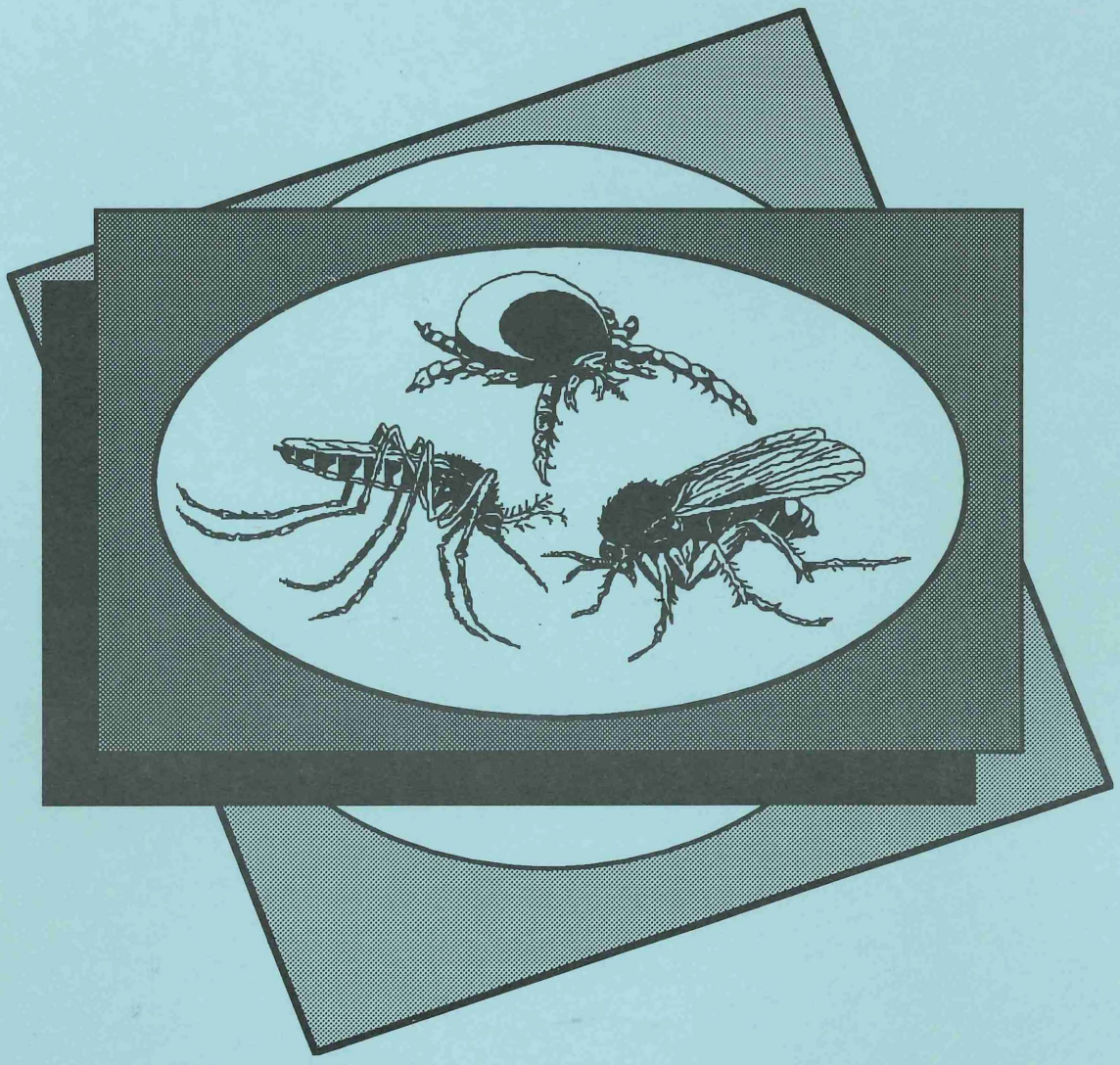
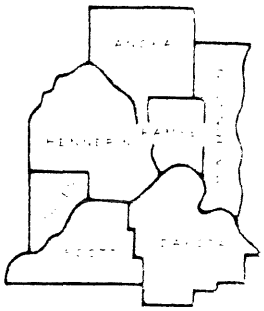
Metropolitan Mosquito Control District



MMCD Response to 1994 TAB Recommendations

MMCD 1994 Operational Review and Plans for 1995



METROPOLITAN MOSQUITO CONTROL DISTRICT

2099 UNIVERSITY AVENUE WEST ■ ST. PAUL, MINNESOTA 55104-3431
612-645-9149 ■ FAX 612-645-3246 TDD use Minnesota Relay Service

JOSEPH F. SANZONE
Director

W.J. CAESAR
Business Admin.

July 7, 1995

Dear Reader;

The following is the Metropolitan Mosquito Control District's (MMCD) 1994 Operational Review and Plans for 1995. MMCD staff prepared this report to outline the program operations based on the goals set forth by the MMCD Board of County Commissioners.

This report has been reviewed by the Metropolitan Mosquito Control Commission's Technical Advisory Board (TAB). The charge of the TAB is to make recommendations for improvements in the District's operation on an annual basis. The minutes and recommendations from their March 3, 1995 meeting are enclosed.

The TAB recommendations and report were accepted by the MMCD Board of Commissioners at the June 28, 1995 Commission Meeting. The MMCD Board has instructed staff to consider the recommendations of the TAB, and report to the Executive Committee of the Commission.

If we can provide further information on the District please contact us.

Sincerely,

Joseph Sanzone

Joseph F. Sanzone
Director

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Department of Entomology
College of Agriculture

219 Hodson Hall
1980 Folwell Avenue
St. Paul, MN 55108-6125
612-624-3636
Fax: 612-625-5299

June 22, 1995

Commissioner Dennis Hegberg, Chair
Metropolitan Mosquito Control Commission
2099 University Ave. W
St. Paul, MN 55104

Dear Commissioner Hegberg:

The Technical Advisory Board (TAB) met on March 3, 1995. The major issue of the meeting was the change in the mission statement for the district. The TAB's consensus was that the mission statement should be relatively brief, but inclusive of District effort.

A discussion of the 1994 MMCD program raised only brief questions from TAB members. Although there is not a motion in the minutes of the meeting, I'm safe on behalf of TAB, to suggest to the Commission that the program continues to be of a very high quality and has as great environmental responsibility as is presently possible.

The TAB met again on June 7, 1995 to discuss recently passed legislation (Metropolitan Livable Communities Act. SF1019 Mondale/Long) which will impact MMCD's future program. Because the TAB originally suggested the establishment of a research program by MMCD, and the establishment of a Scientific Peer Review Panel to examine methodology of that research we feel we would abdicate our responsibility if we did not continue to support that concept. Immediate past research has examined the effects of District mosquito and black fly programs on nontargets, and should be permitted to continue to examine effects of program changes in the future. SF1019 specifically forbids such activities and TAB feels that undesirable.

Sincerely yours,

David M. Noetzel

David M. Noetzel
Professor, TAB Chair

DMN/dr

METROPOLITAN MOSQUITO CONTROL DISTRICT
MMCD
Minutes —1995 Spring Technical Advisory Board Meeting
March 3, 1995

TAB Members Present:

Dave Noetzel, Chair	University of Minnesota-Entomology Dept.
Dave Belluck	Minnesota Pollution Control Agency
Larry Gillette	Hennepin Parks
Howard Krosch	Minnesota Department of Natural Resources
Art Mason	Minnesota Department of Agriculture
Robert Sherman	Hennepin County -Planning/Development
Bob Wryk	Minnesota Department of Transportation

TAB Members Absent:

Al Singer	Environmental Groups
Ron Chatfield	Industry Representative
Craig Hedberg	Minnesota Department of Health
Jim Cooper	University of Minnesota - Fisheries & Wildlife
Richard Anderson	U. S. Environmental Protection Agency
Dave Warburton	U. S. Fish and Wildlife Service

Staff:
Joseph Sanzone, Director
Susan Palchick, Mosquito Program Manager
William Caesar, Business Administrator
Dan Bennek, Administrative Assistant
Diann Crane, Entomology Laboratory
Dave Crews, Black Fly Program Leader
Daniel Dobbert, Data Analyst
Dave Neitzel, Vector-Borne Disease Management Program Leader
Scott Ranta, Cattail Program Leader
Nancy Read, Program Development
Kelly Sharkey, Quality Assurance Program
James Stark, Public Affairs Coordinator

Visitors: None

I. The February 25, 1994, meeting of the Technical Advisory Board (TAB) was called to order at 9:00 a.m. at the Metropolitan Mosquito Control Headquarters in St. Paul by the previous chair, Art Mason.

Joe Sanzone introduced new TAB members, Dave Belluck, from the Minnesota Pollution Control, Bob Wryk, Department of Transportation, and Ron Chatfield, who was not present, as the new industry representative.

II. Based on the chair rotation developed in 1994, the previous year's vice-Chair, Dave Noetzel, would become chair of the TAB. Vice-chair Noetzel indicated that he anticipates retiring at the end of the year, making him unable to complete his year as chair. After a discussion among members it was agreed that Dave Noetzel should become chair up to the time of his retirement. It was also agreed that either his replacement from the University would fill out his remaining time as chair, or the vice-Chair, Dick Anderson would become chair.

III. An annual operations report containing the results from 1994 and plans for the 1995 program was distributed to TAB members prior to the meeting. Discussion of this report formed the basis of the meeting.

Environmental Group Representative Al Singer faxed a letter to the District indicating changes requested in the Annual Operations Report. Copies were distributed to all members. Discussion resulted in the following:

The first topic was the new proposed mission statement. Most members agreed that the shorter statement previously used was clearer. There was also discussion of the definitions of health. After a long discussion regarding the form, length and content of the proposed mission statement, the following **motion** was made by Art Mason:

1. That the District maintain the existing Mission Statement and;
2. That the District add a list of goals incorporating ideas in the proposed mission statement;
3. and that the District add "health" into the mission statement.

Howard Krosch seconded the motion and the motion was passed.

IV. Susan Palchick provided an overview of results from the adult mosquito control notification project done in Excelsior, Mounds View, and Ham Lake. The report will be added to the appendix in the final Annual Operations Report.

V. Susan Palchick noted that the non-target literature review for adulticides was complete and is available on diskette.

VI. Jim Stark noted that a Field Demonstration Day on Mosquito Control Activities has been scheduled for June 7 at 9:00 A.M. (June 9 is the backup day). The demonstration is expected to last all morning. Agendas will be mailed to TAB members. Invitations are also being sent to County Commissioners and the media.

VII. The board discussed the role of the TAB and how the function changed over the years. With the Interagency Panel looking at the effectiveness of the program and the SPRP examining at the non-target effects of the larval control program, what role does the TAB provide? Is the TAB composition appropriate for the current issues? Is the Board's role to look at the research, or is it to review the program?

VIII. The board discussed the pending legislation on the District's future and its impact on the public and the environmental community. The TAB discussed the problems that could follow if many local governments and private citizens perform their own control programs.

IX. Bob Sherman made a **motion** that District staff inform Legislators of the TAB's existence and invite Legislators to meet with the TAB to discuss the program. Although members representing State agencies would not be able to comment because of problems this may cause in representing their agency, other members were interested in commenting on proposals. Larry Gillette seconded, and the motion passed.

ADJOURNMENT

A motion to adjourn was made by Howard Krosch and seconded by Bob Sherman. The motion passed.

Metropolitan Mosquito Control District Responses to 1994 Technical Advisory Board Recommendations

1. **That the MMCD Commission consider having the District conduct an improved public opinion survey. This next survey should ask more difficult questions that would assess the respondents knowledge of insecticides.**
- The District duplicated the public opinion survey it completed in 1994. Minor changes were made in the survey to assess the validity of the original survey. Some of the questions were restructured to inquire more knowledge of mosquito control on the respondents. The sample pool used represented a better distribution of respondents. Results are discussed in Program Development.

2. **That the District continue resistance testing with control materials presently in use.**
- The District did resistance testing in 1994 on both methoprene and permethrin. Testing will continue 1995, and will include resmethrin.

3. **That the District develop and implement a standard operating procedure for determining that control materials, as delivered, meet standards.**
- The District currently tests Altosid® XR briquets and pellets for potency. In 1995, development of a testing procedure for *Bti* corn cob is planned.

4. **The MMCD arrange a field day in 1995 for TAB members and interested parties to see actual field activities. The field day plan will be presented to the TAB at its Fall 1994 meeting.**
- The District is planning a field day demonstration for TAB members, news media, and any interested parties for either late May or early June. A tentative plan is to show as many mosquito activities; sampling sites, Altosid briquet and pellet applications; aerial applications of *Bti* corn cob, and adulticiding applications. Details on dates planned will be presented at the TAB meeting.

5. **That the MMCD consider investigating the non-target impacts of its adulticiding program.**
- Literature review is in progress.

6. **After a final report on the research contracted by the SPRP is completed, the District arrange for a joint meeting to discuss the results with the TAB**
- Once the TAB has completed its final report, a joint SPRP/TAB meeting will be arranged. This may be done at the fall 1995 TAB meeting.

7. **That the current TAB chair work with the MMCD to find new TAB members to represent the Industry Group and the Environmentalist Group.**
- Al Singer, Minneapolis Park Board was appointed the representative for the Environmentalist group. An Industry representative was filled by Ron Chatfield, Solvay Animal Health.

METROPOLITAN MOSQUITO CONTROL DISTRICT

ANNUAL REPORT
SUBMITTED TO THE TECHNICAL ADVISORY BOARD
MARCH 3, 1995

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METROPOLITAN MOSQUITO CONTROL DISTRICT

BOARD OF COUNTY COMMISSIONERS

The Metropolitan Mosquito Control District, established in 1958, controls mosquitoes and gnats (black flies) in the metropolitan counties of Anoka, eastern Carver, Dakota, Hennepin, Ramsey, Scott and Washington. The District operates under the seventeen member Metropolitan Mosquito Control Commission, composed of county Commissioners from the participating counties. A Director is responsible for the operation of the program and reports to the Commission.

Metropolitan Mosquito Control Commission
1995

Dennis Hegberg, Chair	**Washington County**
Dick Wedell, Vice-Chair	**Ramsey County**
Dick Underferth, Secretary	**Scott County**
Dick Lang	**Anoka County**
Margaret Langfeld	**Anoka County**
Dave McCauley	**Anoka County**
John Siegfried	**Carver County**
James Mueller	**Dakota County**
Don Maher	**Dakota County**
Steve Loeding	**Dakota County**
Randy Johnson	**Hennepin County**
Mike Opat	**Hennepin County**
Penny Steele	**Hennepin County**
John Finley	**Ramsey County**
Hal Norgard	**Ramsey County**
Ed Mackie	**Scott County**
Dave Engstrom	**Washington County**

Mission Statement Approved 1989

Metropolitan Mosquito Control District

MISSION STATEMENT

The mission of the Metropolitan Mosquito Control District is to suppress mosquito and tick transmitted disease and to reduce annoyance levels of mosquitoes and black flies below that which interferes with outdoor activities.

Proposed Mission Statement October 1994

Proposed Mission Statement

The Metropolitan Mosquito Control District protects the public from mosquitoes, biting gnats, and ticks which threaten health and well-being, accomplishing this in an environmentally sensitive manner.

We provide advice and services to all levels of government for environmental service projects on wetlands and associated organisms.

We encourage open communication to achieve public understanding, acceptance, and approval.

We believe our mission cannot be accomplished without the commitment of excellent employees, therefore we must provide a safe and supportive working environment to aid employee development and overall program effectiveness.

PROGRAM OVERVIEW

The mission of the Metropolitan Mosquito Control District (MMCD) is to suppress mosquito and tick transmitted diseases and to reduce annoyance levels of mosquitoes and gnats below that which interferes with outdoor activities. MMCD is a seven-county, cooperative governmental agency, including the counties of Anoka, Dakota, Hennepin, Ramsey, Scott, Washington and the eastern half of Carver.

The District is managed by a Director and a Business Administrator. MMCD encompasses a number of programs, the largest being the Mosquito control program. Other MMCD programs are Vector-Borne Disease Management Program, and Black Fly Control. Support is provided by Quality Assurance, Program Development and the Entomology laboratory.

The District's emphasis is on the control of mosquito larvae, while they are in the water. Sites are mapped, sampled and prioritized according to mosquito productivity. The most productive sites are treated using two types of biological control materials that affect immature mosquitoes in an environmentally sensitive approach. A natural soil bacteria (*Bacillus thuringiensis* var. *israelensis* or *Bti*) and an insect growth regulator (methoprene or brand name Altosid®) are used in dry, granulated or briquet forms.

Localized adult mosquito control is done to reduce mosquito annoyance for public events on request. MMCD primarily treats in and around park and recreation areas and for civic events. Adult mosquito control materials are permethrin and resmethrin products. These materials are synthetic pyrethroids and are similar in chemical structure to pyrethrum, a natural botanical insecticide that is the extract of a chrysanthemum flower.

An independent Scientific Peer Review Panel (SPRP) directs contract environmental research to assess potential adverse environmental impacts. The SPRP report on research results will be out this spring.

MMCD has chosen to use the most environmentally compatible control materials available. Staff remain current in advances in mosquito control technology. They continue to evaluate alternative control methods and solicit input from toxicologists about control materials.

To accomplish the above work, the MMCD operations budget for 1995 is no increase from the 1994 budget. The MMCD levy on an $100,000 home was less than $4.80 in 1995. Ninety three percent (93%) of MMCD's budget goes into the field for the control of mosquitoes, disease surveillance, program development, quality control and environmental studies.

As public service agency, MMCD is very sensitive to the questions and concerns of citizens of the metropolitan area. Our public information program provides speakers for schools and groups such as Kiwanis and Lions clubs. Several brochures and write-ups are sent to callers with questions and are available for distribution. In 1994, information booths were located at the State and county fairs. In addition, a video overview of MMCD is available for presentations to citizen groups. A list of additional readings about mosquito control and toxicology is in the Appendix.

METROPOLITAN MOSQUITO CONTROL DISTRICT
STAFF & QUALIFICATIONS

Joseph Sanzone, Director, M.S. Biology/Entomology, B.S. Entomology
William Caesar, Business Administrator, Masters Business Administration, B.S. Business
Susan Palchick, *Aedes* Program Manager, Ph.D. Entomology, Masters Public Health-Epidemiology, M.S. Entomology, B.S. Agricultural Journalism

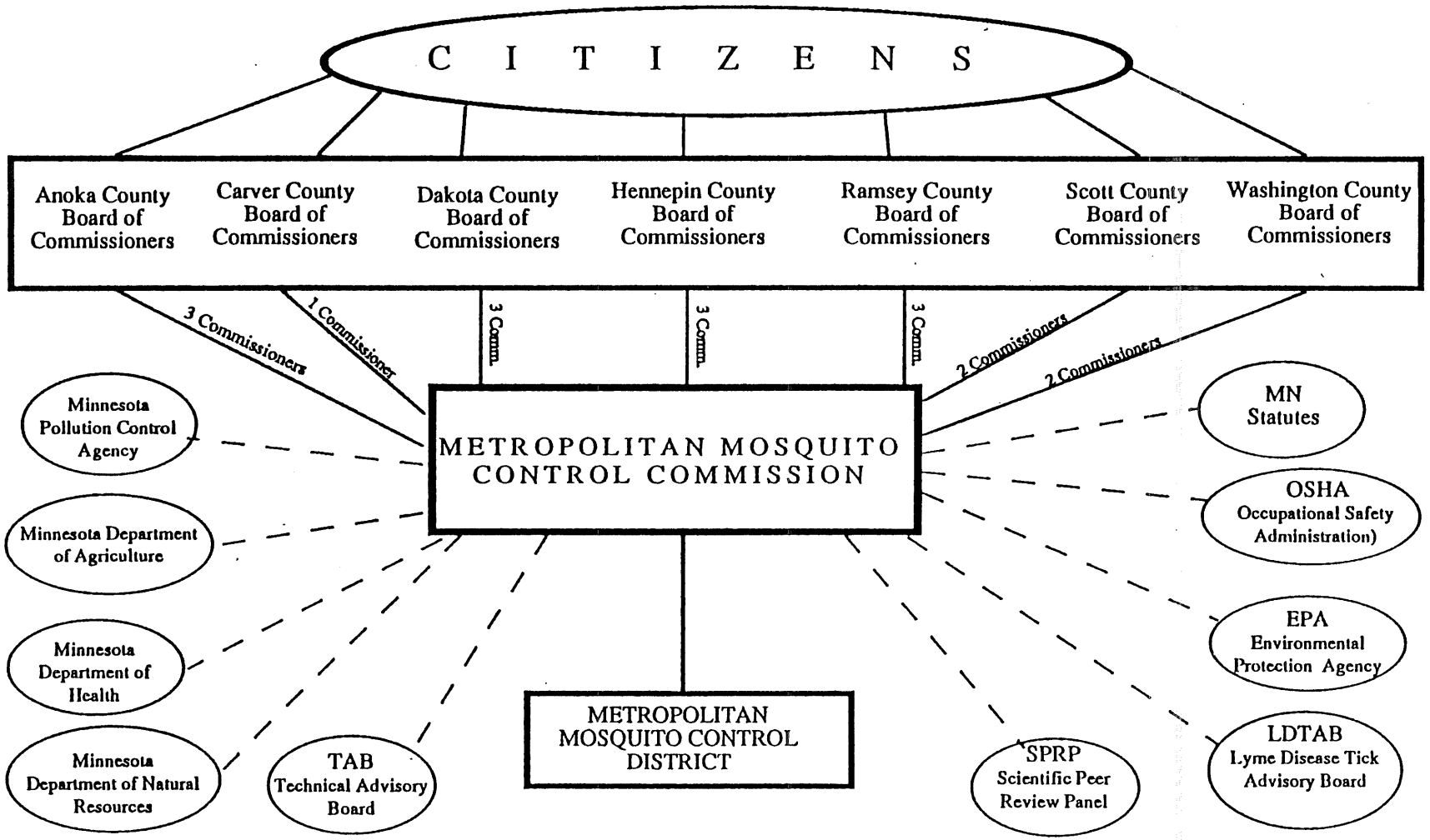
Daniel Bennek, Administrative Assistant, B.S. Business/Marketing
Sandy Brogren, Entomology Laboratory, B.S. Entomology
Dave Clark, Personnel Manager, J.D., B.B.A.
Diann Crane, Entomology Laboratory, B.S. Biology, M.S. Entomology
Dave Crews, Black Fly Program Leader, B.S. Biology
Daniel Dobbert, Data Analyst, Ed.D.
Rosemary Golias, Admin. Secretary, B.Ed Chemistry/Biology, M.A.Theology
Dave Neitzel, Vector-Borne Disease Management Leader, B.S. Wildlife Management, M.S. Environmental Health-Public Health Biology
Scott Ranta, Cattail Program Leader
Nancy Read, Program Development, B.S. Biology, M.S. Entomology, Ph.D. candidate Entomology,
Kelly Sharkey, Quality Assurance Program Leader, B.S. Wildlife Mgmt., M.S. Entomology
Mark Smith, Quality Assurance Program Assistant, B.S. Biology
James Stark, Public Affairs Coordinator, B.S. Journalism
John Thompson, Data Processing Manager, Computer Science Brown Institute, Management Information Systems - Metro State College (in progress)

METROPOLITAN MOSQUITO CONTROL DISTRICT
TECHNICAL ADVISORY BOARD
1995

Member Agency	Representative
Environmental Groups	**Al Singer** Minneapolis Parks 200 Grain Exchange Building 400 South 4th Street Minneapolis, MN 55415
Hennepin County Office of Planning and Development	**Robert Sherman** A-2308 Government Center Minneapolis, MN 55487
Hennepin Parks	**Laurence Gillette** 3800 County Road 24 Maple Plaine, MN 55359

Industry Representative	**Ron Chatfield** Solvay Animal Health 1201 Northland Drive Mendota Heights, MN 55120
MN Dept. of Agriculture	**Art Mason** 90 W. Plato Boulevard St. Paul, MN 55107
MN Dept. of Health	**Craig Hedberg** 717 SE Delaware Street Minneapolis, MN 55440
MN Dept. of Natural Resources	**Howard F. Krosch** Box 25 DNR Building 500 Lafayette Road St. Paul, MN 55155
MN Pollution Control Agency	**Dave Belluck** 520 Lafayette Road St. Paul, MN 55155
MN Dept. of Transportation	**Robert Wryk** Water's Edge 1500 West County Rd. B2 Roseville, MN 55113
University of Minnesota **Entomology Department**	**Dave Noetzel** 226 Hodson Hall St. Paul, MN 55108
Fisheries and Wildlife Department	**Jim Cooper** 200 Hodson Hall St. Paul, MN 55108
US Environmental Protection Agency	**Richard Anderson** Environmental Research Laboratory 6201 Congdon Boulevard Duluth, MN 55804
US Fish and Wildlife Service	**Dave Warburton** Twin Cities Field Office 4101 E. 80th Street Bloomington, MN 55425

METROPOLITAN MOSQUITO CONTROL DISTRICT ADVISORY AND REGULATORY REV IEW



TAB (Technical Advisory Board) — Representation from: Mn Department of Health; Mn Department of Agriculture; Mn Department of Natural Resources; Environmental Organizations; MN Pollution Control Agency; Departments of Entomology and Fisheries and Wildlife, University of Minnesota; U.S. Environmental Protection Agency; U.S. Fish and Wildlife Service; Industry

SPRP (Scientific Peer Review Panel) — Members from North America who are specialists in toxicology, wildlife biology, aquatic biology, ornithology, statistics, and entomology.

