

WW1&2 consent application

Appendix E

on-farm
data

Average N loss/ha/year: Farms within a 20km radius
of WW1x2.

1 Cows	Nitrogen Loss				
		51	515	40	
2	750	51	800	36	
3		31	650	66	
4	500	36	54	480	39
5	580	43	55	650	36
6	900	39	56	280	55
7	500	64	57	730	38
8	415	61	58	450	37
9	570	61	59	470	23
10		52	60	550	36
11		52	61	650	38
12	600	37	62	370	41
13	560	53	63	670	40
14	480	45	64	580	47
15	270	31	65	800	58
16	600	38	66	800	49
17	650	43	67	500	41
18	320	33	68	780	37
19	420	52	69	370	50
20	420	51	70	850	27
21	900	51	71	350	54
22	630	72	72	285	44
23	490	26	73	490	33
24	425	45	74	190	30
25	425	36	75	800	40
26	440	41	76	450	41
27	715	55	77	475	50
28	500	39	78	500	42
29	400	45	79	660	27
30	330	40	80	540	21
31	1100	30	81	300	23
32	700	43	82	425	42
33	220	36	83	1000	58
34	475	59	84	510	49
35	750	39	85	585	46
36	400	44	86	900	42
37	400	47	87	500	44
38	780	34	88	475	44
39	155	43	89	480	50
40	620	25	90	530	54
41	800	37	91	520	46
42	375	38	92	850	64
43	600	26	93	550	39
44	730	50	94	800	46
45	700	30	95	540	55
46	520	34	96	580	38
47	420	41	97	590	54
48	800	29	98	180	41
49	680	68	99	940	45
50	445	32	100	950	43

101	300	42	151		48
102	850	25	152	600	40
103	550	26	153	450	55
104	800	54	154	540	51
105	450	34	155	450	38
106	450	47	156	575	57
107	510	53	157	575	60
108	490	52	158	500	42
109	500	39	159	430	53
110	500	25	160	410	51
111		59	161	600	48
112	600	47	162	525	51
113	300	38	163	760	58
114	900	33	164	880	46
115	540	36	165	265	69
116	1000	29	166	700	54
117	480	41	167	340	43
118	600	72	168	700	52
119	585	42	169	300	30
120	550	56	170	430	23
121	700	66	171	320	48
122	785	55	172	750	67
123	700	50	173	410	67
124	1000	51	174	300	43
125	700	71	175	650	47
126	650	54	176	680	65
127	730	34	177	500	48
128	470	23	178	970	78
129	500	40	179	551	54
130	440	39	180	670	40
131	680	55	181	550	46
132	700	62	182	600	39
133	320	44	183	850	48
134	460	42	184	200	53
135		43	185	280	56
136	860	26	186	580	27
137	620	55	187	310	67
138	500	34	188	250	58
139	200	54	189	500	38
140	520	44	190	640	40
141	580	67	191	525	29
142	580	47	192	900	81
143	350	39	193	550	54
144	560	34	194	400	53
145	780	24	195	250	42
146		68	196	460	36
147	930	47	197	420	35
148	660	48	198	565	35
149	590	41	199	325	32
150	520	68	200	210	57

201	340	52	251	660	61
202	800	26	252	500	73
203	950	51	253	530	89
204	560	30	254	430	54
205	700	29	255	450	52
206		59	256	990	47
207	240	60	257	1100	44
208	1400	63	258	450	44
209	500	52	259	200	55
210	420	20	260	900	28
211	200	45	261	400	34
212	1000	197	262	530	43
213	580	46	263	550	40
214	630	34	264	360	36
215		38	265		48
216	600	50	266	850	65
217	450	49	267	600	39
218	550	78	268		57
219	680	87	269	660	50
220	700	47	270	580	79
221	800	76	271	780	75
222	1100	86	272	850	61
223	650	27	273	600	50
224	640	29	274	900	41
225	700	37	275		29
226	550	20	276	470	45
227	980	19	277		37
228	860	24	278	490	30
229	725	20	279	670	38
230	500	33	280	680	40
231	810	43	281	850	34
232	390	54	282	600	39
233	300	31	283	850	40
234	250	73	284	680	48
235	440	44	285	500	38
236	600	55	286	300	33
237	124	63	287	800	44
238	600	58	288	400	43
239	430	41	289	470	41
240	340	31	290	950	57
241	590	100	291	420	33
242	320	41	292	800	71
243	330	48	293		52
244	660	30	294	230	40
245	590	48	295	620	39
246	335	91	296	420	22
247	420	41	297	320	37
248	690	77	298	800	30
249	1030	74	299	400	33
250		51	300	400	33

