FIREWISE COMMUNITY ASSESSMENT
CHARLESTOWN, RHODE ISLAND

Pitch pine/ Scrub oak forest land in north Charlestown, Rhode Island

TOWN OF CHARLESTOWN

Prepared November 2020

EXECUTIVE SUMMARY

Charlestown Rhode Island is a coastal rural community situated on the south shore of the state along the Atlantic Ocean/Block Island Sound. The town is heavily forested with approximately 19,000 acres of forestland comprising roughly 80% of the town's total lands. With this high percentage of forest land comes the inherent risk of wildland fire. Over the past 10 years there have been over 23 wildland fires in the town of Charlestown, burning over 18 acres of land. The purpose of this document is to create a more robust understanding of the natural hazards facing Charlestown by examining the risk of wildland fire and recommending wildland fire mitigation strategies.

Evaluations of current fire conditions were conducted at two scales, first at a coarse scale analyzing geospatial data, then at a medium scale through in person "windshield assessments". The coarse scale geospatial analysis explores the topography, the vegetative communities, and fire history of Charlestown. The results of this evaluation find vegetation adapted to grow on dry sites, on top of complex kettle topography. These are conditions which support the ignition and spread of wildland fire. This information was then imputed into FlamMap 6, a wildland fire computer modeling program widely used by state and federal wildland fire managers. The outputs from this computer modeling gives the expected rate of spread of a wildland fire, the expected flame lengths of a fire, and the potential for a wildland fire to spread into tree canopies. At its most extreme, the modeling finds areas of Charlestown where flame lengths could be greater than 20 feet tall, and areas where a fire could spread approximately 200 feet per minute. Both metrics rival those of the more fire prone western united states. On the other hand, modeling finds no potential for a wildfire to spread from the ground into tree canopies, in person evaluations finds this last metric to be inaccurate. Computer modeling is only as good as the data available, in this instance, data used to evaluate the vegetative communities was collected via satellite. The remoteness of this collection source results in data that is unrefined in scale, thus the need for in person evaluations to validate model outputs.

For the in-person evaluations, Charlestown is divided into four regions based on fire protection districts: 1) Charlestown Fire District north of highway 1. 2) Charlestown Fire district south of highway 1. 3) Dunn's Corner's Fire District north of highway 1. 4) Dunn's Corners Fire District south of highway 1. This is done for two reasons, to evaluate based upon the jurisdiction of the responsible fire department and break up evaluation blocks into more manageable sizes. The evaluation process itself is a "windshield assessment" strategy, in which risk is assessed by driving along roadways and viewing the community through the windshield of a vehicle. In broad terms, the assessments find Charlestown to be at medium risk of wildland fire. Vegetation management around homes, and home hardening techniques will strongly contribute to reducing fire risk, this of course is the responsibility of the individual homeowner and property owner.

This report recommends home and property owners utilize "defensible space" and "Firewise" principles. Defensible space by its simplest definition, is creating areas around homes in which firefighters can defend property from wildfire. To create this defensible space, many techniques can be utilized, for example, removing flammable vegetation from areas close to homes, and hardening the landscape by utilizing non-flammable building materials. Similarly, Firewise principles take the defensible space concept of focusing on individual homes and apply it to whole communities. A primary tenet of Firewise, is that the wildfire protection is not solely that of the fire department, but also the responsibility of the property owner. To that end, this report recommends specific specifications on defensible space, includes a list of fire-resistant landscape plants, and outlines next steps for Charlestown.

ASSESSMENT PARTICIPANTS

This plan was written by Patrick MacMeekin, for graduate level course work at the University of Rhode Island, Master of Environmental Science and Management (MESM) program. Project Faculty Advisor Dr. Brett Still, Department of Natural Resource Sciences, University of Rhode Island.

Collaborators

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Olney Knight	Fire Program Manager- Rhode Island Department of Environmental Management, Division of Forest Environment

Signatures:
Author- 07/20/2020

INTRODUCTION SECTION

Charlestown is a coastal community located in the southern Rhode Island situated along the Atlantic Coast. To that end, much work has been done to examine the risk of sea level rise and extreme weather events such as hurricanes, nor'easters and severe winter storms. However, Charlestown is also a heavily forested community and has a history of wildland fires.

The purpose of this document is to create a more robust understanding of the natural hazards facing Charlestown specifically by examining the risk of wildland fire and recommending wildland fire mitigation strategies. In this investigation of wildland fire risk the reader of this report must understand the three environmental factors that contribute to the ignition and spread of wildland fires, these include weather, topography and fuels and are summarized below.

1) <u>Weather conditions</u>- Wildland fires ignite and grow larger when the weather is warm to hot and the relative humidity is low (weather is dry). Additionally, when the wind blows it adds oxygen to a fire and pushes the flames further causing a fire to grow and spread.

2) <u>Topographic features</u>- A fire burning on level ground will slowly spread outward in all directions if there is material available for the fire to consume. However, this same fire at the bottom of a steep hill will quickly burn uphill because as heat rises the fir consumes material at higher relief. This is a major contributing factor to the rapid growth of wildfires in the mountainous western united states where a wildfire can grow over 60,000 acres in a single day.

3) <u>Fuel availability and fuel conditions</u>- In reference to wildfires, fuels include any combustible material. Typically, this is the natural vegetation growing in a location- the tall dry grasses, the shrubs, and the trees, but fuels can also include human made materials. Consider a wooden shed in your back yard. Even homes can also become fuel to a fire. Cedar shake shingle siding, for example, is highly flammable. Similarly, wooden decks can become fuel to a wildfire. Although decks are made of pressure treated lumber which have fire retardant chemicals in them, as decks age and become in poor condition, the fire-resistant chemicals begin to deteriorate.

A more detailed discussion of these three environmental factors included later in this report.

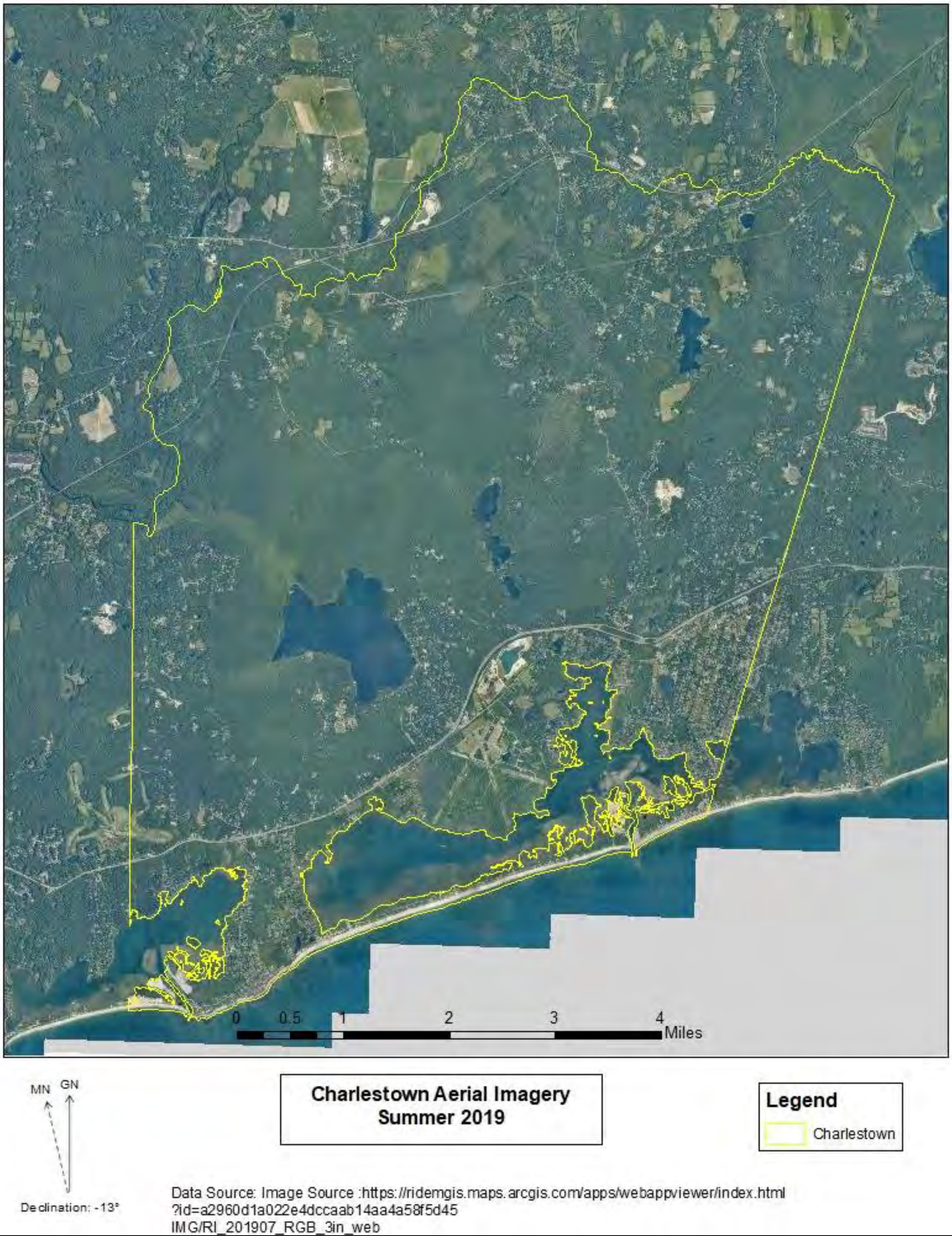
Of these environmental factors, the only one humans can easily manipulate is fuel. Within the time scale of a wildland fire event, we cannot change the weather (from hour to hour, day to day, or month to month). We cannot flatten hills or fill valleys (that is, without substantial effort which is beyond the scope of this report). However, we can remove the fuels available to for a fire to consume by creating "fuel breaks". Strategically placed fuel breaks do not eliminate all risk of wildland fire, but they do allow for compartmentalization of fires to smaller areas, and therefore aid in the quick suppression of fires. Fuel breaks can take many forms- on state owned forest land, for example, a dirt road through the the forest will act as a fuel break. Doubly beneficial, a road allows for firefighting equipment to easily access the location of a fire. To help protect houses in rural neighborhoods, fuel breaks take a different form, through the concept known as "defensible space". Defensible space is the combined use of several tactics to create a space or zone around homes and properties where firefighters and property owners can defend homes form wildfire. Creating defensible space includes maintaining short green grass around a home and removing dead trees and bushes and replacing them with more fire-resistant landscaping (more on fire resistant landscaping later in this report). It is also keeping gutters, eves on roofs, and spaces under decks free from dried leaves and pine needles and replacing a dilapidated wooden deck with a brick patio. Where appropriate, it maybe the complete removal of vegetation, to maintain a 10 ft wide path. Defensible space does not have to be the only management practice of a landscape, but it should be a consideration to supplement other management practices. For example, a landowner who cuts trees for firewood can use defensible space concepts to identify what trees to be cut- the same tree cut down for firewood can be a tree cut down to create defensible space.

There is one more key principle the reader of this report must understand, wildland fires do not recognize property ownership, property boundaries, tax designation, or management authority. Ostensibly, this makes intuitive sense, however in practice this can be a difficult concept for land managers to actualize. When we view a landscape, we consciously or unconsciously see property lines. Whether it is a marked boundary with a fence, sign or stone wall or an unmarked boundary that has been agreed upon by neighbors- the big oak tree, the clearing, or the thicket. Often, management considerations stop at the property line. It is for this reason, that we see the landscape as many small pieces, however wildland fires do not burn in that way. As mentioned before, fires follow the fuels. We see a wooden fence separating two properties, that same fence is fuel to the fire. A dense cluster of bushes between two homes is fuel to a fire. To have a deeper understanding of the fire situation in Charlestown, the reader of this report must view the town of Charlestown without political boundaries. Then the reader will begin to see that their ¼ acre lot with a few trees is really part of a vast forestland. (See Maps, Pgs. v, vi, vii)

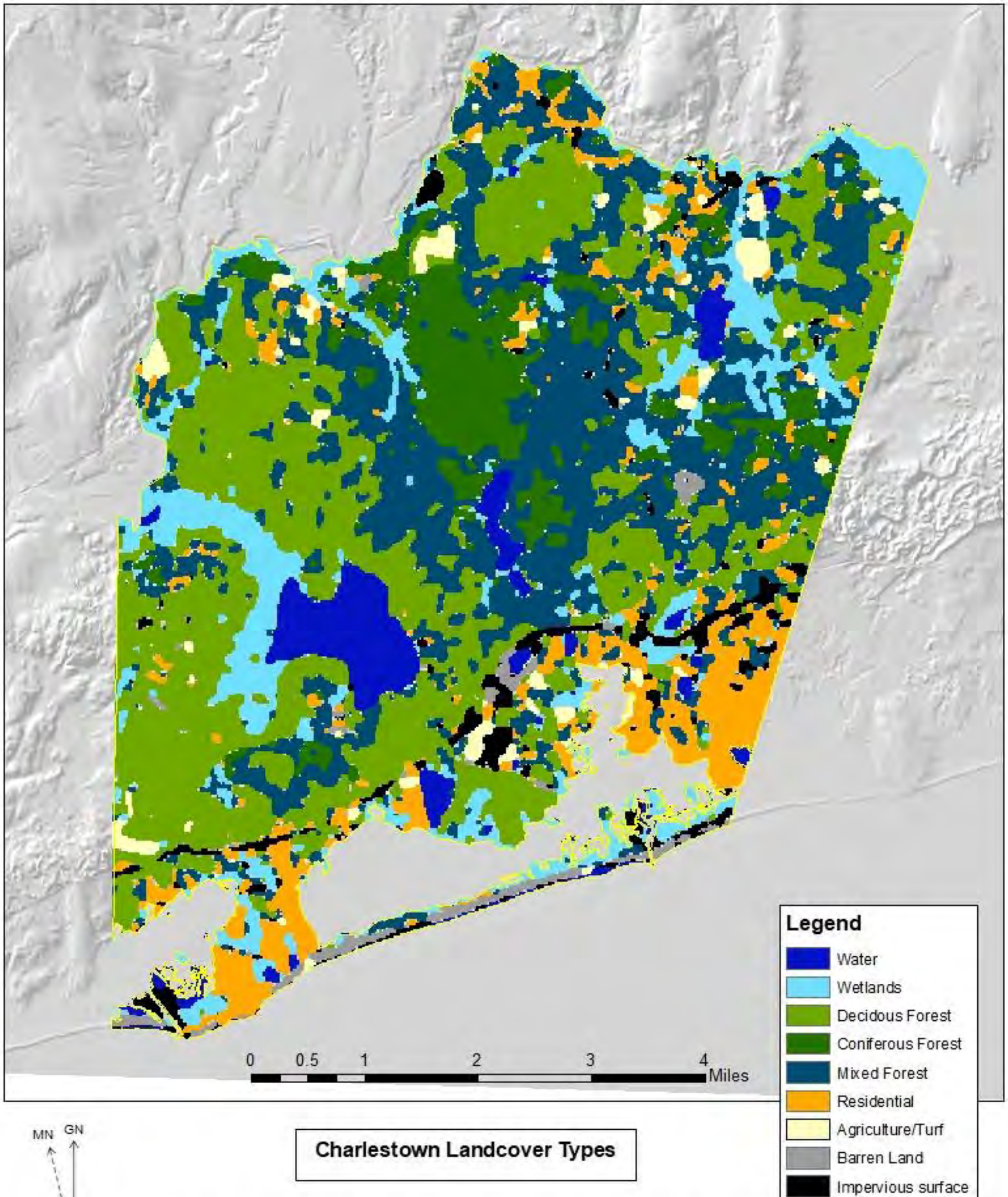
This is where the Firewise Communities program comes into effect. The purpose of this report is to information, tools and practices to help neighbors, landowners, fire officials, and town officials to understand the fire risk in their communities, and to take community ownership over these risks. The following excerpt is a brief overview taken from the Firewise Communities USA FACT Sheet describing the Firewise program:

> ***"Overview:*** *Over the past century, America's population has nearly tripled, with much of the growth flowing into traditionally natural areas. This trend has created an extremely complex landscape that has come to be known as the wildland/urban interface. Encroaching development into forests, grasslands, and farms has put lives, property, and natural resources at risk from wildfire. Unfortunately, once a wildfire ignites firefighters are limited in what they can do to protect the values in its path. The National Firewise Communities Program is a national interagency program that encourages partnerships among communities, homeowners, private industry, tribes and public agencies and officials to develop and implement local solutions for wildfire preparedness – before a fire starts. Wildfires are a natural process. It is the vision of Firewise Communities that with adequate planning and cooperation among varying interests, wildfires can occur without disastrous loss of life, property and resources. To that end, the National Firewise Communities Program provides several wildland/urban interface resources for firefighter safety, community planning, landscaping, construction and maintenance to help protect people, property and natural resources from wildland fire."*

The full fact sheet is available at the Homeland Security Digital Library- URL: www.hsdl.org, under the search term "Firewise".



Map Description: Map shows aerial photograph of Charlestown, Rhode Island in the summer of 2019. This map removes political boundaries (excluding the town boundary) to show the vegetative cover of the town. Charlestown is covered in forestland. For this report- "Forestland" is defined as areas dominated by trees.



