

TABLE OF CONTENTS

- 1.0 Introduction.....2**
- 1.1 Background.....2
 - 1.1.1 DMA 2000 Origins -The Robert T. Stafford Disaster Relief And Emergency Assistance Act....2
 - 1.1.2 Benefits Of Mitigation Planning.....3
- 1.2 Organizations Involved In The Mitigation Planning Effort.....3
- 1.3 Organization Of The Plan.....6
- 1.4 Implementation Of The 2016 Hazard Mitigation Plan8
 - 1.4.1 Implementation Of The Planning Process8
- 2.0 County Profile9**
- 2.1 General Information.....10
 - 2.1.2 Physical Setting.....17
- 2.2 Population And Demographics21
 - 2.2.1 Population Characteristics.....21
 - 2.2.2 Vulnerable Populations23
 - 2.2.3 Population Trends.....31
- 2.3 Land Use/Land Cover33
 - 2.3.1 Changes In Land Use/Land Cover.....33
 - 2.3.2 Open Space And Parkland36
 - 2.3.3 The Highlands Region.....39
- 2.4 General Building Stock.....42
- 2.5 Development Trends And New Development.....48
 - 2.5.2 Redevelopment Areas50
 - 2.5.3 New Residential Construction52
- 2.6 Economic Assets.....55
 - 2.6.1 Employment.....55
 - 2.6.2 Jobs By Employment Sector55
- 2.7 Transportation.....55
- 3.0 Planning Process.....60**
- 3.1 Introduction.....60
- 3.2 Planning Partnership – Organization And Activity.....65
 - 3.2.1 Project Team.....65
 - 3.2.2 Steering Committee.....65
 - 3.2.3 Planning Committee66
 - 3.2.4 Regional Stakeholders.....68
 - 3.2.5 Public Participation – Citizen Involvement.....69

3.3 Outreach And Documentation.....	70
3.3.1 Steering Committee Outreach	70
3.3.2 Planning Committee Outreach	71
3.3.3 Planning Committee Meeting Documentation	75
3.3.4 Stakeholder Outreach.....	77
3.4 Continued Public Involvement.....	78
3.5 Jurisdiction Annex Templates.....	78
4.0 Risk Assessment	82
4.0 Risk Assessment Table Of Contents.....	82
4.1 Risk Assessment Methodology	87
4.1.1 Methodology.....	87
4.1.2 Tools.....	88
4.2 Identification Of Hazards Of Concern.....	91
4.3 Hazard Ranking.....	101
4.3.1 Hazard Ranking Methodology	101
4.3.2 Hazard Ranking Results.....	102
4.4 Critical Facilities And Assets	105
4.4.1 Essential Facilities.....	106
4.4.2 Transportation Systems.....	108
4.4.3 Lifeline Utility Systems.....	108
4.4.4 High-Potential Loss Facilities.....	109
4.4.5 Other Facilities	111
4.5 Hazard Profiles And Vulnerability Assessments.....	111
4.6 Dam Failure	112
4.6.1 Hazard Description	112
4.6.2 Location.....	112
4.6.3 Extent.....	113
4.6.4 Previous Occurrences And Losses.....	115
4.6.5 Probability Of Future Occurrences.....	116
4.6.6 Potential Effects Of Climate Change.....	116
4.6.7 Vulnerability Assessment.....	117
4.7 Drought.....	123
4.7.1 Hazard Description.....	123
4.7.2 Location.....	124
4.7.3 Extent	125
4.7.4 Previous Occurrences And Losses.....	127

4.7.5 Probability Of Future Occurrences.....	128
4.7.6 Potential Effects Of Climate Change.....	128
4.7.7 Vulnerability Assessment.....	129
4.8 Earthquake.....	136
4.8.1 Hazard Description.....	136
4.8.2 Location.....	137
4.8.3 Extent.....	140
4.8.4 Previous Occurrences And Losses.....	145
4.8.5 Probability Of Future Occurrences.....	149
4.8.6 Potential Effects Of Climate Change.....	149
4.8.7 Vulnerability Assessment.....	150
4.9 Flood.....	163
4.9.1 Hazard Description.....	163
4.9.2 Location.....	164
4.9.3 Extent.....	183
4.9.4 Previous Occurrences And Losses.....	184
4.9.5 Probability Of Future Occurrences.....	185
4.9.6 Potential Effects Of Climate Change.....	186
4.9.7 Vulnerability Assessment.....	189
4.10 Geologic.....	206
4.10.1 Hazard Description.....	206
4.10.2 Location.....	208
4.10.3 Extent.....	218
4.10.4 Previous Occurrences And Losses.....	218
4.10.5 Probability Of Future Occurrences.....	220
4.10.6 Potential Effects Of Climate Change.....	220
4.10.7 Vulnerability Assessment.....	221
4.11 Hurricane And Tropical Storm.....	231
4.11.1 Hazard Description.....	231
4.11.2 Location.....	233
4.11.3 Extent.....	234
4.11.4 Previous Occurrences And Losses.....	235
4.11.5 Probability Of Future Occurrences.....	236
4.11.6 Potential Effects Of Climate Change.....	237
4.11.7 Vulnerability Assessment.....	238
4.12 Nor'easter.....	248