ADMINISTRATION

1. Background

The administration of the Metropolitan Mosquito Control District enables the programs to accomplish their tasks in an effective and efficient manner, while controlling and coordinating resource use. The staff seek to work with the public to identify and define citizen expectations. The activities of the program and service level expectations are communicated to the Commission. Staff work to establish Commission policies by designing programs and systems to implement the policies and goals.

Administrative objectives include:

- Provide leadership in the District reorganization, focusing on best use of resources, particularly human resources, in meeting the District's mission and goals.
- Emphasize improvement in program quality through the efforts of the continuous quality improvement initiative of the District.
- Maintain the focus on targeted group purchasing goals and compliance with affirmative action goals.
- Improve information on cost effectiveness of the operations by implementing an activity based costing system to better identify areas of improvement.
- Complete the establishment of a more effective management information system to provide for timely decision making and easy access to basic information important to operations.

2. 1994 Program

- In 1994 the District introduced a new Director to the program. Reorganization efforts began, creating a new vision and mission statement for the program.
- Continuous quality improvement programs have been started, focusing on training staff in CQI principles and leadership development. Actual improvement projects have been somewhat slower in coming.
- A vigorous program to improve management information systems at the District has been undertaken and will continue in 1995.
- The Capital Improvements Plan was completed in 1994, as the South Hennepin and North Hennepin Division headquarters were remodeled and the new Dakota Division headquarters completed.

3. 1995 Plans

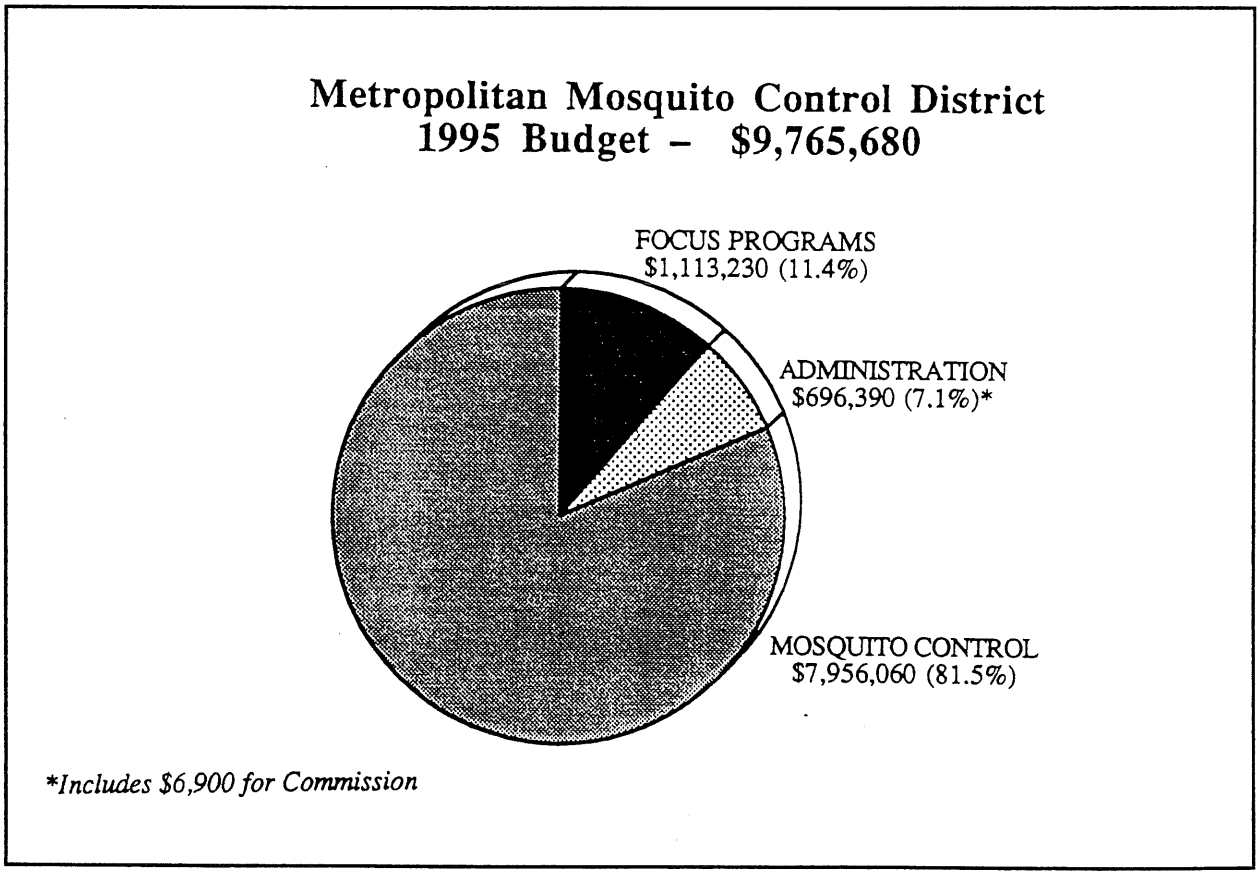
Cost savings are created through centralized procurement of major resources, such as control materials and other uniform needs, while allowing specific needs of individual operations or divisions to be handled on a decentralized basis. Resources, when possible, are shared among various programs and operating units. Through reorganization, this process is expected to be enhanced. The District has been successful in getting control materials and other items at competitive prices. Other operating costs will be examined through the development of the activity based costing system to ensure efficient operation.

The District's Continuous Quality Improvement Program has been spearheaded by administrative staff and Quality Assurance staff. A cross functional steering committee coordinates implementation and provides the workforce education and input in the process. The District is reviewing its vision statement and mission statement with the goal toward greater customer service.

Emphasis on communication with the Minnesota State Legislature and interested activist groups will be a focus of staff in 1995, along with the high degree of importance the District places on response to calls and concerns of our constituents. Requests, comments and complaints are handled quickly and effectively, using a process that includes both central office and field staff.

The District has completed a capital improvements program which provides suitable, good quality facilities. This plan includes six District field operating headquarters and a central office/laboratory building that consolidated several scattered offices and provides a meeting space used by many metro area government agencies.

As part of District reorganization payroll will be outsourced so an emphasis can be placed on streamlining human resources.



PUBLIC AFFAIRS

1. Background

The Public Affairs (PA) program communicates the wide variety of District activities to citizen groups, government agencies, the news media, and the general public. Communication with our public is clear, concise and timely.

District staff conduct Public Information/Education programs for elected officials, citizen groups, civic organizations, and school districts within the MMCD. Press releases and filmed interviews provide the public with information about program activities. In addition, informational literature is developed and updated as MMCD programs and public expectation and needs change.

2. Telephone Response to Citizen Inquiry

As a public agency, the MMCD is responsible to citizen questions and concerns. In 1994 the District received over 1,000 telephone calls inquiring about the District operations (Table 2.1). Staff answer questions, provide information, and obtain information about the caller and their request. Caller information is forwarded daily to the appropriate Supervisor or Program Leader for follow-up. Information requested by the caller is mailed that day or the next morning. The category of calls received and the path of service for each are as follows:

Citizen concerns. Citizens call with a variety of questions or concerns including control material information, notification before treatment, objection to treatment on private property, helicopter use, and chemical sensitivity, among others.

Callers are reassured that their concerns are being heard and that prompt action will be taken. A simple exchange of information is usually sufficient. However, many times callers are angry or upset and such calls are forwarded directly to the PA Coordinator. An investigation is initiated with follow-up that includes contact by letter, additional phone call(s), or personal visit. If the concern demands immediate attention, the Supervisor/Program Leader is located and apprised of the situation. Follow-up and response are completed within two working days. Follow-up for general questions or concerns is completed within five days. District information is sent to the caller in addition to any specific follow-up to their request.

Report of a breeding site. Callers want to know if we are aware of a breeding site on their property or in their neighborhood and whether or not it has been treated.

The information taken from the caller is given to the appropriate Supervisor or Program Leader for follow-up. Maps and records are checked to make sure the site is listed. More than 95% of these calls refer to sites that are already mapped. If the field staff is unfamiliar with or unclear about the site, the citizen is contacted and the area is field-checked. A citizen response sheet is completed and returned to the main office within 5 working days.

The caller is sent information pertaining to breeding site identification and control materials. We include a District brochure that gives a brief overview of our operation. More specific information is available upon request. Our goal is to contact these callers and answer their questions as soon as possible.

Mosquito annoyance complaints. A caller registers a general complaint (e.g."The mosquitoes are terrible! Please help!") with no reference to a breeding site nearby. Many times these calls come from areas in the District where larval control is minimal. Black fly annoyance is also recorded in this category. Caller information is recorded and sent to the appropriate Division. In addition, telephone staff explain our adult mosquito surveillance methods and control operations and information is sent to the caller. The information obtained from the caller is valuable and helps direct control operations in that Division.

Public property treatments. Representatives from civic organizations or government agencies call to request adult mosquito control for park and recreational areas and for civic events (i.e., graduations, sporting events, and local fairs and celebrations). Most public functions are held annually and treatment requests need to be submitted yearly. Information is recorded and sent to the appropriate Division. Treatments are done once the priority work has been completed and weather conditions permit. Field staff document treatments and return information to the main office.

Table 2.1

TELEPHONE SUMMARY
1994

The following shows the number of telephone calls by catergory, received by the MMCD.

TYPE OF CALL*	1990	1991	1992	1993	1994
CITIZEN ISSUES & CONCERNS	239	234	292	233	349
MOSQUITO BREEDING SITE LOCATION	274	347	273	359	293
MOSQUITO/BLACK FLY (GNAT) ANNOYANCE LEVELS	211	112	161	173	137
PUBLIC TREATMENT REQUESTS	171	161	137	171	147
GENERAL INFORMATION	236	194	210	387	111
CALLS TOTAL -	1,131	1,048	1,073	1,323	1,037

* Caller may have voiced more than one concern or issue.

3. Adult Mosquito Control Information Line - 643-8383

To inform citizens concerned about the time and location of mosquito adulticiding operations, the MMCD expanded its adulticiding information line. The information line enables citizens to hear a daily recorded message on where adulticiding activities will be taking place. This provides a greater service to the citizens since they do not have to be at home to receive our call. Staff will call citizens who still desire advanced notice of adult mosquito control treatments.

The MMCD uses its voice mail system to update daily information on this line. District field staff input information to staff at the end of work shifts which then allows staff to update the line by 4:00 P.M. weekdays.

Callers to the information line are first given a general greeting, followed by instructions for specific counties within the Metropolitan area. By pressing the corresponding number to the county requested, the caller receives specific back pack and cold fogging information for each community within the county involved.

Citizen who have expressed concern over adulticiding activities receive a letter with instructions on the use of the system at the beginning of the season. A person who chooses not to use this system can request the MMCD contact them if treatments were to happen in their area.

Results from the number of calls received were tallied, and categorized at the end of the season. (Table 2.2)

Table 2.2

ADULT MOSQUITO CONTROL INFORMATION LINE 1994

	Phone Call Inquiries 1993	Phone Call Inquiries 1994	1994 Percent by County
Anoka	151	106	16.6%
Carver	52	43	6.7%
Dakota	35	51	8.0%
North Hennepin	87	85	13.3%
South Hennepin	286	186	29.1%
Ramsey	98	95	14.8%
Scott	63	44	6.9%
Washington	54	30	4.7%
Total -	826	640	100.0%

4. Metropolitan Mosquito Control District Video

A 10 minute video on MMCD operations was completed in 1993. The video provides an overview of all District programs. This video is used in presentations by staff as an introduction to the program. Additional copies of the video are available for presentations.

5. State & County Fairs Booth Presentations

Information booths are operated at the State and seven metro County fairs. The booths display samples of mosquito and black fly larvae; black-legged and wood ticks; information on Lyme disease; and dog heartworm displays. Informational brochures regarding the wide variety of services provided by the District are also distributed. An estimated 40,000 visitors stopped to look and ask questions, and staff reported the public response to displays and information given was over 95% positive.

Following is a tabulation of the number of people who visited our booth (Table 2.3):

Metropolitan Mosquito Control District
1994 Estimated Visitors to Informational Booths
County and State Fairs

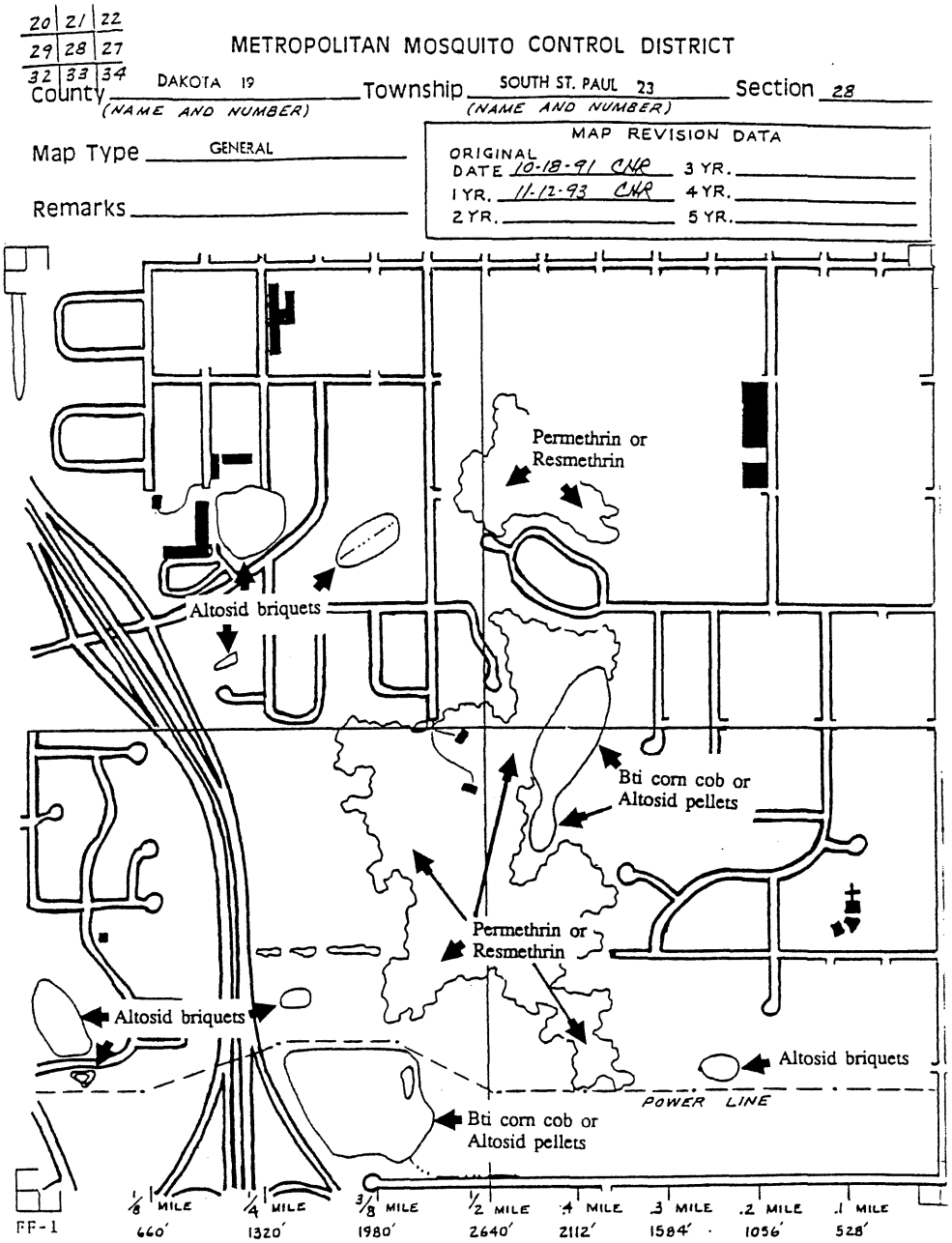
DATE	FAIR	ESTIMATED # PEOPLE VISITED
August 2-7	Anoka County Fair	2,570
August 10-14	Carver County Fair	2,602
August 8-14	Dakota County Fair	3,959
July 28-31	Hennepin County Fair	1,856
July 20-24	Ramsey County Fair	1,500
July 28-31	Scott County Fair	2,166
August 3-7	Washington County Fair	2,500
August 25 - September 5	Minnesota State Fair	23,579
	Total Estimated Visitors -	40,732

MOSQUITO CONTROL MATERIALS

The following is a description of a mosquito breeding site and an explanation of the mosquito control materials currently in use by MMCD. The specific names of products used in 1994 are given. The generic products will not change in 1995, although the specific formulator may. Additional information of the products are located in the Appendix.

Mosquito Breeding Site -

A mosquito breeding site is just about any place which will hold water for a week or more after a rain. The typical summer *Aedes* species mosquito breeding site generally occurs in sites which are less than 4 feet deep and in areas which may contain many grasses. The MMCD has mapped breeding sites in the entire metropolitan area as well as sites in Wright, western Carver and southeastern Sherburne counties. There are over 60,000 breeding sites in the metropolitan area. Breeding site maps are updated on a five year schedule. Below is a example of a breeding site map with typical mosquito applications.



ALTOSID® 150 DAY BRIQUETS

(Sandoz Agro-Zoecon Corporation-Altosid® XR Extended Residual Briquet)

Altosid® briquets are typically applied to mosquito breeding sites which are 3 acres or less. Briquets are applied to the lowest part of the site on a grid pattern of 14-16 ft. apart at 220 briquets per acre. Sites which may flood and then dry up (Types 1 & 2) are treated completely. Sites which are somewhat permanent (Types 3, 4, 5) are treated with briquets to the perimeter of the site in the grassy areas. Pockety ground sites (i.e. sites without a dish type bottom) may not be treated with Altosid® briquets due to spotty control achieved in the uneven drawdown of the site.

Cattail mosquito breeding sites are treated at 330 or 440 briquets per acre. Applications are made in the winter and early spring.

Altosid® briquets are not applied to known fish breeding habitats as defined by the MN Department of Natural Resources (DNR).

ALTOSID® LIQUID

(Sandoz Agro-Zoecon Corporation - Altosid® Liquid Larvicide Concentrate - A.L.L. Liquid)

Altosid® liquid is mixed with water and applied in the spring to mosquito breeding sites which are breeding spring *Aedes* mosquito larvae. Typical applications are to woodland pools. Sites which are greater than 3 acres in size are treated by the helicopter at a rate of 1 ounce of concentrate per acre. The dilution is adjusted to achieve the best coverage of the site.

Altosid® liquid treatments are normally completed by June 1st of each season. Site conditions during the remainder of the season do not allow for successful treatment with a liquid larvacide as the material does not penetrate the vegetation.

ALTOSID® PELLETS

(Sandoz Agro-Zoecon Corporation - Altosid® Pellets)

Altosid® pellets consist of methoprene formulated in a pellet shape. Altosid® pellets are designed to provide up to 30 days control but trials have indicated control up to 40 days. Applications will be made to ground sites (less than 3 acres in size) at a rate of 2.5 lbs. per acre for the *Aedes* control program and 4-5 lbs. per acre for the Cattail mosquito control program. Applications are also done by helicopter in sites which are greater than 3 acres in size at the same rate as ground sites.