301	240	21	352	800	52
302	580	74			
303	485	37			
304	540	34			
305	580	35			
306	270	31			
307	800	36			
308	1000	49			
309		38			
310	550	41			
311	520	38			
313		49			
314	255	26			
315	421	23			
316	620	41			
317	420	66			
318	1600	40			
319	625	60			
320	1500	73			
321	580	62			
322	1500	68			
323		63			
324		51			
325	1100	55			
326		54			
327	600	55			
328	300	44			
329	330	41			
330	380	82			
331	545	48			
332	690	42			
333	340	36			
334	250	54			
335	320	74			
336	450	42			
337	455	40			
338	900	63			
339		65			
340	550	35			
341	410	67			
342	820	64			
343	510	25			
344	200	35			
345	1050	42			
346		34			
347	350	35			
348	480	34			
349	1000	50			
350	820	42			
351	800	38			

Max cow no.s / month : Faems within a 20km radius of WW1K2.

Outlier data.

	January	February	March	April	May	June	July	August	September	October	November	December
5	216	216	216	216	161	130	0	0	230	230	230	230
12	280	280	280	280	200	200	0	0	50	150	280	280
15	225	212	212	212	212	180	0	0	180	225	225	225
18	275	275	275	275	226	226	0	0	293	293	293	293
25	290	270	250	240	240	169	0	14	301	300	300	300
32	320	320	320	320	258	258	0	0	340	340	340	340
33	329	329	329	329	262	262	0	0	350	350	350	350
35	330	320	310	280	240	240	0	0	180	260	345	345
36	329	329	329	280	263	0	0	350	350	350	350	350
38	300	282	282	282	240	0	0	240	300	300	300	300
43	400	400	400	298	298	0	0	425	425	425	425	425
44	367	367	367	300	270	0	0	390	390	390	390	390
45	400	380	350	300	250	0	300	415	420	420	420	402
52	330	330	320	310	300	0	0	50	150	300	360	360
54	339	339	336	312	284	0	0	270	353	352	349	349
72	350	350	340	340	350	0	10	250	350	350	350	350
77	450	450	450	350	350	0	0	100	200	450	450	450
78	450	450	450	350	350	0	0	200	450	450	450	450
80	404	404	404	353	342	0	0	305	430	430	430	430
85	425	420	400	370	320	0	150	400	437	432	430	430
88	451	451	451	374	288	0	49	480	480	480	480	480
89	470	470	470	375	375	0	0	350	400	500	500	500
90	470	470	470	375	375	0	0	500	500	500	500	500
100	470	470	470	390	390	0	0	500	500	500	500	500
112	494	494	494	404	380	0	0	525	525	525	525	525
115	508	508	508	405	405	0	81	540	540	540	540	540
118	471	441	441	408	200	0	0	508	498	492	481	481
122	410	410	410	410	360	0	0	450	445	440	440	440
130	531	531	531	424	356	0	13	565	565	565	565	565
137	545	545	545	435	283	0	0	580	580	580	580	580
141	588	588	588	438	438	0	0	625	625	625	625	625
142	555	555	555	442	442	0	0	590	590	590	590	590
147	500	490	480	450	390	0	0	545	545	545	520	510
148	564	564	564	450	450	0	0	600	600	600	600	600
169	559	559	559	476	476	0	0	595	595	595	595	595
174	525	510	500	485	453	0	0	560	555	545	545	535
175	611	611	611	488	439	0	112	650	650	650	650	650
176	630	630	630	489	469	0	0	529	670	670	670	670
181	590	580	540	500	482	0	0	300	601	600	595	590
182	540	540	540	500	450	0	0	350	500	550	550	550
186	639	639	639	510	332	0	0	483	680	680	680	680
188	550	530	530	510	490	0	50	520	560	550	550	550
189	598	565	533	514	507	0	129	633	623	617	610	604
192	649	649	649	518	518	0	0	690	690	690	690	690

