

# MOSQUITO CONTROL IN CAPE MAY COUNTY THROUGH WATER LEVEL STABILIZATION

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It has been some years since the concept of water management for mosquito control, which would at the same time serve many other community interests, became an established part of New Jersey county mosquito extermination commission programs. The Fishing Creek pump station and channel improvement project, just north of the town of Wildwood Villas on the Delaware Bay shore, represents one modern example in which a whole series of significant controlling circum-

stances were present, which in turn affected construction and operational schedules in the interest of mosquito control. This project is the first of its kind in tidewater New Jersey. It may well serve as an example for similar future undertakings.

The Cape May County Mosquito Extermination Commission conceived the project, was responsible for technical design of the beachfront pumping station, arranged for cooperative funding involv-

ing the County Commission, the County Board of Chosen Freeholders, two municipalities concerned with flood control and sanitary waste disposal as well as mosquito control, and the State Mosquito Control Commission. The county commission was also the focal point for securing the necessary easements and rights of way, which totaled 39 property owners, as well as being the recipient of many inquiries on seemingly conflicting points of view as to benefits to be derived.

In 1962 plans were started to try and control the water table in 6,000 acres of partly salt and fresh water swamp containing 6 miles of ditches. The marsh included salt hay, phragmites, scrub bushes, wildlife ponds, muskrat, and other wildlife. In part, the surrounding area is a watershed for the Wildwood pumping station which supplies four cities. This pumping station pumps 7 million gallons of water per day throughout the summer season. In the same area, the town of Wildwood Villas located in Lower Township, is on a boundary line. This town has no sewerage or water system. Each resident depends upon wells, septic tanks and overflow. Consequently this results in the overflow running into the meadow.

On the opposite boundary line is Middle Township and includes two smaller towns. All houses have similar living conditions.

The consistency of the entire meadow as related to mosquito control would be classified as "rotten bottom" with a live bottom, no bottom in some areas, to the depth of 20 to 25 feet. Condition of waters in the area is stagnant, rancid, etc. The only flow of water was through a wooden sluice which had a flap gate centrally mounted in a sump buried in the barrier beach. This sluice, over 20 years old, was undermined, rotted, showed fire damage, collapsed approach-wall bulkheads and, above all, great damage from floating ice in the tidal bay as the discharge end of the 2½' x 6' flume was gripped by floes in spite of ice breaker poles.

During storms this flume often filled

with sand and held back gravity flow from the meadow behind the beach. Experience indicated that when a differential water head of over 4 feet existed between tide and inner flume for two days the beach would give way to open an irregular tidal breach. This permitted backflooding of the meadow and approaches to Wildwood Villas with salt water.

Fishing Creek meadow has not been a typical tidal estuary for many decades as was attested to by the remains of two former wooden sluices near the site of the one to be replaced by the pumping station. These abandoned structures were filled with sand and leakage of water through them complicated hydraulic analysis of ground-water movement laterally and vertically in the area. Also, Bayshore Road acts as a restraining dike across the line of Fishing Creek, ¼ mile west of the beach. This further barrier holds water levels up on 5 to 7 square miles of swamp and semi-flooded woodland. In 1962 the channel and branches of Fishing Creek were choked with windfall and debris which had not been moved since the early 1930's. Mosquito-producing water surface was greatly increased and during winter storms the highway beds adjacent to the swamp became saturated and were susceptible to freezing damage.

Large areas of the inner marsh enclose ponds which are filled with vegetation attractive to waterfowl. Small game find shelter along their margins. The stored water in the main meadow also provides a surface seal for a deep potable water well field. Agricultural plantings on the western margins have the meadow as a potential source of irrigation water in the ponded swamp.

Shallow wells serve hundreds of houses to the north and south of the Creek outlet and septic tanks receive most of the sewage at or near the surface water table level. Floods upset both shallow well and septic systems here and do occasional surface damage. Water level maintenance is therefore a most critical factor in the

economy of the area. Surface waters invited breeding for *Aedes sollicitans* and *Culex pipiens*. Mosquito light trap records plus inspections backed up these facts. Thousands of gallons of chemicals have been applied to this meadow by airplane, tank tractor, and hand applicators for years. The need of water management or permanent control was imperative.

A civil engineer was hired and drew up the plans for a pumping installation and bids were submitted to the Commission. In the year 1963, title was received for the property where the pumping installation was to be located. An entire block of beachfront property was donated to the County Commission; said property extends one-fourth of a mile to the main road. This property was donated by a local real estate firm.

