MOORE HAVEN MOSQUITO CONTROL DISTRICT REVIEW FINAL REPORT

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Prepared for

The Florida Legislature

Prepared by

The Balmoral Group

165 Lincoln Avenue

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Executive Summary

Moore Haven Mosquito Control District (Moore Haven MCD) serves an approximately one square mile region in Glades County, Florida. Moore Haven MCD is one of the smallest MCDs in the state, serving a population of roughly 1,700 residents of the City Moore Haven in Fiscal Year (FY) 2019-20. The district primarily operates within the city limits of Moore Haven and also provides services to approximately 175 residents in the two neighboring subdivisions of Washington Park and Bowdens. The district also often handles other areas outside of the city limits including coordination with the local prison and water control district. The City of Moore Haven is located on the southwest banks of Lake Okeechobee and is surrounded by the rest of Glades County.

Moore Haven MCD was established in 1976 by the City of Moore Haven and operates with an elected board of three commissioners. Unique to its operations, Moore Haven MCD receives revenue via a fee collected by the City of Moore Haven. The district is the only MCD reviewed by TBG that does not assess ad valorem taxes. The fee is $6 per month for residents and businesses and $75 per month for the school board. For FY 2021-22, total revenues for the district were $72,451, with a large share coming from approximately 950 customer accounts and the remainder from a small state grant.

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.

Moore Haven MCD's operations primarily focus on the provision of adulticide and larvicide treatments in the service area via spraying based on service requests from residents. Moore Haven MCD does not have a strategic plan or clearly defined, measurable goals and objectives and does not formally track and measure performance standards. The district does not appear to have plans for future strategic planning.

The district is audited on a triennial basis only due to its small size and lack of revenue from ad valorem taxes. Moore Haven MCD has had repeated findings in the district's last three audits in FY 2013-14, 2016-17, and FY 2019-20, which have not been addressed by Moore Haven MCD management. The audit findings largely pertain to material weaknesses in internal controls for financial reporting. District representatives have noted that it is infeasible for the district to implement recommendations to address the findings due to insufficient staff.

The Balmoral Group worked in consultation with a mosquito control expert in the course of this review and found that Moore Haven MCD follows several industry standards for Integrated Pest Management and provides mosquito control services to residents as provided in the Florida Statutes. Other local government entities located wholly or partially within Moore Haven MCD do not provide similar mosquito control services and, as such, consolidation with another local government entity is not possible. The district does effectively manage its revenues and expenditures; however, improvements are needed to address prior audit findings.

Based on its review, The Balmoral Group presents the following recommendations for improving mosquito control services in the Moore Haven MCD:

- The Moore Haven MCD could address unresolved financial audit findings.
- The district could adopt goals, objectives, and performance measures and standards through a strategic planning process to consistently monitor and maintain performance information over time; the district could seek guidance from other districts that have conducted strategic planning processes.
- 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.