200	658	658	658	525	525	0	0	700	700	700	700	700
208	634	634	634	533	432	0	32	675	675	675	675	675
214	549	549	549	549	549	0	0	260	495	550	554	554
217	570	570	560	555	480	0	150	400	550	615	580	580
221	658	658	658	560	543	0	17	700	700	700	700	700
227	595	595	570	570	560	0	25	550	610	610	600	598
228	600	600	600	580	500	0	0	600	600	600	600	600
229	600	580	580	580	580	0	0	606	606	606	606	606
238	658	658	658	595	482	0	113	700	700	700	700	700
240	600	600	600	600	600	0	0	650	650	650	650	650
252	620	620	620	605	540	0	50	250	610	675	675	650
258	785	785	785	626	626	0	0	835	835	835	835	835
264	766	766	766	636	636	0	0	815	815	815	815	815
265	766	766	766	636	636	0	83	815	815	815	815	815
266	799	799	799	638	638	0	19	850	850	850	850	850
270	650	640	640	640	530	0	0	685	685	685	675	685
276	690	649	649	649	483	0	100	338	690	690	690	690
290	874	874	874	688	654	0	0	930	930	930	930	930
297	879	879	879	701	701	0	0	935	935	935	935	935
306	875	875	800	750	700	0	0	300	960	960	900	900
314	810	761	761	761	608	0	0	608	810	810	810	810
320	1034	1034	1034	825	776	0	0	1100	1100	1100	1100	1100
327	1128	1128	1128	900	756	0	0	1200	1200	1200	1200	1200
328	1128	1128	1128	900	846	0	207	1200	1200	1200	1200	1200
332	950	950	950	950	750	0	0	700	950	950	950	950
333	970	970	950	950	850	0	0	1000	990	980	980	980
336	1030	1020	1000	970	890	0	0	1120	1095	1075	1065	1030
338	1241	1241	1241	990	990	0	0	515	1320	1320	1320	1320
340	1100	1020	1000	1000	900	0	0	800	1100	1250	1200	1100
341	1050	1050	1000	1000	800	0	0	1000	1200	1200	1150	1100
254	761	761	761	608	590	6	6	810	810	810	810	810
194	520	520	520	520	520	10	10	520	520	520	520	520
260	846	846	846	630	630	19	0	846	900	900	900	900
91	470	470	470	375	375	11	0	500	500	500	500	500
187	639	639	639	510	510	15	0	680	680	680	680	680
284	850	850	850	678	678	20	20	904	904	904	904	904
300	882	882	882	704	704	21	0	938	938	938	938	938
261	790	790	790	630	630	19	0	840	840	840	840	840
347	1532	1532	1532	1222	1222	37	477	1630	1630	1630	1630	1630
277	702	702	676	652	530	17	0	679	718	702	702	702
213	658	658	658	546	546	16	0	700	700	700	700	700
216	696	696	696	555	555	17	0	644	740	740	740	740
157	573	573	573	458	458	14	0	494	610	610	610	610
99	489	489	489	390	390	12	0	520	520	520	520	520
248	724	724	724	601	601	18	78	770	770	770	770	770

155	550	550	550	456	456	14	46	585	585	585	585	585
161	550	550	550	468	468	14	0	585	585	585	585	585
108	470	470	470	400	400	12	0	405	500	500	500	500
172	555	555	555	484	484	15	0	478	590	590	590	590
149	510	500	470	450	425	15	15	525	522	520	515	510
127	470	450	430	420	420	15	15	120	300	518	520	490
105	479	479	479	393	393	16	16	510	510	510	510	510
344	1150	1150	1100	1100	900	50	50	1150	1150	1150	1150	1150
278	680	660	660	660	660	30	30	730	700	680	680	680
267	799	799	799	638	638	38	38	850	850	850	850	850
58	385	385	385	316	316	25	0	381	410	410	410	410
93	470	470	470	375	375	34	90	500	500	500	500	500
224	600	564	564	564	480	48	230	480	600	600	600	600
210	630	630	630	536	520	54	166	670	670	670	670	670
133	540	540	540	430	430	50	50	560	560	550	550	550
281	790	790	790	672	558	81	81	840	840	840	840	840
185	597	597	597	508	508	76	91	635	635	635	635	635
268	799	799	799	638	638	115	115	850	850	850	850	850
95	415	415	400	380	370	60	60	438	438	435	430	425
60	340	320	320	320	255	48	41	207	340	340	340	340
293	761	750	721	694	642	113	113	798	791	788	771	762
68	423	423	423	338	304	64	64	450	450	450	450	450
296	790	780	750	700	650	120	120	812	800	800	800	800
123	575	575	575	410	398	90	90	612	612	612	612	612
294	752	752	752	696	619	118	139	800	800	800	800	800
34	329	329	329	262	241	52	52	350	350	350	350	350
190	620	620	620	515	515	98	252	660	660	660	660	660
282	846	846	846	675	675	135	128	900	900	900	900	900
308	940	940	940	750	615	150	382	1000	1000	1000	1000	1000
203	658	658	658	525	525	110	525	700	700	700	700	700
14	263	263	263	210	193	44	44	280	280	280	280	280
201	705	705	705	525	525	121	105	578	750	750	750	750
202	705	705	705	525	514	121	121	750	750	750	750	750
199	630	630	630	523	445	110	136	670	670	670	670	670
222	752	752	752	560	549	134	437	800	800	800	800	800
274	804	804	804	641	641	147	147	855	855	855	855	855
92	470	470	470	375	322	86	86	500	500	500	500	500
242	752	752	752	600	600	138	228	800	800	800	800	800
259	790	790	790	630	630	145	0	0	0	840	840	840
307	979	979	979	750	750	180	165	938	1042	1042	1042	1042
102	489	489	489	390	390	90	148	520	520	520	520	520
76	432	432	432	345	345	80	80	460	460	460	460	460
280	727	702	682	668	658	130	130	771	761	751	750	750
31	301	301	301	256	256	56	95	320	320	320	320	320
263	776	776	776	635	572	146	210	825	825	825	825	825