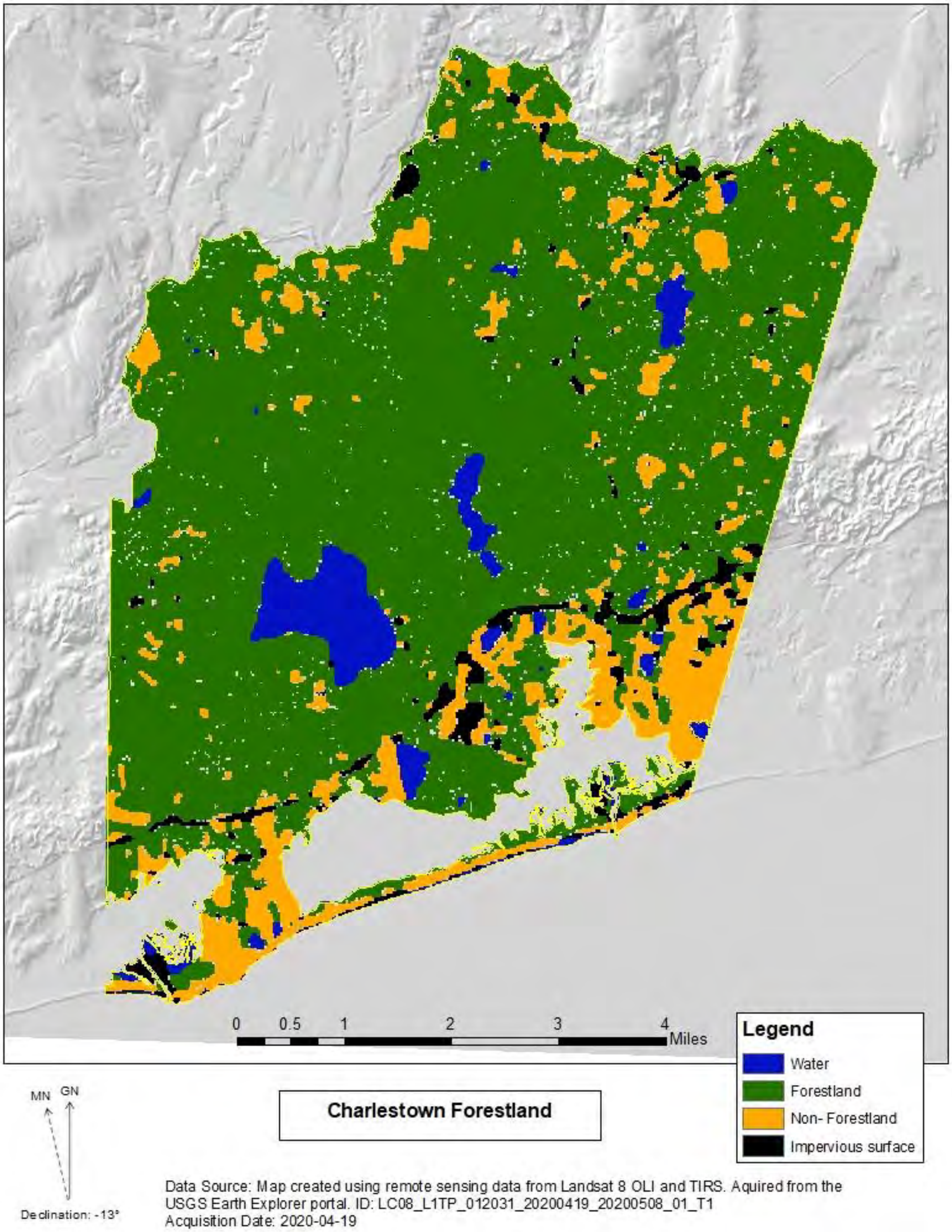
MN GN

Declination: -13°

Charlestown Landcover Types

Data Source: Map created using remote sensing data from Landsat 8 OLI and TIRS. Aquired from the USGS Earth Explorer portal. ID: LC08_L1TP_012031_20200419_20200508_01_T1
Acquisition Date: 2020-04-19

Map Description: Map shows outputs from analysis of remote sensing data. Landcover types were divided into 9 broad categories based on their comparative infrared reflectance signatures. This data is coarse in scale, and therefore very broad in its categorization. For example the areas classified as “residential” have an abundance of tree cover, while the areas classified as “forest” have many homes and roads.



Map Description: This map simplifies the map on the previous page by combining forest categorization (combining deciduous forest, coniferous forest and mixed forest) and by combining non-forestlands. This map series shows the large amount of forestland in Charlestown, approximately 19,000 acres.

PROBLEM STATEMENT:

The landscape of New England has been largely shaped by fire (Abrams, 1992; Barnes et al., 1998; Brown, 1960; Cronon, 2003). Indigenous Peoples in the northeast utilized intentional wildland fire to facilitate hunting, agriculture, control of pests and land clearing to name a few. These practices were later also adopted by European settlers (Cronon, 2003). During the early to mid-20th century, many unintentional wildland fires were ignited by resource extraction across New England. Timber production and harvesting of forest products to fuel the industrial revolution caused fire to be widespread across southern Rhode Island (C. Foster & Foster, 1999; D. R. Foster & O'Keefe, 2000). As fire became more common, suppression of those fires became more sophisticated. Networks of fire lookout towers were erected and state and local wildland fire agencies were established.

In a way, the sophisticated suppression tactics and policies of keeping fires small were too successful. Research related to wildland fire clearly shows the impacts of the historical suppression of fire. Removal of fire from the landscape results in the accumulation of wildland fire fuels. Further, this absence of fire has a compounding affect- effectively erasing the living memory of fire from policy makers, land managers and the public at large.

Charlestown, Rhode Island is a rural community within the forest, it's this rural character that attracts homeowners to live here. However, this also leads to a wildland urban interface problem. Various management frameworks for wildland urban interface communities have existed since the 1990s. The Firewise communities' program has been widely adapted in the arid west and in the southern United States. But only recently has the Firewise program gained traction in Rhode Island.

Charlestown has a history of wildland fire. From 2010 to 2019, a total of 23 wildland fires were reported in the town (Rhode Island Department of Environmental management- Historic Fire Reporting). A resurged interest in the topic of wildland fire may be a result of recent forest pests' outbreaks that have left approximately 226,880 acres of defoliated oak forest across the western and southern part of Rhode Island (Ricard, 2017). Fire managers, natural resource and land managers have recognized the potential for catastrophic wildland fire because of this increased fuel loading.

TABLE OF CONTENTS

FIREWISE COMMUNITY OVERVIEW

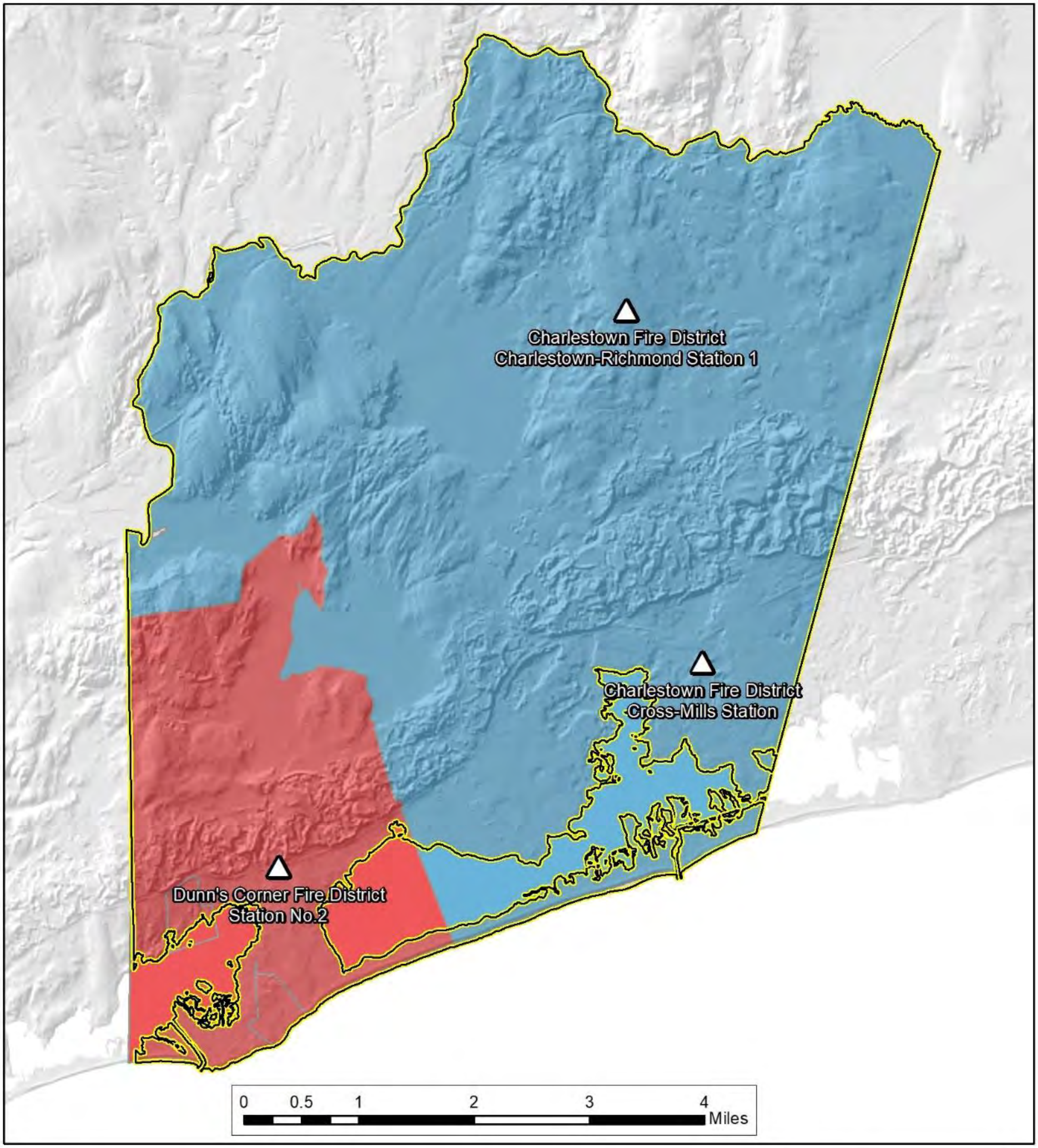
Site Name:	Charlestown
City:	Charlestown (Town)
State:	Rhode Island
Latitude:	41° 24’ 20.0” N
Longitude:	71° 40’ 04.6” W

(approximate geographic center)

Boundary description:

The Charlestown Firewise Community is bound by the administrative town boundary. This community assessment considers the entire town of Charlestown, Rhode Island as a Firewise Community. Charlestown has two separate rural fire protection authorities, the Charlestown Fire District and the Dunn’s Corner Fire District. (see Fire Protection Districts Map, Pg. 2)

This Firewise Community assessment divides the town into four regions based on fire protection districts, dividing the two rural fire protection districts into north and south regions. The resulting regions are Charlestown Fire District North, Charlestown Fire District South, Dunn’s Corner Fire District North, and Dunn’s Corner Fire District South. US Hwy 1 serves as the north/ south division. (See Firewise Region Map, Pg. 3)



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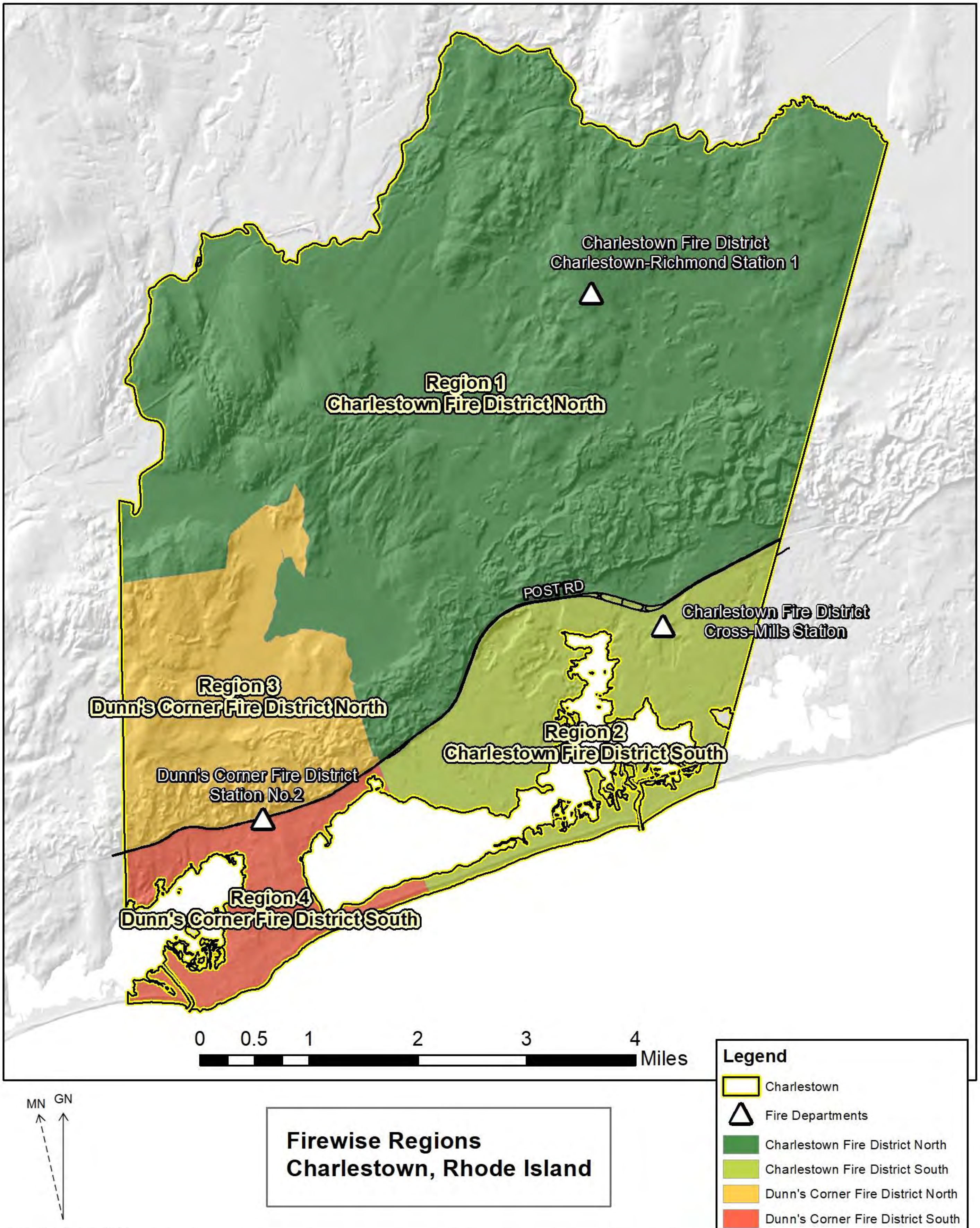
Declination: -13°

Fire Protection Districts
Charlestown, Rhode Island

Data Source: Map created using Charlestown Fire Districts (Source): Town of Charlestown, Rhode Island- GIS Department. Fire_Districts (Data acquired 05/28/2020).

Legend
- Fire Departments
- Charlestown
- Charlestown Fire District
- Dunn's Corner Fire District

Map by: Pat MacMeekin
pat.macmeekin@gmail.com



Firewise Regions
Charlestown, Rhode Island

Data Source: Map created using Charlestown Fire Districts and Charlestown Roads (Source): Town of Charlestown, Rhode Island- GIS Department. Fire_Districts, Cha_roads (Data acquired 05/28/2020).

Map by: Pat MacMeekin
pat.macmeekin@gmail.com

Fire Protection Districts and Partner agencies

Charlestown Fire District:

The Charlestown Fire District was formed in 1974. Prior to that the town of Charlestown was protected by three separate volunteer fire departments- the Dunn's Corner Fire District, the Cross Mills Volunteer Fire Department and the Charlestown- Richmond Volunteer Fire Department. In 1974, the Cross Mills Volunteer Fire Department and the Charlestown-Richmond Volunteer Fire department merged to form the Charlestown Fire District. The Dunn's Corner Fire District remains a separate entity. The Charlestown-Richmond Fire Department located in the north central part of town and the Cross Mills Fire Department in the south-central part of town serve as the two stations for the district. Today the district is staffed by volunteers and a part time District Chief (Charlestown Fire District, 2020).

The Charlestown Fire Department protects 20,954 acres of land.

5 Year Average Response Log:
The following table represents the average number of incident responses for the period of 2015-2019

Response Type	Average number of responses
Structure Fire	11.2
Brush Fire	7.2
Vehicle Fire	4.2
Other Fires	6.2
Alarm Malfunctions	44.8
Accidental Activations	29.6
Medical Emergencies	12.6
Motor Vehicle Accidents	44.2
Hazardous Conditions	28
Service Calls	15.8
Other Calls	35.2
Total average calls	**239**

Retrieved from http://www.charlestownfd.org/home

Apparatus: Charlestown-Richmond Station

Engine 713 2008 Pierce Impel 1500 gpm pump 1000 gallon tank

Engine 716 1991 E-One 1250 gpm pump 1500 gallon tank

Tanker 715 2006 Peterbilt/US Tankers 1250 gpm pump 2700 gallon tank

Unit 700 2001 Ford/E-One SCBA fill station Water & ice rescue equipment

Brush 712 1990 Dodge/E-One 250 gpm pump 200 gallon tank

Forestry 717 2006 Polaris ATV, trailer forestry equipment, 70 gallon tank and 150 gpm pump.

