Chapter 1  Geotechnical Operations and Administration ........................................... 1-1
  1.1  Scope of Geotechnical Design, Construction, and Maintenance Support .......... 1-1
  1.2  Role of Offices Providing In-House Geotechnical Design, Construction, and Maintenance Support .................................................... 1-3
  1.3  Geotechnical Support within the WSDOT Project Management Process (PMP) ... 1-10
  1.4  Geotechnical Report Review Process, Certification and Approval Requirements ... 1-14
  1.5  Reports Produced by Consultants or other Agencies for WSDOT ..................... 1-18
  1.6  Geotechnical Consultant Administration ..................................................... 1-19
  1.7  Geotechnical Information Provided to Bidders ............................................. 1-21
  1.8  Sample Retention and Chain of Custody ................................................... 1-23
  1.9  Geotechnical Design Policies and their Basis ............................................. 1-23
  1.10 Geotechnical Construction Support Policies ............................................ 1-25
  1.11 Geotechnical Construction Submittal Review Policies .................................. 1-27
  1-12 References .................................................................................................. 1-29
Appendix 1-A  Preliminary Geotechnical Engineering Services Scope of Work .......... 1-A-1
Appendix 1-B  Geotechnical Engineering Services Scope of Work for PS&E-Level Design 1-B-1

Chapter 2  Project Geotechnical Planning ................................................................. 2-1
  2.1  Overview ....................................................................................................... 2-1
  2.2  Preliminary Project Planning ................................................................. 2-1
  2.3  Development of the Subsurface Exploration Plan ........................................ 2-8
  2.4  Development of the Laboratory Testing Plan ............................................. 2-15
  2.5  References .................................................................................................. 2-16
Appendix 2-A  Field Exploration Request Form ..................................................... 2-A-1

Chapter 3  Field Investigation ...................................................................................... 3-1
  3.1  Overview ....................................................................................................... 3-1
  3.2  Activities and Policies – Before Exploration .............................................. 3-1
  3.3  Activities and Policies – During Exploration .............................................. 3-3
  3.4  Activities and Policies – After Exploration .................................................. 3-6
  3.5  Standard Penetration Test (SPT) Calibration ............................................... 3-6
  3.6  References .................................................................................................. 3-6
Appendix 3-A  Daily Drill Report Form ................................................................. 3-A-1
Appendix 3-B  Portable Penetrometer Test Procedures .......................................... 3-B-1
Appendix 3-C  Field Investigation Best Management Practices for Erosion and Spill Prevention ................................................................. 3-C-1
Appendix 3-D  Department of Natural Resources Memorandum of Understanding: Drilling Operations – State Owned Aquatic Lands ............................................. 3-D-1
Appendix 3-E  Geotechnical Field Investigation and Contaminated Drilling Waste Management Procedures .......................................................... 3-E-1
## Chapter 8  Foundation Design

8.1  Overview ........................................................................ 8-1
8.2  Overall Design Process for Structure Foundations ................. 8-1
8.3  Data Needed for Foundation Design ..................................... 8-5
8.4  Foundation Selection Considerations ................................... 8-9
8.5  Overview of LRFD for Foundations ..................................... 8-10
8.6  LRFD Loads, Load Groups and Limit States to be Considered .... 8-11
8.7  Resistance Factors for Foundation Design – Design Parameters .... 8-18
8.8  Resistance Factors for Foundation Design – Service Limit States .... 8-19
8.9  Resistance Factors for Foundation Design – Strength Limit States .... 8-19
8.10 Resistance Factors for Foundation Design – Extreme Event Limit States .... 8-19
8.11 Spread Footing Design. ..................................................... 8-20
8.12 Driven Pile Foundation Design ........................................... 8-27
8.13 Drilled Shaft Foundation Design .......................................... 8-41
8.14 Micropiles .................................................................... 8-46
8.15 Proprietary Foundation Systems ......................................... 8-46
8.16 Detention Vaults ............................................................. 8-46
8.17 References ..................................................................... 8-48