4.12.1 Hazard Description.....	248
4.12.2 Location.....	249
4.12.3 Extent.....	249
4.12.4 Previous Occurrences And Losses.....	249
4.12.5 Probability Of Future Occurrences.....	250
4.12.6 Potential Effects Of Climate Change.....	251
4.12.7 Vulnerability Assessment.....	251
4.13 Severe Weather.....	253
4.13.1 Hazard Description.....	253
4.13.2 Location.....	255
4.13.3 Extent.....	257
4.13.4 Previous Occurrences And Losses.....	262
4.13.5 Probability Of Future Occurrences.....	266
4.13.6 Potential Effects Of Climate Change.....	266
4.13.7 Vulnerability Assessment.....	270
4.14 Severe Winter Weather.....	273
4.14.1 Hazard Description.....	273
4.14.2 Location.....	274
4.14.3 Extent.....	275
4.14.4 Previous Occurrences And Losses.....	276
4.14.5 Probability Of Future Occurrences.....	277
4.14.6 Potential Effects Of Climate Change.....	278
4.14.7 Vulnerability Assessment.....	278
4.15 Wildfire.....	282
4.15.1 Hazard Description.....	282
4.15.2 Location.....	284
4.15.3 Extent.....	288
4.15.4 Previous Occurrences And Losses.....	289
4.15.5 Probability Of Future Occurrences.....	289
4.15.6 Potential Effects Of Climate Change.....	290
4.15.7 Vulnerability Assessment.....	290
4.16 Hazardous Material.....	299
4.16.1 Hazard Description.....	299
4.16.2 Location.....	300
4.16.3 Extent.....	304
4.16.4 Previous Occurrences And Losses.....	306

4.16.5 Probability Of Future Occurrences	306
4.16.6 Potential Effects Of Climate Change	307
4.16.7 Vulnerability Assessment.....	307
4.17 Animal Disease	309
4.17.1 Hazard Description	309
4.17.2 Location	311
4.17.3 Extent.....	311
4.17.4 Previous Occurrences And Losses	311
4.17.5 Probability Of Future Occurrences.....	312
4.17.6 Potential Effects Of Climate Change	312
4.17.7 Vulnerability Assessment.....	312
4.18 Civil Unrest.....	314
4.18.1 Hazard Description.....	314
4.18.2 Location	314
4.18.3 Extent.....	314
4.18.4 Previous Occurrences And Losses.....	314
4.18.5 Probability Of Future Occurrences	314
4.18.6 Potential Effects Of Climate Change	315
4.18.7 Vulnerability Assessment.....	315
4.19 Crop Failure.....	316
4.19.1 Hazard Description.....	316
4.19.2 Location	317
4.19.3 Extent.....	320
4.19.4 Previous Occurrences And Losses.....	320
4.19.5 Probability Of Future Occurrences	320
4.19.6 Potential Effects Of Climate Change	320
4.19.7 Vulnerability Assessment.....	321
4.20 Cyber Attack	323
4.20.1 Hazard Description.....	323
4.20.2 Location.....	323
4.20.3 Extent	323
4.20.4 Previous Occurrences And Losses.....	324
4.20.5 Probability Of Future Occurrences	325
4.20.6 Potential Effects Of Climate Change	325
4.20.7 Vulnerability Assessment.....	325
4.21 Economic Collapse.....	327

4.21.1 Hazard Description.....	327
4.21.2 Location.....	327
4.21.3 Extent.....	327
4.21.4 Previous Occurrences And Losses.....	327
4.21.5 Probability Of Future Occurrences.....	329
4.21.6 Potential Effects Of Climate Change.....	329
4.21.7 Vulnerability Assessment.....	329
4.22 Pandemic.....	330
4.22.1 Hazard Description.....	330
4.22.2 Location.....	332
4.22.3 Extent.....	333
4.22.4 Previous Occurrences And Losses.....	334
4.22.5 Probability Of Future Occurrences.....	338
4.22.6 Potential Effects Of Climate Change.....	338
4.22.7 Vulnerability Assessment.....	338
4.23 Power Failure.....	340
4.23.1 Hazard Description.....	340
4.23.2 Location.....	340
4.23.3 Extent.....	341
4.23.4 Previous Occurrences And Losses.....	341
4.23.5 Probability Of Future Occurrences.....	342
4.23.6 Potential Effects Of Climate Change.....	343
4.23.7 Vulnerability Assessment.....	343
4.24 Terrorism.....	345
4.24.1 Hazard Description.....	345
4.24.2 Location.....	347
4.24.3 Extent.....	347
4.24.4 Previous Occurrences And Losses.....	348
4.24.5 Probability Of Future Occurrences.....	348
4.24.6 Potential Effects Of Climate Change.....	348
4.24.7 Vulnerability Assessment.....	349
5.0 Capability Assessment.....	352
5.1 Overview.....	352
5.1.1 Methodology.....	352
5.2 Planning And Regulatory Capability.....	353
5.2.1 Federal Planning And Regulations.....	354

