Acknowledgements

We thank councilwoman Jennifer Van Vrancken of Council District #5 for championing the revitalization of the Bucktown Marsh and Park area. We thank the Jefferson Parish Coastal Division for providing funding and support for this study. We especially thank Lauren Averill, Seamus Riley and Jason Smith for their knowledge, support and input, as well as Byron Almquist for his passion for Bucktown Marsh. We thank Doerr Furniture for funding the original park tree planting and marsh signage in 2012, and we also thank the Jefferson Parish maintenance crew for their help and hard work on the day of the most recent 2019 park tree planting, and after, for securing the trees. We are also grateful to Chris Conley, Executive Director of Camp Hope, for providing volunteers for the most recent park tree planting, and to the volunteers themselves, without whom the planting would not have been possible.
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Executive Summary

In the early 2000’s, the Bucktown Marsh was created as an intermediate marsh to mitigate lake bottom and land reclamation activities. Mitigation was necessary due to 6-acres of harbor dredging and 17-acres of land reclamation activities related to the construction of a new Coast Guard Station and harbor. The marsh was planted with 1,030 trade gallons and 8,000 vegetative plugs of Spartina alterniflora (cordgrass), and marsh creation was officially completed by 2005 just before Hurricane Katrina, which had minimal impact to the newly created marsh.

The objectives of the Lake Pontchartrain Basin Foundation’s current partnership with Jefferson Parish Coastal Division are to conduct and provide Jefferson Parish with annual assessments of the Bucktown Marsh and Park areas for three consecutive years (2018/19-2020/21). The purpose of these assessments is to evaluate the overall health and status of the marsh and park areas ahead of extensive lakefront restoration at and around the Bucktown Marsh and Park area.

For this study, twenty, 1.0-m² permanent plots were established throughout the Bucktown Marsh, with 5 replicate plots established in each of four marsh habitat areas (east marsh, west marsh, waters edge, scrub-shrub; 4 areas * 5 replicates = 20 plots). At each plot, marsh elevation, soil salinity, total cover and species composition, and soil properties (bulk density, organic matter) were determined. Marsh elevation was also determined at multiple points across the marsh and park area beyond the permanent plots. In the park area, seventeen previously planted park trees (10 Taxodium distichum (baldcypress), 7 Quercus virginiana (live oak)) were assessed for general health, and recommendations for future park plantings and needs were determined.

After the first year of study and activities (2018/19), it was determined that the Bucktown Marsh is functioning as a generally healthy, early successional intermediate marsh, that may be partially transitioning to fresh marsh. Soil salinity was in the expected range for intermediate marshes, but lower soil salinity (< 2 ppt) was observed at sites along the waters edge and in the western marsh area. It is possible the marsh is now being influenced by the closure in 2009 of the Mississippi River Gulf Outlet, which has regionally reduced surface water salinity, including Lake Pontchartrain. Plant species were also indicative of intermediate marshes, but did not include some species that would be expected in stable, mature intermediate marshes (i.e. Spartina patens (wiregrass), Sagittaria lancifolia (bulltongue arrowhead)). Also, cordgrass, the only species actually planted in the marsh fifteen years ago, was missing at all plots sampled. Likely, the marsh has been freshening, and the more salt tolerant cordgrass has been outcompeted by fresher species. However, whether the marsh transitioned to intermediate marsh and is still in an early successional phase or whether the marsh is continuing to transition to fresh marsh remains to be seen. The next two years of study should clarify these two assumptions.

It was also determined that the previously planted park trees were generally healthy, with only two of seventeen trees (both live oaks) considered stressed. At the time of the park tree assessment, there was visible ponding at the base of the two stressed live oak trees, likely the cause of tree stress. Ponding was also evident in other areas of the park, especially in the northern section. This ponding ought to be addressed, as future park plantings will face similar issues. One such planting occurred in early 2019; volunteers planted twenty new trees and shrubs to attract birds to the park and marsh. Other plantings, for shade, birds, and other wildlife, should be planned for the coming years. These plantings will complement the new marsh boardwalk currently being designed for Bucktown Marsh, and together, will likely draw more people to the Bucktown Marsh and Park area.
The Bucktown Marsh fits within the Multiple Lines of Defense Strategy by integrating coastal restoration into the surge defense system around Greater New Orleans and Jefferson Parish. Also, study of the Bucktown Marsh should help inform the planned expansion of marsh restoration along the lake shoreline by Jefferson Parish between the Bonabel boat launch and Bucktown Harbor. Rebuilding of the south shore shoreline is included in LPBF planning, including: Pontchartrain Coastal Lines of Defense, LPBF’s Comprehensive Habitat Master Plan, and Comprehensive Recommendations Supporting the Use of the Multiple Lines of Defense Strategy to Sustain Coastal Louisiana.
Highlights

Marsh area
- The marsh is a healthy early successional intermediate marsh
- Some areas of the marsh may be freshening, especially around the water inlet
- The point density of the 2018 elevation survey produced a more comprehensive picture of marsh elevation than previous survey years
- Fourteen plant species were recorded
- *Vigna luteola* (deer pea) was observed at all sites in 2018
- *Spartina alterniflora* (cordgrass), which was planted, was not observed at any sites in 2018
- Soil properties are still transitioning—soil organic matter is similar to intermediate marshes, soil bulk density is still high
- A marsh planting is not recommended at this time
- Only intermittent marsh maintenance (i.e. debris removal) is necessary at this time
- It may take up to 30 years for constructed marshes to attain characteristics (soil, vegetation) and function similarly as natural marshes
- The marsh has been resilient to hurricane impacts

Park area
- The planted *Taxodium distichum* (baldcypress) and *Quercus virginiana* (live oak) are generally healthy
- Poor drainage around a few live oaks are causing stress for two trees
- 17 of 20 trees planted in early 2019 to attract birds appear to be doing well
- Poor drainage in the northern end of the park should be addressed
- The planting of more shade trees is recommended
- The planting of more trees to attract birds and other wildlife is recommended
- Planted trees would benefit from more regular maintenance
- The edge between the park and marsh should be regularly "thinned" to maintain the view of the marsh
Background

Wetland creation is an important component of wetland conservation and management, specifically as it relates to restoring critical ecological functions (i.e. nutrient cycling, refuge and foraging habitat, storm surge protection, etc.) that are lost as wetlands degrade (Craft et al. 2002). Mitigation is a wetland management and conservation tool, and a compensatory requirement, that attempts to restore, establish, enhance or preserve wetland habitats due to the unavoidable damage to a similar habitat (https://www.epa.gov/cwa-404/background-about-compensatory-mitigation-requirements-under-cwa-section-404). The performance of created wetlands compared to natural wetlands is not fully understood due to a lack of long-term data, especially in low salinity marshes. However, it is generally believed that it takes some time (~ 30 years, Ebbets et al. 2019) before created wetlands function similarly to natural wetlands (Craft et al. 2002). The Bucktown Marsh is one such low salinity mitigation marsh (Figure 1), created 14-years ago adjacent to the Bucktown Harbor, in Jefferson Parish (JP), LA.

