

Appropriate Disposal of Sewage in Urban and Suburban Sri Lanka.

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The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

Abstract

This study was aimed at identifying, adapting and evaluating appropriate, cost-effective technologies, in the field, for urban and suburban sewage disposal systems in Sri Lanka. Septic tanks, anaerobic filters, horizontal flow reed beds, infiltration - percolation beds and vertical flow planted gravel filters were adapted and evaluated, at field-scale, as potential technologies to be used as primary, secondary, and tertiary unit processes. The categories considered were individual houses, housing schemes, tourist hotels, schools and halls of residence, and daytime occupancy buildings. A total of 36 full-scale treatment systems were designed, spanning all of the categories under consideration for real situations in the field. 28 full-scale systems were built and evaluated for performance, reliability of operation and treatment, user satisfaction and cost. Maintenance issues and appropriateness of application were found to be key factors in the medium to long-term success of the systems as well as design issues. Anaerobic filters were found to be robust, and reliable for all the categories under consideration for secondary treatment of septic tank effluent for surface discharge, or for reuse after tertiary treatment. Horizontal flow reed beds and vertical flow planted gravel filters were found to be applicable for secondary treatment of septic tank effluent in certain, specific situations. Percolation beds and vertical flow planted gravel filters were found to be appropriate and cost-effective as tertiary treatment unit processes for treatment of effluents for on-site reuse for gardening, toilet flushing and vehicle washing. Specific area requirements have been reduced by almost 80 percent, to the order of 0.2 m²/ p.e., with appropriate adaptation. A case has been established for the cost-effectiveness of these systems for on-site reuse, particularly for tourist hotels, with a potential cost recovery of 13 percent of capital cost per annum. Guidelines for the appropriate selection, design and implementation of these systems are proposed for each of the target categories.

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Table of Contents

Abstract	i
Acknowledgements	ii
Table of Contents	iii
List of Figures	ix
List of Tables	xii
List of Plates	xiv
Abbreviations	xvii
1. INTRODUCTION	1
1.1. Sri Lanka	1
1.1.1. Relief and drainage	1
1.1.2. Climate	3
1.1.3. Population and demography.....	6
1.1.4. Urban settlements.....	8
1.1.5. Housing	10
1.1.6. Government and Authorities.....	11
1.2. Sewage disposal in Sri Lanka	12
1.2.1. Existing situation.....	12
1.2.2. Regulatory trends	12
1.2.3. Public sector trends	13
1.2.4. Private sector trends	14
1.3. Aims and objectives	15
1.3.1. Identification of appropriate technologies	16
1.3.2. Implementation	17
1.3.3. Evaluation and monitoring.....	17
1.3.4. Cost analysis	18
1.4. Scope.....	19
2. REVIEW OF SELECTED TECHNOLOGIES	20
2.1. Introduction.....	20
2.2. Septic tanks.	21
2.2.1. Background	21
2.2.2. Physical description	22
2.2.3. Design	23

2.2.4.	Setback distances	26
2.2.5.	Materials and construction	27
2.2.6.	Influent characteristics and loading	27
2.2.7.	Effluent characteristics and treatment efficiency	29
2.2.8.	Operation and maintenance	30
2.2.9.	Advantages and disadvantages	32
2.3.	Anaerobic filters	33
2.3.1.	Background	33
2.3.2.	Physical description	34
2.3.3.	Design	35
2.3.4.	Setback distances	35
2.3.5.	Materials and construction	36
2.3.6.	Influent characteristics and loading	36
2.3.7.	Effluent characteristics and treatment efficiency	36
2.3.8.	Operation and maintenance	38
2.3.9.	Advantages and disadvantages	38
2.4.	Horizontal flow reed beds	39
2.4.1.	Background	39
2.4.2.	Physical description	39
2.4.3.	Design	40
2.4.4.	Setback distances	43
2.4.5.	Materials and construction	44
2.4.6.	Influent characteristics and loading	44
2.4.7.	Effluent characteristics and treatment efficiency	44
2.4.8.	Operation and maintenance	46
2.4.9.	Advantages and disadvantages	47
2.5.	Infiltration-percolation beds	47
2.5.1.	Background	47
2.5.2.	Physical description	47
2.5.3.	Design	48
2.5.4.	Setback distance	50
2.5.5.	Materials and construction	50
2.5.6.	Influent characteristics and loading	50
2.5.7.	Effluent characteristics and treatment efficiency	51