5.2.2 State Planning And Regulations.....	356
5.2.3 County Planning And Regulations.....	360
5.2.4 Municipal Planning And Regulations	361
5.2.5 Watershed Management Plans	363
5.2.6 Summary Of Findings.....	363
5.2.7 Participation In The Nfip And Crs Program.....	366
5.3 Education And Outreach.....	367
5.4 Administrative And Technical Capability	369
5.4.1 State Administrative And Technical Capabilities.....	369
5.4.2 County Administrative And Technical Capabilities.....	372
5.4.3 Summary Of Findings	374
5.5 Fiscal Capability.....	377
5.5.1 Federal Technical Assistance And Funding	377
5.6 Plan Integration.....	381
5.6.1 Incorporation Of Existing Plans, Studies, Reports And Technical Information.....	381
5.6.2 Regional Intergration Activities	382
5.6.3 County Integration Activities	384
5.6.4 Local Integration Activities.....	385
6.0 Mitigation Strategy.....	392
6.1 Introduction.....	392
6.2 Background And Past Mitigation Accomplishments	392
6.3 General Mitigation Planning Approach	392
6.4 Review And Update Of Mitigation Goals And Objectives.....	393
6.5 Mitigation Strategy Development And Update.....	395
6.5.1 Update Of Municipal Mitigation Strategies	395
6.5.2 Mitigation Action Worksheets.....	396
6.5.3 Update Warren County Mitigation Strategies.....	398
6.5.4 Comprehensive Mitigation Action Summary	398
6.5.5 Mitigation Strategy Evaluation And Prioritization	411
6.5.6 Benefit/Cost Review	443
7.0 Plan Maintenance	446
7.1 Monitoring, Evaluating, And Updating The Plan	446
7.1.1 Monitoring The Plan.....	446
7.1.2 Evaluating The Plan.....	447
7.1.3 Updating The Plan.....	448
7.2 Implementation Of Mitigation Plan Through Existing Programs.....	449

7.3 Continued Public Involvement.....	450
8.0 Plan Adoption	452
8.1 Overview.....	452
8.1.1 Plan Adoption By Local Governing Bodies.....	452
8.2 Sample Resolution.....	453

APPENDICES

APPENDIX VOLUME I- JURISDICTIONAL INFORMATION

VOL I. 1 ALLAMUCHY TOWNSHIP	VOL I. 12 INDEPENDENCE TOWNSHIP
VOL I. 2 ALPHA BOROUGH	VOL I. 13 KNOWLTON TOWNSHIP
VOL I. 3 BELVIDERE TOWN	VOL I. 14 LIBERTY TOWNSHIP
VOL I. 4 BLAIRSTOWN TOWNSHIP	VOL I. 15 LOPATCONG TOWNSHIP
VOL I. 5 FRANKLIN TOWNSHIP	VOL I. 16 MANSFIELD TOWNSHIP
VOL I. 6 FRELINGHUYSEN TOWNSHIP	VOL I. 17 OXFORD TOWNSHIP
VOL I. 7 GREENWICH TOWNSHIP	VOL I. 18 PHILLIPSURG TOWN
VOL I. 8 HACKETTSTOWN TOWN	VOL I. 19 POHATCONG TOWNSHIP
VOL I. 9 HARDWICK TOWNSHIP	VOL I. 20 WASHINGTON BOROUGH
VOL I. 10 HARMONY TOWNSHIP	VOL I. 21 WASHINGTON TOWNSHIP
VOL I. 11 HOPE TOWNSHIP	VOL I. 22 WHITE TOWNSHIP

APPENDIX VOLUME II – OTHER PLANNING DOCUMENTS

VOL II. A – HAZUS REPORTS
VOL II. B – MONITORING TOOLS
VOL II. C – MEETING DOCUMENTATION
VOL II. D – LOCAL MITIGATION PLAN REVIEW TOOL
VOL. II E – PLAN ADOPTION RESOLUTIONS