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1. Background

District Description

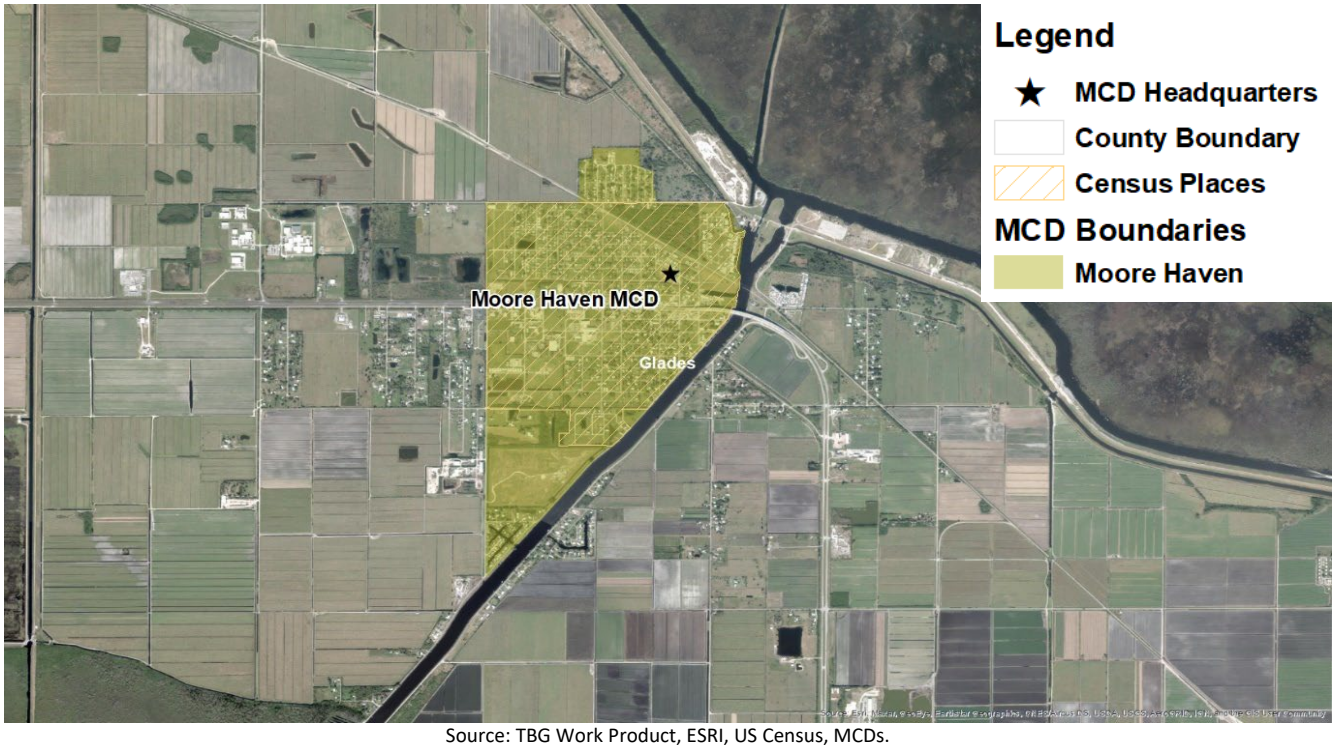
District Purpose

According to district representatives, the purpose of Moore Haven Mosquito Control District (Moore Haven MCD) is to serve the community by managing mosquito populations in the Moore Haven area. Since its inception, Moore Haven MCD's goals have been aligned with promoting the health, safety, and welfare of Moore Haven residents and visitors through an ever-evolving program of integrated pest management practices.

Service Area

The Moore Haven MCD serves a total land area of 1.06 square miles of Glades County, Florida. Moore Haven MCD operates primarily within the city limits of Moore Haven, Florida. The service area also extends to include the adjoining local water control district. **Figure 1** shows a map of the district boundary with the Moore Haven MCD headquarters marked.

Figure 1. Moore Haven MCD Map

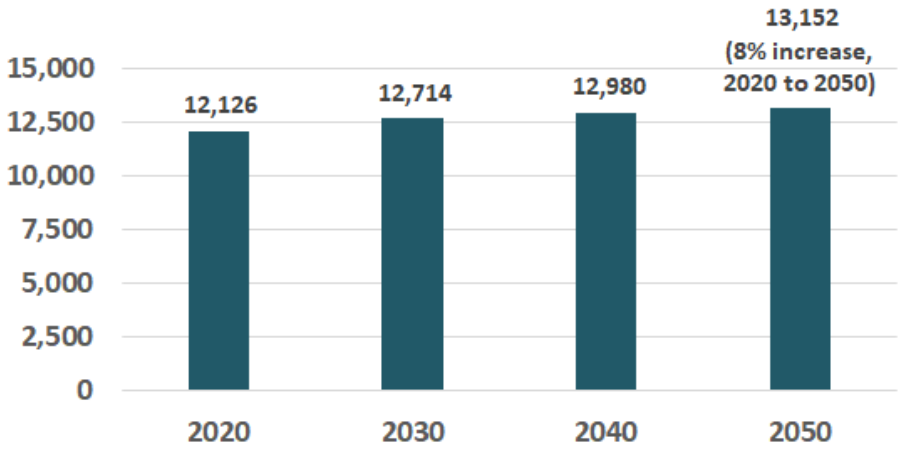


Source: TBG Work Product, ESRI, US Census, MCDs.

