Route 146 Corridor Study

Town of Branford
Town of Guilford

PREPARED FOR

South Central Regional Council of Governments (SCRCOG)

Town of Branford

Town of Guilford

PREPARED BY

100 Great Meadow Road
Suite 200
Wethersfield, CT 06109
860.807.4300

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Executive Summary

The Route 146 Corridor Study is an initiative of the South Central Regional Council of Governments (SCRCOG) on behalf of the Town of Branford and Town of Guilford. The purpose of the study is to evaluate existing conditions within the study area and develop a comprehensive plan to guide potential future investment in transportation and environmental improvements along the corridor while retaining the character of the roadway. The project area includes 13 unsignalized intersections, one signalized intersection, and 13 miles of roadway beginning at the junction of Route 1 (North Main Street) at Route 146 (West Main Street) in Branford and ending at the intersection of Route 146 at Route 1 (Boston Post Road) in Guilford. The study team includes representatives from SCROG, the Towns of Branford and Guilford, the Connecticut Department of Transportation, and the consultant team of VHB and Race Coastal Engineering.

The Route 146 roadway is a unique and scenic byway connecting Branford and Guilford with the coast of Long Island Sound. The corridor provides access to historic homes, cultural resources, wildlife habitats, and scenic vistas enjoyed by locals, tourists, commuters, pedestrians, cyclists, and motorists alike. The lower speed, winding roadways are an aesthetically pleasing alternative to Route 1 or Route 95 which also service the communities. The roadway traverses commercial areas on the west and east ends of the corridor with the majority of the corridor running through limited residential development and with a rural character. Approximately 11 of the 13 corridor miles traverse residentially zoned properties and districts. This is verified by the very residential roadside development in Branford beyond the Branford River, where the roadside development becomes more rural leaving the Pine Orchard District and into Guilford.

Route 146 is listed as a national historic and scenic route from the vicinity of Eades Street in Branford through to its terminus in Guilford at Route 1. Multiple locations in the communities are listed on the National and State Registers of Historic Places and are recognized designations as well. The listing of historic locations included within the study may not be the most complete listing of all historically significant structures and regions within the towns of Branford and Guilford as there are many historic buildings and areas that are not officially listed on local, state, or national registers but are recognized as such by local citizens. The cultural locations within the towns of Branford and Guilford coexist with the multitude of historic properties to enhance the richness of the communities.

CT Route 146 is a state owned and maintained roadway that is classified by CTDOT as a collector roadway within the study area. US Route 146 through Branford and Guilford was originally constructed to provide local access and later became a scenic alternative to Route 1 and was listed on the Connecticut historic register in 1990. The corridor between Church Street in Branford to its terminus at Route 1 in Guilford is considered a scenic highway. The nationally recognized Route 146 historic district runs between Flat Rock Road in Branford and Water Street in Guilford.

Traffic volumes along Route 146 have fluctuated minimally since the 1990's. The Average Daily Traffic (ADT) collected by CTDOT in 2016 reported an ADT of 11,500 vehicles per day just south

of Meadow Street in Branford. VHB conducted counts in July 2019 and reported a maximum ADT of 9,400 vehicles per day recorded south of Sybil Creek Place in Branford. As noted through Automatic Traffic Recorder (ATR) counts as well as public discourse, speeds along Route 146 exceed the 85th percentile, and in some locations the average speeds, exceeds 10 miles per hour over the speed limit.

The provision of adequate sight distance at unsignalized intersections is an important safety concern. The four intersections of Route 146 at Blackstone Avenue, Route 146 at Damascus Road, Route 146 at Moose Hill Road, and Route 146 at Sachems Head Road all experienced sight line obstruction. Obstructions ranged from vegetation, to on-street parking, to roadway curvature or structure. Structures include Amtrak rail over/underpasses, of which there are four rail crossings on the Route 146 corridor. The underpasses throughout the corridor measure from approximately 23 feet in width to 30.5 feet in width with vertical clearances ranging from approximately 10 feet to 14 feet.

In addition to rail over/underpasses, there are six waterway culverts that interact with the Route 146 corridor. In Branford, Route 146 contains three waterway crossings and Guilford contains three waterway crossings on Route 146. These culverts are of variable length ranging from smaller single culver crossings to larger multi-culvert crossings. The primary culvert crossing in Guilford, also known as the crabbing area, is being reviewed by CTDOT for a potential upgrade/reconstruction to address longstanding flooding. That project design efforts are on hold pending the completion of this study. It is worth noting that at the time of this existing conditions review, the Sybil Creek bridge in Branford is currently undergoing reconstruction by CTDOT.

Capacity analyses were conducted on the 14 intersections in the study area and indicate that all intersections within the study area currently operate with acceptable levels of service D or better during the peak periods. This indicates all study intersections can adequately accommodate current traffic demands and that traffic congestion is not a significant concern along the corridor.

Crash analyses were conducted on the corridor and reported 209 crashes along the corridor during a three-year analysis period. Nearly 80% of the crashes reported involved property damage, only one collision on the corridor reported a fatality during the three-year analysis period. Three intersections within the study area experienced more than nine crashes, Route 146 at Whitfield Street, Route 146 at Soundview Road and Goose Lane, and Route 146 at Route 1.

Mentioned frequently throughout the study is the use of Route 146 by non-motorists. The Route 146 roadway is narrow in most sections, running between older homes in many sections and other roadside constraints that limit the shared use of the roadway for bicyclists and pedestrians as there are very limited sections of shoulders and sidewalks. Sidewalks are provided along the corridor intermittently and public transit routes only service the downtown areas of Branford and Guilford.

RACE Coastal Engineering evaluated the coastal flooding risks across the project area as part of the corridor study. Analysis considered the 100-year storm frequency including the potential impacts of 20 inches of sea level rise. The purpose of this effort was to explore how future sea level rise may impact the study area as existing FEMA mapping does not take sea level rise into

consideration. As such, the 100-year storm event with 20 inches of sea level rise was used as the design event for this study. The analysis showed that while Route 146 is already vulnerable to coastal flooding, these problems will be exacerbated by future sea level rise.

Citizens of the towns of Branford and Guilford are noted as being very involved within their communities and the public response process. Through the public meeting (December 1, 2020) and open public comment period (ending January 15, 2021) citizens of the communities voiced concerns on the scope of the project, vehicle speed, pedestrian/cyclist safety and access, and preservation of the areas historic and scenic beauty. All comments received have been recorded and shared with the Study Team to be made public.

1

Introduction

The Route 146 Corridor Study is an initiative of the South Central Regional Council of Governments (SCRCOG) on behalf of the Town of Branford and Town of Guilford. The purpose of the study is to evaluate existing conditions within the study area and develop a comprehensive plan to guide potential future investment in transportation and environmental improvements along the corridor while retaining the character of the roadway.

This document presents a summary of the existing conditions investigation.

1.1 Study Area

The project study area consists of an approximately thirteen-mile segment of the CT State Route 146 corridor within the Town of Branford and the Town of Guilford. The western limit of the study area begins at the intersection of Route 146 (West Main Street) at the east junction of Route 1 (North Main Street) in Branford and extends exactly 13 miles to the east, ending at the west junction of Route 1 (Boston Post Road)in Guilford.

The project study area includes 14 total intersections, all of which are unsignalized intersections except one at Kirkham Street. There is a flashing beacon with stop sign control at the intersection of Soundview Road at Goose Lane in Guilford. These 14 intersections were chosen as study intersections to be investigated in greater detail. The limits of the project study area and the study intersections are identified on Figures 1A-1C.

1.2 Study Team

The study team includes representatives from the Town of Branford, Town of Guilford, SCRCOG, Connecticut Department of Transportation (CTDOT), and the consultant team. The consulting team is led by VHB as the prime consultant, with Race Coastal Engineering as a subconsultant assisting with flood zones and sea level rise predictions.

1.3 Study Process

A comprehensive transportation planning study requires a well-defined structure and process. The Route 146 Corridor Study is comprised of the following six tasks:

- **Task 1: Project Management –** Work closely with SCRCOG, the Town of Branford, and Town of Guilford staff throughout the duration of the project to set and oversee schedule, deliverables, community engagement, and project decisions.
- **Task 2: Community Involvement –** A community involvement program will be conducted at three different levels (public, committee, and institutional) throughout the study in order to provide the opportunity for both broad public outreach and more in-depth stakeholder participation.
- **Task 3: Data Collection and Assessment of Existing Conditions –** Collect data and evaluate the current transportation (motorized and non-motorized) systems, land use, historic and cultural context, and natural resources in the study area.

Efforts beyond Task 3 were discontinued in the study scope of work. These tasks included Task 4 Assessment of Future Conditions, Task 5 Plan Recommendations and Task 6 Final Study Report. These are expected to be incorporated in a future and separate Corridor Management Plan.

1.4 Routes 77 and 146 Corridor Management Plan (1996)

The previous corridor management plan with a similar study area as this current study was commissioned in December 1996 for the Route 77 and 146 Scenic Road Advisory Committee and The Connecticut Department of Transportation. This previous study discussed existing transportation and land use conditions, assessed historical traffic capacity and safety improvements, and recommended short-term and long-term improvements along the study corridor of Route 146 from the Branford Town Green to Route 1 in Guilford and the Route 77 corridor in Guilford.

Most of the recommended improvements from the 1996 corridor study focused on preservation and management to "keep it as it is". The goals and objectives for the corridor study fall under the following categories:

- Views and Vistas: Conserving Scenic Beauty for the Future;
- The Road and Right-of-Way: Balancing Safety and Beauty;
- Economic/ Tourism Development: Helping Stabilize and Support the Local Tax Base;

- Cooperation and Management: Broad Involvement in Strategy Implementation;
- Information and Education: Spreading the News

The 1996 study can be found in the Appendix.

2

Existing Conditions

This chapter summarizes the tasks associated with the evaluation of the current transportation system, flooding impact, land use, and natural resources in the study area.

2.1 Corridor Character

The 1996 Corridor Management Plan, observations from the project team and the Town and SCRCOG Study Advisory Committee members all acknowledge the Route 146 corridor is a special roadway serving Branford and Guilford. The Route 146 roadway is a unique and scenic byway connecting Branford and Guilford with the coast of Long Island Sound. The corridor provides access to historic homes, cultural resources, wildlife habitats, and scenic vistas enjoyed by locals, tourists, commuters, pedestrians, cyclists, and motorists alike. The lower speed, winding roadways are an aesthetically pleasing alternative to Route 1 or Route 95 which also service the communities. The roadway traverses commercial areas on the west and east ends of the corridor with the majority of the corridor running through limited residential development and with a rural character. The roadway is narrow along most of the corridor, with a nominal 24-foot width for two lanes with very limited shoulders, requiring sharing of the roadway between pedestrians, bicyclists and typical automobiles and trucks. The roadway has significant vegetation along much of the route, in some locations a thick vegetative canopy enveloping the

roadway, especially along narrow and curvy sections. As a result of the undulating curve sections with the limited shoulders, vehicle speeds are controlled by the physical geometry and, in some locations, limited sight distances. The roadway is a scenic highway and is designated historic in one section, evidence of the importance of the roadway for the residents and users. The roadway runs along the coast of Long Island Sound in the mid-section and is low lying along the tidal marshes and estuaries. As a result, the roadway is prone to flooding during storm events with sea level rise likely to have a potential to impact the very sensitive nature of the roadway in vulnerable areas.

The corridor is very unique among other State routes in Connecticut and serves a multitude of functions for all involved stakeholders. Understanding and defining the character of the roadway, will vary depending on the stakeholder, user, resident, bicyclist and all others who use the roadway.

2.1.1 Land Use

According to the Towns of Branford and Guilford Zone maps, the Route 146 corridor contains residential, commercial and industrial zoned properties, with the predominate zones being residential in both communities.

For example, with 8.3 miles of the 13 mile Route 146 corridor in Branford, only 1.53 miles of the westernmost portion of the corridor abuts non-residentially zoned property. These zones include IG-2 (General Industrial 2) and BR (Restricted Business). Beyond the Branford River, the remaining 6.83 miles of the corridor is zoned almost entirely residential up to the Guilford Town Line including R-1, R-2, R-3 and R-5. Surrounding the intersection of Route 146 at Linden Avenue, approximately 12 parcels are zoned BL (Local Business). It should be noted that two districts overlay the corridor in Branford, the Town Center Village District, the entire section from Route 1 to the Branford River, and the Pine Orchard Zoning District.

In Guilford, with 4.64 miles of the corridor mileage, less than a half mile of the corridor is zoned non-residential. These zones include Commercial C-1, C-D zones and the TS Transitional and Service District which also abuts Route 1 at the eastern end of the corridor. The Commercial zones are in the Town Center district. All other corridor sections, over 4.1 miles of corridor, are zoned residential R-1, R-3, R-5, R-6 and R-8.

In summary, approximately 11 of the 13 corridor miles traverses residentially zoned properties and districts. This is verified by the very residential roadside development in Branford beyond the Branford River, where the roadway roadside development becomes more rural leaving the Pine Orchard District and into Guilford.

2.2 Historical and Cultural Review

The communities of Branford and Guilford, in addition to being coastal tourist destinations, possess a number of historic and culture rich locations. Route 146 is listed as a national historic and scenic route from the vicinity of Eades Street in Branford through to its terminus in Guilford at Route 1. Multiple locations in the communities are listed on the National and State Registers

of Historic Places and are recognized designations as well. Throughout the existing conditions data collection process, the area has been resoundingly described as a region full of history not just on the local level, but on a national level as well. VHB and RACE have taken great care and consideration of the sensitive historic nature of the towns of Branford and Guilford.

Figures 2A through 2C indicate the locations of the recorded historically designated properties along the Route 146 corridor. Figures 3A through 3C indicate the locations of the noted cultural spots along the Route 146 corridor.

2.2.1 Historic Locations

The following listing of historic locations were found through the respective Town historical webpages[1], the National Register of Historic Places[2], and the State of Connecticut Register of Historic Places[3]. The locations with dates for construction and register additions can be found on the National Register of Historic Places, all others can be found on the State of Connecticut Register of Historic Places.

Branford

- Swain-Harrison House; built 1680, added to register 1975
- Harrison House; built 1724, added to register 1988
- Bradley House; built 1730, added to register 1988
- First Baptist Church- Branford
- Trinity Episcopal Church- Branford
- Branford Town Green
- First Congregational Church of Branford
- Branford Town Hall
- Blackstone Memorial Library
- Palmer House; built 1810, added to register 1988
- Wilford Homestead
- Limewood Avenue Properties (8,10,14)
- Blackstone House; built 1735-1750, added to register 1988

[1] Branford Historical Society; https://branfordhistoricalsociety.org
Guilford Preservation Alliance; Guilford Preservation Alliance
[2] National Register of Historic Places; https://npgallery.nps.gov/nrhp
[3] State of Connecticut Register of Historic Places; https://portal.ct.gov/DECD/Content/Historic-Preservation/03_Technical_Assistance_Research/Research/Historic-Property-Database

- Norton House: built 1715, added to register 1988
- 161 Damascus Road; built 1750, added to register 1988
- Baldwin House; built 1819, added to register 1988
- Zaccheus Baldwin House; built 1775-1800, added to register 1988
- Hoadley House: built 1785-1815, added to register 1988
- Ives House
- Frisbie Homestead; built 1790, added to register 1985
- Palmer House; built 1800-1830, added to register 1988
- 29 Flat Rock House; built 1750-1800, added to register 1988
- Historic Pine Orchard Union Chapel; built 1897, added to register 2000
- Stick Style House at Stony Creek; built 1878, added to register 1972
- Lewis Cottage; built 1882, added to register 1997

Guilford

- Leete House; built 1710, added to register 1974
- Eliot House; built 1723, added to register 1985
- Henry Whitfield State Museum; built 1639, added to register 1972
- Burgis House; built 1736, added to register 2000
- Hyland House; built in 1660, added to register 1976
- Guilford Town Green
- Sabbathday House; built 1735, added to register 1975
- Acadian House; built 1670, added to register 1975
- Griswold House; built 1764, added to register 1975

The above listing may not be the most complete listing of all historically significant structures and regions within the towns of Branford and Guilford as there are many historic buildings and areas that are not officially listed on local, state, or national registers but are recognized as such by local citizens.

Many of the locations listed above date back to the mid seventeenth to early eighteenth century. One such example includes the Harrison House in Branford, which is now home to the Branford Historical Society, was built in 1724 and has maintained its original condition since being restored in 1938. Another example is the Whitfield House in Guilford, which was constructed in

1639 and is now the oldest building in the state of Connecticut. It operates as a museum and was added to the National Register of Historic Places in 1972.

The roadway retains much of its pre-1940 historic character, and there are several properties lining the corridor from previous centuries. One of the features exhibited by these historic buildings is that they are situated close to the edge of the roadway, having been constructed when it was an unpaved coastal road. The roadway itself from the Stony Creek Historic Community into Guilford Town Center Historic Community is its own National Historic District. Repeatedly, the phrase "a road that lies gently upon the land" has been used to describe the Route 146 corridor as the unique geometry and scenic vistas that the roadway provides are just as much a part of the charm and character of Route 146 as the many historic buildings.

