Table of Contents

Foreword .............................................................. vii
Acknowledgements ................................................ viii

Chapter 1 — Irrigation Systems for Landscape/Turf and Agriculture
Landscape/Turf Systems ........................................ 2
Sprinkler Classification and Usage ............................ 2
Types of Landscape/Turf Systems ............................ 3
Agricultural Systems ............................................. 7
Types of Agricultural Systems ................................ 7
Agricultural Irrigation System Selection ................... 20
Summary of Agricultural Systems ........................... 21
Agricultural Components ....................................... 22

Chapter 2 — Soil, Plants, and Water
Soil Horizons and Profiles ...................................... 26
Soil Texture ......................................................... 27
Size of Soil Particles ............................................. 28
Soil Structure and Pore Space ................................. 28
Soil Intake Rate (Infiltration Rate) ........................... 30
Water Storage and Drainage ................................... 31
Soil Moisture Extraction ....................................... 33
Salts in Water and Soil Solutions ............................ 37
Readily Available Water ....................................... 38
Water Available to Plants ..................................... 38
Plant Water Relations ........................................... 41
Soil Moisture Monitoring Devices for Irrigation Scheduling ........................................ 52

Chapter 3 — Precipitation Rates
Fundamental Precipitation Rate Equation .................. 72
General Precipitation Rate Equation ......................... 72
Net Precipitation Rate Equation ............................... 73
Precipitation Rate Equations ................................... 74
Precipitation Rate for Irregular-Shaped Areas ............ 75
Matched Precipitation Rate .................................... 75
Soil Types and Precipitation Rates .......................... 76
NRCS Precipitation Rate for Traveling Sprinkler ....... 77
Precipitation Rate for Center Pivot System ............... 78
Precipitation Rate for Linear Move System ............... 79

Chapter 4 — Efficiency and Uniformity Concepts
Uniformity and Efficiency ....................................... 86
Importance of Application Efficiency ....................... 89
Uniformity Measurements ..................................... 90
Calculating Uniformity ......................................... 91
Sprinkler System Uniformity ................................ 92
Application Efficiency vs. Uniformity ....................... 93
Sprinkler Distribution Profiles/Spacing ..................... 94
Possible Effect of Different Pressures on Sprinkler Distribution Profile ..................................... 96
SPACE Pro® and Sprinkler Coverage Analysis .......... 97
Wind Effects ....................................................... 97
Importance of Drop Size Information ...................... 97

Chapter 5 — Irrigation Scheduling
Basic Concepts ................................................... 102
Determining System Capacity ................................. 109

Chapter 6 — Control Valves, Specialty Valves, Controllers, and Backflow Prevention
Control Valves .................................................... 118
Specialty Valves .................................................. 122
Features to Evaluate Valves ................................... 124
Automatic Controllers and Timers ......................... 124
Chemical Injectors ............................................... 126
Table of Contents, cont.

Chapter 6, cont.
  Devices That Prevent Backflow ......................... 128
  Maintenance and Testing of Backflow
    Prevention Devices .............................. 134

Chapter 7 — Pipe and Fittings
  Pipe for Irrigation Systems ....................... 138
  PVC Pipe Fittings ............................... 147
  Pressure Surges — What Causes Them and
    How to Control Them .......................... 151
  Dangers of Entrapped Air ........................ 153
  Pressure Pipe Design and Selection ............. 154
  System Maintenance Requirements ................. 159

Chapter 8 — Hydraulics of Irrigation Systems
  Hydraulic Topics .................................. 164
  Fundamental Flow ................................ 164
  Darcy-Weisbach Equation ......................... 168
  Scobey Equation ................................. 169
  Hazen-Williams Equation ......................... 170
  Valve and Fitting Losses ......................... 171
  Calculating Pressure Losses ..................... 177
  Pipe Sizing ..................................... 179
  Velocity of Flow ................................ 179
  Velocity Limit Method ............................ 181
  Maximum Available Safe Flow for Systems
    with Water Meters ............................. 182
  Surge Pressure/Water Hammer .................... 183
  Discharge and Pressure Relationships .......... 186

Chapter 9 — Pumps for Irrigation
  How Centrifugal Pumps Operate .................. 200
  Types of Pumps ................................. 203
  Vapor Pressure ................................ 208
  Cavitation ..................................... 209
  Sizing and Specifying Pumps ..................... 210
  Items That Affect Pump Performance ............. 216
  Reading Pump Curves — Landscape/Turf ......... 218
  Choosing a Pump from a Pump Curve —
    Landscape/Turf ................................ 221
  Reading Pump Curves — Agricultural ............ 222
  Choosing a Pump from a Pump Curve —
    Agricultural ................................ 227
  Horsepower Calculations ......................... 228
  Pumps in Series ................................ 230
  Pumps in Parallel ................................ 232
  Pump Affinity Laws (Relationships) ............. 233

Chapter 10 — Wire Sizing and Electrical Principles
  Fundamentals of Electricity ..................... 238
  Electrical Considerations ...................... 240
  Wire Sizing Techniques ......................... 241

Appendix A — Glossary ............................ 255

Appendix B — Tables .............................. 283

Appendix C — Supplemental Materials ............ 327

Appendix D — Answers to Practice Questions ..... 355

Index .................................................. 359