

# Ecoscan



**Middlesex  
University**

## **Quinquennial Review of Jersey Flowing Waters (1998-2004)**

A Report submitted to the States of Jersey Planning and Environment  
Department

(Water Resources Section)

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### Executive Summary

- All Jersey stream sites from the 2002-4, 1999 and 1997/8 surveys have been compared in terms of annual biological water quality.
- The provisional States of Jersey stream classification was used to compare these sites.
- The results of the 2002-4 survey showed that 5% of stream sites achieved the top category 'a', 31% of sites category 'b' (target category), 36% category 'c', 14% category 'd', 9% category 'e' and 3 sites were regarded as highly modified streams, category 'x'.
- Biological water quality showed a dramatic, continuous, improvement when the 2002-4 survey results were compared with previous years data.
- The best quality catchment was Grands Vaux/Vallee des Vaux. The most improved catchment was St. Peter's Valley. The poorest quality catchment was Longueville.
- It is recommended that targets are set for extending monitoring of stream sites, in keeping with UK and Irish Environment Agency practice.
- The provisional States of Jersey stream classification was reviewed in terms of sites of borderline water quality. No modifications were recommended.
- Water Quality Objectives for sites not sampled since 1999 have been appended to this report.

## 1.0 Introduction

### 1.1 Background to this study

The first systematic investigation of biological water quality of Jersey streams, was conducted in 1996, when macroinvertebrate communities were found to be an effective tool in distinguishing biological water quality in the small streams of Jersey (Langley *et al*, 1997). Sixty sites were sampled from ten catchments: Bellozanne Valley; Grand Vaux/Vallee des Vaux; Longueville; La Vallee des Mouriers; Les Pres D’Auvergne; Queen’s Valley (Grouville SSI); St. Peter’s Valley; Rozel; Vaux de Lecq and Water Works Valley. Sites were selected to correspond to those regularly sampled for physicochemical parameters by (the then) States of Jersey Public Services Department and microbiological data collected by Wyer *et al* (1995). No comprehensive baseline record of Jersey’s flowing waters existed prior to this, although records existed for various freshwater groups e.g. aquatic Heteroptera (Le Quesne, 1953), and student projects published e.g. an ecological study of six Jersey streams (Norman, 1990) and assessment of pollution indices (Moss, 1996).

Once baseline data was available, variability of macroinvertebrate communities of Jersey stream sites was assessed between seasons (Spring, Summer and Autumn in 1997/8), together with inter-annual variation, using those samples taken in years 1997/8 and 1999 (Langley *et al*, 2001). Inter-annual consistency enabled the focus of research to move to more variable sites, which were included in a 36 site sample, along with some sites showing little seasonal variability as ‘standards’.

In addition the robustness of different biological water quality indices used by the Environment Agency (for England and Wales) was considered, given that Jersey flowing waters were streams rather than rivers. Parallel with this, quality assurance of sampling, sorting and identification efficiency of States of Jersey staff was first undertaken by Kett *et al*, (1999).

In keeping with the provision of the Water Pollution (Jersey) Law (2000), continuing scientific and technical research was undertaken. This resulted in the construction of regulatory Water Quality Objectives (Langley and Kett, 2003). An assessment of the reliability, sensitivity and robustness of the Water Quality Objectives (WQO’s), and introduction of a provisional States of Jersey stream classification, (Langley and Kett, 2004). This stream classification was designed to be consistent with the European Community Directive 60/2000/EC the Water Framework Directive (WFD).

Of the 60 sites initially surveyed, 3 sites were deemed inappropriate for assessment of biological water quality (Longueville 0, entirely culverted; Longueville 8, a roadside gutter and Vaux de Lecq 2207 which had succeeded to a willow carr). One site was added in 1999, Les Pres D’Auvergne 2, providing the 58 sample sites currently monitored.

## 1.2 Classification of Jersey flowing waters

Biological water quality for Jersey streams has been assessed by the use of water quality indices used on the UK mainland. These were the Biological Monitoring Working Party score (BMWP), the Average Score Per Taxon (ASPT), both reported by Chesters *et al.* (1980) and the Lincoln Quality Index (LQI) (Extence *et al.*, 1987). Assessment of annual biological water quality required combination of seasonal results.

Langley and Kett (2003) showed that Annual ASPT most reliably reflected biological water quality, and was used in the setting of WQO's and stream classification categories.

The UK mainland river classification schemes currently used to monitor changes in biological water quality are the Environment Agency's General Quality Assessment (GQA) scheme for Biology (Environment Agency, 1997), and the Scottish River Classification Scheme (Scottish Environmental Protection Agency, 2000). In December 2000, the Water Framework Directive was published, to bring together existing water policy directives, as well as standardise practice. This introduced a further classification scheme, where the ecological status of surface waters is classified into 6 categories: High, Good, Moderate, Poor and Bad, and Highly modified sites. High Ecological quality was defined as:

'The values of the biological quality elements for the surface water body reflect those normally associated with that type under undisturbed conditions, and show no, or only very minor, evidence of distortion. These are the type-specific conditions and communities' (The European Parliament and the Council of the European Union, 2000). Good to Bad categories were related to the above in terms of only slight/moderate/ major/ severe deviation from High status. The WFD's explicit objective is achieving Good Ecological Status (Everard *et al*, 2002).

Review of biological quality of Jersey streams will follow the provisional States of Jersey stream classification, with commentary upon Annual ASPT, BMWP and LQI scores as appropriate.

### **1.3 Scope of this study**

This report is based upon results of water quality monitoring of 58 sites from 10 stream catchments. These data cover the period 1997/8 – 2003/4. In 1997/8 annual results exist for all sites except Les Pres D’Auvergne 2. In 1999 results are present for all sites. From 2000-2001/2 sampling focused on the 36 variable sites. Over the period 2002/3 – 2003/4 all sites were once again sampled, over a two-year period. This was comparable to Environmental Agency practice where all sites are sampled over a 3-year period. This report will focus on the three periods where full data sets exist. Although this technically spans six years, some sites were only visited 1997/8 – 2002/3 thus this comprises a Quinquennial Review.

In addition to review of biological water quality, this report will also consider the robustness of the provisional States of Jersey stream classification, as well as set Water Quality Objectives for the 22 sites not sampled since 1999 (Appendix D).

### **1.4 Objectives of this study**

- (i) To review changes in biological water quality of Jersey streams over the period 1997/8-2003/4.
- (ii) To assess the robustness of the provisional States of Jersey stream classification.
- (iii) To provide WQO’s for the 22 sites studied in 2003/4.

## 2.0 Method

### 2.1 Biological sampling protocol

The data for this review were gathered by Water Resource Section staff, using a sampling protocol based on a 3 minute sample, developed by the Freshwater Biological Association (FBA) and subsequently adopted by UK Water Authorities. All microhabitats within a 20m site were sampled by vigorous kick/sweep sampling with an FBA designed hand-net (approximately 0.96 square millimetres area mesh) for a period of 3 minutes. The time allocated to sampling each microhabitat was dependent upon its area e.g. if a riffle represented 50% of the area of the site, then 1.5 minutes was spent on this microhabitat. At the end of each 3 minute sample a further one minute was allocated to hand searching, turning stones and vegetation.

Field samples were transported back to the laboratory for same-day sorting and identification of macroinvertebrates.

Macroinvertebrates extracted from samples were identified using dissecting and compound microscopes, with FBA identification guides: Gastropoda [snails] (Macan, 1977), Hirudinea [leeches] (Elliot and Mann, 1979), Malacostraca [Crustacea] (Gledhill *et al.*, 1976), Ephemeroptera [mayflies] (Elliot *et al.*, 1988), Plecoptera [stoneflies] (Hynes, 1977), Hemiptera [bugs] (Savage, 1989), Trichoptera [caddis flies] (Wallace *et al.*, 1990, Eddington and Hildrew, 1981), the AIDGAP Key to adult Coleoptera [water beetles] (Friday, 1988), and Hammond (1983) for Odonata dragon- and damselflies]. All macroinvertebrates were identified to Family except Oligochaeta [worms].

Ten samples from each season were sent for external audit, after preservation to assess extraction efficiency and accuracy of identification. All samples were preserved in 1.5% Propylene Phenoxetol. Delicate specimens were separated into a tube for transportation and fixed in 4% Formalin, prior to preservation in 1.5% Propylene Phenoxetol.

The following physicochemical stream parameters were recorded upon Water Resource Section (WRS) Field Record Sheets, together with site descriptions, macrophyte lists and macroinvertebrate taxa.

- ◆ Stream width at 0, 10 and 20m
- ◆ Stream depth at 0.25, 0.5 and 0.75 of the stream width at the points where width was measured.
- ◆ Depth including depth of water to the surface of substrate, plus sediment depth.
- ◆ flow rate (m/s)
- ◆ Substrate size: % cover of boulders, cobbles, gravels and silt within a 1m<sup>2</sup> area
- ◆ Water temperature (°C)
- ◆ Proportion of microhabitats (e.g. riffles, runs) within the 20m stretch.
- ◆ pH

- ◆ Conductivity ( $\mu\text{S}$ )
- ◆ Dissolved oxygen (%)
- ◆ Calcium (mg/l)
- ◆ Alkalinity (mg/l  $\text{HCO}_3$ )

## 2.2 Statistical methods

### 2.2.1 Annual water quality indices

Three standard water quality indices were applied to the macroinvertebrate communities: Biological Monitoring Working Party score (BMWP), the Average Score Per Taxon (ASPT) and the Lincoln Quality Index. The BMWP method used macroinvertebrate taxa that were generally characteristic of flowing waters. Each of the taxa were given a value between 10 and 1, dependent upon their intolerance of organic pollution e.g. non-biting midges Family: Chironomidae (generally pollution tolerant) scored 2 points, whereas lesser mayflies Family: Ephemerellidae (pollution intolerant) scored 10 points (see Appendix A for full values).

The General Quality Assessment scheme for biological assessment (Environment Agency, 1997) stated that two samples should be taken per year to assess water quality. For annual audit, the Spring and Autumn taxa should be combined.