FIGURES

Figure 2.1 - 1 Warren County Base Map.....	11
Figure 2.1 - 2 Warren County Base Map: Group One – Northern Warren County.....	12
Figure 2.1 - 3 Warren County Base Map: Group Two – Southern Warren County	13
Figure 2.1 - 4 Warren County Base Map: Group Three – Western Warren County.....	14
Figure 2.1 - 5 Warren County Base Map: Group 4 – Southeastern Warren County.....	15
Figure 2.1 - 6 Warren County Base Map: Group 5 – Northeastern Warren County.....	16
Figure 2.1 - 7 Bodies of Water in Warren County.....	18
Figure 2.1 - 8 Watersheds of New Jersey (NJDEP).....	19
Figure 2.2 - 1 Distribution of General Population for Warren County, New Jersey.....	22
Figure 2.2 - 2 SVI Categories (CDC).....	25
Figure 2.2 - 3 SVI by Socioeconomic Status in Warren County (CDC).....	26
Figure 2.2 - 4 SVI by Household Composition/ Disability (CDC).....	27
Figure 2.2 - 5 SVI by Race/Ethnicity/Language.....	28
Figure 2.2 - 6 SVI by Housing and Transportation (CDC).....	29
Overall Social Vulnerability (CDC).....	30

Figure 2.2 - 7 Overall Social Vulnerability in Warren County (CDC)..... 30

Figure 2.2 - 8 Warren County Population Projections, 2010 to 2034 33

Figure 2.3 - 1 2015 Land Use/Land Cover for Warren County..... 34

Figure 2.3 - 2 Highlands Region of New Jersey 41

Figure 2.4 - 2 Distribution of Residential Building Improvement Value Density in Warren County..... 45

Figure 2.4 - 3 Distribution of Commercial Building Improvement Value Density in Warren County..... 46

Figure 2.4 - 4 Distribution of Industrial Building Improvement Value Density in Warren County47

Figure 2.5 - 2 Area in Need of Redevelopment..... 51

Figure 2.5 - 3 Warren County All Housing Units - Building Permits, 2004 - 2018 53

Figure 2.6 - 1 Jobs by Employment Sector in Warren County..... 55

Figure 2.7 - 2 Transportation Facilities in Warren County..... 57

Figure 2.7 - 3 FEMA Community Profiles Tool..... 58

Figure 3.1 - 2 Warren County HMP Project Website: www.WarrenHMP.com 63

Figure 3.1 - 3 Warren County HMP Website Public Comment Section 64

Figure 3.1 - 4 Warren County Press Release [Placeholder]..... 64

Figure 3.3 - 1 Warren County HMP Goals and Hazards..... 75

Figure 4.2 - 1 Steering Committee Hazard Identification Worksheet..... 93

Figure 4.7 - 1 Drought Regions of New Jersey125

Figure 4.8 - 1 ZIP Code-Based Soil Site Class Map138

Figure 4.8 - 2 Faults in Northern New Jersey.....140

Figure 4.8 - 3 Peak Ground Acceleration 100-Year Mean Return Period for New Jersey143

Figure 4.8 - 4 Peak Ground Acceleration 500-Year Mean Return Period for New Jersey144

Figure 4.8 - 5 Peak Ground Acceleration 2,500-Year Mean Return Period for New Jersey145

Figure 4.8 - 6 Earthquakes with Epicenters in Warren County, 1783 to 2020..... 147

Figure 4.8 - 7 Earthquakes with Epicenters in Warren County, 1783 to 2020-Group One148

Figure 4.8 - 8 Census Tracts and Municipal Boundaries in Warren County.....152

Figure 4.8 - 9 Estimated Value (Building and Contents) Damaged by the 100-, 500- and 2,500-Year MRP Earthquake Events (Continued).....158

Figure 4.9 - 1 FEMA Flood Hazard Areas in Warren County166

Figure 4.9 - 2 FEMA Flood Hazard Areas in Warren County: Group 1.....167

Figure 4.9 - 3 FEMA Flood Hazard Areas in Warren County: Group 2168

Figure 4.9 - 4 FEMA Flood Hazard Areas in Warren County: Group 3169

Figure 4.9 - 5 FEMA Flood Hazard Areas in Warren County: Group 4170

Figure 4.9 - 6 FEMA Flood Hazard Areas in Warren County: Group 5.....171

Figure 4.9 - 7 Ice Jams in Warren County.....173

Figure 4.9 - 8 Wetlands in Warren County.....177

Figure 4.9 - 9 Wetlands in Warren County: Group 1.....178

Figure 4.9 - 10 Wetlands in Warren County: Group 2179

Figure 4.9 - 11 Wetlands in Warren County: Group 3.....180

Figure 4.9 - 12 Wetlands in Warren County: Group 4181

Figure 4.9 - 13 Wetlands in Warren County: Group 5182

Figure 4.9 - 14 Statewide Overburdened Communities Map188

Figure 4.10 - 1 Historic Landslide Locations in Warren County, 1782 to 2019..... 209

