EAST FLAGLER MOSQUITO CONTROL DISTRICT REVIEW FINAL REPORT

September 2023

Prepared for

The Florida Legislature

Prepared by

The Balmoral Group

165 Lincoln Avenue

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Executive Summary

Established in 1952, the East Flagler Mosquito Control District (East Flagler MCD) serves the area of Flagler County that is east of U.S. Highway 1 between its northern and southern county lines, totaling 117 square miles. Effective October 2023, revised boundaries will include two new service areas including property east of U.S. Highway 1 following southeast to the Volusia County Line, and west of U.S. Highway 1 to north of the St. Johns County Line. The change reflects demands associated with rapid changes in population growth. The service area will increase by 13%.

East Flagler MCD serves the more populated areas of Flagler County, totaling 107,173 residents in 2020. According to projections, the population of Flagler County could grow by as much as 56% by 2050. The number of parcels subject to district millage grew by about 1,300 properties between Fiscal Year (FY) 2019-20 and FY 2022-23. The taxable value of parcels within the district increased about 36% during the review period. District millage rates increased by 21% since FY 2019-20.

Revenues and expenditures of the East Flagler MCD have increased and are expected to increase further as a result of its expanded service area and commitment to public education. Increased program costs are related primarily to equipment and treatment supplies. Continuity of service, an objective of the adopted strategic plan, is to be supported by an additional service helicopter and pilot. There have been no issues reported in recent audits and assessment of performance by the public has not identified any issues. The services provided by East Flagler MCD are comparable to those of similarly scaled mosquito control districts. There is no comparable service provided by Flagler County or its municipalities.

SCOPE

Section 189.0695, *Florida Statutes,* requires the conduct of performance reviews of Independent Mosquito Control Districts. The Balmoral Group was selected by the Office of Program Policy Analysis and Government Accountability to perform the review, which evaluates the district's programs, activities, and functions, including

- evaluating the district board's primary function and governance;
- assessing service delivery and comparing similar services provided by municipal or county governments located within the district's boundaries;
- describing district purpose, goals, objectives, performance measures, and performance standards and evaluating the extent to which they are achieved;
- analyzing resources, revenues, and costs of programs and activities; and
- providing recommendations for statutory or budgetary changes to improve the special district's program operations, reduce costs, or reduce duplication.

The Balmoral Group (TBG) worked in consultation with a mosquito control expert in the course of this review and found that East Flagler follows industry standards for Integrated Pest Management and provides mosquito control services to residents as laid out in the district's enabling documentation and Florida Statute; East Flagler MCD is not recommended for consolidation. East Flagler MCD has demonstrated efficient and effective resource management; resource needs will continue to grow as the district expands to meet the needs of the growing region. East Flagler MCD has established goals and objectives that address its statutory purpose and the district recently began tracking performance data.

Based on its review, The Balmoral Group presents the following recommendations for the improvement of mosquito control services in the East Flagler MCD:

- The Legislature could consider amending section 403.709(1), *Florida Statutes*, to require a portion of the funds currently administered by DEP for solid waste activities to be allocated to waste tire abatement activities by MCDs.
- The district could formalize additional performance measures and standards that would allow the district to monitor and track progress toward all its goals and objectives. Such performance information would facilitate the district in consistently monitoring its progress.
- The Legislature could consider amending s. 388.46*, Florida Statutes*, to direct the Florida Coordinating Council on Mosquito Control to form a subcommittee consisting of mosquito professionals and researchers from around the state to develop model goals, objectives, and performance measures and standards to assist MCDs with performance monitoring.
- East Flagler MCD could revisit equipment and staffing needs in 2024.
- East Flagler MCD could rebuild the district's connections with DACS and return as a state-approved mosquito control district.

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1. Background

District Description

District Purpose

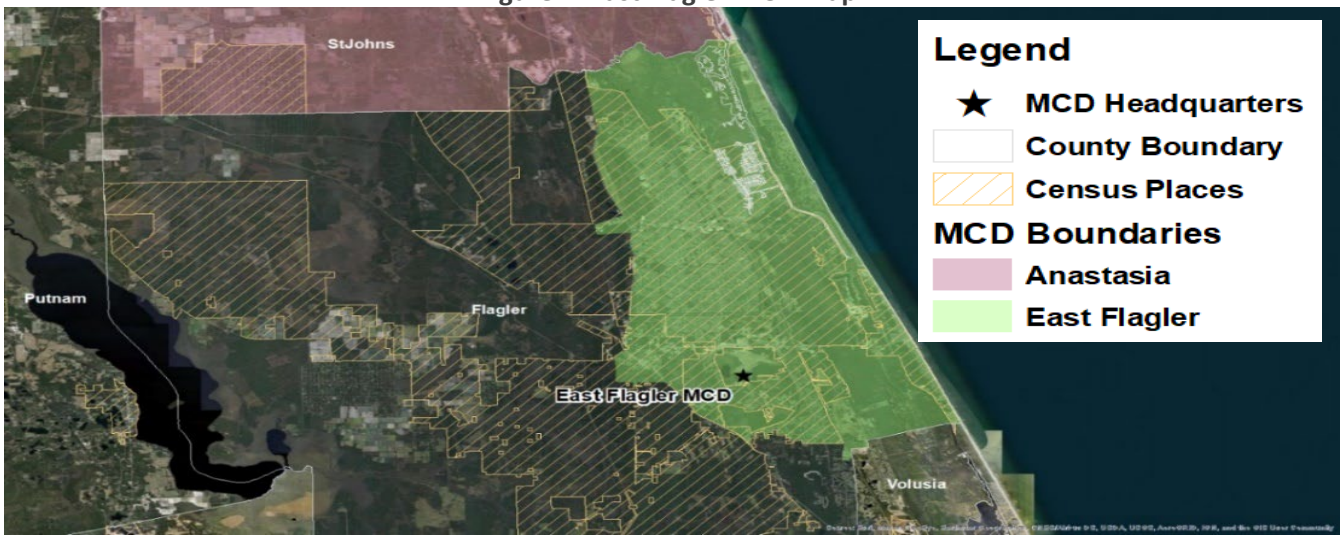
The East Flagler Mosquito Control District (East Flagler MCD) was formed in 1952 to suppress populations of saltmarsh mosquitoes so that the area could be habitable year-round and to allow for development of the area. As of 2022, the mission of the East Flagler MCD is the suppression of those mosquito species that may cause illness or significant discomfort, within a specific control area and with minimal environmental impact. East Flagler MCD seeks to control nuisance mosquito populations and protect the health of residents and visitors. The control of mosquitoes also reduces the risk of disease transmission and improves the quality of life of the community. In turn, as the service area has become a more desirable place to live and visit, increases to property values have followed, aiding in the economic development of the County.

Service Area

East Flagler MCD serves the area of Flagler County that is east of U.S. Highway 1 between the northern and southern county lines, totaling 117 square miles, or 20.5% of Flagler County's 571 square miles. The Board of County Commissioners (BOCC) of Flagler County approved an expansion in November 2022 that will increase the service boundary by 13%, making the district's service area 132 square miles.[1] As of October 2023, there will be two new service areas, including property east of U.S. Highway 1 following southeast to the Volusia County Line, and west of U.S. Highway 1 to north of the St. Johns County Line. The increase in service area reflects the demand for mosquito control services associated with population growth.

East Flagler MCD's headquarters is located at 210 Fin Way, Palm Coast, Florida 32164. **Figure 1** is a map of the East Flagler MCD boundary, with the county boundary and East Flagler MCD's current headquarters marked. This map does not include the expanded boundaries effective October 2023.

Figure 1. East Flagler MCD Map



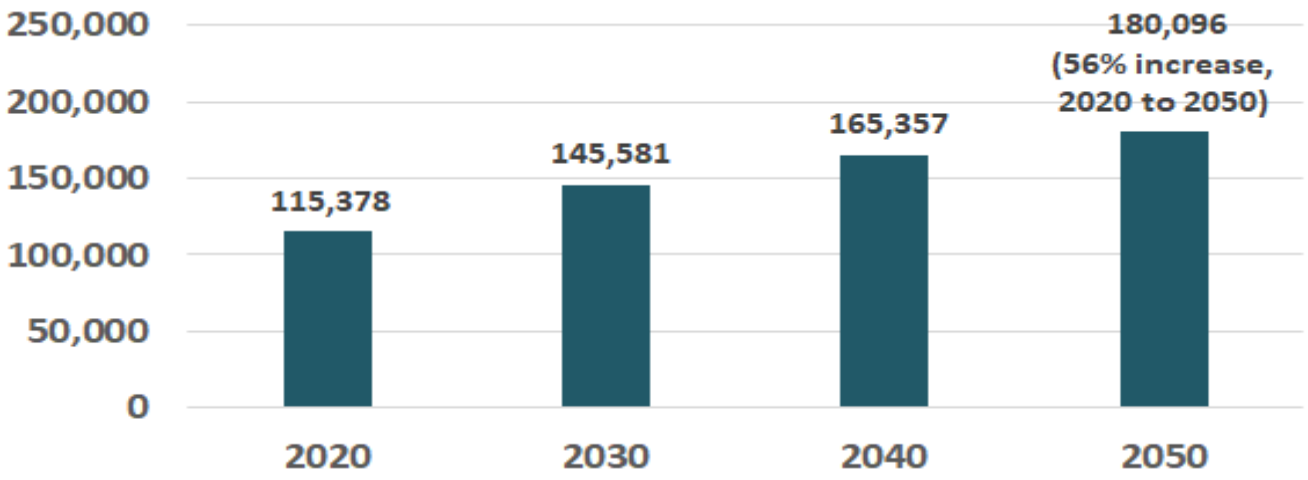
Source: TBG Work Product, ESRI, US Census, MCDs.

[1] District Expansion Resolution22-04; November 2022 BOCC Order for Expansion

Population

East Flagler MCD had a population of 107,173 people in 2020 according to the latest available block level U.S. Census data.[2] Flagler County's population was estimated at 126,705 persons in 2022 according to the U.S. Census.[3] The Florida Legislature's Office of Economic and Demographic Research (EDR) projects Flagler County's population to increase by 56% in 2050 to 180,096 residents compared to a 2020 baseline.[4] **Figure 2** shows Flagler County's projected population estimates calculated by EDR.

Figure 2. Flagler County Population Projection



Source: TBG Work Product, EDR.

District Characteristics

Flagler County is on the east coast of Florida, bordered by the Atlantic Ocean. Adjacent counties include St. Johns to the north, Putnam to the east, and Volusia to the south. The average annual temperature was 70 degrees Fahrenheit and rainfall was just over 55 inches in 2022.