Annual BMWP values were derived by combining seasonal taxa lists. The sum of values for each of the scoring taxa was the annual BMWP score.

Annual ASPT was calculated by dividing the BMWP score by the number of macroinvertebrate taxa contributing to the score. ASPT values range between 0 and 6.0+, higher values indicating better water quality.

A further factor known to influence the number and type of taxa found was the size of the river. Not only will size influence the number of taxa, but larger rivers, with meanders and backwaters, tend to be more habitat rich than brooks. Habitat heterogeneity contributes to species richness. To overcome this problem, the Lincoln Quality Index (LQI) was developed by the Anglian Water Authority, for streams less than 2m wide. This index uses categories of BMWP/ASPT score to calculate LQI values that distinguish between the 11 water quality categories: A++ to I.

A further classification was developed for Jersey streams based on seasonal BMWP scores, seasonal LQI values and the Annual ASPT modified to take account of the inflated values produced by combining seasonal BMWP scores. This forms the provisional States of Jersey stream classification (Appendix C).

### 3.0 Results

#### 3.1 Bellozanne catchment, annual variation (1997/8 – 2003/4)

Site	2402	2403	2404	2406
2003/4				
BMWP	93	100	100	67
ASPT	5.47	5.00	5.00	4.79
LQI	A++	A++	A++	A
Scoring taxa	17	20	20	14
Category	b	b	c	c
1999				
BMWP	101	51	64	79
ASPT	5.32	5.10	4.57	4.65
LQI	A++	A++	A	A
Scoring taxa	19	17	14	17
Category	c	b	c	c
1997/8				
BMWP	113	99	73	91
ASPT	4.91	5.21	4.56	4.33
LQI	A++	A++	A	A
Scoring taxa	23	19	16	21
Category	b	c	c	d

Table 1. Annual variation, Bellozanne, 1997/8-2003/4.

Combined seasonal BMWP scores ranged from 113 in 1999, (c.f. 100, 2003/4 and 101 1997/8) to 51 in 1997/8, (c.f. 67, 2003/4 and 73, 1999). ASPT values ranged from 4.33 to 5.47, the highest value occurring at site 2402 (2003/4), the lowest value was found at site 2406 (1997/8). Bellozanne stream classification ranged from categories 'd' to 'b'.

### 3.2 Grand Vaux/Vallee des Vaux catchment, annual variation, (1997/8 – 2003/4)

Site	2505	2506	2507	2502	GV-SSI	2504	VdV-SSI
2003/4							
BMWP		101	120	103	102	108	90
ASPT		5.05	4.62	5.42	5.37	5.14	5.00
LQI		A++	A++	A++	A++	A++	A++
Scoring taxa		20	26	19	19	21	18
Category		b	c	b	b	b	b
2002/3							
BMWP	115						
ASPT	5.23						
LQI	A++						
Scoring taxa	22						
Category	b						
2001/2							
BMWP	105						
ASPT	5.00						
LQI	A++						
Scoring taxa	21						
1999							
BMWP	91	116	52	113	110	102	90
ASPT	5.06	5.27	4.00	5.38	5.50	4.64	6.00
LQI	A++	A++	C	A++	A++	A++	A++
Scoring taxa	18	22	13	21	20	22	15
Category	b	b	e	b	a	c	c
1997/8							
BMWP	99	92	47	101	122	77	97
ASPT	4.95	4.84	3.62	5.61	5.30	4.53	5.11
LQI	A+	A+	D	A++	A++	A	A++
Scoring taxa	20	19	13	18	23	17	19
Category	c	c	e	b	b	d	b

Table 2. Annual variation, Grand Vaux/Vallee des Vaux, 1997/8-2003/4.

With the exception of site 2507, this catchment showed consistently high water quality over the period studied. In 2003/4 site 2507 also demonstrated excellent water quality in terms of LQI, although with a markedly lower ASPT. Combined BMWP scores ranged from 47 – 120 (both for site 2507). ASPT scores ranged from 3.62 – 6.00. Grand Vaux/Vallee des Vaux stream classification ranged from categories ‘e’ to ‘a’.

### 3.3 Grouville catchment, annual variation (1997/8 – 2003/4)

Site	Grouville SSI
2003/4	
BMWP	86
ASPT	4.30
LQI	A
Scoring taxa	20
Category	d
1999	
BMWP	75
ASPT	3.95
LQI	C
Scoring taxa	19
Category	e
1997/8	
BMWP	98
ASPT	4.08
LQI	B
Scoring taxa	24
Category	e

Table 3. Annual variation, Grouville SSI, 1997/8-2003/4.

Combined seasonal BMWP scores ranged from 98 (1997/8) to 75 (1999). ASPT values were highest at 4.30 in 2003/4 similar for years 1997-8 (4.08) and 1999 (3.95). Grouville SSI stream classification ranged from categories 'e' to 'c'.

### 3.4 Longueville catchment, annual variation (1997/8 – 2002/3)

Site	L2	L3	L4	L5	L5b	L5c
2002/3						
BMWP	74	40	53	81	38	64
ASPT	4.11	3.33	3.79	4.50	3.80	4.57
LQI	B	E	C	A+	D	A
Scoring taxa	18	12	14	18	10	14
Category	x	x	x	d	e	e
Spring 2002*						
BMWP	51	26	45	59	25	46
ASPT	3.64	3.25	3.75	4.21	3.57	4.18
LQI	C	E	D	B	E	C
Scoring taxa	14	8	12	14	7	11
1999						
BMWP	47	50	45	67	48	97
ASPT	3.62	3.57	3.75	3.94	4.36	4.28
LQI	D	E	D	C	C	A
Scoring taxa	13	14	12	17	11	23
Category	x	x	x	e	e	e
1997/8						
BMWP	51	53	26	**nd	34	76
ASPT	3.64	3.79	2.89		4.25	4.75
LQI	C	C	F		C	A
Scoring taxa	14	14	9		8	16
Category	x	x	x		e	e

Table 4. Annual variation, Longueville, 1997/8-2002/3.

Combined seasonal BMWP scores ranged from 97 (1999), to 26 (1997/8). ASPT values ranged from 4.75 (1997/8) to 2.89 (1997-8). Generally the lowest values each year were from sites L4-L2, but in 2002/3 the values from these sites were comparable to L5b. Longueville stream classification ranged from categories ‘e’ to ‘d’, with three sites regarded as Highly modified. The Longueville catchment was not sampled in 2003-4.

Legend: \* No data available Autumn 2001 due to ‘foot and mouth’ restrictions  
 \*\*nd No data available Spring 1998.

### 3.5 La Vallee des Mouriers catchment, annual variation 1997/8 – 2003/4

Site	M1	M3	M4	M5	M6	M7	M8
2003/4							
BMWP	60	85	112	104			
ASPT	4.62	5.00	5.33	5.49			
LQI	A	A++	A++	A++			
Scoring taxa	13	17	21	19			
Category	c	c	b	b			
2002/3							
BMWP					117	92	85
ASPT					5.57	5.11	5.00
LQI					A++	A++	A++
Scoring taxa					21	18	17
Category					a	c	c
2001/2							
BMWP					97	69	81
ASPT					5.11	4.93	4.76
LQI					A++	A	A+
Scoring taxa					19	14	17
1999							
BMWP	83	72	100	90	94	68	77
ASPT	4.61	4.80	5.56	5.00	5.53	5.23	4.81
LQI	A+	A	A++	A++	A++	A+	A
Scoring taxa	18	15	18	18	17	13	16
Category	c	c	b	b	c	c	c
1997/8							
BMWP	117	105	130	80	112	111	60
ASPT	4.89	5.00	5.65	4.71	5.09	5.55	4.29
LQI	A++	A++	A++	A	A++	A++	B
Scoring taxa	24	21	23	17	22	20	14
Category	c	b	a	c	b	b	e

Table 5. Annual variation, La Vallee des Mouriers, 1997/8-2003/2004.

Biological water quality was indicated as excellent within this catchment, with the exception of site M8, which indicated 'good' water quality in 1997/8. ASPT scores ranged from 5.65 (site M4, 1997/8) to 4.29 (site M8, 1997/8). In 2003/4 site M4 provided the highest annual ASPT value recorded to date for this site. Les Mouriers stream classification ranged from categories 'e' to 'a'. Only sites M6, M7 and M8 form part of the 36 sample survey.

### 3.6 Les Pres D’Auvergne catchment, annual variation 1997/8 – 2003/4

Site	LPD’A-SSI	LPD’A 2
2003/4		
BMWP	98	37
ASPT	4.67	4.63
LQI	A+	B
Scoring taxa	21	8
Category	c	e
1999		
BMWP	94	64
ASPT	4.48	4.57
LQI	A	A
Scoring taxa	21	14
Category	d	d
1997/8		
BMWP	106	*nd
ASPT	4.42	
LQI	A+	
Scoring taxa	24	
Category	d	

Table 6. Annual variation, Les Pres D’Auvergne SSI, 1997/8-2003/4.

Combined seasonal BMWP scores for Les Pres D’Auvergne SSI ranged from 106 (1997-8) to 94 (1999). ASPT values were highest in 2003/4 (4.67). ASPT scores were similar between years for Les Pres D’Auvergne 2. Combined BMWP scores, number of taxa were notably lower in 2003/4. Les Pres D’Auvergne stream classification ranged from categories ‘e’ to ‘c’.

\*nd No data available Spring 1998.

