



## Gulf State Park Master Plan and Phase 1 Methods

### **Research Fellow:**

Charlene M. LeBleu, FASLA, FCELA, AICP  
Professor  
Auburn University

### **Research Assistant:**

Kangkhita Aishwarya Bosu  
Master of Landscape Architecture (2023)  
Auburn University

### **Firm Liaison:**

Kelly Farrell  
Ecologist/Landscape Designer  
Sasaki

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The full case study can be found at: <https://landscapeperformance.org/case-study-briefs/gulf-state-park>

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## Research Strategy

The Auburn University research team, partners, and stakeholders gathered, appraised, and analyzed Gulf State Park (GSP) data for approximately 25 weeks in 2022. The team organized its investigation under LAF’s three broad benefits categories (environmental, economic, and social) and identified specific landscape architecture performance benefits for each category. The research team received the necessary permissions and acquired a permit to conduct research on Alabama State Lands. The research team chose quantitative and qualitative methods to substantiate the value of landscape architecture and its performance to the GSP. Chosen methods included: 1) Site observations using Gehl Public Life Tools (Gehl, 2017) accessed from LAF’s Landscape Performance Toolkit, (2) Universal Floristic Quality Assessment Calculator accessed from LAF’s Landscape Performance Toolkit to be used with our collection of primary on-site data (vegetation line transects), and 3) collection of secondary data (data collected/shared by partners and other sources). The research team members were on-site at GSP on March 7-9, 2022, and April 7-10, 2022.

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## Environmental Benefits

- **Reduced building footprint by 9 acres through siting of the new lodge. The former lodge had a much larger footprint which encroached on the primary dunes.**

### **Background:**

The previous lodge at Gulf State Park was built from 1972-1974. The facility provided affordable overnight accommodations at rates lower than the surrounding beachfront hotels. The lodge was also a place for local groups to meet. It was known for the lodge restaurant's renowned seafood buffet. The previous lodge's sprawling lawns, parking areas, and recreational facilities impacted 30 acres (12.1 ha) of Gulf State Park's dunes. In 2004, Hurricane Ivan directly hit Gulf Shores, AL, severely damaging the lodge. In 2007, the facility was demolished, and the rubble was used as an artificial reef. The loss of the lodge had significant impacts on the park and the entire Alabama State Park system. The Gulf State Lodge generated significant revenue and helped support the other state parks across Alabama. In 2010, the BP Oil Spill inflicted additional damage on the Gulf Coast.

In 2014, plans for a new lodge began with the concept of oil spill recovery funding to strengthen the park's resilience to natural disasters. The plans called for "a new model of coastal development for the region" with sustainable and resilient architecture. The new lodge is set back 225 ft (68.6 m) from the primary dune to allow room for natural dune movement (Figure 1).

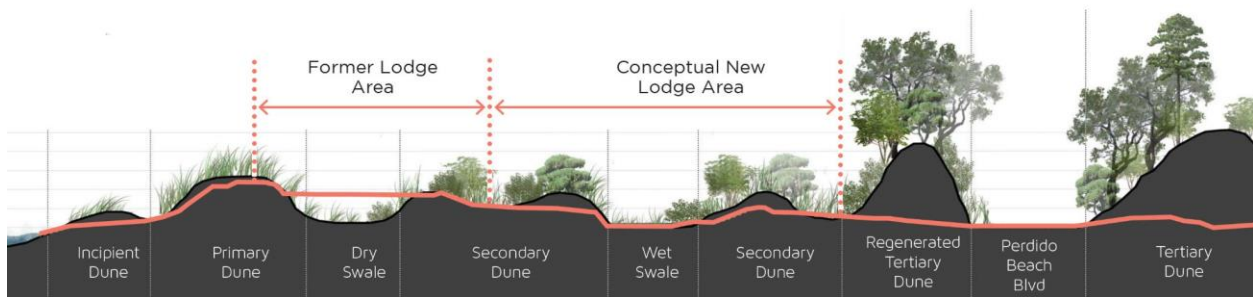


Figure 1. The new lodge is set back 225 ft. (68.6 m) from the primary dune to allow room for natural dune movement (Sasaki Master Plan, 2016).

The new facility is rebuilt on a smaller site than the previous lodge of 21 acres (8.5 ha) vs. 30 acres (12.1 ha) to allow for additional dune restoration (Figures 2 & 3). In addition to overnight accommodations, the facility is a meeting space for mid-sized groups. The landscape is designed with native plantings to enhance and restore the surrounding dune ecosystem.



Figure 2. Approximate building footprint of the new lodge (NOAA, 2020).



Figure 3. Approximate building footprint of the old lodge (NOAA, 2004).

**Method:**

Secondary data source. *Alabama's Gulf State Park--Master Plan* (Sasaki, 2016) provided the background information on the old and new Gulf State Park Lodges. Building footprint imagery

was accessed through NOAA Emergency Response Imagery (NOAA, 2021).

### **Calculations:**

NOAA Emergency Response Imagery: National Geodetic Survey of Gulf Shores, AL (NOAA, 2021) provided acreage measurements of building footprint imagery.

### **Sources:**

Sasaki & Associates, Inc. *Alabama's Gulf State Park–Master Plan 2016*. 219 pages

NOAA. *Emergency Response Imagery: National Geodetic Survey; Gulf Shores, Alabama*. 2021. *Hurricane Sally (2020) + Hurricane Ivan (2004)*. Accessed 24 June 2022.

<https://storms.ngs.noaa.gov>

### **Limitations:**

- Background information on the old lodge (1972-1974) and the new lodge (2018) is dependent on secondary data gathered by Sasaki for the *Alabama's Gulf State Park–Master Plan 2016*.
- Acreage measurements on the *NOAA Emergency Response Imagery* are approximate to those reported by Sasaki.
- ***Captures and reuses approximately 200,000 gallons of stormwater per year, which constitutes 105% of the building and landscape's water use.***

### **Background:**

105% of the GSP Interpretive Center's water is collected from rainwater and stored in an 11,000-gallon (41,640 L) cistern (Figure 4). With an inch of rain, the roofs and gutters of the Interpretive Center can gather over 4,000 gallons (15,142 L). The cistern captures about 200,000 gallons (757,082 L) of water per year, and a series of decorative rain chains help direct the rainwater to the cistern (Figure 5). A kiosk on the exterior of the building shows how the Center is using water in real time.

The Center uses about 156 gallons (591 L) of water per day for its restrooms, water/sand play station and water fountains; the rest is saved for non-rainy days. The Center's restrooms and water/sand play station area use only the UV filtered rainwater. The building's potable water is collected from rainwater harvested from its roof. The Center is certified as a water treatment plant by the Alabama Department of Environmental Management (ADEM). The water filter system can clean up to 530 gallons (2,006 L) of rainwater daily. Rainwater is processed through more than 50 filters, including an ultraviolet (UV) disinfection system, after which it is held in a tank for use (Figure 6). After the water is used, it is purified and allowed to infiltrate into the ground. The Interpretive Center must gather more water than it uses to meet the Living Building Challenge certification water petal.



Figure 4. 11,000-gallon (41,640 L) cistern at the GSP Interpretive Center (LeBleu, 2022).



Figure 5. Decorative rain chains help direct rainwater into the cistern (LeBleu, 2022).



Figure 6. Ultraviolet water disinfection system (LeBleu, 2022).

**Method:** Secondary data source (The Learning Campus).

**Calculations:** Water use data provided by The Learning Campus.

**Sources:**

Interpretive Center at Gulf State Park. *What if a building could make the world better?* 2018. *The Learning Center at Gulf State Park*. Online Brochure. Accessed 31 May 2022. [https://learningcampusgsp.com/documents/IC\\_Web\\_Brochure.pdf](https://learningcampusgsp.com/documents/IC_Web_Brochure.pdf)

Leavell, Matthew. 2018. *The Gulf State Park Interpretive Center: A Southern Success Story*. written for *TrimTab/International Living Future Institute*, 2018. Accessed 31 May 2022. <https://trimtab.living-future.org/trim-tab/issue-35/the-gulf-state-park-interpretive-center-a-southern-success-story/>

Watershed. *Gulf State Park Interpretive Center*. 2020. Accessed 31 May 2022. <https://watershed.pro/portfolio/gulf-state-park-interpretive-center/>

Edelstein, Ken. 2018. *Living Building project caps Gulf State Park's sustainable makeover*. Written for Kendeda Fund Home Page, November 15, 2018. Accessed 31 May 2022. <https://livingbuilding.kendedafund.org/2018/11/15/living-building-challenge-gulf-state-park-sustainable-makeover/>

The Learning Campus at Gulf State Park—Explore the Interpretive Center. Accessed 31 May 2022. <https://learningcampusgsp.com/interpretive-center>

**Limitations:**

The validity of the information on the cistern, rainwater capture and ultraviolet water disinfection system at the GSP Interpretive Center is dependent on secondary data gathered by the CSI research team and the Learning Campus at GSP.

- ***Reuses 230,000 gallons of HVAC condensation each year to supply the pool at The Lodge, saving approximately \$2,300 annually.***

**Background:**

Condensate recovery is the process of reusing the water contained in the discharged heating, ventilation, and air conditioning (HVAC) condensate. Recovering condensate instead of releasing it can offer significant energy and water savings. Condensate is generally considered “good water” – as pure as distilled water, low in mineral content, and able to be used for several applications, including filling a pool. Traditional pool chemicals are still needed.

**Method:**

The Lodge removes more than 650 gallons per guest room annually (353 rooms) using a condensation recovery system enough to fill the pool 4 times annually (Figure 7).



Figure 7. The condensation recovery system at the Lodge provides water for the pool. The system recovers enough water to fill the pool four times yearly (Sasaki, 2018).

**Calculations:**

Secondary data source (Sasaki).

The city of Gulf Shores, AL, charges \$0.005/gal of potable water, and an additional \$0.005 per gallon fee for sanitary sewer (2022).

