TABLE 5. SUMMARY OF PRINCIPAL CHANGES RELATING TO STREAM MANAGEMENT IN THE WHANGAMATA STREAM AT FIVE PERIODS OVER 20 YEARS SINCE RETIREMENT FROM GRAZING. THE FIRST PERIOD (1974/75) WAS IMMEDIATELY PRIOR TO RETIREMENT. negl. = NEGLIGIBLE.

NUTRIENT ABSORPTION UPTAKE OF DISSOLVED INORGANIC NUTRIENTS (kg $year^{-1}$)

	NO_3-N	DRP
1974/75	179	15.2
1979/80	340	19.3
1986/87	475	47.4
1992/93	125	10.7
1997/98	negl.	negl.

TROUT SPAWNING

1974/75	The stream had little cover, was characterised by a wide shallow channel and continually shifting pumice bed, (Photos 6–10, p. 21). Predation by shags was evident (Young 1980, P. Burstall, pers.comm.). Estimate of only 80 spawning trout in the stream.
1979/80	Marginal vegetation developed, stabilising the stream banks and trapping sediment which narrowed and deepened the stream, and provided some cover along the banks. 3258 spawning trout passed through the fish trap.
1986/87	Dense, frost-resistant vegetation growths blocked the stream causing problems for migrating fish. Active channel management over long stretches of the stream was necessary to allow for the spawning migrations.
1992–94	Blocking vegetation had been shaded out by the tall flax and toetoe over much of the stream and active channel management for spawning migrations was confined to the lower reach where selective herbicide was sprayed in controlled conditions.
1997/98	No channel vegetation management is required for spawning access.

WILDLIFE AND BIODIVERSITY ENHANCEMENT

1974–76	Open channel through ryegrass-clover pasture. Banks heavily grazed (Photos 6–10, p. 21). Limited stream bank and channel vegetation in the lower reaches (Section G) included watercress, floating sweetgrass, *Juncus articulatus*, and some floating genera (*Lemna, Azolla*) in back eddies. Twenty-four plant species recorded along the channel with few natives. Shags and white heron recorded, particularly in the lower reaches.
1982	Six years after retirement the total plant species number had increased to 40. Musk had encroached, providing a continuous vegetation cover across much of the stream channel all year. Assisted plantings of toetoe and flax beginning to grow over the dense grass cover on the banks.
1986	Banks were lined with flax and toetoe which had overhung in some places in Sections A–C. Most of the channel was occcupied by dense growths of musk and several submerged and floating species had been displaced and were no longer recorded. Large rise in the total number of plant species (102), of which 45 were natives. Establishment of some woody species along the banks. The lower Section G was still grazed pasture with stock grazing and trampling on the stream banks. First fern bird recorded in Section A-3 in 1985.
1993	Total number of species increased to 118 but further losses of small plants occurred due to shading along the banks. Much of the channel now shaded over. Retirement from grazing applied to Section G, with assisted plantings. Development of woody species and some treeferns on the stream banks, especially in Sections A–C. Willows recorded in Section B. Fernbird recorded together with fantail, pukeko, harrier hawk, blackbird.
1997/98	Total plant species number recorded was 148 of which 60 were natives. Further losses of species with 16 species recorded in 1993 no longer found. Marked growth of the assisted plantings of wetland species in Section G forming a wide wetland. Stream banks now colonised from the springs to the lake by native wetland plants forming a wetland 'corridor' over 2 km inland from Lake Taupo (Photos 6–10, p. 21).

Maximum nutrient removal was recorded in 1986 when 787 kg of N and 71.4 kg of P were removed from the stream waters by biological activity. By 1992/93 these amounts had fallen by 85% and by 1996/97 a further drop had occurred so that the amount removed was negligible. The nutrient concentrations at the source springs have not changed over the last two decades. Thus changes in stream nutrient concentration have been due to a reduction in assimilative capacity along the stream

itself. This loss of efficiency in nutrient removal has been exacerbated in the last three years by increasing discharge rates in the stream.

