



The City of Fort Lauderdale owns four cemeteries within the city limits that are operated by the Parks and Recreation Department. The cemeteries range in size from five acres to fifty-six acres. The first cemetery was acquired in 1917. The City Commission established a ten member Cemetery System Board of Trustees who are responsible for overseeing the Perpetual Care Trust Fund, establishing rules and regulations and making recommendations to the city commission on development and care of the sites.

This Master Plan document aims to be a tool for the City staff and Cemetery System Board of Trustees to utilize in planning for future success of the cemeteries.

The 5 overall project goals of this Master Plan are as follows.

**Goal 1: Develop a Geo-Spatial Database**

- Develop a set of databases with files that are compatible with ArcGIS version 10 Service Pack
- Databases will include:
  1. All cemetery perimeter legal boundaries
  2. Mausoleums
  3. Buildings and facilities
  4. Above ground infrastructure
  5. Irrigation lines and equipment
  6. Roadways and paths

**Goal 2: Develop Asset Condition and Assessment**

- Methodology for assessing grave sites
- Evaluate perimeter fencing and gateways
- Evaluate and give recommendations to improve road material
- Identify areas of persistent flooding and areas where storm water poses a threat to cemetery assets
- Evaluate current tu maintenance
- Evaluate current Irrig

- consumption
- Evaluate sidewalks and pedestrian pathways.

**Goal 3: Develop Site Analysis and Plan**

- Recommendations to increase operational efficiency through alterations
- Determine the major threats to cemetery security
- Signage and wayfinding recommendations
- Recommendations for standards, specifications and siting for appropriate selection of site furnishings.
- Recommendations to enhance landscaping aesthetics, increase operational efficiency, decrease water consumption and ensure health of flora and fauna
- Provide recommendations on the impacts of surface water inundation and rising groundwater table.

**Goal 4: Develop Preservation and Conservation Policy and Funding, Specifically as Tied to the Perpetual Care Fund**

- Identify appropriate and acceptable methods of restoration and repair existing markers
- Provide recommendations for conservation of gravestones, resetting of gravestones, maintenance of commemorative features and monuments, and the use of herbicides and pesticides.
- Determine if the cemeteries and/or features within the cemeteries may be eligible for local, state or federal historical designation
- Recommendations on the stability and viability of the Perpetual Care Trust Fund for a determination of the perpetual care requirements for each cemetery
- Determine if current funding levels are adequate to meet expected standard of care in perpetuity

**Goal 5: Develop and Implementation Guide**

- Provide an implementation guide with recommendations for the rehabilitation, preservation, maintenance, financial solvency, and expansion of the cemeteries in the form of a prioritized project list that includes project descriptions and

**BURIAL TRENDS**

These are examples of some of the popular burial trends that others are utilizing throughout the world.

**STANDARD BURIAL**

Bodies are embalmed and placed in a casket typically 6' below ground. The grave site is typically marked with a headstone. The most common burial type.

**CREMATION**

The body is reduced to ashes and kept in a number of ways whether that be an urn on a mantle or scattered in a special place.

**MAUSOLEUM**

A stately building housing a tomb or tombs of multiple family members.

**COLUMBARIUM**

A walled structure with compartments for urns. Often enclosed around a garden, creating opportunity for meditative space

**GREEN BURIAL**

Environmentally sensitive burial that aims to reduce carbon emissions, preserves natural resources and preserve habitat.

**BURIAL AT SEA**

Releasing of remains in the ocean usually from a ship or boat.

**SCATTER GARDENS**

Designated area to scatter ashes.

**RAISED TOMBS**

Above ground burial tombs. Typically in certain locations that are susceptible to flooding and sea level rise.

**HI-TECH MEMORIALS**

Some cemeteries have incorporated unique applications using modern technology such as touch screen monitor within a Mausoleum or smart phone applications to explore information on those buried within.





## FORT LAUDERDALE CEMETERIES & SEA LEVEL RISE

In March 2016, in Calcasieu Parish, Louisiana, flooding occurring within the cemeteries caused many concerns within the community. The buoyant force created by elevated flood levels forced caskets out of the ground. Gravesites in New Orleans are generally located above ground due to concerns with groundwater levels and the low elevation of land relative to sea level.<sup>1</sup> Closer to Fort Lauderdale, heavy rain in Gifford, Florida in 2011, forced several vaults to rise above ground. The cemetery noted that in 2004 a hurricane caused some vaults to float around.<sup>2</sup> While these examples are associated with heavy rainfall, it is essential to examine them for insight into future conditions, as sea level rise combined with Fort Lauderdale's porous limestone substrate will cause increases in groundwater elevations and reduce the storage capacity for rainfall. Eventually, groundwater levels will be close enough to the surface to flood gravesites during excavation and may inhibit burials.