230,000 gals/year X \$0.005/gal = \$1,150.00/year saved in potable water cost.

230,000 gals/year X \$0.005/gal = \$1,150.00/year saved in sanitary sewer fees.

Total Saved = \$2,300/year

**Sources:**

The City of Gulf Shores AL Utility Board.

[https://www.gulfshoresutilities.com/pdf/Handbook\\_2017.pdf](https://www.gulfshoresutilities.com/pdf/Handbook_2017.pdf)

**Limitations:**

Gallons of water per room is an average of occupied rooms. An unoccupied room may not produce condensation. The validity of the estimate on condensation reused per room is dependent on secondary data from Sasaki.

- ***Restored 15 acres of dunes through plantings and the creation of cuts through an engineered primary dune.***
- ***Restored over 50 acres of habitat along 2 miles of beachfront for the Alabama beach mouse, a federally protected species.***

**Background:**

Beach mice inhabit frontal and scrub dunes along the Alabama coast. They are nocturnal and spend their daylight hours in burrows. The Alabama beach mouse, *Peromyscus polionotus ammobates* (Figure 8), is federally protected. Destruction of the coastal dune ecosystem for development is listed as the main factor for the federal listing. Beach mice are an indicator species of a healthy dune system. The mouse burrows in the primary dunes, collecting, eating and dispersing seeds of native plants like sea oats. The mouse has been known to move inland to tertiary dunes during large storm events. It also uses scrub-shrub plants of the interdunal swales as cover against predators like birds. Conserving beach mouse habitat helps sea turtles, shorebirds, and other species, including humans (US Fish & Wildlife, 2016).



Figure 8. The Alabama Beach Mouse, *Peromyscus polionotus ammobates*, is federally protected (USFWS, 2005).

**Method:** Secondary data source. See Sources.

The extensive dune restoration program implemented innovative strategies to grow a healthy, dynamic, and protective dune system for the park and community. Approximately 15 acres (6.1 ha) of dune were restored to a healthy, dynamic, and complete dune system. This included the creation of cuts through the engineered primary dune, an artificial dune form built of sand brought in from an external source and shaped into a dune using bulldozers and geotextiles. The cuts were strategically created to facilitate sand movement and encourage the growth of secondary and tertiary dunes (Figure 9). Restoration also included plantings of sea oats (*Uniola paniculata*) and saltgrass (*Distichlis spicata*).

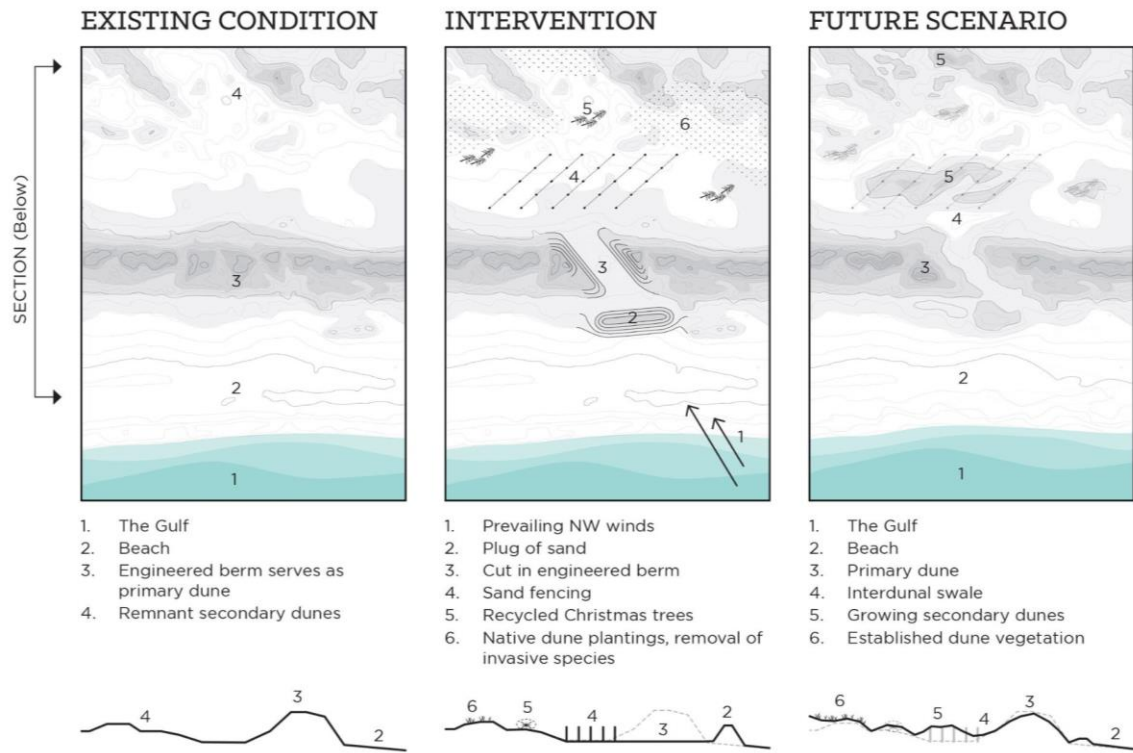


Figure 9. Dune restoration diagram. (Sasaki, 2016).



Figure 10. Dune buffer and restoration improves resilience (Sasaki, 2018).



Figure 11. Planting sea oats and salt grass for dune stabilization and habitat (Sasaki, 2016).



Figure 12. Dune restoration area near The Interpretive Center at GSP (Sasaki, 2018).

### *Monitoring*

Gulf State Park works with a consultant to monitor the endangered Alabama Beach Mouse population along the boundaries of Gulf State Park. This indicator species is trapped in live traps, data taken (including sex, weight and tail stripe), ear-tagged and released. The traps are placed in the dunes on a grid system. Mice are trapped in approximately the same location yearly to monitor the population. If the population numbers or the mouse body weight goes down, it “indicates” to scientists that there may be something going on that is destructive to the ecosystem. The monitoring is made possible through a federal permit issued by the U.S. Fish & Wildlife Service.

Unfortunately, data on the site’s Alabama Beach Mouse population was not able to be obtained by the CSI research team in the course of this study, though the creation of 50 acres of habitat does anecdotally seem to be supporting the Alabama Beach Mouse population on-site.

**Calculations:** Secondary data on dune restoration.

The dune restoration program improved 50+ acres (20+ ha) of Alabama Beach Mouse (*Peromyscus polionotus ammobates*) habitat along GSP’s 2+ miles (3.2+ km) of beachfront (Figures 10, 11, & 12).

**Sources:**

Alabama Beach Mouse. Image. Sept. 19, 2005. Photo Credit: USFWS. Public Domain. Accessed 31 May 2022. <https://www.fws.gov/media/alabama-beach-mouse>

Alminana, J., Tooke., K. and B. Almond. “*Living Landscapes: The Landscape Architect’s Role in Achieving Living Building Challenge Certification*,” Conference on Landscape Architecture. American Society of Landscape Architects. November 15-18, 2019, San Diego, CA.

Alabama Beach Mouse at Gulf State Park. YouTube. March 31, 2020. Accessed 31 May 2022. <https://www.youtube.com/watch?v=dfAfglQq9VU>

**Limitations:**

The validity of the information on the Alabama Beach Mouse and dune restoration at GSP is dependent on secondary data gathered by the Research Team, Sasaki + Partners, GSP Naturalist and the U.S. Fish & Wildlife Service.

- ***Increases ecological quality as demonstrated by an increase in Floristic Quality Index (FQI) from 0 to 5.45 in the bioretention area at The Lodge. Species richness continues to increase, with 3 additional native plant species that were not originally planted observed in the bioretention area (a 17% increase).***

**Background:**

The bioretention area at The Lodge captures and purifies over 1 acre (0.4+ hectares) of stormwater runoff from the adjacent road, parking, and other areas (Figure 13).



Figure 13. Bioretention at The Lodge at Gulf State Park (Bosu, 2022).

The 20,654-sf (1918.8 sqm) bioretention area has 18 species of native and adaptive plants, including sea rocket (*Cakile lanceolata*), muhly grass (*Muhlenbergia capillaris*), little bluestem (*Schizachyrium scoparium*), purple sandgrass (*Triplasis purpurea*), and sea oats (*Uniola paniculata*) to remove contaminants from stormwater runoff while contributing to pollination and local habitat (See Appendix A, List of Bioretention Species Planted). Researchers used a line-transect method to determine the number and density of the plant species within the bioretention area. The line-transect method is well established in theory and practice to determine a species count of vegetation cover in an area (McIntyre, 1953). The method gives precision estimates of the number of vegetation species for a given area. This is especially so when the marked identification of species occurs. The researchers recorded the numerical abundance, or the number of 'hits' of a species along a measured transect line.