Bacillus thuringiensis israelensis (Bti) CORN COB

(Abbott Laboratories Vectobac® G; Novo Nordisk Bioindustrial Bactimos™)

Bti corn cob may be applied in all types of mosquito breeding sites which have targeted mosquito larvae in the water. *Bti* can be effectively applied during the first three instars of the mosquito breeding cycle. Typical applications are by helicopter in sites which are greater than 3 acres in size at a rate of 5-10 lbs. per acre. In sites less than 3 acres, *Bti* may be applied to pockety sites by ground crews with cyclone seeders or power back packs.

PERMETHRIN

(Clarke Mosquito Control Products - Permethrin 57% OS; Vectec- Punt 57 OS)

Permethrin is used by the District to treat adult mosquitoes in known daytime resting or harborage areas. Harborage areas are defined as wooded areas with good ground cover to provide a shaded, moist area for the mosquito to rest during the daylight hours.

Adult control is initiated when MMCD surveillance (harborage and light trap collections) indicates nuisance populations of mosquitoes, when employee conducted landing rate collections document high numbers of mosquitoes, or when a large number of citizen complaints of mosquito annoyance are received from an area. Harborage spraying can also be initiated prior to large outdoor civic events when requested by public officials.

The District mixes permethrin with soybean and food grade mineral oil and applies it to wooded areas with a power back-pack mister at a rate of 17 oz. of mixed material per acre.

RESMETHRIN (Roussel Bio Corporation - Scourge® 4+12)

Resmethrin is used by the District to treat adult mosquitoes in known areas of concentration or nuisance. Resmethrin is applied from truck mounted Ultra Low Volume (ULV) machines which produce a fog which contacts mosquitoes when they are flying. Fogging may also be done with hand held cold fog machines which enable the applications to made in smaller areas than can be reached by truck. Cold fogging is done either in the early morning or at dusk when mosquitoes become more active. Resmethrin is mixed with other oils and is applied at a rate of 1.5 ounces of mixed material per acre.

II. PROGRAMS

1. **Vector-borne Disease Management Program**
2. **Mosquito Program**
3. **Mosquito Surveillance**
4. **Quality Assurance**
5. **Program Development**
6. **Black Fly Program**
7. **Environmental Quality Board Interactions**

VECTOR-BORNE DISEASE MANAGEMENT PROGRAM

1. Background

In 1994, the LaCrosse Encephalitis Prevention Program and Lyme Disease Tick Surveillance Program were combined to form the Vector-Borne Disease Management Program. The program includes all of the services of the former programs, plus additional surveillance for other mosquito and tick-borne diseases (eg. Western equine encephalitis, Jamestown Canyon virus).

LaCrosse encephalitis prevention services were initiated in 1987 to identify areas where there is significant risk of LaCrosse encephalitis cases occurring within the District. Areas with high populations of the primary vector *Aedes triseriatus* (tree hole mosquito), and a history of LaCrosse encephalitis cases, are defined as high risk areas. These high risk areas are targeted for intensive control efforts including public education and mosquito breeding site removal. In addition, monitoring and control procedures are conducted at confirmed LaCrosse encephalitis case sites. An *Ae. albopictus* (Asian tiger mosquito) surveillance program has also been initiated to detect this potential LaCrosse encephalitis vector before it becomes established within the District.

In 1990, the MMCD initiated Lyme disease tick surveillance to determine the range and abundance of the black-legged tick (*Ixodes scapularis*) and the Lyme disease spirochete (*Borrelia burgdorferi*) within the District. To date, we have mapped the current distribution of deer ticks, and have initiated cooperative spirochete studies with the University of Minnesota. All of the data collected are summarized and given to the Minnesota Department of Health (MDH) for their risk analysis. This has been a surveillance and public education effort only, as no large-scale deer tick treatment options are available.

2. 1994 Program

Aedes triseriatus Surveillance

Previous studies were conducted in higher LaCrosse encephalitis risk areas, based on past confirmed cases and suitable *Ae. triseriatus* habitat. This year, intensive surveillance was conducted at 80 randomly chosen woodlots in southwestern Hennepin and northern Carver counties. Adult mosquitoes were collected from each site using a large aspirator. Locations that yielded a season average of 2 or more *Ae. triseriatus*/5 minute sample in 1994 will be priority areas for control in 1995.

The majority of past LaCrosse encephalitis cases have occurred in the Lake Minnetonka region of Hennepin County. High risk neighborhoods within this region were identified during our 1988 and 1989 survey. We have continued to monitor *Ae. triseriatus* levels at those high risk sites, and have identified several locations that require additional control efforts in 1995. We also continued surveillance efforts at all past confirmed LaCrosse encephalitis case locations to prevent further cases in those areas.

Aedes triseriatus Control

The program continued the distribution of the LaCrosse encephalitis prevention brochure. As in past years, we supplied brochures to many city halls, public libraries, county and state fairs, and

other public functions. We also conducted a mass mailing of over 52,000 brochures, as local newspaper inserts, in identified risk areas within Hennepin (Lake Minnetonka region), Dakota, Scott, and Carver counties.

Two press releases on LaCrosse encephalitis were sent to over 50 local media sources. In addition, interpretive posters and other information were presented at each county fair and the state fair. The press releases and presentations outlined LaCrosse encephalitis, and stressed water-holding container removal.

In 1994, our staff removed 40,478 waste tires from high risk areas of the District (Fig. 1.1). The waste tire agreement with the Minnesota Pollution Control Agency (MPCA) continued to reimburse the MMCD for some of the tire disposal costs. In addition, cooperative tire dump cleanup efforts with the MPCA and several county environmental management departments resulted in the elimination of several larger waste tire sites.

Program staff removed artificial containers and modified wet tree holes in several areas including the Lake Minnetonka area (Hennepin County).

There had been no confirmed cases of LaCrosse encephalitis reported in the District between 1989 through 1993 (Fig.1.2), however two cases were reported from a neighborhood in the Shorewood/Deephaven area of Hennepin County in 1994. The cases occurred in an area that was monitored extensively in 1988 and 1989. At that time relatively low numbers of *Ae. triseriatus* mosquitoes and their potential breeding sites were found. The area had received LaCrosse encephalitis brochures since then, including our mass mailing earlier in the year. After the cases were reported, MMCD staff removed several hundred potential *Ae. triseriatus* breeding sites (including 89 tires) from the 1-2 mile area around the case sites.

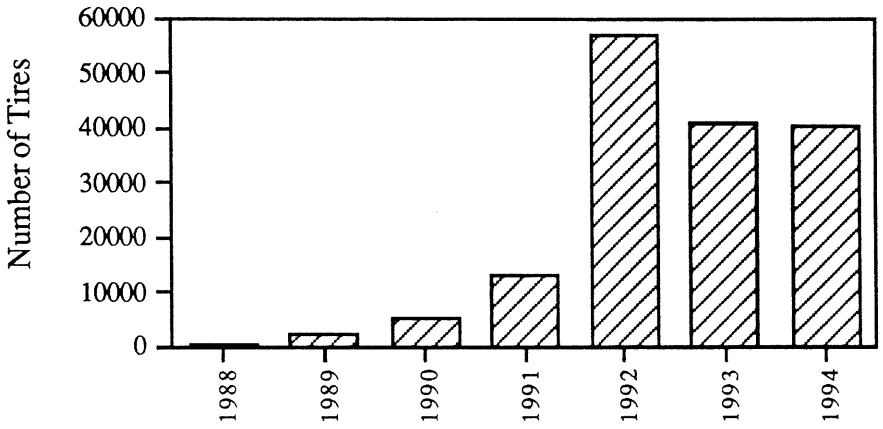
Aedes albopictus (Asian Tiger Mosquito) Surveillance
We found no evidence of *Ae. albopictus* within the District in 1994. The only site that required regular monitoring in 1994 was the tire recycling facility in Scott County, where an infestation had been discovered and eradicated in 1991.

Western Equine Encephalitis (WEE), and Jamestown Canyon Virus (JCV) Surveillance
During 1994, a sentinel chicken flock was established in Wright County to monitor for WEE virus activity, and to give us experience with surveillance for this virus. The birds were sampled (blood samples) weekly to determine if they had been exposed to the virus. No evidence of the virus was found in 1994.

In addition, over 10,000 mosquitoes were collected and tested for Jamestown Canyon virus. A previous MMCD study had documented the presence of this potentially serious virus in local white-tailed deer populations, but we were not sure of the local vector species. In other states, several spring *Aedes* mosquito species appear to be the important vectors, so our collecting efforts focused on them. The Centers for Disease control (CDC) tested the mosquitoes, but were unable to obtain any positive results in 1994.

Lyme Disease Tick and Spirochete Studies.
We continued sampling the network of 100 sites set up in 1991-1992 to look for changes in deer

Fig. 1.1 Waste tires removed by MMCD staff between 1988 and1994. Total tires removed to date=158,852.



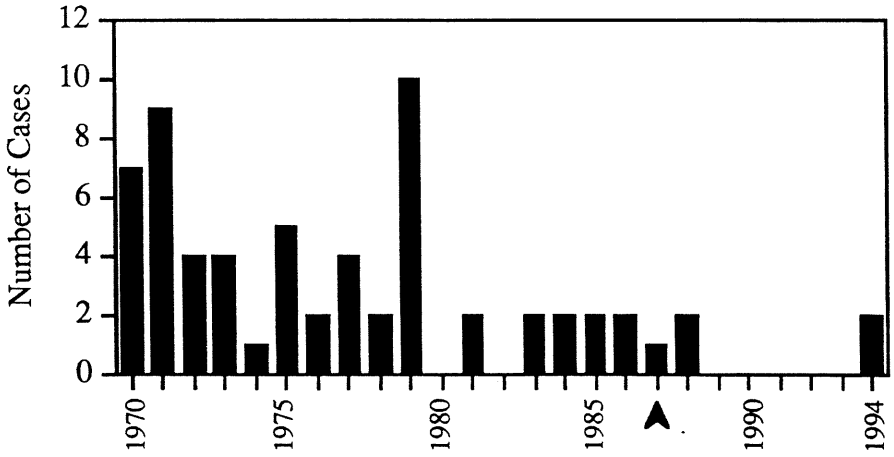


Fig. 1.2. Number of LaCrosse encephalitis cases between 1970 and 1994 in the seven county metropolitan area. LaCrosse Encephalitis Prevention Program began in 1987.

tick distribution over several years. As in previous years, our main sampling method involved capturing small mammals from each site, and removing all attached ticks from them. Over 1,600 mammals were inspected this year, and deer ticks were found at 35 of the sampling locations. Although tick numbers appeared to be relatively high in 1994, we continued to find most *I. scapularis* in the northeastern counties of the District (Fig. 1.3).

We also continued cooperative studies with Dr. Russell Johnson of the University of Minnesota to determine the distribution and prevalence of the spirochete *B. burgdorferi.* Small mammals from six study sites in North Oaks (Ramsey County) were brought to Dr. Johnson to be tested for the spirochetes. North Oaks was chosen for study, as it represents a Lyme disease exposure situation in a metropolitan area suburb. Small mammal infection rates at each site varied from 0-20%. Lyme disease spirochetes appear to be quite localized in the eastern woodlots of North Oaks.

Over 230 of the small mammals collected from North Oaks were also tested (by CDC) for exposure to hantaviruses. We found that 6% of the white-footed mice (*Peromyscus leucopus*) sampled had been exposed to the Seoul strain of hantavirus. This strain has not been associated with human illness in North America. We found no evidence of the Sin Nombre strain that has caused several deaths in the western United States.

Lyme disease public education activities continued in 1994. Personal protection measures, tick identification, and black-legged tick distribution were stressed during presentations at each county fair and the state fair. The MMCD has also become a part of two MDH Lyme disease education work groups, designed to educate the public and the medical profession on important aspects of Lyme disease and other tick-borne diseases.

3. 1995 Plans

The Vector-Borne Disease Management Program will continue the current surveillance and control programs in 1995. LaCrosse encephalitis prevention services will emphasize *Aedes triseriatus* surveillance and control within the Lake Minnetonka region of Hennepin County, due to the recent viral activity in the area. Waste tire removal will continue to be a priority across the entire District.

We will clean up small tire piles that produce *Ae. triseriatus*, and continue to work with the MPCA and county environmental management departments to clean up larger tire piles. We will also continue the *I. scapularis* distribution study and cooperative spirochete studies with the University of Minnesota. The Lyme Disease Tick Advisory Board (LDTAB), made up of local scientists and agency representatives with Lyme disease expertise, will conduct their annual review of our Lyme studies this spring. In addition, we hope to increase WEE monitoring, and continue the JCV vector and hantavirus studies (assuming we can obtain testing at no cost from CDC as in 1994).

We also hope to explore other areas of local vector-borne disease importance as opportunities arise. For example, we may be able to find someone to test tick samples (that we already have collected) to determine if Ehrlichiosis or Babesiosis are a problem within the District.

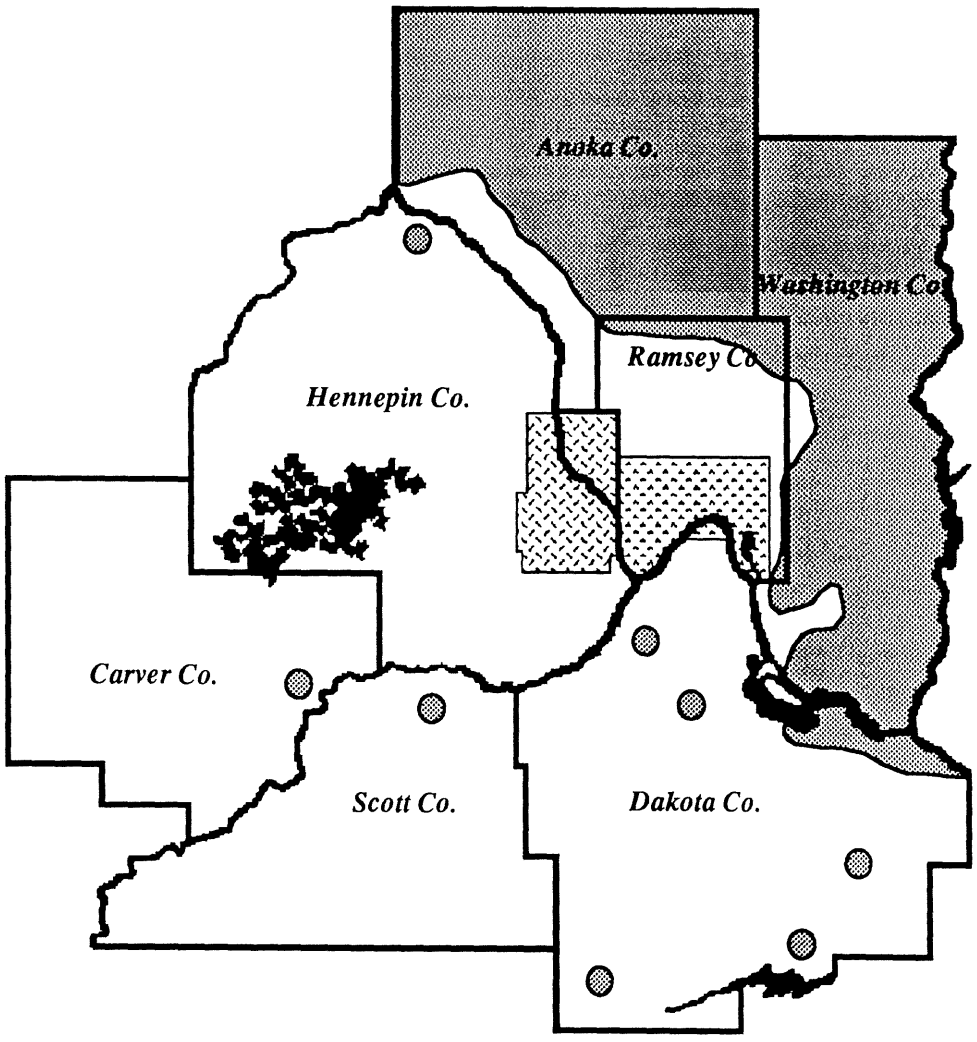


Fig. 1.3. *Ixodes scapularis* distribution within MMCD boundaries as of December, 1994. Shaded area represents locations where tick collections are most likely and shaded circles represent isolated records.

MOSQUITO CONTROL PROGRAM

1. Background

The mosquito control program targets the principal summer pest mosquito, *Aedes vexans*, several species of spring *Aedes*, and the cattail mosquito *Coquillettidia perturbans*. Larval control is the main focus of the program but is augmented by adult mosquito control when necessary. *Aedes* larvae hatch in response to rain with adults emerging at various times during the summer, 10 days to 2 weeks after the rain. Cattail mosquito larvae develop in cattail marshes over twelve months and emerge as adult mosquitoes in June and July.

The floodwater mosquitoes are adept at utilizing the natural resources of the metropolitan area. These same natural resources contribute to the recreation and enjoyment for the citizens of the area. The rolling topography provides an unusually high number of highly productive breeding sites for the mosquito larvae. Summer rains which replenish the aquifers also provide the necessary moisture for mosquito development. Lush wooded areas serve as protection from daily heat and low humidity for the resting adult mosquitoes.

2. Control Strategy Overview

Due to the large size of the metropolitan region, larval control was considered the most cost effective control strategy in 1958 and remains so to date. *Aedes* control and cattail mosquito control had previously been performed by 2 separate programs. Because "a mosquito is a mosquito" to most citizens, we decided to consolidate the programs to provide better control for both mosquitoes. The Mosquito Program targets the most prolific mosquito breeding locations. An insect growth regulator (Altosid® or methoprene) and a soil bacteria (*Bti*) are the larval control materials.

Adult mosquito control is a minor part of the MMCD program. Control is done upon request primarily in high use park and recreation areas and for public events. Two synthetic pyrethroids (resmethrin and permethrin) are used for adult mosquito control. The adult mosquito control policy was updated in 1994 (see appendix).

3. 1994 Mosquito Control

Cattail Mosquito Control

Crews inspected approximately 2,000 *Cq. perturbans* breeding sites from late-August through November, 1993. Larviciding began in February 1994 using Altosid® XR 150-day briquets applied on the ice and snow. Deep sites were treated first and applications continued through April when the small, shallow sites were treated after the spring thaw. A total of 662 acres were treated with Altosid® briquets through April and then 1,782 acres with Altosid® 30-day pellets applied by helicopter in late May.

Floodwater Mosquito Larval Control
As in the past, ground sites (less than 3 acres) were treated primarily with Altosid® briquets. This formulation provides season long mosquito control. Fewer acres (7895) were treated with briquets in 1994 compared to 1993 (9,775 acres) as sites were identified as being more effectively treated with pellets or *Bti*. Approximately 4047 acres were treated with pellets for floodwater mosquitoes in 1994, this is less than 1993 due to limited aerial applications. We limited the aerial applications of pellets due to problems in getting uniform applications at the low (2.5 lbs/acre) rate.

Air sites (3 acres or more) were treated with *Bti* corn cob granules by helicopter. Approximately 102,860 acres were treated in 1994, which is less than the 123,766 treated in 1993, due to the below average rainfall. The treatment threshold was set at 2 larvae per dip in the inner zone of the District. The threshold in the outer zone was variable depending on the total number of acres breeding mosquitoes and the amount of time and material remaining.

ACRES TREATED	1993 Altosid®XR Briquets	1994 Altosid®XR Briquets	1993 Altosid® Pellets	1994 Altosid® Pellets
Cattail Mosquito	782	662	686	1,782
Floodwater Mosquito	9,775	7,895	4,870	4,047
TOTAL -	10,557	8,557	5,556	5,829

Adult Mosquito Control
Permethrin usage (10,499 acres) was greater than usage in 1993 (8,261 acres). Resmethrin usage (40,687 acres) was less than in 1993 (53,634). More adult mosquito control operations were targeted at high populations of *Cq. perturbans* than in previous years because this was a particularly good year for that mosquito and we were better able to identify areas of high concentration.

4. Supporting Research

The following studies were conducted to evaluate present and possible future control methods. More detailed reports are available in the MMCD library.

Efficacy Studies
For cattail mosquito control, staff conducted studies on the efficacy of Altosid® XR 150-day briquets applied on the ice and Altosid® 30-day pellets applied by helicopter. Six emergence cages were placed in each of 8 sites treated with the 150-day briquets, 30-day pellets, and reference sites that have never been treated. Each cage covered approximately one square meter of breeding area within the site. Adult mosquitoes were vacuumed from cages twice weekly

from May 23 through August 22. Overall, briqueted sites had a 85% reduction in mosquito emergence, pellets a 98% reduction compared to the untreated reference sites. Both Altosid® briquets and pellets markedly reduced the number of *Cq. Perturbans* emerging from treated sites compared to untreated sites throughout the study period (Fig 2.1).

Altosid® Liquid Larvicide Testing for Use as Spring Aedes Control

A larval control material that has a residual capability can play an effective role in the control of spring species of *Aedes* mosquitoes. MMCD currently uses Altosid® briquets and pellets for residual control of the spring *Aedes* mosquitoes but Altosid® Liquid Larvicide (A.L.L.) may be an effective and less expensive alternative. Preliminary testing showed that A.L.L. was found to have a residual effect up to 30 days.

This study was designed to compare treatments of 30-day Altosid® pellets and A.L.L. in known spring *Aedes* larvae sites. Due to the relatively dry spring time period, most of our test sites dried up before the testing could be completed. However, in our limited results, we found that A.L.L. worked as well as Altosid® pellets and that both control materials had significantly greater mortality than untreated reference sites (Fig 2.2). Also, both materials appear to be very effective, at least through 20 days post treatment, at controlling spring *Aedes* larvae (Fig.2.3).

Briquet Site Breeding History

A large portion of the control material budget is spent on Altosid® XR briquets placed in sites less than 3 acres in size. The goal of this study was to update our information on the productivity of these sites so as to make more efficient use of the material. The briquet is best used in sites with a high likelihood of breeding with each significant rainfall. Previous studies by Read (internal data) have shown that sites fall into one of three categories: those that breed with every significant rain; those that rarely breed; and those that sometimes breed and not always at high levels. It is our goal to identify sites that can be placed in either of the first two categories so they can be assigned appropriate treatment in the future.

Two approaches were used to acquire this information:

1) *Aedes* field staff chose the sites for which they wished to know larval production. From these data we can make site specific determinations of which sites warrant treatment with briquets.
2) Quality Assurance staff used the randomized list of sites treated with methoprene briquets that was generated for checkbacks as their list of sites to check. From these data, we can generalize about sites throughout the District.

The spotty rains of 1994 gave us some information on these sites but additional data need to be gathered in a more "normal" rainfall year.

