



BUOYANT CITY • HISTORIC DISTRICT RESILIENCY AND ADAPTATION GUIDELINES

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BUOYANT CITY

Miami Beach • March 2020

MIAMIBEACH

Prime Consultant: Architecture | Historic Preservation | Urban Planing



Coastal | Civil | Geotechnical Engineering | Hydrology & Geology | Project Costing

ARUP

Landscape Architeture | Water

dlandstudio architecture + landscape architecture pllc

Structural Engineering | Local





Historic District Resiliency & Adaptation Guidelines

Coastal | Civil Engineering | Local







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An important cultural value of the historic city rests precisely upon its ability to be in a constant evolution, where forms, space and uses are always adapting to replace obsolescence with functionality. This gives rises to the paradox – or perhaps the oxymoron – of the concept of preserving the ability to change.

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Gustavo F. Araoz, Preserving Heritage Places Under a New Paradigm

Collins Waterfront Study Area | Collins Avenue looking North



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Note: the authors have considered a wide range of factors in writing this report all, some or none of which may occur in combination or conjunction with each other in the foreseeable future. The following document represents the authors' views of possible or potential mitigating steps that may be taken in the event of sea level rise, storm events and King Tides in the denoted Study Areas; other scenarios and views should also be considered.

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Terms & Acronyms

100RC	<i>100 Resilient Cities</i> . Funded by The Rockefeller Foundation, 100RC (2013-2019) was dedicated to helping cities around the world, including Miami Beach, become more resilient to the challenges being faced in the 21st century.	Contributing/Non-Contributing	Buildings in Mia to the district's contributing'.
Act	Short form of The National Flood Insurance Act of 1968 and any amendments.	Crowl Space	Crowl and and
Base Flood	A flood having a 1% chance of being equaled or exceeded in any given year.	Crawi Space	They generally
BFE	Base Flood Elevation: The elevation shown on the Flood Insurance Rate Map that indicates the water surface elevation resulting from a flood that has a 1% chance of occurring in any given year. In coastal areas, BEEs are calculated	Date of Construction	The date that a the actual start
	using 4 components: 1) the storm surge stillwater elevation, 2) the amount of wave setup, 3) the wave height above the storm surge stillwater elevation, and (1) the wave runup above the storm surge stillwater elevation.	Dry Floodproofing	Dry floodproofin damage by red
Basement	Any area of a building, including any sunken room or sunken portion of a room, having its floor below ground level (subgrade) on all sides	Elevated Building	A building with ground level by
Blue Infrastructure	Water elements including oceans, rivers, canals, ponds, wetlands, floodplains, rainwater, acquifers and water treatment facilities.	FAR	Floor Area Rati size of the piec imposed on suc
САР	<i>Climate Action Plan.</i> A detailed and strategic framework for measuring, planning, and reducing greenhouse gas emissions and related climatic impacts.	FEMA	<i>Federal Emerg</i> which the Natic Department of
CLG	Certified Local Government. The CLG Program was enacted as part of the National Historic Preservation Act Amendments of 1980. The program links three levels of government federal, state and local into a preservation partnership for the identification, evaluation and protection of historic properties.	FFE	Finished Floor concrete floor s
СОА	<i>Certificate of Appropriateness</i> . A COA is required for work that would change the exterior appearance of a designated historic property in Miami Beach. This	FHBM	Flood Hazard E (FIRM).
	includes alterations, additions, new construction or demolition.	FIRM	Flood Insuranc the Federal Ins
CRO	Chief Resilience Officer. The new municipal position of CRO was created and funded by the Rockefeller Foundation as a major initiative of the 100RC. The CRO is tasked with preparing the given municipality for the environmental,		Hazard Areas a Post-FIRM Buil
	physical and economic impacts of sea level rise. Currently, Miami Beach, Miami- Dade County, Miami and the State of Florida all have CROs.	First Floor Construction	First floor consi in some cases
CRF	<i>City Resilience Framework.</i> The CRF describes the essential systems of a city in terms of four dimensions: Health & Wellbeing; Economy & Society; Infrastructure	Floodplain	A floodplain is a
СННА	& Environment; and Leadership & Strategy. Coastal High Hazard Areas. CHHAs are Special Flood Hazard Areas along	Floodplain Management	Corrective and emergency pre regulations.
	the coasts of the US that have additional hazards due to wind and wave action. These areas are identified on Flood Insurance Rate Maps as zones V, V1, V30 and VE.	Floodproofing	Protective mean above the base Floodproofing a
CRS	<i>Community Rating System</i> . A program under the National Flood Insurance Program that provides a flood insurance premium rate reduction based on a community's floodplain management activities.	Foundation Type	Foundation sys transferring loa
Compact	Short form of Southeast Florida Regional Climate Change Compact.		transfer loads c

ami Beach historic districts are generally qualified as 'contributing' sense of time and place and historic development, or 'non-

are the open areas between the earth and a first-floor structure. have solid foundation walls.

a building permit was issued in the City of Miami Beach, provided t of construction work was within 180 days of the permit date.

ing involves taking measures to lower the potential for flood ducing the frequency of floodwaters that enter a structure.

no basement that has its lowest elevated floor raised above y foundation walls, shear walls, posts, piers, pilings or columns.

tio. FAR is the ratio of a building's total gross floor area to the ce of land upon which it is built. The term can also refer to limits uch a ratio through zoning.

gency Management Agency. FEMA is the federal agency under onal Flood Insurance Program is administered; part of the U.S. Homeland Security.

Elevation. FFE refers to the top of a structural floor deck or slab.

Boundary Map. Another name for Flood Insurance Rate Map

ce Rate Map. FIRM is the official map of a community, on which surance Administration has delineated both the Special Flood and the risk premium zones applicable to the community. See *ilding* and *Pre-FIRM* Building

struction in Miami Beach is generally wood or concrete framed, or a concrete slab on grade.

any land area susceptible to being inundated by floodwaters.

I preventive measures for reducing flood damage, including eparedness plans, flood-control works and floodplain management

asures added to or incorporated in a building that is not elevated e flood elevation to prevent or minimize flood damage. See *Wet* and *Dry Floodproofing*.

stems, the lowest part of any construction, support a building by ads to the earth. In Miami Beach, shallow foundations are typically read footers below ground floor construction. Pile foundations deeply through cylindrical piles drilled or pounded into the earth.

Foundation Walls	Masonry walls, poured concrete walls or precast concrete walls, regardless of beight that extend above grade and support the weight of a building		response options
Freeboard	The additional height, usually expressed as a factor of safety in feet, above	King Tide	Unusually high tid processes. A King
	a flood level for purposes of floodplain management. Freeboard tends to compensate for unknown factors such as wave action, blockage of bridge or culvert openings and bydrological effect of urbanization of the watershed		usually occurs du Miami Beach.
	which could contribute to flood heights greater than the heights calculated for a selected frequency flood and floodway conditions.	LEED	Leadership in End building certificati
GIS	<i>Geographic Information System.</i> GIS is a system designed to capture, store, manipulate, analyze, manage and present geographical data.		and human health selection, sustain
Grade Elevation	The lowest or highest finished ground level that is immediately adjacent to the walls of the building.	LAG	Lowest Adjacent next to a building.
Gray Infrastructure	Constructed structures, typically concrete, including treatment facilities, sewer systems, stormwater systems or storage basins.	Lowest Floor	The lowest floor of An unfinished or f
GM&B	<i>Greater Miami and the Beaches</i> . The entity comprising Miami-Dade County, Miami Beach and Miami.		is built to code.
Green Infrastructure	A range of measures that use landscaping, plant or soil systems, permeable pavement or stormwater harvest and reuse; to store, infiltrate or	Masonry Walls	Walls constructed in and bound toge
	evapotranspirate stormwater and reduce flows to sewer systems or to surface waters.	MDPL	Miami Design Pre arts organization architectural, cultu
Historic Building	In Miami Beach, an historic building is one that is listed individually in the National Register of Historic places or preliminarily determined by the Secretary	Mixed Lee Duilding	surrounding areas
	Register; or Certified or preliminarily determined by the Secretary of the Interior	Mixea-Use Building	A building that ha
	as contributing to the historical significance of a registered historic district, or a district preliminarily determined by the Secretary of the Interior to qualify as a registered historic district; or Individually listed in a state inventory of historic	мннw	Mean Higher High tidal day observed
	places; or Individually listed on a local inventory of historic places.	MLW	Mean Low Water.
НРВ	Historic Preservation Board. The purpose of the City of Miami Beach HPB is to establish procedures adopted pursuant to the Historic Preservation Ordinance	MLLW	Mean Lower Low
	of the City of Miami Beach to organize its practices, procedure and business for the conduct of its hearings; for processing proposals for designation	MTL	<i>Mean Tide Level.</i> Low Water.
	applications for Certificates of Appropriateness and/or Certificates to Dig; and	Multifamily Building	A residential build
Increased Cost of Compliance	Coverage for expenses that a property owner must incur, above and beyond	NAVD	<i>North American V</i> 1992 by the Natio
	the cost to repair the physical damage the structure actually sustained from a flooding event, to comply with mitigation requirements of state or local floodplain management ordinances or laws. Acceptable mitigation measures are elevation, floodproofing, relocation, demolition or any combination thereof	NCD	Neighborhood Cc than a local histor
IPCC	Intergovernmental Panel on Climate Change. The IPCC is an intergovernmental body of the United Nations promoting an objective and scientific view of climate	NFIP	National Flood In: which flood-prone
	שמש מי היב מחונכת ואמוומרה דומוומנוווץ מו משובטוועל מות גטופרונוווט עופא מו מווומנפ		

change, its natural, political and economic impacts and risks and possible response options.

des caused by a mix of gravitational and hydrological ig Tide is the cause of nuisance, or 'sunny day' flooding and uring the months of September, October and November on

nergy and Environmental Design. LEED is an ecology-oriented tion program run by the U.S. Green Building Council (USGBC). In improving performance across five key areas of environmental th: energy efficiency, indoor environmental quality, materials mable site development and water savings.

Grade. LAG is the lowest point of the ground level immediately .

of the lowest enclosed area of a building, including a basement. flood resistant enclosure used for parking, building access or nsidered a building's lowest floor provided that such enclosure

d of individual components (brick, stone or concrete block) laid ether with mortar.

reservation League. MDPL is a not-for-profit preservation and a founded in 1976 which preserves, protects and promotes the tural, social and environmental integrity of Miami Beach and as.

as both residential and non-residential uses.

gh Water. The average of the higher high water height of each ed over the National Tidal Datum Epoch.

The average low tide observed in a day.

Water. The lowest tide observed in a day.

The average tide height between Mean High Water and Mean

ling that is not a condominium building.

Vertical Datum of 1988. The vertical control datum used since onal Geodetic Survey for vertical control in North America.

onservation District. A zoning district category more flexible ric district.

surance Program. The FEMA-administered program under e areas are identified and flood insurance is made available to e property in participating communities.

NGVD	<i>National Geodetic Vertical Datum of 1929.</i> The vertical control datum used by the National Geodetic Survey for vertical control in North America. It was superseded by NAVD in 1988.	Storm Surge	The abnormal rise height of the wate largest water threa
NHPA	<i>National Historic Preservation Act.</i> The 1966 act that established federal processes and institutions for historic preservation in the US.	Subgrade Crawl Space	A crawl space four 5 feet below the to lowest adjacent gr
Participating Community	A community for which FEMA has authorized the sale of flood insurance under the NFIP.	ULI	Urban Land Institu and land use expe
Post-FIRM Building	A building for which construction or substantial improvement occurred after December 31, 1974 or on or after the effective date of an initial FIRM, whichever is later.	USACE	United States Arm the Department of design and constru
Pre-FIRM Building	A building for which construction or substantial improvement occurred on or before December 31, 1974 or before the effective date of an initial FIRM.	Wet Floodproofing	Permanent or cont that prevent or pro
RCAP	Regional Climate Action Plan. RCAP is the Compact's guiding tool for coordinated climate action in Southern Florida to reduce greenhouse gas emissions and build climate resilience. The RCAP provides a set of recommendations, guidelines for implementation and shared best practices for local entities to act in congress with the regional agenda.		to a structure and
Raisability	A tool developed by the City of Miami Beach through the Miller Legg Building Raisability Report (2018).		
Residential Building	A non-commercial building designed for habitation by one or more families or a mixed-use building that qualifies as a single-family, 2-4 family or other residential building.		
Shear Walls	Walls used for structural support but not structurally joined or enclosed at the ends, except by breakaway walls. Shear walls are parallel or nearly parallel, to the flow of the water and can be used in any SFHA.		
SFHA	Special Flood Hazard Area. An area having special flood, mudflow or flood- related erosion hazards and shown on a Flood Hazard Boundary Map or a Flood Insurance Rate Map.		
SFRCCC	Southeast Florida Regional Climate Change Compact. The SFRCCC was executed by Broward, Miami-Dade, Monroe and Palm Beach Counties in January 2010 to coordinate climate mitigation and adaptation activities across county lines.		
SHPO	State Historic Preservation Officer. The SHPO is a state governmental function created in 1966 under the National Historic Preservation Act. Activities of the SHPO include surveying and recognizing historic properties, reviewing nominations for properties to be included in the National Register of Historic Places, reviewing undertakings for the impact on the properties as well as supporting federal organizations, state and local governments and the private sector in preservation activities.	Sources: City of Miami Beach Code of FEMA National Flood Insuran Rockefeller Foundation/100 R Southeast Florida Regional C	Ordinances: library.munic ce Program: https://www. esilient Cities: https://100 limate Change Compact:

e in seawater level during a tropical storm, measured as the er above the normal predicted tide. While this event poses the pat, it is infrequent and temporary.

Indation where the subgrade under-floor area is no more than op of the next-higher floor and no more than 2 feet below the rade on all sides.

tute. ULI is a global network of cross-disciplinary real estate erts.

ny Corps of Engineers. The USACE is a federal agency under of Defense that is one of the world's largest public engineering, ruction management agencies.

ntingent measures applied to a structure and/or its contents ovide resistance to damage from flooding by allowing er the structure. Wet floodproofing measures minimize damage I its contents from water that is allowed into a building.



Overview

- 1.1 Introduction
- 1.2 Study Areas
- 1.3 General Recommenda
- 1.4 A Vision

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Over the next 60 years, most buildings in the historic district study areas will need to be substantially rehabilitated/reconstructed to provide necessary resiliency to rising waters. How shall this be accomplished, and what type of city will result? Will these areas survive as historic districts?

This study argues that Miami Beach's vibrant historic districts should be preserved, must evolve to survive, and that preservation can be redeployed as a powerful adaptive tool; the City of Miami Beach must reconsider its preservation standards, and create mechanisms that will allow adaptive development. It should incentivize adaptive development, by allowing new layers of urban fabric to grow from within.

1.1 // INTRODUCTION

The City of Miami Beach holds thriving historic communities that together have forged a premier global tourist destination. At an average elevation of just under 4 feet NGVD (3.5 feet above sea level), however, this city of barrier islands surrounded by the sea is among the world's most vulnerable places. Miami Beach lives with cyclical flooding from rain events and King Tides, flooding that will only be exacerbated by the threat of sea level rise. The city also lives with the always-present possibility of hurricane storm surge. To complicate this picture, porous geological foundations limit protective and adaptive options. Further, the city's famous and vibrant urban neighborhoods, the effective heart of its identity and economy, are located in designated historic districts where preservation standards may limit resiliency options. Indeed, about 19.5 percent of properties located in Miami Beach sit within these historic districts,¹ yet the majority of them have their ground floors and/or basements sited below FEMA's current Base Flood Elevation (BFE), which predicts a 100 year flood event.

Cities around the globe threatened by sea level rise have multiple avenues of response, but the City of Miami Beach has already made the decision to stay and adapt. This decision is powerful and compelling; the raison d'etre and identity of Miami Beach are tied to its coastal location, and here a city with a dynamic and thriving culture has taken root. The physical environment, the architectural and urban gestalt that constitute its neighborhoods, are unique and attract people from around the world. Miami Beach is also just the type of community that should serve as a model in our current world predicament. Densely inhabited, walkable, bikeable; it has the seeds of a sustainable and resilient community. Although it may not be easy, Miami Beach should propel itself into its next iteration as it responds to rising seas. Even if waters were not rising, it would be prudent to better adapt the city's historic neighborhoods to their coastal location.

Although the City of Miami Beach has taken, and continues to take, significant action to combat sea-level rise, there have been few strategies to date that address resiliency in the city's many historic districts. Yet it is critical that the character and identity of these districts be preserved; these cultural resources not only inform the city's identity, they are in the public good, combining cultural heritage and economic development. As the Urban Land Institute recently noted, these resources are "major economic driver[s]...for the approximately 12 million people who visit Miami Beach proper each year."² Historic districts are the frontier of adaptation and resiliency that urgently must be engaged. The City must recommit to the continuity of these districts. And, in order to attempt preserve them under the national, state and city frameworks that guide preservation, it is critical that these architectural and historic districts not be delisted. It is critical that new preservation standards be developed that work proactively with the city's resiliency efforts.

This study considers distinct areas of the Flamingo Park and Collins Waterfront Historic Districts. Both study areas are located on the western flank of those districts, at the lowest elevation. Within these areas, the team took a typological approach to existing buildings, landscapes and streetscapes. A primary goal of this project is to better understand and effectively communicate the intersection and the delicate, even precarious relationship between resiliency practices and historic preservation. In

addition to illustrating practical steps and proposing new preservation/resiliency frameworks, Buoyant City attempts to paint a picture of how specific adaptation strategies might extend the vibrant culture and experience of the City of Miami Beach amidst the threat of rising water.

To create opportunities for the preservation of both its architecture and its culture, the City should develop adaptation processes that are flexible, and be open to new ways of thinking. These processes should be reflective, open to periodic reevaluation and frequent course corrections. In this spirit, the Buoyant City guidelines are intended to initiate a more complete understanding of the designated study areas in the face of sea level rise, and help to conceptualize the possibilities for retaining the city's unique qualities in the future.

- 1. Establish guidance for the City of Miami Beach, the Historic Preservation Board and City Planning Staff when making decisions about adaptations and changes to buildings in the Collins Waterfront and Flamingo Park districts. As a first step toward understanding the scope of change that will be required, the team sought to improve knowledge of real flooding conditions based on rain, tidal and storm surge events. Accordingly, water levels due to both cyclical and 100-year storm events were projected, using the guidance of the Southeast Florida Climate Change Compact and projecting forward 60 years (to 2080)³. Reviewing these projections, it appears that the City must anticipate much larger quantities of water than anticipated under FEMA's current Base Flood Elevation (BFE) in the study districts. This allowed for a reevaluation of the city's relationship with water and opened an exploration into potential solutions, including but not limited to onsite water retention and infiltration, increased permeable areas, raised structures and utilities, floodproofing and building retrofitting/ adaptation. This also conditioned the team's notion to both set a higher Design Flood Elevation (DFE) and to differentiate between cyclical and storm surge events (See Chapter 2.5, Quantifying Water - Recommendations).
- 2. Develop place-specific strategies that address the conditions found in the two study areas. In order to understand and document these conditions, the team explored the development history and current physical conditions found in these areas. These conditions are investigated in the form of a typological toolkit, which can be used as a working guide for some types of rehabilitation work (See Chapter 3 - Current Conditions). These world-famous districts have, unsurprisingly, local and particular urban conditions, including those noted in both National Register and local historic designation reports. The particular conditions suggest that the development of highly localized adaptive approaches will be necessary.
- 3. Identify best practices, nationally and internationally, combining resilience and historic preservation practices. The adaptation of Miami Beach historic districts will require new tools and strategies that are not currently part of the discourse in the city. Accordingly, the team assembled recent best practices in global resiliency planning. (See Chapter 4 – Best Practices).
- 4. Conceptualize adaptive project design in an historic preservation context. Among the resiliency

strategies the team explored, the concept of "Raise" is gaining acceptance nationally. However, Raise poses significant issues in the particular historic context of Miami Beach. The team was compelled to explore a second strategy, "Adapt in Place". Adapt in place builds on local traditions that have shaped the city to date. This section also identifies frameworks for future resilience in the historic districts of Miami Beach (See Chapter 5 – Resiliency Approaches & Strategies).

- Guidelines).
- individual challenges into a synchronized set of resilient design strategies.
- economic, cultural changes suggests that this is possible.

5. Suggest a toolkit for individual designers, property owners or developers considering responses to the issue of sea level rise. The final section of this report is a set of guidelines, meant to serve as a resource for future development. The team believes that the best way to organize this toolkit was using the typological framework developed in Chapter 3 of this study. (See Chapter 6 – Resiliency

6. The team understands this study as the first step in a dialogue among the City of Miami Beach, property owners, residents, developers, professionals and academics. As a community, this group must decide what is best, what is doable, and how to accomplish those objectives. At every step, this conversation will require a holistic approach, one that takes into consideration the many systems and people affected by water. In the city of Miami Beach, property owners and developers make independent decisions, governed by the Historic Preservation Board, while those in the public sector make different, sometimes conflicting decisions about stormwater management and road raising. These decisions implicate a myriad of networks, and future plans should integrate the diverse scales and layers of the city into an overall strategy that transcends public and private. As a recent Urban Land Institute report noted, "the challenge is to find a way to bring some order to the disparate interests to forge coordinated action, and [develop] strong leadership [that] will be needed to unite the different parties toward a cohesive vision."⁴ It is crucial to coordinate and consolidate these

7. Given the specific historical, geographical and demographic nature of Miami Beach, the team was in experimental territory with few relevant precedents to guide action. Nonetheless, from this lacuna, the City of Miami Beach has the opportunity to emerge as a global leader in resiliency, especially in the adaptation of historic buildings and urban historic districts. The city's adaptation can, itself, form a type of advocacy. Miami Beach's general culture of resiliency in the face of environmental, social,



ATLANTIC OCEAN

1.3 // GENERAL RECOMMENDATIONS

1.3.1 // CONTINUE TO PRESERVE

- Conserve the urban and architectural character of historic neighborhoods.
- Affirm the ongoing, organic and human character of its historic neighborhoods as fundamental to the city's identity.
- Engage conservancy of place, cultural identity and community as ۲ intrinsic values of preservation.
- Take a broad and flexible view of what cultural and built identity actually mean going forward.
- Challenge conventional thinking about preservation and develop local historic preservation priorities.

1.3.2 // RECONCILE PRESERVATION/ADAPTATION EFFORTS

- oriented codes and objectives.
- permitting.
- Grant the Historic Preservation Board increased authority over resiliency-based decisions.
- Advocate for changes to the Florida Building Code, the National
- larger preservation and resiliency goals.

· Reconcile historic preservation ordinances and practices with resiliency-

• Incorporate adaptation as a requirement in all preservation planning; integrate historic preservation concerns into all adaptation planning and

Electrical Code, FEMA's floodplain management guidelines and other national codes that emphasize the particular needs of Miami Beach.

• Authorize the City Building Official to interpret the application of these codes to historic properties in a manner that is consistent with the City's



1.3.3 // EMBRACE INCREMENTAL ADAPTATION

- Embrace an ongoing and dynamic process of learning, adjustment and implementation.
- Take immediate steps to emphasize adaptation and resilience in building/renovation projects.
- Adopt adaptation strategies that consider a mid- to long-term timeframe in order to instrumentalize investment.

1.3.4 // DESIGNATE EXPERIMENTAL ACTION AREAS

- Designate the study areas as Experimental Action Areas.
- Action Area.



• Prototype new codes and process mechanisms in these areas, and allow developers to explore adaptive redevelopment procedures.

• Adopt an integrated and consistent approach in each Experimental



1.3.5 // DEVELOP A VISION

- Adopt strategies that effectively govern future redevelopment in historic districts of Miami Beach.
- Explore adaptation strategies particular to each neighborhood, applying either the Adapt in Place or Raise option, but not both; and conceive of code revisions that support these models.
- Emphasize values already present in Miami Beach's urban and • preservation ecosystems, like respect for existing architecture, adaptive use, intensification of density and layering of new and old architecture. Emphasize the distinct urban paradigms of the city.
- Embrace the experimental nature of the current predicament.

1.3.6 // INCENTIVIZE ADAPTATION

- construction.
- Leverage the economic vibrancy of Miami Beach to encourage developers to build/adapt a new resilient layer of the city.
- incorporate future-proofing tactics.



· Incentivize adaptation of historic properties and districts over new

 Consider phased resiliency bonuses for adaptation projects that employ resiliency strategies, are brought up to current Building Code, and



1.3.7 // INTEGRATE PUBLIC SPACES & RIGHT OF WAYS INTO THE VISION

- Develop a plan for public infrastructure, right-of-ways and public places in historic districts that is consistent with the adaptive character of those districts.
- · Consider public areas from a three-dimensional point of view, understanding that the variable raising of public and private realms will challenge current understandings of the historic district.
- Anticipate the complex relationship that will develop as the adaptation of streets, sidewalks, yards and buildings is staged at different levels, creating a multi-level city.
- Consider ecological goals in its future infrastructure planning.
- Consider the capacity to serve as a national leader in using its public realm as a test-bed in resilient and multi-functional infrastructure.

1.3.8 // INTEGRATE LANDSCAPE INTO THE VISION

- historic buildings and districts.
- saltier volumes of water.
- Emphasize landscapes that tolerate or thrive with water.
- Consider the resilience of various species as a factor in future master plans.

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• Emphasize the power of landscape design to improve the resilience of

• Align the landscape standards for the city's historic districts toward an ecological approach, considering the performance of various species, the need for water storage and drainage and anticipated larger and

Certificate of Appropriateness reviews and in the development of future



1.3.9 // EMPHASIZE SOCIAL EQUITY

- · Affirm the already diminishing role of its historic districts as reservoirs of affordability and social equity.
- Develop active guidelines that support retaining the mix of income groups that characterize the city.
- Offer development incentives for low cost housing and microhousing, and should consider requirements to preserve some low and moderatecost housing in adapted properties that benefit from these incentives.

1.3.10 // CELEBRATE THE NARRATIVE OF ADAPTATION

- Beach.
- layer of Miami Beach's ongoing rich history.
- adapting city as an intentional part of its identity.
- Celebrate Miami Beach's creative identity and cultural industries through art and placemaking initiatives.
- resiliency efforts.



• Promote the city's evolving resilience as part of the story of Miami

• Emphasize that architectural changes to contributing buildings in order to enhance resilience should be legible and interpretable as a visible

 Collaborate with city residents, professionals and academic institutions in finding imaginative ways for Miami Beach to leverage its status as an

• Highlight the way historic preservation frameworks are departing from museum-city orientation and creating an identity-preserving focus to



1.4 // A VISION

Flamingo Park and Collins Waterfront Study Areas – A Vision

While the primary goal of this study is to provide tools for both property owners and the City of Miami Beach, it is also important to promote a vision that can initiate public discourse, serve as a baseline for further discussion and eventually direct the further development of those tools. The tools presented will, if applied absent a vision, create chaotic results; here, consistency of application is especially important because the areas under consideration are designated historic districts.

As suggested in *Chapter 1.3 - General Recommendations*, the City of Miami Beach should use the areas of this study, i.e. the Experimental Action Areas, to test the two major adaptation strategies proposed: Adapt in Place and Raise. It is important that the City adopts an integrated and consistent approach to each district, choosing either (but not both) of this team's proposed resiliency strategies for application.

In consideration of the character and resources of each district, the City should emphasize the Adapt in Place strategy in the residential portion of the Flamingo Park neighborhood, encouraging buildings to adapt internally and incrementally to water; and should emphasize the Raise strategy in the Collins Waterfront neighborhood, which can better support that approach.





Flamingo Park Study Area: Multifamily District | Recommendation: Adapt in Place Flamingo Park, with its tightly spaced and continuous urban fabric of intimate buildings, should be adapted in place. Reimagine Flamingo Park's multifamily district as a vibrant mixed-use area where buildings are preserved by adapting them in place. Ground floor spaces below Design Flood Elevation would be converted to light commercial uses (allowing dry- and wet-floodproofing), while new resilient residential floor areas would be developed above. Incentivized floor area bonuses would promote the development of smaller/affordable units. development of smaller/affordable units.



Flamingo Park Study Area: Residential District (Homes) | Recommendation: Adapt in Place or Raise Reimagine Flamingo Park's single-family home district as a mixed-use environmental area, where increased development can go hand-in-hand with the maintenance of significant open (and floodable) green space, retrofitted as green infrastructure. This scenario would allow the development of new limited-footprint houses, or housing, along the alleys, and promote the redevelopment of contributing low-lying homes into commercial uses (similar to what has already happened along Alton Road).



Flamingo Park Study Area: Residential District (Homes) | Recommendation: Adapt in Place or Raise Reimagine Flamingo Park's single-family home district as a mixed-use environmental area, where increased development can go hand-in-hand with the maintenance of significant open (and floodable) green space, retrofitted as green infrastructure. Allow the development of new limited-footprint houses, or housing, along the alleys, and promote the redevelopment of contributing low-lying homes converted to commercial uses (similar to what has already happened along Alton Road).



Collins Waterfront Study Area | Recommendation: Raise The narrow urban profile of the Collins Waterfront Study Area is poorly suited for Adapt in Place strategies. The long western flank of the area (Indian Creek Drive) is currently being raised by the City. Here, contributing buildings should be raised to protect them from higher water levels, and the proximity of possible wave action from both the Atlantic Ocean and Indian Creek. Green space should also be increased.



Quantifying Water

- 2.1 Introduction
- 2.2 Anticipated Water Lev
 - A. Sea Level Rise
 - B. Rain Events
 - C. King Tides
 - D. Storm Surge
- Water & Buildings 2.3
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It is a revolutionary reality the sea is rising. slowly now she is giving us time to adapt if we dare look at the future

Collins Wat

Excerpted from Sea-Rise, by John Englander @2015

A CEL DE TO



Investment to meet the future resiliency challenges of sea level rise, extreme rainfall events, King Tides and storm surges is likely to be significant. Policy regarding major adaptive rehabilitation projects should therefore take into account a mid- to long term-time horizon. For the purposes of this study, roughly 60 years seems appropriate.

2.1 // INTRODUCTION

The proximity of water and land is a defining feature of Miami Beach. It is also a primary factor in the vulnerability of the city. Preservation of these districts and their associated benefits requires an understanding of present and future flooding potential and associated damage predicted by the various frequency of storm events.

In order to understand possible future impacts of water on Miami Beach historic districts, the following four issues were examined: anticipated sea level rise; 10-year rainfall storm events; King Tides; and storm surge associated with hurricane events. Following the guidance of the South Florida Climate Change Compact, the impact for each was calculated on a timeline of 2040, 2060 and 2080. If significant sea level rise continues past 2080, alternate adaptation and resilience strategies may need to be considered. For the purpose of this study, we have projected future water activity based on the projections of the Compact. Applying the projections of the Compact, ongoing sea level rise combined with other water events will increase the frequency of flooding and volume of damage to the historical properties within the study areas.

Climate resilience is the capability of a community to minimize disruption and recover quickly after the occurrence of hazardous events such as hurricanes or coastal storms that cause extreme flooding. Major property damage or regular disruptions within a community will contribute to reduced property values and the loss of tax base.

The city should continue to explore the susceptibility of historical buildings to flooding during various frequency storm events and assess their long term damage potential. Damage predictions may serve as a measure for evaluating benefits of proposed resiliency guidelines and strategies. The city should consider the economic benefits of potential solutions by measuring the reduced frequency of damage of adapted buildings against the implementation cost and potential loss of neighborhood aesthetics.

2.2 // ANTICIPATED WATER LEVELS

A. Sea level rise

Global warming is contributing to the thermal expansion of seawater and the melting of land based ice sheets and glaciers, resulting in sea level rise. According to the US Global Change Research Program, mean sea level rose 6.3 to 8.3 inches between 1900 and 2016¹. More precise data measurements indicate an acceleration of 3.0 inches of mean sea level rise between 1993 and 2017. Predicting sea level rise is challenging due to the many factors influencing climate change.

Organizations researching climate change and its influence on sea level rise include the Intergovernmental Panel on Climate Change (IPCC), an intergovernmental body of the United Nations, the US Army Corps of Engineers (USACE), a federal agency associated with flood protection, and the National Oceanic and Atmospheric Administration (NOAA), an American scientific agency focused on oceans, waterways and the atmosphere.

In January 2009, Miami-Dade, Broward, Monroe and Palm Beach counties united to form the Southeast Florida Climate Change Compact (SFCCC or Compact) to coordinate climate change mitigation and adaptation activities. The Compact created a Regional Climate Action Plan to outline recommended mitigation and adaptation strategies, including a unified sea level rise projection for the region. Specifically, the Compact formed an ad-hoc working group, identified as the Sea Level Rise Work Group, to update the 2011 Unified Sea Level Rise Projection report. The updated report was drafted and released in 2015, after the National Oceanic and Atmospheric Administration (NOAA) et al. 2012 and US Army Corps of Engineers (USACE) 2013 projections were released. The 2015 projections of the Compact have been used for the purposes of this study.

The Compact utilized the updated projections throughout their 2015 report, and based their adaptation measures on the updated projections. According to the Compact, the 2015 projection update shifted the sea level rise projection start date to 1992, which is the "center of the current mean sea level National Tidal Datum Epoch of 1983-2001"². Within the 2015 Report, the Sea Level Rise Work Group recommended that the updated unified sea level rise projection include three curves: the NOAA High Projection, the USACE High Projection, and a projection corresponding to the median of the IPCC AR5 RCP8.5 scenario (Compact, 2015). These recommendations are summarized in the chart on the facing page.

Guidance is provided within the Regional Climate Action Plan regarding the recommended use of the curves and tables for planning of various municipal projects:

- The lower curve (blue dashed line) is recommended for use in the design of low risk projects with short design lives.
- The shaded zone (in blue, between the IPCC AR5 and the USACE High) is recommended to be applied for most projects, within a short term planning horizon. This zone is projected to reflect the most likely range of sea level rise for the remainder of the 21st century.
- The NOAA High curve (solid orange line) is recommended for projects with medium- to long-term applications, which are not easily replaceable or removable or have a long design life of more than 50 years.

This study has followed the Compact recommendations, using USACE high projections up to 50 years, and NOAA high curve numbers to be used for planning projects with design life of more than 50 years. As the adaptation of historic buildings in Miami Beach will likely require significant investment and imply a lifespan of more than 50 years, the team proposes the NOAA high curve projection for 2080 as a reference point for assessing alternatives and recommending code changes in the city's historic districts.

Coastal Systems International, October 2019



Unified Sea Level Rise Projection, Southeast Florida Regional Climate Change Compact, 2015 annotated

B. Rain events

Water Surface Elevation (Feet NGVD) NOAA 2012 High Curve Projections				
Rainfall Frequency	Present	(+) 20 YEAR	(+) 40 YEAR	(+) 60 YEAR
	2020	2040	2060	2080
Predicted Sea Level Rise	0	(+) 1.0 ft	(+) 2.3 ft	(+) 4.1 ft
1 YEAR	4.10	5.10	6.40	8.20
2 YEAR	4.30	5.30	6.60	8.40
5 YEAR	4.35	5.35	6.65	8.45
10 YEAR	4.50	5.50	6.80	8.60

Coastal Systems International

Intense rain events, where a large volume of water overwhelms an area in a short amount of time, is an important factor of flooding in Miami Beach. When stormwater does not have anywhere to flow when it reaches the ground, it accumulates and leads to flooding conditions. In undeveloped areas, a significant portion of stormwater infiltrates naturally into the soil when it reaches the ground, while the remainder flows by gravity over the surface to collect in low-lying areas — often wetlands, lakes and streams. In Miami Beach and other urban areas, draining of natural wetlands, the dense coverage of buildings and the use of impervious pavement has limited the ability for stormwater to be naturally removed from the surface. The city's low-lying elevations also make drainage a challenge, especially given the high groundwater table in Miami's porous limestone underneath the ground.

