TABLE OF CONTENTS

Page

Abstract .. i
Acknowledgments ... iii
Table of Contents ... vii
List of Tables ... x
List of Figures ... xii
List of Plates ... xvi
Volume II Table of Contents ... xviii

I. Introduction ... 1
- The Delaware Route 896 Improvement Project ... 1
- Lums Pond State Park ... 4
- Report Organization ... 5

II. Cultural and Environmental Background ... 7
- Physical Environment ... 7
  - Geomorphological Setting: A Brief Landscape History ... 7
  - Plant and Animal Resources ... 9
- The Paleoenvironment and Human Occupation of the Middle Atlantic ... 9
- Cultural Development ... 10
  - Paleo-Indian ... 11
  - Archaic ... 12
  - Woodland I ... 13
  - Woodland II ... 15
- Historical Summary ... 15

III. Previous Archaeology in the Project Area ... 17
- Delaware Cultural Resource Management Units ... 17
- Prehistoric Archaeological Sites near Lums Pond ... 18
  - Lums Pond Survey ... 18
  - SR896 Investigations ... 18
  - The Route 1 Corridor ... 19
- Conclusion ... 20

IV. Lums Pond Field Investigations ... 23
- Survey and Testing: Finding and Evaluating the Site ... 23
  - Survey ... 23
  - Testing ... 25
  - Testing Results ... 26
- Evaluating the Potential Significance of the Lums Pond Site ... 29

TABLE OF CONTENTS

Page

V. The Lums Pond Research Design 33
- Introduction 33
- Research Questions 34
  - Chronology 34
  - Environment 35
  - Technology 36
  - Subsistence 40
  - Settlement 40

VI. Data Recovery Investigations 43
- Introduction: Methods and Goals 43
  - Area 1 44
  - Area 2 46
  - Area 3 49
- Laboratory Procedures 52
- Special Laboratory Analyses 53

VII. Analysis 55
- Site Stratigraphy 55
- Radiocarbon Dates 59
  - Area 2 60
  - Area 3 63
- Features 65
  - Feature Descriptions 67
  - Analysis of Pit Feature Cluster 78
  - Summary 83
- Stone Artifacts 84
  - Flake Analysis 85
  - Projectile Point Typology 86
  - Area 1 88
  - Area 2 94
  - Area 3 103
- Ceramic Artifacts 127
  - Area 2 127
  - Area 3 127
- Spatial Study 128
    - Archaeology and Plow Zones 128
    - Data Collection at Lums Pond 129
    - Area 1 130
    - Area 2 131
    - Area 3 136

TABLE OF CONTENTS

Page

VIII. Conclusions 143
Chronology 143
Radiocarbon Dates 143
Relative Dating Methods 145
Environmental Setting 149
Lums Pond 150
Paleovegetation at Lums Pond 153
Regional Correlations 155
Technology 156
Artifact Types and Lithic Assemblage Formation 156
Raw Materials and Reduction Techniques 160
Intra-Site Settlement Patterns 166
Area 1 167
Area 2 168
Area 2 Feature Morphology 169
Area 2 Feature Function 172
Area 3 175
Subsistence 183
Regional Settlement Patterns 185
Conclusion 187
Insights Gained and Future Prospects 187
Picture of the Woodland I 188
The Survey and Testing Strategy 188
Staged Mitigation 190
Settlement Patterns 191
Jasper Characterization and Territories 192
Chronological Indicators 192
Landscape Formation 193
Wood, Nuts, and Seeds 194
Describing Stone Tools 195
Jasper Quality 196
Mapping Clusters 196
Features and Formation Processes 197
Reassembling Sites 199
Blood from Stones 200
Final Conclusion 202

References Cited 205

Glossary of Archaeological Terms 211
List of Project Personnel 216

LIST OF TABLES

Page

Table 1. Comparison of Prehistoric Chronologies 11

Table 2. Historic Period Artifacts from Survey and Testing 27

Table 3. Prehistoric Artifacts from Survey and Testing 28

Table 4: Data Categories Recorded in the Lums Pond Artifact Inventory 52

Table 5. Lums Pond Radiocarbon Assay Results 60

Table 6. Artifact Frequencies, Area 1 Excavation Block 88

Table 7. Chipped Stone Raw Material Frequencies, Area 1 Excavation Block 88

Table 8. Mean Flake Weight (gm) per Size Grade, Area 1 93

Table 9. Artifact Frequencies, Area 2 94

Table 10. Chipped Stone Raw Material Frequencies, Area 2 94

Table 11. Comparison of Majority Lithic Raw Material Frequencies within Artifact Categories from Area 2 99

Table 12. Artifact Frequencies, Block D 101

Table 13. Chipped Stone Raw Material Frequencies, Block D 101

Table 14. Flake Attributes: Remnant Cortex and Platform Type, Area 2, Block D 103

