Water-Level Fluctuations in Limestone Sinks in Southwestern Georgia

With particular reference to breeding places of *Anopheles quadrimaculatus* Say

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1110-E

Water-Level Fluctuations in Limestone Sinks in Southwestern Georgia

By E. L. HENDRICKS *and* MELVIN H. GOODWIN, JR.

CONTRIBUTIONS TO THE HYDROLOGY OF THE UNITED STATES, 1952

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1110-E

A study of the hydrology of several ponds, with brief botanical descriptions and with particular reference to breeding places of malaria-carrying mosquitoes. Prepared in cooperation with Emory University Field Station, Georgia Department of Mines, Mining, and Geology, and U. S. Public Health Service

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PREFACE

This report was prepared cooperatively by the U. S. Geological Survey and the U. S. Public Health Service. The work on which the report is based was sponsored jointly by these agencies, Emory University and the Georgia Department of Mines, Mining, and Geology. Personnel of the Water Resources Division of the U. S. Geological Survey performed advisory services from the inception of the work in 1939 and actively conducted the investigation subsequent to 1944. The project was organized originally under direction of Dr. Justin M. Andrews, officer in charge, Communicable Disease Center, Federal Security Agency, Public Health Service, Atlanta, Ga., who participated actively in subsequent phases of the investigation.

Personnel of the Water Resources Division were under the direction of M. T. Thomson, district engineer, Atlanta, Ga. Personnel of the U. S. Public Health Service were under the direction of Dr. G. H. Bradley, chief, Vector Control and Investigations Branch, Communicable Disease Center, Atlanta, Ga.

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WATER-LEVEL FLUCTUATIONS IN LIMESTONE SINKS IN SOUTHWESTERN GEORGIA

By E. L. Hendricks [1] and Melvin H. Goodwin, Jr. [2]

ABSTRACT

Ponds formed in limestone sinks in southwestern Georgia are the principal breeding places of the malaria-carrying mosquito *Anopheles quadrimaculatus* Say. Hydrologic characteristics of these ponds determine the length of time they hold water, influence the species and density of plants that become established, and hence affect mosquito production. Thus, hydrology of the region affects directly the health of the inhabitants.

Measurements of pond levels, ground-water levels, precipitation, and pan evaporation in a 200 sq mi area in southwestern Georgia during the period 1939–47, provided the basis for quantitative and qualitative analysis of the hydrologic factors affecting pond levels. Analyses of records for 13 ponds in the area made by analytical, statistical, and graphical methods indicate that precipitation and evapotranspiration are the two most important factors affecting pond levels in the region studied. Significant effects of ground water are confined to relatively short periods of extremely high water-table levels. Antecedent pond level greatly influences pond-stage response.

Formulas developed for the 13 ponds to express relationships of pond-stage change, precipitation, antecedent pond stage, pan evaporation, and ground-water level show high degrees of statistical correlation. These formulas provide acceptable means for synthetizing hydrographs of the levels of the specific ponds for which they are derived. No single formula, however, is applicable on a regional basis.

The ratio of pond-stage change to precipitation depth ranges from 1.51 to 4.13 for the ponds studied. The fact that this ratio is greater than unity accounts for the persistence of many ponds despite the fact that evapotranspiration demands exceed precipitation. The ratio of evapotranspiration losses from the ponds to pan evaporation ranges from 0.88 to 3.00. The average ratio of runoff depth to precipitation on the tributary-land areas ranges from 0.075 to 0.278, for the ponds studied.

INTRODUCTION

PURPOSE AND SCOPE OF INVESTIGATION

Hydrologic observations were begun in an area of southwestern Georgia in 1939 as part of a program designed to investigate factors responsible for the natural occurrence of human malaria. The hydro-

[1] U. S. Geological Survey.
[2] U. S. Public Health Service.

logic work was undertaken in connection with investigations related to the ecology of the malaria-carrying mosquito *Anopheles quadrimaculatus* Say, the local vector of malaria in the area. In the area studied, breeding places of the aquatic stages of this insect are quiet bodies of unpolluted fresh water that are partially shaded and contain aquatic vegetation. The numerous limestone sinks that are a feature of the area are conducive to the formation of ponds that meet these requirements. Several authors have indicated the close correlation of solution topography and malaria occurrence (Boyd and Ponton, 1933; Watson and Spain, 1937; Watson and Hewitt, 1941).