The mass uptake of nutrients from wetlands is a function of the discharge, the nutrient concentration and the biomass of the absorbing vegetation (McColl 1979, Howard-Williams 1985). As discharge and concentration (and hence mass flow) increase relative to the mass of absorbing vegetation in contact with the water, the mass uptake of nutrients will decrease, and the efficiency of the biological filter provided by the wetland system will decline (Shaver and Melillo 1984). This is precisely what has happened over the last decade in the Whangamata Stream. In the last three years in particular, discharge has increased 3-fold (Fig. 2) and concentrations of NO_3-N and DRP reaching the Top site have also increased as the removal capacity of the stream flora upstream of the Top site has declined. Therefore the mass of nutrients reaching the study section of the stream has been higher over the last three years than at any time since the study began. At the same time, the mass of fast-growing, nutrient absorbing plants that blocked the stream channel in the 1980s has declined due to shading.

6.1.2 Fish passage

During the first five years following stream bank protection, the semi-aquatic plant community which grew along the banks was dominated by watercress which died back each autumn allowing a clear channel for migrating fish. Spawning increased dramatically over this period (Young 1980) as a result of bank protection, vegetation cover along the banks and an open central channel. Between 1983 and 1989 the watercress was replaced by musk which did not die in winter. This plant caused blockages over long stretches of the stream, preventing spawning migrations. Stream vegetation management by the local angling clubs and then the Department of Conservation began. This initially involved manual weed clearing to keep the channel open in autumn (Taupo Times 1989), and then, later, selective herbicide spraying was used in strictly controlled procedures to help clear the most difficult parts of the channel. By 1994 control was only needed in the lower parts of the stream (Section G) (Target Taupo 1994), because tall flax and toetoe had developed to the extent that most of the musk had been shaded out along the channel to Section G. Coincident with assisted planting in Section G by DOC (Photos 1–5, p. 19), a dense cover of *Carex* cf. *geminatus* (Photos 1–5, p. 19) shaded the Section G channel reach. In 1998 no channel clearing was required prior to the trout spawning run.

7. Summary and Conclusions

The aims of this three-year study were met with water quality and flow measurements at two-monthly intervals to continue the long-term data set. Two-monthly sampling was adequate to record the seasonal patterns in water quality which allowed nutrient flux calculations. Similarly, the five-year interval from the last vegetation survey in 1995 was a suitable monitoring interval to record changes in the species and to map and record changes to cover and distribution. It is noteworthy that, when left alone, the original pasture proved very resistant to invasion. Without assisted plantings along the banks, at least upstream, the changes would have been slower. This study has provided a recognition of timescales of change in this type of ecosystem restoration.

Riparian and streambank vegetation along this stream has been implicated in the prevention of erosion, the trapping of inflow sediments, the trapping of nutrients and wildlife habitat improvement. This study has shown that while the wildlife, biodiversity and fishery values have increased greatly over the last decade, and erosion is now negligible, the 'nutrient filter' has declined. It appears that in the long-term 'you can't have your cake and eat it' in this type of system, and if the stream and its associated riparian vegetation are to be managed as a trap for sediments washed in from the adjacent farmland and as a wildlife and fishery resource, the present developments in the rehabilitation sequence are ideal. However, if the primary management objective is nutrient stripping, then other management options need to be considered. The original vegetation along the stream was kanuka woodland and scrub (Holyoake Family, pers. comm.). There would have been few macrophytes in such conditions and the present tendency for lower nutrient assimilation in the stream is probably close to the natural condition. Howard-Williams et al. (1987) showed how the nutrient removal capacity of a forest stream increased dramatically as the stream entered a pasture. This study has highlighted the need for clear management objectives in restoration and rehabilitation programmes.

8. References

Cronin, S.J. 1996: Elemental deposition of the 17–19 June 1996 Ruapehu ash falls. Report of the Department of Soil Science and Fertiliser and Lime Research Centre. Massey University.

Downes, M.T. 1998: Chemical Methods Manual. NIWA Science and Technology Report.