Population

The City of Moore Haven's population was estimated at 1,710 persons in 2020 according to the latest available block level U.S. Census data.[1,2] Glades County's population was estimated at 12,454 persons in 2022 according to the U.S. Census.[3] The Florida Legislature's Office of Economic and Demographic Research (EDR) projects Glades County's population to increase by 8% through 2050 to 13,152 residents compared to a 2020 baseline.[4] **Figure 2** shows Glades County's projected population estimates calculated by EDR.

Figure 2. Glades County Population Projection



Source: TBG Work Product, EDR.

District Characteristics

The City of Moore Haven is located on the southwest banks of Lake Okeechobee and is surrounded by the rest of Glades County. The average annual temperature was 79 degrees Fahrenheit, and the area received about 70 inches of rain in 2022. Meteorology is the primary driving force for producing mosquitoes, with heavy rainfall events creating standing pools of water that can produce 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 and the meteorological conditions described above, create an environment conducive to extensive mosquito habitats that require constant mosquito control efforts. The services needed to control mosquitoes include routine surveillance of mosquito-producing habitats, source reduction, aerial and ground treatments using pesticides to treat areas with large mosquito populations, and regular testing for disease transmission in animals.

Moore Haven MCD is the only district reviewed by TBG that does not collect revenue via ad valorem taxes; instead, the district collects a flat fee as a part of each utility bill issued by the city. Consequently, the millage, real property data, and tangible property data for the four-year review period are not relevant and not reported here.

[1] Block-level data compiled from Decennial Census P.L. 94-171 Redistricting Data Summary Files and matched to the MCD boundary in GIS.
[2] District staff reported that the Moore Haven MCD also serves two neighboring subdivisions of Washington Park and Bowdens with an additional population of approximately 175 persons.
[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).

History and Composition

According to district representatives, Moore Haven MCD was established in 1976 by the City of Moore Haven under Chapter 189, *Florida Statutes*. The district 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.

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 to employ a director, employees, and others.

As required by s. 388.151, *Florida Statutes,* the board of commissioners must hold monthly meetings, which must be open to the public and noticed in accordance with s. 189.015, *Florida Statutes*. Moore Haven MCD is governed by an elected board of three commissioners who are resident registered electors within the city and has sat full for the past three fiscal years (FYs). During the current FY and past three FYs, the board met on a monthly basis with meetings noticed for and open to the public (**Table 1**); however, board meeting agendas and minutes are not publicly available. As of June 2023, there was one vacancy on the board.

Table 1. Moore Haven MCD Commissioner Meeting Counts

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

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

Intergovernmental Interactions

Moore Haven MCD is an independent special district funded by the City of Moore Haven via billing collections from the property owners within the district. Moore Haven MCD also receives funding via a yearly state grant from the Florida Department of Economic Opportunity (DEO). Moore Haven MCD receives no federal funding, nor has the district sought any.

The district routinely coordinates with local Florida Department of Health offices to monitor for mosquito-borne diseases and assists other nearby MCDs in emergency situations. For example, as reported by district representatives, Moore Haven MCD assisted the nearby Buckhead Ridge Mosquito Control District after hurricane events. The district also assists with needs for mosquito control in areas outside of the district's normal service areas by spraying when a horse is reported with eastern equine encephalitis. Moore Haven MCD also coordinates

with the wastewater treatment district and the local prison when needs arise. The Moore Haven area has been described as a small community in which assisting others when needed is not an issue.

The Moore Haven MCD board uses the town hall of Moore Haven for its monthly, public meetings to comply with Americans with Disabilities Act (ADA) requirements.

Resources for Fiscal Year 2021-22

Moore Haven MCD's funding is derived from the collection of a fee from utility customers by a billing system operated by the city for its residents. The fee is the same for all utility customers regardless of property size, and a higher fee is paid by the school district. The charge is $6.00 a month for each customer who has utility services within the district's boundaries, and $75.00 a month for the school district located within the district's boundaries. Moore Haven MCD collected $72,451 in revenues and spent $60,448 in Fiscal Year 2021-22. Moore Haven MCD had eight paid staff members in Fiscal Year 2021-22, including one contracted staff, four part-time staff for spraying operations, and the three commissioners. The district had no volunteers in Fiscal Year 2021-22. A summary of Moore Haven MCD resources for Fiscal Year 2021-22 is shown in **Table 2**.