As the name suggests, East Flagler MCD's boundaries only cover the eastern portion of Flagler County, along the coast. The majority of the population of Flagler County resides within the district's boundaries, mostly in the cities of Palm Coast, Flagler Beach, and Bunnell. This leaves the large tracts of rural lands in the east as prime larval habitats for mosquitoes.

Tourism is a major attraction for the area. However, Hurricane Ian ravaged the east coast of Florida in 2022, destroying dunes and eroding sands in Flagler County. Decreased beach accessibility, as well as degraded dune security that formerly protected major infrastructure, are some challenges Flagler County has faced over the last year.

Coastal areas also host large swaths of sea oats vegetation, while the interior of the County includes salt marshes, tall pine trees, and low-lying shrubs along the Intracoastal Waterway. Numerous state parks and conservation areas dot the coastline in Flagler County, providing opportunities for outdoor recreation and ecotourism.

[2] Block-level data compiled from Decennial Census P.L. 94-171 Redistricting Data Summary Files and matched to the MCD boundary in GIS.
[3] Population Estimates, July 1, 2022 retrieved from U.S. Census Bureau QuickFacts: United States.
[4] Based on 2021 Estimates, Population: 1970-2050, County projections retrieved from Population and Demographic Data - Florida Products (state.fl.us).

However, natural areas commonly include larval habitat, so controlling mosquito populations in these areas is critical to quality of life in both the coastal and inland portions of the county. Some areas require careful coordination with regulators from the Florida Department of Environmental Protection (DEP) and other environmental agencies, as mosquito treatment may be restricted.

Meteorology is the primary driving force for producing mosquitoes with heavy rainfall events creating standing pools of water that serve as breeding grounds for mosquito species capable of transmitting several arboviruses. Changing water levels through tidal events can also produce such pools. Humans contribute to the problem by allowing water to stand in waste containers, garden pots, tires, and other vessels. The characteristics of the natural areas of the district, combined with the growing population in urban areas of the district and the weather conditions, create an environment conducive to extensive mosquito habitats that require constant mosquito control attention. The services needed to control mosquitoes include routine surveillance of mosquito-producing habitats, source reduction, aerial and/or ground treatments using pesticides to treat areas with large mosquito populations, and regular testing for disease transmission in animals.

Real Property Data

East Flagler MCD collects ad valorem taxes to fund district operations. The total taxable value of properties within East Flagler MCD was $11.8 billion in the most recent fiscal year under a millage rate of 0.2975 (**Table 1**).

95% of Flagler County's taxable parcels and accounts are currently served by the district. Real property parcels subject to district millage have exceeded 71,000 parcels for most of the last four years (**Table 2**). Taxable value of real property parcels increased more than 36% in FY 2022-23 compared to FY 2019-20, due to gains in property values.

Table 1. Millage Rates and Total Taxable Value of Properties Subject to East Flagler MCD Millage

East Flagler MCD	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23
Millage Rate	0.2458	0.2375	0.2575	0.2975
Taxable Value of Parcels ($Mil.)	$8,499	$9,039	$9,811	$11,532
Taxable Value of Accounts ($Mil.)	$247	$248	$272	$299
Taxable Value of Centrally Assessed Property ($Mil.)[1]	$1.9	$1.9	$1.9	$2.1
Total Taxable Value in Millions	**$8,748**	**$9,289**	**$10,085**	**$11,833**

Source: Florida Department of Revenue (FDOR).
[1] Centrally assessed property includes railroad and private carline company assessments as defined in Rule 12D-2.011, *F.A.C.*

Table 2. Real Property Parcels Subject to East Flagler MCD Millage

East Flagler MCD	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23
Just Value of Parcels ($Mil.)	$12,454	$12,934	$14,428	$19,697
Real Property Parcels Subject to District Millage	70,822	71,118	71,305	72,149
Taxable Value of Parcels ($Mil.)	$8,499	$9,039	$9,811	$11,532

Source: FDOR.

Tangible Personal Property Data

In addition to real property, tangible personal property accounts subject to district millage totaled just over 6,200 accounts in FY 2022-23, having grown more than 12% since FY 2019-20 (**Table 3**). Taxable value of tangible personal property accounts also increased in FY 2022-23 by 21% compared to FY 2019-20 due to higher property values.

Table 3. Tangible Personal Property Accounts Subject to East Flagler MCD Millage

East Flagler MCD	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23
Just Value of Accounts ($Mil.)	$483	$575	$596	$808
Tangible Personal Property Accounts Subject to District Millage	5,602	5,664	6,103	6,283
Taxable Value of Accounts ($Mil.)	$247	$248	$272	$299

Source: FDOR.

History and Composition

East Flagler MCD was established in 1952 by the Flagler County Board of Commissioners following a special election.[5] East Flagler MCD is subject to Chapter 189, Florida Statutes, given its status as an independent special district; Chapter 388, *Florida Statutes,* setting forth the requirements for creating and operating MCDs in this state; and Chapter 5E-13, *Florida Administrative Code,* setting forth rules adopted by the Department of Agriculture and Consumer Services (DACS) for mosquito control program administration.

East Flagler MCD is governed by an elected board of three commissioners with one person being the chair. There are no vacant positions at this time. No specific qualifications beyond the state requirements have been identified.

Pursuant to Chapter 388, *Florida Statutes*, the powers and duties of the board of commissioners include:

- Performing all duties necessary for the control and elimination of mosquitoes and other arthropods of public health importance.
- Being authorized to provide for the construction of canals, ditches, drains, dikes, fills, and other necessary works, and to install and maintain pumps, excavators, and other machinery and equipment.
- Preparing and adopting a district budget.
- Being authorized to hold, control, and acquire by gift or purchase for district use any real or personal property.
- Having all the powers of a body corporate, including the power to contract and employ a director, employees, and others.

East Flagler MCD's commissioners held regular monthly meetings over the last fiscal years as required by s. 388.151, *Florida Statutes* (**Table 4**). In addition to regular monthly meetings, special meetings may be called to discuss the draft and final budget for the upcoming fiscal year, as well as strategic planning activities. While all agendas, budgets, and meeting dates are posted on the district's website, meeting minutes and packets are not

[5] EFMCD-creation.pdf (flaglermosquito.com)

accessible for the public in the same way. A board meeting schedule is provided for the current fiscal year on the district's website.[6]

Table 4. East Flagler MCD Commissioner Meeting Counts

Commissioner Meetings	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[1]
Monthly Meetings	12	12	12	7
Special Meetings	2	3	4	0

Source: TBG Work Product, MCD.
[1] 2023 YTD through April.

The board's meetings are open to the public and noticed and conducted in accordance with s. 189.015, *Florida Statutes*.

Intergovernmental Interactions

East Flagler MCD interacts with other local entities. In the past, East Flagler MCD has provided Volusia County with aerial larvicide spraying services under an emergency agreement due to Volusia County not having a helicopter at the time. Spraying was not conducted by East Flagler MCD in Volusia County during the period in review. East Flagler MCD routinely coordinates with the Flagler County Health Department and has been contracted by Flagler County for mosquito treatment in select service areas (some of which are currently being annexed by East Flagler MCD). An agreement with Flagler County Emergency Management allows the district to capitalize on the department's purchasing power, conducting joint purchases with the county to benefit from bulk purchases. The district also received financial assistance from DEP in FY 2022-23 and FY 2021-22 to reimburse the district for two waste tire collection events.

Unlike the 14 other MCDs concurrently reviewed by TBG, East Flagler MCD does not maintain state-approved status with the Department of Agriculture and Consumer Services (DACS). To have such status, a mosquito control program must submit to the DACS documentation that includes monthly chemical usage reports, monthly funding reports, annual detailed work plan budgets, and annual operational work plans.[7] Obtaining state-approved status allows MCDs to be eligible for state aid from DACS. East Flagler MCD has not held state-approved status with DACS since FY 2019-20. TBG requested, but did not receive documentation that would provide an explanation for the district's change in state-approved status. Due to the discontinuation of this relationship with DACS, East Flagler MCD has not reported annual work plans and budgets or monthly chemical usage and funding reports to DACS. While East Flagler MCD can work on DACS-funded research grants with other organizations, the district cannot currently apply for research grants with the department or directly receive any other funding from DACS. The district's lack of state-approved status constrains the district's ability to access resources from the state that could assist the district.

Resources for Fiscal Year 2021-22

The published FY 2021-22 millage rate established by East Flagler MCD is 0.2575. East Flagler MCD received $2.54 million in revenues, most of which are from ad valorem taxes, and spent $1.89 million in FY 2021-22. East Flagler

[6] EFMCD-Board-Schedule-22-23.pdf (flaglermosquito.com)
[7] Rule 5E-13.022, *F.A.C.*; *Mosquito Control Monthly Activity Report* (FDACS-13652, Rev. 07/13); Information for State-Approved Mosquito Control Programs.

MCD had 26 paid staff members in FY 2021-22, including three commissioners, as well as 28 vehicles, two buildings and a carport, and 143 pieces of equipment (**Table 5**).

East Flagler has not conducted an evaluation of staff, equipment, and resources in relation to their service area expansion in October. They will need to conduct this to have accurate information on how much capacity will be needed to handle the new area.

Table 5. East Flagler MCD Resources for FY 2021-22

Resource Item	FY 2021-22 Amount
Millage Rate	0.2575
FY 2021-22 Revenues	$2.54 million
FY 2021-22 Expenditures	$1.89 million
Number of Paid Staff	26 (includes 3 commissioners and 2 vacancies)
Vehicles	1 helicopter, 1 boat, 20 trucks and vans, 6 utility vehicles
Equipment	78 field equipment, 6 lab equipment, 39 office equipment Surveillance equipment: 20 traps
Facilities	1 facility, 2 buildings, 1 open carport

Source: TBG Work Product, FDOR, East Flagler MCD.

2. Findings

Service Delivery

East Flagler MCD delivers a variety of mosquito control services in several areas of Integrated Pest Management that are within the scope of applicable statutes and rules; other local government entities located wholly or partially within Citrus County MCD do not provide similar mosquito control services.

To assess the delivery of services in the district, The Balmoral Group (TBG) requested information on the geographic characteristics of the district; other local governments to which the district provides services or with which it coordinates efforts; the services provided by the district; similar services provided by other entities; district studies or evaluations of alternative service delivery methods including consolidation of services with other government entities; unique contributions from the district relative to the county or municipalities; local stakeholder perceptions of the relative value of the district's services. In addition, TBG requested information from representatives of the Board of County Commissioners, local health department, and local parks and recreation department on their perceptions of the district's service delivery and efficiency.