Downes, M.T.; Howard-Willliams, C.; Schipper, L.A. 1997: Long and short roads to riparian zone restoration: nitrate removal efficiency. Pp. 244–253 in Buffer Zones: their processes and potential in water protection. Haycock, N.E.; Burt, T.P.; Goulding, K.W.T.; Pinay, B. (Eds). Quest Environmental Publishers, Oxford, UK.

Hearne, J.W.; Howard-Williams, C. 1988: Modelling nitrate removal by riparian vegetation in a springfed stream: the influence of landuse practises. *Ecological Modelling 42*: 179–198.

Howard-Williams, C. 1985: Cycling and retention of nitrogen and phosphorus in wetlands: a theoretical and applied perspective. *Freshwater Biology 15*: 391–431.

Howard-Williams, C.; Clayton, J.S.; Coffey, B.T.; Johnstone, I.M. 1987: Ecological invasions: aquatic macrophytes. Pp. 307–331 in Inland waters of New Zealand. Viner, A.B. (Ed). Science Information Publishing Centre, Wellington.

Howard-Willams, C.; Davies, J.; Pickmere, S. 1982: The dynamics of growth, the effect of changing area and nitrate uptake by watercress, *Nasturtium officinale* R.Br. in a New Zealand stream. *Journal of Applied Ecology 19*: 589–601.

Howard-Williams, C.; Pickmere, S. 1994a: Long-term vegetation and water quality changes associated with the restoration of a pasture stream. Final Report on Investigation 356 to Department of Conservation. July 1994. 21 p.

Howard-Williams, C.; Pickmere, S. 1994b: Long-term vegetation and water quality changes associated with the restoration of a pasture stream. Pp. 93–109 in Collier, K.J. (Ed.). Restoration of aquatic habitats. Department of Conservation, Wellington, New Zealand.

McColl, R.H.S. 1979: Chemical runoff from pasture: the influence of fertiliser and riparian zones. *New Zealand Journal of Marine and Freshwater Research 12*: 371–380.

Schouten, C.J.; Terzaghi, W.; Gordon, Y. 1981: Summaries of water quality and mass transport data for the Lake Taupo catchment, New Zealand. *Water and Soil Miscellaneous Publication 24*: 1–167.

Shaver, G.R.; Melillo, J.M. 1984: Nutrient budgets of marsh plants: efficiency concepts and relation to availability. *Ecology 65*: 1491–1510.

Target Taupo 1994: Spraying of muskweed in the Whangamata Stream. *Target Taupo 15*: 30–31. Department of Conservation, Turangi.

Taupo Times 1989: 'Musk problem.' In the 'Talking Conservation' column. Taupo Times 5 July 1985.

Waikato Valley Authority 1966: Take Taupo Catchment Control Scheme. Produced by Waikato Valley Authority (now Environment Waikato), Hamilton, New Zealand.

Young, K. 1980: Soil conservation protects the trout. *Soil and Water*, June 1980: 7–8.