Climate change and a warming environment are likely to lead to more rainfall and stronger storms, putting further strain on drainage systems and other infrastructure. While there is significant variability in year-to-year rainfall, average rainfall has increased about 10% for the Southeast region of the United States during the last century, according to the Florida Climate Center at Florida State University. There has also been an increased frequency of rainfall events of two inches or more, indicating stronger storms. Rising tides and sea levels add additional challenges to draining stormwater as sewer systems can be inundated with tidal flooding that blocks and backs up into municipal stormwater outfalls.

Four Largest Storms Impacting Miami Region since 1880				
Hurricane	Category	Year	Storm Surge Elevation (feet)	Comments
Great Miami Hurricane	4	1926	+15.0	
Unnamed Hurricane	4	1888	+14.0	
Andrew	5	1 9 92	+11.8	North Portion - Biscayne Bay
			+10.0	Downtown Miami
			+17.0	Near point of landfall
Betsy	4	1965	+6.0	Impacted Miami Beach

Four largest storms impacting the Miami region since 1880. Coastal Systems International

C. King tides

King Tide Elevation (Feet NGVD)				
NOAA 2012 High Curve Projections				NOAA High Curve
	Starting Point	(+) 20 YEAR	(+) 40 YEAR	(+) 60 YEAR
	2020	2040	2060	2080
Predicted Sea Level Rise	0	(+) 1.2 ft	(+) 2.2 ft	(+) 3.5 ft
King Tides	3.8	5.0	6.0	8.4

Gravitational forces between the sun and moon cause ocean waters to rise and fall in cyclical tidal patterns. In Miami, there are several times a year when the tide is especially high — known as King Tides. A natural occurrence caused by the moon being closer to the Earth, this temporary phenomenon becomes even more extreme when coupled with permanent sea level rise induced by climate change.

Amplified tidal changes can cause coastal tidal flooding that is more frequent, more extreme and able to travel further inland. A storm is not needed for ocean waters to encroach inland either by overtopping unprotected coasts or backing up into drainage pipes and canals. So-called "sunny-day flooding" or "high tide flooding" is not just a nuisance, but can damage infrastructure, restrict transportation options, hurt commerce and destroy property.

Miami Beach has seen increased tidal flooding with the accelerated rate of localized sea level rise occurring in recent years. If sea level rise projections continue apace, the region could frequently see two flooding events in one day regardless of precipitation — one for each daily high tide.

Coastal Systems International

D. Storm surge

Storm Surge Elevation (Feet NGVD)				
NOAA 2012 High Curve Projections				NOAA High Curve
Storm Frequency	Starting Point	(+) 20 YEAR	(+) 40 YEAR	(+) 60 YEAR
	2003	2040	2060	2080
Predicted Sea Level Rise	0	(+) 1.3 ft	(+) 2.7 ft	(+) 4.6 ft
10 YEAR	8.1	9.4	10.8	12.7
20 YEAR	9.5	10.8	12.2	14.1
50 YEAR	10.8	12.1	13.5	15.4
100 YEAR	13.6	14.9	16.3	18.2
500 YEAR	17.7	19.0	20.4	22.3

Coastal Systems International

During major storm events such as hurricanes, seawater levels can rise abnormally higher than typical high tide marks. This rise in water levels, known as storm surge, is primarily caused by intense winds and by pressure changes of a storm pushing water onshore. Storm surges produce water levels beyond the normal waves that crash onto the coast. Taken together, the typical daily tidal increases and the storm surge account for the total storm tide seen during a hurricane or other major storm event. Hurricanes arriving at the same time as normal high tide cycles can make storm surge especially powerful and damaging.

Sea level rise due to climate change can make storm surge even more intense as the excess water present due to sea level rise is also able to be pushed on shore, inundating greater land area. With higher storm surge, even a low category hurricane can have a major impact, put residents at risk and damage property. Miami-Dade County locates Miami Beach in Zone B as it relates to storm surge planning, meaning that even a Category 2 storm poses significant risk for storm surge. It is important to note that a storm or hurricane does not need to make direct impact with an area for the effects of storm surge to be seen. The winds generated by a storm located miles offshore can still push water inland and upriver, as has been seen in historical hurricanes and tropical storms that have damaged Miami Beach and the surrounding region. Hurricane Irma generated nearly 2' of storm surge in the vicinity of Miami Beach when it struck Florida in 2017.



2.3 // WATER & BUILDINGS

Today



1.2' Sea Level Rise



2.2' Sea Level Rise



4.6' Sea Level Rise



(2080, according to the Southeast Florida Regional Climate Change Compact, 2015)

In order to preserve the historic character of the two districts, and in consideration of their low-lying landscape, the City of Miami Beach should consider a flexible standard of application of anticipated flood elevation. Adaptation of historic buildings should be divided into two categories: Resistance and Resilience. In order to preserve these historic districts, a combination of both resistance and resilience strategies will need to be implemented and a phased approach may need to be taken.

2.4 // MAPPING WATER

Depth to Groundwater and Geology

Flamingo Park & Collins Waterfront District

One of the challenging natural features of the Miami Beach area is the shallow depth to groundwater throughout the city. As shown in the map at right, in the Flamingo Park District the groundwater table lies primarily at most only four feet below the surface. As a result, sea level rise not only poses a threat from water encroaching inland from the shore, but also via elevated groundwater rising up from below. This shallow groundwater is due in part to the relatively low elevation of the land area compared to sea level. Additionally, the presence of porous limestone belowgrade allows water to percolate through the rock layers beneath Miami Beach. As sea levels rise, there is a greater likelihood of saltwater intrusion from the ocean into the freshwater aquifer beneath the city that also serves as a vital source of drinking water. A higher groundwater table also will mean less space available for infiltration of stormwater runoff into soil/rock that is already saturated.





Geology (Environmental), Florida Geographic Data Library, Scale 1:250000, Florida Department of Environmental Protection, Publication Date 2001, https://www.fgdl.org/metadataexplorer/full_metadata.jsp?docld=%7B43653D67-07B3-42E7-BA1E-BC732947DB83%7D&loggedIn=false (Referenced 6/24/2019)



Collins Waterfront Depth to Groundwater, South Florida Water Management District

Flood Risk Map | Current Conditions

Flamingo Park District

Shown on these maps at right are the current 100-year storm floodplain and storm surge risk zones as provided by the Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Maps (DFIRM) database. The flood maps were current as of October 2017 and show that both the Flamingo Park and Collins Waterfront Districts fall within areas subject to inundation by the 1-percent-annualchance flood event as determined by FEMA.



Collins Waterfront District



Flamingo Park 100-Year Flood 2017 DFIRM Map, FEMA and University of Florida GeoPlan Center

SLR High Tide Projections 2040 | 2060 | 2080

Flamingo Park District

The following maps illustrate the potential extent and depth of inundation from sea level rise projections in a given year. The darker shade of purple indicates a deeper level of inundation (higher water levels on land). These sea level rise estimates are based on Mean Higher High Water levels. The east coast typically sees two high tide events and two low tide events in a given day. MHHW levels refer to the average of the higher of the two high tides seen each day. In accordance with the Southeast Florida Climate Change Compact guidance, the maps were created using the sea level rise projections as follows:

2040: USACE HIGH (2013) 2060: USACE HIGH (2013) 2080: NOAA HIGH (2012) Data was gathered from GIS mapping information available from the University of Florida GeoPlan Center.







Flamingo Park 2060 USACE Sea Level Rise Projection (2013-High), USACE and University of Florida GeoPlan Center



1,800 Feet

> Flamingo Park 2080 NOAA Sea Level Rise Projection (2012-High), NOAA and University of Florida GeoPlan Center

SLR High Tide Projections 2040 | 2060 | 2080

Collins Waterfront District

The following maps illustrate the potential extents and depth of inundation from sea level rise projections in a given year. The darker shade of purple indicates a deeper level of inundation (higher water levels on land). These SLR estimates are based on Mean Higher High Water (MHHW) levels. The east coast typically sees two high tide events and two low tide events in a given day. MHHW levels refer to the average of the higher of the two high tides seen each day. In accordance with the Southeast Florida Climate Change Compact guidance, the maps were created using the sea level rise projections as follows: 2040: USACE HIGH (2013) 2060: USACE HIGH (2013) 2080: NOAA HIGH (2012) Data was gathered from GIS mapping information available from the University of Florida GeoPlan Center.







Collins Waterfront 2060 USACE Sea Level Rise Projection (2013-High), USACE and University of Florida GeoPlan Center



Collins Waterfront 2080 USACE Sea Level Rise Projection (2013-High), USACE and University of Florida GeoPlan Center

Stormwater Managment

Flamingo Park District

The Flamingo Park Historic District is approximately 355 acres in area with an existing stormwater management system that has been in place for many years. The storm sewer networks flow from the north towards the south along the alleys and Avenues; and from east towards the west along Streets. This stormwater system discharges into Biscayne Bay through approximately 14 outfall pipes, all of which are located along the western bulkheaded shoreline of Miami Beach. There are several stormwater pump stations along Alton Road that collect water runoff from these streets.

This system also includes approximately 203 drainage wells and an estimated 4,000 linear feet of exfiltration trenches. Drainage wells and exfiltration trenches are two types of stormwater management practices that provide pre-treatment and drainage for individual (or isolated) drainage basins. Drainage wells collect stormwater in perforated chambers and slowly release it to the surrounding soil. An exfiltration trench also collects water for release into the surrounding soil, but uses buried perforated pipes.



Collins Waterfront District

The Collins Waterfront District includes an area of 80 acres consisting of condominiums and hotels between Collins Avenue and Indian Creek Drive. The existing stormwater system consists of a collection of pipes and manholes (known as a network) that discharges into the Indian Creek Canal. Storm water from many of the streets flows west into this network, and discharges under Indian Drive into the Indian Creek Canal through 6 outfall pipes.

In general, as sea level rises, the capacity of the existing stormwater management system will diminish; stormwater management systems utilize the available dry soil above the aquifer to absorb the excess water, and an increase in water levels will decrease the natural drainage capacity of the area, resulting in more frequent flooding. Thus, future stormwater management systems will have to depend on pump-driven systems rather than gravity-driven systems.





Collins Waterfront Stormwater Management System, City of Miami Beach Map from COASTAL

Lidar Study Elevations

Flamingo Park & Collins Waterfront District

The maps at right show the existing road elevations of Miami Beach roads. The City plans to elevate selected low roads to 3.2 NAVD.





Collins Waterfront Elevations, City of Miami Beach LiDAR

Flamingo Park Elevations, City of Miami Beach LiDAR

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2.5 // RECOMMENDATIONS | WATER RELATED

2.5.1 // DESIGN FLOOD ELEVATION

Following projections from the South Florida Climate Change Compact (Compact) out to 2080, data suggests that water levels during cyclical and repetitive events like King Tides and rain events will exceed the current standard of BFE +1 (9.0 NGVD) in the Flamingo Park and Collins Waterfront historic districts. Tracking current data, King Tides may reach 7.9' NGVD and 10-year rain event flooding may reach 8.6' NGVD. The City of Miami Beach should re-examine the determination and application of Base Flood Elevation in order to promote and facilitate new development that pre-loads anticipated water conditions:

- Explore whether a more flexible standard for adapting historic properties is appropriate.
- Consider a new standard: Design Flood Elevation (DFE).
- Consider at what point the application of DFE to existing historic buildings is • counterproductive.
- Agree provisionally on a set of flood projections, either following the Compact or other projections. For the purpose of this study, 10.0 NGVD is used as a project DFE.

2.5.2 // RESISTANCE VS RESILIENCE

- NGVD.
- unreasonable amount of raising.
- second floor of most buildings at risk.
- 11.7' and 12.7' above current elevation. or more.

Resistance

- structures to the city's new DFE.
- ground floor, and at times altering ground floor use.

Resilience

- bouncing back as guickly as possible.
- withstand storm surge impacts.
- flood resistant materials in construction and finishes.

 By 2080, the Compact projects that water levels during a 100-year storm surge will exceed current standard of BFE +1 (9.0 NGVD) in the Flamingo Park and Collins Waterfront districts. Tracking this data, a 100-year storm surge may reach 18.1'

 Storm surge flooding raises complex issues, because raising ground floor levels and their underlying structure to meet these flood levels might imply an extraordinary and

• Preliminary indications show the current average ground floor elevation in Flamingo Park district at 6.5' NGVD and the current ground floor elevation in Collins Waterfront district at 5.5; using an average floor-to-floor elevation of 10', this would put even the

Adapting historic building by raising floors would imply raising floor levels between

 Adapted building structures should positively resist cyclical and frequent occurrence water events (King Tide, High Tide, Low Tide, rain events, etc.). This will involve either raising floor levels, or dry- or wet-floodproofing ground floors and their

This work may include reconstructing floor levels, changing the materiality of the

 Adapted buildings should be upgraded to be resilient to infrequent storm surges (100-year storm surge). This means taking the approach of accepting the water and

Resilience would involve upgrading the structure and shell of the building to

 It may involve wet-floodproofing buildings to anticipated storm surge levels (for instance by incorporating flood vents), material change in structure and the use of

Current Conditions

- Miami Beach Urban 3.1
- Miami Beach Historic 3.2
- Miami Beach Resilier 3.3
- 3.4 Miami Beach Building A. Distribution of Build B. Building Morpholog C. Individual Type De
- 3.5 Typical Building & Lai
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 - A. Flamingo Park Stu
 - **B.** Collins Waterfront



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Is Venice a precious heritage site to be preserved at all costs, or is the ecosystem of the lagoon too fragile to be disrupted in the interest of preserving a gaudy tourist amusement park? (Venice, of course, has been both of those things for at least the last three centuries.) The same tension guided internal discussions about adapting, or not, to contemporary infrastructural needs or desires... Myth can blind us to reality, but it can also move us to shape reality – and it can do both at the same time.

Excerpted from Eglin, John foreword to Venice in Environmental Peril? Myth and Reality, Dominic Standish. Lanham, Maryland: University Press of America, 2015

Collins Waterfront Study Area | Catwalk typology | 1038 11th Street, Miami Beach



3.1 // MIAMI BEACH URBAN FRAMEWORK

A primary characteristic of Miami Beach is its dynamism, its easy susceptibility to change and its constant evolution in urban terms. As it has transitioned organically from its original identity as a leisure suburb to the layered city it is today. Miami Beach has adapted new building types and has redefined its urban spaces. Its evolution is captured in the historic district designations that embed the layering of multiple iterations of the city, rather than casting any singular historical moment as significant. This eclectic approach is also captured in urban patterns that should be considered in conceiving resiliency policy. The study areas comprise not only the largest concentration of 1920s and 1930s-era resort architecture in the United States, but just as importantly human-scaled, urbanistically complex and coherent neighborhoods. The urban gualities of these neighborhoods, described below, should be preserved just as vigorously as the architecture.

Background

Like many American new towns of the Progressive era, Miami Beach was colonized as a speculative venture, and like many Florida cities it was invested with romantic gualities and a special emphasis on health, relaxation and leisure. Begun in 1912, the city was conceived as a leisure suburb extension to Greater Miami as well as a playground for wealthy northern industrialists. In order to build the city, its nearly aquatic terrain had to be cleared and elevated. Dredges and other specialized machinery were used in the first large-scale creation of fresh land in Florida. The mangrove jungles were shredded and filled in an industrial fashion, creating a man-made tabula rasa of bleached sand. Tropical flora and fauna extrinsic to South Florida were introduced onto the new land in a horticultural metamorphosis. The idealist transformation of the native environment into a romantic leisure suburb and city of grand hotels made possible the ideation of what developer Carl Fisher described as "America's Winter Playground."1

Miami Beach was soon influenced by the tremendous 20th-century expansion of wealth in America and advancements in transportation that made it a virtual resort satellite of industrial urban centers like New York City. By the 1930s the romance of a tropical vacation had been appropriated by the rising middle class. Between 1920 and 1942, hundreds of modest hotels and apartment buildings were built on the homesites of South Beach, an area of approximately one square mile at the southern tip of the peninsula of Miami Beach. Highly stylized and constructed in an intensely compact fashion, these 'ordinary' buildings produced coherent urban resort neighborhoods that replaced the once glamorous hotels as the symbol and icon of the city.

Many studies have highlighted the role of style in establishing a sense of place in South Beach, particularly the local streams of Art Deco, Modern, and Streamlining used extensively after 1935. Style was certainly significant to Miami Beach's hoteliers, as it was used as a wrapper to identify the public faces of residential buildings (conversely, the service alleys and the non-public facades remained informal and undecorated). Style was also used to create scenography and vistas as the backdrop to the almost theatrical experience of the city's tourists. Tourists were made actors in the public realm, whether sitting on dining porches, moving through lobby and patio spaces or promenading in the street. The recurrence of stylistic themes in the streetscapes of Miami Beach, whether modern, or the earlier vernacular wood traditions and Mediterranean Revival, was alternating and unsystematic, reflective of the city's piecemeal development. Most buildings incorporated style for visual effect, while in fact the building forms remained inherently tradition bound. Thus one must affirm that the extraordinary urban cohesion of South Beach's districts resulted from forces that transcended stylistic variations. In particular, this cohesion was a product of the configuration of its urban spaces, as determined by building typology and a clearly defined street hierarchy. Within the parameters of a zoning code that aimed at creating a suburban environment, apartment-hotels performed as infill buildings, responding to their restrictive context by using strategies that evolved empirically. These



Map, "Southern Half of the Town of Miami Beach," from Ocean Beach Realty Map, 1915. Courtesy HistoryMi





Excerpt from Miami Beach Nolli Map, (c) Shulman + Associates

strategies comprised the articulation of building masses to form public spaces and the relationship of buildings to spaces.

Miami Beach is an assemblage of distinct building types that define public and semi-public spaces in unique ways. Building placement is controlled by the reticular structure of the American grid, and modulated by the regularity of building forms-setbacks, height, width-which produced a unified streetscape of closely spaced buildings and tight urban spaces. The extremely tight proximity between buildings (typically 10 to 20 feet) makes well defined frontages along the avenues and streets of Miami Beach, but also the development of significant spaces between each other. The regular rhythms and thematic harmonies of these masses and spaces contribute to a feeling of overall aesthetic cohesion, congruity and accord.

This framework has allowed contingencies to develop naturally and chronologically. This landscape is inherently decentralized and flexible, allowing for multiplicities of meaning and form. The pattern of the street grid and the rules governing the relationship of buildings to the street are offset by the almost irrational, spontaneous and organic secondary spaces which develop on corners, between buildings and in courtyards. An informal network of semi-private spaces weaves through the district and around the buildings in a direction running from ocean to bay. The Miami Beach block is like a gridiron of passages permitting labyrinthine circulation. The proximity and horizontal continuity of facades integrates the whole.

Strategies of type usage reinforce the overall hierarchy of streets. Larger and more complex building types are found primarily on corner sites, while simpler bar-shaped types are more common on interior lots. Nevertheless, there is a random quality to the interrelationship of building types in South Beach. The combinations of type and the possibilities for complex urbanism are almost without limits. However, despite a lack of explicit coordination -- there were in fact few real controls in the first decades of its development - Flamingo Park and Collins Waterfront comprise some of the most typologically consistent districts in the United States.

Urban Assemblage – a typological approach

As early as 1914, the enhanced landscape of Miami Beach was the suburban setting for many small homes. During the 1920s, the character of the southernmost section, South Beach, began to shift from houses to apartments, and a new culture of housing began to appear. Small apartment-hotel buildings were built among the scattered homes of the area. These early multi-unit dwellings, providing modest hotel amenities for middle class tourists in the informal lifestyle of an apartment, adapted to the site constraints of single house lots: they were generally simple linear structures bisected by a single corridor providing access to rooms, and occupied most of the lot. In spite of the higher density, these units maintain the city's prescriptive suburban front and side yards. As the Mediterranean Revival style arrived with the Great Florida Land Boom in the 1920s, the character of South Beach began to shift from houses to apartments, and a new culture of housing began to appear. Miami Beach assumed new urban forms and characteristic spaces, especially the courtyard patio. More complex building configurations developed, such as C-, L-, and O-shaped forms. Courtyard spaces supplemented, but did not replace, the importance of the avenue-facing front vard.

In the 1930s, modern building types emerged, with access to units provided through wall-up stairwells or exterior catwalks. Yet in terms of building form, most buildings adopted preexistent massing configurations like single-bars, U-, L-, C- and O-shaped courtyard buildings. Their thinner massing and reduced circulation spaces transformed those types by allowing more open space. The green zones



From Ocean Beach Realty Map, 1915. Courtesy HistoryMiami



Hotels and Apartments at Miami Beach," from brochure "The Lure of Miami Beach Florida," 1928. Published by F.S. Benedict, official publication of the Miami Beach Chamber of Commerce, Courtesy HistoryMiami









Front yard of Miami Beach apartment building. Photo by Allan Shulman, 1998

between parallel rows of the older linear bars now expanded to form passage-like garden courts that bisected the traditional street structure of Miami Beach in a perpendicular fashion. The passageways formed an informal court toward which most units were oriented. This orientation improved the closeness and accessibility of each unit to open space. The quality of the passages emphasized their continuity with the street and their spatial qualities. In most locations the courts became virtual streets, continuous from the avenue to the alley.

They narrower building masses also allowed new types—such as J-shaped buildings, and double- or triple-bar buildings formed by the mirroring of single-bars, which maximized the potential to define the resulting passageways. Walk-up and catwalk types could thus be reorganized asymmetrically to face and activate one sideyard, providing a public entry frontage in the long direction. Modern building types most often generated primary and secondary sideyards, with the secondary sideyard devoted to services.

Tropical landscape was integrated carefully into the overall architectural expression. Planters were attached to the building, allowing the architecture to mold the landscape, or the landscape to serve as architectural ornament. Despite the emphasis on semi-private passageways and courtyards, the traditional front yard space and avenue-facing facade were strictly maintained and highly articulated with regard to the street. The front yard often included low walls or hedges that defined a small paved patio, providing screening and incremental privacy from the avenue.

Postwar continuation

The pattern of urban reinvention illustrated in the first 30 years of the city continued in patterns of boom and bust after World War II. Beginning in the late 1940s, modest motel-type apartment buildings using catwalk circulation systems evolved as an alternative to corridor and walk-up type apartment buildings. Unlike a true motel, these types included no parking, so they primarily emphasized the relationship with the garden. In effect, every unit opened to the sideyard garden or patio. Also, the recourse to pre-existing building forms – C, L, O, and J-shapes, reinforced a sense of continuity with previous building traditions. By the mid-1960s, architects developing buildings in Miami Beach had to contend with new parking requirements that were ill-suited to the small lots of the district. The resulting buildings, sometimes referred to as Dingbats, pushed building volumes up into the air over ground-floor parking lots; they nevertheless also maintained the intimate scale and syncopation of building masses along the streets, like previous building types. Like the motel-type catwalk building, these also assimilated the complex form-making strategies typical in the district, forming U's, C's, L's, and other shapes.

Postwar developments, including modest catwalk apartment buildings and dingbat-types, corresponded to the larger mid-century cultural trends (the ubiquity of the car and the related popularity of the motel-type, for instance), but also to the slowing and changing economy of the resort city. By the 1970s the district was in disrepair, and plans for its progressive demolition were well advanced. During this period, Miami Beach was functioning as a largely-low rent retirement city. The new, less glamorous use seems logical: the communal qualities of the buildings, especially the garden courts and passageways, were ideal for interdependent seniors; modest apartment sizes made agreeable retirement housing. Although this period saw little in the way of new development, it preserved the character of the districts intact. Moreover, it set the stage for historic preservation; even as early preservationists extolled the qualities of the districts' architecture and style, many admitted that the nascent movement was also about the preservation of its urbanism, and the way of life it embodied for its senior residents who admired its underlying design ideals. These years also illustrated the dynamic resilience of the districts in the face of demographic, economic and even environmental changes.



Sunrise Court Apartments, 720 Lenox Avenue, View showing entrance pylon and lighting pylons - Miami Beach Art Deco Historic District, Miami, Miami-Dade County, FL. Photo by Walter Smalling, Jr., 1980. HABS



559 Michigan Avenue, unknown



701 Fourteenth Street - Miami Beach Art Deco Historic District, Miami, Miami-Dade County, FL. Photo by Walter Smalling, Jr., 1980. HABS



Residents of Miami Beach, ca. 1978. Photo by Andy Sweet. Usage permission pending.

BUOYANT CITY 85

By the late 1970s, the unique architectural and urban significance of Miami Beach was brought to the public's attention through advocacy efforts of its citizens. Led by preservationist Barbara Baer Capitman, this group, which became known as the Miami Design Preservation League, achieved the critical success of having the district placed on the National Register of Historic Places in 1979 - the National Register's first twentieth century district. The National Register Designation was soon followed by several local historic designations that covered Flamingo Park and eventually extended to broad areas of the city, covering most of its multi-family and commercial areas.

The district designations, and their widespread recognition by the public and scholars alike, have in the intervening decades attracted an enormous influx of new tourists and residents, reviving a declining economy and setting off a new wave of development. The correspondence between district preservation, identification of neighborhood identity and economic advancement is a meta-theme in the contemporary development of Miami Beach, rendering preservation more than just a cultural force.

In the past few decades, new waves of development have been focused on the rehabilitation and adaptive use of historic properties, the development of empty lots and the replacement of noncontributing buildings within the city's multiple historic districts, which are carefully monitored by the City of Miami Beach Planning Department and Historic Preservation Board. Most extant buildings are preserved, new additions are held to standards of appropriateness to the original architecture; heights are controlled and rooftop additions proscribed in certain neighborhoods. New construction, while not following historic building types, is carefully crafted to exhibit continuity with surrounding context. The effect has been to codify existing building fabric while allowing new, adaptive layers to complement the mix. In this way, the contemporary shape of the city has been shaped not only by past traditions, but also by innovative new layers. Thus a complementary narrative in contemporary Miami Beach is openness to innovation, creativity.

Miami Beach's distinct building types are the building blocks of the city and its urbanism. These bring together the logic of vernacular traditions, successive architectural traditions and complex urban morphologies that respect Miami Beach's unique landscape, climate and culture. It has been the recourse, both intentional and organic, to established models that has given the city its cohesion. In Miami Beach, the interfusion of building types is independent of any comprehensive plan, thus achieving great complexity and inventiveness in an informal manner. The continuity and elasticity of these traditions is the most important legacy of the city, and as the city confronts issues of resilience to sea level rise, it will be important that the dual values of continuity and innovation be honored.



Catwalk type apartment building, Miami Beach. Photo by Allan Shulman



701 Fourteenth Street - Miami Beach Art Deco Historic District, Miami Miami-Dade County, FL. Photo by Walter Smalling, Jr., 1980. HABS





701 Fourteenth Street, Entrance Detail - Miami Beach Art Deco Historic District, Miami, Miami-Dade County, FL. Photo by Walter Smalling, Jr., 1980. HABS





Seventh Street and Lenox Avenue - Miami Beach Art Deco Historic District, Miami, Miami-Dade County, FL. Photo by Walter Smalling, Jr., 1980. HABS

3.2 // MIAMI BEACH HISTORIC PRESERVATION FRAMEWORK

Each historic property is unique. As such, there is no "one-size-fits-all" solution for adapting historic properties to sea level rise. There are, however, legal frameworks to support the maintenance of historic properties' character. These laws often mandate historical review processes aimed at encouraging the protection of irreplaceable historic characteristics.

National

The National Historic Preservation Act (NHPA) of 1966 mandates a review process aimed at encouraging the protection of historic characteristics of historic properties. This review process is established in Section 106 of the law, which requires federal agencies to account for the effects of their actions on historic properties. Any time a federal agency carries out, funds or approves an action (e.g., permitting, licensing or other approval mechanism), the agency must go through the Section 106 historic preservation review process. The Advisory Council on Historic Preservation lists the following steps in Title 36 of the Code of Federal Regulations (CFR), Part 800 as the Section 106 review steps:

Initiate Section 106 Process – This step begins with the determination by a federal agency of whether an action it is undertaking could impact historic properties. Historic properties can include properties on the National Register or those that meet the criteria for the National Register. If an undertaking affects a property that falls into either of these categories, the appropriate State Historic Preservation Officer (SHPO) or Tribal Historic Preservation Officer (THPO) must be consulted by the federal agency throughout the length of the process.

Assess Adverse Effects - An adverse effect is considered to exist if the proposed project may alter the characteristics that are integral to a property's inclusion on the National Register in a manner that diminishes the integrity of the property. Adverse effects may include physical destruction or damage; alterations inconsistent with the Secretary of Interior's Standards for the Treatment of Historic Properties; relocation of the property; change in the character of the property's use or setting; introduction of incompatible visual, atmospheric or audible elements; neglect and deterioration; or the transfer, lease, or sale of a historic property out of Federal control without adequate preservation restrictions.

The goal of the Section 106 review process is to encourage, but not mandate, preservation. If a project is proposed to adapt a historic property to the effects of sea level rise that involves any federal engagement, then the Section 106 process will be initiated. During this process, the mandated consultations with the SHPO or THPO may help historic property owners identify ways to mitigate and minimize any adverse effects.

State of Florida

The State of Florida has its own historic resources Statute, Chapter 267, that mirrors the National Historic Preservation Act, except that the Florida Statute requires review for state, as opposed to federal, undertakings. The Statute mandates a similar review process to that outlined in Section 106 for any State agency project that may adversely impact either a resource listed on the National Register of Historic Places or a historic resource that may be eligible for listing on the Register that is on State lands, receives State funding, or requires a permit from a State agency (see § 267.061(2), Fla. Stat., (2014)). The State agency must also provide the Division of Historic Resources with a reasonable opportunity to comment on a proposed undertaking. Similar to the Section 106 process, if there is an adverse effect on the character, form, integrity or other qualities which contribute to the historical, architectural or archaeological value of a property, then other feasible actions must be considered, in addition to steps to

avoid or mitigate the adverse effects (see § 267.061(2)(b), Fla. Stat., (2014)). If properties considered for adaptation to sea level rise are State-owned or if the project is even partially State-funded or requires a State-permit, then Chapter 267 will be triggered and the proposed actions will come under review by the Florida Division of Historic Resources.

As set forth Section 101b of the National Historic Preservation Act of 1966, a State Historic Preservation Officer (SHPO) is appointed to facilitate historic preservation in all US states and territories. The SHPO's role comprises federal responsibilities, including: conducting a comprehensive survey of historic properties; maintaining an inventory of historic properties; administering state programs of Federal assistance; identifying and nominating eligible properties to the National Historic Register; advising and assisting Federal, State and local governments in matters of historic preservation; preparing and implementing a statewide historic preservation plan; providing public information, education, training and technical assistance; working with local governments in the development of local historic preservation programs and helping them become "certified local governments"; and provide consultation for Federal undertakings under the Section 106 provision of the National Historic Preservation Act. In addition the SHPO's role comprises historic preservation efforts within state government, including: coordinating with tribal governments on historic preservation matters; maintaining and managing historic house museums and historic sites; coordinating state heritage tourism efforts; holding and enforcing historic preservation easements; managing State Rehabilitation Tax Credit programs; maintaining state granting programs; supporting Main Street communities and revitalization efforts; and providing consultation for State undertakings, similar to the Section 106 provision of the National Historic Preservation Act.

Miami Beach

In addition to Section 106 and Chapter 267, local preservation ordinances are also part of the legal framework that governs adaptation actions made to historic properties. Under the National Park Service (NPS) and Florida Division of Historic Resources Certified Local Government Program, Miami Beach is a Certified Local Government (CLG). All CLG's are required to have a preservation ordinance to obtain Certified Local Government program are automatically prioritized for funding allocations annually from the Division. All adaptation project managers are encouraged to consult with the local planning board and/or building department and historic preservation officer to determine the extent and applicability of local ordinances to the project(s). As a CLG, Miami Beach is responsible for managing historic districts, and acting responsibly according to federal and state laws.

Article X of the Miami Beach Code of Ordinances governs historic preservation practice in Miami Beach. Division 2, Sec. 118-531, of Article X establishes and governs the procedures for the Historic Preservation Board, which reviews "improvements upon public rights-of-way and easements located within a historic district and materially affecting any public right-of-way, public easement, building, structure, improvement, landscape feature, public interior or site individually designated".× In order to proceed, an applicant must receive a Certificate of Appropriateness (COA) from the City's Historic Preservation Board. As a standard in evaluating the compatibility of any physical alteration or improvement, the ordinance cites the Secretary of Interior's Standards for Rehabilitation.

The City of Miami Beach Planning Department includes an Urban Design & Historic Preservation Section, which "examines all site and building plans to confirm that physical changes proposed to an existing site or building are consistent with the surrounding aesthetic character of the community."

This Section also provides technical administrative support to the Design Review Board and the Historic Preservation Board. The Historic Preservation Section prepares reports on historically significant buildings and sites, and makes recommendations to the Historic Preservation Board on requests for Certificates of Appropriateness for demolition, rehabilitation, and Historic Designation.

The City of Miami Beach maintains a historic properties database. At the time of this report, the City counts 14 locally designated historic districts and 4 National Register districts, in addition to a number of individually designated buildings and sites. About 30% of all buildings and 25% of all land area are under historic preservation regulation in Miami Beach. In fact the impact is even greater, because the density of historic areas is greater.

Single family homes that are located in a historic district, or are individually designated, are eligible for an ad valorum tax exemption (regulated by Miami-Dade County). This is a local historic preservation tax incentive that can be combined with Historic Preservation Tax Credits (if eligible). All properties must be listed in the National Register of Historic Places, or a locally designated historic structure (designated by the County's historic preservation board or by a local municipality's preservation board) and must be about to undergo restoration and/or rehabilitation.

Article XI of the Miami Beach Code of Ordinances governs Neighborhood Conservation Districts (NCD). NCDs are a protective land use tool that provides criteria and a mechanism to be implemented when desired for the maintenance of neighborhood characteristics. It is an umbrella land use designation overlay that will allow for the tailoring of a master plan and/or design guidelines for any specifically defined area. This could serve as a potential alternative preservation and resilience tool in the event that a historic district does not qualify for the National Register. The four major intents of the NCD tool that support their use for preservation and offer potential adaptation opportunities for resilience are:

- 1. A neighborhood conservation district (NCD) is a protective land use tool that provides criteria and a mechanism to be implemented when desired for the maintenance of neighborhood characteristics. It is an umbrella land use designation overlay that will allow for the tailoring of a master plan and/or design guidelines for any specifically defined area that meets the criteria listed in Section 118-704, Qualification.
- 2. The master plan and/or design guidelines can, among other things, include additional overlay zoning, site, architectural and landscape guidelines, conservation and preservation strategies, streamlining of development review processes, community development strategies and incentive programs.
- 3. It is further intended that such districts and the regulations adopted for them shall be consistent with, and promote the policies set out in, the Miami Beach Comprehensive Plan and other officially adopted plans and regulations in accordance therewith.





3.3 // MIAMI BEACH RESILIENCE FRAMEWORK

The City of Miami Beach, perhaps more than any other city in the Southeastern US, has engaged planning and active initiatives to improve resilience. The city has joined global and regional networks and action groups; it has commissioned, and been the subject of, numerous reports and proposals; it has established committees; it has hired a Resiliency Coordinator; it has developed new means of sharing/ communicating information - in particular the Rising Above website; and more concretely, it has initiated its own strategic and master planning, passed new ordinances, and begun adapting infrastructure like roads and drainage systems.

Global and Regional Networks

Southeast Florida Regional Climate Change Compact (2010-)

In a desire to address resiliency issues regionally, in 2010 the South Florida Tri-County Region (Monroe, Miami Dade, Broward and Palm Beach) collaborated to form the Southeast Florida Regional Climate Change Compact ("Compact"). This bipartisan collective allows for a coordinated exploration of funding and policy change on both the national and local level. The current study is based upon the Unified Sea Level Rise Projection numbers generated by the Compact in 2015. To date, the Compact has not explicitly addressed Miami Beach's historic resources in relation to resiliency.