119	479	479	479	408	408	94	86	484	510	510	510	510
4	192	192	192	153	153	38	50	204	204	204	204	204
243	752	752	752	600	600	150	222	800	800	800	800	800
83	456	456	456	364	364	91	91	461	485	485	485	485
106	479	479	479	398	398	96	96	510	510	510	510	510
346	1230	1230	1200	1200	1050	250	250	1250	1250	1250	1250	1230
215	589	554	554	554	438	113	113	471	589	589	589	589
256	724	724	724	616	585	148	148	770	770	770	770	770
305	874	874	874	725	674	181	181	930	930	930	930	930
140	549	549	549	438	438	114	101	310	584	584	584	584
241	705	705	705	600	600	150	150	750	750	750	750	750
177	500	500	500	490	450	107	263	530	530	530	530	530
64	409	409	409	326	326	88	78	426	435	435	435	435
269	799	799	799	638	549	172	172	850	850	850	850	850
275	771	771	771	648	648	168	149	697	820	820	820	820
53	330	310	310	310	231	69	69	159	330	330	330	330
82	453	453	453	362	362	101	83	448	482	482	482	482
178	620	620	620	495	376	139	139	627	660	660	660	660
55	392	392	392	313	275	88	88	417	417	417	417	417
23	291	291	291	232	153	67	67	310	310	310	310	310
110	470	470	470	400	368	112	400	500	500	500	500	500
135	540	540	540	431	129	129	129	575	575	575	575	575
109	410	410	400	400	350	100	100	420	420	420	420	410
61	365	358	337	321	303	90	90	386	382	378	372	367
249	733	733	601	601	601	186	218	725	780	780	780	733
69	423	423	338	338	338	108	140	450	450	450	450	423
124	517	517	517	412	412	132	214	550	550	550	550	550
271	660	660	640	640	580	170	170	340	680	680	680	680
318	880	850	830	800	780	220	250	650	850	900	900	890
62	404	404	404	322	322	106	113	430	430	430	430	430
219	700	700	700	559	559	184	0	507	745	745	745	745
143	555	555	555	442	442	146	0	590	590	590	590	590
195	611	611	611	520	520	161	161	650	650	650	650	650
164	583	583	583	471	471	155	165	620	620	620	620	620
165	583	583	583	471	471	155	184	620	620	620	620	620
173	583	583	583	484	484	155	276	620	620	620	620	620
6	221	221	221	176	176	60	72	235	235	235	235	235
19	268	268	268	228	228	73	68	285	285	285	285	285
26	301	301	301	240	240	84	96	320	320	320	320	320
29	254	254	272	253	240	71	67	199	259	288	286	271
316	987	987	987	788	788	276	788	1050	1050	1050	1050	1050
107	500	500	500	399	399	144	92	452	532	532	532	532
104	526	526	526	392	392	157	110	560	560	560	560	560
272	660	660	660	640	580	200	180	500	685	680	675	665
74	461	461	461	343	343	141	134	480	490	490	490	490