Park Study

Larval sampling of agency refused entry lands (MDNR, USFWS, Minneapolis Parks, etc) was conducted by field personnel to determine larval productivity in large-scale untreated areas. Data are still being processed.

Resistance Testing
Permethrin resistance trials using *A. vexans* (5 trials) and *Ae. trivitattus* (1 trial) were run using various concentrations of permethrin to determine EC_{50}, EC_{95}, and EC_{99}, etc. These data will be added to previous years' data and will serve as a working baseline from which to evaluate future years' resistance monitoring.

Three trials with *Ae. vexans* were run to determine methoprene resistance. Higher than expected mortality in the controls continue to hinder us from obtaining accurate results. We have enlisted the aid of other entomologists and toxicologists to address control mortality.

Lagenidium Testing
Lagenidium is a larvicidal fungus with strong affinity for mosquito larvae. In other areas of the country, it will remain and recycle in mosquito breeding sites with no intervention. *Lagenidium* was applied to 4 sites in the District to determine if it would be effective against floodwater *Aedes*. No indications of larval mortality were observed, possibly due to inactive batches of fungus. Sites will be monitored in 1995 to look for residual infections in mosquito larvae.

Copepod Monitoring
Several species of copepods have been noted to be predacious on mosquito larvae. Sites were sampled to see if these species were present in *Aedes* breeding sites. *Acanthocyclops vernalis*, *Eucyclops agilis*, and *Cyclops varvus* (or *C. nearcticus*) were commonly found. In studies by Gerry Marten (Centers for Disease Control), *A. vernalis* aggressively preyed on mosquito larvae and *E. agilis* did not eat larvae.

Increased Notification for Adult Mosquito Control Treatments
Providing information to citizens is of utmost importance to MMCD. In light of this, a trial was conducted in 1994 to evaluate methods of informing citizens of upcoming adult mosquito control applications.

The trial was done in 3 geographic areas with treatments planned for Thursday evening, August 25, weather and mosquitoes permitting. We need to have a threshold number of mosquitoes in order to initiate treatment. In addition the temperature needs to be above 60° and winds 2-8 mph.

1. Excelsior had signs placed 4 per side of the street on each block on Thursday. These signs were to be picked up the morning after treatment.
2. Ham Lake residents received a pamphlet on their doors Thursday morning.
3. The cable TV station that serves Moundsview residents received the treatment information to place on their community bulletin board.

A follow-up telephone survey was conducted August 26 through August 29. There are approximately 1168 households in Excelsior, 112 households in Ham Lake and 4,746 in Moundsview. Of these, there were 96 completed calls in Excelsior, 60 in Ham Lake and 99 in Moundsview.

After the residents of Excelsior were phoned, they received another flier explaining that the signs were only a test. Residents of Excelsior and Ham Lake also received a brief explanation of adult mosquito control.

Fig. 2.1. Average number of *Cq. perturbans* collected per week in emergence cages from briqet or pellet treated and reference sites, 1994.

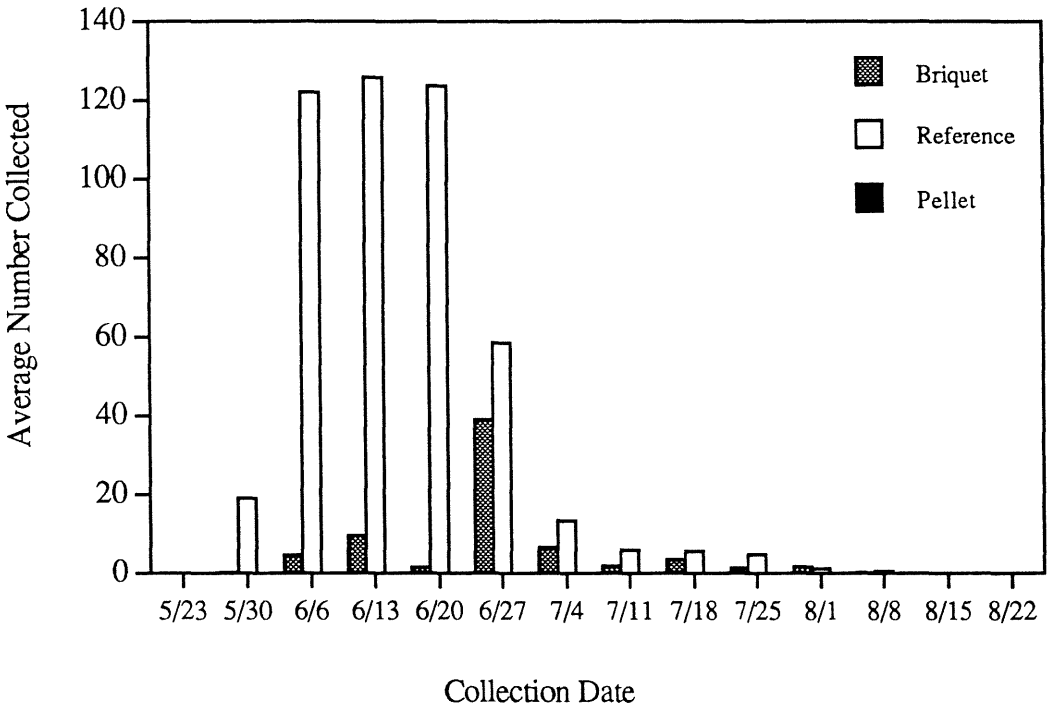
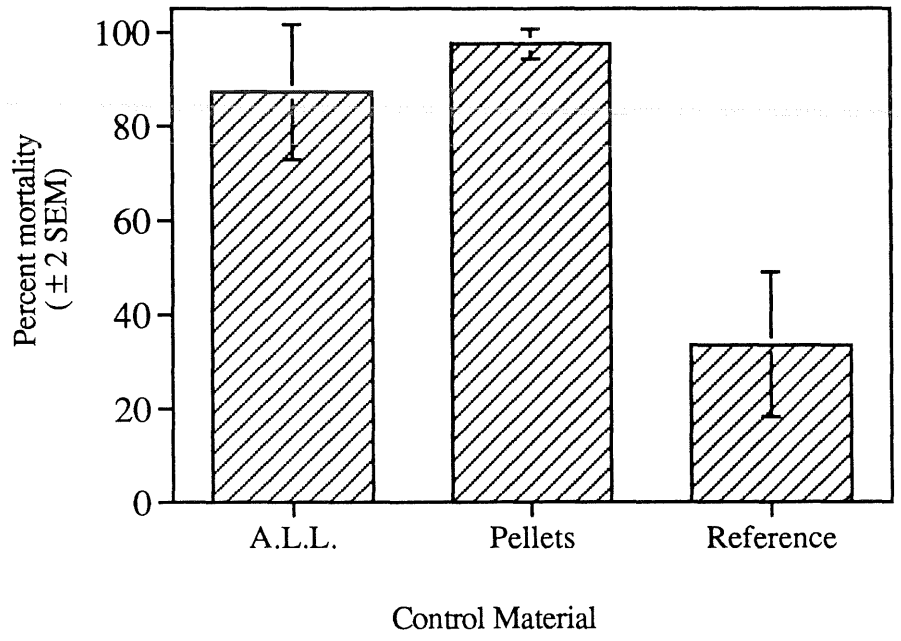


Fig. 2.2. Mortality levels in spring *Aedes* test sites throughout MMCD, 1994.



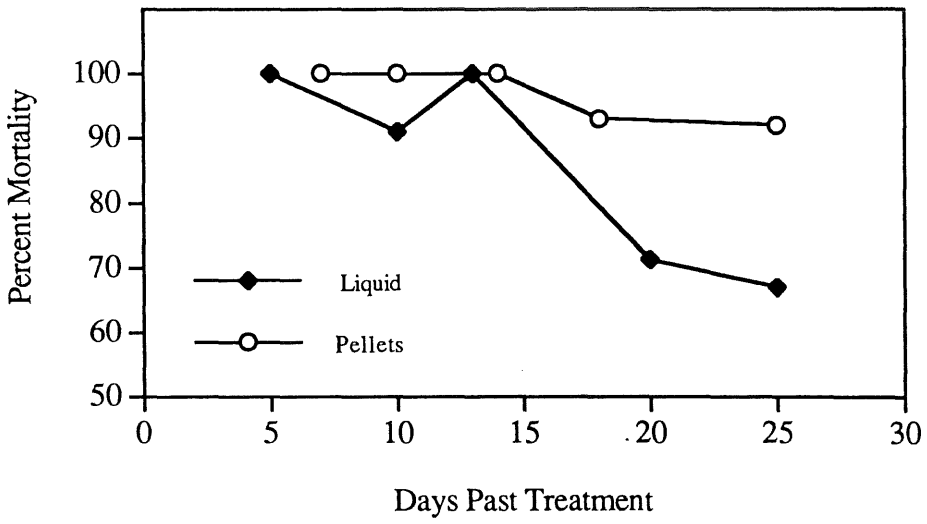


Fig. 2.3. Mortality levels at various days past treatment for Altosid® liquid and Altosid® pellets for spring *Aedes* in test sites, 1994.

The majority of respondents indicated that they would like to be notified when adult mosquito control treatments are made. A slightly higher percentage of respondents in Ham Lake (door flyer) than Excelsior (street signs) were aware of notification. None of the respondents in Moundsview (cable TV announcement) were aware of notification. The majority of respondents indicated that the notification did not affect their activity.

In 1995 MMCD plans to do a similar trial, perhaps exploring some of the possible methods of notification identified by respondents.

5. 1995 Plans for Mosquito Control

Cattail Mosquito

Because *Cq. perturbans* has a limited flight range of 5 miles, the program will focus control activities on the most productive marshes near human population centers. We anticipate expanding treatment in 1995 in all counties except for Hennepin (Fig.2 4). Regular applications of Altosid® XR 150-day briquets will begin in February 1995. We anticipate being able to treat more acres this year because of a shift of a portion of briquets to pellets. Altosid® pellets will be applied by helicopter to large cattail marshes late in May at a rate of 4 lb/ac. During the summer months we will monitor the efficacy of the treatments. We will also monitor the adult populations with the District's evening collections.

Larval Control

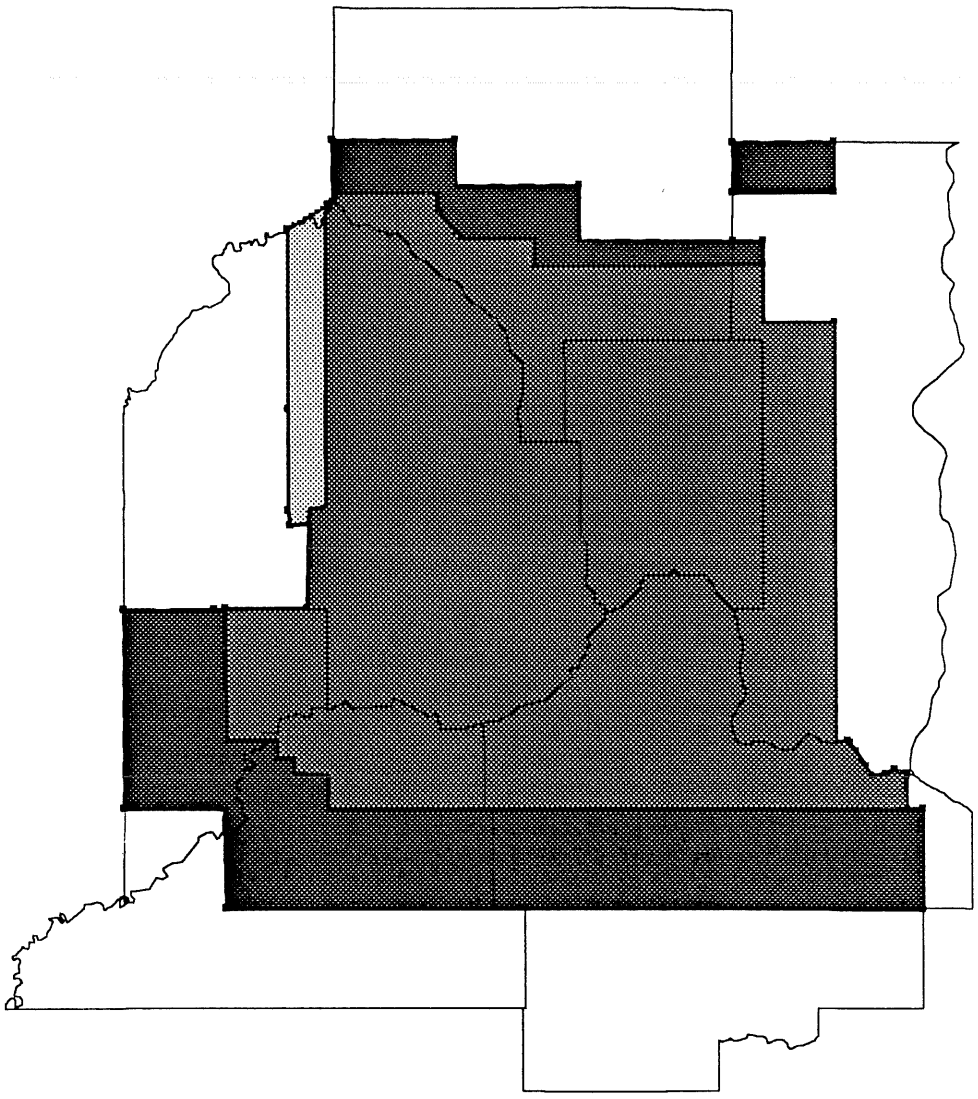
Using preliminary results from the briquet site history study, staff will eliminate some sites from the list of sites that have previously been treated with briquets.

In 1995, we plan to use 5 helicopters for the majority of the operational program with a sixth helicopter available during district wide broods and for widespread mosquito production. This procedure worked very well in 1994, as most sites appropriate for treatment were reached during each brood. Breeding sites in Zone 1 receive treatments first after on a widescale mosquito brood, based on dip counts of mosquito larvae. Treatments are then expanded into Zone 2 where treatments are based on a higher dip count of mosquito larvae (Fig..2.5)

The primary control material will again be *Bti* corn cob granules, the amount of material budgeted is similar to that budgeted in 1994. Thresholds are set to maximize the limited time available to fly each brood. To become more efficient in our *Bti* allocations, we will institute a "rolling" threshold for this year. Based on historical use, a certain amount of *Bti* will be allocated for each month. If that allotment is not used for a particular month, the difference will roll over into the remaining months. In this way we should not end up with either a surplus or deficit of material at the end of the summer.

We have been held back in using pellets applied by helicopter by difficulties in applying the low dose (2.5 lb/acre) in a uniform manner. We seem to attain fairly uniform applications at the 4 lb/acre rate used for cattail mosquito control. The manufacturer is working on a new design for the pellet that will allow for more uniform applications. We will test this as it becomes available.

Figure 2.4 Treatment area for cattail mosquitoes

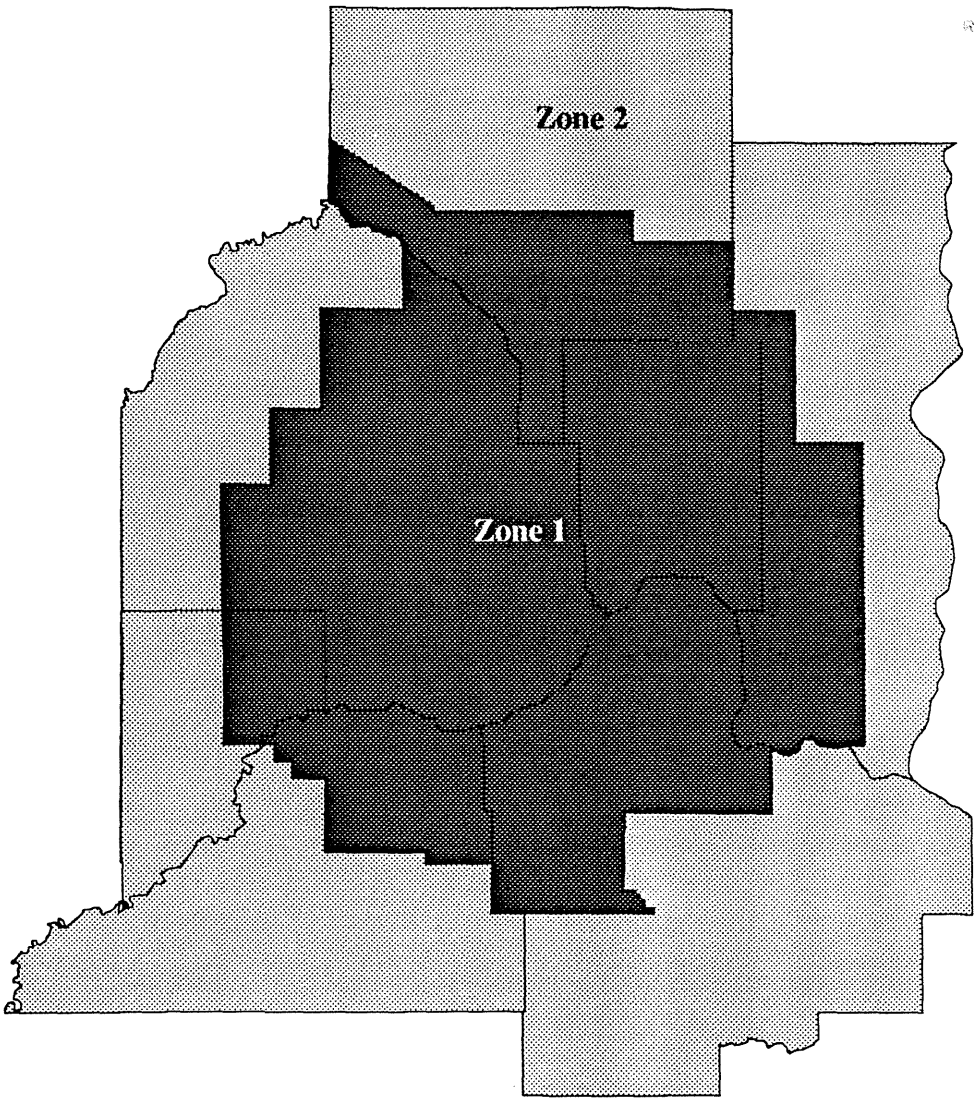


1994 Treatment Area

1995 Expansion

Treated in 1994
but not 1995

Figure 2.5 Treatment area for floodwater mosquitoes planned for 1995.
Zone 1 is generally treated first, followed by Zone 2 as time and materials allow.



Adult Mosquito Control

Both permethrin and resmethrin applications may increase in 1995 from 1994 usage. In addition to targeting high use park and recreation areas, staff will be knocking down cattail mosquito populations in areas where larval control is limited. Two new pieces of equipment (a Hudson back pack sprayer and a Becomist ULV machine) underwent preliminary evaluation in 1994. Evaluation will be expanded this year with each division receiving one of each of these machines.

The adult mosquito control information line (643-8383) will be in use again this year. The use of the information line enables citizens to hear a daily recorded message on where adult mosquito control operations are taking place. This provides a greater service to the citizens since they do not have to be at home to receive our call. However, staff will call citizens who still desire MMCD to call them in advance of adult mosquito control treatments.

MOSQUITO SURVEILLANCE

1. Background

The MMCD Entomology Lab coordinates and processes larval and adult mosquito collections. Mosquitoes from all collections are identified to species. Larval collections are taken from breeding sites prior to treatment to determine whether human-biting species are present in sufficient numbers to treat the site. Light traps monitor disease vector species and provide historical data of mosquito populations. Sweep net collections are taken during the day in wooded areas located on a grid throughout the District to assess areas where control may not be adequate.

2. 1994 Summaries

Rainfall

The Entomology Lab maintains a network of 85 rain gauges located throughout the District to monitor rainfall amounts. Rainfall amounts greater than 1 inch can produce a brood of floodwater mosquitoes. Gauges are read immediately after a rainfall and control efforts are concentrated on areas that received rainfall sufficient to produce a brood.

Average rainfall per gauge in the District in 1994 was 17.72 inches. This was 9% lower than the 36-year average (Table 3.1). Southern counties of the district received more rain than other counties (Fig. 3.1).

MMCD rain gauge readings are also reported to the Minnesota Department of Natural Resources State Climatology office to supplement their network.

Larval Collections

Larval samples are quickly identified and sites that meet threshold are communicated to field personnel so they can perform treatments. Identification of samples from sites to be treated with the helicopter are given priority over ground treated sites.

Weekly summaries of species and number of collections for each county are produced and distributed to personnel. In 1994, 15,506 larval collections were identified. This total is below average for the past 5 years, due to decreased manpower and fewer sites breeding.

Below average rainfall in 1994 produced 14 broods of mosquitoes, 3 of which were medium-sized and the remaining were small, localized broods.

Adult Collections—New Jersey Light Traps

New Jersey light traps operate at night with a 25-watt light bulb used as an attractant. Traps are turned on and off by a timer and are emptied daily for 20 weeks from May to September. New Jersey traps, located throughout the district (Fig. 3.2), have been used by MMCD since 1960 and are the standard collection device for many mosquito control districts.

Table 3.1. Rainfall totals in inches for May 1 - September 30.

