Warwick

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Municipal Resilience Program

Community Resilience Building Workshop

Summary of Findings

November 2020

City of Warwick
Community Resilience Building Workshop
Summary of Findings

Overview

The need for municipalities, regional planning organizations, states, and federal agencies to increase resilience and adapt to extreme weather events and a changing climate is strikingly evident amongst the communities of the state of Rhode Island. Recent events such as Tropical Storm Irene and Super Storm Sandy have reinforced this urgency and compelled leading communities like the City of Warwick to proactively collaborate on planning and mitigating risks. Ultimately, this type of leadership is to be commended because it will reduce the vulnerability and reinforce the strengths of people, infrastructure, and ecosystems and serve as a model for other communities across Rhode Island, New England, and the Nation.

In February 2020, the City of Warwick embarked on certification within the newly established state of Rhode Island's Municipal Resilience Program (MRP). As an important step towards certification, Rhode Island Infrastructure Bank (RIIB) and the Nature Conservancy (TNC) provided the City with a community-driven process (i.e. Community Resilience Building) to assess current hazards and climate change impacts and to surface projects, plans, and policies for improved resilience. In November, 2020, the Warwick Core Project Team organized a Community Resilience Building Workshop lead by TNC in partnership with RIIB. The core directive of this effort was the engagement with and between community stakeholders to define strengths and vulnerabilities and the development, planning, and ultimately, implementation of priority resilience actions for the City of Warwick.

The Warwick Community Resilience Building Workshop's central objectives were to:

- Define top local, natural, and climate-related hazards of concern;
- Identify existing and future strengths and vulnerabilities;
- Identify and prioritize actions for the City;
- Identify opportunities to collaboratively advance actions to increase resilience alongside organizations from across the City, and beyond.

The City of Warwick employed a unique "anywhere at any scale", community-driven process called Community Resilience Building (CRB) (www.CommunityResilienceBuilding.org). The CRB's tools, other relevant reports, and local maps were integrated into the workshop process to provide both decision-support and visualization around shared issues and existing priorities across Warwick. The Warwick Natural Hazard Mitigation Plan (2019), Comprehensive Plan (2014), and Chapter 1 of Resilient Rhody where particularly instructive. Using the CRB process, rich with information, experience, and dialogue, the participants produced the findings presented in this summary report including an overview of the top hazards, current concerns and challenges, existing strengths, and proposed actions to improve resilience to hazards and climate change today and in the future.

The summary of findings transcribed in this report, like any that concern the evolving nature of risk assessment and associated action, are proffered for comments, corrections and updates from workshop attendees and other stakeholders alike. The leadership displayed by the City of Warwick on community resilience building will benefit from the continuous and expanding participation of all those concerned.

Summary of Findings

Top Hazards and Vulnerable Areas for the Community

Prior to the CRB Workshop, the Warwick Core Project Team identified the top hazards for the City. The hazards of greatest concern are flooding along the coast and rivers, sea level rise, and storms that bring wind, ice, rain, and snow (i.e. hurricanes, Nor'easters, winter storms). The other hazards discussed during the CRB Workshop included urban street flooding due to stormwater runoff from heavy precipitation and extreme temperatures (heatwaves and cold snaps). These hazards have direct and increasing impacts on the infrastructure, residents, and resources such as its neighborhoods, natural areas (rivers, wetlands, parks), streets, sidewalks, bridges, dams, businesses, airport, municipal facilities, social support services for disproportionately disadvantaged populations, and other critical infrastructure and community assets.

Top Hazards and Areas of Concern for the Community

Top Hazards

- Major Storms - Hurricanes, Nor'easters, Winter Storms (snow, ice, wind)
- Flooding - Coastal, Riverine, Urban (stormwater inundation and runoff)

Areas of Concern in Warwick* - Several categories and locations were identified as being particularly vulnerable by workshop participants including:

Infrastructure: Wastewater System (Sewer Facility, Sewer Pump Stations (29 in flood zone)), Public Facilities, Power Lines, Kent Hospital, T.F. Green Airport, Emergency Shelters (Mickey Stevens), Schools, Seawalls, Marinas, Docks, Water Infrastructure (Water Lines, Pump Stations), Aging Buildings and Homes, Conimicut Point Historical Boat Ramp, Rocky Point Headwall, Telephone Lines, Impermeable Surfaces, Culverts (Hardig Road culvert), Generators, Morgue, Ice Rink, Marina, Emergency Services (Police, Fire, Department of Public Works), Warwick Mall, Waste Management Warwick Transfer Center, Pontiac Dams (Camp Warwick Pond, Grist Mill), Communications Towers.

Ecosystems/Parks: Rivers (Pawtuxet River, Buckeye Brook), Trees and Forests, Beaches (Oakland Beach, City Park Beach), Saltwater Marshes, Freshwater Wetlands, Estuaries, Watersheds (Buckeye Brook Watershed, Pawtuxet River Watershed, Greenwich Bay Watershed), Coves (Greenwich Cove, Warwick Cove, Bushneck Cove, Apponaug Cove, Pawtuxet Cove), Greenwich Bay, Narragansett Bay, Rocky Point State Park, Coastal Barriers and Buffers, Air Quality, Local Shellfish Beds

Roads, Bridges, and Road Network: Bridges (West Shore Road Bridge, Old Forge Bridge, Old Warwick Avenue Bridge), Roads (I-95, Route 295, end of Fulton Avenue, River Street, Lansdowne Road, Kilvert Street, Main Street, Walker Road, Peck Lane, Arnold's Neck Drive), T.F. Green Airport, Right-of-ways (Shawomet Avenue and Bellman Avenue).

Neighborhoods/Areas: Low Lying and/or Adjoining Coastal and Riverine Areas, Conimicut Point, Knight Street Area, Neighborhoods (Warwick Neck, Buttonwoods, Potowamut), Apponaug Village, East Natick Village, Oakland Beach, Norwood Village.

Vulnerable Populations: Elderly/Senior Citizens, Non-English Speakers, Residents with Special Needs and Disabled Residents, Visitors and Tourists, Local Business Owners, Veterans, Low-Income Residents, Working Poor, Long-term Renters.

*Information from workshop participants augmented via review of the City of Warwick's NHMP (2019). ***See Appendix A for full list of mitigation actions from the City of Warwick NHMP.***

Current Concerns and Challenges Presented by Hazards

The City of Warwick has several concerns and faces multiple challenges related to the impacts of natural hazards and climate change. In recent years, Warwick has experienced a series of highly disruptive and damaging weather events including March 2010 floods (i.e. Pawtuxet River), Tropical Storm Irene (August 2011), Super Storm Sandy (October 2012), winter Nor'easter Nemo (February 2013), and other less impactful but more frequent events. Impacts from Irene included rain-induced, inland flooding and wind damage. Sandy caused some coastal erosion as well as wind and tree damage across portions of Warwick. The winter storm Nemo dropped 19-20" of snow on the City knocking out power and isolating residents and neighborhoods due to extended road closures. The magnitude and intensity of these events and others across Rhode Island has increased awareness of natural hazards and climate change, while motivating communities like Warwick to proactively and comprehensively improve their resilience.

This series of extreme weather events highlights that the impacts from hazards are diverse: ranging from riverine flooding of critical infrastructure, bridges, roads, and low-lying areas; urban flooding from stormwater runoff during intense storms and heavy precipitation events; property damage from trees, wind, snow, and ice. Longer periods of elevated heat, particularly in July and August, have raised concerns about vulnerable segments of the population including elderly, disabled, and/or isolated residents. The combination of these issues presents a challenge to preparedness and mitigation priorities and requires comprehensive yet tailored actions for particular locations and/or areas across the City of Warwick.

The workshop participants were generally in agreement that Warwick is experiencing more intense and frequent storm events and heat waves. Additionally, there was a general concern about the increasing challenges of being prepared for the worst case scenarios (i.e. major disasters, storms, major hurricanes (Cat-3 or above)) throughout the year, but particularly in the fall/winter months due to more intense snow and ice storms coupled with colder weather. The impact of the current Covid-19 pandemic was discussed at length amongst workshop participants.

(Credit: pinterest.com)

(Credit: maineimagining.com)

(Credit: Warwick Firefighters)

Specific Categories of Concerns and Challenges

As in any community, Warwick is not uniformly vulnerable to hazards and climate change, and certain locations, assets, and populations have and will be affected to a greater degree than others. Workshop participants identified the following items as their community's key areas of concern and challenges across three broad categories - Infrastructure, Societal, and Environmental.

Infrastructure Concerns and Challenges

Roads, Bridges, and Road Networks:

- Coastal roadways and overpasses are vulnerable to flooding and/or storms.
- Low-lying roads and buildings close to flood prone rivers and streams subjected to flooding and erosion.
- City highly dependent on the airport and highways for accessing goods & materials.
- Many right-of-ways at end of streets are susceptible to inundation and erosion during major storms. Roads running parallel to the shore are especially at risk during flood events.

Stormwater Management:

- Increasing levels of impervious surfaces and decreasing green spaces raises the risk of flooding and water quality degradation due to untreated stormwater runoff.
- Pump-station generators are inundated by high tides during storms.
- Lack of green stormwater infrastructure to help naturally reduce runoff in neighborhoods.

Dams:

- Recognition of the number of dams (publicly or privately owned) and potential for catastrophic failure under current/future precipitation projections.

Emergency Management and Preparedness:

- Limited evacuation route flexibility during extreme weather events such as the March 2010 flood which resulted in highway exit ramp closure (i.e. "land-locked").
- Need for increased collaboration with neighboring towns and cities to ensure adequate preparation for and prevention of future impacts of extreme weather and climate change.
- Emergency shelters have limited capacity and access route alternatives.
- Need to maintain connection and coordination with Airport staff and operations.

Housing:

- Pre-National Flood Insurance Program coastal homes are increasingly vulnerable to sea-level rise and storm surge.
- Aging and low-income housing are more vulnerable to flooding and sea-level rise.

Specific Categories of Concerns and Challenges (cont'd)

Infrastructure Concerns and Challenges

Power:

- Power outages to residential homes and businesses particularly during winter months which increases isolation of residents.
- Above-ground power lines are vulnerable to storms and falling trees.

Societal Concerns and Challenges

Vulnerable Populations:

- Implications on disproportionately disadvantaged populations (i.e. elderly, working poor, low income residents) due to flooding, winter storms, and heatwaves.
- Low-income populations are particularly vulnerable to urban heat islands.
- Large and growing populations of elderly residents (>20%) with many living alone.

Development:

- Development and redevelopment pressure increasingly threaten to convert land use of the City's last remaining natural resources and environment.
- Ongoing development and redevelopment in hazardous areas subjected to flooding via variances and exceptions coupled with need to support further the dissemination of flood hazard information and mapping..
- Need for additional sustainable redevelopment and associated responsible future development.

Businesses:

- The business community is very vulnerable to natural disasters and major events - 66% of businesses closed for more than 10 days following major events do not recover.

Environmental Concerns and Challenges

Flooding:

- The City has a reactive, not proactive, approach to managing flooding, particularly around riverine flooding (i.e. Pawtuxet River).
- Warwick has 39 miles of coastline making it vulnerable to sea-level rise, Nor' Easters, and coastal storm surge.

Specific Categories of Concerns and Challenges (cont'd)

Environmental Concerns and Challenges

Salt Marsh:

- Loss of this critical natural system that protects people and property for coastal storm surge.

Trees and Forests:

- High levels of impervious surfaces coupled with a loss of greenspaces and trees create areas of elevated and health-threatening air temperatures.
- Increasing impacts on tree health from pests and pathogens resulting in a large number of dead and damaged trees posing risks to power lines and blocking roads during emergencies.
- Salting of roadways can damage tree roots and hasten tree mortality.

Beaches and Shoreline:

- Poor water quality during summer months results in frequent beach and shellfish bed closures.
- Ongoing coastal erosion is narrowing the shoreline and beaches.
- Litter and food remnants left from visitors contributes to localized poor water quality at Warwick's most popular beaches such as City Park and Oakland Beach.

