No Sale Value
N	Building			10
N	Building			10
N	Building			10
N	Building			10
N	1 under construction			80
N	Building			10
N	Building			10
N/S	Barns			10
N	Stanmoor View	E		90
N	Building			10
S	Building			10
N	Building			10
N	Building			10
N	Building			10
N	Gillard's, Lyng Farm			10
N	Lock House	C		60
N	Rosewood	E		90
N	Stanmoor Cottage	C		60
N	The Poplars	D		70
N	No.2			40
N	Building			10
				1500

Note: * Where property valuation band is marked with an asterix, the "best assessed value" contains an element of commercial capital price derived from the applicable local Authority Rateable Values.

Local Authority Council Tax Bands

VALUATION BAND	VALUE
A	Up to and including £40,000
B	£40,000 - £52,000
C	£52,000 - £68,000
D	£68,000 - £88,000
E	£88,000 - £120,000
F	£120,000 - £160,000
G	£160,000 - £320,000
H	£320,000 +

Present value damage for the do nothing option with a breach in 20 years **Schedule F2**

Project :	Stanmoor Bank				
Opyion :	Do Nothing 20 year life	Seepage Damage	£	38,000
Discount rate :	6 %	Damage per breach of	£	9,247,000
Total Damage :	9,247,000 £	PV of Damage cost	£	7,373,301
spread over :	1 Years	r :		0.06

Year i	Disc Factor	Prob of Breach p(i)	Prob that damag occurs pd(i)	Prob that damag does no occur pd'(i)	PV of breach damage £	PV of Seepage damage £
0	1.00	0.05	0.05	0.95	440,333	36,190
1	0.94	0.10	0.09	0.86	791,255	30,890
2	0.89	0.14	0.12	0.74	1,013,062	24,979
3	0.84	0.19	0.14	0.60	1,092,250	19,076
4	0.79	0.24	0.14	0.46	1,042,692	13,712
5	0.75	0.29	0.13	0.33	899,357	9,240
6	0.70	0.33	0.11	0.22	707,042	5,811
7	0.67	0.38	0.08	0.13	508,206	3,394
8	0.63	0.43	0.06	0.08	333,895	1,829
9	0.59	0.48	0.04	0.04	199,997	904
10	0.56	0.52	0.02	0.02	108,714	406
11	0.53	0.57	0.01	0.01	53,278	164
12	0.50	0.62	0.01	0.00	23,336	59
13	0.47	0.67	0.00	0.00	9,032	19
14	0.44	0.71	0.00	0.00	3,043	5
15	0.42	0.76	0.00	0.00	875	1
16	0.39	0.81	0.00	0.00	209	0
17	0.37	0.86	0.00	0.00	40	0
18	0.35	0.90	0.00	0.00	6	0
19	0.33	0.95	0.00	0.00	1	0
20	0.31	1.00	0.00	0.00	0	0
21	0.29	1.00	0.00	0.00	0	0
22	0.28	1.00	0.00	0.00	0	0
23	0.26	1.00	0.00	0.00	0	0
24	0.25	1.00	0.00	0.00	0	0
25	0.23	1.00	0.00	0.00	0	0
26	0.22	1.00	0.00	0.00	0	0
27	0.21	1.00	0.00	0.00	0	0
28	0.20	1.00	0.00	0.00	0	0
29	0.18	1.00	0.00	0.00	0	0
30	0.17	1.00	0.00	0.00	0	0
31	0.16	1.00	0.00	0.00	0	0
32	0.15	1.00	0.00	0.00	0	0
33	0.15	1.00	0.00	0.00	0	0
34	0.14	1.00	0.00	0.00	0	0
35	0.13	1.00	0.00	0.00	0	0
36	0.12	1.00	0.00	0.00	0	0
37	0.12	1.00	0.00	0.00	0	0
38	0.11	1.00	0.00	0.00	0	0
39	0.10	1.00	0.00	0.00	0	0
40	0.10	1.00	0.00	0.00	0	0
41	0.09	1.00	0.00	0.00	0	0
42	0.09	1.00	0.00	0.00	0	0
43	0.08	1.00	0.00	0.00	0	0
44	0.08	1.00	0.00	0.00	0	0
45	0.07	1.00	0.00	0.00	0	0
46	0.07	1.00	0.00	0.00	0	0
47	0.06	1.00	0.00	0.00	0	0
48	0.06	1.00	0.00	0.00	0	0
49	0.06	1.00	0.00	0.00	0	0
Total c/f					7,226,622	146,680
Grand Total						7,373,301

Damage Can only occur once!

Crest level raising for each flood defence improvement option

Schedule F3

		Depth
Cost of Flooding 1 house	£ 1286	0 to 0.05
	£ 2320	0.05 to 01
	£ 4112	0.1 to 2

Location	Chainage m	Crest Option A m ODN	Existing bank level m ODN	Water Level m ODN		No of Houses No	Overtopping m		Flood Cost £	
				1:100	1:200		1:100	1:200	1:100	1:200
Stanmoor Bridge	30			7.74	7.91					
	50	7.71	7.72	7.74	7.91	1	0.02	0.19	1,286	4,112
	100	7.71	7.78	7.74	7.91	1	-	0.13	0	4,112
	150	7.71	7.81	7.74	7.91	0	-	0.10	0	0
	200	7.71	7.77	7.74	7.91	1	-	0.14	0	4,112
	250	7.71	7.87	7.74	7.90	1	-	0.03	0	1,286
	300	7.71	7.80	7.74	7.90	2	-	0.10	0	8,224
	350	7.71	7.78	7.74	7.90	0	-	0.12	0	0
	400	7.71	8.27	7.74	7.90	0	-	-	0	0
	450	7.71	8.19	7.74	7.90	3	-	-	0	0
	500	7.71	7.93	7.74	7.89	3	-	-	0	0
	550	7.72	7.86	7.74	7.89	2	-	0.03	0	2,573
	600	7.72	7.86	7.75	7.89	2	-	0.03	0	2,573
	650	7.72	7.73	7.75	7.86	2	0.02	0.15	2,573	8,224
	700	7.72	7.68	7.75	7.86	1	0.03	0.16	1,286	4,112
	750	7.72	7.74	7.75	7.88	0	0.01	0.14	0	0
	800	7.72	7.78	7.75	7.88	2	-	0.10	0	4,640
	850	7.72	7.72	7.75	7.87	3	0.02	0.15	3,859	12,336
	900	7.73	7.89	7.75	7.87	0	-	-	0	0
	950	7.73	7.94	7.75	7.87	1	-	-	0	0
	1000	7.73	7.85	7.75	7.87	1	-	0.02	0	1,286
	1050	7.73	7.83	7.75	7.87	2	-	0.04	0	2,573
	1100	7.73	7.93	7.75	7.87	3	-	-	0	0
	1150	7.74	7.95	7.75	7.87	2	-	-	0	0
	1200	7.74	8.01	7.75	7.87	2	-	-	0	0
	1250	7.74	7.96	7.75	7.87	3	-	-	0	0
	1300	7.75	8.06	7.76	7.87	0	-	-	0	0
	1350	7.75	8.02	7.76	7.86	1	-	-	0	0
	1400	7.75	7.90	7.76	7.86	2	-	-	0	0
	1450	7.75	7.86	7.76	7.86	0	-	-	0	0
	1500	7.76	7.83	7.76	7.86	3	-	0.03	0	3,859
	1550	7.76	7.68	7.77	7.86	3	0.01	0.10	3,859	12,336
	1600	7.76	7.75	7.77	7.86	2	0.01	0.10	2,573	4,640
	1620	7.76	8.09	7.77	7.86	1	-	-	0	0
Athelney Bridge										
	1630	7.77	8.09	7.77	7.86	0	-	-	0	0
	1650	7.77	8.09	7.77	7.86	0	-	-	0	0
	1700	7.77	8.05	7.77	7.86	1	-	-	0	0
	1750	7.78	8.03	7.78	7.86	0	-	-	0	0
	1800	7.78	8.01	7.78	7.86	2	-	-	0	0
	1850	7.78	8.00	7.78	7.86	1	-	-	0	0
	1900	7.79	7.95	7.79	7.86	0	-	-	0	0
	1950	7.79	8.09	7.79	7.86	1	-	-	0	0
	2000	7.80	8.00	7.80	7.86	1	-	-	0	0
	2050	7.80	7.90	7.80	7.86	1	-	-	0	0
	2100	7.80	7.85	7.80	7.86	1	-	0.01	0	1,286
	2150	7.81	7.97	7.81	7.86	1	-	-	0	0
Railway Bridge						59				
	2200	7.81	7.96	7.81	7.86		-	-	0	0
	2250	7.82	7.96	7.82	7.86		-	-	0	0
	2300	7.83	8.03	7.83	7.86		-	-	0	0
	2350	7.83	7.96	7.83	7.86		-	-	0	0
	2400	7.84	8.05	7.84	7.86		-	-	0	0
	2450	7.84	8.07	7.84	7.86		-	-	0	0
	2500	7.85	8.04	7.85	7.86		-	-	0	0
	2550	7.85	8.04	7.85	7.86		-	-	0	0
	2600	7.86	8.14	7.86	7.86		-	-	0	0
	2650	7.86	8.14	7.86	7.87		-	-	0	0
	2700	7.87	8.17	7.87	7.87		-	-	0	0
	2750	7.87	8.19	7.87	7.87		-	-	0	0
	2800	7.88	8.09	7.88	7.88		-	-	0	0
	2850	7.89	8.03	7.89	7.89		-	-	0	0
	2900	7.89	7.99	7.89	7.89		-	-	0	0
	2950	7.90	8.02	7.90	7.90		-	-	0	0
	3000	7.90	8.14	7.90	7.90		-	-	0	0
	3050	7.90	8.02	7.90	7.90		-	-	0	0
Bank returns to Curload Farm										
	3100			7.91	7.91					
	3150			7.91	7.91					
	3200			7.92	7.92					
Hook Bridge										
						Volume m³	8,641	394,250		
								Total	15,437	82,285

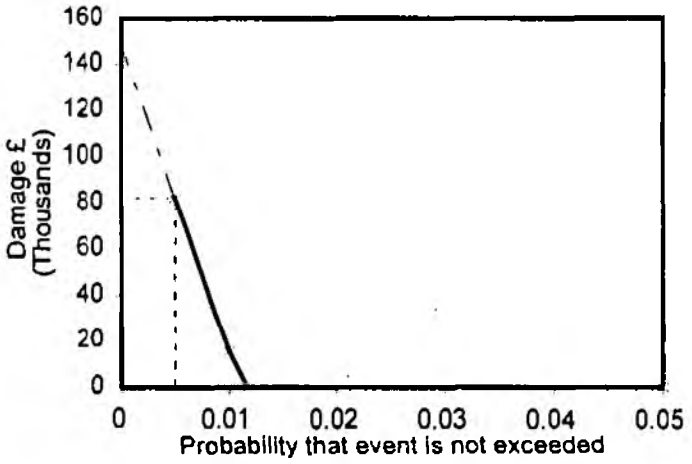
Schedule F4 — Improvement crest level Option A. Average annual damage due to flooding

Project	:	Stanmoor Bank	First mid-year of tabulated dama :	0
Option	:	A 0 years SLR	Last mid year of tabulated dama :	49
			Discount Rate :	6.00 %
			PV factor for mid yea 0 :	16.7
Price Date	:	December 1997		
Cost Scaling Factor	:	1		

	Av waiting Period (yrs) between events/frequency per year					
	1	10	20	85	100	200
	1.000	0.100	0.050	0.012	0.010	0.005
Damage Catagory						
				Damage £ 1		
Residential Property	0	0	0	0	15,437	82,285
Non Residential +	0	0	0	0	0	0
Total £ 1	0	0	0	0	15,437	82,285
Area (ie damage x freq)	0		0	0	14	244

RESULTS	Av Annual damage		Present value	
as table above, 1	258		4,309	
		411		6,874
as above plus rectangle	669		11,183	
		167		2,792
as above plus rectangle and triangle	836		13,975	

Cii: Typical damage frequency curve



Schedule F4

Present value damage for crest level option A spread over 3 years **Schedule F5**

Project : Stanmoor Bank
Opyion :
Discount rate : 6 %
Damage per event : 2,700,000 £
spread over : 1 Years r 0.06

Year i	Disc Factor	Prob of Breach p(i)	Value of Breach damage £	Year i	AAD Overtoppin £	PV of overtopping damage £	AAD Seepage £	PV of Seepage damage £
0	1.00	0.05	128,571	0	669	669	38,000	38,000
1	0.94	0.10	242,588	1	669	631	38,000	35,849
2	0.89	0.14	343,284	2	669	596	38,000	33,820
3	0.84	0.19	431,804	3	669	562	38,000	31,906
4	0.79	0.16	341,166	4	669	530	29,000	22,971
5	0.75	0.09	190,231	5	669	500	19,000	14,198
6	0.70	0.00	0	6	669	472	9,000	6,345
7	0.67	0.00	0	7	669	445	9,000	5,986
8	0.63	0.00	0	8	669	420	9,000	5,647
9	0.59	0.00	0	9	669	396	9,000	5,327
10	0.56	0.00	0	10	669	374	9,000	5,026
11	0.53	0.00	0	11	669	353	9,000	4,741
12	0.50	0.00	0	12	669	333	9,000	4,473
13	0.47	0.00	0	13	669	314	9,000	4,220
14	0.44	0.00	0	14	669	296	9,000	3,981
15	0.42	0.00	0	15	669	279	9,000	3,755
16	0.39	0.00	0	16	669	263	9,000	3,543
17	0.37	0.00	0	17	669	249	9,000	3,342
18	0.35	0.00	0	18	669	235	9,000	3,153
19	0.33	0.00	0	19	669	221	9,000	2,975
20	0.31	0.00	0	20	669	209	9,000	2,806
21	0.29	0.00	0	21	669	197	9,000	2,647
22	0.28	0.00	0	22	669	186	9,000	2,498
23	0.26	0.00	0	23	669	175	9,000	2,356
24	0.25	0.00	0	24	669	165	9,000	2,223
25	0.23	0.00	0	25	669	156	9,000	2,097
26	0.22	0.00	0	26	669	147	9,000	1,978
27	0.21	0.00	0	27	669	139	9,000	1,866
28	0.20	0.00	0	28	669	131	9,000	1,761
29	0.18	0.00	0	29	669	124	9,000	1,661
30	0.17	0.00	0	30	669	117	9,000	1,567
31	0.16	0.00	0	31	669	110	9,000	1,478
32	0.15	0.00	0	32	669	104	9,000	1,395
33	0.15	0.00	0	33	669	98	9,000	1,316
34	0.14	0.00	0	34	669	92	9,000	1,241
35	0.13	0.00	0	35	669	87	9,000	1,171
36	0.12	0.00	0	36	669	82	9,000	1,105
37	0.12	0.00	0	37	669	78	9,000	1,042
38	0.11	0.00	0	38	669	73	9,000	983
39	0.10	0.00	0	39	669	69	9,000	927
40	0.10	0.00	0	40	669	65	9,000	875
41	0.09	0.00	0	41	669	61	9,000	825
42	0.09	0.00	0	42	669	58	9,000	779
43	0.08	0.00	0	43	669	55	9,000	735
44	0.08	0.00	0	44	669	52	9,000	693
45	0.07	0.00	0	45	669	49	9,000	654
46	0.07	0.00	0	46	669	46	9,000	617
47	0.06	0.00	0	47	669	43	9,000	582
48	0.06	0.00	0	48	669	41	9,000	549
49	0.06	0.00	0	49	669	39	9,000	518
Total c/f			1,677,644	Total		11,183		280,200
Grand Total								1,969,027

Damage Can occur more than once!

Present value damage for crest level option A spread over 2 years **Schedule F6**

Project : Stanmoor Bank
Opyion :
Discount rate : 6 %
Damage per event : 2,700,000 £
spread over : 1 Years r 0.06

Year i	Disc Factor	Prob of Breach p(i)	Value of Breach damage £	Year i	AAD Overtoppin £	PV of overtoppin damage £	AAD Seepage £	PV of Seepage damage £
0	1.00	0.05	128,571	0	669	669	38,000	38,000
1	0.94	0.10	242,588	1	669	631	38,000	35,849
2	0.89	0.14	343,284	2	669	596	38,000	33,820
3	0.84	0.10	215,902	3	669	562	24,000	20,151
4	0.79	0.00	0	4	669	530	9,000	7,129
5	0.75	0.00	0	5	669	500	9,000	6,725
6	0.70	0.00	0	6	669	472	9,000	6,345
7	0.67	0.00	0	7	669	445	9,000	5,986
8	0.63	0.00	0	8	669	420	9,000	5,647
9	0.59	0.00	0	9	669	396	9,000	5,327
10	0.56	0.00	0	10	669	374	9,000	5,026
11	0.53	0.00	0	11	669	353	9,000	4,741
12	0.50	0.00	0	12	669	333	9,000	4,473
13	0.47	0.00	0	13	669	314	9,000	4,220
14	0.44	0.00	0	14	669	296	9,000	3,981
15	0.42	0.00	0	15	669	279	9,000	3,755
16	0.39	0.00	0	16	669	263	9,000	3,543
17	0.37	0.00	0	17	669	249	9,000	3,342
18	0.35	0.00	0	18	669	235	9,000	3,153
19	0.33	0.00	0	19	669	221	9,000	2,975
20	0.31	0.00	0	20	669	209	9,000	2,806
21	0.29	0.00	0	21	669	197	9,000	2,647
22	0.28	0.00	0	22	669	186	9,000	2,498
23	0.26	0.00	0	23	669	175	9,000	2,356
24	0.25	0.00	0	24	669	165	9,000	2,223
25	0.23	0.00	0	25	669	156	9,000	2,097
26	0.22	0.00	0	26	669	147	9,000	1,978
27	0.21	0.00	0	27	669	139	9,000	1,866
28	0.20	0.00	0	28	669	131	9,000	1,761
29	0.18	0.00	0	29	669	124	9,000	1,661
30	0.17	0.00	0	30	669	117	9,000	1,567
31	0.16	0.00	0	31	669	110	9,000	1,478
32	0.15	0.00	0	32	669	104	9,000	1,395
33	0.15	0.00	0	33	669	98	9,000	1,316
34	0.14	0.00	0	34	669	92	9,000	1,241
35	0.13	0.00	0	35	669	87	9,000	1,171
36	0.12	0.00	0	36	669	82	9,000	1,105
37	0.12	0.00	0	37	669	78	9,000	1,042
38	0.11	0.00	0	38	669	73	9,000	983
39	0.10	0.00	0	39	669	69	9,000	927
40	0.10	0.00	0	40	669	65	9,000	875
41	0.09	0.00	0	41	669	61	9,000	825
42	0.09	0.00	0	42	669	58	9,000	779
43	0.08	0.00	0	43	669	55	9,000	735
44	0.08	0.00	0	44	669	52	9,000	693
45	0.07	0.00	0	45	669	49	9,000	654
46	0.07	0.00	0	46	669	46	9,000	617
47	0.06	0.00	0	47	669	43	9,000	582
48	0.06	0.00	0	48	669	41	9,000	549
49	0.06	0.00	0	49	669	39	9,000	518
Total c/f			930,345	Total		11,183		245,131
Grand Total								1,186,660

Damage Can occur more than once!

Present value damage for overtopping on option A with raising works for sea level rise carried out in the future **Schedule F7**

Project : Stanmoor Bank
Option : A
Discount rate : 6 %
r : 0.06

		Carry out works for Sea Level Rise in											
		5 years		10 years		20 years		30 years		40 years		50 years	
Year	Disc Factor	AAD Overtopping	PV of overtopping damage	AAD Overtopping	PV of overtopping damage	AAD Overtopping	PV of overtopping damage	AAD Overtopping	PV of overtopping damage	AAD Overtopping	PV of overtopping damage	AAD Overtopping	PV of overtopping damage
i		£	£	£	£	£	£	£	£	£	£	£	£
0	1.00	669	669	669	669	669	669	669	669	669	669	669	669
1	0.94	695	656	695	656	695	656	695	656	695	656	695	656
2	0.89	721	642	721	642	721	642	721	642	721	642	721	642
3	0.84	747	627	747	627	747	627	747	627	747	627	747	627
4	0.79	773	613	773	613	773	613	773	613	773	613	773	613
5	0.75	800	597	800	597	800	597	800	597	800	597	800	597
6	0.70	0	0	826	582	826	582	826	582	826	582	826	582
7	0.67	0	0	852	566	852	566	852	566	852	566	852	566
8	0.63	0	0	878	551	878	551	878	551	878	551	878	551
9	0.59	0	0	904	535	904	535	904	535	904	535	904	535
10	0.56	0	0	930	519	930	519	930	519	930	519	930	519
11	0.53	0	0	0	0	969	510	969	510	969	510	969	510
12	0.50	0	0	0	0	1,008	501	1,008	501	1,008	501	1,008	501
13	0.47	0	0	0	0	1,047	491	1,047	491	1,047	491	1,047	491
14	0.44	0	0	0	0	1,086	480	1,086	480	1,086	480	1,086	480
15	0.42	0	0	0	0	1,125	469	1,125	469	1,125	469	1,125	469
16	0.39	0	0	0	0	1,164	458	1,164	458	1,164	458	1,164	458
17	0.37	0	0	0	0	1,203	447	1,203	447	1,203	447	1,203	447
18	0.35	0	0	0	0	1,242	435	1,242	435	1,242	435	1,242	435
19	0.33	0	0	0	0	1,281	423	1,281	423	1,281	423	1,281	423
20	0.31	0	0	0	0	1,320	412	1,320	412	1,320	412	1,320	412
21	0.29	0	0	0	0	0	0	1,384	407	1,384	407	1,384	407
22	0.28	0	0	0	0	0	0	1,448	402	1,448	402	1,448	402
23	0.26	0	0	0	0	0	0	1,512	396	1,512	396	1,512	396
24	0.25	0	0	0	0	0	0	1,576	389	1,576	389	1,576	389
25	0.23	0	0	0	0	0	0	1,640	382	1,640	382	1,640	382
26	0.22	0	0	0	0	0	0	1,703	374	1,703	374	1,703	374
27	0.21	0	0	0	0	0	0	1,767	366	1,767	366	1,767	366
28	0.20	0	0	0	0	0	0	1,831	358	1,831	358	1,831	358
29	0.18	0	0	0	0	0	0	1,895	350	1,895	350	1,895	350
30	0.17	0	0	0	0	0	0	1,959	341	1,959	341	1,959	341
31	0.16	0	0	0	0	0	0	0	0	2,052	337	2,052	337
32	0.15	0	0	0	0	0	0	0	0	2,146	333	2,146	333
33	0.15	0	0	0	0	0	0	0	0	2,239	327	2,239	327
34	0.14	0	0	0	0	0	0	0	0	2,333	322	2,333	322
35	0.13	0	0	0	0	0	0	0	0	2,426	316	2,426	316
36	0.12	0	0	0	0	0	0	0	0	2,519	309	2,519	309
37	0.12	0	0	0	0	0	0	0	0	2,613	303	2,613	303
38	0.11	0	0	0	0	0	0	0	0	2,706	296	2,706	296
39	0.10	0	0	0	0	0	0	0	0	2,800	289	2,800	289
40	0.10	0	0	0	0	0	0	0	0	2,893	281	2,893	281
41	0.09	0	0	0	0	0	0	0	0	0	0	2,992	274
42	0.09	0	0	0	0	0	0	0	0	0	0	3,092	268
43	0.08	0	0	0	0	0	0	0	0	0	0	3,191	260
44	0.08	0	0	0	0	0	0	0	0	0	0	3,290	253
45	0.07	0	0	0	0	0	0	0	0	0	0	3,390	246
46	0.07	0	0	0	0	0	0	0	0	0	0	3,489	239
47	0.06	0	0	0	0	0	0	0	0	0	0	3,588	232
48	0.06	0	0	0	0	0	0	0	0	0	0	3,688	225
49	0.06	0	0	0	0	0	0	0	0	0	0	3,787	218
Total c/f			3,804		6,558		11,185		14,950		18,062		20,278

APPENDIX G
COST ESTIMATES

Schedule G1
Sheet 1

Derivation of unit costs

All expressed as costs per 100m of constructed works

Costs exclude general and preliminary item costs and any allowance for contingency

Technique 1 **Steel Sheet Piling**

Item	Cost (£)
Excavate	8
Supply Piles	48000
Drive Piles	17000
Blinding	380
Formwork	1200
Reinforcement	2400
Concrete	2700
Scabbling	210
Cast in Bars	1000
Landscaping	540
Access	3800
Total	77238
Say	78000

Technique 2 **Steel Sheet Piling by Hush Piling method**

Item	Cost (£)
Excavate	8
Supply Piles	48000
Drive Piles	20000
Blinding	380
Formwork	1200
Reinforcement	2400
Concrete	2700
Scabbling	210
Cast in Bars	1000
Landscaping	540
Access	3800
Total	80238
Say	81000

Schedule G1
Sheet 2

Technique 3 **Reinforced Concrete L Shaped Wall on Riverward Side of Core Wall**

Item	Cost (£)
Excavate	1000
Blinding	380
Scabbling	1100
Cast in Bars	3000
Formwork for Base	1200
Formwork for Wall	3300
Reinforcement	3900
Concrete for Base	2600
Concrete for Wall	2200
Backfill	1000
Landscaping	540
Access	1800
Total	22020
Say	22000

Technique 4 **Stabilise Corewall with Earth on Landward Side**

Item	Cost (£)
Strip topsoil	150
Imported Fill	2900
Place Topsoil	200
Trim Topsoil	390
Landscaping	260
Access	170
Total	4070
Say	4100

Technique 5 **Impermeable Membrane to Corewall**

Item	Cost (£)
Excavate	440
Install Membrane	250
Backfill	720
Landscaping	540
Access	110
Total	2060
Say	2100

Schedule G1
Sheet 3

Technique 6 **Upstand on Core Wall or other Hard Defence**

	Height		
	0.2	0.4	0.6
Item	Cost (£)		
Scabbling	210	210	210
Cast in Bars	1000	1000	1000
Formwork	2200	3400	4000
Cocrete Provision	310	620	930
Concrete Placing	66	120	160
Finish	62	62	62
Access	500	500	500
Part Load	86	0	86
Total	4434	5912	6948

Intercept	3,251	
Slope	6,285	
Say	3300	
plus	6300	per metre height of raising

Present Value of raising Works with option A depending on timing of the works Schedule G3

Value of Raising Works £ 205,000

Year	Discount Factor	Present Value £
0	1.00	205,000
5	0.75	153,000
10	0.56	114,000
20	0.31	64,000
30	0.17	36,000
40	0.10	20,000
50	0.05	11,000

APPENDIX H
EXISTING ENVIRONMENT – ANNEXES

ANNEX 1

NATURE CONSERVATION CITATIONS

CITATION SHEET

COUNTY: SOMERSET SITE NAME: CURRY AND HAY MOORS

DISTRICT: TAUNTON DEANE

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981 (as amended)

Local Planning Authority: Taunton Deane District Council, Somerset County Council

National Grid Reference: ST323273 Area: 472.74(ha) 1168.14(ac)

Ordnance Survey Sheet 1:50,000: 193 1:10,000: ST 22 NE, ST 32 NW

Date Notified (Under 1949 Act): - Date of Last Revision:

Date Notified (Under 1981 Act): 1992 Date of Last Revision:

Other Information: This is part of the SLM candidate RAMSAR/SPA site.