YEAR	Anoka	Carver	Dakota	N. Henn.	Hennepin	S. Henn.	Ramsey	Scott	Wash.	Wright	DISTRICT
1959	19.34		26.33		21.92		20.73	27.62	18.58		22.42
1960	23.02		17.60		23.00		21.06	18.90	21.10		20.11
1961	16.88		16.41		16.15		16.34	16.71	16.84		16.56
1962	24.45		21.17		25.24		26.42	23.86	26.78		24.65
1963	16.77		14.81		17.09		16.38	14.07	17.66		16.03
1964	17.43		22.41		23.25		20.99	22.47	19.88		21.07
1965	26.87		28.01		29.19		28.87	25.32	30.52		27.97
1966	14.11		15.61		14.41		14.13	13.13	15.95		14.41
1967	14.27		15.27		18.13		17.08	13.26	15.59		15.60
1968	19.97		22.65		24.11		22.77	22.30	23.58		22.62
1969	7.39		10.60		11.07		8.74	10.32	9.69		9.75
1970	16.05		18.39		17.28		16.41	18.28	17.68		17.55
1971	16.80		19.62		16.35		19.06	15.15	21.68		17.82
1972	19.38		17.85		18.34		17.73	15.63	19.85		18.06
1973	17.72		18.30		15.54		19.49	18.24	19.79		17.95
1974	16.23		13.84		15.80		13.09	10.84	14.46		14.32
1975	23.93		22.44		19.99		22.66	16.60	20.02		21.47
1976	8.16		9.27		9.52		9.43	10.74	9.06		9.48
1977	20.28		21.03		22.42		22.66	18.68	24.13		20.90
1978	24.58		26.67		24.41		26.49	21.98	27.98		24.93
1979	18.10		22.01		20.58		20.78	22.68	22.43		19.98
1980	22.79		20.94	18.51	19.13	19.51	20.55	16.00	24.34		19.92
1981	17.13		19.36	17.72	18.01	18.37	19.35	21.40	20.01		19.08
1982	16.84		16.21	15.88	15.46	14.87	14.32	16.71	14.62		15.59
1983	18.17	24.53	19.99	19.74	20.14	20.67	19.55	23.32	19.09		20.31
1984	20.18	27.31	17.35	20.52	21.63	23.10	22.58	22.09	20.75		21.45
1985	24.42	18.29	17.38	20.55	20.47	20.38	21.74	18.02	21.37	26.26	20.73
1986	22.81	21.90	24.87	20.94	21.55	22.31	24.56	24.85	25.59	24.28	23.39
1987	17.10	20.17	20.17	20.63	22.21	23.62	19.72	17.11	17.11	15.70	19.48
1988	13.50	10.50	12.46	11.07	11.69	12.07	14.33	11.90	14.42	9.35	12.31
1989	14.94	16.62	16.16	16.81	16.83	16.85	15.92	18.50	17.66	18.08	16.64
1990	25.23	23.38	22.73	23.04	23.54	24.08	24.61	24.89	22.97	22.49	23.95
1991	27.49	27.14	22.06	29.97	28.19	26.42	27.31	23.15	25.65	27.26	26.88
1992	15.40	18.29	21.67	20.63	19.33	18.13	20.72	25.13	19.37	17.02	19.10
1993	27.81	28.00	26.99	26.79	27.40	28.14	28.73	31.04	27.42	25.46	27.84
1994	**15.90**	**20.99**	**23.37**	**16.21**	**17.50**	**18.76**	**15.05**	**22.67**	**17.85**	**17.62**	**17.72**
Thirty-six year average	18.93		19.50		19.64		19.73	19.27	20.04		**19.39**

Fig. 3.1. Rainfall in each county in 1994 compared to District 36-year average.

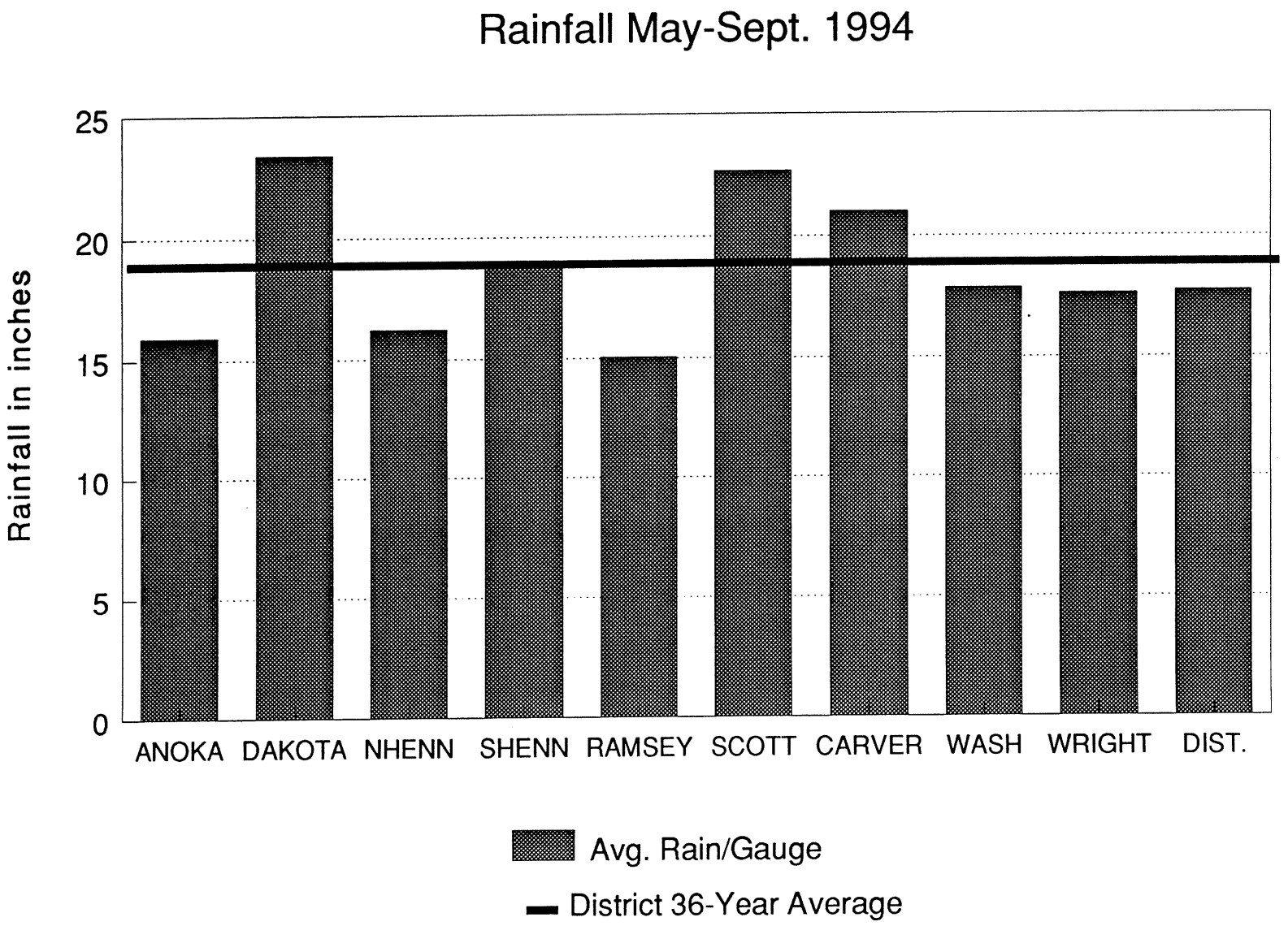
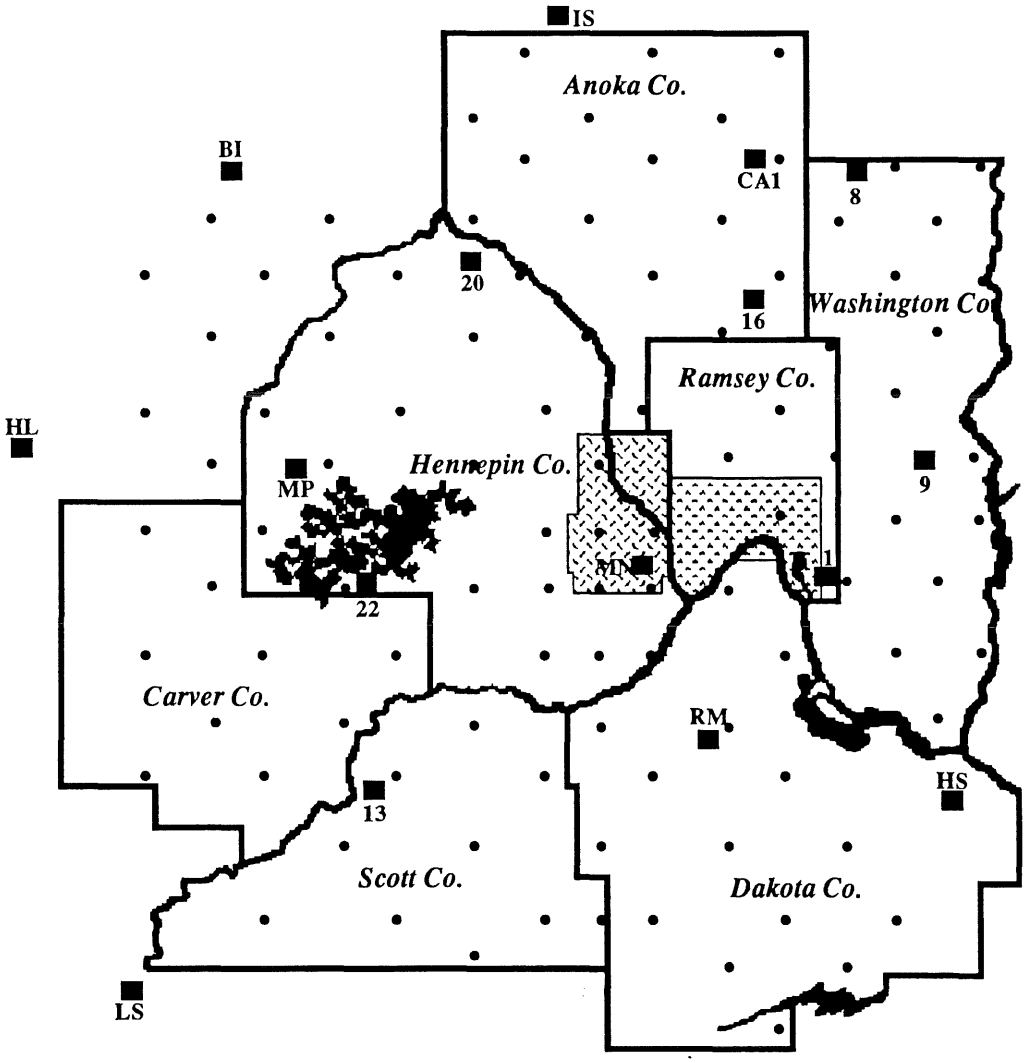


Fig. 3.2. New Jersey light trap and daytime sweep net collection locations in 1994.



In 1994, 16 traps collected a total of 222,635 female mosquitoes (Table 3.2). *Coquillettidia perturbans* was the predominant species collected with 8,577 mosquitoes per trap and *Aedes vexans* second with 3,718 mosquitoes per trap. The average number of *Ae. vexans* mosquitoes caught per night in the traps in 1994 was the lowest since 1989 (Table 3.3).

Adult Collections—Sweep Net

MMCD field personnel take 2-minute sweep net collections in the daytime from 100 wooded resting locations (Fig. 3.2) twice a week. The daytime collections started in 1984 using the method of walking into the wooded area, standing in one spot and sweeping with the net for 2 minutes. In 1990 we changed the method so that collectors kick the brush and sweep the air as they walk through the area to sample resting mosquitoes.

Aedes vexans was the predominant species caught in sweep net collections in 1994, accounting for 57% of all mosquitoes collected (Table 3.4). *Coquillettidia perturbans* was the next most abundant species detected, comprising 10% of the mosquitoes collected. Spring *Aedes* species accounted for 5% and *Ae. cinereus* 4% of all mosquitoes sweep netted.

Aedes vexans has consistently been the most abundant mosquito collected, comprising over 50% of the catch in sweep net samples (Table 3.4). *Ae. vexans* population levels in 1994 were a record low for the past 5 years. Spring *Aedes* levels, though low, have been static over the past 5 years. *Coquillettidia perturbans* populations have increased to their highest levels since 1990, probably due to wetland (i.e. cattail marsh) recovery from drought conditions experienced in the late 1980's. *Aedes cinereus* levels have declined significantly over the last 4 years. In 1990, *Ae. cinereus* was quite abundant, accounting for 21% of all mosquitoes collected. It decreased to 11% in 1991, 1% in 1992, 3% in 1993, and in 1994 it accounted for 4% of mosquitoes collected.

Other mosquito control districts have experienced increased population levels of *Culex tarsalis*, the vector of western equine encephalitis, the year following flooding. Since flooding occurred in the district in 1993, we closely monitored this species in 1994. The weather and breeding site conditions needed to produce large populations did not exist and levels of *Cx. tarsalis* remained low (Table 3.4).

Evening sweep net and CO_2 trap collections-evaluation of collection methods

Adult mosquito sampling is needed to measure program effectiveness, measure annoyance, direct control measures, monitor disease vectors and collect historical data. Our current methods using New Jersey light traps and daytime sweep net collections do not adequately measure all these parameters.

In 1994, we conducted a study to identify the adult mosquito collection method or combination of methods to meet these needs. CO_2-baited trap and 2-minute sweep net collections were taken in the evening in employees' yards once per week for 20 weeks. The evening collections were taken at 5 minutes after the end of twilight, which is about 35-40 minutes after sunset. We operated 29 CO_2 traps and the number of sweep net collections varied from 81-142 (Fig. 3.3). Results of the collections were summarized on topographical maps and distributed to personnel.

Table 3.2. New Jersey light trap collection totals 1994.

TRAP NO.	1	8	9	13	16	20	22	BI	CA1	HL	HS	IS	LS	MN	MP	RM	SEASON	AVG./
LOCATION	St. Paul	Forest Lk.	Lk. Elmo	Jordan	Anoka	Elm Creek	Mtka.	Monticello	Carlos Avery	Howard Lk.	Hastings	Isanti	LeSueur	Mpls.	Maple Plain	Rosemount	TOTAL	TRAP
No. of Collections	119	135	135	139	140	129	137	139	140	135	140	135	116	138	134	119	2,130	
Spring *Aedes*		14	6		2	18	4	17	1,480	11	1	77			9	1	1,640	96.5
Aedes vexans	551	328	3,464	3,048	5,202	2,910	2,717	1,992	21,769	6,498	1,527	2,657	2,647	871	6,149	872	63,202	3,717.8
Aedes cinereus	2	35	39	4	31	59	10	45	452	46	6	191	11	4	64	2	1,001	58.9
Other *Aedes*	13	13	53	72	36	145	65	36	1,623	297	72	827	651	16	136	21	4,076	239.8
Anopheles	2		36	97	41	49	517	182	622	156	25	29	27	4	57	25	1,869	109.9
Culex	55	6	226	61	93	71	170	183	130	389	272	110	253	108	266	60	2,453	144.3
Culiseta	9	6	47	39	216	19	86	97	113	488	56	70	16	32	231	20	1,545	90.9
Cq. perturbans	118	257	996	1,280	5,703	5,092	7,003	3,379	88,381	4,847	323	7,383	7,078	2,062	10,388	1,513	145,803	8,576.6
Other	7	5	210	9	44	112	45	32	334	54	18	25	37	10	80	24	1,046	61.5
Female Total	757	664	5,077	4,610	11,368	8,475	10,617	5,963	114,904	12,786	2,300	11,369	10,720	3,107	17,380	2,538	222,635	13,096.2
Male Total	668	904	3,187	727	3,428	1,899	5,647	5,061	15,875	8,731	1,049	9,649	3,035	538	4,300	246	64,944	3,820.2
Grand Total	1,425	1,568	8,264	5,337	14,796	10,374	16,264	11,024	130,779	21,517	3,349	21,018	13,755	3,645	21,680	2,784	287,579	16,916.4

Table 3.3. Average *Aedes vexans* per night collected in New Jersey light traps.

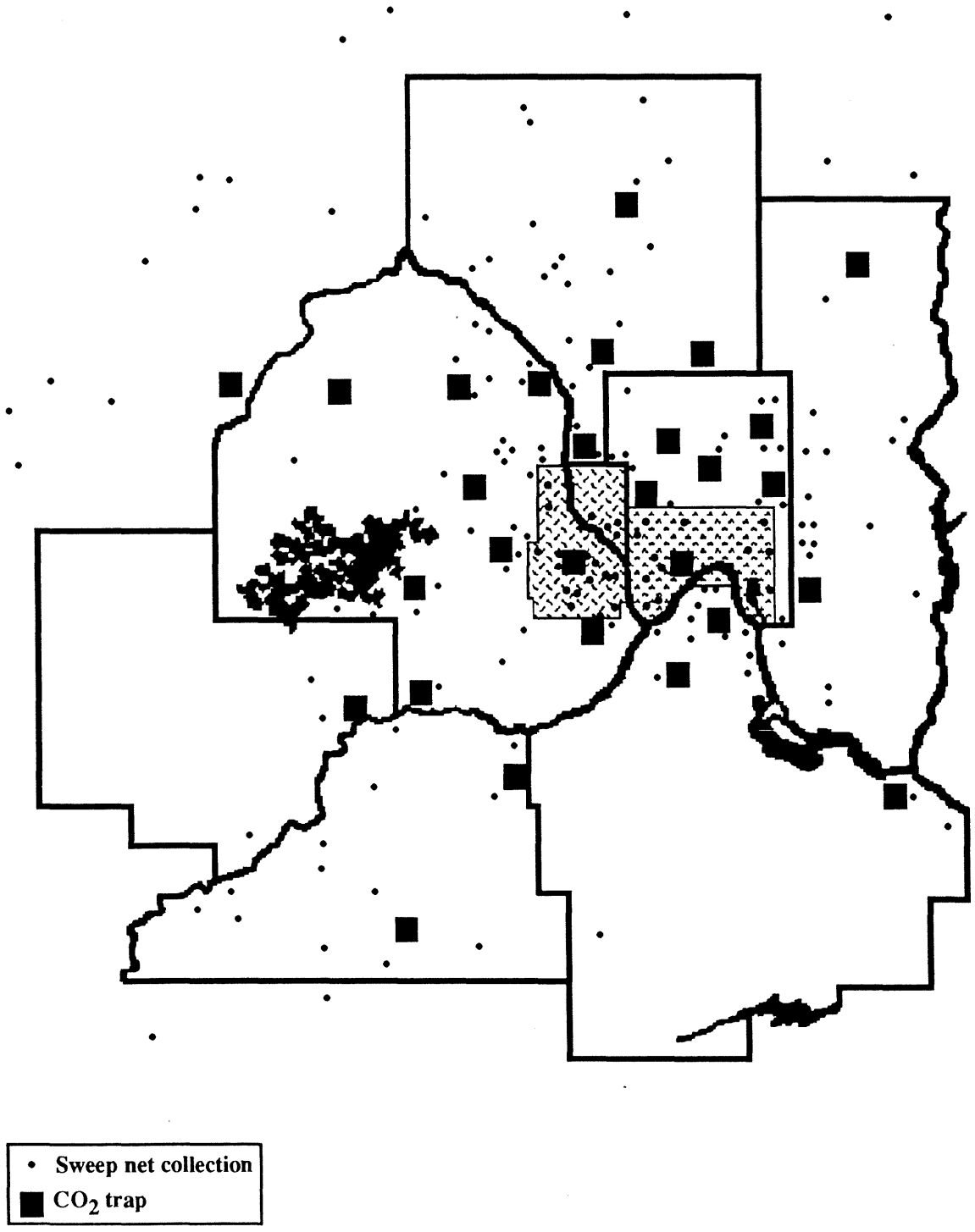
Trap No.	1	3	8	9	13	16	20	BI	CA1	CA2	RM	HL	IS	12	HS	LS	MP	MN	22	DISTRICT	RAIN
	St. Paul	Bloomington	Forest Lk.	Lk. Elmo	Jordan	Anoka	Elm Creek	Monticello	Carlos	Avery	Rosemount	Howard Lk.	Isanti	New Prague	Hastings	LeSueur	Maple Plain	Mpls.	Mtka.		
1960	12.7	9.1	94.9	83.9	30.1															84.5	20.11
1961	5.1	3.6	9.0	23.7	13.0	76.7														41.1	16.56
1962	24.9	15.8	53.5	84.0	36.7	93.9														126.4	24.65
1963	10.0	20.1	29.0	13.3	38.9	72.7														72.0	16.03
1964	8.2	8.8	34.1	9.3	12.1	44.4														32.9	21.07
1965	10.5	11.7	54.0	9.4	43.6	366.2														89.0	27.97
1966	5.3	19.3	26.3	5.2	4.7	57.3														33.7	14.41
1967	55.3	51.3	133.2	58.5	19.3	207.7														75.4	15.60
1968	29.0	59.4	152.3	34.3	90.0	832.2														119.3	22.62
1969	12.5	36.4	31.4	8.4	12.3	48.4														19.9	9.75
1970	15.7	26.8	147.5	22.0	3.7	579.4														73.1	17.55
1971	26.4	42.7	91.8	13.8	14.0	307.6														52.1	17.82
1972	36.0	71.9	53.4	43.6	29.9	1250.5														124.5	18.06
1973	14.8	24.4	39.1	9.4	7.9	595.4														62.2	17.95
1974	16.5	17.1	47.2	11.2	26.3	64.8														30.3	14.32
1975	13.9	37.9	45.1	45.7	22.5	114.0														40.1	21.47
1976	0.6	8.6	6.3	0.8	3.0	2.3														2.3	9.48
1977	10.8	27.6	17.0	21.3	2.7	51.7	24.7													17.5	20.90
1978	25.8	61.2	64.5	15.2	94.5	154.5	34.3													51.4	24.93
1979	9.3	13.5	10.1	7.1	34.1	60.2	3.9													18.3	19.98
1980	30.2	45.4	57.2	35.4	25.8	193.7	53.7													47.4	19.92
1981	22.3	83.8	39.7	23.1	144.6	121.9	16.2													57.0	19.08
1982	7.3	20.6	15.5	5.0	40.0	28.2	26.0													23.1	15.59
1983	12.4	121.2	18.7	20.4	92.5	57.6	70.7													55.6	20.31
1984	13.6	62.6	36.0	29.3	119.0	142.9	60.8													65.4	21.45
1985	3.9	31.9	13.1	5.0	37.6	39.2	20.7													21.2	20.73
1986	4.7	12.9	27.1	37.8	33.8	47.7	17.2													25.8	23.39
1987	6.0	28.9	2.7	32.9	33.5	47.4	49.7													29.1	19.48
1988	1.6	5.4	19.2	19.8	5.0	21.5	49.0	47.9												21.0	12.31
1989	1.9	1.6	1.5	22.9	7.3	19.4	31.6	12.9	30.2											14.4	18.79
1990	12.8	34.1	20.8	86.1	71.4	285.6	160.6	270.8	222.9	95.2	71.8									125.8	23.95
1991	5.8	14.3	15.8	76.6	47.7	207.1	148.5	150.9	160.0	37.1	78.6	167.5	64.9							90.8	26.88
1992	1.7	27.5	4.3	27.1	25.4	143.2	26.3	32.5	24.6	0.6	28.4	48.8	13.3	46.8	12.4	94.8	49.6			36.0	19.10
1993	8.0	--	2.9	58.5	23.5	105.0	43.5	79.7	309.6	--	51.1	125.9	--	20.6	23.8	98.0	148.0	15.5	25.8	71.2	27.84
1994	**4.6**	**--**	**2.4**	**25.7**	**21.9**	**37.2**	**22.6**	**14.3**	**155.5**	**--**	**7.3**	**48.1**	**19.7**	**--**	**10.9**	**22.8**	**45.9**	**6.3**	**19.8**	**29.7**	**17.7**

Table 3.4. Numbers of mosquitoes collected in daytime sweep nets 1990 - 1994

	*1990			**1991			**1992			**1993			***1994		
	Number Collected	% of Total	Avg./ Coll.	Number Collected	% of Total	Avg./ Coll.	Number Collected	% of Total	Avg./ Coll.	Number Collected	% of Total	Avg./ Coll.	Number Collected	% of Total	Avg./ Coll.
Aedes vexans	107734	56	14.2	68397	62	19.1	32603	65	10.7	42939	57	12.6	17288	57	5.1
Aedes cinereus	40228	21	5.3	11728	11	3.3	665	1	0.2	2168	3	0.6	1345	4	0.4
Spring Aedes	11487	6	1.5	7765	7	2.2	2941	6	1.0	3260	4	1.0	1654	5	0.5
Coq. perturbans	75	<1	<0.1	175	<1	<0.1	1905	4	0.6	3147	4	1.0	2908	10	0.9
Culex tarsalis	143	<1	<0.1	27	<1	<0.1	17	<1	<0.1	37	<1	<0.1	6	<1	<.1
Others	33458	17	4.4	21926	20	6.1	11916	24	3.9	24346	32	7.1	7406	24	2.2
Total	193125	100	**25.5**	110018	100	**30.8**	50047	100	**16.4**	75897	100	**22.2**	30607	100	**9.1**
	No. Collection Days 38			No. Collection Days 37			No. Collection Days 31			No. Collection Days 33			No. Collection Days 36		
	No. of Collections 7575			No. of Collections 3575			No. of Collections 3052			No. of Collections 3416			No. of Collections 3422		

*202 Collection locations
**104 Collection locations
***100 Collection locations

Fig. 3.3. Evening sweep net and CO_2 trap locations, 1994.