101	470	470	470	390	390	148	140	405	500	500	500	500
253	760	760	760	606	606	242	218	808	808	808	808	808
150	564	564	564	450	450	180	0	600	600	600	600	600
145	597	597	597	444	426	191	195	616	635	635	635	635
48	385	385	385	308	308	126	71	410	410	410	410	410
183	611	611	611	500	500	200	205	572	650	650	650	650
30	320	320	320	255	255	105	105	340	340	340	340	340
42	314	297	297	297	297	100	100	325	319	321	317	317
20	271	271	271	230	230	94	32	288	288	288	288	288
291	951	951	951	688	688	337	282	759	1012	1012	1012	1012
81	423	423	423	360	360	151	151	450	450	450	450	450
2	140	138	138	130	125	50	50	75	116	141	140	140
325	924	923	894	892	886	341	341	948	940	935	932	927
196	540	540	540	520	460	200	200	580	575	569	565	565
28	338	338	338	252	252	126	0	360	360	360	360	360
179	596	596	596	495	485	223	223	634	634	634	634	634
9	229	221	213	193	163	88	157	248	237	233	231	229
159	564	564	564	462	416	231	240	600	600	600	600	600
167	594	594	594	474	474	251	251	632	632	632	632	632
126	505	505	505	419	419	222	222	537	537	537	537	537
335	1128	1128	1128	960	960	499	480	1020	1200	1200	1200	1200
191	550	517	517	517	412	231	227	358	550	550	550	550
22	265	265	265	231	231	120	139	282	282	282	282	282
158	488	459	459	459	342	209	195	277	488	488	488	488
70	398	398	398	338	338	183	169	423	423	423	423	423
230	644	644	644	580	529	300	300	680	661	661	659	659
193	547	532	520	520	516	250	0	400	500	580	550	547
79	414	414	414	352	352	197	194	383	440	440	440	440
250	808	808	808	602	602	391	397	765	860	860	860	860
67	414	414	414	330	330	201	248	440	440	440	440	440
348	1438	1375	1372	1290	1265	684	684	1549	1540	1523	1486	1444
324	1081	1081	1081	886	886	540	540	874	1150	1150	1150	1150
239	630	626	626	595	500	315	315	663	652	640	635	630
212	649	649	649	545	545	332	191	690	690	690	690	690
334	950	950	950	950	830	510	465	520	750	1030	1020	1015
17	282	282	282	225	225	153	151	270	300	300	300	300
1	89	89	89	70	70	50	48	82	95	95	95	95
166	555	555	555	472	472	316	312	531	590	590	590	590
96	430	420	400	380	360	240	240	450	440	440	440	430
279	700	700	680	660	540	400	400	500	600	700	700	700
315	959	959	959	785	785	557	550	1020	1020	1020	1020	1020
46	320	301	301	301	256	182	187	256	320	320	320	320
146	520	485	485	445	420	300	300	570	550	544	540	540
37	305	305	300	280	260	200	75	175	280	320	320	320
113	430	404	404	404	322	267	93	213	430	430	430	430

286	750	750	680	680	680	500	500	600	600	700	760	750
163	483	470	470	470	450	320	320	510	500	490	483	483
303	740	730	720	720	720	500	500	500	700	760	760	750
339	1060	996	996	996	954	687	687	954	1060	1060	1060	1060
220	595	559	559	559	452	393	108	294	595	595	595	595
231	595	595	580	580	576	420	420	620	620	610	610	610
154	611	611	611	455	455	432	96	481	650	650	650	650
3	140	132	132	132	98	98	98	98	140	140	140	140
128	564	564	564	420	420	420	420	600	600	600	600	600
206	639	639	639	530	530	477	488	680	680	680	680	680
40	357	357	357	293	270	270	293	380	380	380	380	380
71	442	442	442	338	338	338	338	470	470	470	470	470
162	611	611	611	468	468	468	468	650	650	650	650	650
205	620	620	620	528	475	475	0	660	660	660	660	660
345	1532	1532	1532	1174	1174	1174	1174	1630	1630	1630	1630	1630
129	490	480	450	420	580	374	560	520	500	500	470	460
326	950	950	893	893	893	741	741	741	741	950	950	950
134	450	445	430	430	425	350	350	485	475	470	470	450
59	404	404	404	318	318	318	318	430	430	430	430	430
111	495	495	495	401	401	393	393	527	527	527	527	527
144	470	442	442	442	352	352	352	352	470	470	470	470
84	462	462	462	368	368	368	368	363	491	491	491	491
132	455	428	428	428	341	341	341	341	455	455	455	455
184	630	630	630	502	502	502	502	670	670	670	670	670
114	430	404	404	404	322	322	322	322	430	430	430	430
73	429	429	429	342	342	342	342	456	456	456	456	456
116	508	508	508	405	405	405	405	540	540	540	540	540
117	508	508	508	405	405	405	405	540	540	540	540	540
27	306	306	306	244	244	244	244	325	325	325	325	325
323	1081	1081	1081	862	862	862	862	1150	1150	1150	1150	1150
218	696	696	696	555	555	555	555	740	740	740	740	740
57	395	395	395	315	315	315	315	420	420	420	420	420
103	489	489	489	390	390	390	390	520	520	520	520	520
41	371	371	371	296	296	296	296	395	395	395	395	395
39	300	282	282	282	225	225	225	225	300	300	300	300
94	470	470	470	375	375	375	375	500	500	500	500	500
151	564	564	564	450	450	450	450	600	600	600	600	600
152	564	564	564	450	450	450	450	600	600	600	600	600
204	658	658	658	525	525	525	525	700	700	700	700	700
283	846	846	846	675	675	675	675	900	900	900	900	900
309	940	940	940	750	750	750	750	1000	1000	1000	1000	1000
310	940	940	940	750	750	750	750	1000	1000	1000	1000	1000
329	1128	1128	1128	900	900	900	900	1200	1200	1200	1200	1200
337	1222	1222	1222	975	975	975	975	1300	1300	1300	1300	1300
235	733	733	733	585	585	585	585	780	780	780	780	780

