SCCOG Southeastern Connecticut Council of Governments

SOUTHEASTERN CONNECTICUT COUNCIL OF GOVERNMENTS

MUNICIPAL INFRASTRUCTURE RESILIENCE PROJECT

CRITICAL FACILITIES ASSESSMENT: FINAL REPORT

NOVEMBER 27, 2017

CIRCA Connecticut Institute for Resilience and Climate Adaptation

Southeastern Connecticut Council of Governments

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Wendy Leclair, Office Manager

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The mission of the Connecticut Institute for Resilience and Climate Adaptation (CIRCA) is to increase the resilience and sustainability of vulnerable communities along Connecticut's coast and inland waterways to the growing impacts of climate change on the natural, built, and human environment.

More information about CIRCA can be found at circa.uconn.edu.

Contents

Executive Summary

The Southeastern Connecticut Council of Governments conducted an assessment of 18 community facilities located in or near flood zones that are critical for ongoing public services, including fire and police stations, town halls, and departments of public works. The assessment was recommended in the region's 2012 Multi-Jurisdictional Hazard Mitigation Plan Update. The assessment identifies the risks to properties and service continuation from flooding, wind damage, and snow loads now and over the next several decades. For each site, the assessment recommends appropriate flood prevention measures, potentially including relocation, site modifications such as flood walls, flood proofing, and elevation of utilities. Five of the properties were recommended for relocation of services to less vulnerable sites in the long term (20+ years). Flood proofing measures were recommended for the other sites to enable the provision of services despite ongoing flood risks. Approaches to reducing damage from wind and snow were generally the same for all sites: remove materials on site that could become wind-borne debris, consider upgrading roofs to meet higher wind standards when roofs are due for replacement, and develop clear procedures for removal of snow following heavy snowstorms.

Figure 1. Quaker Hill Fire Company. An undersized drainage culvert causes flooding in the area. Relocation of this facility is recommended in the long term.

Project Background and Context

In 2012, The Nature Conservancy conducted a risk and vulnerability assessment workshop with representatives from the towns of Old Lyme, Stonington, Waterford, and East Lyme, the Connecticut River Estuary Regional Planning Agency (now Lower Connecticut River Valley Council of Governments), and the Southeastern Connecticut Council of Governments (SCCOG). The workshop built upon a statewide critical facilities assessment prepared by The Nature Conservancy in 2011. Vulnerabilities identified during the workshop included flood risks to multiple wastewater pump stations, water treatment plants, fire stations, and senior housing facilities located in flood and storm surge zones. Workshop participants called for the Councils of Government to provide a planning framework that would address increased risks from sea level rise in order to promote consistency among towns.

Also in 2012, SCCOG adopted its Multi-Jurisdictional Hazard Mitigation Plan Update, which included individual "annex" reports for each municipality, with each annex including a list of critical facilities, noting whether the facilities were located in flood or storm surge zones. Detailed information about the particular vulnerabilities of each facility was generally not available. The Hazard Mitigation Plan noted the likelihood of more frequent flooding due to sea level rise, but did not identify additional facilities that would be at greater future risk.

Municipal hazard- mitigation recommendations indicated generally that further assessment was needed to direct action. Very few specific recommendations addressed known vulnerabilities (for example, New London's report recommended the relocation of the fire department headquarters out of a flood zone), but more often indicated the need for additional assessment. Each annex report recommended that the municipality *"…work with SCCOG to perform a regional study to identify the vulnerability of critical facilities that may be unable to withstand natural hazard damage. Emphasis should be placed on critical infrastructure, shelters and other sites to ensure structural integrity against various hazards and adequacy of backup supplies."*

This critical facilities assessment, conducted with funding from the Connecticut Institute for Resilience and Climate Adaptation (CIRCA), studies a subset of all critical facilities: fire stations, police stations, public works facilities, and town halls—facilities that are under the purview of municipal governments and that could be adequately assessed given available funding.