Overview of Services

Most mosquito control programs use an Integrated Pest Management (IPM) approach to control mosquito populations, which targets the different stages of a mosquito's life cycle with various prevention and control measures. IPM addresses eight areas. Surveillance of mosquito populations is an essential component of all IPM programs with chemical treatments based on the surveillance findings. IPM can also include source reduction (e.g., container disposal, water/impoundment management), larviciding and adulticiding (using ground and/or aerial treatments), biological and alternative control, and disease surveillance. Research and education are also

important components of IPM programs. See attachment titled, "Integrated Pest Management" for more information. TBG reviewed documentation and interviewed staff and management to assess delivery of services.

East Flagler MCD conducts activities in six areas of IPM. East Flagler MCD's mosquito surveillance activities include ground and aerial surveillance to pinpoint areas of concern. In addition, the district monitors mosquito populations using mosquito trap collection and analysis from more than a dozen sites. Centers for Disease Control and Prevention (CDC) traps are run four days per week, resulting in 3,536 collections per year, while BG-Counter traps are collected daily. East Flagler MCD also assesses landing rate counts (i.e., the number of times a mosquito lands on a person in a minute) to monitor mosquito populations, but has discontinued the sentinel chicken program at this time. District staff reported that the program was discontinued as it provides no usable operational information due to small sample size, limited distribution of the flocks, long turn-around time for confirmed results, and the location of the flocks being in areas where regular mosquito control activities limit the abundance and persistence of infected mosquitoes.

Source reduction activities include resident service request investigations in residential and public areas and the ongoing treatment of the distinct habitats of East Flagler MCD, including saltmarsh, urban, and freshwater areas. The most common forms of source reduction include disposal of waste products like tires and other containers that hold water, and the development of mosquito management plans to address both natural and created wetlands.

Mosquito larvicide treatment by truck or helicopter is conducted to prevent adult mosquitoes from emerging. Aerial treatment is used for larger, more remote areas of the district that would be difficult to spray by truck or by foot. Soil bacterium including Bacillus thuringiensis var. israelensis (Bti) and spinosad, larviciding oils like CocoBear, and insect growth regulators like methoprene are used to arrest normal mosquito larvae development. Resources are allocated based on internal thresholds of landing rate and mosquito trap counts, as well as resident tips. Spray trucks are used for moderate levels of adult mosquito activity, while helicopter spraying is used at higher levels of activity. However, larvicide efforts are the main priority to avoid the occurrence of adult mosquitoes in the first place.

East Flagler MCD's adulticiding activities are carried out by truck, ATV, or helicopter at night when adult mosquitoes are most active, most residents are inside, and non-target species are least active. Adulticide activities are only carried out as a final recourse with the goal of curbing mosquito abundance and providing temporary relief to residents.

East Flagler MCD's website includes mosquito information, tips, and a description of operations including examples of how residents can reduce mosquito production in residential areas. In addition, the district staff provides outreach and education activities by making presentations to K-12 schools with content tailored by grade level to explain the life cycle of mosquitoes and the various mosquito habitats, and providing information on how to help prevent mosquito proliferation and protect against mosquito bites. Other interactions with the public typically occur through resident service requests, public commissioner meetings, student internships, and other community engagement events. In addition, the district has conducted public outreach as part of its strategic planning process to discuss and obtain public feedback on the district's expansion of service areas, types of services, staffing, and equipment. More details about the strategic plan can be found in the Goals, Objectives, and Performance Measures and Standards section of the report.

Activities conducted by East Flagler MCD are summarized in **Table 6**.

Table 6. East Flagler MCD Services Overview

Integrated Pest Management Service	East Flagler MCD Services Provided
Mosquito Surveillance	Ground and aerial surveillance including trap collection and landing rate counts to analyze and identify areas of concern
Disease Surveillance	Monitoring mosquito-borne diseases with sample collection from traps
Source Reduction	Ditch maintenance, diking, elimination of the amount and length of time that water can stand in low areas
Larviciding	Application of larvicides using trucks or helicopters, including soil bacterium (Bti, spinosad), oils (CocoBear), and insect growth regulators (methoprene)
Adulticiding	Delivery of ultra-low volume (ULV) insecticide by truck, ATV, or helicopter as needed
Outreach and Education	Education and outreach facilitated through several avenues, including schools, resident service requests, and public meetings on expanding operations and capacity for a growing and developing service area

Source: TBG Work Product, East Flagler MCD.

Analysis of Delivery of Services

East Flagler MCD delivers several mosquito control services across six of the eight areas of IPM that are within the scope of applicable statutes and rules. East Flagler MCD provides services in six of the eight areas of IPM as described above, and all district services are directed toward the abatement and control of mosquitoes. East Flagler MCD is focused fully on operations and places no priority on research. Plans are set in the Five-Year Strategic Plan to adopt a "one truck" strategy to minimize fleet size while still maintaining capacity, as well as acquiring new types of equipment and technology to stay up-to-date on the most efficient options available. Electric vehicles and automated service-delivery processes are the primary technologies being considered for implementation. East Flagler MCD also aims to expand their current facility as well as plan for future facilities as the area grows in population, the boundaries of the district are expanded, and more intensive mosquito control efforts are required. No activities were noted that fall outside of East Flagler MCD's applicable administrative code or statute.

East Flagler MCD conducts several surveillance and monitoring activities to determine where and when to treat for mosquito control. The district monitors daily trap counts, which areas of East Flagler MCD are being sprayed from week to week, total acreage treated with adulticide or larvicide, and other measures. Preventative measures are based upon monitoring water levels and cycles in the saltmarsh areas of the district. East Flagler MCD also maintains GIS maps of known production sites to help monitor and control mosquito populations. Additionally, East Flagler MCD uses camera arrays, helicopter monitoring, and soil moisture and tide gauge data to monitor when areas are most active with mosquitoes.

East Flagler MCD's goal of expanding its service area is expected to be completed in October 2023, in compliance with the order entered by Flagler County BOCC on November 21, 2022, while expansion of service types is ongoing. There are likely to be different phases of district geographic and service type expansion, including updating tax rolls, acquiring additional equipment and personnel, and monitoring residential development. Additional

mosquito control measures may be needed due to the City of Palm Coast's plans to attract sporting events and visitors to the area.

East Flagler MCD conducts source control, including removal of containers such as tires that can create larval habitats. Tires create problematic mosquito-producing habitats that are difficult to manage through routine chemical applications but can be managed through proper disposal. East Flagler MCD staff reported that the district collected approximately 350 tires during FY 2022-23 and approximately 170 tires in FY 2021-22 at a cost of $2,765 and $1,347, respectively. The district received a DEP grant to host events to collect the tires, and the grants covered the total costs of tire collection and disposal in each of these two fiscal years. Districts like East Flagler MCD would benefit from additional sources of funding to help incentivize continued collection of waste tires in the county.

TBG requested information from representatives of the Board of County Commissioners, local health department, and local parks and recreation department on their perceptions of the district's service delivery and efficiency but did not receive any stakeholder responses after multiple contacts. The mosquito control expert retained by TBG for this review did not identify any alternative methods for providing the district's services that would reduce the district's costs or improve the district's performance.

Comparison to Other Services

Other local government entities located wholly or partially within East Flagler MCD do not provide similar mosquito control services. TBG interviewed staff and reviewed documents available online to establish if services could be or are redundant to or overlapping with county or municipal government services. Services similar to those provided by East Flagler MCD are not provided by Flagler County nor by municipal governments located within the district.

Considerations for Consolidations

Consolidation of operations is not recommended for East Flagler MCD based on the findings of this review. East Flagler MCD operates throughout the populated eastern portion of Flagler County and no other comparable service has been identified for consolidation in the county. In addition, the Flagler County BOCC voted by resolution on November 21, 2022, to expand the service area of the district effective October 2023.

Resource Management

East Flagler MCD has demonstrated efficient and effective resource management; resource needs will continue to grow as the district expands to meet the needs of the area.

To assess the district's resource management, TBG analyzed information on revenue sources, revenue and expenditure trends and their possible causes; analyzed staffing trends and their possible causes; requested data on services delivered by district staff vs third-party contractors for the current and last three fiscal years; analyzed equipment inventory and capital investment trends; reviewed the activities the district conducts to manage costs and plan personnel; requested information on resident feedback survey data related to finances and spending by the district; reviewed audits; and interviewed district staff and board members.

Current and Historic Revenues and Expenditures

Revenues and expenditures have been increasing steadily with revenues exceeding expenditures every fiscal year in the review period, and with East Flagler MCD's expansion, revenues and expenses will likely continue to increase. To review the current and historic revenues and expenditures of East Flagler MCD, TBG requested and received financial information from FY 2019-20 through June of FY 2022-23. In addition, TBG interviewed East Flagler MCD staff and reviewed documentation provided from East Flagler MCD's accounting and operation systems.

East Flagler MCD's fiscal year begins on October 1st and ends September 30th. East Flagler MCD's funding is primarily comprised of ad valorem taxes. The Flagler County Property Appraiser, with approval from FDOR, certifies the county's tax roll each year and provides the information to the Flagler County Tax Collector, which in turn collects monies authorized under the district's taxing authority. Millage rates are set each year by East Flagler MCD's Board of Commissioners.

Revenues increased steadily from $2.13 million in FY 2019-20 to $2.54 million in FY 2021-22, with the vast majority of revenues in each year coming from ad valorem taxes and a relatively small percentage from interest earnings, equipment sales, and other miscellaneous sources (**Table 7**). Expenditures have declined slightly during the same period from $1.95 million in FY 2019-20 to $1.89 million in FY 2021-22 Revenues exceeded expenditures in all fiscal years.

East Flagler MCD revenues should continue to rise as increasing millage rates and an expansion of the service area brings in new taxable parcels and accounts. As shown in **Table 1**, the FY 2022-23 millage rate rose to 0.2975 from 0.2575 in FY 2021-22. The corresponding increase in taxable value for properties in the service area is estimated at 17%. East Flagler MCD's service area expansion, which will take place before the next fiscal year begins, will likely affect millage rates in the future as well. In addition to the service area expansion, the existing service area is developing rapidly and will require greater service capacity. It is uncertain whether the continued increases in revenues due to district expansion will be sufficient to cover higher future costs due to expanded service needs.

Table 7. Revenue and Expenditures

Revenue and Expenditures (in $Mil.)	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[1]
Revenues[2]	**$2.13**	**$2.15**	**$2.54**	**$3.45**
Ad Valorem	$2.08	$2.13	$2.51	$3.34
Other Sources	$0.05	$0.02	$0.04	$0.11
Expenditures[2]	**$1.95**	**$2.07**	**$1.89**	**$1.76**
Administrative Costs	$0.38	$0.39	$0.37	$0.25
Direct Program and Activity Costs	$1.58	$1.67	$1.52	$1.51
Other Expenditures	$0	$0	$0	$0

Source: East Flagler MCD.
[1] 2023 YTD through June.
[2] Totals might not add up due to rounding.