138	545	545	545	435	435	435	435	580	580	580	580	580
139	545	545	545	435	435	435	435	580	580	580	580	580
255	763	763	763	609	609	609	609	812	812	812	812	812
331	1175	1175	1175	938	938	938	938	1250	1250	1250	1250	1250
180	620	620	620	495	495	495	495	660	660	660	660	660
49	385	385	385	308	308	308	308	410	410	410	410	410
50	385	385	385	308	308	308	308	410	410	410	410	390
136	536	536	536	433	433	429	429	570	570	570	570	570
16	273	273	273	220	220	220	220	290	290	290	290	290
322	871	962	878	849	855	776	773	746	887	872	889	873
295	865	865	865	699	699	699	699	920	920	920	920	920
156	564	564	564	456	456	456	456	600	600	600	600	600
207	658	658	658	532	532	532	532	700	700	700	700	700
289	846	846	846	684	684	684	684	900	900	900	900	900
288	680	680	680	680	600	550	550	720	720	720	720	720
292	855	855	855	692	692	692	692	910	910	910	910	910
65	404	404	404	327	327	327	327	430	430	430	430	430
56	338	337	332	315	300	273	108	108	360	352	350	344
63	395	395	395	323	323	323	323	420	420	420	420	420
317	975	975	975	798	798	798	798	1037	1037	1037	1037	1037
131	519	519	519	425	425	425	425	552	552	552	552	552
13	254	254	254	208	208	208	208	270	270	270	270	270
251	640	602	602	602	493	493	493	493	640	640	640	640
98	470	470	470	385	385	385	385	500	500	500	500	500
160	564	564	564	462	462	462	462	600	600	600	600	600
225	600	564	564	564	462	462	462	462	600	600	600	600
287	830	830	830	680	680	680	680	883	883	883	883	883
343	1269	1269	1269	1040	1040	1040	1040	1350	1350	1350	1350	1350
285	827	827	827	678	678	678	678	880	880	880	880	880
236	716	716	716	587	587	587	587	762	762	762	762	762
168	578	578	578	474	474	474	474	615	615	615	615	615
24	291	291	291	239	239	239	239	310	310	310	310	310
153	545	545	545	452	452	452	452	580	580	580	580	580
226	686	686	686	569	569	569	569	730	730	730	730	730
301	750	705	705	705	585	585	500	750	750	750	750	750
298	846	846	846	702	702	702	702	900	900	900	900	900
299	846	846	846	702	702	702	720	900	900	900	900	900
237	600	600	590	590	590	500	500	500	620	600	600	600
311	893	893	893	750	750	750	750	950	950	950	950	950
11	235	235	235	198	198	198	198	250	250	250	250	250
7	212	212	212	180	180	180	180	225	225	225	225	225
171	567	567	567	482	482	482	482	603	603	603	603	603
232	682	682	682	580	580	580	580	725	725	725	725	725
223	662	662	662	563	563	563	563	704	704	704	704	704
170	564	564	564	480	480	480	480	600	600	600	600	600