DESCRIPTION AND REASONS FOR NOTIFICATION

Curry and Hay Moors form part of the complex of grazing marshes known as the Somerset Levels and Moors. The low-lying site is situated adjacent to the River Tone which annually overtops, flooding the fields in winter. Soils are predominantly alluvial clays overlying Altcar series peats.

Vegetation in the grazing meadows consists almost entirely of agriculturally improved swards. A small number of hay meadows are herb-rich, containing species such as Pepper Saxifrage (Silaum silaus), the nationally scarce Corky-fruited Water-dropwort (Oenanthe pimpinelloides), Tubular Water-dropwort (O. fistulosa) and Meadowsweet (Filipendula ulmaria).

The flora and fauna of the ditches and rhynes is of national importance. Over 70 aquatic and bankside vascular plants have been recorded including Frogbit (Hydrocharis morsus-ranae), Flowering Rush (Butomus umbellatus), Wood Club-rush (Scirpus sylvaticus) and Lesser Water-plantain (Baldellia ranunculoides). Over 100 species of aquatic invertebrates inhabit the ditches including one nationally rare soldier fly, Odontomyia ornata and 8 nationally scarce species including the water beetles Agabus uliginosus, Hydaticus transversalis and Helophorus nanus.

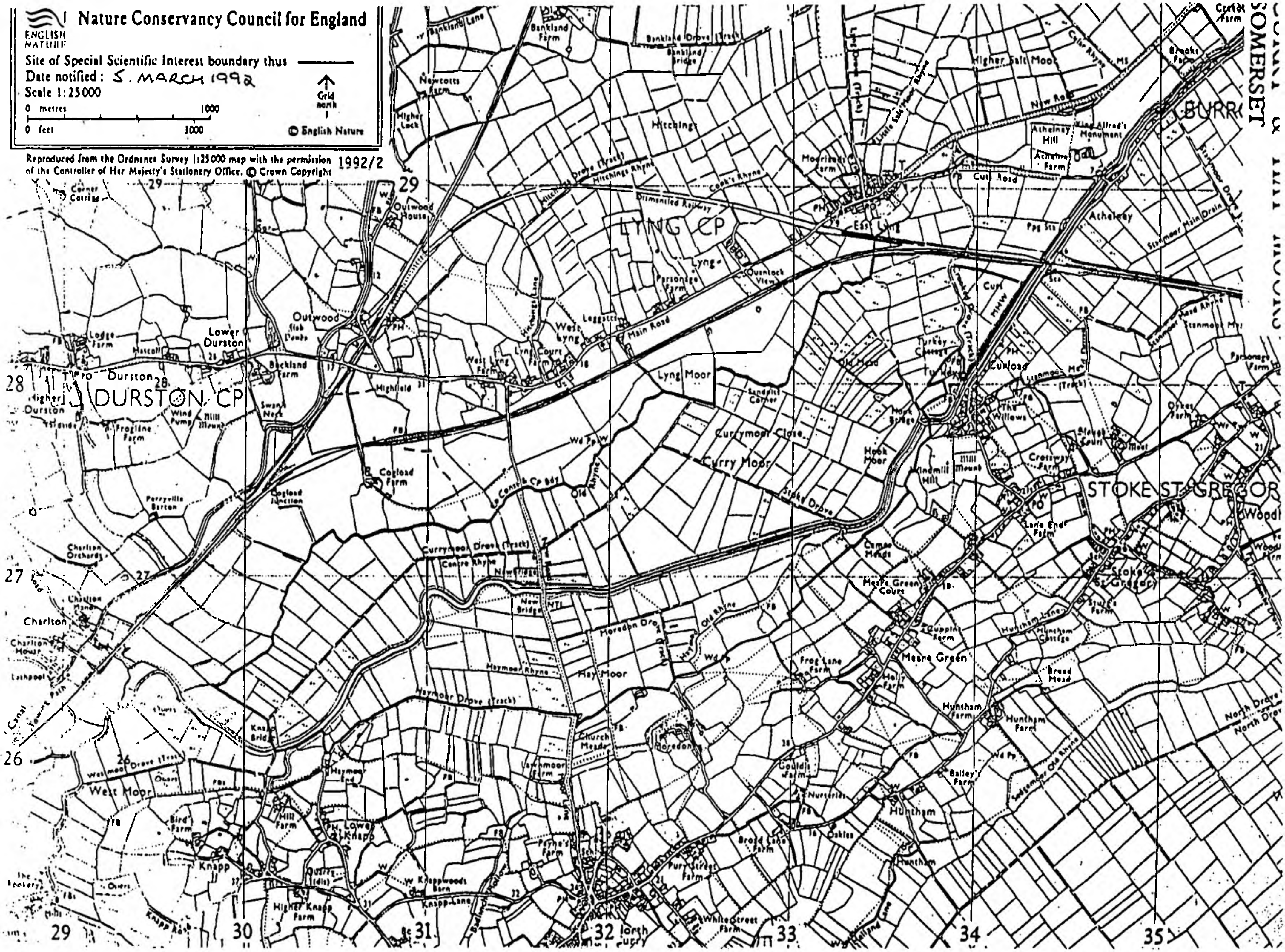
In winter the flooded fields provide food for large numbers of waterfowl with several thousand Lapwing (Vanellus vanellus), hundreds of Snipe (Gallinago gallinago) and smaller numbers of Golden Plover *(Pluvialis apricaria) and Dunlin (Calidris alpina) regularly present. Over two hundred Bewick's Swans *(Cygnus bewickii) have been recorded, making the site an internationally important wintering ground for this species. Large numbers of Wigeon (Anas penelope), Teal (Anas crecca) and Pochard (Aythya ferina) regularly winter on the flooded fields.

Raptor species such as Short-eared Owl *(Asio flammeus), Merlin *(Falco columbarius) and Peregrine *(Falco peregrinus) regularly hunt over the site in winter.

The moist fields in spring and early summer support a diverse and numerous breeding bird population which is now nationally rare. Species breeding include Lapwing, Snipe, Redshank (Tringa totanus), Curlew (Numenius arquata), Yellow Wagtail (Motacilla flava), Whinchat (Saxicola rubetra), Grasshopper Warbler (Locustella naevia) and Mute Swan (Cygnus olor).

Vertebrate species present include Grass Snake (Natrix natrix) and Common Frog (Rana temporaria). Otters (Lutra lutra) are regularly recorded on the site.

* These species are listed on Annex 1 of EC Directive 79/409 on the Conservation of Wild Birds.


ENGLISH NATURE
Nature Conservancy Council for England
Site of Special Scientific Interest boundary thus
Date notified: 5. MARCH 1992
Scale 1:25000
0 metres 1000
0 feet 3000
Grid north
© English Nature
Reproduced from the Ordnance Survey 1:25000 map with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright
1992/2
DURSTON CP
LYNG CP
STOKE ST GREGOR
SOMERSET
Lower Durston
Durston
Higher Durston
Outwood
West Lyng
East Lyng
Lyng Moor
Currymoor Close
Curry Moor
Hay Moor
West Moor
Knapp
Lower Knapp
Higher Knapp Farm
Mearn Green
Huntham
Athelney
Hitchings
Higher Salt Moor
Charlton
Cogload Farm
Stoke Drove
Currymoor Drove (Track)
Haymoor Drove (Track)
North Drove
28
27
26
29
30
31
32
33
34
35

EU Directive 79/409 on the Conservation of Wild Birds:
Special Protection Area

SOMERSET LEVELS AND MOORS
(1003A)

The Somerset Levels and Moors is the largest area of lowland wet grassland and associated wetland habitat remaining in Britain, covering about 35,000 hectares in the floodplains of the Rivers Axe, Brue, Parrett, Tone and their tributaries. The proposed SPA comprises a series of sites within the extensive area bounded by Bridgwater Bay in the west and the higher ground of the Mendips, Dorset Hills, Blackdown Hills, Brendons and Quantocks. The majority of the site is only a few metres above mean sea level and drains through a large network of ditches, rhynes and rivers. Flooding may affect large areas in winter to an extent that depends on levels of rainfall on the moors and surrounding higher ground, and on tidal conditions. The site is mainly given over to cattle grazing, often in conjunction with hay or silage production, although withy growing is also an important traditional activity. Parts of the site around Westhay Moor and Shapwick Heath include areas of former raised peat bog, now substantially modified by agricultural improvement and peat extraction. The pSPA supports internationally important numbers of waterfowl in winter and is one of the most important sites in southern Britain for breeding waders associated with lowland wet grassland.

The pSPA covers 6,386.01 hectares and includes the following twelve Sites of Special Scientific Interest (SSSI), notified under the Wildlife and Countryside Act, 1981: Catcott, Edington & Chilton Moors, Curry & Hay Moors, King's Sedgemoor, Moorlinch, Shapwick Heath, Southlake Moor, Tealham & Tadham Moors, West Moor, West Sedgemoor, Westhay Heath, Westhay Moor and Wet Moor.

The Somerset Levels and Moors pSPA qualifies under Article 4.1 of the EU Birds Directive by regularly supporting nationally important numbers of wintering Bewick's swan *Cygnus columbianus bewickii* and golden plover *Pluvialis apricaria*, both Annex 1 species. In the five year period 1989/90 to 1993/94 the site supported a peak mean of 310 Bewick's swan (4.4% of the British and 1.8% of the north-west European population) and 3,110 golden plover (1.2% of the British population).

The site qualifies under Article 4.2 of the Directive as a wetland of international importance by regularly supporting over 20,000 waterfowl in winter. The five year peak mean for the period 1989/90 to 1993/94 was 58,093 birds, comprising 41,442 waders and 16,651 wildfowl.

The site further qualifies under Article 4.2 by regularly supporting internationally important numbers of the migratory species teal *Anas crecca* and lapwing *Vanellus vanellus*. In the five year period 1989/90 to 1993/94 the site supported a peak mean of 7,476 teal (5.3% of the British and 1.9% of the north-west European population) and 36,565 lapwing (exceeding 20,000 threshold for a wetland of international importance).

Notable also are nationally important numbers of the following species in winter (figures are five year peak means for the period 1989/90 to 1993/94): 94 gadwall *Anas strepera* (1.2% of British population), 5,927 wigeon *A. penelope* (2.1% of British population) and 217 shoveler *A. clypeata* (2.1% of British population). The site also supports an important assemblage of breeding and wintering birds in addition to the species mentioned above, including important populations of breeding waders associated with lowland wet grassland. The Annex 1 marsh harrier *Circus aeruginosus* breeds and the Annex 1 species bittern *Botaurus stellaris*, merlin *Falco columbarius*, peregrine *F. peregrinus*, hen harrier *Circus cyaneus* and short-eared owl *Asio flammeus* are regularly present in winter.

SPA Citation
ICC/CAR
March 1995

Ramsar Convention on Wetlands of International Importance
Especially as Waterfowl Habitat

SOMERSET LEVELS AND MOORS
(1003A)

The Somerset Levels and Moors is the largest area of lowland wet grassland and associated wetland habitat remaining in Britain, covering about 35,000 hectares in the floodplains of the Rivers Axe, Brue, Parrett, Tone and their tributaries. The proposed Ramsar site comprises a series of sites within the extensive area bounded by Bridgwater Bay in the west and the higher ground of the Mendips, Dorset Hills, Blackdown Hills, Brendons and Quantocks. The majority of the site is only a few metres above mean sea level and drains through a large network of ditches, rhynes and rivers. Flooding may affect large areas in winter to an extent that depends on levels of rainfall on the moors and surrounding higher ground, and on tidal conditions. The site is mainly given over to cattle grazing, often in conjunction with hay or silage production, although withy growing is also an important traditional activity. Parts of the site around Westhay Moor and Shapwick Heath include areas of former raised peat bog, now substantially modified by agricultural improvement and peat extraction. The proposed Ramsar site supports internationally important numbers of waterfowl in winter and is one of the most important sites in southern Britain for breeding waders associated with lowland wet grassland.

The proposed Ramsar site covers 6,386.01hectares and includes the following twelve Sites of Special Scientific Interest (SSSI), notified under the Wildlife and Countryside Act, 1981: Catcott, Edington & Chilton Moors, Curry & Hay Moors, King's Sedgemoor, Moorlinch, Shapwick Heath, Southlake Moor, Tealham & Tadham Moors, West Moor, West Sedgemoor, Westhay Heath, Westhay Moor and Wet Moor.

The site qualifies under Criterion 2a of the Ramsar Convention as it supports an outstanding assemblage of rare invertebrates, particularly water beetles. The following seventeen species of Red Data Book (RDB) invertebrates are found within the proposed Ramsar site: RDB 1; the lesser silver water beetle *Hydrochara caraboides*, a weevil *Bagous nodulosus*, a soldier fly *Odontomyia angulata* and a leaf beetle *Oulema erichsoni*: RDB 2; a snail *Valvata macrostoma*, a soldier fly *Odontomyia ornata*, the large marsh grasshopper *Stethophyma grossum*, a fly *Pteromicra leucopeza* and a hoverfly *Lejops vittata:* RDB 3; a sawfly *Stethomostus funereus*, a soldier beetle *Cantharis fusca*, a rove beetle *Paederus caligatus* and the water beetles *Hydaticus transversalis*, *Dytiscus dimidiatus*, *Hydrophilus piceus*, *Limnebus aluta* and *Laccornis oblongus*.

The site qualifies under Criterion 3a of the Convention by regularly supporting over 20,000 waterfowl in winter. The five year peak mean for the period 1989/90 to 1993/94 was 58,093 birds, comprising 41,442 waders and 16,651 wildfowl.

The site further qualifies under Criterion 3a by regularly supporting internationally important numbers of the following species of waterfowl in winter (figures are five year peak means for the

period 1989/90 to 1993/94): 310 Bewick's swan *Cygnus columbianus bewickii* (4.4% of the British and 1.8% of the north-west European population), 7,476 teal *Anas crecca* (5.3% of the British and 1.9% of the north-west European population) and 36,565 lapwing *Vanellus vanellus* (exceeding 20,000 threshold for a wetland of international importance). Notable also are nationally important numbers of wintering gadwall *Anas strepera* (94 birds; 1.2% of British population), wigeon *A. penelope* (5,927 birds; 2.1% of British population), shoveler *A. clypeata* (217 birds; 2.1% of British population) and golden plover *Pluvialis apricaria* (3,110 birds; 1.2% of British population).

The site also supports an important assemblage of breeding and wintering birds in addition to the species mentioned above and is particularly important for breeding waders associated with lowland wet grassland. The rare marsh harrier *Circus aeruginosus* breeds and species regularly wintering include bittern *Botaurus stellaris*, merlin *Falco columbarius*, peregrine *F. peregrinus*, hen harrier *Circus cyaneus* and short-eared owl *Asio flammeus*.

Ramsar Citation
ICC/CAR
March 1995

ANNEX 2

RIVER CORRIDOR SURVEYS

(1991 AND 1997)

RIVER TONE

RIVER CORRIDOR SURVEY REVIEW

Hook Bridge to Parrett Confluence

June 1997

RIVER TONE RIVER CORRIDOR SURVEY REVIEW

River Tone: Hook Bridge to Parrett Confluence **June 1997**

L. Kerry
N. Barker

Introduction

Six ten-metre lengths of the River Tone were surveyed along the 3km tidal section of the River Tone, from Hook bridge to Parrett confluence, to compare with a River Corridor Survey undertaken in 1991 and to establish whether or not the complete section needed re-surveying. The survey was carried out on 19th June 1997, while the tide was ebbing. The water was cloudy but submerged vegetation in the shallows could be seen. A proportion of the tall ruderal vegetation along the banks had recently been cut and this was also being carried out during the survey. Recent dredging had also taken place.

Description

Sketches to accompany the following descriptions and a typical cross-section follow this text. The location of each 10m length is indicated on the 1991 River Corridor Survey.

Length 6

LB: mown/grazed grass and herbs of little wildlife interest. Taller ruderal vegetation with dense *Phalaris arundinacea* occurs on the river bank.
RB: tall dense ruderal vegetation grading into *Phalaris arundinacea* towards the mud banks and waters edge. The northern metre of this length was regularly mown grass and herbs forming a 'lawn' for the adjacent house.
Channel: no vegetation was present.

Length 7

LB: tall ruderals and grasses including docks and nettles with a wide fringe of *Phalaris arundinacea*. Some *Polygonum hydropiper* present.
RB: frequently mown grass adjacent to houses.
Channel: occasional *Potamogeton pectinatus* present.

Length 8

LB: tall ruderals with a wide fringe of *Phalaris arundinacea*.
RB: frequently mown grass and herbs adjacent to houses.
Channel: no vegetation recorded.

Length 9

LB: tall ruderals and grasses with a wide fringe of *Phalaris arundinacea* and occasional *Polygonum hydropiper*. Top of the bank is grazed with some *Cirsium arvense*.
RB: tall ruderals and grasses with a wide fringe of *Phalaris arundinacea*.
Channel: no vegetation present. Otter prints were recorded on the exposed mud banks.

Length 10

LB and RB: recently cut tall ruderal vegetation with short grass and herbs along the top of the bank.
Channel: no vegetation present.

Length 11

LB: recently cut tall ruderal vegetation with short grass and herbs along the top of the bank. Under the power lines these tall ruderals are still present, with a wide fringe of *Phalaris arundinacea*.
RB: tall floristically diverse ruderals including *Rumex hydrolapthum, Chrysanthemum vulgare, Lactuca serriola, Lathyrus pratensis, Epilobium hirsutum* and *Heracleum sphondylium*. Reed warblers breeding in the *Phalaris arundinacea* fringe.
Channel: no vegetation present.

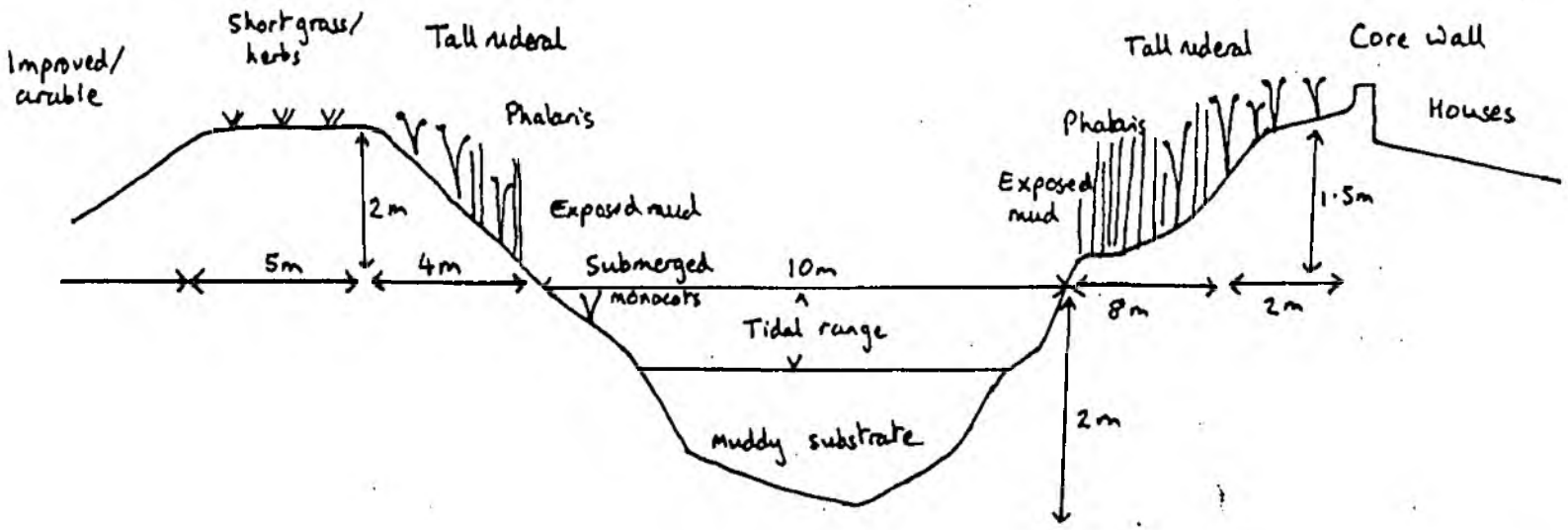
Conclusions

In conclusion, comparing the 1991 survey with the present lengths only minor differences in vegetation were found as the management regime for the banks has remained the same during the intervening years: namely the bankside vegetation is cut once a year (except under powerlines) and the channel is dredged once every two years with the spoil being placed on the banksides. The channel is also agitated every year to displace a certain amount of silt. A new survey would map the extent of present cutting, dredging and short frequently mown `lawns' but would present very little new information.