Appendix 1

NUTRIENT CONCENTRATION DATABASE

TLE	Whangamata Stream									
PLE	Date Colle	Lab ID	DRP	TDP	DOP	NH4-N	NO3-N	TDN	DON	SS
			ppb	ppb	ppb	ppb	ppb	ppb	ppb	mg/l
	3/5/95	TF 1	66	70	4	3	931	1035	101	1
	3/5/95	TF 2	34	73	39	6	936	1036	94	1
	3/5/95	TF 3	66	74	8	8	868	1008	132	7
	3/5/95	TF 4	66	77	11	8	867	995	121	7
ng	3/5/95	TF 5	54	57	3	6	750	868	111	
ng	3/5/95	TF 6	78	76	-2	1	1053	1106	53	
	27/6/95	TF 7	76	84	8	8	1064	1180	107	
	27/6/95	TF 8	74	82	8	4	1035	1264	225	
	27/6/95	TF 9	72	78	6	8	996	1163	159	
	27/6/95	TF 10	64	68	4	12	971	1284	301	
ng	27/6/95	TF 11	64	69	5	10	1004	1163	149	
ng	27/6/95	TF 12	81	88	6	4	1114	1215	97	
	31/7/95	TF 13	66	72	6	9	1117	1233	107	7
	31/7/95	TF 14	68	70	2	9	1059	1203	135	1
	31/7/95	TF 15	67	69	2	10	1037	1170	122	1
	31/7/95	TF 16	60	68	9	10	1043	1198	145	1
ng	31/7/95	TF 17	56	64	8	12	1058	1178	107	
ng	31/7/95	TF 18	79	81	3	4	1129	1221	88	
	19/10/95	YV1	70	71	1	10	1115	1181	57	16
	19/10/95	YV2	70	70	0	9	1111	1217	97	14
	19/10/95	YV3	68	68	0	11	1061	1167	96	18
	19/10/95	YV4	69	70	1	11	1070	1164	82	16
ng	19/10/95	YV5	81	82	1	6	1017	1121	99	3
ng	19/10/95	YV6	65	66	1	11	1147	1272	113	20
	19/12/95	YV7	59	61	2	10	1060	1165	95	0
	19/12/95	YV8	58	60	1	6	1067	1190	118	1
	19/12/95	YV9	49	51	2	9	932	1033	91	0
	19/12/95	YV10	50	51	1	16	932	1033	85	0

TLE	Whangamata Stream									
PLE	Date Colle	Lab ID	DRP	TDP	DOP	NH4-N	NO3-N	TDN	DON	SS
			ppb	ppb	ppb	ppb	ppb	ppb	ppb	mg/l
	27/02/96	YV11	59	59	0	14	1073	1177	90	0
	27/02/96	YV12	60	60	0	7	1079	1174	87	
	27/02/96	YV13	42	43	2	6	878	994	110	0
	27/02/96	YV14	41	42	1	7	884	1002	111	0
	23/04/96	YV15	63	63	0	8	1206	1337	123	2
	23/04/96	YV16	63	64	1	7	1216	1358	135	2
	23/04/96	YV17	66	68	2	11	1189	1384	184	8
	23/04/96	YV18	65	67	2	10	1192	1410	208	8
ng	23/04/96	YV19	80	81	1	7	1103	1274	164	2
ng	23/04/96	YV20	58	59	1	10	1290	1464	164	3
	25/06/96	YV20a	67	68	1	12	1310	1487	165	2
	25/06/96	YV21	67	68	1	8	1312	1475	155	23
	25/06/96	YV22	67	69	2	14	1280	1403	109	3
	25/06/96	YV23	67	70	3	13	1291	1465	161	4
	20/08/96	GK 1	68.7	71.6	2.9	6.3	1307	1350	36.7	
	20/08/96	GK 2	70.6	72.8	2.2	4.9	1318	1361	38.1	
	20/08/96	GK 3	62	66.1	4.1	2.3	1271	1310	36.7	
	20/08/96	GK 4	64.8	68.5	3.7	7.7	1281	1361	72.3	
	5/11/96	GK 5	58.2	62.4	4.2	4.4	1380	1457	72.6	
	5/11/96	GK 6	57.1	61.8	4.7	2.8	1374	1411	34.2	
	5/11/96	GK 7	56	65.5	9.5	4.9	1337	1405	63.1	
	5/11/96	GK 8	54.4	64.9	10.5	9.9	1345	1412	57.1	
	18/12/96	GK 9	61.8	62.9	1	6.5	1236	1367	124.0478	
	18/12/96	GK 10	62.8	62.9	0.1	6.5	1236	1354	111.4187	
	18/12/96	GK 11	62.2	62.6	0.4	6.9	1191	1365	167.6842	
	18/12/96	GK 12	62.6	62.6	0	7.5	1192	1335	135.5276	
	21/02/97	GK 13	63.2	63.4	0.2	7.2	1195	1352	150.1138	
	21/02/97	GK 14	62.7	63.4	0.7	8.4	1191	1363	163.6497	