Greater Miami & the Beaches/100 Resilient Cities (2016-)

Comprising the City of Miami, the City of Miami Beach, and Miami-Dade County, the hybrid Greater Miami & the Beaches (GM&B) was similarly borne from a desire to address climate change threats collectively. In 2016, GM&B became part of the Rockefeller Foundation's global resilience-building network, 100 Resilient Cities (100RC) (2016-2019). 100RC focused on global urban resilience strategies. Developed by Arup, the City Resilience Framework (CRF) (2015) that underpinned the 100RC describes the essential systems of a city using four indicators: Health & Wellbeing: Economy & Society; Infrastructure & Environment; and Leadership & Strategy. A major component of 100RC was the mandate for the creation of Chief Resilience Officers (CROs), a position intended to spur change in city government operations. In Miami Beach, Susanne M. Torriente was named the CRO in 2016. As a result of the activities undertaken during RC100, GM&B published its comprehensive Resilient305 strategy in 2019 (see below).

Strategic Plans, Master Plans, Reports and Proposals

Resilient305 (2019-)

Resilient305 focuses on governance and how existing resiliency efforts will be implemented across metro Miami. The plan addresses key issues of urbanization, globalization and climate change with the goal of maintaining the economic vibrancy of the region. Conceptually, it also takes a broad look at challenges like the opioid epidemic and youth violence. The plan calls out 59 different actions across its key issues. Implementation will be led by a team called PIVOT (Progress, Innovation, and Vision for Our Tomorrow) comprising members from Miami-Dade County, the City of Miami, the City of Miami Beach and The Miami Foundation, as well as other local, county and national organizations like the Army Corps of Engineers, the Miami-Dade County Public School System, universities, nonprofit organizations and other public partners.

Rising Above (2018)

The City reinvented its 2005 Strategic Plan: Through the Lens of Resilience, calling the new plan Miami Beach Rising Above. Published in 2018 along with an eponymous website. Rising Above is a clearinghouse for information about the City's resiliency initiatives through the filters of Climate Science, Climate Adaptation and Climate Mitigation. The site is kept continually updated, making it a valuable resource.

Urban Land Institute Stormwater Management and Climate Adaptation Review (2018)

ULI Advisory Services was invited as part of 100 Resilient Cities to assess the City's current funded \$600 million stormwater management strategy. ULI hosted a workshop, led by ULI members from both the local ULI Southeast Florida/Caribbean District Council and the national Urban Resilience program, culminating in a report that was complimentary of the City's proactive, process-oriented program. At the ULI's suggestion, the City hired Jacobs Engineering as a consultant in 2018 to reconfigure the plan "with an eve toward more nature-based infrastructure."FN

Miami Beach Stormwater Management Master Plan (2011, updated 2017)

Funded by Greater Miami & the Beaches as part of the Resilient305 strategy, the City of Miami Beach's million stormwater management master plan by CDMSmith is being implemented. The City has started to raise roads and retrofit existing, or install new pumps and treatment systems to address more frequent flooding and subsequent water quality issues. It is upgrading its stormwater infrastructure to improve drainage with the use of tidal control valves and numerous pump stations. The City has also created a stormwater drainage system, separate from its sanitary sewer system, that is designed to minimize the effects of flooding by draining water during high tide events as well as rainfall. In addition to elevating roads and installing pumps, the city also raised the standard seawall height to 5.7 feet NAVD with an interim condition of 4.0 feet NAVD in consideration of existing structures .

Preliminary Resilient Assessment (PRA) (2017).

This assessment by Greater Miami & the Beaches (GM&B) reached out to businesses, residents and community organizations to outline resilience priorities.

Regional Climate Action Plan (RCAP) (2011/2014) & Miami Beach Climate Action Plan (CAP)

The RCAP was developed by the Compact in 2011 as a direct outcome of the baseline greenhouse gas emissions inventory with the intention of supporting the climate legislation championed at the time by elected officials. The goal of the RCAP is to reduce citywide emissions while adapting to the effects of climate change. It was revised in 2014 based on updated numbers from NOAA, USACE and IPCC. In 2015 sea level rise projection data was released. The City of Miami Beach is developing its own Climate Action Plan (CAP) based on the organization of the RCAP.

Property Resiliency Assessment and Structural Resiliency Assessment (both 2018)

Commissioned by the City of Miami Beach, these twin studies by Miller Legg Engineers and Youssef Hachem Consulting Engineers preceded the Resiliency Guidelines study. They gathered elevational data in the study areas of Flamingo Park and Collins Waterfront and extrapolated that data into an assessment of structural resiliency of the surveyed properties.

Resolutions, Ordinances and Policy Changes

The City of Miami Beach has translated resiliency thinking and planning into resolutions, ordinances and policy changes in a number of critical areas. These areas include its Comprehensive Plan and Land Use Ordinances.

Comprehensive Plan changes

AAA: The Miami Beach Comprehensive Plan designates the entire City as an Adaptation Action Area (AAA) containing one or more areas that experience coastal flooding due to extreme high tides and storm surge, and that are vulnerable to the related impacts of rising sea levels.

Future Land Use Element Policy 3.6 requires that the City "Maximize unpaved landscape to allow for more stormwater infiltration. Encourage planting of vegetation that is highly water absorbent, can withstand the marine environment, and the impacts of tropical storm winds. Encourage development measures that include innovative climate adaption and mitigation designs with creative co- benefits where possible.

Conservation/Coastal Zone Management Element Policy 2. 12 provides that "Salt tolerant landscaping and highly water-absorbent, native or Florida friendly plants shall continue to be given preference over other planting materials in the plant materials list used in the administration of the landscape section of the Land Development Regulations and the design review process; and

Conservation/ Coastal Zone Management Element Objective 13 provides policies to "Increase the City' s resiliency to the impacts of climate change and rising sea levels by developing and implementing adaptation strategies and measures in order to protect human life, natural systems and resources and adapt public infrastructure, services, and public and private property."

Ordinances:

Ordinance No. 2017-4123 - SEA LEVEL RISE AND RESILIENCY REVIEW CRITERIA instructs the City's land use boards to incorporate new resilience-focused criteria. As the City is facing an increase in flooding due to sea level rise, it is important that Land Use Boards incorporate criteria to address and plan for the effects of sea level rise and climate change. The ordinance amendment establishes Sea Level Rise and Resiliency Review Criteria within Chapter 133, entitled "Sustainability and Resiliency," of the Land Development Regulations. This criteria will facilitate the climate adaptation and mitigation discussion between the applicant and staff during the review process, and subsequently at land use board review.

Ordinance No. 2016-3993 - SUSTAINABILITY AND RESILIENCY/GREEN BUILDING provides sustainability requirements for new construction over a certain square footage. High performance sustainable building and development is a means of balancing economic development with the preservation of quality of life. This ordinance requires all new construction over 7,000 square feet or ground floor additions to existing buildings over 10,000 square feet to be LEED Gold Certified or Future Living Institute Living Building Challenge or Petals Certified. In order to achieve green building standards, the proposed ordinance requires the payment of a Sustainability Fee for eligible buildings prior to

obtaining a Temporary Certificate of Occupancy TCO), Certificate of Occupancy (CO), or Certificate of Completion (CC). This fee is set at five percent (5%) of the construction valuation. The proposed fee is based on research that indicates that this is the average cost of achieving LEED Gold Certification. The proposed ordinance then provides for refunds of the fee based upon the level of green building certification achieved.

Ordinance No. 2016-4009 – FREEBOARD amends definitions of base flood elevation, Crown of Road and Freeboard. The ordinance amended Chapter 54," Floods", by establishing a minimum and maximum freeboard above base flood elevation for all properties. It requires the ground floor of new buildings to be located a minimum of 1 foot and up to 5 feet above the FEMA base flood elevation or have enough headroom to raise the floor in the future without affecting the maximum permissible height of the building.

Ordinance No. 2016-4027 – PERIL OF FLOOD ensures that local CAPs regulate flood risk mitigation. In 2015, the Florida Legislature adopted Senate Bill 1094, entitled "Peril of Flood," which requires the Coastal Management elements of local government Comprehensive Plans to include regulations related to the mitigation and reduction of flood risks in coastal areas. Additionally, in 2011 the Florida Legislature passed the Community Planning Act (CPA), which amended Section 163.3177, Florida Statutes, which allows local governments the option of planning for coastal hazards and the potential impacts of sea level rise within the Comprehensive Plan. This provided local governments with the option of designating Adaptation Action Areas (AAA). The designation is for areas that experience coastal flooding and that are vulnerable to the related impacts of rising sea levels, with the purpose of prioritizing funding for infrastructure and adaptation planning. In order to improve the city's ability to mitigate the impacts of sea level rise and comply with Senate Bill 1094, the proposed amendment would affect future land use, infrastructure, conservation/coastal zone management, and intergovernmental coordination.

Ordinance No. 2017-4102 – SUSTAINABLE ROOFING allows for the use of various sustainable roofing systems. The ordinance amendment allows for the use of sustainable roofing systems for roof replacement such as solar roofs, blue roofs, cool roofs, green roofs, and other roofing systems that will reduce the heat island effect, allow reuse or retention of stormwater or reduce greenhouse gases to be used in the City. Additionally, it expands the use of energy efficient roofing systems, such as standing seam metal, and prohibits the use of asphalt shingles which typically absorb heat and increase the urban heat island effect and surrounding temperatures.

Ordinance No. 2017-4121 – RM-1 & RM-2 DEVELOPMENT REGULATIONS permits non-air-conditioned understory space located below minimum flood elevation, plus freeboard.

Ordinance No. 2017-4124 COMMERCIAL HEIGHT STANDARDS allows commercial buildings up to 5 feet of additional height where using maximum freeboard and allowing a minimum 12 foot floor-to-floor height. This ordinance amendment would allow for buildings in commercial districts to be developed up to an additional five (5) feet of height, provided that the first floor has a minimum of 12 feet from the base flood elevation (BFE) plus maximum freeboard, to the top of the second floor slab. This would provide for the ability of the ground floor to be placed at a lower level, while providing sufficient ceiling high for the ground floor to be raised when roadways or sidewalks are raised.

Ordinance No. 2017-4138 ALTERNATIVE PARKING REQUIREMENTS reduces parking requirements with an eye toward reducing both traffic and emissions. The city desires to further reduce the use of private vehicles for commuting in order to reduce congestion and greenhouse gas emissions. The

Transportation Master Plan and Comprehensive Plan incorporate a 2035 mode share vision which seeks to reduce commuting through private vehicles to 42 percent and increase the share of other modes respectively. The ordinance helps reduce vehicle parking requirements, provided tangible forms of alternative transportation, including bicycle facilities, are provided.

Ordinance No. 2016-4010 – GRADE ELEVATIONS AND HEIGHT establishes For this reason, the Base Flood Elevation (BFE) was established at 8.0 ft. NGVD (6.44 ft. NAVD) throughout the City.

Ordinance No. 2017-4118 – NON-CONFORMING BUILDINGS SUSTAINABILITY requires that certain buildings undergoing a substantial renovation, in excess of 50% of the value of the structure, be subject to the Sustainability and Resiliency Requirements of Chapter 133 of the City Code, including requiring a minimum of LEED Gold Certification, or the payment of a fee of five percent 5%) of construction value.

Committees and Panels

- Flood Task Force In 2013, in recognition of rising waters, the Miami Beach City Commission created the Flood Task Force Ad-Hoc Committee.
- Blue Ribbon Panel on Flooding and Sea Level Rise. In 2014, then-Mayor Philip Levine and the City Commission created the Blue Ribbon Panel on Flooding and Sea Level Rise. One initiative of the panel was the development of proposed code modifications as part of a project undertaken with AECOM: Enhancing Resiliency: Sea Level Rise Adaptation Strategies in 2016.
- Resiliency Communications Committee The Resiliency Communications Committee was formed in 2017 to educate the public about the NFIP.
- Sustainability Committee The Sustainability Committee guides and educates the public related to the City's sustainable initiatives.
- City Commission committees include the Sustainability and Resilience Committee (renamed from the Flood Mitigation Committee in 2015)



Flooded courtyard in Miami Beach. By B137 - Own work, CC0, https://commons.wikimedia.org/w/index.php?curid=52231418

3.4 // MIAMI BEACH BUILDING TYPOLOGY

Flamingo Park & Collins Waterfront Districts

The two historic districts from which the City designated the study areas comprise different building types. Flamingo Park is largely lowscale, including many single family homes of the Cottage or Urban Villa type. Collins Waterfront comprises both residential and commercial buildings and includes larger-scaled buildings.

















A. Distribution of Building Type



INSTITUTIONAL / COMMERCIAL / PARKING GARAGE

BACK BUILDING



Fib

N/A

B. Building Morphology Matrix

	MORPHOLOGY	COTTAGE	SINGLE BAR	L-BAR 2	L-BAR 3	C-BAR 1	C-BAR 2
TYPOLOGY							
CH COTTAGE / HOUSE		•	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
		•	\bigcirc	\bigcirc	\bigcirc	\bigcirc	\bigcirc
	TO PROPERTY	\bigcirc	•	\bigcirc	\bigcirc	•	\bigcirc
	OR	\bigcirc	•	\bigcirc	\bigcirc	\bigcirc	\bigcirc
		\bigcirc	٠	•	•	٠	•
C Catwalk		\bigcirc	•	\bigcirc	\bigcirc	•	•
		\bigcirc	٠	•	•	\bigcirc	•
		\bigcirc	٠	•	•	\bigcirc	
		\bigcirc	•	\bigcirc	\bigcirc	\bigcirc	٠





C. Individual type description

Сн) Cottage / House

Cottages are generally single-family homes, but in some cases have been adapted as apartment buildings or commercial structures (along Alton Road). In Miami Beach, cottages are generally based on bungalow plan types common in the early 20th century. In the higher-density historic districts of Miami Beach (including most parts of the two districts being studied here, Flamingo Park and Collins Waterfront), Cottages persist as a memory of the first layer of the city's foundation as a suburban enclave. On the west side of the Flamingo Park district, an intact pocket of Cottages, mostly still single-family homes, remains. Most Cottages date from early years of the city's development, 1910s-30s, although some postwar examples also are found. They are styled eclectically from Vernacular, Mission and Mediterranean Revival styles to Art Deco and other modernist languages. Similar to the surrounding district, stoops, pronounced door surrounds, built-in planters, and complex massing reflected in multiple stucco planes are common. They are also distinguished by their varied massing, porches and sunrooms, expressed chimneys, and features like wrought iron window grills and projecting eaves on wood brackets. Cottages generally require open circulation from the front and back of the building.









Flamingo Park

1. 1430 Michigan Ave; Architect: Henry Hohauser, 1939 | 2. 1330 Michigan Ave; Architect: Harold McNeil, 1940 | 3. 1426 Lenox Ave; Architect: David T. Ellis, 1940.







(uv) Urban Villa

Urban Villas are a type of low-density urban housing, reminiscent of early 20th century European urban models of Garden City heritage (popular in Rome, for instance). Configured to look like large homes, or villas, this type comprises a small number of apartment units (generally 2-4 units), either flats or 2-story maisonettes. These detached blocks may occupy the full buildable width of the lot, although some include a driveway, and they generally benefit from more green space, and/or parking than other typologies. The term may also refer to single-family cottages that have been adapted for multifamily housing purposes. Stylistically, Urban Villas follow a residential architectural vocabulary, including tile roofs, elaborated stoops and door surrounds, and often feature a more complex, asymmetrical massing. Urban villa type buildings generally require open circulation from the front and back of the building.





Flamingo Park

1. 1550 Michigan Ave; Architect: W. F. Brown, 1931 | 2. 1524 Euclid Ave; Architect: L. Avery, 1934 | 3. 222 36th St; Architect: A. Zink, 1929



(R) Rambler

Although the term "Rambler" is typically applied to ranch homes in the US in the postwar period, in Miami Beach it is used to describe long and low one-story apartment buildings of the same vintage. These Ramblers, which are elaborated horizontally, generally face the side lot line, and they are often used at end-block conditions, where they open to east-west streets. They are balanced between the expression of a home and an apartment building, and exhibit characteristics common to both. Units are generally identified by private stoops and door surrounds. Rambler type buildings generally require open circulation along both (long) sides of the building.



Collins Waterfront





1. 1121 8th Street; Architect: Henry Hohauser, 1941 | 2. 1605 Michigan Ave; Architect: Gerard Pitt, 1953 | 3. 700 Lenox Ave; Architect: V. H. Nellenbogen, 1936

(ic) Interior Corridor

Interior Corridor buildings are urban housing that was first introduced into Miami Beach in the 1910s, and most commonly built in the 1920s-30s. Part of the original urbanization of the beach, they are the archetype for housing in South Beach; they introduced high unit densities and a more urban architectural paradigm that included tall stuccoed frontages and elaborated balconies. In its simplest form, the deep rectangular bar-shaped structure features a central-corridor organization with apartments arrayed into the depth of the lot, facing sideways, and occupies the full buildable depth of a single 50-foot lot. Mostly three stories tall and featuring flat roofs, they are maintained freestanding by the provision of five-foot side setbacks. Larger buildings of this type are configured to frame courtyards, following the trend of the Garden Apartment movement. The front yard, observing the suburban setback requirement formerly applied to homes, is the main public focus of the building and maintains the primacy of the avenue as an urban space. In the Flamingo Park and Collins Waterfront districts, most are styled Masonry Vernacular or Mediterranean Revival, and characterized by stuccoed wall surfaces, flat or low-pitched terracotta and tile roofs, arches, scrolled or tile-capped parapet walls, articulated elaborate door surrounds and decorative grillwork. Interior corridor type buildings generally require open circulation from the front and back of the building.











1. 1502 Jefferson Ave; Builder: L. S. Parks, 1926 | 2. 1619 Lenox Ave; Architect: L. L. Wade, 1925 | 3. 230 31st St | Architect: Gordon E. Mayer, 1937

Walk-Up (WU)

Walk-up type apartments are low-density residential buildings based on the housing elements of the Zeilenbau (interwar German worker housing estates). They were introduced to the US and Miami through the active interwar discussion of urban housing issues in American architectural periodicals (writers and architects such as Catherine Bauer and Henry Wright), ignited by a national housing shortage and Roosevelt's reform programs. In Miami Beach, these mainly two-story buildings with flat roofs feature space-saving arrangements that eliminate lobbies and corridors. Instead, a limited number of units are served by a common entry stair; they feature two-room-deep units with multiple exposures. Most importantly, the transverse building thickness is reduced from forty feet to about thirty five feet, allowing enough space on a single lot for a side yard garden court in which each stair hall is identified by a stoop and articulated door surround. The formal articulation of the building mass in relationship to both the front and side yards defines an expanded public realm, made even more rich on double lots where more complex courtyards are developed. Many were built originally as 'apartment-hotels' to accommodate seasonal modest-income tourists. Walk-up type buildings generally require open circulation along both (long) sides of the building.





Collins Waterfront





1. 950 9th St; Architect N/A, 1940 | 2. 505 15th St; Architect: Anton Skislewicz, 1940 | 3. 1005 Meridian Ave; Architect: Gene E. Baylis, 1939







(ca) Catwalk

Catwalk, or gallery access, buildings are postwar Garden Apartment types that feature a continuous exterior terrace or catwalk linking all units. Drawing connections with the contemporary and highly popular 'motel', they are based on interwar German Laubengang models, such as at Dammerstock Colony in Karlsruhe, Germany by architect Walter Gropius. The mainly flat-roofed two stories buildings have floor-through apartment units that promote cross ventilation. On single lots, they are generally rectangular with the primary open galleries or catwalk facing a side yard court, offering a strong sense of community while providing ample space for greenery. Often, in lieu of the catwalk, ground floor units are equipped with their own stoop, planter or semi-private garden space. Part of the extraordinary artifice of these simple apartment buildings was their highly efficient, almost laconic decorative program that, although individualized, followed predictable norms. Exterior open stairs, treated decoratively with ornamental railings, are usually the most significant design feature, but most include stylizing devices relied on the subtle extenuation of the façade's inherent features, like projecting roof planes and balconies, window surrounds, supporting pylons. Ornamental concrete or metal screens, such as perforated breeze block, temper a sense of transparency promoted by the exterior galleries and open stairways. Catwalk type buildings generally require open circulation along both (long) sides of the building.















1. 1038 11th St; Architect: Samuel M. Puder, 1957 | 2. 1330 Michigan Ave; Architect: Harold McNeil, 1940 | 3. 4001 Indian Creek Dr; Lester Avery, 1954

(LR) Low-Rise Hotel

Low-rise hotels are a type of low or medium density resort accommodation found throughout Miami Beach. Generally three floors with a flat roof, they form rectangular blocks, sometimes configured around an internal patio, and feature a type of interior corridor arrangement of hotel rooms. The street-facing portion of the building includes a front terrace framed by railings and balusters, a modest lobby, and decorative treatment of the façade. Other semi-public rooms occupy the ground floor, and many buildings of this type also include a basement comprising support and service areas. Stylistically more complex than residential apartment models, most low-rise hotels follow Moderne or Art Deco styling, with smooth hard surfaced materials, rounded corners, corner windows, glass wall blocks, mirrored panels, ribbon or band windows with metal frames, signage, and string courses along the coping of the wall. Other characteristic building elements include projecting concrete eyebrows, porthole windows, and the spare use of decorative glass and metalwork that are motifs of the city itself. Low-rise hotels generally require open circulation from the front and rear of the building.





1. 3500 Collins Ave; Architect: Martin L. Hampton, 1928 | 2. 3900 Collins Ave; Architect: Albert Anis, 1939 | 3. 2925 Indian Creek Dr; Architect: Nadel and Nordin, 1936







(HR) High-Rise Hotel

High-rise hotels located west of Collins Avenue in the Collins Waterfront district generally comprise cubic volumes, poised in scale between the higher skyscraper-type hotels on the east side of Collins and low-rise hotels and residential buildings to the west. They include upper floors of hotel rooms over a raised ground floor dedicated mainly to public areas, like the lobby. As hotel amenities were historically related to room count, these larger hotels offer a larger suite of amenities. Fronting the street are raised terraces surrounded by decorative balusters or railings. In the Collins Waterfront district, most high-rise hotels feature Moderne and Art Deco styling; their broad facades are animated vertically, horizontally, or in some combination. Vertical accentuation is often provided by continuous pylons or pilasters that rise to the parapet, interwoven with recessed spandrel panels and windows. The vertical emphasis of such buildings sometimes surrounds a central totemic pylon, rising to signage, a cubic glass block lantern or abstracted heraldry at the building's top. Other buildings feature a more horizontal design, with flat planes offset by continuous eyebrows. High-rise hotels generally require open circulation from the front and rear of the building.





Collins Waterfront

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1. 3720 Collins Ave; Architect: Dean Parmalee, 1937 | 2. 4100 Collins Ave; Architect: Albert Anis, 1947 | 3. 4130 Collins Ave; Architect: Martin L. Hampton, 1936







D Dingbat

The Dingbat is a type of residential building featuring ground floor parking spaces below upper residential floors that flourished in Miami Beach in the mid-1960s. The genesis of this type in locally is generally attributed to zoning changes at that time that introduced a parking requirement for new residential units, however the type if found throughout the sunbelt, and was celebrated as a Los Angeles type by author Reyner Banham in Los Angeles: The Architecture of Four Ecologies. The ground floor parking area, featuring columns that support the building above, may also feature a modest lobby or community meeting space. In Miami Beach, Dingbats mainly rise 4-5 stories, and generally observe austere midcentury architectural styling. The sparse decoration found on this type is articulated by the railing systems that define balconies and catwalks.







1.1575 Euclid Ave; Architect: Raul V. Gonzalez, 1968 | 2.910 Jefferson Ave; Architect: Eugene R. Fortune, 1968 | 3.910 Jefferson Ave; Architect: Eugene R. Fortune, 1968



3.5 // TYPICAL BUILDING & LANDSCAPE ELEMENTS

Stoops

Stoops are raised platforms typical of residential architecture in Miami Beach. Functionally, they help transition from the raised first floor height of units to the ground level. Aesthetically they help define individual entranceways, and are part of the stylistic articulation of the entrance, which may also include decorative door surrounds, planters and metal railings and quarry tile paving. Stoops are character-defining elements of historic buildings and should be maintained, both in relation to the building entrances and in relation to ground-level walkways.















Terraces & Balconies

Terraces and balconies are projections from the simple volumetric enclosure of residential buildings, and are part of the building's engagement of the lot/landscape.. They serve an aesthetic as well as functional purpose, softening the box-like character of some residential buildings, while providing direct access from units to enjoy outdoor space. Articulation of terraces and balconies ranges from solid masonry and stucco, to breezeblock, brick or metal railing systems. Integrated into architectural treatment, they are character-defining elements of historic buildings and should be maintained, both in relation to the building opening and in relation to the ground.







1. 1300 Euclid Ave | 2. 1044 Pennsylvania Ave | 3. 1000 Meridian Ave | 4. 1220 Pennsylvania Ave | 5. 934 Meridian Ave | 6. 911 7th St Jefferson Ave







Front Yards

Front yards, which line the avenue frontages of the Flamingo Park district and parts of the Collins Waterfront district, are a remnant of the original role of the area as a suburban home district. They have persisted and evolved, often working in combination with semi-public passageways and courtyards. Many or most front yards were adapted long ago into urbanized social patios; some are paved in terrazzo, others in concrete. The front yard often includes low walls or hedges that provide screening and incremental privacy from the avenue. The provision of the front yard is a character-defining feature of Miami Beach, and these areas should either be maintained or reinterpreted.















Side Yards

Sideyards were prescribed by the first zoning ordinances of Miami Beach, and conceived to protect its original suburban character. These narrow spaces have evolved with the urbanization of the city, often expanding to form passage-like garden courts that bisect the traditional street structure, especially in the Flamingo Park district. Continuous from the avenue to the alley, most units and building entrances/ stoops are oriented towards these passageways. Often, continuity between street and sideyard court is emphasized by curving walls, steps in the building massing and wrap-around windows. The side yard forms an authentic local tradition that should be retained or re-interpreted.







1. 1606 Jefferson Ave | 2. 1520 Meridian Ave | 3. 720 Jefferson Ave | 4. 628 Jefferson Ave & 634 Jefferson Ave | 5.750 Lenox Ave | 6. 920 Meridian Ave & 934 Meridian Ave



Planters

Planters are built in or attached components of buildings that contain landscape features – generally tropical plants. Integrated into the overall expression of buildings, planters allow the architecture to mold the landscape, or the landscape to serve as architectural ornament. The integration is carefully organized with regard to spatial constraints, especially in side yard walkways. Planters are character-defining elements of historic buildings and should be maintained in relation to the building and the ground.















Utilities

As the primary connection point for water, sewer, gas and electrical service, as well as for trash collection and for deliveries, the utility façade of buildings in Miami Beach is an operative machine, a life support system for the building. As these facades do not contribute to the main public frontages in historic districts, and are utilitarian in function, they should be optimized for adaptation.







1.844 Jefferson Ave | 2.609 Lenox Ave | 3.808 Jefferson Ave | 4.1008 Jefferson Ave | 5.752 Meridian Ave | 6.750 Lenox Ave



6

Interior Corridor

Interior corridor buildings are urban housing that was first introduced into Miami Beach in the 1910s, and most commonly built in the 1920s-30s. Part of the original urbanization of the beach, they introduced high unit densities and a more urban architectural paradigm that included tall stuccoed frontages and elaborated balconies. In its simplest form, the deep rectangular bar-shaped structure features a central-corridor organization with apartments arrayed into the depth of the lot, facing sideways, and occupying the full buildable depth of a single 50-foot lot. Mostly 3 stories tall and featuring flat roofs, they are maintained freestanding by 5-foot side setbacks. Larger buildings of this type are configured to frame courtyards, following the trend of the Garden Apartment movement.







1 1205 Meridian Ave | 2. 3624 Collins Ave | 3. 760 Meridian Ave - Image Credit: www.realtor.com

Alley Frontages | Flamingo Park District

Combined with avenues and streets, alleys are tertiary but important roads that form the foundational urban network of Miami Beach. Alleys are generally used for utility connections, including water, sanitary sewer, gas and electric. Alleys are also used for trash collection and for deliveries. Their utilitarian function allows avenues and streets to remain largely unencumbered. However, alleys can be seen as narrow streets, with good urban qualities. Life along Miami Beach alleys is also supported by ancillary building functions, like laundry machines and ad hoc parking. In order to maintain the functionality of buildings, alleys should be maintained, but may acquire new meanings and qualities.







1.1439 Lenox Ave | 2.750 Lenox Ave | 3.1050 Jefferson Ave | 4.750 Lenox Ave | 5.750 Lenox ave | 6.1008 Jefferson ave



BUOYANT CITY 129

Front Hedge & Fence

The hedge is a ubiquitous feature across Miami Beach landscapes, notably for private single and multifamily residents and small hotels. Hedges tend to define the property lines, sometimes in association with boundary fencing.

The plantings used for the hedges vary, but common types include Pitch-Apple (Clusia rosea), Eugenia (Eugenia sp.), Cocoplum (Chrysobalanus icaco), Sea grape (Coccoloba uvifera), and button mangrove (Conocarpus erectus).













1. 2925 Indian Creek Dr | 2. Alley next to 915 8th St | 3. 1540 Pennsylvania Ave | 4. 600 15th St | 5. 1568 Pennsylvania Ave | 6. 1443 Lenox Ave

Tropical plantings

Tropical plants are any vegetation in tropical climate, which is a frost-free climate with only two seasons: a wet summer season and a relatively dry winter season. Miami Beach is located in a tropical monsoon climate, which is primarily classified by the temperature and the amount of rainfall. Average rainfall for Miami Beach is 66.5 inches per year.

Common tropical plants in Miami Beach include sea grape, banana trees, cycads, ficus, small palm trees, date palms and palm-like plantings, and epiphytes such as ferns, orchids and bromeliads.







1. 1040 Jefferson Ave | 2. 2727 Indian Creek Dr | 3. 27th St and Indian Creek Drive | 4. 737 11th St | 5. Miami Beach Boardwalk at 27th St | 6. Palm tree on Alton Road



Palm trees

Miami Beach's palm trees are located along the major boulevards such as Washington Avenue and along the east-west streets throughout the Flamingo Park and Collins Waterfront Historic Districts.

Although not native to Florida, the coconut palms were the original iconic Miami Beach palm tree but have been subject to lethal yellowing disease in recent years. The Royal palm (Roystonea sp.) is the more current iconic Miami Beach palm tree. Other palm trees include the Montgomery Palm, Parotis Palm, and Alexander Palm, among others.







1.901 7th St | 2.1043 8th St | 3. Espanola Way & Euclid Ave | 4. Flamingo Park | 5.279 16th St | 6.836 10th St | 7.1508 Pennsylvania Ave







Canopy shade trees

Miami Beach has a distinct pattern for street tree organization, with the palm trees along the eastwest streets and larger canopy shade trees along the north-south avenues, notably within the Flamingo Park Historic District. The Calophyllum trees along Meridian Ave are notably beautiful but sensitive to cold weather.







1. 1005 Meridian Ave | 2. 1325 Meridian Ave | 3. 829 15th St | 4. 1017 Meridian Ave | 5. 1415 Meridian Ave | 6. 11th St & Michigan Ave



BUOYANT CITY 133

Consistent Characteristics | Existing



Existing Condition | Small building footprint



Examples:





A. Planters









134





Existing Condition | Large Building Footprint







Examples:



3.6 // NEIGHBORHOOD CONTEXTS

A. FLAMINGO PARK STUDY AREA

Flamingo Park is located in Miami Beach from Lincoln Lane S to 6th Street between Alton Road and Meridian Avenue. Primarily a residential district, it is broken largely into two zoning areas: RM-1 and RS-4, although there are also small areas of CD-1, CD-2, and RO. The RS-4 zone is made up entirely of single family cottages/houses, although some of these (facing Alton Road) have been adaptively used as commercial buildings. The RM-1 zone contains a variety of multi-family residential typologies — including cottages/houses, urban villas, ramblers, walk-ups, catwalks, interior corridors, and dingbats. The initial suburban character of Flamingo Park as a district of cottages and homes is preserved in the continuous height and setbacks that make this an extremely coherent district. The aggregation of mainly 2-3 story structures, closely spaced, yields a garden-city type, low-rise yet urban fabric. The variation of mass and void on each lot creates unexpected pockets of space between adjacent typologies. The Flamingo Park district generally slopes from east to west, and the current project area occupies its lower,





Typical avenue section | Michigan Avenue



Typical street section | 8th Street



Typical street section | 11th Street



Typical alley section



Typical avenue section | Single family area | Lenox Avenue

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Typical street section | Single family area | 14th Street



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Typical alley section | Single family area



Public space



Private open space







PRIVATE OPEN SPACE

Flamingo Park District | Study Area Analytics

Contributing/Non-Contributing

Buildings in Miami Beach historic districts are generally qualified as 'contributing' to the district's sense of time and place and historic development, or 'non-contributing'. 70.6% of buildings in the Flamingo Park Study Area are contributing.

(Based on City of Miami Beach GIS information (transmitted 01/31/19, 03/22/19 and 04/22/19)

Year of Construction

Year of Construction generally refers to the year the building permit was issued. Building construction in Miami Beach follows cycles of boom and bust, and boom cycles often corelate to architectural style. The largest boom cycle in the Flamingo Park Study Area was the period between 1933-42, when 44.2% of buildings there were constructed.

Based on City of Miami Beach GIS information (transmitted 01/31/19, 03/22/19 and 04/22/19)

Finished Floor Elevation

Finished Floor Elevation (FFE) refers to the top of the structural floor deck, or concrete floor slab. Finished Floor Elevations vary from 3.6' to 16.1' NGVD, and average 6.5' NGVD in the Flamingo Park Study Area.

Based on Miller Legg Property Raisability Assessment (2018). Elevational data incomplete; projections based on extrapolation of existing data.



CONTRIBUTING (70.6%) NON-CONTRIBUTING (20.9%)

Contributing | Non Contributing



Date of Construction (*From Year 1920 to Year 2018)



Finished Floor Elevation | Ground floor (*From FFE 3.60ft to FFE 16.10ft)

Foundation Type

Foundation systems, the lowest part of any construction, support a building by transferring loads to the earth. In Miami Beach, shallow foundations are typically continuous spread footers below the ground floor construction. Pile foundations transfer loads deeply through long cylindrical piles drilled or pounded into the earth. 74.6% of buildings in the Flamingo Park Study Area are supported on shallow foundations. Current code requirements typically require pile foundations for most Miami Beach building types.

Based on YHCE Structural Resiliency Assessment 2018.

First Floor Construction

First floor construction in Miami Beach is generally wood or concrete framed, or may in some cases comprise a concrete slab on grade. Concrete is generally more resilient to flooding. 60.9% of buildings in the Flamingo Park Study Area are built using wood first floor construction.

Based on YHCE Structural Resiliency Assessment 2018.

Raisability

Raisability predicts the ability of a building to be successfully raised. 66.4% of buildings in the Flamingo Park Study Area have been projected to have a good possibility to be raised.

Based on YHCE Structural Resiliency Assessment 2018.







First Floor Construction



Raisability

Lowest Adjacent Grade (LAG)

is the lowest point of the ground level immediately next to a building (FEMA). Lowest Adjacent Grade in the Flamingo Park Study Area varies from 2.8' to 6.2' NGVD.

Based on Miller Legg Property Raisability Assessment (2018)

Building Height

Height of the building in floors. Most buildings in the Flamingo Park Study Area are between two and three stories high.

Based on City of Miami Beach GIS information (transmitted 01/31/19, 03/22/19 and 04/22/19)

Crawl Space Height

Crawl spaces are the open areas between the earth and the first-floor structure.

Based on YHCE Structural Resiliency Assessment 2018.