### 3.7 St. Peter's catchment, annual variation 1997/8-2002/3

Site	Tess. M.	P13	P9	P9a	P8a	P7	P7a	P5	P5a	P4a	P4	P3	P2	P1
2002/3														
BMWP	114	81	98	96	128	96	118	96	111	106	102	58	109	40
ASPT	4.96	4.76	4.67	4.80	5.33	4.80	5.62	4.80	4.83	5.05	4.86	4.46	4.54	3.33
LQI	A++	A+	A+	A+	A++	A+	A++	A+	A++	A++	A++	B	A++	E
Scoring taxa	23	17	21	20	24	20	21	20	23	21	21	13	24	12
Category	c	c	c	c	b	c	b	c	c	b	c	d	c	e
2001/2														
BMWP	120	108	96	106	94	84	123	76	102	80	78	58	99	40
ASPT	5.22	4.91	4.57	4.61	5.53	4.94	5.35	4.47	4.86	5.33	4.59	3.87	4.50	3.33
LQI	A++	A++	A+	A++	A++	A+	A++	B	A++	A+	A	C	A+	E
Scoring taxa	23	22	21	23	17	17	23	17	21	15	17	15	22	12
Category	b	c	c	c	b	c	b	d	c	c	c	e	d	e
1999														
BMWP	108	65	66	89	101	67	84	96	85	80	50	37	111	48
ASPT	5.14	4.64	4.40	4.68	4.81	4.47	4.67	4.80	4.47	4.71	3.83	3.70	4.44	3.00
LQI	A++	A	B	A+	A++	B	A+	A+	A	A	D	D	A+	E
Scoring taxa	21	14	15	19	21	15	18	20	19	17	13	10	25	14
Category	c	c	d	c	c	d	d	c	d	c	e	e	d	e
1997/8														
BMWP	79	40	*nd	111	91	93	71	60	58	62	30	48	82	32
ASPT	4.39	3.64		5.05	4.79	4.89	4.18	4.00	4.14	4.43	3.33	3.69	4.1	3.2
LQI	B	D		A++	A+	A+	B	C	B	B	E	D	B	E
Scoring taxa	18	11		22	19	19	17	15	14	14	9	13	20	10
Category	d	e		c	d	c	e	e	e	e	e	e	e	e

Table 7. Inter-annual variation, St. Peter's, 1997/8-2002/3.

\*nd No data available Spring 1998

Table 7. shows annual water quality. Combined seasonal BMWP scores ranged from 114-40 (2002/3), 120-40 (2001/2), 111-48 (1999) and 111-30 (1997/8). ASPT values ranged from 5.62-3.33 (2002/3), 5.35-3.33 (2001/2), 5.14-3.00 (1999) and 5.05-3.2 (1997/8). Site P1 showed the lowest LQI values in all years (shared with P4 in 1997/8). St. Peter's stream classification ranged from categories 'e' to 'b'. This catchment was not sampled in 2003/4.

### 3.8 Rozel catchment, annual variation 1997/8 – 2003/4

Site	R5	R4	R3	R2	Rozel-SSI	R1
2003/4						
BMWP		105	102	137	93	86
ASPT		5.25	5.39	5.48	4.89	4.53
LQI		A++	A++	A++	A+	A+
Scoring taxa		20	19	26	19	19
Category		b	b	b	c	d
2002/3						
BMWP	119					
ASPT	5.95					
LQI	A++					
Scoring taxa	20					
Category	a					
2001/2						
BMWP	85					
ASPT	5.00					
LQI	A++					
Scoring taxa	17					
1999						
BMWP	75	82	90	102	68	99
ASPT	5.77	5.13	5.29	5.10	4.25	4.71
LQI	A+	A++	A++	A++	B	A+
Scoring taxa	13	16	17	20	16	21
Category	c	c	b	b	d	c
1997/8						
BMWP	63	97	89	85	93	96
ASPT	5.25	5.39	5.24	5.00	4.65	4.57
LQI	A+	A++	A++	A+	A+	A+
Scoring taxa	12	18	17	17	20	21
Category	c	b	b	b	c	c

Table 8. Annual variation, Rozel, 1997/8-2003/2004.

Biological water quality was indicated as excellent within this catchment, with the exception of Rozel SSI in 1999, which showed good water quality. Combined ASPT scores were generally above 5.00 for sites R5 –R2 and in the range 4.25 – 4.89 for sites Rozel SSI and R1. Rozel stream classification ranged from categories ‘d’ to ‘a’. Only site R5 forms part of the 36 sample survey.

### 3.9 Vaux de Lecq catchment, annual variation 1997/8 – 2002/3

Site	2202	2203	2204	2205	2206	2208
2002/3						
BMWP	99	103	70	59	70	99
ASPT	5.50	5.42	4.38	4.21	4.67	4.95
LQI	A++	A++	B	B	A	A+
Scoring taxa	18	19	16	14	15	20
Category	b	b	e	d	d	c
2001/2						
BMWP	96	104	87	78	55	75
ASPT	5.33	5.20	4.58	4.33	4.23	4.69
LQI	A++	A++	A+	B	B	A
Scoring taxa	18	20	19	18	13	16
1999						
BMWP	68	103	86	59	44	77
ASPT	4.86	5.42	4.53	4.54	4.00	4.53
LQI	A	A++	A+	A	D	A
Scoring taxa	14	19	19	13	11	17
Category	e	b	d	d	e	d
1997/8						
BMWP	91	100	70	64	40	*nd
ASPT	5.35	5.26	4.38	4.27	4.00	
LQI	A++	A++	B	B	D	
Scoring taxa	17	19	16	15	10	
Category	c	b	d	e	e	

Table 9. Annual variation, Vaux de Lecq, 1997/8-2002/3.

Combined seasonal BMWP scores ranged from 104 (2001/2002) to 40 (1997/8). ASPT values ranged from 4.00 (1997/8, 1999) to, 5.42 (1999). Sites 2202 and 2203 were the only sites to possess ASPT scores higher than 5.00. Site 2206 tended to provide lower annual ASPT scores than other sites, although in 2002/3 possessed a higher value than sites 2204 and 2205. Vaux de Lecq stream classification ranged from categories 'e' to 'b'. This catchment was not sampled in 2003/4.

Legend: \*nd No data available Spring 1998.

### 3.10 Waterworks Valley catchment, annual variation 1997/8 – 2002/3

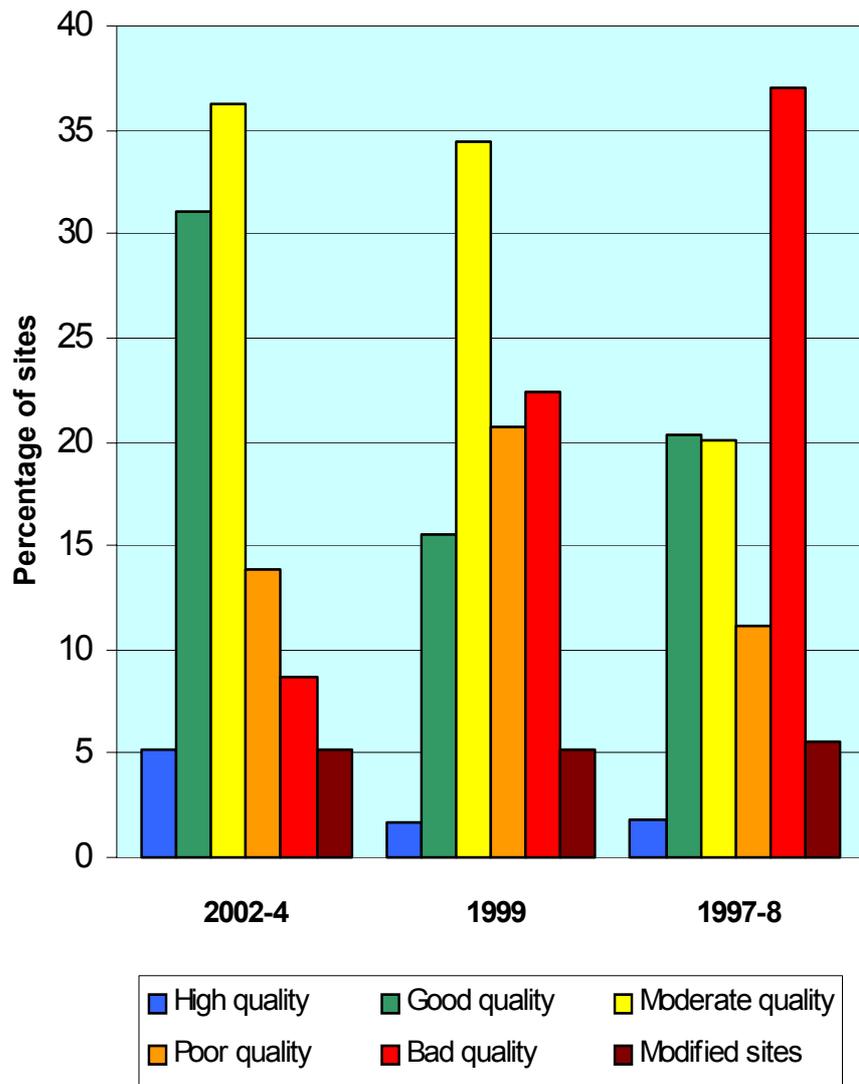
Site	W4	W3	W2	W1	Millbrook-SSI
2002/3					
BMWP	63	66	74	130	100
ASPT	4.50	4.13	4.93	5.91	4.76
LQI	A	B	A	A++	A+
Scoring taxa	14	16	15	22	21
Category	d	d	c	a	c
2001/2					
BMWP	63	*	42	97	99
ASPT	4.20		4.20	5.39	4.71
LQI	B		C	A++	A+
Scoring taxa	15		10	18	21
1999					
BMWP	62	81	38	99	53
ASPT	4.43	4.26	3.80	4.71	3.79
LQI	B	A	D	A+	C
Scoring taxa	14	19	10	21	14
Category	e	d	e	c	e
1997/8					
BMWP	48	42	36	99	47
ASPT	4.80	3.82	5.14	5.21	3.92
LQI	B	D	A	A++	D
Scoring taxa	10	11	7	19	12
Category	e	e	e	c	e

Table 10. Annual variation, Waterworks Valley, 1997/8-2002/3.