An objective of the over-all program was to study, quantitatively if possible, the relation of physical and biological factors to the occurrence of malaria. This study was designed to determine if relationships or indicators could be discovered that would permit anticipation or prediction of conditions favorable for malaria transmission. Basically, the existence of ponds in which mosquito larvae can develop is necessary for the production of vectors capable of perpetuating the disease. Soon after delineation of areas where malaria foci existed, ponds representative of the principal types where malaria-carrying mosquitoes developed were selected for intensive study. Measurements of physical factors believed to be related to the formation or persistence of these ponds were begun.

Because pond stage determines the size of the mosquito-breeding places, the amount and kind of vegetation inundated, and to some extent the surface conditions of the pond, measurements of variations in water-surface elevations were begun as one of the first hydrologic observations. Measurements were also made of ground water and precipitation as it was assumed that these factors might be related directly to pond stage.

As data were accumulated and examined, it appeared that possible benefit to the field of hydrology, aside from its immediate application to the malaria research program, warranted development of a program designed to study somewhat independently the hydrologic characteristics of limestone-sink terrane. Consequently, the program was expanded to embrace this objective. This report covers primarily the hydrologic aspects of the study; relations of these data to the biological program are indicated secondarily.

The objectives of the hydrologic investigation were to determine what factors control the levels of these ponds and to ascertain if the reaction of ponds to these factors was consistent enough for use in predicting pond levels in individual ponds or on a regional basis. Ponds were selected to sample the various types of ponds in the area as well as to obtain good areal distribution. The locations of the ponds are shown in figure 20. The three hydrologic factors selected