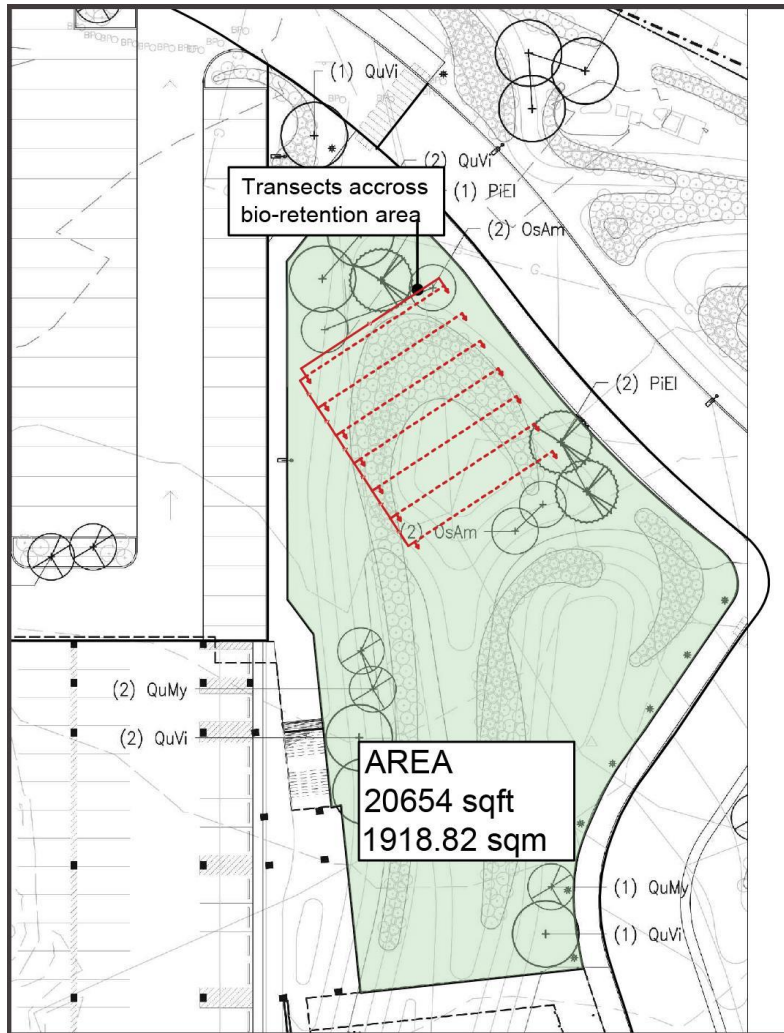


Figure 14. Bioretention area at The Lodge showing the approximate location of transects, Gulf State Park, Gulf Shores, AL (Bosu, 2022).

**Methods:**

*Line Transects*

Fieldwork took place in the spring season (April 2022) at The Lodge on the grounds of Gulf State Park. Six 50 ft. (15.2 m) transects were measured using a 100 ft (30.5 m) reel-type steel measuring tape. The starting point of the first transect was chosen based on the perceived typicalness of the plant community within the bioretention and a random toss of the measuring tape (Walker & Menaut, 1991). Each proceeding transect was located parallel to the last and 10 ft apart. Plant species and area coverage were identified along the six 50-ft (15.2 m) transects. Transect lines were photographed for future reference (Figures 15 & 16).



Figure 15. Kangkhita Aishwarya Bosu photographing vegetation along a transect line (LeBleu, 2022).



Figure 16. Transect line crossing woody goldenrod, *Chrysoma pauciflosculosa*, in bioretention area (Bosu, 2022).

#### *Universal Floristic Quality Assessment (FQA)*

The Universal Floristic Quality Assessment (FQA) calculator was also used to evaluate the ecological integrity of the native plant communities within the bioretention site. The FQA is a standardized assessment method that calculates a numerical index reflecting the quality of native plant communities for a given area. It indicates the impacts of invasive species and can also be used to monitor the effectiveness of land management and restoration practices.

Previously, the bioretention area was part of the old lodge site that Hurricane Ivan destroyed in 2004. The remains of the old lodge were demolished in 2007, making the site essentially a brownfield. Pre-existing plant species were not officially documented, but a 1985 Google Earth photograph of the pre-existing site shows it to be mostly bare sand (Figure 17).



Figure 17. Brownfield site of the demolished old lodge at Gulf State Park, Gulf Shores, AL (Google Earth, 1985).

The site was redeveloped from 2016-2018. A native plant palette was applied to the redeveloped site (including the bioretention area) to increase ecological resilience by providing habitat for various species. The Universal Floristic Quality Assessment (FQA) tool was used to qualify the impact of the plant species found by the researchers in the bioretention area of the new lodge when applying six 50 ft (15.2 m) plant transects to the area in April 2022.

To understand the ecological impact of the plants found along the transect, the Universal Floristic Quality Assessment (FQA) tool was utilized. The FQA method assigns value to species based on their “tolerance to disturbance” and “fidelity to habitat integrity” (Gianopulos, 2014).

The plant list for six transects run by the researchers contains 20 species, 19 of which are native and found in *The Coefficient of Conservatism Database Development for Plants Occurring in the Southeast United States* by Gianopulos. One species found, common bermuda grass, *Cynodon dactylon*, is a non-native plant that is grown as a turfgrass or as forage for livestock, but it also can be an invasive weed.

**Calculations:**

*Universal Floristic Quality Assessment (FQA)*

Table 1 lists the C-Values for the plants identified in the transects. The plant C-Value ranged from 3 – 8. The total C-Value is 109, and the mean C-Value is 5.45. An area with a native mean C-value of 3.5 or higher likely has “sufficient floristic quality to be of at least marginal natural area quality” (Freyman, 2016).

Table 1. Plant Species Identified in Line Transects in Bioretention at Gulf State Lodge and their C-Value

<b>Scientific Name</b>	<b>Common Name</b>	<b>Native</b>	<b>C-Value</b>
<b><i>Shrubs</i></b>			
<i>Chrysoma pauciflosculosa</i>	Woody Goldenrod	Yes	7
<i>Serenoa repens</i>	Saw Palmetto	Yes	7
<b><i>Forbs</i></b>			
<i>Cakile lanceolata</i>	Sea Rocket	Yes	6
<i>Chrysopsis godfreyi</i>	Godfrey’s Golden Aster	Yes	7
<i>Gaillardia pulchella*</i>	Blanket Flower		4
<i>Helianthus debilis</i>	Sunflower	Yes	5
<i>Heterotheca subaxillaris</i>	Golden Aster/Camphorweed	Yes	4
<i>Ipomoea imperati</i>	Beach Morning Glory	Yes	3
<i>Physalis augustifolia</i>	Ground Cherry	Yes	3

Polygonella Sp.	Jointweed	Yes	4
<b>Grasses</b>			
Aristida geniculata	Plains Three-Awn	Yes	6
Distichilis spicata	Inland Salt Grass	Yes	7
Muhlenbergia capillaris	Muhly Grass	Yes	7
Panicum amarum	Seaside Panicum/Switchgrass	Yes	4
Paspalum vaginatum*	Seashore paspalum	Yes	7
Schizachyrium scoparium	Little Bluestem	Yes	7
Sporobolus virginicus*	Seashore dropseed	Yes	7
Triplasis purpurea	Purple Sandgrass	Yes	6
Uniola paniculata	Sea Oat	Yes	8
Cynodon dactylon*	Common Bermuda Grass	No	0

\* Indicates species not shown on the bioretention CD set.

### *Discussion*

Of the 20 species used to calculate the FQA value, 19 or 95% were classified as native and 1 (5%) as non-native. The total mean Coefficient of Conservatism for the plants was 5.45, while the adjusted FQI was 24.3. The post-development conditions (4 years since planted) reflect a total mean Coefficient of Conservatism that is over 5 times higher than pre-development. The researchers assume a pre-development FQI value of 0 as there was little to no vegetation in the old lodge site due to the previous building demolition.

Table 2: FQA calculations

<b>Gulf State Park Master Plan &amp; Phase 1</b>		
FQA DB Region	Southeast	
FQA DB Publication Year	2014	
FQA DB Description	Gianopoulos	
Practitioner(s)	LeBleu & Bosu	
Latitude	30.1505.78 N	
Longitude	87.3955.92 W	
Private/Public:	Private	
<b>Conservatism-Based Metrics:</b>		
Total C-Value	109	
Total Mean C-Value	5.45	
Total Native Mean C-Value	5.74	
Total FQI	23.76	
Native FQI	25	

Adjusted FQI	24.3	
% C value 0	0	
% C value 1-3	10	
% C value 4-6	40	
% C value 7-10	45	
Native Tree Mean C	0	
Native Shrub Mean C	7	
Native Herbaceous Mean C	5.9	
<b>Species Richness</b>		
Total Species	20	
Native Species	19	95%
Non-native Species:	1	5%

*Line Transects*

We found 4 species growing in the bioretention area that were not shown as planted on the planting plan in the construction documentation: blanket flower (*Gaillardia spp.*), seashore panicum (*Paspalum vaginatum*), seashore dropseed (*Sporobolus virginicus*), and common bermuda grass (*Cynodaon Dactylon*). These additional species seem, for the most part, to be present due to the natural scatter of vegetation seed (wind, animal transport or other) from the adjacent native and planted areas.

18 species planted in bioretention; 3 additional plant species found (*common bermuda grass was excluded because it is not native to the area and can be an invasive weed*)  
 $3/18 = N/100$  or  $300/18 = 16.67$  or 17%

### **Sources:**

McIntyre, G. A. 1953. *Estimation of Plant Density Using Line Transects*. Journal of Ecology. Aug. 1953, Vol. 41, No. 2 (Aug. 1953), PP. 319-330. British Ecological Society.  
<https://doi.org/10.2307/2257044>

Peters, D. 2019. Floristic Quality Assessment: a Critique, a defense, and a primer. ECOSPHERE, Vol. 10, Issue 8, August 2019. <https://doi.org/10.1002/ecs2.2825>

Sasaki. 2017. The Lodge at Gulf State Park, Gulf Shores, AL. *Site–Key Plan, L000*. Date: 02/23/2017. Bidding document. Used with permission.

Spyreas, Greg. 2019. Floristic Quality Assessment: a critique, a defense, and a primer. Ecosphere. Ol. 10, issue 8, August 2019. <https://doi.org/10.1002/ecs2.2825>

Universal Floristic Quality Assessment (FQA), Openlands, 2015. Accessed 23 June 2022. <https://universalfqa.org/>

Walker, B. H. & Menaut, J-C (eds) 1991. Research Procedure and Experimental Design for Savanna Ecology and Management, IBUS, RSSD, Responses of Savannas to Stress and Disturbance, 119 pp. ISBN 0643048111.

### **Limitations:**

- The transects, though randomly located in an area that appeared to be representative, may not represent the species planted in the bioretention area.
- FQA relies on correctly identified species. The researchers are well-trained in plant identification, however, there may be a few misidentified plants due to nuances between species within a genus.
- Planted species numbers are based on the construction document set; it is thought that there were no substitutions for this area.
- Plant species C values are subjectively assigned in the FQA, yet the tool is presented as an objective measure.