Project Description/Goals/Methods

This project addressed 18 critical facilities in southeastern Connecticut located in or very near flood zones. These facilities include town halls, public works facilities, and police and fire stations. While several of the facilities have suffered from flood damage before, the majority of sites located in flood zones have not been impacted by flood events in the recent past. It was therefore critical for this exercise to document potential risks and make site managers and municipal leadership aware of those risks and action steps that could potentially prevent damage and interruption of services. Each facility was assessed for its vulnerability to damage from flooding, wind damage, and snow loads, now and over the coming decades. FEMA elevation certificates were prepared for 15 of the 18 sites. A summary of findings is displayed in Figure 2.

The project scoping began by mapping all critical facilities relative to FEMA flood and storm surge zones and then refining the list of sites to be studied. Police and fire stations and town halls were included because they provided a manageable number of sites to assess with the available funding and, for the most part, are owned or overseen by municipal governments (unlike schools, which are governed by Boards of Education, or privately owned sites). With sites selected, the first task was to identify the appropriate points of contact for each by working with municipal Chief Elected Officials. SCCOG then issued a request for proposals for consulting assistance in conducting assessments. Engineering firm Milone & MacBroom, Inc. was chosen after a Quality Based Selection Process.

A kickoff meeting was held at SCCOG offices to brief each site contact on the goals of the project. Each site was visited twice by firm engineers. The first visit was to perform all elevation measurements necessary for FEMA elevation certificates, to assess potential site modifications (such as berms or sea walls) that could reduce flooding events, and to review building conditions. The second visit was made by building engineers to assess building construction features that determine resistance to wind and snow damage. The engineers then prepared assessments for each site outlining current conditions, risks, and recommendations to reduce those risks, including order-of-magnitude cost estimates. Sheets were produced separately for flooding, snow, and wind. FEMA elevation certificates were also produced for each site that did not already have a valid certificate. A final briefing session was convened at SCCOG to report the overall results of the study. The meeting was attended by about one third of the site representatives, as well as by Montville Mayor and current SCCOG

Chairman Ron McDaniel. Information from the assessments was also incorporated into the 2017 Multi-Jurisdictional Hazard Mitigation Plan being prepared concurrently for SCCOG by Milone and Macbroom.

Municipality	Facility	Elevation Measurements (Feet)			Flooding	
		First Floor Elevation vs BFE	Utility Elevation vs BFE	Next Floor Elevation vs BFE	Short-Term (0-20 years)	Long-Term (>20 years)
Stonington Borough	Fire House and EOC	-2.22	-6.22	13.98	No action needed	Increase height of floodproofing
	Borough Hall and Public Works	-3.48	-3.03	-0.3	Dry floodproof the utility room	Wet floodproof all remaining lower areas
Stonington Town	Old Mystic FD	3.85	3.85	17.66	No action needed	Wet and dry floodproofing or low berm or flood wall
	Quiambaug FD	-4.03	-4.03	NONE	Wet and dry floodproofing	Relocate facility
	Mystic FD	-2.38	-1.27	-1.27	Dry floodproof the utility room	Wet floodproof all remaining lower areas
Town of Groton	GLP Police and Fire	-6.74	-4.79	-5.25	Additional utility room dry floodproofing and expanded wet floodproofing	Relocate facility
	Town Hall	2.07	2.32	10.62	No action needed	Low berm or flood wall
City of Groton	Municipal Building	-3.18	-2.88	8.58	Drainage improvements	Upgrade drainage as needed
	Public Works	not measured	not measured	not measured	Wet and dry floodproofing	Low berm or flood wall
New London	Fire HQ and EOC	-4	-4	10.00	Stormwater improvements and backflow prevention; dry floodproof utility room	Wet floodproof all remaining lower areas
Waterford	Quaker Hill Fire Co.	1.06	9.25	4.44	Wet floodproofing	Relocate facility
Montville	Chesterfield Fire Co.	3.17	3.15	18.8	No action needed	No action needed
Norwich	Yantic Fire Co. No. 1	-10.7	-12.6	NONE	Eliminate basement, elevate equipment	Relocate facility
	Occum FD	-6.1	-6	0.5	Eliminate basement	Relocate facility
	Public Works	2.8	6.4	NONE	Dry floodproof the utility room	Wet floodproof all remaining lower areas
Preston	Public Works	2.79	3.29	NONE	No action needed	Wet and dry floodproofing
Sprague	Town Hall	-1.95	-3.25	10	Eliminate utility room basement	Wet floodproof all remaining lower areas; or construct flood wall
	Public Works	-3.64	-3.25	5.73	Eliminate utility room basement	Wet floodproof all remaining lower areas; or construct flood wall