2.2.2 Cultural Locations

The following listing of cultural locations includes places where people would be expected to gather within the community (places of worship, parks/Town Greens, schools, etc.).

Branford

- St. Mary's Church
- Community Baptist Church
- John B. Sliney School
- First Baptist Church- Branford
- Trinity Episcopal Church- Branford
- Branford Town Green
- First Congregational Church of Branford
- Branford Center Cemetery
- Indian Neck School
- Branford Elks Club
- Francis Walsh Intermediate School
- Stony Creek Cemetery
- Branford Trail Trailhead

Guilford

- Guilford Yacht Club
- Popular Crabbing Location
- A.W. Cox Elementary School

- St. George Catholic Church
- First Congregational Church of Guilford
- Christ Episcopal Church
- Guilford Town Green
- Guilford Fair Grounds
- Assembly of God Church
- Alder Brook Cemetery

The cultural locations within the towns of Branford and Guilford coexist with the multitude of historic properties to enhance the richness of the communities. Places of worship, schools, and other popular spots for locals and visitors alike to gather add to the social landscape that shapes Branford and Guilford. It is with the deepest consideration and respect for what makes these communities that VHB and RACE have conducted their studies on the existing conditions along the Route 146 corridor.

2.3 Existing Traffic Conditions

This section summarizes the tasks associated with the evaluation of the current transportation system in the study area.

2.3.1 Roadway Network

This section includes an evaluation of the physical roadway conditions in the study area. This information is intended to identify current transportation design issues and was based on multiple field visits and a review of available record plans and reports.

2.3.2 Roadway Geometrics and Classification

CT Route 146 is a state owned and maintained roadway that is classified by CTDOT as a collector roadway within the study area. US Route 146 through Branford and Guilford was originally constructed to provide local access and later became a scenic alternative to Route 1 and was listed on the Connecticut historic register in 1990. The corridor between Church Street in Branford to its terminus at Route 1 in Guilford is considered a scenic highway. The nationally recognized Route 146 historic district runs between Flat Rock Road in Branford and Water Street in Guilford.

The existing pavement width along Route 146 varies within the study limits from approximately 47-feet (at the western junction of Route 1), to narrow 23.5 sections in the Railroad overpasses, to 36 feet in Guilford Town Center and 30 feet at the eastern junction with Route 1. One lane per direction is provided consistently throughout the corridor with exclusive turn lanes limited to just two intersections in the entire corridor and both in Branford: Pine Orchard Road, and Route 1 North Main Street (west junction).

The posted speed limits along Route 146 vary from 20 MPH to 35 MPH throughout the corridor.

2.4 Traffic Volumes

To identify current traffic flow characteristics along the study corridors, historical traffic data collected by CTDOT was reviewed and supplemented by the collection of additional traffic data in July 2019. The traffic data reviewed in this study includes daily and peak hour traffic volumes, vehicle speeds and composition, travel times, and pedestrian volumes. The following section summarizes this traffic data collection process and documents the results.

2.4.1 Daily Traffic Volumes

Automatic Traffic Recorders (ATRs) were installed at four key locations along the Route 146 corridor to collect data on traffic volumes and speeds by direction over a minimum 48-hour period. Figure 4A-4B identifies the approximate ATR count locations and the average daily traffic in both directions at each. Table 1 provides a more detailed summary of the daily and peak hour traffic volume data collected from each ATR count.

Table 1
2019 Existing Weekday Average Daily Traffic Volume Summary

Location	Weekday ADT [1]	Weekday Morning Peak Hour				Weekday Evening Peak Hour			
		Vehicles Per Hour	Dir. Dist. [2]		"K" [3] Factor	Vehicles Per Hour	Dir. Dist.		"K" Factor
Route 146, south of Sybil Creek Place	9,400	269	51%	NB	2.86%	528	60%	SB	5.62%
Route 146, east of Pine Tree Drive	2,800	79	51%	EB	2.82%	181	56%	EB	6.46%
Route 146, east of Moose Hill Road	3,200	131	55%	EB	4.09%	188	54%	EB	5.88%
Route 146, west of Pearl Street	6,300	227	53%	WB	3.60%	313	51%	EB	4.97%

Source: ATR counts conducted by VHB in July 2019.
1 ADT = Average Daily Traffic
2 Directional distribution
3 "K" factor is the percentage of total daily traffic occurring during the peak hour
4 ATR count conducted by CT DOT in 2016

As shown in the table above, based upon the 2019 traffic counts conducted by VHB, the highest traffic volumes recorded in the study area were located on Route 146 south of Sybil Creek Place in Branford with an ADT of 9,400 vehicles per day. The daily traffic volumes decrease further east on Route 146, where the ADT along Route 146 from Pine Tree Drive to Moose Hill Road ranged between 2,800 to 3,200 vehicles per day. Daily traffic volumes along Route 146 increased west of Pearl Street in Guilford to 6,300 vehicles per day at the eastern end of the study area. It is worth

noting that the CT DOT count station located south of Meadow Street in Branford recorded an ADT of 11,500 vehicles per day in 2016.

Approximately 2-4% of the daily traffic volumes along Route 5 corridor occur during the weekday morning peak hour, and 5-7% of the daily traffic volumes occur during the weekday evening peak hour.

2.4.2 Peak Hour Traffic Volumes

While the daily traffic data provides an overview of the level of traffic demand along the study corridor, a key focus of this task was to evaluate the capability of the study intersections in accommodating the traffic demands placed upon them during the peak traffic periods. As such, manual turning movement counts (TMCs) were conducted at the 14 study intersections along the Route 146 corridor to collect peak hour traffic data. The TMCs were conducted between the hours of 11:00 AM to 1:00 PM and 4:00 PM to 6:00 PM on Tuesday, August 18, 2020.

The resulting peak hour traffic volume networks are shown on Figures 4A through 4C.

2.5 Vehicle Speeds

Vehicle speed data at multiple locations along the Route 146 corridor were compiled from speed surveys conducted by CTDOT and supplemented with the Automatic Traffic Recorder (ATR) counts collected by VHB in July 2019.

The vehicle speed data is summarized in Table 2. The table and figure each show the average speed and 85th percentile speed in each travel direction. The 85th percentile speed is the speed at which 85-percent of vehicles travel at or below, and transportation agencies typically use it to establish speed limits. The table is organized by location of each speed data collection site along the corridor from west to east.

For most of the corridor, the 85th percentile speeds exceed ten miles per hour above the posted speed limit. In some locations, even the average speeds exceed ten miles per hour above the posted speed limit. The locations where the average or 85th percentile speeds are greater than or equal to ten miles per hour above the posted speed limit are highlighted in Table 2.

Table 2
Vehicle Speed Summary

		Eastbound		Westbound	
Location	Posted Speed Limit (mph)	Average Speed (mph)	85th % Speed (mph)	Average Speed (mph)	85th % Speed (mph)
Branford					
Route 146, vicinity of Home Place [2]	35	38	42	37	41
Route 146, vicinity of Church Street [2]	25	33	**37**	32	**35**
Route 146, vicinity of Barker Place [2]	25	34	**37**	**35**	**38**
Route 146, south of Sybil Creek Place [1]	25	30	34	30	33
Route 146, vicinity of Wilford Road [2]	25	27	31	30	33
Route 146, vicinity of Fifth Avenue [2]	25	34	**38**	34	**38**
Route 146, vicinity of Selden Avenue [2]	25	**37**	**41**	**36**	**40**
Route 146, vicinity of Griffing Pond Road [2]	25	32	**36**	33	**37**
Route 146, east of Whiting Farm Road [2]	25	33	**37**	33	**36**
Route 146, east of Pine Tree Drive [1]	25	34	**38**	**36**	**39**
Route 146, vicinity of School Street [2]	25	33	**36**	32	**35**
Route 146, west of Branford/Guilford Town Line [2]	35	40	44	39	43
Guilford					
Route 146, east of Moose Hill Road [1]	35	36	41	37	43
Route 146, east of Moose Hill Road [2]	35	41	**46**	43	**49**
Route 146, east of Wildrose Avenue [2]	30	39	**42**	37	**41**
Route 146, vicinity of South Fair Street [2]	30	32	37	32	37
Route 146, west of Pearl Street [1]	25	31	34	30	34
Route 146, east of Union Street [2]	25	**35**	**39**	**37**	**41**
Route 1, east of Route 146 [2]	45	42	45	40	42

1 Based on ATR counts conducted in July 2019

2 Based on speed surveys conducted by CTDOT in 2013

Shaded areas denote speed 10 or greater miles per hour above speed limit

2.6 Intersection Sight Distance

Due to the rural and historic nature of the Route 146 corridor, the provision of adequate intersection sight distance (ISD) at unsignalized intersections is an important safety concern. The speed data noted in the previous section was used to determine the appropriate intersection sight distance, based on design standards identified by the Connecticut Department of Transportation[4]. Field measurements were then conducted at each of the study intersections to determine whether adequate sight distances are provided and, if not, to identify sightline obstructions. The results of this investigation are summarized in Table 3. As indicated in this table, adequate intersection sight distance is not available at multiple locations along the Route 146 corridor.

[4] Connecticut Department of Transportation; Highway Design Manual; December 2006

Table 3 Intersection Sight Distance Evaluation

	Study Intersection / Approach	Design Speed (mph)[1] Left	Design Speed (mph)[1] Right	Recommended ISD[2] Left	Recommended ISD[2] Right	Available ISD[3] Left	Available ISD[3] Right	Meets Standard Left	Meets Standard Right	Notes
2	Route 146 at Montowese Street									
	- EB Route 146	38	38	420’	420’	>420’	>420’	Yes	Yes	
3	Route 146 at Meadow Street									
	- EB Meadow Street	38	38	420’	420’	>420’	>420’	Yes	Yes	
6	Route 146 at Pine Orchard Road (east)									
	- SB Pine Orchard Road	41	41	450’	450’	>450’	>450’	Yes	Yes	
7	Route 146 at Blackstone Avenue									
	- NB Blackstone Avenue	41	41	450’	450’	50'	>450’	NO*	Yes	* Sight lines to left obstructed by stone pillar.
	- SB Blackstone Avenue	41	41	450’	450’	155’	50’	NO**	NO***	** Sight lines to left obstructed by trees and horizontal curvature. *** Sight lines to right obstructed by stone pillar.
8	Route 146 at Damascus Road									
	- NB Totoket Road at Damascus Road	39	39	430’	430’	240’	>430’	NO*	Yes	* Sight lines to left obstructed by trees and mailbox.
	- EB Route 146 (Totoket Rd) at Stony Creek Road	39	39	430’	430’	>430’	215’	Yes	NO**	** Sight lines to right obstructed by trees and horizontal curvature.
10	Route 146 at Moose Hill Road									
	- NB Shell Beach Road	43	43	475’	475’	>475’	335’	Yes	NO*	* Sight lines to right limited by horizontal and vertical curvature.
11	Route 146 at Sachems Head Road									
	- EB Route 146	42	42	465’	465’	315’	220’	NO*	NO*	* Sight lines to left limited by bridge. Sight lines to right limited by vegetation.
12	Route 146 at Whitfield Street									
	- EB Route 146 (Water Street)	40	40	440’	N/A*	>440’**	N/A	Yes	N/A	* Intersection has stop control on 3 approaches. Sight lines only needed facing uncontrolled southbound approach.
	- WB Route 146 (Boston Street)	40	40	N/A*	440’	N/A	>440’	N/A	Yes	** Presence of parked cars on street may limit sight lines.
14	Route 146 at Route 1									
	- EB Route 146	45	45	495’	495’	>495’	430’	Yes	NO*	* Sight lines to right limited by horizontal and vertical curvature.

1 Design speed for approaching vehicle based on closest available 85th percentile speed data or 10 mph over the posted speed limit.
2 Recommended Intersection Sight Distance calculated based on design speed of approaching vehicle and design standards identified in the Connecticut Department of Transportation Highway Design Manual.
3 Available Intersection Sight Distance based on field measurements conducted by VHB in November 2020.

2.7 Railroad Over/Underpasses and Culverts

The Route 146 roadway parallels the Amtrak/ Shoreline East railroad along much of the project and in some locations, crisscrosses the railroad tracks with rail over/underpasses. The Amtrak line crosses Route 146 in four locations along the corridor, the Tilcon Railroad crosses Route 146 on Blackstone Avenue in Branford, and the Tilcon crossing intersects Route 146 just west of Pepperwood Lane in Branford. With the exception of the aforementioned crossings, all other railroad interactions grade separated crossings, with railroad bridges over the roadway. The underpasses throughout the corridor measure from approximately 23 feet in width to 30.5 feet in width with vertical clearances ranging from approximately 10 feet to 14 feet. The bridge measurements and locations are displayed in Figures 5A-5C.

Drainage culverts along and under the roadway corridor carry rivers, marshes, and wetland flows. The proximity of the corridor to the Long Island Sound lends itself to waterway inlets interacting with roadway infrastructure as well as recurring flooding along sections of the roadway. In Branford, Route 146 contains three waterway crossings and Guilford contains three waterway crossings on Route 146. These culverts are of variable length ranging from smaller single culver crossings to larger multi-culvert crossings.

The primary culvert crossing in Guilford, also known as the crabbing area, is being reviewed by CTDOT for a potential upgrade/reconstruction to address longstanding flooding. That project design efforts are on hold pending the completion of this study. It is worth noting that at the time of this existing conditions review, the Sybil Creek bridge in Branford is currently undergoing reconstruction by CTDOT.

2.8 Traffic Operations

Capacity analyses were conducted to evaluate traffic operations at the study intersections during the weekday midday and weekday evening peak traffic periods based on the 2020 traffic volume networks shown on Figures 4A through 4B. The following section summarizes the methods of capacity analyses used in this study and documents the results.

2.8.1 Capacity Analysis Methodology

The capacity analyses were conducted using industry standard Synchro™ software (Version 10), based on the evaluation criteria contained in the 2000 Highway Capacity Manual[5] (HCM). The HCM 2000 methodology was used instead of HCM 2010 or HCM 6th Edition due to limitations in these newer HCM methodologies that would preclude analysis of some study intersections. For instance, the HCM 2010 and HCM 6th Edition methodologies do not support analysis of intersections with non-NEMA phasing, more than four approaches, or clustered intersections.

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5 Highway Capacity Manual 2000; Transportation Research Board, National Research Council, Washington, DC (2000).

Capacity analyses results are reported using a variety of performance measures, including "Level of Service" (LOS), Volume-to-Capacity (v/c) ratio, and queue length. These performance measures are described below.

Level-of-Service (LOS)

The level of service designation is based on the average control delay experienced by a vehicle traveling through the intersection. Similar to a report card, LOS designations are letter based, ranging from A to F, with LOS A representing the best operating condition (lowest vehicle delays) and LOS F representing the worst operating condition (highest vehicle delays). LOS D or better conditions are typically considered to be acceptable during the peak hours, while LOS E or F conditions are typically considered to be overly congested. In some instances, however, LOS E or F conditions may be deemed tolerable, provided that the lengthy delays do not lead to other, more serious conditions, such as increases in crash frequency.

LOS is assigned differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of all traffic entering the intersection, and the LOS can be reported for individual turning movements, approaches, or for the intersection as a whole. For unsignalized intersections with stop-control on the side street approaches, the analysis assumes that through and right-turning movements on the main street are unimpeded by side street traffic. As such, LOS is reported only for left-turns from the main street and for all movements from the side street; the overall intersection LOS is not reported. Additionally, the delay values for each range are slightly longer for signalized intersections than unsignalized intersections. This is based on the presumption that the public will be more patient at signalized intersections where they are guaranteed entry into the intersection in a reasonable amount of time.

Volume-to-Capacity (v/c)

Volume-to-Capacity (v/c) can be reported for individual lane groups or for the intersection as a whole. Volume-to-Capacity is a ratio comparing the volume of vehicles proceeding through an intersection (or lane group) with the capacity of the intersection (or lane group) to accommodate that volume. A v/c ratio of 1.0 indicates an intersection operating at its capacity.

Queue Length

Vehicle queues are the expected length of vehicles waiting at an intersection. This report documents the 50th percentile and 95th percentile vehicle queue lengths in feet. The 50th percentile queue represents the maximum vehicle queue length that is expected to occur during a signal cycle under typical (median) traffic flow rates during the peak period analyzed. The 95th percentile queue represents the maximum vehicle queue length that is expected to be exceeded only during the 5-percent of signal cycles (two or three times per hour) in the peak hour with the heaviest traffic flow. The 95th percentile queue is generally considered the maximum vehicle queue for design purposes.

2.8.2 Capacity Analysis Results

The overall intersection LOS during the weekday morning and evening peak traffic periods at each study intersection were analyzed. The capacity analyses indicate that all intersections within the study area currently operate with acceptable levels of service D or better during the peak periods. This indicates all study intersections can adequately accommodate current traffic demands and that traffic congestion is not a significant concern along the corridor.

A more detailed summary of the capacity analysis results, including delays, level of service, v/c ratios, and vehicle queues lengths at each intersection, is included in the Appendix.