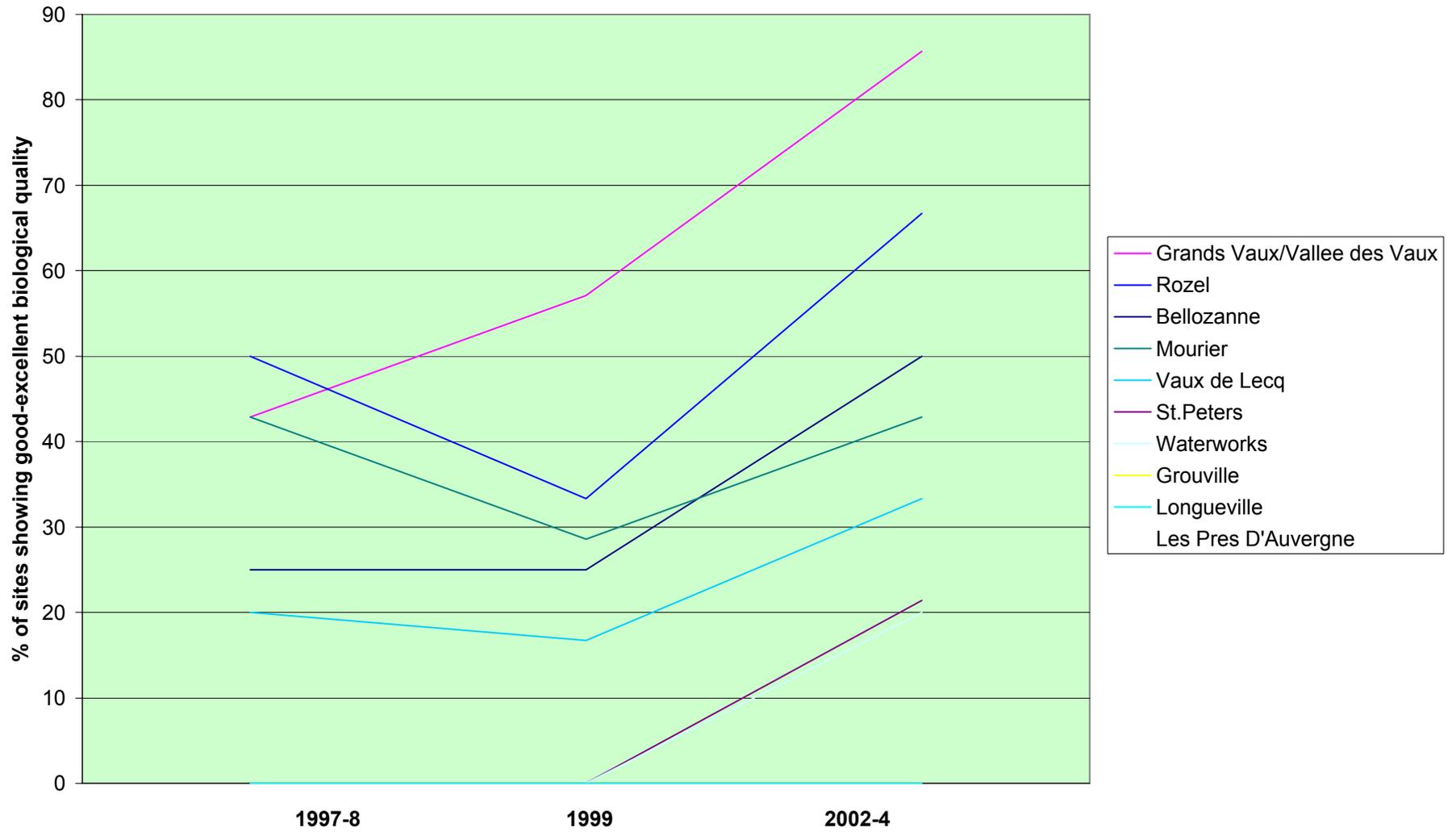
Legend: \* No data collected due to 'Foot and mouth' restrictions.

Combined seasonal BMWP scores ranged from 130 at site W1 (in seasons 2002/3, 1999 and 1997-8) to 36 site W2 (1997-8). ASPT values ranged from 5.91 to 3.79, the highest value occurring in 2002/3. The greatest variation in ASPT values occurred at site W2. Waterworks Valley stream classification ranged from categories 'e' to 'a'. This catchment was not sampled in 2003/4.

**Figure 1. Stream quality trends 1997/8  
- 2002-4**



Percentage of streams showing good or higher biological quality



Site	Annual ASPT	Average seasonal ASPT	Difference
2402	5.47	5.23	0.25
2403	5.00	4.66	0.34
2404	5.00	4.63	0.37
2406	4.79	4.45	0.34
2505	5.23	5.15	0.09
2506	5.05	4.96	0.09
2507	4.62	4.26	0.36
2502	5.42	4.89	0.53
GV-SSI	5.37	5.32	0.05
2504	5.14	4.78	0.36
VdeV-SSI	5.00	5.23	0.23
Grouville SSI	4.30	3.99	0.31
L2	4.11	3.83	0.28
L3	3.33	3.05	0.28
L4	3.79	3.52	0.27
L5	4.50	4.23	0.27
L5b	3.80	3.87	0.07
L5c	4.57	4.22	0.37
M1	4.62	4.33	0.29
M3	5.00	4.98	0.02
M4	5.33	5.23	0.10
M5	5.49	5.29	0.20
M6	5.57	5.33	0.24
M7	5.11	5.10	0.01
M8	5.00	4.58	0.42
LPD'A-SSI	4.67	4.77	0.10
LPD'A2	4.63	4.32	0.31
Tesson Mill	4.96	4.84	0.12
P13	4.76	4.63	0.13
P9	4.67	4.27	0.40
P9a	4.80	4.71	0.09
P8a	5.33	5.19	0.14
P7	4.80	4.36	0.44
P7a	5.62	5.63	0.01
P5	4.80	4.53	0.27
P5a	4.83	4.71	0.12
P4a	5.05	5.07	0.02
P4	4.86	4.94	0.12
P3	4.46	3.89	0.57
P2	4.54	4.25	0.29
P1	3.33	3.23	0.10
R5	5.95	5.89	0.06
R4	5.25	5.43	0.18
R3	5.39	5.36	0.03
R2	5.48	5.28	0.20
Rozel-SSI	4.89	4.55	0.34
R1	4.53	4.50	0.03
2202	5.50	5.17	0.33
2203	5.42	5.42	0.00
2204	4.38	4.39	0.01
2205	4.21	4.11	0.10
2206	4.67	4.17	0.50
2208	4.95	4.86	0.09
W4	4.50	3.95	0.55
W3	4.13	4.00	0.13
W2	4.93	4.28	0.65
W1	5.91	5.48	0.43
Millbrook SSI	4.76	4.41	0.35

Table 11. Comparison of Annual ASPT values and Average seasonal ASPT values (2002-2004 data).

## **4.0 Discussion**

### **4.1 Overview of Jersey biological water quality**

Biological water quality categories were calculated using the provisional States of Jersey stream classification for each of the sites. 58 sites were sampled in 2002-4 and 1999, 54 in 1997/8. Figure 1 shows change in water quality categories over the survey period. For each year approximately 5% of the sites were regarded as highly modified (Longueville L2, L3 and L4). In 1997/8 the dominant category was e (Bad biological water quality), which accounted for 37% of sites. Through 1999 to 2002-4 there was a continual drop in this category, in 2002-4 accounting for only 8.6% of sites. There was a concomitant rise in other water quality groups. Sites regarded as High quality, rose from one in 1997/8 to three in 2002-4. 31% of sites were regarded as good quality (the target Water Framework Directive quality), a rise from 20% in 1997/8 which dropped to 15.5% in 1999. 67% of sites were categorised as good or moderate in 2002-4 compared with 40% in 1997/8. These data demonstrate a dramatic increase in biological water quality for the Island.

The 2003 review of the Environment Agency for England and Wales stated that 95% of river were of good or fair quality (c.f. 90% in 1990). Fair is defined as “The biology shows considerable differences from that expected for an unpolluted river of this size, type and location. Sensitive families are scarce and contain only small numbers of individuals” and Good “The biology shows minor differences from Grade ‘a’ and falls a little short of that expected from an unpolluted river of this size, type and location. There may be a small reduction in the number of families that are sensitive to pollution, and a moderate increase in the number of individuals in the families that tolerate pollution (like worms and midges). This may indicate the first signs of organic pollution.” For Jersey, the equivalent figure would be 76% (classification categories ‘a’ – ‘c’), but the categories are not directly comparable; the Environment Agency category ‘fair’ is closer to our category ‘d’.

The latest reports of the Environment Agency, Scottish Environmental Protection Agency and Irish Scottish Environmental Protection Agency, all report increases in the amount of waters regularly monitored, and set targets for future expansion. The length of stream monitored for biological quality in Jersey has not changed from the 1997/8 figure. In keeping with the mainland, perhaps targets should be set for this.

### **4.2 Biological water quality by catchment**

#### **4.2.1 Bellozanne Valley**

The critical category to reach for any site is ‘b’, ‘Good biological quality’. Of the four sites monitored, 25% reached this category in 1997/8 and 1999 (site number 2402 and 2403 respectively) and both reached this category in 2002-4. Figure 2 demonstrates the percentage of streams showing good or higher water quality by catchment. This increase in water quality is also demonstrated by other parameters e.g. year on year increase in annual ASPT at sites 2402, 2404 and 2406. Site 2403 had an annual ASPT of 5.00 or above in all years.

Site 2404 had the first occurrence of Goeridae in Spring 2004, perhaps a result of the reduction in water fowl population, following the change in landuse in 1997. Site 2406 is the top site in the catchment, in a residential garden and arises from piped inflows, hence less available for colonisation than the other three sites.

#### 4.2.2 Grand Vaux/Vallee des Vaux catchment

The best catchment on the Island, with 86% of sites classified as good. The only site not so classified (2507), was category 'c', reflected in the lack of Group 1 BMWP taxa, which were possessed by all other sites in this catchment. With the exception of 2507 all sites possessed annual ASPT values of 5.00 and above in 2002-4.

Nevertheless, 2507 has shown a significant increase in water quality from samples taken in 1999 and 1997/8, when it was graded at 'e'. This site is fed from a reservoir approximately 20m upstream of this site and subject to severe siltation. Sensitive management off this reservoir will be important in maintaining and possibly improving the biological water quality of this site further.

#### 4.23 Grouville SSI

This was the only site sampled in the Queen's Valley catchment. In 2002-4 it achieved a biological water quality category 'd' (poor), which was an improvement over the category 'e' from 1997/8 and 1999.

