

# Reservoir Sedimentation Handbook



**DESIGN AND MANAGEMENT OF  
DAMS, RESERVOIRS, AND WATERSHEDS  
FOR SUSTAINABLE USE**

Gregory L. Morris • Jiahua Fan

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# RESERVOIR SEDIMENTATION HANDBOOK

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**Design and Management  
of Dams, Reservoirs, and Watersheds  
for Sustainable Use**

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**Gregory L. Morris**

*Gregory L. Morris & Assoc.  
San Juan, Puerto Rico, USA*

**Jiahua Fan**

*Professor and Senior Engineer  
Institute of Water Conservancy  
Hydroelectric Power Research  
Beijing, China*

**McGraw-Hill**

New York San Francisco Washington, D.C. Auckland Bogotá  
Caracas Lisbon London Madrid Mexico City Milan  
Montreal New Delhi San Juan Singapore  
Sydney Tokyo Toronto

## Library of Congress Cataloging-in-Publication Data

Reservoir sedimentation handbook : design and management of dams,  
reservoirs, and watersheds for sustainable use / Gregory L. Morris  
: Jiahua Fan.

p. cm.

Includes bibliographical references (p. ) and index.

ISBN 0-07-043302-X

I. Reservoir sedimentation. I. Morris, Gregory L. II. Fan,  
Jiahua.

TD396.R473 1997

627'.86—dc21

97-1065

CIP

# McGraw-Hill



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1 2 3 4 5 6 7 8 9 0 DOC/DOC 9 0 2 1 0 9 8 7

ISBN 0-07-043302-X

*The sponsoring editor for this book was Larry Hager, the editing supervisor was  
Peggy Lamb, and the production supervisor was Pamela A. Pelton. It was set in  
Times Roman by Estelita F. Green of McGraw-Hill's Professional Book Group  
composition unit.*

*Printed and bound by R. R. Donnelley & Sons Company.*



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*For Daniel, Richard...  
and the others of the next generation.*

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# Preface

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When the first author began researching problems of reservoir sedimentation many years ago, the lack of a book-type treatment of the subject became immediately apparent. While there is a significant amount of literature, it is widely scattered, written in several languages, and much of it is "gray literature" published in the form of engineering reports and conference proceedings which is not readily accessible. This handbook is an outgrowth of the need for a comprehensive treatment of this complex subject.

An in-depth treatment of each of the major technical topics is, of course, impossible within the context of a single handbook, and the treatment herein is by no means comprehensive and all-inclusive. The topics in each chapter are themselves of sufficient complexity to warrant book-length treatment. It is hoped that this conceptual overview of the major themes in each topic area, supported with a list of references and case studies, will facilitate the readers' comprehension of existing and potential problems at their own particular reservoir and watershed, and the types of remedial actions that have proved useful at other sites. The authors strongly feel that the most fundamental problem is to properly diagnose a sedimentation issue and select the conceptually appropriate course of action. Once the nature of the problem has been conceptually identified and one or more feasible courses of action identified, the approach to be used for subsequent detailed technical studies will usually be clear.

The first author's research on reservoir sedimentation topic was sparked by Ariel Lugo, and a discussion of problems at Puerto Rican reservoirs several years later with A. Santiago Vázquez. Both authors would like to express their special thanks to María Margarita Irizarry who, during her term as Executive Director of the Puerto Rico Aqueduct and Sewer Authority, started sediment management activities at the Loíza reservoir. Work at this site initiated the collaboration between the co-authors that eventually resulted in this handbook.

Many workers from around the world, too numerous to name individually, have been very helpful in providing time, insight, information, material, photographs, and permission to reproduce material. We are particularly indebted to those who provided detailed information on case studies: Esmail Tolouie (Sefid-Rud); Gian Rechsteiner (Gebidem); Alexis Rodríguez, Ake Sundborg, and Margareta Jansson (Cachí); Xia Maidong (Heisonglin); Richard Webb and Allan Zack (Loíza); and Donna Lindquist, Clay Clifton, Larry Harrison, Howard Chang, and Scott Tu (Feather River). Alain Petitjean and Jean-Pierre Bouchard at Electricité de France provided information on French reservoirs. Contributions by Shou-shan Fan at the U.S. Federal Energy Regulatory Commission are greatly appreciated. Robert MacArthur, George Annandale, Robert Strand, Vic Galay, Andrea Handler-Ruiz, Tom Skelly, Rollin Hotchkiss, and Kathleen Wilson were all particularly helpful. Professionals at the following institutions also provided invaluable information and assistance: China Institute of Water Resources and Hydropower Research (Beijing), Northwest Hydrotechnical Institute (Xian), U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, U.S. Geological Survey, U.S. Natural Resources Conservation Service, U.S. Forest Service, Puerto Rico Aqueduct and Sewer Authority, and Los