Figure 2. Summary Results of Site Assessments.

Summary of Risks and Recommendations
Stonington Borough Hall and Public Works
26 Church Street
Stonington

Description of current flood risk *(all elevations are in feet, NAVD88)*	• The facility is mapped in an AE flood risk zone (BFE of 12') with lowest adjacent grade at 8.77', lowest floor elevation of 8.52', utility room at elevation 8.97', and primary (occupied) floor elevation of 11.70'. This places all of the lower levels of the facility at risk of a coastal flood that has a 1% chance of occurring in any year. • The 0.2 annual chance flood elevation is assumed to be 15' (BFE x 1.25). The elevation of 18.6' cited in the FIS is believed unrealistic for the site. In either case, the facility is at risk of severe flooding from the 0.2% annual chance flood. • The facility is located in SLOSH zone 3. • The storm surges from Hurricane Sandy in 2012 and T.S. Irene in 2011 did not flood the facility.
Description of future flood risk *(all elevations are in feet, NAVD88)*	• Climate change is believed to be accelerating sea level rise and increasing the frequency of coastal storm events, which will lead to increasing risk of flooding during storm events. • MHW is 0.84'; therefore, sea level rise will likely not cause daily high tide flooding of the facility in this century.
Description of municipal capabilities to address risks	• The Borough addresses heavy snow buildup, strong wind forecasts, and flood watches and warnings as needed. Borough administration functions can be temporarily carried out in other locations. • The Borough Hall does not have a fixed-in-place generator. Obtaining a generator is a new action listed in the hazard mitigation plan.
Description of flood risk reduction design criteria *(all elevations are in feet, NAVD88)* *FFRMS = Federal Flood Risk Management Standard* *FVA= Freeboard Value Approach* *CISA = Climate Informed Science Approach*	• The 0.2% flood elevation of 15' represents the design criteria per State requirements for critical facilities. • FFRMS flood risk based on the FVA is 15' (BFE + 3' for critical facilities). • FFRMS flood risk based on the 0.2% is 15'. • FFRMS flood risk based on CISA is approximately 13' to 15'. • NYC Resiliency design criteria is BFE + 24" + SLR adjustment of 0.5'-3' = 14.5' to 17'.
Recommendations for building-specific flood risk reduction such as floodproofing, building elevation, elevation of utilities, sealing of openings, etc.	• Elevating the building is not feasible. • Relocating the facility's uses (Borough administration and public works) may be possible, but few areas of the Borough are available at higher elevations. • Short-Term: the utility room should be dry floodproofed because a 1% annual chance flood could cause two feet of flood depth. Even a storm similar to Hurricane Sandy (maximum water surface elevation 9-10 feet in western Connecticut) could flood the utility room if aligned with the

Figure 3. Sample Flood Risk Assessment Sheet (page 1 of 2 pages).

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

OMB No. 1660-0008
Expiration Date: November 30, 2018

ELEVATION CERTIFICATE

Important: Follow the instructions on pages 1–9.

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

SECTION A – PROPERTY INFORMATION		FOR INSURANCE COMPANY USE
A1. Building Owner's Name MYSTIC FIRE DISTRICT		Policy Number:
A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 34 BROADWAY AVENUE		Company NAIC Number:
City STONINGTON	State Connecticut	ZIP Code 06378

A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.)
MAP 174 / BLOCK 19 / LOT 10

A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.) NON-RESIDENTIAL

A5. Latitude/Longitude: Lat. 41.351160 Long. -71.964173 Horizontal Datum: ☐ NAD 1927 ☒ NAD 1983

A6. Attach at least 2 photographs of the building if the Certificate is being used to obtain flood insurance.