(Charlestown Fire District, 2020)

Apparatus: Cross-Mills Station

Engine 812 2012 Pierce Arrow XT 1500 gpm pump 1000 gallon tank 30 gallon foam tank

Engine 813 2018 Pierce Enforcer 1500 gpm pump 1000 gallon tank

Engine 814 1998 International/E-One 500 gpm pump 500 gallon tank

Unit 811 1997 Ford Explorer Water & ice rescue equipment

Engine 816 1988 Ford/E-One 1000 gpm pump 1000 gallon tank. Used as a reserve apparatus

ATV 8 2006 John Deere 4wd Gator

(Charlestown Fire District, 2020)

Dunn's Corners Fire District:

The Dunn's Corner Fire District protects the Southwestern part of Charlestown, as well as a portion of the neighboring town of Westerly, Rhode Island. The Dunn's Corner Fire District protects 5,492 acres of land within the Town of Charlestown jurisdictional boundary (Dunn's Corner Fire Department, 2020)

5 Year Average Response Log:

The following table represents the average number of incident responses for the period of 2012-2016 (only complete available data), (DCFD Staff. (n.d.), 2020).

Total incident responses by year	2012	2013	2014	2015	2016	5 year Average
Fire						
Building	13	11	6	8	10	9.6
Brush Fire	3	7	7	13	6	7.2
Vehicle Fire	4	4	5	3	5	4.2
Other Fires	11	10	7	8	8	8.8
Rescue	11	113	291	315	373	220.6
Hazardous condition	51	77	56	68	61	62.6
Service call						
Unauthorized burning	9	21	9	8	5	10.4
Other service	41	51	41	60	45	47.6
Good intent	16	15	78	103	110	64.4
Authorized burning	1	--	--	--	--	.2
False Alarm	129	150	160	130	159	145.6
Special type of incident	--	--	1	1	--	.4
Severe Weather	--	91	--	--	13	20.8

Dunn's Corner Fire District Apparatus

Rhode Island Department of Environmental Management, Division of Forest Environment:

The Division of Forest Environment (DFE) is the state forestry agency responsible for wildland fire suppression and prevention (Rhode Island General Laws- Title 2, Chapter 2-11, Section 2.) The division of Forest Environment (DFE) operates two offices, the Arcadia Management Area headquarters located in Richmond, Rhode Island. And the George Washington Management Area located in Gloucester, Rhode Island. Each office has 2 full time wildland fire staff. DFE's primary role in the control of wildland fires is to support rural fire protection districts- to add capacity during suppression efforts by means of personnel and equipment (RI DEM DFE, 2020).

DFE is also the state agency that that approves wildland fire planning documents such as Community Wildfire Protection Plans, and Firewise Community Plans.

Statewide 5 Year Average- response Log:

The following table describes the total number of wildland fire responses by year and the average size fire by acres for that year. This table shows DEM, Division of Forest Environment responses, statewide.

Year	Number of Fires	Average size (acres)
2015	91	1.3
2016	82	0.7
2017	32	0.7
2018	33	0.4
2019	43	0.7

(RI DEM DFE, 2020)

[5] **Rhode Island Department of Environmental Management, Division of Forest Environment Apparatus:**

[5] RI DEM DFE, 2020 - Fire Apparatus, obtained from Allan Waterman, accessed July 2020.

5, 6

One- Type 3 Engine	150 GPM minimum pump capacity	800-gallon tank	500 ft- 1 ½" hose	500 ft- 1" hose
Four- Type 6 Engine	30 GPM minimum Pump capacity	200-gallon tank	300 ft 1 ½" hose	300 ft- 1" hose
One Patrol vehicle	--	--	--	--
One UTV		65-gallon Tank	--	100 ft garden hose

(RI DEM DFE Fire Apparatus, obtained from Allan Waterman, accessed July 2020. (RIDEM DFE 2020))
(US DOI, 2019)

FIREWISE REGIONS:

Charlestown Fire District- North (Region 1)

This is the largest of the four regions. The landscape consists of large tracks of deciduous forest land and has a mix of upland forests, forested wetlands with small pockets of Pitch Pine forest throughout. The ownership of the area is primarily private, non-industrial forest land consisting of small acreages (less than 10 acres). However the area does have a few large landowners. Additionally, the 1,800 acre Narragansett Indian Tribal Reservation is located in this Region. The Narragansett Indian Tribe contracts with the Charlestown Fire District for fire protection services. (See Charlestown Fire District Map, Pg. 12)
Total Acreage: 16,924 Acres

Fire Department:	Charlestown Fire District, Charlestown-Richmond Station
Address	4377 S. County Trail, Charlestown, RI
Latitude	41° 25' 34.4"
Longitude	71° 38' 53.5"
Non-Emergency Phone:	(401) 364-9909

Homes:

Number of Homes	2,096
Number of residents:	--
	Primarily Single Family

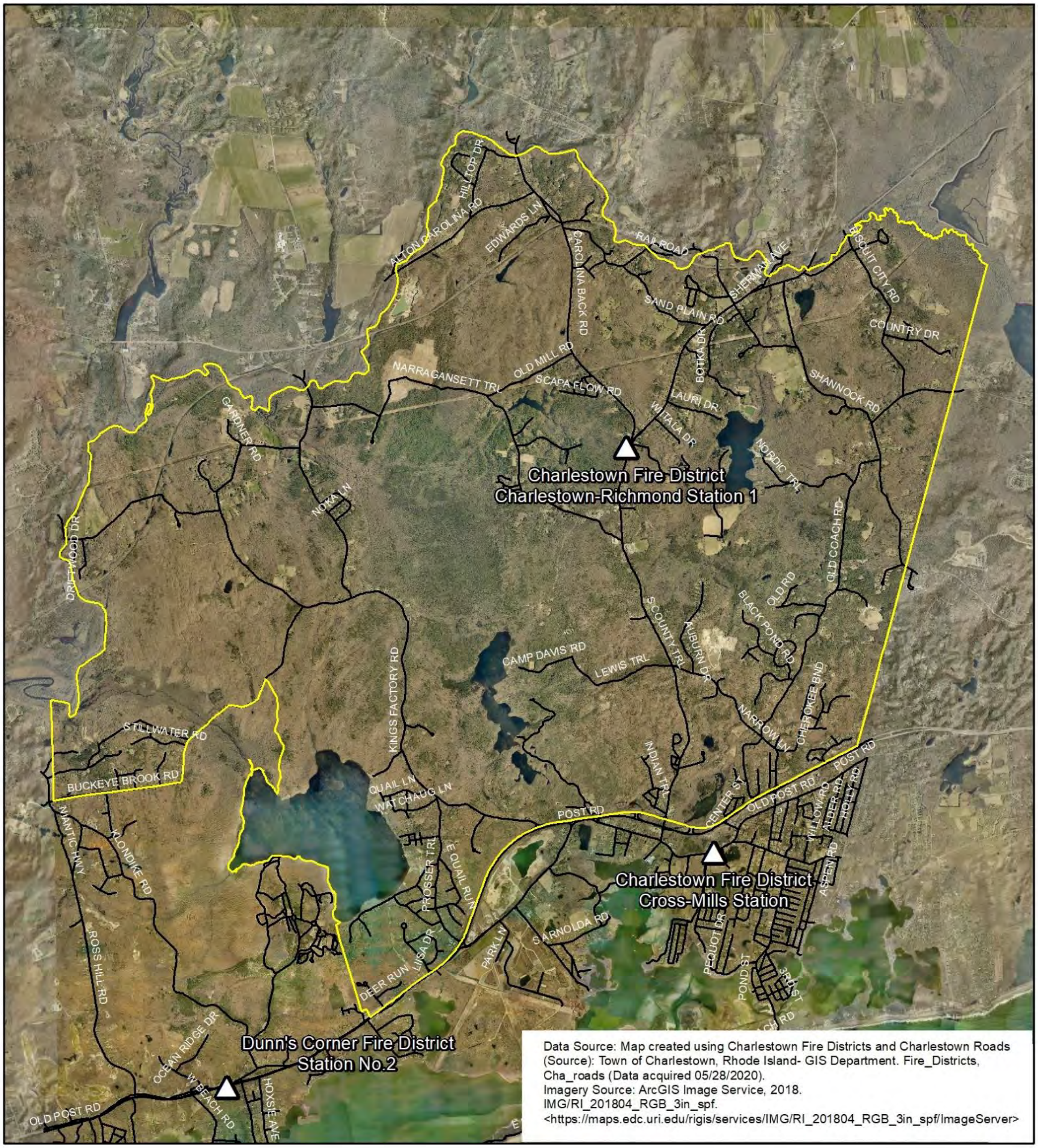
Residential Types that apply: Single Family, Duplex, Mobile/Manufactured

Type of ownerships: Private, Public, Tribal

Lot Sizes

<.5 Acres:	247 Parcels
.5- 1 acre:	624 Parcels
1 acre- 10 acres:	1,430 Parcels
> 10 Acres:	206 Parcels
	Total Parcels: 2,507

Wildland Urban Interface type: Mixed interface- Homes are intermixed with wildland fuels



Region 1
Charlestown Fire District North

Map by: Pat MacMeekin
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Charlestown Fire District- South (Region 2)

This is the most densely populated Region and has a different character than Charlestown Fire District-North. This area is situated along the Atlantic coast and has many more homes. The geography of this area consists of mainly coastal6-10 foot high shrublands surrounding three coastal lagoons, locally termed Salt Ponds. Landward of the salt ponds, the vegetation profile transitions into more deciduous forest land. The coastline consists of a series of headlands and coastal barriers that bracket the salt ponds.

Many of the dwellings here are seasonal occupancy only or vacation rentals mostly occupied in the summer months. However there is also a year-round population in this area A majority of the homes on Charlestown Beach Road are elevated on pilings to protect from coastal flooding. While the elevated homes protect from flooding, they greatly increase the risk of wildland fire given the opportunity for brush undergrowth beneath these homes. In many cases there is no defensible space or fuel breaks. A wildland fire can potentially have severe effects on property in this area. This is because fires burn upwards, if vegetation is growing beneath a structure (elevated wooden deck, or elevated home) and that vegetation would catch fire, the flames would burn upward igniting the structure above. (See Charlestown Fire District – South Map, Pg. 14)

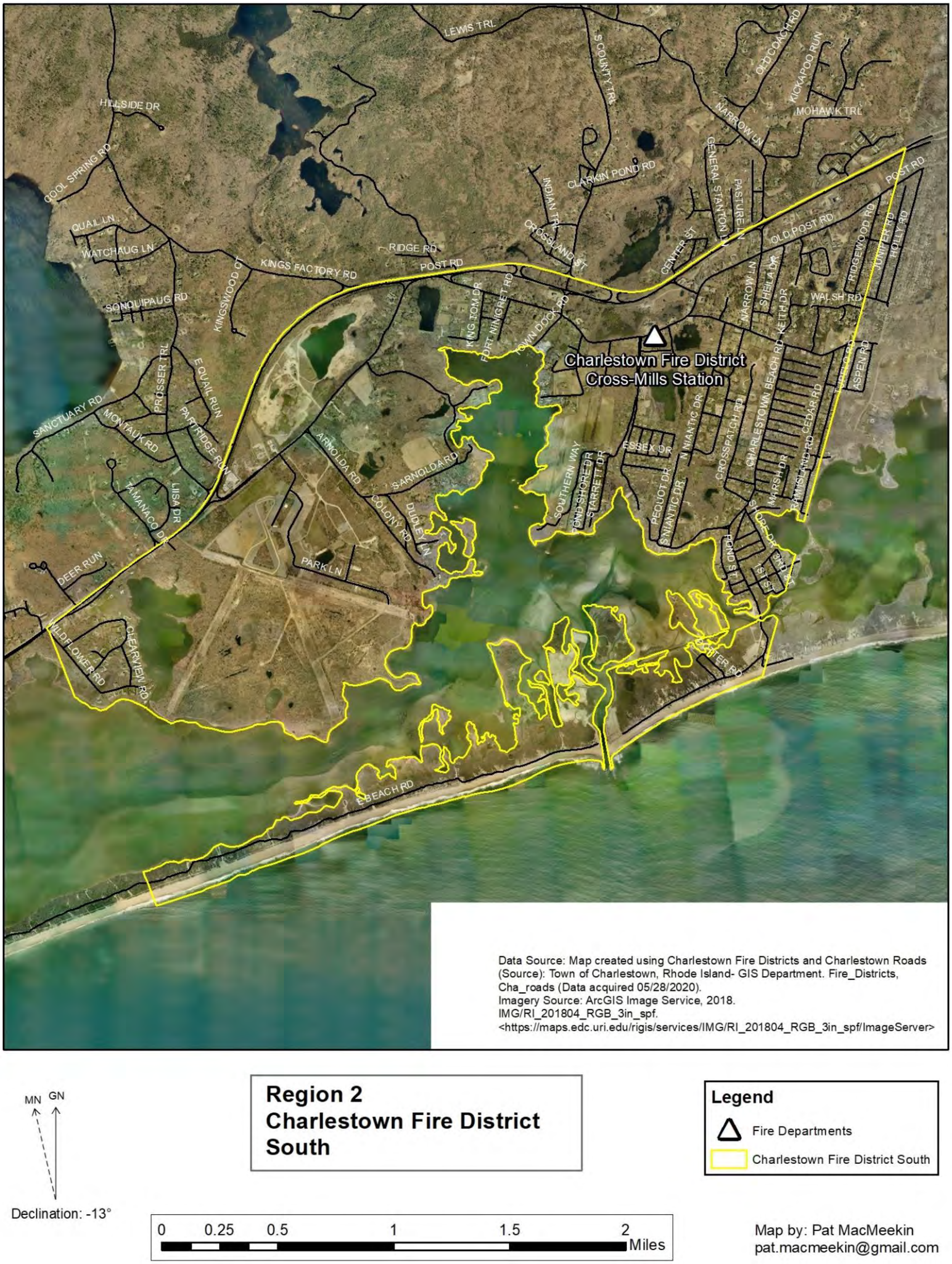
Total Acreage: 3,001

Fire Department:	Charlestown Fire District, Cross Mills Station
Address	4258 Old Post Rd, Charlestown, RI
Latitude	41° 22’ 54.8”
Longitude	71° 38’ 05.6”
Non-Emergency Phone:	(401) 364-6511

Number of homes: 1,421
Residential Types that apply: Single Family, Duplex, Vacation Rentals
Type of ownerships: Private, Public
Lot Sizes

<.5 Acres:	1,065 Parcels
.5- 1 acre:	414 Parcels
1 acre- 10 acres:	392 Parcels
> 10 Acres:	30 Parcels
	Total Parcels: 1,901

Wildland Urban Interface type: Mixed interface- Homes are intermixed with wildland fuels


LEWIS TRL
S COUNTY TRL
OLD COACH RD
KICKAPOO RUN
MOHAWK TRL
NARROW LN
HILLSIDE DR
COOL SPRING RD
CLARKIN POND RD
INDIAN TRL
GENERAL STANTON LN
PASTURE LN
POST RD
QUAIL LN
WATCHAUG LN
RIDGE RD
CROSSLAND ST
CENTER ST
OLD POST RD
RIDGEWOOD RD
JUNIPER RD
HOLLY RD
KINGS FACTORY RD
SONQUIPAUG RD
KINGSWOOD CT
KING TOM DR
FORT NINIGRET RD
TOWN DOCK RD
SHEILA DR
WALSH RD
KEITH DR
ASPEN RD
Charlestown Fire District
Cross-Mills Station
PROSSER TRL
E QUAIL RUN
SANCTUARY RD
MONTAUK RD
PARTRIDGE RUN
ARNOLDA RD
S ARNOLDA RD
SOUTHERN WAY
POND SHORE DR
STARRETT DR
ESSEX DR
N NIANTIC DR
CROSSPATCH RD
CHARLESTOWN BEACH RD
CEDAR RD
MARSH DR
TAMANACO DR
LIISA DR
COLONY RD
DUDLEY LN
PEQUOT DR
S NIANTIC DR
ISLAND RD
POND ST
1ST ST
DEER RUN
PARK LN
WILDFLOWER RD
CLEARVIEW RD
OYSTER RD
E BEACH RD
Data Source: Map created using Charlestown Fire Districts and Charlestown Roads (Source): Town of Charlestown, Rhode Island- GIS Department. Fire_Districts, Cha_roads (Data acquired 05/28/2020).
Imagery Source: ArcGIS Image Service, 2018.
IMG/RI_201804_RGB_3in_spf.
<https://maps.edc.uri.edu/rigis/services/IMG/RI_201804_RGB_3in_spf/ImageServer>
MN GN
Declination: -13°
Region 2
Charlestown Fire District
South
Legend
Fire Departments
Charlestown Fire District South
0 0.25 0.5 1 1.5 2
Miles
Map by: Pat MacMeekin
pat.macmeekin@gmail.com

Dunns's Corners Fire District- North (Region 3)

This region is the least most densely populated with few homes and relatively large tracks of forestland. The Burlingame Management Area is a state forest preserve managed by the Rhode Island Department of Environmental Management. The area is comprised of mostly deciduous and wetland forestland with a few pockets of coniferous forestland. (See Dunn's Corners Fire District – North Map, Pg. 16)

Total Acreage: 3,114

Fire Department:	Dunn's Corner Fire District- Station No. 2
Address	5564 Post Rd, Charlestown, RI
Latitude	41° 21' 21.4"
Longitude	71° 42' 19.3"
Non-Emergency Phone:	(401) 322-0577

Homes:

Number of Homes	350 Primarily Single Family

Residential Types that apply: Single Family, Duplex,

Type of ownerships: Private, Public

Lot Sizes

<.5 Acres:	46 Parcels
.5- 1 acre:	81 Parcels
1 acre- 10 acres:	287 Parcels
> 10 Acres:	30 Parcels
	Total Parcels: 444

Wildland Urban Interface type: Mixed interface- Homes are intermixed with wildland fuels

MN GN

Declination: -13°

Region 3
Dunn's Corner Fire District North

Legend

Fire Departments

DCFD_North

0 0.25 0.5 1 1.5 2 Miles

Map by: Pat MacMeekin
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Dunns's Corner Fire District- South (Region 4)

Similar in character to Charlestown Fire District South Region, this area of Charlestown is densely populated with vacation rentals, summer cottages and a year-round population. This area has many private roads with a single access point and limited turn-around space for fire apparatus. Additionally, on East Beach Road, south of Ninigret Pond, the vegetation transitions from deciduous forest to 6-10 ft high shrubland with elevated dwellings intermixed. A wildland fire could potentially have severe impacts on property in this area (See Dunn's Corners Fire District- South Map, Pg. 18).