2.5.8.	Operation and maintenance.....	51
2.5.9.	Advantages and disadvantages.....	51
2.6.	Vertical flow planted gravel filters (VGPGF's).....	52
2.6.1.	Background	52
2.6.2.	Physical description	52
2.6.3.	Design	53
2.6.4.	Setback distances	54
2.6.5.	Materials and construction.....	54
2.6.6.	Influent characteristics and loading	54
2.6.7.	Effluent characteristics and treatment efficiency.....	54
2.6.8.	Operation and maintenance.....	55
2.6.9.	Advantages and disadvantages.....	55
3.	EXPERIMENTAL FULL SCALE SYSTEMS	56
3.1.	Introduction.....	56
3.2.	Design	57
3.2.1.	Site visits	57
3.2.2.	Conceptual design.....	60
3.2.3.	Unit process design	60
3.2.4.	Optimisation.....	66
3.3.	Construction and commissioning.....	66
3.4.	Monitoring and evaluation program	67
3.5.	Hotels and restaurants	68
3.5.1.	The Swiss Residence.....	68
3.5.2.	Devon hotel	73
3.5.3.	Devon Rest.....	76
3.5.4.	Hotel Thilanka.....	79
3.5.5.	Ivy Banks	88
3.5.6.	Kings Park.....	91
3.5.7.	Coral Sands	95
3.5.8.	Hotel Suisse.....	98
3.5.9.	Wattles Inn	100
3.5.10.	Summary of hotel treatment systems	101
3.6.	Houses.....	104
3.6.1.	Kadugannawa.....	104

3.6.2.	Nugegoda	107
3.6.3.	Nawala	108
3.6.4.	Kelaniya	109
3.6.5.	Talwatte.....	109
3.6.6.	Moratuwa	110
3.6.7.	Summary of individual house systems.....	110
3.7.	Housing schemes.....	111
3.7.1.	Ranpokunugama.....	112
3.7.2.	Luisawatte	113
3.7.3.	Ceylinco Leisure	117
3.7.4.	Poorwarama	118
3.7.5.	Summary of treatment systems for housing schemes	119
3.8.	Schools and halls of residence	120
3.8.1.	Ladyhill	120
3.8.2.	Akbar-Nell Hall.....	122
3.8.3.	Jayathileke Hall.....	125
3.8.4.	Kal Eliya	125
3.8.5.	Summary of systems for schools and Halls of residence.....	126
3.9.	Day-time occupancy buildings.....	127
3.9.1.	Avanhala	127
3.9.2.	Sampath Hall.....	129
3.9.3.	Seeduwa warehouse and showroom complex.....	131
3.9.4.	Engineering library complex.....	132
3.9.5.	PGIA library and auditorium complex.....	133
3.9.6.	Ceylon Cold Stores factory complex	135
3.9.7.	Summary of systems for day-time occupancy buildings	136
4.	RESULTS AND DISCUSSION	137
4.1.	Introduction.....	137
4.2.	The Swiss Residence, System 1	137
4.2.1.	Plant performance	137
4.2.2.	Unit process performance	141
4.2.3.	Operation and maintenance.....	142
4.3.	The Swiss Residence, System 2.....	145
4.3.1.	Plant performance	145

4.3.2.	Operation and maintenance.....	148
4.4.	Akbar - Nell Hall.....	149
4.4.1.	Plant performance	149
4.4.2.	Operation and maintenance.....	159
4.5.	Ladyhill Hall	165
4.5.1.	Plant performance	165
4.5.2.	Operation and maintenance.....	167
4.6.	Devon Rest.....	167
4.6.1.	Plant performance	167
4.6.2.	Operation and maintenance.....	171
4.7.	Kadugannawa.....	172
4.7.1.	Plant performance	172
4.7.2.	Operation and maintenance.....	175
4.8.	Other Treatment systems.....	177
4.8.1.	Hotels	177
4.8.2.	Housing Schemes.....	181
4.8.3.	Houses.....	184
4.8.4.	Schools and Halls of Residence	185
4.8.5.	Day-time occupancy buildings.....	185
4.9.	System Costs	186
4.9.1.	Hotels	186
4.9.2.	Houses.....	193
4.9.3.	Housing Schemes.....	195
4.9.4.	Schools and Halls of Residence	196
4.9.5.	Day-time occupancy buildings.....	199
4.10.	Unit process costs.....	200
4.10.1.	Septic tanks	200
4.10.2.	Anaerobic filters.....	203
4.10.3.	Reed beds, percolation beds and VFPGF's.....	206
4.11.	Comparison of unit process costs and actual system costs.....	207
4.12.	Evaluation of unit processes.....	208
4.12.1.	Septic tanks	208
4.12.2.	Anaerobic filters.....	211
4.12.3.	Reed beds	212