To include sea level rise, Broward County has created a Future Conditions Wet Seasons Groundwater Elevation map.<sup>3</sup> The estimate is for the time period of 2060-2069, roughly 50 years from now, and during the wet season, the months of May through October. It is a modeled estimate of the groundwater elevation and should be used to consider soil saturation and ground water levels when planning for future conditions including sea level rise.<sup>4</sup>

The chart below shows the estimated future conditions groundwater elevation and average ground elevation estimate at each cemetery.

The future condition groundwater elevation is projected to be within six feet of the average surface of Woodlawn, Lauderdale Memorial, and Sunset Memorial Gardens cemeteries. This is illustrated with contour maps of each cemetery depicting the difference in elevation between the existing ground surface and the projected future wet season groundwater level. Refer to maps colored with red, yellow and green in subsequent sections of this document.

Red indicates areas where the groundwater elevation is expected to be within 4 feet of the existing grade. Yellow depicts areas where the existing ground surface is expected to be between 4 and 6 feet above the groundwater level, and green indicates areas where the existing grade is expected to be greater than 6 feet above the projected groundwater level. It is recommended that areas depicted in red be explored for alternative burial options beyond in-ground interment.

There are no areas of Evergreen where groundwater is expected to be within 4 feet of the existing ground surface, shaded red on the maps. The western portion of the cemetery is expected to have groundwater within 6 feet of the surface. A significant portion of the northwestern quadrant of Lauderdale Memorial is expected to have groundwater within 4 feet of the surface, with most of the cemetery having groundwater within 6 feet of the surface by 2060. Woodlawn and Sunset are in similar situations.

Areas shaded in red or yellow could be explored for alternative burial types of uses. It is recommended that the City should consider whether groundwater inundation of gravesites will disrupt normal burial operations and adjust burial methods or operations accordingly.

In addition to the consideration of groundwater elevation, structures around the cemetery should be analyzed for flood risk and proposed structures should be built in consideration of sea level rise. The Southeast Florida Regional Climate Change Compact (SFRCC) Unified Sea Level Rise Curve adopted by the City of Fort Lauderdale, should be used for this effort. The planning document states, "the upper curve of the projection should be utilized for planning of high risk projects to be constructed after 2025 have a long design life, other infrastructure or not easily replaceable."

Brizaga has developed Action Elevation is the I

during a given year, excluding extreme events like hurricanes. Currently (2018), the Adaptation Action Elevation for Broward County is 2.1 ft. NAVD. It is recommended that adaptation actions be taken now for any critical components located below this elevation. Using the high curve projection of 3.5 feet of sea level rise in the next 50 years, the 50-year Adaptation Action Elevation is 5.6 feet NAVD. Any critical building components or other infrastructure located below the 50-year Adaptation Action Elevation is recommended to be retrofitted or replaced within that 50-year timeframe to reduce risk of flood damages from tidal flooding events. However, considering the assumed permanency of cemeteries, special considerations should be taken now.

The sea level rise projections published by the National Oceanic and Atmospheric Administration (NOAA) are shown in the figure below. The high curve as indicated by the SFRCC is colored red.

<sup>1</sup> <https://www.cbcnews.com/news/louisiana-flooding-caskets-calcasieu-parish/>

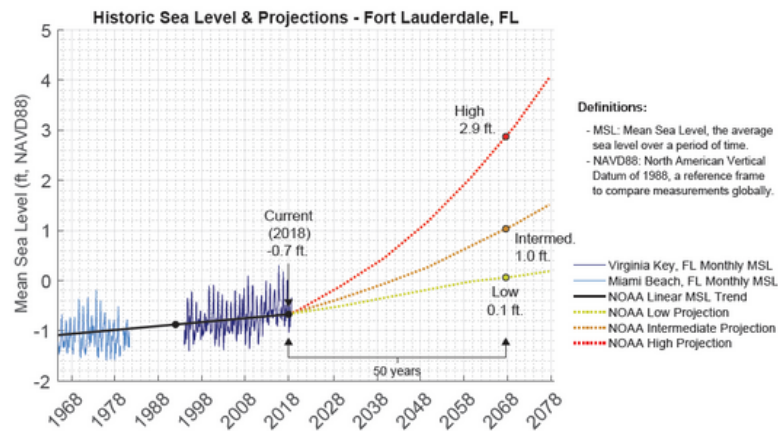
<sup>2</sup> <https://miami.cbslocal.com/2011/11/03/rain-forces-graves-above-ground-in-fla-cemetery/>