![Figure 1: Location of Bucktown Marsh and Park in Jefferson Parish, LA. The inset shows a close-up view of the marsh and park area along the south shore of Lake Pontchartrain.](image)

In the early 2000’s, the Bucktown Marsh was created to mitigate lake bottom and land reclamation activities. Mitigation was necessary due to 6-acres of harbor dredging and 17-acres of land reclamation activities related to the construction of a new Coast Guard Station and harbor (Figure 2). Marsh substrate was dredged from the proposed Bucktown Harbor area in the summer of 2000. The target elevation of the marsh was 1.5 to 2.0’ NGVD (Burke and Kleinpeter 2001). The marsh was planted with 1,030 trade gallons and 8,000 vegetative plugs of Spartina alterniflora (cordgrass) on August 2, 2003. Marsh creation was officially completed by 2005 before Hurricane Katrina. LPBF staff examined the marsh after Hurricane Katrina and found virtually no consequential impact from the hurricane. From
2003-2011, with input and funding from the Lake Pontchartrain Basin Foundation (LPBF), the marsh was monitored to assess its health and trajectory towards stability (Burke and Kleinpeter 2006, Hester et al. 2005, Hester and Willis 2007, Hester and Willis 2008, Hester and Willis 2011). In the meantime, harbor construction continued until late 2011. Also, in 2011, with involvement by both JP and LPBF, benches, parking, marsh signage and sidewalks were installed in the open area between the harbor and the marsh, essentially creating a new 3-acre park area for the public (see timeline, Appendix A). Trees (17; Taxodium distichum (baldcypress), 10; Quercus virginiana (live oak), 7) were planted in the park area in 2012 with funding from Doerr Furniture.

![Figure 2: Overview of Bucktown Marsh and Park area in relationship to the Coast Guard Station and harbor.](image)

Although the Bucktown Marsh was constructed for required mitigation, it is also a valuable demonstration project adding natural features to the armored and leveed shoreline of Lake Pontchartrain. Restoration of the shoreline here can have great ecological significance, including establishment of the ecologic functions of a fringing marsh to Lake Pontchartrain and acting as a natural coastal buffer to storm surge for the adjacent Federal hurricane levee. The Bucktown Marsh fits within the Multiple Lines of Defense Strategy by integrating coastal restoration into our surge defense system around Greater New Orleans and Jefferson Parish (Lopez, 2009). Study of the Bucktown Marsh should help inform the planned expansion of marsh restoration along the lake shoreline by Jefferson Parish. Rebuilding of the south shore shoreline is included in LPBF planning, including: Pontchartrain Coastal Lines of Defense (www.saveourlake.org), LPBF’s Comprehensive Habitat Master Plan (LPBF, 2006), and Comprehensive Recommendations Supporting the Use of the Multiple Lines of Defense Strategy to Sustain Coastal Louisiana (2008). In addition, the Bucktown Marsh is an important educational and
recreational asset for Bucktown Harbor, the public recreational area managed by Jefferson Parish, and to the nearby commercial district and residential community of Bucktown.

Previous studies

Three multi-year monitoring efforts have been conducted within Bucktown Marsh. First, Burke and Kleinpeter (2006) described marsh construction, planting, and establishment from 2001-2006. Second, the LPBF contracted with Dr. Mark Hester and Dr. Johnathan Willis (University of New Orleans, LA) to conduct a multi-year study (2005-2011) to evaluate whether the created marsh was on a trajectory towards becoming a stable oligohaline (intermediate) marsh, and what effect stressors, such as herbivory and eutrophication have on the marsh. Simultaneously, a separate multi-year study examined bird usage of the marsh area, specifically population density and reproductive success (Yaukey 2011).

By 2006, Burke and Kleinpeter reported that the marsh appeared relatively healthy and resilient to storms, having been only minimally impacted by Hurricane Katrina. It was noted that cordgrass density varied across the marsh, increasing in some areas and being lost in others, and that baldcypress trees planted in the marsh by JP appeared to not have survived. At the end of their study, Drs. Hester and Willis came to three major conclusions: (1) despite some interannual variation, the marsh was progressing towards exhibiting characteristics of normal intermediate marshes (i.e. vegetation and soils), (2) the effect of herbivory on the marsh was minimal, and (3) nutrient influx (i.e. Bonne Carre opening) altered the nutrient content of vegetation and soils. Further, they noted that the percent cover of cordgrass, the only herbaceous plant species planted in the marsh, was decreasing over time. Yaukey (2011) similarly reported generally positive findings. The Bucktown Marsh attracted a wide variety of wetland bird species, and the density of a few key species (i.e. Red-winged Blackbird, Swamp Sparrow), was especially encouraging. However, reproductive success of the Red-winged Blackbird was less than in natural habitats, and further study was recommended.

Current objectives

The objectives of LPBFs current partnership with JP are to conduct and provide JP with annual assessments of the Bucktown Marsh and Park areas for three consecutive years (2018/19-2020/21). The purpose of these assessments is to evaluate the overall health and status of the marsh and park areas ahead of extensive lakefront restoration at and around Bucktown Marsh and Park area (https://www.fox8live.com/2018/11/14/report-grant-plan-wetlands-restoration-between-bucktown-bonnabel-jefferson-parish/). There is particular interest in the status of the marsh due to the Mississippi River Gulf Outlet closure in 2009. The closure appears to have lowered surface water and soil salinity north of the closure and up the Pontchartrain Estuary, and may be affecting the trajectory of the marsh, which would not have been foreseen when the marsh was constructed (Henkel 2017). Assessments shall include annual soil salinity, elevation and vegetation surveys (marsh), and assessments of the general health of planted trees (park). The annual assessments will provide recommendations to increase bird usage of the marsh and park, hydrological enhancement of the marsh, signage for the proposed boardwalk, and future plantings for both marsh and park. Annual assessments will be provided to JP in the form of a report.
Methods

Marsh Area

Study site

The Bucktown Marsh is a mitigation marsh (1.42 hectares/3.5 acres) constructed outside the Lake Pontchartrain levee system, adjacent to the 17th Street Canal and the Bucktown neighborhood of greater New Orleans, in JP, LA. The marsh was planted as previously described, and it was expected that species diversity would increase by rapid colonization of the area (Burke and Kleinpeter 2001). The most recent assessment of the marsh was completed in 2011 (Hester and Willis 2011), and indicated a generally healthy young marsh with a decreasing presence of cordgrass in tandem with increasing plant diversification across the marsh. Marsh elevation appeared stable at ~ 1.5 to 2.0’ NAVD. More information and documentation, including previous reports on the Bucktown Marsh can be found at https://saveourlake.org/lpbf-programs/coastal/technical-reports/.