Table 15. Artifact Frequencies, Area 3, Stage 1 104

Table 16. Chipped Stone Raw Material Frequencies, Area 3, Stage 1 104

Table 17. Artifact Frequencies, Woodland II Deposits, Block A 108

Table 18. Chipped Stone Raw Material Frequencies, Woodland II Deposits, Block A 108

Table 19. Cortex Frequency, Woodland II Deposits, Block A 109

Table 20. Artifact Frequencies, Woodland I Deposits, Block A 109

LIST OF TABLES

Page

Table 21. Chipped Stone Raw Material Frequencies, Woodland I Deposits, Block A 109

Table 22. Raw Material Frequencies Among Cores and Flakes, Woodland I Deposits, Block A 112

Table 23. Mean Flake Weight per Size Grade, Woodland I Deposits, Block A 116

Table 24. Cortex Frequency by Size Grade, Woodland I Deposits, Block A 116

Table 25. Artifact Frequencies, Woodland II Deposits, Block B 118

Table 26. Chipped Stone Material Frequencies, Woodland II Deposits, Block B 118

Table 27. Artifact Frequencies, Woodland I Deposits, Block B 120

Table 28. Chipped Stone Raw Material Frequencies, Woodland I Deposits, Block B 120

Table 29. Mean Flake Weight per Size Grade, Woodland I Deposit, Block B 126

Table 30. Additional Flake Attribute Data, Woodland I Deposit, Block B 126

Table 31. Lums Pond Area 2, Feature Functions 173

LIST OF FIGURES

Page

Figure 1. Lums Pond Project Location in Regional Context 2

Figure 2. Lums Pond State Park and Vicinity 4

Figure 3. Survey and Testing Excavations with Artifact Density Contours 25

Figure 4. Projectile Points Recovered During Survey and Testing 29

Figure 5. Flake Attributes 53

Figure 6. Three-Dimensional Rendering of the Lums Pond Landscape 56

Figure 7. Stratigraphy in Area 3, Block A and Block B 57

Figure 8. Archaeological Stratigraphy in Area 3, Block B 58

Figure 9. Graph of Aggregation Analysis of Radiocarbon Samples from Features in Area 2 62

Figure 10. Radiocarbon Assay Results from Area 2 Features 63

Figure 11. Graph of Aggregation Analysis of Radiocarbon Samples from Stratigraphic Proveniences in Area 3 65

Figure 12. Feature 10, Profile Section 69

Figure 13. Feature 14, Profile Section 70

Figure 14. Feature 19, Profile Section 73

Figure 15. Comparison of Count, Weight and Mean Weight Data for Pit Features in Area 2 Cluster 79

Figure 16. Mean Fire-Cracked Rock Weight Variation in Area 2 Feature Cluster 80

Figure 17. Frequency of Nutshell and Wood Charcoal in Area 2 Feature Cluster 82

Figure 18. Projectile Points Recovered From Area 1 Excavation Block 89

Figure 19. Raw Material Frequencies Among Bifacially Worked Artifacts Area 1 92

LIST OF FIGURES

Page

Figure 20. Counts of Chronologically Diagnostic Projectile Points from Area 2 95

Figure 21. Notched and Stemmed Points from Area 2 96

Figure 22. Narrow-Bladed, Stemmed Points from Area 2 97

Figure 23. Teardrop and Other Points from Area 2 98

Figure 24. Chert Uniface from Area 2 99

Figure 25. Flake Size Distributions Measured by Weight, Area 2, Block D 102

Figure 26. Counts of Chronologically Diagnostic Projectile Points from Area 3 Sampling 105

Figure 27. Projectile Points from Area 3 Sampling 106

Figure 28. Triangular Points from Area 3 Sampling 107

Figure 29. Projectile Points from Woodland I Deposit, Block A 110

Figure 30. Flake Size Distribution by Weight, Woodland I Deposits, Block A 115

Figure 31. Projectile Points from Woodland II Deposits, Block B 119

Figure 32. Projectile Points from Woodland I Deposit, Block B 121

Figure 33. Uniface from Woodland I Deposits, Block B 122

Figure 34. Flake Size Distribution by Weight, Woodland I Deposit, Block B 125

Figure 35. Results of Random Sampling, Area 1 129

Figure 36. Artifact Distribution in Area 1 Excavation Block 130

Figure 37. Results of Random Sampling, Area 2 132

LIST OF FIGURES

Page

Figure 38. Comparison of Plow Zone Artifacts and Feature Location, Block E, Area 2 133

Figure 39. Comparison of Plow Zone Artifacts and Feature Location, Block C, Area 2 134

Figure 40. Comparison of Plow Zone and Sub-Plow Zone Artifact Locations, Block D, Area 2 135

Figure 41. Results of Random Sampling, Area 3 136

Figure 42. Artifact Concentrations in Woodland II Layer, Block A 137

Figure 43. Artifact Concentrations in Woodland I Layer, Block A 138

Figure 44. Concentrations of Heated Jasper and Chert in Woodland I Layer, Block A 139