Figure 4.10 - 2 Historic Landslide Locations in Warren County, 1782 to 2019: Group 1.....210

Figure 4.10 - 3 Historic Landslide Locations in Warren County, 1782 to 2019: Group 2211

Figure 4.10 - 4 Historic Landslide Locations in Warren County, 1782 to 2019: Group 3212

Figure 4.10 - 5 Historic Landslide Locations in Warren County, 1782 to 2019: Group 4.....213

Figure 4.10 - 6 Historic Landslide Locations in Warren County, 1782 to 2019: Group 5.....214

Figure 4.10 - 7 Carbonate Rock in the New Jersey Highlands.....216

Figure 4.10 - 8 Abandoned Mines in New Jersey..... 217

Figure 4.11 - 1 Historical Tropical Storm and Hurricane Tracks 2005 to 2020.....234

Figure 4.11 - 2 . Density of Losses for Structures (All Occupancies) for the 100-Year MRP Wind Event
.....243

Figure 4.11 - 3 Density of Losses for Structures (All Occupancies) for the 500-Year MRP Wind Event244

Figure 4.13 - 1 Wind Zones in the United States.....256

Figure 4.13 - 2 NWS Heat Index Chart 260

Figure 4.13 - 3 Figure 5.4.8 2. Adverse Effects of Prolonged Exposures to Heat on Individuals.....261

Figure 4.13 - 4 NWS Wind Chill Index261

Figure 4.13 - 5 Annual Days Suitable for Thunderstorms/Damaging Winds267

Figure 4.13 - 6 Monthly Mean Temperatures in Northern New Jersey, 1895 to 2014.....268

Figure 4.13 - 7 New Jersey’s Extreme Temperature and Precipitation Months, 1895-2019.....269

Figure 4.15 - 1 Wildfire Fuel Hazard for Warren County.....286

Figure 4.15 - 2 Wildfire Risk for Warren County..... 287

Figure 4.16 - 1 Major Transportation Routes in Warren County.....305

Figure 4.17 - 1 List of Animal Diseases by Animal Species310

Figure 4.19 - 1 Ash Density on Forest Land in New Jersey.....318

Figure 4.19 - 2 EAB Detections in New Jersey.....319

Figure 4.19 - 3 Top Agricultural Products by County322

Figure 4.22 - 1 Lab Confirmed Cases (PCR) in Warren County, as of 2/8/2021..... 337

Figure 4.22 - 2 Pandemic Severity Index.....339

Figure 4.24 - 1 New Jersey’s Assessed Threat Level in 2020350

Figure 5.1 - 1 Capability Assessment Worksheet (Page 1 of 6) 353

Figure 5.6 - 1 Ongoing Planned Municipal Integration Activities..... 387

Figure 6.5 - 1 Mitigation Action Worksheet Evaluation..... 397

Figure 6.5 - 2 Qualitative Cost and Benefit Ratings..... 443

TABLES

Table 1.2 - 1 Participating Jurisdictions in the 2021 Warren County HMP 4

Table 1.2 - 2 FEMA Local Mitigation Plan Review Tool.....	5
Table 1.3 - 1 Crosswalk of 2016 HMP Sections and 2021 HMP Sections.....	8
Table 2.2 - 1 Warren County Vulnerable Populations (2018).....	23
Table 2.2 - 2 Warren County Population Trends, 1900 to 2018	31
Table 2.2 - 3 Top Ten Most Populous Municipalities in Warren County.....	32
Table 2.2 - 4 Population Trends in Warren County by Municipality	32
Table 2.3 - 1 Changes in Land Cover, 2007 and 2015	33
Table 2.3 - 2 Open Space in Warren County.....	37
Table 2.3 - 3 Open Space Acreage in Warren County by Municipality.....	38
Table 2.3 - 4 Acreage of the Highlands Region in Warren County Municipalities	40
Table 2.4 - 1 Number of Buildings and Improvement Value by Occupancy Class	42
Table 2.5 - 1 Proposed New Development in Warren County	48
Table 2.5 - 2 Warren County Building Permits 2008-2018.....	52
Table 2.1-1 Vacant Developable Land Located Within FEMA’S SFHA (in acres).....	54
Table 2.7 - 1 County Roads That Experience Flooding.....	56
Table 3.1 - 1 Participating Jurisdictions in the Warren County HMP.....	60
Table 3.1 - 2 FEMA’s Four Core Planning Steps.....	61
Table 3.2 - 1 Steering Committee Members.....	66
Table 3.2 - 2 Warren County Hazard Mitigation Planning Partnership.....	67
Table 3.3 - 1 Summary of Steering Committee Outreach	70
Table 3.3 - 2 Summary of Planning Committee Outreach.....	71
Table 3.3 - 3 List of Local Official Participation, By Jurisdiction.....	74
Table 3.3 - 4 Local Meeting Participation and Documentation, By Jurisdiction.....	77
Table 3.3 - 5 Stakeholder Meetings	77
Table 4.2 - 1 Hazard Identification Crosswalk.....	94
Table 4.2 - 2 Identification of Hazard of Concern for Warren County	94
Table 4.2 - 3 FEMA Major Disaster Declarations in Warren County.....	100
Table 4.3 - 1 Probability of Occurrence.....	102
Table 4.3 - 2 Numerical Values and Definitions for Impacts on Population, Property and Economy ...	102
Table 4.3 - 3 Probability of Occurrence Ranking for Hazards of Concern for Warren County	103
Table 4.3 - 4 Impact Ranking for Hazards of Concern for Warren County	103
Table 4.3 - 5 Total Risk Ranking Value for Hazards of Concern for Warren County	105
Table 4.4 - 1 Essential Facilities by Jurisdiction.....	107
Table 4.4 - 2 Lifeline Utility Systems by Jurisdiction.....	109
Table 4.4 - 3 High Potential Loss Facilities by Jurisdiction	110
Table 4.4 - 4 Other Facilities by Jurisdiction	111
Table 4.6 - 1 Number of Dams in Warren County.....	113
Table 4.6 - 2 New Jersey Dam Inspection Requirements.....	114