Administrative Costs

Expenditures on administrative staff and other costs increased 17% from FY 2019-20 through FY 2021-22, accounting for about 21% of total expenditures on average. As requested by TBG, East Flagler MCD provided a breakdown of total expenditures by administrative cost category for FY 2019-20 through June of FY 2022-23.

Expenditures fell into several categories, with the highest amounts of administrative costs during the review period including the indirect Personal Services and Operating Expenses categories (**Table 8**). In FY 2021-22, costs increased 12% year-over-year and, with the exception of administrative Supplies and Materials, all categories increased at a higher rate than the previous fiscal year. Through June of FY 2022-23, total administrative costs were $402,190.

Table 8. Administrative Cost Data

Expenditure Category[1]	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[2]
Personal Services	$184,218	$191,654	$206,906	$157,340
Personal Service Benefits	$24,032	$26,537	$50,801	$38,247
Operating Expenses	$140,353	$133,541	$142,327	$176,652
Travel, Utilities, Repair, & Maintenance	$17,110	$25,562	$27,170	$28,966
Supplies and Materials	$9,611	$16,998	$12,998	$985
Land and Buildings	-	-	-	-
Total	**$375,325**	**$394,292**	**$440,203**	**$402,190**

Source: TBG Work Product, East Flagler MCD.

[1] Categorization of administrative costs was completed by East Flagler MCD based on an outline provided by TBG to ensure consistency across reports.

[2] 2023 YTD through June.

Direct Program Costs

Expenditures on direct program costs varied between $1.6 and $1.7 million from FY 2019-20 through FY 2021-22, accounting for about 79% of total expenditures on average during this timeframe. As requested by TBG, East Flagler MCD provided a breakdown of total expenditures by direct program costs for FY 2019-20 through June of FY 2022-23.

In contrast to administrative costs, direct program costs have not steadily increased over the review period (**Table 9**). Direct Personal Services and Supplies and Materials are the major cost categories, each topping $500,000 in some years. In FY 2021-22, Travel, Utilities, Repair, & Maintenance expenses increased significantly due to a 168% increase in equipment maintenance costs. In that same fiscal year, supplies and materials saw a significant decline due to a 74% drop in chemicals, solvents, and additives costs. Through June of FY 2022-23, total direct costs were $1.36 million.

Table 9. Direct Program Cost Data

Expenditure Category[1]	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[2]
Personal Services	$422,779	$523,147	$599,414	$505,451
Personal Service Benefits	$159,537	$200,883	$142,851	$201,297
Operating Expenses	$5,693	$7,780	$7,976	$4,439
Travel, Utilities, Repair, & Maintenance	$216,210	$203,697	$309,772	$190,211
Supplies and Materials	$506,758	$573,124	$272,043	$275,306
Capital Outlay	$266,193	$162,380	$116,561	$182,959
Total[3]	**$1,577,169**	**$1,671,012**	**$1,448,617**	**$1,359,663**

Source: TBG Work Product, East Flagler MCD.
[1] Categorization of direct program costs was completed by East Flagler MCD based on an outline provided by TBG to ensure consistency across reports.
[2] 2023 YTD through June.
[3] Totals might not add up due to rounding.

Contracts for Services

Contracted service costs were relatively consistent during the review period. TBG reviewed documentation provided by East Flagler MCD to determine what services were contracted rather than being conducted in-house, as well as any services East Flagler MCD is contracted to provide to other entities.

Based on East Flagler MCD's income statements, contracted service expenses have been relatively stable throughout the review period. In addition, East Flagler MCD has received miscellaneous contracted revenues during the review period. It has provided Volusia County with larviciding services under an emergency agreement in the past as Volusia County was without aerial support at the time. East Flagler MCD is also contracted by Flagler County for treatment in select service areas (some of which are currently being annexed by East Flagler MCD) (**Table 10**).

Table 10. Summary of Contracted Services

	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[2]
Revenues				
Miscellaneous Revenues	$23,057	$7,670	$17,507	$14,540
Expenses				
Professional Services	-	$25	$2,013	-
Legal & Engineering Services	$36,000	$36,000	$36,000	$27,000
Accounting & Auditing	$32,700	$33,800	$33,100	$28,200
Other Contractual Services	$5,328	$6,415	$6,791	$4,079
Total	**$74,028**	**$76,240**	**$77,904**	**$59,279**

Source: TBG Work Product,
[1] Categorization of contracted services costs was completed by East Flagler MCD based on an outline provided by TBG to ensure consistency across reports.
[2] East Flagler MCD. 2023 YTD through June.

Staff

East Flagler MCD employed a variety of administrative, technical, and field staff positions in FY 2022-23. In FY 2022-23, East Flagler MCD had 27 paid, in-house staff positions available, including three commissioners, administrative and management staff, as well as several technical and field staff including field technicians, pilots, and seasonal spray technicians (**Table 11**).

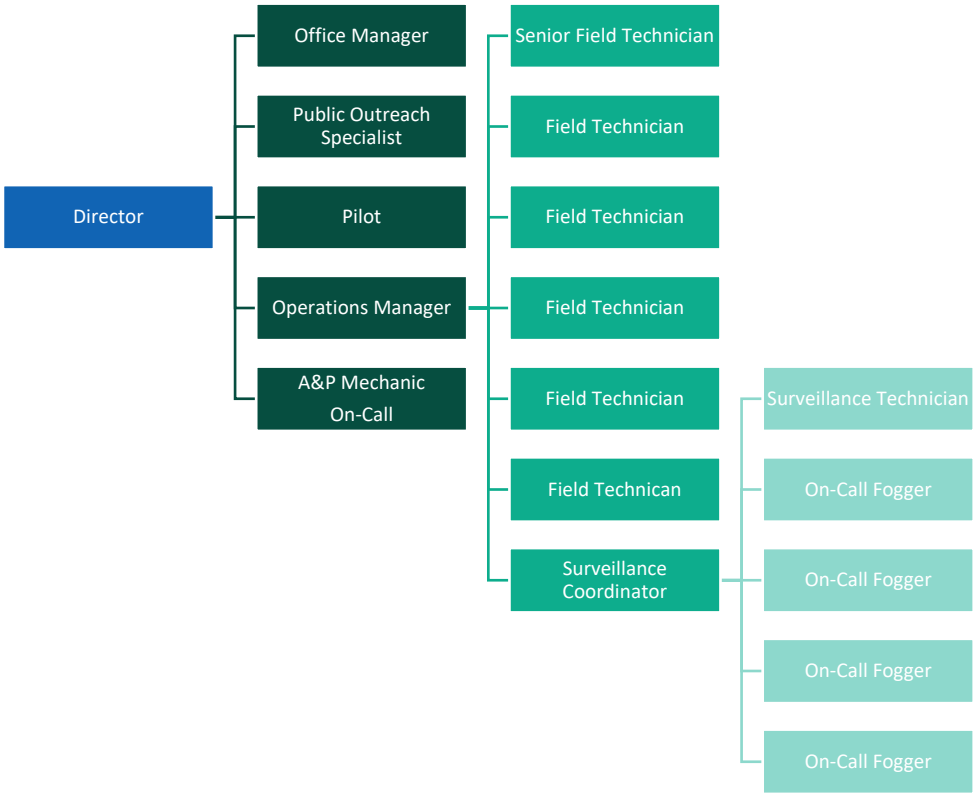
Table 11. East Flagler MCD Staff Positions

• Commissioners • Director • Senior Field Technician • Surveillance Technician • PT A&P Mechanic	• Operations Supervisor • Pilots • Surveillance Coordinator • Seasonal Spray Techs	• Office Manager • Public Outreach Specialist • Field Technicians • FT Seasonal Field Technicians

Source: East Flagler MCD Detailed Work Plan filed with DACS.

An organizational chart is provided in **Figure 3**.

Figure 3. East Flagler MCD Organizational Chart



Source: East Flagler MCD.

Analysis of Program Staffing Levels

East Flagler MCD staffing levels have remained fairly stable over the current and past three fiscal years and appear to be appropriate for the scale and scope of the district's operations; however, increased staffing needs should be considered as the district continues to grow. TBG examined staffing information provided by East Flagler MCD and interviewed staff.

In FY 2022-23, East Flagler MCD had 25 total available positions, 23 of which were filled. Of the occupied positions, 15 were filled by full-time employees, three were commissioners, and five were part-time or seasonal positions.

Two of the 25 positions were reported as vacant: one full-time pilot and one seasonal field technician. East Flagler MCD has been looking to hire another full-time pilot for their staff but has not found a suitable candidate at this writing.

Full-time and part-time staffing levels have grown slightly over the last few years from 17 staff members in FY 2019-20 to 20 in FY 2022-23, with vacancies remaining at two or three per year (**Table 12**). East Flagler MCD has similar staffing in comparison to other MCDs of similar expenditure level such as Beach MCD or South Walton MCD, which had 31 and 18 total positions in FY 2022-23, respectively.[8] Continued growth of staff may be needed to handle the increased service area and population of East Flagler MCD. High school volunteers are often used at events such as the "Touch a Truck" event and various library events, but exact counts are not tracked by the district. Although contracted employees are not currently utilized by the district, East Flagler MCD's strategic plan includes plans to outsource staff who perform non-core functions.

The average turnover rate for the past four fiscal years is 8%, with East Flagler MCD having one or two full-time employee separations per year between FY 2019-20 and FY 2021-22. Total salaries (excluding commissioners) have increased by 9% from $597,397 in FY 2019-20 to $653,191 in FY 2022-23. The share of salaries that are direct versus administrative has also increased slightly every year, with direct costs increasing from 71% in FY 2019-20 to 77% in FY 2022-23.

Table 12. East Flagler MCD Staff Counts

Employee Counts	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[1]
Commissioners	3	3	3	3
Full Time	11	11	15	15
Part Time/Seasonal	6	6	6	5
Contracted	0	0	0	0
Volunteers	Unknown	Unknown	Unknown	Unknown
Vacancies	2	3	2	2
Total Positions	**22**	**23**	**26**	**25**
Annual Termination	1	1	2	0
Turnover Rate	9%	8%	13%	0%

Source: TBG Work Product, MCD.

[1] 2023 YTD through April.

Equipment and Facilities

Equipment and facilities of East Flagler MCD are sufficient for current operations compared to similarly sized mosquito control districts and are being serviced regularly to maintain and maximize efficiency in operational capabilities. Plans are in place to expand capacity as their service area grows. In addition, a replacement helicopter is needed to avoid downtime and costly maintenance. TBG analyzed documentation provided by East Flagler MCD and interviewed staff to review any trends or changes in the level of equipment and facilities purchased or maintained over the review period.

