

Contents

I HEALTH AND WATER QUALITY

1 Health Aspects of Water Supplies in Tropical Countries	3
<i>David J. Bradley</i>	
1.1 The Need for Understanding Health Aspects	3
1.2 The Ways in which Water Supplies Affect Health	5
1.3 Classification of Water-related Infections	6
1.4 Water-borne Diseases	9
1.5 Water-washed Diseases	12
1.6 Water-based Diseases	13
1.7 Water-related Insect Vectors of Disease	14
1.8 Diseases of Defective Sanitation	15
1.9 Conclusion	16
1.10 References	17
2 The Health Implications of Irrigation Schemes and Man-made Lakes in Tropical Environments	18
<i>David J. Bradley</i>	
2.1 Introduction	18
2.2 Health Protection for Project Staff and Labourers	19
2.3 Health Risks to Displaced People and Immigrants	20
2.4 Vector-borne Diseases	21
2.5 References	29
3 Microbiological Criteria for Tropical Water Quality	30
<i>Lilian M. Evison and A. James</i>	
3.1 Introduction	30
3.2 Microbiology of Natural Waters in Hot Climates	31
3.3 Microbiology of Abstracted Waters in Hot Climates	37
3.4 Concluding Remarks	49
3.5 References	49
4 Surface Water Quality Criteria for Tropical Developing Countries	52
<i>M. B. Pescod</i>	
4.1 Introduction	52
4.2 Water and Wastewater Quality Criteria	52

4.3	Characteristics and Assimilation Capacity of Tropical Surface Waters	54
4.4	Major Water Uses and Quality Constraints	56
4.5	Rational Water and Wastewater Quality Criteria	60
4.6	The Technology of Water Pollution Control	67
4.7	Pollution Control Policy Alternatives	70
4.8	Conclusions	71
4.9	References	72

II WATER SUPPLIES FOR LOW-INCOME COMMUNITIES

5	Water Supplies for Low-income Communities: Resource Allocation, Planning and Design for a Crisis Situation	75
	<i>Richard G. Feachem</i>	
5.1	The Nature of the Crisis	75
5.2	The Need for Defined Goals	76
5.3	The Need for Complementary Inputs	78
5.4	The Design Benefit Concept	79
5.5	The Water Collection Journey	80
5.6	Water-related Diseases	81
5.7	The Quality-Quantity Dilemma	85
5.8	Risk-taking Design	91
5.9	Applications of the Method	92
5.10	References	95
6	Patterns of Domestic Water Use in Low-income Communities	96
	<i>Anne U. White</i>	
6.1	Volume of Domestic Water Use	96
6.2	The Population Involved	98
6.3	Settlement Patterns	98
6.4	Water Use in Different Types of Community	101
6.5	Factors Affecting Water Use Patterns	108
6.6	References	111
7	Water Supply and Community Choice	113
	<i>Anne Whyte and Ian Burton</i>	
7.1	Introduction	113
7.2	Community Frames of Reference	115
7.3	The Role of Water in the Community	121
7.4	Community Choice	124
7.5	Conclusion: The Design of User-choice Schemes	127
7.6	References	129

8 The Economics of Community Water Supply	130
<i>Ian Carruthers and David Browne</i>	
8.1 Introduction	130
8.2 Status of Water Supplies	131
8.3 Key Economic Concepts	133
8.4 Sectoral Allocations, Objectives and Criteria	136
8.5 Benefits of Rural Water Supplies	137
8.6 Cost-Benefit and Cost-effectiveness Analysis	143
8.7 Appropriate Standards and Design Criteria	144
8.8 Selection Criteria	152
8.9 Questions Raised by Self-help	155
8.10 Finance of Water Supplies	156
8.11 References	160
9 Water Treatment in Developing Countries	162
<i>John Pickford</i>	
9.1 Why Treat Water?	162
9.2 Water Fit for Use	163
9.3 Impurities in Raw Water	166
9.4 Protection and Treatment at Source and Intake	169
9.5 Storage and Sedimentation	175
9.6 Aeration	178
9.7 Filtration	181
9.8 Disinfection	185
9.9 Plans and Programmes	188
9.10 References	190