A7. Building Diagram Number 3

A8. For a building with a crawlspace or enclosure(s):

a) Square footage of crawlspace or enclosure(s) N/A sq ft

b) Number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade 0

c) Total net area of flood openings in A8.b N/A sq in

d) Engineered flood openings? ☐ Yes ☒ No

A9. For a building with an attached garage:

a) Square footage of attached garage 4105.00 sq ft

b) Number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade 0

c) Total net area of flood openings in A9.b N/A sq in

d) Engineered flood openings? ☐ Yes ☒ No

SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1. NFIP Community Name & Community Number	B2. County Name	B3. State
TOWN OF STONINGTON	NEW LONDON	Connecticut

B4. Map/Panel Number	B5. Suffix	B6. FIRM Index Date	B7. FIRM Panel Effective/ Revised Date	B8. Flood Zone(s)	B9. Base Flood Elevation(s) (Zone AO, use Base Flood Depth)
09011C0527	J	08-05-2013	08-05-2013	AE	11.0

B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in Item B9:
☐ FIS Profile ☒ FIRM ☐ Community Determined ☐ Other/Source:

B11. Indicate elevation datum used for BFE in Item B9: ☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source:

B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? ☐ Yes ☒ No
Designation Date: ☐ CBRS ☐ OPA

Figure 4. FEMA Elevation Certificate Excerpt.

Relation of Project to CIRCA Mission and Research

The mission of the Connecticut Institute for Resilience and Climate Adaptation is to increase the resilience and sustainability of vulnerable communities along Connecticut's coast and inland waterways to the growing impacts of climate change on the natural, built, and human environment. The critical facilities assessment directly contributes to this mission by encouraging municipalities to protect the provision of public services from existing and future threats, while providing them with specific guidance on risks and solutions. CIRCA's updated sea level rise projections were released after the project was completed; however, because floodplain elevation measurements were taken during site assessments and used for preparation of elevation certificates, SCCOG and its member municipalities can assess each site's vulnerability to future sea level rise by adding the projected 1 ft. 8 in. in sea level rise to the reported base flood elevation (BFE) to determine a future higher elevation to plan for. None of the coastal sites with first floors above current BFE will be below the future BFE with the projected sea level rise. CIRCA research also indicates that the frequency of 100-year floods occurring in southeastern Connecticut will occur 8x more frequently, from a 1% chance of flooding each year to an 8% chance (once every 12.5 years, on average).

Project Outcomes

Figure 5. Groton Long Point Police & Fire. First floor elevation 6.74 ft below BFE. Recommended for long-term relocation of services.

Figure 6. New London Fire HQ & EOC, Interior. First floor elevation and utilities 4 ft below BFE (behind flood wall). Recommended for floodproofing.

Flooding

To assess the risk from flooding, engineers visited the site to measure the elevations of the site relative to potential flood levels, including elevations of first floor (ground level), level of utilities, and any second level to which materials and services could potentially be relocated in a flood event. Utility rooms in the majority of sites (11 of 18) were below base flood elevation, the level at which the site can be expected to flood in a 100-year storm. Solutions for these sites include relocating utilities to upper levels, backflow prevention, and dry flood proofing (sealing the room against water). Utilities in basements should be relocated and the basements filled in.

First floors of buildings include garage spaces, which may suffer little from floods, and finished office spaces, which could be significantly damaged by floodwaters. First floor elevations in a majority of sites (11 of 18) are below BFE. Recommendations include dry flood proofing, wet flood proofing (modifications to allow for temporary flooding), and flood walls or berms to keep floodwaters out of the site. Summaries of conditions and recommendations for each of the sites are included in the September 29, 2017 presentation in the appendix to this report. Individual flood, wind, and snow assessments for each site are also included in the appendix.