Coquillettidia perturbans was the predominant species collected in the evening sweep net collections, comprising 69% of all mosquitoes collected (Table 3.5). *Aedes vexans* was second at 25% of the total. The opposite situation occurred in the daytime sweep net collections, with *Ae. vexans* predominant and *Cq. perturbans* second.

During the study, several collectors noted that mosquitoes were more active earlier than at the designated collection time. A few employees took extra collections at intervals between sunset and the designated collection time to determine biting activity peaks. Results of these collections showed that we were correctly sampling the *Cq. perturbans* peak and most often correctly sampling the *Ae. vexans* peak, at the locations used for the extra sweeps.

The CO_2 traps were operated for 2 hours, starting at 1 hour and 50 minutes before the sweep net collection, and ending 10 minutes after the sweep net collection. The 2-hour period was designed to include the evening black fly activity peak before sunset and the mosquito activity peak after sunset. A black fly sweep net collection was also taken prior to set up of the CO_2 trap.

The CO_2 traps collected 65.5% *Ae. vexans* and 31% *Cq. perturbans* (Table 3.5). This is the opposite of the evening sweeps which were predominantly *Cq. perturbans.*

The meaning of the changing predominant species with different methods is unclear. We would expect lower numbers of *Cq. perturbans* in daytime collections because the collection sites were chosen to be prime *Ae. vexans* daytime resting areas. The switch in predominant species in the night collections (*Cq. perturbans* in the sweep, *Ae. vexans* in the CO_2 traps) may be due to light repellency of *Cq. perturbans* with the CO_2 traps or it may be due to biological factors such as peak activity times for each species. This will be investigated in 1995.

The seasonal distribution of species collected in the 2 night sampling methods are shown in Tables 3.6 and 3.7. Both methods showed the major *Ae. vexans* peaks on Aug.1 and peaks for *Cq. perturbans* on July 11.

3. Plans for 1995

After further analysis of the evening collections methods study, we will determine which method or methods to use in 1995. Ideally, we would like to develop methods that could collect both mosquitoes and black flies most efficiently and cost effectively and reduce or replace the current daytime resting site collections.

To reduce the time involved in processing priority larval samples from Scott County, a field person in the Scott/Carver division will be trained in larval identification. Travel time to bring larval samples to the main office from the Scott/Carver headquarters will be reduced and site treatment by helicopter will be more timely.

Table 3.5. Numbers of mosquitoes collected in evening and daytime sweep nets and evening CO2 traps 1994.

	Evening Sweep Net Collections		**Evening CO2 Trap Collections**		**Daytime Sweep Net Collections**	
	Number Collected	% of Total	Number Collected	% of Total	Number Collected	% of Total
Aedes vexans	4570	25	27762	65.5	17288	57
Aedes cinereus	204	1	188	0.4	1345	4
Spring Aedes	88	1	59	0.1	1654	5
Cq. perturbans	12323	69	13095	31.0	2908	10
Culex tarsalis	4	<1	23	<.1	6	<1
Others	766	4	1274	3.0	7406	24
Total	17955	100	42401	100	30607	100
No. Collection Nights		20		20		36
No. of Collections		2490		510		3422

Table 3.6. Average number of mosquitoes per evening CO2 trap collection 1994, peak periods in bold type.

Sample Date	*Ae. vexans*	*Cq. perturbans*	Black leg Spring Aedes	Band leg Spring Aedes	*Ae. cinereus*	*Cx. tarsalis*	*Ae. trivittatus*	*Ae. sticticus*	Aedes others	Other	Trap Total
02-May-94						0.05			0.19		0.24
09-May-94			0.07			0.04			0.79		0.89
16-May-94			**0.29**			0.04			0.11	0.04	0.46
23-May-94	**136.52**		0.04		0.36	0.04		**1.68**	0.04		**138.68**
01-Jun-94	45.19	0.07	0.04	**0.44**	0.44	0.04		0.37	0.07	0.15	46.81
06-Jun-94	71.46	1.36	0.14	0.25	0.89			0.89	0.04	0.54	75.57
13-Jun-94	21.48	7.96	0.07	0.15	1.11			0.04	0.15	0.04	31.00
20-Jun-94	28.15	**109.46**			**1.46**	0.04	**3.73**	0.27	0.42	3.73	**147.27**
27-Jun-94	17.62	**60.73**	0.04	0.08	0.38	0.12	3.08	0.04	0.19	0.27	82.54
06-Jul-94	44.92	**91.72**		0.04	0.16	0.20	1.08	0.08	1.12	0.28	139.60
11-Jul-94	46.88	**100.96**			0.04		1.92		0.12	0.15	150.08
18-Jul-94	**148.33**	**73.37**		0.07	0.07	0.07	0.81	**1.78**	3.30	3.56	**231.37**
25-Jul-94	78.08	35.60				0.16	**4.28**	0.04	1.64	1.96	121.76
01-Aug-94	**172.00**	19.77	0.12	0.04	0.42		0.81	0.04	1.88	1.42	196.50
08-Aug-94	37.00	2.56			0.40		0.12	0.04	0.12	0.44	40.68
15-Aug-94	74.54	1.38			**0.50**	0.12	0.35	0.04	1.00	1.69	79.62
22-Aug-94	43.81	0.15	0.31		0.42		0.04		0.08	0.42	45.23
29-Aug-94	40.42	0.21			0.29		0.04		0.25	0.29	41.50
07-Sep-94	45.61	0.09			0.17		0.04	0.04	0.13	0.35	46.43
12-Sep-94	26.95	0.05			0.05		0.10		0.33	0.14	27.62
Total	54.44	25.68	0.06	0.06	0.37	0.05	0.83	0.28	0.61	0.79	83.14

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Table 3.7. Average number of mosquitoes per evening sweep net collection 1994, peak periods in bold type.

Sample Date	*Ae. vexans*	*Cq. perturbans*	Black leg Spring Aedes	Band leg Spring Aedes	*Ae. cinereus*	*Cx. tarsalis*	*Ae. trivittatus*	*Ae. sticticus*	Aedes others	Other	Sweep Total
02-May-94										0.03	0.03
09-May-94										0.01	0.01
16-May-94	0.01									0.01	0.01
23-May-94	1.64		0.04	0.01	0.04			0.08	0.15	0.01	1.97
01-Jun-94	0.60	0.04	0.03	0.02	0.05			0.08	0.09	0.05	0.97
06-Jun-94	1.50	0.49	0.07	0.01	0.27			0.09	0.09	0.07	2.59
13-Jun-94	0.90	2.80	0.13	0.04	0.17			0.04	0.04	0.06	4.17
20-Jun-94	1.13	**10.33**	0.10	0.02	0.07		0.07	0.07	0.73	0.08	12.60
27-Jun-94	0.53	**18.86**		0.01	0.03		0.08		0.15	0.03	19.69
06-Jul-94	1.71	**11.05**	0.02	0.01	0.02		0.03		0.09	0.10	13.02
11-Jul-94	1.91	**14.70**	0.01	0.01	0.03	0.01	0.03	0.01	0.03	0.09	16.82
18-Jul-94	2.84	5.98		0.01	0.03	0.01	0.03		0.32	0.04	9.26
25-Jul-94	3.23	4.53		0.02	0.07		0.11		0.25	0.19	8.39
01-Aug-94	**4.84**	2.45		0.01	0.33	0.01	0.11		0.42	0.06	8.21
08-Aug-94	0.85	0.26			0.04		0.02		0.02	0.02	1.21
15-Aug-94	1.30	0.22			0.03				0.05	0.08	1.67
22-Aug-94	1.68	0.11			0.08				0.04	0.06	1.96
29-Aug-94	1.21	0.04			0.01		0.03		0.02	0.02	1.32
07-Sep-94	1.08				0.01		0.01	0.01	0.32	0.02	1.46
12-Sep-94	1.18						0.01		0.01	0.02	1.22
Total	1.84	4.95	0.03	0.01	0.08	0.00	0.03	0.02	0.18	0.07	7.21

NSAVGTB

QUALITY ASSURANCE

1. Background

The Quality Assurance (QA) Program provides project management and technical support for quality related areas of MMCD operations. 1994 projects include:

1 Testing efficacy of methoprene pellets and briquets on mosquitoes in the field
2. Testing efficacy of *Bti* corncob on mosquitoes in the field
3. Comparing efficacy of two rates of *Bti* corncob on mosquitoes
4. Testing Acrobe® brand *Bti* corncob
5. Acceptance sampling of Altosid (methoprene) briquets and pellets
6. Checking field placement of methoprene briquets
7. Coordinating the redrawing and updating of MMCD section maps

2. 1994 Program

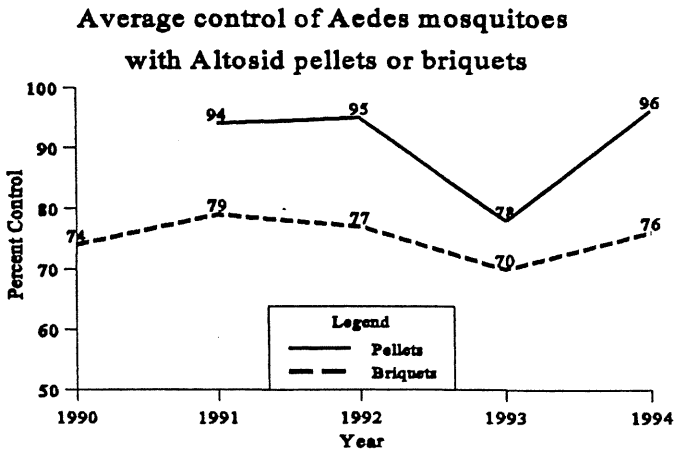
During the May 1- September 30 mosquito season, rainfall was below normal until late when heavy rains brought the season total to 17.72 inches, or about 10% below the 36 year average of 19.39 (MMCD records). The rains produced 13 broods of mosquitoes, many of which were small or localized broods. In this environment, 2 larval control materials showed increases in efficacy against *Aedes* mosquitoes compared to last year, 1 showed a decline and one remained the same.

Efficacy of Altosid® Pellet and Briquet Applications.
Altosid® pellets were applied at 2.5 lbs/acre by helicopter, seeder or hand to sites totaling 4,047 acres. Altosid® XR briquets were applied by hand at a rate of 220 briquets per acre to breeding sites totaling 7,895 acres. (Note: Cattail Program treatments are not included.)

Methods: We use the pupal collection method to assess the performance of methoprene products in the field. This method is recommended by Zoecon Corporation and is described in last year's TAB report.

Results and Discussion:
Average percent control returned to the mid 90's (96%, n = 52) for Altosid pellets. The decline in 1993 was probably due to the high rainfall that year and resulting increased water depth.

For briquets, average percent control was in the 70's for the fifth consecutive year, this year at 76% (n = 79). Control was higher early in the year and lower later,

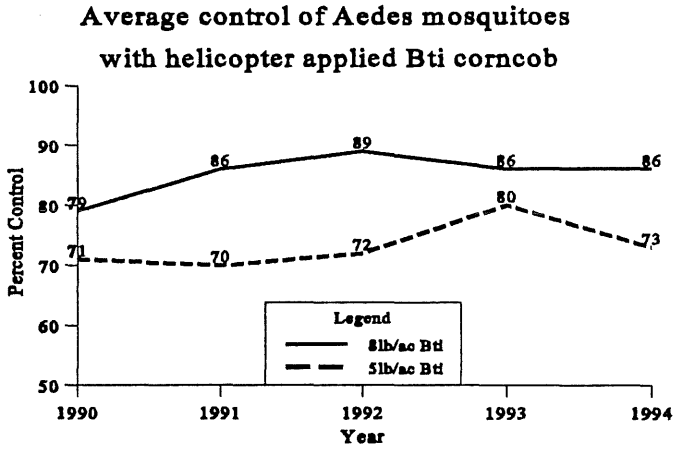


but over the 150 day claim of effectiveness, continues a mediocre trend. Although our reliance on Altosid briquets continues to decline because of lower efficacy against *Aedes* mosquitoes, they do have some advantages. We can treat only once per season those wetlands with difficult access or places where landowners allow us access only once per year. They also allow us to concentrate on the many large wetlands that must be treated by helicopter after each rainfall.

Efficacy of Bti Corncob Applications.
Bactimos® brand *Bti* from Novo Nordisk Bioindustrials was the predominant *Bti* corncob product applied by helicopter in 1994. The 5 lb/acre rate was used early in the season when the vegetation in breeding sites was sparse. Later in the year, the 8 lb/acre rate was used to offset the shielding effect of dense vegetative canopies in breeding sites. All *Bti* corncob used in 1994 was of the larger (5/8) mesh size.

Efficacy was measured by foremen and seasonal staff using the pre-treatment and post-treatment dipping method. This method consists of taking a series of dips in breeding sites soon after a rainfall and estimating the average number of mosquito larvae per dip (pre-treatment count). The process is repeated in a randomly selected sample of sites 24-48 hours after treatment (post-treatment count). Counts are recorded on an airwork treatment form (FF-10) and control percentages calculated as a percent reduction based on the difference between the 2 counts.

Results and Discussion: Our pre/post dip counts show 73% average control (n=489) with 5 lbs/ac Bactimos® and 86% (n=386) for 8 lbs/ac Bactimos. These results are lower than last year at 5 lbs/ac, but the 8 lb rate is the same (Vectobac® brand *Bti* from Abbott Labs was used last year). Last year when rainfall was 40% above normal (vs this year's 10% below normal), our control materials were subjected to a more severe test. More water makes it more difficult for our control materials to work because the active ingredient is diluted.



Evaluation of 5 lb vs 8 lb Bactimos® Bti Corncob.
Results of this test show that in cold water (below 50 degrees F), 8 lbs/ac works a lot better than 5 lbs/ac (70%, n=15 vs 49%, n=14)). In warm water (above 50 degrees F), dosage rate doesn't matter as much (80%, n=9 vs 73% , n=7), but the sample size is small and reduces confidence in the results.

Evaluation of Acrobe® Bti Corncob.
Average control with helicopter applied Acrobe® *Bti* from American Cyanimid was 70% (n=20) at 8 lbs/ac. Ground tests indicate very good control at 5 lbs/ac (100%, n= 16) , but curiously, results were lower at 8 lbs/ac (77%, n= 5). The small sample size reduces confidence in the results.

Acceptance Sampling of Altosid (methoprene) Briquets and Pellets
In January, we collected a random sample of briquets and pellets from shipments received from Zoecon Corporation and had them analyzed for methoprene content by Huntingdon (formerly known as Twin City Testing). The analysis method used was CAP No. 311, "Procedure for the Analysis of S-Methoprene in Briquets and Premix" furnished by Zoecon Corporation, Dallas, Texas. Of the 17 briquets analyzed, all were at or above the label claim of 1.8% methoprene (avg 1.94, sd 0.06). Of the 22 pellet samples analyzed, all were at or above the label claim of 4.0% methoprene (avg 4.57, sd 0.18).

Accuracy of Briquet Placement.
In 1994, 1,400 briqueted sites were inspected for quality of treatment. Treatments were made primarily by seasonal employees and checkbacks were made by foremen, supervisors and quality assurance staff. The number of sites inspected represents approximately 5% of the briquet treatments.

Materials and Methods: A worksheet containing treatment information on up to 20 sites (FF2) was filled out daily by each applicator of briquets. One site from each FF2 was selected at random by Quality Assurance staff and assigned for checkback to the foreman responsible for the work completed on the FF2. Supervisors received one site from all work completed in their division that day to check. Quality Assurance staff also inspected some sites. Briquet placement was evaluated and categorized as follows: 1) spacing correct, low areas hit; 2) spacing correct, low areas missed; 3) spacing too close, <12′; 4) spacing too far apart, >18′; 5) erratic placement; 6) briquets absent.

Results And Discussion: Inspections show that 85% of the sites were treated correctly, which is an improvement from last year's 80%. Briquets were absent in 5% of sites inspected, down from 6% last year. These results indicate that progress is being made in briquet application quality and will presumably allow briquets to achieve maximum effectiveness at the specified application rates.

Section Maps Reviews. Section maps are the primary means of locating breeding sites for treatment. Most ground larviciding is done by a seasonal work force that changes from year to year so it is essential that section maps are easily navigated and accurately portray site locations. Each fall over 20% of our ca 3,000 section maps are redrawn or revised to reflect changes which have occurred within the sections. The methods for review of section maps are included in the 1991 report to the TAB. The mapping season concludes in mid-February and results will be available in March, 1995.

UV-Sunlight Effect on Altosid® Pellets.
In specific treatment situations, MMCD will use 30-day Altosid® pellets in dry breeding sites as a prehatch larval control method. These 4% methoprene pellets may be exposed to extended periods of direct sunlight before the site floods and produces mosquito larvae. This study was to test if ultraviolet light could significantly lower the methoprene content of the pellets to sufficient levels for larval control.

Pellets were kept in a dry state and were exposed to one of four conditions. These include placement on a screen and exposed to direct sunlight, placement in grass and exposed to direct sunlight, placement on grass and covered by a tarp, and placement on a screen in the total absence of sunlight. After 47 days, only the pellets on the screen and in direct sunlight had significantly reduced levels of methoprene. However, even in this worst case scenario, the methoprene content of all pellets was greater than 3.5%, indicating that there was still sufficient levels methoprene for larval mosquito control. Therefore, the UV-sunlight effect on prehatch treatments of Altosid® pellets is not detrimental to MMCD's larval control program.

3. 1995 Program

We plan to continue measuring efficacy of larval control materials, determining accuracy of briquet placement and coordinating the mapping project. In addition, we will begin acceptance testing of *Bti* corncob granules. We will compare efficacy of 5 lb/acre and 8 lb/ acre *Bti* in cool and warm water. We will increase emphasis on coldfog and backpack operations by measuring flow rate, droplet size and efficacy for equipment we are evaluating for future use. We intend to investigate the use of a water based permethrin product for application with backpacks.

PROGRAM DEVELOPMENT

1. Background

Program development projects this year focused on assessing citizen expectations for the District and assessing the District's performance. This involved survey research, assembling a comprehensive Self-Assessment of Performance similar to those being done by other agencies, working with representatives from state agencies to find better ways to assess the effectiveness of District programs, and working with the District Entomology Lab on ways alternative mosquito surveillance methods. Additional projects included continuing progress on Geographic Information System development for the District, and exploration of wetland management issues as they relate to District activities.

2. 1994 Program

Phone Survey
In 1994 a phone survey of 390 metro-area residents (generalizable to the MMCD service area) was conducted by the Center for Survey Research, University of Minnesota, for the District. Respondents were asked to rate the importance of controlling mosquitoes and gnats (black flies). Ratings were made on a scale of 1 to 7 with 1 = not important, 4 = neutral, and 7 = very important.

- About 72% of respondents rated the importance of controlling mosquitoes 5, 6 or 7 on the 7-point scale. Overall importance rankings were slightly higher for control of mosquitoes than for gnats. Most respondents said mosquitoes and gnats decreased their enjoyment of the outdoors.
- 68% agreed (5, 6 or 7 on 7-point scale) with the statement "the MMCD provides an important service to the community", 58% agreed "the MMCD is a good buy for the money", 54% agreed "the level of mosquito and gnat control should be increased", and 32% agreed that "the amount of MMCD funding should be increased".
- About 18% felt the methods used to control immature mosquitoes in the water were "harmful to the environment" or "harmful to human health", and about 23% felt that "Spraying to control adult mosquitoes at parks, events, and wooded areas is harmful to the environment" or "to human health".
- 66% reported using repellents.
- Respondents who reported they were aware of the District were less likely to express concern about environmental or human health impacts, and were more likely to express satisfaction with the mosquito control program.
- Overall, about 45% of respondents expressed satisfaction with MMCD, 15% expressed dissatisfaction, and 40% were neutral or no opinion.

In general, results were similar to the 1993 survey results, but improvements in sampling and data collection make this survey higher quality and generalizable to the metro-area population (in telephone households).

Geographic Information System Development
The District continued work on evaluating Geographic Information System (GIS) potential for our use. A needs assessment and some preliminary study of data structures was done in 1994, and some basic equipment (a PC with CD-ROM drive) was purchased to allow exploration of data and software available. Information sessions were conducted for all interested staff by the State's Land Management Information Center (LMIC) demonstrating the MMCD Dayton township pilot project they conducted for us in 1991.

3. 1995 Plans

Public Opinion Evaluation
We are considering the use of focus groups in 1995 to identify issues regarding how the public perceives mosquitoes and gnats and what their expectations are about the District.

Self-Assessment of Performance
This report will be updated as needed.