Angeles County Public Works Department. Editorial support from McGraw-Hill was outstanding.

Production of this handbook also represents a 2-year team effort by personnel at Gregory L. Morris & Assoc. We could not have made it through the long ordeal of manuscript preparation without the capable editorial assistance of Marco Flores, and graphic materials prepared by Elias Castro. Ada Sotto, Sebastian García, Pully Torres, and Miguel Menar helped keep the office running throughout the long writing process. Former employees Guangdou Hu and G.T. Anderson discussed ideas and performed literature searches at university libraries.

The first author greatly appreciates the support by his wife, Miriam, and sons Daniel and Richard, who graciously accepted the long hours and forfeited hiking and kayaking trips. Also gratefully acknowledged are the many years of dedication by his parents, and guidance by many excellent teachers. The second author greatly appreciates more than 45 years of support and help in his sediment research for water resources development by his wife, Song Xiuzhen, and the support of his daughters Ying, Bing, and Xing.

We hope that society will benefit from our collected thoughts about water and sediment management.

*Gregory L. Morris*  
*San Juan*

*Jiahua Fan (FAN Jiahua)*  
*Beijing*



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# CONTENTS

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## Preface   xxiii

---

## Chapter 1. Introduction

1.1

- 1.1. Need for Sediment Management   1.1
- 1.2. Elements of Sediment Management   1.4
- 1.3. Handbook Approach   1.5

---

## Chapter 2. Reservoirs and Sustainable Development

2.1

- 2.1. Water Supply and Water Scarcity   2.1
  - 2.1.1. Global Water Resources   2.1
  - 2.1.2. Water Scarcity   2.2
- 2.2. Importance of Reservoirs   2.5
- 2.3. Consequences of Sedimentation   2.8
  - 2.3.1. Upstream Consequences   2.8
  - 2.3.2. Downstream Consequences   2.10
- 2.4. Concepts of Reservoir Life   2.13
- 2.5. Geomorphic Stages of Reservoir Life   2.14
- 2.6. Rate of Storage Loss   2.16
- 2.7. Concepts of Sustainable Development   2.17
- 2.8. Reservoirs as Nonrenewable Resources   2.20
- 2.9. Economics and Sustainability   2.22
- 2.10. Criteria-Based Approach to Sustainability   2.23
- 2.11. Actions to Achieve Sustainable Use   2.24
  - 2.11.1. Sedimentation Assessment   2.24
  - 2.11.2. Evaluation of Sedimentation Impacts   2.25
  - 2.11.3. Identification of Priority Sites   2.25
  - 2.11.4. Screening of Sediment Management Alternatives   2.25
  - 2.11.5. Implementation Measures and Scheduling   2.26
  - 2.11.6. Design, Implementation, and Monitoring of Control Measures   2.26
- 2.12. Population and Food Sustainability   2.27

---

## Chapter 3. Engineering Features of Dams and Reservoirs

3.1

- 3.1. Historical Perspective   3.1
  - 3.1.1. Dams in Antiquity   3.1
  - 3.1.2. Modern Dam Construction   3.3
- 3.2. Characteristics of Dams   3.4
  - 3.2.1. Functions of Dams   3.4
  - 3.2.2. Embankment Dams   3.5
  - 3.2.3. Concrete Dams   3.5
- 3.3. Reservoir Characteristics and Operation   3.6