Much of the site was silt covered, and although moderately taxa rich (16-17 taxa per season), contains most of the taxa from BMWP groups 7,8,9 i.e. low scoring taxa. WRS fieldsheets note poached areas, implying cattle use of this stream. Few aquatic macrophytes were present in this stream.

#### 4.2.4 Longueville catchment

Sites L2, L3 and L4 were regarded as highly modified sites. The channel consisted of a trapezoidal concrete structure, with raised square blocks on the base. The function of these sections is not known to the authors, but practically serve as an extended silt trap. Site L2 was not particularly taxon poor (15-16 taxa noted per season), but BMWP groups 7-9 predominate (although Sericostomatidae was recorded in Spring 2003). Site L3, upstream of L2 is species poor (9 recorded from each season in 2002/3). L4 has intermediate species richness and arises from a culverted area, hence has reduced opportunity for recolonisation. These sites would have achieved biological water quality category 'e'.

L5 lies upstream of L2-4 and had a biological water quality category of 'd', an improvement on 'e' in 1999. The 2002-3 annual ASPT was the highest recorded from this site and had it been 0.1 units higher, would have been a category 'c' waterbody. L5b and L5c were consistently graded at 'e' in all years, indeed have

shown no improvement from 1997/8 in any annual water quality parameters. Hence it is suggested that any resources should be directed at site L5 to increase biological water quality in this catchment.

Site L5b is a site in a cow-grazed valley. Poaching and siltation of the stream was recorded from the 2002/3 survey. It is taxon poor and in the past has allegedly been subject to milk spills from the nearby depot. The Landowner is open to quite radical changes in environmental management e.g. infilling the valley for landfill (with an accompanying reedbed area as ecological mitigation!). This is mentioned solely to emphasise that opportunities exist for in-stream improvement.

Site L5c is a slightly better site, and in Spring 2003 possessed an LQI of C (good water quality) and an ASPT > 4.0, with Sericostomatidae present. Again this stream is cattle grazed.

#### 4.2.5 La Vallee des Mouriers catchment

A good-moderate quality catchment, with all sites achieving at least biological water category 'c' and 43% of sites with a biological water quality of 'b' or higher (including one category a site, M6).

Site M1 (the spillway) was the poorest site of the catchment with an annual ASPT of 4.62 (all other sites at 5.00 or above). No improvement at this site has been shown since 1997/8. M3 was the second poorest site, which showed a drop in biological water quality since 1997/8 when it achieved category 'b'. Site M4 achieved category 'b' in 1999 and 2003/4, but achieved category 'a' in 1997/8. More taxa were found in 1997/8, and in 2003/4 it was the lower seasonal BMWP (and corresponding annual ASPT) which consigned it to this category. Site M5 achieved category 'b', as it did in 1999, an improvement on 1997/8. M6 was one of the three sites from the 2002-4 survey that was categorised as 'undisturbed' (rather at odds with the road running alongside it!). Previous surveys had categorised it as moderate to good, i.e. this is an improving site. In 2002/3 M6 possessed a good range of BMWP group 3, as well as Group 1 and 2 taxa. Sites M7 and M8 achieved category 'c' biological water quality; an improvement for site M8 (achieved 'e' in 1997/8) and a reduction in biological water quality for M7 which achieved category 'b' in 1997/8.

The priorities for this catchment are unclear, it could be argued that given sites M3 and M7 had achieved good biological water quality in previous years, these would most easily regain the target category 'b'. However, one could equally argue that as these sites were known to be able to reach good biological water quality, those sites which would benefit from greatest focus were M8 (an improving site) and M1 which may be close to its maximum biological water quality, but is not enhanced by the outfall from the desalination plant.

#### 4.2.6 Les Pres D'Auvergne catchment

Two sites have been monitored from this catchment, site LPD'A2 only from 1999.

LPD'A SSI showed an increase in biological water quality to category 'c' (moderate water quality) from 'd' in 1997/8 and 1999. There is a consistent increase in annual ASPT over this period.

Conversely LPD'A2 showed a decrease in biological water quality from 'd' in 1999 to 'e'. In 2003/4 this site was taxa poor. Only 4 taxa were found in Autumn 2003, compared with 12 in Autumn 1999.

#### 4.2.7 St. Peters Valley catchment

This is the most improved catchment on Jersey. No sites have dropped in quality since 1997/8, and with the exception of P1 and P9a, sites have shown a steady improvement in biological water quality. In 2002/3 21% of the sites showed 'good' biological water quality and 79% showed 'moderate' biological water quality or above. As contrast, in 1997/8 only 14% of sites showed biological water quality of 'moderate' or above and 64% of sites showed 'bad' biological water quality.

In the 2002-4 survey sites P8a, P7a and P4a, all tributaries of the main stream showed 'good' water quality. These were the first sites in the catchment to achieve this over the three periods considered in this report. Sites P3 and P1 were the only sites to show water qualities below 'c', giving values of 'd' and 'e' respectively. P3 showed an increase on both 1999 and 1997/8, P1 showed similar quality in these years. Site P9a showed a consistent category 'c' from the year 1997/8, 1999, 2002-4.

In determining a focus for further improvements to this catchment, high annual ASPT scores (>5.00) provide the opportunity for category 'b' waters. The highest non-category 'b' site was Tesson Mill. To check the potential of sites in this catchment only, biological classifications were calculated for 2001/2 results.

In 2001/2 Tesson Mill gained category 'b' (due to very high Spring water quality parameters). No further 'good' site could be identified. Site P4a only gained category 'c' in 2001/2, so perhaps awareness of past pollution sources should be maintained. It also occurred to the authors, that if tributaries could provide category 'b' waters, if upstream sites could be improved, then this should enhance quality of the lower sites. Regrettably the 2001/2 data could provide no further insight. From the 2002-4 survey, site P4 only failed to make category 'b' by an annual ASPT of 0.14, a result of low Autumn 2002 parameters; Spring parameters were similar to P4a.

One further point of note was that in 2001/2 site P1 was below category 'e' (i.e. undefined) for the provisional States of Jersey stream classification. Site P1 is not a highly modified stream site, it is a ditch. Should it be considered as one of the sites reviewed in the St. Peter's catchment?

#### 4.2.8 Rozel catchment

Rozel is another high quality catchment in which 67% of sites gained 'good' biological water quality or higher. Sites R4, R3 and R2 achieved category 'b' and site R5 gained category 'a'. In a sense the latter is anomalous given the continuing high conductivities (in excess of 1000 $\mu$ S in Autumn 2002) inflicted upon the biological community, but both seasons had superb biological water quality results.

Site Rozel SSI, a mixture of still and flowing waters gained 'c' moderate biological water quality, and site R1 gained category 'd' poor biological water quality. This was the lowest quality recorded for R1, a drop from both 1999 and 1997/8, however, had it possessed an annual ASPT of 0.07 units higher, it would have gained category 'c', as per other years.

Rozel shows some very consistent sites: R2 and R3 have possessed 'good' biological water quality since 1997/8. Site R4 achieved category 'b' in 1997/8, but dropped to 'c' in 1999 due to low Spring water quality parameters.

Priorities for this catchment include maintaining the high water quality for R5, which in other years has been category 'c'. R5 was originally included in the 36 site sample because of high conductivity measurements, at the time assumed to be due to agricultural run off. The WFD makes provision for water chemistry to moderate biological water quality. This stream is at risk of downgrading if the pollution is in the form of agricultural runoff, for which nitrate and phosphate maximum limits are defined. The source of high conductivity needs to be determined, and if confirmed as agricultural runoff, moderated. This would be expected to have benefits for sites downstream of R5.

Site R1 is partially affected by taxa that drift from Rozel SSI. No BMWP Group 1 taxa were found in R1 (although present in Rozel SSI), perhaps they do not survive the silted pond by the 'stepping stones' in Rozel SSI. Equally this could indicate intermittent organic pollution (alleged from R1 in the past). Perhaps this site should be added to the 36 site sample (with loss of P1? 2505?).

#### 4.2.9 Vaux de Lecq catchment

A catchment of variable water quality, with 50% of the sites possessing 'moderate' biological water quality or higher. Sites 2202 and 2203 possessed category 'b' good water quality.

With the exception of sites 2203 and 2204, sites in this catchment have increased in biological water quality over time. Site 2203 has maintained 'good' water quality since 1997/8. Site 2204 has decreased from 'poor' water quality (1997/8, 1999) to 'bad' water quality in 2002/3, by the simple expedient of the landowner relocating the stream bed in Autumn 2002. Spring 2003 showed colonisation by about half the expected taxa; leeches and snails notably absent.

#### 4.2.10 Waterworks Valley

The sites of the Waterworks Valley all showed improvement since the 1997/8 baseline (albeit some sites may have been of higher quality before this). The top sites of the catchment W3 and W4 have risen from 'bad' quality in 1997/8 to 'poor' quality in the 2002-4 survey. W2 rose from category 'e' in the 1997/8 and 1999, to 'c' in 2002/3. W1 rose from category 'c' in 1997/8 and 1999 to 'a' in 2002/3, and is probably the least 'disturbed' of the sites accredited with this classification. This site was particularly rich with BMWP Group 1-3 caddis in Spring 2003. Millbrook SSI increased from 'e' in 1997/8 and 1999 to 'c' in the 2002-4 survey, again primarily due to the presence of high scoring caddis taxa in Spring 2003.

Two foci for improvement are suggested for this catchment: further monitoring of W3, a site which in the past has been subject to silt-laden waters from dredging of ponds upstream. Site W2 has shown improvement, but has the capacity for much more. In 1996 this site had exposed gravel, not laden with the black (particulate carbon bearing?) silts that have been washed down from upstream. In 1996 this site had a higher BMWP than Millbrook SSI and a BMWP comparable with W1 (4.6 c.f. 4.9). This site should be restored to its former status (ideally on a 'polluter pays' principle).

