Reservoir engineering: guidelines for practice

Edward M Gosschalk



Contents

	Preface	ix
	Acknowledgements	xi
Part I. Co	onceptual and planning practice for reservoirs	1
Chapter 1.	Introduction and philosophy of approach	3
	Introduction	3
	Background	3
	Disciplines needed	4
	Constraints on training and experience	5
	The Engineering thread	6
	Mode of work	8
	The need for mutual understanding	9
	The roles of empirical and theoretical methods	10
	References	13
Chapter 2.	Objectives	15
-	The purposes of reservoirs	15
	The engineering planning of reservoirs	17
	Plan of work	19
	Reference	21
Chapter 3.	Selection of potential dam sites and conceptual	
	schemes	23
	Appraisal of data and formulation of possible	
	projects	23
	Prefeasibility studies	29
	Choice of dam type	35
	Choice of size of dam	42
	References	44

Chapter 4.	Investigation of selected sites and geological studies	45
_	Site investigations	45
	Methods	47
	Conclusion	61
	References	61
Chapter 5.	Hydraulic studies	63
	Introduction	63
	Past experience	64
	Analytical methods	66
	Computational models	67
	Physical models	71
	Bibliography	81
Chapter 6.	Hydrological studies	83
	Background	83
	Deterministic methods	84
	Flood studies	86
	Droughts	97
	References	99
	Addendum to Chapter 6: Guidelines from the	
	United States of America	100
Chapter 7.	Spillways	101
	Intensity of flood flow to be provided for The effect of type of dam on type of spillway	101
	needed	105
	Energy dispersal	111
	References	115
	Further reading	116
Chapter 8.	River diversions during construction	117
	Intensity of flood discharge to be provided for	117
	Methods of river diversion	118
	Closure of river diversions on completion	120
Chapter 9.	Seismic loading	123
-	The relevance of seismic risk to dams in the UK The Engineering Guide to Seismic Risk to Dams	123
	in the United Kingdom	128
	Peak ground accelerations for design in relation	0
	to factors of safety and accelerations liable to	
	be suffered	131

	Case histories of seismic incidents Conclusions from case histories on improving	136
	the earthquake resistance of dams	159
	Conclusion	161
	References	162
	Further reading	163
Part II. D	evelopment practice for reservoirs	165
Chapter 10.	Water conduits for reservoirs	167
	Purposes	167
	Types	167
	Routing	174
	Permissible velocities of flow	178
	Tunnel lining	179
	Steel lining in tunnels	181
	Grouting in tunnels	182
	Final tunnel cross section	182
	References	183
Chapter 11.	Tunnelling problems and excavation of shafts	185
	Low stresses in rock surround	185
	Two more case histories	191
	Methods of excavating shafts	195
	Concluding remarks on tunnelling problems	197
	Reference	198
Chapter 12.	Electro-mechanical equipment and controls	199
	Introductory remarks	199
	Turbines	200
	Generators	207
	Transformers	207
	Main travelling cranes	208
	Transmission systems	210
	Hydraulic valves and gates	211
	References	218
Chapter 13.	Environmental considerations	219
	Introduction	219
	Overview of the arguments for more large reservoir	
	projects	223
	Dams and development — the World Commission	
	on Dams	226

	Environmental impact assessments	229
	References	238
Chapter 14.	Costs and benefits	241
enupter i ti	General	241
	Cost estimates	242
	Principles of project appraisal	247
	References	254
Chapter 15.	Efficient management for irrigation	255
•	Introduction	255
	The meaning of efficiency	256
	Planning for efficiency and control	258
	Basic criteria	261
	Water requirements	261
	Water distribution systems	263
	Balancing storages	264
	Sources of water supply	265
	Analysis	266
	Control	266
	Forecasting	267
	Planned water shortages	268
	Final design and economic analysis	269
	References	269
Chapter 16.	Small hydropower	271
	Introduction	271
	Criteria for successful development	272
	Sound planning and design	273
	Multiple development	274
	Operation at optimum load factor	275
	Conjunctive operation	276
	The needs for small hydropower	276
	Different users	279
	Classifying and selecting small hydro schemes	283
	Conclusions	287
	Further information	288
	References	288
Chapter 17.	Safety and inspection of reservoirs	289
	Introduction	289
	The Reservoirs Act 1975	291
	Proposed changes	298

	Reviews by panels of experts Remedial works References	299 300 303
Chapter 18.	Operation and maintenance, monitoring and	
-	inspection	305
	General	305
	Final construction report	305
	Operating and maintenance instructions	306
	Monitoring and inspection	308
	Training and staffing	310
	Potential unforeseen human, mechanical and	
	electronic problems	311
	Investigation and solution of leakage problems	
	observed during inspections	313
	Other problems	315
	References	316
	Index	327
	••	