4.12.4.	Percolation beds	213
4.12.5.	VFPGF's	215
5.	CONCLUSIONS AND RECOMMENDATIONS	218
5.1.	Introduction	218
5.2.	Unit Processes	218
5.2.1.	Septic tanks	218
5.2.2.	Anaerobic filters	219
5.2.3.	Reed beds	221
5.2.4.	Percolation beds	222
5.2.5.	VFPGF's	222
5.3.	Treatment systems	223
5.3.1.	Hotel systems	226
5.3.2.	Individual houses	229
5.3.3.	Housing schemes	230
5.3.4.	Schools and Halls of Residence	231
5.3.5.	Day-time occupancy buildings	231
5.4.	Appurtenances	232
5.4.1.	Access manholes	232
5.4.2.	Dosing siphons	233
5.4.3.	Foot valves	234
5.5.	Implementation	235
5.5.1.	Materials	235
5.5.2.	Construction	236
5.5.3.	Commissioning	238
5.5.4.	Operation and maintenance	240
5.6.	Effluent standards	240
5.7.	Future work	243
6.	REFERENCES	244

List of Figures

Figure 1-1. Relief and drainage map of Sri Lanka.....	2
Figure 1-2. Average annual rainfall in Sri Lanka	4
Figure 1-3. Average annual temperatures in Sri Lanka ³	5
Figure 1-4. Population density by administrative districts in Sri Lanka.....	7
Figure 1-5. Distribution of settlements in Sri Lanka which are currently classified as ‘urban’	9
Figure 2-1 Schematic section of a septic tank.....	22
Figure 2-2 Schematic section of an anaerobic filter.....	34
Figure 2-3 Schematic section through a reed bed.	40
Figure 2-4 Schematic section through a buried percolation bed.....	48
Figure 2-5 Schematic section through a VFPGF.	53
Figure 3-1. Legend for process flow diagrams	68
Figure 3-2. Process flow diagrams for The Swiss Residence treatment systems	69
Figure 3-3. Process flow diagram of Devon Hotel treatment system	73
Figure 3-4. Process flow diagram for the Devon Rest treatment system.....	76
Figure 3-5. Process flow diagrams for Hotel Thilanka wastewater treatment systems	80
Figure 3-6. Process flow diagram for Ivy Banks wastewater treatment system	89
Figure 3-7. Process flow diagram for Kings Park treatment system.....	91
Figure 3-8. Process flow diagram for Coral Sands Hotel treatment system.	95
Figure 3-9. Process flow diagram for Hotel Suisse treatment system.	99
Figure 3-10. Process flow diagram for Wattles Inn treatment system.	101
Figure 3-11. Process flow diagram for the Kadugannawa house treatment system	104
Figure 3-12. Process flow diagram for the Nugegoda house treatment system.....	108
Figure 3-13. Process flow diagram for the Nawala house treatment system.	108
Figure 3-14. Process flow diagram for Kelaniya house treatment system.....	109
Figure 3-15. Process flow diagram for the Talwatte house treatment system.	110
Figure 3-16. Process flow diagram for the Moratuwa house treatment system.....	110
Figure 3-17. Process flow diagrams for the Ranpokunugama treatment systems. ..	112
Figure 3-18. Process flow diagram for Luisawatte treatment systems.	114
Figure 3-19. Process flow diagram for the Ceylinco treatment systems.....	118
Figure 3-20. Process flow diagram for Poorwarama treatment system.	118