- **Generates an estimated 24,820 kWh of solar power annually, 105% of the Interpretive Center’s energy use. This has saved an estimated 41,840 lbs in carbon dioxide emissions since solar panel installation in 2018, equivalent to 316 trees planted.**

**Background:**

The Interpretive Center at GSP is a gateway to the park and introduces visitors to the environment. The Center was designed for net-positive energy, water, and carbon. The 7,500-sf (696.8 sqm) facility is located at the GSP Beach Pavilion and produces its electricity using a 1.48-kW solar array (51 solar panels) installed upon the Center’s completion in 2018 (Figure 18). Solar system production, weather, carbon dioxide emissions avoided, and consumption are continuously monitored online using apps SolarEdge and Green Hub (Figure 19).



Figure 18. Solar panels are used to power the Interpretive Center (LeBleu, 2022).

A kiosk on the exterior of the Center shows how the building uses electricity and water in real-time. On an average day, the system generates 68 kWh of electricity, more than enough to meet the 52 kWh used on a typical day. During a power outage, the Center’s two batteries can keep things running for up to a week. The Center is LEED Platinum-certified and received the FORTIFIED commercial certification. The Center also needs to generate more energy than it needs to meet the *Living Building Challenge* energy petal criteria.

**Method + Calculations:** Secondary data source (SolarEdge Online) provided by site managers including average annual energy, lifetime CO2 emissions saved, and equivalent trees planted.

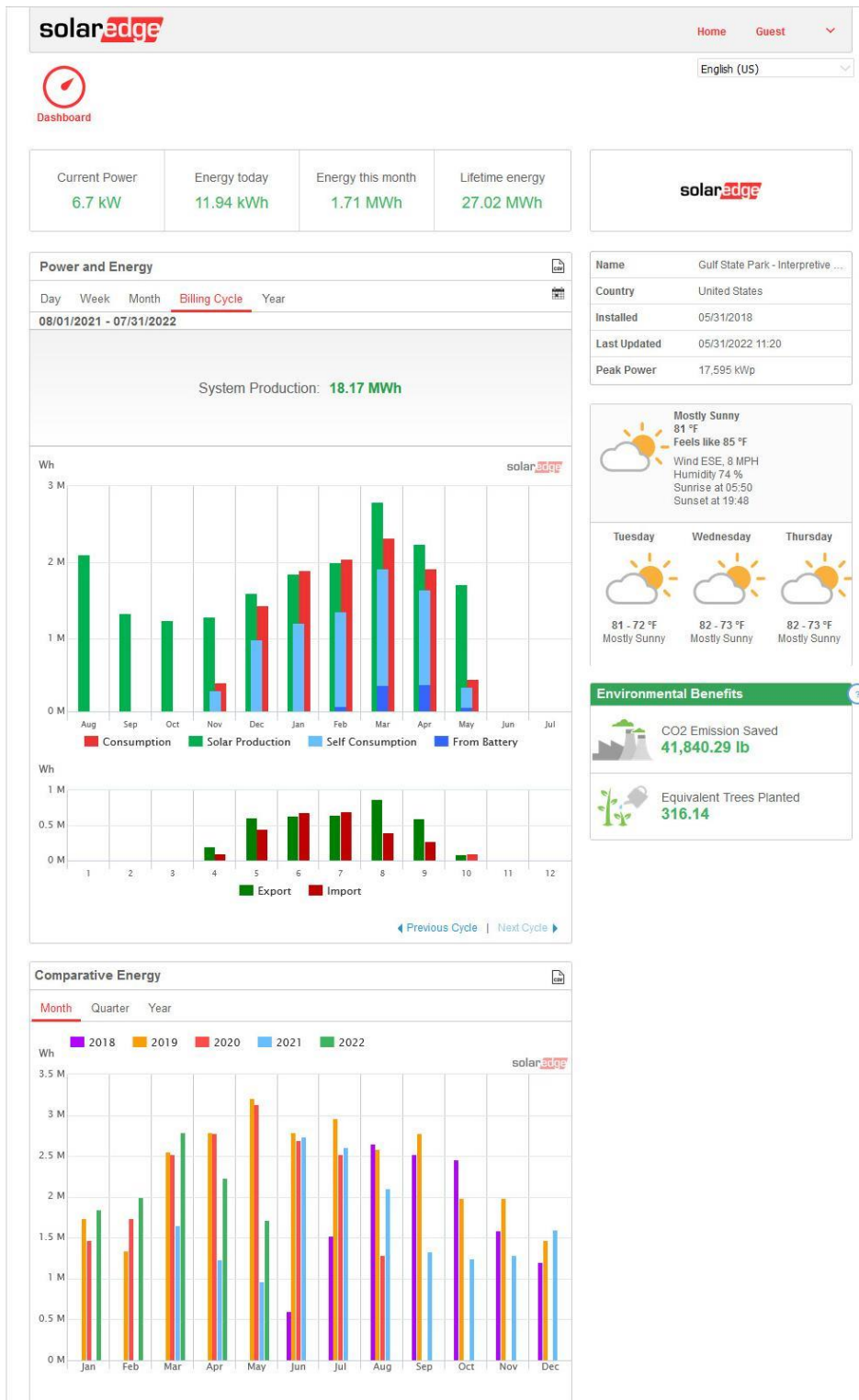


Figure 19. Example screen capture from SolarEdge Online (Tues., May 31, 2022).

On an average day, the system generates 68 kWh of electricity, more than enough to meet the 52 kWh used on a typical day.

68 kWh X 365 days /year = **24,820 kWh per year (estimated)**

### **Sources:**

Gulf State Park - Interpretive Center. 2018. SolarEdge PV Realtime Online Monitoring. Accessed 31 May 2022. <https://monitoringpublic.solaredge.com/solaredge-web/p/site/public?name=Gulf%20State%20Park%20-%20Interpretive%20Center#/dashboard>

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Watershed. *Gulf State Park Interpretive Center. 2020*. Accessed 31 May 2022. <https://watershed.pro/portfolio/gulf-state-park-interpretive-center/>

Edelstein, Ken. 2018. *Living Building project caps Gulf State Park's sustainable makeover*. Written for Kendeda Fund Home Page, November 15, 2018. Accessed 31 May 2022. <https://livingbuilding.kendedafund.org/2018/11/15/living-building-challenge-gulf-state-park-sustainable-makeover/>

The Learning Campus at Gulf State Park—Explore the Interpretive Center. Accessed 31 May 2022. <https://learningcampusgsp.com/interpretive-center>

### **Limitations:**

Information on the effectiveness of solar panels at the GSP Interpretive Center is dependent on the SolarEdge PV Online Monitoring System and secondary data gathered by the CSI research team and the Learning Campus at GSP.

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## **Social Benefits**

- ***Accommodates an estimated 2 million daily visitors annually.***
- ***Promotes physical activity, with 909 visitors observed doing recreational activities***

***at the Interpretive Center and Lake Shelby Park on a typical Friday and Saturday in April.***

***Background:***

Gehl Public Life Tools are a means of observation and survey tools to evaluate public spaces. There are several tools, but we used Age and Gender Tally and People Moving Count in this research. Directions for the use of each tool can be found on the Gehl website, including worksheets and a summary of limitations for each tool (Public Life Tools, 2022). The Age and Gender Tally tool helped us observe and estimate the number of people in our selected areas and their approximate age and gender (Age & Gender Tally, 2022). The People Moving Count tool allowed us to record how many people move through our sites and their mode of movement (People Moving Count, 2022). Limitations related to these tools include variation in findings due to weather, time of day, day of the week, and season on observation days.

***Method:***

The number of visitors and activities at the Interpretive Center and Lake Shelby Park was observed for two days in April 2022 (Friday, April 8, 2022, and Saturday, April 9, 2022) using the *Age and Gender Tally* Public Life Tool and *Age* and the *People Moving Count* public life tool developed by the Gehl Institute. One observer from the research team was stationed at the Interpretive Center, while the other was stationed at Lake Shelby Park. Each observer performed 30-minute counts at timed intervals. The weather observed on Friday, April 8, between 1:30 - 4 pm averaged 68 F (20 C) with winds West at 22 mph (35.4 kph). It was a windy day! The weather was observed on Saturday, April 9, between 10 am -11:30 am and 2 pm - 4 pm at 61 F (16.1 C), with winds West to Southwest at 12 mph (19.3 kph). It was a beautiful day!

***Summary of Users Observed at the Interpretive Center***

*Friday, April 08, 2022 from 1:33 pm – 4:04 pm*

- At the Interpretive Center, during the afternoon on a Friday, a total of 128 people were seen on a very windy day. (Figure 19)
- Children were visiting with parents and engaging in a variety of activities that include:
  - Kite flying
  - Playing with sand
  - Playing with beach toys
  - Group play
  - Swinging on the swing set near the parking (Figure 20)
- Dogs are not allowed on the beach due to sanitation rules, so people were mostly seen carrying their dogs in a stroller.
- Adults (55-60 years old) were seen using bikes more often than younger people. However, a couple of families were noticed riding bikes.
- People on the bikes would usually come from the trail on the side of the Interpretive Center, park their bikes in the bike parking, and take a walk on the beach. They usually would return from the beach within 15-20 minutes, presumably because of the time of

the day.

- The Gulf State Park passenger trams operate every day from 8 am- 5 pm, and they stop at the parking near the Beach Pavilion next to the Interpretive Center every 30 minutes.
- There was a very lively wedding ceremony going on at the Beach Pavilion. People attending the wedding were entering from the east of the pavilion.
- People who were coming back from the beach to change were using the public restrooms at the end of the pavilion near the east side, which seems to cross the open hall where the private wedding ceremony was taking place.