[8] TBG reviewed FY 2021-22 expenditures and total available staff positions across the 15 MCDs as part of this review and categorized districts as follows: very small districts are those with expenditures less than $1 million and staff under 10 (Buckhead Ridge, Fort Myers Beach, and Moore Haven MCDs); small districts are those with expenditures between $1 and $5 million and staff between 11 and 49 (Amelia Island, Beach, Citrus, East Flagler, Indian River, and South Walton County MCDs); moderately-sized districts are those with expenditures between $5 and $10 million and staff between 11 and 49 (Anastasia, Manatee, and Pasco MCDs); and large districts are those with expenditures over $11 million and more than 50 staff positions (Collier, Keys, and Lee MCDs).

East Flagler MCD operates out of one facility, comprised of two buildings and one open carport for vehicle storage, which is comparable to similarly sized districts. The facility was built on Flagler Executive Airport property and is leased to East Flagler MCD by the Federal Aviation Administration. In FY 2021-22, East Flagler MCD owned one 18-year-old helicopter, one boat, 20 trucks and six utility vehicles (**Table 13**). East Flagler MCD also owned 123 pieces of equipment, including 78 items used in the field, 6 pieces of lab equipment, and 39 computers or other office equipment.

In FY 2021-22, East Flagler MCD's agreement with Flagler County Emergency Management allowed for the purchase of a mosquito trap equipped with technology to autonomously count mosquitoes. The district also implemented remote monitoring (cameras, soil moisture probes, and pressure transducers) in saltmarsh habitats to have a better understanding of which areas should be prioritized and by doing so, improve mosquito surveillance.

East Flagler MCD has stated that they are looking for a replacement helicopter due to the age and maintenance requirements of their current model. The district plans to upgrade other equipment as well.

In comparison to other MCDs of similar expenditure level and staff sizes such as Beach MCD or South Walton MCD, East Flagler is similarly equipped for its purposes of mosquito control. In FY 2022-23, Beach MCD had two helicopters, 18 trucks and vans, and two utility vehicles. South Walton also had 18 trucks and vans, and five utility vehicles. East Flagler falls slightly ahead, with one helicopter, 21 trucks and vans, and seven utility vehicles in the same fiscal year.

Table 13. District Vehicles, Equipment, and Facilities

	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[1]
Vehicles	**24**	**26**	**28**	**30**
Helicopters	1	1	1	1
Boats	1	1	1	1
Trucks and Vans	16	18	20	21
ATVs and Utility Vehicles	6	6	6	7
Equipment	**106**	**117**	**123**	**124**
Field Equipment	68	75	78	79
Lab Equipment	6	6	6	6
Office Equipment	32	36	39	39
Facilities	**1**	**1**	**1**	**1**
Buildings	3	3	3	3

Source: TBG Work Product, East Flagler MCD.

[1] 2023 YTD through April.

Surveillance equipment is reported separately in **Table 14**. East Flagler MCD makes use of mosquito traps, which are an important part of mosquito surveillance. Of the 20 traps utilized by East Flagler MCD, 17 are CDC Light Traps and three are BG-Counter Traps. As mentioned elsewhere in the report, East Flagler MCD has discontinued the sentinel chicken program at this time.

Table 14. Surveillance Equipment

Surveillance Equipment	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[1]
Mosquito Traps	**20**	**20**	**20**	**20**
CDC Light Traps	17	17	17	17
BG-Counter Traps	3	3	3	3
Sentinel Chicken Coops	**0**	**0**	**0**	**0**
Sentinel Chickens	**0**	**0**	**0**	**0**

Source: TBG Work Product, East Flagler MCD.

[1] 2023 YTD through April.

Strategic or Other Formal Plans for the District's Future

East Flagler MCD has adopted a five-year strategic plan to improve its practices and expand capacity for its service area. East Flagler MCD has a five-year strategic plan that is updated regularly. The most recent 2022 update details the main goals of East Flagler MCD and what measures are currently being taken to achieve them.

In addition, East Flagler MCD raised millage rates in FY 2022-23 to facilitate the purchase of a new helicopter. Aerial spraying is an important part of East Flagler MCD services and too much downtime and ongoing maintenance costs negatively impact the program.

East Flagler MCD has not conducted staff and equipment evaluations to address expansion of their service area. This will be needed as it will allow East Flagler MCD to accurately know their capacity and where this capacity needs to grow to handle the expanded service area.

Previous Performance Reviews, Financial Audits, and Resident Feedback Surveys

East Flagler MCD has not conducted performance reviews, and reported residential feedback is minimal; there were no material findings nor weaknesses in internal controls identified in the FY 2019-20 through FY 2021-22 audits. Analysis of East Flagler MCD's financial audits was conducted for FY 2019-20 through FY 2021-22, as provided by the district and confirmed with the annual reports published on the Florida Auditor General's website.[9]

Residential feedback was sought in relation to the expansion of their service area at a public workshop in August 2021. Residents, who wished to speak, were each provided three-minutes. Ten residents attended. Approximately, half supported the expansion while the other half did not. No additional public hearings have been held to specifically address the expansion of East Flagler MCD.

East Flagler MCD has not used resident surveys to collect feedback, nor were other performance review documents identified. Interaction with the public is typically through public commissioner meetings, resident service requests, and public outreach and education.

[9] Florida Auditor General - E-Files (flauditor.gov)

Analysis of Management Reports/Data and Performance Information

East Flagler MCD recently started tracking performance metrics and other information per the district's strategic plan. To assess management reporting and performance information, TBG reviewed documentation provided by East Flagler MCD, interviewed staff, and reviewed online documentation.

East Flagler MCD routinely reports program activities and outcomes to the board of commissioners and has summarized the district's accomplishments and milestones from FY 2021-22 in an Annual Operations Report. With the advent of their latest strategic plan, additional metrics will be tracked to measure performance. However, this plan has not been in place long enough for East Flagler MCD to make significant progress on these goals.

Evaluation of Cost, Timing, and Quality of Current Program Efforts

The recent formalization of goals and objectives in East Flagler MCD's strategic plan should improve tracking of program costs and service timing and quality. To assess cost, timing, and quality of program efforts, TBG reviewed documentation provided by East Flagler MCD and interviewed staff.

East Flagler MCD tracks water levels and soil moisture by helicopter and camera array in areas that are common for mosquito production. This information is then compiled to give East Flagler MCD the best information needed on when and where to spray. In addition, mosquito traps are monitored on a daily and weekly basis to ensure timely response to growth in mosquito populations. Resident service requests further indicate areas of need.

East Flagler MCD has also outlined a plan to replace their 18-year-old helicopter. Increasing maintenance costs and service outages due to down time led East Flagler MCD to raise the millage rate in FY 2022-23 to fund the purchase. The existing and expanded service area that will come online in FY 2023-24 will benefit from a more reliable means of aerial spraying.

The development of a strategic plan gives East Flagler MCD direction and objective measures to work toward in the future. Historical financial information shows that East Flagler MCD has consistently operated with revenues exceeding expenditures in the current and past three fiscal years. In addition, audited financial reports have consistently found no issues.

Goals, Objectives, and Performance Measures and Standards

East Flagler MCD has established several goals and objectives that address its statutory purpose but information on associated performance measures and standards developed by the district is limited; the district has kept arbovirus counts at zero for the current and past three calendar years and responded to all service calls in the current and past three fiscal years.

To assess the district's goals, objectives, performance standards, and performance measures, TBG requested district's charter; requested and reviewed the district's strategic plan and the last three years of annual reports; requested information on performance measures and standards and records of current and previous three fiscal years' measures, standards, and records of success or failure to meet the standards and evaluated the district's actual performance in meeting its goals and objectives. TBG assessed whether performance measures and

standards are relevant, useful, and sufficient to evaluate the performance and costs of the programs and activities, whether they are being met, and whether they need to be revised. TBG requested and reviewed audits and requested performance reviews; requested district assessments of why (if applicable) the district failed to meet performance measures and standards and/or goals and objectives; and requested information from the district on actions taken to address and prevent such failures in the future. In addition, TBG interviewed district staff and relevant local government entities about district performance and requested any available results of district-generated resident feedback surveys conducted during the current and previous three fiscal years.

Goals

East Flagler MCD has several general goals for the purpose of mosquito control, as outlined in their strategic plan. Goals of East Flagler MCD include:

- Monitoring and controlling the population of pestiferous and disease-transmitting mosquitoes to baseline levels to prevent disease and enhance quality of life.
- Public outreach and education.
- Expansion of the service area and service types including planning for and acquiring additional equipment and personnel to deliver expanded services and developing additional control measures in recreational areas.
- Improved continuity of operations, equipment, and facilities.

Objectives

East Flagler MCD has several objectives outlined in their strategic plan. Objectives of East Flagler MCD include:

- Mapping the saltmarshes in geographic information systems (GIS) and monitoring the wet/dry status of larval sites in real time to track the water cycle and apply larvicide at the optimal times.
- Surveying adult mosquito populations and applying control measures to prevent the emergence of adult saltmarsh mosquitoes.
- Surveillance and analysis of mosquito production sites, using safe and functional equipment and pesticides, and remote technology to understand hydrologic cycles and soil moisture.
- Ensuring staff is experienced and trained and developing policies to attract and retain staff.
- Ensuring equipment is reliable and sufficient to quickly respond to surges in mosquito populations.
- Community outreach to include participating in public events, providing educational materials, creating educational social media content, partnering with schools, and working with local officials to help residents understand the services of the MCD.
- Preparing for increased development and the increased needs of a larger service area, including providing new control measures and expanding current equipment capacity and facilities.
- Updating current equipment, eliminating outdated equipment.

The problems addressed by the district's goals and objectives relate to controlling mosquito populations in the district, reducing environmental impacts, and communicating effectively with the public. In an attempt to reduce the use of harsher adulticides, East Flagler MCD concentrates on larval habitats to prevent their emergence as adults into the environment. In addition, larvicides used do not pose unreasonable risks to human health according to the U.S. Environmental Protection Agency.

The expected benefits of the district's goals and objectives are that the application of specific IPM practices and technologies will effectively manage mosquito populations in the district, that use of technology will reduce environmental impacts, and that communication with the public will improve through various outreach and communication activities. Some expected benefits of reducing mosquito populations are the prevention of disease, including serious illnesses like encephalitis, West Nile virus, Zika virus, yellow fever, and dengue fever. The general public welfare is also improved with the reduction of nuisance mosquito populations.