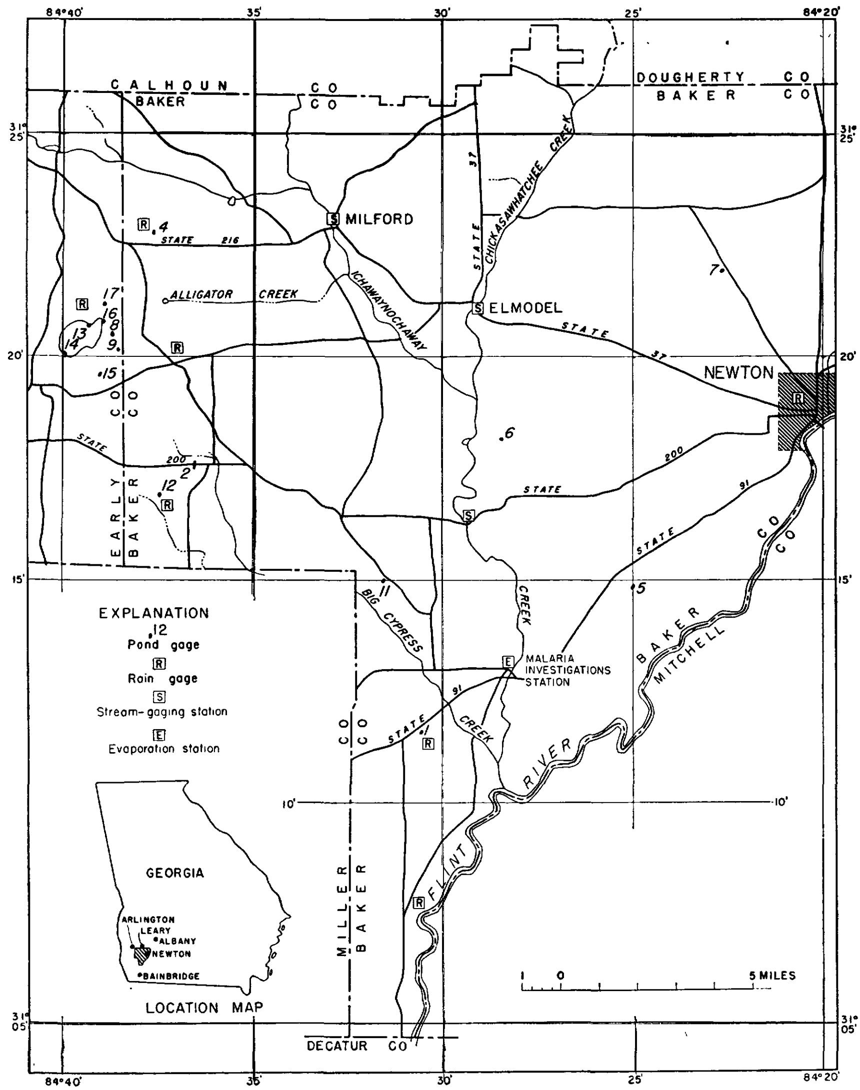

FIGURE 20.—Sites of hydrologic measurements in southwestern Georgia.

as being most likely to control pond level were yield from precipitation, losses from evapotranspiration, and changes in ground-water conditions.

Outflow from the ponds does not usually occur in well-defined channels but is more in the nature of surface seepage or overflow into another ponded area. As such, outflow can be considered an addition to the area of pond surface in so far as the effect of these three factors are concerned.

In the course of the investigation it was found that the effect of these three hydrologic factors varied with the height of the water in a pond. Thus the stage of each pond is a primary factor having more effect on change in stage of the pond levels than any of the other three factors taken alone.

Rainfall records were used to evaluate yield from precipitation falling on the surface of the pond and falling on the area tributary to the pond. Evaporation records were employed to compute an average pan evaporation for 7-day periods throughout the year that was used to evaluate the loss by evaporation from the surface of the pond and by transpiration. Ground-water conditions were sampled by observation wells and pond stage was read directly. The collection of the basic data used to evaluate the effect of these four factors is described later in this report.

The effect on changes in pond level of each of these four factors was studied independently and collectively. The results of these analyses are shown statistically and graphically. The basic data are published in this report as a matter of record and to enable other hydrologists to make such other analyses as they desire.

Botanical studies were made by Dr. Don E. Eyles, National Institutes of Health, Public Health Service, who kindly made the data available for this report. Dr. Robert F. Thorne, Department of Botany, State University of Iowa, also supplied plant list for some of the ponds, reviewed nomenclature, and made identifications. Grateful acknowledgment is made of these services.

PHYSIOGRAPHY AND GEOLOGY OF THE STUDY AREA

The area investigated covers approximately 200 sq mi of Baker and Early Counties in southwestern Georgia. The center of the area is approximately latitude 30°20′ N., longitude 84°40′ W., and about 190 miles west of the Atlantic Ocean and 90 miles north of the Gulf of Mexico. The elevation ranges from 100 to 250 ft above sea level. The area lies within the Dougherty plain, which covers about 7,000 sq mi. The Dougherty plain is flat and geologically featureless (Veatch, 1911; Cook, 1925). The average elevation is approximately 160 ft above sea level. Herrick and LeGrand studied certain aspects of the geology of this area and the description given here is taken largely from their unpublished report. The general region is an example of karst topography, characterized physiographically by the development of extensive solution features. Limestone which once overlay the area has been removed by the solution action of ground water leaving a residuum ranging from 70 to 100 ft in thickness. The residuum is composed of unsorted sands and clays with local inclusions of silicified boulders. Beneath the residuum are undissolved remnants of Oligocene and Eocene limestones.

Most of the topography of the Dougherty plain is old age. Ordinarily this condition in karst topography is characterized by a positive dot pattern where the plain is broken by the occasional occurrence of residual remnants as domes or rises. On the Dougherty plain, however, this pattern is not evident; presumably because it is obscured by the thick residuum. However, a "negative" dot pattern of sinks and surface depressions is conspicuous in this area (fig. 21). It is believed that these sinks result from collapse of the overburden when the remnants of the deep limestones covered by the residuum is dissolved. Depressions thus formed have gentle sloping sides and lack evidence of fracture of the surface strata. Limestone sinks which are caused by solution at or near the surface have, characteristically, steeper sides and show evidence of slumping of the surface strata.