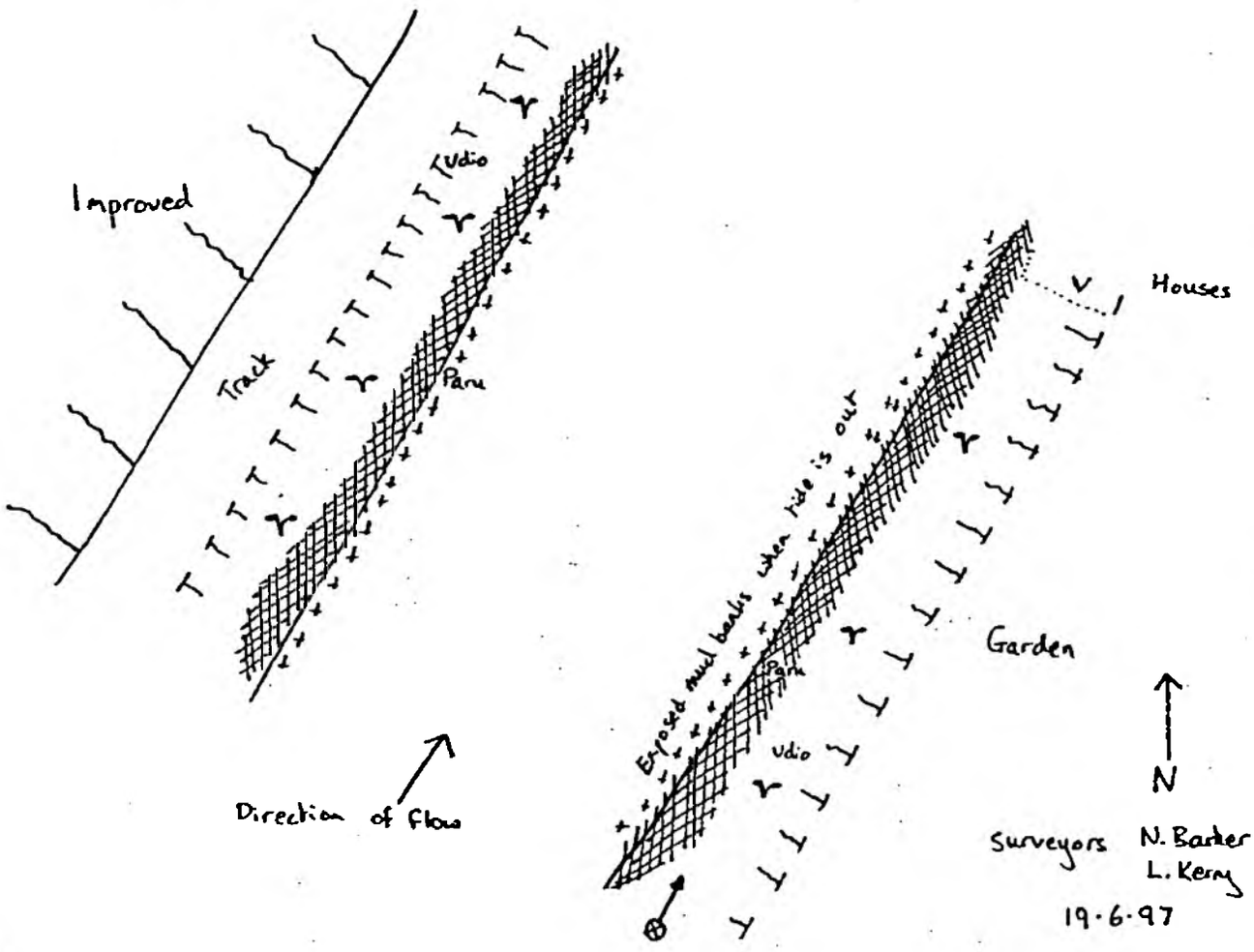
However, an important point does emerge from this survey: the tall bankside vegetation should not be cut during April to July, not only to allow birds to breed but also so that plants can set seed and the taller vegetation can provide more cover for invertebrates.

The presence of otters is also important to note.

River Tone Cross-Section Sketch



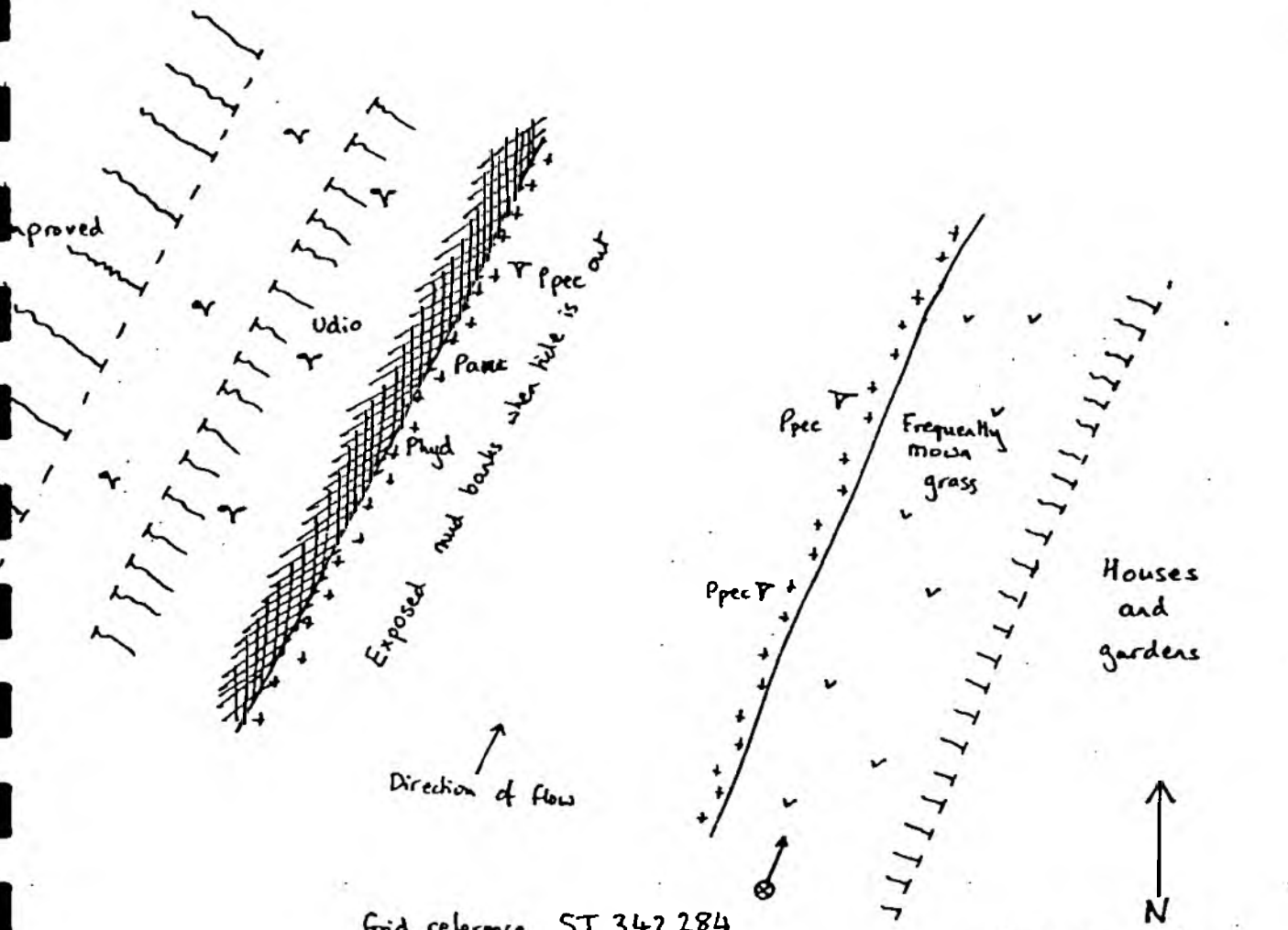
River Tone. Length 6



Surveyors N. Barker
L. Kerry
19·6·97

Grid reference ST 339 279

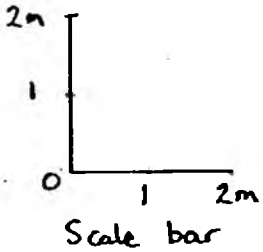
River Tone. Length 7.



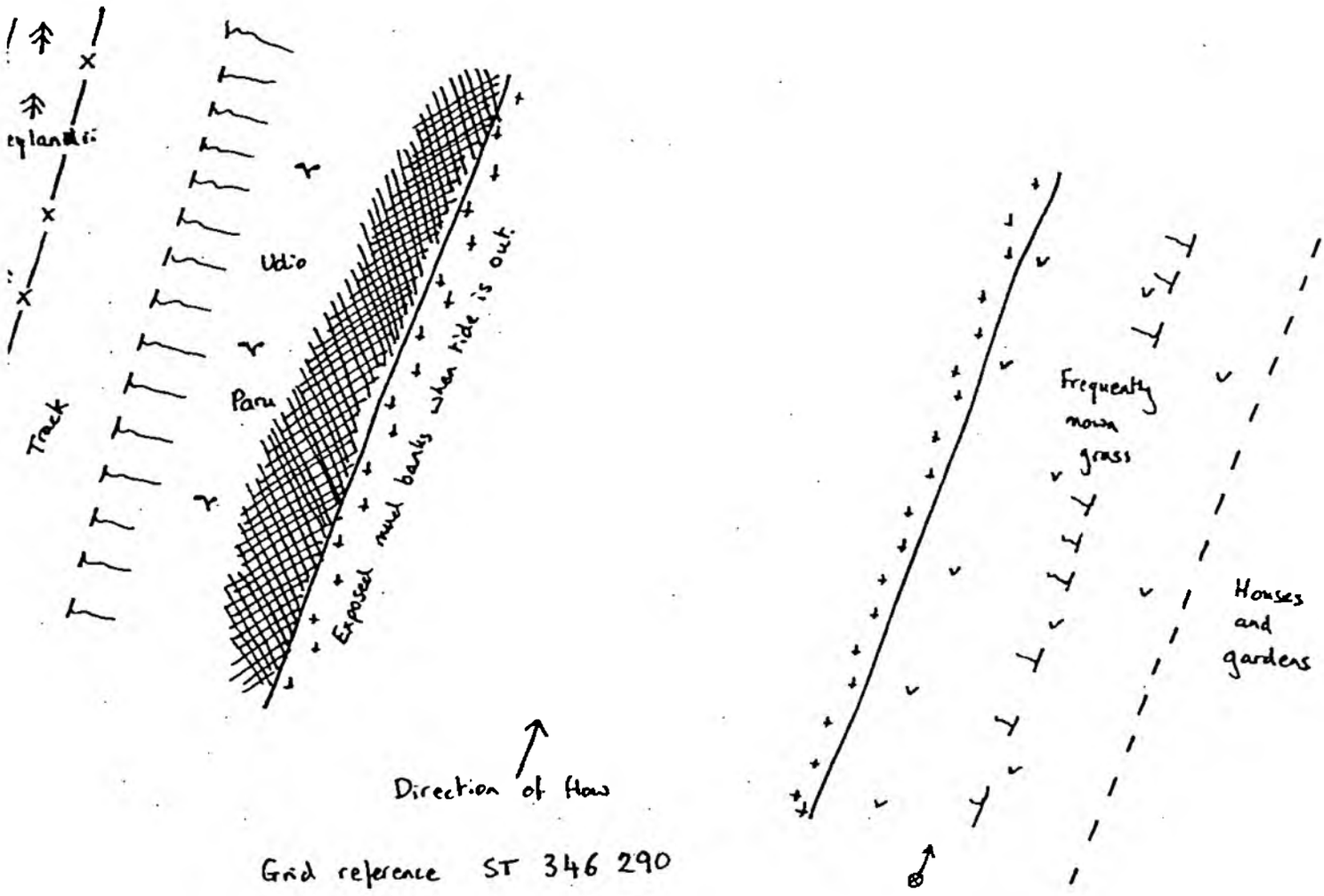
Grid reference ST 342 284

Surveyors N. Barker
L. Kemy

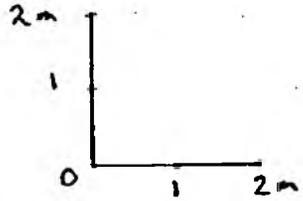
19·6·97



River Tone. Length 8.

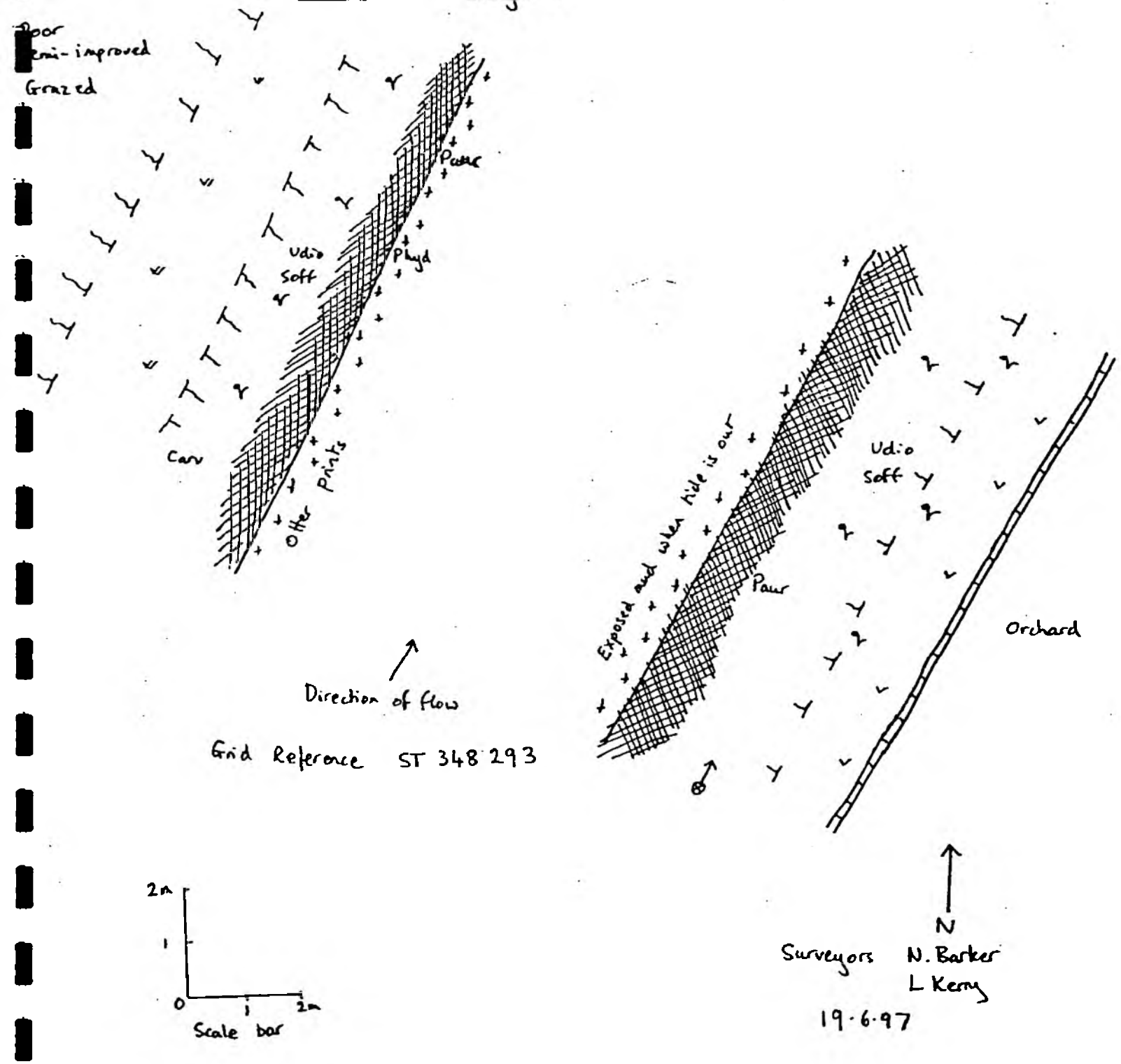


Grid reference ST 346 290



Surveyors N. Barker
L. Kemy
19·6·97

River Tone. Length 9.

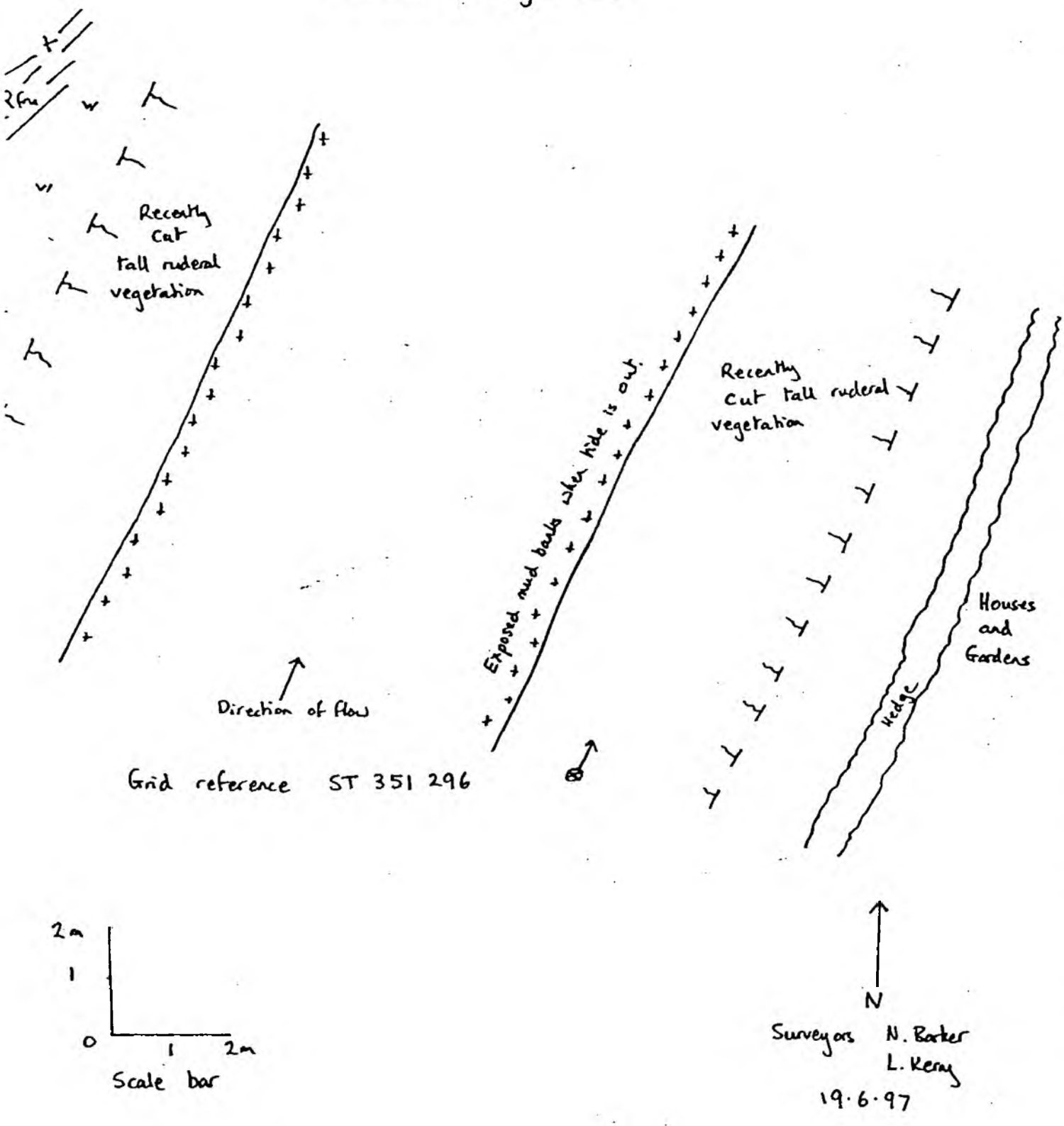


Grid Reference ST 348 293

Surveyors N. Barker
L Kerry

19·6·97

River Tone. Length 10.

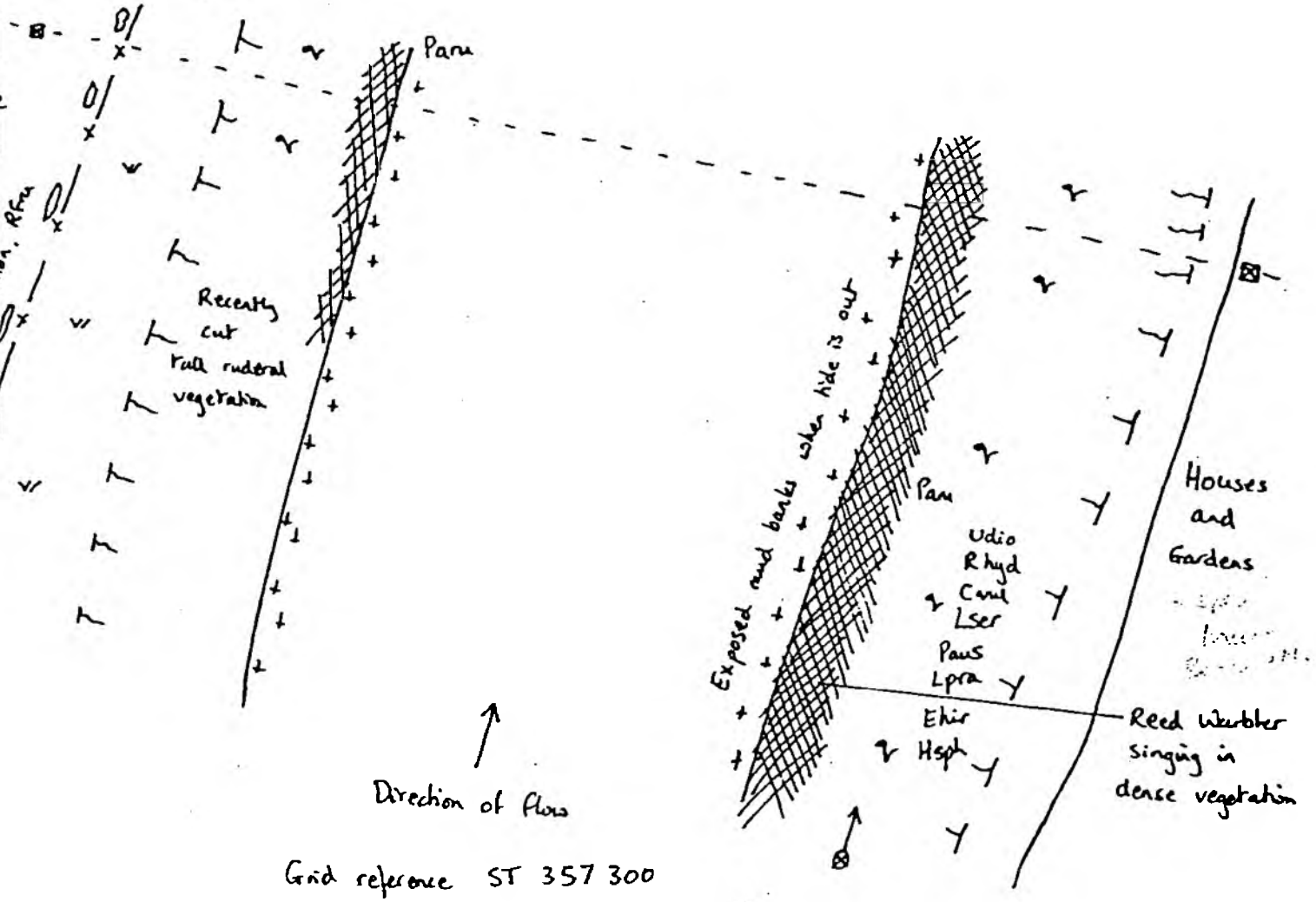


Grid reference ST 351 296

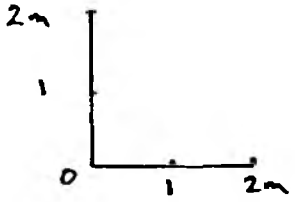
Surveyors N. Barker
L. Kemp

19.6.97

River Tone. Length 11.