Sea-level Rise:

- Rising sea levels infringes on infrastructure, roadways, docks, boating, and utility lines.

Earthquakes:

- Multiple fault lines near and within the City increase the risks of earthquakes.

(Credit: warwickri.gov)

Current Strengths and Assets

Just as certain locations, assets, and populations in Warwick stand out as particularly vulnerable to the effects of hazards and climate change, other features are notably assets for Warwick's resilience building. Workshop participants identified the following items as their community's key strengths and expressed interest in using them as the core of future resilience building actions.

- Clearly, the responsive and committed leadership exhibited by officials and staff is a very appreciated strength within and across Warwick. Ongoing collaboration between business community, faith-based organizations, NGOs, Airport, and state-level organizations, among others on priorities identified will help advance comprehensive, cost-effective, community resilience building actions.
- The City has highly experienced staff with access to adequate resources for most emergency situations. The coordination amongst various departments including leadership, Police, Fire, and EMS within and across the City (including the Airport) was cited as a highly valued community strength.
- The City is a close-knit community with high levels of communication and coordination and has a high willingness to establish partnerships and listen to new ideas.
- The geographic location gives the City advanced warning about the need to prepare for hurricanes and disasters in comparison to other parts of the United States.
- The City has strong wastewater and stormwater management systems and continuously upgrades utility infrastructure. The water department has a certified EPA Emergency Response Plan, redundant backup generators, and the ability to shut down specific valves if the City's water infrastructure is compromised during a storm surge. The City has an independent sewer authority.
- Presence and deep involvement of the NGO communities, both locally and regionally, across and for the City.
- Good emergency shelter system including Mickey Stevens and schools, as necessary.
- The Airport, Interstate 95, and train station at the airport form the core of the City's strong transportation infrastructure.
- Some villages have adopted local master plans that identify their strengths, weaknesses, and improvement opportunities.

Current Strengths and Assets (cont'd)

- Cox Communications deploys generators at cell towers and other primary communication spots around the City.
- The City is increasingly preparing for climate change.
- City is enrolled in FEMA's National Flood Insurance Program, Community Rating System.
- Multiple undeveloped riverine and floodplain areas help increase stormwater runoff storage.
- The City is acquiring coastal properties to create more parks and greenspaces (i.e. Rocky Point).
- The Sea View Drive and Strand Avenue Shoreline Restoration project in Oakland Beach will reestablish the vegetated coastal buffer, remove low-lying pavement, and reduce vulnerabilities to coastal flooding.
- The shoreline is a recognized asset which contributes towards tourism, recreational opportunities, commercial shell fishing industry, marina facilities, and boating.
- The shoreline is highly accessible to City residents, with multiple public beaches and coves.
- Substantial municipal commitment supporting mitigation efforts to reduce street flooding and construct Low Impact Development (LID) stormwater infrastructure to reduce flooding and pollutant loads to our waterways.
- Emphasis by residents on volunteering time and resources to strengthen their community and help other residents thrive.
- Numerous public amenities and open spaces that improve residents' quality of life in Warwick including a substantial coastal park system, recreational complexes, and amenities such as the Warwick Public Library.

(Credit: visitwarwickri.com)

Recommendations to Improve Resilience

A common theme among workshop participants was the need to continue community based planning efforts focused on developing mitigation measures to reduce Warwick's vulnerability to climate change, sea level rise, and other common concerns raised. To that end, the workshop participants reached agreement on several key topics requiring more immediate and/or ongoing attention including:

- Coastal and Riverine Flooding (i.e. right-of-way/end of road erosion, design storm guidelines, water quality, ecological restoration, voluntary buyouts/relocation, acquisition of open space properties in Special Flood Hazard Areas).
- Infrastructure improvements (i.e. generators, wastewater treatment system and facilities, stormwater management systems, green stormwater infrastructure);
- Quality of life improvements (i.e. tree management, greening of neighborhoods, walkability, sustainability, park access maintenance, green infrastructure, community events, and affordable housing);
- Emergency management (i.e. preparedness, communications, outreach, education, heating/cooling centers, continuation of services, business recovery).

In direct response, the workshop participants developed the high priority actions below organized across several sub-categories including capacity building, projects, plans/ preparedness/studies/outreach, and policy. Mitigation actions from the Warwick NHMP (2019) are provided in Appendix A for cross reference.

Higher Priority Actions

Capacity Building:

- Reassess and address staffing needs for departments working on coastal infrastructure and shoreline access.
- Increase funding for capacity to help clear waterways of vegetation and refuse, particularly upstream from problematic culverts and under roadways.
- Improve cross-organization and cross-department collaboration on planning, projects, and policies designed to increase resilience in Warwick, ideally in conjunction with surrounding municipalities, where appropriate.

Higher Priority Actions (cont'd)

Projects:

- Create a coordinated, city-wide tree management and funding plan that focuses on removing dead trees and limbs near power lines, planting new trees in strategic areas, and maintenance of the urban tree canopy over time.
- Conduct right-of-way and end-of-road coastal adaption projects to mitigate erosion, increase public access, restore habitats and green spaces, and improve stormwater management and water quality in receiving water bodies.
- Dredge Warwick and Brushneck Cove to maintain boat navigability.
- Implement green stormwater infrastructure projects (rain gardens, bioswales, etc.) in priority locations to reduce localized flooding and pollutant loading.
- Improve stormwater infrastructure through de-paving, replacing pipes, planting trees, and expanding green infrastructure and open, undeveloped spaces.
- Acquire open space properties located in Special Flood Hazard Areas, including dedication of annual funding to foreclosing rights of redemption on tax title properties in these areas.

Plans/Preparedness/Studies/Outreach:

- Develop a comprehensive resilience plan for the City, creating tiered action plans tied to capital improvement budgets on a 5, 10, and 25-year basis.
- Review and mitigate impacts on greenspace due to development pressures, including commercial development, via permit restrictions and best management practice incentives.
- Evaluate long-term strategies for relocating or removing, via voluntary buyouts, at-risk structures from the existing coastline prioritizing Severe Repetitive Loss (SRL) and Repetitive Loss (RL) structures.
- Provide generators to address backup power needs at emergency facilities (i.e. warming stations, morgue (ice rink), pump stations, cell towers, etc.).

Higher Priority Actions (cont'd)

Plans/Preparedness/Studies/Outreach:

- Create a complete risk assessment and inventory of facilities - including attributes like elevation and proximity to threats - and use it to improve emergency plans, zoning laws, and building codes.
- Evaluate and research options to increase the City's immediate and longer-term sustainability via procurement revisions, recycling, and renewable energy use.
- Convene and strategically identify open space parcels for future acquisition that will improve the overall resilience of Warwick and dedicate funding via bonding and other sources of funds to secure priority parcels that will increase quality of life and reduce risk of flooding and heatwaves for residents.
- Conduct resilience and emergency preparedness education for residents regarding evacuation routes, homeowner preparedness, business preparedness, local nature-based solutions (i.e. rain gardens, shade tree planting), and building and zoning standards.
- Create youth and neighborhood engagement programs focused on resiliency.

Policy:

- Encourage and advocate for an update to the Rhode Island Stormwater Design and Installation Standards Manual to better account for extended storm events with greater intensity and duration.
- Establish or strengthen existing policies that require development plans to include maximum use of green infrastructure (i.e. tree planting, green stormwater infrastructure, etc.).

(Credit: visitnewengland.com)

(Credit: visitwarwickri.com)

(Credit: visitrhodeisland.com)

Priority Actions

In addition to these higher priority actions, the workshop participants identified the following list of priority actions organized across several sub-categories including capacity building, projects, plans/preparedness/studies/outreach, and policy. These actions are considered important or "priority" for Warwick, but not as high priority as the preceding list, currently.

***Capacity Building*:**

- Review and modify on an annual basis the Capital Plan to ensure resilience in fully integrated into funded projects and other budgeted expenditures.
- Budget for the better design, repairs, and elevation of bridges and/or culverts to ensure infrastructure is prepared to accommodate future storms and hazards.
- Access funding to support and manage the acquisition or mitigation of Severe Repetitive Loss and Repetitive Loss Properties in Warwick.
- Continue to secure funding to further protect National Historic Register Properties that are currently and likely to be impacted by extreme weather and climate change.
- Use the Village Associations and neighborhood groups as points of contact for local businesses to help improve understanding of resources needed to both prepare and recover from major events.
- Consider the creation of a specific emergency response fund to help businesses and community members following extreme weather events or other major crises.

Projects:

- Adopt road construction approaches that facilitate easier long-term maintenance.
- Implement more green infrastructure projects to help improve water quality, with the goal of reducing beach and shellfish bed closings.
- Upgrade mechanical systems at Municipal and School buildings to reduce energy consumption and improve local air quality.
- Plant native trees and greenery to reduce communities' vulnerability to heat, including at bus stops, school yards, playgrounds, and other vulnerable neighborhoods.

Priority Actions (cont'd)

Projects:

- Continue to improve energy efficiency within public buildings.
- Continue to invest in resiliency improvements to Warwick's Water System to ensure delivery of clean drinking water.
- Work with FEMA, engineers, and other experts to develop better approaches and methods to elevate roadbeds and roadways within flood zones.
- Reimplement the use of scrubbers in stormwater collection systems to capture chemicals in stormwater runoff and improve the water quality in watersheds and bays.
- Reduce the stagnation at Conimicut marshes via improved tidal flushing and increase habitat value as well as storm surge amelioration.
- Remove old structural debris (wooden bulkhead parts) along the north shore in Conimicut to prevent future impacts during storm events.
- Work with the Rhode Island Airport Corporation and the State of Rhode Island to remove obstructions in rivers and tributaries to improve the natural flow of water, protect habitats and historic herring runs, and reduce localized flooding (i.e. Buckeye Brook System).
- Conduct small-scale, de-paving projects in areas experiencing routine flooding.
- Support relocation of water mains and valves subject to repeated inundation.
- Mark all major watersheds in the city with roadway signs noting to motorists that they are entering or leaving that specific watershed in hopes of promoting awareness.
- Incentivize small-scale stormwater management on private property through the use of rain barrels, down spout disconnection, tree planting, etc.

Plans/Preparedness/Studies/Outreach:

- Use up-to-date climate data to assess threats and impacts from increased storms and flooding across Warwick.

Priority Actions (cont'd)

Plans/Preparedness/Studies/Outreach:

- Create a business continuity plan and consider establishing regular business resilience workshops in advance of hurricane season, annually.
- Offer more educational information regarding resilience and conservation for residents and business owners through the City's website.
- Repair, replace, and relocate water and sewer lines as necessary to make them more resilient.
- Conduct public outreach to convey new ideas, particularly regarding watershed protection and stormwater runoff and establish an open dialogue on neighborhood -specific challenges.
- Address the impact of COVID-19 on residents dependent on food stamps.
- Review and update Emergency Flood Evacuation Plan, improving outreach and marketing regarding evacuation routes and emergency shelters.
- Continue to update and revise drought contingency plans based on evolving climate conditions.
- Conduct feasibility assessment for undergrounding utility lines in high-risk areas.
- Examine residential buildings in the floodplain, determine the best mitigation actions to protect them, and consider a voluntary acquisition program for high-risk residential areas.
- Research how zoning and property rights may conflict in coastal areas.
- Conduct study to review hydrologic impacts (including flood reduction and water level impact) of Pontiac Dam removal and cost.
- Expand environmental education in schools and create multilingual environmental awareness programs for residents.
- Examine how to best communicate with residents without internet access and considering the use of youth ambassadors to strengthen response.

Priority Actions (cont'd)

Plans/Preparedness/Studies/Outreach:

- Research and share information about the health effects of climate change.
- Create and implement a city-wide plan for safe and efficient bike and pedestrian routes.