Table 2. Moore Haven MCD Resources for FY 2021-22

Resource Item	FY 2021-22 Amount
Millage Rate	Not Applicable
Revenues	$72,451
Expenditures	$60,448
Number of Paid Staff	8
Vehicles	2 trucks
Equipment	Field equipment: 2 Lab equipment: 0 Office equipment: 1 Surveillance equipment: 0
Facilities	1 facility, 1 building

Source: TBG Work Product, MCD.

2. Findings

Service Delivery

Moore Haven MCD follows several industry standards for Integrated Pest Management and provides mosquito control services to residents as provided in the Florida Statutes; other local government entities located wholly or partially within Moore Haven 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; and 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. Moore Haven MCD conducts activities in five areas of IPM.

Moore Haven MCD monitors the mosquito population in the district primarily through landing rates. When an increase in landing rates and service requests occurs, the district increases its rate of spraying. Moore Haven MCD provides adulticide and larvicide services in response to all service requests; contracted aerial spraying is triggered after severe weather events.

Moore Haven MCD monitors the rate of infectious diseases in the district. The district also monitors weekly counts of arbovirus incidence in humans from Florida Department of Health (DOH) data as published on DOH's website.

The district conducts source reduction through the collection of containers that hold water and create larval habitat. This includes the collection of waste tires, which staff reported have been a problem in the area. District staff stated they collect approximately 30 tires annually at a cost of approximately $75 per year, and the City of Moore Haven provides assistance to the district to transport the tires for disposal.

The district also conducts public outreach to provide education about mosquito control in the community through public meetings, service requests, and informational booths at events.

A summary of the six areas of IPM in which Moore Haven MCD conducts activities is set forth in **Table 3**.

Table 3. Moore Haven MCD Services Overview

Integrated Pest Management Service	Moore Haven MCD Services Provided
Mosquito Surveillance	Weekly ground surveillance using landing rate counts
Disease Surveillance	Coordinating with the county health department or local horse owners when the need arises
Source Reduction	Emptying containers when responding to resident service requests and community education on source reduction
Larviciding	Application of larvicides using trucks or by hand
Adulticiding	Delivery of ultra-low volume (ULV) insecticide using trucks or occasionally by helicopter when contracted
Outreach and Education	Education and outreach facilitated primarily through resident service requests, public meetings, and information booths at events

Source: TBG Work Product, Moore Haven MCD.

Analysis of Delivery of Services

Moore Haven MCD provides services in six areas of IPM as described above that are within the scope and purposes outlined in applicable laws and regulations. All district services are directed toward the abatement and control of mosquitoes. No services were noted that fall outside the district's charter or applicable laws and regulations. The district does not provide services to other local governments or districts, except in the case of emergency need. The district has not conducted studies of alternative service delivery methods or consolidation of services.

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 stakeholders did not provide a response 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 Moore Haven MCD do not provide similar mosquito control services. TBG reviewed documents available online to establish if services could be or are redundant to or overlapping with county and municipal government services. Mosquito control services are not provided by the county or by the City of Moore Haven.

Considerations for Consolidations

Consolidation of operations is not recommended for Moore Haven MCD based on the findings of this review. TBG reviewed documentation from Moore Haven MCD as well as surrounding areas, and, as indicated above, no other similar service has been identified for consolidation.

Resource Management

Moore Haven MCD effectively manages its revenues and expenditures; however, improvements are needed to address prior audit findings.

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 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 performance reviews and audits; and interviewed district staff and board members.

Current and Historic Revenues and Expenditures

Revenues and expenditures were relatively consistent, with revenues exceeding expenditures every fiscal year in the review period. To review the current and historic revenues and expenditures of Moore Haven MCD, TBG requested and received financial information for FY 2019-20 through April of FY 2022-23. In addition, TBG interviewed Moore Haven MCD staff and reviewed documentation published online.

Moore Haven MCD's fiscal year begins October 1 and ends September 30. To fund mosquito control operations in the district, every customer who has utility services within the district boundaries pays $6.00 per month, and the school district pays $75.00 per month. The remainder of the funding required for expenditures is covered by an annual state grant.