Grid reference ST 357 300



Scale bar

N

Surveyors N. Barker
L. Kemy

19·6·97

Appendix 1 Abbreviated plant names

Cvul	*Chrysanthemum vulgare*	Tansy
Ehir	*Epilobium hirsutum*	Great willowherb
Hsph	*Heracleum sphondylium*	Hogweed
Lpra	*Lathyrus pratensis*	Meadow vetchling
Lser	*Lactuca serriola*	Prickly lettuce
Paru	*Phalaris arundinacea*	Reed canary-grass
Paus	*Phragmites australis*	Reed
Phyd	*Polygonum hydropiper*	Water pepper
Ppec	*Potamogeton pectinatus*	Fennel pondweed
Rhyd	*Rumex hydrolapthum*	Water dock
Soff	*Symphytum officinale*	Common comfrey
Sxup	*Symphytum x uplandicum*	Russian comfrey
Udio	*Urtica dioica*	Nettle

Grasses present:

Elymus repens	Common couch grass (most dominant)
Arrhenatherum ellatius	False oat grass
Dactylis glonerata	Cox foot
Poa annua	Meadow grass (between bank and improved field near Brooks farm)

Appendix 2 Definitions

Dicotyledon	two first leaves on the germinating seedling. Leaves are usually net-veined.
Herb	non-woody plant dying back each winter to an underground tuber, rhizome etc, or to a basal leaf-rosette, or an annual.
Monocotyledon	one first leaf on germinating seedling. Leaves are usually parallel-veined.
Ruderal	vegetation growing on waste ground or amongst rubble e.g. nettles, docks, ragwort, tansy, thistles. Often tall dense stands of perennial weeds with creeping or invasive rootstocks.

Appendix 3 Standard Symbols for use in River Corridor Surveys (1992)

Appendix 4 Standard Symbols used for River Corridor Surveys prior to 1992

POSFORD DUVIVIER
EXETER

Job No.	30510
Reg No.	B/01
File No.	

RECEIVED
04 NOV 1997

Director	ICH		
Reply			
A	I	Initials	Sign	Date
		NB	R	4/11/97
		HMH	SCC	4/7
		S		

3/7/97

Dear Natasha

RCS Symbols

DEVON wildlife TRUST
Shirehampton House
35-37 St David's Hill
Exeter, Devon
EX4 4DA
Tel: 01392 79244
Fax: 01392 433221

After discussion with Andy Baines & colleagues at Environment Agency, North Wessex we believe the symbols have the following meanings:

ııı = grazed - we assume Denise's ıı is equivalent to this symbol

Hence:-

ıı - short grazed grass (?)

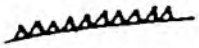
ıı - grazed, sparse, bankside vegetation.

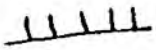
Ψ = emergent broadleaves.

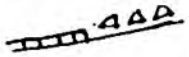
Mary de Lemos
Project Officer

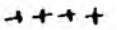
TABLE OF SYMBOLS FOR INTERPRETING THE MAPS

BANKSIDE FEATURES

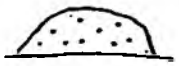

earth cliff

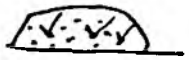

rock cliff


artificial bank


mud

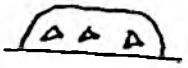

sand


bare gravel/pebbles

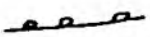

vegetated gravel/pebbles

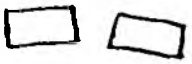

natural cobbles


natural boulders


bedrock

ditch/drain


fence


building

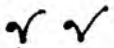
BANKSIDE VEGETATION


tree/large shrub (broadleaved or conifer)


scrub/small shrubs/bramble thickets

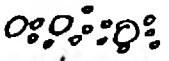

reed/sedge

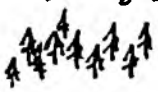

dense ruderal/tall herb vegetation


sparse ruderal/tall herb vegetation


grass


hedge


broadleaved woodland


conifer woodland

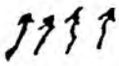
RIVER FEATURES

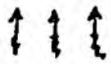

bridge


weir

pool

slack


riffle


run


protruding rocks

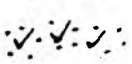

fallen log/tree

Margins/exposed substrates

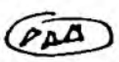

mud

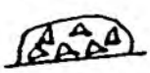

sand


bare gravel/pebbles


vegetated gravel/pebbles


cobbles


boulders


bedrock

2.2 Notes to table of symbols

The descriptions in inverted commas are taken from the NCC publication 'Surveys of Wildlife in River Corridors - Draft Methodology'.

Boulders are 'rocks larger than 25cm in diameter and up to 4m in diameter'.

Cobbles are 'rocks exceeding 6.5cm in diameter'.

Pebbles are 'smaller than cobbles but larger than 1.6cm in diameter'.

Gravel is 'smaller than pebbles and larger than 0.2cm in diameter'.

Silt is 'of soft texture and not abrasive'.

A riffle is 'shallow water flowing fast over coarse substrates; often the surface will be broken and cobbles and boulders may be exposed'.

A pool is 'a distinct, deeper area of water, often resulting in slower velocity or a swirling of the water around a deep depression'.

A slack is an 'area of deep or shallow water where the velocity is slow due to a very shallow slope in the river'.

Earth cliffs are 'at least 1m high and have a slope ranging from 80 to greater than 90 degrees'.

Artificial banks 'may be of any substance - rock, concrete, wood, metal etc. They are usually vertical or steeply sloping'.

Bedrock is shown where it forms a noticeable outcrop in the channel or banksides.

Reed/sedge are reeds and reed-like grasses or sedges, often forming distinct blocks on banksides, in the channel or on adjacent land.

Dense ruderal vegetation is composed of species such as nettles, Indian balsam or willowherb, in thick belts usually on the banktop.

Sparse ruderal vegetation is composed of species such as thistles, often combined with tall grasses.

Grass species: these areas are usually grazed, or colonized with short grasses and low-growing herb species.

Standard trees are those which have grown naturally without periodic coppicing or pollarding.

Coppiced trees are multi-stemmed, having regrown from periodic cutting.

Scrub habitats are usually blocks of bramble, blackthorn or other small shrubs of varying density.

Mud or bare earth on the bankside is usually the result of trampling or cattle grazing.

Hedgerows are shown where they are a continuous and significant feature, not having fallen into neglect or been partially removed.

Tall ruderal ground cover in the adjacent land is usually composed of species such as nettles, bracken and docks.

Agriculturally improved grassland has been greatly affected by the use of fertilisers, herbicides or even re-seeding. It supports a minimal number of grass or herb species.

Semi-improved grassland is usually partly affected by the use of artificial fertiliser, and may be heavily grazed, so that it supports a relatively small range of grasses and herb species, but more than improved grassland.

Unimproved grassland is unaffected by artificial fertiliser, and supports a varied community of grasses, sedges, rushes and herbs. This category encompasses a wide range of soil types, and also includes estuarine salt marsh.

Mud flats lie within the inter-tidal zone in estuarine sections.

2.6 Symbols used in maps

RIVER HABITATS

Substrates (submerged)

BR ..... Bedrock

b ..... Boulders

c ..... Cobbles

p ..... Pebbles

g ..... Gravel

s s ..... Sand

+++ ..... Silt/mud

Habitats and flow

 ..... Bridge

 ..... Weir

 ..... Pool

..... Slack

 ..... Riffle

 ..... Rapids

 ..... Waterfall

 ..... Protruding rocks

 ..... Trash

 ..... Fallen log/tree

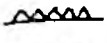
Margins/exposed substrates

+++ ..... Mud

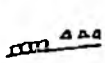
s s ..... Sand

 ..... Bare

BANK FEATURES

 ..... Earth cliff

 ..... Rock cliff

 ..... Artificial

+++ ..... Mud

s s ..... Sand

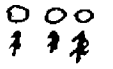
+ + ... Mud

 ..... Vegetated

 ..... Cobbles

 ..... Boulders

Bank and adjacent vegetation

 ..... Trees

 ..... Alder

 ..... Willow

 ..... Scrub

 ..... Reed/sedge

 ..... Dense open

 ..... Sparce open

 ..... Short grass

 ..... Exposed tree roots

 ..... Hedge

 ..... Fence

 ..... Footpath

 ..... Track

not until chainage 22 (Map 31). that there was moderate rainfall and the river level rose to a more normal level. Working down from this point there were a number of rainy spells which caused minor spates. the river was not surveyed when in spate. however it should be noted that evidence of otter may well have been washed away.

Working down the river. the increase in depth due to reduced slope and increased flow made it increasingly more difficult to investigate the margins from the channel. making it less likely that otter hovers and spraints would be found. Below chainage 13.5 the turbidity of the water due to discharges from clay pits made it impossible to wade in the channel or to ascertain substrate and depth.

Downstream of chainage 10.5 (Map 7) the river is tidal. Most of the sections below this were surveyed at high tide and all the maps were produced as if the river was at high water. Due to water depth. muddy banks and margins the channel was not entered for these sections. Between chainages 10.5 and 9.5 the nature of the dense bankside undergrowth and that of the adjacent land made it impossible to approach the river bank in most places. Precise detail for these stretches is not as accurate as that for the rest of the river.

2.4 Glossary of terms used in text and symbols

The descriptions in inverted commas are adapted from 'Surveys of Wildlife in River Corridors - Draft Methodology' NCC 1985.

Bedrock is 'solid rock which is firmly positioned on the river bed and larger than a boulder'.

Boulders are 'rocks > 25cm in diameter and up to 4m in diameter'.

Cobbles are 'rocks > 6.5cm but < 25cm in diameter'.

Pebbles are '> 1.6cm but < 6.5cm in diameter'.

Gravel is '> 0.2cm but< 1.6cm in diameter'.

Sand is 'Smaller than gravel but larger than silt'.

Mud/silt is 'of soft texture and not abrasive.

A riffle is 'shallow water flowing fast over coarse substrates; often the surface will be broken and cobbles and boulders may be exposed'.

Rapids are 'regions of rapid water velocity resulting in coarse substrates. water may be deep or shallow'.

A pool is' a distinct. deeper area of water. often resulting in slower velocity or a swirling of the water around a deep depression'.

A slack is 'an area of deep or shallow water where the velocity is slow due to a very shallow slope in the river'.

Earth cliffs are ' at least 1m high and have a slope ranging from 80 to greater than 90 degrees'.

Artificial banks 'may be of any substance - rock. concrete. wood. metal. gabions etc. They are usually vertical or steeply sloping'.

Reed beds are composed of reeds and reed-like grasses forming distinct blocks on the banksides. channel or in adjacent land.

Dense open vegetation comprises a solid cover of ruderal or tall herbaceous species. such as nettles. willow herb and Indian balsam.

Sparce open vegetation comprises an incomplete cover of the above species often interspersed with short grass or bare ground.

Short grass may be either grazed or mown.

Standard trees are those which have grown naturally without periodic coppicing or pollarding.

Coppiced and pollarded trees are multi-stemmed. regrowing after periodic cutting.

Scrub habitats are usually blocks of hawthorn, blackthorn or bramble of varying density.

Hedgerows are shown where they are continuous and a significant feature, they are often on banks.

Semi-improved grass is usually partly affected by the use of artificial fertilizer, and may be intensively grazed, such that species diversity may be much lower than that expected from wholly un-improved grassland.

Improved grass is regularly grazed and treated with artificial fertilizer, it will often have recently been resown with agricultural grass species and is very poor in other plant species.

Unimproved grass is unaffected by artificial fertilizer, and supports a varied community of grasses, herbs, sedges and rushes, it may be grazed.

2.5 Glossary of terms relating to otters

Considerable evidence of otter activity was found on the river Teign. This glossary explains those terms used in the text that refer to otter signs and habitats.

Holt A holt is an actively burrowed out chamber, usually beneath a mature oak, ash, or sycamore in the bankside, showing signs of recent habitation (eg, tracks, spraints or claw marks around or close to the entrance). A holt is not necessarily a breeding site.

Hover A hover is an eroded hollow in the bankside, usually among the root system of an ash, oak or sycamore, used as a temporary resting point and often marked with spraints.

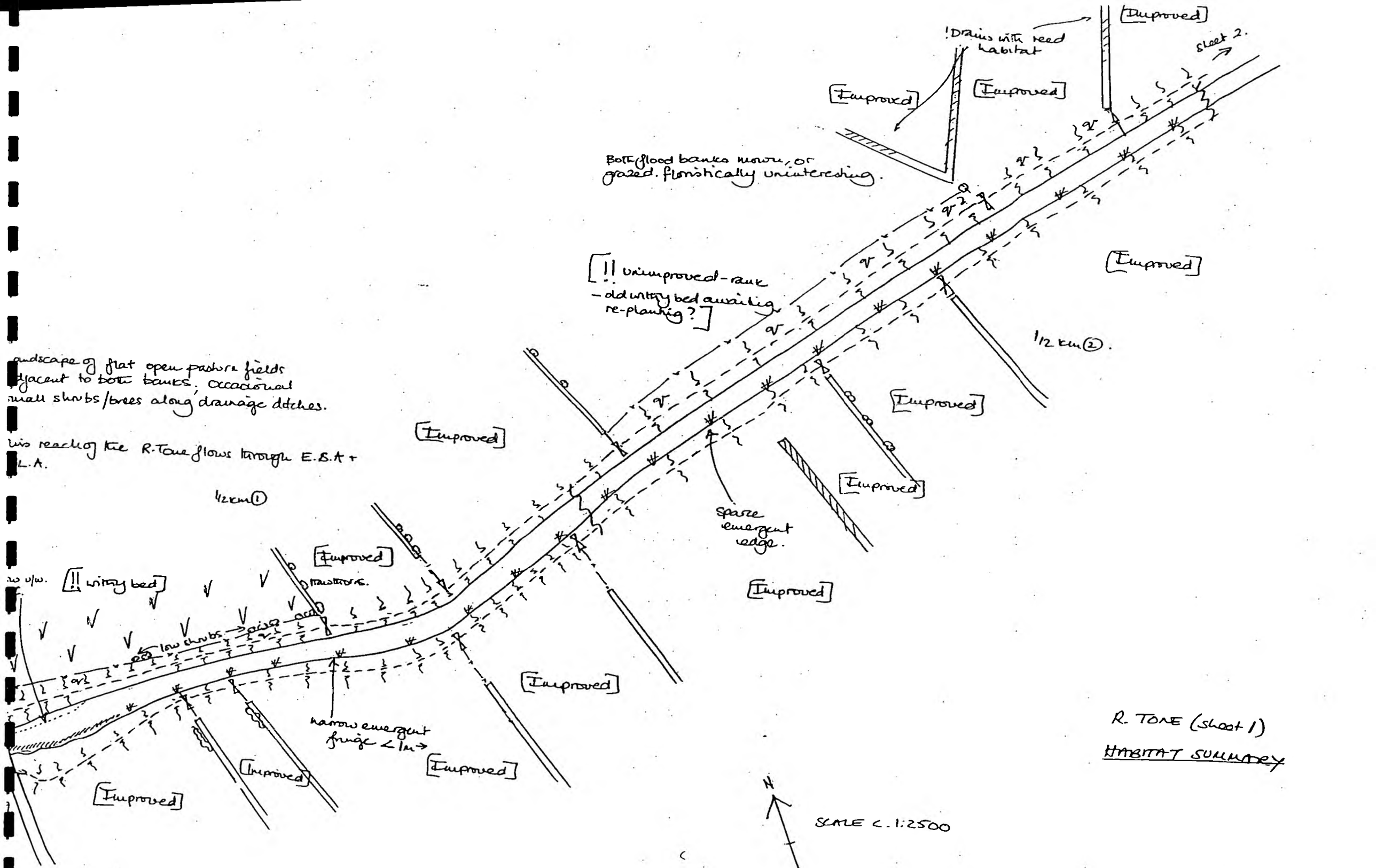
Lying up cover This is dense ground cover close to the river or on an island, usually composed of scrub, low coppice regrowth, immature woodland, tall ruderal plants or coarse wetland habitats. Bramble, blackthorn or willow scrub is most commonly used.

Spraint These are otter droppings used as territorial markers. They have a dark, tar-like appearance when fresh, and a rich, musky scent; fish bones and scales are usually discernable within the spraint. They are usually deposited at conspicuous points along the river, on large boulders or logs, on projecting tree limbs, at the base of bridges and at the confluence of rivers and streams.

Sign heap This is a small pile of sand or mud scraped up by the otter and usually marked with a spraint.

andscape of flat open pasture fields
djacent to both banks, occasional
mall shrubs/trees along drainage ditches.

his reach of the R. Tone flows through E.S.A +
L.A.

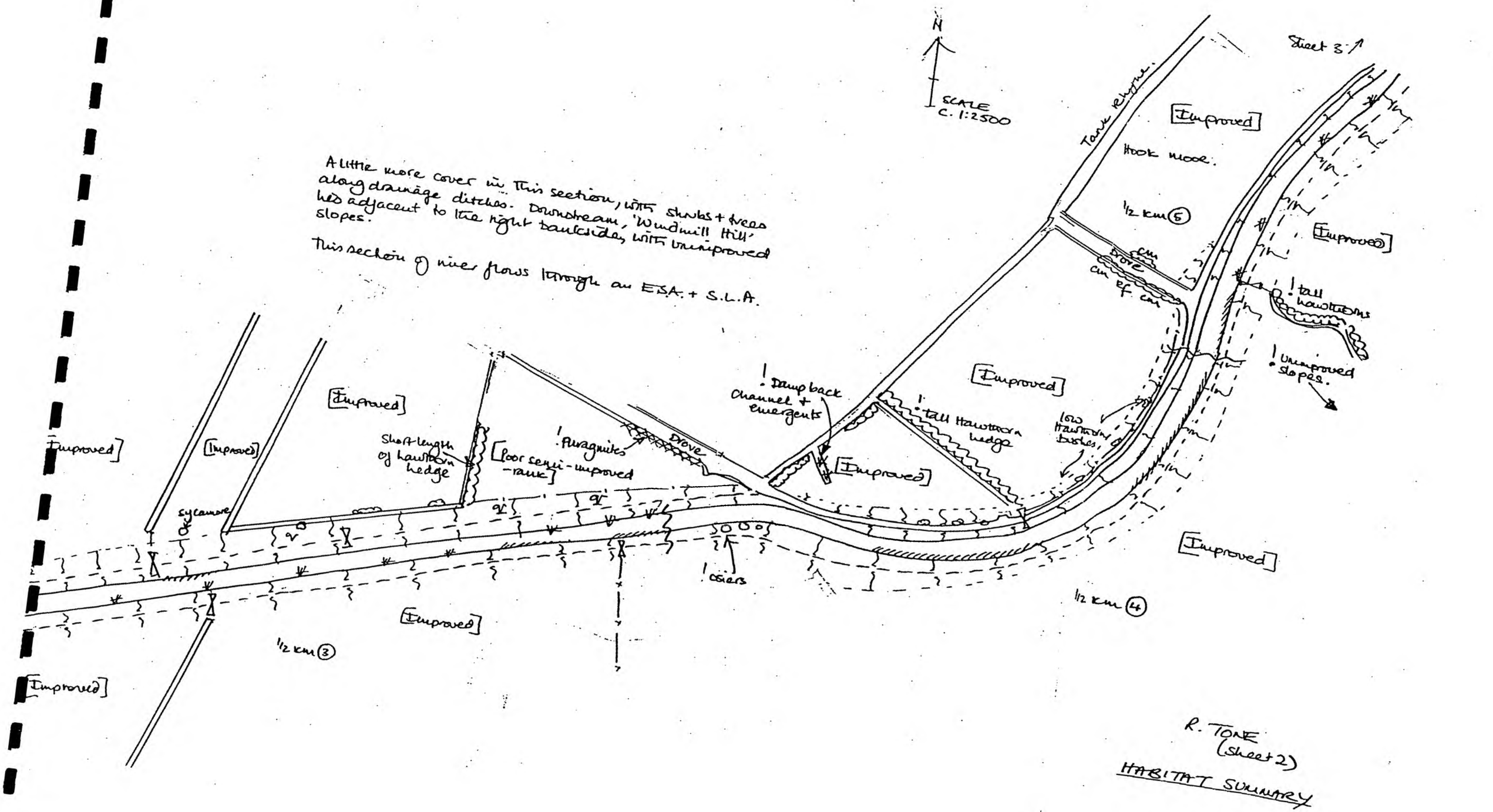


R. TONE (sheet 1)

HABITAT SURVEY

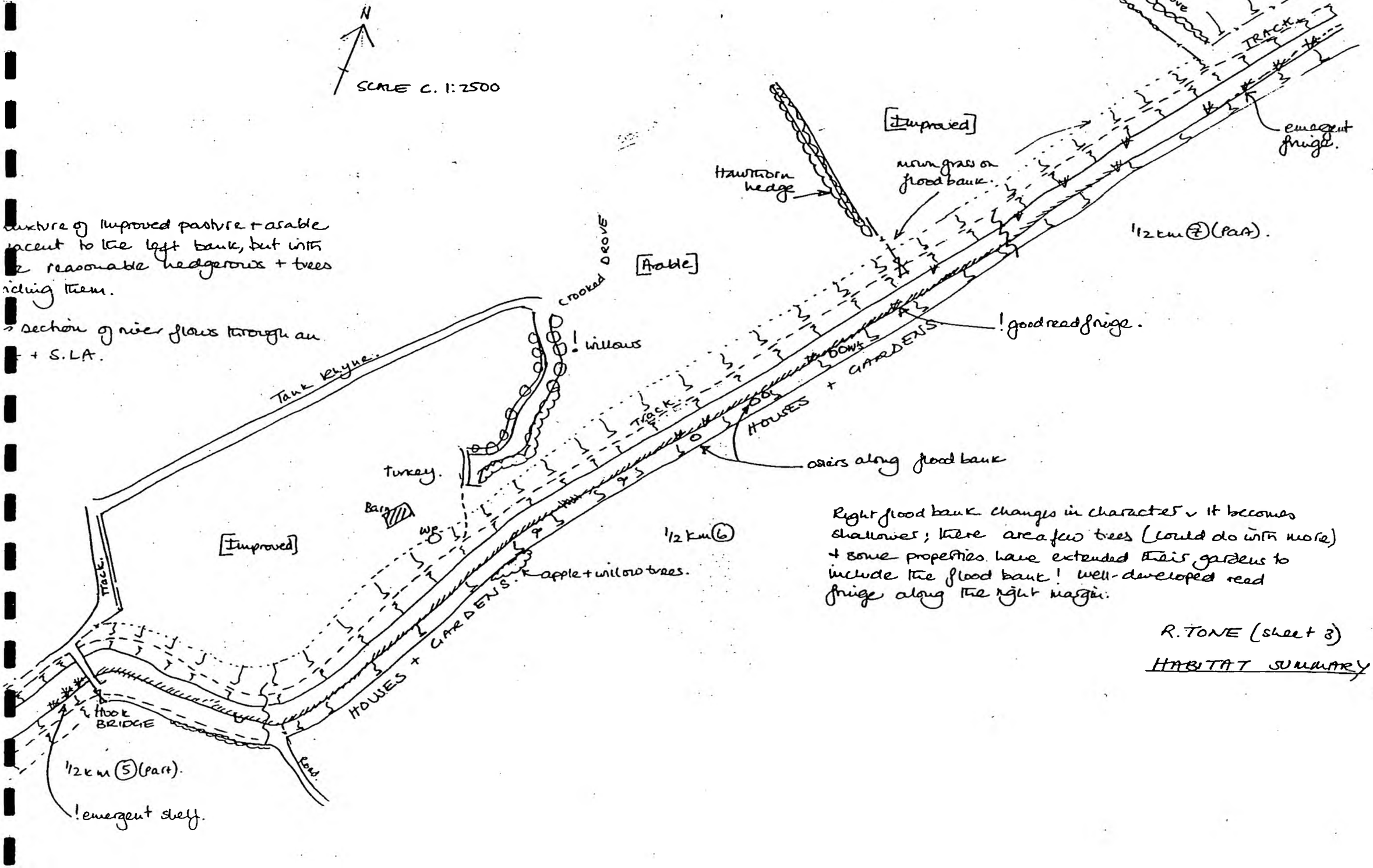
A little more cover in this section, with shrubs + trees along drainage ditches. Downstream, 'Windmill Hill' lies adjacent to the right bankside, with unimproved slopes.

This section of river flows through an E.S.A. + S.L.A.



