Allied Biological

Allied Biological Inc.
of New Jersey
Rockport Road
Hackettstown, NJ 07840
(908) 850-0303
FAX 850-4994

Lake Survey Report

Beaverdam Lake
Orange County, New York

Prepared for

Beaverdam Lake Rehabilitation and Protection District

Prepared by

Allied Biological Inc.

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1.0 INTRODUCTION

Beaverdam Lake is currently displaying the effects of cultural eutrophication. Eutrophication is a natural aging process of a body of water which eventually leads to land. Under natural influences this process can take hundreds of years. However, man's activities within the lake's watershed can greatly accelerate this process through siltation and nutrient enrichment.

Beaverdam Lake, located within the towns of New Windsor, Blooming Grove, and Cornwall, New York, is a 164 acre man made impoundment. The Beaverdam Lake Survey, conducted by the BEAVERDAM LAKE REHABILITATION AND RESTORATION DISTRICT, and ALLIED BIOLOGICAL, INC., will provide a better understanding of existing water quality conditions, watershed characteristics, and lake biology. With the establishment of this baseline information, the DISTRICT will be able to identify those factors within the watershed that are causing an adverse impact upon the lake. The Survey will also be a source from which sound lake management/restoration programs can be formulated.

2.0 PHYSICAL SETTING

The watershed of Beaverdam Lake (Figure 1) is approximately 7530 acres (11.7 square miles). The watershed extends some 7 miles north of Beaverdam Lake where it ends 0.3 miles south of Route 52. The watershed at its widest point is 2.7 miles. The topography contained within the watershed consists of areas with 5-10% slopes which represent approximately 70% of the area. The remaining 30% of the watershed is relatively flat and includes fairly extensive wetland areas. Major development within the watershed is centered around Beaverdam Lake, and Stewart Air Force Base some 4 miles north of the lake.

The trophic state of a lake depends largely on the characteristics of the watershed. The soils and geologic structure of the watershed influence the basic water chemistry of the lake, such as pH, alkalinity, hardness, and baseline nutrient concentrations. The topography has an effect on the hydrologic budget of the lake as well as having a influence on the erosivity of disturbed soils which may accumulate within the lake basin. These basic characteristics of the watershed may somewhat buffer the Lake from the adverse effects of man's activities, or they may contribute to an acceleration of siltation and nutrient enrichment into the lake.

The size of the Beaverdam Lake watershed when compared to the size of Beaverdam Lake yields a ratio of 46:1. This large ratio suggests that there is a substantial amount of water coming into Beaverdam Lake which will result in a fairly rapid flushing rate. This large ratio also indicates that there is an increased opportunity for the adverse effects of man's activities to impact upon the Lake.