CYA



Lowest Adjacent Grade | NGVD (*From NGVD 2.80ft to NGVD 6.20ft)



Builing Heights | In stories



Crawl Space Height (*From 10in to 24in)

3.6 // NEIGHBORHOOD CONTEXTS

B. COLLINS WATERFRONT STUDY AREA

Collins Waterfront is located in Miami Beach from A1A to 26th Street between Indian Creek Drive and Collins Avenue. It is encompassed entirely within the RM-2 zoning district and is a more varied district comprising a mix of commercial, residential and hotel typologies. Developed as a resort district occupying a one block-wide isthmus between the Atlantic Ocean and Indian Creek, it comprises a mix of scales and intensities, including a number of more recent buildings.

The district's local historic designation is based on three categories: Association with events that have made a significant contribution to the history of Miami Beach, the county, state or nation; Association with the lives of Persons significant in our past history; and Embody the distinctive characteristics of an historical period.



Avenue section | Collins Avenue

Drive section | As renovated | Collins Avenue





Typical street | 28th Street



Public space

Private open space

COLLINS AVE INDIAN CREEK DR CROSS STREETS ALLEYS PUBLIC OPEN SPACE

PRIVATE OPEN SPACE





Flamingo Park District | Study Area Analytics

Contributing/Non-Contributing

Buildings in Miami Beach historic districts are generally qualified as 'contributing' to the district's sense of time and place and historic development, or 'non-contributing'. 67.4% of buildings in the Collins Waterfront Study Area are contributing.

Based on City of Miami Beach GIS information (transmitted 01/31/19, 03/22/19 and 04/22/19)

Year of Construction

Year of Construction generally refers to the year the building permit was issued. Building construction in Miami Beach follows cycles of boom and bust, and boom cycles often corelate to architectural style. The largest boom cycle in the Collins Waterfront Study Area was the period between 1933-42, when 32.6.2% of buildings there were constructed.

Based on City of Miami Beach GIS information (transmitted 01/31/19, 03/22/19 and 04/22/19)

Finished Floor Elevation

Finished Floor Elevation (FFE) refers to the top of the structural floor deck, or concrete floor slab. Finished Floor Elevations vary from 1.7' to 8.9' NGVD, and average 5.5' NGVD in the Collins Waterfront Study Area.

Based on Miller Legg Property Resiliency Assessment (2018). Elevational data incomplete; projections based on extrapolation of existing data.









Finished Floor Elevation | Ground floor (*From FFE 1.70ft to FFE 8.90ft)

Foundation Type

Foundation systems, the lowest part of any construction, support a building by transferring loads to the earth. In Miami Beach, shallow foundations are typically continuous spread footers below the ground floor construction. Pile foundations transfer loads deeply through long cylindrical piles drilled or pounded into the earth. 67.4% of buildings in the Collins Waterfront Study Area are supported on pile foundations. Current code requirements typically require pile foundations for most Miami Beach building types.

Based on YHCE Structural Resiliency Assessment 2018.

First Floor Construction

First floor construction in Miami Beach is generally wood or concrete framed, or may in some cases comprise a concrete slab on grade. Concrete is generally more resilient to flooding. 68.5% of buildings in the Collins Waterfront Study Area comprise concrete first floor construction.

Based on YHCE Structural Resiliency Assessment 2018.

Raisability

Raisability predicts the ability of a building to be successfully raised. 57.6% of buildings in the Collins Waterfront Study Area have been projected to have a good possibility to be raised.

Based on YHCE Structural Resiliency Assessment 2018.







First Floor Construction



Raisability

Lowest Adjacent Grade

Lowest Adjacent Grade (LAG) is the lowest point of the ground level immediately next to a building (FEMA). Lowest Adjacent Grade varies from 2.9' NGVD. to 5.5' NGVD in the Collins Waterfront Study Area.

Based on Miller Legg Property Resiliency Assessment (2018)

Building Height

Height of the building in floors. Most buildings in the Collins Park Study Area are between two and five stories high.

Based on City of Miami Beach GIS information (transmitted 01/31/19, 03/22/19 and 04/22/19)

Building Height

Height of the building in floors. Most buildings in the Collins Park Study Area are between two and five stories high.

Based on City of Miami Beach GIS information (transmitted 01/31/19, 03/22/19 and 04/22/19)



Lowest Adjacent Grade | NGVD (*From NGVD 2.90ft to NGVD 5.50ft)



Builing Heights | In stories



Crawl Space Height (*12in)

Best Practices

- 4.1 Adaptation of Historic Bo Venice, Italy Darlington, Wisconsin Newport, Rhode Island Boston, Massachusetts Los Angeles, California Seattle, Washington
- 4.2 Living with Water Waterbuurt, Amsterda Mekong Delta, Vietna Pointe Coupee Parish Amphibious House, U Tasinge Square, Cop
- 4.3 Raising of Historic Bu Chicago, Illinois Galveston, Texas Belhaven, North Caro Plano, Illinois Gulf Coast Region, M Highlands, New Jerse Charleston, South Ca
- 4.4 Landscape / Green In Hunter's Point Area, I Bishan Ang Mo Kio P Sponge Park, New Yo Portland Green Stree
- 4.5 Stormwater Management Mexico Beach, Florida Coral Gables, Florida NYCHA Hook Houses, New York Lessons from Hurricane Sandy, New York



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Collins Waterfront Study Area | Collins Avenue at 38th Street lo



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4.1 // ADAPTATION OF HISTORIC BUILDINGS & DISTRICTS

VENICE, ITALY

RECONCILING PRESERVATION WITH RESILIENCE

For centuries, Venetians have adapted to living with water by continuously elevating the city above flood level. They have done so "simply by building on top of other buildings, turning Venice into a kind of architectural layer cake."¹ Today, through the accelerating impacts of sea level rise, the city has become vulnerable to deterioration and damage. While the Italian government has gone to great lengths to create a mobile dam system, the Modulo Sperimentale Elettromeccanico (MOSE) barrier, the populace has stringently protested such innovative large-scale solutions. In Venice, more impactful strategies have often proven to be small-scale actions on the part of home and business owners. As of 2015, it was estimated that 42% of residential buildings and 36% of commercial buildings in the historic city center have taken measures to protect themselves from water.² These measures include the use of flood and saltwater resistant materials (like impermeable limestone), dry/wet floodproofing of the ground floor, use of temporary barriers and installation of pumps. These solutions work well in the short-term, as they have but gentle impact on Venice's historic buildings and can be implemented quickly. However, employing them in the absence of a larger plan can also be perceived as a retreat from modernity. Venice struggles with the contradictory activities of preserving rich heritage with effective resiliency planning.

Potential applications in Miami Beach:

- Change of use of the ground floor
- Wet/dry floodproofing
- Flood panels / barriers
- Waterproof / flood resistant materials
- Installation of small-scale pumps



Temporary Catwalk, Piazza San Marco | Photo Stefano Mazzola/Awakening/Getty from Taylor, Alan, "Acqua Alta, or Venice Underwater" theatlantic.com, 10/30/18

DARLINGTON, WISCONSIN, USA **BAISING INTERIOR FLOORS**

Flooding from the Pecatonica River is a near-constant problem in Darlington, Wisconsin. After a devastating flood in 1993, the town decided to act in order to save its Main Street Historic District. The primary challenge was mitigating future flooding while retaining the historic character of the district. To preserve the historic storefronts, commercial property owners took advantage of high ceiling heights and raised interior first floors to the Base Flood Elevation. The newly-raised first floors were dry floodproofed to BFE +2, basements were filled in, and utilities were raised. In some buildings, wet floodproofed vestibules were created behind existing façades to provide space for stairs to the newly-elevated floor, and preserve the storefronts' historic entrances and relationship with the street. During a flood event (when a flood shield is inserted at the top of the stairs) the vestibule acts as a sealed flood wall. In the District, historic buildings were brought up to code and innovative solutions were implemented, such as ADA ramps behind the buildings that could also act as floodwalls. For this work, the City of Darlington won a Preservation Achievement Award from the State Historical Society of Wisconsin in 1998. Yet, despite widespread recognition for its comprehensive flood hazard mitigation plan, as of October 2019 the city has seen 7 moderate flood events (defined as 15' or higher) since 2017, more floods than the previous 25 years combined.³

- Preservation of district character, streetscape, and relationship with the ground
- Wet floodproofing of areas below BFE
- Dry floodproofing of usable floor area above BFE
- Water / floodproof materials
- ADA compliant ramps as floodwalls
- Infill basements
- Raised utilities



Installing a vestibule | NFIP Floodplain Management Bulletin storic Structures, FEMA P-467-2, May 2008, p. 17



First floor is elevated behind storefront. | Langrehr, James. " 'It's becoming a bit discouraging:" Darlington dealing with 7th flood in two years'." 3 October 2019

74 BRIDGE STREET, NEWPORT, RHODE ISLAND, US

SHORT-TERM PROTECTION

Located in the flood-prone area of the historic Point Neighborhood of Newport, Rhode Island, 74 Bridge Street, or The Christopher Townsend House, dates back in part to the 1720s. The finished ground floor is only four feet above sea level and requires the use of a constantly running sump pump to drain a basement floor that is below groundwater level. Mechanical equipment including the building's water heater and furnace have been moved up to the first floor to prevent damage from rain and floodwaters. Sandbags and door barriers are temporarily deployed during flood events. The Newport Restoration Foundation (NRF) currently owns the property. Coordinated by the NRF, a two-day design charrette in January 2016 was held with design professionals, academics, city planners, and members of the community members. The building's development as case study for resiliency has been a collaboration among the NRF, Building Conservation Associates New England, Union Studio and Mohamad Farzan, RIBA, AIA. 4

Potential Applications in Miami Beach:

- Short-term solution to protect against infrequent flooding ٠
- Elevation of key utilities ٠
- Temporary barriers for floodproofing
- Pumps to drain interior spaces and protected areas ٠



BOSTON, MASSACHUSETTS, USA

TYPOLOGICAL APPROACH

In the US, Boston has been a leader in establishing a roadmap for a city to retrofit its historic districts. Boston employed several retrofitting strategies for existing historic and contemporary buildings, by typology, along the Boston waterfront. Each strategy meets FEMA and NFIP requirements for retrofitting existing buildings and offers design scenarios that help mitigate the unintended impacts of individual retrofits on a neighborhood's urban cohesion. Retrofitting of structures in the century-old floodplain often conflicted with the City's existing zoning codes: with its 2017 Retrofitting Plan, Boston posited that openness to regulatory change, and coordinated incentivization, are crucial to support effective resiliency planning. The result of a collaboration between the Boston Planning & Development Agency and the City of Boston, a draft of the Coastal Flood Resilience Design Guidelines was published in September 2019⁵.

- Typological approach to retrofitting
- Incentivization of retrofitting strategies ٠



Photo by David L. Ryan/Boston Globe via Getty Images. Usage permission pending



Boston typologies. From Retrofitting Boston Buildings for Flooding - Potential Strategies Report, 2019

LOS ANGELES, CALIFORNIA, USA

ACCRETIVE ADDITIONS

The City of Los Angeles developed and implemented an innovative adaptive reuse program in the city's downtown, originally approved in 1999. In 2003, the ordinance was approved for additional neighborhoods. The Adaptive Reuse Ordinance has become one of the most significant incentives related to historic preservation in Los Angeles, facilitating the conversion of dozens of historic and underutilized structures into new housing units. It provides an expedited approval process and ensures that older and historic buildings are not subjected to the same zoning and code requirements that apply to new construction. The result has been the creation of several thousand new housing units, with thousands more in the development pipeline, demonstrating that historic preservation can serve as a powerful engine for economic revitalization and the creation of new housing supply.⁶

Potential Applications in Miami Beach:

- Regulatory change to support resilience planning ٠
- Adapt-in-Place/accretive strategy



third floor was added on the two-story rear portion of a building. Photo: Chadd Gossmann, Aurora Photography, LLC.

The compatible addition is set back and does not compete with the historic building. Photo: Chadd Gossmann, Aurora Photography, LLC.

SEATTLE, WASHINGTON, US ACCRETIVE ADDITIONS

Seattle's Landmarks Preservation Board has approved the adaptive use of, and accretive additions to, historic properties throughout the city. One such example is the treatment of the 1950 Federal Reserve Bank, placed on the National Register of Historic places in 2013. In 2015, a local developer purchased the property and proposed an addition on top of the existing building. Ultimately, the Board's Architectural Review Committee approved seven stories of office space and felt like even with the addition the historic value of the existing building would be preserved.

Another Seattle national landmark, the Maritime Building, is a good example of the integration of old and new in a single building. The Maritime Building is a 1911 waterfront commercial building located in downtown Seattle, with unobstructed views of Elliot Bay. Shortly after listing the building on the National Register a proposal was approved to add three floors of new office on top of the building. A \$25 million renovation and rooftop addition was completed in 2018 and the building now serve as headquarters for a major software company.⁷

- Regulatory change to support resilience planning
- Adapt-in-Place/accretive strategy



The renovation of the century-old Maritime Building on the Seattle waterfront preserved the structure's historic while opening up the interior for modern use. Photo Turner ENRNorthwes



4.2 // LIVING WITH WATER

WATERBUURT, AMSTERDAM

FLOATING CITY

Like Rotterdam, Amsterdam is a global leader in water management. UNESCO recognizes the city's system of canals and locks in its Canal Ring and Defense Line on the World Heritage List. Dutch expertise in hydraulics, engineering, and urban planning is borne out in these still-intact systems. Many of the adjacent houses constructed in the 17th and 18th centuries are still standing.

Floating architecture, a contemporary approach to living with water, is becoming prevalent throughout the Netherlands, and there are several compelling examples in Amsterdam. Currently, this approach is being tested on a small scale, with floating houses (below, by architect Marlies Rohmer), multifamily apartments, offices and parks. A particularly innovative subset of academics and professionals are now discussing entire floating cities. The biggest challenge to the idea of floating architecture may be environmental regulations and barriers of zoning and building codes. In Amsterdam, however, local architects have discovered ways to include underwater infrastructure that restores natural habitat functions.¹

Potential Applications in Miami Beach:

٠ Innovative approach to living with water



Floating Houses, liburg, 2011

MEKONG DELTA. VIETNAM

AMPHIBIOUS HOMES FOR VULNERABLE POPULATIONS

This pilot project led by Dr. Elizabeth English, (associate professor at the University of Waterloo) involved the retrofit of four houses in the Mekong Delta of Vietnam. It was funded by a partnership between the Global Resilience Partnership (GRP) and Z Zurich Foundation of Zurich Insurance. This region in Vietnam is prone to flooding from annual monsoons, and in response, residents have typically chosen to elevate their homes on stilts to withstand the water. However, often times these buildings aren't raised high enough if these homes are raised too high, they can become unstable and unable to withstand the fast-moving currents of the monsoon floods. This project was able to retrofit amphibious foundations to buildings that already exist. The retrofitted structure consists of three parts: 1) buoyant blocks under the home that allow it to float; 2) guideposts that anchor the house and create a track for vertical movement; 3) a structural frame that attaches the house to the guideposts. At \$2,400 per home, the project was executed at a relatively low cost, and the new foundations were quick to implement, each taking 2-3 weeks to complete.²

- Retrofit existing buildings with amphibious foundations
- Flexible strategy that allows for changing levels of water and sea level rise
- Would need exception from FEMA, which requires that structure in flood-prone areas beadequately anchored to prevent flotation, collapse or lateral movement



Buoyant foundation homes in Vietnam, Photo: University of Waterloo



Elevated structure in Vietnan

POINTE COUPEE PARISH, LOUSIANA, USA

INCENTIVIZATION BUYOUT/ABANDONMENT

While the effectiveness of amphibious housing has also been explored in places like Great Britain, Bangladesh, and Taiwan, it has been slow to catch on in the United States. That is partially due to FEMA, which favors permanently elevated homes in flood zones. FEMA mandates that technology that relies on mechanical processes to provide flood protection is not equivalent to the same level of safe protection provided by permanent elevation. In Louisiana, a large-scale effort to incentivize building elevation was called the Restore Louisiana Buyout and Resilient Housing Incentive Program. Federal regulations prohibit Restore Louisiana – which is funded by the U.S. Dept. of Housing and Urban Development (HUD) – from repairing or reconstructing homes located inside a federally designated floodway. However, federal funds can be used for the voluntary buyout of eligible properties located in a floodway.³

Potential Applications in Miami Beach:

- City providing incentives for building elevation
- Flexible strategy that allows for changing levels of water and sea level rise
- Would need exception from FEMA, which requires that structure in flood-prone areas be adequately anchored to prevent flotation, collapse, or lateral movement



Courtesy KPF

AMPHIBIOUS HOUSE, UNITED KINGDOM FLOATING FOUNDATION

Located along the Thames in Buckinghamshire, this is the first constructed amphibious house in the United Kingdom. Like other amphibious architecture projects, this house is designed to float on guiding posts when water floods the site — up to 2.5 meters (well above the future flood levels for the area. However, unlike other comparable projects, where the building either permanently sits on the water or is raised a few feet on buoyancy blocks, this house provides an elegant solution by submerging the basement (and thus the buoyancy device) underground. This helps retain the house's relationship with the ground / street and doesn't create accessibility issues other than those that elevated homes typically experience. The garden is designed in a series of terraces that progressively flood and utilities are strung through flexible pipes that keep the building from becoming 'unplugged' as it floats.⁴

Potential Applications in Miami Beach:

- Flexible strategy
- Retain connection with the ground/street
- Create tethered, flexible utilities
- Utilize green infrastructure
- Retain accessibility in non-flood events











Buoyant House by Baca Architects (2016) Images courtesy Baca Architects

TASINGE SQUARE, COPENHAGEN

CLIMATE-ADAPTED PARK

Copenhagen has been experimenting with the concept of "climate resilient neighborhoods" and has also invested guite heavily in public infrastructure to manage excess water. In considering their public infrastructure, the city proposed several options:

Grey system option. Expand the city's existing subterranean sewer and drainage system. This would have meant doubling down on the 20th-century philosophy that a city can handle higher volumes of rainwater as it falls by burying more and larger pipes to handle the runoff.

Green-Blue system option. As an alternative to funneling all stormwater at once through underground pipes, this option re-thinks the management of water at the street level through a network of parks, cloudburst boulevards and retention zones.

Ultimately, Copenhagen opted for a Climate Adaptation Plan that relies almost exclusively on Green-Blue (technical solutions above-ground) options as they address challenges when there is water — but also provides value for the community when it is dry.

The city's first climate-adapted park, Tasinge Plads, is at the center of a neighborhood (Saint Kjelds) that is considered to be Copenhagen's first climate resilient neighborhood. The site was previously paved with asphalt and primarily used as a parking lot. Today it has hidden water management features that form a large part of the basis of the city's climate change plan.⁵

Potential Applications in Miami Beach:

- Flexible strategy that allows for changing levels of water and sea level rise
- Would need exception from FEMA, which requires that structure in flood-prone areas be ٠ adequately anchored to prevent flotation, collapse, or lateral movement



CHICAGO, ILLINOIS, USA **ELEVATION OF A DISTRICT**

In the 19th century, the city of Chicago was not higher than the shores of Lake Michigan. When the lake flooded, natural drainage of water was not possible. Poor living conditions followed, with contamination and water-logging frequently a source of diseases, dysentery among them. A cholera outbreak in 1854 led to the death of about 6 percent of the city's total population. This catastrophe prompted the city's engineers and city council members to seriously consider the drainage problem and its mitigation. In 1856 engineer Ellis S. Chesbrough proposed an extensive sewer system, a proposal that the city later adopted. This massive infrastructure project entailed the laying of drains, regrading and refinishing of roads and sidewalks, and raising a huge proportion of the city's buildings with hydraulic jacks.¹

Potential Applications in Miami Beach:

Collective Raise



Tasinge Square, St. Kjeld before. Photo Tredje Natur

Fasinge Square, St. Kjeld after. Photo Tredje Natur



Raising a block of buildings on Lake Street

GALVESTON, TEXAS **ELEVATION OF A DISTRICT**

Flood mitigation and retrofitting/adaptation is at the heart of the history of Galveston. Over a century ago, building elevation and building relocation was deployed en mass following the Great Storm of 1900. The City built a 3-mile-long seawall, raised the ground elevation of the whole city by 8 feet (17 feet at the seawall) and 2,000+ buildings were raised as high as 17 feet above their original foundation height. More than 16 million cubic yards of sand were dredged to raise the ground elevation to the underside of the raised buildings. Consistent efforts to preserve Galveston's built environment (including 1000+ residential and commercial historic buildings, 4 National Register Historic Districts and 2 National Historic Landmark Districts), in spite of periodic natural disasters, makes it one of the best examples of well preserved. historic cities in the country.

The local preservation organization, the Galveston Historical Foundation, has taken it upon themselves to be experts in historic building resilience and climate adaptation. One of the things they do is host annual symposiums and workshops related to mitigating flood damage for historic buildings and districts. Recently, they hosted a hands on workshop to test different building strategies to minimize flood vulnerability: reinforcement, flood-proofing, structural elevation, and amphibious architecture.

Potential Applications in Miami Beach:

Collective raise



Before and After: This house was elevated ten feet, and the owners constructed a new porch and fence. Source | Galveston County Museum, Galveston, Texas.

BELHAVEN, NORTH CAROLINA METICULOUS PLANNING

The Town of Belhaven, North Carolina, along the Pungo River, is subject to repeated flooding. In its last flood event, over 60 percent of the town's buildings were damaged, including most of the buildings in the National Register-listed Belhaven Historic District. In an effort to retain the town's historic and economic link to the waterfront, the decision was made to elevate the 379 buildings in place rather than relocate them to higher ground or demolish and rebuild them. With assistance from the North Carolina State Historic Preservation Officer, plans were developed for an elevation project that would best preserve the historic character of the district. In the plan, frame buildings were raised onto concrete block foundations faced with brick veneer. Brick buildings were elevated onto continuous concrete block foundations, which were also faced with brick veneer. A projecting brick course was used to demarcate where the original house ended and the new foundation began. Additional guidance was drafted for preserving porches, railings, balusters, and steps, and for replacing old materials with appropriate new materials where necessary. To prepare for the elevation project, large-format archival photographs were taken of each building that would be included in the project. These photographs provided a permanent record of the historic appearance of the district. Due to all these extra planning efforts for preserving its historic properties, the Belhaven Historic District was able to maintain its National Register status.⁴

- Retaining National Register District designation
- Building elevation on new legible base
- Preservation of accessory historic elements, like porches, railings and stoops
- Documentation of historic structures before resilience strategies are implemented
- Possible funding through FEMA's Hazard Mitigation Grant Program



Belhaven waterfrom

Frame Building elevated on concrete block foundation faced with brick venee

THE FARNSWORTH HOUSE, ILLINOIS

TECHNOLOGICAL SOLUTIONS

The early modernist Farnsworth House in Plano, Illinois designed by Mies Van Der Rohe was built in 1951 adjacent to the Fox River. The property and home have seen intense river flooding, leading the National Trust for Historic Preservation to explore flood-protection options for the site, including relocating the house off-site to higher ground. Instead, a hydraulic lift designed by Silman Engineers is currently being implemented. It will allow the home to be temporarily raised in place only as needed during a flood event. 6

Potential Applications in Miami Beach:

• Flexible building raise



Elevation showing main level raised while lower terrace remains and is allowed to flood (RSA, 2014)



Schematic elevation of existing structure (RSA, 2014)

GULF COAST REGION, MISSISSIPPI BUILDING RAISE GUIDELINES

The Elevation Design Guidelines for Historic Homes in the Mississippi Gulf Coast Region specifically mentions an important intention of providing elevation guidelines: "to limit the total height of elevation for historic buildings so they maintain their historic character in relation to other historic buildings within each local historic district, thus protecting the architectural qualities of each historic district as a whole." 6

- Retaining National Register District designation
- Building elevation on new legible base
- Preservation of accessory historic elements, like porches, railings and stoops
- Documentation of historic structures before resilience strategies are implemented
- Possible funding through FEMA's Hazard Mitigation Grant Program



Severe flooding in New Orleans

HIGHLANDS, NEW JERSEY COLLECTIVE RAISE

Just outside of New York City, Highlands, New Jersey experienced damage to over 80 percent of its homes during Hurricane Sandy in 2012. City government decided to raise historic buildings in tandem. The challenge to rebuild various areas of New Jersey after Sandy was a complex one, involving urban density, property values, lifestyles, employment disruption and significant tourism revenues, weighed against the risk and costs of similar severe weather events in the future. In addition, local development in Highlands is governed by a dense network of plans and regulations: municipal zoning and master plans; the state's environmental regulations, including those dedicated to water resources and to guiding coastal development; and the ways in which the city had directed investments in water, transportation and power infrastructure. The collective raise approach was ultimately not implemented in New Jersey.⁷

Potential Applications in Miami Beach:

- Coastal location
- Coastal Resilience Plan
- Collective raise approach



A view of Barbarie Avenue in Highlands



Highlands flooding during hurricane Sandy

CHARLESTON, SOUTH CAROLINA **TECHNOLOGICAL SOLUTIONS**

The City of Charleston has been exploring options to raise and adapt their historic structures that are most vulnerable to sea level rise and storm surge during hurricane season and King Tides. The Board of Architectural Review (BAR) has taken on the task of leading the effort to develop building elevation guidelines for Charleston's historic districts and buildings. One of the options that the guidelines consider and allow for is elevating internal floors within a building, particularly feasible and recommended in historic commercial structures with tall ceilings.8

- Coastal location
- Coastal Resilience Plan
- Raising internal floor heights



House at 42 Rutledge being raised, Charleston

4.4 // LANDSCAPE & GREEN INFRASTRUCTURE

HUNTER'S POINT SOUTH WATERFRONT PARK, NEW YORK, USA **GREEN INFRASTRUCTURE**

As part of a larger redevelopment of the Hunter's Point area in Long Island City, New York, an 11-acre riverfront park was created in two phases. Providing playgrounds, basketball courts, river overlooks, playing fields, beaches, and passive public spaces, the park was designed to account for future flood patterns of the adjacent East River. The park incorporates green infrastructure and natural landscape materials to provide for more sustainable and resilient local ecology in a former industrial site. Adjacent to the park site is a development of residential buildings that have also incorporated resiliency into their design: elevating mechanical systems and back-up generators, designing exterior ground level doors to receive flood gates, and utilizing a concrete base along the building wall that extends up to flood elevations.¹

Potential Applications in Miami Beach:

- Elevating the majority of the waterfront park above flood levels ٠
- Elevating new adjacent streets and buildings above flood levels
- Selecting durable materials such as stone walls, stone pavers, and water-resistant wood decking
- Utilizing native coastal plantings in bioswales and stormwater planters
- Porous pavement sidewalks
- Valves and backflow preventers installed on separate storm and sanitary sewers
- Construction of new wetlands for natural stormwater management



Photo Credit: ARUP

BISHAN ANG MO KIO PARK, SINGAPORE EMBRACING WATER

Singapore's Active Beautiful Clean Waters Program was developed in 2006 in order to create new community and recreation spaces in association with the country's water system. Resulting from this initiative, the re-imagined Bishan Ang Mo Kio Park provides a model for an ecological park designed to function also as a water management system. The park design, by landscape architect Ramboll Studio Dreiseitl, renovated the previously channelized Kallang River into a naturalize river system.

The park is designed to flood during storm events, accommodating 40% more stormwater than the previous channel could, while simultaneously creating ecological spaces and habitat, allowing recreational and educational opportunities, and creating social spaces for people to enjoy. The design creates amenities and increases ecological benefits in addition to updating the stormwater system.²

Strategies & Potential Applications for Miami Beach:

- Combining a water management system and ecology with a social function
- Allowing an area to flood temporarily during a storm event



Photo: Lim Shaing Han for Arup

GOWANUS CANAL SPONGE PARK, NEW YORK, USA **GREEN INFRASTRUCTURE**

Gowanus has a rich history. Originally a large, marshy wetland, the area is the site of early Dutch settlement, important Revolutionary War battles, and commercial industrial activity stretching back over 100 years. Now an EPA Superfund site, planners and real estate developers envision the area to be a locus of large residential development — a controversial proposal in light of the area's overburdened infrastructure and highly-contaminated environment. In this context, and working closely with local community organizations, government agencies, and elected officials, DLANDstudio initiated and designed a new kind of public open space called Sponge Park[™]. The Sponge Park[™] design grants equal value to the aesthetic, programmatic, and productive importance of treating contaminated water entering the Gowanus Canal. The Gowanus receives many millions of gallons of combined sewage effluent every year. The park is designed as a working landscape that improves the health of the canal over time. This innovative plan proposes strategies to divert stormwater run-off for use in the public park along the canal, reducing the input of stormwater into the sewer system. The Sponge Park[™] Pilot, completed in 2016, manages nearly 2,000,000 gallons of stormwater per annum. Landscape Architect | DLANDstudio³

Potential Applications in Miami Beach:

- The Sponge Park Pilot Project's modular system design creates replicable results, leading to cost benefits by significantly reducing the testing and approval process.
- The Sponge Park modular cells are precast concrete and can function at low elevations or within a water body, allowing for tidal fluctuations or salt water to be present.
- The challenge for Miami Beach to use a precast modular green infrastructure planter would be the variable and dimensions of existing built-out neighborhoods.



Image: DLANDstudio



Photo: DLANDstudio

PORTLAND GREEN STREETS, OREGON, USA **GREEN + GRAY INFRASTRUCTURE**

In 2002, the city of Portland, Oregon was faced with the challenge of combined sewage overflows into the Willamette River violating the Clean Water Act. Portland chose to add green infrastructure to divert stormwater at a fraction of the cost of updating their drainage pipes. The 2005 pilot project, the SW 12th Avenue Green Street Project, includes four green infrastructure planters which were shown to manage nearly all of the SW 12th Avenue's 180,000 gallons of runoff and to reduce the runoff intensity of the 25 year storm by 70%. As a result of this successful pilot project, Portland's City Council passed a Green Streets Policy in 2007 mandating the removal of 60 million gallons of stormwater annually from the combined sewer system through green infrastructure. In 2011 Portland also constructed new grey infrastructure to almost eliminate sewer overflow into the river. In addition to cost saving, street beautification and improved water quality, the green infrastructure slows the storm event peak flow rate, and the decrease in system pressure leads to less basement sewer backups when storm events are larger than the 25 year storm for which the grey infrastructure is designed.⁴

- Use of stormwater planters to reduce sewage overflow
- Use of gray infrastructure to reduce sewer overflow





City of Portland, OR

4.5 // STORMWATER MANAGMENT

MEXICO BEACH, FLORIDA

FINANCIAL MITIGATION STRATEGIES

The City of Mexico Beach was impacted by Hurricane Michael on October 10, 2018, a Category 5 storm considered to have a return period frequency of 1 in 500 years. The storm surge exceeded +15.5 feet along the coast, with wave crest elevations inland exceeding +20 feet. A large area of the City has been mapped by FEMA to be an X-Zone, or an area of minimal flood hazard, outside of the 0.2% annual-chance flood (or the 1 in 500 year storm). Yet over 50% of the buildings within the X-Zone were completely destroyed. Since buildings within an X-Zone are not required to purchase flood insurance, many of those property owners will bear the cost of rebuilding. The City's antiquated building codes, lack of understanding of its vulnerability, gap in available insurance coverage, reliance on the FEMA flood zone mapping and unavailability of immediate funds profoundly impacts their recovery. Team member Coastal Systems presented recommendations to ensure that the City is structurally and financially prepared, should another disaster strike, and developed mitigation solutions to limit future damage impacts.¹

Potential Applications in Miami Beach:

- Compile a database with property values, floor elevations, and flood damage coefficients ٠
- Conduct detailed Coastal and Stormwater flood modeling to understand vulnerability
- Quantify probable damage costs associated with various storm events, now and in the future
- Conduct a benefit-cost analysis of mitigation solutions that will reduce future damage
- Revise building codes to ensure a clear strategy for rebuilding and recovery after a storm event
- Establish policies to ensure a 100% level of insurance coverage
- Understand which amenities, features, and areas the municipality may be willing to give up to protect ٠ the community.



Photo Credit: Coastal Systems

CORAL GABLES, FLORIDA DRAINAGE MANAGEMENT SYSTEM

The City of Coral Gables aimed to improve the public realm in the downtown area of Miracle Mile and Giralda Avenue with the creation of a civic promenade that would protect commercial and retail spaces from flooding events. A drainage management system was developed that includes roof and Right-of-Way drainage systems that harvest rainwater for the purpose of irrigation to large planting areas. The system was designed to contain the full amount of water produced by storm events, and treat rainwater on-site within the same space. The roof drainage system is located underneath the sidewalk and parking spaces. The Right-of-Way drainage system is a parallel system; the surface run-off is collected through a continuous 4-inch trench drain over a large-diameter slotted drainage pipe. The implemented drainage management system provided a total amount of rainwater storage that meets Miami-Dade County Department of Environmental Resources Management (DERM) and Florida Department of Transportation (FDOT) requirements for 25-year (3-day) and 100-year (1-day) storm events, respectively.²

Potential Applications in Miami Beach:

- discharge overflow subsequent to flooding events.
- Harvest rainwater for irrigation purposes



Design roof and Right-of-Way drainage management system to retain and store rainfall, and





Photo Credit: ?*

NYCHA RED HOOK HOUSES, NEW YORK **RESILIENCY AND RENEWAL STUDY**

Hurricane Sandy permanently damaged the majority of the electrical and heating systems while also causing extensive roof and basement flood damage throughout the 28-building campus of the New York City Housing Authority (NYCHA) Red Hook Houses in Brooklyn, NY. In restoring and redesigning the site, an enhanced sitewide hot water distribution network was developed utilizing a central plant complete with back-up electric generators in case of future power outages. Other MEP and utility equipment upgrades were relocated to new smaller utility buildings constructed above design flood elevations calculated for future storm surges incorporating expected sea level rise. New building roofs and other impervious area directs runoff to underground infiltration tanks that can provide temporary rainfall storage during storm events and then also allow for natural infiltration into the ground. Through a combination of sloped earth, retaining walls, stairs, and ramps, the area between residential buildings was elevated to serve as "lilypads"— a park-like gathering space that will be free from floodwaters and able serve as an active programming area for additional playgrounds, landscaping and seating.³

Potential Applications for Miami Beach:

- Increased drainage capacity through new catch basins and renovated drainage system ٠
- Backflow preventers installed on storm and sewer outlets
- Pervious paving used for site pathways, basketball courts, and seating areas
- Key utilities elevated in new raised utility buildings and remaining utilities within basements to be ٠ flood protected
- Retention tanks installed for stormwater management and floodwater storage
- Plaza space elevated between buildings
- Passive flood barriers installed for areas that cannot be raised above design flood elevations ٠
- Coordination between buildings and property owners required for a districwide utility system such as shared hot water or electric generation











2. <5% slopes provide barrier-free access 3. Surface programmed for residents

Passive barriers deployed in flood



In 2012, coastal regions of New York and New Jersey were devastated by Hurricane Sandy. Along the New York City waterfront, parks and surrounding streets were submerged in brackish and salt water. Important case studies at waterfront parks, such as Brooklyn Bridge Park, highlight the major horticultural concern of flushing soils that were exposed to storm surge and salt spray, because salt damages soil structure, ultimately resulting in the loss of water and air availability necessary for healthy soil biology. Salt-damaged soil is also more prone to erosion and causes root loss¹. After the storm event at Brooklyn Bridge Park while the electricity was still down, water trucks were brought in to spray foliage and flush soils in low-lying lawns and beds. Various salinity-reducing soil additives were also tested although data on these methods is still limited. Using the unfortunate event of a super-storm to test remediation strategies for future hurricanes can turn a potentially devastating event into a teaching opportunity.⁴

- High wind-resistant trees, with low centers of gravity and deep penetrating roots.
- Preventative pruning
- · Immediately following a storm, flush soils of plant-toxic salts with fresh water





Image Credit: Allison Joyce/Getty Images



Image Credit: GrowNYC



Resiliency Approaches & Strategies

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5.1 // INTRODUCTION

In considering adaptation models and strategies for Miami Beach historic districts, it is important to affirm evident realities, as well as community values. In spite of its vulnerability to sea level rise, it is unlikely the City will ever be able to make use of flood barriers at an urban scale. The impossibility of retreat must also be considered; the city has no substantially higher ground. Further, Miami Beach is relevant, historic and economically viable because of its coastal situation. In the face of any rational cost vs. benefit analysis, the social and cultural values of the city argue to adapt in place. Indeed, the City has made the critical choice to preserve its community and focus on adaptation, as demonstrated through various initiatives and documented on the Rising Above website: www.mbrisingabove.com. The strategies that follow are built on this adaptive aim, and on the calculus that the City of Miami Beach will continue to maintain, through infrastructure improvements, its viability as a stable setting for private adaptive redevelopment.