Revenues declined from $77,195 in FY 2019-20 to $72,451 in FY 2021-22 due to a decrease in state grant funding and billing collections. FY 2022-23 is in progress and revenues were $17,629 as of April 2023 (**Table 4**). Expenditures fluctuated during the review period, increasing from $66,008 in FY 2019-20 to $75,260 in FY 2020-21 then decreasing to $60,448 in FY 2021-22. Expenditures were less than revenues in FYs 2019-20, 2020-21, and 2021-22. Expenditures exceed revenues thus far in FY 2022-23; however, the fiscal year is ongoing.

Table 4. Revenue and Expenditures

Revenues and Expenditures	FY 2019-20[1]	FY 2020-21[1]	FY 2021-22[1]	FY 2022-23[1]
Revenues	**$77,195**	**$78,221**	**$72,451**	**$17,629**
Billing Collections	$68,065	$64,361	$62,945	$17,629
Other Sources	$9,129	$13,860	$9,506	$0
Expenditures	**$66,008**	**$75,260**	**$60,448**	**$50,203**
Administrative Costs[2]	Not Provided	Not Provided	Not Provided	Not Provided
Direct Program and Activity Costs[2]	Not Provided	Not Provided	Not Provided	Not Provided
Other Expenditures[2]	Not Provided	Not Provided	Not Provided	Not Provided

Source: TBG Work Product, MCD.
[1] YTD through April 2023.
[2] TBG requested but did not received this information.

Due to the district's revenues relying on monthly service charges instead of property valuation, Moore Haven MCD revenues do not rise as property values increase. Consequently, the effects of inflation are costlier for the district. The trend of decreasing revenues and decreasing expenditures leaves it unclear as to whether Moore Haven MCD will have sufficient resources to sustain its operations into the future. District staff reported that the $6 utility fee that supports the operations of the district is established by city ordinance and could be increased if the City of Moore Haven chose to do so in the future.

Administrative and Direct Program Costs

Moore Haven MCD provided a breakdown of total expenditures by broad categories only for FY 2019-20 through FY 2022-23. Without additional information from the district, it is not possible to present an accurate breakout of the district's administrative versus direct costs in each of these categories.

For example, the category of personal services is likely to contain salaries for field staff, which would constitute a direct cost, but the category also would include salaries of administrative staff, which would constitute an administrative cost. Some costs are attributable to direct program costs, including Insurance, Maintenance and Repairs, Materials and Supplies, Gas/Oil/Lubricants, Chemicals, and Training.

TBG pursued more clarification on these costs from the district, but a breakdown was not received. **Table 5** includes TBG's assessment of whether the cost category is likely to include administrative costs, direct costs, or a combination of both.

Table 5. Program Cost Data

Expenditure Category	TBG's Cost Type Categorization	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[1]
Personal Services	Admin & Direct	$35,658	$28,771	$33,440	$14,125
Personal Service Benefits	Admin & Direct	$4,306	$5,412	$3,305	$2,031
Operating Expense	Admin & Direct	$11,570	$10,864	$11,365	$4,763
Travel & Per Diem	Admin & Direct	$1,006	$0	$0	$1,684
Communication Services	Admin & Direct	$1,687	$750	$0	$750
Freight Services	Admin & Direct	$41	$41	$47	$0
Utility Service	Admin	$767	$623	$596	$259
Rentals & Leases	Admin & Direct	$0	$480	$0	$0
Insurance	Direct	$9,276	$8,695	$8,331	$349
Repairs & Maintenance	Admin & Direct	$541	$2,787	$571	$158
Promotional Activities	Admin & Direct	$69	$0	$0	$0
Other Charges	Other	$112	$106	$340	$458
Office Supplies	Admin	$250	$0	$0	$166
Gasoline/Oil/Lubricants	Direct	$550	$467	$618	$453
Chemicals	Direct	$0	$15,992	$2,020	$0
Publications & Dues	Admin	$175	$271	$175	$700
Training	Direct	$0	$0	$0	$540
Capital Outlay	Direct	$0	$0	$0	$23,766
Total		**$66,008**	**$75,260**	**$60,808**	**$50,203**

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

Contracts for Services

Moore Haven MCD contracts for aerial application services. TBG reviewed documentation provided by Moore Haven MCD and interviewed district staff to determine what services were contracted rather than conducted in-house. Aerial spraying is provided by Clarke Mosquito Control under a contract to spray three to four times a year, typically before the holidays or large events. Moore Haven MCD did not provide a detailed breakdown for contracted services costs.