2.9 Crash Analysis

In order to assess safety conditions within the study area, collision data was collected from the University of Connecticut, Connecticut Crash Data Repository (CTCDR) for the most recent full three-year period available, from January 2017 to December 2019. It should be noted that only collisions that result in death, injury, or property damage in excess of $1,000 are required to be reported. The collision data was reviewed for the entire Route 146 corridor within the project study area, with particular focus given to the study area intersections.

According to this data, 209 crashes were reported in the study area during the three-year analysis period. The type and severity of all collisions recorded along Route 146 within the study area are summarized in Table 4 and Table 5, respectively.

Table 4
Route 146 Collision Types

Type of Collision	2017	2018	2019	Total Collisions	Percent
Rear End	22	17	13	52	24.9%
Angle	18	18	17	53	25.4%
Fixed Object	8	5	10	23	11.1%
Sideswipe, Same Dir.	5	3	5	13	6.2%
Animal	2	4	3	9	4.3%
Head On	2	1	1	4	1.9%
Sideswipe, Opposite Dir.	3	2	3	8	3.8%
Bicycle	1	3	1	5	2.4%
Pedestrian	1	1	1	3	1.4%
Other	4	0	3	7	3.3%
Not Applicable	7	7	4	18	8.6%
Rear to Rear	1	1	1	3	1.4%
Rear to Side	3	6	2	11	5.3%
Total	**77**	**68**	**64**	**209**	**100%**

Source: UConn Connecticut Crash Data Repository

As indicated in the table above, just over one quarter (25.4%) of the collisions reported within the study area were angle collisions. The next most common collision types were rear-end (24.9%), fixed object (11.1%), not applicable (8.6%), sideswipe same direction (6.2%), and rear to side (5.3 %). The various other collision types each accounted for less than 5% of the total collisions reported in the study area.

Table 5
Route 146 Collision Severity

Type of Collision	2017	2018	2019	Total Collisions	Percent
Property Damage Only	56	56	55	167	79.9%
Injury	20	12	9	41	19.6%
Fatal	1	0	0	1	0.5%
Total	**77**	**68**	**64**	**209**	**100%**

Source: UConn Connecticut Crash Data Repository

79.9% of the reported collisions resulted in property damage only, an injury or suspected injury was reported in 19.6% of the collisions, and one fatal collision (0.5%) was reported during the three-year analysis period.

The one fatal collision involved a vehicle traveling on Indian Neck Avenue, an errant vehicle crashing into a tree after crossing onto Route 146/South Montowese Street.

The number of collisions reported at each of the 14 study intersections is depicted in Figures 6A through 6C. As shown on this figure, the following three intersections experienced the greatest number of reported crashes during the three-year analysis period:

- Route 146 at Whitfield Street (9 crashes)
- Route 146 at Soundview Road and Goose Lane (Soundview Road Extension) (14 crashes)
- Route 146 at Route 1 (12 crashes)

2.10 Active Transportation

The existing pedestrian, bicycle, and transit facilities along the segment of Route 146 under study were investigated to identify current conditions and issues. The Route 146 roadway is narrow in most sections, running between older homes in many sections and other roadside constraints that limit the shared use of the roadway for bicyclists and pedestrians as there are very limited sections of shoulders and sidewalks.

2.10.1 Pedestrian and Bicycle Facilities

There are no exclusive bike facilities along the corridor; sidewalks and roadway shoulders act as shared-use paths for pedestrians and bicyclists. It is worth noting that Route 146 is listed as a state designated bike route. In the section below, these facilities are described in order of location, starting at the westernmost point (the Route 146 at Kirkham Street intersection) and ending at the easternmost point (Route 146 at Route 1).

Route 146 at Kirkham Street to just north of the Branford River

- Sidewalks are provided on both sides of the roadway from Kirkham Street to South Main Street. This area is suburban commercial with sidewalks and a wide shoulder for on-street parking. Sidewalks become intermittent on the northern side of the roadway along the Town Green between the South Main Street fork and Montowese Street. Through this section of roadway shoulders become narrower.
- Along Montowese Street from the intersection with South Main Street to the bridge over the Branford River, roadway shoulders are wide to accommodate on-street parking and cyclists. However, sidewalks become limited to the eastern side of the roadway at the Pine Orchard Road intersection. Sidewalks end just north of the bridge over the Branford River, with sidewalks existing on the bridge itself.
- In locations where there are gaps in the available sidewalk, pedestrians must walk on the grass next to the roadway. These sections are not accessible to pedestrians with wheelchairs, strollers, and other devices.

- Crosswalks and pedestrian signalization are provided at the intersection of Kirkham Street, Monroe Street, and Route 146. All other study area intersections are unsignalized and do not provide pedestrian signals. Crosswalks are present at the intersections in this segment of the corridor.

Branford River Bridge to Beach Access Points

- No sidewalks are provided. Crosswalks are available at key intersections. Shoulder widths vary through this section of corridor.
- Access to the Shoreline Greenway Trail is available off of Tabor Drive. Narrow shoulders and narrow right-of-way width exist south of Tabor Drive.

Beach Access Points to Blackstone Avenue

- No sidewalks are provided. Crosswalks are available at some key intersections. Shoulder widths vary through this section of corridor.
- Roadway shoulder widths widen at the curve where Hotchkins Grove Road (Route 146) becomes Elizabeth Street (Route 146).
- Route signage at the intersection of Pine Orchard Road (Route 146) at Blackstone Avenue is not clear. There is only one advance sign on eastbound Pine Orchard Road (Route 146) indicating that Route 146 turns left onto Blackstone Avenue instead of continuing on the through movement of Pine Orchard Road. A supplemental sign at the intersection would reduce confusion for motorists.

Blackstone Avenue to Leetes Island Village

- No sidewalks are provided. Crosswalks are available at key intersections. Shoulder widths vary through this section of corridor.
- Speeds throughout this portion of the corridor were noted as higher than the 85th percentile and over 10 miles per hour over the posted speed limit. The higher speeds combine with the geometry of the roadway leads to a general feeling of being unsafe for pedestrians and cyclists.

Leetes Island Village to Guilford Town Line

- This section of the corridor is lined with historic houses that sit close to the edge of the road.
- Crosswalks are provided at key intersections. No sidewalks are available through this area; shoulders on the roadway are narrow.
- The Amtrak overpass located approximately 0.6 miles west of the intersection of Route 146 at Moose Hill Road and Shell Beach Road does not provide adequate sight lines for vehicles to see non-motorists. The opening of the overpass is narrow and does not allow enough space for vehicles and pedestrians/cyclists to maneuver through simultaneously.

- This portion of the corridor has been noted for flooding concerns during high tide, storm surge, and projected sea level rise events further impacting non-motorist accessibility.

Guilford Town Line to Guilford Center

- Crosswalks are provided at key intersections, beginning at the Town Center intersection with Route 77. No sidewalks are available through the segment of corridor from Moose Hill Road to River Street; shoulders on the roadway are of variable width.
- The Town has plans to construct sidewalks along portions of Route 146 which will be reviewed under Future Conditions.
- Popular recreational hiking trails are located off of Sam Hill Road, there exists a small parking lot at the trail entrance, however it was noted that many vehicles park on-street on Sam Hill Road narrowing the roadway.
- This portion of the corridor has been noted for flooding concerns during high tide, storm surge, and projected sea level rise events further impacting non-motorist accessibility.
- From River Street to the Town Green, roadway shoulders are narrow as on-street parking is preferential. This area is suburban commercial, and sidewalks are wide and present on both sides of the roadway.

Guilford Center to Route 1

- Sidewalks provided on both sides of the roadway from the Town Green to the west of Lovers Lane. From the west of Lovers Lane to the Alder Brook Cemetery sidewalks are present on the northern side of the roadway. Through this section of roadway shoulders become narrower.
- In locations where there are gaps in the available sidewalk, pedestrians must walk on the grass next to the roadway. These sections are not accessible to pedestrians with wheelchairs, strollers, and other devices.

2.11 Public Transportation

2.11.1 Transit Facilities

The Route 146 corridor is adjacent to services by CT transit and CTrail services. CT transit bus route 201 maintains stops along Main Street in Branford and Broad Street in Guilford. Route 201 runs primarily along Route 1 and connects the town centers. The Guilford Amtrak station is located to the south of the project area on Old Whitfield Street in Guilford. Branford's Amtrak station is located south of Route 146 on Kirkham Street.

CT transit bus stops along the portion of the Route 146 corridor study area do not provide passenger amenities and typically are only indicated by a signpost along the sidewalk. The Amtrak Branford and Guilford stations provide modern rail passenger amenities at locations about half of a mile from the study corridor. The Shoreline East rail line provided by Amtrak is the only rail line that stops at the Branford and Guilford terminals.

The transit facilities and routes are shown in the Appendix G and discussed below.

CT transit Route 201

This route serves New Haven, Branford, Guilford, and Madison. It utilizes a portion of Route 146 in Branford and Guilford but primarily utilizes Route 1. New Haven Union Station is the westernmost stop and Downtown Madison is the easternmost stop.

With respect to the Route 146 corridor study area, CT transit Route 201's service stops on Main Street in Branford and just north of the study area on Broad Street in Guilford. Table 6 outlines hours of operation:

Table 6
CTtransit Route 215 Operation

	Day of Week	Average Headway (minutes)	Hours of Operation	
			Inbound	Outbound
CT transit Route 201	Weekdays	10 – 60	6:00 AM – 7:50 PM	5:50 AM – 6:52 PM
	Saturday	60	8:10 AM – 6:03 PM	7:00 AM – 4:47 PM

CTRail Shore Line East Line

The Shore Line East Line provides commuter rail service spanning from New London, CT to New Haven Union Station each day of the week. The Guilford Station stop is roughly half a mile south of the Route 146 corridor via Old Whitfield Street. The train makes stops at the Guilford Station eight times toward New Haven and eight times toward New London on each weekday and each weekend day. The next station stop to the west is the Branford Station, which is located approximately half a mile from the Route 146 corridor south via Kirkham Street. From the Guilford Station, the next station stop to the east is the Madison Station, the Madison station is outside the Route 146 study area. Table 7 summarizes hours of operation for the Shore Line East Line.

Table 7
CTrail Shore Line East Line Operation

		Hours of Operation	
	Day of Week	To New Haven	To New London
CTrail Shore Line East Line	Weekdays	7:06 AM – 11:27 PM	5:20 AM – 9:48 PM
	Weekends	7:06 AM – 11:27 PM	5:20 AM – 9:48 PM

2.12 Environmental Conditions- RACE Coastal Engineering

RACE Coastal Engineering, ("RACE"), in support of the Route 146 Corridor Study project, evaluated coastal flood risk across the project area. **RACE** reviewed water levels, waves and wind speeds from published sources such as the Federal Emergency Management Agency (FEMA), the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Army Corps of Engineers (USACE). The analysis considered the 100-year storm frequency including the potential impacts of 20 inches of sea level rise. The purpose of this effort was to explore how future sea level rise may impact the study area as existing FEMA mapping does not take sea level rise into consideration. As part of this analysis, **RACE** developed the approximate, future flood zone elevations across the project area and identified areas with increased flood risk in the future.

The 100-year event has a 1% chance of occurring in any given year. FEMA utilizes the 100-year event to produce their Flood Insurance Rate Maps (FIRM) and it is the industry standard to design coastal structures to be able to withstand this type of event. In accordance with Connecticut General Statutes Section 25-68o(b), in the preparation of any municipal evacuation plan or hazard mitigation plan, such municipality shall consider the most recent sea level change scenario. 20 inches of sea level rise is the projected 2050 planning threshold recommended by the Connecticut Institute for Resilience and Climate Adaption (CIRCA) and the value that has been adopted by the CT Department of Energy and Environmental Protection (CT DEEP) Commissioner for compliance with this statute. As such, the 100-year storm event with 20 inches of sea level rise was used as the design event for this study.

The analysis was performed using the methodology that FEMA used to develop the effective Flood Insurance Study (FIS) N0. 09009CV001C for the study area and outlined in the FEMA publications, *"Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update –Final Draft*," dated February 2007 and *Guidelines and Specifications for Flood Hazard Mapping Partners and current revisions*. The analysis incorporated site specific conditions, including publicly available Light Detection and Ranging (LiDAR) elevation data from NOAA, State of Connecticut, and USACE. For the effective study, FEMA used cross-shore transects that are placed at specific intervals along the shoreline of the open coast area to predict the extent of floodwaters over land. FEMA flood lines are then drawn by interpolating between these transects. Figure 7: Effective Flood Insurance Rate Map (FIRM) shows the existing FEMA 100-year flood plain and transect locations in the project area.

There are 20 FEMA transects across the study area. To determine the future flood zones and elevations across the project area, **RACE** re-analyzed these 20 transects with 20 inches of sea level rise. **RACE** performed a desktop coastal engineering analysis to determine the starting (offshore) parameters associated with the 100-year event at each transect, and then transformed the wave onshore and over land to determine the extent and depth of the future flood zone.

The flood zone boundaries are determined using the higher of the wave crest elevation on top of the total water level (TWL) or the wave runup. Total water level (TWL) is defined as the water level including astronomical tides, storm surge, and wave setup or super elevation of the water due to wave breaking, but without the crest of the wave. Wave runup is defined as the jet or

spray of water in a near-vertical direction as the wave breaks on a slope or vertical seawall. These two parameters are used to determine the extent of the flood zone.

FEMA uses two main categories for delineating coastal flood hazard zones: a velocity zone ("VE" designation) and an inundation zone ("AE" designation). In some instances, FEMA also demarks an area known as the Limit of Moderate Wave Action (LiMWA), which is an area subject to wave heights of 1.5 feet or higher. VE Zones include areas of 1%-annual-chance ("100-year storm") flooding which are subject to wave action with wave heights of 3 feet or higher. VE Zones are typically associated with significant construction restrictions due to the loads associated with the larger waves. Construction requirements for AE Zones within the LiMWA, also known as the "Coastal A Zone," are similar to the VE Zone requirements. Construction requirements in an AE Zone are somewhat less restrictive but are still subject to inundation and should be designed as such.

RACE delineated between the VE Zone and AE Zone as part of the analysis. Table 8: Existing FEMA Data vs. FEMA Data +20 Inch of Sea Level Rise (SLR) shows the starting total water level, runup elevation, extent of the inland flooding and extent of the velocity zone of the effective FEMA data and the condition with sea level rise and Table 9: Flood Zone Increases with 20 Inch Sea Level Rise (SLR) summarizes the difference between the existing and sea level rise conditions at each transect.

Table 8: Existing FEMA Data vs. FEMA Data +20 Inch of Sea Level Rise (SLR)

Transect	Existing				With + 20" SLR			
	Total Water Level ft, NAVD 88	Runup Elevation ft, NAVD 88	Station of Inland Flooding	Station of Inland VE Zone Extent	Total Water Level ft, NAVD 88	Runup Elevation ft, NAVD 88	Station of Inland Flooding	Station of Inland VE Zone Extent
32	10.8	21	47	47	12.4	21	83	83
33	12.3	14	758	69	13.9	14	758	75
34	11.3	17	746	96	13.0	17	746	108
35	10.7	10	2520	1328	12.4	13	2584	2454
36	11.7	12	107	107	13.4	15	107	107
37	12.1	15	23	23	13.7	15	27	27
38	10.3	11	201	149	11.9	14	239	239
39	11.7	12	1860	110	13.3	18	1873	148
40	10.5	11	1433	22	12.1	14	1442	22
41	11.2	15	2847	567	12.9	15	2847	603
42	10.8	11	2134	2134	12.4	13	2138	2138
43	11.3	13	615	53	12.9	17	615	187
44	10.2	10	2726	117	11.8	12	2726	812
45	12.1	15	800	97	13.8	15	1769	97
46	11.1	11	1712	287	12.8	14	1728	338
47	11.0	14	1265	26	12.7	19	1274	82
48	11.9	12	193	62	13.5	14	967	86
49	10.4	10	1070	764	12.0	13	1073	773
50	12.1	11	4881	104	13.7	15	4895	139
51	11.3	8	5449	3924	12.9	12	5664	3990

*Note: Sta. 0 references the shoreline at El. 0.0'

Table 9: Flood Zone Increases with 20 Inch Sea Level Rise (SLR)

Transect	Increase in Total Water Level, ft	Increase in Runup Elevation, ft	Expansion of Flood Zone Boundary	Expansion of the Velocity Zone
32	1.7	0	36	36
33	1.7	0	0	6
34	1.7	0	0	12
35	1.7	3	64	1126
36	1.7	3	0	0
37	1.7	0	4	4
38	1.7	3	38	90
39	1.7	6	13	38
40	1.7	3	9	0
41	1.7	0	0	36
42	1.7	2	4	4
43	1.7	4	0	134
44	1.7	2	0	695
45	1.7	0	969	0
46	1.7	3	16	51
47	1.7	5	9	56
48	1.7	2	774	24
49	1.7	3	3	9
50	1.7	4	14	35
51	1.7	4	215	66

*Note: Sta. 0 references the shoreline at El. 0.0'

The information in these tables was used to develop the approximate, future flood zone elevations across the project area based on the 20 inches of sea level rise projection. Figures 8-12 show the extent of the future flood zone throughout the project area. Figure 8: Legend is a key to be used in Figures 9-12. Figure 9: Overview Plan shows the overall extent of the project area. Figure 10 through 12: Flood Zones with 20 Inches of Sea Level Rise 1 through 3 show the future flood zone throughout the project site. The areas hatched in blue are areas where the flood zone is increasing.