### 4.3 The robustness of the provisional States of Jersey stream classification

In a sense any classification system used consistently will be able to monitor improvements from a baseline. The current classification is quite stringent in that 3 criteria have to be met before the appropriate classification is conferred. The criteria used are:

- (i) maximum seasonal BMWP score (based on LQI stream categories);
- (ii) LQI classifications (LQI categories are defined for both seasons for category 'a' streams);
- (iii) an annual ASPT score, which has been modified to take into account the inflation which arises in calculating the combined BMWP score, from which the annual ASPT is calculated.

The use of this classification has not resulted in an over-abundance of category 'a' sites which reflect "undisturbed conditions, and show no, or only very minor, evidence of distortion" (EEC, 2000). Neither has it refrained from categorising damaged or species poor sites as 'poor' or 'bad' quality. Nevertheless, the authors became aware during the calculation of classifications, that sometimes a site that passed the BMWP and LQI criteria, failed the annual ASPT criterion. This encouraged the authors to look more closely at the modification applied, and whether it had been overly strict.

The Scottish Environmental Protection Agency (SEPA) calculate an annual ASPT value, by the average of the two seasonal values, rather than based on the combined annual BMWP, with the attendant inflation of values. The provisional States of Jersey stream classification uses 'annual ASPT minus 0.5 units' to compensate for this inflation. 'Annual ASPT minus 0.5 units' arose as part of the calculation of Water Quality Objectives and was thus adopted for the classification. To determine whether the 0.5 units overcompensated for the inflated combined BMWP scores, a calculation of annual ASPT minus average seasonal ASPT is presented in table 11 using the 2002-4 survey results.

Table 11 shows that the majority of annual ASPT values have a positive increase from the seasonally averaged figure, therefore inflation of values exists. The difference between annual ASPT and seasonally averaged ASPT shows that there can be a wide variation between sites even in the same catchment. The difference between the two ASPT measures varies from 0.65 to 0.00. Therefore 3 sites (5% of the data set) lay outside the 0.5 unit modification and therefore could possibly bias the stream classification category upwards. If a value of 0.4 ASPT units were used, 14 sites (24% of the data set), could possibly bias the stream classification category upwards. Hence no change to the provisional classification is suggested, although it is recognised as conservative. That some sites meet two, but not all of the classification criteria imply that these are borderline sites, and inevitably such sites will occur when a classification based on categories is proposed.

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## **Appendices**

- Appendix A. BMWP values for each of the scoring taxon
- Appendix B. Jersey streams macroinvertebrate data 2003/4
- Appendix C. Provisional States of Jersey stream classification
- Appendix D. Water Quality Objectives for the 22 sites sampled 2003/4

## Appendix A. BMWP values for each of the scoring taxa

### Taxa with a value of 10:

Siphonuridae  
Heptageniidae  
Leptophlebiidae  
Ephemerellidae  
Potamanthidae  
Ephemeridae  
Taeniopterygidae  
Leuctridae  
Capniidae  
Perlodidae  
Perlidae  
Chloroperlidae  
Aphelocheiridae  
Phryganeidae  
Molannidae  
Beraeidae  
Odontoceridae  
Leptoceridae  
Goeridae  
Lepidostomatidae  
Brachycentridae  
Sericostomatidae

### Taxa with a value of 8:

Astacidae  
Lestidae  
Agriidae  
Gomphidae  
Cordulegasteridae  
Aeshnidae  
Corduliidae  
Libellulidae  
Psychomyiidae  
Ecnomidae  
Philopotamidae

### Taxa with a value of 7:

Caenidae  
Nemouridae  
Rhyacophilidae  
Glossosomatidae  
Polycentropodidae  
Limnephilidae

### Taxa with a value of 6:

Neritidae  
Viviparidae  
Ancylidae  
Acroloxidae  
Hydroptilidae  
Unionidae  
Corophiidae  
Gammaridae  
Crangonyctidae  
Platycnemidae  
Coenagriidae

### Taxa with a value of 5:

Mesovelidae  
Hydrometridae  
Gerridae  
Nepidae  
Naucoridae  
Notonectidae  
Pleidae  
Corixidae  
Haliplidae  
Hygrobiiidae  
Dytiscidae  
Noteridae  
Gyrinidae  
Hydrophilidae  
Hydraenidae  
Clambidae  
Scirtidae  
Dryopidae  
Elmidae  
Chrysomelidae  
Curculionidae  
Hydropsychidae  
Tipulidae  
Simuliidae  
Planariidae  
Dugesiidae  
Dendrocoelidae

### Taxa with a value of 4:

Baetidae  
Sialidae  
Piscicolidae

### Taxa with a value of 3:

Valvatidae  
Hydrobiidae Bithyniidae  
Lymnaeidae  
Physidae  
Planorbidae  
Sphaeriidae  
Glossiphoniidae  
Hirudinidae  
Erpobdellidae  
Asellidae

### Taxa with a value of 2:

Chironomidae

### Taxa with a value of 1:

Oligochaeta

## **Appendix B**

- Appendix B1 Annual review Bellozanne 2003/4
- Appendix B2 Annual review Grands Vaux 2003/4
- Appendix B3 Annual review Vallee des Vaux 2003/4
- Appendix B4 Annual review Grouville 2003/4
- Appendix B5 Annual review Les Pres D'Auvergne 2003/4
- Appendix B6 Annual review Mouriers 2003/4
- Appendix B7 Annual review Rozel 2003/4

## Appendix C Provisional States of Jersey stream classification

The provisional States of Jersey biological water quality categories are:

- a. A maximum BMWP score in range 101-120 (BMWP rating X=6), LQI categories showed at least A/A++ in both seasons (LQI 'excellent' in both seasons), Annual ASPT minus 0.5 ASPT units, of 5.0 or more.
- b. A maximum BMWP score in range 81-100 (BMWP rating X=5), at least one season showed an LQI categories of A++ (the stream has the capacity to reach the top 'excellence' category), an Annual ASPT minus 0.5 ASPT units  $\geq 4.50$ .
- c. A maximum BMWP score in range 51-80 (BMWP rating X=4), possessed at least one 'A' LQI category (the stream has the capacity to achieve the lowest 'excellence' rating), an Annual ASPT minus 0.5 ASPT units  $\geq 4.1$ .
- d. A maximum BMWP score in range 51-80 (BMWP rating X=4), possessed at least one 'B' LQI category (the stream has the capacity to achieve at least 'good' LQI water quality), an Annual ASPT minus 0.5 ASPT units  $\geq 3.8$ .
- e. A maximum BMWP score in range 25-50 (BMWP rating X=3), possessed at least one 'E' LQI category (the stream has the capacity to achieve at least 'moderate' LQI water quality), an Annual ASPT minus 0.5 ASPT units  $< 3.8$ .
- x. A highly modified site.

## Appendix D Water quality objectives for 22 sites sampled 2003/4

Site	WQO range (ASPT value) based on 2003/4 data	ASPT value Autumn 2003	ASPT value Spring 2004
2402	4.97-5.47	5.00	5.47
2403	4.50-5.00	4.22*	5.11
2404	4.50-5.00	4.94	4.33*
2406	4.29-4.79	4.73	4.17*
2502	4.92-5.42	4.36*	5.42
GV SSI	4.87-5.37	5.17	5.47
2504	4.64-5.14	4.57*	5.00
2506	4.55-5.05	4.82	5.11
2507	4.12-4.62	4.11*	4.41
VdeV SSI	4.50-5.00	5.08	5.38
Grouville SSI	3.80-4.30	3.69*	4.29
LPD1	4.17-4.67	5.00	4.53
LPD2	4.13-4.63	4.00*	4.63
M1	4.12-4.62	4.67	4.00
M3	4.50-5.00	4.88	5.09
M4	4.83-5.33	5.47	5.00
M5	4.97-5.47	5.40	5.19
R1	4.03-4.53	4.43	4.56
R2	4.98-5.48	5.17	5.38
R3	4.89-5.39	5.44	5.27
R4	4.75-5.25	5.33	5.53
Rozel SSI	4.39-4.89	4.43	4.67

\* indicates sites not meeting WQO

## Appendix B1

<b>Appendix B1a Annual review Bellozanne 2003/4</b>							
M'INVERT.TAXON	2402 Aut 2003	2402 Spr 2004	2402 Combined		2403 Aut 2003	2403 Spr 2004	2403 Combined
<u>Group 1 Taxa</u>							
EphemereIIDae							
Goeridae	1	1	1				
Lepidostomatidae		1	1				
Seriocostomatidae	1	1	1			1	1
<u>Group 2 Taxa</u>							
Cordulegasteridae						1	1
Aeshnidae							
Philopotamidae							
<u>Group 3 Taxa</u>							
Nemouridae							
Rhyacophilidae		1	1			1	1
Polycentropodidae	1	1	1		1	1	1
Limnephilidae		1	1			1	1
<u>Group 4 Taxa</u>							
Ancylidae							
Gammaridae	1	1	1		1	1	1
Coenagruidae						1	1
<u>Group 5 Taxa</u>							
Corixidae							
Haliplidae							
Dytiscidae							
Hydrophilidae						1	1
Elmidae	1	1	1		1	1	1
Hydropsychidae		1	1			1	1
Tipulidae	1	1	1			1	1
Simuliidae					1	1	1
Planariidae	1	1	1		1	1	1
<u>Group 6 Taxa</u>							
Baetidae		1	1		1	1	1
<u>Group 7 Taxa</u>							
Hydrobiidae						1	1
Lymnaeidae							
Physidae							
Planorbidae					1		1
Sphaeriidae	1	1	1			1	1
Glossiphoniidae						1	1
Erpobdellidae	1	1	1				
Asellidae	1	1	1				
<u>Group 8 Taxa</u>							
Chironomidae	1	1	1		1	1	1
<u>Group 9 Taxa</u>							
Oligochaeta	1	1	1		1	1	1
BMWP Score	60	93	93		38	97	100
Total Taxon No.	12	17	17		9	19	20
ASPT	5	5.47	5.47		4.22	5.11	5
LQI	A+	A++	A++		C	A++	A++