Figure 3-21. Process flow diagram for Ladyhill treatment system.....	120
Figure 3-22. Process flow diagram for Akbar-Nell Hall treatment system.	122
Figure 3-23. Process flow diagram for Jayathileke Hall treatment system.....	125
Figure 3-24. Process flow diagram for Kal Eliya treatment system.	126
Figure 3-25. Process flow diagram for Avanhala treatment system.	127
Figure 3-26. Process flow diagram for Sampath Hall treatment system.....	130
Figure 3-27. Process flow diagram for the Seeduwa treatment system.	132
Figure 3-28. Process flow diagram for the Engineering Library complex treatment system.....	132
Figure 3-29. Process flow diagram of the PGIA treatment system.....	133
Figure 3-30. Process flow diagram of the Ceylon Cold Stores treatment system. ..	136
Figure 4-1. Performance characteristics of The Swiss Residence treatment system.	139
Figure 4-2. Performance characteristics of the Swiss Residence Anaerobic filter. .	141
Figure 4-3. BOD ₅ removal by the Swiss Residence Percolation bed.	142
Figure 4-4. BOD ₅ removal by the VFPGF unit during phase 1.	146
Figure 4-5. BOD ₅ removal by the VFPGF unit during phase 2.....	147
Figure 4-6. Graph of removal efficiency vs. pH for the VFPGF unit.....	147
Figure 4-7. Current configuration of Swiss Residence treatment systems.	149
Figure 4-8. Wastewater flow through the reed bed system.....	150
Figure 4-9. Flow characteristics of the individual reed bed channels.....	151
Figure 4-10. Comparison of design and actual hydraulic loading rates.....	153
Figure 4-11. Comparison of design and actual organic loading rates.....	153
Figure 4-12. Comparison of design and actual specific areas of the reed beds.	154
Figure 4-13. Variation of BOD ₅ concentration in Channel 3 over a four-month period.	154
Figure 4-14. Variation of BOD ₅ concentration in Channel 2 over a four-month period.	155
Figure 4-15. Overall performance of the system in terms of BOD removal.....	155
Figure 4-16. BOD removal efficiencies for the reed bed system.....	156
Figure 4-17. Performance of the reed beds in terms of Suspended Solids.	157
Figure 4-18. Variation of turbidity through the reed bed stages.....	158
Figure 4-19. Long-term performance of the Ladyhill anaerobic filter.....	165
Figure 4-20. Suspended solids concentrations for the Ladyhill anaerobic filter.....	166

Figure 4-21. BOD ₅ values for the Devon Rest treatment system.	168
Figure 4-22. Suspended Solids values for the Devon Rest treatment system.....	169
Figure 4-23. Removal efficiencies of the anaerobic filter unit	170
Figure 4-24. BOD ₅ performance of the Kadugannawa treatment system.....	173
Figure 4-25. Suspended solids performance of the Kadugannawa system.....	173
Figure 4-26. Removal efficiencies of the Kadugannawa treatment units	174
Figure 4-27. Plot of system cost vs. p.e. excluding septic tanks.....	191
Figure 4-28. Plot of system cost vs. p.e. including septic tanks	192
Figure 4-29. Comparison of specific implementation costs of hotel systems.....	192
Figure 4-30. Specific costs for individual house systems	194
Figure 4-31. specific costs for housing schemes.....	196
Figure 4-32. Specific costs for schools and halls of residence	198
Figure 4-33. Specific costs for daytime occupancy buildings	200
Figure 4-34. Variation of cost with p.e. for different types of septic tanks	201
Figure 4-35. Variation of cost vs. p.e. for brick septic tanks	202
Figure 4-36. Variation of cost vs. p.e. for concrete septic tanks.....	203
Figure 4-37. Variation of cost vs. p.e. for brick anaerobic filters	204
Figure 4-38. Variation of cost vs. p.e. for concrete anaerobic filters.....	204
Figure 4-39. Variation of specific cost with p.e. for brick anaerobic filters	205
Figure 4-40. Variation of specific cost with p.e. for concrete anaerobic filters.....	206
Figure 4-41. Plot of estimated and actual system costs vs. p.e. including septic tanks.	207
Figure 4-42. Plot of estimated and actual system cost vs. p.e. excluding septic tanks.	207
Figure 4-43. Variation of tank volume with p.e. for different design methods.	209
Figure 4-44. Comparison of specific volume variation with emptying cycle.....	210
Figure 4-45. Percentage of tank volume allocated for sludge storage vs. p.e.....	211
Figure 5-1. Comparison of costs for secondary treatment units with land valued at SLR 2000/m ²	224
Figure 5-2. Cost comparison of secondary treatment units with land valued at SLR 4000/ m ²	225
Figure 5-3. Recommended flow process for hotel systems	228
Figure 5-4. Annual value of hotel effluent available for reuse vs. p.e.....	229