Staff

Moore Haven MCD employs a small staff of commissioners, a director, and several mosquito control technicians. TBG examined detailed staffing information provided by Moore Haven MCD, as well as documentation available online and through DACS reporting and audits. In FY 2022-23, Moore Haven MCD's staff consisted of four part-time employees (the director and three mosquito control technicians), two commissioners, and one contracted staff (bookkeeper). As of June 2023, there is one commissioner vacancy that the district is actively working to fill. An organizational chart was not provided.

Analysis of Program Staffing Levels

Moore Haven MCD's relatively small staff is commensurate with the district's level of service and mosquito control activities but lacks sufficient administrative staff. To assess program staffing levels, TBG reviewed documentation provided by Moore Haven MCD and interviewed staff. Given the challenges smaller districts often encounter with retaining full-time staff and other operational needs, it is appropriate that the district has a smaller, part-time based staff than other MCDs and the number of positions is commensurate with the level of activities undertaken by the district in its mosquito control efforts. However, as described below, prior audits have identified financial and other reporting issues that the district has not addressed, and the district appears to be lacking the administrative staff needed to address the audit findings.

Staff numbers have been relatively constant during the current and previous three fiscal years, and turnover rates were low. The current director has been with the district for more than four decades (**Table 6**).

Table 6. Moore Haven MCD Staff Counts

Employee Counts	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[1]
Commissioners	3	3	3	2
Full Time	0	0	0	0
Part Time	5	4	4	4
Contracted	0	1	1	1
Volunteers	0	0	0	0
Vacancies	0	0	0	0
Total Positions	**8**	**8**	**8**	**7**
Annual Termination	0	0	1	1
Turnover	0%	0%	13%	13%

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

Equipment and Facilities

Moore Haven MCD maintains a relatively small number of vehicles and equipment and one building that are commensurate with the services provided by the district. TBG analyzed documentation provided by Moore Haven MCD and interviewed staff to review any changes in the level of equipment and facilities purchased or maintained over the review period.

During the current and prior three fiscal years, Moore Haven MCD has owned two pickup trucks and two ULV sprayers for usage in spraying operations. In FY 2022-23, the district added an additional vehicle and a John Deere Gator utility vehicle to its fleet (**Table 7**).

Moore Haven MCD owns one building that it uses for its headquarters, with commissioner meetings held in the City Hall for ADA compliance.

Table 7. District Vehicles, Equipment, and Facilities

	FY 2019-20	FY 2020-21	FY 2021-22	FY 2022-23[1]
Vehicles	**2**	**2**	**2**	**4**
Airplanes	0	0	0	0
Helicopters	0	0	0	0
Boats	0	0	0	0
Trucks and Vans	2	2	2	3
Campers and Buses	0	0	0	0
ATVs and Utility Vehicles	0	0	0	1
Equipment	**3**	**3**	**3**	**3**
Field Equipment	2	2	2	2
Lab Equipment	0	0	0	0
Office Equipment	1	1	1	1
Facilities	**1**	**1**	**1**	**1**
Buildings	1	1	1	1

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

Moore Haven MCD staff reported that the district does not use mosquito traps for surveillance, nor does it have a sentinel chicken program. Landing rates are determined by field sprayer observations.

Strategic or Other Formal Plans for the District's Future

Moore Haven MCD does not record performance by any formal measures; instead, the district responds to service requests and complaints from district customers. TBG interviewed Moore Haven MCD staff and reviewed provided information but was unable to find evidence of formal planning efforts for the district. Adulticiding and larviciding services are conducted as needed based on service requests, complaints, and mosquito counts from landing rates.

Previous Performance Reviews, Financial Audits, and Resident Feedback Surveys

Moore Haven MCD does not conduct resident feedback surveys and has had repeated findings on triennial audits, with no actions taken to address the findings. TBG reviewed audits provided by Moore Haven MCD and analyzed the revenues, costs, and findings.