The increases in the flood zones along Route 146 as shown in Figures 9-12 is described below:

- The flood zone is expanded such that portions of Route 146 known as Montowese/S Montowese Street between Pine Orchard Road to Indian Neck Ave & Limewood Ave previously out of the Special Flood Hazard Area (SFHA) will be located a Zone AE.
- Portions of Route 146 known as Limewood Ave previously out of the SFHA will be located a Zone AE.
- Portions of Route 146 known as Stony Creek Road between Leetes Island Road and Totoket Road previously out of the SFHA will be located a Zone AE.
- Portions of Route 146 known as Leetes Island Road between Quarry Road and Moose Hill Road previously out of the SFHA will be located in Zone AE and portions previously in the Zone AE will be located in the Zone VE.

- Portions of Route 146 known as Leetes Island Road near the DOT Bridge Project in Guilford previously in the Zone AE will be located in the Zone VE.
- Portions of Route 146 between Sachem's Head Road and Mulberry Point Road previously out of the SFHA will be located in Zone AE and portions previously in the Zone AE will be located in the Zone VE.
- Portions of Route 146 known as Water Street between Mulberry Point Road and Whitfield Street previously out of the SFHA will be located in Zone AE.
- Portions of Route 146 between Union Street and U.S. Route 1 previously out of the SFHA will be located in Zone AE.

A "bathtub" model showing stillwater flooding was produced to show how 20 inches of sea level rise could impact the road in more frequent, minor storm events. The model shows the inundation from the combination of the astronomical tide and design event storm surge not including wave impacts. Figures 13 – 22 show the following stillwater flood events:

- Mean Higher High Water (MHHW) = El. +1.2'
- Mean Higher High Water + 20" of Sea Level Rise (SLR) = El. +2.9'
- 1-yr Stillwater Level (Expected annual event) = El. +4.3'
- 1-yr Stillwater Level +20" of Sea Level Rise (SLR) = El. +6.0'
- 10-yr Stillwater Level (10% chance of annual occurrence) = El. +6.1'
- 10-yr Stillwater Level +20" of Sea Level Rise (SLR) = El. +7.8'
- 50-yr Stillwater Level (2% chance of annual occurrence) = El. +8.0'
- 100-yr Stillwater Level (1% chance of annual occurrence) = El. +9.1'
- 50-yr Stillwater Level +20" of Sea Level Rise (SLR) = El. +9.7'
- 100-yr Stillwater Level +20" of Sea Level Rise (SLR)= El. +10.8'

The analysis showed that while Route 146 is already vulnerable to coastal flooding, these problems will be exacerbated by future sea level rise. The information presented as part of this study will be used to develop and evaluate concepts and to assist SCRCOG/Towns with long term planning to reduce flood risk as part of the Concept Development Phase.

2.13 December 1, 2020 Public Meeting Summary

A public information meeting was held with the towns of Branford and Guilford on December 1, 2020 at 6:30 PM via Zoom virtual meeting. Due to COVID-19 restrictions on in-person meetings, the public was asked to join virtually for the project presentation and open forum discussion. Approximately 140 citizens were present for the virtual meeting and a multitude of comments, questions, and concerns have been recorded from citizens writing in to share their thoughts. Subsequent to the meeting, dozens of comments have been filed via email and in writing to SCRCOG and are included herein.

From this meeting there were re-occurring questions and comments that spoke to the concerns and fears of the citizens surrounding this project.

The Towns of Branford and Guilford hold their historic and scenic charm in high esteem and greatly value the preservation of the area's aesthetic. Almost all the concerns and comments that were voiced prefaced their statements with great admiration of the historic and scenic nature of Route 146 with calls to preserve the existing landmarks and vistas.

The first overarching concern that was expressed prior to the meeting via an email campaign was that of the project's scope. Citizens expressed concerns that the scope of the project was more interested in making vast roadway improvements and disregarding the character of the road. Given Route 146's designation as a Scenic Highway the fear that was echoed was that under traffic operations improvements Route 146 would hold onto the highway designation and become wider and more improved highway.

The second overarching concern that was expressed both in the public meeting forum and prior to the meeting was speed and pedestrian/cyclist safety on the Route 146 corridor. Shoulders along the corridor are narrow to nonexistent in some locations and combined with vehicles traveling at higher speeds than posted is cause for alarm on non-motorized user safety. One citizen who wrote in described how they had been hit by a vehicle while out cycling, while another citizen during the meeting mentioned that their house had been hit multiple times over the course of the 20 years that they had lived there.

Citizens of the towns of Branford and Guilford are noted as being very involved within their communities and the public response process. There are two ongoing projects within the towns for trail and bridge improvements that have raised concerns. Citizens are now more cautious and protective over their communities from the previous project process.

All of the concerns that were brought forth have been answered by the study team, either during the discussion in the presentation, or through email platforms. The study team has taken great care to ensure a response to each individual who raises concerns or questions on the study area and scope. Public comment on the project was originally to close on December 31, 2020, however this comment period has been extended to January 15, 2021, after which time comments or concerns on the Route 146 corridor improvement project will be received but not be recorded as part of official record. All received comments, questions, and concerns received by January 4, 2021 have been recorded and are included within the Attachments. The comment,

question, and concern record have been updated through the closing of the comment period on January 15, 2021.

Study Intersections
1. Route 146 at Kirkham Street
2. Route 146 at Montowese Street
3. Route 146 at Meadow Street
4. Route 146 at Pine Orchard Road (west)
5. Route 146 at Indian Neck Road
6. Route 146 at Pine Orchard Road (east)
7. Route 146 at Blackstone Avenue
8. Route 146 at Damascus Road

MATCHLINE FIGURE 1-B

LEGEND
- # Study Intersection
- Study Corridor

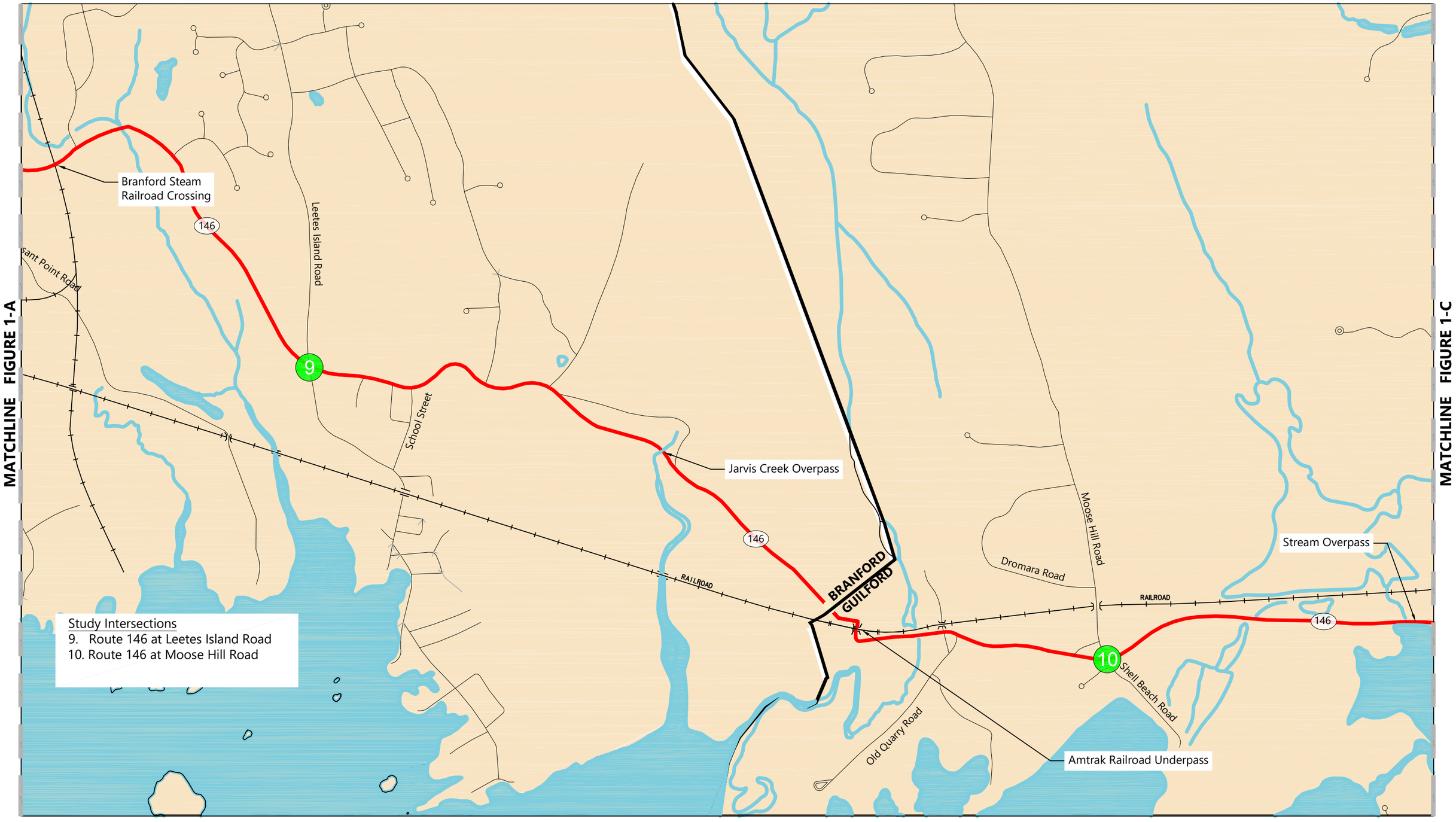
0 600 1200 Feet

vhb

Study Intersection Locations
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 1-A

Nov. 2020



LEGEND

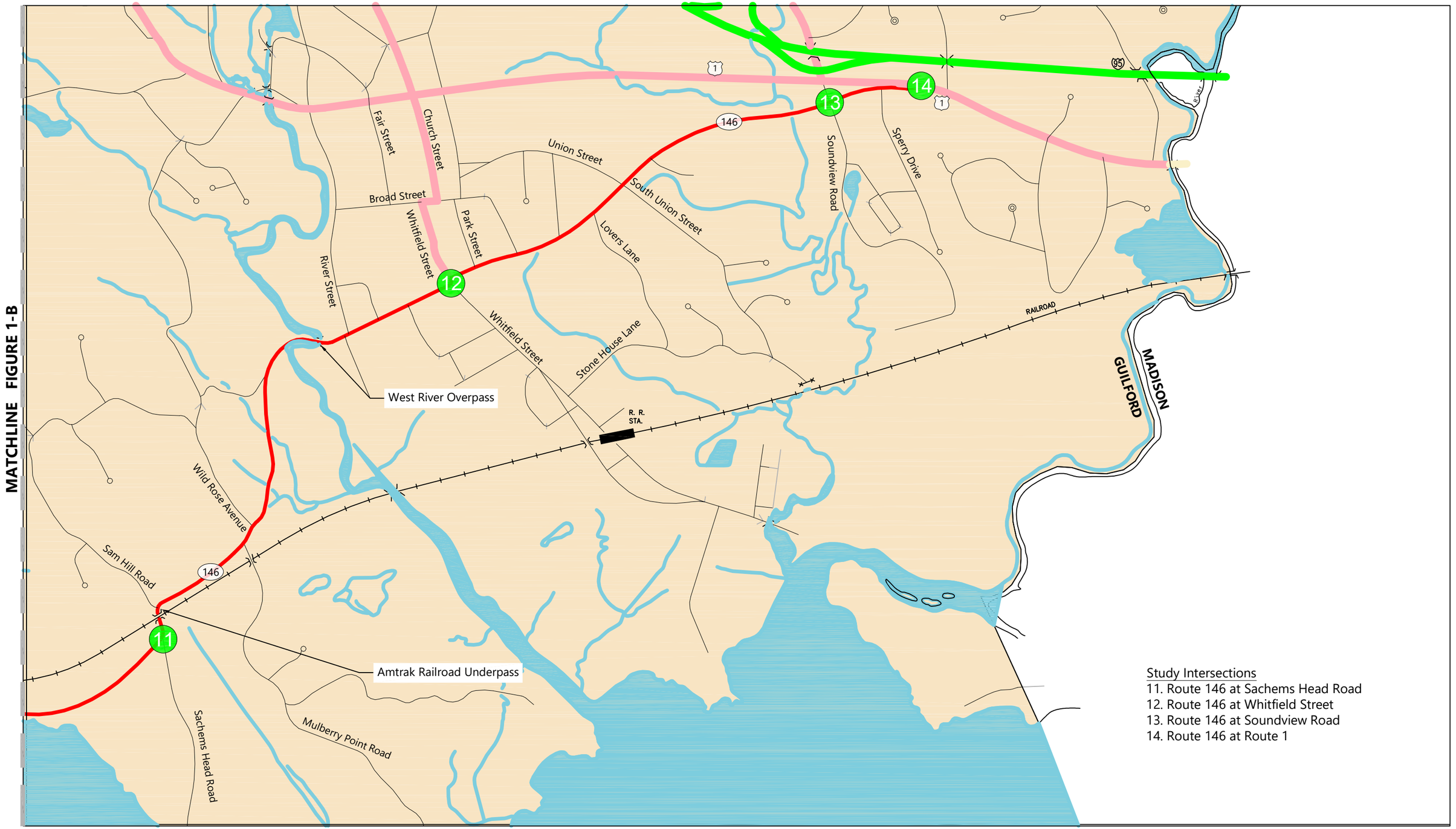
- # Study Intersection
- Study Corridor

0 600 1200 Feet

Study Intersection Locations
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 1-B

Nov. 2020



Study Intersections
11. Route 146 at Sachems Head Road
12. Route 146 at Whitfield Street
13. Route 146 at Soundview Road
14. Route 146 at Route 1

LEGEND

- # Study Intersection
- Study Corridor

0 600 1200 Feet

Study Intersection Locations
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 1-C

Nov. 2020

LEGEND

- # Registered Historic Location
- Study Corridor
- Scenic Highway
- Historic District