3.3.1.	Reservoir Size	3.6
3.3.2.	Pool Geometry	3.7
3.3.3.	Pool Allocation	3.8
3.3.4.	Stage-Storage Relationships	3.8
3.3.5.	Types of Reservoir Operation	3.9
3.4.	Outlets and Gates	3.11
3.5.	Hydropower Plants	3.12
3.5.1.	Nomenclature	3.12
3.5.2.	Types of Hydraulic Turbines	3.12
3.5.3.	Energy Relations	3.14
3.5.4.	Sediment Impact on Tailwater	3.14
3.6.	Abrasion and Cavitation	3.16
3.6.1.	Abrasion of Turbines	3.16
3.6.2.	Abrasion of Concrete Structures	3.16
3.6.3.	Cavitation	3.17
3.7.	Reservoir Backwater and Flood Routing	3.19
3.8.	Reservoir Yield	3.19
3.8.1.	Storage-Yield Relationship	3.20
3.8.2.	Gould's Gamma Method for Estimating Yield	3.20
3.8.3.	Computing Yield by Behavior Simulation	3.22
3.8.4.	Hydrologic Time Series	3.22
3.8.5.	Sedimentation Effect on Yield	3.23

## Chapter 4. Concepts of Reservoir Limnology

4.1

4.1.	Comparisons of Lakes and Reservoirs	4.1
4.1.1.	Summary Differences	4.1
4.1.2.	Hydrologic Size and Loading Rates	4.1
4.1.3.	Age and Senescence	4.3
4.1.4.	Geometry and Longitudinal Gradients	4.3
4.1.5.	Shorelines and Water Level Variation	4.4
4.1.6.	Sediment Loading	4.4
4.2.	Temperature and Stratification	4.4
4.2.1.	Stratification	4.4
4.2.2.	Seasonality of Stratification	4.5
4.2.3.	Density of Water	4.6
4.3.	Hydraulic Short-Circuiting	4.7
4.3.1.	Horizontal Focusing	4.7
4.3.2.	Vertical Focusing	4.8
4.4.	Selective Withdrawal	4.9
4.5.	Light and Transparency	4.11
4.6.	Productivity and Eutrophication	4.12
4.6.1.	Primary Production	4.12
4.6.2.	Diurnal Variations in Dissolved Oxygen	4.12
4.6.3.	Productivity	4.13
4.6.4.	Factors Limiting Primary Production	4.14
4.6.5.	Trophic Status	4.14
4.7.	Nutrients	4.16
4.7.1.	The Concept of Limiting Nutrients	4.16
4.7.2.	Phosphorus	4.17
4.7.3.	Nitrogen	4.19
4.8.	Gradients, Sedimentation, and Biological Processes	4.20
4.9.	Closure	4.22

## Chapter 5. Sediment Properties

5.1

5.1.	Size Classification of Sediment	5.1
------	---------------------------------	-----

5.1.1.	Size of Sediment Grains	5.1
5.1.2.	Particle Shape and Roundness	5.2
5.1.3.	Grain Size Distribution	5.4
5.1.4.	Classification by Mode of Transport	5.5
5.2.	Characteristics of Sediment Grains	5.7
5.2.1.	Sand	5.7
5.2.2.	Silt	5.7
5.2.3.	Clay and Clay Flocculation	5.7
5.3.	Bulk Properties of Sediment	5.9
5.3.1.	Sediment Density and Weight	5.9
5.3.2.	Unit Weight or Bulk Density of Sediment	5.11
5.3.3.	Angle of Repose	5.11
5.4.	Sediment-Water Mixtures	5.12
5.4.1.	Void Space	5.12
5.4.2.	Sediment Concentration	5.13
5.4.3.	Density of Water-Sediment Mixtures	5.14
5.5.	Settling Velocity of Sediment Grains	5.14
5.5.1.	Fluid Viscosity	5.14
5.5.2.	Reynolds Number	5.15
5.5.3.	Settling Velocity of Silts and Clays	5.16
5.5.4.	Settling Velocity of Coarse Grains	5.16
5.5.5.	Simplified Equations for Fall Velocity	5.16
5.5.6.	Effect of Concentration on Settling Velocity	5.18
5.5.7.	Sweep Flocculation and Hindered Settling	5.18
5.6.	Laboratory and Field Analysis of Sediment Concentration	5.21
5.6.1.	Filtration Method	5.21
5.6.2.	Evaporation Method	5.22
5.6.3.	Specific Gravity Bottle	5.22
5.6.4.	Sediment Volume	5.22
5.7.	Laboratory Analysis of Sediment Size	5.23
5.7.1.	Use of Deflocculants	5.24
5.7.2.	Organic Material	5.25
5.7.3.	Separation of Sand and Fines by Sedimentation	5.25
5.7.4.	Dry Sieving	5.25
5.7.5.	Wet Sieving	5.26
5.7.6.	Direct Measurements of Nominal Diameter	5.26
5.7.7.	Visual Accumulation Tube	5.27
5.7.8.	Pipet Method	5.27
5.7.9.	Bottom Withdrawal Method	5.27
5.7.10.	Hydrometer	5.27