Policy:

- Establish ordinance that prevent the removal of native grasses and plants that already act as natural coastal barriers.
- Rezone areas along the coastline to reduce/restrict development that increases the long-term need for emergency management services and risks the economic well-being of the City.
- Pass ordinances and legislation that tighten building codes to improve resiliency.
- Ensure city compliance with zoning laws and improve upon existing zoning laws to preserve open spaces.
- Support policies that require more stringent carbon emission requirements for aircraft and commercial vehicles.
- Improve enforcement of existing policies and executive orders relating to conserving wetlands and floodplains, therefore helping to improve stormwater management across Warwick.

(Credit: visitwarwickri.com)

(Credit: wikitravel.com)

(Credit: goprovidence.com)

CRB Workshop Participants: Department/Organization

City of Warwick - Office of the Mayor
City of Warwick - Planning Department
City of Warwick - Fire Department
City of Warwick - Office of Community Development
City of Warwick - Facilities Management
City of Warwick - Police Department
City of Warwick - Building Department
City of Warwick - Senior Services
City of Warwick - DPW Water Division & Engineering Division
City of Warwick - Sewer Authority
City of Warwick - Planning Board
City of Warwick - Zoning Board
City of Warwick - Harbor Commission
City of Warwick - Wildlife and Conservation Commission
City of Warwick - Historic District Commission
Rhode Island Airport Corporation
Apponaug Village Association
Conimicut Village Association
East Natick Village Association
Oakland Beach Association
Norwood Village Association
Pontiac Village Association
Buckeye Brook Coalition
Westbay Community Action
Pawtucket River Authority
Central Rhode Island Chamber of Commerce
National Grid
Save the Bay
Vanasse Hangen Brustlin

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Appendix A

City of Warwick

Natural Hazard Mitigation Plan (2019)

Mitigation Actions

VULNERABLE AREA: Flood Prone Drainage Systems, Streets, or Infrastructure

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
1. Improve flood safety messaging for motorists. a) Place permanent alternate route signage on Arnold's Neck Drive. b) Place evacuation route signage on Conimicut.	☐Local Plans and Regulations ☐Structure and Infrastructure ☐Natural Systems Protection ☒Education and Awareness	☒1 ☐7 ☐2 ☐8 ☒3 ☐9 ☐4 ☐10 ☐5 ☐11 ☐6	☐High ☐Medium ☒Low **ACTION STATUS** New

VULNERABLE AREA: Flood Prone Drainage Systems, Streets, or Infrastructure

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
2. Reduce riverine flood damage in the Bellow Street industrial park area. a) Educate building tenants about floodproofing options.	☐Local Plans and Regulations ☐Structure and Infrastructure ☐Natural Systems Protection ☒Education and Awareness	☐1 ☐7 ☒2 ☐8 ☐3 ☐9 ☒4 ☐10 ☐5 ☐11 ☒6	☐High ☐Medium ☒Low **ACTION STATUS** 2011

VULNERABLE AREA: Bridges

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
3. Maintain the usefulness of Warwick's bridges. a) Establish a local bridge inspection program for municipally owned bridges. b) Prioritize repairs to failing bridges. c) Consider bridge elevation when undergoing structure maintenance/improvements.	☒Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☒1 ☐7 ☐2 ☐8 ☐3 ☐9 ☒4 ☐10 ☐5 ☐11 ☐6	☐High ☒Medium ☐Low **ACTION STATUS** New

VULNERABLE AREA: Wastewater

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
4. Improve sewer pump station resiliency. a) Identify and secure funding for the Oakland Beach sewer pump station. b) Prioritize remaining pump stations for elevation. c) Obtain 8 backup generators (short term action) d) Elevate prioritized pump stations.	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☒1 ☐7 ☐2 ☐8 ☐3 ☐9 ☒4 ☐10 ☒5 ☐11 ☐6	☐High ☒Medium ☐Low **ACTION STATUS** 2011

VULNERABLE AREA: Water Supply

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
5. Fund and implement the Build phase of relocating 42-inch water main valve subject to inundation to allow 1) access to the valve during flooding and, 2) ability to isolate 42-inch main under Pawtuxet River during flood events.	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☒1 ☐7 ☐2 ☐8 ☐3 ☐9 ☒4 ☐10 ☒5 ☐11 ☐6	☒High ☐Medium ☐Low **ACTION STATUS** 2011

VULNERABLE AREA: Dams

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
6. Communicate to the State/Federal government the issue of flood control at existing upstream dams- outside of Warwick.	☐Local Plans and Regulations ☐Structure and Infrastructure ☐Natural Systems Protection ☒Education and Awareness	☒1 ☐7 ☐2 ☐8 ☐3 ☐9 ☐4 ☐10 ☐5 ☐11 ☐6	☐High ☒Medium ☐Low **ACTION STATUS** New

VULNERABLE AREA: Marinas/Docks

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
7. Provide more dependable locations to take out boats prior to a storm. a) Review the list of ramps from the Harbormaster b) Prioritize conditions of all ramps, not just City owned facilities. c) Improve/fix prioritized ramps.	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☒Education and Awareness	☐1 ☐7 ☒2 ☐8 ☐3 ☐9 ☐4 ☐10 ☐5 ☐11 ☒6	☐High ☐Medium ☒Low **ACTION STATUS** 2011

VULNERABLE AREA: Marinas/Docks

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
8. Coordinate education and outreach efforts with the RI Marine Trade Association to distribute messaging about the dangers of watercraft turning into destructive debris during a storm.	☐Local Plans and Regulations ☐Structure and Infrastructure ☐Natural Systems Protection ☒Education and Awareness	☐1 ☐7 ☒2 ☐8 ☐3 ☐9 ☐4 ☐10 ☐5 ☐11 ☐6	☐High ☐Medium ☒Low **ACTION STATUS** New

VULNERABLE AREA: Critical Facilities

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
9. Maintain continuity of services at City Hall and Management Information Services (MIS) during a power outage. a) Conduct a generator needs assessment b) Secure necessary funding c) Purchase and install generator	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☐1 ☐7 ☒2 ☐8 ☐3 ☐9 ☐4 ☐10 ☒5 ☐11 ☐6	☒High ☐Medium ☐Low **ACTION STATUS** New

VULNERABLE AREA: Critical Facilities

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
10. Maintain supplemental power at Pilgrim High School which serves as a warming/cooling center. a) Secure necessary funding to replace the generator b) Purchase and install new generator	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☐1 ☐7 ☒2 ☐8 ☐3 ☐9 ☐4 ☐10 ☒5 ☐11 ☐6	☒High ☐Medium ☐Low **ACTION STATUS** New

VULNERABLE AREA: Critical Facilities

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
11. Maintain supplemental power at Fire Station 4. a) Identify funding to either repair or replace existing generator b) Install new generator	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☐1 ☐7 ☐2 ☐8 ☐3 ☐9 ☐4 ☐10 ☒5 ☐11 ☒6	☒High ☐Medium ☐Low **ACTION STATUS** New

VULNERABLE AREA: Critical Facilities

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
12. Improve the resiliency of the Public Works garage on Sandy Lane. a) Install a new roof b) Purchase and install a new generator	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☐1 ☒7 ☒2 ☐8 ☐3 ☐9 ☐4 ☐10 ☒5 ☐11 ☐6	☒High ☐Medium ☐Low **ACTION STATUS** New

VULNERABLE AREA: Critical Facilities

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
13. Retire and replace aging vehicles. a) Purchase a new bucket truck to aid the existing truck that has been in service for 15 years. b) Replace the 6-wheel dump truck and 4-wheel drive pick-up truck that are showing signs of excessive wear.	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☐1 ☒7 ☒2 ☐8 ☐3 ☐9 ☐4 ☐10 ☒5 ☐11 ☐6	☐High ☒Medium ☐Low **ACTION STATUS** New

VULNERABLE AREA: Critical Facilities

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
14. Purchase a wood chipper and a rear loading yard waste truck.	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☐1 ☒7 ☒2 ☐8 ☐3 ☐9 ☐4 ☐10 ☒5 ☐11 ☐6	☐High ☒Medium ☐Low **ACTION STATUS** New

VULNERABLE AREA: Critical Facilities

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
15. Purchase a new Harbor Master Boat.	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☒1 ☒7 ☐2 ☐8 ☐3 ☐9 ☐4 ☐10 ☐5 ☐11 ☐6	☐High ☒Medium ☐Low **ACTION STATUS** New

VULNERABLE AREA: Populations

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
16. Reduce the number of flood claims in Warwick. a) Create an inventory of private structures in the floodplain.	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☒1 ☐7 ☒2 ☐8 ☐3 ☐9 ☐4 ☐10 ☐5 ☐11 ☐6	☐High ☐Medium ☒Low **ACTION STATUS** 2011

VULNERABLE AREA: Populations

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
17. Reduce the number of flood claims in Warwick. a) Determine appropriate structural activities (including participation in a voluntary acquisition program) for high risk residential properties.	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☐1 ☐7 ☒2 ☐8 ☒3 ☐9 ☐4 ☐10 ☐5 ☐11 ☐6	☐High ☒Medium ☐Low **ACTION STATUS** 2011

VULNERABLE AREA: Populations

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
18. Confirm emergency plans for senior housing and nursing homes. a) Suggest generator hook ups if necessary. b) Suggest infrastructure changes if current emergency sheltering facilities are inadequate.	☐Local Plans and Regulations ☐Structure and Infrastructure ☐Natural Systems Protection ☒Education and Awareness	☒1 ☐7 ☐2 ☐8 ☒3 ☐9 ☐4 ☐10 ☐5 ☐11 ☐6	☐High ☐Medium ☒Low **ACTION STATUS** New

VULNERABLE AREA: Recreation Facilities

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
19. Encourage visiting sport referees and coaches to sign up for Warwick's Code Red to be alerted to local emergencies.	☐Local Plans and Regulations ☐Structure and Infrastructure ☐Natural Systems Protection ☒Education and Awareness	☒1 ☐7 ☐2 ☐8 ☒3 ☐9 ☐4 ☐10 ☐5 ☐11 ☐6	☐High ☐Medium ☒Low **ACTION STATUS** New

VULNERABLE AREA: Natural Resources

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
20. Remove debris (silt, and vegetation) from Buckeye Brook to reduce flooding and allow for Warwick Pond to retain more flood waters.	☐Local Plans and Regulations ☐Structure and Infrastructure ☒Natural Systems Protection ☐Education and Awareness	☐1 ☐7 ☒2 ☐8 ☐3 ☐9 ☐4 ☐10 ☐5 ☐11 ☐6	☒High ☐Medium ☐Low **ACTION STATUS** New

VULNERABLE AREA: Historic Resources

MITIGATION ACTION	MITIGATION TYPE	ALIGNMENT WITH PLAN GOALS	ACTION PRIORITY
21. Develop and implement a plan to protect historic structures, collections, and public records. a) Make records electronic b) Create additional electronic storage	☐Local Plans and Regulations ☒Structure and Infrastructure ☐Natural Systems Protection ☐Education and Awareness	☐1 ☐7 ☒2 ☐8 ☐3 ☐9 ☐4 ☐10 ☐5 ☐11 ☐6	☐High ☒Medium ☐Low **ACTION STATUS**