Study design

Twenty (20), 1.0-m² permanent plots were established on August 6, 2018 throughout the Bucktown Marsh, with 5 replicate plots established in each of four marsh habitat areas (4 areas*5 replicates=20 plots, Appendix B). Marsh habitat areas were described previously in assessments completed prior to Hurricane Katrina (Hester et al. 2005), and after (Hester and Willis 2006, 2007, 2008, 2011). Habitat areas consisted of water edge, east marsh, west marsh, and scrub-shrub habitat (Figure 3, Figure 4). The naming convention of these four habitat areas within the Bucktown Marsh has not been consistent across the previous reports, therefore, this report follows most closely the naming convention of the initial report. The previous reports (Hester and Willis 2006, 2007, 2008, 2011) emphasized elevation descriptors such as “eastern low marsh” or “high marsh” as marsh area names; we returned to the naming convention of the very first report because those elevation descriptors are not accurate anymore, as “high marsh” (west marsh) elevation is statistically similar in 2018 to “eastern low marsh” (east marsh) elevation. Further, Bucktown Marsh also contains a fifth marsh area, north marsh, which was not fully completed at the time of the earlier monitoring efforts and reports, and was not analyzed for vegetation and soils for this report, but will be in future monitoring.
Figure 3: The created marsh is characterized as five distinct zones: water’s edge (blue), west marsh (pink), scrub-shrub (brown), eastern marsh (green), and north marsh (grey). The north marsh was not monitored for vegetation for this report due to no previously established study sites in that area.

Figure 4: Zones of the created marsh in pictures: water’s edge (A), west marsh (B), scrub-shrub (C), and east marsh (D). North marsh not shown.
Variables and procedures

Soil salinity

Soil salinity (interstitial salinity, porewater salinity) was measured at each plot by extracting a porewater sample from the ground using a soil sipper, which is a 30 cm tube with 0.5 mm holes on one end, attached to flexible tubing and a syringe on the other end (Folse et al. 2008; Figure 5A and 5B). The receiving container was rinsed three times prior to obtaining measurements. After rinsing, three measurements were made from samples collected at a depth of approximately 30 cm, unless otherwise noted.

Marsh vegetation

Plant community composition was determined by visual estimation using a 1 m² quadrat on August 7, 2018 (Figure 5C). First, all species were identified and then total percent cover was estimated based on the total amount of ground covered by vegetation compared to bare ground in the quadrat. Second, percent cover was estimated by species, such that the summation of all cover by species at a plot equaled the total cover at that plot. The Floristic Quality Index (FQI, 1-100), adapted for coastal Louisiana, can help determines the quality of wetlands based on species composition and abundance (Cretini et al. 2011). Including both native and non-native species, the modified FQI is predicated on coefficients of conservation (CC, 0-10) scores assigned to plants based on a plant’s status (disturbance species, opportunistic species, not vigorous wetlands, vigorous wetlands, and dominant in vigorous wetlands) in a particular coastal habitat. Parasitic plants, submerged aquatic vegetation and floating aquatic vegetation are not assigned CC scores and are thus not considered in FQI calculations. The FQI was calculated using the following formula:

\[ \text{FQI} = \left( \frac{\sum \text{cover}_i \times \text{cc}_i}{100} \right) \times 10; \]

where \( \text{cover}_i \) is the percent cover for a given species (i) at a monitoring station at a given time (t), and \( \text{cc}_i \) is the coefficient of conservatism for species (i) (USGS 2011). Generally, FQI scores of 1-19 represent low quality, including successional, wetlands, FQI scores of 20-35 represent high quality wetlands, and FQI scores > than 35 represent stable, natural wetlands (Wilhelm and Rerich 2017).

Marsh soils

One soil core was collected at each plot. A PVC corer with 5-cm diameter tube was pushed into the ground to a depth of 20 cm, and soil cores were extracted for the determination of soil bulk density (BD; g cm⁻³) and organic matter content (OM; %) (Figure 5D). Extracted core length was measured in the field. Soil cores were stored on ice until returned to the laboratory, and then dried at 65 °C until a constant weight was achieved. Bulk Density was calculated by dividing core weight by core volume. Thereafter, soil samples were homogenized using a mortar and pestle, and two subsamples (4 g) were analyzed for each core (plot), combusted at 550 °C for 5 hours, to determine OM content through the loss-on-ignition method (Heiri et al., 2001).
Figure 5: At each site soil salinity (ppt) was sampled using a soil sipper (A & B), vegetation cover was measured using a 1 m² quadrat (C), and soil cores were extracted (D) to determine bulk density (g cm⁻³) and percent organic matter. Pictures B and D are only representative and were not taken at Bucktown Marsh.

Elevation

All data points were collected using a Trimble Geo Explorer 6000 GeoXR GPS receiver attached to a Zephyr Model 2 GNSS external antenna. Using an internet connection to access LSU’s C4G real-time network (RTN) the unit was capable of Real Time Kinematic (RTK) data collection. RTK data collection means that when surveying, real time corrections are acquired from nearby base stations and post processing collected data is not necessary. This survey grade GPS system provides latitude, longitude, and elevation (XYZ) of land locations to a high degree of precision.

On three separate occasions from August 2017 through February 2018, the GPS unit and external antenna were used to complete a survey across the marsh and the adjacent park area. The park area was surveyed on August 31, 2017, and the marsh area was surveyed on November 14, 2017. A follow-up visit to the marsh occurred on February 21, 2018 to fill in data gaps not covered in the previous surveys. Each point collected contained a latitude, longitude, and elevation. A total of 699 GPS points were collected. GPS points were more densely collected within the marsh area (<0.5 m intervals), and at greater distances apart in the park area (Figure 6). A few small areas in the marsh were not as densely surveyed due to inaccessibility from ponding of water. The cut into the marsh and connection to Lake Pontchartrain is of particular interest, and therefore a greater concentration of points was purposely captured in this area. After quality assurance, all points were imported into ArcMap 10.6 and constrained to either the marsh area or park area using the clip tool. An interpolation of the data was performed in each area individually (marsh and park), using the splining with barriers technique. The resulting interpolations represent surface elevation across the marsh and park in summer 2018.
Figure 6: Elevation was measured (feet, NAVD 88) at each plot (20), and across the marsh and park at over 550 extra locations (right) using a Trimble Geo Explorer 6000 GeoXR GPS receiver attached to a Zephyr Model 2 GNSS external antenna (left).

Park trees

Park trees were assessed on October 2, 2018, using a modified 16 question tree evaluation on each individual tree (Appendix C). Answers were categorized to correlate to a general health index: healthy, OK, stressed. At the end of each questionnaire, answers were totaled. A tree was assessed as healthy when ≥10 answers indicated a healthy status, and ≤3 answers indicated unhealthy status. A tree was assessed as OK if answers were generally equal across all categories or when answers indicating healthy did not occur more than 50% of the time. A tree was assessed as stressed when ≤3 answers indicated healthy, and ≥10 answers indicated unhealthy.