## Appendix B1 (cont.)

Appendix B1a Annual review Bellozanne 2003/4							
MTINVERT.TAXON	2404	2404	2404		2406	2406	2406
	Aut 2003	Spr 2004	Combined		Aut 2003	Spr 2004	Combined
<u>Group 1 Taxa</u>							
EphemereIIDae							
Goeridae	1		1				
Lepidostomatidae							
Seriocostomatidae	1		1		1		1
<u>Group 2 Taxa</u>							
Cordulegasteridae							
Aeshnidae							
Psychomyiidae		1	1				
Philopotamidae							
<u>Group 3 Taxa</u>							
Nemouridae							
Rhyacophilidae	1	1	1		1		1
Polycentropodidae	1		1				
Limnephilidae						1	1
<u>Group 4 Taxa</u>							
Ancylidae					1	1	1
Gammaridae	1	1	1		1	1	1
Coenagriidae							
<u>Group 5 Taxa</u>							
Nepidae	1		1				
Corixidae							
Hydrophilidae							
Elmidae	1	1	1		1	1	1
Hydropsychidae	1	1	1				
Tipulidae	1	1	1				
Simuliidae		1	1				
Planariidae	1	1	1		1	1	1
Dendrocoelidae						1	1
<u>Group 6 Taxa</u>							
Baetidae	1	1	1		1	1	1
<u>Group 7 Taxa</u>							
Hydrobiidae		1	1				
Lymnaeidae							
Planorbidae							
Sphaeriidae	1	1	1			1	1
Glossiphoniidae	1	1	1		1	1	1
Erpobdellidae	1	1	1		1	1	1
Asellidae	1		1				
<u>Group 8 Taxa</u>							
Chironomidae	1	1	1		1	1	1
<u>Group 9 Taxa</u>							
Oligochaeta	1	1	1		1	1	1
BMWP Score	84	65	100		52	50	67
Total Taxon No.	17	15	20		11	12	14
ASPT	4.94	4.33	5		4.73	4.17	4.79
LQI	A+	B	A++		A	C	A

## Appendix B2

Appendix B2 Annual review Grands Vaux 2003/4							
M'INVERT.TAXON	2502	2502	2502		GV SSI	GV SSI	GV SSI
	Aut 2003	Spr 2004	Combined		Aut 2003	Spr 2004	Combined
<u>Group 1 Taxa</u>							
Ephemerellidae		1	1			1	1
Goeridae		1	1		1	1	1
Seriocostomatidae	1	1	1		1	1	1
<u>Group 2 Taxa</u>							
Agridae		1	1		1	1	1
Cordulegasteridae							
Psychomyiidae						1	1
Philopotamidae							
<u>Group 3 Taxa</u>							
Nemouridae							
Rhyacophilidae	1	1	1				
Polycentropodidae							
Limnephilidae		1	1			1	1
<u>Group 4 Taxa</u>							
Ancylidae		1	1				
Gammaridae	1	1	1		1	1	1
Coenagriidae					1		1
<u>Group 5 Taxa</u>							
Corixidae							
Haliplidae							
Hygrobiidae							
Dytiscidae							
Elmidae	1	1	1		1	1	1
Hydropsychidae		1	1				
Tipulidae	1	1	1		1	1	1
Simuliidae		1	1			1	1
Planariidae							
<u>Group 6 Taxa</u>							
Baetidae		1	1			1	1
<u>Group 7 Taxa</u>							
Hydrobiidae	1	1	1		1	1	1
Lymnaeidae							
Physidae							
Planorbidae							
Sphaeriidae	1	1	1		1	1	1
Glossiphoniidae	1	1	1		1		1
Erpobdellidae						1	1
Asellidae	1	1	1			1	1
<u>Group 8 Taxa</u>							
Chironomidae	1	1	1		1	1	1
<u>Group 9 Taxa</u>							
Oligochaeta	1	1	1		1	1	1
BMWP Score	48	103	103		62	93	102
Total Taxon No.	11	19	19		12	17	19
ASPT	4.36	5.42	5.42		5.17	5.47	5.37
LQI	C	A++	A++		A+	A++	A++

## Appendix B3

Appendix B3a Annual review Vallee de Vaux 2003/4									
M'INVERT.TAXON	2504 Aut 2003	2504 Spr 2004	2504 Combined	2506 Aut 2003	2506 Spr 2004	2506 Combined	2507 Aut 2003	2507 Spr 2004	2507 Combined
<u>Group 1 Taxa</u>									
EphemereIIDae									
Goeridae		1	1	1	1	1			
Seriocostomatidae				1	1	1			
<u>Group 2 Taxa</u>									
Agriidae	1		1						
Cordulegasteridae		1	1						
Aeshnidae							1		1
Psychomyiidae					1	1			
Philopotamidae								1	1
<u>Group 3 Taxa</u>									
Rhyacophilidae	1	1	1	1	1	1		1	1
Polycentropodidae	1	1	1						
Limnephilidae		1	1		1	1		1	1
<u>Group 4 Taxa</u>									
Ancylidae		1	1	1		1			
Gammaridae	1	1	1	1	1	1	1	1	1
Coenagriidae							1	1	1
<u>Group 5 Taxa</u>									
Mesovelidae								1	1
Nepidae	1	1	1					1	1
Notonectidae							1		1
Corixidae							1	1	1
Haliplidae							1		1
Hydrophilidae							1		1
Elmidae	1	1	1	1	1	1		1	1
Hydropsychidae		1	1	1	1	1			
Tipulidae		1	1	1	1	1	1	1	1
Simuliidae	1	1	1	1	1	1		1	1
Planariidae	1	1	1	1	1	1	1	1	1
<u>Group 6 Taxa</u>									
Baetidae	1	1	1		1	1	1	1	1
<u>Group 7 Taxa</u>									
Hydrobiidae				1	1	1	1	1	1
Lymnaeidae				1		1	1	1	1
Planorbidae							1	1	1
Sphaeriidae	1	1	1	1	1	1	1	1	1
Glossiphoniidae		1	1	1	1	1	1	1	1
Erpobdellidae	1	1	1	1	1	1	1	1	1
Asellidae	1	1	1				1	1	1
<u>Group 8 Taxa</u>									
Chironomidae	1	1	1	1	1	1	1	1	1
<u>Group 9 Taxa</u>									
Oligochaeta	1	1	1	1	1	1	1	1	1
BMWP Score	64	100	108	82	92	101	78	97	120
Total Taxon No.	14	20	21	17	18	20	19	22	26
ASPT	4.57	5	5.14	4.82	5.11	5.05	4.11	4.41	4.62
LQI	A	A++	A++	A+	A++	A++	B	A	A++

## Appendix B3 (cont.)

<b>Appendix B3b Annual review Vallee de Vaux 2003/4</b>			
M'INVERT.TAXON	VdeV SSI Aut 2003	VdeV SSI Spr 2004	VdeV SSI Combined
<u>Group 1 Taxa</u>			
Ephemerellidae			
Goeridae	1	1	1
Lepidostomatidae			
Seriocostomatidae	1	1	1
<u>Group 2 Taxa</u>			
Cordulegasteridae			
Aeshnidae			
Philopotamidae			
<u>Group 3 Taxa</u>			
Nemouridae			
Rhyacophilidae	1	1	1
Polycentropodidae		1	1
Limnephilidae			
<u>Group 4 Taxa</u>			
Ancylidae		1	1
Gammaridae	1	1	1
Coenagriidae			
<u>Group 5 Taxa</u>			
Corixidae			
Haliplidae			
Hydrophilidae			
Elmidae	1	1	1
Hydropsychidae	1	1	1
Tipulidae		1	1
Simuliidae	1	1	1
Planariidae	1	1	1
<u>Group 6 Taxa</u>			
Baetidae	1	1	1
<u>Group 7 Taxa</u>			
Hydrobiidae	1		1
Lymnaeidae			
Physidae			
Planorbidae			
Sphaeriidae		1	1
Glossiphoniidae			
Erpobdellidae	1	1	1
Asellidae		1	1
<u>Group 8 Taxa</u>			
Chironomidae	1	1	1
<u>Group 9 Taxa</u>			
Oligochaeta	1		1
BMWP Score	66	86	90
Total Taxon No.	13	16	18
ASPT	5.08	5.38	5
LQI	A+	A++	A++

## Appendix B4

<b>Appendix B4 Annual review Grouville 2003/4</b>			
M'INVERT.TAXON	Grouville SSI Aut 2003	Grouville SSI Spr 2004	Grouville SSI Combined
<u>Group 1 Taxa</u>			
Ephemerellidae			
Goeridae			
Seriocostomatidae		1	1
<u>Group 2 Taxa</u>			
Cordulegasteridae			
Aeshnidae			
Philopotamidae			
<u>Group 3 Taxa</u>			
Nemouridae			
Rhyacophilidae			
Polycentropodidae			
Limnephilidae		1	1
<u>Group 4 Taxa</u>			
Ancyliidae			
Gammaridae	1	1	1
Coenagriidae			
<u>Group 5 Taxa</u>			
Notonectidae	1		1
Corixidae	1	1	1
Haliplidae			
Dytiscidae	1		1
Hydrophilidae			
Elmidae		1	1
Hydropsychidae			
Tipulidae	1	1	1
Simuliidae		1	1
Planariidae	1	1	1
<u>Group 6 Taxa</u>			
Baetidae	1	1	1
<u>Group 7 Taxa</u>			
Hydrobiidae	1	1	1
Lymnaeidae	1	1	1
Physidae	1		1
Planorbidae			
Sphaeriidae	1	1	1
Glossiphoniidae	1	1	1
Erpobdellidae	1	1	1
Asellidae	1	1	1
<u>Group 8 Taxa</u>			
Chironomidae	1	1	1
<u>Group 9 Taxa</u>			
Oligochaeta	1	1	1
BMWP Score	59	73	86
Total Taxon No.	16	17	20
ASPT	3.69	4.29	4.3
LQI	C	B	A