The audits of Moore Haven MCD's financial statements from FY 2019-20 found issues with the financial reporting process and material audit adjustments, including issues with inventory processes, QuickBooks logging and recording of financial information, and reporting procedures. These findings were also specified in the prior FY 2016-17 and FY 2013-14 audits and remain unresolved. District representatives have stated that is infeasible for

the district to implement the auditor's recommendations to address the findings due to insufficient staff. No records of performance reviews or resident feedback surveys were provided.

Analysis of Management Reports/Data and Performance Information

Moore Haven MCD has not established goals and objectives and lacks formal performance measures. TBG reviewed documentation provided by Moore Haven MCD and interviewed district staff. Interviews with Moore Haven MCD determined that there are not any formal goals, objectives, and performance measures and standards in place; operations are based on need.

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

Moore Haven MCD has kept costs low by contracting spraying services and hiring part-time staff; revenues regularly exceed expenditures but unaddressed prior audit findings related to financial reporting should be resolved.

To assess cost, timing, and quality of program efforts, TBG reviewed documentation provided by Moore Haven MCD, publicly available data and reports, and interviewed district staff. Current program efforts are provided on an as-needed basis, with district employees working on a request-based, part-time schedule. With the lower working hours, Moore Haven MCD is able to keep its expenses low by hiring part-time employees and contracting for some aerial spraying services. Revenues exceeded expenditures in FY 2019-20 through FY 2021-22. The district, however, has had unaddressed audit findings related to deficiencies in financial and other reporting that it should resolve.

Goals, Objectives, and Performance Measures and Standards

Moore Haven MCD does not have formally defined goals and objectives and does not formally track and measure performance standards; however, the district has kept arbovirus counts at zero in the current and past three fiscal years.

To assess the district's goals, objectives, performance standards, and performance measures, TBG requested the district's charter, strategic plan, and the last three years of annual reports; information on goals, objectives, and performance measures and standards; previous performance reviews and audits. 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

Moore Haven MCD has not formally established specific programmatic goals and objectives for the district. Moore Haven MCD staff reported that the district has a general goal of curbing mosquito populations that may become a nuisance or a threat to public health in the City of Moore Haven by providing adulticiding, larviciding, and source reduction services to prevent the growth of disease-spreading adult mosquito populations.

Objectives

Moore Haven MCD has not defined specific objectives for its operations. Moore Haven MCD does not have any formally defined objectives that guide its operations.

Performance Measures and Standards

Moore Haven MCD has not established formal performance standards and measures but does maintain and track prevalence of arbovirus cases in humans in the district. TBG conducted interviews with Moore Haven MCD staff and reviewed provided documentation to determine the standards of measurement. Moore Haven MCD tracks performance based on disease prevalence using DOH disease incidence reports published on DOH's website weekly and follows the general standard of no cases of arbovirus found in humans acquired in Florida and detected in the district for the past four years.[5] This has not changed in the past three fiscal years.

Analysis of Goals, Objectives, and Performance Measures

Moore Haven MCD does not have clearly defined goals, objectives, or performance measures and standards; it has performed well with respect to keeping arbovirus cases low in the current and past three calendar years. Moore Haven MCD has effectively curbed mosquito populations that may become a nuisance or a threat to public health. According to DOH data, no arbovirus cases acquired in Florida or elsewhere have been detected in Glades County during the review period (**Table 8**).

Table 8. Performance Measures for Moore Haven MCD

Performance Measure	CY 2020[1]	CY 2021[1]	CY 2022[1]	CY 2023[1]
Arbovirus Cases (Florida)	0	0	0	0
Arbovirus Cases (Travel)	0	0	0	0
Arbovirus Deaths	0	0	0	0

Source: TBG Work Product, Moore Haven MCD, Florida DOH.
[1] Florida DOH data is provided by calendar year (CY).

Performance measures and standards for Moore Haven MCD are summarized in **Table 9**.

Table 9. Assessment of Performance Measures and Standards for Moore Haven MCD

Performance Measure	Performance Standard	Assessment
Counts of arbovirus incidence in humans	No cases of arbovirus acquired in Florida and detected in Moore Haven MCD	Standard met.