Total Acreage: 1,380

Fire Department:	Dunn's Corner Fire District- Station No. 2
Address	5564 Post Rd, Charlestown, RI
Latitude	41° 21' 21.4"
Longitude	71° 42' 19.3"
Non-Emergency Phone:	(401) 322-0577

Homes:

Number of Homes	886
	Primarily Single Family

Residential Types that apply: Single Family, Duplex, Vacation Rentals

Type of ownerships: Private, Public

Lot Sizes

<.5 Acres:	712 Parcels
.5- 1 acre:	197 Parcels
1 acre- 10 acres:	194 Parcels
> 10 Acres:	18 Parcels
	Total Parcels: 1,121

Wildland Urban Interface type: Mixed interface- Homes are intermixed with wildland fuels
Classic Interface- Clear line of demarcation between Homes and Fuels

MN GN

Declination: -13°

Region 4
Dunn's Corner Fire District
South

Legend

Fire Departments

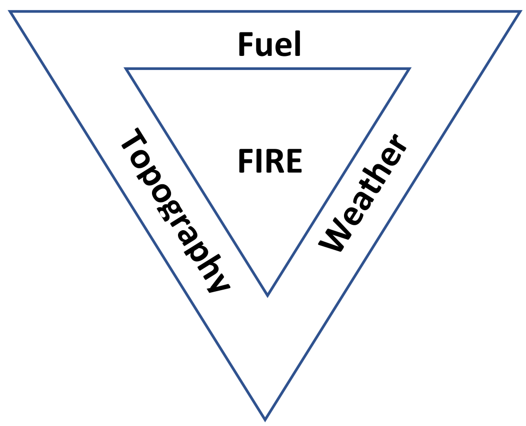
DCFD_South

0 0.25 0.5 1 1.5 2 Miles

Map by: Pat MacMeekin
pat.macmeekin@gmail.com

THE FIRE ENVIRONMENT

In 1972, Clive Countryman, a researcher with the US Forest service Pacific Southwest Forest and Range Experiment Station outlined a framework for understanding how wildland fires interact with the environment. Countryman called this concept the Fire Environment and it is widely cited in wildland fire literature. The Fire Environment Framework consists of three factors, fuel, weather and topography. This framework can be imagined as a triangle with each factor influencing the others. (Countryman, 1972, Pyne et al.,1996).



Of the three fire environment factors topography is the most static. While topography does change over long periods of time when compared to the timeframe of a wildland fire topography remains unchanged. Weather is the most dynamic factor changing seasonally, daily and hourly. Fuels are more difficult to categorize largely remaining unchanged from day to day or even month to month, the condition of the fuels can change rapidly by the hour. Specifically, the amount of moisture in the fuels, referred to as the fuel moisture.

These three factors are closely interrelated. Weather influences such as solar radiation and wind, can dry fuels and reduce fuel moisture. Topography in part dictates the types of vegetation (fuels) growing in a particular area. Topography also influences local weather patterns with winds funneling through valleys and over ridges. The suppression or mitigation of wildland fire or the use of prescribed fire depends on altering the fire environment. The most practical factor to influence is fuel by removing fuels to create fire breaks. We cannot alter the weather although we can take advantage of favorable conditions such as conducting prescribed fire operations during less volatile fire weather periods. Similarly, we cannot influence the topography without large scale efforts, but we can use topographic features as natural fire breaks.

The following sections are a further depiction of the three factors of the fire environment and how they apply to the wildland fire situation specifically to Charlestown, Rhode Island.

Weather and Climate

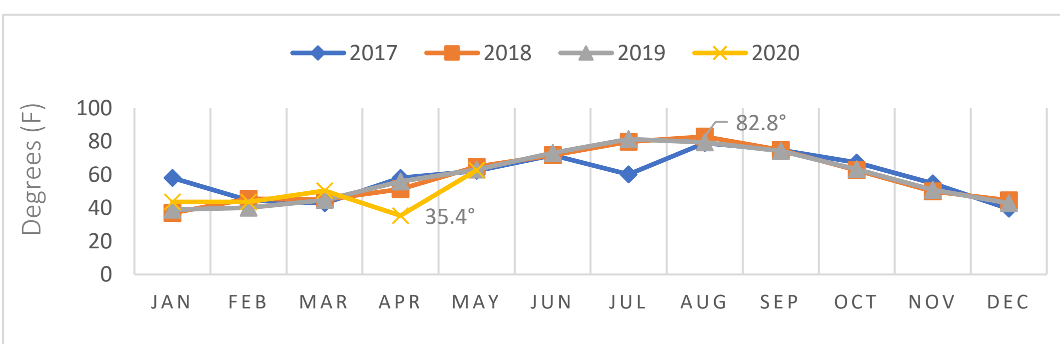
Weather describes the conditions on any day in a specific location, temperature, relative humidity, wind speed and direction and atmospheric stability. Climate on the other hand, describes the long term seasonal trends which dictate the vegetative composition of an area, and the favorable conditions for a local "fire season" (Pyne et al., 1996). In relation to the fire environment, weather has the most influence on fire conditions with solar radiation as the largest driver of fire weather. (Schroeder & Buck, 1970). In the eastern United States, favorable wildland fire climatic conditions tend to occur in the spring and fall with summer fires less frequent but not uncommon.

High levels of solar radiation quickly dry wildland fire fuels and in the late winter to early spring much of the deciduous and herbaceous vegetation is still dormant. This dormancy has a twofold effect on fuels. First, because the vegetation is dormant it has low fuel moisture. Second, because there are no leaves on the forest canopy the solar radiation reaches the forest floor further drying the small diameter woody vegetation. Similarly, the dormant vegetation in the early spring causes wind speeds to have an increased effect on fuels and fire. Without leaves winds are less impeded by the forest again causing a drying effect on fuels (Schroeder & Buck, 1970). Although solar radiation is increased in the summer months, the forest canopy is fully extended preventing solar radiation from reaching the forest floor, causing higher fuel moistures in ground level fuels.

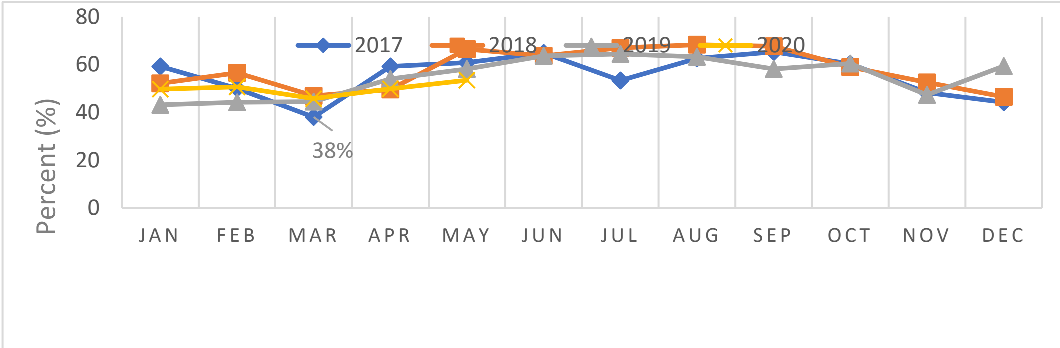
Charlestown Weather

Remote Access Weather Stations (RAWS) are a network of automated weather stations administered by federal and state land management agencies to monitor weather conditions for the purpose of wildland fire preparedness. RAWS track weather metrics such as temperature, relative humidity, solar radiation, precipitation, wind speed, wind direction, among other metrics. RAWS operate continuously collecting hourly data without interruption. In Rhode Island, there is one active station located at the Ninigret wildlife refuge. This station has been online since June of 1998 and has been continuously collecting data for over 21 years. This data is freely available to the public via the RAWS website: https://raws.dri.edu/index.html

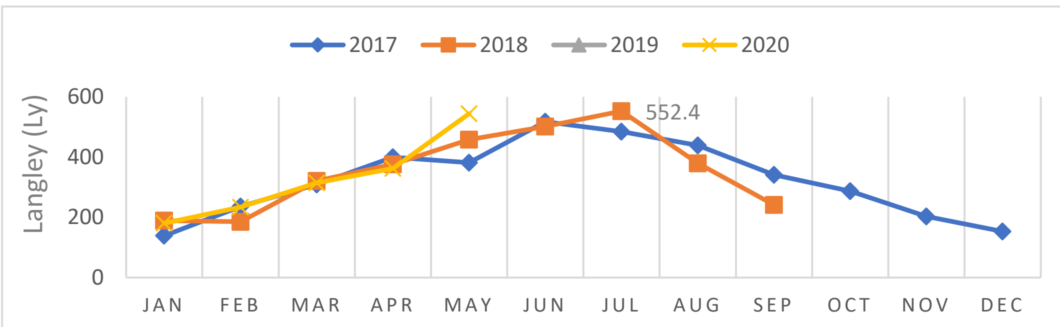
To understand and assess fire conditions as a function of local weather for this analysis observations were gathered from the Ninigret RAWS located at the USFWS- Ninigret National Wildlife Refuge (Station Location- Latitude: 41.3500, Longitude: -71.6500). Monthly averages were collected for years 2017 through 2019 and January to May 2020. Data collected include monthly maximum average temperature, monthly minimum average relative humidity (RH), monthly average maximum wind speed, monthly average wind direction, monthly solar radiation and monthly precipitation (Cooperative Climatological Data Summaries, accessed 2020).



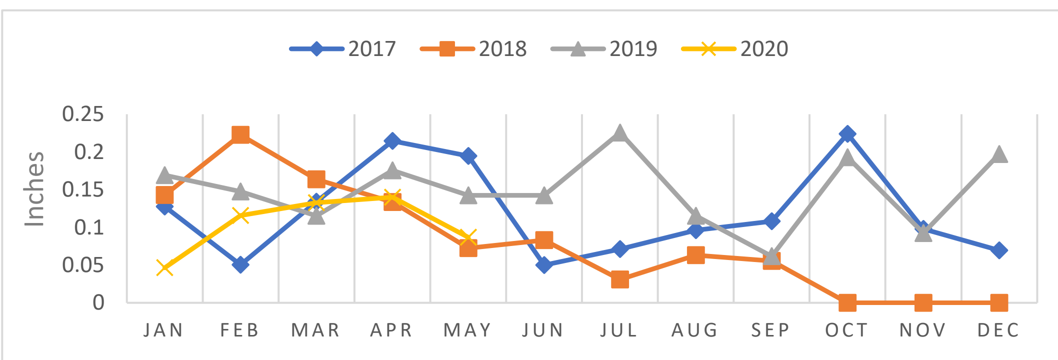
MONTHLY AVERAGE MAXIMUM TEMPERATURE



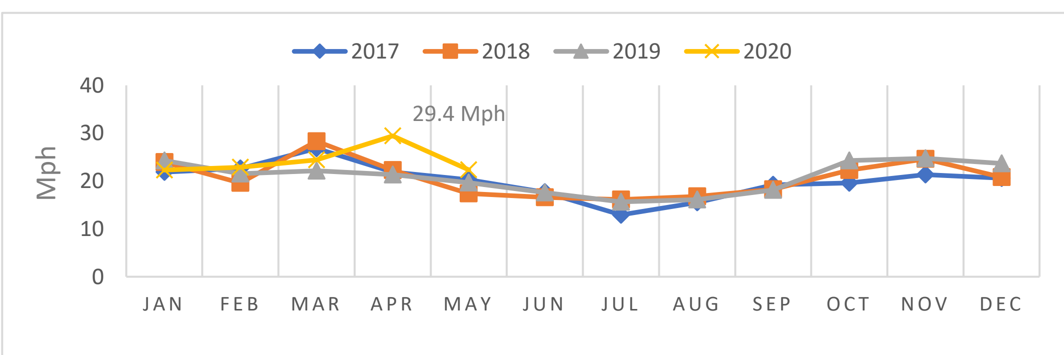
MONTHLY AVERAGE MINIMUM RELATIVE HUMIDITY



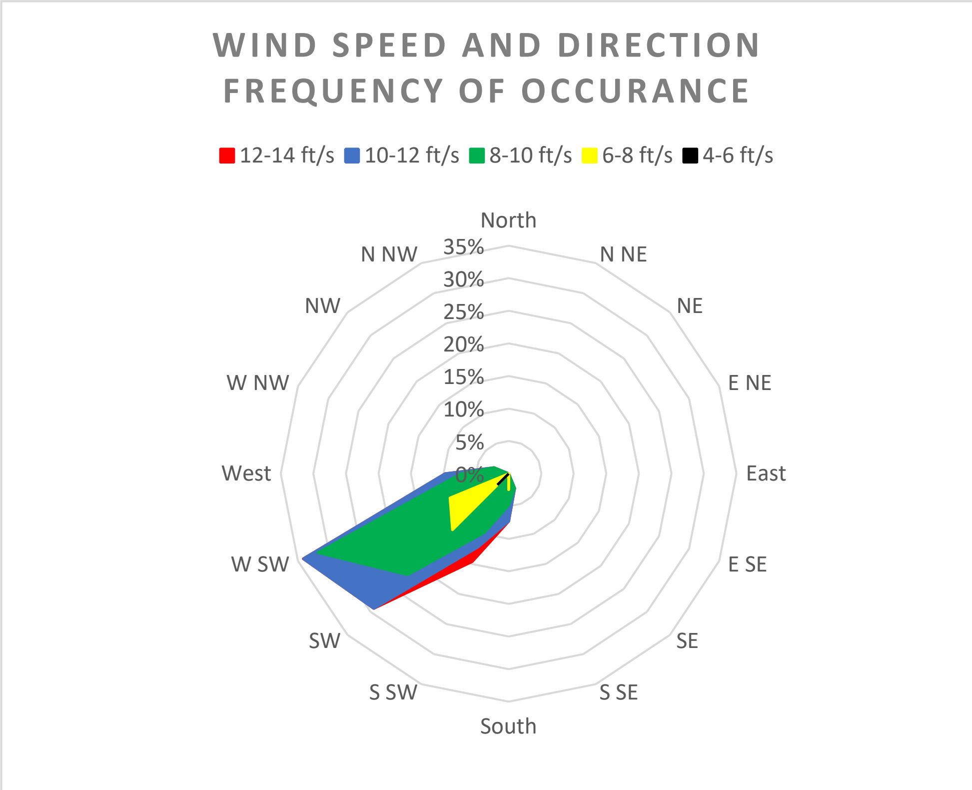
MONTHLY AVERAGE SOLAR RADIATION



MONTHLY AVERAGE PRECIPITATION



MONTHLY AVERAGE MAXIMUM WIND SPEED



Weather Discussion

The above graphs show weather metrics from the Ninigret RAWS station. Relating to wildland fire activity, temperature has a positive correlation. Elevated temperatures bring fuels closer to the point of ignition, however this can be somewhat negated by high relative humidity. For a wildland fire to grow and spread, weather conditions must be both hot and dry. Hot humid days cause fuels to have too much moisture within them making it difficult for small diameter vegetation to ignite. Cold and dry weather allows for small diameter vegetation to ignite more easily, however because the fuel is so cold it is difficult for fire to spread (more about fuel moisture in the following section).