197	611	611	611	520	520	520	520	650	650	650	650	650
245	705	705	705	600	600	600	600	750	750	750	750	750
211	639	639	639	544	544	544	544	680	680	680	680	680
209	626	626	626	533	533	533	533	666	666	666	666	666
97	451	451	384	384	384	384	480	480	480	480	480	451
75	404	404	404	344	344	344	344	430	430	430	430	430
47	357	357	357	304	304	304	304	380	380	380	380	380
120	479	479	479	408	408	408	408	510	510	510	510	510
121	479	479	479	408	408	408	408	510	510	510	510	510
8	216	216	216	184	184	184	184	230	230	230	230	230
66	385	385	385	328	328	328	328	410	410	410	410	410
312	700	700	750	750	750	600	600	800	750	700	700	700
302	808	808	808	705	705	705	705	860	860	860	860	860
342	1156	1156	1156	1009	1009	1009	1009	1230	1230	1230	1230	1230
51	329	329	329	308	308	308	308	350	350	350	350	350
125	442	442	442	414	414	414	414	470	470	470	470	470
313	794	794	794	752	752	752	452	525	525	525	525	525
21	230	230	230	230	230	230	230	230	230	230	230	230
244	600	600	600	600	600	600	350	400	620	620	620	620
247	650	650	650	600	600	650	650	650	650	650	650	650
10	193	193	193	195	185	197	197	185	185	193	193	193
87	388	388	380	370	360	398	398	395	395	390	388	388
319	570	670	790	800	660	690	660	560	790	820	770	670
262	660	660	660	630	630	680	680	675	670	665	665	665
234	580	580	580	580	560	600	600	600	600	600	580	580
321	825	825	825	825	700	855	855	825	825	825	825	825
233	640	640	600	580	520	670	670	670	670	650	650	650
273	710	710	710	640	566	755	755	755	755	755	755	755
304	800	760	750	720	600	810	810	810	810	810	810	810
257	591	583	619	618	659	622	0	824	682	663	603	592
330	949	948	948	931	931	1020	1010	1005	992	983	979	952
86	390	390	390	370	370	420	420	420	420	390	390	390
246	600	550	600	600	600	650	650	640	630	625	625	625
198	0	0	560	520	510	625	625	620	610	599	595	0

Drummond Swamp vegetation report

Introduction

Drummond Swamp is classified as a Wildlife Management Reserve and is located c. 4km south-east of Drummond. Drummond Swamp is one of the larger reserves on the Southland Plains (256.42ha). It is one of only two peatland reserves on the Southland Plains. Despite its ecological importance it has received relatively little botanical attention and remains relatively poorly known. The current survey was undertaken to improve botanical knowledge of the wetland also to assess weed control requirements. The survey was undertaken by myself, Lynne Huggins, Graeme Miller and Jolie Hazley, on 26 February 2008.

Ecological Setting

Drummond Swamp is a large peat bog is the eastern portion of the Southland Plains (Southland Plains Ecological District). Peat bogs are a distinctive feature of the Southland Plains ED. The Southland Plains Ecological District – Survey report for the Protected Natural Areas Programme (Walls and Rance, 2003) considered the 1840 extent of peat bogs to be 3% (7,520ha) of the Southland Plains ED. The two major protected areas are Drummond Swamp (256 ha) and Bayswater Scientific Reserve (528 ha = 210 + c.318 ha addition)

Vegetation

Wirerushland: This is the most extensive community with wirerush (*Empodisma minus*) dominant throughout. However there is some variation, probably dependent upon the fire history.

Generally the community is dominated by wirerush (*Empodisma minus*, 50-90% cover, average 80%, including c. 5% dieback), with much tangle fern (*Gleichenia dicarpa*, 2-50%, average 20%), sphagnum moss (*Sphagnum cristatum*, up to 15%) and swamp inaka (*Dracophyllum oliverii*, up to 10%). Other minor species include manuka (*Leptospermum scoparium*), *Celmisia gracilentia*, *Cyathodes empetrifolia*, *Nertera scapaniodes*, *Baumea rubiginosa* and *B. tenax*.

Areas that have not been burnt for longer have a greater cover of wood species with manuka (5%) and swamp inaka (2%), also tangle fern tends to be more common in these areas.

Lowland flax is locally common in areas on the north side of the wetland.

There are some localised and small scale mossy hollows containing *Baumea rubiginosa* and *B. tenax*.