Interagency Panel
The panel will continue to meet and plans to develop specific research proposals to address some issues related to effectiveness.

Geographic Information System Development
This work will continue in 1995. After an advertised Request for Proposals for entry of our wetland data, we have chosen to work with the University of Wisconsin, LaCrosse, Geographic Information Systems lab. Contacts with county GIS offices have been made and offer numerous opportunities for working together or sharing information. We are now in the process of contacting other agencies interested in wetlands data.

BLACK FLY PROGRAM

1. Background

The black fly program began in 1984 with only the small stream treatment program. Studies by the MMCD during the early years of the program revealed that the three major black fly pests of human in the Twin Cities breed only in large rivers. Between 1987 and 1989, the MMCD conducted *Bti* efficacy and acute toxicity studies on the large rivers. Based on the positive outcome from those tests, the MMCD began to phase in an operational control program on the large rivers in 1990. Currently, the Black Fly Program monitors larval black fly populations that develop in the small streams and large rivers during spring and summer within the MMCD. Sites that reach larval population thresholds are then treated with liquid *Bti*.

2. 1994 Program

Simulium venustum Control Program

Simulium venustum is a human biting black fly with one, early spring generation in the MMCD region. Larvae breed in small streams throughout the District. The MMCD began using *Bti* to control *S. venustum* in 1984.

More than 300 potential breeding sites were sampled in mid-April to determine the density of *S. venustum* larvae using the standard grab sampling technique developed by the MMCD in 1990. Treatment decisions were based on a threshold of 50 *S. venustum* per sample. Forty three sites met the threshold and were treated once with *Bti* at a dosage rate of 10 ppm. A total of 12.01 gallons of *Bti* were used for the treatments in 1994 (Table 6.1).

Table 6.1 Summary of *Bti* treatments for black fly control by the MMCD in 1994.

Water body	Number of application sites	Total number of treatments	Gallons of *Bti* used
Small streams	43	43	12.01
Mississippi River	2	15	1015
Crow River	3	17	295.49
Minnesota River	7	34	2592.5
Rum River	3	22	132.5
Total	58	131	4047.5

Large River Program

There are 3 large river-breeding black fly species which the MMCD targets for control. *Simulium luggeri* breeds mainly in the Rum and Mississippi rivers, although it also breeds in smaller numbers in the Minnesota and Crow rivers. *Simulium luggeri* is abundant from mid-May through August. *Simulium meridionale* and *S. johansenni* breed mainly in the Crow and Minnesota rivers. These species are most abundant in May and June, although *S. meridionale* populations will remain high throughout the summer if stream flow is also high.

In 1990, the District began operational treatments, at a restricted number of breeding sites, on the large rivers with *Bti*. On the Mississippi River, operational treatments were linked to a 3-year non-target insect production and community structure study. This study, requested by the DNR, examined indirect effects of black fly control such as alteration of the invertebrate community and food web.

The black fly population density at each treatment location was measured every 7 days using artificial substrates. The treatment thresholds used in 1994 were the same as those used since 1990.

A total of 4,035 gallons of *Bti* were used to treat the large rivers in 1994 (Table 6.1). This is compared to 5,070 gallons in 1993. Less *Bti* was used in 1994 than in 1993 because of lower flows in the rivers due to less rainfall. Control of black fly larvae on the large rivers ranged between 70 and 95% in 1994, which is comparable to previous years.

Adult Population Sampling

The adult black fly population was monitored in 1994 at 99 locations using the over-head net-sweep technique. This same technique has been used since 1984. Samples were taken twice weekly from mid-May to September.

The average number of all species of adult black flies captured in 1994 was 1.89 (Table 2). Except for the drought year of 1988, this was the lowest number of black flies captured since the program began. The reduction in the number of adult black flies since the start of the operational treatment program in 1990 compared to the years before any large river *Bti* treatments began (1984, 1985 and 1986) clearly demonstrates the effectiveness of the control program (Table 6.2).

The average number of *S. meridionale* captured in 1994 was 0.04, which was the lowest number captured since the program began (except for the 1988 drought year) (Table 2). This was substantially lower than in 1993, when the average was 1.55 following heavy flooding and cancellation of *Bti* treatments on the Minnesota River, which is the major breeding site for *S. meridionale*.

The *S. luggeri* counts averaged 1.79 in 1994, which was only slightly higher than the record low count (except for the 1988 drought) of 1.71 in 1993 (Table 2).
The average number of *S. venustum* captured per sample in 1994 was 0.01, which is

similar to the results of the previous years of the program. The number of *S. venustum* captured in the net-sweep samples always is quite low and not representative of the actual populations. This is due to the fact that samples are averaged for the entire field season but *S. venustum* adults are rare after late May because there is only one generation per year. However, this method of sampling is continued because it allows year-to-year comparison of the population.

Table 6.2. Annual mean number of black fly adults captured in over-head net sweeps in bi-weekly samples taken at standard sampling locations throughout the MMCD between mid-May and mid-September.

Year	All Species[1]	*Simulium luggeri*	*Simulium johansenni*	*Simulium meridionale*
1984	16.02	14.06	0.04	1.77
1985	11.62	10.71	0.02	0.83
1986	11.38	8.26	1.30	1.61
1987	5.92	5.7	0.02	0.13
1988	1.87	1.77	0.09	0.00
1989	5.79	4.89	0.50	0.19
1990	6.03	5.44	0.02	0.53
1991	4.04	3.06	0.14	0.77
1992	2.40	1.93	0.12	0.26
1993	3.32	1.71	0.04	1.55
1994	1.89	1.79	0.00	0.04

[1]All species includes *S. luggeri*, *S. meridionale*, *S. johansenni*, *S. vittatum*, and *S. venustum*.

Non-target Studies

The three-year invertebrate community structure and production study on the Mississippi River, that was required by the MDNR, has been completed. Results of this study did not indicate any major changes in the invertebrate community structure following three years of operational *Bti* treatments. Production of *S. luggeri*, the target black fly species, declined by several orders of magnitude in both the treated section and the untreated control section of the river. The reason for the decline in the *S. luggeri* population in the control section of the river was not due to *Bti* (no *Bti* treatments were made there). It is hypothesized that it was due to the decline in the population in the treated section of the

river. Female black flies generally are believed to fly upstream to deposit their eggs. Thus, the decline in the population in the treated section of the river may have affected upstream recolonization. The only other major change in the invertebrate community observed during the study was a substantial increase in the production of the filter feeding chironomid, *Reotanytarsus* sp. at all stations, including the control station. It is hypothesized that this insect filled the spatial and trophic niches created by the reduction of the *S. luggeri* population. Production of a non-filter feeding chironomid species, two mayfly species and two filter feeding caddisfly species did not change during the three year study.

Field work on the Rum River Plecoptera production study was completed on schedule in October 1994. Laboratory processing of the samples will be completed in March, 1995. The final report will be completed as scheduled in June 1995.

The MMCD is working collaboratively with the MDNR to develop an operational non-target monitoring program for the Mississippi River. Plans for this program will be finalized this winter. Monitoring will begin in 1995.

3. 1995 Plans

The 1995 goals of the Black Fly Program are to: 1) continue effective control of the small stream and large river black flies, 2) complete the Rum River Plecoptera production study final report, 3) implement the Mississippi River non-target monitoring program, and 4) begin a comprehensive assessment of the adult black fly sampling program.

ENVIRONMENTAL QUALITY BOARD INTERACTIONS

1. Background

In 1993, the MMCD met with the Environmental Quality Board (EQB) to report progress of the Scientific Peer Review Panel (SPRP) research on non-target impacts of larval control materials. Later that year the EQB began discussing holding an Administrative Law Judge hearing on environmental effects and efficacy of the MMCD. The EQB referred the issue to a technical work group made up of staff from EQB member agencies for review. A representative from MMCD and from an environmental organization participated ex-officio.

2. EQB Technical Work Group Report

The work group prepared a report (agreed upon by all members), recommending:

- That no official hearings be held on efficacy and environmental impacts, primarily because of lack of available information.
- That assessment of impacts of larval control materials await the SPRP report, but that several other issues be addressed, including
  a. reassessment of health risks and public communication regarding the materials used to control adult mosquitoes, as well as preparation of a literature review on the materials' non-target impacts;
  b. initiation of a process to study efficacy issues, by establishing an Interagency Panel to recommend and oversee studies and review existing information (including EIS and Supplemental EIS).
- That the MMCD clearly define and communicate its mission, goals and objectives.
- That the EQB and MMCD consult on possible changes in legislation needed regarding funding for efficacy studies and formalizing the relationship between the MMCD and state environmental agencies, including the EQB.

The report was accepted by the EQB and the MMCD commissioners in April, 1994. An additional suggestion made at the EQB meeting was that MMCD complete a performance assessment similar to those required of state agencies.

3. Actions taken by MMCD:

Self-Assessment of Performance

The District completed a Self-Assessment of Performance, 1994, held five public meetings and solicited comments regarding the assessment, and made revisions or responses accordingly. The resulting document was distributed to all metro-area county commissioners, members of the Environment and Natural Resources Committees and Local Government Operations Committees of the Minn. House and Senate, the Legislative Audit Commission and the Legislative Auditor's Office, Environmental

Quality Board members and technical representatives, members of District advisory panels, and any citizens requesting a copy.

The Self-Assessment articulated the goals of each program and the evidence of progress toward those goals. The District has developed a new mission statement (included in the Self-Assessment), and is training all employees in Continuous Quality Improvement. The Self-Assessment was designed to be updated regularly and any comments or suggestions for future versions are welcomed.

Interagency Panel on Effectiveness

The District assembled an Interagency Panel with representatives from EQB-related state agencies, including the Pollution Control Agency (Gretchen Sabel, Panel chair), Department of Transportation (Greg Busacker), Office of Environmental Assistance (Victoria Reinhardt), Department of Agriculture (Art Mason), Department of Natural Resources (Gary Montz), supported by District staff. The purpose of the panel is to:

- assist the MMCD in developing a methodology to assess effectiveness;
- identify resources and measurement tools needed to implement an assessment of effectiveness; and
- maintain communication with MMCD staff and commissioners and with the EQB.

Representatives from other organizations have attended at the panel's request to provide additional input, including Char Brooker, Isaak Walton League; John Nelson, City of Bloomington, Trudy Dunham, Metro. Parks Commission, and Harriet Lykken, Sierra Club. Input was also requested from the Minn. Dept. of Health, the Minn. Dept. of Public Service, the Minn. Conservation Federation, and the Minn. Golf Course Superintendents' Assoc.

The panel plans to follow a three-phase process:

1. Define 'effectiveness' and determine evidence needed to measure it, including objective measures (e.g., insect numbers) and perceptive measures (e.g., people's annoyance by mosquitoes),
2. Develop proposal(s) for studies to be conducted, and
3. Oversee studies and prepare a report with findings.

The panel decided to limit its focus to the two mosquito species causing most human annoyance, the floodwater mosquito, *Aedes vexans*, and the cattail mosquito, *Coquillettidia perturbans*. The panel has outlined information available or needed to examine physical measures such as mosquito breeding potential, weather, controls used, and the overall number of mosquitoes, as well as looking at people's response to mosquito numbers, including perception and behavior. The panel plans to bring in additional technical advisors to assist in developing studies (Phase 2). The total process may take two years or more if long-range studies are planned. No changes in legislation regarding research funding have been proposed at this time.

Scientific Peer Review Panel

The Scientific Peer Review Panel (SPRP), which has been overseeing studies looking for possible non-target impacts of the District's larval control methods, has been reviewing the final report of the long-term study conducted by the Natural Resources Research Institute (NRRI), Duluth. The SPRP met in January, 1995, and expects to present a report to the EQB this year by June 30. Work is also planned for 1995 on the impact of *Bti* on chironomids (midges), and treatments will continue to be made to the long-term study sites used in the NRRI study (Wright Co.) to enable future tests.

Adult control material issues

The District will continue to work with the Minnesota Department of Health on health issues related to control materials, and will implement recommendations from the MDH as appropriate. District personnel are working on a literature review on possible non-target effects of adult mosquito control materials and will share that information with anyone who requests it. (Some preliminary information from the non-target literature review was included in the Self-Assessment appendix in the descriptions of control materials used.)

Other issues brought up by EQB members

At the EQB meeting in April, 1994, some EQB members stated they had difficulties getting information from the District in the past. The MMCD Commission reaffirmed that the District library and meetings are open to the public, and invited EQB members and their staff to visit with Commissioners and District staff and observe operations first-hand. The District continues to send its Annual Operations Report to the EQB as it has in the past, and would welcome EQB members or staff to attend Technical Advisory Board meetings, where agency and environmental group representatives review past and proposed District operations.

The EQB has recently stated that it is pleased with MMCD's cooperation and the progress that is being made by the District in its commitments to the EQB.

APPENDIX

ADDITIONAL READINGS ABOUT MOSQUITO CONTROL

The following articles are available at the MMCD's library and provide additional information about control materials, mosquito control, toxicology, repellents and alternative mosquito control.

MOSQUITO CONTROL

Olkowski, H. "On the Research Front - Demonstrating Successful Mosquito Control;" *Common Sense Pest Control Quarterly* Spring 1987, 111(2), II-1 - II-2.

Describes an Integrated Pest Management approach for mosquito control.

Olkowski, W. "Mosquitos: The Water Connection;" *Common Sense Pest Control Quarterly* Spring 1987, 111(2), 1-12.

Describes mosquito biology and components of safe and effective mosquito management.

Benzon, G.L. "Controlling Mosquitos and Other Flying Insects Within Municipalities;" *Public Works* 1988, 119, 46-49.

An overview of municipal mosquito control agencies, explaining larval control, adult control and public information.

Challet, G.L. "Problem-Solving at the Local Level;" Journal of Environmental Health 1988, 51(2), 79-80.

An overview of organization and management of mosquito control districts across the United States.

HUMAN HEALTH

Minnesota Department of Health. *Risk Assessment on Scourge® and Punt™ 57-OS Materials used by the Metropolitan Mosquito Control District for the Control of Adult Mosquitoes*, [Report of evaluation requested by the Metropolitan Mosquito Control District] MN Department of Health Division of Environmental Health Section of Health Risk Assessment: Minneapolis, MN, [1993].

Evaluation by Elizabeth V. Wattenberg, Ph.D., Environmental Toxicologist. Exposure to Scourge® or Punt™ through ingestion or skin contact should not pose a health risk to humans under the scenarios described in the document. Brief inhalation exposure to the pesticides should not pose a health risk.

Minnesota Department of Health. *Evaluation of the Human Health Hazards of Resmethrin/Piperonyl Butoxide Insecticide*, [Report of evaluation requested by Metropolitan Mosquito Control District] MN Department of Health: Minneapolis, MN, [1984].

This evaluation includes a review of the scientific literature as well as discussions with scientists and physicians. The literature review indicates that the acute and chronic toxicity of both resmethrin and piperonyl butoxide is very low. There were not studies indicating these compounds were either allergens or toxic irritants.

ANIMAL HEALTH

Adams, A. W., Jackson, M. E., and Pitts, C. W. "A Feed Additive to Control Flies in Poultry Manure;" *Poultry Science* 1976, 55(5), 2001-2003.

Methoprene was fed to poultry to control flies emerging from poultry manure. Neither egg production nor egg quality was affected by the additive.

Beadles, M. L., Miller, J. A., Chamberlain, W. F., Eschle, J. L., and Harris, R. L. " The Horn Fly: Methoprene in Drinking Water of Cattle for Control;" *Journal of Economic Entomology* 1975, 68(6), 781-785.

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Bacillus thuringiensis var. *israelensis (Bti)*
(Vectobac® or Bactimos™ granules, Vectobac® liquid)

Bacillus thuringiensis var. *israelensis* serotype H-14 (*Bti*) is a naturally occurring soil microorganism that was discovered in Israel in 1976. *Bti* is a bacterium which has a highly specific mode of action against a narrow host spectrum. This selective activity is limited to the order Diptera (flies), specifically mosquito, midge, and black fly larvae. Since its discovery, the organism has shown rapid larvicidal activity against both mosquitoes and black flies. MMCD chose to use *Bti* because of its extreme selectivity. In contrast to the variety of *Bt* used in gardens and forests against moth pests (*Bacillus thuringiensis* var. *kurstaki*), *Bti* has no activity against lepidoptera (moths and butterflies).

MODE OF ACTION: Larvicidal activity is dependent upon ingestion of the *Bti* active ingredient, endospores and delta endotoxin crystals. Upon ingestion, alkaline pH conditions and enzymes in the gut of mosquito or black fly larvae dissolve the crystals. Sub-units (sub-proteins) are released, which adhere to specific receptor sites on the midgut lining. Paralysis and eventual rupturing of the gut wall causing death soon follows. (Hayes and Laws, 1991; Abbot, 1993)

PRODUCT SAFETY: No toxic effects on non-target species have been demonstrated against mammals; fish (including bluegills and mosquito fish); birds; amphibians (including tree frog and toad tadpoles); crustacea (including scuds, fairy shrimp and copepods); mollusca (including freshwater snail and mussels); other insects (including mayfly n ymphs, damsel or dragon fly nymphs); or other wildlife at tested field rates, either directly or indirectly through the food chain. Mammalian safety: no toxicity observed taken orally in rats; no dermal reaction in rabbits; no adverse effects observed in rats for inhalation studies (Hayes and Laws, 1991; Abbot, 1993). Because of *Bti*'s low toxicity to people (human LD50 of 6.6 lbs *Bti* per 100 lbs body weight; dose used for mosquito control is 0.02 lbs per acre), *Bti* has been registered by the EPA for use in water systems which will be purified and used as a source of drinking water. No reports of adverse effects to the environment have been documented since *Bti* has been used commercially. All product components are biodegradable (Hayes and Laws, 1991). Numerous field and laboratory studies in streams and other aquatic habitats have demonstrated the lack of effect on nontarget organisms (see list below).

USE: MMCD uses two formulations of *Bti*. One is a corn cob-based dry granule manufactured by Abbot Laboratories (Vectobac® G) or by Novo Nordisk Bioindustrial (Bactimos™), used for mosquito control; the other is a liquid manufactured by Abbott Laboratories (Vectobac® 12AS), used for black fly control. For effective mosquito control *Bti* granules must be applied when larvae are in life stages that actively feed. Granules are applied at a rate of 5-10 lbs. per acre (0.01 -0.02 lbs active ingredient per acre) using a helicopter in sites which are greater than 3 acres in size, or using a cyclone seeder or power backpack in smaller sites. For black fly control, *Bti* liquid is applied to

rivers and streams by pouring or pumping a known quantity in a location such that it mixes throughout the flowage.

PROBLEMS: *Bti*'s activity can be affected by water quality, temperature and larval density, thus higher dosage rates may be needed in some conditions to maintain effectiveness. The short half-life (bio-degradation is less than 7 days) requires repeated treatments for continued control.

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Methoprene

(Altosid® briquet, pellet, or liquid)

In 1975 methoprene was registered as the first biochemical (now termed biorational) agent for mosquito control. Methoprene is a synthetic insect growth regulator (IGR) which mimics insects' natural juvenile growth hormone and disrupts normal development IGR's act on highly species-specific hormonal systems controlling metamorphosis and molting.

MODE OF ACTION: Methoprene is a true analog of a mosquito's own juvenile hormone. The immature larvae have an absolute requirement for these hormones to progress through the usual larval stages. During the 3rd and 4th larval instar stages, juvenile hormone levels normally drop to a very low level or zero, which is necessary for the larvae to complete development into an adult mosquito. Methoprene maintains the juvenile hormone concentration, in water, at a higher level than normal. This juvenile hormone is ingested and absorbed through the larvae's cuticle. In the presence of this higher hormonal level in the latter instar stages, the insect does not develop the physical features necessary for adult emergence. Mortality of the insect usually occurs during the pupal stage. (Hayes and Laws, 1991; Zoecon, 1993)

PRODUCT SAFETY: Methoprene has minimal effects on the food chain. Having the mosquito larvae present to the pupal stage provides food for vertebrate and invertebrate predators. Extensive testing has been done on mammals (rats, mice, cattle), birds (wading birds, shore birds, migratory waterfowl), amphibians (salamanders, frogs and toads), fish (trout, guppies and bluegill), aquatic invertebrates (fairy shrimp, copepods, water fleas, and others), non-target insects (mayfly, dragonfly, caddisfly), with no adverse effects found on these species using label rates. Methoprene has been fed to beef and dairy cattle to control fly development in fecal matter. The World Health Organization has also recommended methoprene for use in drinking water supplies to control container-breeding mosquitoes in tropical and subtropical areas. (Zoecon, 1991, 1993)

USE: MMCD uses three formulations of methoprene, all manufactured by Sandoz Agro - Zoecon Corporation.

Altosid® XR Extended Residual Briquets have microencapsulated methoprene in a plaster and charcoal base, designed to release a small, controlled dose over a period of 150 days in the water. For floodwater mosquito control, they are applied at a rate of 220 briquets per acre (grid 14-16 ft. apart) to sites which are 3 acres or less (active ingredient concentration in water: 2 ppb). Sites which may flood and then dry up (Types 1 & 2) are treated completely; sites with somewhat permanent water (Types 3 or 4) are treated with briquets around the perimeter of the site (usually in grass). Pockety sites with uneven terrain are not well suited to treatment with briquets if the grid pattern leaves areas of water untreated. Sites are treated once, in spring or early summer. For cattail mosquito control, briquets are applied at a rate of 330 or 440 briquets per acre in cattail marshes

known to contain cattail mosquito larvae, and treatments are made in winter or early spring when marshes are covered with ice. Currently, briquets are not applied to known fish breeding habitats as defined by the MN Department of Natural Resources (DNR).

Altosid® pellets are similar in formulation to briquets, but are much smaller, and are designed to release for a period of 30 days in the water. For floodwater mosquito control, pellets are applied at a rate of 2.5 lbs per acre, and for cattail mosquito control they are applied at a rate of 4-5 lbs. per acre. Applications are made using a helicopter in sites larger than 3 acres, or using a cyclone seeder or power backpack in smaller sites.

Altosid® Liquid Larvicide (A.L.L.) is mixed with water and applied in the spring to floodwater mosquito sites where early spring species are found (typically, woodland pools). The dose is 1 ounce of concentrate per acre. Dilution may be adjusted to achieve good coverage of the site. Applications are made using a helicopter in sites larger than 3 acres, or by hand in smaller sites. A.L.L. is not usually used after June 1 because it does not penetrate vegetation very well.