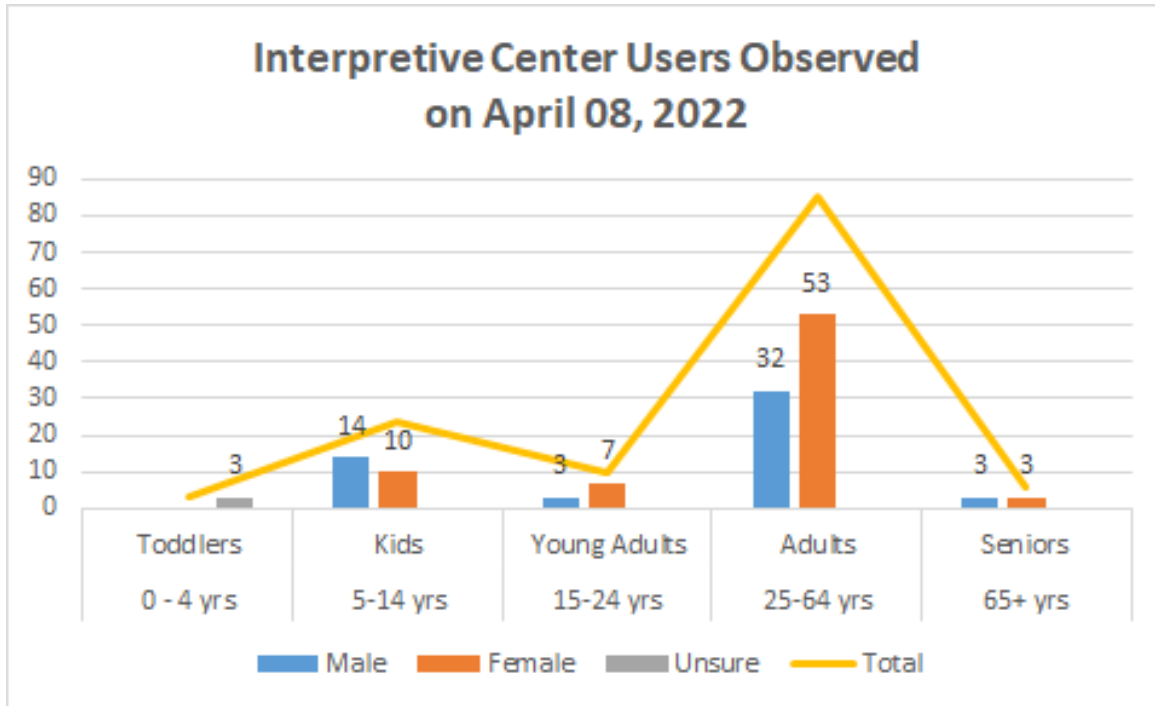


Figure 19. 128 Users at the Interpretive Center in Gulf State Park on April 8, 2022 (Bosu, 2022).

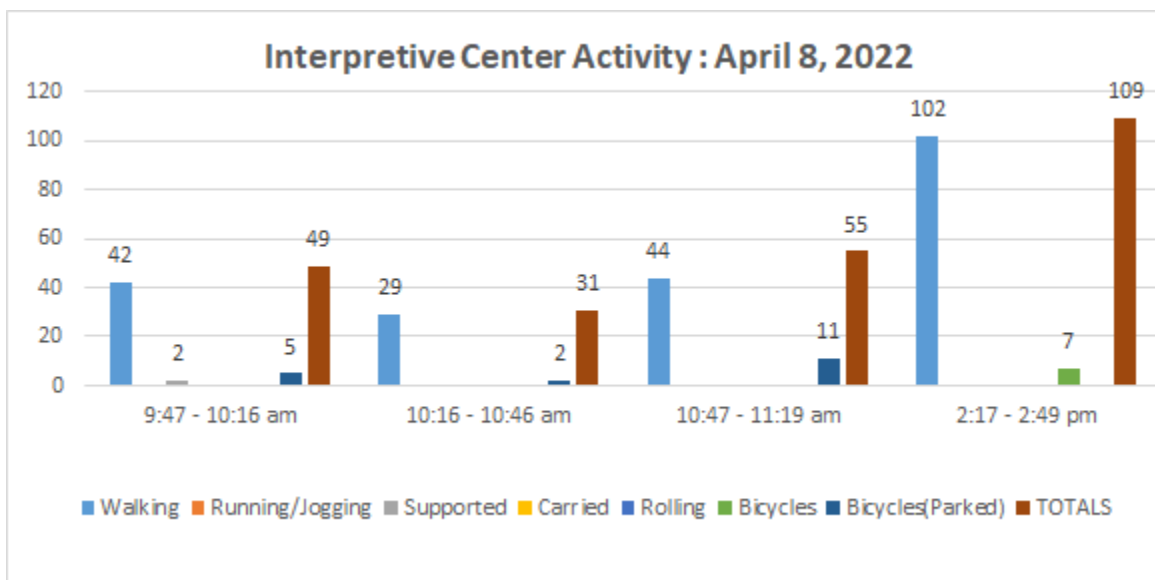


Figure 20. Activity at the Interpretive Center in Gulf State Park on April 8, 2022 (Bosu, 2022).

### ***Summary of Users Observed at the Interpretive Center***

*Saturday, April 09, 2022 from 9:47 am – 11:19 am*

- A windy, sunny morning.
- A group of 14 young adults arrived on a “Cline Tour” bus and went towards the Interpretive Center. They had a guide with them.
- Couples on bikes arrived from the west side of the Interpretive Center, parking their bikes and going towards the beach.
- An RV arrived at the parking lot, parked, and a family of 4 with two young children from the RV, went towards the beach with their beach toys.
- The Gulf State Park Tram came every 30 minutes.
- The group of 14 visiting the Interpretive Center returned after almost 1 hour.
- There was an event later that afternoon. It was an overnight campout at the beach arranged by Gulf State Park. The park volunteers and the staff were making arrangements for the event, including decorations and other necessary arrangements.
- People were starting to arrive for the campout event as early as 10:30 am.

*Saturday, April 09, 2022 from 2:17 pm – 3:56 pm*

- A lot of people started to arrive at the beach for the overnight camping event which was at 4 pm (Figure 21).
- People were arriving with tents, chairs and trolleys.
- Lots of kids arrived with their beach toys. Some of them played a lot on the swings.
- People staying at Gulf State Park Lodge receive a free parking pass. Otherwise, visitors must pay for a parking pass at the automatic parking ticket machine.
- The Gulf State Park staff and volunteers take turns monitoring the territory in their golf carts. They even took care of the dogs of a couple who didn’t know that dogs were not allowed on the beach and brought them without their dog strollers. They were very friendly to the visitors.
- The volunteers did a lot of work in keeping the park clean at all times. They would wash and dry the decks off to remove water and sand.

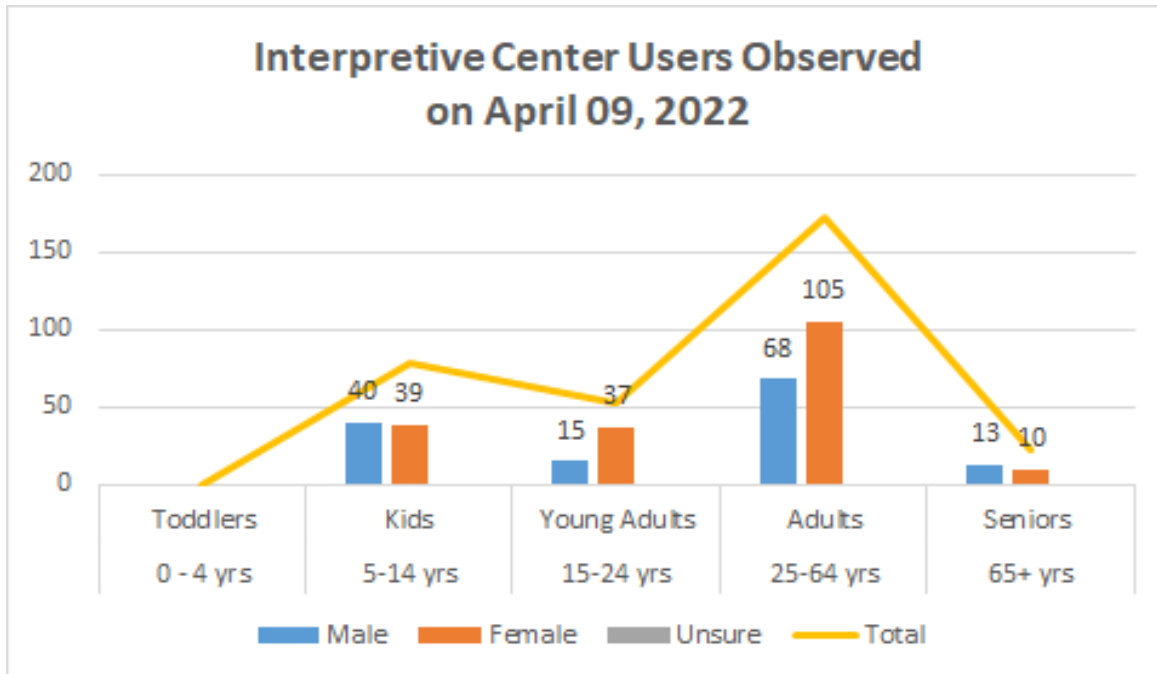


Figure 21. 327 users at the Interpretive Center in Gulf State Park on April 9, 2022 (Bosu, 2022).