Data analysis

All variables (soil salinity, elevation, total cover, BD, OM) were analyzed using the univariate one-way ANOVA framework, using the GLM model procedures of SAS 9.1. In all cases a significance level of $p=0.05$ was accepted. If significant differences occurred, Tukey’s method for post hoc analysis was used. Soil salinity and elevation data were interpolated in ESRI ARC 10.6 using the splining with barriers method.
Results

Marsh area

Soil salinity

There was a statistical difference in soil salinity by marsh area (Figure 7; \(F_{3,16}=8.68, p=0.0002\)). Soil salinity across the marsh ranged between 1.1 to 4.4 ppt. Soil salinity at waters’ edge was lowest (mean 1.4 ppt ±0.01 SE), but was similar to soil salinity in the western marsh (mean 1.7 ppt ± 0.3 SE). Soil salinity in the eastern marsh was higher, but statistically similar to the western marsh (mean 2.7 ppt ± 0.2 SE). Soil salinity at scrub-shrub sites was highest (3.5 ppt ±0.5 SE), but statistically similar to east marsh (2.7 ppt ±0.2 SE). Soil salinity was not measured in the northern marsh area.

![Figure 7](image)

**Figure 7**: Soil salinity differed by area in the marsh. Scrub-shrub and eastern marsh was higher and different than waters’ edge. Different letters indicate statistical differences.

The interpolation of soil salinity data showed that, in general, soil salinity was lowest on the western side of the marsh and at sites close to the water inlet cut into the marsh (Figure 8; <1.7 ppt). However, one site classified as western marsh, which is located away from the inlet did have slightly higher soil salinity (2.7 ppt). The highest soil salinity observations were taken at 3 sites in the middle of the marsh that are classified as scrub-shrub (4 to 4.4 ppt), but again, not all scrub-shrub sites had high soil salinity. A single scrub-shrub site along the northern edge of the marsh had soil salinity as low as the western marsh/waters’ edge sites (1.5 ppt). Soil salinity at the eastern marsh sites was intermediary, ranging between 2.2 to 3.1 ppt. There was a large swath of area across the northern section of the marsh with no established sites, where taking additional soil salinity measurements would likely refine the interpolation of data across the marsh.
Figure 8: Soil salinity in the Bucktown Marsh ranged between 1.1 to 4.4 ppt. Freshest areas appeared to be located in the “waters’ edge” and “western” portions of the marsh. Highest salinity appeared to be located in the “scrub-shrub” area of the marsh.

**Elevation**

There was a statistical difference in marsh elevation by marsh area (Figure 9; $F_{4,599}=48.63$, $p<0.0001$). Elevation across the marsh ranged between -2.18’ to 2.66’ NAVD 88. Elevation at waters’ edge was lowest (mean 0.38’ NAVD 88 ±0.10 SE), and different than all other areas. The western and eastern marsh areas were similar in elevation (west marsh-mean 0.92’ ± 0.04 SE; east marsh- mean 0.84’ ±0.02 SE). Highest marsh elevation was recorded in scrub-shrub areas (mean 1.12’ ± 0.04 SE), and in the northern/unclassified marsh area (mean 1.21’ ± 0.02 SE), which did not differ from each other.
Figure 9: Elevation across marsh areas ranged between 0.38’ to 1.21”. There were significant differences across marsh areas. Different letters indicate statistical differences.

The interpolation of marsh elevation data showed that, in general, marsh elevation decreased moving from north to south across the marsh. The exception to this was the area around the water inlet on the western side of the marsh, which was quite heterogeneous (Figure 10). Similarly, the elevation gradient across the marsh was also heterogeneous, with many pockets of higher and lower elevation moving north to south. Specifically, in the most southern portions of the marsh interior, elevation changed by as much as 1’ within 25 m. Most of the highest elevation observations were taken in the northern section of the marsh and around the edge of the marsh, in scrub-shrub habitat. Scrub-shrub habitat in the interior marsh was a bit lower in elevation than along the edge. The lowest elevation observations were taken along the water inlet, and at several small areas in the eastern marsh area.
Figure 10: Elevation across the Bucktown Marsh ranged between -2.18’ to 2.75’ NAVD 88.

Vegetation

There was a statistical difference in total vegetation cover by marsh area (Figure 11; $F_{3,16}=4.02$, $p=0.0262$). Total cover across the marsh ranged between 15 to 85% at individual sites. Total cover at sites in the western marsh was highest (mean 59% ±7 SE), but similar to waters’ edge (mean 49% ±9 SE) and the eastern marsh cover values (mean 48% ±3.7 SE). Overall lowest total cover was observed in scrub-shrub habitat (mean 27% ±6 SE), which was different than all others. There are no established sampling sites in the northern portion of the marsh, as such that marsh area was not part of the analysis.
The scrub-shrub areas had less overall vegetation coverage than the western marsh. Different letters indicate statistical differences.

A total of 14 species were identified at sampling sites across the marsh (Figure 12; Appendix D). Vigna luteola (deer pea), a vine, was the only species observed at all sites. The number of different species per site (richness) ranged between 2-6 species, but there were no significant differences in species richness by marsh areas. However, there were broad observable patterns of dominant vegetation across different marsh areas (Figure 13). For instance, Panicum repens (torpedoggrass) was dominant and present at all eastern marsh sites, but much less dominant along the waters’ edge and in scrub-shrub habitat, and was absent at western marsh sites. Polygonum punctatum (smartweed) dominated the western marsh sites, but was completely absent from the eastern marsh. Deer pea and smartweed dominated the waters’ edge sites, and deer pea, smartweed, and Iva frutescens (marsh elder), dominated the scrub-shrub sites. In general, the waters’ edge sites and scrub-shrub habitat were home to a greater number of less dominant species, which also included, but was not limited to Solidago sempervirens (seaside goldenrod), Cuscuta sp. (dodder), Zizaniopsis miliacea (giant cutgrass), and Ambrosia trifida (giant ragweed). Marsh elder was only found at one scrub-shrub site, but was observed throughout the scrub-shrub habitat. Cordgrass was found at no sites across the marsh.
Figure 12: All plant species identified per site across the marsh. Size of pie charts corresponds to total vegetation coverage per site. Size of pie chart “slice” corresponds to percentage of coverage by species per sight relative to total vegetation coverage (disregarding percent unvegetated area). See Appendix D for complete list of scientific and common names of plants.
**Figure 13:** All plant species identified in the marsh by area. Size of “slice” is relative to percentage of coverage. Grey = unvegetated areas as a percentage of the whole. See Appendix D for the complete list of scientific and common names of plants.

For the 13 plant species assigned a CC score (Cretini et al. 2011, Appendix D), non-native species were assigned a CC score of 0, and accounted for 8% (1 species), and other disturbance species (CC = 1–3) accounted for 31% of the total (4 species). Species commonly found in less vigorous wetlands (CC = 4-6) accounted for 46% of the total (6 species), and species found in more vigorous wetlands (CC = 7-8) accounted for 15% of the total (2 species). No species received the highest scores of 9 or 10. FQI scores across individual sites ranged between 5.5 and 39.5, with marsh area averages ranging between 11.3-27.1 (Figure 14). The highest scores were found in the western marsh, which had the highest overall total cover, but also the highest cover by smartweed (CC = 5), not an opportunistic species. The lowest FQI scores were found in the scrub-shrub area, which had the lowest overall total cover (11.5%), and several disturbance and opportunistic species (ragweed, torpedograss, deer pea), with low CC scores (<3).
Figure 14: Floristic Quality Index (FQI) across the Bucktown Marsh, by marsh areas.

