CONTENTS

Foreword, Cliff Garten  xiii
Preface  xv
Introduction  xvii

PART I: THE PROCESS AND SYSTEMS OF SUSTAINABLE DESIGN  1

Chapter 1: The Process of Sustainable Engineering Design  3
  Creating a New Paradigm for Design  4
    INTEGRATING DISCIPLINES: ARCHITECTS AND ENGINEERS  4
  The Sustainable Design Team: An Engineer’s Perspective  6
  Design Drivers for Sustainable Infrastructure Systems  8
    Project Drivers  8
    Establishing Project Values and Setting Goals  9
    Defining Desired Outcomes and Metrics  10
    Creating Frameworks and Action Plans  12
    Design Strategies  12
  Implementing the Process  13
    APPLYING INTEGRATIVE DESIGN TO OLD MINT PLAZA  16
    GOAL SETTING AT AQUATERA, FLORIDA  16

CHAPTER 2: Sustainable Infrastructure Frameworks  19
  Establishing a Framework  23
    GREEN BUILDING RATING SYSTEMS: HELPING OR HURTING? AN ARCHITECT’S
    PERSPECTIVE  24
  Using Sustainable Infrastructure Frameworks  25
    Using Frameworks for Different Types of Development  25
    Framework #1: Pillars of Sustainability  26
    Pillars of Sustainability at the Great Wall Eco-Villages  29
    PlanNYC: Pillars of Sustainability in Action  33
    Framework #2: The Scale-Density Framework  35
    Applying the Scale-Density Framework to New Development  37
    Framework #3: The Transect  40
    Using the Transect to Redevelop Tehachapi  43
    AIA/COTE Ten Measures of Sustainable Design  46
    Framework #4: The Built Form–Ecology Framework  47
    Balancing Human and Ecological Development on the
    Santa Lucia Preserve  50
    Ecosystem Services  52
    Synergy and Sustainable Community Design  53
    One Planet Living Framework: Sonoma Mountain Village  54
  Notes  56
PART II: SUSTAINABLE RESOURCE SYSTEMS 57

Chapter 3: Water Conservation and Supply 59

Water Management Plans 64
Achieving Water Balance 66
Looking at a Water Balance for a Retreat Center 68
Water Balance on the “Ahwahnee” Project 72
The Living Building Challenge: Water 73

Analyzing Water Sources 74
Groundwater 74
Surface Water 75
Rainwater 75
Brackish Water 76
Seawater 76
Stormwater 77

Water Supply Strategies 77
Reduce Demand/Conserve Water 80
Improvements to Infrastructure 82
Expansion of Existing Water Resources 82
Residential Rainwater Harvesting in Sausalito 82

Notes 93

Chapter 4: Integrated Water Management 95

Water as Resource, Not Waste Product 96
Impacts of Modern Wastewater Practice 97
Redefining Wastewater 100

Integrated Stormwater Management 101
Effects of Development on Stormwater Runoff 101
Low-Impact Development Design Principles 104
Benefits of LID Stormwater Management 106
Order of Design Operations 107
Urban Stormwater Treatment Strategies in San Mateo County 110

Urban Stormwater Treatment Strategies 111

Extensive Stormwater Treatment Systems 118
Addressing Constraints and Barriers to Implementation 120
Inadequate Local Resources 121
Cost 121
Physical Site Constraints 121
Utility Conflicts 122
Maintenance Burden 123
Old Mint Plaza 125
San Francisco’s Urban Watershed Planning Charrette 126

Graywater Treatment and Reuse 128
Graywater Quality Characterization 129
Potential as an Alternative Water Source 130
Graywater Reuse Systems 132
Chapter 5: Energy and Greenhouse Gases 165

Reducing Demand through Design 169
  Reducing Energy Use in Buildings 170
  Passive Design Strategies 171
  Using Energy Efficiently 176
  Energy-Efficient Systems for Communities 178
  Accounting for Water as an Energy Use 180
  Reducing Demand through Transportation Changes 180

Designing Sustainable Power Supplies 183
  Solar Power 184
  Photovoltaics 185
  Solar Thermal 186
  Wind Power 187
  Geothermal Systems 188
  Biomass 190
  Biogas 191
  Water Power 191

Addressing Climate Change and Reducing Carbon Footprint 192
  Measuring a Project’s Carbon Footprint 192
  Reducing a Project’s Carbon Impact 195
  Developing Carbon-Neutrality Management Plans 197

Policy Measures for Increasing Energy Security and Efficiency 199
  Setting Caps 199
  Net Metering 199
  Renewable Energy Certificates 200
  Green Power Programs 200
  Incentive Programs 200
  Regional Power Purchasing Agreements 201
  Building-Scale Financing Options 201
  Utility Profit Decoupling Strategies 202
  Efficiency Incentives and Requirements 202

Design Guidelines and Performance Standards 202
  Efficiency Programs and Standards 202
  Performance Standards 203

Notes 203
Chapter 6: Sustainable Site Planning, Built Systems, and Material Flows 207

Sustainable Site Planning 208
Understanding a Site as a Living System 209
Understanding Natural Patterns 209
Analysis: Performing Contextual Background Studies 210
Synthesis: Interpretation and Response 221

Green Streets and Transportation Networks 224
Complete Streets 226
Typical Street Types and Uses 227
Implementing a Woonerf: Santa Monica Borderline 232
Implementing Smart-Growth Streets 233

Green Streets 234
Chicago Green Alleys Program 236
City of Portland, Oregon, Green Streets Program 238

Working with the Land 239
Sensitive Streetscape Design 239
Santa Lucia Preserve Street Design Process 242
Sensitive Site Design 243
Balancing Earthwork Using Grading Analysis 245

Material and Waste Flows 246
Evaluating the Environmental Impact of Infrastructure Materials 246
Materials Red List 248
Choosing Environmentally Appropriate Materials 252
Post-Tensioning in Concrete Structures 260
Construction Methods and Management 261
Solid Waste Management 263

Notes 264

PART III: DESIGN APPLICATIONS 265

Chapter 7: City-Scale Approaches 267
Guangzhou: City-Scale Transformation in China 269
Tianjin Eco-City Master Plan 277
PlaNYC: An Integrated Stormwater Approach 279
San Francisco City Greening Initiatives 281
1. San Francisco Better Streets Plan 282
2. Urban Forest Master Plan 283
3. Stormwater Design Guidelines 284
4. Sewer System Master Plan 285
5. Mission Streetscape Plan 285
6. Cesar Chavez Green Street Corridor 286
7. Old Mint Plaza 287
8. Pavement to Parks Initiative 288
The Expressive Potential of Infrastructure 290

Notes 291
Chapter 8: Applications for Sustainable Communities  293
   Achieving a Perfect Balance: Pearl Island, Panama  294
   Going Beyond Engineering: Sharing Standards for Sustainability  313
   Integrating Stormwater Strategies into the Transect at the Community Scale: Cattle Creek, Colorado  315
   Stitching Together Lost Connections with Green Infrastructure  321

Chapter 9: Building-Scale Sustainable Infrastructure  325
   The California Academy of Sciences, San Francisco, California  327
   Creating the New Academy  328
   Chartwell School: Design Teaches Children to Celebrate Water and Energy  331
   Pearl Island, Panama: Designing Buildings for Energy Savings  334
   Sustainable Sites Initiative  337
   Brisbane City Hall: Green Site Design  338
   Stanford University Green Dorm: A Living Laboratory  341
   Pearl River Tower, Guangzhou, China  344

Notes  347

Conclusion  349
Index  351