## Chapter 6. Erosion

## 6.1

6.1.	Concepts and Definitions	6.1
6.2.	Consequences of Soil Erosion	6.6
6.2.1.	On-Site Impacts	6.6
6.2.2.	Off-Site Impacts	6.6
6.3.	Erosion Rates	6.7
6.4.	Interrill and Rill Erosion	6.8
6.4.1.	Interrill Erosion	6.8
6.4.2.	Rainfall	6.9
6.4.3.	Rill Erosion	6.10
6.4.4.	Size of Eroded Particles	6.11
6.5.	Gully Erosion	6.12
6.5.1.	Gully Erosion Process	6.12
6.5.2.	Quantification of Gully Erosion	6.14
6.6.	Channel Erosion	6.15
6.6.1.	Processes	6.15
6.6.2.	Quantifying Channel Erosion	6.16

6.7.	Slope Failure	6.17
6.8.	Field Measurement of Erosion	6.18
6.8.1.	Erosion Plots	6.19
6.8.2.	Fabric Dams	6.19
6.8.3.	Experimental Watersheds	6.19
6.8.4.	Measurement Equipment	6.20
6.8.5.	Simulated Rainfall	6.21
6.8.6.	Other Methods	6.22
6.9.	Erosion Modeling with USLE and RUSLE	6.23
6.10.	Erosion Modeling Using WEPP	6.25
6.11.	Sediment Delivery Ratio	6.26
6.11.1.	Basic Delivery Ratio Concepts	6.26
6.11.2.	Causes of Reduced Sediment Delivery	6.27
6.11.3.	Measurement	6.29
6.11.4.	Variation in Delivery Ratio	6.29
6.11.5.	Estimating Sediment Delivery Ratio	6.31
6.11.6.	Sediment Sorting and Enrichment	6.33
6.12.	Closure	6.36

## Chapter 7. Sediment Yield from Watersheds

7.1

7.1.	Spatial Variability in Sediment Yield	7.1
7.2.	Temporal Variability in Sediment Yield	7.5
7.2.1.	Temporal Focusing of Sediment Yield	7.5
7.2.2.	Within-Storm Variation in Suspended Load	7.5
7.2.3.	Seasonal Variability in Sediment Yield	7.10
7.2.4.	Interannual Variability in Sediment Yield	7.10
7.2.5.	Long-Term Changes in Sediment Yield due to Disturbances	7.10
7.2.6.	Changes in Long-Term Yield due to Geomorphic Factors	7.15
7.3.	Strategies for Measuring Sediment Yield	7.18
7.3.1.	Reservoir Resurvey	7.18
7.3.2.	Fluvial Monitoring	7.20
7.3.3.	Uncertainty in Sediment Yield	7.21
7.3.4.	Quantifying Interannual Variability in Sediment Load	7.22
7.4.	Sediment Rating Curves	7.23
7.4.1.	Fitting Sediment Rating Curves	7.24
7.4.2.	Visual Curve Fitting	7.25
7.4.3.	Mathematical Curve Fitting	7.25
7.4.4.	Rating Curve Example	7.27
7.5.	Computing Sediment Load	7.28
7.5.1.	Time-Series Sediment-Rating Curve Technique	7.28
7.5.2.	Load-Interval Flow-Duration Technique	7.29
7.5.3.	Interpolation Procedures	7.29
7.5.4.	Estimating Bed Load	7.29
7.6.	Estimating Sediment Yield	7.30
7.6.1.	Regional Rate of Storage Loss	7.30
7.6.2.	Regional Regression Relationship	7.31
7.6.3.	PSIAC Method	7.32
7.6.4.	Sediment Yield Maps	7.35
7.6.5.	Erosion Modeling	7.36
7.7.	GIS and Erosion Prediction	7.37
7.8.	Identifying Suspended-Sediment Sources	7.39
7.8.1.	Indirect Determination	7.39
7.8.2.	Direct Measurement	7.39
7.8.3.	Qualitative Erosion Inventory	7.40
7.8.4.	Sediment Fingerprinting	7.40
7.8.5.	Lake and Reservoir Deposit Histories	7.43
7.9.	Closure	7.43