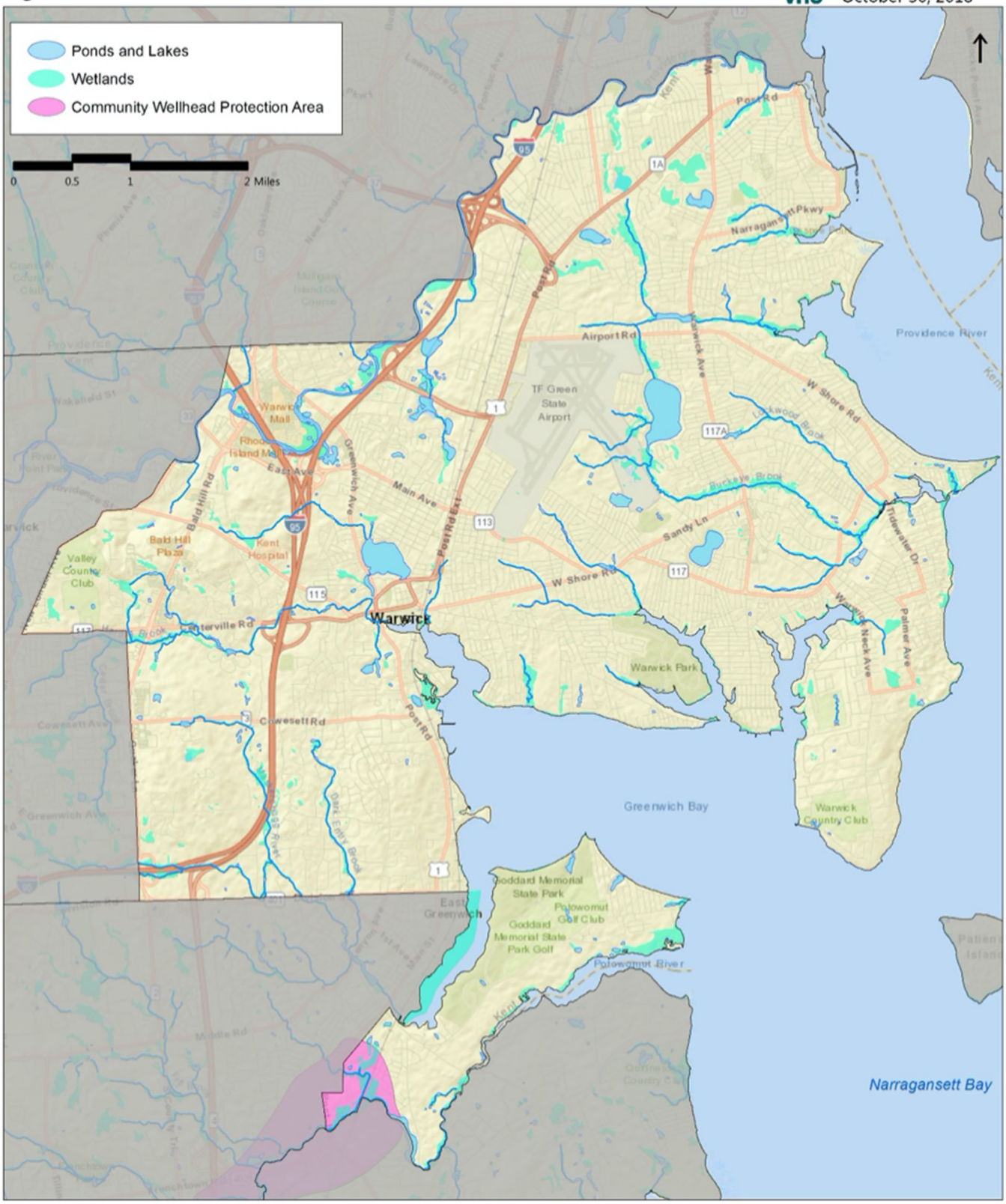
Appendix B

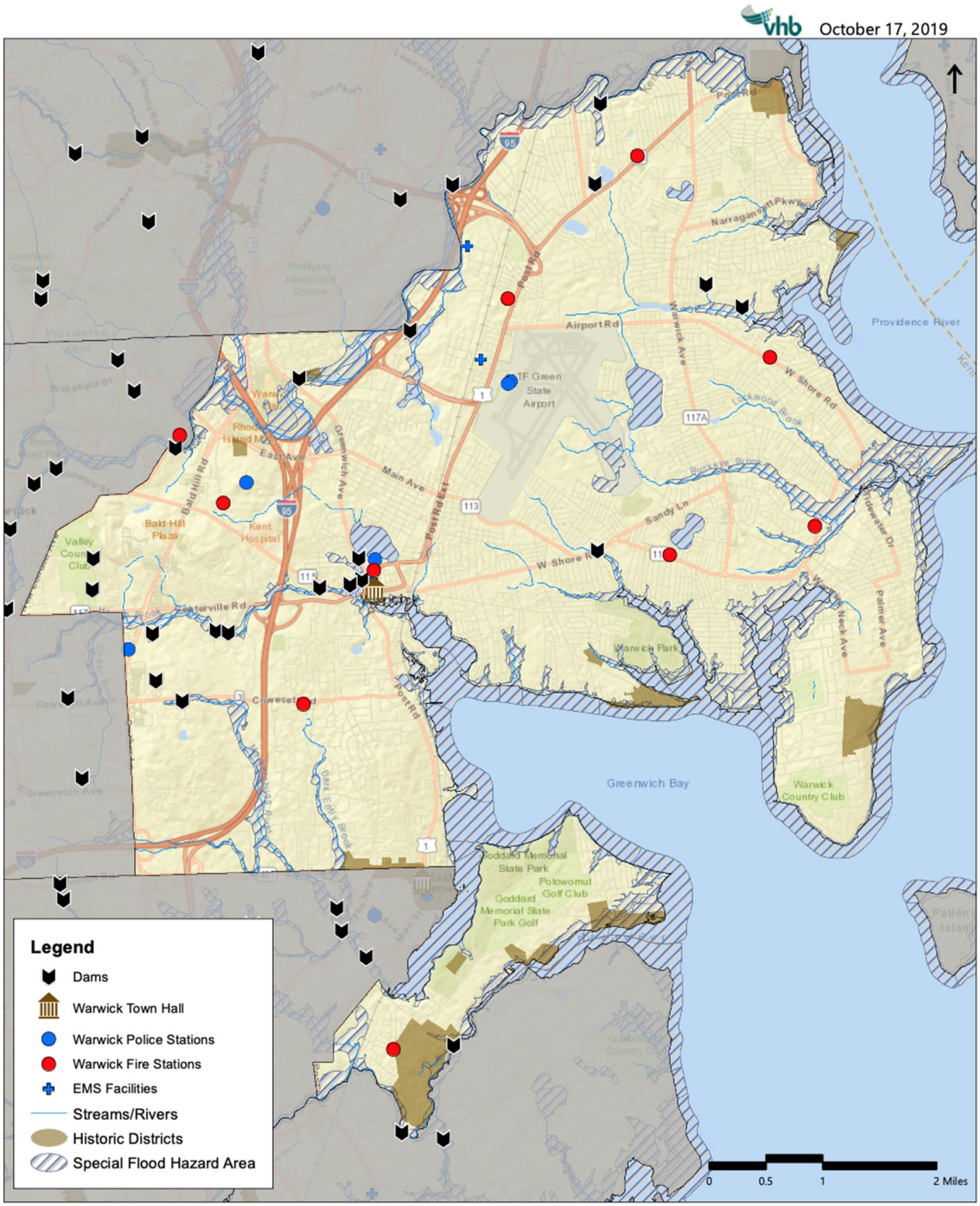
Warwick
Map Resource Packet*
Used During
Workshop

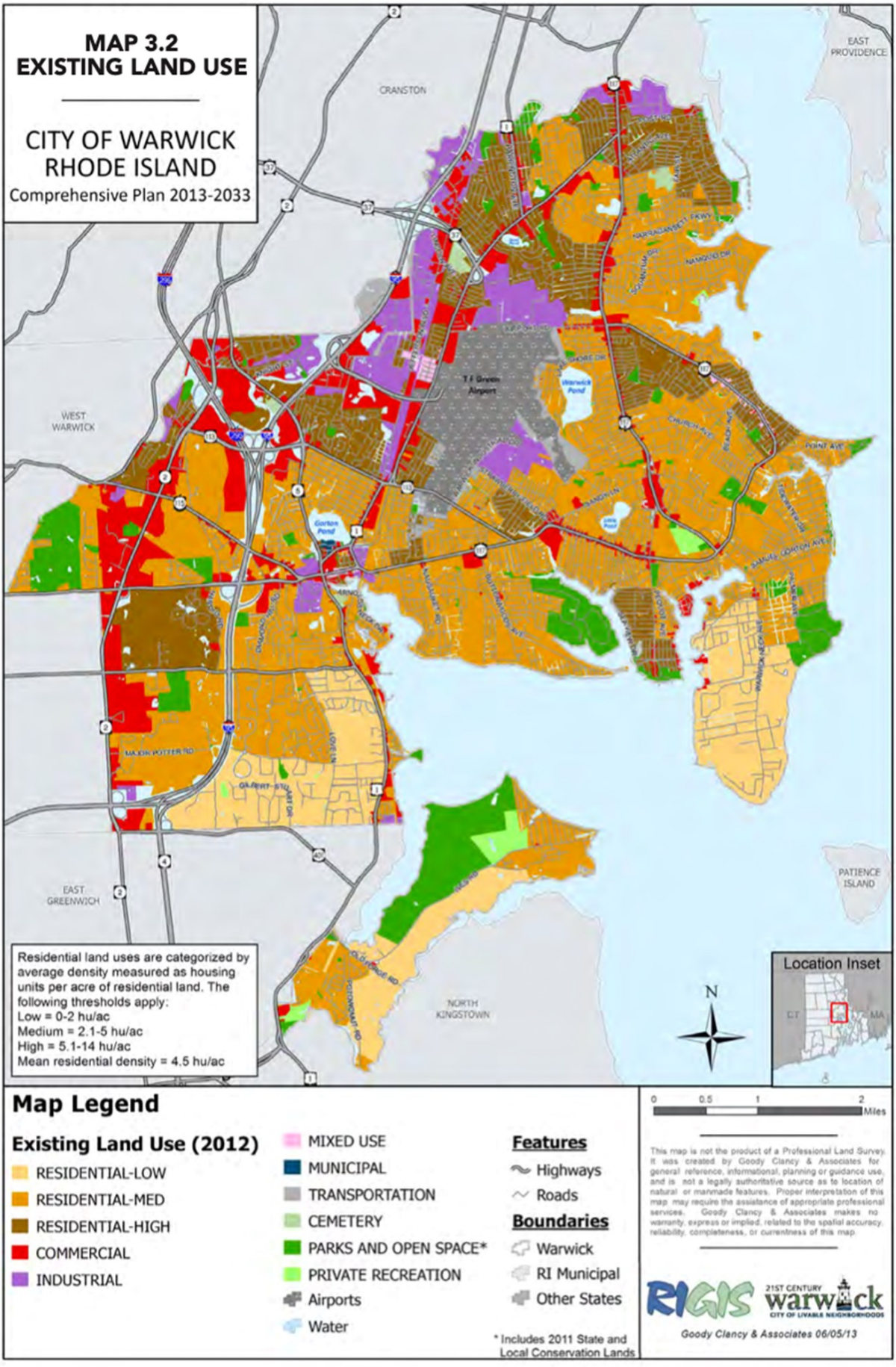
***Gathered from Warwick's Hazard Mitigation Plan (2019) & Comprehensive Plan (2014)**

Figure 4: Water Resources in Warwick

vhb October 30, 2018




vhb
October 17, 2019
Legend
Dams
Warwick Town Hall
Warwick Police Stations
Warwick Fire Stations
EMS Facilities
Streams/Rivers
Historic Districts
Special Flood Hazard Area
Greenwich Bay
Providence River
Airport Rd
Post Rd
Main Ave
Greenwich Ave
Bald Hill Rd
East Ave
Warwick Ave
W Shore Rd
Sandy Ln
Palmer Ave
Warwick Neck Ave
Post Rd Ext
Cowesett Rd
Quaterville Rd
Bald Hill Plaza
Kent Hospital
Valley Country Club
Warwick Park
Warwick Country Club
Goddard Memorial State Park
Potowomut Golf Club
Goddard Memorial State Park Golf
T F Green State Airport
0
0.5
1
2 Miles