III INSTITUTIONAL DEVELOPMENT

10 Institutional Development for Sanitation and Water Supply	195
<i>Michael G. McGarry</i>	
10.1 Background	195
10.2 Urban Sanitation and Water Supplies	196
10.3 Manpower Development	198
10.4 Health and Conditions of the Rural Poor	200
10.5 Village Sanitation and Water Supply	202
10.6 Primary Health Care and the Improvement of Rural Sanitation	207
10.7 Conclusions	210
10.8 References	211
11 Progress in the Rural Water Programmes of Latin America	213
<i>David Donaldson</i>	
11.1 Introduction	213

11.2	Current Goals and Approaches	215
11.3	Current and Future Problems	223
11.4	References	227

IV SANITATION

12	Sanitation and Low-cost Housing	231
	<i>Gerrit van R. Marais</i>	
12.1	Introduction	231
12.2	Determination of 'Housing' Needs	235
12.3	Evaluation of Sanitation Systems	236
12.4	Conclusions	238
12.5	References	238
13	Waste Collection in Hot Climates: A Technical and Economic Appraisal	239
	<i>Michael G. McGarry</i>	
13.1	Introduction: The Problem	239
13.2	Why Sanitation?	239
13.3	Approach to Design	241
13.4	Rural Sanitation	243
13.5	Urban Wastewater Collection	248
13.6	The Technology Choice: An Economic Comparison	259
13.7	Conclusions	262
13.8	References	263
14	Wastewater Treatment in Hot Climates	264
	<i>D. D. Mara</i>	
14.1	Introduction	264
14.2	Principles of Waste Treatment	266
14.3	Waste Stabilization Ponds	269
14.4	Aerated Lagoons	276
14.5	Oxidation Ditches	278
14.6	Process Selection	280
14.7	Nightsoil Treatment	282
14.8	References	282
15	Entomological and Helminthological Aspects of Sewage Treatment in Hot Climates	284
	PART A—Insect Breeding in Relation to Sanitation and Waste Disposal	284
	<i>B. R. Laurence</i>	
15.1	Introduction	284

15.2	The Identification of Flies	285
15.3	The Life History of Flies	286
15.4	The Families of Flies Associated with Waste Disposal	287
15.5	Other Insects	294
15.6	Control Measures	294
15.7	References	296

**PART B—Helminthological Aspects of Sewage Treatment in Hot
Climates 299**

Mark Shephard

15.8	Introduction	299
15.9	General Biology of Helminths	299
15.10	The Transmission of Helminths	301
15.11	The Effect of Sewage Treatment	303
15.12	The Agricultural Utilization of Sewage	307
15.13	The Possibilities of Control	308
15.14	References	309

Rural Sanitation: Editorial Introduction

16 Problems of Village Sanitation in India 312

R. N. Shelat and M. G. Mansuri

16.1	Introduction	312
16.2	Survey of Existing Conditions	313
16.3	Problems of Village Sanitation	314
16.4	Excreta Collection, Treatment and Disposal	317
16.5	Conclusions	319
16.6	Reference	319

17 Solid Waste in Hot Climates 320

John Pickford

17.1	Introduction	320
17.2	Solid Waste Data	320
17.3	The Effects of Solid Waste Mismanagement	325
17.4	On-site Storage and Collection	328
17.5	Treatment and Disposal of Refuse	331
17.6	Land Reclamation by Controlled Tipping	334
17.7	Composting	339
17.8	Other Treatment Processes	341
17.9	Conclusions	342
17.10	References	343

V EFFLUENT RE-USE AND RECLAMATION

18 Domestic Wastes as an Economic Resource: Biogas and Fish Culture	347
<i>Michael G. McGarry</i>	
18.1 The Biogas Plant	347
18.2 The Reclamation Fish Pond	355
18.3 Biogas Bibliography	363
18.4 Fish Culture Bibliography.. .. .	363
19 Public Health Considerations in Wastewaters and Excreta Re-use for Agriculture	365
<i>H. I. Shuval</i>	
19.1 Introduction	365
19.2 Types of Contaminants	366
19.3 Health Aspects of Various Types of Agricultural Re-use ..	369
19.4 Summary and Conclusions	379
19.5 References	380
20 Planning and Construction of Wastewater Reclamation Schemes as an Integral Part of Water Supply	383
<i>G. J. Stander and A. J. Clayton</i>	
20.1 Introduction	383
20.2 Internal Re-use of Water by Industries	384
20.3 Reclamation of Effluents	386
20.4 Conclusions.. .. .	390
Index	393