Performance Measures and Standards

East Flagler MCD monitors performance using information on responses to service calls and arbovirus prevalence in the district; the district reported that it has additional performance measures and standards that it will use in the future but did not provide information on such measures or standards. TBG reviewed documents prepared by East Flagler MCD, interviewed staff, and reviewed records provided by the district or available online through the Florida Department of Health (DOH) website. The district reports that it recently began tracking data on other performance measures and will report this data during their operations updates and future annual reports. However, the type of data the district is tracking was not provided to TBG, and it is therefore unknown what performance measures and standards the district has developed. East Flagler MCD performance measures and standards that were able to be quantified for this review:

1. **Standard:** Zero human cases or deaths related to arboviruses acquired in Florida and detected in the East Flagler MCD.

   Measure: East Flagler MCD analyzes DOH reports to measure the success of their disease prevention efforts.

2. **Standard:** Address resident requests for mosquito control efforts in a timely manner.

   Measure: All service requests directed to East Flagler MCD are reviewed and responded to. Service requests are received via phone, email, or the website. Starting in 2022, the district has started logging citizen tips on mosquito activity to better track response rates.

Analysis of Goals, Objectives, and Performance Measures

East Flagler MCD has goals and objectives but needs additional performance standards and measures to allow the district to measure progress towards its goals; arbovirus counts have been zero over the review period and the district has consistently responded to service requests. Based on the data reported in this review, East Flagler MCD has effectively curbed mosquito populations that may become a nuisance or a threat to public health within the current and last three calendar years. Only five human arbovirus cases were reported by Florida DOH in Flagler County over the review period, all of which were travel-related and did not originate in Florida. In addition, no human deaths have occurred according to DOH's data. The district has responded to all service calls in the current and past three fiscal years, but the district did not provide data on timeliness of service call responses.

Table 15 illustrates performance measures that were able to be quantified by East Flagler MCD for the current and past three calendar or fiscal years, as applicable, including documented human arbovirus cases from the Florida DOH and district service calls and responses.

Table 15. Performance Measures for East Flagler MCD

Performance Measures	CY 2020[1]	CY 2021[1]	CY 2022[1]	CY 2023[1, 2]
Arbovirus Cases (Florida)	0	0	0	0
Arbovirus Cases (Travel)	0	0	5	0
Arbovirus Deaths	0	0	0	0
	FY 2019-20	**FY 2020-21**	**FY 2021-22**	**FY 2022-23[2]**
Service Calls	202	185	263	356
Service Responses	202	185	263	356

Source: TBG Work Product, East Flagler MCD, DOH.
[1] Florida DOH data is provided by calendar year (CY).
[2] 2023 YTD through April.

A summary of East Flagler MCD's performance measures and a brief assessment of whether standards were met is provided in **Table 16**.

Table 16. Assessment of Performance Measures and Standards for East Flagler MCD

Performance Measure	Performance Standard	Assessment
Human arbovirus disease cases	Zero human cases or deaths related to arboviruses acquired in Florida and detected in East Flagler MCD	Standard met.
Calls received and responded to	Address and respond to all citizen requests for mosquito control efforts in a timely manner	Standard of responding to all service calls was met; unable to assess timeliness of service call responses due to lack of data.

Source: TBG Work Product, based on review of information provided by East Flagler MCD.

Perceptions of the District's Performance by Local Government Stakeholders, Residents, and Other Relevant Local Stakeholders

Perceptions of the East Flagler MCD's performance by stakeholders is limited. TBG reviewed online documentation relating to public information and stakeholder workshops and interviewed district staff to assess public perceptions. East Flagler MCD held a public workshop in August 2021 to gauge public opinion on the expansion of the district. Ten people attended the event and reactions were mixed on the proposed expansion. TBG reached out directly to the Florida DOH in Flagler County and the Flagler County Parks & Recreation for stakeholder input on East Flagler MCD operations, but received no response after multiple attempts.

3. Recommendations

Discussion and Analysis

TBG analyzed findings by fiscal year to determine if revisions to district organization or administration can improve the efficiency, effectiveness, and/or economical operation of the district. TBG recommends a legislative change to allow the district access to solid waste management grant funds, which could help improve the efficiency of the district's operations by reducing costs for an important and never-ceasing source reduction activity of waste tire collection and disposal. TBG also recommends that the district address equipment and staffing needs, re-establish participation with DACS, and develop additional performance measures and standards.

Waste Tire Collection and Disposal Fees: Waste tires are commonly found scattered throughout residential and commercial areas across the state, and the design of tires makes them ideal habitat for mosquito larva, particularly for species of mosquito that are known to be important disease vectors. The removal of waste tires can help reduce populations of these disease-carrying mosquitoes and reduce the threat of diseases like dengue and Zika. However, the problematic mosquito-producing habitats created by waste tires are difficult to manage through routine chemical applications but can be managed through proper disposal.

East Flagler MCD conducts source control, including removal of containers such as tires that can create larval habitat. District staff reported that the district collected approximately 350 tires during FY 2022-23 and approximately 170 tires in FY 2021-22 through waste tire collection amnesty events hosted by the district and at a cost of $2,765 and $1,347, respectively. The district applied for and received financial assistance from DEP to cover the total costs of each of these tire collection events. Although East Flagler MCD has had excess revenues in each of the past three fiscal years, it is important for any public entity like an MCD to keep funding reserves to be prepared for unexpected expenditures that could result from disease outbreaks.

In Florida, DEP regulates the disposal of waste tires by creating requirements for the collection and disposal of waste tires at solid waste management facilities and waste tire processing facilities across the state.[10] These facilities typically charge fees for the disposal of waste tires, which frequently cannot be waived due to bond requirements for the facilities. MCDs must pay these fees if the districts choose to collect and dispose of waste tires.

The state currently collects a waste tire fee of $1 per each new tire sold at retail.[11] These funds are allocated in different amounts defined in statute to various activities related to solid waste management in the state, including funds that DEP is directed to use for general solid waste activities.[12] DEP currently uses a portion of this funding to reimburse counties for hosting waste tire amnesty events during which residents may bring in waste tires for disposal free of charge (businesses are not eligible for participation). DEP opens this opportunity annually from July through May to all counties in the state, and any county may apply for the assistance through the department by providing a scope of work including a description of how the amnesty event will be held, how many tires the district anticipates receiving, and other information. According to DEP representatives, the department advertises this funding opportunity specifically to counties; however, DEP has also allowed MCDs to apply for and receive

[10] Sections 403.717 and 403.718, *F.S.* and Rule Chapter 62-711, *F.A.C.*
[11] Section 403.718, *F.S.*
[12] Section 403.709(1), *F.S.*

the funding for waste tire amnesty events. For example, East Flagler MCD, as discussed above, and Florida Keys MCD, as discussed in its report, received such funding in FY 2022-23.

For districts in which waste tires present a significant mosquito control challenge, the availability of funding to support waste tire abatement would be beneficial. Although DEP in its discretion has allowed MCDs to apply for the waste tire amnesty event funding in the past, advertising for the funding is not directed toward MCDs, and the department is not required by statute to continue to offer such funding in the future. Moreover, some MCDs would benefit from the reimbursement of waste tire disposal fees and other costs incurred by the district for tires collected and disposed of by district staff, in addition to funding for hosting waste tire amnesty events. Facilitating increased and consistent access to waste tire disposal funds by MCDs could help increase tire collections around the state, which has benefits beyond mosquito control, including general pollution reduction and beautification.

To allow regular access to waste tire abatement funding by MCDs, facilitate increased waste tire collection by MCDs around the state as a means of mosquito control, and increase the hosting of events like waste tire amnesty days by MCDs, the Legislature could consider amending section 403.709(1), *Florida Statutes*, to require a portion of the funds currently administered by DEP for solid waste activities to be allocated to waste tire abatement activities by MCDs.

Revisit equipment and staff needs in 2024: As the district incorporates new areas into its service area and more development occurs, East Flagler MCD should review staffing and equipment levels to accommodate the increased demand. Filling vacancies, hiring a second pilot, increasing equipment inventory, and acquiring a replacement helicopter are some suggestions to ensure East Flagler MCD continues to deliver mosquito control services in an efficient and cost-effective manner in the future.

Re-establish Participation with DACS: Florida mosquito control programs that wish to maintain state-approved status with or without state aid are required to submit specific documentation to DACS, which makes them eligible for state grant funding. East Flagler MCD has not held state-approved status with DACS since FY 2019-20, but the district does not explain why this is the case. As a result of the discontinuation of this relationship, East Flagler MCD has not reported annual budgets or monthly updates to DACS, nor does the district provide chemical usage reports. In addition, the district cannot currently receive funding from DACS and therefore has less access to financial resources from the state that could assist the district.

Performance Standards and Measures: East Flagler MCD has developed a formal strategic plan with clear goals and objectives but has not developed formal performance measures and standards tied to each district goal and objective. The district could establish clearly defined performance measures and standards with which to assess its progress towards achieving its goals and objectives.

Florida Coordinating Council on Mosquito Control: During TBG's review of the 15 independent MCDs, TBG found that most districts have not developed sufficient goals, objectives, or performance measures and standards. The Florida Coordinating Council on Mosquito Control was established by the Legislature to foster maximum efficient use of existing resources and to assist entities involved in mosquito control with best management practices. Membership on the council includes the agency heads for the DACS, the DEP, and the Fish and Wildlife Conservation Commission, the State Surgeon General, as well as representatives of federal agencies, the University of Florida Medical Entomological Research Laboratory, Florida MCDs, and others. The Legislature could direct the council to form a subcommittee consisting of mosquito professionals and researchers from around the

state to develop model MCD goals, objectives, and performance measures and standards to assist MCDs with performance monitoring.[13]

Recommendations

Table 17 summarizes recommendations and associated considerations.

[13] Section 388.46, *F.S.*

Table 17. Recommendations with Associated Considerations

Recommendation	Considerations
The Legislature could consider amending section 403.709(1), *Florida Statutes*, to require a portion of the funds currently administered by DEP for solid waste activities to be allocated to waste tire abatement activities by MCDs.	• This recommendation would require a statutory change. • This recommendation would require DEP staff to communicate information about resources available through the department for waste tire collection and disposal assistance to MCDs and might add nominal additional administrative costs for the department. • This recommendation could lead to additional expenditures by the department from the Solid Waste Management Trust Fund; department staff reported that there tend to be unexpended funds from this funding source each year.
East Flagler MCD could revisit equipment and staff needs in 2024.	• This recommendation could include expansion of program staff, equipment, and associated administrative capacity. • Increased funds will likely be needed to handle this expansion. • The expanded tax base can potentially fill in this funding need, but will need to be monitored.
East Flagler MCD could rebuild their connections with DACS and return as a state-approved mosquito control district.	• This recommendation would require additional staff time and would incur additional administrative costs to the district.
The district could formalize additional performance measures and standards that would allow the district to monitor and track progress toward all its goals and objectives. Such performance information would facilitate the district in consistently monitoring its progress.	• This recommendation would require additional staff time and may result in additional administrative costs to the district.
The Legislature could consider amending s. 388.46, *Florida Statutes*, to direct the Florida Coordinating Council on Mosquito Control to form a subcommittee consisting of mosquito professionals and researchers from around the state to develop model goals, objectives, and performance measures and standards to assist MCDs with performance monitoring.	• This recommendation would require a statutory change. • This recommendation would impose additional workload on council members and staff. • The council's membership could assemble a subcommittee with a broad range of expertise that could be ideal for the development of such model performance information. • While this guidance will assist all MCDs, it will be of particular benefit to MCDs that lack staff resources for the development of such performance information.