<sup>3</sup> <http://www.broward.org/Environment/Engineering/Pages/Groundwater/Maps.aspx>

<sup>4</sup> <http://www.southeastfloridaclimatecompact.org/wp-content/uploads/2015/10/2015-Compact-Unified-Sea-Level-Rise-Projection.pdf>

	Future Conditions Groundwater Elevation (NAVD)	Average Ground Elevation Estimate* (NAVD)
Woodlawn	2.5 ft.	6.3 ft.
Lauderdale Memorial Park	2.5 ft.	7.3 ft.
Evergreen	1.5 ft.	8.5 ft.
Sunset Memorial Gardens	3.0 ft.	8.1 ft.

\* Based on topographic survey data provided by KEITH.



### Understanding historic sea level and future projections:

- Historic data is from tidal gauges and future projections are based on the best available science and models.
- The range in projections (from low to high) is mostly due to uncertainty in how much ice on land will melt.

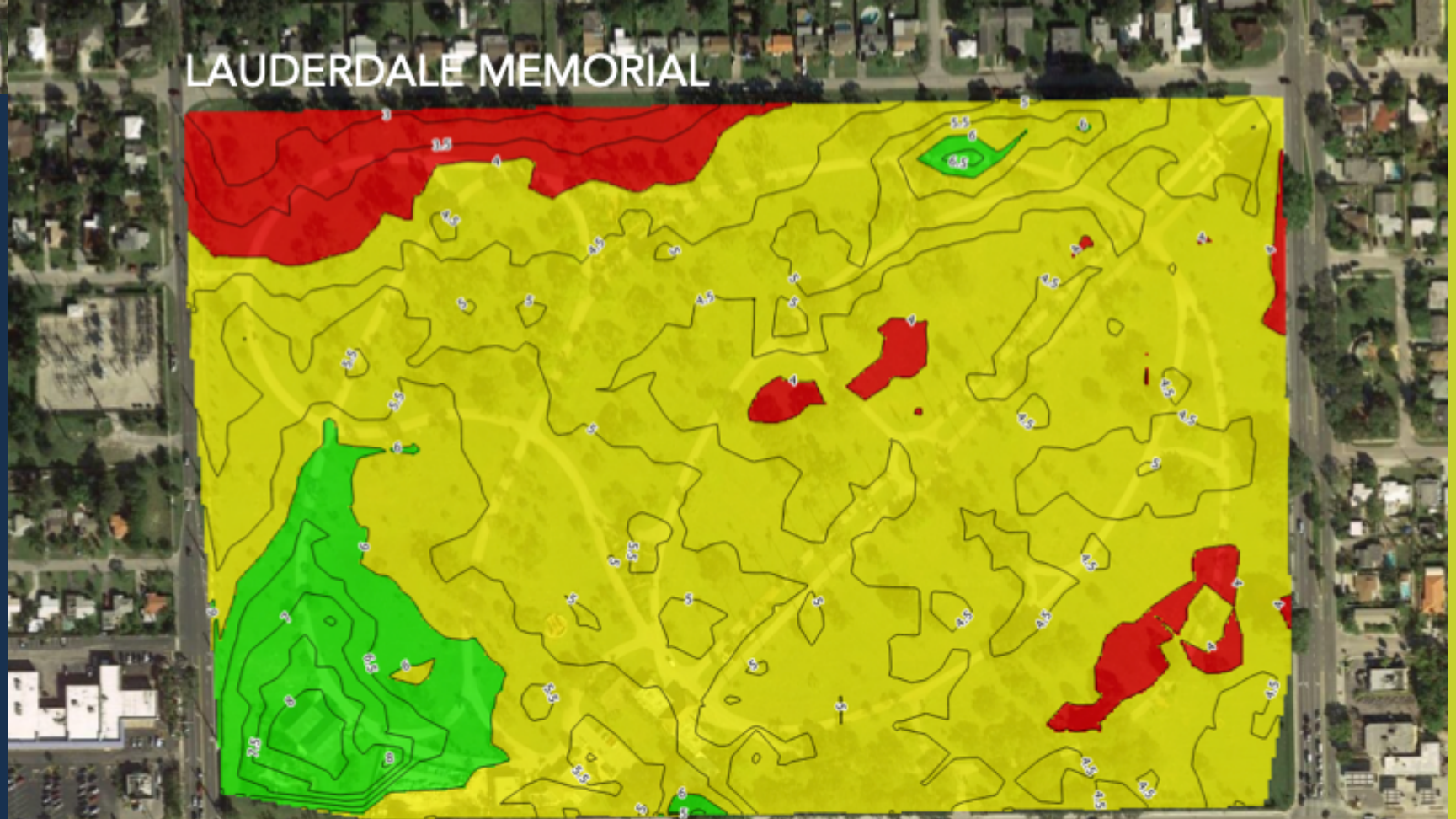




# EVERGREEN

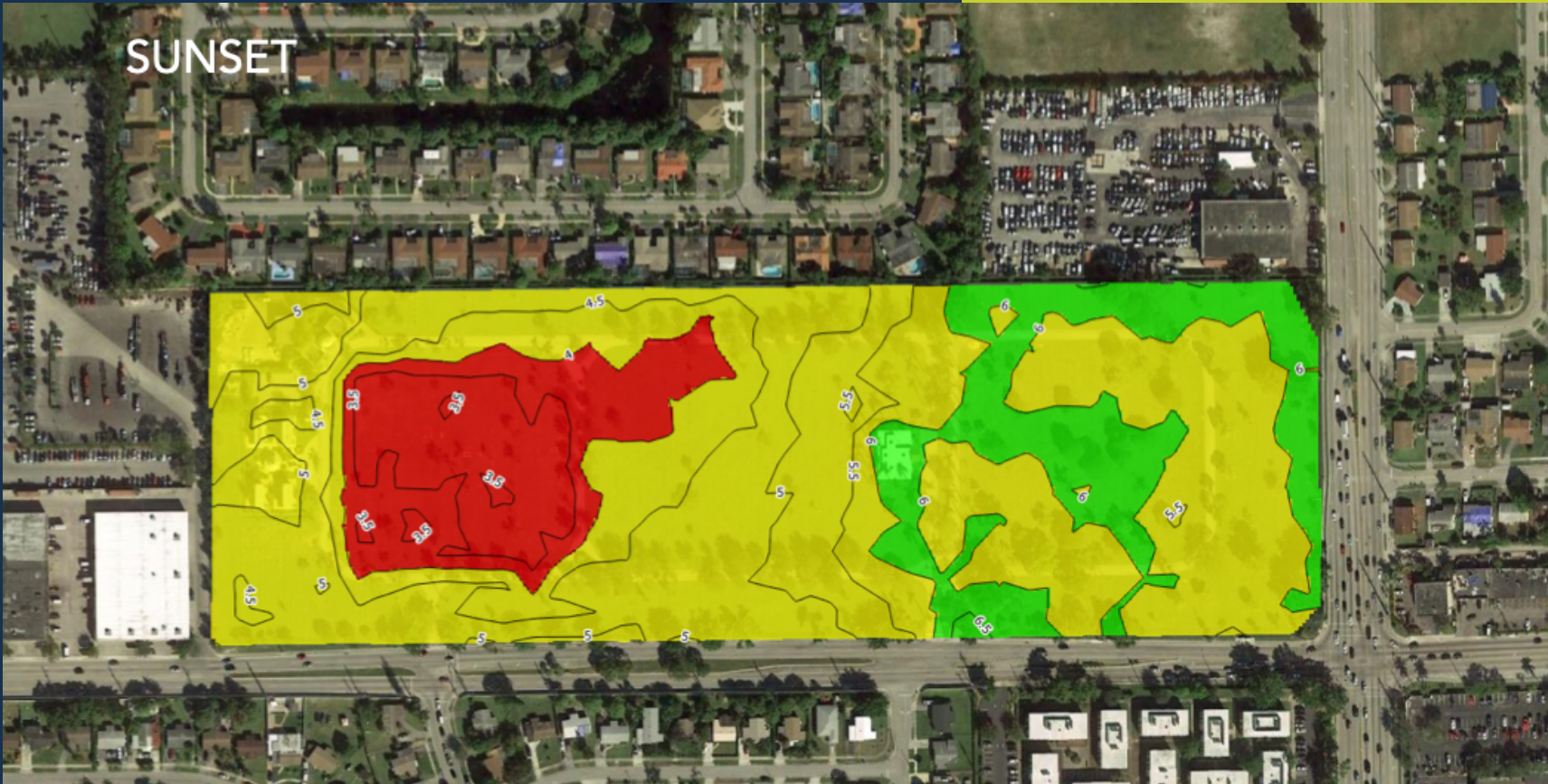


# LAUDERDALE MEMORIAL





SUNSET



WOODLAWN