Figure 45. Concentration of Fire-Cracked Rock in Woodland I Layer, Block A 139

Figure 46. Artifact Concentrations in Woodland II Layer, Block B 141

Figure 47. Artifact Concentrations in Woodland I Layer, Block B 142

Figure 48. Occupation Episodes Indicated by Radiocarbon Dates from Areas 2 and 3 145

Figure 49. Woodland I Stemmed and Teardrop Projectile Points 147

Figure 50. Sample of Experimental Ceramics Recovered from Pit Features 148

Figure 51. Three-Dimensional Rendering of the Lums Pond Landscape 150

Figure 52. Lums Pond Site Formation Model 151

Figure 53. Lums Pond Site Formation Model 153

Figure 54. Land Use Prints Based on Phosphate Geochemistry 154

Figure 55. Lithic Assemblage Formation Model 157

Figure 56. Debitage:Tool Ratio 158

LIST OF FIGURES

Page

Figure 57. Tool Count vs. Debitage, Occupation Span 159

Figure 58. Comparison of Raw Materials in Woodland I Assemblages in Areas 1 and 3 160

Figure 59. Stone Tool Manufacturing Processes at Lums Pond 162

Figure 60. Refit Bipolar Pebble 166

Figure 61. Areas Identified in Survey and Testing Program 167

Figure 62. Artifact Concentrations in Area 1 Block 168

Figure 63. Pit Features in Area 2 and Fire-Cracked Rock Clustering 169

Figure 64. Dimensional Proportions of Lums Pond Features (dots) in Relation to Feature Categories (I-III) from Fisher Farm 170

Figure 65. Dimensional of Lums Pond Features (dots) in Relation to Feature Categories (I-III) from Cabin Run 172

Figure 66. Artifacts Recovered from Pit Features in Area 2 174

Figure 67. Fire-Cracked Rock Clusters and Refits 177

Figure 68. Artifact Cluster and Refits 178

Figure 69. Artifacts Recovered from Block B, Stratum D/E 179

Figure 70. Vertical Proveniences of Temporally Diagnostic Projectile Points in Area 3 180

Figure 71. Vertical Frequency Distribution of Artifacts in Sub-Plow Zone Deposits in Block A and Block B 181

Figure 72. Vertical Distribution of Refits 182

Figure 73. Potential Sources for Jasper Recovered at the Lums Pond Site 186

LIST OF PLATES

Page

Plate 1. Aerial Photograph of Lums Pond Site During Survey and Testing Investigations 24

Plate 2. Area 1, Fully Excavated Plow Zone 45

Plate 3. Aerial Photograph of Area 2 47

Plate 4. Sampling Excavations in Area 2, View West 48

Plate 5. Data Recovery Excavations in Block C, Area 2, View North 48

Plate 6. Pit Features in Block C, Area 2 49

Plate 7. Aerial Photograph of Area 3 50

Plate 8. Data Recovery Excavations in Block A, Area 3, View West 51

Plate 9. Data Recovery Excavations in Block B, Area 3, View East Showing Screening 51

Plate 10. Cluster of Pit Features in Block C of Area 2, View South 66

Plate 11. Cluster of Pit Features in Block C of Area 2, View East 66

Plate 12. Feature 10, Fully Excavated 68

Plate 13. Feature 14, Fully Excavated 71

Plate 14. Feature 19, Partially Bisected 74

Plate 15. Feature 19, Trowelling Exposing Fire-Cracked Rock 74

Plate 16. Feature 19, Fully Excavated 75

Plate 17. Feature 25, Fully Excavated 77

Plate 18. Early Stage Biface from Area 1 Manufactured from Quartz 90

Plate 19. Late Stage Biface from Area 1 Manufactured from Chert 91

Plate 20. Sample of Flakes Recovered from Area 1 93

LIST OF PLATES

Page

Plate 21. Hammerstone From Area 2 Showing Battering on Edge 100

Plate 22. Early Stage Biface from Woodland Deposits, Block A.....111

Plate 23. Hammerstone and Anvil, Woodland I of Block A.....113

Plate 24. Celt from Woodland I Depostis, Block A.....114

Plate 25. Anvil from Woodland I Deposits, Block B 123

Plate 26. Celt from Woodland I Deposits, Block B.....124

Plate 27. Fire-cracked rocks, Block A, Area 3 view east.....140

Plate 28. Area 2 Pit with Fire-Cracked Rock and Charcoal for Radiocarbon Dating 144

Plate 29. Area 3, Block B Wall Profile, with Charcoal-rich Horizon (Stratum C) for Radiocarbon Dating.....144

Plate 30. Jasper being Procured for Experiments 163

Plate 31. Antler and Hammerstone Percussors and Chipping Debris resulting from Jasper Experiments.....164

Plate 32. Jasper Experiment Showing Production of Biface and Flaking Debris.....164

Plate 33. Jasper Grades Showing Poor Flaking Characteristics.....165

Plate 34. Refit Fire-Cracked Rock from Block A, Area 3 (Group 3a).....176

Plate 35. Refit Fire-Cracked Rock from Block A, Area 3 (Group 4a).....176