Source: TBG Work Product, based on review of information provided by East Flagler MCD.

4. District Response

Each independent MCD under concurrent review by TBG was provided the option of submitting a formal response letter for inclusion in the final published report. East Flagler MCD did not provide TBG with a response letter for inclusion in the final report.

Attachment 1

GLOSSARY OF TERMS
MOSQUITO CONTROL DISTRICT REVIEWS

September 2023

Prepared for

The Florida Legislature

Prepared by

The Balmoral Group

165 Lincoln Avenue

Winter Park, FL 32789

Attachment 1

Term	Definition
Adulticide	A chemical that kills adult insects, which is usually applied as a spray; depending on the circumstances, adulticide applications can be made from the ground (most commonly with ultra-low volume spray trucks) or from the air (with either fixed- or rotary-wing aircraft or helicopters)
***Aedes aegypti* mosquitoes**	The primary type of mosquitoes (commonly referred to as yellow fever mosquitoes) that spread Zika, dengue, chikungunya, and other viruses; because these mosquitoes live near and prefer to feed on humans, they are more likely to spread these viruses to humans than other types of mosquitoes
***Aedes albopictus* mosquitoes**	Although competent vectors of dengue, eastern equine encephalitis, and other viruses that affect humans, these mosquitoes (commonly referred to as Asian tiger mosquitoes) feed on animals as well as humans and are, thus, less likely to spread viruses to humans than *Aedes aegypti* mosquitoes
Altosid	The trade name for a mosquito larvicide that contains a synthetic version of the juvenile hormone insect growth regulator methoprene as the active ingredient
American Mosquito Control Association (AMCA)	A professional association that includes individuals working for mosquito control programs, academics conducting research on mosquitoes and other disease vectors, and industry representatives who support mosquito control efforts around the world; the AMCA is active in member training and educating the public on the health importance of mosquito control in the U.S. and beyond; the association is international in scope and has approximately 1,500 members
***Anopheles* mosquitoes**	A genus of mosquitoes with more than 400 species; female mosquitoes in approximately 40 of these species transmit malaria; this is the only genus of mosquitoes that can transmit malaria
Arbovirus	Arthropod-borne viruses that are transmitted to humans primarily through the bites of infected mosquitoes, ticks, sand flies, or midges; includes West Nile virus, eastern equine encephalitis virus, St. Louis encephalitis virus, dengue, chikungunya, Zika, California encephalitis group viruses, and malaria
Arthropod	As defined in Ch. 388, *Florida Statutes*, titled "Mosquito Control," "arthropods" are insects of public health or nuisance importance, including all mosquitoes, midges, sand flies, dog flies, yellow flies, and house flies

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Barrier island	Land that separates the ocean from the mainland; frequently an estuary or a lagoon will be located between the barrier island and mainland
Biogents	A company that produces mosquito traps with the goal of reducing mosquito populations that are produced in container-type habitats
***Bacillus thuringiensis israelensis* (*Bti*)**	A naturally occurring bacteria commonly used as a mosquito larvicide since the 1980s
Chikungunya	A mosquito-transmitted disease caused by a virus that originated in Africa and is transmitted by *Aedes* mosquitoes; symptoms include fever, joint pain, and rash; the name chikungunya comes from the African Makonde language and means "to bend over in pain," which is the stance that many who contract this disease exhibit
***Culex* mosquitoes**	A genus of mosquitoes, several species of which serve as vectors of one or more important diseases of birds, humans, and other animals; the diseases they vector include West Nile virus, Japanese encephalitis, and St. Louis encephalitis.
***Culiseta melanura* mosquitoes**	A species of mosquitoes (commonly referred to as the black-tailed mosquito) that is significant due to its role in the transmission cycle of eastern equine encephalitis virus and potentially West Nile virus; these mosquitoes primarily feed on birds but can spread arboviruses to mammals as well
Dengue	A mosquito-transmitted virus that causes sudden fever and acute joint pain; occasionally occurs in Florida where the mosquito vector is *Aedes aegypti* or *Aedes albopictus*
Dibrom	The trade name for an organophosphate insecticide with the active ingredient naled; used in mosquito control as an adulticide and is typically applied with aircraft
Dipper	An approximately 300 ml container attached to an extension pole that is used to sample for the presence of mosquito larvae in aquatic habitats
Eastern equine encephalitis virus (EEEV)	A mosquito-transmitted virus that is rare but very dangerous when contracted by a horse, human, or other mammal; an average of 13 cases per year were reported in the United States from 2018-2022; approximately 30% of people with EEEV die and many survivors have ongoing neurologic

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	problems; in Florida, the freshwater swamp inhabiting mosquito *Culiseta melanura* is the primary vector of this disease
Fixed-wing aircraft	Commonly referred to as an airplane, these aircraft include stationary wings that provide lift for the aircraft; in mosquito control, these aircraft are commonly used for larvicide and adulticide applications
Florida Coordinating Council on Mosquito Control	An interagency council created in Ch. 388, *Florida Statutes,* in 1986, primarily to address issues concerning mosquito control applications, possible environmental impacts of control actions, and mosquito control management on State of Florida-owned lands
Florida Department of Agriculture and Consumer Services	The state agency that oversees and regulates mosquito control programs in Florida
Florida Department of Environmental Protection	The state agency responsible for coordinating efforts for intensified mosquito control on protected public lands when needed
Florida Department of Health (DOH)	The state agency responsible for implementing the Florida Sentinel Chicken Surveillance Program, reporting weekly data on the prevalence of arboviruses in this state, issuing public health arbovirus advisories and alerts, conducting or participating in arbovirus epidemiologic investigations, distributing weekly arbovirus epidemiology summary reports for mosquito control agencies, healthcare agencies, researchers, and others, and reporting human and animal arbovirus cases to the national arbovirus surveillance database
Florida Fish and Wildlife Conservation Commission	The state agency responsible for maintaining a database that enables the surveillance of bird mortality from arboviruses and for providing assistance and information on arboviruses in wildlife
Florida Medical Entomology Laboratory	A University of Florida laboratory (within the Institute of Food & Agricultural Sciences) that conducts research primarily on the control of mosquitoes; for the past 70 years, research at this lab has been instrumental in assisting mosquito control programs in Florida and elsewhere
Florida Mosquito Control Association (FMCA)	Created in the 1920s, the FMCA is Florida's professional association that includes individuals working for mosquito control programs, academic personnel conducting research on mosquitoes and other disease vectors,

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	and industry, which supports mosquito control efforts in Florida; the FMCA is active in the training of members and educating the public on the public health importance of mosquito control
Florida Sentinel Chicken Arboviral Surveillance Program	A program of the DOH that provides laboratory assistance to local agencies to monitor for the transmission of mosquito-transmitted viruses; sentinel chickens are stationed at locations throughout the state; when the chicken is bit by an arbovirus-transmitting mosquito, the chicken develops antibodies to the virus (the chicken does not become sick and cannot spread the virus to other mosquitoes); blood samples obtained from the sentinel chickens are submitted to DOH's lab in Tampa to be examined for the presence of antibodies; when present, the results indicate that arbovirus-transmitting mosquitoes are circulating in the location, enabling the increase of mosquito control efforts to reduce the risk of humans and animals from becoming ill
Genetically modified mosquitoes	*Ae. aegypti* mosquitoes that have been genetically modified to carry two genes: 1) a self-limiting gene that prevents female mosquito offspring from surviving to adulthood; and 2) a fluorescent marker gene that glows under a special red light, thereby allowing researchers to identify the genetically modified mosquitoes in the wild; because the female offspring die before becoming adults, the population of *Ae. aegypti* mosquitoes decreases
Geographic Information System (GIS)	Integrated computer hardware and software that stores, manages, analyzes, and visualizes geographic information
Good Laboratory Practices Program (GLP)	The goal of GLP is to ensure the quality and integrity of test data related to non-clinical safety studies
Granular application	Granular applications of chemicals differ from liquid applications by having a solid particle carrying the insecticide, which can better penetrate vegetation; this application is primarily used for larvicides to deliver mosquito toxin to the water where mosquito larvae are developing
Impoundment	Impoundments along Florida's central-east coast were created in the 1950s and 1960s by building earthen dikes around salt marshes known to produce mosquitoes; this allows the mosquito control program to manage the water level within the impoundment to prevent saltmarsh mosquitoes from laying

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	their eggs in these areas, thus effectively reducing their populations with a minimum need for pesticides; approximately 40,000 acres of impoundments were constructed from Volusia County south to Martin County; the impoundments remain a source reduction control method in the region
Landing rates	A surveillance method to determine the extent of a mosquito problem, where a person stands in a specific location and counts the number of mosquitoes that land on them within a designated period (such as 60 seconds)
Larvicide	A chemical that kills insects in their larval stages; for mosquitoes, larvicide must be introduced into the water where the larvae are developing; depending on the circumstances, larvicide applications can be made from the ground or from the air with either fixed- or rotary-wing aircraft or drones
Light Detection and Ranging (LiDAR)	A remote sensing technology used to precisely detect objects, such as mosquitoes, in real space
Malaria	A life-threatening illness transmitted primarily in tropical locations by female mosquitoes in the genus *Anopheles* primarily in tropical locations; symptoms include fever, headache, and chills and usually occur within 10-15 days after a bite
Methoprene	A synthetic juvenile hormone, which is an insect growth regulator, that has been used as a larvicide since the mid-1970s
Millage	A tax rate on property expressed as the number of dollars assessed for each $1000 of property value; for example, the property owner of a house valued at $250,000, which is assessed at a millage rate of 1.0, would be charged $250
Mosquito Control District	A local government entity enabled through a voter-approved local or state legislative act to provide mosquito control services in a geographically defined area
Mosquito counts	Surveillance of mosquito populations using a variety of techniques (*e.g.*, traps or landing rates); this term is usually used in reference to adult mosquitoes rather than immature ones
Natular	The trade name for a larvicide that includes the bacteria spinosid as its active ingredient