MAP 3.2
EXISTING LAND USE
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan 2013-2033
CRANSTON
EAST PROVIDENCE
WEST WARWICK
EAST GREENWICH
NORTH KINGSTOWN
PATIENCE ISLAND
T F Green Airport
Warwick Pond
Gorton Pond
Residential land uses are categorized by average density measured as housing units per acre of residential land. The following thresholds apply:
Low = 0-2 hu/ac
Medium = 2.1-5 hu/ac
High = 5.1-14 hu/ac
Mean residential density = 4.5 hu/ac
Location Inset
CT
RI
MA
N
Map Legend
Existing Land Use (2012)
RESIDENTIAL-LOW
RESIDENTIAL-MED
RESIDENTIAL-HIGH
COMMERCIAL
INDUSTRIAL
MIXED USE
MUNICIPAL
TRANSPORTATION
CEMETERY
PARKS AND OPEN SPACE*
PRIVATE RECREATION
Airports
Water
Features
Highways
Roads
Boundaries
Warwick
RI Municipal
Other States
* Includes 2011 State and Local Conservation Lands
0 0.5 1 2 Miles
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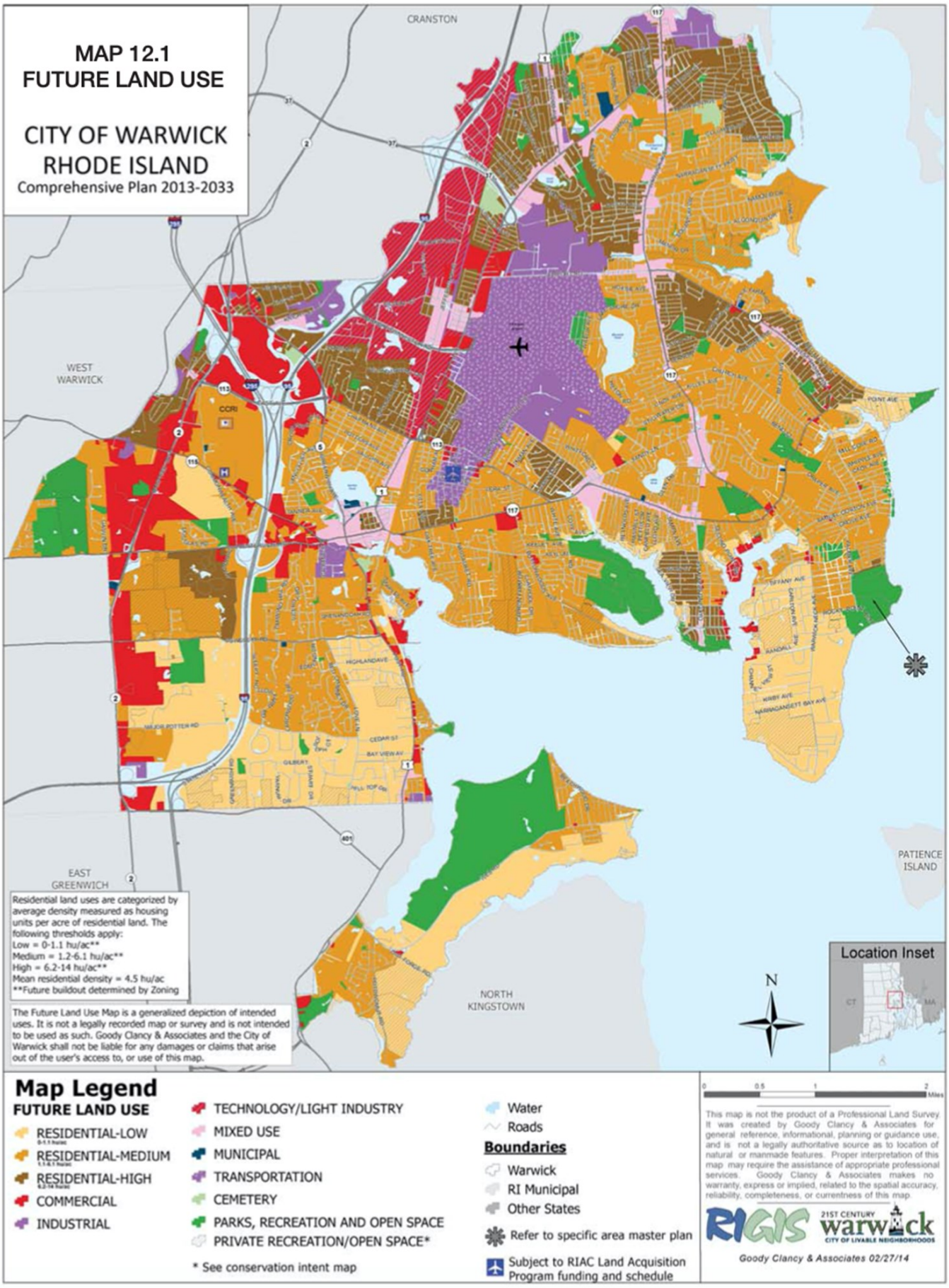
21ST CENTURY warwick
CITY OF LIVABLE NEIGHBORHOODS
Goody Clancy & Associates 06/05/13


MAP 12.1
FUTURE LAND USE
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan 2013-2033
CRANSTON
WEST WARWICK
EAST GREENWICH
NORTH KINGSTOWN
PATIENCE ISLAND
CCRI
Residential land uses are categorized by average density measured as housing units per acre of residential land. The following thresholds apply:
Low = 0-1.1 hu/ac**
Medium = 1.2-6.1 hu/ac**
High = 6.2-14 hu/ac**
Mean residential density = 4.5 hu/ac
**Future buildout determined by Zoning
The Future Land Use Map is a generalized depiction of intended uses. It is not a legally recorded map or survey and is not intended to be used as such. Goody Clancy & Associates and the City of Warwick shall not be liable for any damages or claims that arise out of the user's access to, or use of this map.
Location Inset
N
Map Legend
FUTURE LAND USE
RESIDENTIAL-LOW
RESIDENTIAL-MEDIUM
RESIDENTIAL-HIGH
COMMERCIAL
INDUSTRIAL
TECHNOLOGY/LIGHT INDUSTRY
MIXED USE
MUNICIPAL
TRANSPORTATION
CEMETERY
PARKS, RECREATION AND OPEN SPACE
PRIVATE RECREATION/OPEN SPACE*
* See conservation intent map
Water
Roads
Boundaries
Warwick
RI Municipal
Other States
Refer to specific area master plan
Subject to RIAC Land Acquisition Program funding and schedule
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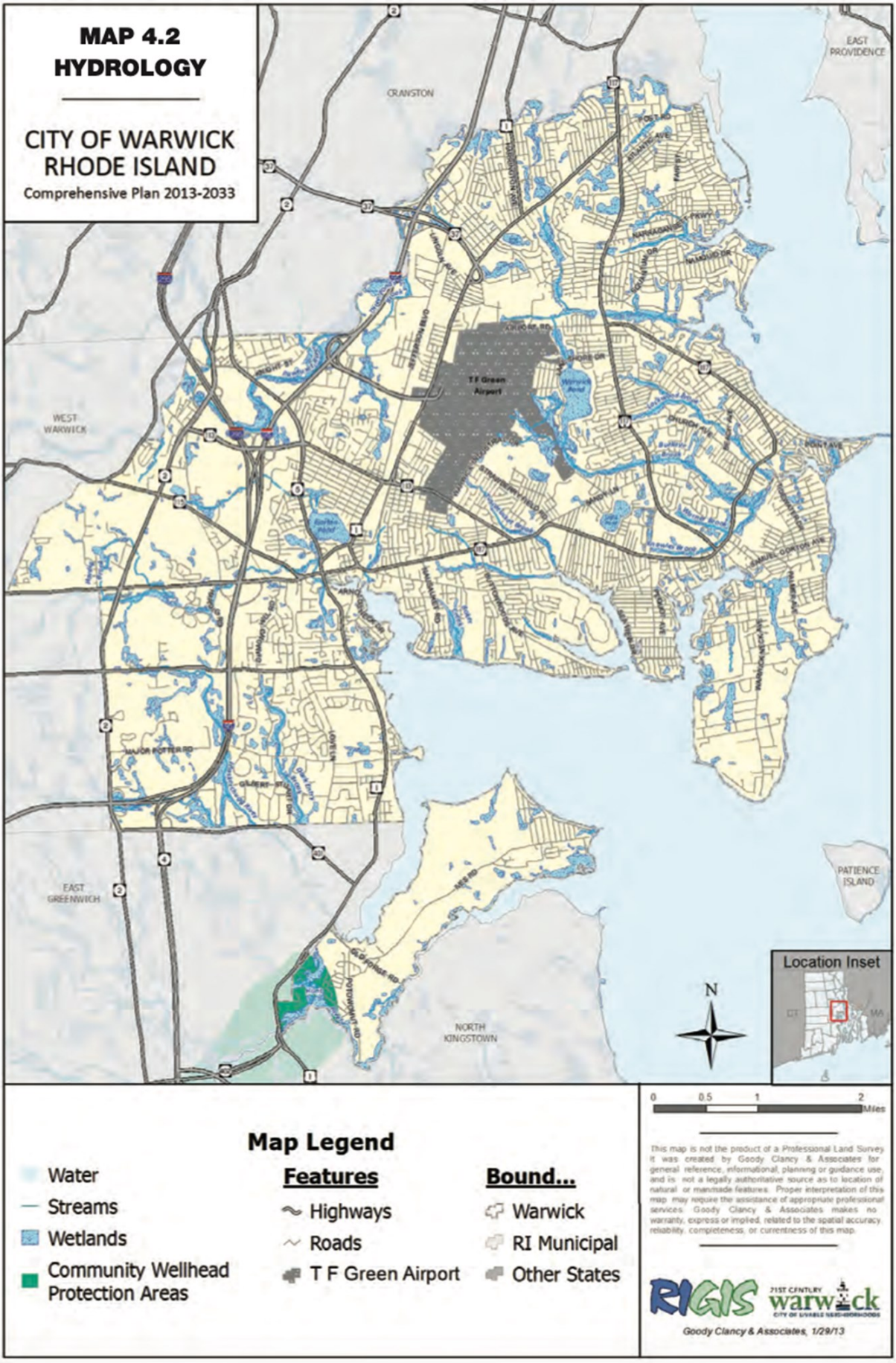
CITY OF LIVABLE NEIGHBORHOODS
Goody Clancy & Associates 02/27/14