**Chapter 8. Fluvial Morphology and Sediment Sampling****8.1**

- 8.1. Stream Form and Classification 8.1
  - 8.1.1. Stream Order 8.1
  - 8.1.2. Drainage Density 8.2
  - 8.1.3. Stream Patterns 8.2
  - 8.1.4. Meandering and Stream Migration 8.3
  - 8.1.5. Lane's Balance 8.5
  - 8.1.6. Differences between Sand and Gravel Bed Rivers 8.6
  - 8.1.7. Armoring 8.7
- 8.2. Suspended-Sediment Sampling 8.8
  - 8.2.1. Vertical Concentration Gradient 8.9
  - 8.2.2. Isokinetic Sampling 8.9
  - 8.2.3. Sampling Location 8.10
  - 8.2.4. Sampler Designations 8.11
  - 8.2.5. Depth-Integrating Sampler 8.11
  - 8.2.6. Point Integrating Sampler 8.12
  - 8.2.7. Sampling in Transverse Direction 8.13
  - 8.2.8. Single-Stage Sampler 8.14
- 8.3. Pumped Samplers 8.14
  - 8.3.1. Equipment Description 8.14
  - 8.3.2. Sampler Intake Placement 8.15
  - 8.3.3. Sampling Depth 8.16
  - 8.3.4. Nozzle Orientation 8.17
  - 8.3.5. Cross-Section Coefficient 8.18
- 8.4. Continuous Turbidity Measurement 8.18
  - 8.4.1. Application 8.18
  - 8.4.2. Types of Turbidimeters 8.19
  - 8.4.3. Relationship between Turbidity and Suspended Solids 8.19
  - 8.4.4. Limitations of Turbidity Data 8.21
- 8.5. Sampling Strategies for Pumped Samplers and Turbidity 8.22
  - 8.5.1. Statistically Based Strategies for Pumped Samplers 8.22
  - 8.5.2. Sampling Strategies for Turbidimeters 8.23
- 8.6. Duration of Monitoring 8.24
- 8.7. Bed Load Sampling 8.24
  - 8.7.1. Bed Load Transport 8.24
  - 8.7.2. Bed Load Sampling 8.25
  - 8.7.3. Continuous Bed Load Measurement 8.26
  - 8.7.4. Grain Tracking 8.27
- 8.8. Sampling of Coarse Bed Material 8.27
  - 8.8.1. Sampling Sand Beds 8.27
  - 8.8.2. The Sampling Problem in Gravel-Bed Streams 8.27
  - 8.8.3. Selection of Sampling Areas 8.28
  - 8.8.4. Selection of Sampled Stones 8.29
  - 8.8.5. Measurement of Stone Sizes 8.30
  - 8.8.6. Frequency by Size Class 8.30
  - 8.8.7. Number of Stones Sampled 8.31
  - 8.8.8. Presentation of Grain Size Results 8.31
  - 8.8.9. Truncated Samples 8.31
  - 8.8.10. Use of Photographs 8.32
- 8.9. Bed Material Grain Size Conversion Factors 8.32
  - 8.9.1. Areal Count to Bulk-Sieve Conversion 8.34
- 8.10. Sources of Error 8.35
  - 8.10.1. Sampling Precision and Accuracy 8.35
  - 8.10.2. Sampling Equipment 8.36
  - 8.10.3. Number of Sampling Points 8.37
  - 8.10.4. Laboratory Error 8.39
  - 8.10.5. Rating Curves 8.39
  - 8.10.6. Sampling Frequency and Computational Error 8.40
  - 8.10.7. Bias in Curve Fitting 8.40
- 8.11. Closure 8.40