R. TONE
(Sheet 2)

HABITAT SUMMARY



mixture of improved pasture + arable
jacent to the left bank, but with
a reasonable hedgerows + trees
iding them.

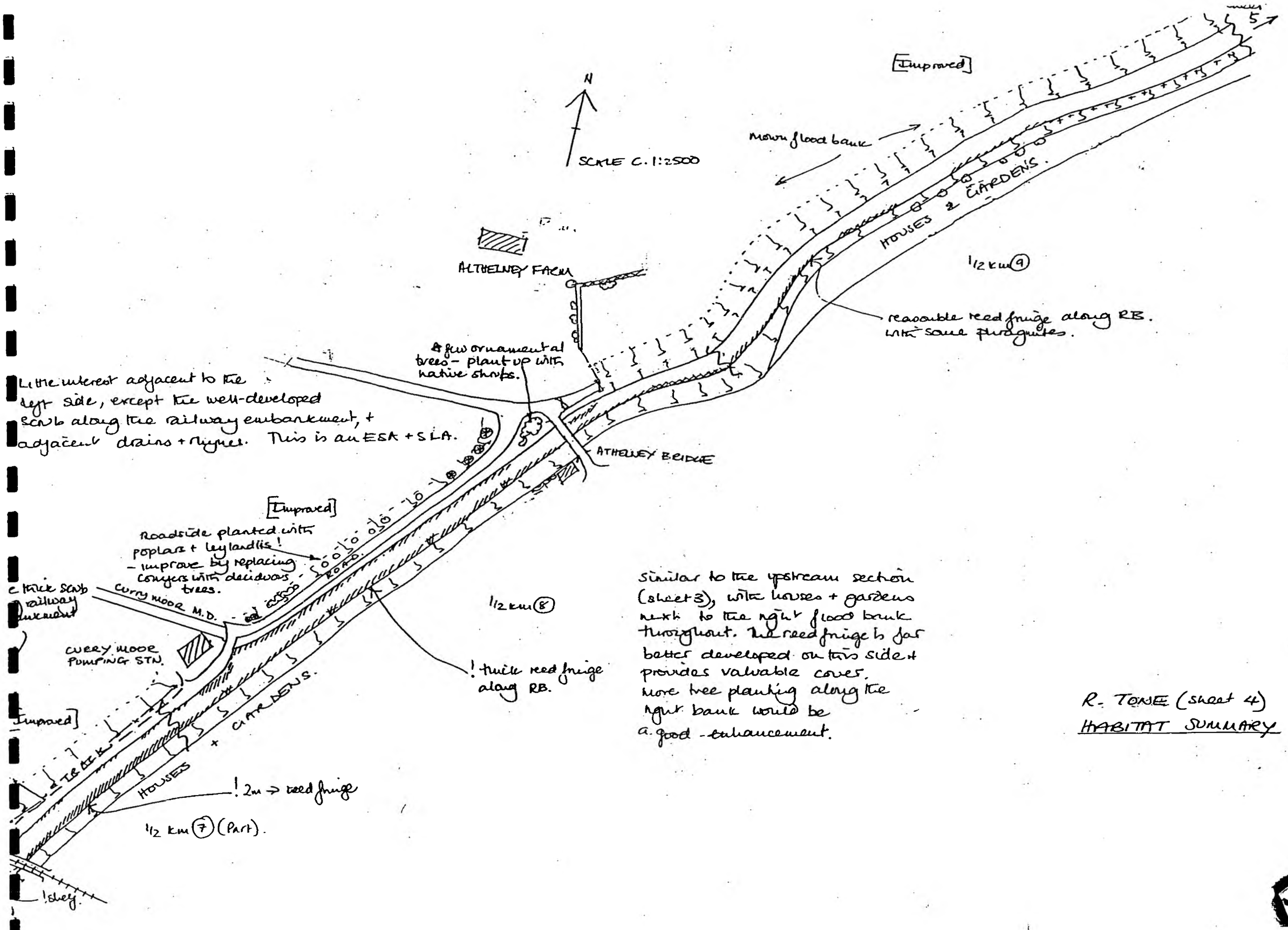
→ section of river flows through an
+ S.L.A.

doors along flood bank

Right flood bank changes in character ~ it becomes shallower; there are a few trees (could do with more) + some properties have extended their gardens to include the flood bank! well-developed reed fringe along the right margin.

R. TONE (sheet 3)

HABITAT SUMMARY



Little interest adjacent to the left side, except the well-developed scrub along the railway embankment, + adjacent drains + rhynes. This is an ESA + SLA.

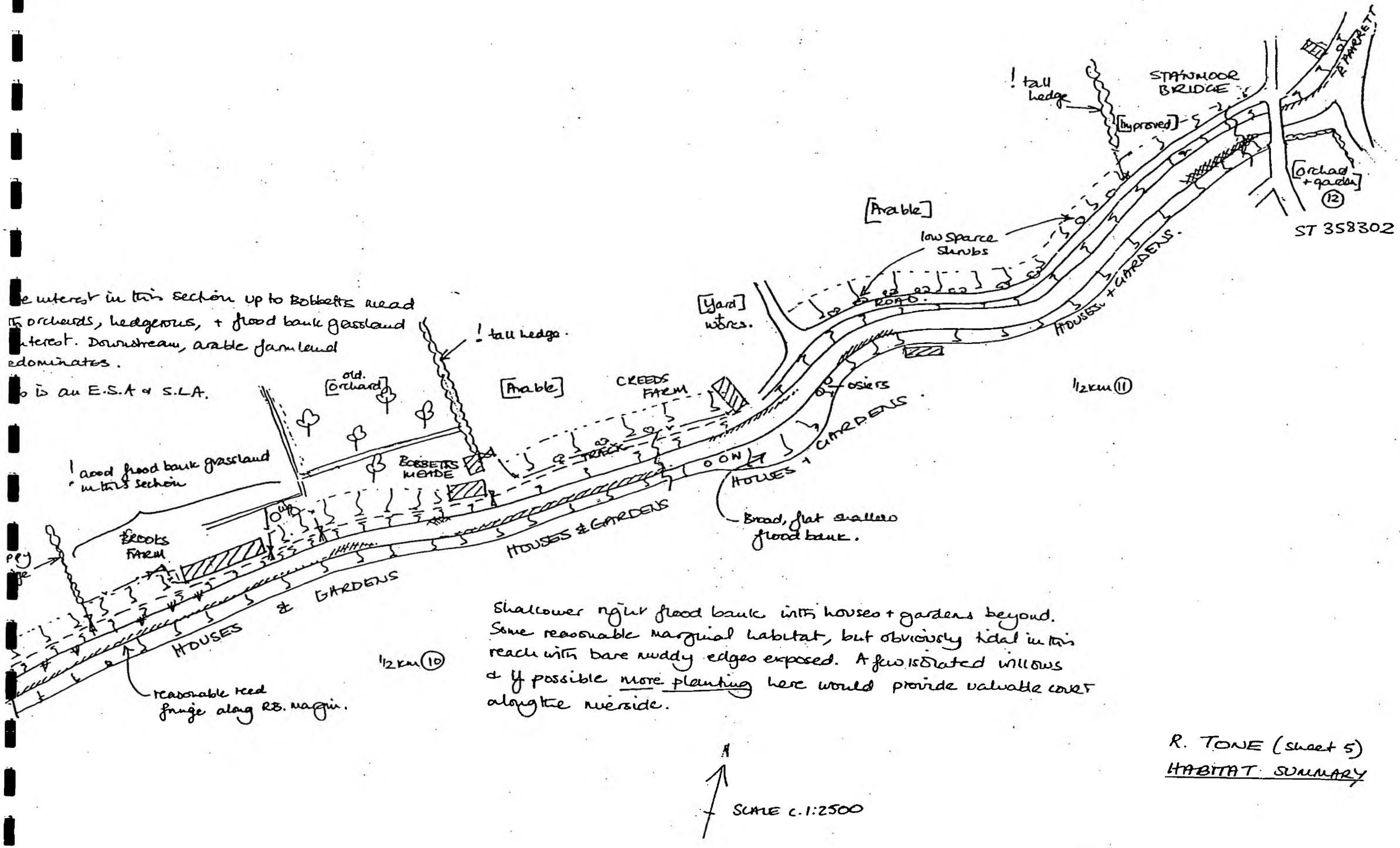
similar to the upstream section (sheet 3), with houses + gardens next to the right flood bank throughout. The reed fringe is far better developed on this side + provides valuable cover. More tree planting along the right bank would be a good enhancement.

R. TONE (sheet 4)

HABITAT SUMMARY

e interest in this section up to Bobbetts Mead
h orchards, hedgerows, + flood bank grassland
nterest. Downstream, arable farmland
edominates.

o is an E.S.A & S.L.A.



Shallower right flood bank with houses + gardens beyond. Some reasonable marginal habitat, but obviously tidal in this reach with bare muddy edges exposed. A few isolated willows & if possible more planting here would provide valuable cover alongthe riverside.

N

SCALE c.1:2500

R. TONE (sheet 5)

HABITAT SUMMARY

RIVER TONE

RIVER CORRIDOR SURVEY

Hook Bridge - Parrett Confluence

1991

RIVER CORRIDOR SURVEY

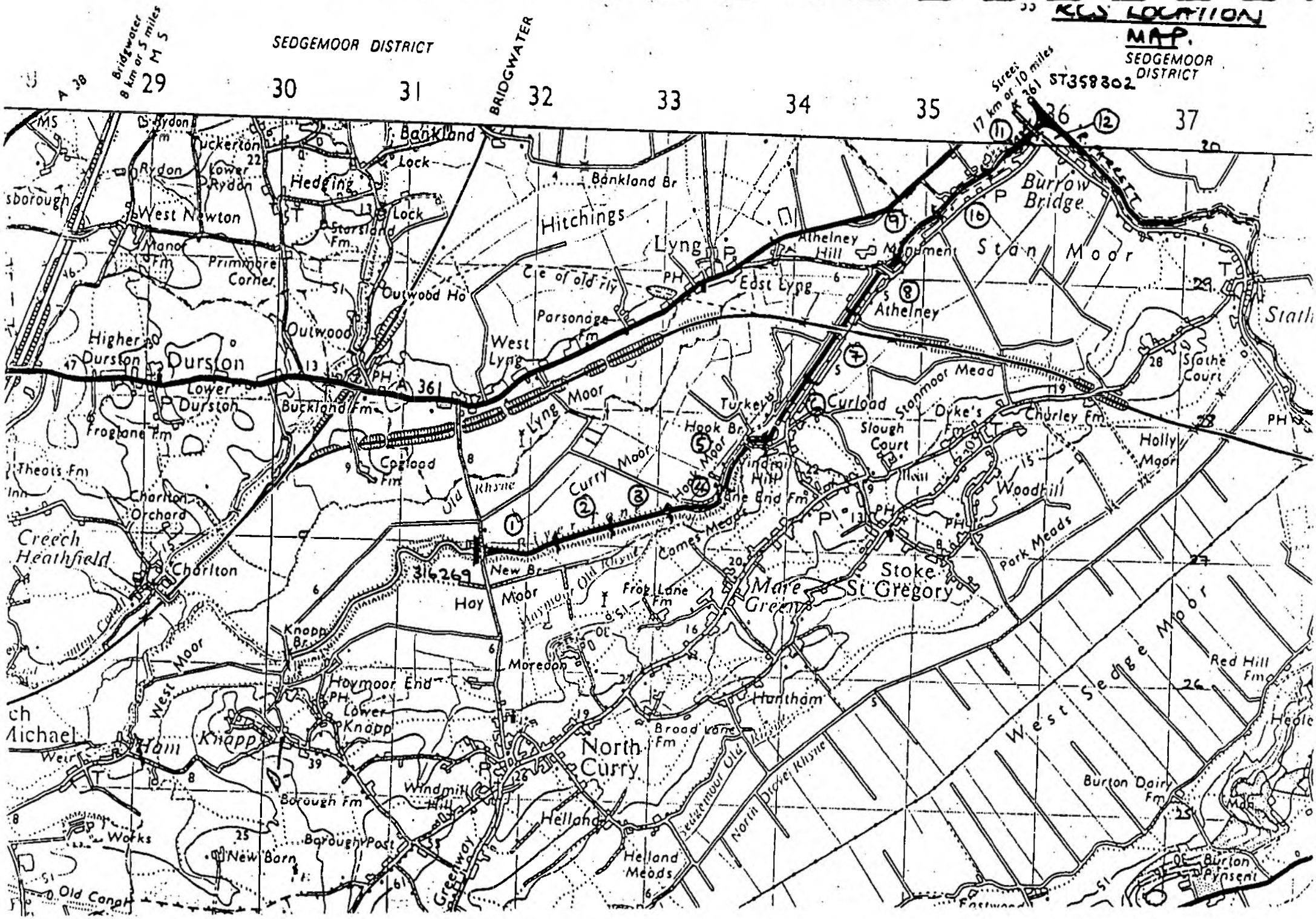
RIVER TONE, New Bridge - Parrett confluence

ST316269 - 358302 Ref. S26C

Surveyed September 1991
Denise Exton MSc.

KEY LOCATION MAP.

SEDGEMOOR DISTRICT



RIVER TONE, Section No. 6 Surveyed 20.9.91

Physical features

Banks:

Both banks approximately 2m high, 4m wide, 40-50 degree slope.

Channel:

Narrower here, approximately 7m wide; depth unknown.

Vegetation

Banks:

LB continues to be mown/grazed grass & herbs of little wildlife interest.

RB suddenly improves with a well-developed reed fringe of *Phalaris arundinacea* and *Phragmites communis*, and occasional osiers and other willows! The reason for this unmanaged stretch of bank could be due to the adjacent houses, the gardens of which have extended onto the flood bank with vegetable plots and apple trees being noted here.

Channel:

No submergents recorded, but turbid water restricted visibility.

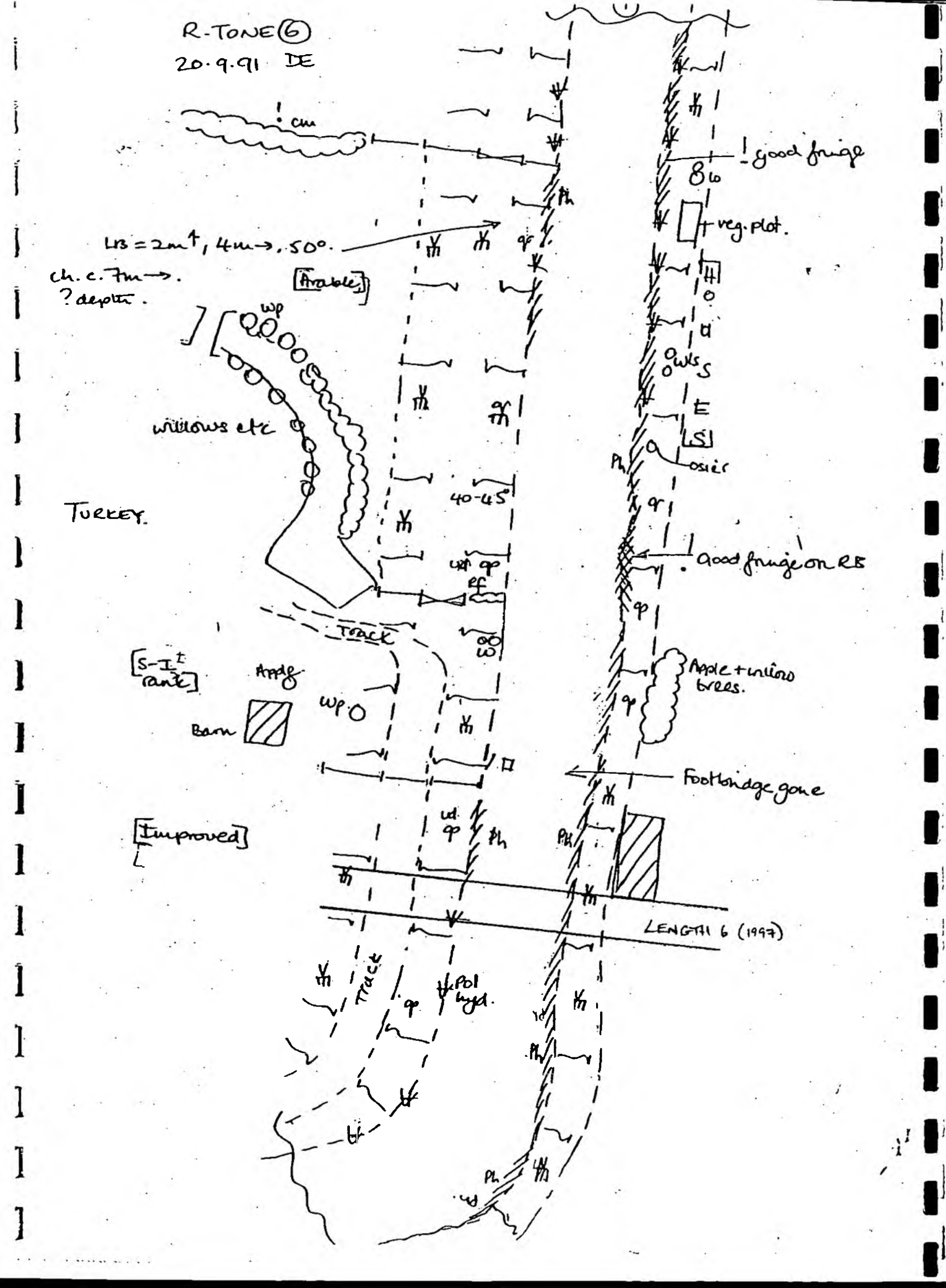
Adjacent land

LB: Farm buildings, farmyard and improved and arable fields. Some notable willow pollards and a hawthorn hedge provided useful cover.

RB: Mostly houses and gardens throughout.

Other interest

The marginal river habitat is naturally enhanced where annual maintenance is reduced or ceases. The reed fringe along the RB is an important habitat scarce or absent in upstream stretches.


R-TONE (6)
20.9.91 DE
! cm
! good fringe
8b
veg. plot.
LRS = 2m↑, 4m→, 50°.
ch. c. 7m→.
? depth.
Arable
wp
willows etc
owls
E
LSI
osier
TURKEY.
40-45°
ef
good fringe on RB
TRACK
S-I
Apple + various trees.
Barn
wp
Footbridge gone
Improved
LENGTH 6 (1997)
Track
Pol hyd.

RIVER TONE, Section No. 7 Surveyed 20.9.91

Physical features

Banks:

Left bank higher than right bank, both over 1.5m high.

Channel:

Wide straight channel, deep and uninteresting.

Vegetation

Banks:

Right bank mown grass; left bank tall ruderals and grasses including docks and nettles.

Channel:

No visible submergent vegetation recorded; fringes of *Phalaris arundinacea* and *Polygonum hydropiper* along both bank margins - particularly well developed in the downstream end of the RB.

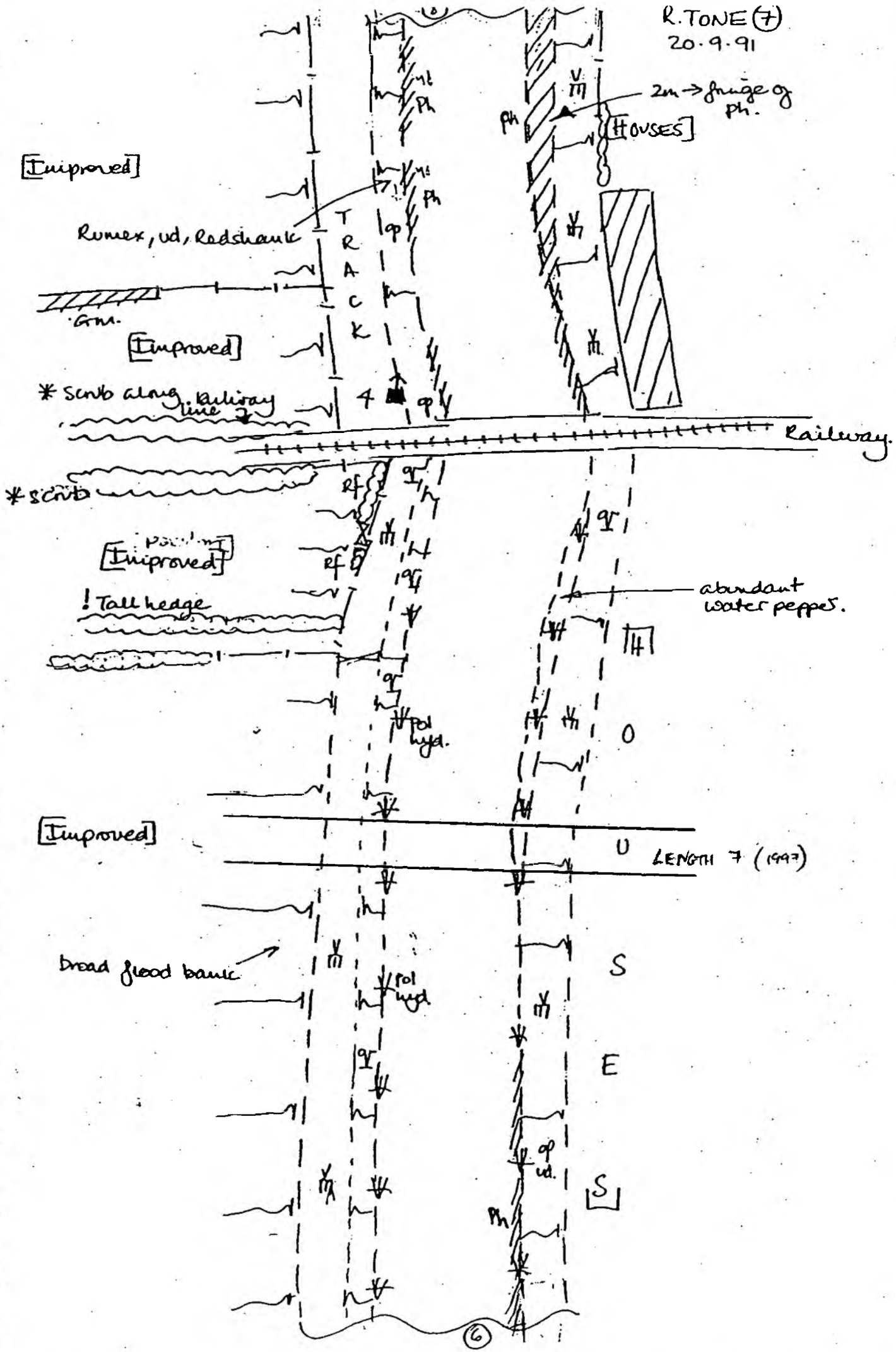
Adjacent land

LB: Improved grassland divided by ditches or hedgerows. The railway cuttings and embankments were scrubbed over providing good cover.

RB: Houses and gardens throughout.

Other interest

None noted.


R. TONE (7)
20.9.91
2m → gauge of ph.
HOUSES
Improved
Rumex, ud, Redshank
TRACK
Gm.
Improved
* scrub along Railway line
Railway.
* scrub
Improved
! Tall hedge
abundant water peppers.
pol hyd.
0
Improved
U
LENGTH 7 (1997)
broad flood bank
S
E
S
ud.
ph
6

RIVER TONE, Section No. 8 Surveyed 20.9.91

Physical features

Banks:

Both banks over 1.5m high, variable width, and slope between 40-60 degrees. A road and trackway ran past the Currymoor pumping station on the left bank. Exposed mud at the base of the banks, particularly downstream of Athelney Bridge (tidal).

Channel:

A wide channel, depth of water unknown, turbid and lacking interest. Currymoor main drain entered from the leftside.

Vegetation

Banks:

Both banks mown or grazed grass and ruderal vegetation.

Channel:

No submergents recorded, but a thick reed fringe of *Phalaris arundinacea* and *Phragmites communis* along the right bank; discontinuous reed fringe along the left bank.