The strategies developed here may be applied across a variety of scales, from modest improvements that can be accommodated today to more significant changes rooted in a place-based vision. They are based on consideration of building type, typical significant historic resources, typical structural systems, local development and building practices, context, and current zoning and building code requirements. In General Adaptation Strategies (Chapter 5.2), tactics are informed by best practices internationally, with special attention to the specific issues found on Miami Beach. In Mid- and Long-term Adaptation Strategies (Chapter 5.3), the approaches demonstrate more profound scenarios that look forward 60 years. They anticipate that Miami Beach will, over time, reframe these study areas as essential laboratories of resilience, expanding the placemaking potential and environmental performance of buildings, landscapes and streetscapes while building the future identity of the city. Together, the strategies illustrated were conceived with the objective of keeping the city vibrant, not just above water.

The study areas chosen by the City for this report represent particularly low areas of Miami Beach, where issues of sea level rise, extreme rain events and King Tides are particularly present. The adaptive tools and medium- to long-term strategies developed here are based on water conditions identified in the Quantifying Water section of this document (Chapter 2). As suggested there, the adaptation strategies incorporate separate planning for cyclical events vs. storm surge.

Considering that most building adaptation will be financed by individual property owners, the City should consider leveraging increased density and intensity to incentivize adaptive rehabilitation. Patterns of development found in Miami Beach's history demonstrate how the city can transform rapidly, although current limitations on growth must also be considered. The section titled Cost | Incentivization (Chapter 5.4) demonstrates ideas about how the study areas may accommodate increased densities.

As William J. Murtagh notes in *Keeping Time: The History and Theory of Preservation in America*, "The preservation of a neighborhood should be seen as a heterogeneous product, the whole of which exceeds the value of the individual parts". Preserving how the buildings of the district relate to each other and to their context is important, but other elements including landscape, streetscape and infrastructure are vital. The sections titled Landscape Strategies (Chapter 5.5) and Streetscape Strategies (Chapter 5.6) demonstrate approaches to making more adaptive and ecologically-balanced neighborhoods.

The New Historic Preservation and Resiliency Framework (Chapter 5.7) suggests new contours for balancing historic preservation with resilient design. The final section (Chapter 5.8) comprises specific recommendations related to preservation and resiliency.

5.2 // GENERAL ADAPTATION STRATEGIES

General adaptation strategies are tools that can be applied at any scale of adaptive rehabilitation. These tools are grouped under four categories: Building and Systems Strategies, Green Infrastructure, Stormwater Management, and Futureproofing; although many strategies may be considered to overlap categories. These general adaptation strategies find guidance from FEMA and others, and are generally based on national best practices.

A reasoned application of these approaches according to building type and adaptation strategy can be found in the Guidelines section of this study (Chapter 6). Further description of the general adaptation strategies can be found at the Appendices (Chapter 7).

Adaptation work in Miami Beach historic districts must consider fixed factors including site elevation, property configuration and access, building configuration and access, building footprint and orientation, adjoining property, building type, building elevation, and building foundation and construction system. The complexity of integrating this work will depend on a number of factors; an architect should be consulted to determine the appropriateness and scope of work required.

Although not strictly building-resiliency related, futureproofing strategies, like the use of wind and solar power, and the re-use of water, are also included here. Reducing the demand for energy and water resources not only builds sustainable practices that reduce environmental impact, it reduces loads on city infrastructures, lowering their costs and vulnerability.



A. BUILDING & SYSTEMS STRATEGIES | For more detail see Appendix III



BACKFLOW PREVENTION

Elevated water levels can cause waste in sanitary sewer lines to back up through drainpipes and flow into homes through toilets and other drains. One solution is to install backflow prevention valves on sewer lines in existing structures. Backflow prevention valves allow flow in only one direction. Waste or stormwater can flow out through the sewer pipe but is also prevented from flowing back into the structure.



MECHANICAL SYSTEMS FLOOD PROTECTION

Mechanical equipment primarily includes heating, ventilation and air conditioning (HVAC) systems. Small amounts of saltwater can guickly corrode mechanical systems, rendering them inoperable. the simplest and most effective ways to protect primary mechanical system components is to elevate them above DFE. In Miami Beach, where buildings occupy most of their lot, mechanical units should likely be relocated to the roof of the building, where there is typically sufficient structural capacity.



UTILITY & LIFE-SAFETY FLOOD PROTECTION

Unless an electrical system - electric panels, meters, switches, outlets, light fixtures, and the wiring that connects them all together - is specifically designed to be submerged underwater, floodwater can severely damage its various components. Similarly, gas and water meters, unless rated for submersion, can be damaged by flooding. Use flood-rated equipment or relocate above DFE.

DRY FLOODPROOFING

Dry floodproofing involves taking measures to make a building watertight to prevent entry of water into interior spaces. Dry floodproofing measures must be paired to prevent failure. Reinforcing openings and walls to withstand floodwater pressures should be combined with reinforcing or anchoring the building slab to resist flotation from uplift pressures and other buoyancy forces.



WIND MITIGATION

Wind mitigation is the implementation of certain building techniques in order to limit damage caused by intense wind. These building features include opening protection of the doors and windows, appropriate roof deck and roof-to-wall attachment, use of appropriate roof coverings and implementation of secondary water resistance systems.

SEEPAGE AND WATERPROOFING



While most building materials appear solid and impenetrable to the naked eye, when sustaining flood loads, water may pass through these materials. Waterproofing techniques render a building envelope more impermeable and reduce the amount of water that can infiltrate. Waterproofing can be applied from either inside or outside a building wall, depending on the type of sealant used. Impermeable membranes can also be used to waterproof foundation walls belowgrade to resist groundwater seepage.



FLOOD RESISTANT BUILDING MATERIALS

Everyday building materials may be susceptible to rot and mold when exposed to flooding. Using flood-resistant materials can reduce the damage and make cleanup easier following a flooding event. Building materials are considered flood-resistant if they can withstand direct contact with flood waters for at least 72 hours without being significantly damaged (damage requiring more than cosmetic or low-cost repairs).

ADA ACCESSIBILITY FEATURES

The Americans with Disabilities Act (ADA) requires businesses that serve the public to remove barriers from older buildings and to design and build new facilities implementing features that provide access to customers with disabilities. These features include parking, access to the building entrance, route into and through the establishment, access to the store's goods and services, restrooms, cashier stations and egress from the building.



WET FLOODPROOFING

Wet floodproofing is a concept that accepts some level of flooding, rather than working to reinforce the structure against floodwater pressures. Strategically designed and placed openings allow floodwaters to automatically enter and exit the enclosed area.

B. GREEN INFRASTRUCTURE | For more detail see Appendix III

RAIN GARDENS



Rain gardens are special planting areas designed to capture and store rainwater. Not only do rain gardens assist in reducing overall storm runoff guantity, but they can also aid in purifying water from pollutants and contaminants using natural filtration processes present in soil and plants. Plantings and microorganisms in the soil have the ability to break down biological toxins and also bioaccumulate toxins. Rain gardens are usually located within a small depression in a property to allow water to naturally flow to low points.

GREEN ROOFS



Green roofs are partially or fully vegetated roofs that are layered over waterproofing. In addition to providing shade, a green roof's plants remove air particulates and produce oxygen. Another benefit of green roofs is their ability to reduce and slow stormwater runoff in urban environments.

SUNKEN PLAZAS AND PATIOS

Recessed parks, building courtyards and plazas may contain impervious surfaces designed to temporarily store water during extreme events. These landscape features keep water out of adjacent properties and reduce inputs to storm drains not sized for current and future more extreme storm events. These landscapes can retain water until a storm has passed, at which time the collected rainfall can be drained to a storm sewer system or other storage area.

PERMEABLE PAVEMENT

Permeable pavements and surfaces allow direct infiltration of water into the ground. By allowing water to naturally infiltrate into the ground, stormwater can be stored underground before flowing into stormwater systems, recharging local freshwater aquifers, and feeding nearby plants. Permeable paving helps reduce the load on traditional storm sewers that were not sized for the severity of contemporary storm events.

CISTERNS

Cisterns below ground and rain barrels that hold water from roof drains are a simple and affordable way for property owners to capture water, reducing the amount of stormwater impacting their property and harvesting rainwater for other uses. Rain barrels capture water for later use in irrigation or even cleaning purposes. Likewise below ground cisterns can also be used for irrigation and flushing a landscape of salt after larger storm events. With proper treatment, cistern water can also be used for water features and car washing.

C. STORMWATER MANAGEMENT STRATEGIES | For more detail see Appendix III



BLUE ROOFS

Blue roofs capture rainwater by functioning as a tank-like structure and often collect it for reuse within the building through non-potable (water not used for drinking or cooking) needs such as irrigation and flushing toilets. Typically, stored water is designed to be drained within 24 hours if not within an enclosed system to prevent insects and other issues that can come with standing bodies of water.



INJECTION WELLS

Miami Beach's unique geology and high groundwater table can often make storage of rainwater difficult. One alternative is to use injection wells to send water into an area of the earth where more space is available for water to infiltrate. Stormwater injection wells are used throughout Miami for larger, developed sites where there is minimal space available for natural infiltration or storage at or near the surface.

D. FUTURE PROOFING | For more detail see Appendix III



SOLAR PANELS

Solar panels are used to absorb the sun's rays and convert them into electricity or heat through photovoltaic effect. Use of solar panels helps decrease greenhouse gas emissions as well as reliance on fossil fuels and traditional power sources.



WIND TURBINES

uses.

Wind turbines are an alternate source of electricity. They operate via wind energy, which turns two or three propellers, or blades, around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity.



WATER RECYCLING SYSTEMS

The recycling of water involves treating wastewater and reusing it. Recycled water can be reused again to treat wastewater, or can be used for irrigation or other non-potable

Utility Relocation Study

As recommended under General Adaptation Strategies, building utilities and services should be raised or protected up to the Design Flood Elevation (DFE).





5.3 // MID- & LONG- TERM ADAPTATION STRATEGIES

The following mid- and long-term strategies explore how the adaptation of the Miami Beach historic districts might work as they face the threat of rising water. In general, the strategies follow two pathways: Adapt-in-Place (Strategy 1) and Raise (Strategy 2).

Adapt-in-Place and Raise explore divergent scenarios for adapting buildings in the Flamingo Park and Collins Waterfront study areas (which the team recommends designating as Experimental Action Areas) in response to issues of resiliency. Both are based on the belief that contributing buildings in these districts will need to be flexible enough to respond to varying conditions of water in two distinct ways; namely, that buildings should be resistant to projected tidal flooding and rain events while simultaneously being resilient (able to bounce back) to projected storm surges.

To preserve the historic resources and local building types under consideration -- mainly hundreds of modest residential apartment buildings, homes and commercial buildings -- their context, designation criteria and historical development were considered; Miami Beach building practices, current land use regulations and building code requirements were also taken into account. Particular emphasis was placed on the character and identity of historic neighborhoods - the intimate relationship between the buildings and the ground plane and the crucial role the streetscape and thresholds between public and private (characteristic stoops, built-in planters, side-yard gardens, and door yards) play in defining Miami Beach's historic districts. It is here that the two sets of strategies vary most; they test alternate thinking about Miami Beach historic districts: are the buildings primary or is the district as a whole primary? Here a question of preservation goals becomes crucial. There may not be a single answer to this question, and approaches may need to differ by district.

Certainly, Miami Beach was not conceived according to a unified plan, but evolved and accreted in layers over many generations. Notwithstanding the lack of conformance to any singular pattern, the variegated streetscapes of Miami Beach, in their particular ad-hoc arrangements, have become a relevant image. Adapt-in-Place works to preserve these streetscapes, the relationships between building and ground, and interstitial spaces that make up the rich experience of each historic neighborhood. It acknowledges that individual buildings need to evolve in order to survive, but that in this evolution the vibrancy of the districts can be preserved and enhanced. Raise prioritizes the preservation of individual buildings as they are, even as it requires that unless every building and its lot are raised equivalently, the look and feel of the district will be changed.

The Strategies suggested here vary considerably, but each, taken to its logical conclusion, will yield a vision of a future resilient historic district. In reality (no matter what Strategy is followed) Miami Beach is about to become a more complex, challenging and stimulating preservation environment. It is the opinion of our team that the City must continue to progress and develop its next resiliency layer in order to preserve the vibrancy of its historic districts.

Note: the team believes that Strategies can be mixed across the city, but not within subdistricts. Each district should take one approach (Adapt-in-Place or Raise).

Adapt in Place Strategy 1



1A **Internal Raise**

Raise Strategy 2





2A Individual Approach

1B Adaptive Use Approach

1C Building in a Building

2B **Combined Approach**

Adapt in Place | Strategy 1



Adapt in Place proposes incremental adaptation/expansion of buildings in their current position and within their current 'authentic' building facades. As current or anticipated water levels render the ground floor of current buildings obsolete and/or unsustainable, buildings can be adapted in place by change of use or raising interior floor levels. The tactics grouped in Strategy 1 argue the primacy of the tightly-knit fabric of existing structures in terms of their relationship to the ground and to other buildings and features. The three strategies demonstrated here allow more surgical approaches to retain the public facades, but also the fine-grained semi-public landscape of interstitial spaces, patios, stoops, planters, and exterior stairs. By raising or adapting floor areas while leaving existing facades and site features at their current elevation, Strategy 1 infers the development of neighborhood, site and landscape retrofits to support living with water during extreme flood or storm events.

While proposing more continuity in the urban landscape, Strategy 1 emphasizes inventive, even radical, approaches to the architecture itself. It provides ample room for experimental preservation, as it imagines buildings adapting one-by-one, nudged by the need for adaptive procedures, but also by market forces and incentivized zoning regulations. Strategy 1 would have the effect of allowing preservation and adaptability to coexist in layered juxtaposition, highlighting typological consistency and architectural innovation as primary characteristics of the Experimental Action Areas within the Miami Beach historic districts.

The arguments for a more surgical approach are many: in the study areas investigated, most interiors are less significant as historic resources and have a longer history of change; most buildings are substantially deficient in code terms, so any substantial renovation would likely require bringing the building up to current Florida Building Code – requiring substantial structural improvements, new windows and roofing, fire and life-safety improvements, and the upgrading or replacement of many components. Further, in order to help offset the cost of adapting buildings, the City of Miami Beach may wish to consider compensatory floor areas to replace residential floor areas lost to resilience, or bonus floor area, as incentives.

Strategy 1 and its variations explore the logic that the building façade (the public face) and building interior (the private face) fulfill different functions and thus may be detached. Admittedly, this approach runs up against the National Park Service Secretary of Interior's Standards for Rehabilitation – in particular Standards 2, 5 & 6, which counsel against the removal of historic materials, advocate for the retention of existing finishes and construction techniques, and advocate repair rather than replacement of deteriorated historic features.

Adapt in Place has ample precedent in current preservation practice in Miami Beach. It is founded on preserving as much of the current contributing historic resources of a building (generally the facades and public interior spaces) as possible, while allowing internal adjustments, limited external expansion and adaptive use. To date, adaptive use has made sense in Miami Beach, allowing buildings to adjust to shifting economic conditions and evolving neighborhood context by adopting new programs. Ground floor apartment/hotel uses have been recast as retail spaces, entire residential buildings have been converted to commercial or office uses, and buildings have been rebuilt from the inside to respond to Building Code requirements. Beyond their origins in entrepreneurial practice, such changes of use may generally deploy a range of adaptation strategies, and often bring substantial urban amenity.

Raise | Strategy 2

Raise proposes lifting buildings in their current position on site, retaining as much of their current construction as possible. Raising buildings would adapt them to higher water levels, in principle necessitating fewer internal changes to the fabric and use of the buildings. Studies confirm that a majority of contributing buildings in both study areas can be raised (See Section 3.6). A description of techniques for raising buildings can be found in Appendix III.

Raise takes a more purist approach to the structures themselves, allowing them to be variously raised as intact (albeit, as normally required by Building Code, FEMA requirements and ASCE 24, substantially improved) artifacts. It suggests less architectural innovation, while permitting a more permissive approach to the continuity of district streetscapes. Indeed, as buildings are variously raised or not, the strategy may result in local discontinuities. The National Park Service (NPS) has not endorsed raising buildings; indeed, by NPS standards, moving a building entirely may be preferable to raising it. The effect on neighbors is not well understood, with few if any local precedents.

Though raising buildings has little precedent in Miami Beach, it is shaping up nationally as an accepted approach toward adaptation of historic buildings – although admittedly more in the treatment of individual houses and single-family residential districts. For the purpose of this study, the team has considered two Raise scenarios: individual raise and combined raise. The latter would clearly be preferable, as historic relationships between adjacent buildings might be maintained. Two thresholds of Raise have been investigated: the first elevates the ground floor of historic buildings to 10' NGVD, the Design Flood Elevation (DFE) suggested earlier in this study; the second raises the ground floor of historic buildings to 14' NGVD, an elevation that roughly represents current permitted freeboard. Further, the team has investigated two ways of raising buildings. The first would raise only the structure and any necessary adjacent land necessary to maintain entry and egress from the current building doors and stoops (this largely means the side yards). The second raises the entire lot along with the buildings, establishing a speculative new ground plane and finding additional space for compensatory flood storage. These strategies were tested in order to explore the appropriateness of raising buildings, especially in the Flamingo Park study area. Whatever the merits, consistency of approach is critical in any raise.

While raising buildings reduces or eliminates the need for dry or wet floodproofing, the team recommends constructing a new first floor in concrete to provide further resilience against future tidal or rain events. Raising buildings allows the area beneath the raised building/lot to be used for water storage systems (cisterns, etc.). On the other hand, stringent measures must be taken to combat the 'bathtub effect' and retain as much water on the new, raised site as possible.

As raising buildings individually would be disruptive, one variant would be to conceive a system allowing multiple raises; leaving a grillage of steel in the building after one raise; this would mitigate much of the cost of the next raise.



Internal Raise | Strategy 1A



- Retain and preserve all facades, stoops, stairs, built-in planters and yards at current positions.
- Construct new raised floors behind existing contributing facades.

Strategy 1A proposes that buildings be adapted internally by constructing new raised floors behind the existing contributing facades, stoops, stairs and planters. First floors would be raised to the Design Flood Elevation (DFE), making them compliant with FEMA regulations. As current Finished Floor Elevations (FFE) vary across Miami Beach according to both location and building type, the actual amount of raise would vary.

Internally raising floors in isolation from the building envelope is a strategy highlighted by FEMA in its Flood Plain Management Bulletin. For instance, the bulletin cites the successful integration of historic preservation and hazard mitigation in Darlington, Wisconsin, where floors were raised behind historic retail facades, earning a Preservation Achievement Award from the State Historical Society of Wisconsin.

Raising floors behind the existing façade would be particularly appropriate where this can be done within existing building walls, capitalizing on the existing attic space and/or generous parapet heights found in most flat-roofed buildings (Corridor and Walk-up type buildings are best for this option).

Strategy 1A retains all current exterior building features and relationships that establish the character of the district. On the other hand, interior arrangements would be entirely rebuilt, either following the original historic layout or by inventing new layouts.

This strategy imagines that in some cases, the combination of storeys into taller floors without penalty should be permitted. Limited rooftop additions would be allowed, to compensate for the removal of floor area.



Adaptive Use Approach | Strategy 1B

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- Retain and preserve all facades, stoops, stairs, built-in planters and yards at current positions.
- Upgrade ground floor at current level below Design Flood Elevation, improving its resilience by transforming ground floor uses and using wet or dry-floodproofing.

Strategy 1B, the Adaptive Use approach, allows buildings to adapt by transforming their ground floor into flex amenity or limited commercial uses; this strategy preserves a maximum amount of existing building fabric in place by allowing adaptive use of the ground floor to programs that are more resilient than housing. The adaptive use of ground floor spaces would create a new horizontal 'innovation layer' along the ground plane of the district, in the most vulnerable area of the existing buildings.

The potential uses in this area could yield an interesting new economic/social/cultural dynamic, allowing historic districts to become much more mixed-use in nature, and provide enhanced live-work opportunities. Limited commercial activities like professional offices, service establishments, small shops, pop-up retail (as is already the case, for instance, in the small homes located where the Flamingo Park district abuts Alton Road), could thrive here. However, another solution would be use of the ground floor space for building amenities, lobbies, storage and logistical/service areas, or perhaps as flex space (for instance as dedicated art space).

An advantage of this accretive approach is that all current floor levels may be maintained, although the team recommends that the ground floor be reconstructed in concrete and made accessible; the structure would also be brought up to code. Uses in the ground floor innovation layer, below current BFE+1, would be either wet floodproofed, a lower cost solution that would allow them to flood during high water, or dry floodproofed, including the impermeabilization of ground floor with flood barriers and a hydrostatic slab.

In some capacity, Strategy 1B could work for all building typologies, allowing most of the existing building to be retained. Overall, it would allow buildings and the district to grow in intensity, transforming and invigorating vulnerable areas. Even absent any other incentivization, this may have the effect of spurring redevelopment and adaptation. However, the team recommends pairing this strategy with incentives that allow the exploitation of unused development rights, and the replacement of residential floor areas distributed in the innovation layer.


Building in a Building (Matryoshka doll) Approach | Strategy 1C



- Retain and preserve all facades, stoops, stairs, built-in planters and yards at current positions
- Develop new adaptive structures behind the existing contributing facades.

Strategy 1C, the Building in a Building approach, allows buildings to be raised internally by developing new adaptive structures behind the existing contributing facades, stoops, stairs and planters, to be maintained in their current position (aka façade retention). It allows a legible reading of the adaptation strategy, with contemporary new structures delineated behind historic 'artifactual' facades. Open spaces such as terraces, patios and gardens can help resolve the inevitable elevational offset between historic façade and new structure, located at the Design Flood Elevation.

Strategy 1C acknowledges the resonance of building façades culturally, as part of the larger intact whole of the district, and as an example of its architectural style or period. It offers an honest reading of the bifurcation between exterior and interior, and allows the material of the historic facade to read as an architectural layer. This strategy would yield poignant but perhaps awkward relationships. To address this issue, a preservative layer of construction on the front of the building, perhaps 20' deep along the Avenue-facing facade, might be retained at current floor elevations, in order to mitigate sight lines to the new construction.

This strategy raises philosophical and ethical questions, and is controversial in the preservation community (especially in the US; the strategy is widely used abroad). Is the façade preserved for purely aesthetic or decorative purposes? Is the facade reduced to a farcical mask? Does the loss of the interior historic building fabric result in the loss of the building's architectural and historic integrity? The term "facadism" is often used to describe development practices where the preserved facade of a building is considered separately from, or not well integrated into, the rest of the building. Many preservationists believe that "what lies behind a building's facade should be related to it both architecturally and historically."^{FN} Further, buildings entirely rebuilt behind facades are new, and the unit arrangement will likely respond to new development criteria. Does this contradict the purpose of the retention of the district, to retain its current housing stock?

Yet some loss of a building's integrity may be inevitable if a building is to be preserved in the face of rising waters. Of course, the practice of building new structures inside existing preserved facades is already common in Miami Beach, although the new building is generally reconstructed behind the existing façade in an invisible way. These instances require the structural stabilization of the building facades, as masonry and concrete loadbearing walls are temporarily braced, or adapted to support themselves.

Perhaps such practices can be understood as a compromise situation in a difficult context: the 'force majeur' aspect of sea-level rise. The contrast of old and new can be treated in an interesting and didactic way, and several remarkable contemporary projects illustrate how architecturally and culturally rich the contrast can be. Perhaps this strategy would not be appropriate for building types like hotels, banks or cinemas, comprising significant interior public rooms, but in modest residential and commercial buildings, the value of interior vs. exterior may justify it.



Individual Raise Approach | Strategy 2A

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Individual property owners raise buildings/properties one by one

Strategy 2B, the Individual Raise approach, anticipates buildings to be lifted individually, according to owner prerogative. It acknowledges the interest of some, but perhaps not all, property owners to invest in protecting their properties (building elevation would likely require a substantial investment, as it would create conditions requiring other improvements and upgrades).

An advantage of individual raise is that property owners may consider the disposition of their buildings in their own way. It follows some recent national practices, for instance in Charleston, SC, where new regulatory standards have been developed and historic buildings may now be raised.

The idea of raising buildings individually raises important preservation issues for the district. As a district of low-rise buildings in very close proximity, changes in height in some buildings can break the continuity that characterizes the neighborhood, and create awkward juxtapositions. Until every building is raised, raising buildings one by one will change the relationship of building to the ground and surrounding context. This strategy may challenge the idea of an historic district as a stable entity. Private initiative in raising buildings may result in a scattered approach to saving historic fabric; A mix of building lifecycle, building type and owner prerogative would govern the shape of historic district.

It is reasonable to assume that, without controls, the amount that buildings are raised may vary substantially. On the other hand, raising buildings from their varied existing heights to a uniform floor elevation would subtly change the relationships between them. Over time, standards will likely change during the evolution of any particular street or block, so the degree of raise may also change. Many owners and developers expending the effort of raising buildings may wish to raise them a maximum amount, taking advantage of freeboard, in order to prepare for future changes in Base Flood Elevation. Buildings that are not raised may confront even more water due to drainage from raised sites (the bathtub effect), or the hydraulic movement of water around raised sites. Any raised building will need to retain and dispose of its water without affecting its neighbors.

Raising one-by-one also creates issues for the building and its surrounding lot. Given the intimate relationship of buildings with their ground plane in Miami Beach (through stoops, exterior stairs, planters, and the provision of narrow side-yard walkways), raising buildings will need to be accompanied by the partial or total raising of the lot. While most residential buildings in Miami Beach historic district are not currently accessible, raising buildings will contribute to or even worsens their inaccessibility.

If buildings are raised individually, a uniform standard of Raise set by the City Planning Department and Historic Preservation Board would assure at least some continuity within the district. As only some buildings and infrastructure will be raised at any time, one may imagine a two-layer or multi-layer city evolving, where raised viaducts and properties are interspersed with structures and infrastructure at the city's original ground level (areas of historic Rome come to mind).



Combined Raise Approach | Strategy 2B



• Property owners coordinate with the city and each other to raise buildings/ properties as a group.

Strategy 2B, the combined approach to Raise, anticipates all buildings and landscape features could be elevated in a coordinated fashion. Such a combined approach would require a coordinating body, such as the City or other agency, to manage. In a coordinated raise, an area of the district (perhaps a block at a time) would be raised together, observing an equal amount of raise to maintain existing relationships. The raising of private property could perhaps also be coordinated with the raising of public infrastructure like avenues, streets and alleys, and with the concurrent development of water collection and storage systems, as well as water gardens and green infrastructure. By raising all elements of the built landscape in parallel, all components of the district would be reproduced according to their current relationships at a higher elevation.

Coordinated Raise may seem merely an efficient or cost-effective improvement on raising buildings one by one. Indeed, there likely would be significant savings, not only because of the quantity of work, but also because individual site retaining walls, railing systems and individual access points to raised properties would not be necessary. However, by addressing the complex interaction of buildings with each other – for instance the disposition of interstitial spaces – the combined approach offers significant advantages in preserving the character of the district.

The combined raise approach, as it suggests the development of 'superblocks', might bring other advantages as well. For instance, a coordinated approach to parking, strategies to reduce pavement, and advantages in obtaining funding, for the application of municipal resources, and perhaps in applying for grants from funds like the FEMA Hazard Mitigation Grant Program.

Reformulation of a new ground level may seem radical, but much of Miami Beach was built using similar land-raising strategies. All of the Flamingo Park district was originally a tidal wetland and was developed as a result of dredge and fill operations conducted in the early 20th century. Other land-filling operations are currently underway. Further, this approach is already being used in road raising. And if historic districts around the nation are considering retreat and relocation, why cannot the city consider relocating its districts – vertically.

Further, the coordinated approach to raising buildings has some precedent in North American urban history. Galveston, Texas was famously raised after a devastating hurricane in 1900. Highlands, New Jersey, has also promoted raising the whole town after most of its buildings were destroyed following Hurricane Sandy. In general, the application of this approach has followed destructive events; the mechanisms to make this work (policy, finance, etc.) as a preventative measure are less well understood. This approach does not follow the typical property-by-property mechanisms of development in Miami Beach, but should nonetheless be considered.



Individual Approach | Strategy 2A





Combined Approach | Strategy 2B













CATWALK

WU WALK-UP



















WU WALK-UP







Strategy 2B | Rambler facing Walk-Up



Rambler facing raise Walk-Up



Strategy 2B | Walk-Up facing Interior Corridor



Walk-Up facing raise Interior Corridor



Strategy 2B | Walk-Up facing Interior Corridor



Walk-Up facing raise Interior Corridor



Strategy 2B | Catwalk facing Urban Vila



Catwalk facing raised Urban Vila



5.4 // COST | INCENTIVIZATION

Although specific types or patterns emerge, each building in Miami Beach is distinctive, and the cost to adapt the structure will depend on a number of issues. As individual building owners consider their situation, and the options available, they will need to take several factors into consideration. Among those factors:

- First floor elevation of the building
- Elevation of adjacent grade
- Building construction type
- Building condition/level of alteration or improvement since initial construction
- Building structural system/first floor construction
- Contributing or non-contributing status in its historic district
- Foundation type
- Strategy of adapt-in-place or raise
- Future use/income potential
- Further development potential (unused FAR, etc.) ٠

The cost of adapting existing structures, especially contributing buildings, will likely be considerable. In addition to the cost of improvements that directly enhance resilience, most adaptive work will gualify the building for upgrade to current Building Code requirements. This is because of dual requirements: (1) the FEMA 50% rule under the National Flood Insurance Program, and (2) the Florida Building Code's Level 3 Alteration rule. In (1), building rehabilitation that exceeds 50% of the assessed market value of a building (not including land) must meet the requirements for new construction under the current code, including, the requirements of ASCE 24, and be brought up to current floodplain management standards. In (2), the Florida Building Code generally requires that Level 3 Alterations - rehabilitation work where the work area exceeds 50% of the aggregate area of the building (total floor area) - or where more than 30% of the total floor and roof areas of the building or structure have been or are proposed to be involved in structural alteration within a 5-year period, require bringing the structure to current code. While bringing a building up to code aligns with the adaptation goals posited in this study by enhancing its strength and resilience, it adds considerable cost.

It is likely that the cost burden of adaptive rehabilitation will be carried by individual property owners. Absent other options, including substantial funding sources for adaptation, there will be increased pressure to demolish existing contributing buildings.

The value of Miami Beach's cultural patrimony to the city, as a public good, would be difficult to calculate, but is certainly very significant. Therefore, rehabilitation work that combines preservation and adaptation would be a public benefit. In order to promote this combination, the City of Miami Beach should consider incentivizing adaptation of historic properties/districts, over new construction, as a tool of resiliency. The City should consider establishing a resiliency standard for adaptation in order to evaluate such incentive bonuses. It should consider granting incentives to adaptation projects that fully implement a resiliency strategy that meets the City's minimum standard and which are brought up to current Building Code. Bonuses should be implemented in a phased way that rewards greater efforts toward adaptation. Using incentives, the City may leverage the attraction, lifestyle benefits and economic vibrancy of Miami Beach to encourage developers to build/adapt new resilient layers of the city.

Such a strategy builds on the powerful existing modus of development potential in Miami Beach (buildable floor area) as a lever to spur adaptation. Building additions (either rooftop and ground-up) are quite common in the city, as building sites are optimized in terms of floor area and amenity. However, incentivization imagines new floor areas developed on the roof/rear of existing buildings as stylistically/ materially distinct from historic building fabric, as a legible 21st century layer of urban development, and as a signal of 21st century adaptation. It would reveal, instead of concealing, the changes wrought by a proactive resilience to sea level rise.

In order to implement incentives, the City should consider changes in its standards and guidelines that would address issues arising from building additions. Additions, generally expanding the bulk and height, and perhaps changing aspects of a building's appearance, may go against the sense of Standard 9, which counsels that additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property, and that they should be compatible with the massing, size, scale, and architectural features. In practice in Miami Beach, such additions are encouraged to be outside public sightlines. See incentives in Recommendations (Chapter 5.8).

For the purposes of this study, the team suggests four alternative strategies for accommodating incentivized buildings of the historic district:

- 1. Transfer of Development Rights
- 2. Accretive Urbanization Rear Development
- 3. Accretive Urbanization Rooftop
- 4. Accretive Urbanization Mixed

While the Transfer of Development Rights approach suggests no visible incentivized additions within historic districts, the accretive approaches would require both a conceptual and regulatory change in the way the City allows redevelopment of historic structures. In particular, it would be contingent on a consensus understanding that historic buildings are organic and may grow (ideally in a way that is predictable and clearly legible). It would require an understanding that incentives will expand intensity of uses in the district. The City would need to amend its Land Use Regulations to allow additions that exceed 1-story maximum over the existing roof (where controlled in location and footprint). It should also allow accretive additions without demolishing the historic building fabric, especially facades, underneath. The continuity of historic facades, even as new structures rise behind or above, should be maintained.





1 Transfer of Development Rights

2 Accretive Urbanization Rea



3 Accretive Urbanization Stepped



4 Accretive Urbanization Spread

Rooftop Additions

Rooftop additions to historic buildings are one of the most sensitive issues in historic preservation. Nationally, Standards 9 and 10 of the Secretary of the Interior Standards for Rehabilitation, which govern the administration of the Historic Preservation Tax Incentives program, suggest strong controls on the scope and impact of new additions. According to Standard 9, "New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment;" and Standard 10 states "New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired." Notwithstanding the above, rooftop additions are common in Miami Beach, although most follow City guidance that they are set beneath sight-lines from the fronting avenue or street. In character, most are designed to be discreet.

However, if added floor area was to be a necessary component in compensating floor area located below Base Flood Elevation, or incentivizing robust adaptation, and if rooftops are the only area where new floor area might be located, new paradigms of adding to historic buildings will probably be necessary. From iconic landmarks to industrial heritage to everyday historic buildings, architects around the world are exploring bold additions to historic structures, adding a new layer in a way the reinvigorates the existing structure. Perhaps the most famous of these is Herzog & de Meuron's rehabilitation of Sir Giles Gilbert Scott's Bankside Power Station in London. Its transformation into the Tate Modern featured strikingly contemporary rooftop additions that announce the new program of the structure. Herzog & de Meuron has practiced this approach in several other notable structures, including the CaixaForum in Madrid and Elbphilharmonie in Hamburg.

Such approaches have proliferated especially in Europe, where the challenge of accommodating growth or new programs in a tight urban context is particularly present. Eschewing a discreet approach (hiding or minimizing rooftop additions), these recent structures use rooftop additions to visibly adapt buildings, proclaim continuity and demonstrate contemporary approaches. One key to these additions is legibility – rooftop additions are clearly distinguishable as a product of their time and place. Often, emphasis is placed on poignant contrasts of form, orientation, materiality and color.