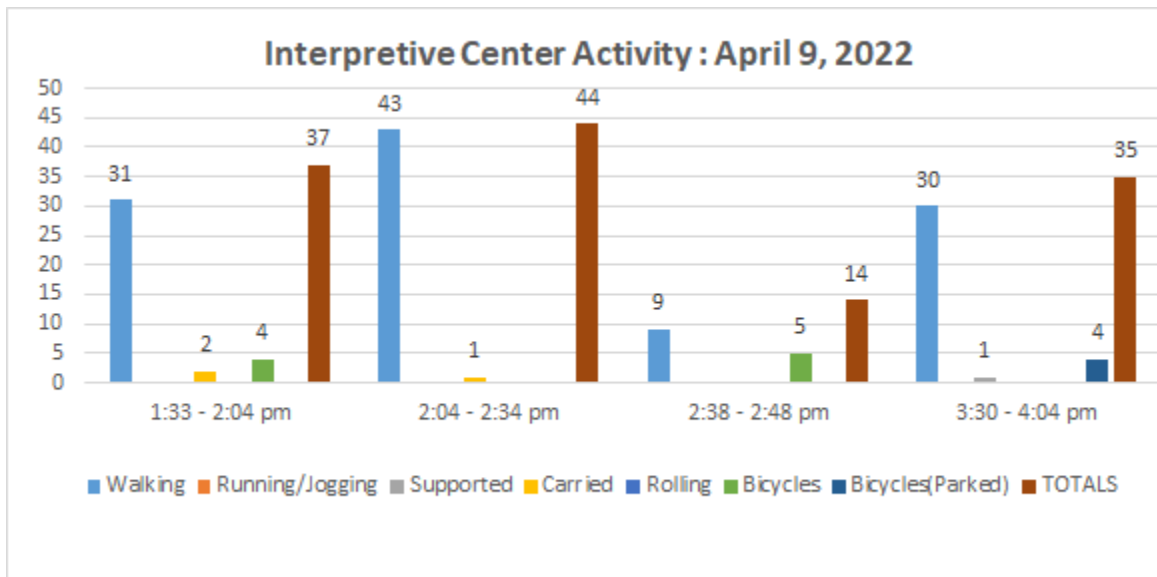


Figure 22. Activity at the Interpretive Center in Gulf State Park on April 9, 2022 (Bosu, 2022).

### Lake Shelby Park

Friday, April 08, 2022 from 1:30 pm - 4:00 pm.

At Lake Shelby Park, on a Friday afternoon, there was a total of 327 people. (Figure 23.) It was a cool, windy, blustery day with temperatures averaging 68°F (20 C) with west winds averaging 22 mph (35.4 kph).

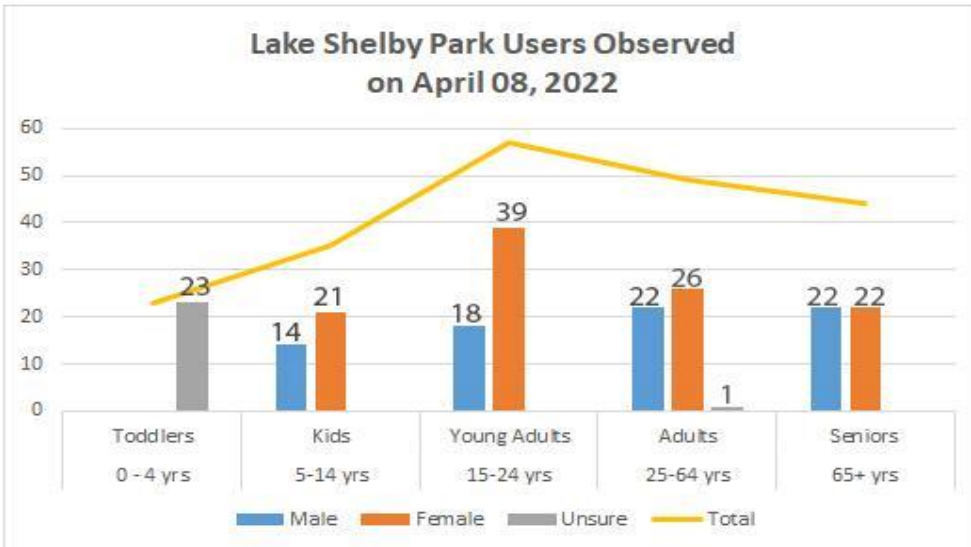


Figure 23. 208 users at Lake Shelby Park in Gulf State Park on April 8, 2022 (LeBleu, 2022).

There were many adults and children on the playground on the playground until about 4 pm. There were also many people ranging in ages 5 - 65 families with small children that were on bicycles riding east toward the campground and Interpretive Center and west towards The Lodge and Learning Center. Other activities included running/jogging, supported (wheelchairs), infants being carried and a few hoverboards. The people on the bikes would usually come from the east trail (campground & Interpretive Center). Several families with small children stopped at the playground before venturing west toward the Learning Center. (Figure 24.)

There were a few dogs. Dogs are allowed at Shelby Lake Park. There is a Dog Park on the west side of the park.

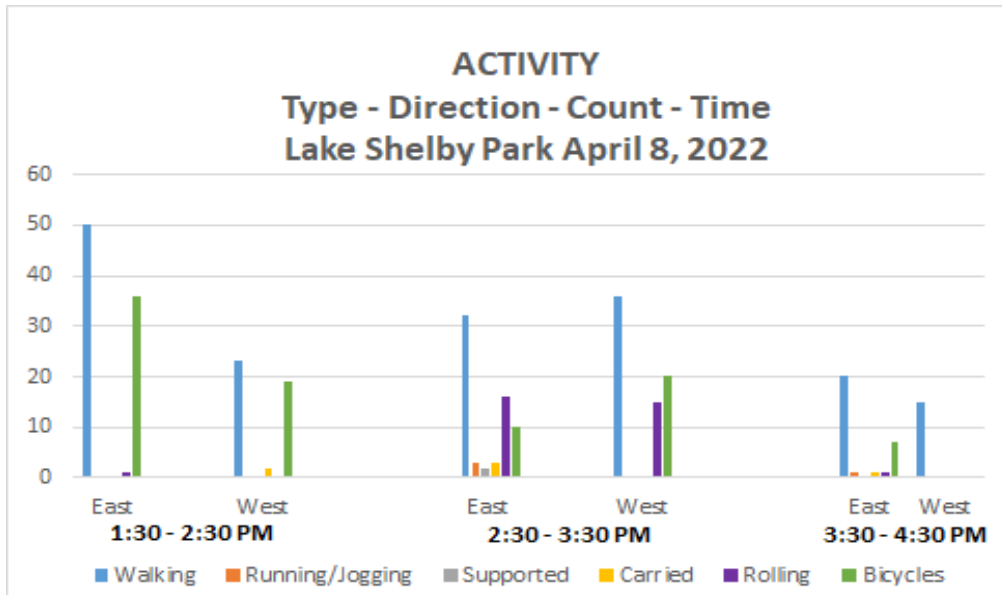


Figure 24. Activity at Lake Shelby Park in Gulf State Park on April 8, 2022 (LeBleu, 2022).

**Saturday, April 09, 2022, from 10 am – 11:30 am**

It was a cool beautiful morning at Lake Shelby Park on Saturday, April 09, 2022, from 10 am – 11:30 am. The average temperature was 61° F (16.1 C) with winds WSW at 12 mph (19.3 kph).

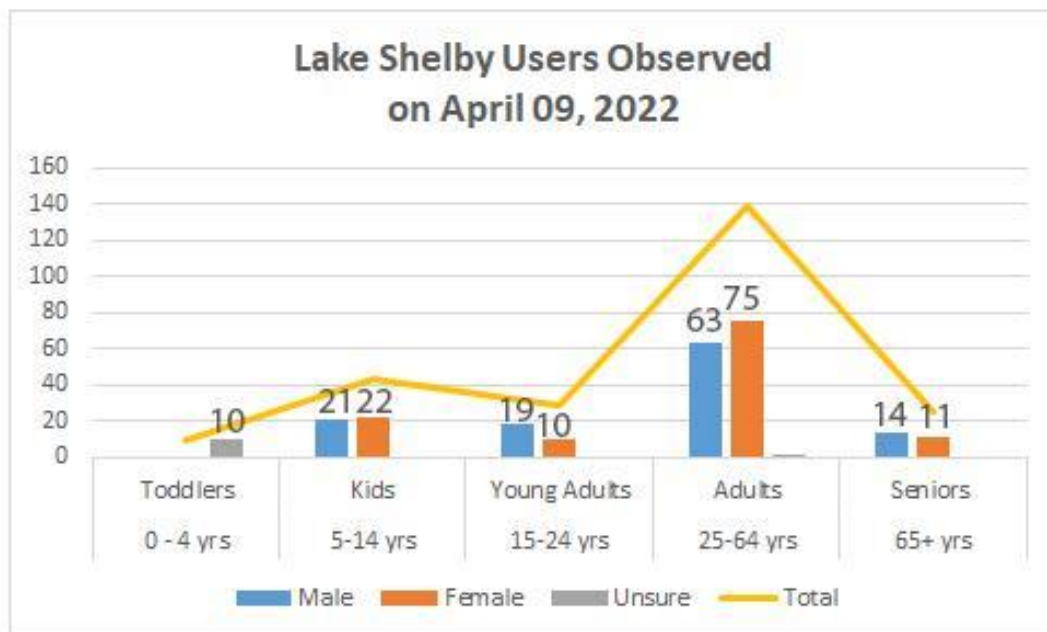


Figure 25. 246 users at Lake Shelby Park in Gulf State Park on April 9, 2022 (LeBleu, 2022).

\*Time frames were 10 - 11:30 am and 2 - 4 pm, and the average temperature was 61 F (16.1 C) with winds WSW at 12 mph (19.3 kph) (beautiful day!)

Many adults were riding and walking in groups and were coming and going from east to west and west to east. These groups brought and used their own bikes. There were few children and adults on the playground this cool morning.

**Saturday, April 09, 2022, from 2:00 pm – 4:00 pm**

The afternoon remained cool at Lake Shelby Park on Saturday, April 09, 2022, from 2 pm – 4 pm. There wasn't much bicycle traffic or playground use. There was a camp out on the beach near the Interpretive Center. Perhaps everyone was headed there? Even though there were fewer children on the playground, 246 people were observed walking, biking, running/jogging or rolling on a hoverboard through the park on Saturday, April 09, 2022. (Figure 26.)