**Chapter 9. Hydraulics of Sediment Transport****9.1**

- 9.1. Definitions and Units 9.2
- 9.2. Flow Resistance Equations 9.4
  - 9.2.1. Chézy Equation 9.4
  - 9.2.2. Manning Equation 9.4
  - 9.2.3. Darcy-Weisbach Equation 9.5
- 9.3. Hydraulic Flow-Resistance Factors 9.5
  - 9.3.1. Grain Roughness 9.5
  - 9.3.2. Estimating Total Roughness 9.6
  - 9.3.3. Cowan's Method 9.8
  - 9.3.4. Effect of Vegetation on Flow Resistance 9.13
- 9.4. Bed Forms in Sand-Bed Channels 9.15
- 9.5. Velocity Distribution 9.15
  - 9.5.1. Reynolds Number 9.15
  - 9.5.2. Boundary Conditions 9.18
  - 9.5.3. Boundary Reynolds Number 9.18
  - 9.5.4. Vertical Velocity Distribution 9.18
  - 9.5.5. Velocity Profile Measurement 9.20
  - 9.5.6. Horizontal Velocity Distribution 9.20
- 9.6. Vertical Distribution of Sediment Concentration 9.20
- 9.7. Initiation of Motion 9.21
  - 9.7.1. Bed Shear or Tractive Force 9.22
  - 9.7.2. Approximate Methods 9.23
  - 9.7.3. Empirical Criteria 9.23
  - 9.7.4. Shields Diagram 9.23
  - 9.7.5. Yang's Criteria 9.26
  - 9.7.6. Annandale's Erodibility Index Method 9.27
  - 9.7.7. Example 9.1 9.30
  - 9.7.8. Example 9.2 9.31
  - 9.7.9. Initiation of Motion in Graded Sediments 9.32
- 9.8. Stable Channel Design 9.32
  - 9.8.1. Shear Stress Distribution 9.32
  - 9.8.2. Slope Stability 9.33
- 9.9. Bed Material Transport 9.34
  - 9.9.1. Akers and White 9.34
  - 9.9.2. Engelund and Hansen 9.36
  - 9.9.3. Yang's Equation for Sand Transport 9.36
  - 9.9.4. Yang's Equation for Gravel 9.38
  - 9.9.5. Yang's Modification for Water-Sedimentation Mixtures 9.38
- 9.10. Hyperconcentrated Flow 9.39
- 9.11. Cohesive Sediments 9.40
  - 9.11.1. Importance of Cohesive Sediments 9.40
  - 9.11.2. Settling and Compaction of Cohesive Sediment 9.42
  - 9.11.3. Rheology of Cohesive Sediment Mixtures 9.44
  - 9.11.4. Laboratory Testing of Cohesive Sediment 9.45
  - 9.11.5. Erosion Thresholds for Cohesive Sediment 9.47
  - 9.11.6. Erosion Rate of Cohesive Sediment 9.49
  - 9.11.7. Deposition Rate of Cohesive Sediment 9.49
  - 9.11.8. Angle of Repose 9.50
  - 9.11.9. Settling of Individual Coarse Particles 9.51
  - 9.11.10. Group Settling of Cohesionless Sediment 9.52
- 9.12. Closure 9.52

**Chapter 10. Sediment Deposits in Reservoirs****10.1**

- 10.1. Significance of Deposit Patterns 10.1
- 10.2. Generalized Deposition Patterns 10.1
  - 10.2.1. Depositional Zones 10.2