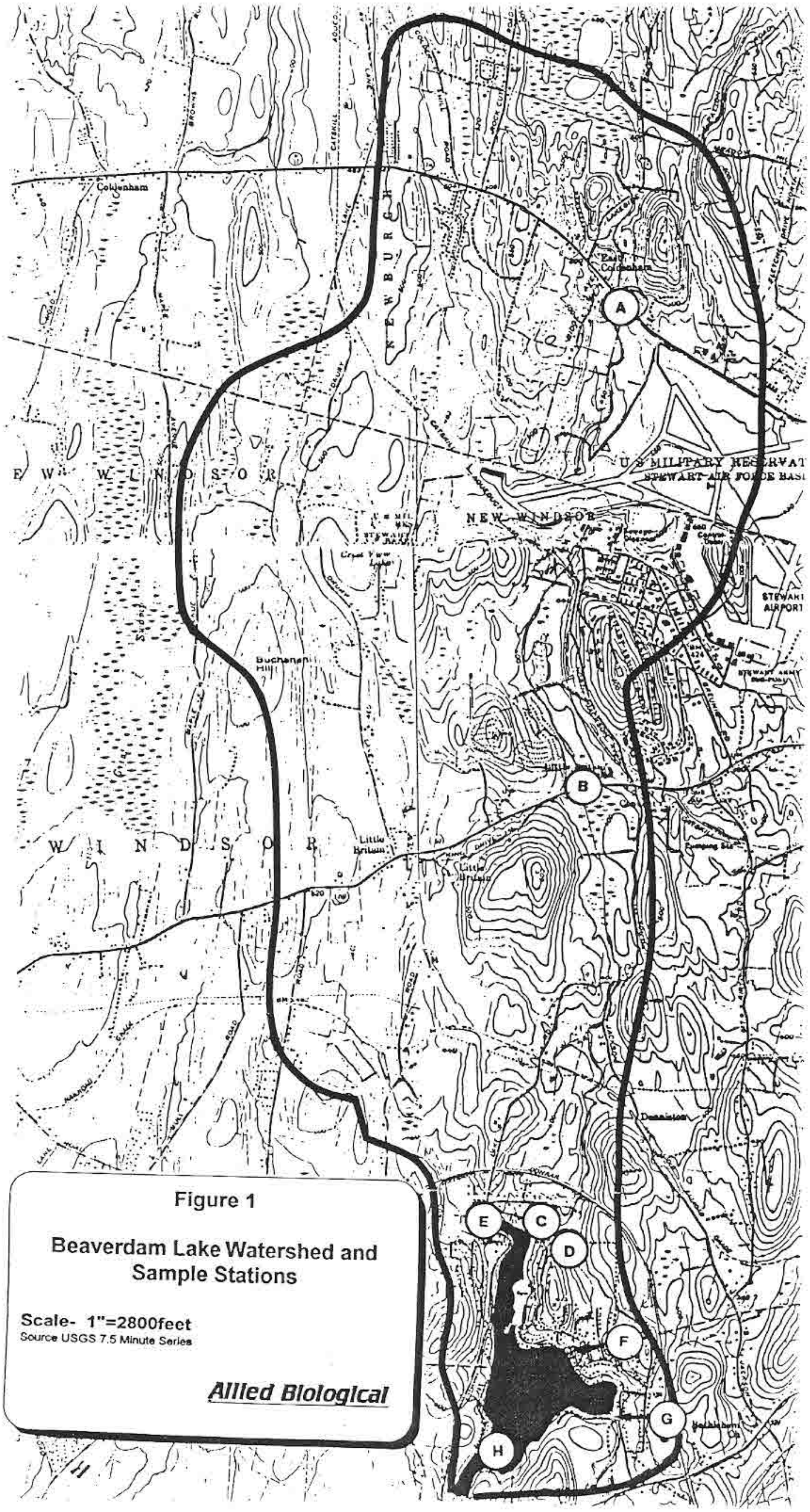

Figure 1

Beaverdam Lake Watershed and Sample Stations

Scale- 1"=2800feet
Source USGS 7.5 Minute Series

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2.1 SOILS

The major soil groups within the Beaverdam Lake watershed are of the Mardin-Erie series (Soil Survey of Orange County, New York, 1981). All the soil phases associated with these two series are represented within the watershed. The Mardin soil series includes soils that are moderately well drained, gently sloping to very steep soils. The soils of the Mardin series are generally found in the hilly portions of the watershed.

Soils of the Erie series are nearly level to gently sloping soils and are somewhat poorly drained. These soils are found mostly within the more level portions of the watershed.

The Mardin and Erie soil series have severe limitations with regard to building development and septic system absorption fields. These limitations are based on slope of the Mardin soils and the poor drainage of the Erie soils (Soil Survey of Orange County, New York). The poor drainage of these soils may have an adverse effect upon the Lake in that poorly designed septic systems may leach into surface waters that would eventually drain into the Lake, thereby adding nutrients that would promote the growth of algae. With regard to soils with steep slopes, adequate erosion control methods must be implemented to prevent unwanted siltation into the Lake.