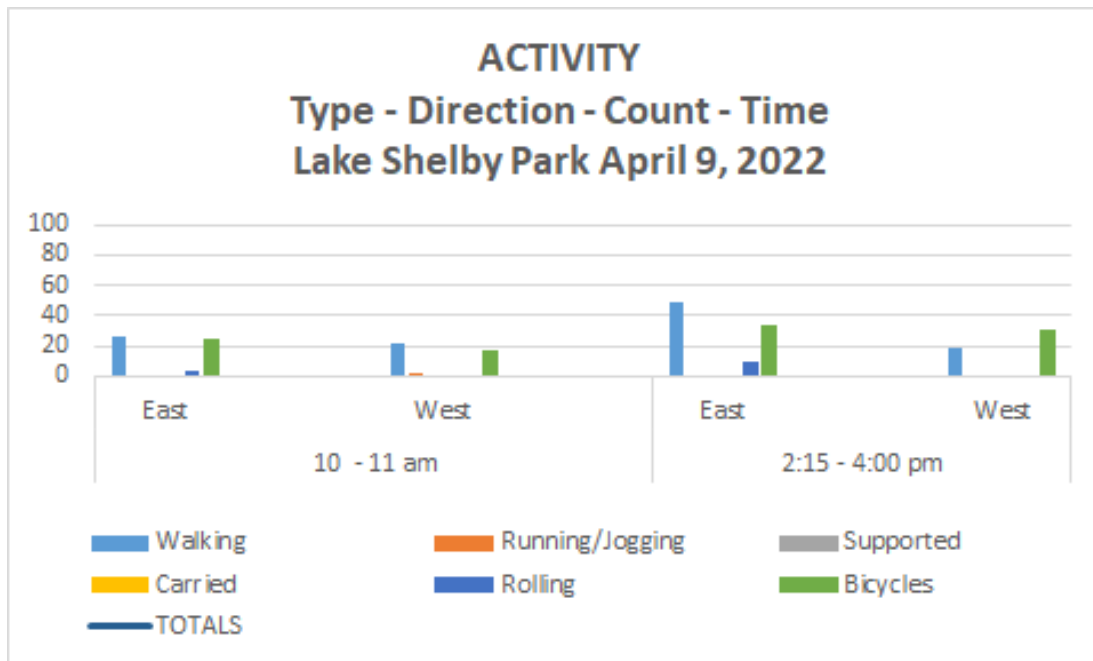


Figure 26. Activity at Lake Shelby Park in Gulf State Park on April 9, 2022 (LeBleu, 2022).  
 \*Time frames were 10 - 11:30 am, and 2 - 4 pm and average temperature was 61 F (16.1 C) with winds WSW at 12 mph (19.3 kph). It was a beautiful day!

**Calculations:**

Total users observed at the Interpretive Center and Lake Shelby Park on a typical Friday and Saturday in April.

Users Observed at the Interpretive Center April 8, 2022	128
Users Observed at the Interpretive Center April 9, 2022	<u>327</u>
Total	455
Users Observed at Lake Shelby Park April 8, 2022	208
Users Observed at Lake Shelby Park April 9, 2022	<u>246</u>
Total	454

455 + 454 = **909 Total Users**

**Sources:**

*Age and Gender Tally.* Gehl Institute. Accessed 31 May 2022.  
<https://gehlpeople.com/tools/age-gender-tally/>

*People Moving Count.* Gehl Institute. Accessed 31 May 2022.  
<https://gehlpeople.com/tools/people-moving-count/>.

*Public Life Tools.* Gehl Institute. Accessed 31 May 2022. <https://gehlpeople.com/tools/>

Sasaki & Associates, Inc. *Alabama's Gulf State Park–Master Plan 2016.* 219 pages

**Limitations:**

- Users were observed for two days during the month of April, which does not capture the variation in the number of users (weekend, seasonal, annual, special events, holidays, etc.).
- Observers estimated the gender and age of the users.
- ***Encourages bike use, with 40 visitors observed utilizing the free rental bikes and an additional 156 visitors utilizing other bikes on a typical Friday and Saturday in April.***

**Background:**

The Gulf State Park launched the Gulf State Park Bike Share program as a part of the park's enhancement project, which allows visitors to explore over 28 mi (28 km) of bike trails in the park. As of September 6, 2019, 50 bikes were available, and another 150 bikes have since been added. The bikes are single-speed with a solar-powered locking system unlocked by a smartphone app named BLOOM (Figure 27). Bikes are free for the first 3 hours; after that, there is a charge of \$5 per hour. The app also lists a phone number to report issues. Anyone 16 years or older is allowed to use the program. Only one bike can be accessed through one phone. However, one credit card can reserve multiple bikes. Safety equipment such as a helmet is not provided with the bike. The bikes must be used within the Gulf State Park. The hours of availability are 6:30 am to 6:30 pm (hours are subject to change accordingly with weather conditions or seasons).



Figure 27. The Bike Share program is part of the park's enhancement project (Sasaki, 2019).

There are 5 bike rental locations: The Lodge at Gulf State Park, Woodside Restaurant, the Interpretive Center/ Beach Pavilion, Eagles Loop Trailhead, and Gulf Oak Ridge Trailhead. As shown on the map, some new locations have also been added recently (Figure 28). Bikes can be returned to any of the designated bike parking areas; however, they do not have to be returned to the same locations where they were checked out.



Figure 28. Bike Share Program locations map (Sasaki, 2016; Bosu, 2022).

The credit card on file to borrow the bikes will only be charged if rules and guidelines were not followed:

- \$5 for each hour over 3-hour limit.
- Parking bike in an undesignated area.
- Bike is damaged (amount varied depending on types of damage.)
- Bike is not returned.



Figure 29. Fisherman using free bike share to explore fishing opportunities at GSP (LeBleu, 2022).

Visitors enjoying the bike trails can easily travel throughout the park interior and beachside using one of the two bridges over Beach Blvd. located at the east and west ends of the park (Figure 30 & 31).



Figure 30. The bridge at the west end of the park near The Lodge (Sasaki, 2018).



Figure 31. The bridge at the west end of the park showing ramps (Sasaki, 2018).

There are bike rental providers nearby where bikes are available for an all-day ride (Figure 32):

- Beach Bike Rentals is located right off the Rosemary Trailhead in Gulf Shores and offers onsite day parking or will even deliver the bike to the renter.
- Infinity Bicycles is less than .25 miles from the Orange Beach trail entrance and rents a variety of bikes suitable for all ages and skill levels.
- Coastal Segway Adventures is located near Lake Shelby inside the Gulf State Park and offers bicycle rentals by the day.
- The Camp store inside Gulf State Park campground offers daily bike rentals.



Figure 32. There are other bike rental providers where bikes are available for an all-day ride (Sasaki, 2018).

**Method:**

Many visitors were observed riding bicycles at Lake Shelby Park for two days in April 2022 (Friday, April 8, 2022, and Saturday, April 9, 2022). The bicycle types observed included those from the *Gulf State Park (GSP) Bike Share Program bikes (free)*, *electric bikes* and *other bike types* (i.e., personal or rented from a vendor). One observer from the research team was stationed at Lake Shelby Park. The observer counted the number of bicycles, bicycle types and noted the time of observation. The weather observed on Friday, April 8, from 1:30 - 4 pm averaged 68° F (20 C) with winds West at 22 mph (35.4 kph). A windy day to ride a bike! The weather observed on Saturday, April 9, from 10 am -11:30 am and 2 pm - 4 pm 61° F (16.1 C) showed winds West to Southwest at 12 mph (19.3 kph). It was a beautiful day for a bike ride!

*Summary of Bike Types and Time of Use*

Friday, April 8, 2022

Most of the bicycles observed were *other bike types* (64), with most of these seen between 1:30 pm to 2:30 pm. 22 GSP Bike Share Program (free) bikes were observed from 1:30 pm to 3:30

pm. An additional six electric bikes were observed between 2:30 and 3:30 pm (Figure 33).

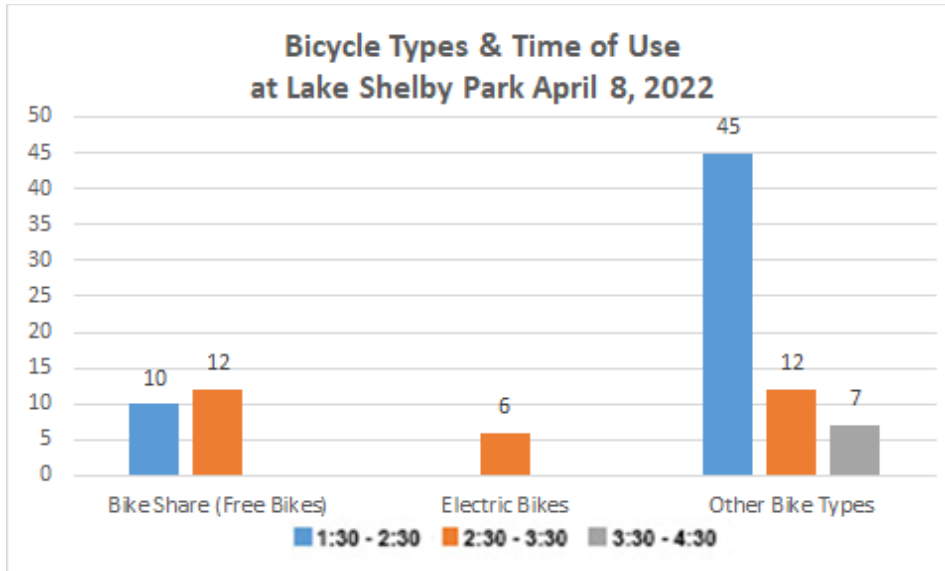


Figure 33. Bicycle Types and Time of Use at Lake Shelby Park April 8, 2022 (LeBleu, 2022).

Saturday, April 9, 2022

Most of the bicycles observed were *Electric Bikes* (48), and the numbers were about equally split between 1:30 - 2:30 pm (23) and 3:30 - 4:30 pm (25). 18 GSP Bike Share Program (free) bikes were observed from 1:30 pm to 4:30 pm with the majority seen from 1:30 - 2:30 pm (17). An additional 38 Other Bike Types were observed from 1:30 pm to 4:30 pm (Figure 34).