PROBLEMS: It is difficult to determine the effectiveness of methoprene in reducing mosquito populations, since bioassays of the pupae are needed to determine what effect it has on the mosquito. Methoprene is rapidly degraded by sunlight and aquatic microorganisms, its half life is less than two days, and different formulations are necessary to extend methoprene's effective life. Different wetland characteristics influence effectiveness, including pocketyness, hummocks, volume of water site receives, and canopy.

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Resmethrin and Piperonyl butoxide
(Scourge®: resmethrin 4%, synergist piperonyl butoxide 12%)

For many years pyrethrin, a natural botanical insecticide found in the flowers of *Chrysanthemum cinerariaefolium*, was used to control mosquitoes. In 1966 a synthetic ester of chysanthemumic acid, known as resmethrin, was discovered. Resmethrin is termed a synthetic pyrethroid. It was 20 times more toxic to mosquitoes than the natural pyrethrins. This active ingredient is one of the most potent mosquito adulticides known that contain only carbon, hydrogen, and oxygen.

Piperonyl butoxide was developed as a synergist for pyrethroids in 1947. The main effect of this material is to inhibit the enzymes insects use to detoxify insecticides. By increasing a compound's effectiveness, the synergist lowers the unit cost of treatment.

MODE OF ACTION: Scourge® has rapid "knock down" activity whereby mosquitoes very quickly lose coordination and become unable to fly. Synthetic pyrethroids such as the resmethrin in Scourge® affect the sodium channel in nerve axons, causing subtle changes in their function, and allowing nerve signals to become unclear. This can lead to repetitive motion, loss of coordination, and metabolic increase which can cause the insect's death. Synthetic pyrethroids are rapidly metabolized by mammals and thus the material does not reach the area of nerves where it is active. When manufactured, resmethrin contains a mixture of cis and trans isomers. The cis isomer is more effective than the trans but also poses more risk to nontarget organisms. Scourge® contains a maximum of 30% cis isomer. (Hayes and Laws, 1991; Roussel)

PRODUCT SAFETY: Resmethrin is less toxic to rats than are the natural pyrethrins (Roussel). Long term toxicology and metabolism studies suggest that under normal conditions of use, Scourge® presents no risk to human health. The Minnesota Department of Health did a health risk assessment in 1993 evaluating MMCD's use of Scourge®. At that time they concluded that oral, dermal, or brief inhalation exposure should not pose a health risk, but that children should be prevented from having prolonged inhalation exposure (such as following pesticide applicators while they work). Resmethrin is considered relatively non-toxic to dogs, cats, and other mammals and is used for flea control directly on animals (Roussel, b). Resmethrin has been shown to affect fish in the lab at relatively low doses, but it degrades rapidly in sunlight and has not been related to fish mortality in the field. Tests on mallard ducks and quail showed no acute or chronic effects on survival or reproduction (Roussel, b).

Piperonyl butoxide affects the enzymes known as mixed-function oxidases. Insects are much more suceptible to its effects than are mammals. It has very low mammalian acute toxicity (rat LD50 7,500 mg/kg; dose used in mosquito control is 0.1 mg per square foot). Dietary levels 50 to 1000 times greater than maximum field dosages had no effect in humans or other mammals tested, even after prolonged exposure. At very high dosages in rats, mice, or dogs, some effect was seen on liver function. The majority of

studies of chronic exposure to high dosages (ca. 100 mg/kg) in rats showed no carcinogenic effects. Piperonyl butoxide enhances toxicity of some compounds, but protects against toxicity of others, and has been shown to have anticonvulsant activity. (Hayes and Laws, 1991)

USE: The resmethrin formulation used by the District is Scourge® 4+12, manufactured by Roussel Bio Corporation. It is applied to areas known to contain large numbers of adult mosquitoes, using either a truck-mounted or hand-held Ultra Low Volume (ULV) cold fogging machine. Fogging is usually done early in the morning or at dusk, when mosquitoes are active. Fog may also be applied to mosquito resting areas. Scourge® is mixed with other oils and applied at a rate of 1.5 ounces of mixed material per acre.

PROBLEMS: Several factors can limit the effectiveness of Scourge®, such as calibration, mechanical failure, and unfavorable weather conditions. MMCD has instituted equipment evaluations to eliminate, or at least minimize, poor calibration and equipment failure. Applications are limited to times when winds are between 2-8 mph and temperatures are above 60°. Scourge® should applied only under optimal environmental conditions and when mosquitoes are most active.

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Permethrin

(Permethrin 57% OS, Clarke Mosquito Control Products; Punt™ 57 OS, Vectec, Inc.)

Pyrethrin, a natural botanical insecticide found in the flowers of *Chrysanthemum cinerariaefolium*, has been used for many years to control mosquitoes, but its use was limited because of its rapid degradation in sunlight. More stable compounds have been developed based on pyrethrin, known as synthetic pyrethroids. Permethrin is a synthetic pyrethroid first described in 1973. It has demonstrated insecticidal activity against a wide range of important ornamental, crop, public health, house and garden, industrial and food storage pests. Permethrin is a photostable pyrethroid and therefore is more persistent than natural pyrethrins or resmethrin. Its longer residual activity makes it a useful residual insecticide on surfaces visited by insects.

MODE OF ACTION: Synthetic pyrethroids such as permethrin affect the sodium channel in nerve axons, causing subtle changes in their function, and allowing nerve signals to become unclear. This can lead to repetitive motion, loss of coordination, and metabolic increase which can cause the insect's death. Synthetic pyrethroids are rapidly metabolized by mammals and birds and thus the material does not reach the area of nerves where it is active. When manufactured, permethrin contains a mixture of cis and trans isomers. The cis isomer is more effective than the trans but also poses more risk to nontarget organisms. Permethrin products used by MMCD contain a maximum of 35% cis isomer.

PRODUCT SAFETY: Many tests have been done on permethrin's effect on a wide variety of organisms. Permethrin has no effect in rats (Gaughan et al. 1977) and poses no hazard for mammals (Gray and Soderlund 1985, Bradbury and Coats 1989). The oral LD50 to rats has been determined to be in excess of 4000 mg/kg of body weight (dose used in mosquito control is about 1 mg per square foot). The risk assessment done by the Minn. Dept. of Health found that oral, dermal, or brief inhalation exposure to permethrin should not pose a risk to human health, but children should avoid prolonged inhalation exposure, such as by following applicators while they work, and avoid consuming unwashed treated foliage.

Permethrin poses no hazard to birds, even if they eat treated insects or foliage (Hill 1985, Smith and Stratton 1986, Bradbury and Coats 1989). It had no acute or teratogenic effects on mallard eggs (Hoffman and Albers 1984). Snail survival is not affected by permethrin (Spehar 1983), and it is relatively nontoxic to earthworms (Roberts and Dorough 1984). Microbial activity leads to rapid degradation of permethrin in soils (Williams and Brown 1979). It has relatively low toxicity to many terrestrial insect predators (Smith and Stratton 1986). Although lab tests show permethrin is highly toxic to bees, field tests show it presents little or no hazard to honey bees when used at field rates (Smith and Stratton 1986), which may be due to its temporary knockdown and repellency (Gerig 1985).

Permethrin can have a major effect if it is applied to aquatic environments in sufficient dose. Aquatic insects are generally more sensitive to pyrethroids than are terrestrial (Seigfried 1993), and mayfly nymphs are known to be affected (Friesen et al. 1983). Effects have been shown in both zooplankton (Day 1989) and amphipods, which have been controlled in water distribution systems using permethrin (Abel and Garner 1986). Permethrin is highly toxic to fish (Bradbury and Coats 1989), and has been shown to affect frogs if injected (Cole and Cassida 1983). Because of the many effects in aquatic systems, a buffer zone of 20m (66 ft) has been calculated and tested for ground-based permethrin applications that provides a margin of safety for aquatic systems under a wide variety of environmental conditions (Payne et al. 1988).

USE: MMCD has used several formulations of permethrin from different manufacturers. The products currently used are Permethrin 57% OS, manufactured by Clarke Mosquito Control Products, and Punt™ 57 OS, manufactured by Vectec, Inc. Permethrin is used to treat adult mosquitoes in wooded areas with good ground cover where mosquitoes rest in shaded, moist areas during the daytime. The permethrin is mixed with soybean oil and food grade mineral oil, and applied at a rate of 25 oz. mixed material per acre using a power backpack mister (0.1 lb AI/acre). It is usually applied to brush at the edge of a woods as a border treatment.

PROBLEMS: Permethrin is highly toxic to fish, and care must be taken not to apply near fish-bearing water. The label requires a buffer of 100 ft, and the District has extended this to a 150-foot buffer. Permethrin should not be applied near areas where bees forage.

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ADULT MOSQUITO CONTROL POLICY - JUNE 1994

ADMINISTRATIVE MANUAL	-POLICY -GENERAL INFORMATION -PROCEDURE	SECTION: PAGE: 1

Adult Mosquito Treatments

RELEASE DATE: July 27, 1994
POSITION(S) RESPONSIBLE: Director

POLICY — The Metropolitan Mosquito Control District (MMCD) treats functions open to the public, and public owned park and recreation areas for adult mosquitoes upon request and at no charge if the event is not for profit. Public events operated for profit will be treated with the cost charged to the sponsor. The District will also respond to citizen requests and will treat adult mosquitoes in a potential disease situation.

TREATMENT INITIATION — Treatment requests come from Park and Recreation Directors and community event organizers and should be received by the District office a minimum of 7 days before a special function. With one request, Park and Recreation Directors can schedule season long treatment for a particular park.

When a request comes in from a citizen (or neighborhood of citizens) for adult mosquito control, MMCD will inform a community leader (someone in an official capacity such as from the city or county offices) that a treatment was requested and will be performed. We will also respond to telephone requests from responsible officials (e.g. mayor, city clerk, council member) who ask for a treatment. These treatments may either be for functions or for perceived annoyance by a group of citizens.

Callers will be informed that there are private companies that can do adult mosquito control on their property or for a private function.

Treatments may be initiated by MMCD supervisory field staff if they become aware of high adult mosquito counts in populated areas and confirm these through sweep collections or CO_2 trap collections. These treatments will be cleared through the Director or *Aedes* Program Manager.

Health concerns such as a case of LaCrosse encephalitis or Western equine encephalitis may also initiate adult mosquito control treatments in an area.

EXAMPLES OF TREATMENT — The following are examples of areas that may be treated for adult mosquitoes (The list is by no means inclusive) if they are not for profit: Park and recreation areas, School events (e.g. graduation, athletic events), Public events

Adult Mosquito Treatments

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(e.g. county fair, Fourth of July celebration), Golf course - city/county owned, Youth camps (e.g. boy scout, girl scout, church camps), LaCrosse encephalitis previous case sites with at least 2 *Aedes triseriatus,* and Border treatment of areas not accessible for larval control.

NOTIFICATION PROCEDURE

Any scheduled adult mosquito treatment is identified by county and specific location and is available by calling 643-8383. This information is available by 4 p.m. for that evening and the following day. For those citizens who request phone notification, field staff will attempt to contact them or leave a message before treatment. Perimeter permethrin treatment areas are posted during the time of treatment to notify the public of our presence.

When treatments are performed for "not for profit" public gatherings (e.g. county fairs, community festivals), the event organizers will be informed of what service the District has performed and ask that the District be listed as a contributor to the event.

GENERAL INFORMATION

The Metropolitan Mosquito Control District program is primarily one of regional larval control and limited localized adult mosquito control for highly frequented public parks and civic functions and in potential disease situations. The type of treatment and materials used depend on several factors -- particularly the available daytime resting habitat for the mosquitoes. Permethrin is applied to the perimeter vegetation of these daytime resting areas with a back pack sprayer. In the absence of the preferred vegetation of these daytime resting areas, resmethrin is applied from truck or ATV mounted cold foggers or hand held ultra low volume sprayers.

REQUESTS OF NO TREATMENT

Private citizens may request that the District not perform adult mosquito control activities on their property. These requests will be honored. The District will maintain a buffer around citizens who request that we stay a distance away from their property for cold fogging operation.

If a community requests that the District not perform adult mosquito control activities on community property, the District will attempt to honor the request but retains the right to make the decision based on health or severe annoyance. If infestations reach levels which affect health or cause severe public annoyance the District retains the ability to do adult mosquito control.

DRAFT

CONTROL MATERIALS USED BY THE MMCD FOR MOSQUITO & BLACK FLY CONTROL
NUMBER OF ACRES TREATED BY MATERIAL TYPE FOR 1987-1994

NUMBER ACRES TREATED

CONTROL MATERIAL	1987	1988	1989	1990	1991	1992	1993	1994
ALTOSID XR BRIQUET 150 DAYS	280	4,235	11,700	11,351	10,862	10,376	10,537	8,557
ALTOSID SAND 3-DAY	0	706	13,900	84,286	12,079	0	0	0
ALTOSID SAND - GFM Research Only	0	0	0	0	0	625	630	678
ALTOSID PELLETS 30-DAY	0	0	0	0	75	5,689	5,562	5,374
ALTOSID SR-20 LIQUID	0	0	0	0	1	3,279	15	13
BTI CORN COB GRANULES	44,300	24,248	67,300	100,100	134,011	101,877	126,778	102,860
BTI LIQUID BLACKFLY (GALLONS)	36	15	214	2,009	3,574	4,418	5,090	4,047
PERMETHRIN ADULTICIDE	11,483	8,771	9,225	38,787	22,062	12,812	8,261	10,499
RESMETHRIN ADULTICIDE	219,051	15,787	58,880	225,900	155,922	48,716	53,345	40,687

1994 Amounts Used by Material Type in MMCD Divisions

Control Material	Anoka	Dakota	No. Henn.	So. Henn.	Ramsey Washington	Scott-Carver	Cattail	SPRP Research	District Totals
Altosid XR Briquet *(Cases)*	833.0	841.0	1,268.0	1,495.0	1,936.0	1,522.0	1,099.0	0.0	8,994.0
Altosid Pellets *(Pounds)*	2,222.0	508.0	1,143.0	1,834.0	2,160.0	2,251.0	6,710.0	0.0	16,828.0
Altosid GFM Sand *(Pounds)*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,390.0	3,390.0
Altosid A.L.L. Liquid *(ounces)*	1.0	0.4	1.0	10.0	0.0	0.6	0.0	0.0	13.0
***Bti* Granules** *(Pounds)*	50,954.0	40,060.0	97,932.0	192,728.0	104,200.0	157,006.0	0.0	6,088.0	648,968.0
Permethrin *(Gallons)*	187.0	212.3	259.0	186.0	312.5	237.6	0.0	0.0	1,394.4
Resmethrin *(Gallons)*	83.0	6.9	150.0	37.0	125.0	74.9	0.0	0.0	476.8
Bti* Liquid* *(Black Fly Program)*	-	-	-	-	-	-	-	-	4,047.0

* includes eastern Carver, Wright, Sherburne Counties

** Total gallons used for black fly control

DRAFT

TECHNICAL ADVISORY BOARD (TAB)
Metropolitan Mosquito Control District
Minutes—Fall, 1994 Technical Advisory Board Meeting

Members:

Art Mason, Chair	Minnesota Department of Agriculture
Dave Noetzel, Vice-Chair	University of Minnesota, Entomology Department
Robert Sherman	Hennepin County, Office of Planning/Development
Craig Hedberg	Minnesota Department of Health
Judy Helgen (for Mary Knutson)	Minnesota Pollution Control Agency
Dave Warburton (for Stan Smith)	U.S. Fish and Wildlife Service
Jim Cooper	University of Minnesota, Dept. Fish and Wildlife
Larry Gillette	Hennepin County Parks
Al Singer	Environmental Group

Staff:

Joe Sanzone	Director
Susan Palchick	*Aedes* Program Manager
Dan Bennek	Administrative Assistant
Sandy Brogren	Entomology Laboratory
Diann Crane	Entomology Laboratory
Dan Dobbert	Environmental/Legislative Liaison
Dave Neitzel	LaCrosse/Lyme Program Leader
Scott Ranta	Cattail Program Leader
Nancy Read	Program Development
Kelly Sharkey	Quality Assurance
Mark Smith	Quality Assurance
Brian Zeigler	Ramsey-Washington Division Foreman

Visitors:

Peg Borkman	U.S. Fish and Wildlife Service

I. The November 17 meeting of the Technical Advisory Board (TAB) was called to order at 9:00 A.M. at the Metropolitan Mosquito Control Headquarters in St. Paul by Art Mason, meeting chair. As recommended at last year's TAB, this autumn meeting was held to review the District's summer activities and provide input for the upcoming season. The fall meeting is designed to have more informal structure to allow for more discussion between TAB members and MMCD staff. A summary of District activities was provided to all TAB members prior to the meeting which was then used as for the topics of discussion.

A short introduction was given by Joe Sanzone, who succeeded Bob Sjogren as Director on March 1, 1994. Joe listed his priorities as Director as being; 1) maintaining and improving the program's environmental softness, 2) providing more effective services, and 3) being more proactive with government and special interest groups.

II. Following are comments about the District's activities from this past summer. (Italics indicate questions by TAB members).

Self-Assessment.
How often will the assessment be updated? The assessment will be updated as major program changes are made.

LaCrosse Encephalitis Cases.
Why did this outbreak occur? The area was surveyed and all breeding habitat was removed in 1988 and 1989. Five years have passed since then, and it appears that residents have been busy creating *Ae. triseriatus* habitat. After we were notified of the cases, we again surveyed the area found 89 discarded tires in the area surrounding the case sites.

Was any control done? We adulticided in the vicinity of the case sites and surveyed and eliminated any breeding sites found within 1/2 mile radius of the case sites.

Are gutters and drains potential breeding sites? Not likely; gutters are higher off the ground than their preferred breeding habitat is.

Larvicide Efficacy.
Why were the briquets ineffective? The overall low control rates may be due to rates reported late in the season. Briquetting is usually finished by the end of May and the life span of a briquet is normally 150 days. A mosquito hatch late in September occurred beyond the normal 150-day life of the briquets which probably accounted for low control rates.

Low control rates of *Bti* corn cob were also experienced. We had a different supplier this year. Researchers at NRRI tested the potency and found it was lower than last year.
Mason: The potency needs to be checked before applied in the field
Noetzel: It's difficult to test potency once the material is formulated with something else.

Natural mortality is 40-60%—how do you account for the percent control for Bti? Mortality is factored into control calculations for briquets, but not for *Bti* because the exposure time is so short. When we calculate per cent control for briquets, we use Mulla's formula which factors in pupal mortality. Reference or control briquets assays have 85% survival.

Why don't you use controls for Bti? We don't know how. Larvae are difficult to keep alive in the laboratory.

Mosquito Surveillance
Are you looking at other trapping methods? Yes, we recognized that our current methods do not reflect what citizens are experiencing mosquito-wise with our current methods of daytime sampling. This year we conducted evening collections with MMCD employee volunteers to determine if such a sampling regime was feasible.

A different way of reporting results would be helpful—somehow illustrate regional variation. Identify indicator areas—areas that always have large numbers of mosquitoes.

Can you develop a model to predict mosquito populations? We started working on a model, but unfortunately we found that many of the assumptions used in the model are inaccurate. More research needs to be done to address this problem.

Refused Entry
At what rate is the amount of refused entry acreage changing. We have regained some area, but its hard to tell the rate of change right now. We are developing an improved tracking system.

Can the District go onto refused entry lands in cases of severe public annoyance? Yes, according to the legislation that directs the District we have the right of entry for disease and nuisance mosquito outbreaks on public lands. We would enforce it in the case of a disease situation, but

we do not enforce it for nuisance mosquito problems. (On private property, we have right of entry in disease outbreaks only.)

What would it take for you to enforce it in a nuisance situation. It would take a number of telephone calls from the public and elected officials.

Disease in General
Mason: One critique recently voiced was that it appears the District is leaning towards an image of a public health function rather than a nuisance mosquito control function. I don't agree that is a problem. Just how prevalent are these new insect or arthropod-borne viral diseases we are hearing about.
Hedberg: It is hard to tell. Currently there are limitations on the diagnostic level. However, in the summer most clinicians think of mosquitoes as possible causes to certain illnesses. We may not be missing outbreaks, but probably are missing sporadic cases. The CDC is concerned about emerging infections and may dedicate money for surveillance. The District is very helpful for public health. Although it mostly provides nuisance control now, the health emphasis could increase.

Attractant Study
Cooper: It is important to have a good statistical design for this study.
District (Zeigler): This was a pilot study. Improvements in design will be made for 1995.

Interagency Panel
Noetzel: Moved to disband the TAB because the Interagency Panel (IP) is a duplication of efforts. (Motion died for lack of second.)
Palchick, Sanzone: The IP is going to deal with a small component of the TAB's charge. The group can look at one question intensively. We can use other agencies' expertise in evaluating their programs' effectiveness when evaluating ours.
Hedberg: IP may have been set up because of doubts about the TAB's effectiveness.
Mason: Yes there is overlap, the TAB needs good communication with the IP. He could be the liaison between the two groups for now.
Cooper: The IP will need more technical input to address questions.
Hedberg: Request the IP provide meeting minutes to TAB members monthly.
Read: Will provide the TAB with monthly IP minutes.
Sherman: Need to clarify the role of the two groups at the spring TAB meeting.

Field Day Presentation
Will likely be held the end of May or early June. It will probably take 4 hours. Expect demonstrations of helicopter, ground, and adulticiding applications.

Refused Entry Survey
Singer: Numbers don't add up to 100%.
District (Smith): 53% were either very satisfied, satisfied, or neutral with our response to honoring their requests. 1.6% were either very dissatisfied or dissatisfied. 15.6% are no longer restricted access, 6.3% no longer live at the address, 4.7% refused to complete the survey, and 18.8% were unable to be contacted.

Newsletter
Mason: Have you considered an internal newsletter?
Sanzone: Yes, it's in the works.

Budget
Are there changes in the 1995 budget? The budget will actually go down due to staff reductions and the use of methoprene pellets over briquets. Services should remain at the same level.

1995 Control Strategies
We are working with the pellet supplier to develop a pellet with a shape that is easier to apply by helicopter and seeder. We are hoping to get it for 1995.

Adulticiding
Do you adulticide on large golf courses? Although it is not our regular practice, we will do spot applications for no charge or pay-for spray for large events. As of two years ago, our official pay-for-spray program was discontinued. This year our official policy was modified to reflect that status. We also tried to determine how prevalent adulticiding by private groups is. Most companies refused to give the information. It appears that most companies are using chemicals intended for other pests, which would include mosquitoes.

ADJOURNED