Appendix 8-A  Approved Proprietary Foundation Systems (Vacant) .... 8-A-1
Appendix 8-B  Approved AASHTO LRFD Bridge Design Specifications Drill Shaft Design Provisions ........................................ 8-B-1

## Chapter 9  Embankments

9.1  Overview and Data Needed .............................................. 9-1
9.2  Design Considerations ..................................................... 9-6
9.3  Stability Mitigation .......................................................... 9-15
9.4  Settlement Mitigation ....................................................... 9-28
9.5  Construction Considerations and PS&E Development ............. 9-30
9.6  References ..................................................................... 9-38

Appendix 9-A  Examples Illustrating Staged Fill Construction Design .... 9-A-1

## Chapter 10  Soil Cut Design

10.1 Overview and Data Acquisition ......................................... 10-1
10.2 Overall Design Considerations ......................................... 10-5
10.3 Soil Cut Design ............................................................. 10-6
10.4 Use of Excavated Materials .............................................. 10-11
10.5 Special Considerations for Loess ........................................ 10-12
10.6 PS&E Considerations ..................................................... 10-19
10.7 References ................................................................. 10-20

Appendix 10-A  Washington State Department of Transportation Loess Slope Design Checklist .................................................. 10-A-1
## Chapter 11 Ground Improvement

11.1 Overview ............................................................... 11-1
11.2 Development of Design Parameters and Other Input Data for Ground Improvement Analysis .................................................. 11-2
11.3 Design Requirements ................................................ 11-3
11.4 References ................................................................. 11-3

## Chapter 12 Rock Cut Design

12.1 Overview ............................................................... 12-1
12.2 Development of Design Parameters and Other Input Data for Rock Cut Stability Analysis .................................................. 12-1
12.3 Design Requirements ................................................ 12-1
12.4 References ................................................................. 12-1

## Chapter 13 Landslide Analysis and Mitigation

13.1 Overview ............................................................... 13-1
13.2 Development of Design Parameters and Other Input Data for Landslide Analysis .................................................. 13-1
13.3 Design Requirements ................................................ 13-1
13.4 References ................................................................. 13-1

## Chapter 14 Unstable Rockslope Analysis and Mitigation

14.1 Overview ............................................................... 14-1
14.2 Development of Design Parameters and Other Input Data for Unstable Rockslope Analysis .................................................. 14-1
14.3 Design Requirements ................................................ 14-1
14.4 References ................................................................. 14-1

## Chapter 15 Abutments, Retaining Walls, and Reinforced Slopes

15.1 Introduction and Design Standards .................................. 15-1
15.2 Overview of Wall Classifications and Design Process for Walls .................................................. 15-2
15.3 Required Information ................................................ 15-3
15.4 General Design Requirements ...................................... 15-12
15.5 Wall Type Specific Design Requirements ...................................... 15-22
15.6 Standard Plan Walls ................................................ 15-62
15.7 Temporary Cut Slopes and Shoring .................................. 15-63
15.8 References ................................................................. 15-75

Appendix 15-A Preapproved Proprietary Wall and Reinforced Slope General Design Requirements and Responsibilities .................................................. 15-A-1
Appendix 15-B Preapproved Proprietary Wall/Reinforced Slope Design and Construction Review Checklist .................................................. 15-B-1
Appendix 15-C Wall/Reinforced Slope Systems Evaluation: Submittal Requirements .................................................. 15-C-1
Appendix 15-D Preapproved Proprietary Wall Systems .................................................. 15-D-1
Appendix 15-E Description of Typical Temporary Shoring Systems and Selection Considerations .................................................. 15-E-1
Appendix 15-F Preapproved Wall Appendix: Specific Requirements and Details for LB Foster Retained Earth Concrete Panel Walls .................................................. 15-F-1
Appendix 15-G Preapproved Wall Appendix: Specific Requirements and Details for Eureka Reinforced Soil Concrete Panel Walls .................................................. 15-G-1