The site assessments included recommendations for both short-term improvements to serve the site over the next 20 years, and long-term actions of value beyond 20 years. Several of the sites are situated in locations that will flood more and more frequently as climate change and sea level rise make storms more damaging and push flood zones further inland. Five of the facilities are recommended for eventual relocation to safer locations. These sites include Quiambaug Fire Department (Stonington), Groton Long Point Police and Fire (Groton), Quaker Hill Fire Company (Waterford), Yantic Fire Company (Norwich), and Occum Fire Department (Norwich). The Stonington and Groton facilities are located near the Long Island Sound coastline, while the Waterford and Norwich sites are adjacent to the Thames, Yantic, and Shetucket Rivers.

Recent projections prepared by CIRCA recommend planning for sea level rise of 1 ft. 8 in. by 2050. None of the coastal sites currently above BFE are projected to be below BFE given projected sea level rise, although the Town of Groton's Town Hall comes closest, with the first floor elevation a little over two feet above current BFE.

Flood-Related Cost Estimates

Flood mitigation project costs vary depending on:

- Building size (square footage of footprint, number of stories)
- Building construction material (wood-frame, masonry, brick, etc.)
- Foundation type (basement, crawlspace, slab-on-grade)
- Flood depth at the site (the higher the floodwaters, the more expensive the project)
- The local availability of resources and professionals (this will affect the cost of labor and materials)
- Other variables (including the costs of surveys, design work, permits, and maintenance)

These factors make it difficult to develop detailed cost estimates. Nevertheless, planning-level cost estimates for different alternatives can be developed using resources such as:

- FEMA P-348 (Protecting Building Utility Systems From Flood Damage)
- FEMA P-936 (Floodproofing Non-Residential Buildings)
- FEMA P-551 (Selecting Appropriate Mitigation Measures for Floodprone Structure)
- FEMA P-259 (Engineering Principles and Practices of Retrofitting Floodprone Residential Structures)
- FEMA P-1037 (Reducing Flood Risk to Residential Buildings That Cannot Be Elevated)
- New Haven Commercial Industrial Toolbox (2017)
- "Selecting Floodproofing Techniques - Financial Considerations" prepared by the Southern Tier Central Regional Planning and Development Board (STCRPDB)
- ClimateTechWiki (www.climatetechwiki.org, accessed 9/26/2017; authored by Matthew M. Linham and Robert J. Nicholls, School of Civil Engineering and the Environment, University of Southampton, UK.)
- Information gleaned from previous project experience
- Unit cost estimates are summarized below.

Note that the estimated costs of some of the recommendations may trigger the "Substantial Improvement" requirements. In such a case, the building being adapted may need to be brought into compliance with local floodplain regulations and ordinances. These requirements may increase the costs of, or sometimes preclude, the recommendations.

Measure	Description	Cost ($)	Unit	Additional Costs
Elevation	Raise structure so first floor is above the water surface elevation during a flood event.	**$29.00 to $96.00**	Per Square Foot	
Wet Floodproof	Building is retrofitted to allow flooding without being damaged.	**$2.20 to $17.00**	Per Square Foot	Flood openings for a building can cost $30 to $400 (each), or $5,000 to $10,000 (total)
Dry Floodproof	Building is retrofitted to withstand flooding.	**$5.50 to $16.80**	Per Linear Foot of Wall	$600 to 3,000 for drainage and check valves; $400 to 1,230 per door; $2 to $7 per sf for polished concrete floor; $400 to $1,100 per window for glass block
Elevate Electrical Systems	Elevate panels, meter, outlets, wiring	**$1,500 to $2,000**	Per 1,000 square foot building	
Eliminate Basement	Eliminate (fill in) basement after utilities are moved to higher levels.	**$50,000**	Per basement	Costs to move the utilities will depend on where they are moved
Anchor Tanks	Anchor a tank to prevent flotation	**$300 to $500**	Per tank	
Floodwalls	Walls built to protect against flooding. Control gates are open to allow access under normal conditions, and are closed during storms.	**$100.00 to $5,000.00**	Per Linear Foot	$5,000 interior drainage $2,000-$5,000 per opening in the wall

Figure 7. Estimated Costs of Flood Proofing Measures.