List of Tables

Table 1-1. Classification of river basins by catchment area	3
Table 1-2. Selected housing statistics for 1981 and 1994.....	10
Table 2-1. Comparison of some Codes of Practice for septic tank design.	25
Table 2-2. Some examples of setback requirements for septic tanks in the US.	27
Table 2-3. Comparison of ‘typical’ wastewater characteristics from individual residences in the US	28
Table 2-4. ‘Typical’ physical and chemical parameters of septic tank effluents.....	30
Table 2-5. Typical desludging frequencies for septic tanks in Europe.....	31
Table 2-6. Comparison of anaerobic filter performance for domestic sewage treatment.....	37
Table 2-7. Typical treatment that could be expected by reed beds for secondary treatment of septic tank effluents in Sri Lanka.	46
Table 3-1. Example of flow estimation worksheet for tourist hotels.....	61
Table 3-2. Example of the worksheet for septic tank design.	62
Table 3-3. Example worksheet for anaerobic filter design	63
Table 3-4. Example worksheet for VFPGF’s and Percolation beds	64
Table 3-5. Example worksheet for Reed bed design.....	65
Table 3-6. Summary information of hotel wastewater treatment systems.....	102
Table 3-7. Summary of treatment systems for individual houses.....	111
Table 3-8. Summary of treatment systems for housing schemes.....	119
Table 3-9. Summary information of treatment systems for schools and halls of residence.....	126
Table 3-10. Summary of information on treatment systems for daytime occupancy buildings.....	136
Table 4-1. Comparison of design and actual loading rates for the Akbar- Nell reed beds	152
Table 4-2. Implementation costs of hotel treatment systems.....	187
Table 4-3. Implementation costs of hotels adjusted for purposes of comparison....	188
Table 4-4. Implementation costs for individual houses	193
Table 4-5. Implementation costs for housing schemes	195
Table 4-6. Implementation costs for schools and housing schemes	198
Table 4-7. Implementation costs for day-time occupancy buildings.....	199

Table 4-8. Cost of septic tanks in thousands of SLR's	202
Table 4-9. Cost in thousands of SLR's for anaerobic filters of varying HRT	205
Table 5-1. Basis for estimating design flow for hotel systems.	227
Table 5-2. Tolerance limits for selected quality parameters prescribed by Sri Lanka Standards	241

List of Plates

Plate 3-1. Main entrance to The Swiss Residence with treated effluent being used for gardening.....	70
Plate 3-2. Service access to the Swiss Residence under which system 1 units are located, with treated effluent being used for vehicle washing.....	71
Plate 3-3. Excavation for the VFPGF unit for system 2 during construction stage...	72
Plate 3-4. The VFPGF unit after commissioning.....	72
Plate 3-5. View of the hotel forecourt area under which the treatment units are located	74
Plate 3-6. A view of the hotel building.	75
Plate 3-7. Laying of the percolation bed during the construction phase.....	75
Plate 3-8. Hotel entrance and driveway during construction of the anaerobic filter unit.	77
Plate 3-9. The anaerobic filter unit during construction.	78
Plate 3-10. A view of the driveway after construction was completed.....	78
Plate 3-11. Steep terrain behind office block where VFPGF units of System 1 were located.	82
Plate 3-12. Area where the lower VFPGF unit was located prior to construction....	82
Plate 3-13. A view of the same area with the VFPGF unit in place, prior to planting.	83
Plate 3-14. The VFPGF unit after establishment of vegetation and commissioning.	83
Plate 3-15. The second VFPGF during construction.	84
Plate 3-16. The combined septic tank – anaerobic filter unit during construction under a parking area.....	84
Plate 3-17. The same parking area soon after construction of the septic tank – anaerobic filter unit.	85
Plate 3-18. The treated effluent from System 1 being reused for gardening.	85
Plate 3-19. The VFPGF unit of System 2 under construction.....	86
Plate 3-20. Influent dosing in progress soon after commissioning	87
Plate 3-21. The VFPGF unit after complete establishment of vegetation.....	87
Plate 3-22. The treated effluent being reused for gardening.....	88
Plate 3-23. The combined septic tank-anaerobic filter unit during construction	90
Plate 3-24. The percolation bed being laid under the garage floor.	90