Table 4.6 - 3 State-Regulated Dams with High (H) or Significant (S) Hazard Potential 114

Table 4.6 - 4 FEMA DR and EM Declarations Since 2015 for Dam Failure Events in Warren County.... 115

Table 4.6 - 5 Total Number of and Replacement Cost Value (RCV) for Essential Facilities with Risk of Dam Failure 119

Table 4.6 - 6 Total Number of and Replacement Cost Value (RCV) for Transportation Systems with Risk of Dam Failure..... 120

Table 4.6 - 7 Total Number of and Replacement Cost Value (RCV) for Lifeline Utility Systems with Risk of Dam Failure..... 120

Table 4.6 - 8 Total Number of and Replacement Cost Value (RCV) for High Potential Loss Facilities with Risk of Dam Failure..... 121

Table 4.6 - 9 Total Number of and Replacement Cost Value (RCV) for Other Facilities with Risk of Dam Failure..... 122

Table 4.7 - 1 FEMA DR and EM Declarations Since 2015 for Drought Events in Warren County 127

Table 4.7 - 2 USDA Drought Disaster Declarations..... 128

Table 4.7 - 3 Probability of Future Drought Events 128

Table 4.7 - 4 Drinking Water Suppliers in Warren County..... 131

Table 4.7 - 5 Total Number of Wells by Jurisdiction 132

Table 4.7 - 6 Economic, Environmental, and Social Impacts of Drought..... 133

Table 4.7 - 7 Total Area of Agricultural Land by Cropland Types 134

Table 4.8 - 1 NEHRP Soil Classifications..... 137

Table 4.8 - 2 NJDOT Soil Classifications..... 137

Table 4.8 - 3 Richter Magnitude Scale..... 140

Table 4.8 - 4 Modified Mercalli Intensity Scale..... 141

Table 4.8 - 5 Modified Mercalli Intensity and PGA Equivalents..... 141

Table 4.8 - 6 Damage Levels Experienced in Earthquakes..... 142

Table 4.8 - 7 FEMA DR and EM Declarations Since 2008 for Earthquake Events in Warren County... 146

Table 4.8 - 8 Probability of Future Earthquake Events..... 149

Table 4.8 - 9 Estimated Displaced Households and Population Seeking Short-Term Shelter from 500- and 2,500-year MRP Events by Municipality 153

Table 4.8 - 10 Estimated Number of Injuries and Casualties from the 500-Year MRP Earthquake Event 154

Table 4.8 - 11 Estimated Number of Injuries and Casualties from the 2,500-Year MRP Earthquake Event 154

Table 4.8 - 12 Example of Structural Damage State Definitions for a Light Wood-Framed Building..... 155

Table 4.8 - 13 Estimated Buildings Damaged by General Occupancy for 100-year and 500-year MRP Earthquake Events..... 156

Table 4.8 - 14 Estimated Buildings Damaged by General Occupancy for 2,500-year MRP Earthquake Events..... 156

Table 4.8 - 15 Estimated Value (Building and Contents) Damaged by the 500- and 2,500-Year MRP Earthquake Events..... 156

Table 4.8 - 16 Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Warren County for the 500-Year MRP Earthquake Event..... 159