Precipitation has a lagging effect on fire conditions. Precipitation has an obvious immediate effect on fire conditions, after a rain event fuels are too wet to ignite. However, in the long term compounding effects of drought slowly dry fuels making them more susceptible to ignition. On the other hand, an abundance of precipitation in the spring creates a “green up” where small diameter vegetation quickly grows and proliferates meaning more fuel on the ground. A summer drought could then lead to high fire probability conditions in the late summer and early fall.

Winds effects on fire is self-evident high winds add oxygen to fires and allows them to grow more quickly. With these discussion points in mind an analysis of the 3.5 year weather data found that in Charlestown, the months of **March** and **April** have the most ideal fire weather conditions. Moderate to high solar radiation with low relative humidity and high sustained winds quickly dry forest fuels.

Fuels

Of the three factors of the fire environment, fuels are the only factor that can be manipulated to change the fire environment, and therefore mitigate the risk of wildland fire. This is primarily done through the removal of flammable vegetation to create fire breaks. Mechanical removal of vegetation with chainsaws, mowers, and masticators is often utilized as a control method because of its low risk. While the use of prescribed fire to burn away fuels is also utilized, however this method comes with greater inherent risk, and therefore more administrative burden. The US Fish and Wildlife Service conducted large scale prescribed burns and removal of forest fuels at the Ninigret National Wildlife Refuge in Charlestown in 2012.

While the fuels themselves largely remain unchanged, from month to month the moisture content within those fuels can change rapidly. Time lag categories are one way to monitor fuels moistures and are often a consideration of wildland fire managers. Time lag categories are divided by diameter size consisting of four classes. (US Forest Service, n.d.)

- 1 Hour fuels- consisting of fuel less than a ¼ inch in diameter- grasses, pine needles
- 10 Hour Fuels- ¼ inch to 1 inch in diameter- woody shrubs
- 100 hour fuels 1 inch to 3 inch diameter- large branches and small trees
- 1,000 hour fuels- 3 inch to 8 inch in diameter- small to medium sized trees

The hour categorization refers to how long it takes a fuel to equalize to the relative humidity of the ambient environment. For example, it takes grasses 1 hour to equalize the internal fuel moisture to that of the surrounding environment. When considering time lag categories, a campfire is a useful analogy, a match directly to a log will not ignite a log. First the small diameter kindling must be ignited which in turn will ignite the logs. Similarly, as 1-hour fuel moisture drop those fuels are more easily ignited but they take the least amount of energy to extinguish. 1,000-hour fuels on the other hand require a large amount of energy to ignite and a large amount of energy to extinguish. 1,000-hour fuels are the primary driver of large-scale wildland fires.

Another categorization of fuels is the division of fuels into fuel models, a simplified and standardized classification system developed for use in mathematical equations to predict fire behavior. (Pyne et al., 1996). The most wildly used fuel models are the 13 standard fuel models developed by Hal Anderson in 1982, and the 40 fuel models developed by Joe Scott and Robert Burgan in 2005. Anderson's 13 fuel models largely assumes fuel uniformity in fuel size (time lag categorization) and distribution, while Scott and Burgan's fuel model allows for a more diverse interpretation of fuels (Scott & Burgan, 2005). It's important to understand that these fuel models are just that, models. Their primary role is to aid in computer modeling simulations at broad scales. In person evaluations of fuels at a given location are typically more nuanced. In person evaluations also tend to consider different characteristics of the fuels. Factors such as fuel arrangement (both horizontal and vertical), distribution, continuity and compactness are just a few of the elements considered.

Charlestown Wildland Fuels

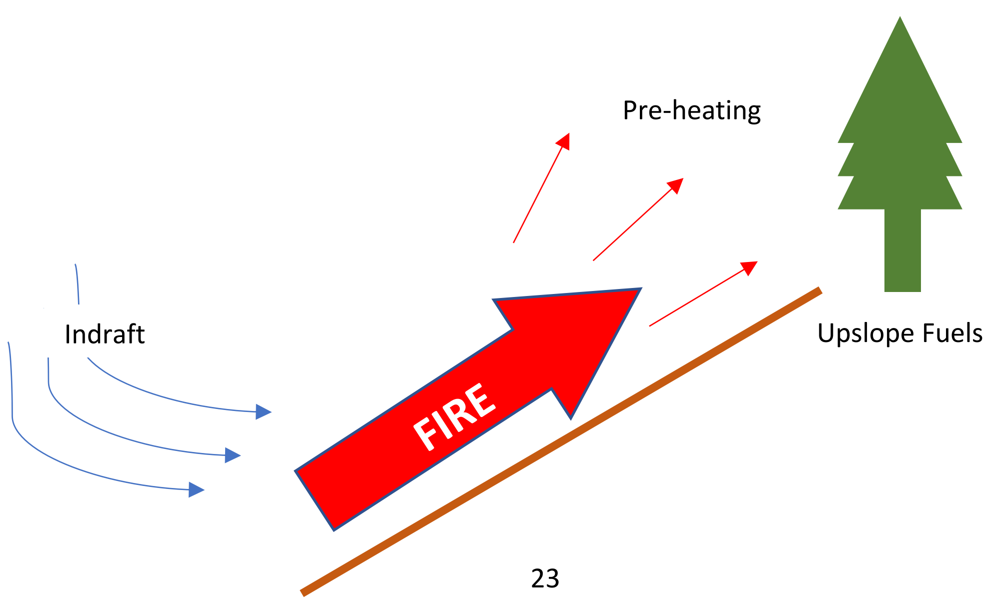
A preliminary examination of the fuels of Charlestown was conducted by utilizing the Scott and Burgan 40 fuel models shapefile obtained from LANDFIRE, a geospatial data distribution site. The analysis found the three largest fuel types in Charlestown to be Shrub Type 6 (SH6), Timber Understory Type 1 (TU1), and Non-burnable Type 1 (NB1). The fuel types are shown spatially in the attached Fuel Map on page 24) and are tabulated below in **Table 1.**

Fuel type description from *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model*	
Shrub Type 6-Dense shrubs, little or no herb fuel, depth about 2 feet. Spread rate high; flame length high	34% of the total area
Timber Understory Type 1**-** Fuel bed is low load of grass and/or shrub with litter. Spread rate low; flame length low	23 % of the total area
*Non-burnable Type 1- Urban or suburban development; insufficient wildland fuel to carry wildland fire.	14% of total area

*The non-burnable classification is inaccurate. The data set uses a coarse scale with one pixel representing a 30 x 30 square meter. The non-burnable lands are clustered in the southeast part of the town in Firewise Region 2, Charlestown Fire District South. Most of the parcel sizes in this area are less than 0.5 acres. Therefore, the coarseness of the raster data categorizes all fuels as non-burnable, whereas the on-the-ground reality identifies more diverse fuel types clustered in proximity. An in-person evaluation found dense vegetation intermixed with high density structures.

Topography

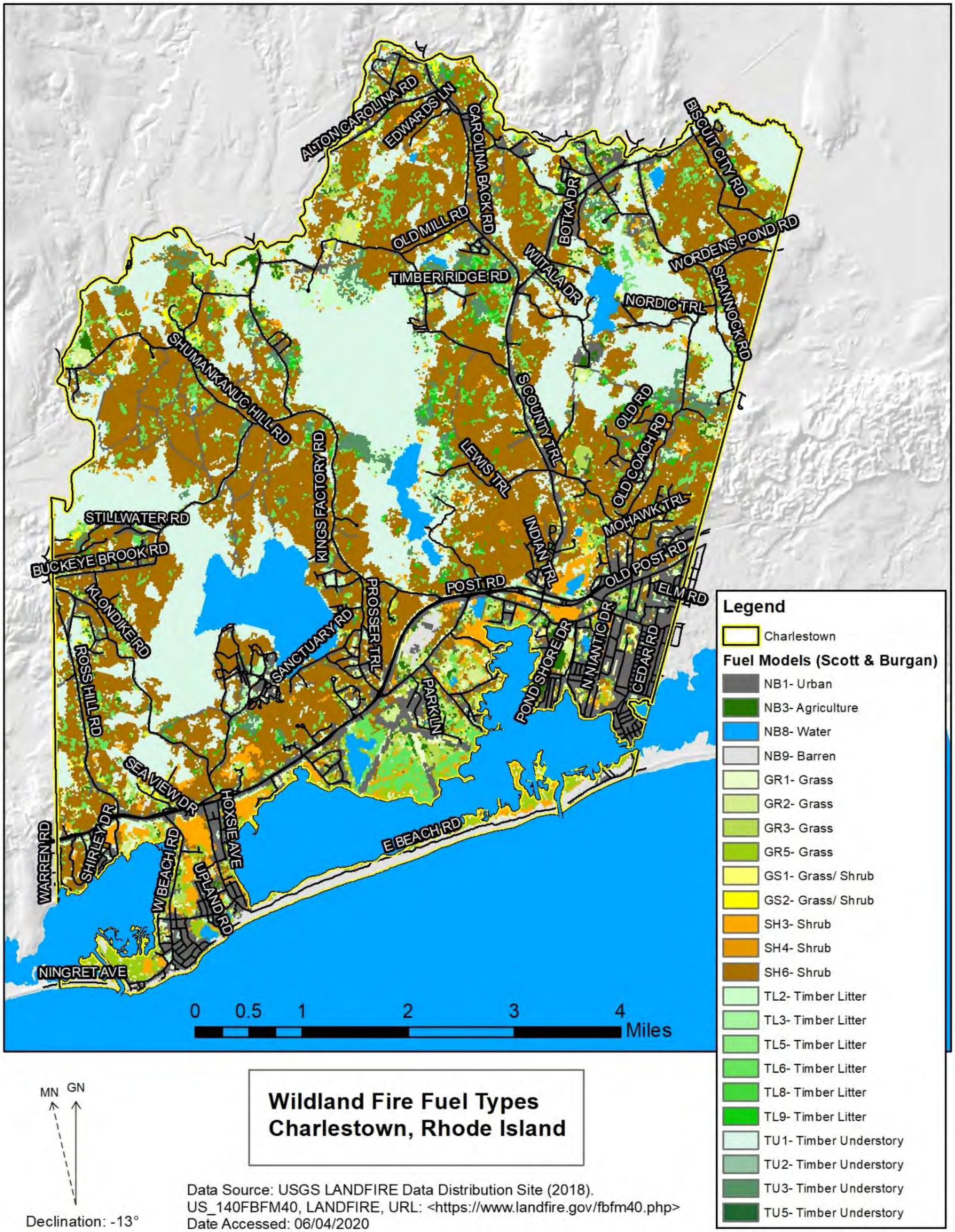
While topography is a constant in the fire environment, it's influence should not be understated. Topographic factors such as steepness and aspect often amplify the influence of weather and fuels. South and west facing slopes receive more solar radiation in the afternoon and evening and with hotter temperatures normally occurring in the afternoon fuels on south and west facing aspects achieve lower fuel moistures (Wright & Sautter, 1988.). Additionally, the steepness of a slope has direct effects on fire behavior. As fire burns uphill, the hot air and gasses preheat the fuels above the fire bringing them closer the ignition temperature. As this hot air is displaced a pressure differential pulls fresh air in from below causing a compounding effect, forcing fire uphill (Pyne et al., 1996).



Charlestown Topography

A band of hummocky glacial till called the Charlestown Moraine stretches east to west across the Town along the north side of US HWY 1. North of the Charlestown Moraine, the geography is dominated by glacial till hills interspersed with sandy drainage valleys and large swaths of various types of wetlands. South of US HWY 1, the geologic setting consists of generally flat well drained glacial outwash plains. Throughout moraines and till uplands hummocky topography consisting of many small and medium hills, twisting valleys, and kettle holes is dominant (Wright & Sautter, 1988). This topographic setting is a particularly challenging environment for wildland fire suppression. The inconsistent topographic features cause winds to eddy and causes surface winds to differ from prevailing winds. Additionally, communications between fire fighters becomes difficult with topographic features blocking handheld radio signals and line of sight communications. The map below illustrates sloping gradients across the Town. Of particular note is the extremely hummocky terrain associated with the Charlestown Moraine in a bank just north of the salt ponds trending east to west.

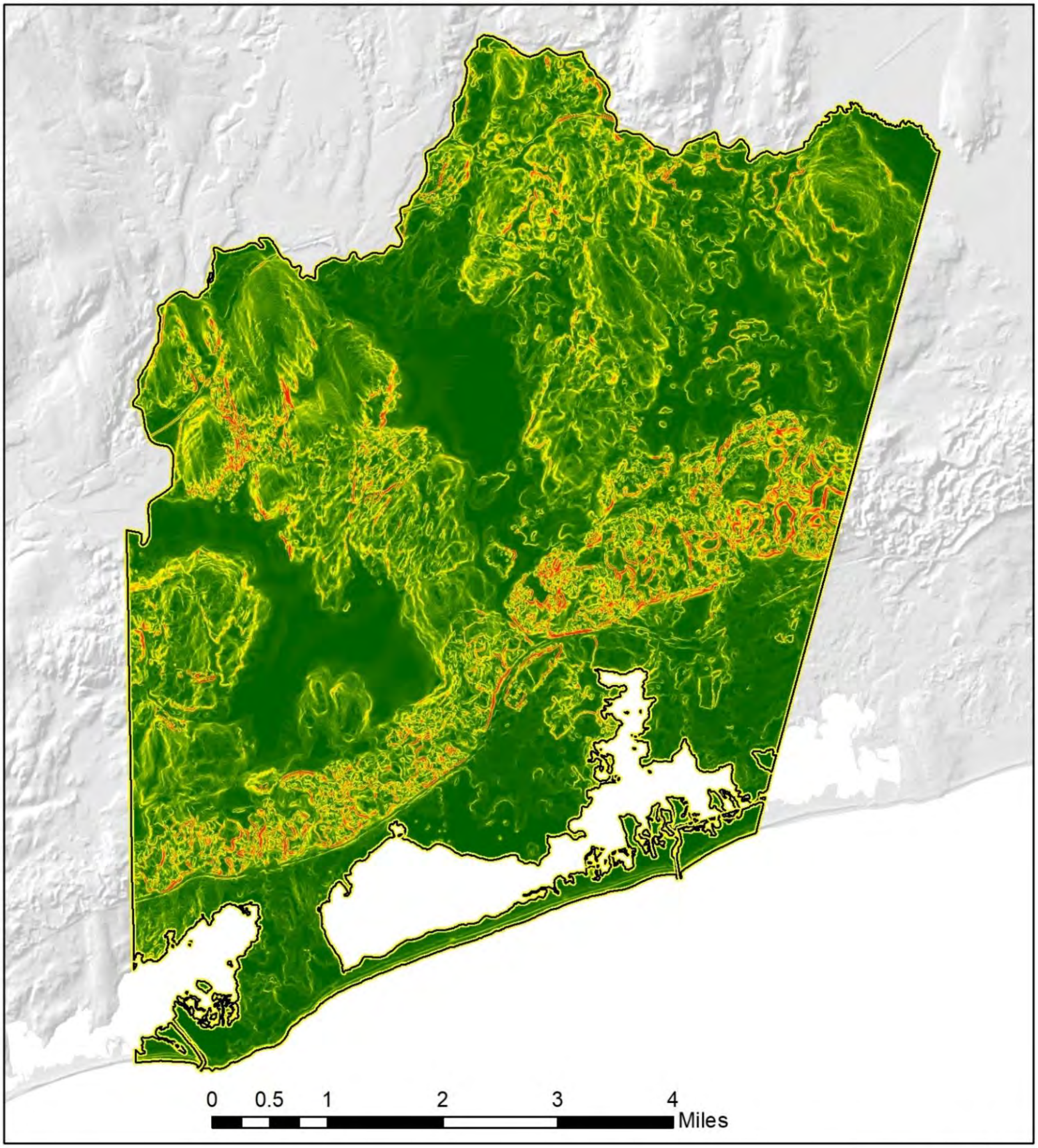
The well drained sandy/gravely soils also drive vegetation species and communities that grow in this area, promoting vegetation adapted to xeric sites (dry site) such as Pitch Pine (Pinus ridgia), a fire adapted species.



Wildland Fire Fuel Types
Charlestown, Rhode Island

Data Source: USGS LANDFIRE Data Distribution Site (2018).
US_140FBFM40, LANDFIRE, URL: <https://www.landfire.gov/fbfm40.php>
Date Accessed: 06/04/2020

Map by: Pat MacMeekin
pat.macmeekin@gmail.com



MN GN

Declination: -13°

Percent Slope
Charlestown, Rhode Island

Data Source: Map created using 5 ft topographic lines (Topographic line source): RIGIS, 2019. Contour Lines: 5 Foot. Rhode Island. Rhode Island Geographic Information System (RIGIS) Data Distribution System, URL: <http://www.rigis.org>, Environmental Data Center, University of Rhode Island, Kingston, Rhode Island (last date accessed: 03 March 2019).