TLE	Whangamata Stream									
PLE	Date Colle	Lab ID	DRP	TDP	DOP	NH4-N	NO3-N	TDN	DON	SS
			ppb	ppb	ppb	ppb	ppb	ppb	ppb	mg/l
	21/02/97	GK 15	60.4	61.4	1.1	6	1153	1310	150.3795	
	21/02/97	GK 16	59.9	60.8	0.9	6.3	1164	1315	144.9709	
	2/5/97	NV1	70.4	70.6	0.3	10.9	1256	1385	117	
	2/5/97	NV2	70.5	70.6	0.1	9.1	1273	1416	133	
	2/5/97	NV3	68.1	68	-0.1	8.7	1231	1372	131	
	2/5/97	NV4	69	69.6	0.6	11.6	1224	1378	142	
ng	2/5/97	NV5	82.8	82.7	-0.1	4	1016	1165	145	
ng	2/5/97	NV6	66.2	67	0.8	10.9	1346	1505	148	
	30/06/97	NV7	73.5	74	0.4	17.4	1284	1439	137	
	30/06/97	NV8	73	73.7	0.7	15.9	1296	1450	138	
	30/06/97	NV9	73.6	73.7	0.1	14.2	1281	1414	119	
	30/06/97	NV10	72.6	73.7	1.2	14.2	1277	1430	139	
	25/08/97	RM1	70.2	72.8	2.6	20.9	1308	1390	61	
	25/08/97	RM2	70.9	72.6	1.7	21.2	1330	1419	67	4
	25/08/97	RM3	69.9	71.7	1.8	24	1273	1373	76	3
	25/08/97	RM4	71.3	72.6	1.3	19.5	1294	1371	58	3
ng	25/08/97	RM5	78.8	80.4	1.6	6.9	1094	1142	41	
ng	25/08/97	RM6	66.6	68.1	1.5	30.9	1355	1451	65	3
	21/10/97	RM7	65.4	66.4	1	15.6	1254	1323	53	1
	21/10/97	RM8	64.8	65.9	1.1	13.4	1243	1339	83	1
	21/10/97	RM9	62.4	66.2	3.8	19.2	1140	1234	75	2
	21/10/97	RM10	61.3	66.1	4.8	13.2	1179	1207	15	2
	12/12/97	RM11	63.7	69.2	5.5	10.8	1203	1249	35	
	12/12/97	RM12	63.7	66.1	2.4	10.9	1208	1259	39	2
	12/12/97	RM13	60	61.8	1.8	9.4	1125	1167	31	2
	12/12/97	RM14	58.6	61.9	3.3	58.6	1143	1180	28	2
	16/02/98	RM15	61.1	63.8	2.7	9.9	1148	1223	65	1
	16/02/98	RM16	60.8	60.9	0.1	6.3	1167	1220	47	-

LE	Whangamata Stream									
LE	Date Colle	Lab ID	DRP	TDP	DOP	NH4-N	NO3-N	TDN	DON	SS
			ppb	ppb	ppb	ppb	ppb	ppb	ppb	mg/l
	16/02/98	RM17	61.6	62.7	1.1	7	1133	1180	40	7.76
	16/02/98	RM18	62.5	62.9	0.4	7.7	1136	1167	23	8.33
	17/04/98	RM19	67	71	4	11	1272	1241	0	5.758
	17/04/98	RM20	71	73	2	10.7	1271	1273	0	5.516
	17/04/98	RM21	69	72	3	11.3	1241	1219	0	12.747
	17/04/98	RM22	73	73	0	10.4	1251	1193	0	11.67
	20/05/98	RM23	74.5	75.2	0.7	15.2	1276	1304	13	13.99
	20/05/98	RM24	74.9	77.1	2.2	14.5	1219	1406	172	14.92
	20/05/98	RM25	74.5	75.7	1.2	15.2	1214	1207	0	17.174
	20/05/98	RM26	73.5	76.1	2.6	15.8	1188	1156	0	18.891
ng	20/05/98	RM27	70.2	72.3	2.1	20.2	1298	1336	18	18.12
ng	20/05/98	RM28	88.3	88.5	0.2	6.2	1106	1078	0	3.984