Snow & Wind

The risks to sites from wind and snow events were also assessed. In all cases, roofs were found to be adequate for normal snow loads, with a recommendation to formalize procedures for removal of heavy snow. Risks from wind damage were likewise fairly consistent across sites, with a few sites called out for the presence of materials that may become wind-borne. Long-term, site managers should consider upgrading roofs to 160 mph specifications when roofs are due for replacement.

Wind-Related Cost Estimates

Homeadvisor.com (some from FEMA)

Hurricane Shutters

Roll Down $20-$30/sf

Accordion $15-$25/sf

Colonial $200-$500 per window

Hurricane Glass

$1,000 per window or $40-$55/sf

NOAA

Hurricane Shutters

Roll Down $20-$35/sf

Accordion $15-$25/sf

Storm Panels $7-$15/sf

Lessons Learned

The primary lesson learned is that coastal southeastern Connecticut faces real threats to critical facilities from increased flooding and sea level rise, and that capital planning must address these threats over the coming decades. While a number of vulnerabilities may be addressed with measures costing less than $100,000 per site, others will require more intensive work, such as relocating utilities and filling basements. Some sites are untenable for long-term use providing necessary municipal services and must be relocated to safer locations. Sites such as police and fire stations must remain operational during storm events, so even temporary interruptions in service are unacceptable. In addition to building conditions, site access must also be maintained (a fire station cannot function if its bay doors must be kept closed to keep floodwaters out).

Ownership and responsibility of critical facilities is also complicated, in that some facilities are owned and operated by independent fire districts, not the municipalities they serve. Property points of contact for the 18 sites included First Selectmen, Police Chiefs, Fire Chiefs, public works directors, and Emergency Management Directors, some of whom lack specific facility management experience and some of whom serve on a volunteer basis. It was often difficult to reach site representatives by phone or email. Site representatives were generally cooperative and interested in the results of each assessment, while stating that funding will prevent implementation of recommendations in the near term. In one case, the visit from the engineer prompted identification of an easy plumbing fix that immediately reduced flooding events. While some site contacts accompanied the engineers during site visits and attended project meetings, others were not directly involved in the project except to allow site access.

The critical facilities study was conducted at the same time as the consultant prepared an update to the Multi-Jurisdictional Hazard Mitigation Plan. The synchronicity of work allowed for some efficient data sharing and for the results of the study to be incorporated in the Hazard Mitigation Plan.

For future risk assessment, a number of key questions should be asked to determine the best path to flood resilience:

A) Has the facility experienced a flood?

A critical facility that has experienced a flood is likely to experience another flood unless actions have already been taken to reduce the risk. A critical facility that has experienced a flood should employ some combination of methods to reduce the risk of damage from the next flood, and should be considering relocation in the long-term, unless the cause of flooding can be stopped.

Examples: Yantic Fire Company, Groton City Hall

B) Is the facility in the 1% annual chance flood zone (Special Flood Hazard Area) or the 0.2 annual chance flood zone?

FEMA often notes that a home in a Special Flood Hazard Area (SFHA) has a 25% chance of flooding during a 30-year mortgage. The same can be said of a critical facility in a SFHA—except that critical facilities are typically used far more than 30 years. A critical facility in a SFHA should employ some combination of methods to reduce the risk of flood damage. Connecticut's flood management statutes treat critical facilities similarly whether they are in a SFHA or the 0.2% annual chance flood zone. Therefore, a critical facility in a 0.2% annual chance

flood zone should also employ some combination of methods to reduce the risk of flood damage.

Examples: Stonington Borough Hall, Norwich Public Works

C) Is the facility's lowest floor below or above the base flood elevation?

Location in a flood zone is a key consideration but does not tell the whole story. If the lowest floor (basement, utility room, or first floor) is below the BFE, risk of costly damage is much higher than it would be if the lowest were above the BFE. Ideally, the lowest floor can be eliminated or converted to a floodable space and the principal uses can be moved higher.