**Soils**

Soil BD was similar across marsh areas, with no statistical differences (Figure 15). Mean BD was $0.52 \pm 0.05$ g cm$^{-3}$. Bulk density at individual sites ranged between 0.22 - 1.0 g cm$^{-3}$.

Figure 15: Soil bulk density (BD; g cm$^{-3}$) across the Bucktown Marsh by marsh area. BD ranged between 0.39-0.64 g cm$^{-3}$ across areas. Repeating letters indicate no significant differences.
Soil OM was also similar across marsh areas, with no statistical differences (Figure 16). Mean OM was $24.0 \pm 3.1\%$. Soil organic matter at individual sites ranged between 5.4 – 52.8%.

**Figure 16**: Soil organic matter (OM; %) across the Bucktown Marsh by marsh area. OM ranged between 18-34% across areas. Repeating letters indicate no significant differences.

### 2010 to 2018

Comparisons between data gathered in 2010 and in 2018 come with explicit limitations or caveats and were therefore, the old and new data were not analyzed statistically. We did not sample the exact same sites as were sampled in the previous marsh study, rather, we established sites in close proximity to the older sites, but in the same previously defined marsh areas. Further, the methods used to gather elevation data in the marsh, and the density of points collected was different in 2010 compared to 2018. Given these caveats, there appears to have been a large change in marsh elevation between 2010 and 2018 (Figure 17A). Elevation appears to have decreased across all areas in the marsh (see discussion). In 2010, marsh elevation appeared stable and did not differ across areas, but in 2018 elevation was significantly lower at the waters’ edge and higher in scrub-shrub, compared to all other areas. Interestingly, both BD and OM increased across all marsh areas from 2010 to 2018. Usually, an inverse relationship between BD and OM is expected (Figure 17B & D). Lastly, vegetation cover decreased across all marsh areas from 2010-2018, most dramatically in the scrub-shrub area (Figure 17C).
Figure 17: Between 2010 and 2018 marsh elevation appeared to decrease (A), bulk density (g cm\(^{-3}\)) and organic matter (%) appeared to increase (B & D), and total cover (%) also decreased (C).
Park area

Elevation

The interpolation of park elevation data showed that elevation was highest around and just south of the gazebo area (6.5-7.5′NAVD 88), in the southeastern portion of the 3-acre park. Elevation decreases, radiating out from the gazebo area in all directions (Figure 18). Not surprisingly, the exception to this is a nearby section of the hurricane flood protection levee that was also surveyed (8.5-9.2′NAVD 88). Besides the levee, the elevation gradient moving away from the highest spot was relatively uniform, decreasing smoothly across the park, with the lowest elevations found at the edge of the marsh and park (< 3.0′NAVD 88). Two other low spots (3.5-4.0′NAVD 88) were located in the northern and southern sections of the park.

Figure 18: Marsh elevation across the Bucktown Park area ranged between 3.0 to 9.2′ NAVD 88. The highest elevations were along the flood protection levee. The lowest elevations were located on the western boundary of the park (interface of park and marsh), along the northern portion of the park, and a section in the southwest corner of the park.

Park trees planted in 2012

Trees were first planted in what is now the park area during the spring of 2012, as construction of the Bucktown Harbor was near completion (additional trees and shrubs were planted in 2019). A total of 17 trees were planted: 10 baldcypress and 7 live oaks (Figure 18, Figure 19). Trees were donated by Doerr Furniture (New Orleans, LA; www.doerrfurniture.com), planted by the LPBF and JP, and were approximately 8-10′ tall when planted. Spacing between trees is a minimum of 10 meters (32′). Tree
placement was spread across the elevation gradient of the park. Three trees (2 baldcypress, 1 live oak) are located at 7.0-7.5’ NAVD 88, eight trees (3 baldcypress; 5 live oak) are located at 5.5-6.0’ NAVD 88, three trees (2 baldcypress, 1 live oak) are located at 5.0-5.5’ NAVD 88, and three trees (baldcypress only) are located at 4.5-5.0’ NAVD 88. No live oaks were planted at the lowest planting elevation.

**Figure 19**: Compilation of pictures of most of the trees (baldcypress and live oak) previously planted at Bucktown Park. Pictures taken on 10/2/2018.

**Tree assessment**

Overall, the baldcypress and live oak trees previously planted in the park area are doing well (Figure 20). The assessment of park trees showed that a majority of trees (11 of 17) were healthy, and exhibited characteristics associated with healthy trees (i.e. dense canopies, wound-free trunk, trunk flare, etc., Figure 21). All but one of the healthy trees were baldcypress and all 10 of the baldcypress trees in the park were assessed as healthy. Four of the planted trees were assessed as “OK”, and exhibited characteristics both good and bad, which indicated that those four trees were not intensely thriving, but were not extremely stressed either. All four of these trees were live oak. Two of the planted trees were assessed as stressed, and exhibited characteristics associated with struggling trees (i.e. sparse canopy, leaning, fungus, etc., Figure 22). Both of these trees were also live oak. Both stressed trees and three of the four “OK” trees were growing at an elevation of 4.5-5.5’ NAVD 88, and had visible ponding of water at the base of the trees at the time of the assessment.
**Figure 20:** General assessment of tree health at Bucktown Park. Green = healthy; Yellow= OK; Red = stressed. See Appendix C for list of questions used in tree assessment.

**Figure 21:** Examples of tree characteristics related to healthy trees: thick canopy, healthy leaves, fruiting, baldcypress knees, full canopy shape, etc.
Figure 22: Examples of tree characteristics related to stressed trees: split trunks, fungus, mushrooms, scarred roots, excessive gravel in soil at base, old mulch, leaning trees, etc.

Discussion

State of the marsh

The mitigation marsh at Bucktown Harbor is a generally healthy early successional intermediate marsh that may be partially transitioning to fresh marsh. It contains plant species expected of an intermediate marsh, but thirteen years after construction is still missing the classically dominant species of intermediate marshes (i.e. *Spartina patens* (wiregrass), *Sagittaria lancifolia* (bulltonue arrowhead), *Schoenoplectus californicus* (California bulrush)) that typically signify stable, mature intermediate marshes (Visser et al. 2000). These species may be missing because the marsh is partially transitioning to fresh marsh, however, even non-transitioning mitigation marshes take a long time to mature and become stable. Transitioning to fresh marsh could also explain the complete absence of cordgrass, the only herbaceous species actually planted after the marsh was constructed, since cordgrass would be outcompeted by more fresh tolerant species. Three of four marsh areas had FQI scores <19, indicating unhealthy, or successional marsh, although two of three were close to 19. One marsh area (western marsh) had an FQI score > 20, indicating healthy marsh, which further indicates that the marsh is still successional rather than unhealthy. A few more years of monitoring may clarify the marsh’s trajectory.