One of the major points to be considered was the water level to be maintained on the meadows. The State Water Policy Board finally endorsed the joint suggestion of the State Experiment Station and the Cape May County Mosquito Commission's water policy management proposal. A letter of authorization was received January 25, 1965 from Commissioner Roe authorizing the installation of the pumping station subject to the provisions and recommendations of the State Water Policy Supply and Council. The letter from Commissioner Roe stated that "the surface water level at the Bayshore Road Culverts be maintained from April 1st through March 31st at Elevation plus 2.50 feet" (U.S.C.G. datum.) The Commission's engineer drew up a new contract making changes in the specifications to comply with the necessary requirements.

The work on this installation was started June 29, 1965. The main pump installation is located on the rim of the beach 200 feet from the "high water mark" of Delaware Bay. A large hole was dug 80 x 80 feet square, 8 feet deep or to water level. The sides of the hole were sloped to a one to one taper to prevent caving in. No sheathing was used

on the sides and no cave-ins occurred during the entire project. A 10-inch vacuum line was installed around the outside of the hole at water level. One hundred eight well points, 21 feet deep, were sunk every 2 feet. Holes around wells were filled with clean, coarse sand. Each well was tested to find the flow of water to the well point, which ranged from 30 to 50 gallons of water per minute. Wells also were tested for fresh or salt water. The water was found to be brackish. Pumps held water to 18 feet below surface.

After the well system was put into use, 46 pilings were placed for the foundation. Pilings were jettied in 13 feet, then hammered down another 3 feet, thus making certain that no sand would be moved from the lower end of the piling and also permitting the piling to rest on a solid undisturbed base of sand.

The bottom slab or base was 30 x 30 x 18 inches and reinforced with a  $\frac{3}{4}$  inch steel rod. Two layers of steel were used. Four inches of cement was placed under the first layer; four inches of cement over the top layer of reinforcement steel. Steel rods were placed forming 12 x 12 inch squares over the entire bottom slab. Then  $\frac{3}{4}$  inch steel dowels were placed upright around each well in order to tie the bottom base and wells together. Forms were set up for the outside wall. Reinforcement steel was placed in it to form two layers, 6 x 9 inches over the entire surface of the side walls. The walls were 18 inches thick. Seventy-eight yards of cement were then poured into the side walls. Intermediate walls and an approach apron were set up in the same way; 38 yards of cement were used in this manner. All in all, a total of 168 yards of concrete were used for this pump installation.

The vacuum line and well points were removed as soon as possible. It took 7 hours after the pumps were stopped for water to show on the bottom slab and 24 hours for the water to arrive at surface level.

The contractor then set 16-foot pilings for discharge lines through the beach into the bay and also set 18-foot high pilings for ice breakers at the end of the discharge lines. Tide gates were placed on the outer end of the pipe.

Three Peerless Vertical Turbine Open Lineshaft (2—20,000 g.p.m. and 1—15,000 g.p.m.) pumps and casings, etc. were installed by crane and set according to specifications. The entire unit was to be out in the open as the main pumps were classified as "All Weather Pumps" capable of withstanding all weather conditions. All units were hooked up.

The pumps were turned on and worked perfectly, but the volume of water on the discharge end was so tremendous that the rocks in the spillway were washed down the beach causing a washout. Therefore, the spillway had to be cemented. When this was completed, the unit was fine but danger to the public was so great on the discharge end that it had to be caged in.

In the meantime, a severe four-day "northwester" blasted the sand so badly that a fine dust from the moving sand covered the pumps. The engineer was consulted. He advised that the bearings of the pump were sealed and the sand could not get into them while sealed. However, he stated that in case the sand did get into any other part, a compressor would be put on and blow the sand out (if any) before starting the operation of the pumps. It was decided that the units should be housed.

A concrete building was constructed to enclose the entire pumping unit.

During the sandstorm it was noted that the main creek 20 feet wide would become sanded. Thus two 100-foot bulkheads leading into the pumping unit were installed.

June 2, 1966 the pumping installation was completed. Thus Phases 1 and 2 had been completed. A working program for the three pumps was mapped out and put into effect in order to test the pumps. After 4 days of daily pumping (24 hours a day) the pumps proved satisfactory. A record of the water levels was taken in the entire area and they worked out in accordance with the State Water Policy Board's requirements. Two 6-inch test wells were installed by the County some 300 feet away; one well at 80 feet and another at 120 feet. Both wells produced potable water and are in use today.

Seasonal rains have created problems; however, these problems have been corrected. Keeping the water table to the proper depth is our big problem. A rainfall of 4 inches or more keeps all units running 24 hours a day. The unit is manned 365 days a year, the only problem being trash and debris in the bar screen, and this is removed daily.

The final step, Phase #3, the recleaning and widening of the original main creek to the east, 4 miles in length, is now completed. Another 2 miles of ditching was added through the County Airport area. Therefore, 6 miles of ditching, a 10-foot wide, 6-foot deep canal, feeds the main pumping installation some 10 miles away on the Delaware Bay Beach.

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