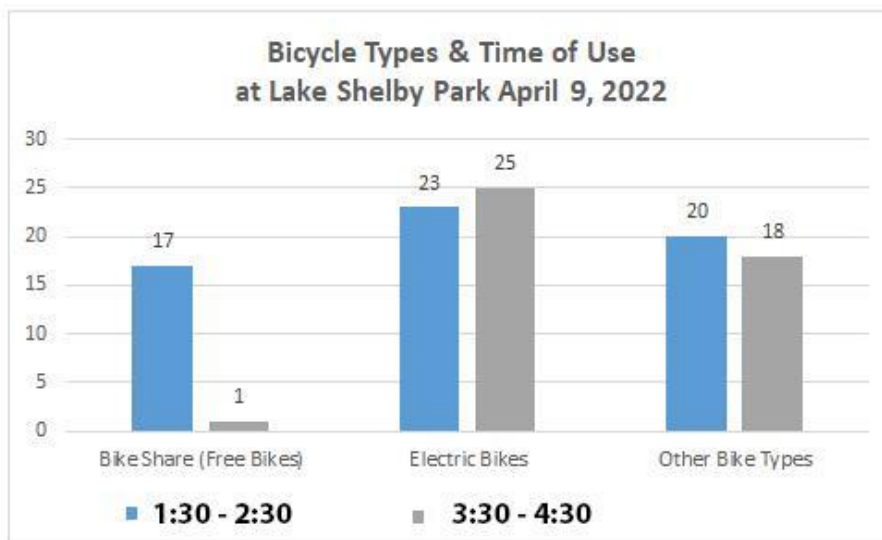


Figure 34. Bicycle Types and Time of Use at Lake Shelby Park April 9, 2022 (LeBleu, 2022).

### **Calculations:**

*Total Bikes (all types) observed April 8 & 9, 2022*

92 bikes were observed on the windy afternoon of Friday, April 8, 2022.

(10+12) GSP Bike Share + 6 electric + (45+12+7) other types = Bikes on Friday

**22 GSP Bike Share + 6 electric + 64 other types = 92 Bikes on Friday**

104 bikes were observed on the sunny and mild afternoon of Saturday, April 9, 2022.

(17 + 1) GSP Bike Share + (23 + 25) electric + (20 + 18) other types = Bikes on Saturday

**18 GSP Bike Share + 48 electric + 38 other types = 104 Bikes on Saturday**

92 Total Bikes on April 8, 2022 + 104 Total Bikes on April 9, 2022 = **196 Total Bikes (all types) observed April 8 & 9, 2022**

*Individual Bike Type Totals*

22 GSP Bike Share on April 8, 2022 + 18 GSP Bike Share on April 9, 2022 = **40 Total GSP Bike Share Bikes observed April 8 & 9, 2022**

6 Electric Bikes on April 8, 2022 + 48 Electric Bikes on April 9, 2022 = **54 Total Electric Bikes observed April 8 & 9, 2022**

64 Other Types on April 8, 2022 + 38 Other Types on April 9, 2022 = **102 Total Other Types of Bikes observed April 8 & 9, 2022**

### **Conclusions:**

A total of 196 bicyclists were observed at Lake Shelby Park on April 08-09, 2022. Observations for Friday, April 8, 2022, and Saturday, April 9, 2022, include 40 free GSP Ride Share bikes, 54 electric bikes and 102 other types of bikes (156 other + electric bikes).

### **Sources:**

Personal observations.

### **Limitations:**

- Users were observed for two days during the month of April, which does not capture the variation in users (weekend, seasonal, annual, special events, holidays, etc.)
- Though the observer is familiar with all bike types, misidentification of bike type or miscount of users is possible.

## Cost Comparison

- ***The FORTIFIED, hurricane-resilient roof on The Lodge is estimated to have cost 25%-40% more in fastening costs than a typical roof. The premium paid for the FORTIFIED roof is estimated at \$100,000, but the roof will be resilient to storms up to storms with wind speeds of up to 111-135 mph.***

### ***Background:***

A FORTIFIED Roof protects against wind and wind-driven rain by improving roof sheathing attachment and providing a sealed roof deck. The roof deck is attached to the rafters below it with ring shank nails and sealed to prevent any water from entering the structure. These nails have ridges that make them twice as difficult to pull out as the standard smooth shank nails. A FORTIFIED Roof prevents wind from getting underneath the roof edge. This stronger system offers protection from high winds, hurricanes, hailstorms and even tornadoes up to EF-2 (Enhanced Fujita Scale), which have wind speeds up to 111-135 mph..

According to the Project Architect, the FORTIFIED roof certification required for the new Lodge at GSP required increasing the safety factor used in calculating roof design wind pressure. Standard Code requires a safety factor of 1.0 and FORTIFIED required a factor of 2.0. The premium cost is primarily in how the roof is attached. The FORTIFIED roof cost about 25%-40% more in fastening costs than otherwise would have been required, and the fastening costs are estimated at about 30% of the total cost of the roof.

The FORTIFIED design required more fasteners, more adhesive, and more labor. On top of the increased safety factor, the roof was subject to at least two inspections by certification engineers that flew in from Miami (Figure 35).



Figure 35. The Gulf Shores State Park Lodge was built with a FORTIFIED roof (Sasaki, 2018).

**Method:**

Secondary data source.

**Calculations:** None

**Sources:**

Richard Ellison, AIA, LEED AP, Principal, Raburn Architects, Atlanta Georgia. Email to Kate Tooke, Principal and Project Landscape Architect, Sasaki & Associates. Date received June 1, 2022.


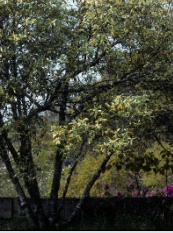

Insurance Institute for Business and Home Safety (IBHS). 2022. Accessed 23 June 2022.  
<https://ibhs.org/>






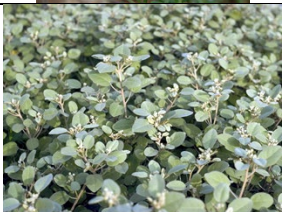

**Limitations:**



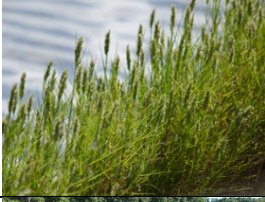



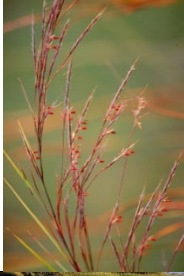

- Some FORTIFIED buildings will experience damage during extreme weather.
- A FORTIFIED roof offers little added protection from falling trees.
- Information is from a secondary source and could not be verified by the research team.



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## **Appendix A–List of Bioretention Species Planted**

Category	Scientific name	Common name	Picture	Size (At maturity)	Sun exposure	Seasonal interest
Deciduous trees	<i>Quercus myrtifolia</i>	Myrtle Oak		36 feet	Sun	Mar, Apr, May
	<i>Quercus virginiana</i>	Live Oak		40-50 feet	Sun, Part shade	Mar, Apr, May
Evergreen trees	<i>Pinus elliottii</i> var. <i>elliottii</i>	Slash pine		72-100 feet	Part shade	Dec, Jan, Feb
Understory trees	<i>Osmanthus americanus</i>	Wild olive		12-36 feet	Part shade	Apr, May
Shrubs	<i>Callicarpa americana</i>	Beautyberry		3-6 feet	Part shade	May, Jun, Jul
	<i>Ceratiola ericoides</i>	Sandhill-Rosemary		6-8 feet	Sun, Part shade	Mar, Apr, May, Jun
	<i>Chrysoma pauciflosculosa</i>	Woody Goldenrod		3 feet	Sun	Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec

	<i>Ilex vomitoria</i>	Yaupon		12-45 feet	Sun, Part shade, shade	Apr, May
	<i>Iva frutescens</i>	Marsh-Elder		6-12 feet	Sun	Aug, Sep, Oct
	<i>Serenoa repens</i>	Saw palmetto		12-36 feet	Part shade	May, Jun, Jul
Forbes	<i>Asclepias humistrata</i>	Sandhill-Milkwood		1-3 feet	Sun	Mar, Apr, May, Jun
	<i>Conradina canescens</i>	Beach Heather		3-6 feet	Sun	Feb, Mar, Apr
	<i>Croton punctatus</i>	Gulf croton		1-3 feet	Sun	May, June
	<i>Polygonella gracilis</i>	Jointweed		3-6 feet	Sun, Part shade	Aug, Sep, Oct, Nov

Grasses	<i>Andropogon glomeratus</i>	Bushy Bluestem		3-6 feet	Sun	Aug, Sep, Oct, Nov
	<i>Cyperus retrorsus</i>	Pinebarren Flatsedge		0-3 feet	Sun, Part shade	Jul, Aug, Sep, Oct
	<i>Distichilis spicata</i>	Inland Slat Grass		0-1 feet	Sun	Apr, May, Jun, Jul, Aug, Sep, Oct
	<i>Juncus roemerianus</i>	Lobe-Head Rush		1-3 feet	Sun	May, Jun, Jul, Aug, Sep, Oct
	<i>Muhlenbergia capillaris</i>	Muhly Grass		1-3 feet	Sun	Oct
	<i>Panicum amarum</i>	Seaside Panicum		3-4 feet	Sun	Aug, Sep, Oct
	<i>Schizachyrium scoparium</i>	Bluestem		3-6 feet	Sun, Part shade	Jun, Jul, Sep, Oct, Nov, Dec
	<i>Spartina patens</i>	Salt Meadowgrass		1-3 feet	Sun	Apr, May

	Triplasis purpurea	Purple Sand Grass		1-3 feet	Sun	Jun, Jul, Aug, Sep
	Uniola paniculata	Sea oats		5 feet	Sun	Jun, Jul