Legend

Charlestown

36%

0% (Flat)

Map by: Pat MacMeekin
pat.macmeekin@gmail.com

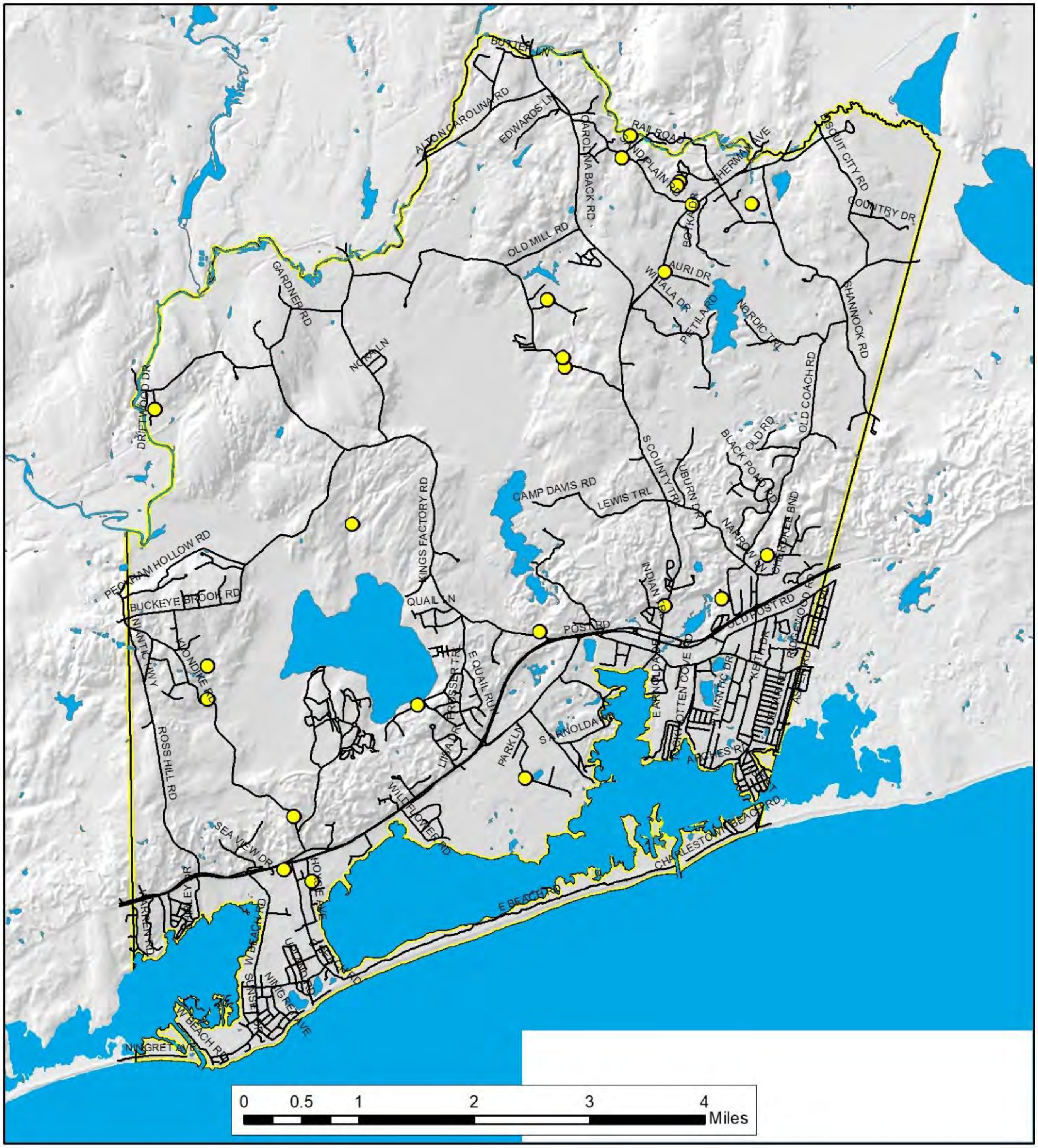
Fire History:

Before widespread European colonization of current day New England, indigenous peoples widely utilized intentional wildland fire. They intimately understood this landscape and used fire as a land management tool. Upland areas like hilltops and ridges were regularly burned because these locations tend to be drier and have vegetation adapted to grow in dry soils making them susceptible to fires. This single act of burning had a multitude of effects. Clearing understory vegetation allowed of an ease of navigation and travel through dense forestlands. Additionally, fires tended to only burn in the upland areas, as a fire approached a swamp fires would naturally burn out because vegetation in these areas hold enough moisture that fires could not carry between fuels. Repeated burning created a mosaic landscape with open uplands and dense wetlands. Wildlife species would then seek refuge in these denser lowlands creating prime hunting grounds adjacent to dense swamps. Repeated burning had an effect on the vegetation as well as fire dependent tree species like Pitch Pine (*Pinus ridgia*) began to colonize upland dry areas (Cronon, 2003).

Managing the land through burning enhanced aspects of hunting, agriculture, control of pest and land clearing to name a few and these practices were later carried on by European settlers (Cronon, 2003). During the early to mid-20th century many unintentional wildland fires were ignited by resource extraction across New England. Timber production and harvesting of forest products to fuel the industrial revolution caused fire to be widespread across southern Rhode Island (C. Foster & Foster, 1999; D. R. Foster & O'Keefe, 2000). As fire became more common, suppression of those fires became more sophisticated. Networks of fire lookout towers were erected, and state and local wildland fire agencies were established.

Rhode Island has a long history of wildland fire and fire has had a major impact on the landscape we see here today. In the early 1800s, westward expansion to the present-day midwestern United States resulted in the abandonment of agricultural and farm fields in southern New England. Many abandoned fields successional reverted to forest land, largely growing into stands of white pine (C. Foster & Foster, 1999). After these stands began to mature, indiscriminate harvesting to support the industrial revolution led to an increase of wildland fires in the early 1900's (Cronon, 2003; C. Foster & Foster, 1999). Fire was common on the southern New England landscape until the 1950s, when fire suppression techniques became more sophisticated. Smoky Bear was a successful public outreach means to educate the public that fires were unnatural and should be suppressed, fires have decreased since the 1960s.

Despite this, fires are still part of the landscape today, in the last ten years (2010-2019) there have been 23 wildland fires in Charlestown burning over 18 acres (see map, Pg. 28) (DEM, DFE Historic fire reporting).



MN GN

Declination: -13°

Wildland Fires 2010 - 2019
Charlestown, Rhode Island

Data Source: Map created using Latitued and Longitude coordinates from CompiledFireData1965-2019Final06/12/20 from Rhode Island Department of Environmental Management, Division of Forest Environment (Data acquired 06/26/2020)

Legend

- Wildland Fires 2010-2019
- Charlestown
- Water

FIRE MODELING

Fire modeling was performed using *FlamMap 6*, a computer-based wildland fire simulation program which computes and generates various wildland fire behavior characteristics. Outputs from *FlamMap 6* were then converted to raster format and imported into ArcGIS for further analysis. Input parameters for the *FlamMap 6* simulations were obtained from LANDFIRE, a multi-partner wildland fire program which, in part generates comprehensive geospatial wildland fire data.

The following tables describe the input parameters required by *FlamMap 6* to generate models.

Fuel and Topographic Data:

[8] **LANDFIRE INPUT SHAPEFILES**	
Fuel Data (Vegetation Data)	
Data Name	Data Type
US_140CBD	Canopy Bulk Density
US_140CBH	Canopy Base Height
US_140CC	Canopy Cover
US_140CH	Canopy Height
US_140FBFM40	40 Fire Behavior Fuel Models- Scott & Burgan
Topographic Data	
Data Name	Data Type
US_ASP2016	Aspect
US_DEM2016	Elevation
US_SLP2016	Slope

Weather Data:

Winds Metrics	
Wind Speed MPH @ 20'	26
Wind Direction Azimuth (Degrees)	216°
[9] Fuel Moistures Metrics	
1 Hour FM:	5%
10 Hour FM:	8%
100 Hour FM:	12%
Herbaceous FM:	30%
Live Woody FM:	30%
Foliar FM	100%

FlamMap 6 works to compare fuels and topography data against various weather conditions. In the time scale of a wildland fire event, fuels and topography change so slowly they can be considered static. Fuels change over the course of months to years while topography take years to decades to change. Comparatively, weather changes very rapidly in a scale of hours to days. In the modeling environment, fuels data and topography data are entered as shapefiles (unchanging elements) while weather and fuel moistures are manipulated to generate output products. *FlamMap 6* has additional functionality,

whereas fuels data can be manipulated to represent various fuels treatment, however this level of examination is beyond the scope of this report.

Fire modeling was conducted to give land managers and fire managers an idea of the possible outcomes of a wildland fire event. Fire modeling shows how quickly a fire could spread (see rate of spread map pg. 34), how tall the flames of a fire could be, (see flame length map, pg. 32) and if fires could begin to burn into the canopies of trees, which is a significantly more difficult fire to suppress (see Crown Fire Potential Map, pg. 36).

For this specific modeling exercise, the weather metrics used are the yearly averages collected from the Ninigret RAWS station and the fuel moisture metrics selected are the typical fuel moistures in a given summer, these fuel moistures were taken from the Prudence Island Community Wildfire Protection Plan.
Modeled data were utilized to compile the following maps.

Maximum Flame Length

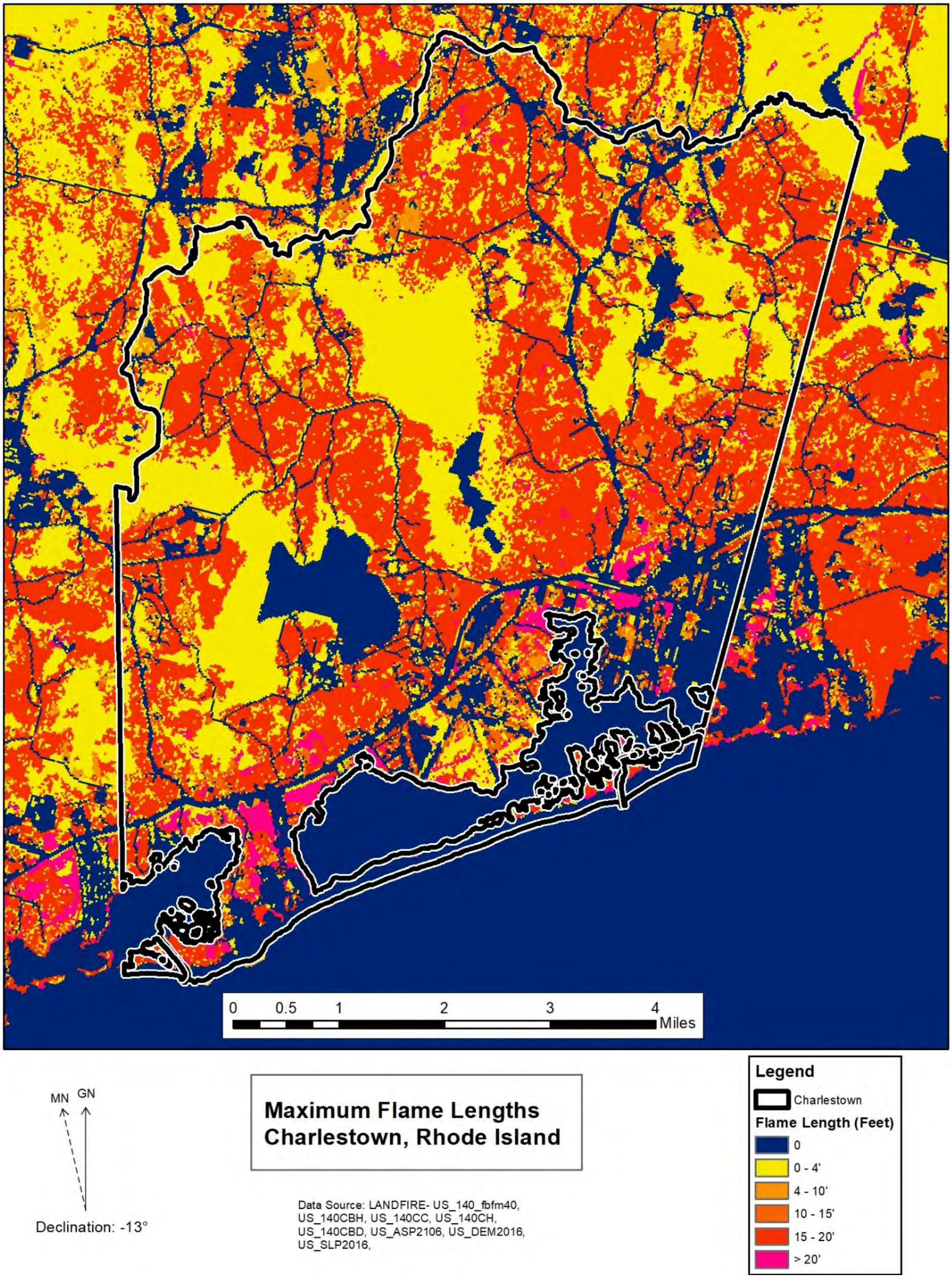
Figure X shows the maximum flame lengths a fire could produce in a given location based on the topography and fuels of a location as well as the typical weather conditions. Yellow areas on the map represent areas that firefighters could expect between 0’-4’ flame lengths. This is consistent with ground observations as much of these areas align with wetlands where we would expect little fire activity. Moving up the scale, there are some areas where firefighters could expect very large flame lengths, greater than or equal to 20’ in height. These are likely areas where tall dry grasses are mixed with dense shrubs and there are few overstory trees. These vegetative conditions would lead to longer flame lengths. Note, this is a modeled prediction for assessment purposes and is based solely on the inputted information, actual on the ground conditions may vary from modeled outputs.

Crown Fire Potential Map

Crown Fire potential means the potential for a fire to burn into tree canopies, a significantly more difficult fire to suppress. Fire are classified in 3 categories- a surface fire, is a fire the burns across the grounds surface, and is typically a low to medium severity fire. A passive crown fire (touching) is a fire that mostly burns across the grounds surface, but individual tree canopies catch fire, or torch, this is a medium to high severity fire. an active crown fire is where fire burns into tree canopies, and spreads from canopy to canopy across many trees, this is a very high severity fire. during an active crown fire, firefighters have little recourse other than to pull back and wait for a fire to consume all available fuels. The map on the previous page shows fires are likely to be surface fires, burning on the ground. In modeling exercises, even under unrealistically extreme fire conditions, models predicted fire to burn as surface fires only.