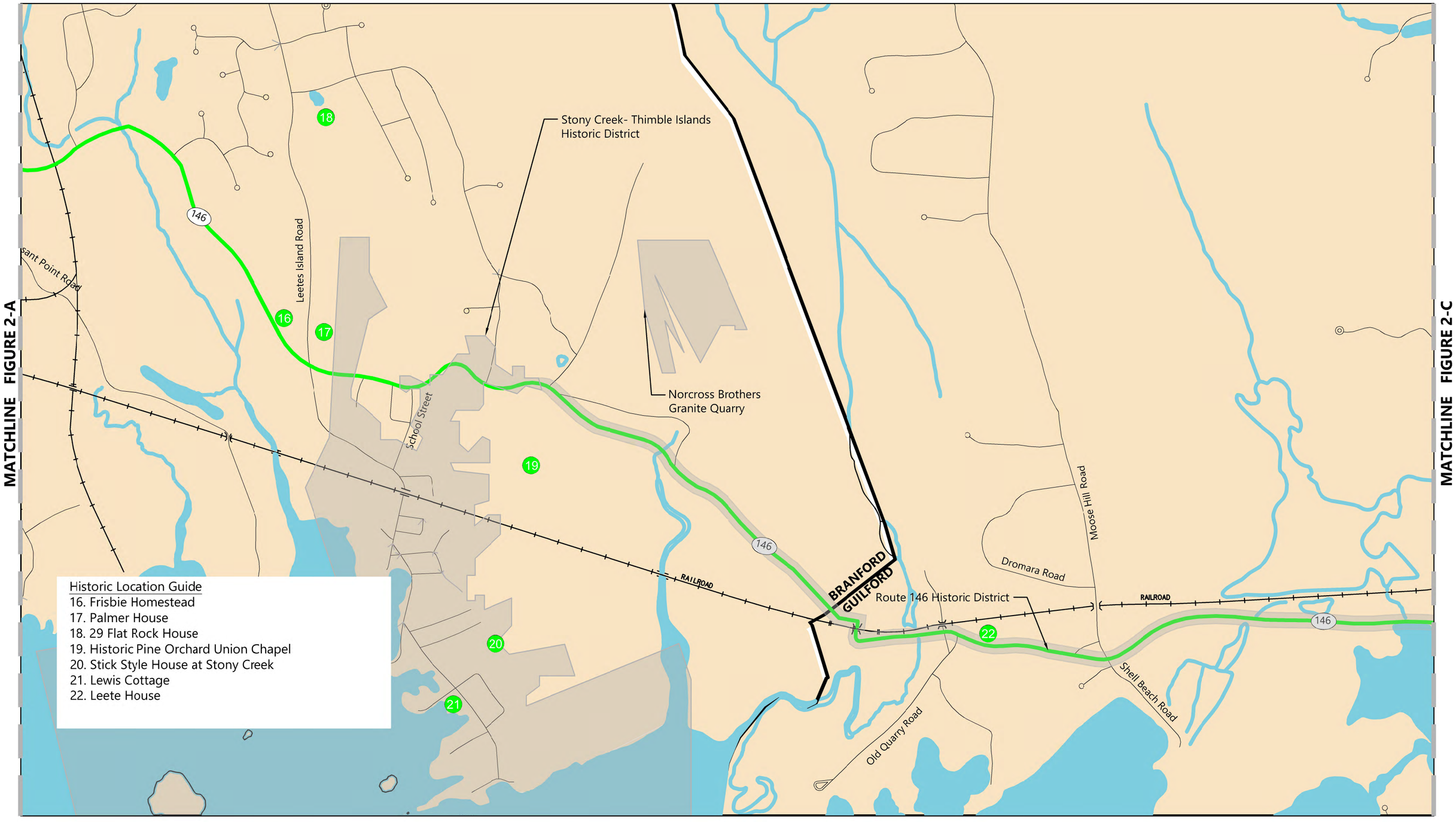
0 600 1200 Feet

vhb

Historic Locations
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 2-A

Jan. 2021



LEGEND

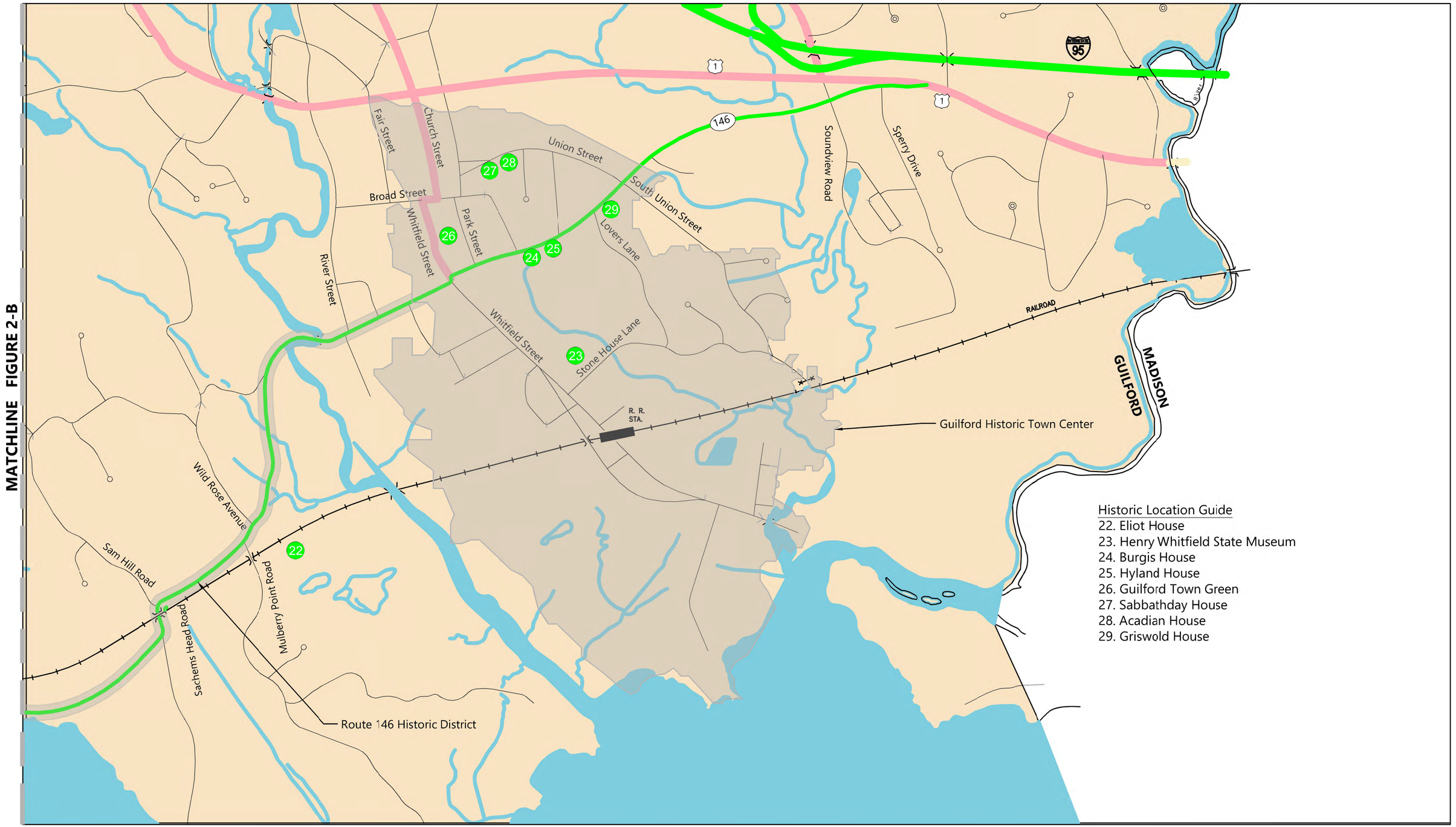
- # Registered Historic Location
- Study Corridor
- Scenic Highway
- Historic District

0 600 1200 Feet

Historic Locations
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 2-B

Jan. 2021



LEGEND

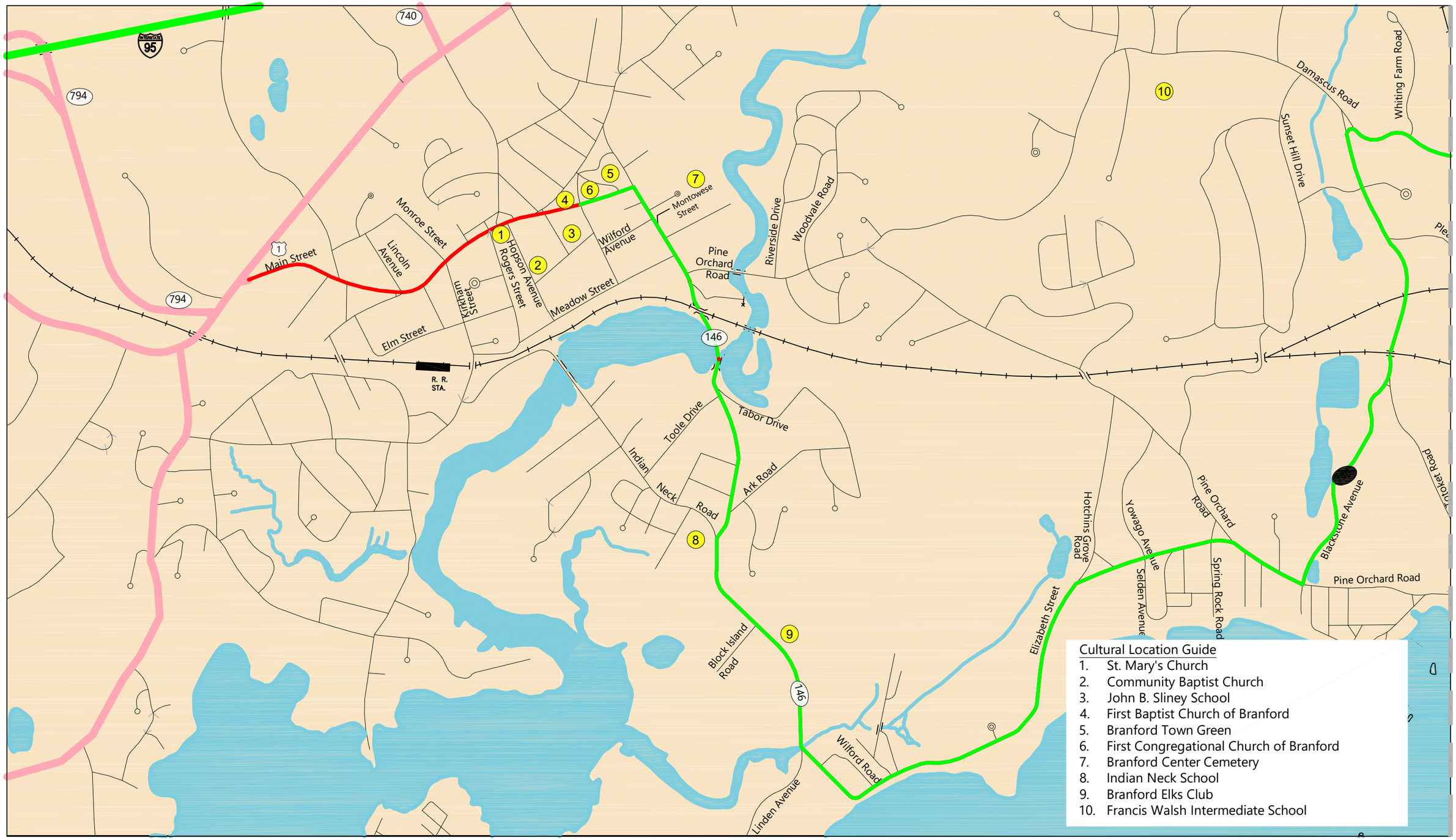
- # Registered Historic Location
- Study Corridor
- Scenic Highway
- Historic District

0 600 1200 Feet

Historic Locations
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 2-C

Jan. 2021



MATCHLINE FIGURE 3-B

LEGEND

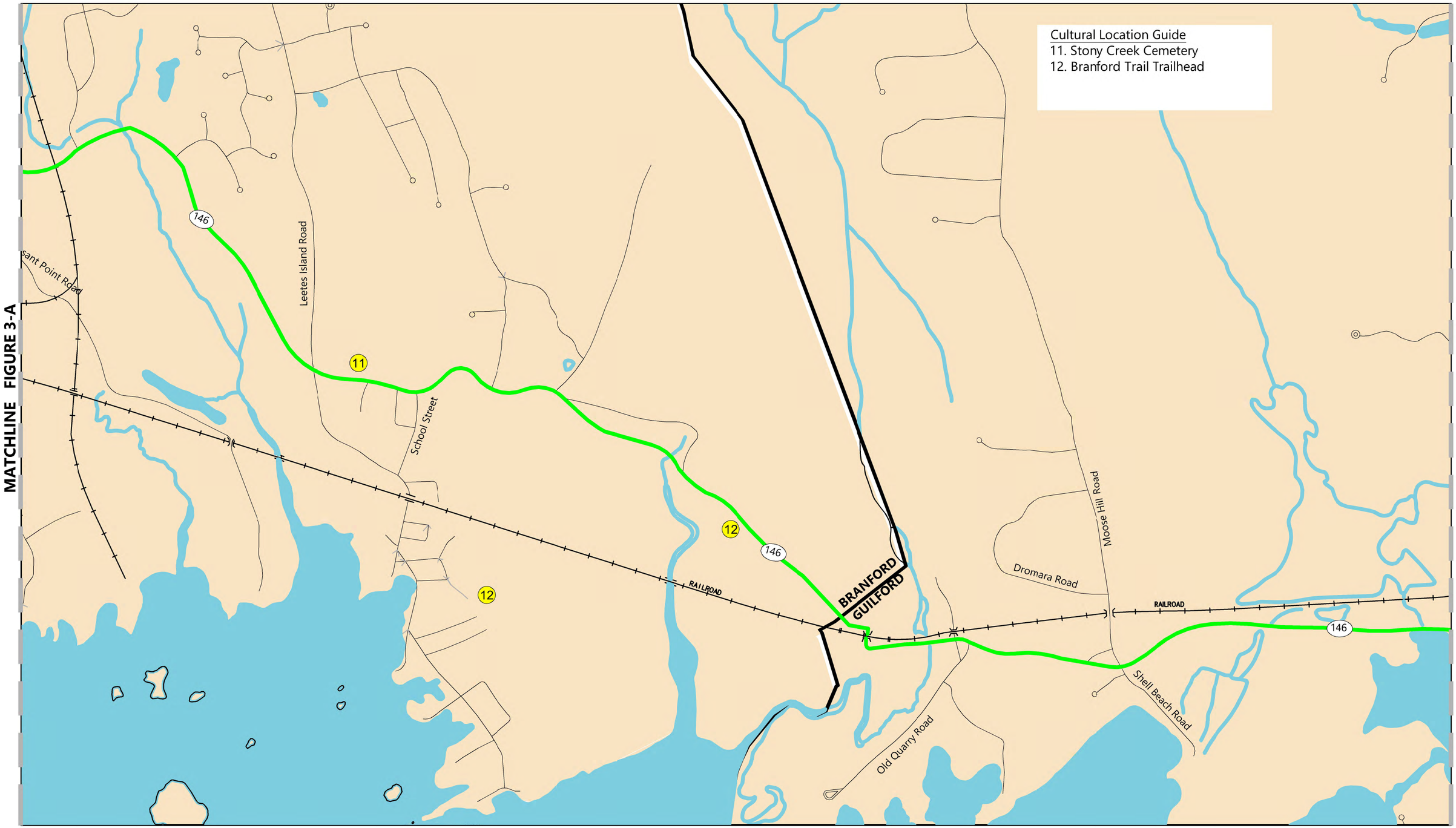
- # Cultural Location
- Study Corridor
- Scenic Highway

0 600 1200 Feet

Cultural Locations
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 3-A

Jan. 2021



LEGEND

- (#) Cultural Location
- Study Corridor
- Scenic Highway

0 600 1200 Feet

Cultural Locations
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 3-B

Jan. 2021

MATCHLINE FIGURE 3-B

Fair Street
Church Street
Union Street
Broad Street
Whitfield Street
Park Street
River Street
South Union Street
Lovers Lane
Soundview Road
Sperry Drive
Whitfield Street
Stone House Lane
Wild Rose Avenue
Sam Hill Road
Sachems Head Road
Mulberry Point Road
RAILROAD
R. R. STA.
MADISON
GUILFORD
146
1
95

Cultural Location Guide
13. Guilford Yacht Club
14. Popular Crabbing Location
15. A.W. Cox Elementary School
16. St. George Catholic Church
17. First Congregational Church of Guilford
18. Christ Episcopal Church
19. Guilford Town Green
20. Guilford Fair Grounds
21. Assembly Of God Church
22. Alder Brook Cemetery

LEGEND

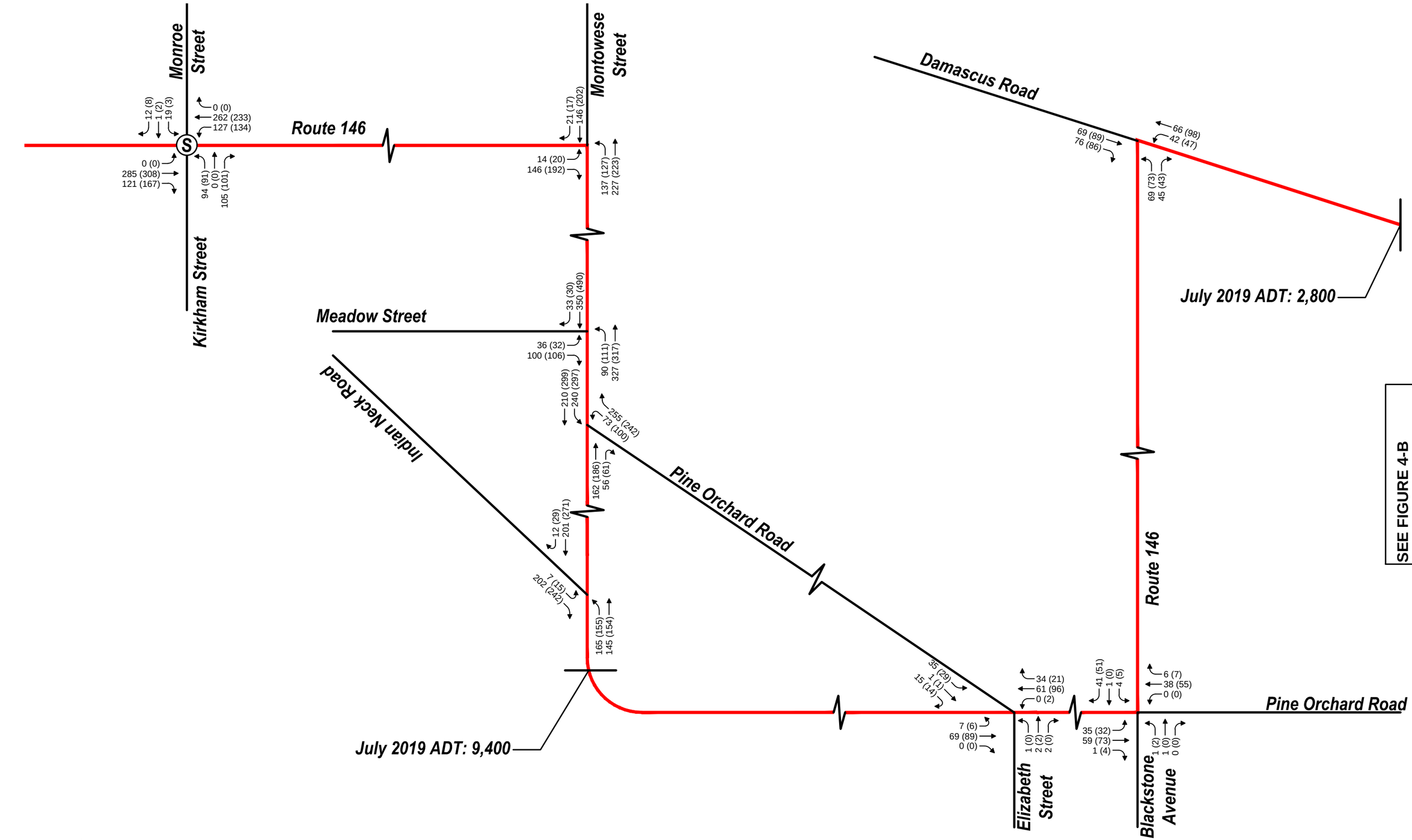
- # Cultural Location
- Study Corridor
- Scenic Highway