In Miami Beach, such an approach seems doable and practical, and as noted above is already present. Perhaps resiliency improvements in Miami Beach must fundamentally be understood as 'adaptive use', rather than as 'renovation'. Such adaptive use, paired with strict preservation of historic facades, would put greater emphasis on innovation in development of new layers of architecture. In this team's opinion, this approach seems particularly applicable to the Strategy 1, Adapt in Place models of adaptation, as these already provide for the careful maintenance-in-place of existing building envelopes. Of course, as is the case today, any changes to the characteristic look of historic buildings should be carefully reviewed by City Planning staff, and by the Historic Preservation Board.







1 | Breiner 310, Portugal, Ezzo, 2015 2 | Louis Sullivan's Pilgrim Baptist Church, Chicago, Dirk Lohan 3 | RaabestraBe, Berlin, Gussman Atelier, 2010 4 | Iberostar Grand Hotel Budapest, Budapest, Peter Reimholz and Peter Nagy, Tamas Nemeth, 2010 5 | Increase in MargaretenstraBe, Vienna, MG9, 2012. 6 | Corso I Karlin, Prague, RBTA, 2000.



Transfer of Development Rights | Incentivization 1



Transfer of Development Rights is a zoning technique that "conserves land by redirecting development that would otherwise occur on the land (the sending area) to a receiving area suitable for denser development. The technique operates so that owners in the sending area can be compensated for their redirected development rights. Transfer of Development Rights would allow properties in historic districts to receive development incentives for qualified adaptation projects, while maintaining the current scale and look of the district.

Unused development potential, such as Floor Area, may be transferred from sites within Miami Beach historic districts, to sites outside such districts.

Opportunities

- Maintain the look and feel of historic districts while also rewarding adaptation in a way that can be monetized
- Prioritize the adaptation of historic districts in the granting of further density outside historic districts.

Challenges

- Pressure to keep areas outside historic districts at a compatible low scale
- Find appropriate locations for additional Floor Area
- The potentially huge amount of Floor Area that can be generated by incentives or unused development rights might overwhelm nearby receiving areas.
- Would require that the market for additional floor area in receiving areas is robust.







Area of intervention

Transfer of Development Rights | Incentivization 1



Accretive Urbanization | Rear Development | Incentivization 2



As an incentive to adaptive redevelopment, allow new ground-up additions to the rear 35' of a structure (on a typical 140' lot). The accretive Rear Development, or Alley (in Flamingo Park) approach, promotes compensatory housing development as a legible new adaptive layer set deeply behind the city's iconic avenue/street facades. The development of taller, limited-footprint additions along the alley of building lots would create a receiving area for new incentivized development within the historic district, even perhaps within each block.

Set back 105' from the street right-of-way line, and approximately 85' from the front facade of existing contributing buildings, this new housing would constitute an experimental zone of new architectural approaches, massing strategies, contemporary façade articulation strategies and adaptive architectures. In the Flamingo Park district, a new vertical urbanism would emerge within the block as alleys are redeveloped in this way.

The accretive Alley approach works particularly well for cottages and urban villas, where new additions at the rear of the property would be ground-up, not requiring demolition or costly refiguring of existing structural elements. The accretive Rear Development approach also works best at mid-block buildings, where appropriate setbacks from nearby right-of-ways can be maintained. It would be problematic on endblocks where buildings have secondary frontages on E-W streets. The team recommends that these properties incentivize through Transfer of Development Rights.

Opportunities

- Maintain the look and feel of historic districts as a primary layer while also rewarding adaptation in a way that can be monetized
- Prioritize the adaptation of historic buildings in-situ.
- Allow evolution of building types and development of new urbanisms within the context of existing historic architectural and urban fabric.
- · Replace residential floor area of existing floor plates below DFE while maintaining the residential intensity of the district.
- Highlight creative approaches as a new attraction of Miami Beach

Challenges

- · Compatibility/integration of taller new structures with existing lowscale building fabric
- Visibility of new layers, albeit as a secondary layer, from the public right of ways
- · Would require robust market for additional floor area in the historic district



Accretive Urbanization | Rear Development | Incentivization 2



Accretive Urbanization | Rooftop Stepped | Incentivization 3



As an incentive to adaptive redevelopment, allow various rooftop additions that exceed the current standard of not being visible. The Accretive Mixed approach promotes compensatory housing development as a legible new adaptive layer spread over the top of existing buildings. The development of rooftop additions would create a receiving area for new incentivized development within the historic district.

Although visible rooftop additions are discouraged by the US Secretary of Interior Standards for Rehabilitation, the strategy is quite common in other countries, and has been deployed in remarkable architectural icons. New architectural approaches, massing strategies, contemporary façade articulation and adaptive architectures could be explored and developed on the rooftops, high above anticipated flooding. The Accretive Mixed approach would allow maximum flexibility for the redevelopment of contributing properties in historic districts, and stimulate variety in approach. Rooftop additions of varied character have already been approved and constructed in Miami Beach, although most follow a standard of being built behind sightlines from the right of way.

As a whole, the accretive approach would require both a conceptual and regulatory change in the way the City allows redevelopment of historic structures. In particular, it would depend on a consensus understanding that historic buildings are organic, and that they may grow in a way that is predictable and clearly legible. It would further require an understanding that intensity of uses in the district might expand if incentives are allowed. Code-wise, the city would need to allow additions that might exceed one story over the existing roof. Finally, the City would need to allow such accretive additions without demolishing the historic buildings underneath. The continuity of historic facades, even as new structures rise behind or above, should be maintained.

Opportunities

- Maintain the continuity and location of existing building fabric, while also rewarding adaptation in a way that can be monetized
- Prioritize the adaptation of historic buildings in-situ.
- Allow evolution of building types within the context of existing historic architectural and urban fabric by allowing new vertical layers.
- Replace residential floor area of existing floor plates below Design Flood Elevation. Maintain the residential intensity of the district.
- Highlight creative approaches as a new attraction of Miami Beach

Challenges

- Compatibility/integration of rooftop structures with existing low-scale building fabric below
- Visibility of new layers from the public right of ways
- Would require robust market for additional floor area in the historic district



Accretive Urbanization | Rooftop Stepped | Incentivization 3









Accretive Urbanization | Rooftop Spread | Incentivization 4



As an incentive to adaptive redevelopment, allow rooftop additions that exceed the current standard of not being visible. The Rooftop Spread approach promotes compensatory housing development as a legible new adaptive layer spread over the top of existing buildings. By spreading the additional floor area, it would be more visible, but not as tall. The development of spread rooftop additions would create a receiving area for new incentivized development within the historic district.

Although visible rooftop additions are discouraged by the US Secretary of Interior Standards for Rehabilitation, and have generally not been either proposed or approved in Miami Beach (where most additions must follow a standard of falling behind sightlines from the right of way), the strategy is quite common in other countries and has been deployed in remarkable architectural icons. New architectural approaches, massing strategies, contemporary façade articulation strategies and adaptive architectures could be explored and developed on the rooftops, high above anticipated flooding. The Rooftop Spread approach emphasizes visibility as a poignant new counterpoint to historic building fabric.

Opportunities

- Maintain the continuity and location of existing building fabric, while also rewarding adaptation in a way that can be monetized
- Prioritize the adaptation of historic buildings in-situ.
- Allow evolution of building types within the context of existing historic architectural and urban fabric by allowing new vertical layers.
- Replace residential floor area of existing floor plates below Design Flood Elevation while maintaining the residential intensity of the district.
- · Highlight creative approaches as a new attraction of Miami Beach

Challenges

- Compatibility/integration of rooftop structures with existing low-scale building fabric below
- Visibility of new layers from the public right of ways
- Would require robust market for additional floor area in the historic district



Accretive Urbanization | Rooftop Spread | Incentivization 4







image description

image description

5.5 // LANDSCAPE STRATEGIES

Opportunities for Improved Ecology

Miami Beach is surrounded by the rich and diverse ecosystem of the Biscayne Bay and ocean reefs. These fragile ecologies are sensitive to stormwater runoff, which can modify the natural temperature, salinity, turbidity and chemical composition of these water bodies.

The City of Miami Beach has recently added pumping systems to trap and remove a large percentage of the debris, oil, and other pollutants that are added to stormwater runoff as it travels across the roads and yards of the city, which greatly improve the quality of runoff before it enters the Bay.

As both the City and private owners grapple with the implications of sea level rise, there is an opportunity to design in ecological measures to further treat stormwater runoff through an extensive use of green infrastructure within both private yards and along public streets.



Planting for the future

To account for future climate conditions, the plantings of Miami Beach should be chosen looking towards the future. Plantings in Miami Beach should be drought tolerant, salt tolerant, and tolerant of wind or hurricane conditions.

The choice of plantings should also facilitate local ecology. There is a benefit to native plantings in order to provide food and shelter for the pollinators and bird populations. Native plant communities including the beach dune, coastal strand and maritime hammock communities are naturally drought and salt tolerant, and are a natural fit for green infrastructure. Native and resilient plantings are the best and recommended choice for Miami Beach.



RECOMMENDED PLANTING MATRIX

This matrix lists high performance native plantings from coastal plant communities which are tolerant of salt, drought, and wind, as well as being appropriate for green infrastructure use. These plants can be used to replace any invasive or intolerant plantings for the existing prevalent Miami Beach vegetal typologies of hedges, shrubs, palm trees and canopy trees. This plant matrix presents a limited list of possibilities, with the sources listed for further recommendations.

CHARACTERISTICS

DROUGHT GREEN RECOMMENDATION SALT NATIVE TOLERANT TOLERANT INFRASTRUCTURE SOURCE HEDGE COCOPLUM 1, 5, 6 CHRYSOBALANUS ICACO SEAGRAPE 1, 2, 3, 4, 5 COCCOLOBA UVIFERA BUTTON MANGROVE CONOCARPUS ERECTUS 1, 2, 3, 4, 5 SHRUBS 1,6 SEA LAVENDER ARGUSIA GNAPHALODES CHAMAESYCE PROSTRATA PROSTRATE SANDMAT \bigcirc WAXMYRTLE 1 MORELLA CERIFERA 1, 3, 6 GULLFEED SCAEVOLA PLUMERI SPANISH BAYONET \bigcirc 1, 3 YUCCA ALOIFOLIA

NATIVE TOL SPICEWOOD CALYPTRANTHES PALLENS BUTTONSAGE LANTANA INVOLUCRATA SAW PALMETTO SERENOA REPENS PALM TREES PAUROTIS PALM ACOELORRHAPHE WRIGHTII ROYAL PALM ROYSTONEA SPP. FLORIDA THATCH PALM THRINAX RADIATA CABBAGE PALM SABAL PALMETTO

Recommendation Source

- 1. NRCS; Native Plants For Coastal Dune Restoration
- 2. SFWMD.GOV; Storm Wise South Florida Landscapes
- 3. Univ Of Florida ; Salt Tolerant Plants For Florida 4. Miami Dade County: Guide To Tree Planting And M
- Miami Dade County; Guide To Tree Planting And Maintenance Recommended Species For Rain Gardens, Bioswales, And
- 5. Recommended Species For Rain Gardens, Bioswales, And Bioretention Cells In Puerto Rico And The Caribbean Islands
- 6. USFWS; Beach Dune, Coastal Strand And Maritime Hammock

CHARACTERISTICS

SALT LERANT	DROUGHT TOLERANT	GREEN INFRASTRUCTURE	WIND TOLERANT	RECOMMENDATION SOURCE
•	•	\bigcirc		
\bigcirc	\bigcirc	\bigcirc		1
•	•	•		1, 3
	•	\bigcirc	•	2, 3
•	•	•	•	2, 3, 5
	•	\bigcirc	•	2, 3
	•	•		1, 2, 3, 6

RECOMMENDED PLANTING MATRIX

Recommendation Sources

- 1.
- 2.
- З. 4.
- 5.
- NRCS; Native Plants For Coastal Dune Restoration SFWMD.GOV; Storm Wise South Florida Landscapes Univ Of Florida ; Salt Tolerant Plants For Florida Miami Dade County; Guide To Tree Planting And Maintenance Recommended Species For Rain Gardens, Bioswales, And Bioretention Cells In Puerto Rico And The Caribbean Islands USFWS; Beach Dune, Coastal Strand And Maritime Hammock
- 6.

CHARACTERISTICS

		NATIVE	SALT TOLERANT	DROUGHT TOLERANT	GREEN INFRASTRUCTURE	WIND TOLERANT	RECOMMENDATION SOURCE
CANOPY TREES	DAHOON HOLLY ILEX CASSINE	•	\bigcirc	•	•	•	2
	GUMBO LIMBO BURSERA SIMARUBA	•	•	•	•	•	2, 3, 4, 6
	REDBAY PERSEA BORBONIA	•	\bigcirc	•	•	•	2,4, 6
	STRANGLER FIG FICUS AEREA	•	•	•	\bigcirc	•	2,4, 6
	MASTIC SIDEROXYLON FOETIDISSIMUM	•	•	•	\bigcirc	•	2, 6
	LIVE OAK QUERCUS VIRGINIANA		•		\bigcirc		2, 3, 4, 6

DO NOT PLANT LIST

The following list is trees that are not recommended for Miami Beach, due to wind intolerance, weak branches, or a tendency to uproot easily. These plants are included in a list of trees to consider removing due to performance in recent storms, and should not be planted.1

		CHAR
		UPROOTS OR FALLS IN WIND
TREES NOT TO PLANT	EARLEAF ACACIA ACACIA AURICULIFORMIS	\bigcirc
	NORFOLK ISLAND PINE ARAUCARIA HETEROPHYLLA	\bigcirc
	HONG KONG ORCHID BAUHINIA VARIEGATE	
	JAVANESE BISHOPWOOD BISCHOFIA JAVANICA	
	BLACK OLIVE BUCIDA BUCERAS	\bigcirc
	AUSTRALIAN PINE CASUARINA SPP.	
	CARROTWOOD CUPANIOPSIS ANACARDIOIDES	
	ROYAL POINCIANA DELONIX REGIA	\bigcirc
	EUCALYPTUS EUCALYPTUS CAMALDULENSIS	\bigcirc
	WEEPING FIG FICUS BENJAMINA	
	SILK OAK GREVILLEA ROBUSTA	\bigcirc
	JACARANDA JACARANDA MIMOSIFOLIA	\bigcirc
	JAVA PLUM SYZYGIUM CUMINI	
	YELLOW TABEBUIA TABEBUIA CARAIBA	
X	QUEEN PALM SYAGRUS ROMANOFFZIANUM	
	WASHINGTON FAN PALM WASHINGTONIA ROBUSTA	

1 "Storm Wise South Florida Landscapes", South Florida Water Management District, West Palm Beach FL, Accessed September 23, 2019, https://www.sfwmd.gov/sites/default/ files/documents/bts_stormwise_landscapes.pdf.

RACTERISTICS



LANDSCAPE STRATEGIES FOR PROPERTY OWNERS

High performance preservation

Although densely urbanized, Miami Beach properties retain meaningful and functional open spaces. In the Flamingo Park district, and to a lesser extent in the Collins Waterfront district, front yard spaces form continuous green buffers between the right-of-way and the buildings. The terraces and patios that often occupy these spaces are a Miami Beach tradition. Between the buildings, fine grained intersticial spaces are used as courts and buffers. It is possible to preserve the current uses of private sites while adding a high-performance upgrade to manage stormwater runoff. The building types described in this study describe common configurations with similar percentages of open space. The following diagrams are intended to provide guidance for property owners to manage stormwater in these spaces.



Green infrastructure opportunities for a small building footprint

Small buildings on larger sites provide greater opportunities for using the landscape to manage flood water. Many simple interventions in the landscape can help. These include hardscape strategies such as replacing impermeable terraces, drives, parking areas and walks with permeable pavers. Rain barrels can capture water from roofs. Construction of rain gardens with engineered soils and native salt tolerant plantings can help improve site drainage and evapotranspiration.

Applicable typologies





Green infrastructure opportunities for a larger building footprint

The building typologies with a lower percentage of open space have less of an opportunity to manage stormwater in the landscape. However, buildings with flat roofs present an opportunity to add intensive or extensive green roofs to absorb excess storm water. Depending on the roof structure, these roofs can manage different amounts of water with the deeper profile allowing for greater capacity. All green roofs add insulation value and help to reduce ambient temperature of the surrounding area to reduce heat island effects. Lower temperatures and increased insulation help reduce air conditioning costs and lower energy bills. Larger footprint sites can also include permeable paving to enhance overall site drainage.



Green infrastructure opportunities for a courtyard building footprint

The courtyard building typologies present the opportunity to manage stormwater through simple interventions in the landscape. Sponge landscapes, sunken plazas and rain gardens can all be integrated in the overall design. This diagram shows the approximate amounts of managed stormwater, although the actual amount would be based on the specific site as the courtyard configurations vary significantly in size.



5.6 // STREETSCAPE STRATEGIES

Public Right of Ways

Miami Beach's wide avenues and streets offer excellent opportunities for increased tree canopy, green space, amenity and environmental/hydrological functions. Reducing excessive pavement in these rights of ways, the use of permeable pavements for car and bicycle parking areas, and the installation of continuous green infrastructure systems will increase water storage and recycling and reduce stormwater runoff. Reduced paved areas can still accommodate wide sidewalks, on street parking and designated bicycle lanes.

Looking to the future, provision needs to be made for accessibility between raised streets and adjacent properties. The raising of the roads and the adaptation or raising of buildings will not happen simultaneously. Indeed, there is no certainty that private properties will be raised at all. The team recommends adding a planting buffer within the public right-of-way that will allow the sidewalk and the roadway to be at different elevations. The planter buffer will provide continuous green infrastructure along the streetscape. Raised tree planters located in this planting buffer/parking zone will allow roadways or sidewalks to be repeatedly raised in the future without disturbing mature canopy trees along the avenues and streets.



Road diet for E-W streets

Converting E-W streets into one-way streets would create space to fit both bike paths and green infrastructure along the street and mitigate raised roadway conditions. One-way street design precedents include streets in Brooklyn, where the streets include one way driving lanes, a bike lane and parking on both sides of the street.





Bergen Street, Brooklyn



Moderating change

The planting buffer within the public right-of-way will allow the sidewalk and the roadway to be at different elevations to allow flexibility for the sidewalk elevation within the interior of the block. This planter buffer will also provide continuous green infrastructure along the streetscape, and will not disturb the mature street trees when roadways or sidewalks are repeatedly raised in the further future.



Modular planter

The planter design was inspired by masonry screens that characterize many garden enclosures throughout the district. The design is modular and expandable with edges that can be added to and components that can be buried over time. Formed from masonry units, the material is durable and units easily replaceable. The walls can be buried in soil and periodically submerged in water.



Road or sidewalk grade changes + mature tree remains



Modular additive planter

Plan for Avenue & Street | Existing Conditions

The existing conditions for the Flamingo Park neighborhood include avenues with a 70' Public Rightof-Way lined with mature canopy trees. Front yard setbacks along the avenues range from 15' - 25' width, and usually include a perimeter hedge and small patio with seating. The streets have a 50' Public Right-of-Way with minimal side yards typically 5' wide, often with planted palm trees lining the streets.



Plan for Avenue & Street | Raised Roadway at 8.5 NGVD

In the condition where the road has been elevated to 8.5 NGVD, the buffer planter will moderate between the different elevations of the sidewalk and the roadway while maintaining a mature tree canopy. In addition to the planter zone, the new streetscape will include bike paths, parking and planters that can absorb storm water. A best-case scenario would include permeable paving in the parking areas. Excess pavement in the public right-of-way should be eliminated.











Raised road



Raised road



Raised Street

 Exisitng Groung Level
 Existing Groung Level



Individual approach | NGVD 14' | Raise building & lots (some) | Strategy 2A

Existing Avenue



Raised Avenue
5.7 // NEW HISTORIC PRESERVATION & RESILIENCY FRAMEWORKS

Over the next 60 years, the study areas considered will need to be reconstructed/adapted in significant ways. As adaptive rehabilitation projects are conceived for vulnerable contributing properties, how should the City of Miami Beach and its Historic Preservation Board consider proposals outside its current preservation frameworks? New frameworks will need to be developed to address both the specificity and generality of the issues. The team recommends a broad approach to developing these frameworks: first, establish new historic preservation standards and guidelines that align with future resiliency goals and strategies; as part of this effort, reconcile these historic preservation standards with resiliency mandates and initiatives citywide; in order to communicate the relevance of newly adaptive historic districts, reframe these important districts as cultural resources and leaders of resiliency; and finally, in order to maintain a diverse population in the adaptive districts, reconcile resiliency goals with affordability and social equity objectives.

Establish new Historic Preservation Standards/Guidelines

The established theory and practice of historic preservation, locally and nationally, will likely present obstacles to the adaptation of contributing buildings in Miami Beach. The Secretary of Interior Standards for Rehabilitation, as well as other guidance from the National Park Service, have over time become the default guidance for regulatory review of a wide range of projects involving historic buildings. While not required to do so, local preservation ordinances, including those in Miami Beach, have incorporated the Standards to guide their own reviews, making them the de facto preservation policy governing preservation nationwide. Nevertheless, as a Certified Local Government, Miami Beach is responsible for determining and enforcing its own regulations. While the Standards have been an excellent preservation tool to date, the city should initiate the next generation of its guidelines, and consider these as an opportunity to correlate local building types with issues of resiliency more directly.

As an example of the obstacles that will be confronted, the mid and long-term strategies proposed by this study – Strategy 1, Adapt in Place and Strategy 2, Raise – present numerous issues under current preservation standards. The challenges include modification to the use and appearance of individual buildings, removal of original building materials, change in the landscape and paving around buildings to accommodate green infrastructure, and changes that exceed what could be removed/recovered in the future. The lifting or moving of buildings changes how buildings interact with each other and their setting, and challenges preservation guidelines in a number of other ways. Zoning incentives, such as added floor area, height, relief from setbacks and open space requirements will pose additional challenges as they come up against the Secretary of Interior Standards, and current guidance to the HPB. Yet, in adaptive rehabilitation projects, the removal of historic materials, the alteration of distinctive features, finishes and construction techniques, replacement of building structural systems, rooftop additions, and the alteration of interior spaces may be unavoidable.

The City will need to develop more flexible frameworks and procedures that tolerate and even support adaptive projects, and help guide HPB members in their decisions. Such a new paradigm of historic preservation may de-emphasize the importance of integrity and authenticity (visual and material), and instead place emphasis on the cultural and place-making value of historic resources. It might suggest a more organic approach to the evolution of historic districts, in which contributing buildings function as DNA, and as elements of a mosaic that forms the urban fabric. This paradigm may emphasize the need to alter or add to an historic property to meet adaptation goals while retaining the property's historic character. It should also emphasize environmental principles as necessary for long-term resilience. Specific recommendation for new historic preservation standards are included in Recommendations at the end of this chapter (Chapter 5.8).

As it revises its standards and guidelines, the City should avoid decisions that may lead to de-listing of historic districts, and work with partners to find agreement on strategies. The City should lobby Miami-Dade County, the State Historic Preservation Officer in Tallahassee, and the National Park Service to develop Programmatic Agreements that would qualify sponsored approaches to resiliency in historic districts for future tax credits, State Accessibility Waivers, and County ad-valorum tax credits.

Reconcile Resiliency and Historic Preservation Objectives

Up to this point, resiliency and preservation initiatives have generally proceeded outside a coordinated framework. However, in order to confront the issues facing Miami Beach, such a framework must be invented. This task is complicated because there is no accepted national standard defining how historic preservation and resiliency should work together (although a number of recent initiatives, described below, are exploring this topic).

Historic preservation has long played a critical role in Miami Beach. The city's Historic Districts and the National Register Architectural Districts have emerged over the past few decades as cultural resources that drivers of the local identity and economy. The urban character and historic architecture of these districts are so culturally impactful that they have redefined Miami Beach's original resort vocation. The foundations that support historic preservation are about to be challenged, because on the adaptive front, the need to act is compelling.

Historic preservation and resiliency are, perhaps naturally, opposing concepts. Historic preservation emphasizes the permanence of buildings and their ongoing role in the collective memory of cities. In preservation terms, the 'design lifetime' of buildings can be considered as suspended. In contrast, resiliency considers the continuous adaptability of structures and systems. It commonly acts against the idea of permanence. The Urban Land Institute (ULI) has observed that "future coastal communities may need to be treated as temporary cities." Resilience concerns may be used as a reason not to improve property, or to demolish it. Conversely, preservation considerations may be cited as a reason not to improve resiliency. In these oppositions, the city must navigate how historic buildings can contribute creatively to the discussion of resiliency. Miami Beach will define itself as a leader by inventively amalgamating preservation thinking and practice with issues of resilience and sustainability in policy and in practice.

At a minimum, the City of Miami Beach should undertake a process of reconciliation of historic preservation ordinances and practices with resiliency-oriented codes and objectives. It should channel the often-disparate discrete decision-making of various jurisdictional authorities (as well as property owners) into a coordinated vision. The City should incorporate adaptation as a requirement in all preservation planning, and historic preservation concerns should be carefully integrated into all adaptation planning and permitting. The City's Historic Preservation Board should be granted increased authority over resiliency-based decisions (in the same way it was granted increased authority over zoning variances in the 2010's.)

Further, the city should advocate for changes to the Florida Building Code, the National Electrical Code, FEMA's flood plain management guidelines and other national codes in order to emphasize the particular needs of Miami Beach (both in terms of preservation and resilient adaptation), and should authorize the City Building Official to interpret the application of these codes to historic properties in a manner that is consistent with the City's larger preservation and resiliency goals.

Reframe the Importance of Historic Districts as Leaders in Resiliency

Global climate change poses a threat to cultural heritage. In the preservation community, much work has been done in the last 10 years to gain a better understanding of climate change and sea level rise threats, including quantifying potential impacts on historic landmarks, historic districts, and historic buildings listed on the National Register of Historic Places. A number of preservation-related organizations have taken on the task of reframing the discourse of preservation and adaptation. For instance, the Climate Heritage Coalition, established in 2015 and grouping professionals from both the cultural heritage and climate science, has been helping push the preservation field from inaction to action, and to feel more equipped to handle making decisions about historic properties and places in the context of climate projections.

The National Trust for Historic Preservation is leading the charge to evolve our thinking about historic preservation. Borrowing from the context of the 1970s oil crisis and notion that historic preservation is the "ultimate recycling," the Trust has taken the position that the preservation field needs to face the challenge of climate change head on; to be persistent, creative, and innovative in demonstrating historic buildings' compatibility with adaptation. The Trust recognizes that addressing the impacts of climate change and sea level rise will require both policy makers and the preservation community to be flexible and willing to consider non-traditional solutions, such as moving buildings, raising them, or using newer, experimental approaches and building materials. The Trust's Research & Policy Lab - formerly the Preservation Green Lab - conducts research and explores conservation through policy-making; the NPS has focused on resilience to natural hazards, and is developing new adaptive treatments necessary to respond to challenges of resilience; FEMA, which focuses on pre-and post-disaster mitigation, has highlighted new approaches in its Floodplain Management Bulletin, and sponsors a Hazard Mitigation Grant Program.

It makes perfect sense that preservation, as a field and as a profession, belongs at the front lines of helping communities to make the necessary tough decisions and to design innovative approaches to the impacts of sea level rise. Preservationists are experts at saving places, preserving buildings, and have long documented the way in which — over time — various regions throughout the country have adjusted their building and construction techniques to adjust for changing weather, new technology, and advances in science. While the original impetus for preservation policy and law was to prevent demolition of historic buildings, it is now widely understood that the field has advanced to address other issues and interests too. In practice, preservation is evolving toward models that are flexible, adaptable, and creative. This perspective allows for a broader and more holistic interpretation of significance and the notion of continued value.

In Miami Beach, historic districts should take the lead in testing climate adaptation and neighborhoodwide flood mitigation retrofits. As the preservation community in Miami Beach is strong, and where historic districts are under threat of water, the city is well positioned to develop new frameworks. Historic Preservation infrastructure offers several tools, including Federal Tax Credits and assistance from the State Historic Preservation Officer (SHPO). The National Flood Insurance Program (NFIP) floodplain management regulations already offer relief to historic structures, which do not have to meet the floodplain management requirements of the program. Miami Beach typically grants relief through variance exemption (44 CFR 60.6(a)) or exclusion (44 CFR 59) of historic buildings from requirements. The organizational, legal and procedural frameworks of preservation in Miami Beach can be deployed to further resiliency.

Reconcile Resiliency and Affordability / Social Equity Culturally relevant and vibrant places are maintained when the diversity and character of a city's population (not just its architecture) are preserved.

Although Miami Beach is a wealthy city by many measures, it is home to many vulnerable populations - defined by Boston's CRO Dr. Atyia Martin as "children, the elderly, the sick, the disabled, renters, low-income communities, minority residents, those with less than a high school education, and those with limited English proficiency." According to 2016 US Census Bureau figures, 16.7% of Miami Beach residents live below the poverty line. This is 4.4% higher than the national average, and does not take into account citizens above the poverty line who still have significant need, like the 50% of renters [who] are rent burdened and [the] 38 percent of home-owners [who] are house-burdened. When making decisions about resiliency, it is crucial that cities consider the specific challenges these vulnerable populations will face — challenges of finance, mobility, communication — to make living with water an equitable reality for all.

The Southeast Regional Climate Change Compact released an updated version of its Regional Climate Action Plan (RCAP) in December 2017. The RCAP 2.0 includes a new Social Equity section that makes recommendations for local governments about policy, community engagement and infrastructure adaptation. These recommendations suggest, at every level of government, making equity an integral part of project planning and policymaking. They suggest prioritizing investments in infrastructure that support issues of health and safety as well as economic mobility, and focusing on access to transit and green infrastructure; and they propose more effective engagement of community leaders and residents in discussions of infrastructure design and preparedness planning.

Further, the RCAP 2.0 outlines the following facts:

In 2017, Hurricane Irma caused an estimated \$50 billion in damage and 97 deaths nationwide, with the worst effects occurring in Florida. Global and national trends show that extreme weather events are increasing in frequency and intensity. In 2017, the most destructive extreme weather events across the country — including hurricanes Irma and Maria—caused more than \$300 billion in damage, setting a new annual record. While upper-income households often have the resources to rebuild relatively quickly in the wake of such disasters, it can take years for low- and moderate-income households to rebuild—if they are able to do so at all.

Sea level around Southeast Florida is projected to rise from 6 to 10 inches above 1992 levels by 2030, increasing flood risks and the need for resilient infrastructure and housing. Nuisance floods-small, frequent floods that can block roads and create other hazardous conditions-have outsized impacts on working people when they are forced to spend limited funds or go into debt to meet flood recovery costs; when places of employment close; or when commutes become physically impossible.

While investments in infrastructure and education are key to the development of inclusive cities, the implementation of broad policies alone will not suffice. Low-income and vulnerable communities often do not have the resources to rebuild after a disaster, nor are they able to adapt and "futureproof" in preparation for these events. According to the Urban Land Institute's (ULI) 2018 Stormwater Management and Climate Adaptation Review of Miami Beach, "the city needs to ensure that low-income populations are given priority for investments in stormwater management" and strive to create a more equitable, resilient community that offers "more housing options affordable for people at a range of

income levels." The ULI recommends "the establishment of a community adaptation fund [that] would provide low-interest loans to help residents and businesses finance the large upfront costs of retrofitting properties." While social equity goals, such as increasing transportation, establishing an Adaptation Fund and "enhancing affordable housing and income diversity [may] reach beyond the remit of a stormwater management program, they are critical goals to inform the city's broader resilience work."

At times, both preservation and resiliency have acquired reputations as harbingers of gentrification. Indeed, in Miami Beach, vulnerable populations are located in the midst of a partly gentrified community, most often in unrenovated and un-adapted structures. Preservation and adaptation strategies for these buildings will no doubt be costly, increasing pressure on vulnerable populations to leave. Specific strategies should be developed in parallel with resiliency and preservation legislation, to retain vulnerable populations. Such strategies may include: incentivizing low-cost housing in adapted buildings; reducing the average unit size requirements for adapted housing; remove the parking requirement for low-cost housing; establishing a community adaptation fund that would provide low-cost loans to projects meeting both resiliency and social equity goals; adopting a Miami-Dade County inclusionary zoning provision; creating block-wide pool/credit program to incentivize lower-cost, affordable and inclusionary housing; and promoting greater physical accessibility to rehabilitated/adapted properties.



5.8 // Recommendations | Resiliency & Preservation Related

5.8.1 // REVIEW HISTORIC DESIGNATIONS

The City of Miami Beach should review local and national district designations to study how adaptation will affect those designations. The City should consider changes/ amendments to these designations that would prepare them for dealing with likely issues connected with adaptation. Where these designations are constructed on architectural criteria alone (i.e. the Miami Beach Architectural District), expand the criteria to include cultural and other criteria. Expand the platform of significance to support the relevance of the districts going forward.

5.8.2 // SELECT A RESILIENCY STRATEGY

The City of Miami Beach should establish Experimental Action Areas (EAA) in each study area, or a subdistrict of a study area, in order to test resiliency strategies and approaches. Within each EAA, it should adopt a coordinated, integrated and consistent resiliency strategy (for instance, select the Adapt-in-Place strategy, or the Raise strategy, but not both). Within each EAA, it should emphasize goals associated with the selected strategy. For instance, emphasize contextual appropriateness in Adapt-in-Place strategies, and the connection of building to ground --stoops, planters, entranceways --in Raise strategies. The City should allow a period of experimentation, and commission a review of the results. The team vision for implementation of each strategy is further explained in Chapter 6.

5.8.3 // DEVELOP A TIERED PRESENTATION MODEL

The City of Miami Beach may consider different levels of preservation for different types of structures.

Tiering is a system in use abroad, such as in the UK, where the Historic England Grading System has been in place since 1947. Under the English system, historic buildings fall into one of three grades, based on differing levels of significance: Grade II buildings are of special interest, warranting every effort to preserve them; Grade II* buildings are particularly important and of more than special interest; Grade I buildings-the highest grade-are of exceptional interest.

In Miami Beach, such a tiering system may be based on civic/artistic quality or current degree of authenticity. The system may emphasize more stringent preservation requirement to capital structures, while allowing more flexibility in the vastly larger number of modest hotels, residential and commercial buildings that make up the fabric of the city. Note: such a system should not be construed as selecting what to preserve, since most buildings that make up Miami Beach historic district are

preservation system could work as follows:

Tier 1: highest degree of civic/artistic quality and degree of authenticity Example: the Miami Beach Post Office (Howard Lovewell Cheney, 1937) Allow/require building elevation to minimize impacts to contributing structure. Require low-impact solutions with minimal effect on interior resources.

Tier 2: moderate degree of civic/artistic quality and degree of authenticity Example: An oceanfront Art Deco hotel facing Lummus Park, such as The Breakwater (Anton Skislewicz, 1936) Allow creative approaches to adaptation, including building elevation; allow some flexibility in pursuing adaptive use of ground floor, prioritize wet floodproofing as a low-impact solution to infrequent flooding.

Tier 3: lowest degree of civic/artistic quality Example: modest residential building type Focus on maintaining the facades and elements that contribute to the continuity of the surrounding district. Allow the most flexibility in the interior of the building, including reconstruction with adaptive materials. Allow elevation in Experimental Action Areas where Raise has been selected as the appropriate adaptation strategy. Follow resilience design guidelines, enforced by the HP Board, for most renovations.

Note: Under this system, the City of Miami Beach should tier all buildings (in the same way all buildings are currently classified as contributing or non-contributing). For the purposes of this study, the team would consider all buildings in the Flamingo Park study area and most buildings in the Collins Waterfront study area as Tier 3 structures. Hotels in the Collins Waterfront study area may be considered Tier 2.