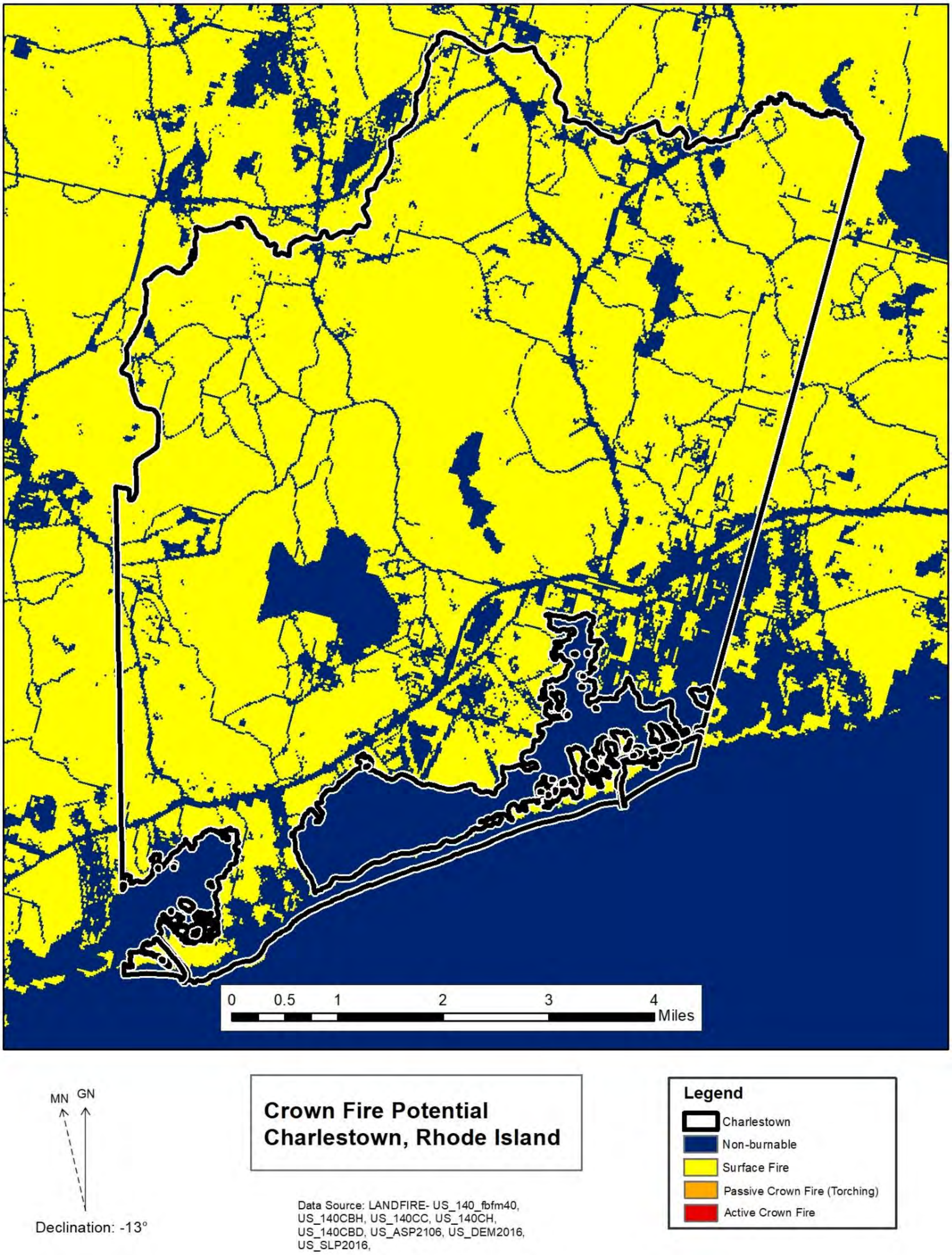
Maximum Rate of Spread Map Description

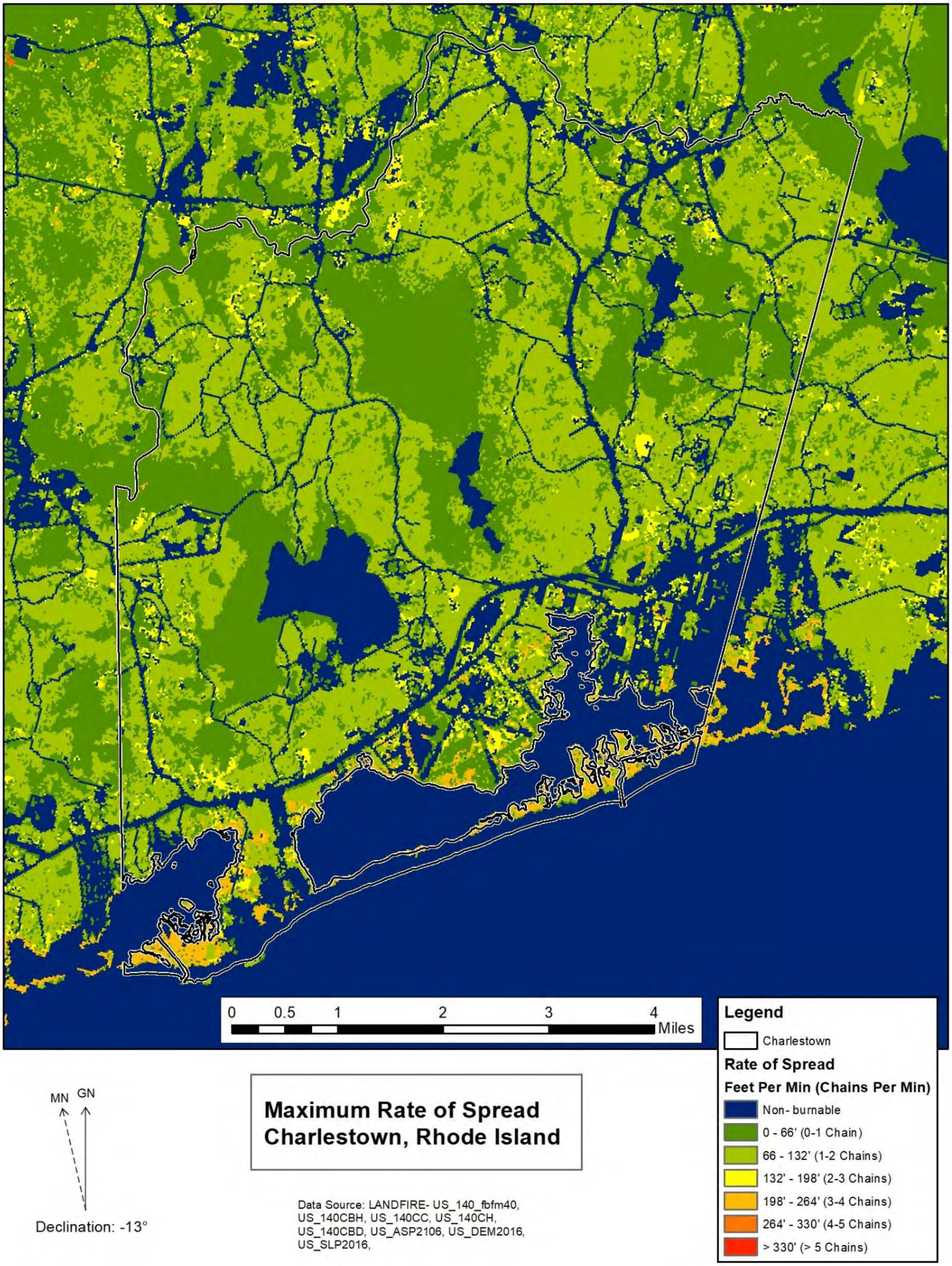
This map shows the maximum speed at which a fire will spread based on the given inputs. The model predicts that fires could spread up to 132’ per minute (dark green and light green areas) for most of town, with a few small areas of more rapid spread highlighted in yellow. The reader will also notice an alternative distance measurement of “chains per minute”, this is a bit of a relic unit of measurement still used by the forestry and wildfire community- a chain is equal to 66’ hence feet per minute is divided into 66’ intervals.
Again, this rate of spread prediction seems to generally match with the on the ground conditions with slower rate of spread in wetlands and more rapid spread in areas with drier and smaller diameter fuels .



**Maximum Flame Lengths
Charlestown, Rhode Island**

Data Source: LANDFIRE- US_140_fbfm40, US_140CBH, US_140CC, US_140CH, US_140CBD, US_ASP2106, US_DEM2016, US_SLP2016,


0 0.5 1 2 3 4 Miles
MN GN
Declination: -13°
Crown Fire Potential
Charlestown, Rhode Island
Legend
Charlestown
Non-burnable
Surface Fire
Passive Crown Fire (Torching)
Active Crown Fire
Data Source: LANDFIRE- US_140_fbfm40, US_140CBH, US_140CC, US_140CH, US_140CBD, US_ASP2106, US_DEM2016, US_SLP2016,


0 0.5 1 2 3 4 Miles
Legend
Charlestown
Rate of Spread
Feet Per Min (Chains Per Min)
Non-burnable
0 - 66' (0-1 Chain)
66 - 132' (1-2 Chains)
132' - 198' (2-3 Chains)
198' - 264' (3-4 Chains)
264' - 330' (4-5 Chains)
> 330' (> 5 Chains)
MN GN
Declination: -13°
Maximum Rate of Spread
Charlestown, Rhode Island
Data Source: LANDFIRE- US_140_fbfm40,
US_140CBH, US_140CC, US_140CH,
US_140CBD, US_ASP2106, US_DEM2016,
US_SLP2016,

OBSERVATIONS AND RECOMMENDATIONS

Community Assessments

One of the most important aspects of the Firewise program is a community risk assessment to understand and quantify risk associated with the urban/developed land/wildland interface. These assessments examine the vulnerability of homes and surrounding home ignition zones to embers. The results of these assessments will help residents understand their wildfire risk and engage in risk reduction efforts. These assessments were conducted on a wide scale as part of this document. Community assessments were performed at a coarse scale, as "windshield assessments", an overall view of the community from driving the roads and viewing Charlestown from a vehicle. The community was scored on four categories.

1) Fire Environment Rating: This assessment includes an examination of wildland fire fuels and topography. As discussed in pervious sections of this report, dry and dense vegetation and steep slopes constitutes higher fire risks, while open areas or well irrigated vegetation on flat slopes constitutes lower fire danger.

2) Community Access Rating: In a fire emergency, it may be necessary for the public to evacuate their homes and retreat from an approaching wildfire. During emergency evacuations, small roadways can become clogged as everyone attempts to simultaneously evacuate. Neighborhoods with a single access point scored poorly, while neighborhoods with multiple access points scored better. This category also examined access for fire equipment. Fire engines come in a variety of sizes depended on their intended use. Most fire departments have Type 1 or Type 2 fire engines the large engines staffed by 3-4 fire fighters. These engines can 30 to 40' long (some can be even longer) and up to 12' high and 10' wide. Since these engines are large, they require sufficient turnaround space and overhead clearance. Narrow roads with many low hanging branches and limited turn around space scored poorly, while wide roads ending in cul-de-sacs scored better.

3) General Building Characteristics: Includes and assessment of building materials used for homes throughout the community. This category used rough estimations because every home is different. Generally, areas where many homes used cedar shake style shingle siding and roofing scored poorly, and fire-resistant building materials scored better. Additionally, elevated wooden decks and homes built on pilings scored poorly for increased opportunity for fires to burn beneath.

4) Additional Hazards: This category attempts to consider other factors that contribute to fire risk such as utilities. Overhead electrical lines without sufficient tree canopy clearance scored poorly while power lines in open areas scored better.

Windshield assessments were divided by Firewise Region, utilizing this “windshhield” method, the four regions were determined to have varying ranges of fire danger at the course scale:

Region	Rating
Region 1- Charlestown Fire District- North	Medium Fire Risk
Region 2- Charlestown Fire District- South	Medium to High Fire Risk
Region 3- Dunn’s Corners Fire District- North	Medium Fire Risk
Region 4- Dunn’s Corners Fire District- South	High Fire Risk

Assessment forms are attached to this document as **Appendix 1** (Pgs. 48 - 69)
Individual home assessments are available by request from the Rhode Island Department of Environmental Management, Division of Forest Environment.

Defensible Space:

The primary method fire managers and property owners can mitigate wildland fire risk is through the manipulation of fuels. Often, this means systematically and strategically removing vegetation by cutting dead or dying trees, removing dead landscape vegetation, creating a ten foot clearing between a home and a forested area and/or replacing flammable vegetation (tall dry landscape grasses) with more fire resistant vegetation (short green ground cover). These mitigation strategies can take various forms depending on the application, the landscape and the values to be protected.

When the intent is to protect homes in rural communities, this concept is termed “defensible space”. Specifically, creating ***defensible space*** is when property owners create ***Space*** on their property in which firefighters can ***defend*** the property from an approaching wildfire. Since no two properties are identical, defensible space will vary from property to property but there are some generally agreed upon specifications for what defensible space should look like.

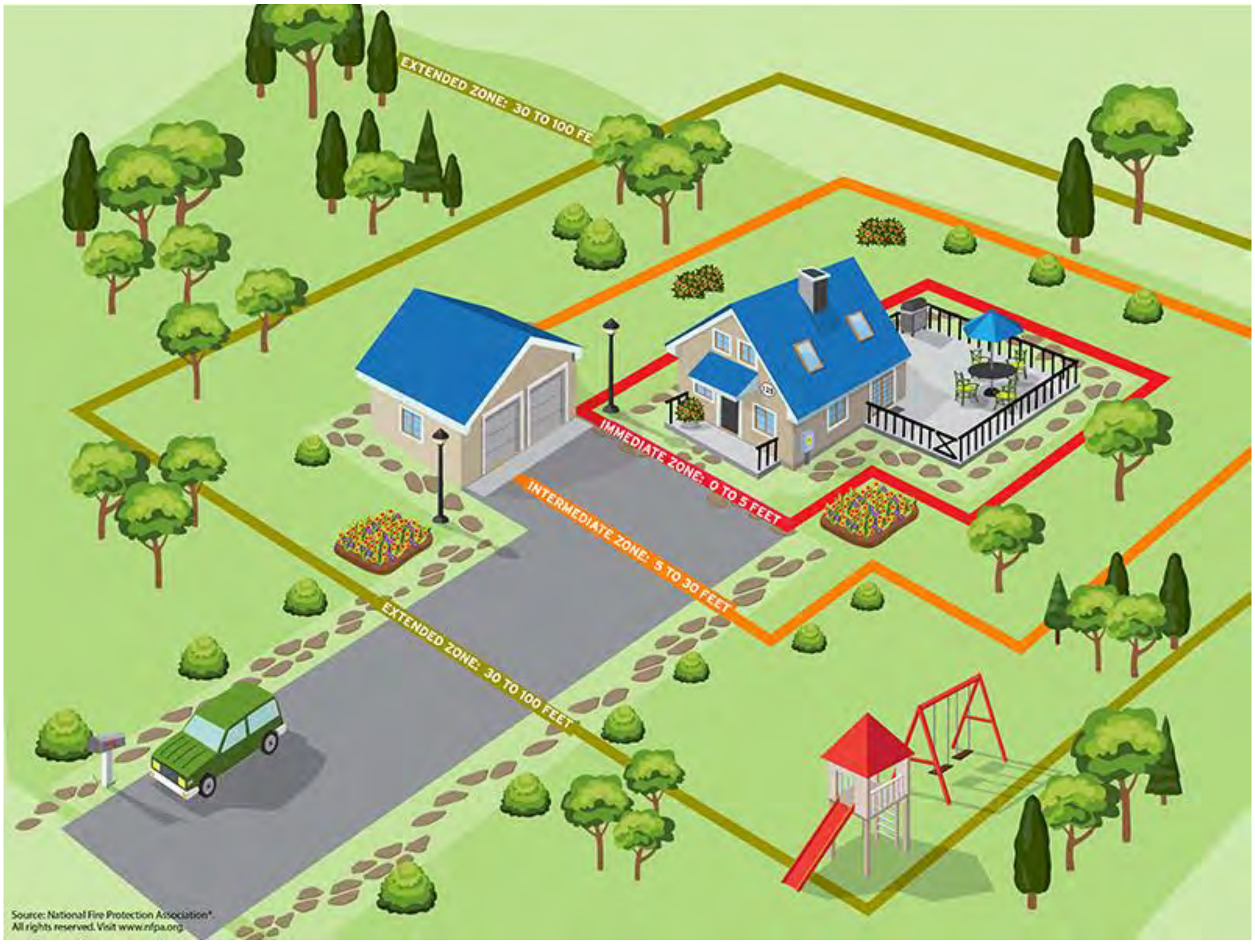
The two most important concepts of creating defensible space are:

1) **Defensible space must be created long before a wildfire ever occurs.** At a minimum, creating defensible space should occur yearly as part of a spring clean-up. In many cases creating defensible space and maintain defensible space should happen multiple time throughout the growing season. Creating defensible space is a preparation activity since once a wildfire begins to burn it is simply too late to begin creating defensible space.

2) **It is the responsibility of the property owner to create defensible space, not the firefighter.** Experienced fire personnel should be utilized as a resource to help identify areas where defensible space is needed and specific methods of creating defensible space. However, it is the responsibility of the property owner to create defensible space. However, firefighters cannot take the burden of creating defensible space for property owners. Plainly put, there are too many homes and too few fire fighters.

To aid property owners in creating defensible space and to help create general guidelines that would apply to most properties the home ignition zone concept was created and defined by the National Wildfire Coordinating Group. The home ignition zone concept divides a property into 3 areas, the Immediate zone (the area within 5’ of the home) the intermediate zone (the area between 5’ and 30’ away from the home) and the extended zone (the area between 30' and extending to the edge of the property) each one of these zones has specific mitigation strategies. Referring to the home mitigation zone graphic, each zone and mitigation measures are included below.

The Home Ignition Zone concept:



Immediate zone

The immediate zone consists of the home itself and the area zero to five feet from the furthest attached exterior point of the home and is defined as a non-combustible area. Science tells us this is the most important zone to take immediate action on as it is the most vulnerable to embers. Risk reduction strategies begin with implementing the mitigation steps below starting with the home itself and to work outward into the area within five-feet of the home, then move to the next zone.

Specific mitigation steps:

- Clean roofs and gutters of dead leaves, debris and pine needles that could catch flying embers,
- Replace or repair any loose or missing shingles or roof tiles to prevent ember penetration into the house,

- Reduce embers that could pass through vents in the eaves by installing 1/8-inch metal mesh screening.,
- Clean debris from exterior attic vents and install 1/8-inch metal mesh screening to reduce ember ignition,
- Repair or replace damaged or loose window screens and any broken windows. Screen or box in areas below patios and decks with wire mesh to prevent debris and combustible materials from accumulating, and
- Move any flammable material away from wall exteriors – mulch, flammable plants, leaves and needles, firewood piles, anything that can burn. Remove anything stored underneath decks or porches.

Intermediate zone

The intermediate zone consists of a perimeter of five to 30 feet from the furthest exterior point of the home. The majority of the mitigation measures implemented in the Intermediate Zone relate to landscaping and hardscaping and include employing careful landscaping or creating breaks that can help influence and decrease fire behavior.

Specific mitigation steps:

- Clear vegetation from under large stationary propane tanks,
- Create fuel breaks with driveways, walkways/paths, patios, and decks,
- Keep lawns and native grasses mowed to a height of four inches or less.
- Remove ladder fuels (vegetation under trees) so a surface fire (burning on the ground) cannot reach tree crowns. Prune trees up to six to ten feet from the ground; for shorter trees do not exceed 1/3 of the overall tree height,
- Space trees to have a minimum of eighteen feet between crowns with the distance increasing with the percentage of slope (steeper slopes means greater distance between trees),
- Tree placement should be planned to ensure the mature canopy is no closer than ten feet to the edge of the structure, and
- Tree and shrubs in this zone should be limited to small clusters of a few each to break up the continuity of the vegetation across the landscape.

Extended zone

This zone extends from 30 to 100-feet from the dwelling to 200-feet or the edge of property. Again most mitigation measures here involve landscaping practices. The goal is not to eliminate fire but to interrupt fires path and keep flames smaller and on the ground.