Source: TBG Work Product, based on review of information provided by Moore Haven MCD.

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

Information on perceptions of Moore Haven MCD's performance by stakeholders and residents is limited; no negative feedback was noted. TBG requested information from stakeholders and interviewed district staff to assess public perceptions of the district. Moore Haven MCD is a small district compared to others in the state and operates in response to the direct needs of its constituents. Commissioners conduct outreach in the community and district staff report that the perception of the district by community residents is favorable overall. TBG

[5] Mosquito-Borne Disease Surveillance | Florida Department of Health (floridahealth.gov)

reached out directly to the Florida DOH in Glades County and the City of Moore Haven Parks & Recreation for stakeholder input on Moore Haven 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 and presents one recommendation for the Legislature's consideration. TBG determined that the district could address past financial audit findings; adopt formalized district goals, objectives, and performance measures and standards; and that the Legislature may wish to consider directing the Florida Coordinating Council on Mosquito Control to develop model goals, objectives, and performance measures and standards to assist MCDs in this state.

Address Audit Findings: Audit findings for Moore Haven MCD's triennial audit show material weaknesses in internal controls over financial reporting. Due to the lack of internal controls, the district is exposed to the potential for material misstatements in annual financial statements. The district's material weakness in internal control over financial reporting is primarily due to limited personnel which prevents some accounts being reconciled properly due to time constraints. Additionally, there is only one user for QuickBooks, although the audit findings report three different people entered information during FY 2019-20, which prevents identification of who entered information and accountability for errors. Addressing the audit findings would establish internal controls to ensure the fair presentation of financial statements and related disclosures in conformity with the U.S. generally accepted accounting principles (U.S. GAAP).

Strategic Plan and Performance Measurement: Moore Haven MCD does not have a formal strategic plan or formally established goals, objectives, or performance measures and standards. The district could adopt goals, objectives, and performance measures and standards through a strategic planning process to consistently monitor and maintain performance information over time. A successful strategic plan includes outlining the mission, vision, and background of the district as well as identifying the operational and growth needs to fulfill the future needs of mosquito control within the district in a timely manner with sufficient staff and resources and within budget. A successful strategic plan outlines goals of the district over a specified time horizon, typically five years and may include identifying potential capital improvement projects and opportunities for the district to improve efficiencies.

The district could seek guidance on strategic planning processes and development of goals and objectives from other districts that have recently conducted such processes, such as Anastasia MCD or Indian River MCD. Florida's MCDs vary with regard to geography, incidences of species, and the scale and complexity of operations, however, there are similarities and opportunities for shared resources. Strategic planning processes such as those undertaken by Indian River MCD or Anastasia MCD could serve as a model for other MCDs.

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 Florida Department of Agriculture and Consumer

Services, the Florida Department of Environmental Protection, and the Fish and Wildlife Conservation Commission, the State Surgeon General, as well as representatives of federal agencies, the University of Florida's Florida Medical Entomology 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 standards and measures to assist MCDs with performance monitoring.[6]

Recommendations

Table 10 summarizes TBG's recommendations and associated considerations.

Table 10. Recommendations with Associated Considerations

Recommendation	Considerations
Moore Haven MCD could address unresolved financial audit findings.	• This recommendation will likely result in additional administrative costs to the district.
The district could adopt goals, objectives, and performance measures and standards through a strategic planning process to consistently monitor and maintain performance information over time; the district could seek guidance from other districts that have conducted strategic planning processes.	• This recommendation would require additional staff time and may result in additional administrative costs to the district. • Staff in other districts may incur some additional workload if the district chooses to seek guidance from other districts regarding strategic planning processes.
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, like Moore Haven MCD, that lack staff resources for the development of such performance information.

Source: TBG Work Product, based on review of information provided by Moore Haven MCD.

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

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. Moore Haven 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

Attachment 1

Term	Definition
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

Term	Definition
	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,

Term	Definition
	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

Term	Definition
	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

Term	Definition
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

Term	Definition
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

September 2023

Prepared for

The Florida Legislature

Prepared by

The Balmoral Group

165 Lincoln Avenue

Winter Park, FL 32789

Attachment 2

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.

Term	Summary
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.