MAP 4.2
HYDROLOGY
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan 2013-2033
CRANSTON
EAST PROVIDENCE
WEST WARWICK
EAST GREENWICH
NORTH KINGSTOWN
PATIENCE ISLAND
T F Green Airport
Location Inset
N
Map Legend
Water
Streams
Wetlands
Community Wellhead Protection Areas
Features
Highways
Roads
T F Green Airport
Bound...
Warwick
RI Municipal
Other States
0 0.5 1 2 Miles
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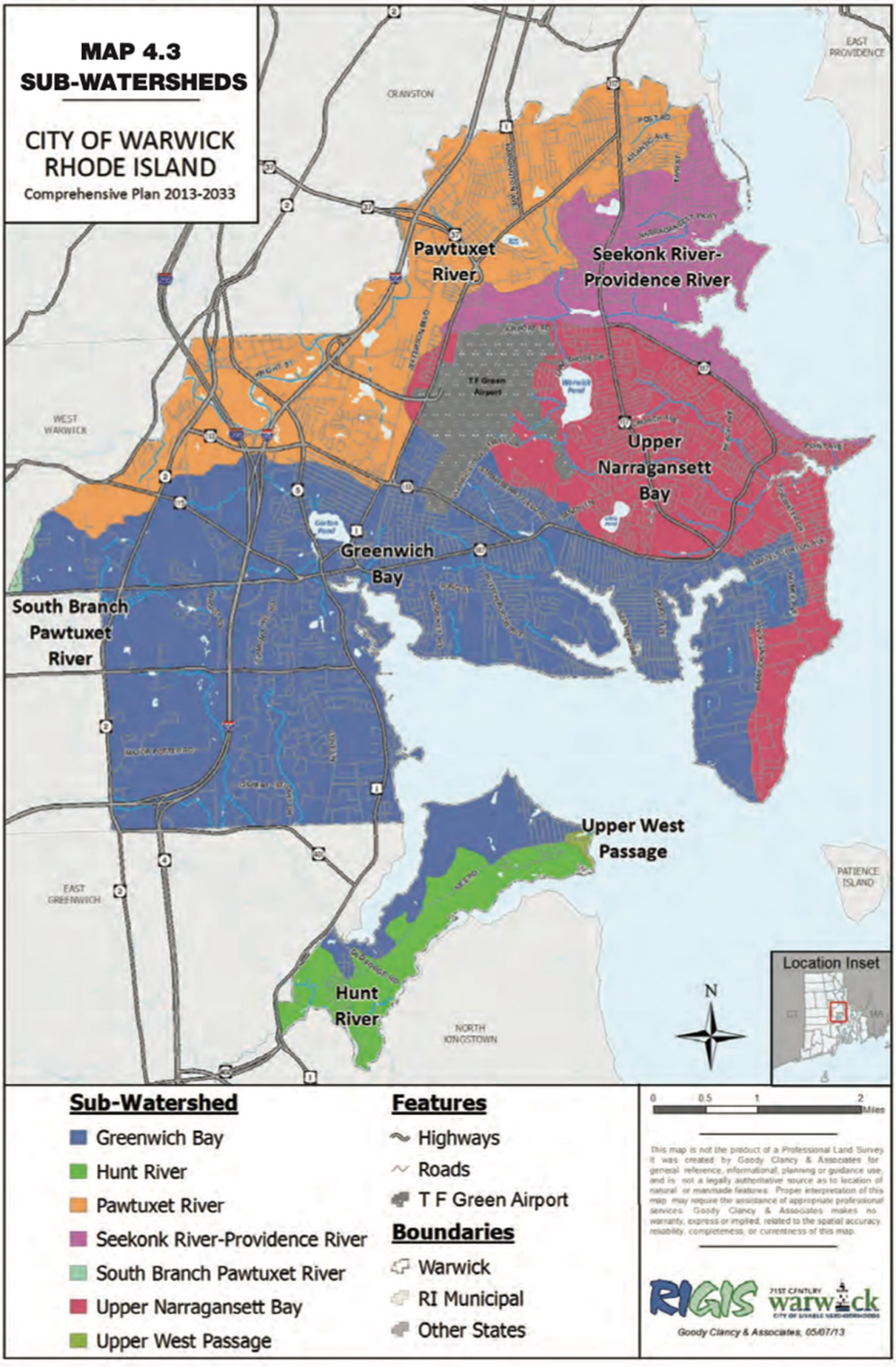
MAP 4.3
SUB-WATERSHEDS
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan 2013-2033
Pawtuxet River
Seekonk River-Providence River
Upper Narragansett Bay
Greenwich Bay
South Branch Pawtuxet River
Upper West Passage
Hunt River
CRANSTON
EAST PROVIDENCE
WEST WARWICK
EAST GREENWICH
NORTH KINGSTOWN
PATIENCE ISLAND
T F Green Airport
Location Inset
N
Sub-Watershed
Greenwich Bay
Hunt River
Pawtuxet River
Seekonk River-Providence River
South Branch Pawtuxet River
Upper Narragansett Bay
Upper West Passage
Features
Highways
Roads
T F Green Airport
Boundaries
Warwick
RI Municipal
Other States
0 0.5 1 2 Miles
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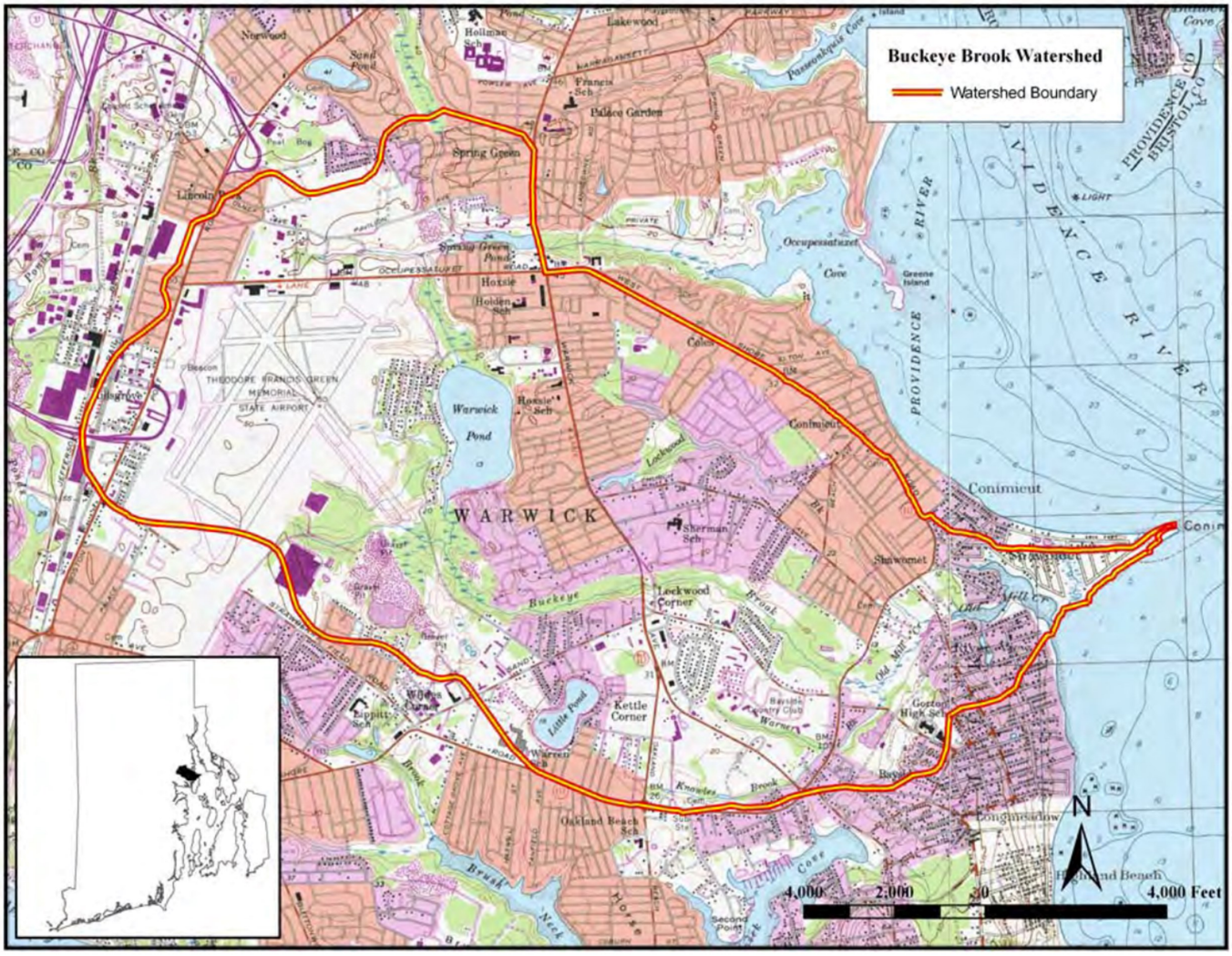
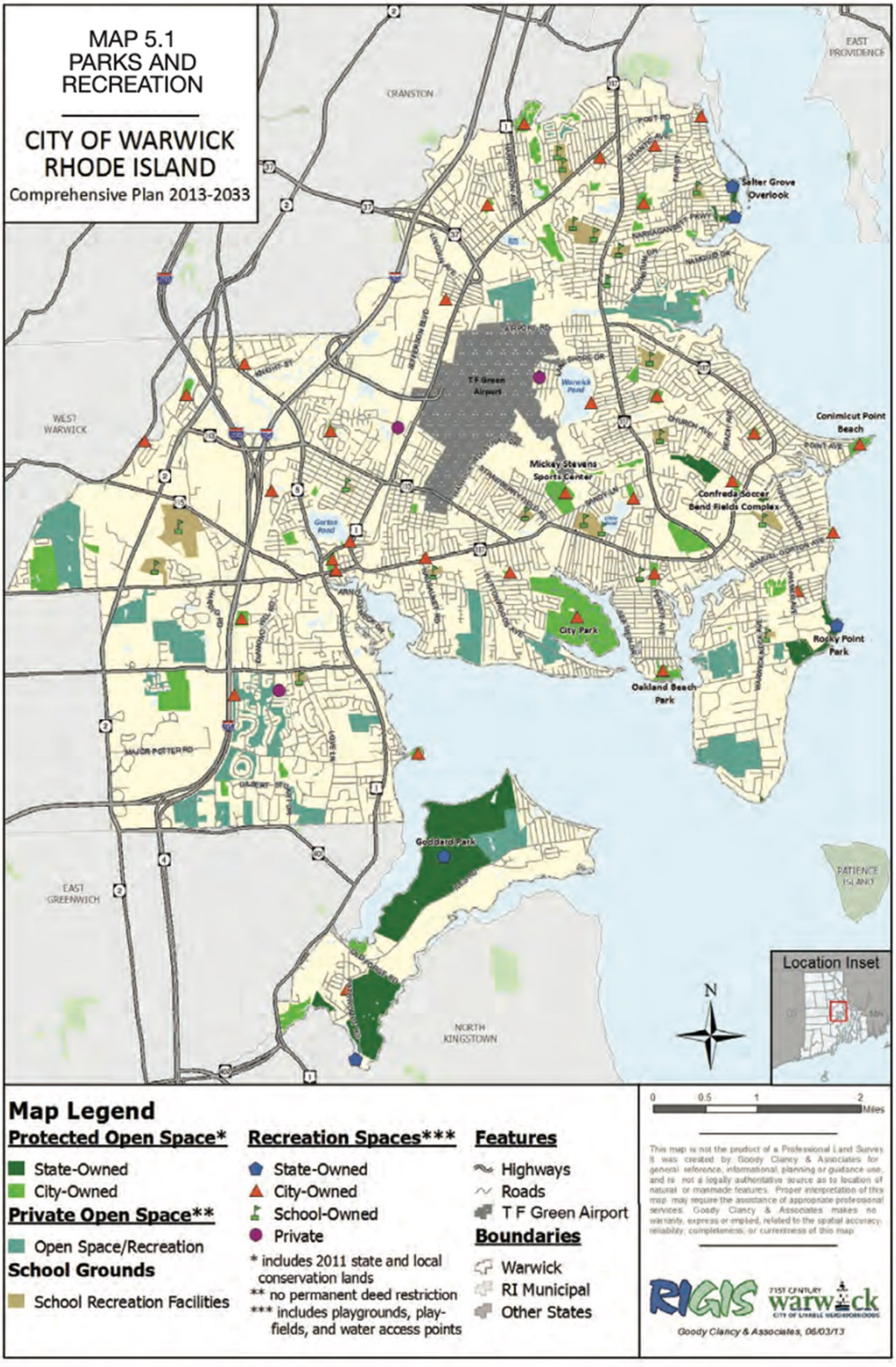
Map 4.3: Buckeye Brook Watershed