In western Baker and eastern Early Counties the flat terrain is interrupted by an interuvala ridge between Ichawaynotchaway and Spring Creeks. An interuvala ridge is defined as a ridge between depressions formed by depression sinks (Von Engeln, 1948). This prominent feature represents topography which is physiographically younger than the remainder of the Dougherty plain (fig. 21). Nine of the 13 ponds where observations were made are located on this ridge.

CLIMATE

The climate of the study area, in common with that of the rest of the region, is warm and moist. Annual precipitation is about 50 in. The heaviest precipitation occurs ordinarily during July and August but there usually is a secondary peak in rainfall during February and March. The fall season is the driest of the year. Wide variations in amounts of annual rainfall are experienced.

For the years 1892 to 1947, annual rainfall in the southern division of Georgia ranged from 36.84 to 70.37 in. (U. S. Weather Bureau, 1947). The July precipitation ranged from 3.95 to 14.69 in. Normal precipitation figures in inches for three stations near the area having records of 50 yr or more are shown in table 1.

The average annual temperature at Bainbridge, located about 32 miles southwest of the area, is 67.6 F (table 2). Very changeable temperature conditions prevail in winter; daily maxima are rarely below 32 F, and frequent warm periods occur. The highest recorded January mean temperature exceeds the lowest recorded January mean temperature by about 20 F. Summer temperatures are more consistent; the highest recorded July mean temperature exceeds the lowest recorded July mean temperature by about 6 F. The average date of the first killing frost in fall is November 15; the average date of the