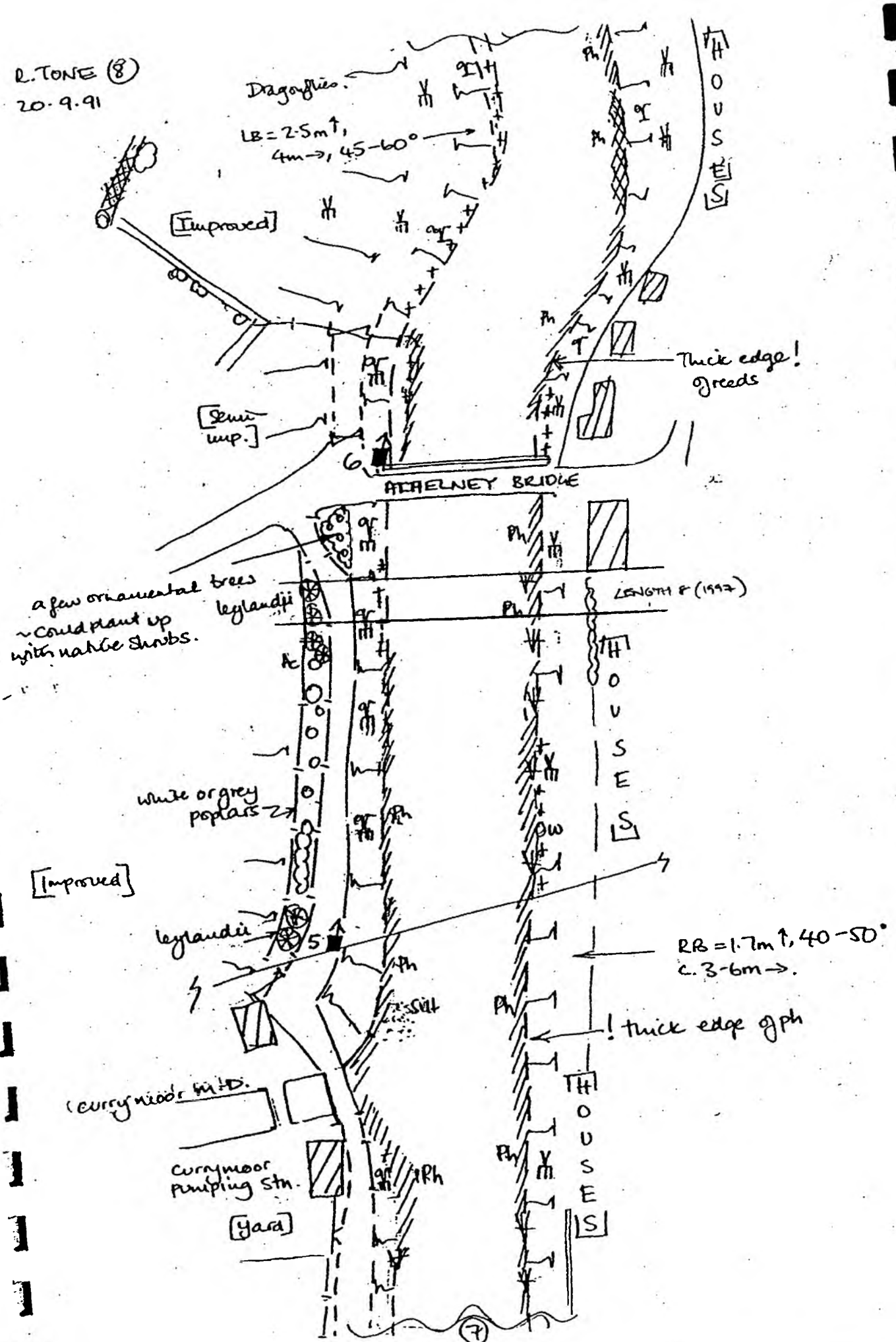
Adjacent land

LB: Improved and semi-improved grassland. A row of poplars and leylandii trees lined the driveway to the pumping station, and another small patch of ornamental trees at Athelney Bridge.

RB: Houses and gardens throughout.

Other interest

Many dragonflies noted along the riverside.


R. TONE (8)
20.9.91
Dragonflies.
LB = 2.5m ↑, 4m →, 45-60°
[Improved]
[Semi imp.]
Thick edge! greeds
ATHELNEY BRIDGE
a few ornamental trees ~could plant up with native shrubs.
leylandii
LENGTH R (1992)
HOUSES
white or grey poplars
[Improved]
leylandii
RB = 1.7m ↑, 40-50° c. 3-6m →.
! thick edge gph
Currymoor Pumping Stn.
[Yard]
7

RIVER TONE, Section No. 9 Surveyed 20.9.91

Physical features

Banks:

Both banks 3m high, 3-5m wide and 45-60 degree slope.

Channel:

Wide, muddy and deep.

Vegetation

Banks:

Mown or grazed grass with thistles on the leftbank; mown or grazed on the right bank.

Channel:

No submergents recorded. A fringe of Phalaris arundinacea, Phragmites communis, and Polygonum hydropiper was reasonably well-developed along the right bank margin; left margin was more muddy with only occasional Polygonum hydropiper.

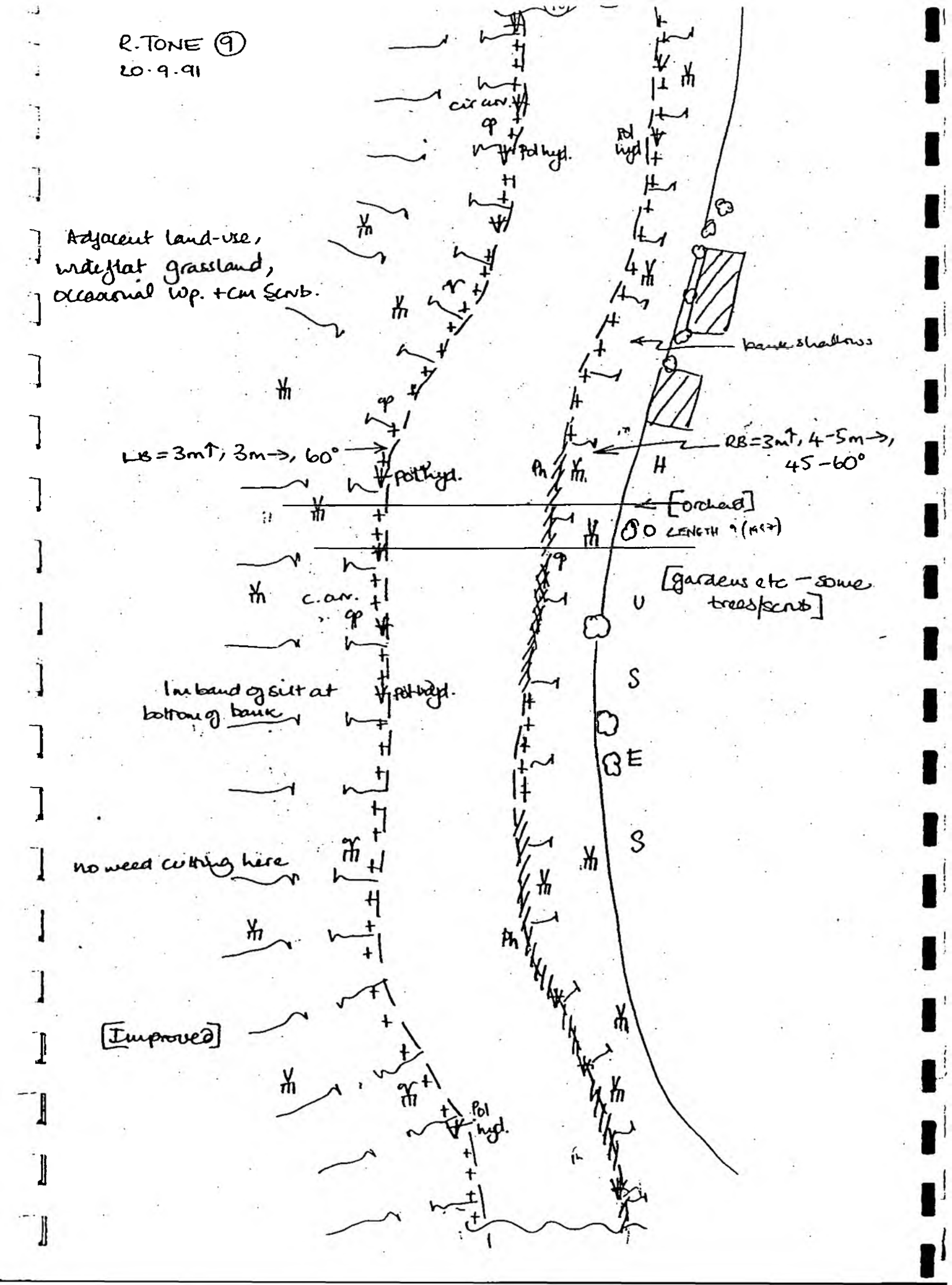
Adjacent land

LB: A wide expanse of improved grassland with occasional willow pollards and hawthorn scrub.

RB: Houses, gardens and small orchards.

Other interest

None noted.


R. TONE ⑨
20.9.91
Adjacent land-use, wide flat grassland, occasional Wp. + Cm Scrub.
circ ann.
qp
Pol hyd.
bank shallows
LB = 3m↑, 3m→, 60°
RB = 3m↑, 4-5m→, 45-60°
[orchard]
LENGTH 9 (M(?))
[gardens etc - some trees/scrub]
c. an.
Imbanded silt at bottom of bank
no weed cutting here
[Improved]
U
S
E
S

RIVER TONE, Section No. 10 Surveyed 20.9.91

Physical features

Banks:

Left bank higher than right bank, both over 1.5m high, and of varible width and slope. Muddy edge to both banks indicating tidal influence.

Channel:

Over 12m wide, sinuous but generally featureless.

Vegetation

Banks:

RB: For the mostpart ungrazed or mown on the front face, but comprising tall herbs and grasses - quite floristically diverse by Brooks Farm with valarian, tansy, fleabane, yarrow, etc. and favoured by invertebrates. Tall herbs and ruderals downstream including tansy, nettles and teasels.

LB: Generally short grass vegetation.

Channel:

No submergents recorded, but a reasonable fringe of Phaleris arundinacea and Polygonum hydropiper along both bank margins.

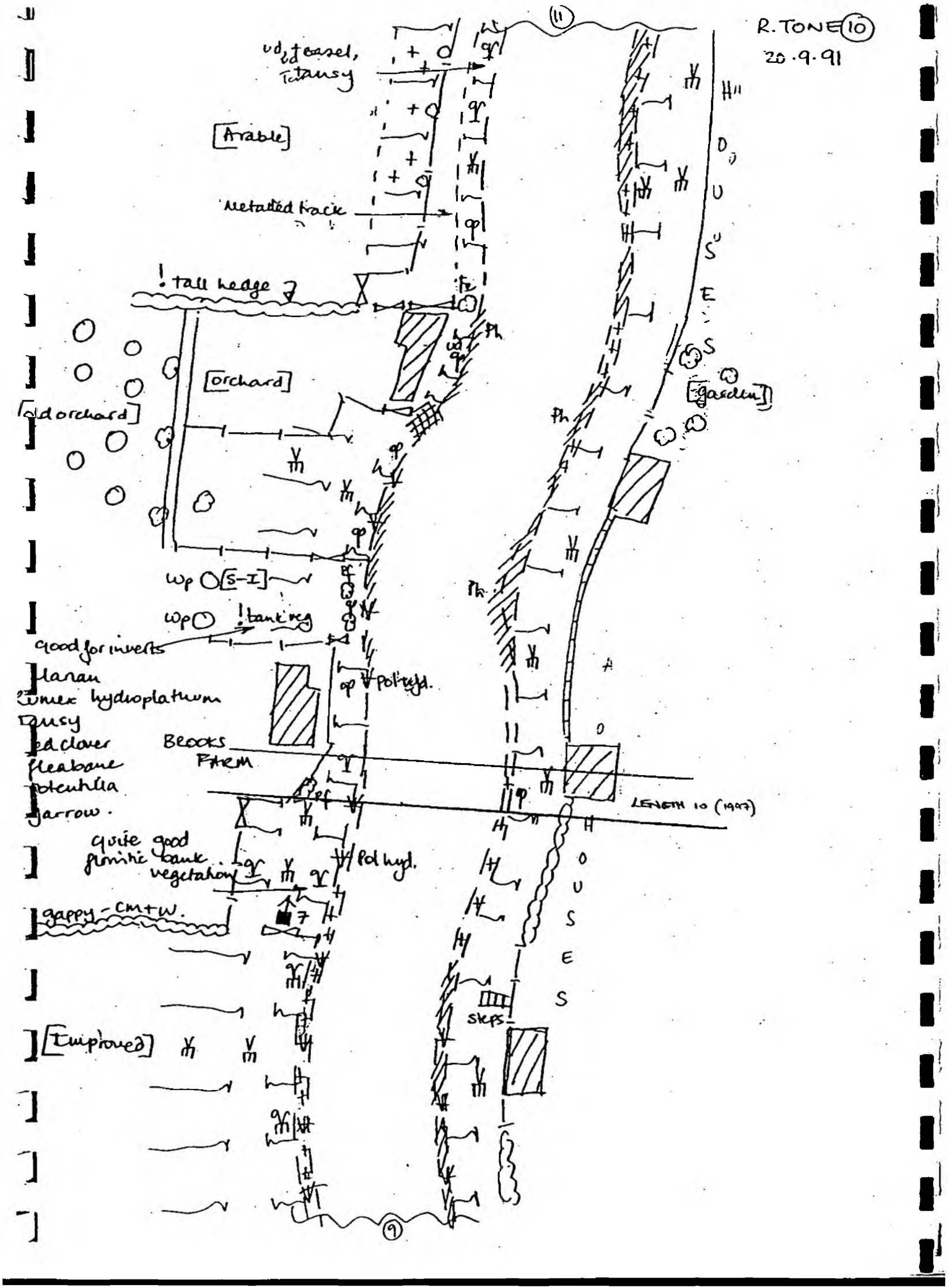
Adjacent land

LB: Most interesting habitats were around Brooks Farm with orchards, hedgerows, semi-improved pasture and willow pollards. Arable field in the downstream end.

RB: Houses and gardens throughout.

Other interest

None noted.


R. TONE (10)
20.9.91
(11)
vd teasel, tansy
[Arable]
Metalled track
! tall hedge ?
[orchard]
[d orchard]
[garden]
HOUSES
wp [S-I]
wp ! banking
good for inverts
Planan
Cirsium hydroplatium
Daisy
Red clover
Fleabane
Potentilla
Yarrow.
Pol hyd.
Brooks
Prem
LENGTH 10 (1997)
quite good
flowing bank
vegetation
Pol hyd.
gappy - CM+W.
steps
[Improved]
(9)

RIVER TONE, Section No. 11 Surveyed 20.9.91

Physical features

Banks:

Both banks generally over 2.0m high, but variable. Shallower sections on the RB and very wide in places. A metalled trackway ran on top of the LB in this stretch.

Channel:

Wide, over 12m; gently curving but generally featureless.

Vegetation

Banks:

LB: tall herbs/ruderals along front face of flood bank; back face forms part of the arable and improved fields.

RB: Generally grass vegetation but with a few young osiers and ash trees on the front face of the flood bank.

Channel:

Same as upstream sections - no submergent vegetation recorded (turbidity cut down visibility), but fringes of Phalaris arundinacea and Phragmites communis. Muddy margin noticable along RB.

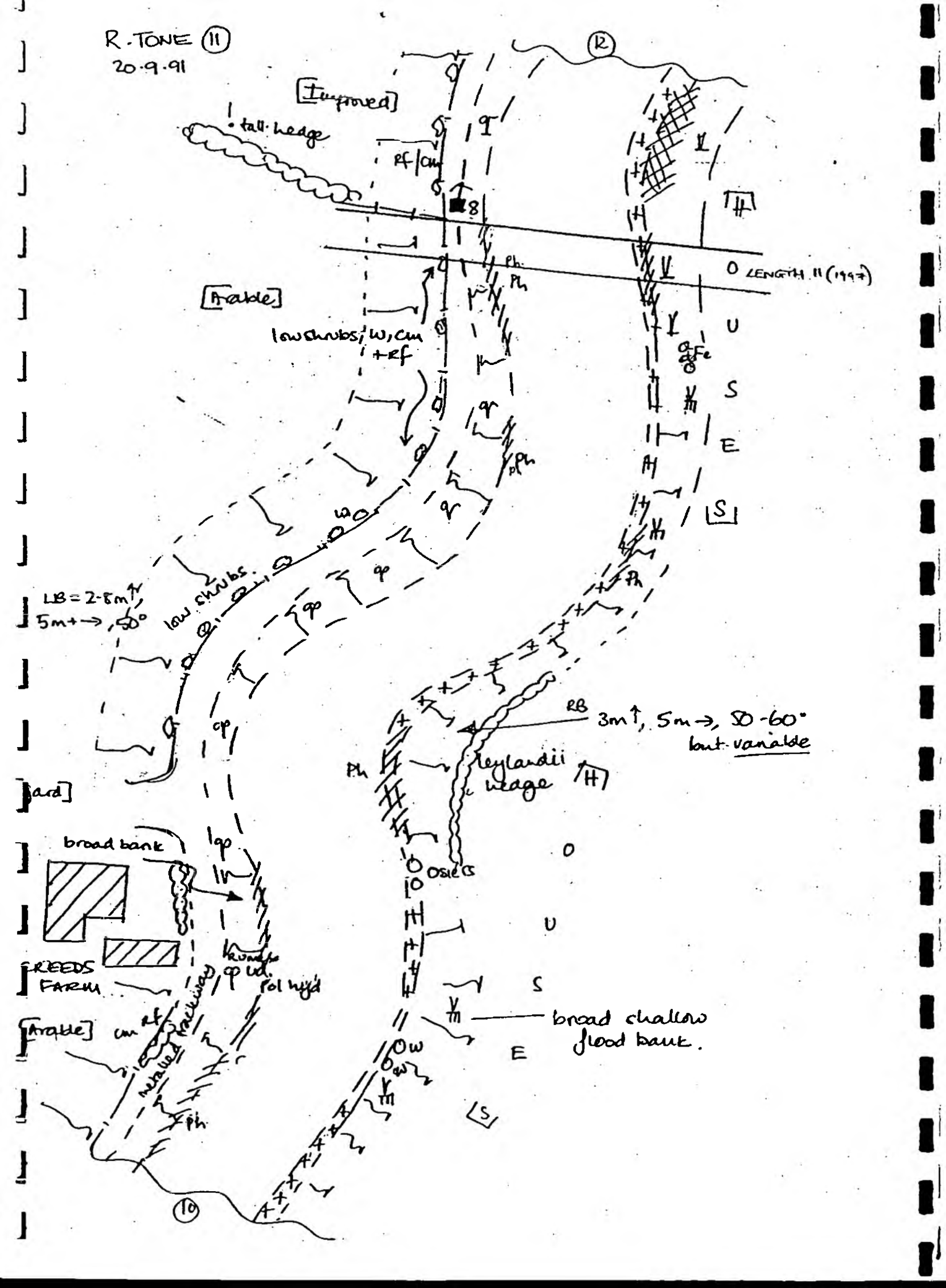
Adjacent land

LB: Mainly arable; one notable tall hedge in the downstream end. Scattered scrub along top of flood bank/field boundary.

RB: Houses and gardens throughout.

Other interest

None noted.


R. TONE (11)
20.9.91
(R)
[Improved]
tall hedge
Rf/Cm
8
Ph
Ph
O LENGTH II (1997)
[Arable]
low shrubs; W, Cm
+Rf
qr
qp
U
S
E
[S]
LB = 2-5m↑,
5m+→, 50°
low shrubs
RB
3m↑, 5m→, 50-60°
but variable
Reylandii
hedge
[H]
broad bank
OSIERS
O
U
S
broad shallow
flood bank.
E
W
[S]
CREEDS
FARM
[Arable]
Cm
Rf
(10)

RIVER TONE, Section No. 12 (80m) Surveyed 20.9.91

Physical features

Banks:

Both banks 1.5-2.0m high, variable width, 40 degrees or more.

Channel:

Wide, deep and lacking interest.

Vegetation

Banks:

Downstream of Stanmoor Bridge the front face of the left bank comprises a broad bank of ruderals, mown grass on the top. The RB is mown grass throughout.

Channel:

A margin of *Phalaris arundinacea* fringed the right bank; bare exposed mud with few aquatics along the RB. No submergents recorded.

Adjacent land

LB: Improved pasture upstream of Stanmoor Bridge; a garden below the bridge.

RB: Houses and gardens/orchard.

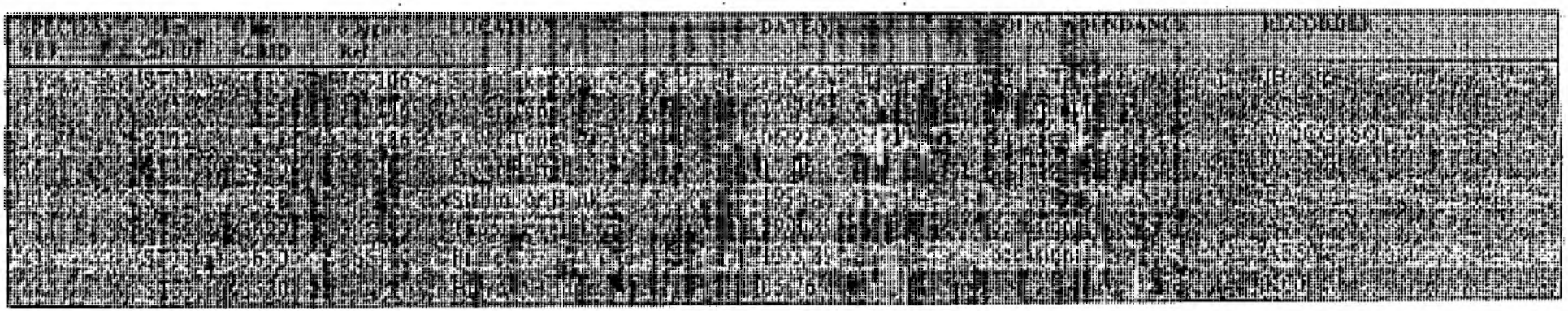
Other interest

None noted. There are no scheduled sites along the River Tone, New Bridge - Parrett confluence, but it falls within a Special Landscape Area and an Environmentally Sensitive Area.

ANNEX 3

BIODIVERSITY SPECIES

Key species present within the Stanmoor Bank study area

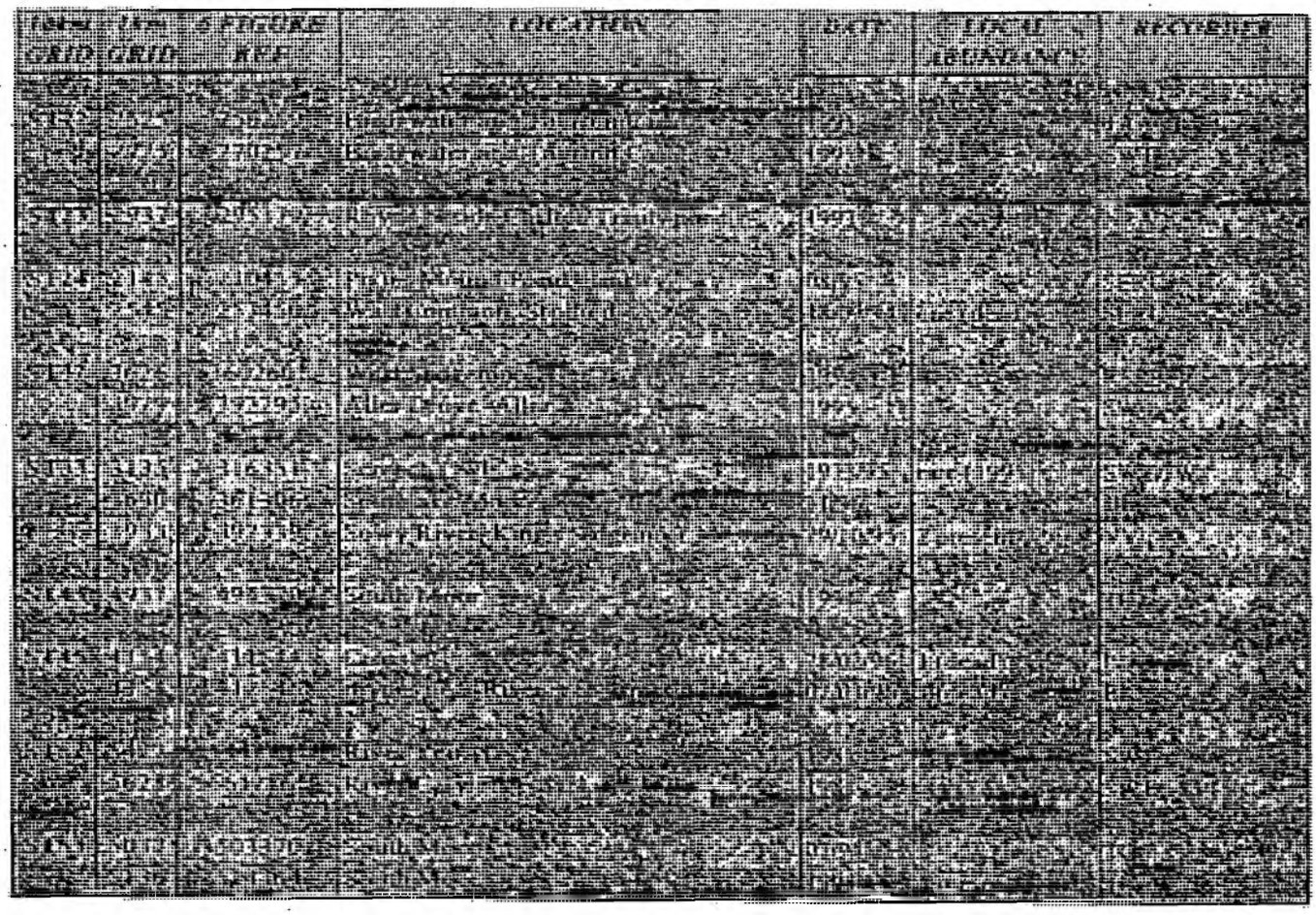


NB Data sheets for individual species should be referred to.