MAP 5.1
PARKS AND
RECREATION
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan 2013-2033
CRANSTON
EAST PROVIDENCE
WEST WARWICK
EAST GREENWICH
NORTH KINGSTOWN
PATIENCE ISLAND
Salter Grove Overlook
TF Green Airport
Warwick Pond
Conimicut Point Beach
Mickey Stevens Sports Center
Confreda Soccer Bend Fields Complex
City Park
Rocky Point Park
Oakland Beach Park
Goddard Park
Location Inset
N
Map Legend
Protected Open Space*
State-Owned
City-Owned
Private Open Space**
Open Space/Recreation
School Grounds
School Recreation Facilities
Recreation Spaces***
State-Owned
City-Owned
School-Owned
Private
* includes 2011 state and local conservation lands
** no permanent deed restriction
*** includes playgrounds, play-fields, and water access points
Features
Highways
Roads
T F Green Airport
Boundaries
Warwick
RI Municipal
Other States
0 0.5 1 2 Miles
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CITY OF LIVABLE NEIGHBORHOODS
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MAP 5.3
PROTECTED
OPEN SPACE
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan, 2013-2033
CRANSTON
EAST PROVIDENCE
T F Green Airport
WEST WARWICK
EAST GREENWICH
NORTH KINGSTOWN
PATIENCE ISLAND
Location Inset
N
Map Legend
Protected Open Space*
Permanently Protected
(fee-simple or easement)
Conservation Intent
(no permanent deed restriction)
* includes 2011 state and local conservation lands; excludes recreation
Features
Highways
Roads
T F Green Airport
Boundaries
Warwick
RI Municipal
Other States
0 0.5 1 2 Miles
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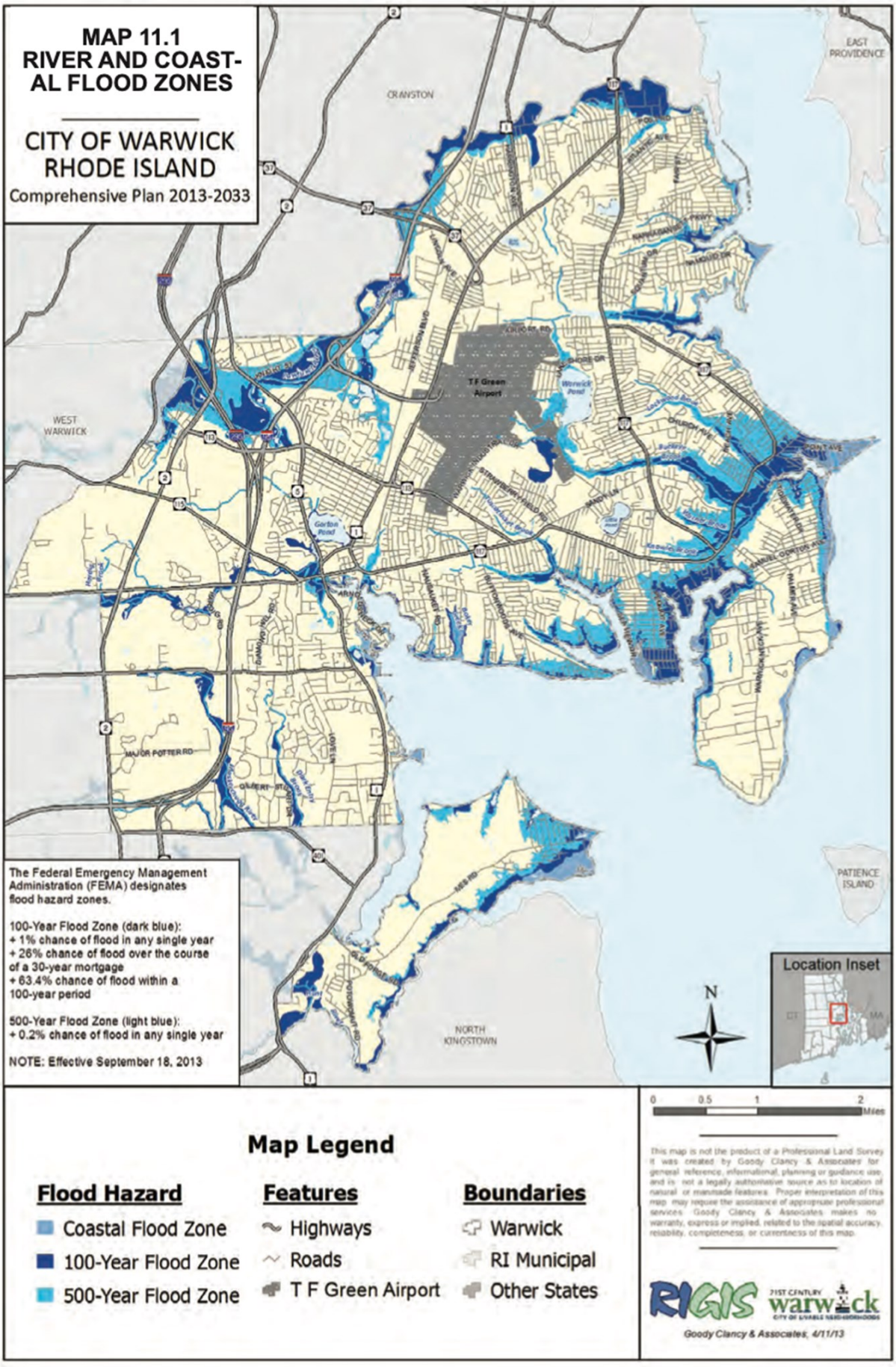
MAP 11.1
RIVER AND COASTAL FLOOD ZONES
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan 2013-2033
CRANSTON
EAST PROVIDENCE
WEST WARWICK
T F Green Airport
NORTH KINGSTOWN
PATIENCE ISLAND
The Federal Emergency Management Administration (FEMA) designates flood hazard zones.
100-Year Flood Zone (dark blue):
+ 1% chance of flood in any single year
+ 26% chance of flood over the course of a 30-year mortgage
+ 63.4% chance of flood within a 100-year period
500-Year Flood Zone (light blue):
+ 0.2% chance of flood in any single year
NOTE: Effective September 18, 2013
Location Inset
N
Map Legend
Flood Hazard
Coastal Flood Zone
100-Year Flood Zone
500-Year Flood Zone
Features
Highways
Roads
T F Green Airport
Boundaries
Warwick
RI Municipal
Other States
0 0.5 1 2 Miles
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MAP 10.3
PUBLIC SAFETY
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan 2013-2033
CRANSTON
EAST PROVIDENCE
WEST WARWICK
EAST GREENWICH
NORTH KINGSTOWN
PATIENCE ISLAND
Airport
Police Department
T F Green Airport
Warwick
Police Department
Kent County
Sheriff's Office
Future
Station
Location Inset
N
Map Legend
Public Safety
Police Station
Fire Station
Features
Highways
Roads
T F Green Airport
Boundaries
Warwick
RI Municipal
Other States
0 0.5 1 2 Miles
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CITY OF LIVABLE NEIGHBORHOODS
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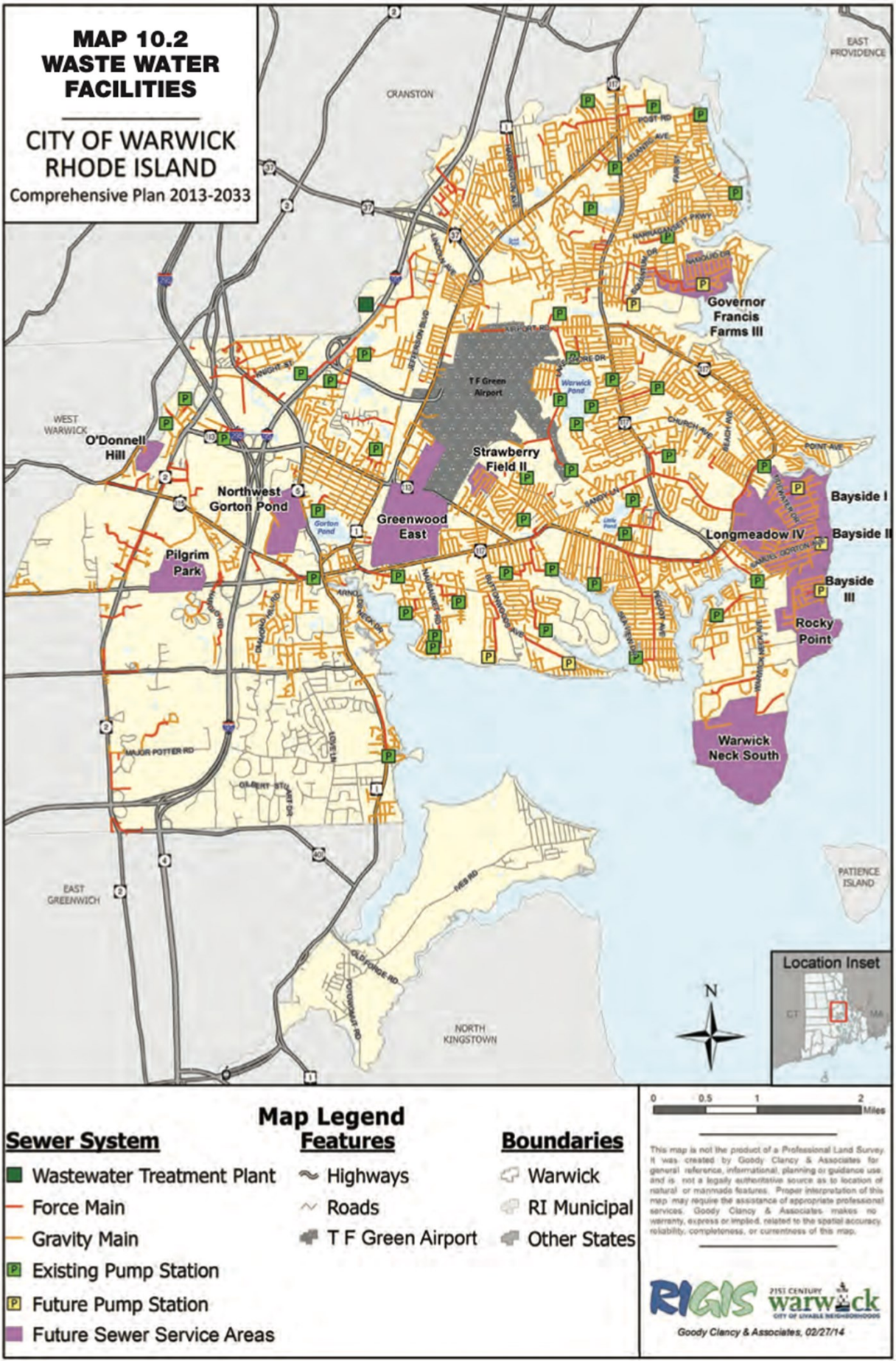
MAP 10.2
WASTE WATER FACILITIES
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan 2013-2033
CRANSTON
EAST PROVIDENCE
WEST WARWICK
EAST GREENWICH
NORTH KINGSTOWN
PATIENCE ISLAND
Governor Francis Farms III
T F Green Airport
Strawberry Field II
O'Donnell Hill
Northwest Gorton Pond
Greenwood East
Pilgrim Park
Longmeadow IV
Bayside I
Bayside II
Bayside III
Rocky Point
Warwick Neck South
Location Inset
CT
MA
N
Map Legend
Sewer System
Wastewater Treatment Plant
Force Main
Gravity Main
Existing Pump Station
Future Pump Station
Future Sewer Service Areas
Features
Highways
Roads
T F Green Airport
Boundaries
Warwick
RI Municipal
Other States
0 0.5 1 2 Miles
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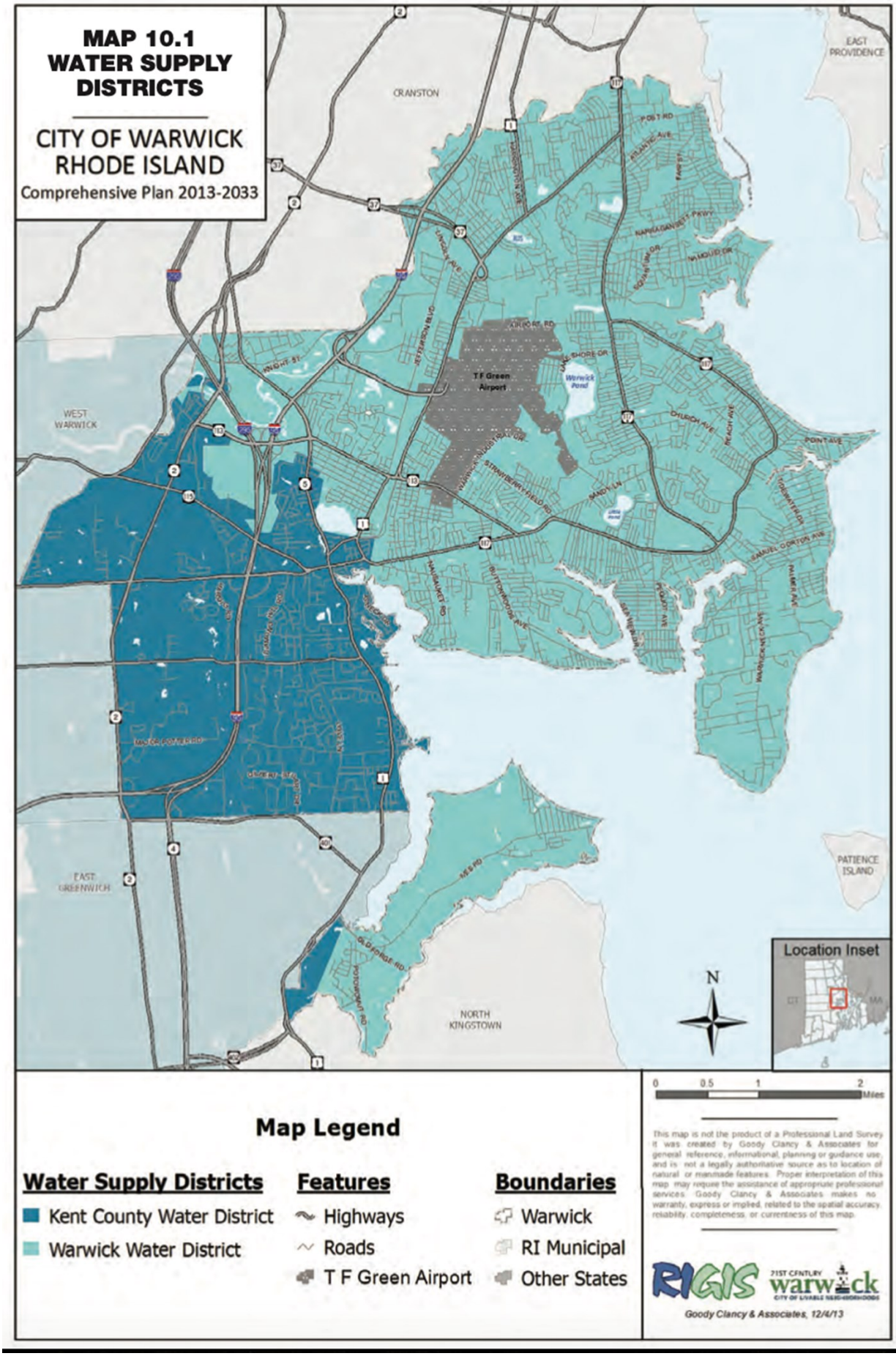
RIGIS
21ST CENTURY warwick
CITY OF LIVABLE NEIGHBORHOODS
Goody Clancy & Associates, 02/27/14