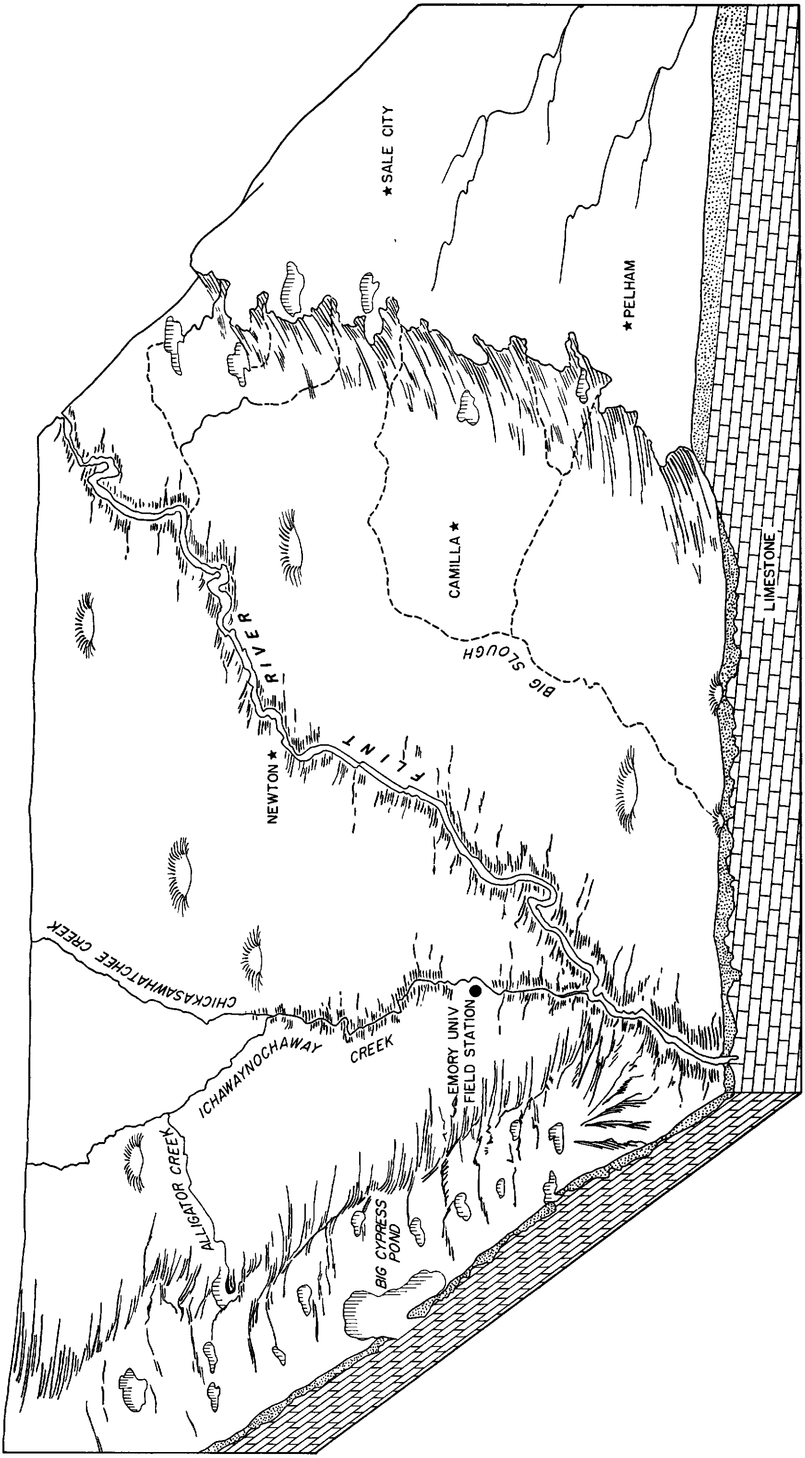

FIGURE 21.—Block diagram of adjacent sections of Baker and Mitchell Counties, Ga. A portion of the experimental area is located west of the Flint River.

last killing frost in spring is March 10. The average length of the growing season is 250 days. Snowfall is rare.

Relative humidity is highest in winter, with a secondary peak in midsummer. Spring and fall have the driest atmosphere, conforming to the pattern of rainfall distribution. Evaporation from a Class *A* pan at Tifton, Ga., 60 miles east of the area, averaged 59.7 in. annually for 11 yr (1937–47).

TABLE 1.—*Average monthly precipitation, in inches, at Albany, Blakely, and Bainbridge, for period 1882–1948*

Month	Albany [1]	Blakely [2]	Bainbridge [3]
January	4.10	4.63	4.03
February	4.92	5.26	4.54
March	4.90	5.36	4.49
April	3.84	4.44	3.83
May	3.68	3.43	3.28
June	4.52	4.54	4.96
July	5.90	6.70	6.50
August	5.63	6.90	5.90
September	3.34	3.79	4.28
October	2.27	2.65	2.21
November	2.29	2.96	2.20
December	3.90	4.45	4.06
Annual	49.29	55.11	50.28

[1] 36 miles from the study area.
[2] 18 miles from the study area.
[3] 32 miles from the study area.

TABLE 2.—*Mean monthly air temperature, in degrees Farenheit, at Bainbridge, based on records for 1880–1948*

January	52.1	August	81.5
February	54.2	September	78.2
March	61.1	October	68.2
April	67.5	November	58.4
May	74.8	December	52.4
June	80.6		
July	81.9	Annual	67.6

TECHNIQUES AND PROCEDURES FOR MEASUREMENTS

Data on which these analyses are based were collected with relatively simple measuring devices. Pond-stage readings were made to the nearest 0.01 ft on vertical staff-gage sections graduated in 0.02-ft intervals. These gages were set to arbitrary datum planes and later referred to mean sea level so that stage readings at different stations could be compared.

Ground-water observation wells, located usually within 100 to 200 ft of the shoreline of the ponds, were dug to a depth ranging from 15 to 40 ft with 2-, 6-, or 8-in. soil augers. These wells extended into the unconsolidated residuum only and did not penetrate into the limestone strata beneath. The top 3 ft of each well was cased with drain tile. The well opening was enclosed by a concrete curb. cast in place, which extended about 6 in. above ground. A knife-edge measuring point made of ½ by 1 in. strap-iron was built into the concrete curb. Distances from the measuring point to water in the well were obtained with a steel tape by letting the water in the well wet the face of a chalked section of tape. Elevations of the measuring points above mean sea level were determined and ground-water stages were expressed as elevations above mean sea level. The conversion to the same datum for pond and ground-water levels permitted direct comparison.

At ponds 1, 4, 12, 15, 16, and 17 pipe wells were driven into the pond bottom to provide supplemental information. These wells consisted of 3-ft screened wellpoints on 2-in. galvanized-iron pipes.

Precipitation was measured with standard U. S. Weather Bureau 8-in. can-type rain gages daily at about 8 o'clock each morning.