10.2.2.	Longitudinal Deposit Geometry	10.2
10.2.3.	Lateral Deposition Patterns	10.3
10.2.4.	Layered Deposits	10.5
10.2.5.	Influence of Regulation Regime	10.5
10.2.6.	Shoreline Erosion and Landslides	10.6
10.3.	Delta Deposits	10.6
10.3.1.	Delta Deposition Patterns	10.6
10.3.2.	Slope of Delta Deposits	10.11
10.3.3.	Foreset Slope	10.13
10.4.	Measurement of Deposition Rate	10.13
10.4.1.	Sediment Mass Balance	10.13
10.4.2.	Horizon Tracing Using $^{137}\text{Cesium}$	10.13
10.4.3.	Subbottom Profiling	10.14
10.4.4.	Spud Surveys	10.14
10.4.5.	Sedimentation Plates	10.15
10.5.	Reservoir Capacity Surveys	10.16
10.5.1.	Types of Surveys	10.16
10.5.2.	Survey Intervals	10.16
10.5.3.	Survey Techniques	10.17
10.5.4.	Survey Errors	10.17
10.5.5.	Reporting	10.18
10.6.	Contour Surveys	10.18
10.6.1.	Contour Survey Methods	10.18
10.6.2.	Volume Computations from Contour Data	10.20
10.7.	Range Surveys	10.20
10.7.1.	Location of Ranges	10.20
10.7.2.	General Considerations for Computing Volumes from Ranges	10.22
10.7.3.	Computing Range End Area	10.22
10.7.4.	Average End Area	10.22
10.7.5.	Surface Area—Average End Area	10.23
10.7.6.	Constant Factor Method	10.23
10.7.7.	Width Adjustment Method	10.24
10.8.	Reservoir Releasing and Trapping Efficiency	10.24
10.8.1.	Brune Curve	10.26
10.8.2.	Churchill Method	10.27
10.9.	Specific Weight of Reservoir Deposits	10.28
10.9.1.	Compaction Processes	10.28
10.9.2.	Range of Unit Weights	10.29
10.9.3.	Lara-Pemberton Method for Initial Bulk Density	10.29
10.9.4.	Sediment Compaction	10.31
10.10.	Empirical Prediction of Deposit Patterns	10.32
10.10.1.	Deposits in Flood Control Pool	10.32
10.10.2.	Area-Increment and Empirical Area Reduction Methods	10.32
10.11.	Sampling Sediment Deposits	10.39
10.11.1.	Planning the Sampling Program	10.40
10.11.2.	Sampling for Chemical Contaminants	10.40
10.11.3.	Surface Dredges	10.41
10.11.4.	Gravity Corers	10.41
10.11.5.	Piston Corer	10.42
10.11.6.	Other Methods	10.42
10.12.	Closure	10.42

## Chapter 11. Modeling of Sediment Transport and Deposition in Reservoirs

11.1

11.1.	Introduction	11.1
11.2.	Modeling Protocol	11.1
11.3.	Conceptual Modeling	11.4
11.4.	Numerical Modeling	11.6

11.5.	Construction and Calibration of Numerical Models	11.7
11.5.1.	Hydrology	11.7
11.5.2.	Geometry	11.8
11.5.3.	Selection of Transportation Equation	11.8
11.5.4.	Calibration	11.11
11.6.	Descriptions of Selected Numerical Models	11.14
11.6.1.	HEC-6	11.14
11.6.2.	GSTARS	11.16
11.6.3.	FLUVIAL	11.17
11.6.4.	TABS	11.18
11.6.5.	SSIIM	11.18
11.7.	Physical Modeling	11.19
11.7.1.	Applicability of Physical Models	11.21
11.7.2.	Disadvantages of Physical Models	11.22
11.8.	Combining Numerical and Physical Models	11.22
11.9.	Examples of Physical Model Scaling and Operation	11.22
11.9.1.	Problem Identification	11.24
11.9.2.	Model Type and Scales	11.25
11.9.3.	Establish the Initial Boundary Conditions and Scale Sediment	11.26
11.9.4.	Model Construction	11.26
11.9.5.	Calibration	11.26
11.9.6.	Predictive Simulation	11.27
11.9.7.	Design Recommendations	11.27
11.9.8.	Validation	11.27
11.10.	Closure	11.28