The marsh was created as an intermediate marsh. Soil salinity measured in the marsh in 2018 indicates that the marsh remains partially within the expected range of salinity found in intermediate marshes (2-8 ppt; Chabreck 1970). However, 10 of 20 soil salinity measurements at Bucktown Marsh fell below 2.0 ppt; this could be indicating a transition to fresh marsh (0-3 ppt; Chabreck 1970). The western portion of the marsh, which is most exposed to Lake Pontchartrain, is less salty than the more protected middle and eastern portion of the marsh. Despite Lake Pontchartrain’s connection to the Gulf of Mexico, the lake has been freshening since the closure of the Mississippi River Gulf Outlet in 2009 (Henkel 2017),
which likely was not anticipated when the marsh was created in 2003-2005. For instance, the marsh was mono-specifically planted with cordgrass in 2003. Cordgrass is a dominant species in brackish (4-10 ppt) and saline marshes (8-29 ppt). In the years prior to the marsh’s creation, salinity in Lake Pontchartrain had been increasing for several years due in part to a regionwide drought; salinity in the lake averaged 6-9 ppt (https://pubs.usgs.gov/of/2002/of02-206/biology/sav.html). Planting cordgrass made perfect sense at the time, and although cordgrass is also adapted to fresher environments, it is easily outcompeted in them.

At present, the range of total cover values across all sites is similar compared to 2011, however, the overall average total cover values by marsh areas has decreased across the board, especially in scrub-shrub habitat. Some of this difference may be attributed to differences in cover estimation techniques between investigators in 2011 and 2018. However, it is also likely that in scrub-shrub habitat specifically, which is the only marsh area containing the woody marsh elder, that herbaceous vegetation has decreased as marsh elder increased. More broadly across all areas, it is also possible that as cordgrass disappeared and other intermediate species increased, cover values became more variable. A second factor possibly depressing cover across the marsh is the expansion of deer pea vine. This native vine was present in 2011, but was restricted to a few sites; in 2018 it was observed at every site. An annual vine, it grows out beginning in late spring through early fall, and then dies. It temporarily blankets the marsh during the peak of the growing season, likely slowing growth of other species underneath (Myers et al. 1995). Despite this, it is not an invasive species and eradication is not necessary as density of deer pea cover likely fluctuates interannually. However, some mechanical means (hand removal) could be used to control its’ spread for aesthetic purposes.

Marsh soils and their properties also determine whether created wetlands exhibit the characteristics of natural wetlands. Intermediate marshes naturally exhibit great variability in soil properties, especially OM. For example, at two CRMS stations along the Maurepas Landbridge identified as intermediate (CRMS 0030 & 0033), OM in the top 20 cm of soil is 28% at one site and 62% at the other. Similarly, OM at a CRMS site (2830) identified as intermediate in the LaBranche Wetlands was 30%, but was 55% at a CRMS site (4355) identified as intermediate in St. Bernard Parish, near Caernarvon. BD was more consistent, between 0.1-0.2 g cm\(^{-3}\) on the Maurepas Landbridge, and approximately 0.22 g cm\(^{-3}\) at both the LaBranche Wetlands and near Caernarvon. At Bucktown Marsh, soil OM was similar across the four marsh areas, and was 24% (±0.03) overall, similar to the lower end observed in natural intermediate marshes on the Maurepas Landbridge and in the LaBranche Wetlands (CPRA 2019). This is a slight increase compared to Bucktown Marsh in 2011, indicating that detritus from vegetation continues to be incorporated into marsh soils. BD in soils at Bucktown Marsh was higher than all CRMS mentioned above, and to Bucktown Marsh soils in 2011. This is unusual, as an inverse relationship between OM and BD is usually expected. Hester and Willis (2011) reported two sedimentation events at Bucktown Marsh from 2006-2007 and 2007-2008, and in 2007 also observed an increase in soil BD. Similar sedimentation may have occurred since 2011, which could have introduced reworked mineral sediments from the lake bottom or river sediment from opening of the Bonnet Carre Spillway. The spillway has been opened 4 x’s since 2010 (2011, 2016, 2018, 2019), three of which are included in the timeframe of this report and analysis. The most recent 2019 opening has been by far the longest of all the recent openings and will be incorporated in the 2019/2020 report. It will be interesting to see whether the spillway opening will have a detectable impact on soil properties at Bucktown Marsh.
The sedimentation events in 2006-2007 and 2007-2008 resulted in increased marsh elevations as measured at the end of those years. By 2011, marsh elevation appeared to have stabilized across the marsh, with no difference between areas, and little variability since 2007 and 2008. By 2018, marsh elevations substantially decreased compared to 2011, across all marsh areas. This likely reflects some settling of the soil (compaction), however, it’s just as likely that the more intense coverage of elevation measurements across the marsh produced a more realistic estimation of marsh elevation.

State of the park
Currently the park area is adjacent to the harbor and is used for walking, jogging, biking, picnics, and bird watching. It’s the objective of the harbor redevelopment plans to draw more people to the area, and to the marsh and lake. The park contains parking, sidewalks, benches, waste receptacles, and a gazebo, all of which could easily be incorporated into redevelopment plans. The park also contains plenty of open green space, as well as 17 baldcypress and live oak trees which were planted in 2012. The two major needs in the park area are to 1) increase shade and attract birds to the area by continuing to strategically plant trees, and 2) fill or strategically use the depressions in the green space that hold water after rain.

The planted trees are in generally good health, and the baldcypress especially are beginning to provide shade due to their stature and thick canopies. Two live oak trees appear somewhat stressed, likely due in part to standing water at the base of those trees and lack of nutrients in the soil. Live oaks are considered intolerant of flooded conditions, preferring ample water, but in well drained soils (McKnight et al. 1981). Improving drainage around some of the live oaks is recommended. Standing water was also observed in the northern section of the park, one of the likely locations of future park plantings. Unless drainage is addressed in that area, care needs to be taken to choose tree species adapted to sporadically waterlogged conditions.

Recent Activities
2019 Bucktown Park Planting
As stated above, one of the objectives of the park is to attract more birds to both the marsh and park (Appendix E). Birds use marshes as foraging grounds, refuge, and habitat (Cody 1985). As a predominantly intermediate marsh, Bucktown Marsh is important habitat for wading birds (Michot et al. 2003). Additionally, this is an excellent educational initiative in the park.

On January 24, 2019, JP Coastal Division and LPBF partnered to jointly host a tree planting in the Bucktown Park. The focus of this particular planting was to plant trees that would attract birds. It was decided to plant 10 *Morus rubra* (mulberry) trees, 5 *Ilex casine* (dahoon holly), and 5 *Magnolia virginiana* (sweet bay magnolias). All trees were purchased from Bantings Nursery (Lacombe, LA), arrived in either 5 gal. (mulberry) or 15 gal. (dahoon holly, sweet bay magnolia) pots, and were approximately 10’ tall when planted. The planting location was the northwestern area of the park, an open area adjacent to the marsh (Figure 23). The hope is that these trees will facilitate movement of birds into the marsh. On the day of the planting, 20 Camp Hope volunteers joined LPBF and JP Coastal Division staff to plant trees (Figure 24). Councilwoman Van Vrancken of Council District #5 spoke of the importance of this planting and coastal restoration in general to the volunteers. Trees were set out in loose groups, widely spaced (>10’) across the planting area, taking care to not block the future entrance to the planned boardwalk and kayak launch in the most northwest corner of the park. JP staff returned
at a later date to secure trees with stakes and rope. A brief check of trees in April, 2019, indicated that 17 of 20 trees were thriving, and three of the trees were struggling, but alive.