0 600 1200 Feet

Cultural Locations
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 3-C

Jan. 2021



Legend

XX → Weekday Morning Traffic Volume

(XX) → Weekday Evening Traffic Volume

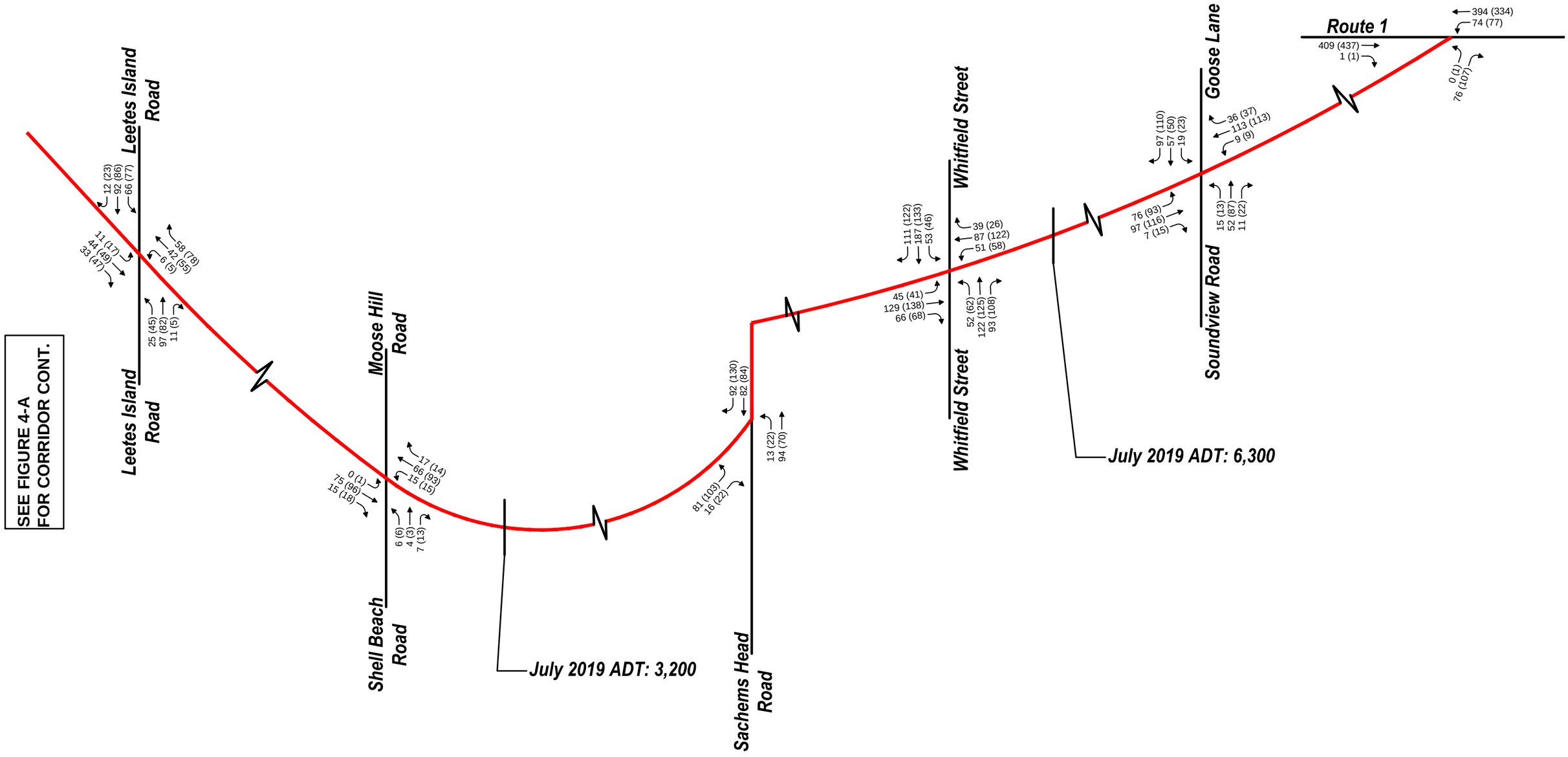
Ⓢ Signalized

NOT TO SCALE

SCROG Route 146 Corridor Study
Peak Hour Traffic Volumes
Branford/Guilford, CT

Figure 4-A

November 2020



Legend

XX → Weekday Morning Traffic Volume

(XX) → Weekday Evening Traffic Volume

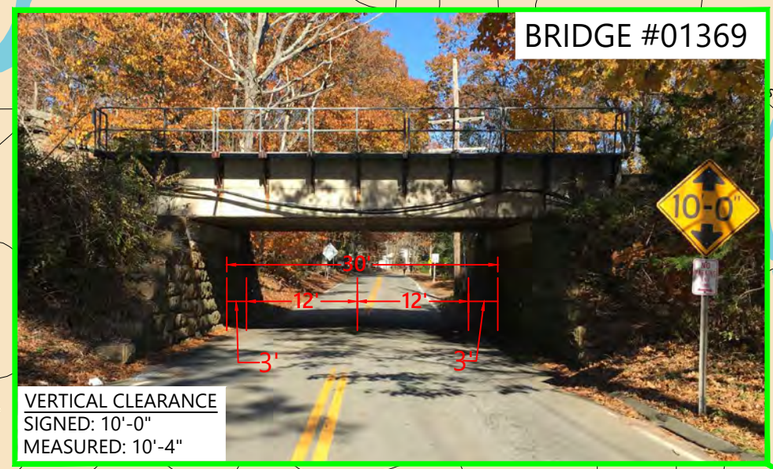
Ⓢ Signalized

NOT TO SCALE

SCROG Route 146 Corridor Study
Peak Hour Traffic Volumes
Branford/Guilford, CT

Figure 4-B

November 2020



LEGEND

- Study Corridor
- Bridge

0 600 1200 Feet

Bridge Observations
Route 146 Corridor Study
Branford, CT
Guilford, CT

Figure 5-A

Nov. 2020

MATCHLINE FIGURE 5-A

MATCHLINE FIGURE 5-C

146

Leetes Island Road

School Street

RAILROAD

BRANFORD
GUILFORD

Dromara Road

Rose Hill Road

RAILROAD

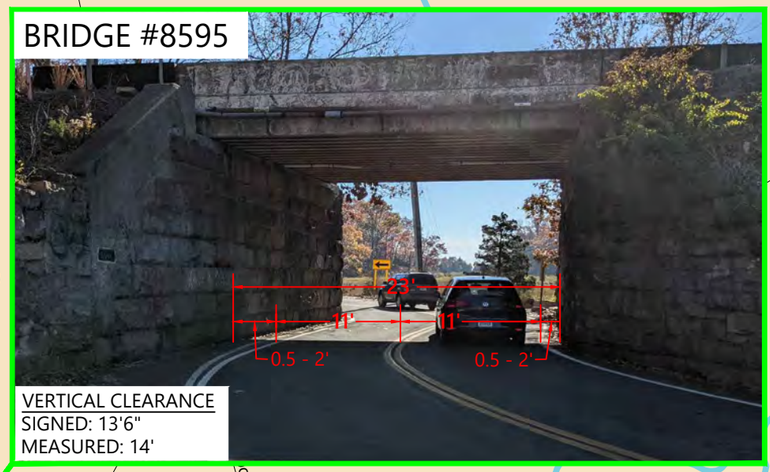
146

Shell Beach Road

Old Quarry Road

146

BRIDGE #8595



VERTICAL CLEARANCE
SIGNED: 13'6"
MEASURED: 14'

LEGEND

- Study Corridor
- Bridge

0 600 1200 Feet

Bridge Observations
Route 146 Corridor Study
Branford, CT
Guilford, CT

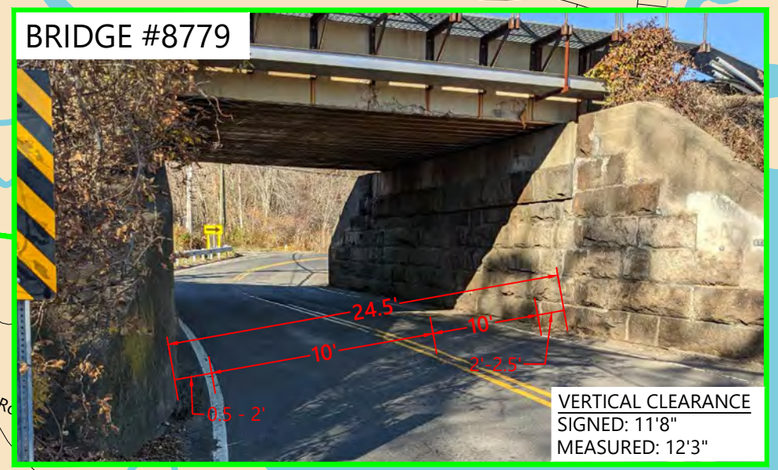
Figure 5-B

Nov. 2020

MATCHLINE FIGURE 5-B

Fair Street
Church Street
Union Street
Broad Street
Whitfield Street
Park Street
River Street
Lovers Lane
South Union Street
Soundview Rd
Sperry Drive
Stone House Lane
Whitfield Street
Wild Rose Avenue
Sam Hill Road
Hachems Head Road
Mulberry Point Rd
RAILROAD
R. R. STA.
MADISON
GUILFORD
River
146
1
95

BRIDGE #8779



VERTICAL CLEARANCE
SIGNED: 11'8"
MEASURED: 12'3"

LEGEND

- Study Corridor
- Bridge

0 600 1200 Feet

Bridge Observations
Route 146 Corridor Study
Branford, CT
Guilford, CT

Figure 5-C

Nov. 2020

MATCHLINE FIGURE 6-B

LEGEND

Number of Crashes Per Intersection

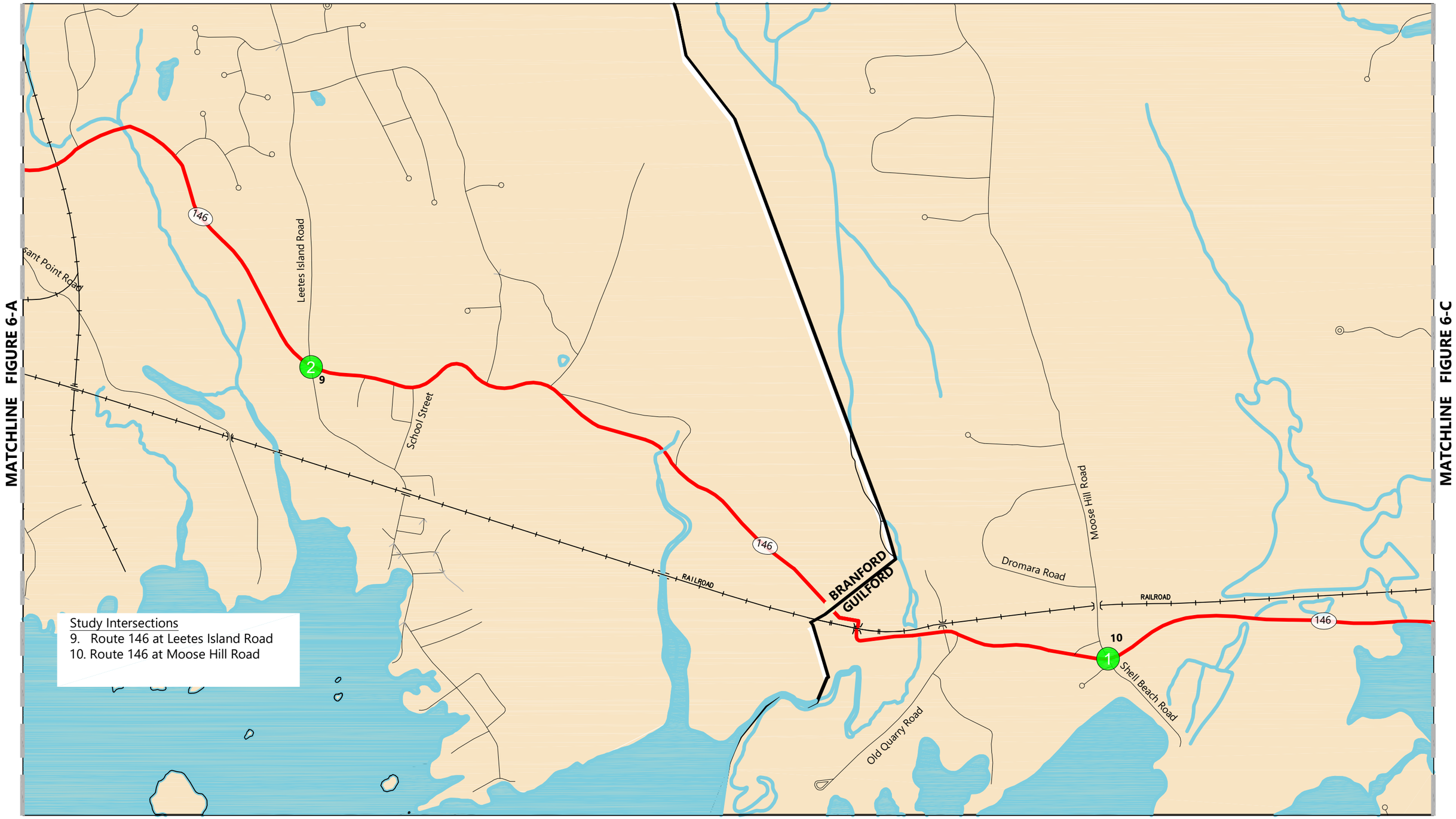
- # 0 - 5
- ## 6 - 10
- ## 11-15
- ## 16+
- F APPROX. LOCATION OF FATAL COLLISION

0 600 1200 Feet

Crash History (2017-2019)
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 6-A

Nov. 2020



LEGEND

Number of Crashes Per Intersection

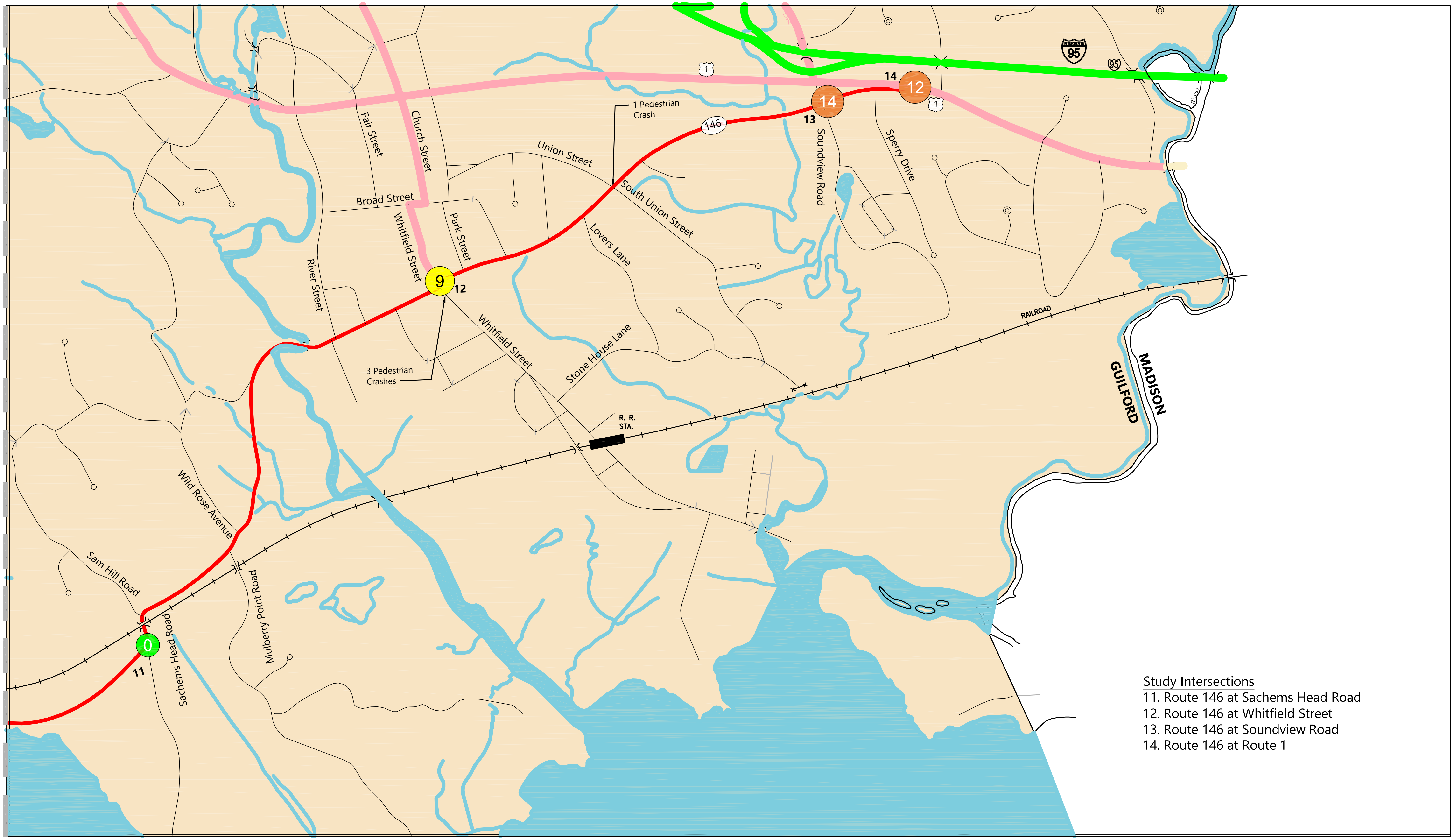
- # 0 - 5
- ## 6 - 10
- ## 11-15
- ## 16+
- F APPROX. LOCATION OF FATAL COLLISION