35. *Arvicola terrestris* the water vole ✓

A rather large vole which occurs throughout mainland Britain, but very local in upland areas and the north-west of Scotland. Absent from Ireland and most islands except Anglesey and the Isle of Wight. Abundant fossils show that it was present in Britain in previous inter-glacials. Occurs mainly on well vegetated banks of lowland ponds, rivers, canals and drainage ditches. Swims and dives readily (note that the brown rat is frequently found in the same habitats and also swims readily). In Europe it is less aquatic in habits and burrows like a mole in pastures and this habit has been occasionally recorded in Lincolnshire. Feeds mainly on grasses and nests mainly underground, though occasionally in reed tussocks in marshes, producing around two litters of 5 offspring per year.

Corbet, G.B. & Southern, H.N. (1977). *The Handbook of British Mammals*. Blackwell, Oxford.



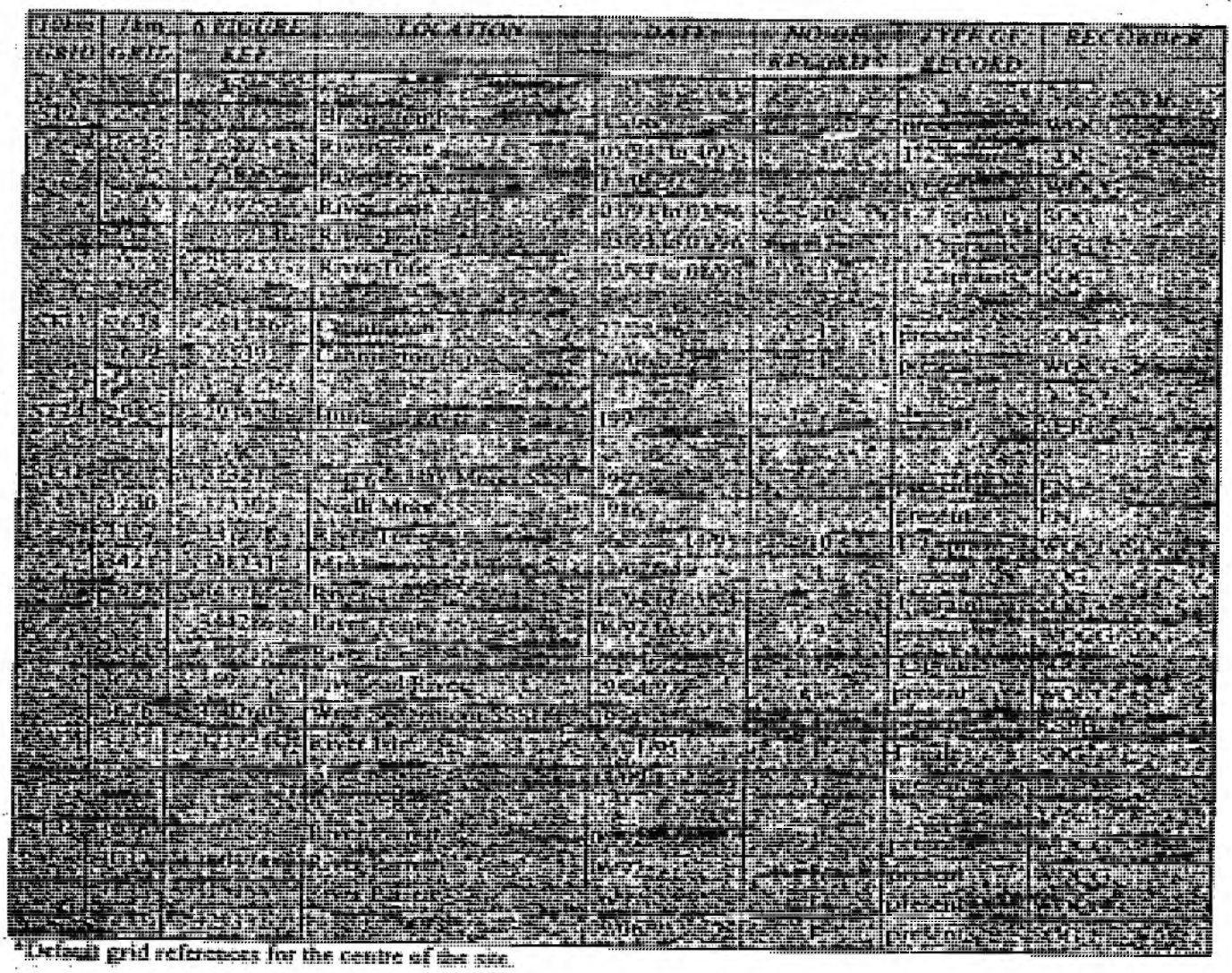
*Default grid references for the centre of each site.

Notes:
1970 cut-off date. This was formerly a common species and, as such, was under-recorded until its recent decline. However, it is likely to occur in a number of extra, as yet unidentified, sites.

36. *Lutra lutra* Otter ✓

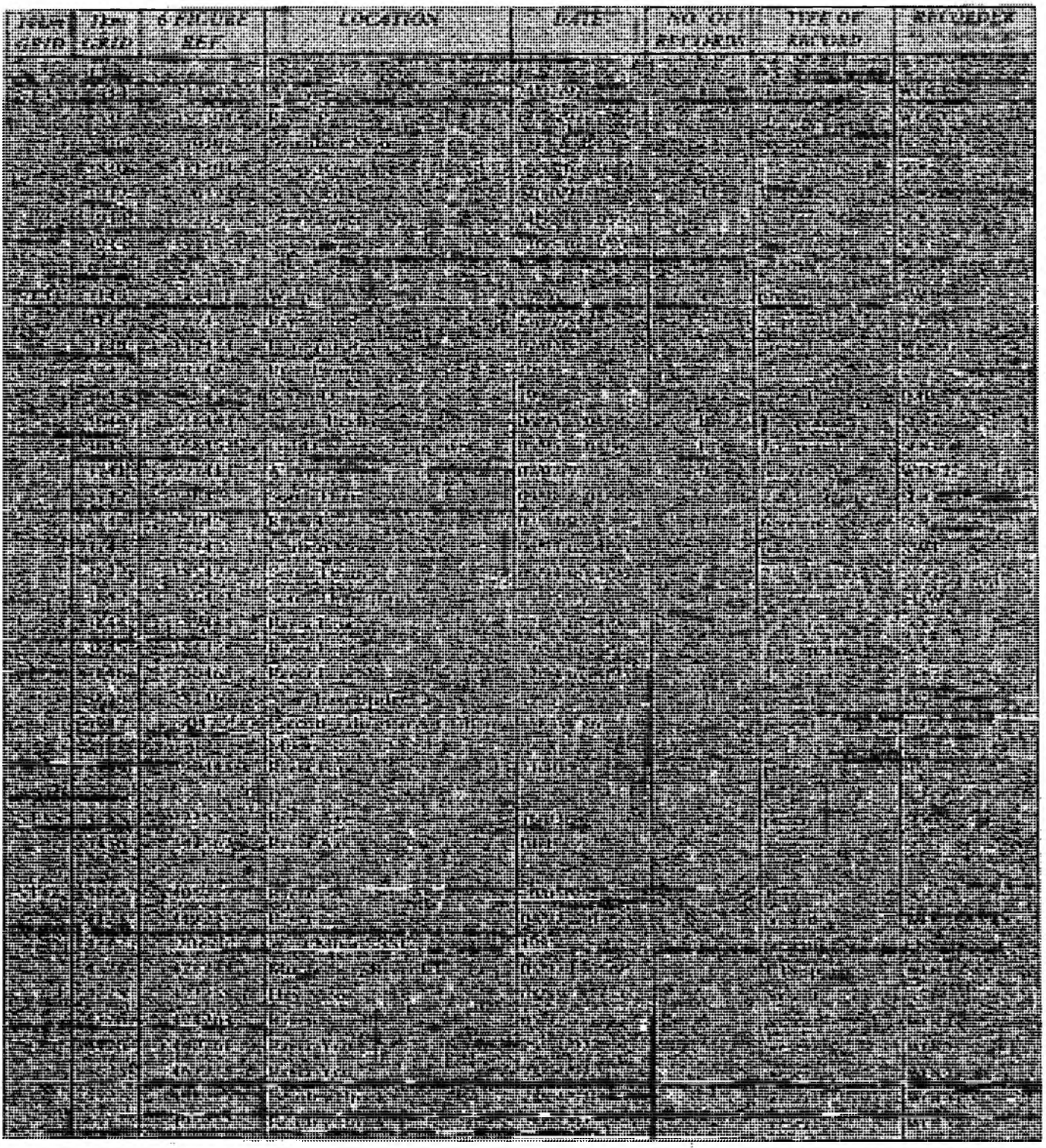
Large carnivore associated with lakes, rivers and marshes. Widespread in Britain, including offshore islands, until 1950s after which there was a steady decline in much of the settled lowlands. Populations remain in western Scotland and the Scottish islands, west Wales, south-west England and parts of the northern England and are slowly spreading. Attempts to re-establish captive bred animals in East Anglia made from late 1980s. Usually found near water, but capable of long overland journeys between watersheds. Coastal in western Britain. Usually nocturnal, especially if disturbed. Mainly solitary and occupying a large home range of up to c. 15km diameter. Lives almost entirely on fish, crustacea and aquatic insects, but may take small numbers of birds and small mammals. Fish taken appear to be unselective and reflect availability. Breeding occurs at any time of year. 2-3 young are born in a 'holt'. Family groups stay together for about one year. Females first breed at about 2 years old. Length of life in wild not known, but lives up to 20 years old in captivity.

Corbet, G.B. & Southern, H.N. (1977). The Handbook of British Mammals. Blackwell, Oxford.



*Default grid references for the centre of the site.

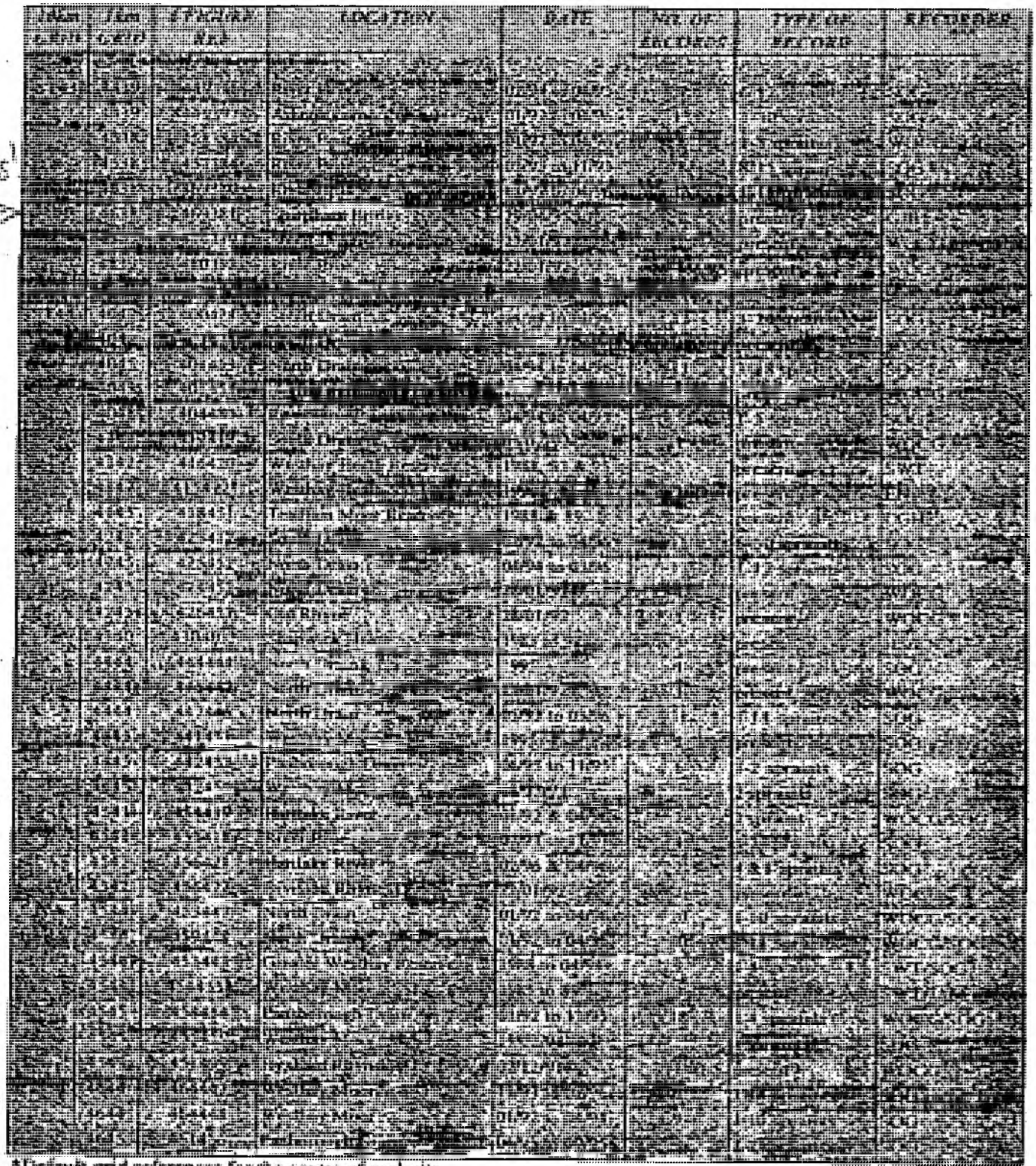
36. *Lutra lutra* Otter *(continuation)*



10km GRID	1km GRID	GRID REF.	LOCATION	DATE	NO OF RECORDS	TYPE OF RECORD	RECORDER

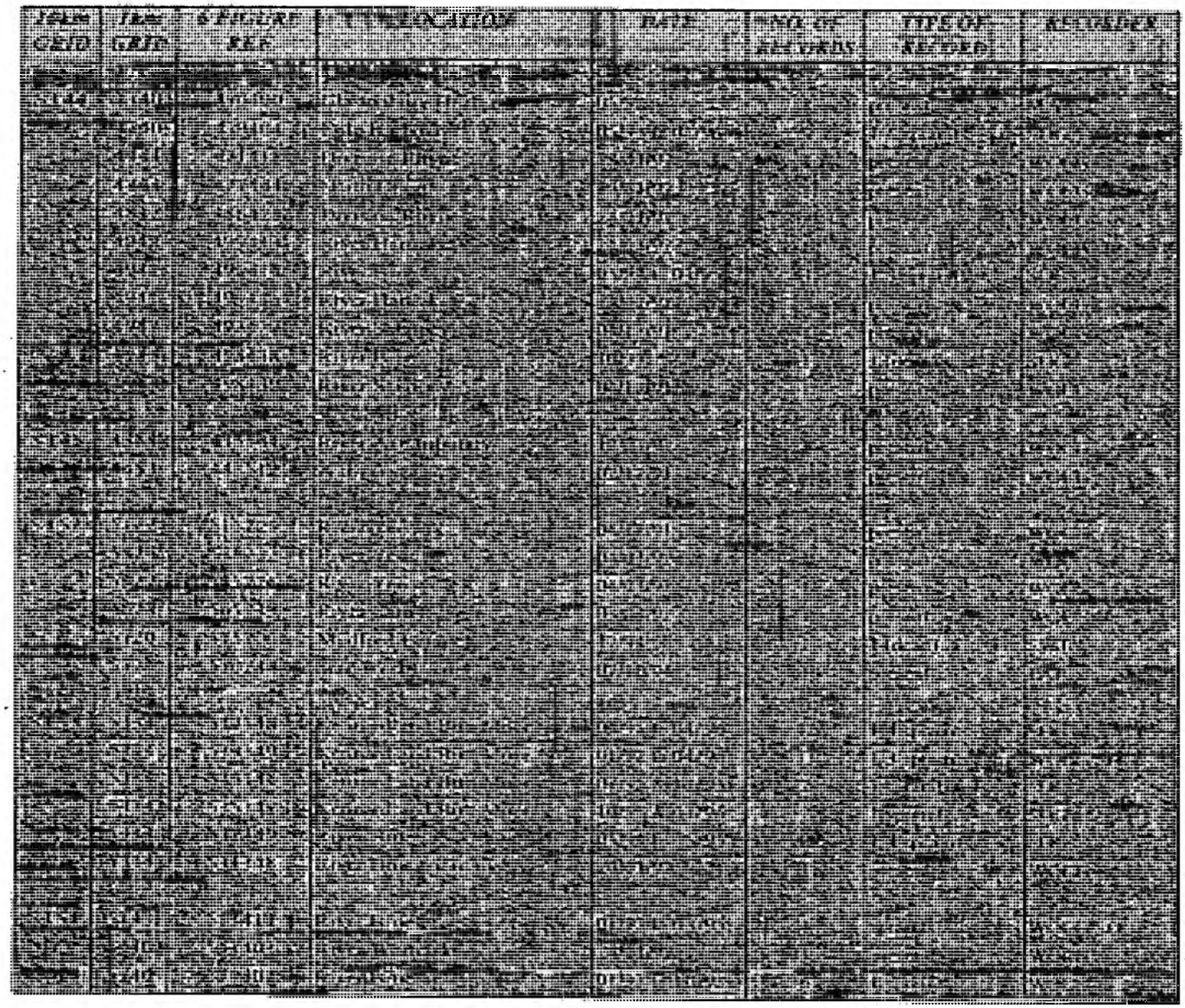
*Default grid references for the centre of each site.

36. *Lutra lutra* Otter *(continuation)*



*Default grid references for the centre of each site.

36. *Lutra lutra* Otter *(continuation)*



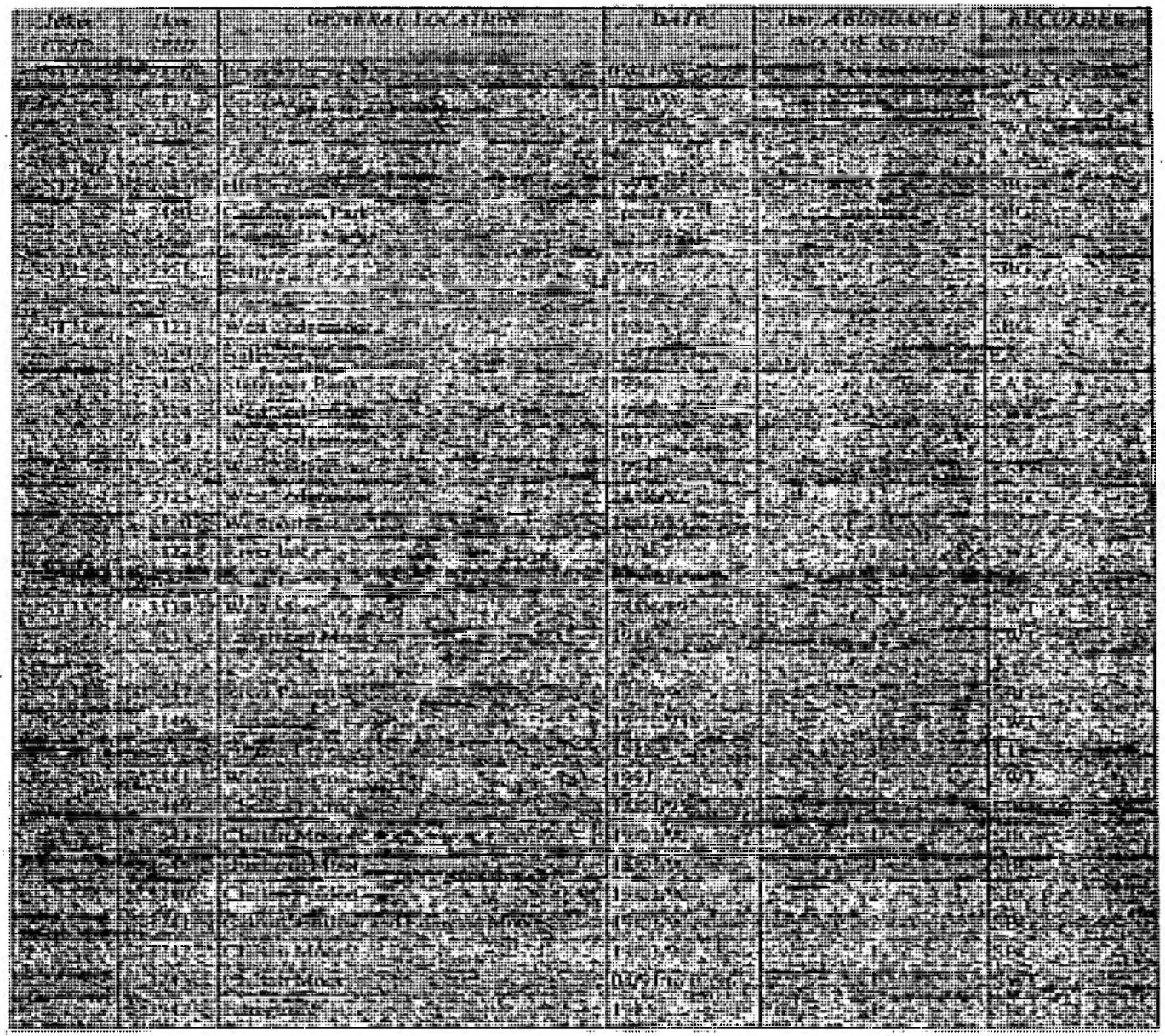
*Default grid references for the centre of each site.

Notes:
1980 cut-off date. The otter has only recently begun to return the area after suffering a long decline. Recording efforts have increased considerably since the 1980s.