Figure 23: Area of tree planting (red box) at Bucktown Park (spring 2019) to attract birds.

Figure 24: January 2019 planting of new trees (A) in the northwest corner of Bucktown Park (B).
Marsh clean-up

Multiple 10’ PVC poles that are the likely remnants of some of the site markers from the previous studies are still scattered across the marsh. Additionally, four PVC “cages” used in the herbivory study also remain in the marsh. These items are no longer of use as new sites were established for the present study. We used 4’ PVC poles that are not quite as visible in the marsh, which makes the work a little harder, but keeps the marsh looking cleaner. The older PVC poles and “cages” were removed in July 2019 by LPBF and JP staff.

Future Activities

Proposed marsh boardwalk

Jefferson Parish has been developing a design for a public boardwalk to allow better visual access to the Bucktown Marsh. Pontchartrain Restoration Program funds and other resources have been used to finalize a design through a local engineering firm (Stantec Inc.). LPBF and others have also been consulted several times to share design considerations. The final boardwalk design is a publicly accessible boardwalk which follows the outer edge of the marsh adjacent to Lake Pontchartrain. Points of entry will be at either end of the boardwalk. Approximately midway of the boardwalk, a short boardwalk extends toward the interior of the marsh. The design is optimum because it allows views of the marsh and lake with minimal impact to the marsh. Jefferson Parish expects the boardwalk to be completed in 2019, and will be a significant enhancement to the Bucktown Marsh and Park area.

Boardwalk signage

As a complement to the boardwalk, interpretive signage will be strategically placed along the length of the boardwalk. Stantec Inc. was contracted for this job as well, and with input from LPBF five interpretive signs were designed during the spring of 2019. The signs are meant to be educational and immersive, and each sign describes an important aspect of the area around and within Bucktown Marsh. The first sign, beginning on the eastern end of the boardwalk, will describe the location of Bucktown Marsh within the Pontchartrain Estuary. The second sign will describe the creation of Bucktown Marsh. The third and fourth signs will describe plant and bird species found in the marsh. A final sign at the western end of the boardwalk, as people are exiting while facing the storm protection levee, will describe the function of levees in the New Orleans area. This last sign will especially informative for out of town visitors not familiar with our levee system.

Recommendations

Adaptive monitoring

As previously explained, for this first year it was decided to closely follow the previous Bucktown Marsh monitoring efforts (2005-2011), in order to facilitate some comparison between 2011 and 2018. This came with some caveats, also previously mentioned. Monitoring revealed that the northern section of the marsh was completely devoid of study sites, likely because that section of the marsh was not completely filled in when the original monitoring sites were established. Moreover, elevation analysis in 2018 showed this area was higher and different than several other areas of the marsh, and several species of plants (Iris versicolor (blue flag iris), Colocasia sp. (elephant ear)) were growing prolifically in this area, and were not detected at any other site (Figure 25). Therefore, for the 2019 and 2020 monitoring years, LPBF plans to establish five new study sites in the northern section of Bucktown Marsh (see Figure 2). Establishing sites in this area will ensure better coverage for soil salinity, soil
properties and vegetation analyses. This will provide a more comprehensive picture of the conditions in the marsh.

Figure 25: The previously established monitoring sites failed to capture large swaths of dominant plant species, such as *Iris versicolor* (native blue flag iris; left) and *Colocasia* sp. (elephant ear; right). The addition of extra monitoring sites is recommended.

**Marsh maintenance**

Overall, after the first year of study, it was determined that the marsh requires no regular maintenance at this time, and should be left to develop naturally. However, there may be a few instances when it would be appropriate to organize one-time marsh maintenance events, such as:

- litter and debris removal
- mechanical thinning of overgrown deer pea
- removal of *Salvinia minima* (Salvinia) from the water inlet

In each of the above cases, or in combination, hosting a volunteer event would be an excellent and efficient way to take care of whichever maintenance issue has arisen, and get the community involved and invested in the marsh and park area.

**Park maintenance**

All trees would benefit from more regular maintenance, such as:

- mulching twice a year
- more care while mowing over roots
- a general slow release fertilizer once a year
- fixing the drainage of water around a few live oaks as described earlier

Close to the lake and planted in soil full of gravel, the park is an overall harsh growing environment, and a bit more care would benefit the established trees immensely. Additionally, maintaining the
perimeter of the marsh by regularly clearing the ragweed that grows up between marsh elder bushes along the edge would help maintain access and the view of the marsh. All benches face the marsh for this purpose (Figure 26).

Figure 26: Maintaining openings between the park and marsh areas for viewing is recommended.

Future park plantings
We recommend at least 1-2 more tree/shrub plantings focused on attracting birds, bees, butterflies and other wildlife to the marsh and park, preferably starting in the winter of 2019/2020. Additionally, we suggest also planting 10-12 more baldcypress and live oak trees. Even when a 300’ buffer is maintained off the centerline of the levee, and maintaining ample open green space for recreation, there are still opportunities to plant shade trees along parts of the sidewalk, gazebo and parking area. Planting the same species as before will create cohesion with the previous shade tree planting, while the birding trees provide variety and opportunities for bird watching. Trees planted in 2012 appear to have grown substantially in the past seven years and are already providing much needed shade. Planting additional baldcypress and live oak is recommended as soon as possible.

Potential marsh plantings
Marsh plantings are currently not necessary. The marsh is progressing more or less as expected. The most recent data indicates that it takes up to 30 years for constructed wetlands to fully attain the characteristics (vegetation, soils), and function similarly as natural wetlands (Ebbets et al. 2019). That said, 1-2 small demonstration plantings with volunteers would not hurt the marsh. These plantings would be purely educational; they are not necessary. Suggested species are baldcypress, wiregrass, bulltongue arrowhead and California bulrush).
Hydrological recommendations

We have no hydrological recommendations for the marsh at this time, and prefer to wait on further study, when more data has been collected and analyzed.

Conclusions

The mitigation marsh at Bucktown Harbor is a generally healthy early successional intermediate marsh, that may be partially transitioning to fresh marsh. A partial transition to fresh would explain the complete absence of cordgrass, the only herbaceous species actually planted after the marsh was constructed. Vegetation and soil organic matter are indicative of intermediate marshes, but soil bulk density remains high, and thirteen years after its’ construction the marsh is still missing the classically dominant species of intermediate marshes (i.e. wiregrass, bulltonue) that typically signify stable, mature intermediate marshes (Visser et al. 2000). This is not uncommon, as the most recent data indicates that constructed and restored marshes take up to 30 years to attain vegetation and soil characteristics comparable to natural marshes (Ebbets et al. 2019).