An evaporation station was established in the area (fig. 20) October 1, 1945. A U. S. Weather Bureau Class *A* evaporation pan 10 in. deep, 48 in. in diameter, made of galvanized sheet metal, was used. The pan was set on timbers with the bottom of the pan 6 in. above ground. Earth was banked within about 1 in. of the top of the timbers, leaving space for air circulation beneath the pan. Daily water loss from the pan was determined by measurement of the water level with a hook gage. Precipitation at the site was measured with a standard 8-in. can-type gage. Maximum and minimum thermometers and a dial type anemometer were also read daily. A recording thermograph provided a continuous record of water-surface temperature in the pan, and wet- and dry-bulb temperatures were obtained from a recording close-coupled psychrometer.

Beginning about July 1, 1945, recording instruments were installed at ponds 1, 4, and 12 to furnish more precise and complete measurements. Water-stage recorders were installed on each of the ponds and on an observation well at each one. At each of these 3 ponds a recording thermograph measured surface-water temperatures, and a recording hygrothermograph located near the margin of each pond recorded air temperatures and relative humidity. Recording rain gages and dial-type anemometers were also used at these 3 ponds.

DESCRIPTION OF PONDS

PHYSICAL AND BOTANICAL FEATURES

Sinks and depressions are formed as part of the physiographic process in development of karst topography. Those depressions that contain water, either permanently or intermittently, are considered to be ponds. In the area studied, two geological types of ponds are discernible. Ponds on the lower portion of the Dougherty plain (fig. 21) are physiographically younger than those on the interuvala ridge because their formation is due to rejuvenation of solution of the residual remnants of the Ocala limestone. These ponds have relatively pervious bottoms and contain water intermittently. Ponds on the interuvala ridge are in the same stratigraphic formation but the residual material is not so thick because this area has not been reduced by erosion as much as the bordering plain. These latter ponds are static geologically and plant succession is more advanced than in ponds on the plain. These ponds on the interuvala ridge have relatively impervious bottoms and contain water for longer periods than ponds on the lower part of the plain. It is probable that the ponds on the ridge are similar to those which occurred in the surrounding terrain before reduction took place. Ponds on the lower plain may eventually resemble those on the ridge when further plant development occurs.

Some important physical characteristics of the ponds included in this study are given in table 3. Water area and tributary land areas were computed for the approximate overflow stages. As topographic surveys of all ponds were not made, some figures in table 3 were estimated.

Luxuriant growths of vegetation tend to develop in the ponds and the amount and types of plants present are fairly reliable indicators of the extent of ecological succession of the ponds, but not necessarily geological age. All the ponds studied contained long-established vegetation. Only in the deepest areas of some ponds was the water surface free of vegetation during any season of the year. Ponds with scanty vegetation were not investigated as they are not conducive to *Anopheles* mosquito breeding. The 13 ponds studied are, however, representative of all types in the area. Possible exceptions are grassy flats that rarely contain water, and deep sinks with vertical sides devoid of aquatic vegetation. The diversity of vegetative associations prevents grouping or classification of ponds on the basis of the botanical associations which developed in them.

Plants are very closely associated with *Anopheles* mosquito breeding and several studies have been made of the correlation of *Anopheles* mosquito production with the occurrence of various plant species. Bradley (1932) reported observations on the association of various plants with *Anopheles* larvae production. Bellamy (1940) listed the more important plants which occur in breeding places and indicated the degree of correlation between the occurrence of these plants and the presence of larval mosquitoes. Hess and Hall (1943) and Rozeboom and Hess (1944) have shown physical relation of plants to mosquito production by determining values for the intersection line,

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defined as the line of intersection between three interfaces, water-air, water-plants, and plant-air in various stands of vegetation. The intersection value was expressed as the number of meters of intersection line per square meter of water surface.

Depth of the pond, the proportion of time that it holds water, character of the vegetation in the environs of the pond, and other factors influence the species and density of plants which can become established. The pond stage determines to a considerable degree the kind and amount of aquatic vegetation that will develop, and the species of plants that will be floating, emergent or submerged, and thus is a critical element in the geologic development and ecologic succession of ponds.