5.8.4 // DEVELOP A TIERED APPROACH TO HISTORIC RESOURCES

The City of Miami Beach may consider tiering of historic resources within each structure/ site. Such a tiered system might give further guidance to the Historic Preservation Board in evaluating proposed rehabilitation projects in the context of implementing adaptive measures. The tiered resources model could work as follows:

modest structures, and the districts are significant for the way these structures work together to establish character and identity. However, within this fabric, the varied resilience characteristics of contributing buildings, and the greater importance of the building facade in establishing significance, argue for more flexibility. The tiered

Primary Resources

- Building skin facing streets and primary sideyards/courts, including all architectural features
- Projecting and decorative facade features, such as balconies, eyebrows, bas-relief •
- Built-in exterior stairs, stoops, planters, railings
- Site features, such as terraces, patios, site walls •
- Historic signage

Secondary Resources

- Building skin facing secondary (service or inaccessible) side yards, alleys •
- Lobbies and other public spaces (except in hotels and civic buildings)
- Interior historic resources, like fireplaces, characteristic plaster moldings

Tertiary Resources

Other unit interior areas

5.8.5 // DEVELOP A RESILIENCY DESIGN STANDARD

The City of Miami Beach should set resiliency objectives, but be open to different levels of adaptation. It should set adaptation standards for new rehabilitation projects, and incentivize greater resilience. For instance, it should require or incentivize that ground floor structures be reconstructed in concrete (wet or dry-floodproofed if commercial); use only flood-resistant building materials and finishes below projected storm surge levels; and install water storm storage systems in the space below raised buildings. However, it should allow a variety of levels of engagement, allowing property owners to take a phased approach in fortifying their structures against water (for instance by using Take Action Now strategies where possible; see Chapter 6). As a guide for adherence to requirements, and for incentivization, it should establish tiered adaptation levels.

5.8.6 // RECONCEIVE HISTORIC PRESERVATION STANDARDS

The City should develop revised and highly localized historic preservation standards and guidelines that complement or replace the Secretary of Interior Standards for Rehabilitation. These new guidelines should address issues posed by the two main strategies available for building adaptation: Adapt in Place and Raise.

Specific suggestions for a new historic preservation standard include:

 Prioritize contribution to the character of the historic district and urban consistency by emphasizing the typological characteristics of buildings, and the importance of facades, planters, stoops, and Miami Beach's characteristic yards and courtvards.

- not associated with the public realm.
- additions, and facades in particular, be demolished
- ground floor.

5.8.7 // PROMOTE INCENTIVES FOR ADAPTIVE REHABILITATION

The City of Miami Beach should consider incentivizing adaptation of historic properties/ districts, over new construction, as a tool of resiliency. It should consider establishing a resiliency standard for adaptation in order to evaluate such incentive bonuses. It should consider granting incentives to adaptation projects that fully implement a resiliency strategy that meets the City's minimum standard and which are brought up to current Building Code. Bonuses should be implemented in a phased way that rewards greater efforts toward adaptation. See Section 5.5 for a full discussion of incentives.

5.8.8 // DEVELOP A RESOURCE VULNERABILITY INDEX

The City of Miami Beach should integrate resource vulnerability and significance as a method of evaluating rehabilitation proposals. The City should remap its districts with new layers of information, including properties that are vulnerable due to issues related to elevation of lot or adjacent grade; elevation of basement/first floor; construction type/ material content; wind resistance; and vulnerable population as owners or inhabitants.

5.8.9 // UNIFY RESILIENCY AND PRESERVATION REVIEW UNDER THE HISTORIC PRESERVATION BOARD

The City of Miami Beach should unify historic preservation and adaptation decision making under the Historic Preservation Board, which should be granted increased authority over resiliency-based decisions (in the same way it was granted increased authority over zoning variances, etc.). Require for any new rehabilitation project a Resiliency Resources Report (RRR) documenting existing conditions and proposed adaptation measures.

5.8.10 // DEVELOP THRESHOLD DOCUMENTATION

As the City confronts greater threats from flooding, and embarks on a new era of adaptive rehabilitation, it should employ state-of-the-art imaging technology to document the current state of its existing historic districts and resources. Such documentation would serve as a baseline for evaluating proposed changes, and could be an invaluable resource in

Deemphasize in modest contributing residential and commercial buildings the importance of the interiors, and the integrity and authenticity of physical properties

 Remove the existing requirement that historic structures below new multi-story Allow flood plain waivers, but favor strategies that increase the resilience of the any post-storm event reconstruction effort. It would preserve an accurate record of historic properties that can be used in research and other preservation activities. It could also be configured to bolster the very incomplete HABS documentation on file at the National Park Service. The City should solicit documentation proposals from professionals and local academic institutions. At a minimum, this documentation should cover photography, photogrammetry, imaging from drones, 3D laser scanning, and enhanced GIS database development.

5.8.11 // NEGOTIATE PROGRAMMATIC AGREEMENTS

The City of Miami Beach should develop a Programmatic Agreement with State and Federal preservation offices that streamlines Federal action in applying alternative mitigation strategies appropriate to Miami Beach. Such an agreement should cover Federal action in National Register districts requiring an 'undertaking', as defined under Section 106 of the National Historic Preservation Act (NHPA), but also Historic Preservation Tax Credits and the status of districts listed on the National Register of Historic Places. Such a programmatic agreement may also be possible with Miami-Dade County, for the purposes of County ad-valorum tax credits. The programmatic agreement should encompass the issues that will be encountered under mid and long-term adaptation strategies, and with incentivization of resilience bonuses. Programmatic agreements should consider the large number of individual architectural and historic resources in Miami Beach districts, by developing systems that can be applied to multiple buildings and districts.

5.8.12 // DEVELOP COMMUNITY ADAPTATION FUND

Establish a community adaptation fund that would provide low-cost loans to projects meeting both resiliency and social equity goals. Such a program might be funded by application fees for development outside historic districts in Miami Beach.

5.8.13 // ESTABLISH CONSISTENT STANDARD FOR BUILDING RAISING

Where buildings are raised, the City should establish and enforce a consistent standard for such raising for each district. This standard might, at a minimum, include height of raise, the question of raising the building only, the building and its attendant circulation systems, or the building and lot together. An explanation of the differences in approach is demonstrated in Chapter 6.

5.8.14 // MITIGATE BUILDING CODE COMPLIANCE WITH STANDARDS FOR NEW CONSTRUCTION

As a way of reducing the cost of adaptive rehabilitation, empower the City of Miami Beach Building Official to carve exemptions in practice for resilience in historic districts. Allow resiliency upgrades without triggering full code upgrade to existing structures, or compartmentalize code upgrade areas to allow experimental changes.

5.8.15 // IMPLEMENT LAND USE REGULATORY CHANGES

The City should introduce zoning modifications that encourage new behaviors in EAAs. Zoning amendments that combine preservation and adaptation objectives may replace Building Codes as the most powerful tool determining and propagating adaptation models. Such changes may include:

- Allowing mixed-uses in RM-1 district; emphasize adaptive use of ground floor area below Design Flood Elevation.
- Counting ground floor areas below BFE +1 a 50% of calculated floor area (similar to how basements are currently treated).
- Reconsidering the open nature of Freeboard in rehabilitation projects. Establish a single freeboard target in each district to maintain consistency of approach.
- Incentivizing resiliency measures in a phase or stepped manner, awarding the highest incentives to projects that meet current Building Code requirements and meet the highest standard of resiliency.
- Incentivizing 'future-proofing' tactics with additional Floor Area. Such tactics may inclu the use of alternative energy systems, like solar panels and windmills, as well as gray water systems.

5.8.16 // RECYCLE BUILDINGS AND BUILDING MATERIAL

Emphasizing new regulations that promote the preservation of existing structures of development of new structures. Where buildings or building components must be demolished, require recycling as a preservation and resilience strategy.

1S	6.	Incentivizing Social Equity goals and targets, like low-cost housing in adapted buildings, with additional Floor Area through FAR or other bonuses
at	7.	Reducing the average unit size requirements for adapted housing
1	8.	Removing the parking requirement for adapted housing
	9.	Adopting Miami-Dade County inclusionary zoning provision
d	10.	Creating block-wide pool/credit program to incentivize lower-cost, affordable and inclusionary housing
ıde	11.	Promoting greater physical accessibility to rehabilitated/adapted properties, using the FHA and ADA guidelines where appropriate, even if exempted.



Resiliency Guidelines

- 6.1 Strategy Matrix by Typ
- 6.2 Guidelines by Type &
 - Take Action Now Strategy 1A Strategy 1B Strategy 1C
 - Strategy 2A & 2B

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Collins Waterfront Study Area | Collins Avenue looking North



6.1. STRATEGY MATRIX BY TYPE



COLLINS WATERFRONT: RAISE

STRATEGY 1C

STRATEGY 2A & 2B







GREEN INFRASTRUCTURE















BUILDING & SYSTEMS STRATEGIES











CONTRIBUTING BUILDING







Install pavements surfaces that allow for direct infiltration of water into the ground where possible. Preserve terrazzo pavements

CISTERNS Implement the use of rain water barrels that can capture water runoff for later use in irrigation and



14



5











GREEN INFRASTRUCTURE





Special planting areas located within a small depression in a property, designed to capture and store rainwater









PERMEABLE Install pavements surfaces that allow for direct infiltration of water into the ground where possible. Preserve terrazzo pavements

CISTERNS

Implement the use of rain water barrels that can capture water runoff for later use in irrigation and cleaning purposes

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GREEN INFRASTRUCTURE



Raise electrical panels above storm surge elevation where possible

YEAR STORM SURGE

Future proofing strategies mounted on existing roof depending on structural capacity

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GREEN INFRASTRUCTURE











Strategy 1A











GREEN INFRASTRUCTURE



















WALK-UP



GREEN INFRASTRUCTURE


























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7.1 // APPENDIX I | SCOPE ISSUES & COST PROJECTION

The full expression of the strategies for improvements and adaptation developed by the team requires an understanding of possible scope issues and ramifications of current zoning and building codes.

Resiliency improvements will require bringing the building up to current building code if:

- 1. Scope of structural work > 50% of area of footprint of building
- 2. Scope of all work > 50% of value of current improvement (building only)

As basic resiliency improvements are likely to exceed one of these thresholds, the team believes it is prudent to imagine that any work in Scenario 1 and 2 will likely need to be upgraded for code compliance. Additionally, most required code compliance improvements (structure strengthened against lateral loads; impact resistant windows and doors; upgraded fire protection, electrical, plumbing systems) translate to improved building resilience.

Apartment Building

Structural/building shell

- Foundations combination of new helical piles, pin piles, micro piles, and auger piles.
- Reinforce walls (generally channel block walls, add rebars and grout.)
- Impact windows; reinforce jambs (generally channel block, add rebars and grout.)
- Provide fall protection for windows below 42" above floor.
- Upgrade roof structure using UL roofing assembly (generally add hurricane ties)
- Install roofing membrane with Florida product approval or Miami-Dade County NOA.
- Upgrade roof drainage to internal leaders; provide overflow scuppers.
- Masonry remedial work.
- Stucco remedial work including decorative elements.

Electrical

- Upgrade main electrical disconnect and panel.
- Possible upgrade of wiring and switching, depending on age of building/current state of system.
- Currently FPL transformers/vaults don't need to be dry floodproofed, but the Switch-Gear room does.

Fire Protection

- Fire alarm and fire protection upgrade. (sprinklers in large building, stand pipes, FPC (Siamese cat connection) etc.
- Code compliant fire alarm system.
- PDA communication system.

Plumbing

- Revise gas connections.
- Revise water main connections.
- Revise sanitary connections.
- Replace plumbing fixtures to meet new Energy Conservation code.

Air conditioning

- Remove all wall-thru air conditioning systems.
- Replace with split system.
- New/existing roof mounted compressors with tie-downs.

Landscape

- Meet minimum landscaping requirements.
- Provide irrigation for landscaped areas.
- Relocate irrigation valves and landscape lights.

Civil

- Improve drainage to retain all water on site; install injection well.
- 24hr percolation for site water.
- Relocate all ground clean outs and raise inlets of existing site drainage catch of area.

Basement (if any)

- Dry floodproof.
- Sewage ejector.

- Backwater valves.
- Waterproofing all perimeter walls and penetrations up to BFE.

Accessibility

• FHA compliance not required in buildings occupied prior to March 13, 1991.

Trash Collection

• Trash rooms need to be dry floodproofed with walls waterproofed up to BFE+1.

Hotels

Structural/building shell

- Foundations combination of new helical piles, pin piles, micro piles, and auger piles.
- Reinforce walls (generally channel block walls, add rebars and grout)
- Impact windows; reinforce jambs (generally channel block, add rebars and grout)
- Provide fall protection for windows below 42" above floor.
- Upgrade roof structure using UL roofing assembly (generally add hurricane ties)
- Install roofing membrane with Florida product approval or Miami-Dade County NOA.
- Upgrade roof drainage to internal leaders; provide overflow scuppers.
- Masonry remedial work.
- Stucco remedial work including decorative elements.

Electrical

- Upgrade main electrical disconnect and panel.
- Upgrade main electrical disconnect and panel.
- Upgrade wiring and switching, depending on age of building/current state of system.
- New emergency generator.
- For historic hotels not up to current code, smoke evacuation plans for open lobbies.

Fire Protection:?

- Fire alarm upgrade.
- Code compliant fire alarm system.
- PDA communication system.
- Annunciator (large hotels only)
- Emergency lighting at egress path.

Plumbing

- Revise gas connections.
- Revise plumbing connections.
- Revise sanitary connections.
- Replace plumbing fixtures to meet efficiency code.

Air conditioning

- Remove all wall-thru air conditioning systems. Replace with split system
- New/existing roof mounted compressors with tie-downs.

Landscape

- Meet minimum landscaping requirements
- Provide irrigation for landscaped areas
- Relocate irrigation valves and landscape lights

Civil

- Improve drainage to retain all water on site; install injection well
- 24hr percolation for site water
- Relocate all ground clean outs and raise inlets of existing site drainage catch of area

Basement (if any)

- Dry floodproof
- Sewage ejector
- Backwater valves
- Waterproofing all perimeter walls and penetrations up to BFE.

Accessibility

• FHA compliance not required in buildings occupied prior to March 13, 1991

Trash Collection

Trash Collection

• Trash rooms need to be dry floodproofed with walls waterproofed up to BFE+1.

Strategy 1a | internal raise

- Brace and shore existing building facades.
- Design, engineer and install steel shoring system; coordinate shoring for installation of new structure.
- Demolish wood floor framing, wood wall framing, wood roof framing and all interior finishes at all levels.
- Install new structure within shell and tie the shell back to the new structure; remove shoring system.
- Upgrade foundation in consistent with current code requirements, including support of new slab.
- Upgrade existing structure with new perimeter tie-beams at new floor levels.
- Install new concrete floor system at new ground floor level.
- Install new wood framed floor, walls and roof at new levels.
- Extension of vertical circulation at ground floor.
- Install new finishes, fixtures, equipment, systems
- Install new impact windows; provide fall protection at windows less than 42" above finish floor
- New water and sewer connections at ground floor.
- Relocate electric and gas meters to new levels.

Strategy 1b – Adaptive use

Front of building.

- Brace and shore existing shell for removal of wood floor framing and wood wall framing at ground floor.
- Design, engineer and install steel shoring

system; coordinate shoring for installation of new floor/column structure supporting upper floors.

- Demolish wood floor framing, wood wall framing and flooring system at ground floor.
- Install wet or dry-floodproofed concrete floor system at existing ground floor below BFE+1.
- Dry-floodproofed system.
- Foundational walls upgraded to be watertight, substantially impermeable to the passage of water, and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy
- waterproof foundation walls both sides.
- Install helical or pin piles.
- Install hydrostatic slab at current floor elevation.
- Provide flood barriers at doors/window openings below BFE+1
- Design floor for commercial use
- Create blind recess at location of former crawl space vents; retain decorative vent covers, if any.

Wet-floodproofed system

- Foundational walls upgraded to be watertight, substantially impermeable to the passage of water, and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy
- waterproof foundation walls both sides.
- Install new clean structural fill.
- Install new slab on grade (hydrostatic?)
- Install smart floodvents.
- Create blind recess at location of former crawl space vents; retain decorative vent covers, if any
- Install steel columns/beams at rear to transfer loads from upper floors of building.
- Install water-resistant finishes on ground floor spaces; no drywall.

Code compliance of front of building

- Upgrade front of building to code compliance
- Provide ADA access ramp/lift to ground floor commercial use.

*Note: building improvements in the front of the building may be kept under full code compliance threshold if it would be possible to allow replacement of ground floor wood framing with concrete structural system without 'penalty'

Back of building.

- Brace and shore existing building facades
- Design, engineer and install steel shoring system; coordinate shoring for installation of new structure.
- Install new multi-story concrete/steel structure within building adaptation zone of lot and tie to existing building walls.
- Auger cast or micro piles.
- Pile caps.
- Foundation walls.
- Concrete floor slabs of 2 new units/floor (new floor structure footprint approx. 1300sf/ floor + 250sf/floor balcony.
- 2 stairs (or scissor stair)
- Traction machine room-less elevator
- Exterior walls 50% masonry & stucco; 50% floor to ceiling glass window wall or sliding glass doors
- Habitable roof and roofing system (note large area of roof to be covered by mechanical equipment.)

Scenario 1c – Matroyshka Doll approach

- Brace and shore existing building facades
- Design, engineer and install steel shoring system; coordinate shoring for installation of new structure.
- Retain and upgrade first 20' of floor structures from Avenue-facing front building façade; behind, demolish wood floor framing, wood wall framing, wood roof framing and all interior finishes at all levels.

• Reinforce existing building facades behind first 20' for free-standing condition.

Install new structure within shell; remove shoring system

- Install new auger cast piles.
- Install new pile caps.
- Install new foundation walls.
- Install new concrete floor system at new floor levels.
- Install 2 stairs .
- Install traction machine room-less elevator
- Exterior walls 50% masonry & stucco; 50% floor to ceiling glass window wall or sliding glass doors.
- Habitable roof and roofing system.
- Install new finishes, fixtures, equipment, systems.
- Install new impact windows; provide fall protection at windows less than 42" above finish floor

Scenario 2a – Individual approch

Building raise

- Prepare steel supports and cribbing/ stabilize structure (ideally steel supports can be designed to remain in place for future raising)
- Cut attached stoops, planters and fountains for separate raise.
- Raise building to necessary height (8'-12') for construction of new foundations and installation of new infrastructure.
- Lower building to final height.
- Reinstall stoops, planters and fountains at new elevation.

New foundations

- Helical, pin or micro piles (most buildings not currently on piles)
- New pile caps.
- New foundation walls.
- Waterproof foundation walls both sides to

BFE+1; membrane waterproofing on inside, applied waterproofing on outside.

Site

- Raise lot in parallel with building raise
- Construct new masonry retaining wall on piles and continuous footer
- Add fill between waterproof new foundation
 wall and new masonry retaining wall
- Construct new stairs to connect main walkway from building entrances to sidewalk and alley
- Construct new stair to connect secondary walkway (if any to alley)

Landscape

 New landscape and irrigation on new raised site/planters.

Code compliance

• Upgrade building to code compliance.

Cost Projection

A construction cost model was developed by Arup in parallel with the design and engineering effort of the resiliency strategies prepared for the City of Miami Beach. Individual estimates were generated for each of the different typologies and scenario permutations. Within each estimate, there were three different cost groupings: resiliency, code compliance, and sustainability. The resiliency grouping contains all of the costs involved with increasing the structures' abilities to withstand rising sea levels and other climate change related events. The code compliance grouping contains the costs engendered by updating the structures to code if the resiliency designs within each scenario triggered a Level 3 Structural Alteration as described by Florida's building code when implemented. The sustainability cost grouping contains costs associated with additional design measures in each scenario that further add to the structures' and the City of Miami Beach's adaptability and long-term prosperity. Given the variability of structures within each building typology, a representative structure of each typology was chosen to base the required quantification of elements upon. Available as-built drawings and structural inspection reports were analysed for quantities and cost

Typology	Scenario 0	Scenario 1A	Scenario 1B	Scenario 1C	Scenario 2A
T1 - Home					
T2 -Urban Villa					
T3 - Rambler					
T4 - Walk Up					
T5 - Interior Corridor					
T6 - Catwalk					
T7 - Dingbat					
T8 - Low Rise Hotels					
T9 - High Rise Hotels					

elements. Unit rates for the proposed elements were then applied using Arup's internal construction cost database, publicly available historical information, and outreach with regional contractors. The product of the quantities and unit rates were then used to generate direct costs for each element. The direct costs for each typology in each scenario were summed, with indirect costs being calculated based on a percentage of the total direct cost summation. The total cost was then calculated as the sum of the total direct and indirect costs. The table included shows the relative cost of each scenario as compared to the least and most expensive building types with red being the most expensive and green being the least expensive. The gray squares represent the typologies that have been omitted from the matrix conditioning due to their absence from the given scenario. It is important to note however, that the level of protection and resilience resulting from each adaptation scenario are not equivalent. While Scenario 0 is overall the least expensive, the building remains in place and is not elevated to be protected internally from floodwaters. Therefore, while the comparison gives an idea of cost per typology and scenario, the cost comparisons are not equivalent to resiliency value.

Total Cost by Structure Type and Scenario

7.3 // APPENDIX II | SUPPLEMENT WATER PROJECTIONS / DATA

7.3.1 Quantifying water summary | Coastal systems analysis

A. National Geodetic Vertical Datum (NGVD 29) versus North American Vertical Datum (NAVD 88)

Two vertical datums are commonly referenced to measure ground and flood elevations within Miami Beach. The National Geodetic Vertical Datum (NGVD 29) is a system that has been used nationally for most of the 20th century. This datum was established by the National Geodetic Survey (NGS) in 1929 based on an established network of 26 tidal gauges within the United States and Canada.

Recent satellite technology discovered distortions in surveyed elevations, causing the NGS to develop a new system to establish elevation measurements. Specifically, the North American Vertical Datum (NAVD 88) was developed by NGS in 1988 to account for local variations caused by currents, wind, barometric pressures, temperature, topography of the sea bed, salinity differences and varying mean sea levels.

The elevations in Miami Beach can be easily converted from the NAVD to NGVD datum by adding 1.56 feet. For example, an elevation of +6.4 feet NAVD is equivalent to +8.0 feet NGVD.

Previously, most FEMA flood maps had used the NGVD datum as their reference. More recently, these maps are being converted to the NAVD datum. The FEMA flood zone maps published for Miami Beach are referenced to NGVD and prescribe a base flood elevation of +8 feet NGVD within the AE8 zone referenced for the Flamingo Park Historical District. It is important that all flood, ground and building elevations use the same datum when assessing flood risk. For the purpose of this report, all elevations will be converted and referenced to the NGVD datum.

B. Sea Level Rise

Human-caused global warming is contributing

to the thermal expansion of seawater and the

melting of land-based ice sheets and glaciers, resulting in sea level rise. Scientists determined that mean sea level has risen 6.3 to 8.3 inches between 1900 and 2016. More precise data measurements indicate an acceleration of 3.0 inches of mean sea level rise between 1993 and 2017. Predicting sea level rise is challenging due to the many factors influencing climate change.

Organizations researching climate change and its influence on sea level rise include, among many, the Intergovernmental Panel on Climate Change (IPCC) – an intergovernmental body of the United Nations, the U.S. Army Corps of Engineers (USACE) - a U.S. federal agency associated with flood protection, and the National Oceanic and Atmospheric Administration (NOAA) - an American scientific agency focused on oceans, waterways and the atmosphere. In January 2009, Broward, Miami-Dade. Monroe and Palm Beach Counties united to form the Southeast Florida Climate Compact (Compact) to coordinate climate change mitigation and adaptation activities. The Compact created a Regional Climate Action Plan to outline recommended mitigation and adaptation strategies, including a unified sea level rise projection for the region.

Specifically, the Compact formed an ad-hoc working group, identified as the Sea Level Rise Work Group, to update the 2011 Unified Sea Level Rise Projection report. The updated report was drafted and released in 2015, after the National Oceanic and Atmospheric Administration (NOAA) et al. 2012 and U.S. Army Corps of Engineers (USACE) 2013 projections were released.

The Compact utilized the updated projections throughout their 2015 Report, and based their adaptation measures on the updated

Estimated Relative Sea Level Change Scenarios for Miami Beach, FL (2020-2100) All values are expressed in feet (NGVD 29)							
Source	NOAA et al. 2012			USACE 2013			
Scenario	NOAA Low	NOAA Int Low	NOAA Int High	NOAA High	USACE Low	USACE Int	USACE High
1992 (-18YR)	0.60	0.60	0.60	0.60	0.60	0.60	0.60
2020 (Today)	0.82	0.89	1.04	1.22	0.82	0.89	1.11
2030 (+10YR)	0.90	1.03	1.31	1.64	0.90	1.03	1.43
2040 (+20YR)	0.98	1.18	1.64	2.15	0.98	1.18	1.83
2060 (+40YR)	1.13	1.54	2.46	3.50	1.13	1.54	2.85
2080 (+60YR)	1.29	1.98	3.50	5.25	1.29	1.98	4.16
2100 (+80YR)	1.45	2.48	4.78	7.41	1.45	2.48	5.77



Table 2.1: Unified Sea Level Rise Projection, Southeast Florida Regional Climate Change Compact,

Figure 3.1: High and Low Tide Elevations Observed at Virginia Key, FL.

projections. According to the Compact, the 2015 Projection update shifted the sea level rise projection start date to 1992, which is the "center of the current mean sea level National Tidal Datum Epoch of 1983-2001" (Compact, 2015).

Within the 2015 Report, the Sea Level Rise Work Group recommends that the updated unified sea level rise projection include three curves: the NOAA High Projection, the USACE High Projection, and a projection corresponding to the median of the IPCC AR5 RCP8.5 scenario (Compact, 2015). These recommendations are summarized in Figure 2.1 and Table 2.1 as presented below.

Guidance is provided within the Regional Climate Action Plan regarding the recommended use of the curves and tables for planning of various municipal projects:

• The lower curve (blue dashed line) is recommended for use in the design of low risk projects with short design lives.

• The shaded zone (in blue, between the IPCC AR5 and the USACE High) is recommended to be applied for most projects, within a short term planning horizon. This zone is projected to reflect the most likely range of sea level rise for the remainder of the 21st century.

• The NOAA High curve (solid orange line) is recommended for projects with medium to long term applications, which are not easily replaceable or removable or have a long design life of more than 50 years.

It is recommended that the NOAA High curve be used for planning purposes in assessing alternatives and recommending code changes in the Historic Districts.

C. King Tides

King Tides are the cause of nuisance, or "sunny-day", flooding, and usually occur during the months of September, October and November on Miami Beach. Tides are a result of the movement of water over the earth's surface caused by the gravitational forces of the moon, sun and earth's rotation. The moon moves around the earth in an elliptical orbit approximately every 29 days while the earth moves around the sun in a similar elliptical orbit approximately every 365 days. King Tides are the highest predicted high tides of the year, occurring when the moon and the sun are closest to the earth during their respective orbits, and when the planets are most closely aligned to a single axis in space. This infrequent but predictable occurrence results in the greatest combined gravitational pull of water across the earth's surface, causing higher than average tide water levels, referred to as King Tides. Measured King Tides may be further amplified by local weather or ocean influences occurring simultaneously with the alignment of peak planetary gravitational forces.

The graphic below (Figure 3.1) depicts tide levels observed at the Virginia Key tide station between October 1, 2017 and October 31, 2017. This station is the closest tide gauge station to Miami Beach, and is representative of tides within the region. The highest King Tide was measured on October 5, 2017 at +3.8 feet NGVD, with each of the two daily high tide events occurring between October 4 and October 7 equaling or exceeding +3.5 feet NGVD.

The documented mean high water, mean low water and mean sea level elevations are also presented on the graph – referenced at +1.7 feet NGVD, -0.3 feet NGVD and +0.7 feet NGVD, respectively. It is noted that the mean range of tide elevations during the peak King Tides are abnormally higher than the documented mean range occurring during normal tide conditions. **D. Predicted Flooding within the Districts due to King Tides**

The depth of King Tide flooding within the

Districts is determined by subtracting the actual

surveyed sidewalk or building floor elevations from the highest measured King Tide elevation. Future flooding is similarly calculated, with the inclusion of sea level rise predictions superimposed on top of the highest King Tide elevation.

The predicted change in sea level rise in 20, 40, and 60 years is calculated as the difference between the predicted sea level elevation in 2017 (time of the maximum King Tide) and each of the future years considered. Table 4.1 summarizes the predicted highest water surface elevation in 20, 40, and 60 years, by adding the 2017 measured King

Tide to the projected differences. Figures 4.1 and 4.2 illustrate ground and road elevations relative to the NGVD datum within each of the Flamingo Park and Collins Waterfront Historic Districts, respectively.

The Flamingo Park and Collins Waterfront Historic Districts have ground elevations ranging from +3.6 to +5.0 feet NGVD. With King Tide elevations predicted to reach +5.1 feet NGVD by 2040 these districts will be subject to regular King Tide flooding within 20 years. Flooding will continue to increase in regularity and flood depth out 50 years and beyond. It is recommended that any major improvements to existing buildings be designed with a minimum first floor elevation above +7.0 feet NGVD.

E. Storm Surge

Storm surge is the abnormal rise in seawater level during a tropical storm, measured as the height of the water above the normal predicted tide. Storms are measured by their return period or recurrence level. Storms having a 10- 20-, 50-, 100- or 500-year period (recurrence level) are significant when assessing vulnerability and flood risk. The Federal Emergency Management Agency (FEMA) prepares flood maps indicating levels of flood risk based on the 100-year storm event, which is a storm having a one percent probability of occurring in any given year.

Various numerical models have been developed by both public and private entities for calculating storm surge elevations at a given location for storms having different probabilities of occurrence. Storm parameters generally used as input into the numerical models include wind stress, bottom stress, dynamic wave set up, topology, astronomical tide, storm speed, size and atmospheric pressure. The Florida Department of Environmental Protection (DEP) uses a model developed by R.G. Dean and T.Y. Chui, (Dean 2003) as the basis of their Coastal Construction Control Line Program. The Federal Emergency Management Agency (FEMA) most commonly uses the "FEMA Coastal Flooding -Hurricane Storm Surge Model" (FEMA Surge) for assessing flood hazard (FEMA 2009). The accuracy of model predictions depends on the guality of available data and precision of each model.

Coastal Systems reviewed the studies published by DEP and FEMA, and compared the water surface level predictions associated with storm surge events in Miami Beach, resulting from each study. Figure 5.1 presents a graph illustrating the storm surge versus return period storm from each of these two studies. It is noted FEMA predicted the 100-year storm surge at +7.1 feet NGVD, which translated to a prescribed flood hazard zone of AE8 within the Historic Districts. The DEP model predicts a storm surge elevation of +13.6 feet NGVD for the same 100-year storm, representing a 6.5 foot difference in predicted flood elevations.

For reference purposes, the literature review as conducted by U-Surge, presents a summary of historical storm surge elevations measured for 28 storm events that occurred in Miami since 1880. The storm surge elevations for four storms impacting the Miami area are summarized in Table 5.1. Documented storm surge elevations of these historical storms support the storm surge predictions as presented in the DEP report. Archived photos of the 1926 Great Miami Hurricane and Hurricane Betsy in 1965 are presented as Exhibits 5.1 - 5.3, below. The storm surge flooding and resulting impacts within the Miami Beach region further support storm surge predictions as presented in the DEP report. Storm surge elevations associated with the 25-year, 50-year, 100-year, and 500year storms as presented in the 2003 DEP report are listed as Present Day elevations. However, as sea levels rise, so too will the storm surge wave heights from the various return period storms. These elevations are adjusted for sea level rise increases between 2003 (the date of the DEP study) and for years 2040, 2060, and 2080. The results are listed below in Table 5.2. Figures 5.2 and 5.3 present east-west cross sections illustrating the 100year storm surge elevations within the Flamingo Park and Collins Waterfront Historic Districts, respectively. Under present conditions, the 100-Year storm surge elevation is +13.6 feet NGVD, representing significant flooding of the first floor of the buildings within these districts. In 60 years, sea level elevations are projected to increase by 4.4 feet as summarized in Table 5.2, thus translating to a 100-Year storm surge elevation of +18.0 feet NGVD - similar to the predicted 500-Year storm surge elevation for present conditions, which is +17.7 feet NGVD.

The second floor of the buildings within the Historic Districts will be flooded during the 100-Year storm in 50 to 60 years. Crest elevations of dunes along Miami Beach dune are approximately +14 feet NGVD. In 60 years with sea level rise, the wave crests associated with the 100-Year storm surge elevations will be higher than the existing dune system, resulting in additional damage impacts associated with both the increased storm surge water level elevation, plus the force of propagating waves.

It is recommended that code revisions allow for existing buildings within the Historic Districts to be raised to achieve habitable floor elevations

above +17.7 feet NGVD. Alternatively, the code could provide for flood proofing of a newly created ground floor and foundation system along with a change in use to provide for a revenue-producing use of the building. Similarly, code revisions should provide for an increase of the ground floor elevation, to be above the predicted King Tide elevations in 60 years, or above +7.9 feet NGVD.

F. Rainfall

In order to analyze other possible water levels anticipated throughout the historic districts, Coastal Systems reviewed the most current Draft Basin Studies of Indian Creek Parkway and Flamingo Park prepared by AECOM. The reports models a closed stormwater system which includes a total of 5 pump stations for the Flamingo and Collins Historic Districts, designed to provide a positive Level of Service for a 10-Year, 1-Day Storm event. The model also includes a tailwater equivalent to the projected 60-Year Sea Level and yields a maximum stage below the crown of the road. Assuming the system is water tight and check valves are installed at the outfall locations, it is conceivable that the seawater will not intrude into the stormwater system. This will allow the stormwater system to operate exclusively during rain events. However, several existing catch basins and surrounding grade elevations are below the projected 60-Year sea level. Due to the porosity of the soils, the water table may rise above the surrounding grounds. This scenario will fully saturate the soils and excess water will run off into the catch basins resulting in continuous running of the stormwater pumps. It is recommended that additional studies be conducted to determine if specific roads or historic buildings will need to be raised in the future to remain dry and above the water table elevation. This will result in a dry system, as originally designed by AECOM, and allow the pumps to operate exclusively during rain events.

Rainfall Events: Coastal Systems referred back to the 2011 CDM Stormwater Master Plan



Return Period Storm (Year)

Figure 5.1: Storm Surge associated with Return Period Storms.

Report prepared for the City of Miami Beach. As part of the report, the existing conditions were modeled, the water levels for various rainfall events were recorded, and rainfall volumes were used to calibrate and validate the modeled results. Based on the models and observed water levels throughout the region, the following water levels were determined:

- 1-Year Storm: +4.10' NGVD
- 2-Year Storm: +4.30' NGVD
- 5-Year Storm: +4.35' NGVD
- 10-Year Storm: +4.50' NGVD



Exhibit 5.2: The Great Miami Hurricane of 1926 generated a 15ft (4.57-m) storm tide in Miami. Submerged palm trees reveal the extraordinary water levels in this historic photo. Source: U-Surge



Exhibit 5.1: Hurricane Betsy's storm tide in Miami Beach, FL (1965). Source: Getty Images, U-Surge



Exhibit 5.3: Miami Beach following the Great Miami Hurricane of 1926. Source: U-Surge

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7.4 // APPENDIX III | SUPPLEMENTAL GENERAL ADAPTATION

A4 General buildings strategies A4.1 Backflow prevention

While floodwaters can cause direct damage alone, many of the secondary effects caused by rising waters can be equally damaging to property and create other health hazards. For example, elevated water levels can cause waste in sanitary sewer lines to back up through drain pipes and overflow out into homes through toilets and other drains. Sanitary sewer systems can often become inundated with floodwater during storm events. Combined sanitary and storm sewer systems are even more susceptible to backflow problems caused by flooding as they are designed to capture both wastewater and stormwater drainage.

Rising sea levels add an additional problem to existing drainage systems. Beyond just flooding events causing sewers to back up, some sewer systems that eventually drain into ocean waters can also back up during high tide events on sunny days. When first constructed, these pipe outfalls were always above the surface elevation of the water. However, as oceans rise, the water easily backs up into pipe openings during high tides unless a valve is installed to prevent this. During major emergency events, failure of a municipal sewer pump station can also cause sewage to back up into a home.