Disturbed areas: Within the wetland was a large disturbed area, which was thought to be an old gull colony. This area was dominated by exotic grasses (65%, mainly sweet vernal and Yorkshire fog), soft rush (*Juncus effusus*, 20%), catsear (*Hypochaeris radicata*, 5%),

manuka, bulbous rush (*Juncus bulbosus*), giant rush (*Juncus procerus*), wirerush, pedicelled sedge (*Carex secta*), blackberry (*Rubus fruticosus*) the liverwort *Marchantia beteroana* and locally cutty grass (*Carex coriacea*).

Ponds: Near the northern boundary of the wetland are a couple of ponds. These ponds have a margin containing much pedicelled sedge and lowland flax. Adjacent to the ponds is a wet channel dominated by pedicelled sedge and lowland flax.

Treeland: In the north-western boundary (adjacent to McLeish's ponds) is a treeland. This community is dominated by wirerush (35-50%), bracken (*Pteridium esculentus*, 25-45%), a gum tree (*Eucalyptus* sp. 25%), manuka (8%), *Amalancher* sp. (5%), tangle fern (<5%), water fern (*Histeopteris incisa*), lowland flax and swamp inaka.

Flora

A flora of 44 indigenous plant species has been recorded from Drummond Swamp. This flora is typical of peat bogs on the Southland Plains. The woody flora is limited with bog pine, celery pine and pygmy pine all absent.

The most notable plant recorded was *Olearia laxiflora*, with a single plant recorded from the southern boundary. It is uncommon on the Southland Plains.

Weeds

A total of 36 exotic species were recorded. Of these 11 are considered of conservation concern. These include:

Gorse (*Ulex europaeus*): Gorse is the most widespread weed species, however is largely confined to the modified margins of the wetland. Without control it will expand around the margin of the wetland and slowly invade into the wetland.

Blackberry (*Rubus fruticosus*): Blackberry was scattered through disturbed internal areas which were thought to be old gull colony site. It will expand in these areas and potentially invade into more intact areas. It is of particular concern because of its ability to grow on peat soils and its ability to spread widely through bird dispersal.

Cut-leaved blackberry (*Rubus laciniatum*): This blackberry was localized, however poses a similar threat the common blackberry.

Grey willow (*Salix cinerea*): Grey willow was scattered through disturbed internal areas which were thought to be old gull colony site. It will expand in these areas and potentially invade into more intact areas. It is of particular concern because of its ability to grow on peat soils and its ability to spread widely through wind dispersal.

Silver birch (*Betula pendula*): Silver birch was scattered through disturbed internal areas which were thought to be old gull colony site. It will expand in these areas and potentially invade into more intact areas. It is of particular concern because of its ability to grow on peat soils and its ability to spread widely through wind dispersal.

Service berry (*Amelanchier* sp.): Service berry was confined to the treeland area adjacent to the north-western boundary. This small tree is a relatively recent discovery as a weed on peat bogs in Southland. It currently has a restricted distribution within the wetland, however is spreading. It is a priority to control while it remains localized.

Rowan (*Sorbus aucuparia*): Rowan was also localized and uncommon within the wetland. It is a known weed of peat bogs and so is a priority for control.

Gum trees (*Eucalyptus* sp.): The gum trees have slowly invaded the peat bog and now form a treeland community adjacent to the north-western boundary. While their spread is slow the existing trees demonstrate the ability to invade the peat bog. They are a lower priority for control than other more aggressive weeds, but their removal needs to be planned.

Crack willow (*Salix fragilis*): Crack willow was confined to some ponds near the northern edge of the wetland. It is localized and probably not spreading, however should be removed.

Broom (*Cytisus scoparius*): Broom was uncommon in the wetland.

Pine tree (*Pinus* sp.): A few pine trees were present within the wetland (mainly treeland area adjacent to the north-western boundary).

Rhododendron (*Rhododendron* sp.): A single rhododendron plant was observed. The plant was relatively large and is thought to have been present for many years. This plant is thought to have self seeded and is therefore of concern as it presents a seed source for further establishment.

Summary

Drummond Swamp is a large peat bog reserve, being one of the largest and most intact peat bogs on the Southland Plains. It has previously received limited management input. The wetland is generally intact though has suffered from historic fires. A modified area in the central portion is thought to have resulted from a gull colony. This area should be monitored to check that recovery is occurring.

Weed control is the major management requirement for the wetland. There are a number of weeds present. Those that have an ability to invade intact peat bogs are the priority for control. These include grey willow, silver birch, service berry, rowan, blackberry and cut-leaved blackberry.

Brian Rance
4 June 2008