Table 4.8 - 17 Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Warren County for the 2,500-Year MRP Earthquake Event	160
Table 4.8 - 18 Estimated Debris Generated by the 500- and 2,500-year MRP Earthquake Events.....	161
Table 4.9 - 1 Acreage of Wetlands by Municipality.....	174
Table 4.9 - 2 Natural and Beneficial Land in Warren County	175
Table 4.9 - 3 FEMA DR and EM Declarations Since 2015 for Flood Events in Warren County.....	184
Table 4.9 - 4 Flood Events, Warren County, 2015-2020	185
Table 4.9 - 5 Ice Jam Events, Warren County, 2015-2020	185
Table 4.9 - 6 Probability of Future Flood Events.....	186
Table 4.9 - 7 Total Land Area in the 1-Percent and 0.2-Percent Annual Chance Flood Zones (Acres).	191
Table 4.9 - 8 Estimated Population Exposed to the Flood Hazard.....	191
Table 4.9 - 9 Estimated Population Displaced or Seeking Short-Term Shelter from the 1-percent Annual Chance Flood Event	193
Table 4.9 - 10 Estimated General Building Stock Exposure to the 1-Percent Annual Chance Flood Event – All Occupancies.....	194
Table 4.9 - 11 Estimated General Building Stock Exposure to the 0.2-Percent Annual Chance Flood Event – All Occupancies.....	195
Table 4.9 - 12 Estimated General Building Stock Potential Loss to the 1-percent Annual Chance Flood Event.....	196
Table 4.9 - 13 Occupancy Class of Repetitive Loss (RL) and Severe Repetitive Loss (SRL) Structures in Warren County.....	198
Table 4.9 - 14 Occupancy Class of Repetitive Loss Structures in Warren County, by Municipality	198
Table 4.9 - 15 NFIP Policies, Claims and Repetitive Loss Statistics.....	199
Table 4.9 - 16 Total Number of and Replacement Cost Value (RCV) for Essential Facilities in the SFHA	200
Table 4.9 - 17 Total Number of and Replacement Cost Value (RCV) for Transportation Systems in the SFHA*	201
Table 4.9 - 18 Total Number of and Replacement Cost Value (RCV) for Lifeline Utility Systems in the SFHA.....	201
Table 4.9 - 19 Total Number of and Replacement Cost Value (RCV) for High Potential Loss Facilities in the SFHA	202
Table 4.9 - 20 Number of Critical Facilities Located in the 0.2-Percent Annual Chance Flood Zone.	203
Table 4.9 - 21 Estimated Debris Generated from the 1-percent Flood Event.....	204
Table 4.10 - 1 FEMA DR and EM Declarations Since 2015 for Geologic Hazard Events in Warren County	219
Table 4.10 - 2 Probability of Future Geologic Events.....	220
Table 4.10 - 3 Estimated Population Located in the Geologic Hazard Areas	223
Table 4.10 - 4 Estimated Building Exposure in the Geologic Hazard Areas.....	224
Table 4.10 - 5 Total Number of and Replacement Cost Value (RCV) for Essential Facilities within the Steep Slope Protection Area	226
Table 4.10 - 6 Total Number of and Replacement Cost Value (RCV) for High Potential Loss Facilities within the Steep Slope Protection Area	227

Table 4.10 - 7 Total Number of and Replacement Cost Value (RCV) for Essential Facilities in the Carbonate Formation Hazard Area.....	227
Table 4.10 - 8 Total Number of and Replacement Cost Value (RCV) for Transportation Systems in the Carbonate Formation Hazard Area*	228
Table 4.10 - 9 Total Number of and Replacement Cost Value (RCV) for Lifeline Utility Systems in the Carbonate Formation Hazard Area.....	228
Table 4.10 - 10 Total Number of and Replacement Cost Value (RCV) for High Potential Loss Facilities in the Carbonate Formation Hazard Area	229
Table 4.10 - 11 Total Number of and Replacement Cost Value (RCV) for Other Facilities in the Carbonate Formation Hazard Area.....	230
Table 4.11 - 1 The Saffir-Simpson Hurricane Scale	234
Table 4.11 - 2 FEMA DR and EM Declarations since 2015 for Hurricane and Tropical Storm Events in Warren County.....	235
Table 4.11 - 3 Probability of Future Hurricane and Tropical Storm Events	237
Table 4.11 - 4 Description of Damage Categories.....	239
Table 4.11 - 5 Estimated Building Value (Structure Only) Damaged by the 100-Year and 500-Year MRP Hurricane-Related Winds.....	240
Table 4.11 - 6 Estimated Residential and Commercial Building Value (Structure Only) Damaged by the 100-Year and 500-Year MRP Hurricane-Related Winds.....	241
Table 4.11 - 7 Estimated Impacts to Critical Facilities for the 100- Year Mean Return Period Hurricane-Related Winds.....	245
Table 4.11 - 8 Estimated Impacts to Critical Facilities for the 500-Year Mean Return Period Hurricane-Related Winds.....	245
Table 4.11 - 9 Debris Production for 100- and 500-Year Mean Return Period Hurricane-Related Winds	246
Table 4.12 - 1 RSI Ranking Categories.....	249
Table 4.12 - 2 FEMA Declarations Since 2015 for Nor'Easter Events in Warren County.....	250
Table 4.12 - 3 Nor'Easter Events, Warren County, 2015-2020.....	250
Table 4.12 - 4 Probability of Future Nor'Easter Events	250
Table 4.13 - 1 NWS Wind Descriptions.....	257
Table 4.13 - 2 Fujita Damage Scale.....	258
Table 4.13 - 3 Enhanced Fujita Damage Scale.....	258
Table 4.13 - 4 Hail Size.....	260
Table 4.13 - 5 MRCC Temperature Extremes.....	262
Table 4.13 - 6 FEMA DR and EM Declarations Since 2015 for Severe Weather Events in Warren County	263
Table 4.13 - 7 USDA Drought Disaster Declarations.....	263
Table 4.13 - 8 Severe Weather Events in Warren County, 2015-2020	264
Table 4.13 - 9 Probability of Future Severe Weather Events.....	266
Table 4.14 - 1 RSI Ranking Categories.....	275
Table 4.14 - 2 FEMA Declarations Since 2015 for Severe Winter Weather Events in Warren County.....	276
Table 4.14 - 3 Severe Winter Weather Events in Warren County, 2015 to 2020	276