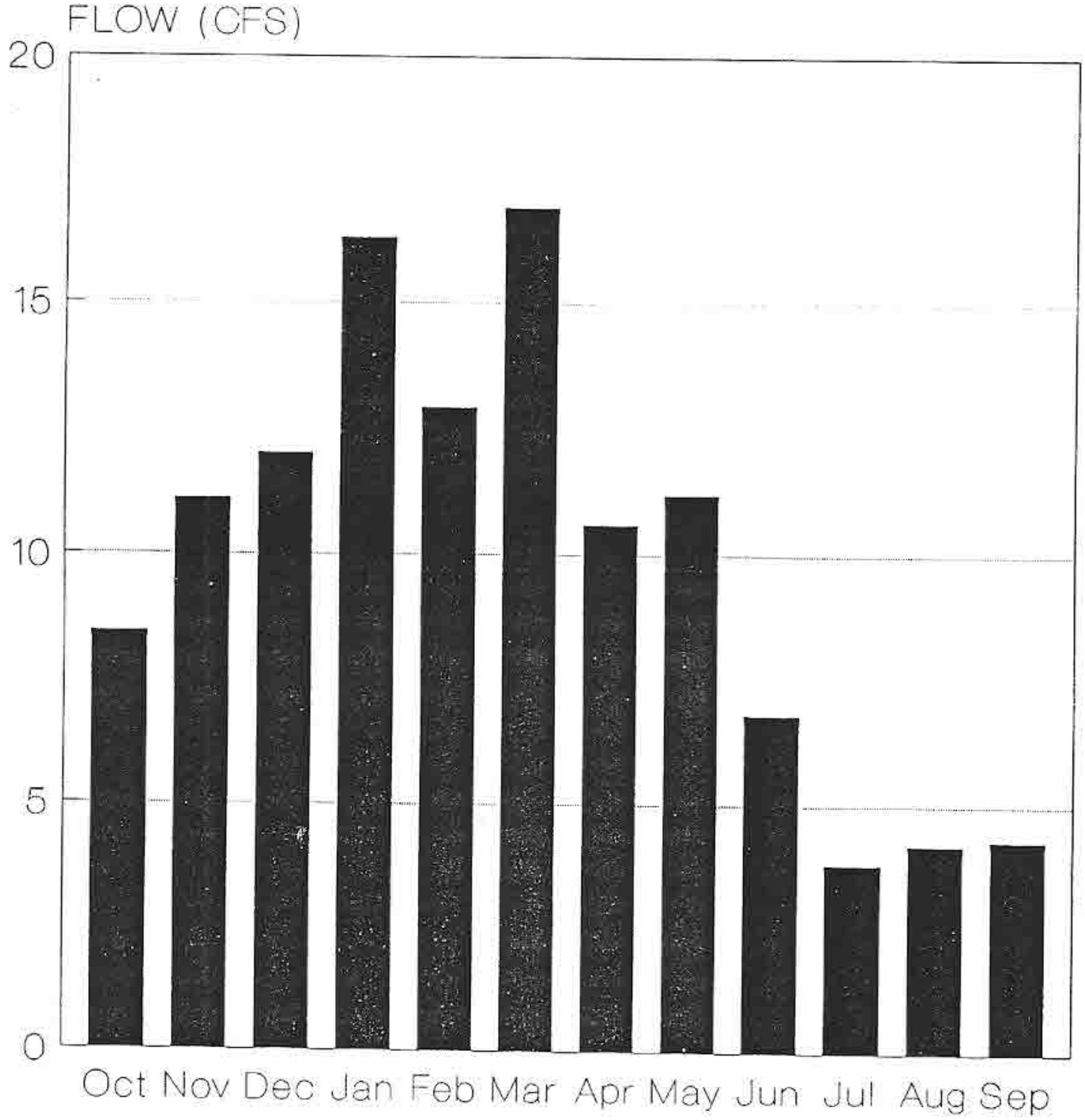
3.0 HYDROLOGY

A preliminary water budget for Beaverdam Lake was determined by two methods, the Rational Method and from actual water volume measurements from the main inlet stream. The Rational Method utilizes the size of the watershed, the watershed's physical features, and average annual rainfall. The average annual rainfall for the region is approximately 45 inches or 3.75 feet (National Oceanographic and Atmospheric Administration). The watershed area, not including the Lake is 7366 acres. The amount of water entering the Lake from the watershed was then found to be approximately 9667 acre-feet per year.