Examples: Mystic Fire District, Occum Fire Department

D) Is the facility's lowest floor below or above the future high tide level?

When we speak of sea level rise, we understand that vast areas of land surface may not be inundated in our lifetimes. However, areas that are vertically within one to three feet of today's daily high-tide level will soon begin to flood once per year, then multiple times per month within a decade or two, and then eventually twice per day. Obviously, flooding of a couple times per month is unacceptable for a critical facility. If the lowest floor of a coastal critical facility is in the range of elevation 4 to 7 feet NAVD88, relocation is the best option.

Examples: Groton Long Point Police/Fire, Quiambaug Fire District

E) Are there any situations where a flood wall is advisable?

Flood walls can be effectively used to protect critical facilities when they do not interfere with access. For example, the Binghamton (New York) Hospital is protected from flooding with a high flood wall that contains numerous, automatically deployed gates at driveway and road openings. Fire station operations would be incompatible with closed gates; however, the area and layout of some critical facilities' lots are such that flood walls or berms may be effective methods at reducing risk. While we are careful to avoid over-prescribing the use of flood walls due to the false sense of security that can result, there are situations where these may be good options.

Examples: Groton Town Hall, Sprague Town Hall

F) What about other circumstances?

Is it possible to follow a "one size fits all" approach to choosing flood resilience options? *The answer is no*. Some critical facilities may be able to employ solutions that do not seem (at face value) to match the risk. For example, the

New London Fire Headquarters primarily needs to address stormwater in the short term despite its position in an area of significant residual coastal flood risk behind a flood protection system. On the other hand, the Quaker Hill Fire Company's building elevations do not seem to be too adverse until one considers the combination of risks (riverine and coastal) that will worsen over time. The bottom line is that an understanding of the cause of flood risks and facility elevations is necessary to make decisions, rather than simply stating "If X, then we must always do Y."

Examples: New London Fire Headquarters, Quaker Hill Fire Company

Next Steps

The risk assessment sheets for each site have been distributed to municipal Chief Elected Officials and to each site's primary representative. The information collected as part of the assessment will be valuable in the planning of capital investments and management of municipally owned facilities. Municipal officials should consider the following:

- What is the long-term viability of critical activities at the site, especially given the projected 1 foot 8 inch sea level rise by 2050 and 100-year level floods expected to occur 8x more frequently?
- What flood reduction strategies can be implemented given available and potential funding?
- How can planned capital improvements incorporate flood, wind, and snow protection components?
- Will the value of flood protection improvements trigger the FEMA's "substantial improvements" rule requiring elevation or relocation?
- Will state or federal funding for potential investments be made more difficult to obtain given the site's location in a flood plain?

The assessment information has been incorporated into the updated Multi-Jurisdictional Hazard Mitigation Plan and its municipal annexes. Additional work should be done at the local or regional level to assess facilities not included in this project, such as water treatment plants and pump stations and privately-owned facilities such as health centers and nursing homes.

Final Project Schedule & Budget Summary

The bulk of the work for this study took place between March and September of 2017. Consultant costs were $30,000, consuming the entirety of the grant. State of Connecticut Regional Services Grant funds supported SCCOG staff time for project management and outreach.

Task	Jun-16	July	August	September	October	November	December	January	February	March	April	May	June	July	August	Sep-17
Finalize Grant Agreement	x	x														
Refine Site List			x	x												
Develop/Release RFP & Negotiate consultant contract				x	x	x										
Outreach to Sites									x	x					x	
Kick-off meeting										x						
Site visits/data collection											x					
Write-up of findings												x	x	x		
Final Briefing																x

Appendices (available at www.seccog.org/publications)

A. Project FAQ
B. Milone & Macbroom September 29, 2017 Presentation to Site Representatives
C. Site Flood, Wind, and Snow Assessments and Site Visit Memos
D. Elevation Certificates available upon request