Table 4.14 - 4 Probability of Future Severe Winter Weather Events.....	278
Table 4.15 - 1 Approximate Area in the Wildfire Fuel Hazard Ranking Zones in Warren County	285
Table 4.15 - 2 Approximate Area in Wildfire Fuel Hazard Ranking Zones in Warren County.....	285
Table 4.15 - 3 Fire Danger Rating and Color Code.....	288
Table 4.15 - 4 FEMA DR and EM Declarations Since 2015 for Wildfire Events in Warren County.....	289
Table 4.15 - 5 Probability of Future Wildfire Events.....	289
Table 4.15 - 6 Estimated Vulnerable Population	292
Table 4.15 - 7 Total RCV of the General Building Stock Located in Wildfire Fuel Hazard Ranking Zones	293
Table 4.15 - 8 Total Number of and Replacement Cost Value (RCV) for Essential Facilities in Wildfire Hazard Areas.....	294
Table 4.15 - 9 Total Number of and Replacement Cost Value (RCV) for Transportation Systems within Wildfire Hazard Areas*	295
Table 4.15 - 10 Total Number of and Replacement Cost Value (RCV) for Lifeline Utility Systems in Wildfire Hazard Areas.....	295
Table 4.15 - 11 Total Number of and Replacement Cost Value (RCV) for High Potential Loss Facilities in Wildfire Hazard Areas.....	296
Table 4.15 - 12 Total Number of and Replacement Cost Value (RCV) for Other Facilities in Wildfire Hazard Areas.....	297
Table 4.15 - 13 Total Number of and Replacement Cost Value (RCV) for Other Facilities in Wildfire Hazard Areas.....	297
Table 4.16 - 1 Total Number of Known Contaminated Sites in Warren County as of 09/30/2020.....	302
Table 4.16 - 2 Hazardous Materials Release Events in Warren County, 2016 to 2020.....	306
Table 4.16 - 3 Probability of Future Hazardous Material Release Events.....	307
Table 4.17 - 1 Impacts and Consequences for Animal Disease Outbreak.....	311
Table 4.17 - 2 Animal Disease Incidents in New Jersey.....	312
Table 4.19 - 1 USDA Crop Failure Related Disaster Declarations (2011 to 2017)	320
Table 4.20 - 1 Threat of Malware to Different Systems.....	323
Table 4.20 - 2 Cyber Attack Impact Summary.....	325
Table 4.22 - 1 Previous Pandemic Occurrences.....	334
Table 4.23 - 1 Power Failure Events.....	341
Table 5.2 - 1 Planning & Regulatory Capabilities Findings	364
Table 5.2 - 2 Optional Planning and Regulations Capabilities, Based on Municipal Review.....	365
Table 5.2 - 3 Communities Participating in National Flood Insurance Program (NFIP) and the Community Rating System	366
Table 5.3 - 1 Education and Outreach Capabilities Based on Responses	368
Table 5.4 - 1 Administrative & Technical Capabilities, Based on Responses.....	375
Table 5.4 - 2 Municipal Staffing Capabilities Based on Responses	376
Table 5.5 - 1 Federal Funding.....	377
Table 5.5 - 2 State Funding.....	380
Table 5.5 - 3 Regional, County, and Local Funding	381

Table 6.4 - 1 Warren County HMP Goals and Objectives	394
Table 6.5 - 1 Comprehensive Mitigation Action Summary.....	398
Table 6.5 - 2 Mitigation Actions Evaluated and Prioritized	413