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Nuisance mosquito	A term used to designate a mosquito that typically does not transmit a pathogen such as a virus; these mosquitoes are in contrast to disease-transmitting mosquitoes that are readily capable of transmitting a pathogen
Pest resistance	The situation in which mosquitoes are no longer killed by the standard dose of an insecticide or manage to avoid coming into contact with the insecticide
Pyrethrum	A biochemical derived from a chrysanthemum plant that contains insecticidal properties; typically used in mosquito control as an adulticide
Rotary-wing aircraft	Aircraft that use a rotary blade rather than wings; a helicopter is the most common example
Rotational impoundment management	A management technique common in saltmarsh impoundments along Florida's Indian River Lagoon where the impoundment is artificially flooded during part of the spring and summer to prevent mosquitoes from laying their eggs in the marsh and is opened for the remainder of the year through culvert pipes to provide a hydrological connection between the impounded marsh and adjacent estuary or lagoon
Saint Louis encephalitis virus	A virus most commonly transmitted by *Culex* mosquitoes that can affect the central nervous system when a human is infected
Source reduction	Refers to the elimination of habitats that can produce mosquitoes; ranges from the proper disposal of waste containers to the complicated management of impoundments
Spinosid	A naturally occurring bacteria that contains insecticidal properties; is commonly applied as a larvicide; Natular is a commercial product that uses spinosid as its active ingredient
Sterile Insect Technique	A method whereby male insects are sterilized by radiation or other means; when the sterilized male mates with the female insect, viable offspring are not produced
Subcommittee on Managed Marshes	An interagency committee created in 1986 by the Florida Legislature in Ch. 388, *Florida Statutes,* to promote the wise management of Florida's wetlands for the mutual benefit of mosquito control and environmental enhancement
Ultra-low volume	A technique to dispense extremely small droplets of insecticide; while historically used for adulticiding, in some instances the technique is now used for larviciding

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United States Department of Agriculture (USDA)	Through its national Agricultural Research Service, the USDA participates in Florida mosquito control efforts largely with the Center for Medical, Agricultural and Veterinary Entomology, a laboratory in Gainesville, Florida, that conducts research on the biology and control of mosquitoes and other insects
United States Environmental Protection Agency	The federal agency that regulates mosquito control in Florida primarily through their approval and enforcement of chemical labels for insecticides
Unmanned Aerial System (UAS)	Aerial vehicles and associated equipment that do not carry a human operator and are remotely piloted or fly autonomously; drones are an example of a UAS
Vector	A living organism that transmits a pathogen (*e.g.*, virus, plasmodium, nematode) from an infected animal to a human or another animal; mosquitoes are an example of a vector
Vector surveillance	Monitoring for vectors that can be accomplished in several ways (e.g., various types of traps or landing rates)
Waste tires	Vehicle tires that are no longer of value and that have been improperly disposed in a manner that allows water to collect in the tires; some species of mosquitoes (e.g., *Aedes aeypti* or *Aedes albopictus*) lay their eggs in the standing water where the immature mosquitoes will develop to adulthood
Water management	In mosquito control, this term refers to a source reduction technique to minimize the production of mosquitoes in a particular aquatic habitat; the management of saltmarsh impoundments and some ditches are examples of water management projects
West Nile virus (WNV)	Introduced into the United States in New York around 2000, the virus is carried by birds and primarily transmitted by *Culex* mosquitoes; humans who contract the virus can develop a fever and other symptoms including headache, body aches, joint pains, and rash; most recover completely but symptoms can linger for weeks to months
Yellow fly trap	A sticky-type trap used to entangle yellow flies, a type of biting fly that occurs regularly in the Florida Panhandle, to reduce their population without insecticides

Term	Definition
Zika virus	A virus that originated in the Zika region of Africa and is transmitted by the mosquitoes *Aedes aegypti* and *Aedes albopictus;* humans who contract the virus can have symptoms similar to dengue such as fever, rash, headache, and joint pain; Zika passed from a pregnant woman to her fetus can result in birth defects including microcephaly and other brain abnormalities

Source: TBG work product.

Attachment 2

INTEGRATED PEST MANAGEMENT SUMMARY

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Term	Summary
Integrated Pest Management	Most mosquito control programs use an Integrated Pest Management (IPM) approach to control mosquito populations, which targets the different stages of a mosquito's life cycle with various prevention and control measures. IPM addresses eight areas. Surveillance of mosquito populations is an essential component of all IPM programs with chemical treatments based on the surveillance findings. IPM can also include source reduction (e.g., container disposal and water/impoundment management), larviciding and adulticiding (using ground and/or aerial treatments), biological and alternative controls, and disease surveillance. Research and education are also important components of IPM programs.
Mosquito Surveillance	The general approach to surveillance is to define area-specific problems with mosquitoes through the establishment of a mosquito surveillance program. The program assists in determining the types of mosquito control efforts needed in each area so that pesticide applications are used only when necessary. Service requests made to mosquito control programs serve as one means of surveillance. Other means for adult mosquito surveillance include monitoring the landing rates and counts of mosquitoes in traps to determine when and where they are most prevalent and observing the effects of adulticide, larvicide, and source reduction efforts. Immature mosquito surveillance is conducted by collecting eggs, larvae, and pupae. Surveillance may also include inventorying and mapping data and using emerging technologies such as geo-referenced maps, geographic information systems (GIS), smart traps (e.g., a trap with an electronic device that differentiates mosquitoes from other insects, counts them, and wirelessly transmits the results), and unmanned aerial vehicles.
Source Reduction	Source reduction, also known as physical or permanent control, is considered the most effective mosquito control technique and is accomplished by eliminating larval habitats in salt marshes, freshwater habitats, temporarily flooded locations, and containers. Current saltmarsh source reduction techniques in Florida include • construction of shallow ditches that enhance drainage and thus eliminate mosquito-producing sites and create connectivity among water bodies to allow larvivorous fish (fish that feed upon insect larvae) access to mosquito habitats; and • management of impoundments by maintaining a sheet of water across a saltmarsh to prevent mosquitoes from laying eggs on the soil; this achieves saltmarsh mosquito control with minimum insecticide use.

Term	Summary
	Source reduction is also conducted in freshwater habitats and is based on the principle that manipulating water levels in low-lying areas will eliminate or reduce the need for insecticide use. The primary strategy used is reducing the amount of standing water or reducing the length of time that water can stand in low areas following significant rainfall. Another important area of source reduction is through aquatic plant management, which can be accomplished using chemical, biological, or mechanical control methods. Waste tire management is also a significant activity for many mosquito control districts because the proliferation and accumulation of discarded tires throughout the state continues to create habitats highly favored by mosquitoes, and these tires can be costly and labor-intensive to remove. Removing any receptacles that can contain water is beneficial in controlling mosquitoes.
Larvicides and Larviciding	Larvicides are insecticides used to kill insects in the larval stage. Most mosquitoes spend three to five days of their life cycle in the larval stage when they are highly susceptible to predation and control efforts; therefore, well-planned and timed larviciding is important for efficient operations to save labor costs and reduce chemical use. This also requires understanding the local mosquito ecology and patterns of arbovirus transmission to select the appropriate control techniques. Equipment used for ground application of larvicide can include trucks with sprayers mounted on the front bumper, all-terrain vehicles (ATVs), boats, and various hand-held and backpack sprayers. Aerial application uses various devices such as nozzles and metered systems that are attached to fixed-wing or rotary-wing aircraft (i.e., helicopters).
Adulticides and Adulticiding	Adulticides are insecticides used to kill adult mosquitoes. The majority of adulticiding in Florida is conducted using ultra-low volume (ULV) spraying during which an aerosol spray is released by specialized spray equipment mounted in aircraft, on the back of trucks or ATVs, or carried by hand or in a backpack. The spray drifts through the air and is effective only while it remains airborne; thus, having a short-term effect only. Where a longer-term effect is needed, residual sprays are applied to barriers or surfaces such as a stadium, park, or resident's yard and are often applied with a modified vehicle-mounted hydraulic sprayer. The mosquito must land on the surface where the residual insecticide has been deposited for it to be effective. Equipment operators must be properly trained in equipment maintenance and adulticide application because timing, targets, and thresholds for the application are based on numerous factors and can be challenging to establish.

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Biological and Alternative Control	Biological control agents include microbial control agents (e.g., bacteria, such as *Bacillus thuringiensis* or *Bt*, that can be sprayed over waterbodies to kill developing mosquito larvae), invertebrate arthropod mosquito predators (e.g., small aquatic crustaceans, such as copepods, that eat insect larvae), and vertebrate mosquito predators (e.g., larvivorous fish and birds). It is common for mosquito control districts in Florida to provide larvivorous fish as a service to the public. For example, Collier Mosquito Control District provides Gambusia mosquitofish to Collier County residents to release in standing water on their property to manage mosquito larvae. Alternative control methods include the sterile insect technique, trapping, repellents, and bug zappers.
Disease surveillance	Because of its geographic location and proximity to the Caribbean, Florida is vulnerable to the introduction of new vector-borne pathogens as occurred with the introduction of Zika virus in 2016 in South Florida. Disease surveillance includes monitoring for human cases of mosquito-borne arboviral diseases including dengue, chikungunya, West Nile virus, St. Louis encephalitis, and others. In addition, many mosquito control programs conduct regular blood testing of sentinel chickens. The state established the Florida Sentinel Chicken Arboviral Surveillance Program (FSCASP) in 1977 to provide laboratory services to local agencies to monitor the transmission of certain vector-borne diseases. The services are primarily used by mosquito control programs around the state. The programs submit sentinel chicken blood samples to the Florida Department of Health's Bureau of Laboratories in Tampa, where an antibody test is performed to identify if the chicken has been exposed to one of several viruses. Results are provided to participating agencies on a weekly basis.
Mosquito Control Research	Mosquito control programs must base their activities on sound and up-to-date scientific research in order to provide safe, effective, and efficient mosquito control services. Research that is either conducted or reviewed by mosquito control programs is essential to developing and implementing new and innovative methods and technologies. Numerous federal, state, and other entities conduct mosquito control research, as do several mosquito control districts in this state.
Outreach and Education	Increasing the public's understanding of the work of the mosquito control districts is an important component of overall mosquito control efforts. Public education helps people understand what is involved in mosquito control, the biology of mosquitoes, ecological issues, arboviral disease transmission, and actions that can be taken to prevent mosquito bites and reduce mosquitoes in yards and

Term	Summary
	neighborhoods. When adequately informed, the public is in a better position to protect themselves and support mosquito control efforts. This state's mosquito control programs and other entities, such as the Florida Department of Agriculture and Consumer Services, Florida Mosquito Control Association, and the University of Florida's, Institute of Food and Agricultural Sciences-Florida Medical Entomology Laboratory, dedicate significant efforts toward education.

Source: TBG work product.