The amount of rainfall that falls directly on the Lake is 615 acre-feet per year (164 acres x 3.75 feet of precipitation per year). Yearly evaporation from the Lake is 410 acre-feet (30 inches of evaporation per year, NOAA). The net water gain for the Lake is therefore 205 acre-feet per year. Combining the water input from the watershed with the net water gain on the Lake results in a total water input of 9872 acre-feet per year. The average outflow from Beaverdam Lake was then determined to be 13.5 cubic feet per second (cfs).

The volume of water coming into the Lake was calculated using flow data from the main inlet stream of Beaverdam Lake. Flow measurements were recorded by District personnel from October, 1990 through September, 1991. The average flow from the main inlet stream was found to be 9.9 cfs. The highest recorded flow was 24.3 cfs on March 4, 1991 while the lowest recorded flow was 1.9 cfs on July 14, 1991. The results of the flow measurements are presented in Table A and Figure 2.

Figure 2: BEAVERDAM LAKE AVERAGE MONTHLY FLOW



October 1990 - September 1991

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TABLE A: FLOW MEASUREMENTS OF MAIN INLET STREAM

DATE	FLOW(CFS)	DATE	FLOW (CFS)	DATE	FLOW(CFS)
10-29-90	8.4	1-04-91	12.7	5-07-91	19.5
11-01-90	8	1-07-91	12.2	5-11-91	12
11-03-90	7.5	1-23-91	25.5	5-25-91	6.5
11-06-90	8.9	2-02-91	15	6-06-91	7
11-11-90	17.3	2-16-91	14.1	6-14-91	6.1
11-14-90	10.3	2-23-91	10.3	6-16-91	5.6
11-19-90	12.2	3-04-91	24.3	6-18-91	4.7
12-03-90	8.4	3-06-91	15.9	6-19-91	4.2
12-05-90	15	3-08-91	15	6-22-91	6.6
12-08-90	11.3	3-24-91	15.5	7-14-91	1.9
12-09-90	10.8	3-28-91	13.6	7-24-91	5.6
12-10-90	10.3	4-09-91	10.3	8-06-91	3.3
12-16-90	14.5	4-21-91	11.7	8-11-91	4.3

The main inlet stream accounts for 73% of the water budget for Beaverdam Lake. The remaining 27% of the water coming into the Lake is supplied from other smaller inlet streams and ground water.

On October 24, 1991 ALLIED BIOLOGICAL, INC. conducted a water depth survey of Beaverdam Lake. The survey was performed with a recording fathometer. A water depth contour map (Figure 3) was developed from the fathometer data. The results of the depth survey indicate that the average depth of Beaverdam Lake is 11.8 feet and the volume of the Lake is 1940 acre-feet.

Using the Lake volume of 1940 acre feet and the average outflow of 13.6 cfs, it was determined that the flushing rate, the time it takes for the Lake to renew its volume, is once every 72 days or approximately 5 times per year.

The determination of the flushing rate is important in that there is a relationship between flushing rate and nutrient accumulation within a lake. Generally, the slower the flushing rate the more likely it is that nutrients that enter a lake will accumulate and concentrate in sufficient amounts to promote the growth of algae and vascular plants.

The relatively rapid flushing rate of Beaverdam Lake would suggest that nutrients that enter the Lake from outside sources may not accumulate to the same degree that would occur in lakes with slower flushing rates. This is a beneficial feature in that if outside sources of nutrient import can be identified and managed, the overall nutrient concentrations within the lake may diminish sufficiently to reduce densities of unicellular algae.