Appendix 2

COMPILATION OF SPECIES (WILDLAND CONSULTANTS REPORT)

Table 1: Vascular Plants of Whangamata Stream (grid reference NZMS 260 T17 649806)

1998 survey

Key

* Not recorded in 1986; but recorded in 1993 and 1998
\+ New record, not recorded in 1986 or 1993

Percentage cover class scale

Percentage Cover	Cover Class
<1	1
1 - 5	2
6 - 25	3
26 - 50	4
51 - 75	5
76 - 100	6

(from Allen 1992)

See Figure 1 for Sections A-G

	Cover Class Abundance Survey Area						
	A	B	C	D	E	F	G
VASCULAR PLANTS							
Gymnosperms							
*Dacrycarpus dacrydioides**		1	2	1			1
Monocot. trees and shrubs							
Cordyline australis	2	2	2	2	1	1	1
Phormium tenax	4	3	2	2	2	1	4
Dicot. trees and shrubs							
Brachyglottis repanda var. *repanda**	1						
Coprosma robusta	2	1	1	1			1
Coriaria arborea	1		1	1			
Fuchsia excorticata	2						
Gaultheria antipoda+		1			1		
Geniostoma rupestre var. *ligustrifolium*+	1						
*Griselinia littoralis**	2						
*Hebe stricta**	4	3	1	2	1	1	1
Hebe sp. (cultivar)	1						
Kunzea ericoides var. *ericoides**	1	1	1			2	2
Leptospermum scoparium	1	1		1	1	2	
*Leucopogon fraseri**	1	1					
Melicytus ramiflorus subsp. *ramiflorus**	1						
*Nothofagus fusca**	1(p)	1					

*Pittosporum colensoi**	2	1					
Pittosporum eugenioides+							1
*Pittosporum tenuifolium**			2			1	1
Pseudopanax arboreus+	1	1	1	1			
*Sophora tetraptera**	1	1	1				1
Dicot. lianes							
*Calystegia sepium**	2	1		1			1
Muehlenbeckia australis	2					1	1
Ferns							
Asplenium flaccidum subsp. *flaccidum*	1	1	1				
Asplenium polyodon+	1	1		1			
Blechnum "blackspot" (unnamed, common species)	1	1	1	1	1		1
Blechnum fluviatile+	1			1			
Blechnum minus	1	1					
*Blechnum penna-marina**				1			
Cyathea dealbata+	1						
Dicksonia squarrosa	1	1	1	1	1	1	1
Diplazium australe			1				
Histiopteris incisa	1	1	1	1			
Hypolepis ambigua	1	1	1	1			
Paesia scaberula	1	1	1				
*Phymatosorus pustulatus**	1	1					
Polystichum vestitum	1	1					
Pteridium esculentum	3	2	1	1		2	2
Grasses							
Cortaderia fulvida	3	3	2			3	3
Cortaderia toetoe	1		1				
Rytidosperma sp. *		1					
Sedges							
Carex lessoniana							1
Carex secta	3	2	1			1	
Carex virgata	2	1	1	1	1		1
Carex sp. (*C. geminata* agg.)	3	1	1	1		3	2
Eleocharis acuta	1						1
Rushes							
Juncus gregiflorus					1		
Luzula picta+	1						