Likewise, the park area at Bucktown Harbor contains generally healthy baldcypress and live oak trees that were planted in 2012 (Figure 27). The trees would benefit from more regular maintenance due to the relatively harsh growing conditions on the site. Despite this, the planted trees appear to have grown substantially since 2012 and are beginning to provide much needed shade. The planting of more shade trees is desirable, as is the planting of more trees to specifically attract birds to the park and marsh. These activities will complement the redevelopment plans for Bucktown Harbor.

Figure 27: Overview of marsh areas, sampling sites and planted trees at Bucktown Marsh and Park.
Completed Tasks August 2018 to July 2019

Marsh area
- Met with Byron Almquist to discuss Bucktown Marsh 2018
- Annual vegetation survey of the Bucktown Marsh 2018
- Annual elevation survey 2018
- Annual soil salinity survey 2018
- Annual assessment of soil properties 2018
- Consulted on new marsh boardwalk design 2018
- Consulted on new boardwalk signage 2019
- Removed PVC from marsh area 2019

Park area
- Annual elevation survey 2018
- Annual assessment of planted trees 2018
- New planting of trees to attract birds 2019

Report
- Monitoring results 2018
- Monitoring recommendations 2018/19
- Tree assessment results 2018
- Recommendations for additional tree plantings 2018/19
- Recommendations for tree maintenance 2018/19
Literature Cited


Lopez, J.A., 2009. The multiple lines of defense strategy to sustain coastal Louisiana. Journal of Coastal Research 186–197 (Special Issue 54 — Geologic and Environmental Dynamics of the Pontchartrain Basin (FitzGerald & Reed)). 


http://saveourlake.org/PDF-documents/MLODSreportFINAL12-7-08with-comments.pdf


Appendix A: Bucktown Marsh and Park timeline.

Bucktown Marsh and Park Timeline

- Harbor creation
- Park creation

2000: Harbor dredging
2002: Marsh planting
2003: Marsh completion
2004: Hurricane Katrina
2006: Marsh monitoring
2008: Hurricane Gustav
2009: Hurricane Irene
2010: Harbor completion
2011: Park planting
2012: Benches, sidewalk, parking construction
2014: Hurricane Isaac
2016: Park planting
2017: Marsh and park monitoring
2018: Park planting
2019: Marsh PVC removal
2020
2021
Appendix B: Site locations in the Bucktown Marsh, in decimal degrees.

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Appendix C: Bucktown Park tree assessment questionnaire
Bucktown Park Area Tree Assessment

Date/Time:

Data Collectors:

Tree #

Tree Location (lat/long):

1. Trunk wounds
What percentage of the trunk is intact?

a) 100% of the trunk bark is present and firm = Healthy tree
b) ~80-90% of the trunk diameter is missing bark = Unhealthy tree
c) ~40%-80% of the trunk diameter is missing = Unsafe tree
d) Spiral of bark missing from the trunk from high up in the tree = Unhealthy tree
e) Numerous woodpecker holes on trunk = Unhealthy tree

2. Mushrooms
Are mushrooms visible?

a) None visible = Healthy tree
b) Visible on large branches = Unhealthy tree
c) Visible on main trunk = Unsafe tree

3. Co-dominant branches
Are co-dominant branches present?

a) Strong central leader, no co-dominants visible = Healthy tree
b) 1-2 co-dominant branches = Unhealthy tree
c) >3 co-dominant branches = Unsafe tree

4. Annual branch extension
Every branch contains a small scar that indicates how much it grew the previous year. Measure between terminal bud scars to determine annual growth.

a) >10” (25cm) per year = Healthy tree
b) <2” (5cm) per year = Unhealthy tree

5. Annual trunk diameter growth
Using a diameter tape (or the formula diameter = circumference/pi if using a regular tape measure) calculate how much the tree grew (*this assumes you have made the same measurement in the previous year).

a) > 3/4” (2 cm) per year = Healthy tree
b) <1/4” (0.63cm) per year = Unhealthy tree

6. Trunk flare
Can you see the trunk flare?

a) Visible = Healthy tree
b) Buried = Unhealthy tree
7. Surface roots
*How do the roots appear at the surface?*

a) Radiate from trunk like spokes on a wheel = Healthy tree  
b) Wrap around trunk and each other = Unhealthy tree

8. Soil drainage rate
*Using a hand spade, take a small hole about the size of a drinking glass in the soil at the base of the tree, taking care not to cut any healthy roots. Fill this hole with water and allow it to drain through. Refill the hole and time how long it takes to drain completely. Divide the number of inches/cm that drained by time in hours to calculate the infiltration rate.*

a) 1/2” to 3” (1.2cm to 7.5cm) per hour = Healthy soil for trees  
b) <1/8” (.3cm) per hour = Unhealthy soil for trees

9. Density of canopy leaves
*Can you see through the canopy?*

a) Cannot see through = Healthy tree  
b) Can see through = Unhealthy tree

10. Canopy perimeter shape
*What is the shape of the canopy?*

a) Continuous round or oval = Healthy tree  
b) Large holes, almost like bites = Unhealthy tree

11. Canopy north to south spread
*Measure: ________meters*

12. Canopy east to west spread
*Measure: ________meters*

13. Canopy dieback
*Estimate ________%*

14. Canopy missing
*Estimate ________%*

15. Leaf color and appearance
*How do the leaves appear?*

a) Dark green, large = Healthy tree  
b) Yellow and small = Unhealthy tree  
c) >50% leaf scorch = Unhealthy tree

16. Fruiting
*Is the tree fruiting?*

a) yes=healthy  
b) no=neutral
17. Fungus
*Does the tree show signs of fungus?*

a) yes = unhealthy
b) no = healthy

18. Trunk and trunk base branches
*Are there branches sprouting from the base or lower trunk?*

a) No small branches visible on main trunk or base of tree = Healthy tree
b) Small branches sprouting from the trunk that are relatively new = Unhealthy tree
c) Small branches sprouting from the base of the trunk, looks almost like a shrub = Very unhealthy tree

19. Mulch
*If mulch is present, how does it appear?*

a) Mulch forms a dish with thin layer (<2"/5cm) over main roots = Healthy application
b) Mulch forms a thick mound and touches trunk = Unhealthy application

20. Standing water
*Is standing water present at the base of tree?*

a) yes = unhealthy
b) no = healthy

*questions for assessment taken from [http://www.deeproot.com/blog/blog-entries/13-simple-steps-to-evaluate-trees](http://www.deeproot.com/blog/blog-entries/13-simple-steps-to-evaluate-trees), and in consultation with David Baker (botanist/arborist; New Orleans, Louisiana)*
Appendix D: Common and scientific names of plants identified at sites in Bucktown Marsh

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**Appendix E: Birds observed at Bucktown Marina, Jefferson, LA.**

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