

Appendix II

BEST MANAGEMENT PRACTICES FOR MOSQUITO CONTROL IN STORMWATER MANAGEMENT FACILITIES

VOLUSIA COUNTY MOSQUITO CONTROL

The surface storage of stormwater required by state and local regulations has created mosquito larval habitats. Our goal is to eliminate larval mosquito production from stormwater management facilities. This effort requires a basic understanding of mosquito life cycles and habitats. The immature stages of mosquitoes (eggs, four instars of larvae, and pupae) use permanently or intermittently wet habitats. The most pestiferous mosquitoes lay eggs on damp ground that periodically floods. These eggs may survive for years between floodings. Primary disease vectoring mosquitoes lay eggs on the water's surface. Some mosquitoes can develop to adults in as few as six days. Top minnows are the most effective predator of immature mosquitoes in permanent or semi-permanent water bodies that are free of vegetation. The use of this information can result in proper design, construction, and maintenance of stormwater management facilities to prevent mosquito production.

Three elements are important to assure that a stormwater management facility does not produce mosquitoes:

- 1) **Design** of the proper facility for the site – based on soils and other site constraints
- 2) Proper **construction** and certification by the designer
- 3) Guaranteed **maintenance** of the system

These three elements, when done together, can achieve the goal of no mosquito production from stormwater facilities.

Design

The three basic types of designs are wet, dry, and intermittent systems. Designs should be based on site characteristics and sound engineering principles and include consideration of soils, seasonal high water table, and pre-development drainage characteristics. The Soil Survey of Volusia County provides good but less detailed information that should be field validated. Slopes should allow ease of maintenance and for small children to extricate themselves. Maintenance plans

should be carefully reviewed to prevent additional problems. The soil technician at the Volusia County Agriculture Center is available for free consultation on soil and water tables.

Wet system retention or detention facilities are usually used in a high water table situation. The permanent water table can maintain top minnows, provided there is eighteen inches of water during the driest periods. The bottom should be graded to avoid isolated pockets of standing water. A maintenance easement of at least fifteen feet should surround the facility above the high water line. Wetland plantings are discouraged as they cause mosquito or maintenance problems.

Dry systems (retention areas or swales) are best used in low water table, permeable soils. These areas should be designed to be dry within three days of a rainfall event based on a twenty-five year frequency storm of twenty-four hour duration. A good rule of thumb is to place the bottom one foot above the seasonal high water table. Where this minimum freeboard cannot be achieved by raising the retention area, a wet system should be used. We do **not** recommend the use of underdrains to control water elevations because of their expense, susceptibility to failure, and frequency of maintenance. As an alternative to surface storage, we have regularly approved underground exfiltration systems in low water table soils. The pipe should be placed at least one foot above the seasonal high water table. The inlet sumps may produce a few mosquitoes, but the maintenance value outweighs this easily treated problem. These systems can be maintained regularly and easily by jetting the pipe with a Vac-type truck unit.

The least desirable system is an intermittently wet/dry system. It is used at a site where overriding design criteria exist such as tree preservation in a high water table soil. These undesirable systems can be significantly improved by utilizing minnow reservoirs, constructed of Florida Department of Transportation type "C" catch basins. The tops of the catch basins are installed at ground level with a minimum depth of two feet with a solid bottom and grated top. The catch basin becomes a protected refuge for minnows when the retention facility is dry. Each individual depression within the retention area will require one reservoir. Maintenance of these reservoirs can be done by hand or with a jet/pump system. A small permanent water pond in one part of the facility could act in a similar fashion. Retrofitting existing facilities that function as intermittent wet/dry systems, contrary to the original design, would benefit from this revised design.

Construction

Inlets and outlets should be constructed with erosion protection devices. Construction should be done with hydraulic excavators or similar equipment to avoid depressions. A professional engineer should certify that the facilities have been constructed according to the proposed plans.

Maintenance

An agreement in the stormwater management permit should specifically identify the party responsible for maintenance. A maintenance schedule – and a procedure to insure that maintenance is carried out – also are important. Mandated maintenance is an important element in local stormwater regulations. Side slopes should be kept free of weeds. Grass should be properly managed to prevent erosion. Weed management (chemical and/or physical removal) should be used in permanent water facilities. Requests to stock top minnows in wet facilities can be made to Volusia County Mosquito Control. Tire tracks in roadside swales and other activities that cause ruts and depressions in dry facilities should be avoided.

This guidance allows professionals involved in stormwater management to prevent a problem with some simple solutions. It is possible to solve existing problems using the same information. It is our hope that this document will convince people to become a part of the solution – not part of the problem. Proper surface storage of stormwater to eliminate mosquito production is one of the most inexpensive and environmentally sensitive approaches to mosquito control available today.