Specific mitigation steps include:

- Dispose of heavy accumulations of ground litter/debris.
- Remove dead plant and tree material.
- Remove small conifers growing between mature trees.
- Remove vegetation adjacent to storage sheds or other outbuildings within this area.
- Trees 30 to 60 feet from the home should have at least 12 feet between canopy tops.
- Trees 60 to 100 feet from the home should have at least 6 feet between the canopy tops.

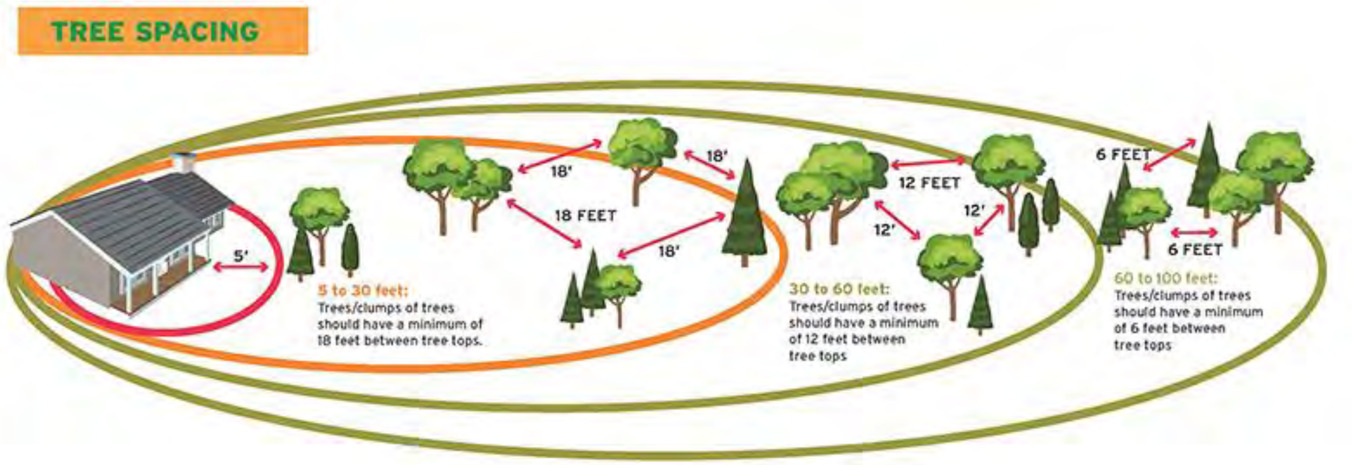


Diagram is a visual depiction of recommended tree spacing described in the three-zone concept on the previous page.

The official recommendations for creating defensible space and the three zones concept from the National Fire Protection Association (NFPA), Firewise USA program (obtained from the Firewise USA – Preparing homes for wildfire website: https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Preparing-homes-for-wildfire). National Fire Protection Association (NFPA), Firewise USA program (2020)

Fire Resistant Landscape Plants

No plant is fireproof; however, some plants are more fire resistant than others. Generally, deciduous trees, and woody shrubs are more fire resistant than coniferous trees, and grasses. All landscape plants should be at least 2-3' away from wood siding and wooden attachments (decks, fences). Instead of plants use fireproof landscape materials like bricks, gravel, crushed shells, stone, boulders, or water features immediately adjacent to wooden attachments. Outside of the 2-3' zone, use low growing fire-resistant landscape plants, with ample space between plants or small clusters of plants. As you move to the intermediate zone and extended zones on your property, taller plants and more dense plantings are acceptable within the guidelines of defensible space mentioned in the previous section.

The following is only a partial list of fire-resistant landscape plants.

All plants on this list are appropriate to plant in southern New England. In the table below, "Native" means the plant is native to the region, "Ornamental" means the plant is not native, but commonly used as a landscape plant around homes. None of the plants on this list are considered invasive, or nuisance plants. This list was compiled by cross referencing online plant guides to identify native plants that were also fire resistant. Superscripts 10-13 at the bottom of page 45 list the online plant guides used.

List begins on next page→

Fire Resistant Landscape Plants for Southern New England

Common Name	Scientific Name	Native/Ornamental
Ground cover		
Carpet Bugleweed	*Ajuga reptans*	Ornamental
Geranium	*Geranium spp*	Ornamental
Hen and Chicks	*Sempervivum spp*	Ornamental
Purple Iceplant	*Delosperma cooperi*	Ornamental
Yellow Iceplant	*Delosperma nubigenum*	Ornamental
Nasturtium	*Tropaeolum spp.*	Ornamental
Periwinkle	*Vinca spp.*	Ornamental
Bell Flower	*Campanula spp.*	Native
Chamomile	*Chamaemelum nobile*	Ornamental
Red Fescue	*Festuca rubra*	Native
English Ivy,	*Hedera helix*	Ornamental
Wintergreen	*Gaultheria procumbens*	Native
St Johnswort	*Hypericum calycinum*	Ornamental
Perennials		
Red Columbine	*Aquilegia canadensis*	Native
Black-eyed Susan	*Rudbeckia hirta*	Ornamental
Blanket Flower	*Gaillardia spp.*	Ornamental
Cone Flower	*Echinacea purpurea*	Ornamental
Hosta	*Hosta spp.*	Ornamental
Joe Pye Weed	*Eutrochium pupureum*	Native
Lavender	*Lavandula spp*	Ornamental
Lilly-of-the-Valley	*Convallaria majalis*	Native
Lupine	*Lupinus spp.*	Native
Rose	*Rose spp.*	Native/Introduced
Goldenrod	*Solidago spp.*	Native
Bird-foot Violet	*Viola pedata*	Native
Woolly blue violet	*Viola sororia*	Native
Eastern prickly-pear	*Opuntia humifusa*	Native
Woody Shrubs		
White Meadowsweet	*Spiraea alba*	Native
High bush Blueberry	*Vaccinium corymbosum*	Native
Low bush Blueberry	*Vaccinium pallidum*	Native
Rhododendron	*Rhododendron*	Native
Redosier Dogwood	*Cornus sericea*	Native
Sweet Pepperbush	*Clethra alnifolia*	Native
Hydrangea	*Hydrangea spp.*	Ornamental
Witch Hazel	*Hamamelis virginiana*	Native
Arrowwood	*Arrowwood dentatum*	Native
Black Elderberry	*Sambucus nigra*	Native
Common Buttonbush	*Cephalanthus occidentalis*	Native

Sumac species	*Rhus spp.*	Native
Black Chokeberry	*Aronia melanocarpa*	Native
Trees		
Eastern Hop Hornbeam	*Ostrya virginiana*	Native
Oak Species	*Quercus spp.*	Native
White Oak	*Quercus alba*	Native
Swamp White Oak	*Quercus bicolor*	Native
Scarlett oak	*Quercus coccinea*	Native
Black oak	*Quercus velutina*	Native
Northern Red Oak	*Quercus rubra*	Native
Maple species	*Acer spp.*	Native
Red Maple	*Acer rubrum*	Native
Silver Maple	*Acer saccharinum*	Native
Sugar Maple	*Acer saccharum*	Native
Hickory Species	*Cayra spp.*	Native
Pignut Hickory	*Carya glabra*	Native
Shagbark Hickory	*Carya ovata*	Native
white ash	*Fraxinus americana*	Native
Beech	*Fagus grandifolia*	Native
Sassafras	*Sassafras albidum*	Native
Black cherry	*Prunus serotina*	Native

Go Botany Native Plant Trust (2020), Firewise Landscaping Plants for New Jersey (2015), Rhode Island Native Plant Guide (2020), Fire Resistant Landscape Plants for the Willamette Valley (2015)

Next Steps

A Firewise designation requires community engagement and participation in fire mitigation and community education. This Firewise plan only serves as one step in establishing a Firewise community, but without community acceptance and participation this planning effort will not succeed.

The next steps in establishing the Town of Charlestown as a Firewise community are to:

1) Form a Firewise board or committee,
2) As a board, identify specific fire mitigation projects,
3) Host an annual Firewise outreach event,
4) Annually invest the equivalent of one volunteer hour per dwelling unit in fire risk reduction actions, and
5) Continuously update this Firewise Community assessment.

A Firewise Board of committee

– This board or committee should be comprised of town residents and other wildfire stakeholders such as fire department personnel, emergency management personnel and state forestry agencies. The Firewise board will be responsible for ensuring the community is maintaining its Firewise status. The Firewise board will have to create a profile on the Firewise online portal. Here, the board will submit this Firewise plan for review to the NFPA, certify that the community has meet its **yearly requirements to maintain Firewise status of hosting an outreach event and**

investing 1-hour per dwelling unit on fire risk reduction projects (Item 4). Additionally, this board will be responsible for maintaining this document and **updating it at least every three years**.

Identify specific fire mitigation projects - No one knows the community better than the residents that live there. As a board, this group should identify wildfire problem areas within the community and outline succinct steps for addressing those problems. Some examples of mitigation projects include identifying a specific community space with an abundance of dense dead vegetation in need of clean up, or plan to collect more robust community evaluations. The board will have to decide on achievable fire mitigation projects appropriate for the community, and realistic means for addressing the issues.

Host an annual Firewise outreach event - To maintain the status of a Firewise Community, it **is required that the community host an annual Firewise outreach event**. Often, this is a local fire department open house, where the public is invited to meet the fire staff, view the fire equipment, and discuss Firewise concepts such as creating defensible space. There must be a record of this event, and documentation must be provided on the Firewise online portal.

Annual Volunteerism - To maintain Firewise status the community is required to implement annual fire mitigation actions in the town. The Firewise Communities USA program requires towns to annually invest the equivalent of one volunteer hour per dwelling unit on fire risk reduction activities. This could mean utilizing town staff to remove dead vegetation from community areas such as parks. Or this could be every resident in town spending one hour on wildfire mitigation activities on their property by maintaining clean gutters, removing dead vegetation from under decks, maintaining healthy green landscape vegetation, removing dead dry vegetation or other applicable measures.

After the above requirements have been accomplished, the Firewise board will self-certify using the Firewise online portal to maintain currency in the program. Visit nfpa.org/firewise to access the online reporting portal, and to view the reporting and currency requirements

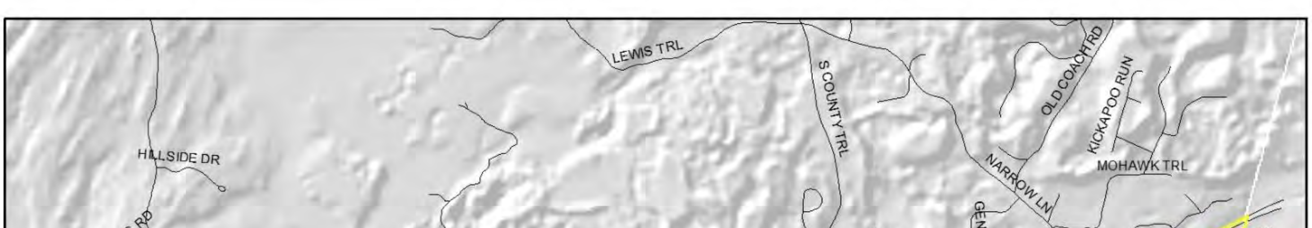
Additional Next Steps

Due to the scale of this Firewise community assessment, time constraints and limited personnel, community evaluations or Windshield Assessments were broad in scope. While the assessments serve as a good representation of the Firewise region evaluated, it is a recommendation of this plan that more in depth community evaluations with a more systematic assessment system are conducted by fire district staff, trained fire department members, town planning staff or emergency management staff.

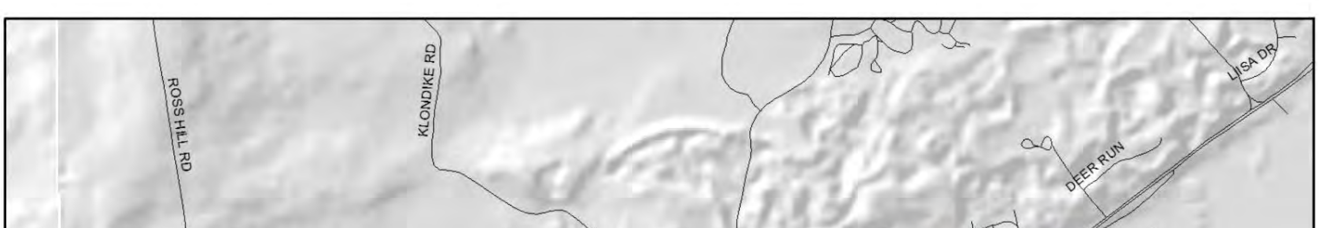
The maps on the following pages are suggested evaluation areas by Firewise Region. Evaluators should use the “Rhode Island Community Wildfire Hazard Evaluation Form” (Appendix 2) or a similar in person evaluation.

Suggested Firewise Evaluation Area Maps

These suggested community evaluation areas were identified by driving the community. These areas represent neighborhoods or clusters of homes in close proximity to each other and are a manageable scale for conducting a windshield assessment. These are simply suggested areas, the Firewise board may decide it more beneficial to adjust these evaluation areas to better meet their management objectives.


LEWIS TRL
S COUNTY TRL
OLD COACH RD
KICKAPOO RUN
HILLSIDE DR
MOHAWK TRL
NARROW LN


BROOK RD


ROSS HILL RD
KLONDIKE RD
LISA DR
DEER RUN

These suggested community evaluation areas were identified by driving the community and making visual observations. These areas represent neighborhoods or clusters of homes in proximity and are a manageable scale for conducting a windshield assessment. These are suggested areas and the Firewise board may decide it more beneficial to adjust these evaluation areas to better meet their management objectives.

Landowner Resources:

Natural Resource Conservation Service (NRCS)

NRCS is a division of the United States Department of Agriculture that focuses on working with private landowners, non-profit landowners and municipal landowners. NRCS works with landowners to identify resource concerns, create a mitigation plan and implement on the ground practices to address those concerns. Landowners that enroll in NRCS programs are eligible for payments to help mitigate the cost of practice implementation and for expert consultations for their individual properties.

The following is a list of practices offered by NRCS Rhode Island to help private landowners address wildland fire fuel mitigation, and suppression.

Code	Practice
106	Forest Management Plan- Written
112	Prescribed Burning Plan- Written
314	Brush Management
338	Prescribed Burning
384	Woody Residue treatment
655	Forest Trails and Landings
660	Tree and Shrub Pruning
666	Forest Stand Improvement

(NRCS, 2020)

Contact NRCS, Rhode Island for more information on program eligibility, and practice information
NRCS- Rhode Island
60 Quaker Lane, Suite 40
Warwick, RI 02886
Phone: 401-828-1300
https://www.nrcs.usda.gov/wps/portal/nrcs/site/ri/home/

Rhode Island Department of Environmental Management, Division of Forest Environment (DFE)

DFE is the state organization that administers the state Firewise program. DFE offers in person **Firewise Homeowner Assessments** where rangers will evaluate homes and properties to assess individual fire risk and identify areas where property owners can improve their defensible space and lower fire risk.

The Division of Forest Environment's website has many resources for property owners to begin reducing fire risk. Contact the Rhode Island Department of Environmental Management, Division of Forest Environment for more information

Southern Rhode Island:
Arcadia Management Area
260 Arcadia Rd
Hope Valley, RI 02823
(401) 539-1052

Northern Rhode Island:
George Washington Management Area
2185 Putnam Pike
Chepachet, RI 02814
(401) 568-2013

http://www.dem.ri.gov/programs/forestry/

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Geographic Information Systems (GIS) Data Sources:

Rhode Island Geographic Information System (RIGIS) Data Distribution System, URL: <http://www.rigis.org>, Environmental Data Center, University of Rhode Island, Kingston, Rhode Island (last date accessed: 03 March 2019).

Shape Files: Contour Lines: 5 Foot. Rhode Island
Municipalities
USGS Hydrolines
Ponds and Lakes
Spring 2018 Aerial Photos

Town of Charlestown, Rhode Island - GIS Department (2020)
Shape Flies: Fire_Districts
Cha_Roads

United States Geological Survey. (2019). *LANDFIRE Data Distribution Site*. Landfire Data DIstribution Site. https://www.landfire.gov/viewer/viewer.html?extent=-74.1560996978641,40.5150022938849,-69.8726210418063,44.5398361067571

Shape Files: US_140FBFM40
US_140CBH,
US_140CC,
US_140CH,
US_140CBD,
US_ASP2106,
US_DEM2016,
US_SLP2016

Appendix 1

[9] (*Go Botany: Native Plant Trust*, 2020)
[10] (Department of Emergency Management, 2015)
[11] (University of Rhode Island Cooperative Extention, 2020)
[12] (Edmunds et al., 2015)
(United States Department of Agriculture, 2019)
(National Fire Protection Association, 2020)
(Entrup & Carlson, 2018)
(Western Regional Climate Center, 2020)
(United States Department of Interior, 2019)
(DCFD Staff, n.d.)
(CFD Chief, 2020)
(United States Geological Survey, 2019)
(Davis, 1989)

(Intini, 2019)
(Oregon Department of Forestry, n.d.)
(Oregon Department of Forestry & Oregon State Fire Marshall, 2017)