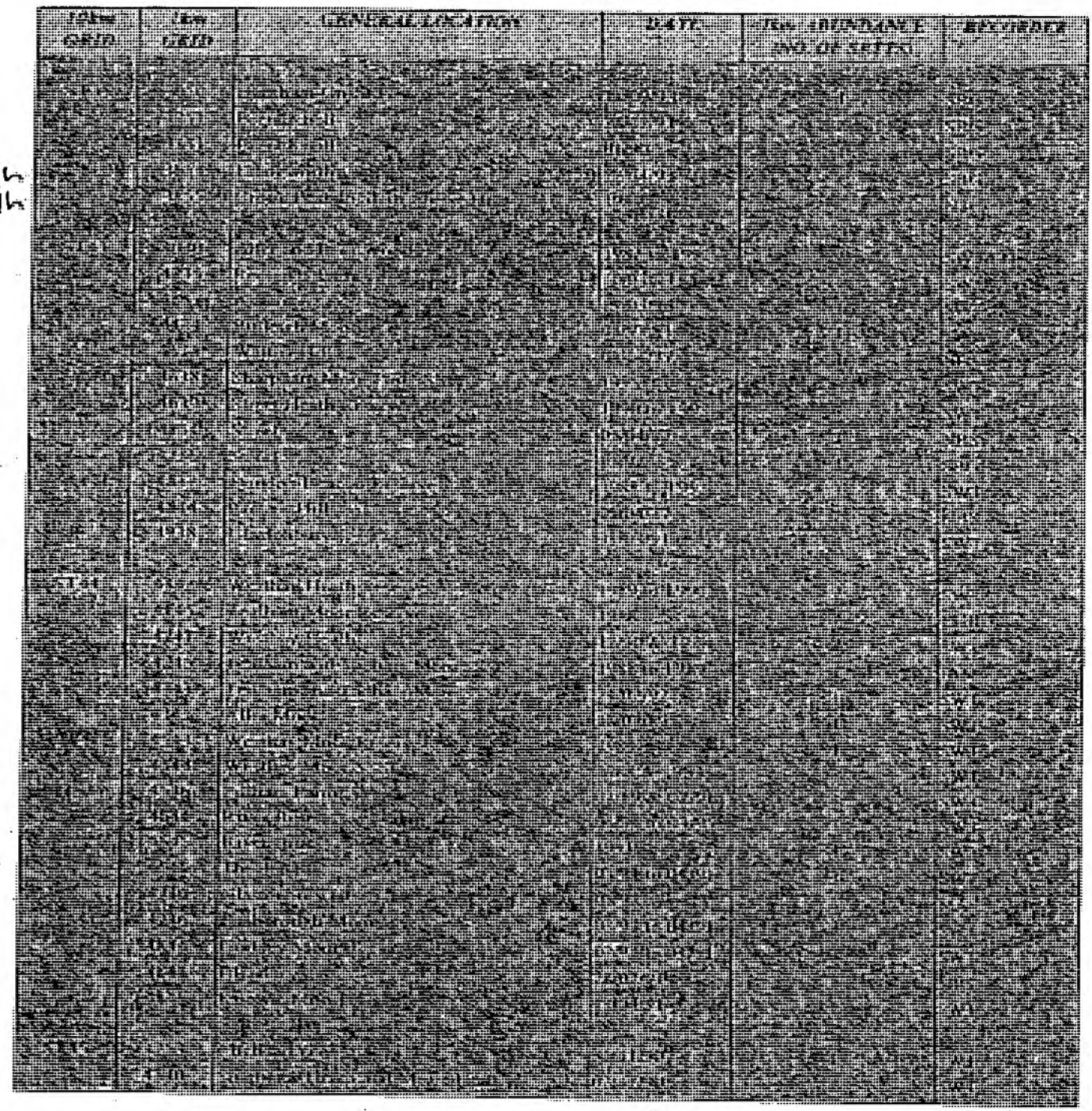
37. *Meles meles* Badger ✓

Present throughout the British Isles, but absent from offshore islands except Anglesey and the Isle of Wight. Most abundant in lowland, lightly wooded countryside and thinly distributed in the highlands of Scotland and low-lying wet areas such as the fens of East Anglia. Setts are most often constructed in woods and copses, hedgerow and scrub, but may also be found on moorland, sea cliffs and under buildings. The important factors appear to be the presence of cover, well drained easily dug soil, absence of disturbance and plentiful and varied food supply nearby. A true omnivore, the diet depending upon availability, and including small mammals, amphibians, earthworms, carrion, roots, fruit of all kind and some green food including grass. A single litter of 1-4 cubs is born underground early in the year. Cubs remain underground for first 2-3 months and stay with the sow until autumn. Badgers live in social groups of up to 15 animals including adults of both sexes and cubs of the previous year. Adults probably live to 14-15 years.

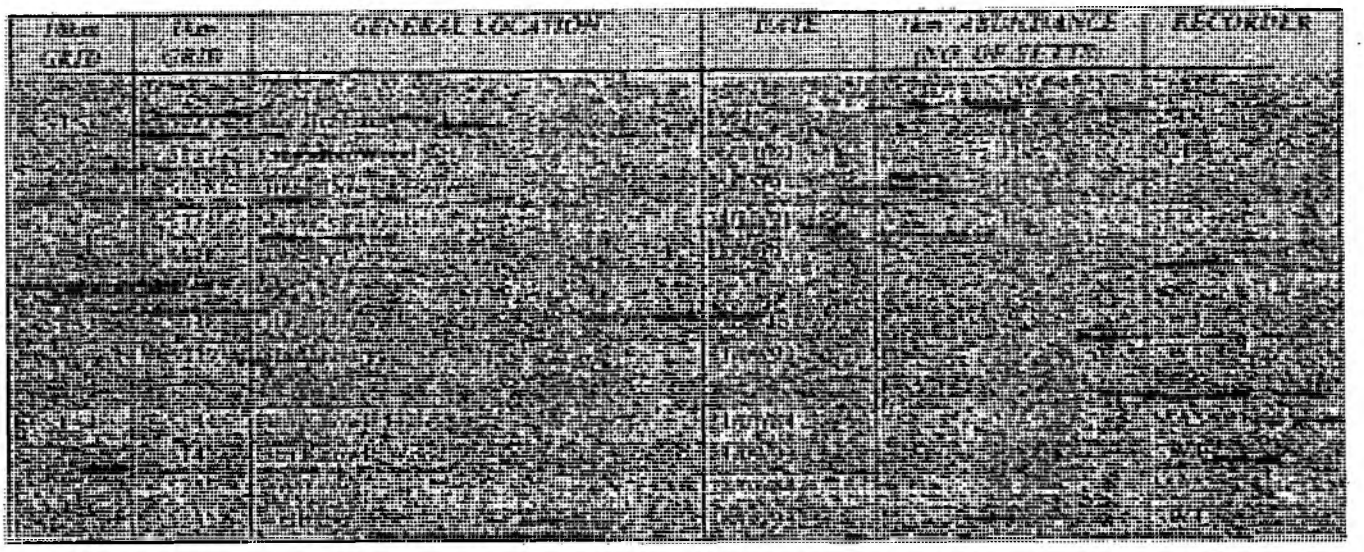
Corbet, G.B. & Southern, H.N. (1977). The Handbook of British Mammals. Blackwell, Oxford.



37. *Meles meles* badger *(continuation)*



37. *Meles meles* badger *(continuation)*

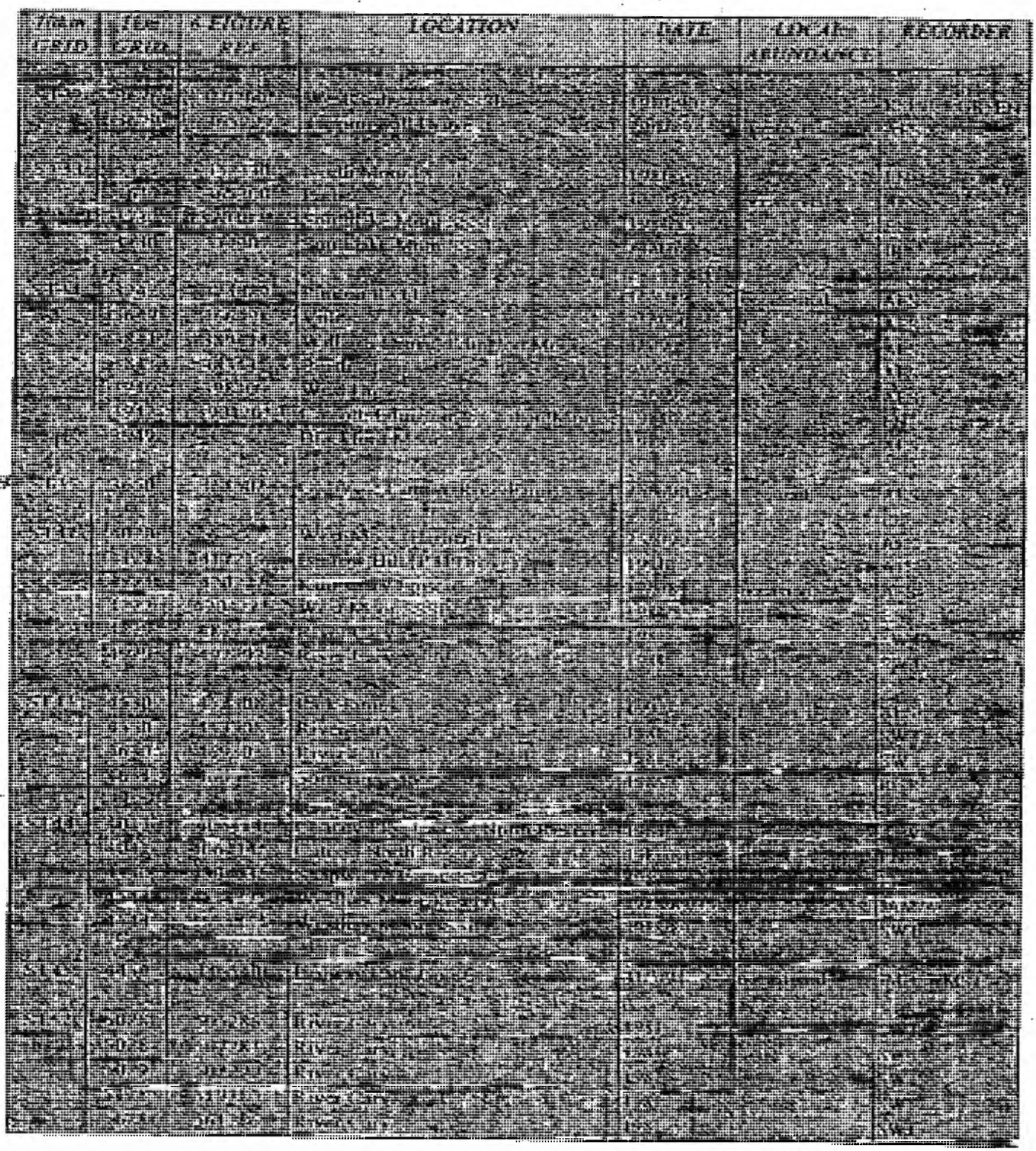


Notes:
1975 cut-off date.

43. *Sium latifolium* greater water-parsnip ✓

A glabrous perennial umbellifer found in shallow water, especially in fen ditches. Very local and mainly to the south-east of a line from the Humber to the Bristol Channel. Apparently decreasing.

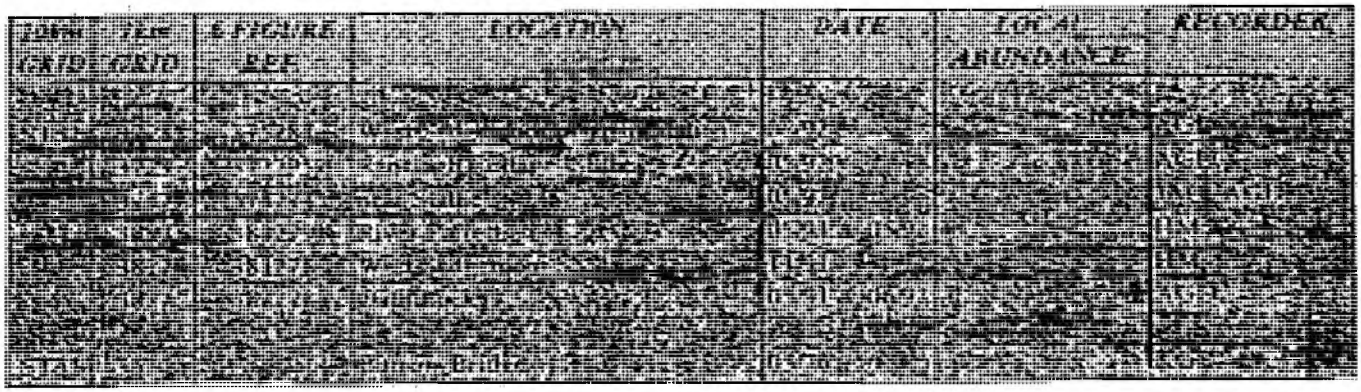
Tutin, T.G. (1980). *Umbellifers of the British Isles*. BSBI Handbook No.2.



*Default grid references for the centre of each site.

44. *Synaptus filiformis* a click beetle ✓

Click beetle recorded from SW Britain on riverbanks, usually by sweeping grasses although larva probably develops in rotting willow wood. Very rare.



ANNEX 4

RECORDED SITES OF ARCHAEOLOGICAL INTEREST

Recorded Sites of Archaeological Interest

Ref	Site Name	Status	Description
10540	Monument, Isle of Athelney	SAM 367b	An early C19 monument recording the site of Athelney Abbey. The monument is a low obelisk on a plinth about 3 m high.
10547	Building and road, north-east of Athelney Farm	SMR	A C17 building.
11117	Athelney Abbey	SAM 367a	A low lias hill covering an area of approx. 8 ha with two summits and a saddle between. Location of Alfred's fortress (constructed 878) and Alfred's monastery (878-893). Also the site of prehistoric flint finds.
43101	Rhynes on north-east of Stan Moor	SMR	Three short lengths of E-W rhynes suggesting remains of previous system of land division.
43653	Withy boiler, Walkey Farm Burrow Bridge	SMR	Disused withy boiler of the Cornish type
43654	Withy boiler, Walkey Farm Burrow Bridge	SMR	Disused withy boiler
43655	Withy boiler, Stan Moor	SMR	Disused withy boiler, box type
43657	Withy boiler, Creeds Farm, Stoke St Gregory	SMR	Box type withy boiler, still in use
43658	Withy boiler, Curload	SMR	Disused withy boiler, box type
43663	Withy boiler, Burrow Bridge	SMR	Disused withy boiler, Cornish type
44256	Deserted site, west of Walker's Farm Stathe	SMR	Enclosures with orchards, well and small building
45002	Bog oak find, Stan Moor	SMR	A sample of oak sawn off from a piece revealed by ploughing

APPENDIX I
RISK ASSESSMENT

STANMOOR BANK RISK ASSESSMENT

With all the options and techniques investigated in this report, there are varying degrees of risk associated with the original estimation of cost, programme, quality and effect on environment. An enclosed risk register indicates the relative risk of a particular occurrence and indicates its impact. There are a number of general or generic risks that would impact upon whole project, irrespective of which option was chosen. These are summarised in the risk register in Part A. Part B of the register indicates general risks associated with the construction of the strategic options and techniques discussed in section 6 of the main report. Part C of the register indicates specific risks associated with the individual and strategic options.

The likelihood of a risk occurrence has been assessed as low, medium or high with the consequences assessed in a similar manner. At this stage, the risk assessment is qualitative as opposed to quantitative due to the difficulty in comparing the risks in terms of budget and programme.

Key risks specific to all construction options, which will undoubtedly affect the works, are as follows:

- High water levels

  Most likely in, but not limited to, the winter months, water levels can remain high for several weeks. It is likely that during these periods of high water it would not be possible to carry out any works along the banks. This would have a significant impact on the programme and consequently the cost of the project.

- Access

  Irrespective of the option or technique chosen, it will be necessary to move materials along the bank. If the access track were to become degraded or unusable, there would be both cost and programme implications. In addition the majority of the bank is not of sufficient width to track vehicles along the lower berm and it would be necessary for vehicles to travel along the top of the bank in close proximity to residential properties. With the possibility of a relatively large number of traffic movements, the risk of property damage is high with consequences on both cost and programme.

RISK REGISTER

PROJECT NO. G7655	PROJECT MANAGER
PROJECT NAME Stanmoor Bank	
BRIEF PROJECT DESCRIPTION	Improve stability of existing bank and core wall

Risks (Identification)	Probability H/M/L	Consequence H/M/L	Effect of Occurrence Cost/Time/Quality Environment	Method of Control (Refer to Generic Risk Guidance)	Action By
PART A - GENERIC RISKS					
Unforeseen Ground Conditions	M	H	Cost Time	• Significant earthworks proposed over approx. 3km • Greater level of ground investigation • Appropriate references in contract documentation.	PD/EA
Inadequate/Incomplete Consultations	M	M	Cost Time Quality	• Allow sufficient time for consultations • Make Communication Plan and Action List • Make written file note of all consultations • Confirm understanding of significant consultations in writing • Use visual aids to assist understanding of proposals where appropriate • Inform third parties of EA named points of contact	PD/EA
Inaccurate Estimates	M	H possibly in extreme cases	Cost Time	• Compensations calculated by qualified valuer • Allowance for known or anticipated difficult landowner requirements • Full capital salary cost and fees. Estimate checked by QS. • Detailed estimate based on recent similar projects • Plan contingencies (refer residual risks) • Obtain written budget quotes from utilities/ suppliers	PD/EA
Inappropriate Design	L	M	Cost Time Quality	• Consult operational client during all stages of project • Safety Officer to have opportunity to comment on design drawings pre-tender invitation • Independent design review by consultant before tender award • Continued stability of existing structures • Adequate specification of the requirements	PD/EA
Contractor will not meet specification	L	M	Quality, Environment	• Ensure site supervision and contract admin staff are of adequate quality • Provide and encourage feedback on performance at progress meetings	PD/EA
Non acceptance or delayed acceptance of asset by Operational Client	H	M	Time Cost	• Agree handover procedure in advance of contract substantial completion • Operational Manuals to be available on handover	PD/EA

RISK REGISTER CONTINUED

PROJECT NO. G7655	PROJECT MANAGER				
PROJECT NAME Stanmoor Bank					
Risks (Identification)	**Probability H/M/L**	**Consequence H/M/L**	**Effect of Occurrence Cost/Time/Quality Environment**	**Method of Control (Refer to Generic Risk Guidance)**	**Action By**
PART A - Continued					
Inappropriate Consultant/Contractor	L	M	Cost Time Quality	• Appoint consultant/contractor with relevant experience • Use Contractor's Database Standing List to develop tender list • For non-standard work (eg tunnelling) draw tender list from job specific advertisement not standing lists • Consult national Agency performance systems • Consult national contractor claims information • Limit new tenderers to the Agency to maximum of one per tender list • Carry out sensitivity analysis of tender prices and assess impact on project contingency • Establish programme of meetings with consultants and contractors to include feedback on performance and reassessment of risks • Consider use of Considerate Constructors Scheme	EA re consultant EA/PD re contractor
Adverse PR	L	M	Cost Time	• See "Inadequate/Incomplete consultations" • Be pro-active and open using one named individual where possible • Issue regular progress bulletins • Resident site staff to have good working knowledge of EA and have good PR as well as appropriate technical skills	EA/PD
Failure to Meet Programme	L	H	Time Cost	• Develop target times for key activities • Early preparation and continuing monitoring of detailed project plan showing all significant activities and timescales (including inter-dependencies)	EA/PD
Adverse river water levels, currents, wind etc.	H	H	Cost Time	• Appropriate references in contract specifications (area is prone to high water levels (flooding)) • Select appropriate construction periods • Provide adequate flood warning	PD/EA
Third Party approvals not sought/received	M	M	Cost Time	• Identify all necessary approvals • Check all approvals are in place before tender awarded • Early and extensive consultation with landowners, user groups, environmental groups and the public	PD/EA

RISK REGISTER CONTINUED

PROJECT NO. G7655	PROJECT MANAGER				
PROJECT NAME Stanmoor Bank					
Risks (Identification)	Probability H/M/L	Consequence H/M/L	Effect of Occurrence Cost/Time/Quality Environment	Method of Control (Refer to Generic Risk Guidance)	Action By
PART B - SCHEME SPECIFIC RISKS					
MAFF do not fund scheme	L	H	Cost Time	• Apply to MAFF in good time	PD/EA
SI 1217 objections	L	H or M	Cost Time	• Allow time to deal with objections	PD/EA
Accidents	L	H	Cost Time	• CDM	PD/EA
Affordability	L	L	Time	• Confirm benefits and costs	PD/EA
Pollution	L	L	Cost Time Environment	• Appropriate references in contract documentation	PD/EA
Acquisition of land	M	M	Cost Time	• Maximum area of land required • Careful negotiation	PD/EA
Maintenance access	M	M	Cost Time Environment	• Liaise carefully with EA operations staff	PD/EA
Visual Intrusion	H	M	Cost Time Environment	• Liaise carefully with residents & EA	PD/EA

RISK REGISTER CONTINUED

PROJECT NO. G7655	PROJECT MANAGER				
PROJECT NAME Stanmoor Bank					
Risks (Identification)	**Probability H/M/L**	**Consequence H/M/L**	**Effect of Occurrence Cost/Time/Quality Environment**	**Method of Control (Refer to Generic Risk Guidance)**	**Action By**
PART C - OPTION TECHNIQUE SPECIFIC RISK (not covered in Part A or B)					
OPTION 1 - DO NOTHING *	H	H	Cost Time Environment		
Bank breach					
OPTION 2 - DO MINIMUM *	H	H	Cost Time Environment		EA/PD
Bank breach				• Damage limitation	
OPTION 3 - TIDAL BARRAGE *					EA/PD
Barrage failures	L	L	Cost Time Environment	• Appropriate design	
Upstream flooding	M	M	Cost Time Environment	• Ensure adequate flood warning, i.e. hydraulic design	
Bank breach	H	H	Cost Time Environment	• Damage limitation	
OPTION 4 - FLOOD RELIEF/ DIVERSION CHANNEL *					EA/PD
Flooding	M	M	Cost Time Environment	• Damage limitation	
Bank breach	H	H	Cost Time Environment	• Damage limitation	
OPTION 5 - RIVER CHANNEL IMPROVEMENT					EA/PD
Flooding	M	M	Cost Time Environment	• Damage limitation	
Bank breach	H	H	Cost Time Environment	• Damage limitation	

* Options are not viable on either engineering/cost or environmental grounds

RISK REGISTER CONTINUED

PROJECT NO. G7655	PROJECT MANAGER				
PROJECT NAME Stanmoor Bank					
Risks (Identification)	**Probability H/M/L**	**Consequence H/M/L**	**Effect of Occurrence Cost/Time/Quality Environment**	**Method of Control (Refer to Generic Risk Guidance)**	**Action By**
PART C - OPTION TECHNIQUE SPECIFIC RISK (not covered in Part A or B) continued					
OPTION 6 - ON LINE DEFENCE WORKS, BANK BREACH The following techniques have been considered in whole or in part along the bank:	L	H	Cost Time Environment	• Damage limitation	
TECHNIQUE 1 - Steel Sheet Pile Wall					
Vibration damage to property	H	H	Cost Time Environment	• Careful consideration of piling method, i.e. contract documentation	
Noise disturbance	H	H	Cost Time Environment	• Careful consideration of piling method, i.e. contract documentation	
Service disruption	L	M	Cost Time	• Adequate liaison with utilities	
TECHNIQUE 2 - SSP - Hush Piling method					
Vibration damage	L	H	Cost Time Environment	• Careful consideration of piling method, i.e. contract documentation	
Noise disturbance	L	H	Cost Time Environment	• Careful consideration of piling method, i.e. contract documentation	
Service disruption	L	M	Cost Time Environment	• Adequate liaison with utilities	
TECHNIQUE 3 - Stabilising works on riverward side of core wall					
Wall collapse into excavation	M	H	Cost Time Environment	• Ensure adequate contract documentation	
Service disruption	L	M	Cost Time Environment	• Adequate liaison with utilities	
TECHNIQUE 4 - Stabilising works to riverward side of core wall				• No specific risks identified	
TECHNIQUE 5 - Impermeable membrane to core wall					
Wall collapse into excavation	L	M	Cost Time Environment	• Ensure adequate contract documentation	
Disruption to services	L	H	Cost Time Environment	• Adequate liaison with utilities	
TECHNIQUE 6 - Raise defences					
Wall collapse (increased risk)	M	H	Cost Time Environment	• Ensure stability of wall prior to construction	

The indications from the above table are that the strategic option of On-Line Defence works with Technique 2 - Hush Piling Method, exhibits the least risk of affecting cost, time, quality or environment.