MAP 10.1
WATER SUPPLY DISTRICTS
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan 2013-2033
CRANSTON
EAST PROVIDENCE
WEST WARWICK
EAST GREENWICH
NORTH KINGSTOWN
PATIENCE ISLAND
T F Green Airport
Warwick Pond
Location Inset
N
Map Legend
Water Supply Districts
Kent County Water District
Warwick Water District
Features
Highways
Roads
T F Green Airport
Boundaries
Warwick
RI Municipal
Other States
0 0.5 1 2 Miles
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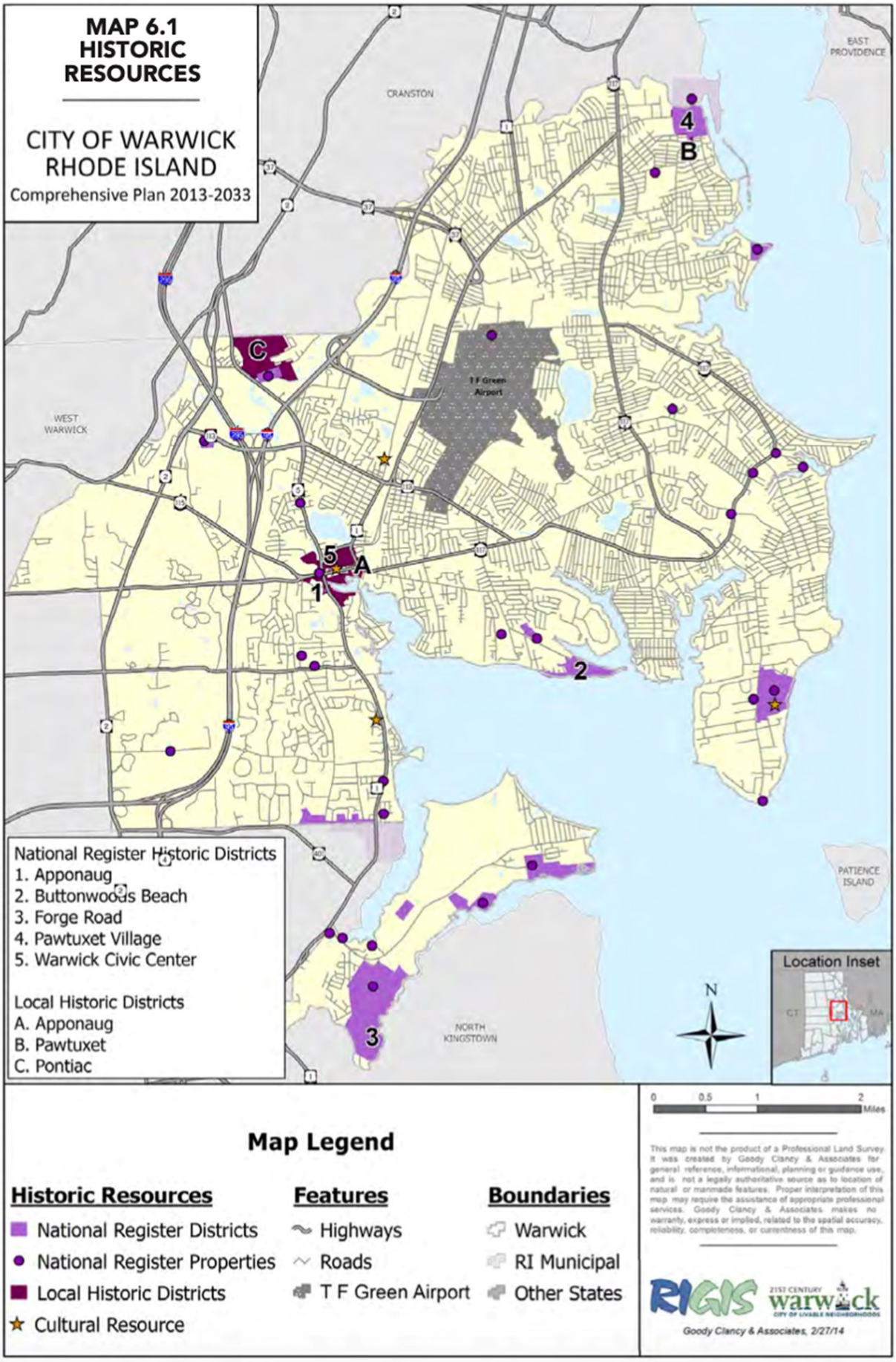
Goody Clancy & Associates, 12/4/13


MAP 6.1
HISTORIC
RESOURCES
CITY OF WARWICK
RHODE ISLAND
Comprehensive Plan 2013-2033
CRANSTON
EAST PROVIDENCE
WEST WARWICK
T F Green Airport
NORTH KINGSTOWN
PATIENCE ISLAND
National Register Historic Districts
1. Apponaug
2. Buttonwoods Beach
3. Forge Road
4. Pawtuxet Village
5. Warwick Civic Center
Local Historic Districts
A. Apponaug
B. Pawtuxet
C. Pontiac
Location Inset
CT
MA
N
0 0.5 1 2 Miles
Map Legend
Historic Resources
National Register Districts
National Register Properties
Local Historic Districts
Cultural Resource
Features
Highways
Roads
T F Green Airport
Boundaries
Warwick
RI Municipal
Other States
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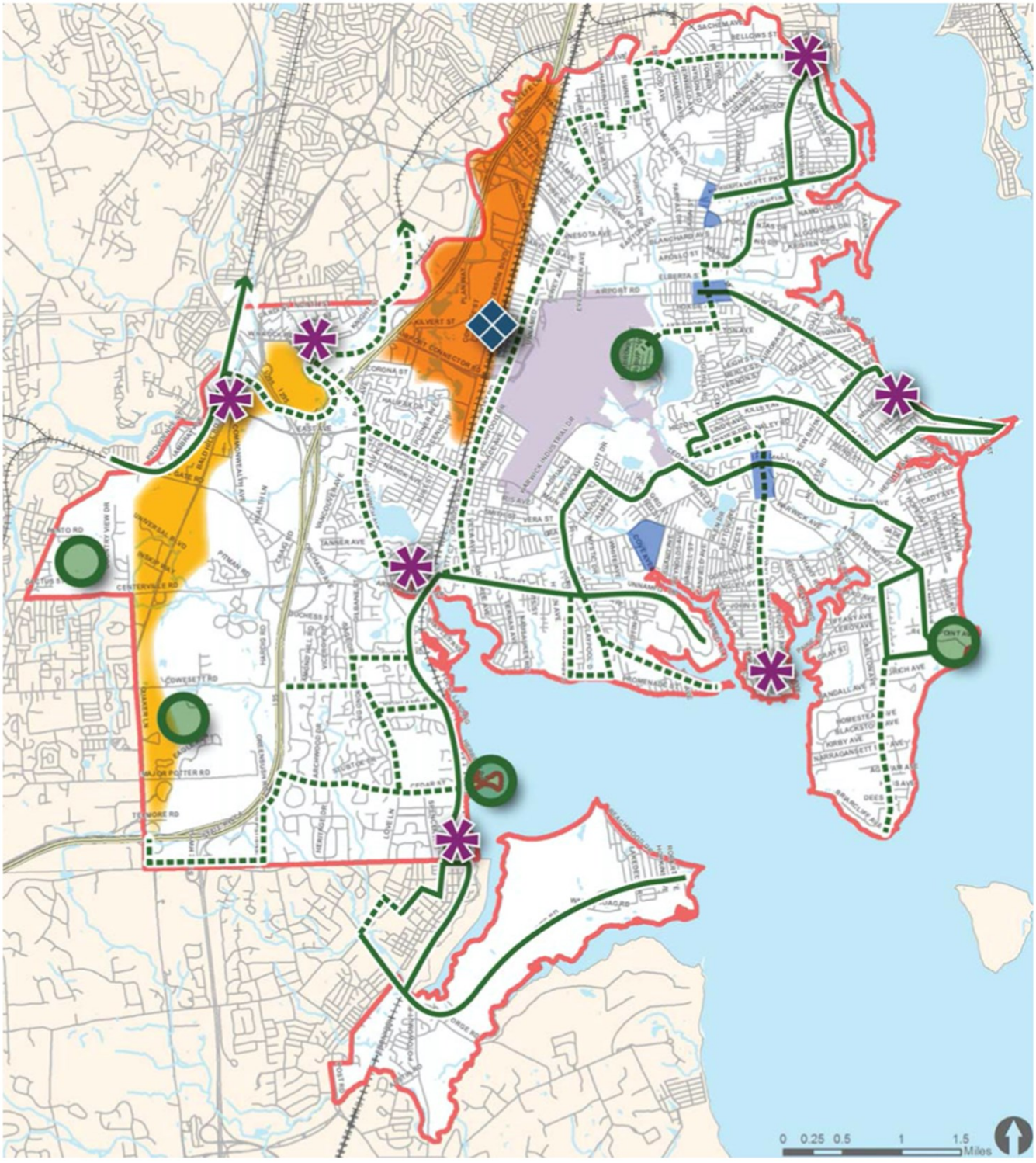
RIGIS
21ST CENTURY warwick
Goody Clancy & Associates, 2/27/14

Strategic Priorities