## Chapter 12. Reduction of Sediment Yield

12.1

12.1.	Introduction	12.1
12.1.1.	Applicability	12.1
12.1.2.	Limitations	12.2
12.1.3.	Additional Sources of Information	12.3
12.2.	Basic Technical Principles	12.4
12.2.1.	Technical Strategies for Erosion Control	12.4
12.2.2.	Classification of Erosion Control Techniques	12.7
12.2.3.	Types of Sediment Trapping Structures	12.7
12.2.4.	Sediment Trapping in Upstream Reservoirs	12.8
12.2.5.	Sediment Trapping versus Erosion Control	12.8
12.3.	Formulating an Erosion Control Strategy	12.9
12.3.1.	What Causes Erosion?	12.9
12.3.2.	Identifying and Prioritizing Sediment Sources	12.10
12.3.3.	Identification of Partners	12.11
12.3.4.	Economic Costs, Benefits, and Erosion Control Strategies	12.12
12.4.	Erosion Control Measures on Farms	12.13
12.4.1.	Contouring	12.14
12.4.2.	Strip Cropping	12.14
12.4.3.	Grass Filter Strips	12.14
12.4.4.	Conservation Tillage	12.14
12.4.5.	Grassed Waterways	12.15
12.4.6.	Terraces	12.16
12.4.7.	Contour Grassed Hedges	12.16
12.5.	Implementing Erosion Control on Farms	12.19
12.5.1.	Types of Farms	12.19
12.5.2.	Criteria for Successful Erosion Control	12.19
12.6.	Erosion Control on Mechanized Farms	12.21
12.7.	Erosion Control on Subsistence Farms	12.22
12.7.1.	Erosion Control Strategy	12.23
12.7.2.	Terracing	12.23
12.7.3.	Agronomic Strategies to Reduce Erosion	12.24
12.7.4.	The World Neighbors Program in Honduras	12.24



	12.7.5. Implementation in Ecuador	12.25
12.8.	Erosion Control and Forestry Practices	12.26
	12.8.1. Definitions	12.26
	12.8.2. General Strategies for Erosion Control	12.27
	12.8.3. Yarding Methods	12.27
	12.8.4. Log Landings	12.29
	12.8.5. Riparian Buffer Strips	12.29
	12.8.6. Logging Roads	12.30
12.9.	Reservoir Shoreline Erosion	12.31
12.10.	Control of Channel Erosion	12.32
	12.10.1. Types of Channel Erosion	12.32
	12.10.2. Basic Strategy for Gully Control	12.32
	12.10.3. Check Dams	12.33
	12.10.4. Vegetative Control of Gullying	12.35
	12.10.5. Channel Linings	12.36
12.11.	Erosion Control Strategies for Rangeland	12.36
12.12.	Erosion Control Strategies in Urbanizing Areas	12.38
12.13.	Sediment Detention Basins	12.39
	12.13.1. Design Philosophy	12.39
	12.13.2. Detention Basin Geometry	12.41
	12.13.3. Design Computations for Plug Flow	12.43
	12.13.4. Sedimentation under Turbulent Nonidealized Conditions	12.48
	12.13.5. Dewatering Orifice	12.48
	12.13.6. Weir Discharge	12.49
12.14.	Debris Basins	12.50
	12.14.1. Debris Basin Configurations	12.50
	12.14.2. Sediment Trapping by Debris Basins	12.51
	12.14.3. Debris Basin Cleanout	12.53
12.15.	Closure	12.54

## Chapter 13. Sediment Routing

13.1

13.1.	Concept and Application	13.1
	13.1.1. Overview	13.1
	13.1.2. Classification of Techniques	13.1
	13.1.3. Advantages and Disadvantages	13.2
13.2.	Sediment Pass-Through by Seasonal Drawdown	13.3
	13.2.1. Technique	13.3
	13.2.2. Partial Drawdown	13.3
	13.2.3. Partial Drawdown at Three Gorges Project	13.3
	13.2.4. Seasonal Emptying of Reservoir	13.6
	13.2.5. Normally Empty Reservoir	13.7
13.3.	Flood Drawdown	13.7
	13.3.1. Technique	13.7
	13.3.2. Sediment Balance by Flood Routing	13.8
	13.3.3. Sediment Adjustments under Routing	13.9
	13.3.4. Modeling Considerations	13.10
13.4.	Flood Drawdown by Hydrograph Prediction	13.10
	13.4.1. Technique	13.10
	13.4.2. Application	13.10
	13.4.3. Operational Sequence	13.11
	13.4.4. Monitoring Reservoir Volume	13.12
	13.4.5. Hydrograph Prediction	13.12
13.5.	Flood Drawdown by Rule Curve	13.13
	13.5.1. Technique	13.13
	13.5.2. Operational Example	13.13
13.6.	Sediment Bypass for Instream Reservoirs	13.15
	13.6.1. Technique	13.15
	13.6.2. Application	13.15
13.7.	Off-Stream Reservoirs	13.16