0 600 1200 Feet

Crash History (2017-2019)
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 6-B

Nov. 2020



LEGEND

Number of Crashes Per Intersection

- 0 - 5
- 6 - 10
- 11-15
- 16+
- APPROX. LOCATION OF FATAL COLLISION

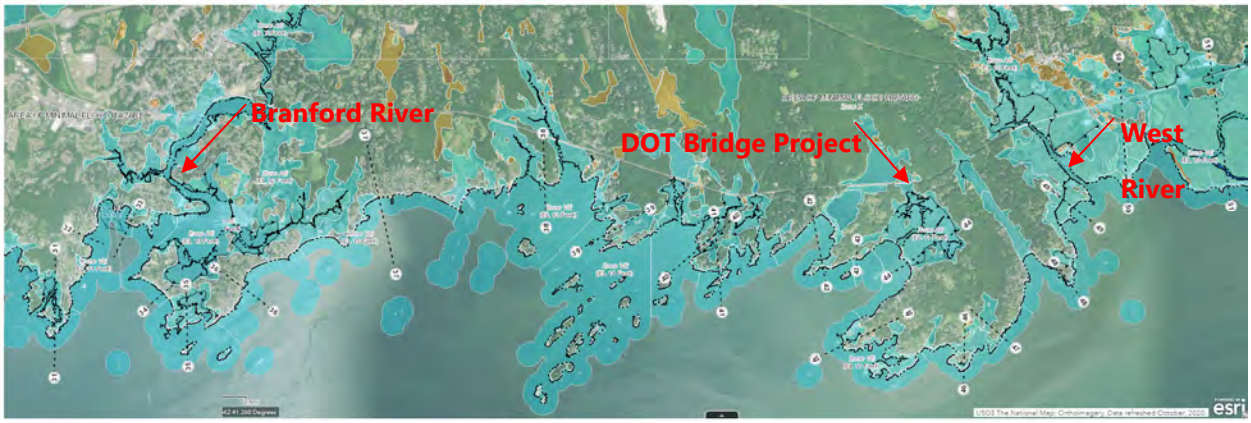
0 600 1200Feet

Crash History (2017-2019)
Route 146 Corridor
Branford, CT
Guilford, CT

Figure 6-C

Nov. 2020

Figure 7: Effective Flood Insurance Rate Map (FIRM)



This map was produced by FEMA's National Flood Hazard Layer (NFHL) Viewer and can be viewed in greater detail at: <https://hazards-fema.maps.arcgis.com/apps/webappviewer/index.html?id=8b0adb51996444d4879338b5529aa9cd>.

Figure 8: Legend

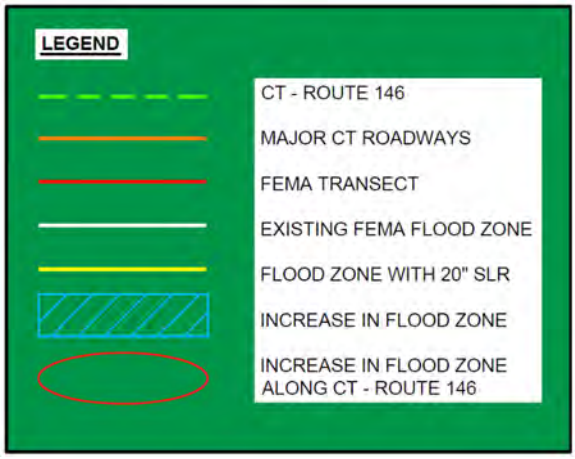


Figure 9: Overview Plan

Figure 10: Flood Increases Zones with 20 Inches of Sea Level Rise (1 of 3)

Figure 11: Flood Increases Zones with 20 Inches of Sea Level Rise (2 of 3)

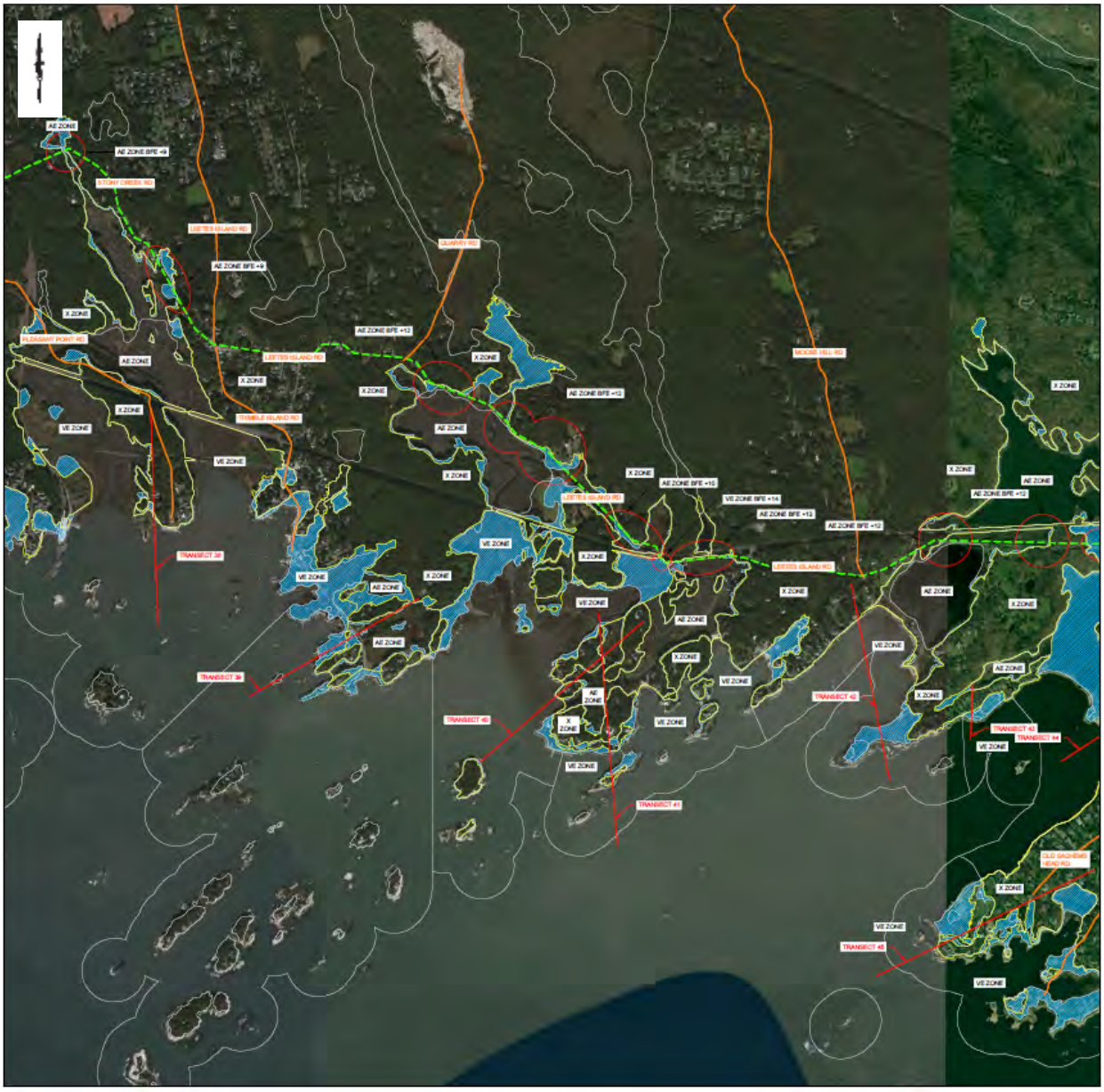


Figure 12: Flood Increases Zones with 20 Inches of Sea Level Rise (3 of 3)

Figure 13: Mean Higher High Water (MHHW) = El. +1.2'

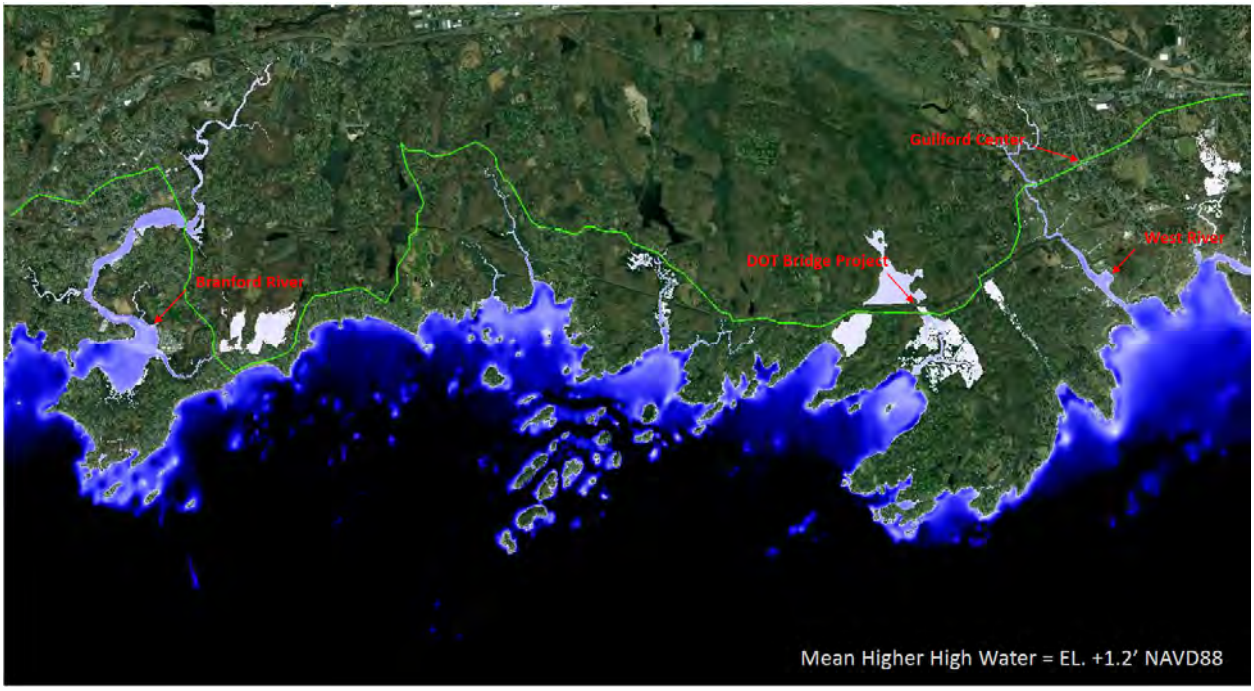


Figure 14: MHHW + 20" of SLR = El. +2.9'