One solution to this issue is to install backflow prevention valves on sewer lines exiting homes. Backflow prevention valves allow flow in only one direction. Waste or stormwater can flow out through the sewer pipe, but is also prevented from flowing back into the home. There are different kinds of valves available for backflow prevention as outlined below. A backflow prevention valve should be always installed correctly by a trained/licensed plumber or contractor who has obtained any necessary building permit documentation before commencing work.

It is important to note that when a backflow prevention device is engaged during a flood event, it will not be possible to use the plumbing system within the home. The sanitary lines will not be able to drain until the flood levels recede and the valve can be opened again. However, this system downtime will reduce the need for costly restoration work that is the alternative if a backflow valve is not used.

Backflow Prevention Valve Types:

Gate Valves

- require manual operation
- provide a tighter seal against backflowing liquid
- more expensive

Flap/Check Valves

- operate automatically
- can become blocked by debris and fail to close properly and prevent backflow
- require regular inspection and cleaning
- least expensive

Dual Backflow Valves

- most expensive
- more complex
- offer redundancy in case failure occurs in one portion of the valve system



Source: FEMA Homeowner's Guide to Retrofitting

A4.2 Mechanical System Flood Prevention

Mechanical equipment primarily includes heating, ventilation, and air conditioning (HVAC) systems. These pieces of equipment contain sensitive components such as monitoring instruments and calibration devices that are easily impacted by flooding or even increased moisture levels. Small amounts of saltwater can quickly corrode mechanical systems, rendering them inoperable. Not only are the major components of mechanical systems at risk, but also their secondary components that easily serve as pathways for floodwaters to travel through. These include ducts, grilles, registers, and control valves—all openings that floodwater can enter.

One of the simplest and most effective ways to protect primary mechanical system components (boilers, air handling units, compressors, fans, etc.) is to elevate them above design flood elevations. Primary components are high value items to replace, typically making the cost of elevating these units worth the investment. If the entire home is being raised, the unit can be raised with the house and if necessary, placed alongside the house on a new cantilevered structural platform. If just the mechanical equipment is being raised, a standalone pedestal or portion of raised earth can provide the required elevation to protect the unit from floodwaters.

If there is sufficient structural capacity, primary units can also be relocated to the roof of the buildings they serve. However, consideration should be given to the visual impact of this move, especially on low-rise structures. Screening of this equipment may be appropriate to provide cover from the street. Any screening, however, must still provide adequate manufacturer clearances and free area openings to not restrict performance of the equipment. In addition, when relocating to the roof existing utility points of entry may require significant re-routing of mechanical system secondary components to reach the new unit location.

performance of the equipment. In addition, when relocating to the roof existing utility points of entry may require significant re-routing of mechanical system secondary components to reach the new unit location.

If elevating or relocating is not feasible, mechanical equipment can also be protected in place by constructing watertight walls around the unit. This is not a desirable option as it will require the clearance between the equipment and the water-tight walls to be large enough to allow for a person to have adequate access and perform maintenance. In addition, space must be provided in accordance with manufacturer requirements for recommended heat of reject clearances and other air inflow/outflow requirements. Given the possibility of failure or water overtopping the walls in extreme events, the equipment should also be adequately anchored to its base to resist floodwater buoyancy forces. For other considerations related to protecting equipment in place, see the Dry Floodproofing section.

Similar to primary units, secondary components of mechanical systems should also be relocated above design flood elevations if feasible. HVAC ductwork can be relocated to run within ceiling soffit or attic space, as opposed to crawlspace below the first floor. Ductwork can be sizable; however, and therefore relocation may require significant interior finish renovations to integrate fully with the desired interior layout and structural framing system. Alternatively, a ductless split system ("mini-split") could be utilized as a new installation. This would reduce or eliminate the need for ductwork in the building and help in facilitating retrofit construction and cost.

Any mechanical system control devices or electrical components should be relocated above flood elevations, something that can usually be done for minimal cost. For both controls and primary units, access for maintenance operations must be considered. electrical components should be relocated above flood elevations, something that can usually be done for minimal cost. For both controls and primary units, access for maintenance operations must be considered.

For regulations regarding new construction or substantial improvements to a building within a flood hazard area, refer to the Florida Building Code, Chapter 3, Section R322 – Flood Resistant Construction.







Source: FEMA Homeowner's Guide to Retrofitting

A4.3 Power & life-safety/ utilities flood prevention

Unless an electrical system is specifically designed to be submerged underwater, floodwater severely damages its various components. These include electric panels, meters, switches, outlets, light fixtures, and the wiring that connects them all together. Even with just a short period of contact with water, electrical system components can be destroyed beyond repair and require complete replacement. Beyond the loss of function and inconvenience of a power outage, electrical components interacting with floodwaters can also trigger fire hazards and hold the risk of electrocution. In an emergency situation, sustained power loss is not only an inconvenience but can prevent the ability for speedy cleanup and recovery after a flood or other event.

Like mechanical systems, the easiest way to protect electrical systems is to locate them as high above the design flood elevation. For new construction, this is relatively easy to incorporate into design plans for the home. For mitigating risk to existing electrical systems, relocating them to high elevations is still the preferred solution for ensuring protection and resiliency to flooding. When locating electrical system components at higher elevations, however, it is important to remember that code guidelines often have access requirements that can limit how high major components (such as meters and panels) can be located unless direct access is available through a deck or other secondary structure. In addition to electric power components, the same considerations should also be taken for IT and communication system components (phone, Internet, television). If electrical components must be located in areas that can see potential flooding. there are certain kinds of equipment better designed to handle exposure to water and other considerations that can be made:

• Attach utilities and conduits on the side of the building facing inland and anchor to foundation elements

• Do not mount any conduit or cables on walls or

framing structures design to break away during flood events

• Design and orient electrical components to

properly drain and not retain water

• Circuits located below the design flood

elevation should be designed in a way that

allows them to be isolated electrically from the remainder of the power system. This can be done by using separate GFCI breakers (Ground Fault Circuit Interrupter) that are clearly labeled in the electric panel box

• If permitted by code, install conduit that is non-

metallic, corrosion resistant, and easily cleaned

after a flood event

• GFCI outlets should be used in any area

located below the design flood elevation. These

outlets are typically installed in locations that see everyday exposure to water such as above kitchen counters and in bathrooms

For regulations regarding new construction or substantial improvements to a building within a flood hazard area, refer to the Florida Building Code, Chapter 3, Section R322 – Flood Resistant Construction.



A4.4 Dry Floodproofing

As the name implies, dry floodproofing involves taking measures to make a building watertight to prevent entry of water into interior spaces. Dry floodproofing can be done for the entirety of a building or for a select portion of an enclosed area that requires higher levels of protection from water (for example, key utility equipment that cannot be elevated).

Some key concerns that must be considered when dry floodproofing a building including the following:

1) Shielding doors, windows, and other openings where water can easily infiltrate. See the Flood Barriers section for more information.

2) Reinforcing walls to withstand floodwater pressures from the weight of water pushing against the building. A licensed structural engineer should be consulted for evaluation of these loads and measures that can be taken.

3) Reinforcing or anchoring a building slab to resist flotation from uplift pressures and other buoyancy forces as water pushes up on the building from underneath. Again, a licensed structural engineer can assist with understanding these forces and determining if action is required during dry floodproofing.

4) Removing any water that inevitably leaks into the building, despite efforts to prevent its infiltration. This will include drainage systems and sump pumps to collect the water. Sump pumps should be installed with an emergency power source such as a battery or generator that can ensure operation even if electricity is lost during a flooding event or other emergency,

5) Providing membranes or other sealant techniques to prevent floodwater gradually seeping through walls and minor penetrations. See the Seepage and Waterproofing section for additional information. Chapter 54 of Miami Beach, FL – Code of Ordinances provides criteria for dry floodproofing.

 - Upper floor walls	Water surface level
 Slab/wall connections Foundation -> Floor slab walls	Ground



A4.5 Wind mitigation

Wind mitigation is the implementation of certain building techniques in order to limit damage caused by intense wind. Following Hurricane Andrew, Florida passed a law requiring insurance companies to offer their customers discounts and credits for existing building features and home improvements that reduce damage and loss from wind.1 These building features include opening protection of the doors and windows, appropriate roof deck and roof to wall attachment, use of appropriate roof coverings and implementation secondary water resistance systems.

Opening protection refers to the level of wind resistance of the windows and doors in the building, whether applied to the openings in case of an intense wind event (hurricane shutters) or integral to the construction of the windows and doors (impact resistant products). Roof deck construction and attachment to the building's walls is crucial to the integrity of the structure in case of high winds. This is achieved by originally designing the structure up to code or retrofitting it to comply with the appropriate building codes through the implementation of appropriate anchors, installation patterns, and hurricane straps.

Roof coverings and secondary water resistance systems are part of the construction of the outermost roof layers. Properly secured roof shingles and waterproof underlayments are the first line of defense against storm winds and rain. The installation of products with notice of acceptance (NOA's) or Florida Product Approvals for the HVHZ (High Velocity Hurricane Zone) is a building code requirement for all new construction and substantial renovation of existing buildings.

1 Wind Mitigation by Nick Gromicko and Kenton Shepard, https://www.nachi.org/wind-mitigation. htm



A4.6 Seepage & waterproofing

While most building materials appear solid and impenetrable to the naked eye, when sustaining flood loads there is a greater likelihood of water passing through walls to interior spaces. The seepage rate of water through the building envelope will vary wildly based on material type, construction type,

building condition, building age, depth, elevation, and the properties of the groundwater and soil adjacent to thebuilding. How fast and how much water penetrates the building will also depend on how the duration and intensity of a storm and/or level of flooding that occurs.

Despite all of this variance, there are waterproofing techniques that can be used during dry floodproofing that can make a building envelope more impermeable and reduce the amount of water than can infiltrate. As mentioned previously, however, a building being waterproofed in the context of dry floodproofing needs to be evaluated for its structural capability to withstand unbalanced hydrostatic pressure from floodwater and saturated soils.

Some considerations and options for waterproofing to reduce building seepage include:

- Permanently seal all structural joints
- Seal around all utility penetrations and other openings for windows and vents

• Waterproofing can be applied from either inside or outside a building wall depending on the type of sealant used. Refer to manufacturer guidelines for installation details and recommendations

 Typical materials for sealants include cement and asphalt-based coatings that can be applied to the exterior of the building. However, some aesthetic properties of the building facade may be lost the building. However, some aesthetic properties of the building facade may be lost

• Clear coatings can be applied using epoxy materials and polyurethanes if preserving the visual

appearance is of major concern. However, their waterproofing effectiveness is often reduced compared to other techniques

- Other products are painted onto the inside of wall surfaces or foundation walls above ground. These
- include liquid rubber coatings or other sealers that cover cracks and defects while providing additional

waterproofing protection

 In addition to coatings and sealants, another protection method consists of adding an additional

waterproof veneer to exterior walls to block water from infiltrating from the outside

• Impermeable membranes can also be used to waterproof foundation walls below grade to resist

groundwater seepage



A4.7 Wet floodproofing

Rather than working to prevent water from infiltrating your home, wet floodproofing is a concept that follows the logic of accepting that some level of flooding will occur and impact the property. It is an approach that best works when raising of the lowest occupied floor to be at or above the design flood elevation is possible. The space below this elevation is then modified with the understanding that inundation will likely occur during a storm or flood event.

Wet floodproofing offers structural advantages to the force of floodwater that can impact your home during a flood event. These only includes hydrostatic pressure—the weight of standing water pushing against the walls and the foundation of your house (both exposed portions and those underground). Rather than working to reinforce your structure against these additional loads, it works with the floodwater pressures. Wet floodproofing, however, will not protect your home any more than other floodproofing techniques when considering hydrodynamic forces (the force of flowing water against your home) or the potential damage caused by floodborne debris hitting your home or any long-term impact from flood-borne contaminants and pollutants.

Wet floodproofing provides this structural advantage against hydrostatic pressure by allowing forces to equalize both inside and outside the building. Strategically designed and placed openings in the wet flood-proofed space allow floodwaters to automatically enter and exit the enclosed area. A key component of this design is that water levels must rise and fall at the same rate both inside and outside the home. Typically, pumps are not needed to discharge water once floodwaters have receded from wet flood-proofed areas. However, proper cleaning and drying of the space is still required after a flooding event to ensure excess moisture does not encourage the growth of mold or other bacteria.

Any space that is to be wet flood-proofed should be modified with flood-damage resistant building materials that can survive long-term exposure to water. For the Miami area, these flood-resistant materials need to be especially designed to withstand the saltwater that will typically be involved with flooding due to storm surge, sea level rise, and tidal impacts.

For practical purposes, no high value contents or property should be stored in the wet flood proofed space. Flooding can sometimes occur with minimal advanced warning for property owners to remove items from these enclosed areas. The National Flood Insurance Program only allows for wet flood proofing to be used in spaces reserved for storage, access, or parking.

Chapter 54 of Miami Beach, FL – Code of Ordinances provides criteria for wet floodproofing.



Source: FEMA Homeowner's Guide to Retrofitting

A4.8 Flood resistant building materials

Using flood-resistant building materials can both reduce the damage caused by floodwaters and make cleanup easier following a flooding event. Building materials are considered flood-resistant if they can withstand direct contact with flood waters for at least 72 hours without being significantly damaged. In this case, significantly damaged designates damage requiring more than cosmetic or low-cost repairs.

More generally, materials that are considered non-flood-resistant are those that easily absorb or retain water or can dissolve and deteriorate in water. It is important to consider not only the primary building material, but all the components that are used in the complete construction process including adhesives, sealants, connectors, and fasteners. Given Miami's coastal location, preference should be for flood-resistant materials that are also non-corrosive and can withstand saline environments or saltwater inundation.

Flood-resistant building materials can be used in combination with typical building materials if cost is a concern by prioritizing use of floodresistant building materials in portions of the building below the design flood elevation. However, coastal environments include airborne salts that contribute to corrosion, so exposed building materials even not seeing direct water inundation can still be affected. In the context of historic structures, care should be given to selecting flood-resistant building materials that fit within the historic and aesthetic context of the structure and overall neighborhood.

Note: Flood-resistant building materials must be rated as Class 4 or 5 to meet FEMA national flood insurance program requirements. See FEMA NFIP Technical Bulletin 2-08 for more information on ratIng systems.

Material Type	Acceptable	Unacceptable
Structural Flooring Materials	Concrete Naturally decay-resistant lumber Pressure-treated plywood	Engineered wood or laminate flooring Oriented-strand board (OSB)
Finish Flooring Materials	Clay tile Ceramic or porcelain tile Terrazzo tile Vinyl tile or sheets	Engineered wood or laminate flooring Carpeting Wood flooring
Structural Wall and Ceiling Materials	Brick face, concrete, or concrete block Cement board / fiber-cement board Pressure-treated plywood Solid, standard structural lumber (2x4) Non-paper-faced gypsum board	 Fiberglass insulation Paper-faced gypsum board OSB
Finish Wall and Celling Materials	Glass blocks Metal cabinets or doors Latex paint	Wood cabinets and doors Non-latex paint Particleboard cabinets and doors Wallpaper

Source: "Reducing Floor Risk to Residential Buildings that Cannot be Elevated" FEMA, 2015

A4.9 ADA Accessibility features

More than 50 million Americans with disabilities are potential customers for retail businesses across the country. These 50-million-plus customers, along with their families and friends, patronize clothing boutiques, mall outlets, grocery stores, and more, if the businesses are accessible.

The Americans with Disabilities Act (ADA) requires businesses that serve the public to remove barriers from older buildings and to design and build new facilities to provide access to customers with disabilities. A key component of ADA compliance is maintaining those features so they remain usable. Even brand-new buildings designed for complete accessibility can become inaccessible without proper attention. If key elements - often including the parking, building entrance, route into and through the establishment, access to the store's goods and services, restrooms, cashier stations, and egress - are not maintained, then access is reduced or eliminated. 2 Where commercial uses are proposed on the ground floor of the building accessible routes shall be provided. These may include access ramps that comply with the applicable building and accessibility codes, wheelchair lifts if space does not allow for ramps, and appropriate clearances for wheelchair access through the commercial space. Public restrooms shall comply with the accessibility requirements of the Accessibility section of the Florida Building Code as well.

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B4 Green Infrastructure B4.1 Rain Gardens

Rain gardens are special planting areas designed to capture and store rainwater. They are one of the most common ways green infrastructure is used to offer relief to conventional sewer and storm networks that become overwhelmed during storms. Not only do rain gardens assist in reducing overall storm runoff quantity, but can also aid in purifying water from pollutants and contaminants using natural filtration processes present in soil and plants. Allowing for both temporary rainwater storage and infiltration, bioretention practices help effectively manage stormwater during storms.

It is important to select vegetation types for planting that can withstand routine flooding and the saline environment of Miami Beach. Once installed, a regular maintenance and inspection regime to remove trash, trim overgrown vegetation, weed unwanted plants, and reduce excess sediment can help ensure green infrastructure practices are functioning properly and helping to manage stormwater runoff quantity and quality.

Rain gardens are usually located within a small depression in a property to allow water to naturally flow to low points. In addition, to prevent potential damage to adjacent buildings, rain gardens should be located a minimum five feet away from any structures because of the impact from infiltrating water.

Within the rain garden is a slightly elevated overflow drain inlet to allow excess rainwater to be piped away from the plantings and prevent overwhelming inundation. To allow for proper infiltration, rain gardens should be installed in areas where the groundwater table is deepest (ideally four feet).

However, given Miami's underlying porous limestone and eventual rising groundwater table,

typical construction of rain gardens will likely be challenging in the near future. One alternative is to provide for an alternative water storage structure or soil/ground replacement beneath the rain garden installation.



B4.2 Green Roofs

A typical building roof is often underutilized space that contributes heavily to the amount of impervious surface in a given property. By utilizing the roof for stormwater storage, water is captured before it reaches the ground or a piped drainage system. Green and blue roofs can also provide localized cooling benefi ts while serving as a home for attractive vegetation. When retrofi tting existing buildings and historic properties, additional structural reinforcement is likely to be required to allow a roof to support the weight of new soil and planting layers (green roof) or temporary storage of rainwater (blue roof). Blue roofs capture rainwater by functioning as a tank-like structure and often collect it for re-use within the building through non-potable (water not used for drinking or cooking) needs such as irrigation and fl ushing toilets. Typically, stored water is designed to be drained within 24 hours if not within an enclosed system to prevent insects and other issues that can come with standing bodies of water. Excess water is channeled to a building's sewer system or typical gutters and roof leaders that would provide drainage for a normal roof.

Due to the high expense of installing a green or blue roof and related structural renovations, they are typically more costeffective

for larger properties or commercial buildings. In general roofs also need to be relatively fl at with minimum pitch. The amount of water that will be stored within a green or blue roof varies with the roof size and potential depth of planting and storage medium layers. They also must be designed to allow for safe access for maintenance and inspection.



B4.3 Sunken Plaza & Patios

Recessed parks, building courtyards, and public plazas are impervious surfaces that can be designed to temporarily store water during extreme events to prevent flooding from overwhelming both the storm system and adjacent properties. For smaller properties, even patios and outside seating areas can be sunken lower than the surrounding landscape by several inches to a foot to serve a depression for water to accumulate during storm events. The storage capacity of a sunken plaza or patio will vary with how deep the depression is and how large of an area is being utilized.

Sunken plazas and patios fill up with water during a period of rapid rainfall and alleviate localized flooding around a wider site or property. Once the storm has passed, this collected rainfall can be drained to a storm sewer system or other storage area. When not being utilized for stormwater management, the area can serve as a dynamic outside area for recreation and relaxation. Depending on the design and construction of the area amid the larger property topography. the sunken plaza or patio can be drained naturally through gravity, pumps, or a combination of the two.

Because of sometimes minimal warning before intense rain events, any furniture or equipment to be used in this area should be of a material capable of withstanding inundation with water, or of low enough cost to be easily replaceable. Sunken patios should be designed to drain within 24 hours to prevent insects utilizing the standing water for breeding.



B4.4 Underground Retention Storage Systems

While detention systems capture and hold water during and after a storm event for longer periods, retention systems function by temporarily providing a place for water to collect during a storm event.

Retention systems are also tanks, chambers, or storage area where water can collect rather than ponding or flooding a property. However, retention systems typically do not drain by pump or gravity

through a pipe system, but allow water to infiltrate out into the surrounding ground as floodwaters recede and the ground is no longer saturated with water. Retention systems are available from a variety of manufacturers that offer proprietary underground devices to contain stormwater during flooding events. Often a retention system can become a detention system by wrapping the storage system with an impermeable liner or other material that restricts water flow.

In its simplest form, a retention system can be a gravel pit installed within the ground that provides more storage capacity than normal, compacted soil. However, water within a gravel pit can only be stored within the spaces between stones (approximately 40% of the total gravel volume), resulting in a much-reduced capacity when compared to more open, chamber-like systems.

The high water table of Miami Beach makes it difficult for retention systems to be used extensively in the area. A retention system would need to be constructed at a shallow depth to utilize the unsaturated ground above the water table. While partially sealing certain sides of the retention system can prevent groundwater from seeping into the rainwater storage space, there is still the concern over groundwater uplift pressure pushing up on the system.



B4.5 Permeable pavement

Permeable pavements and surfaces allow for direct infiltration of water into the ground that typical hard surface pavement materials (standard asphalt and concrete) prevent. Together with building roofs, typical hard surfaces are significant contributors to stormwater runoff and ponding during storm events. By allowing water to naturally infiltrate into the ground, stormwater can be stored underground, recharge local freshwater aquifers, and be taken up by nearby plants. Permeable surfaces may see reduced effectiveness, however, given Miami Beach's relatively high ground water table.

Permeable pavements and surfaces can vary greatly in material type, overall look, and effectiveness at managing stormwater. At the simpler end are gravel surfaces or similar natural stone pathways and driveways. Other paving units and block pavers are installed with grass or fine gravel between them to allow for infiltration, as opposed to typical mortar mixes. The most complex permeable pavements resemble closely typical asphalt and concrete surfaces, but use a unique mix of stones and binding agents to allow water to filter through into the ground. Permeable pavements are also frequently installed over a perforated drainage pipe that can direct excessive infiltrated water to an additional storage area or outlet of a piped drainage system.

Permeable surfaces are most effective when used over well-draining, sandy, natural soils. As with any surfacing installation, it is also important to check the maximum manufacturer recommended

loads (i.e. how much weight the pavement or surface can withstand before failing) for specific products against your expected use and traffic loads in the area (i.e. will heavy vehicles frequently be driving vehicles frequently be driving over the surface). Typically, a permeable surface will require a minimum of four inches of well-draining gravel to be placed beneath the paving surface itself, where surfacing depth will vary based on material type.

Permeable pavements and surfaces also lose effectiveness if installed on steep slopes. As with most stormwater management techniques, routine maintenance of the system is also required often in the form of flushing pavements with high pressure water. If not cared for, clogging of voids with debris, organic particles, and mud will reduce the ability for permeable pavements to infiltrate water in the ground—making them functionally equivalent to typical pavements that contribute to stormwater runoff.



B4.6 Cisterns

Cisterns, also frequently referred to as rain barrels, are a simple and affordable way for property owners to both reduce the amount of stormwater that can impact their property while also harvesting rainwater for other uses. Rain cisterns can be installed to manage the stormwater that falls onto a building roof that would typically be routed to the ground or a piped drainage system through gutters and downspouts. Rain barrels can capture that water for later use in irrigation or even cleaning purposes.

A typical capacity for a single rain cistern is around 60-gallons. While installing even a few cisterns may not capture a substantial amount of water during intense storms, cisterns can reduce the stormwater runoff and local flooding impacts for typical, everyday rain events. One important consideration when installing a rain barrel is to provide an emergency overflow pipe at the top of the barrel to allow for rainwater to escape if the barrel reaches capacity during intense storms or infrequent periods of use. Rainwater harvest pipes and systems should also be inspected routinely to check for clogging with debris or any potential leaks. Filters or screens installed on gutters and inlet pipes can help capture large material that could lead to reduced cistern capacity.

In Miami Beach, an important concern is the ability for standing water to serve as mosquito breeding grounds. Beyond just the nuisance factor of increased mosquitos and other insects in an area, there is concern over increasing the likelihood for transmission of insect-borne diseases such as the West Nile virus. For rain barrels, an easy solution to discourage mosquito breeding in captured stormwater is to only utilize closed system barrels rather than open-topped cisterns. Additionally, frequently using and draining down your barrel is an easy and effective way to prevent longterm standing water. As a last resort, trace amounts of additives such as liquid dish soap or vegetable oil can prevent mosquitos from being able to breed, while treatment with bacterial larvicides can be used for water held over longer periods.



C4 Stormwater Management C4.1 Blue roofs

A typical building roof is often underutilized space that contributes heavily to the amount of impervious surface in a given property. By utilizing the roof for stormwater storage, water is captured before it reaches the ground or a piped drainage system. Green and blue roofs can also provide localized cooling benefi ts while serving as a home for attractive vegetation. When retrofi tting existing buildings and historic properties, additional structural reinforcement is likely to be required to allow a roof to support the weight of new soil and planting layers (green roof) or temporary storage of rainwater (blue roof). Blue roofs capture rainwater by functioning as a tank-like structure and often collect it for re-use within the building through non-potable (water not used for drinking or cooking) needs such as irrigation and fl ushing toilets. Typically, stored water is designed to be drained within 24 hours if not within an enclosed system to prevent insects and other issues that can come with standing bodies of water. Excess water is channeled to a building's sewer system or typical gutters and roof leaders that would provide drainage for a normal roof.

Due to the high expense of installing a green or blue roof and related structural renovations, they are typically more costeffective

for larger properties or commercial buildings. In general roofs also need to be relatively fl at with minimum pitch. The amount of water that will be stored within a green or blue roof varies with the roof size and potential depth of planting and storage medium layers. They also must be designed to allow for safe access for maintenance and inspection.

C4.2 Injection Wells

The core idea of stormwater management is finding a place for water to go during a rain event rather than collecting in locations that can damage property or prevent people from traveling. The strategies outlined previously rely on using natural storage areas or creating additional stormwater storage space above or immediately underground. However, what if there is no space

either above or below ground for the water generated during a storm event to be stored? Miami Beach's unique geology and high groundwater table can often make storage of rainwater difficult. To

put it simply, if the ground is already full of water, rainfall will have minimal space to be stored.

One alternative is to use injection wells to send water into an area of the earth where more space is available for water to infiltrate. Stormwater injection wells are used throughout Miami for larger, developed sites where there is minimal space available for natural infiltration or storage at or near

the surface. Large pipes that are typically two feet in diameter or more are drilled deep into the earth. Conventional drainage systems (drains and catch-basins) collect rainwater and direct it to injection well pipes so it can be pushed deep underground. While efficient, careful consideration

needs to be made for understanding the local geology of a site and avoiding potential impacts to below ground drinking water sources.



D4 Future Proofing D4.1 Solar panels

Solar photovoltaic (PV) systems directly convert a portion of light (photo) energy from the sun into electricity (voltage) that can be used at home or sold back to your local utility. These systems are assembled from a set of interconnected components operating in one of three general ways: grid-tied; off-grid; and hybrid.¹ Florida laws require solar panel systems to be grid-tied. Grid-tied PV systems typically offer the fastest rate of return on their investment as many utilities offer incentives. At a minimum, qualified renewable energy generator in Florida owning PV systems up to 2 megawatts (MW) in size may take advantage of the "one for one" net-metering rules implemented by the Florida Public Service Commission.²

"One-for-one" net metering means that each kilowatt-hour (Kwh) of exported power offsets the cost of another kWh at a time your solar system couldn't service the electric demand of your home.

If your solar system is producing more energy than what is needed in the home the excess power is sold to FPL via through the grid. FPL are required by law to value each kWh sold to them at the retail price you pay for power. What makes net metering such a great incentive is because most homeowners use little power during the day, this means more power sent to the grid and credited by FPL.2 Great sunshine and amazing incentives make Miami Beach one of the greatest cities in America to install solar panels. As a Miami Beach resident, you most likely purchase your power from Florida Power and Light (FPL). Once again, this month FPL put up their residential rates and this is set to continue in

1 http://www.myfloridahomeenergy.com/help/library/energy-services/home-solar-pv

following years. There has never been a better time as an FPL customer to install solar panel systems. $^{\rm 2}$

Given the inherent risk of hurricanes and strong wind events in South Florida along with the typical installation of solar systems on the roofs of buildings, proper installation and engineering of roof stands and attachments is crucial to the long-term life and productivity of photovoltaic panel arrays. All products installed on building roofs shall be approved for use in the High Velocity Hurricane Zone (HVHZ) by a Florida Product Approval, Notice of Acceptance (NOA) or through engineering calculations of all anchoring and structural elements.



D4.2 Wind turbines

Florida residents have become accustomed to paying attention to the wind. In fact, we are usually concerned with too much wind from hurricanes and other severe weather events. We can use wind to our advantage, by harnessing and converting it into electricity using a turbine. Wind turbine is the term now used for what has historically been called a windmill. When the wind is blowing, it turns blades, around a rotor. This rotor is connected to a main shaft that spins a generator to produce electricity. ¹

Wind energy in the U.S. is increasing, yet there are many factors that determine the feasibility and cost effectiveness of wind energy from one geographic location to the next. Wind energy in Florida and the Southeastern U.S. is not as practical or cost effective as in other parts of the country. However, Florida does play an important role in national and global markets for wind energy. Furthermore, two main factors are very important when determining where to site a wind turbine for maximum efficiency: wind speed and duration.¹

Ideal wind turbine sites include the tops of smooth, rounded hills, open plains or shorelines, and mountain gaps that funnel and intensify wind.1 Due to the coastal location of Miami Beach, shoreline winds are significant enough to provide a substantial amount of power. It is important to recognize, however, that even within a region of high wind energy potential, specific sites should be evaluated on a case-by-case basis as proximity to buildings, water and many other factors can affect wind speed and duration.¹

Wind duration is also an important factor that affects the wind potential capacity from one site to another. At most sites, wind duration is much more difficult to forecast over long periods of time, so electricity produced on site using wind energy goes directly to the power grid rather than being consumed or stored on site. This means that the electricity you use by pulling from the power grid comes indirectly not only from the power your wind system produced, but also from all the other sources of electricity providing power to the grid. Research is continuing to develop the means to store distributed power, once generated on site, for later use both on site and at the utility (power grid) level.¹

As is the case with solar panel arrays, attachment of wind turbine systems atop of buildings require engineering and approval of attachments, anchoring and structural members by means of Florida Product Approvals, NOA's or engineering calculations in compliance with the Florida Building Code.



1 http://www.myfloridahomeenergy.com/help/library/energy-services/windenergy

² https://www.solar-estimate.org/solar-panels/miami-florida

D4.3 Water recycling systems

Water reuse plays an important role in water resource, wastewater and ecosystem management in Florida. When reclaimed water is used, it eases the demand on traditional, often limited, sources of water. By recycling or reusing gray water, communities can still grow while minimizing or even reducing their impact on the water resources around them.1 The exact definition of gray water varies from state to state, but generally includes any household wastewater other than that which comes in direct contact with human waste (such as water used for toilet flushing) or that has the potential to contain a large amount of organic material (such as food waste from kitchen sinks). As defined in Chapter 381 of the Florida Statutes, gray water includes water from baths, showers, clothes washers, laundry trays, and sinks, but does not include wastewater from kitchen sinks (Florida Statutes 2008).² Reusing gray water reduces the use of drinkingquality (potable) water for non-drinking quality (non-potable) needs. Potable water is often used unnecessarily around the household for purposes for which gray water would be acceptable. Replacing some or all the potable water used for non-potable needs (such as toilet flushing and irrigation of non-edible portions of the landscape) can significantly reduce demand for fresh water.2

Water reuse involves using highly treated domestic wastewater for a new purpose. Reclaimed water systems are continually monitored to ensure the health and welfare of the public and the environment are protected.¹ There are several requirements for gray water systems for flushing toilets (water closets) and urinals in Florida. Distribution piping must be clearly identified as containing nonpotable water by pipe color or with metal tags. Gray water must be filtered, disinfected, and dyed. Gray water storage reservoirs must be appropriately sized and must have a make-up potable water supply. Storage reservoirs must also have drains and overflow pipes which must be indirectly connected to the sanitary drainage system.

Using reclaimed water reduces discharges to surface waters, recharges ground water and postpones costly capital investments in the development of new, more costly water sources and supplies.¹



1 Water Reuse, South Florida Water Management District, https://www.sfwmd. gov/our-work/alternative-water-supply/reuse 2 Gray Water Reuse in Florida, Christopher J. Martinez, https://edis.ifas.ufl.edu/ ae453#FOOTNOTE_2

Building Raise Procedures

While not a common practice in Miami Beach, there are numerous examples of existing buildings being raised in the country today. In the Northeast, elevations are being done in New York (Brooklyn, Queens, and Staten Island) and Atlantic City, New Jersey. These cities are densely populated with structures built almost on top of each other. Elevation companies strategically develop lift plans that include using multiple smaller steel I-beams along with toe jacks to raise structures in any environment. In some urban areas, a temporary street closing or sidewalk closing is utilized in order to enhance safety while equipment is in use. When concentrating work within a neighborhood or block, cost savings are possible due to economies of scale. The savings are a result of supply chain, transportation and project management. Team member SJ Hauck's experience comes from a grant program located in a community in North Jersey where the entire program of 30 houses was located in one square mile; many were next-door neighbors. This allowed for the sharing of resources between jobsites, less drive time between sites, and one project manager for the collective job. SJ Hauck estimates the economies of scale on this grant allowed for a +/- 10% cost savings. **Building Raising Technology**

- In every case, a unified jacking machine is utilized in lifting a structure. The unified jacking machine ensures that each jack will receive exactly the same volume of oil and extend at the same rate, regardless of the weight or pressure on it. The jacks are what apply the pressure to the steel beams in order to elevate the structure.

- Besides the typical jacks with dog ear clamps you find on most elevations, toe jacks can be used as well. Toe jacks are also connected to the unified jacking machine with the hydraulic lines and support the home from the exterior. The benefit here is a home on a crawl space with limited space under it can be lifted in order to safely place the steel under the structure. Methodology In Miami Beach, there are a few different methods to raise that are dependent on the type of building construction.

1. Concrete Framed Structures

When elevating a concrete framed structure on a crawl space, the foundation wall is saw cut every few feet in order to run steel under the flooring system. Once the steel is in place, larger main beams are placed under the perpendicular support steel. The crib stacks support the main beams and receive the pressure from the jacks. The main beams are elevated and catch the support beams. The support beams catch the floor system and support the exterior concrete walls.

















2. Wood Framed Building on Crawlspace

This is more common along the East Coast up into the Mid Atlantic due to the frost line but can also be found in Miami. The building in this case has the steel inserted into the crawlspace perpendicular to the floor joists. The structure is lifted and supported on the cribs while the foundation is built.

When elevating a structure, the goal is to raise it only as high as is necessary. Typically the elevation contractor will elevate high enough for the foundation to be built safely. If the foundation is to be completely removed or if helical pilings are to be driven, it is safest for the building to be elevated 9 feet above grade in order for the heavy machinery to access the area for demolition and pile driving. If the structure is to be elevated over 10 feet above grade, it is recommended that cross bracing is added between crib stacks to ensure structural integrity.

Best practices:

- Identify a neighborhood or city block to consolidate work.
- Educate the building owner in order to ensure expectations are set.
- Standardize the engineered drawings to ensure common language.

o Example – Use common footings size for new foundations, common helical piling material if needed.

- Expedite permits and inspections.
- Pre-qualify contractors and require an elevation contractor's license.
- o Set a minimum requirement on experience, equipment, and insurance.

- Ensure funding and payment schedules are understood. Set up milestones.

- Create guidelines on approved scope of work items.









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