Plate 3-25. A view of the hotel building	92
Plate 3-26. The cover slab of the anaerobic filter being laid during construction	93
Plate 3-27. The same area after construction and relaying of the lawn.	93
Plate 3-28. The VFPGF unit immediately after commissioning.....	94
Plate 3-29. The VFPGF unit a few weeks after commissioning.....	94
Plate 3-30. View of the hotel building on the seaward side of the road.	96
Plate 3-31. Combined septic tank-anaerobic filter unit nearing the end of construction	97
Plate 3-32. The VFPGF unit with the bed partially laid.	97
Plate 3-33. The VFPGF unit soon after planting.....	98
Plate 3-34. A view of Hotel Suisse.	99
Plate 3-35. The treatment units under construction.	100
Plate 3-36. Site for treatment units prior to commencement of construction	105
Plate 3-37. The constructed treatment system prior to commissioning	106
Plate 3-38. The reed bed unit one year after commissioning.....	106
Plate 3-39. The percolation bed unit after conversion to a VFPGF.....	107
Plate 3-40. The anaerobic filter unit at Ranpokunugama after commissioning.....	113
Plate 3-41. Luisawatte housing scheme under construction	115
Plate 3-42. A septic tank unit under construction	115
Plate 3-43. One of the reed bed systems during early stages of construction.....	116
Plate 3-44. A simplified sewer line being laid.	116
Plate 3-45. House connections with removable cleaning doors during installation.	117
Plate 3-46. A view of Ladyhill staff hostel	121
Plate 3-47. The anaerobic filter unit.....	121
Plate 3-48. One of the reed bed stages at Akbar-Nell, soon after construction.	123
Plate 3-49. A vegetated reed bed channel at Akbar-Nell.....	124
Plate 3-50. A septic tank under construction outside one of the dormitory wings. .	124
Plate 3-51. The combined septic tank-anaerobic filter under construction.....	128
Plate 3-52. The raised access manholes of the septic tank-anaerobic filter.	129
Plate 3-53. The anaerobic filter under construction at Sampath Hall.	130
Plate 3-54. The entrance forecourt after completion of construction.....	131
Plate 3-55. A view of the Library complex.....	133
Plate 3-56. A view of the PGIA Library complex with the anaerobic filter beside it.	134

Plate 3-57. The discharge point of the PGIA anaerobic filter.....	135
Plate 4-1. A typical effluent sample from system 1 compared to tap water.	140
Plate 4-2. The new arrangement of the effluent collector pipes being laid.....	144
Plate 4-3. The percolation bed being re-laid with stone chips.	144
Plate 4-4. The gravel road beside the system waterlogged with leaking sewage from the beds.	160
Plate 4-5. An unvegetated reed bed channel with inlet zone clogging.	161
Plate 4-6. A completely clogged reed bed channel.	161
Plate 4-7. The biomat layer soon after releasing the stagnant water.....	162
Plate 4-8. The reed stems a couple of days after planting.....	163
Plate 4-9. A close up view of the fully vegetated bed with no sign of biomat formation.	163
Plate 4-10. The effluent discharge elbows in a poor state of repair.	164
Plate 4-11. The excavation for the percolation bed intersecting the black soil layer.	172
Plate 4-12. The Kadugannawa reed bed with the open outlet tray.....	176
Plate 4-13. A typical effluent sample from the Thilanka treatment system.....	178
Plate 4-14. The Ranpokunugama reed beds after eight months of operation.	182
Plate 4-15. A close up view of the clogged area of the reed bed.	183
Plate 4-16. A view of the channel immediately after clearing the clogged area.....	184
Plate 5-1. A typical inspection port.....	233
Plate 5-2. Dosing siphons fabricated with plastic barrels.	234
Plate 5-3. Bed media being washed by immersion in water.	236
Plate 5-4. The assembled liner being placed in the excavation for the bed.	237
Plate 5-5. A retaining wall being built to protect a VFPGF unit.	238
Plate 5-6. Visible bubbling of the water surface in an anaerobic filter.....	239

Abbreviations

AF	Anaerobic filter
BOD	Biochemical oxygen demand
BOD ₅	5-day biochemical oxygen demand
CFU	Colony-forming unit
COD	Chemical oxygen demand
GBP	Pounds Sterling
HLR	Hydraulic loading rate
HRT	Hydraulic retention time
KST	Kitchen septic tank
MST	Main septic tank
NTU	Nephelometric turbidity unit
OLR	Organic loading rate
Pax	Catered guests in restaurants and hotels
PB	Percolation bed
P.E.	Population equivalent
PVC	Poly-vinyl chloride
uPVC	Un-plasticised poly-vinyl chloride
RB	Reed bed
RBC	Rotating biological contactor
SS	Suspended solids
SLR	Sri Lankan Rupees
SLS	Sri Lankan Standard
UASB	Upflow anaerobic sludge blanket reactor
UK	United Kingdom
US	United States of America
USD	US Dollars
VFPGF	Vertical flow planted gravel filter