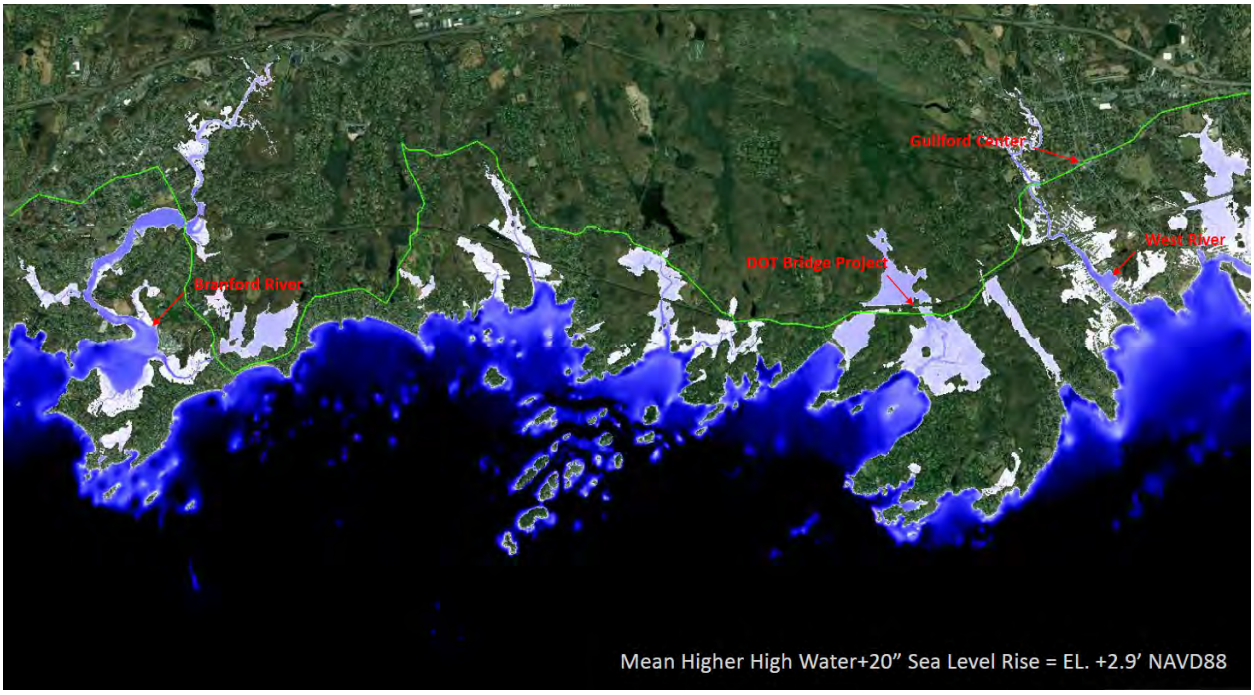


Figure 15: 1-yr Stillwater Level (Expected annual event) = El. +4.3′

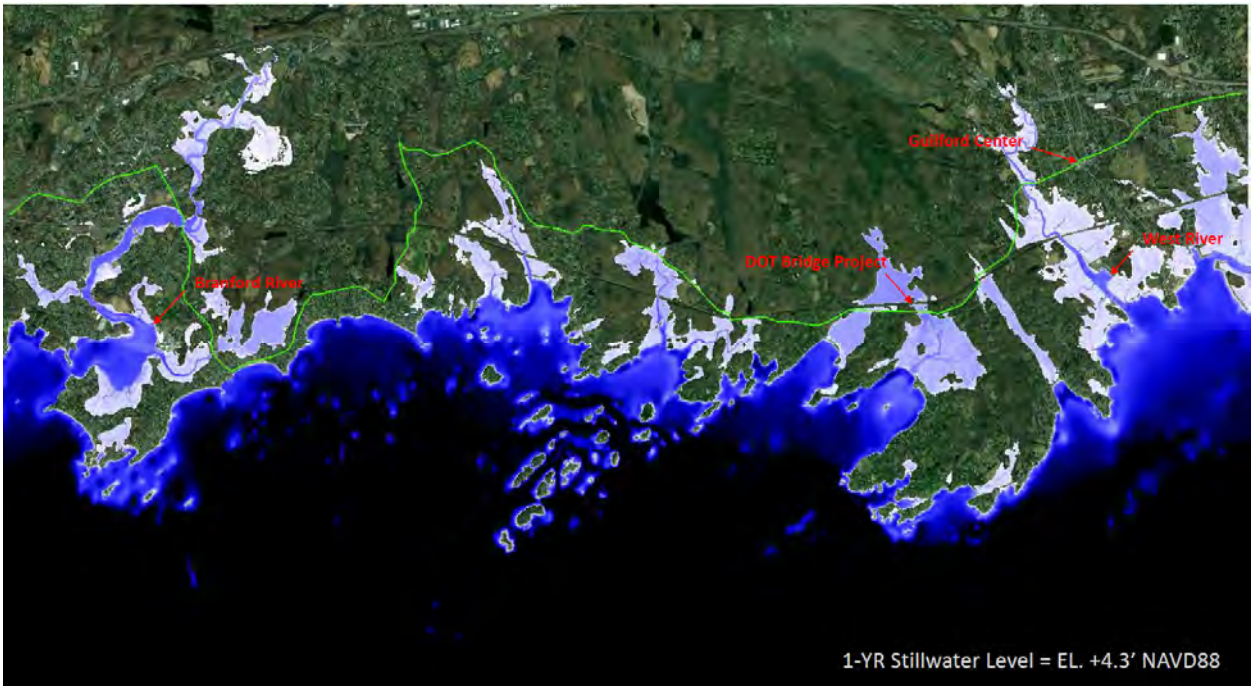


Figure 16: 1-yr Stillwater Level +20″ of SLR = El. +6.0′

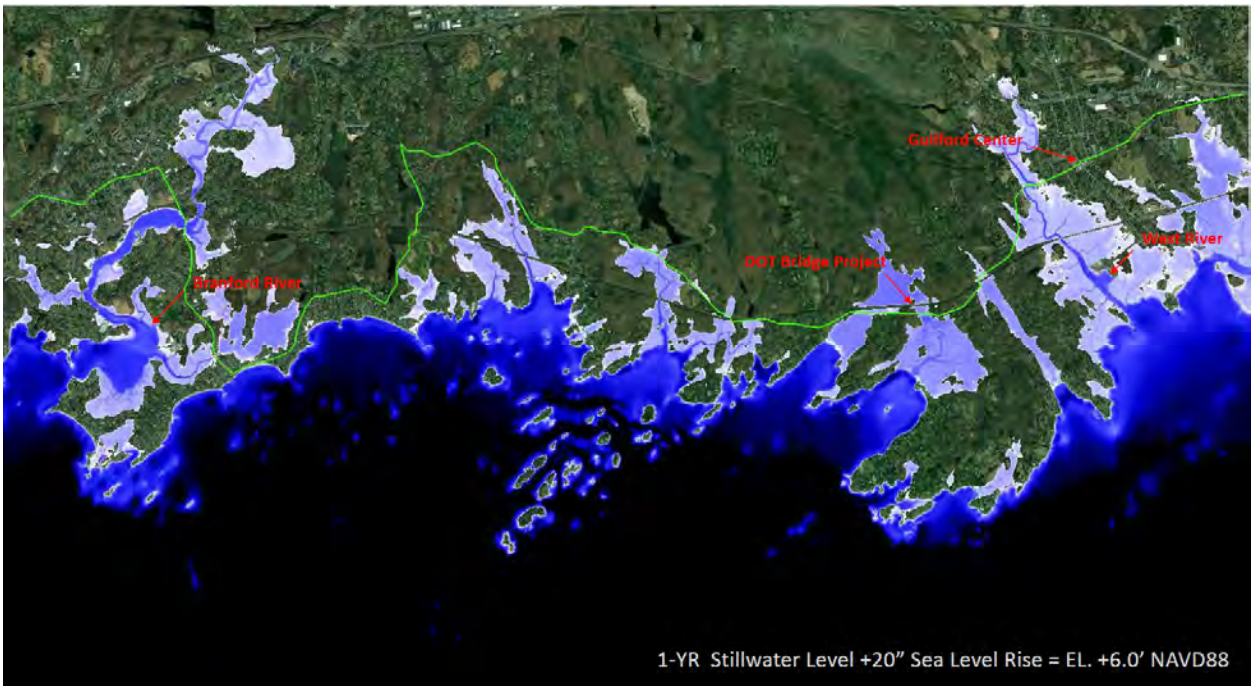


Figure 17: 10-yr Stillwater Level (10% chance of annual occurrence) = El. +6.1'

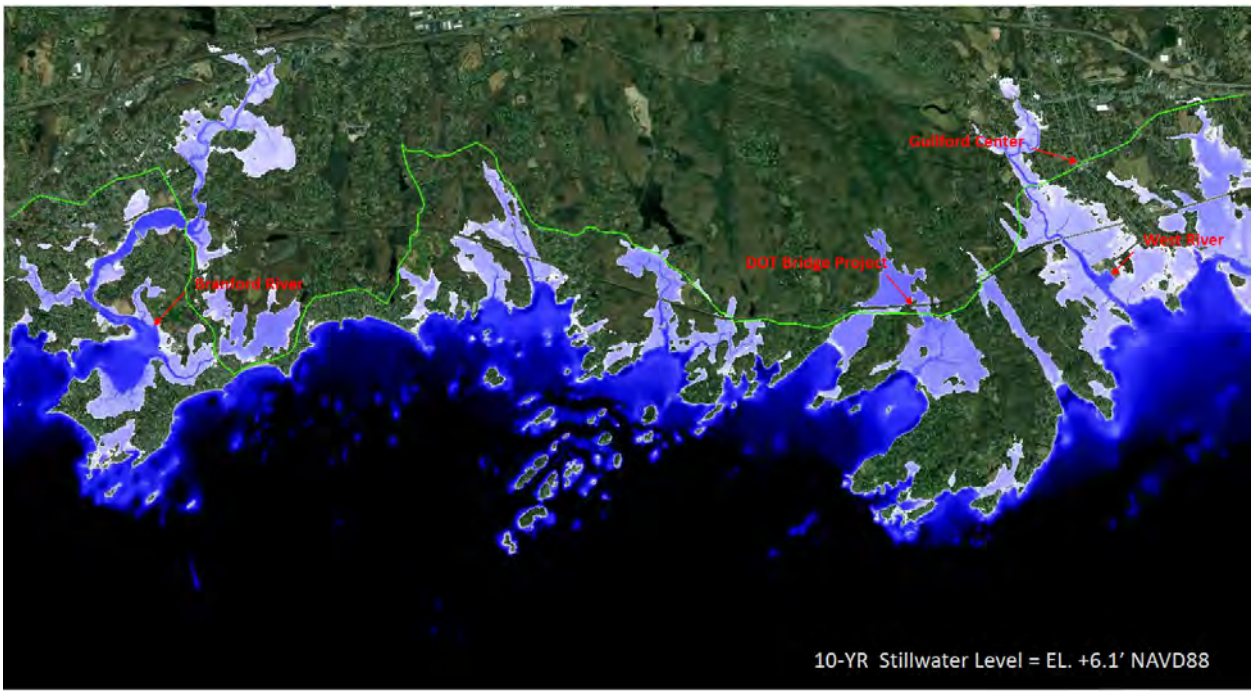


Figure 18: 10-yr Stillwater Level +20" of SLR = El. +7.8'

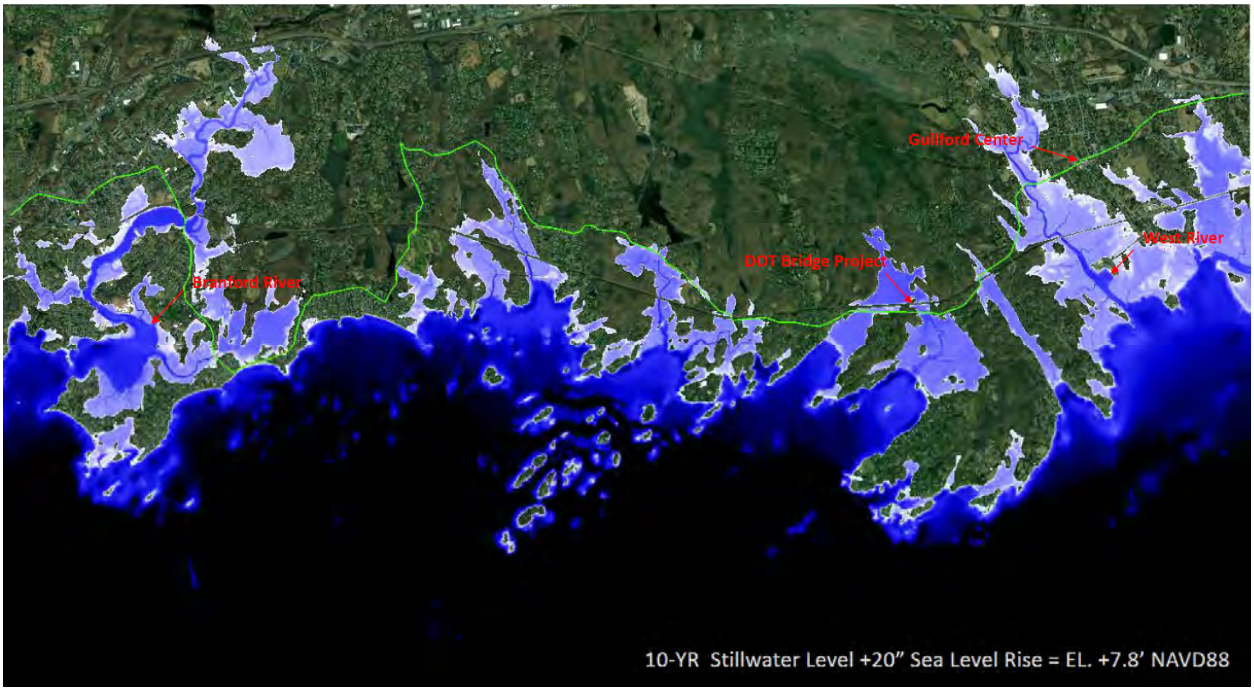


Figure 19: 50-yr Stillwater Level (2% chance of annual occurrence) = El. +8.0'

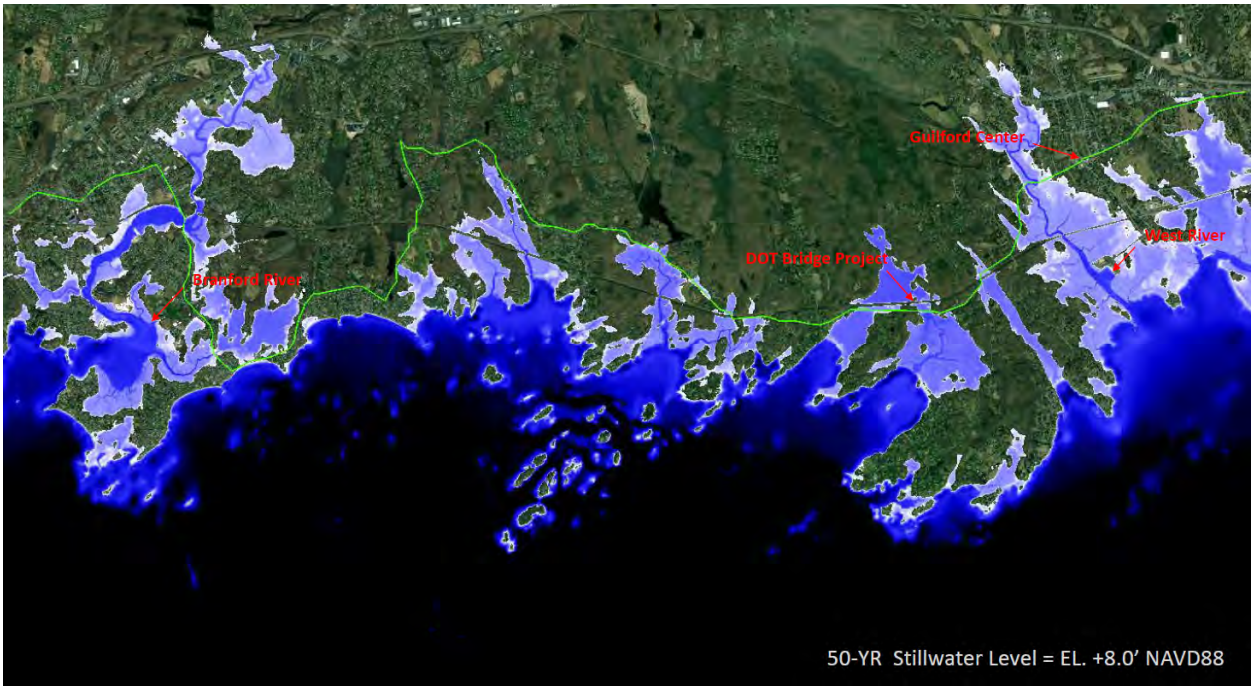


Figure 20: 100-yr Stillwater Level (1% chance of annual occurrence) = El. +9.1'

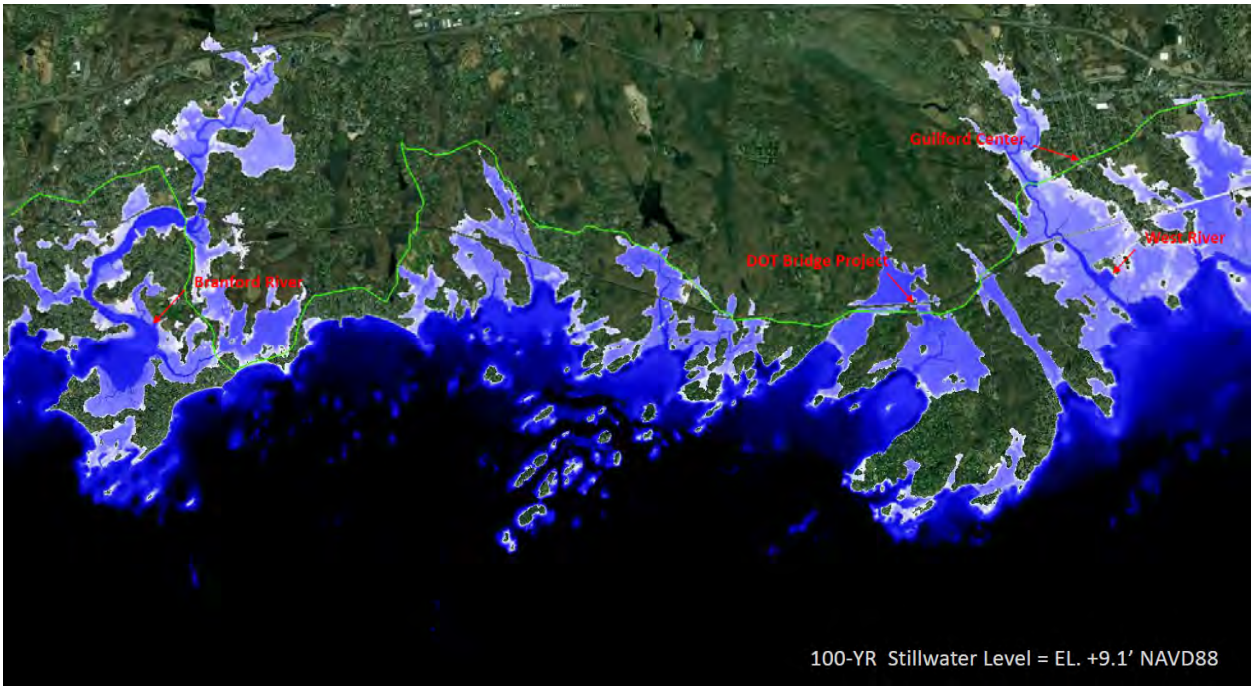


Figure 21: 50-yr Stillwater Level +20" of SLR = El. +9.7'

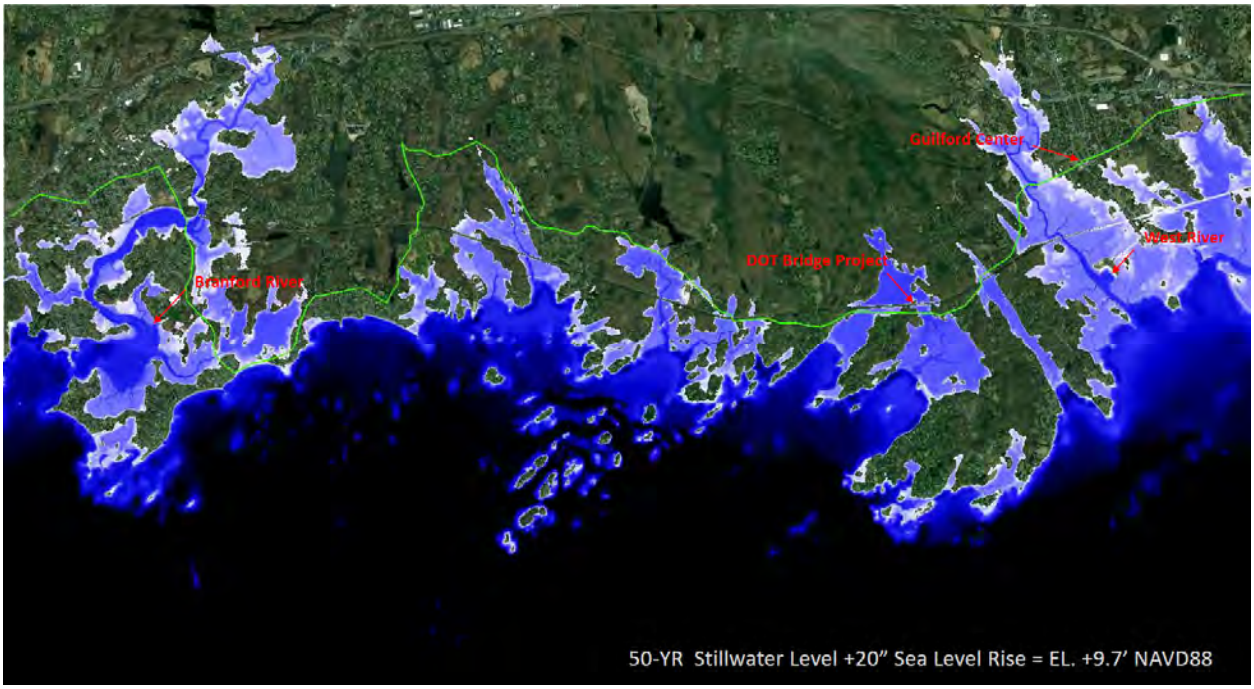


Figure 22: 100-yr Stillwater Level +20" of SLR = El. +10.8'