## Appendix B5

Appendix B5 Annual review Les Pres D'Auvergne 2003/4							
M'INVERT.TAXON	LPD1	LPD1	LPD1		LPD2	LPD2	LPD2
	Aut 2003	Spr 2004	Combined		Aut 2003	Spr 2004	Combined
<u>Group 1 Taxa</u>							
Ephemereillidae							
Goeridae							
Seriocostomatidae							
<u>Group 2 Taxa</u>							
Cordulegasteridae	1	1	1				
Aeshnidae							
Psychomyiidae						1	1
Philopotamidae							
<u>Group 3 Taxa</u>							
Nemouridae							
Rhyacophilidae	1	1	1			1	1
Polycentropodidae	1	1	1		1	1	1
Limnephilidae							
<u>Group 4 Taxa</u>							
Ancylidae	1	1	1				
Gammaridae		1	1		1	1	1
Coenagriidae							
<u>Group 5 Taxa</u>							
Mesovelidae	1		1				
Notonectidae	1		1				
Corixidae	1		1				
Dytiscidae							
Hydrophilidae	1		1				
Elmidae	1	1	1				
Hydropsychidae	1	1	1				
Tipulidae	1		1				
Simuliidae	1		1				
Planariidae		1	1				
<u>Group 6 Taxa</u>							
Baetidae	1	1	1				
<u>Group 7 Taxa</u>							
Hydrobiidae	1	1	1				
Lymnaeidae							
Physidae							
Planorbidae							
Sphaeriidae		1	1			1	1
Glossiphoniidae							
Erpobdellidae		1	1				
Asellidae	1	1	1			1	1
<u>Group 8 Taxa</u>							
Chironomidae	1	1	1		1	1	1
<u>Group 9 Taxa</u>							
Oligochaeta		1	1		1	1	1
BMWP Score	80	68	98		16	37	37
Total Taxon No.	16	15	21		4	8	8
ASPT	5	4.53	4.67		4	4.63	4.63
LQI	A+	A	A+		E	B	B

## Appendix B6

Appendix B6a Annual review Mouriers 2003/4							
MTINVERT.TAXON	M1	M1	M1		M3	M3	M3
	Aut 2003	Spr 2004	Combined		Aut 2003	Spr 2004	Combined
<u>Group 1 Taxa</u>							
Ephemereillidae							
Goeridae							
Seriocostomatidae	1		1		1	1	1
<u>Group 2 Taxa</u>							
Cordulegasteridae					1	1	1
Aeshnidae							
Philopotamidae							
<u>Group 3 Taxa</u>							
Nemouridae							
Rhyacophilidae					1	1	1
Polycentropodidae	1	1	1		1		1
Limnephilidae						1	1
<u>Group 4 Taxa</u>							
Ancylidae	1	1	1				
Gammaridae	1	1	1		1		1
Coenagriidae							
<u>Group 5 Taxa</u>							
Hydrometridae					1		1
Corixidae							
Dytiscidae							
Hydrophilidae					1		1
Elmidae	1		1		1	1	1
Hydropsychidae							
Tipulidae	1		1		1	1	1
Simuliidae					1	1	1
Planariidae	1		1				
<u>Group 6 Taxa</u>							
Baetidae		1	1				
<u>Group 7 Taxa</u>							
Hydrobiidae	1	1	1		1	1	1
Lymnaeidae							
Physidae							
Planorbidae							
Sphaeriidae	1	1	1		1	1	1
Glossiphoniidae							
Erpobdellidae	1		1		1		1
Asellidae					1		1
<u>Group 8 Taxa</u>							
Chironomidae	1	1	1		1	1	1
<u>Group 9 Taxa</u>							
Oligochaeta	1	1	1		1	1	1
BMWP Score	56	32	60		78	56	85
Total Taxon No.	12	8	13		16	11	17
ASPT	4.67	4	4.62		4.88	5.09	5
LQI	A	D	A		A	A+	A++

## Appendix B6 (cont.)

Appendix B6b Annual review Mouriers 2003/4							
MTINVERT.TAXON	M4	M4	M4		M5	M5	M5
	Aut 2003	Spr 2004	Combined		Aut 2003	Spr 2004	Combined
<u>Group 1 Taxa</u>							
EphemereIIDae							
Goeridae	1		1		1		1
Seriocostomatidae	1	1	1		1	1	1
<u>Group 2 Taxa</u>							
Cordulegasteridae	1	1	1				
Psychomyiidae					1		1
Philopotamidae							
<u>Group 3 Taxa</u>							
Nemouridae	1	1	1			1	1
Rhyacophilidae	1		1		1	1	1
Polycentropodidae	1	1	1		1	1	1
Limnephilidae		1	1			1	1
<u>Group 4 Taxa</u>							
Ancylidae		1	1			1	1
Gammaridae	1	1	1		1	1	1
Coenagriidae							
<u>Group 5 Taxa</u>							
Corixidae							
Dytiscidae							
Hydrophilidae							
Elmidae	1	1	1		1	1	1
Hydropsychidae	1		1				
Tipulidae	1	1	1		1	1	1
Simuliidae	1	1	1		1	1	1
Planariidae	1	1	1		1	1	1
<u>Group 6 Taxa</u>							
Baetidae	1	1	1		1	1	1
<u>Group 7 Taxa</u>							
Hydrobiidae	1	1	1		1		1
Lymnaeidae							
Physidae							
Planorbidae							
Sphaeriidae	1	1	1			1	1
Glossiphoniidae		1	1				
Erpobdellidae		1	1		1	1	1
Asellidae							
<u>Group 8 Taxa</u>							
Chironomidae	1	1	1		1	1	1
<u>Group 9 Taxa</u>							
Oligochaeta	1	1	1		1	1	1
BMWP Score	93	90	112		81	83	104
Total Taxon No.	17	18	21		15	16	19
ASPT	5.47	5	5.33		5.4	5.19	5.47
LQI	A++	A++	A++		A++	A++	A++

## Appendix B7

Appendix B7a Annual review Rozel 2003/4									
	R1	R1	R1	R2	R2	R2	R3	R3	R3
M'INVERT.TAXON	Aut 2003	Spr 2004	Combined	Aut 2003	Spr 2004	Combined	Aut 2003	Spr 2004	Combined
<u>Group 1 Taxa</u>									
Ephemerellidae									
Goeridae				1	1	1	1	1	1
Seriocostomatidae				1	1	1	1	1	1
<u>Group 2 Taxa</u>									
Agriidae	1	1	1		1	1	1		1
Cordulegasteridae				1		1	1		1
Aeshnidae									
Psychomyiidae					1	1			
Philopotamidae				1		1			
<u>Group 3 Taxa</u>									
Nemouridae									
Rhyacophilidae	1		1		1	1		1	1
Polycentropodidae		1	1		1	1			
Limnephilidae	1	1	1	1	1	1	1	1	1
<u>Group 4 Taxa</u>									
Ancylidae		1	1	1	1	1			
Gammaridae	1	1	1	1	1	1	1	1	1
Coenagriidae									
<u>Group 5 Taxa</u>									
Corixidae									
Dytiscidae				1		1			
Hydrophilidae							1		1
Elmidae	1	1	1	1	1	1	1	1	1
Hydropsychidae				1	1	1	1	1	1
Tipulidae		1	1		1	1	1	1	1
Simuliidae	1	1	1		1	1		1	1
Planariidae	1	1	1	1	1	1	1	1	1
<u>Group 6 Taxa</u>									
Baetidae		1	1		1	1	1	1	1
<u>Group 7 Taxa</u>									
Hydrobiidae	1	1	1	1	1	1	1	1	1
Lymnaeidae									
Physidae									
Planorbidae	1		1						
Sphaeriidae	1	1	1	1	1	1		1	1
Glossiphoniidae	1	1	1	1	1	1	1	1	1
Erpobdellidae	1		1	1		1			
Asellidae	1	1	1	1	1	1			
<u>Group 8 Taxa</u>									
Chironomidae		1	1	1	1	1	1		1
<u>Group 9 Taxa</u>									
Oligochaeta	1	1	1	1	1	1	1	1	1
BMWP Score	62	73	86	93	113	137	87	79	102
Total Taxon No.	14	16	19	18	21	25	16	15	19
ASPT	4.43	4.56	4.53	5.17	5.38	5.48	5.44	5.27	5.39
LQI	B	A	A+	A++	A++	A++	A++	A+	A++

## Appendix B7 (cont.)

Appendix B7b Annual review Rozel 2003/4							
M'INVERT.TAXON	R4	R4	R4		Rozel SSI	Rozel SSI	Rozel SSI
	Aut 2003	Spr 2004	Combined		Aut 2003	Spr 2004	Combined
<u>Group 1 Taxa</u>							
Ephemerellidae							
Goeridae	1	1	1			1	1
Lepidostomatidae							
Seriocostomatidae	1	1	1		1	1	1
<u>Group 2 Taxa</u>							
Cordulegasteridae					1		1
Aeshnidae							
Philopotamidae							
<u>Group 3 Taxa</u>							
Nemouridae							
Rhyacophilidae	1	1	1				
Polycentropodidae	1		1				
Limnephilidae	1	1	1			1	1
<u>Group 4 Taxa</u>							
Ancylidae		1	1				
Gammaridae	1	1	1		1	1	1
Coenagriidae							
<u>Group 5 Taxa</u>							
Hydrometridae						1	1
Corixidae					1		1
Dytiscidae					1		1
Hydrophilidae							
Elmidae	1	1	1		1		1
Hydropsychidae	1	1	1				
Tipulidae	1	1	1		1	1	1
Simuliidae	1	1	1				
Planariidae	1	1	1			1	1
<u>Group 6 Taxa</u>							
Baetidae	1	1	1			1	1
<u>Group 7 Taxa</u>							
Hydrobiidae	1	1	1		1	1	1
Lymnaeidae							
Physidae							
Planorbidae							
Sphaeriidae					1	1	1
Glossiphoniidae		1	1		1	1	1
Erpobdellidae	1		1		1	1	1
Asellidae	1		1		1	1	1
<u>Group 8 Taxa</u>							
Chironomidae	1	1	1		1	1	1
<u>Group 9 Taxa</u>							
Oligochaeta	1		1		1	1	1
BMWP Score	96	83	105		62	70	93
Total Taxon No.	18	15	20		14	15	19
ASPT	5.33	5.53	5.25		4.43	4.67	4.89
LQI	A++	A++	A++		B	A	A+