Monocot herbs (other than orchids, grasses, sedges and rushes)							
Lemna minor+	1	1			1		1
Composite herbs							
Gnaphalium audax+					1		
Gnaphalium coarctatum+							
Pseudognaphalium luteoalbum+					1		
*Senecio minimus**				1			
Dicot. herbs (other than composites)							
*Epilobium nummulariifolium**							
Epilobium pedunculare		1					
Haloragis erecta subsp. *erecta*	1						
Persicaria decipiens+ (= *Polygonum salicifolia*)							
Pratia angulata+	1						
Urtica incisa	1						
Adventive Plants Gymnosperms							
Pinus radiata+		1				1	
Pseudotsuga menziesii+	1	1		1		1	
Dicot. trees and shrubs							
Acacia melanoxylon	1	3	4	3			1
Acer sp.+							1
Betula pendula+	1				1		
Buddleia davidii+						1	
Castanea sp.	1						
*Chaemaecytisus palmensis**		2	1	1			2
Cytisus scoparius	1	2	1	1		2	
*Erica lusitanica**	1	1		1	2	1	1
Eucalyptus globulus+		2	2	1			
Larix sp. +				3			
Leycesteria formosa+			1				
Lupinus arboreus			1	1	1	1	1
Malus domestica+						1	1
Populus nigra cv. *Italica**	1				2		1
Prunus sp.	1						
Quercus sp.+	1	1					
Rosa rubiginosa	1	1	1	1		1	1
Rubus sp. (*R. fruticosus* agg.)	4	2	1	1		2	2
*Salix cinerea**	2	1		1			1

*Salix fragilis**	2	1			1	1	1
Ulex europaeus+							1
Grasses							
Agrostis capillaris	3	3	3	3	4	2	3
Anthoxanthum odoratum	2	2	2	2			2
Bromus willdenowii+	1						
Dactylis glomeratus	2	3	4	3	3	4	4
Glyceria declinata	1	1					
Glyceria fluitans+						1	1
Glyceria maxima+							1
Holcus lanatus	1	3	3	2	2	2	2
Lolium perenne	1				2		1
Paspalum dilatatum					1		
*Phleum pratense**						1	1
Poa sp.+		1		1			
Sedges							
Carex ovalis			1		1	1	1
Rushes							
Juncus articulatus		1		1	1		1
Juncus bufonius	1						
Juncus effusus	1	1			1		
Juncus tenuis					1	1	
Ferns							
Deparia petersenii+	1						
Composite herbs							
Bidens frondosa		1	1				1
Cirsium arvense	1	1	1	1		1	
Cirsium vulgare	1	1	1	1	2		1
Conyza albida	1				1		1
Crepis capillaris	1	1	1		1	1	
Gnaphalium coarctatum+					1		
Hypochaeris radicata	1	1		1	1		
Mycelis muralis	1	1	1	1			
Senecio jacobaea	1	1				1	
Senecio sylvaticus+		1					
Sonchus oleraceus	1	1	1	1		1	1
*Taraxacum officinale**	1	1	1	1	2	1	1
Dicot. herbs (other than composites)							
Aceana novae-zelandiae	1		1				1
Achillea millefolium	1	1	1	2	2	3	2

Callitriche stagnalis	1	1		1	1		1
Cerastium fontanum subsp. *triviale*							1
Epilobium ciliatum	1	1	1	1	1	1	1
Galium aparine	1	1		1	1	1	1
Geranium robertianum+		1	1				
Hypericum sp.				1			
*Lactuca serriola**		1					
Lotus pedunculatus	1	2		2	2	2	3
Medicago sativa+					2		
Mentha spicata subsp. *spicata*						1	1
Mimulus guttatus	1	2		1		1	
Mimulus moschatus+				1		1	
Myosotis scorpioides		1		1	1		1
*Plantago lanceolata**		1		1	2	1	
Plantago major+					1		
Polygonum hydropiper		1		1	1	1	1
Polygonum persicaria+	1						
Polygonum prostratum+					3		
Prunella vulgaris	1						
*Ranunculus acris**	1	1	1				1
Ranunculus repens	1		1	1		2	2
Rorippa nasturtium-aquaticum	2	1	1	1		1	1
*Rumex acetosella**	1	1		1	2	1	1
Rumex conglomeratus							1
Rumex obtusifolius	1	1		1		1	1
*Solanum nigrum**	1			1			
Solanum tuberosum+						1	
Stellaria media	1		1	1			
Trifolium arvense						1	
Trifolium pratense		1	1	1		2	
Trifolium repens	1	1	1	1	3	3	1
*Verbascum virgatum**							