TABLE 3.—*Water area, tributary land area, and maximum depth at overflow stage for ponds studied*

Pond no.	Water area (in acres)	Tributary land area (in acres)	Maximum depth at overflow stage (in feet)
1	0.5	5.4	1.2
2	8	[1]	2.5
4	12	[1]	5.5
5	.9	7.9	4.7
6	13	[1]	5
8	12.5	52.8	1.5
9	1.5	20.5	3
11	4.6	49.5	2.5
12	15.2	26.3	4.5
13	538	953	[1]
15	1	[1]	2
16	10	[1]	1.5
17	4.9	47.8	2

[1] Not determined.

As this report is intended to provide additional information on the natural history of *Anopheles quadrimaculatus,* as well as to indicate interrelations of physical factors that are involved in pond ecology, the ponds investigated are described in some detail. The types and abundance of vegetation provide the best means of characterizing pond habitats. The listing of the more common plant species should enable the aquatic biologist to visualize better the ecological situations studied.

At the beginning of this study, detailed botanical surveys were made in four representative ponds. The species, density and frequency of occurrence of plants, exclusive of trees, observed during these surveys are shown in tables 4–7. These data indicate the diversity of vegetation found in the area and are presented as a matter of record and for possible comparisons with ponds in other areas. In ponds 4, 8, and 9 one meter square quadrats were staked out in representative stands of vegetation. The species present were identified and the amount of cover afforded by each species was determined. When no new species were found by further sampling, it was considered that plants in the pond had been sampled adequately (Braun-Blanquet, 1932). In pond 12, grid lines were established at 100-ft intervals. Quadrats were established at the intersections of grid lines (pl. 8). The numbers omitted from table 7 are those quadrats which were dry when observations were made.

TABLE 4.—*Botanical communities on pond 4 (Putney Pond)*

[Mat layer under cypress and gum]

Legend: (*), Very sparsely present; cover negligible. 1, Present but of very small cover value. 2, Covering at least 1/20 of the area. 3, Covering 1/4 to 1/2 of the area. 4, Covering 1/2 to 3/4 of the area. 5, Covering more than 3/4 of the area.

Plant species	Relative abundance and cover for indicated quadrat																				Frequency (percent)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Myriophyllum heterophyllum	1	1	5	2	2	(*)	2	3	---	5	3	2	(*)	4	5	4	3	(*)	(*)	(*)	95
Juncus repens	2	(*)	(*)	2	4	1	3	2	4	1	(*)	1	1	1	(*)	1	2	1	2	1	100
Bacopa caroliniana	---	(*)	1	5	(*)	(*)	(*)	---	---	---	---	---	1	2	(*)	3	4	4	5	2	70
Potamogeton diversifolius	---	3	(*)	---	---	---	2	3	2	---	1	1	(*)	(*)	(*)	---	(*)	(*)	1	3	70
Isoetes sp	---	3	---	---	2	1	(*)	1	(*)	---	---	1	1	---	---	---	---	---	(*)	1	50
Sagittaria graminea	1	---	---	---	---	(*)	---	---	---	---	---	---	2	1	---	---	---	---	(*)	---	25
Chara sp	---	1	---	---	2	1	(*)	---	---	---	---	---	---	---	---	---	---	---	---	---	20
Ludvigia palustris	---	1	---	---	---	---	---	---	1	---	---	---	---	---	---	(*)	---	---	---	---	15
Proserpinaca palustris	---	---	---	1	---	(*)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	10
Eleocharis sp	---	---	---	---	---	---	---	---	(*)	---	1	3	---	---	---	---	---	---	---	---	15
Polygonum hydropiperoides	---	---	---	(*)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	5
Ludvigia sphaerocarpa	---	(*)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	5

The following condensed descriptions of the ponds studied are presented primarily for biologists. No attempt has been made to indicate all the pertinent physical characteristics.

Pond 1, Springfield Pond (fig. 22).—A shallow woodland pond, normally about 0.5 acre in area located in an extensive sand flat supporting a heavy growth of live oak (*Quercus virginiana*) and scattered pines (*Pinus palustris*). The basin of the pond is shaded by a dense stand of gum trees (*Nyssa sylvatica biflora*). In the wet mud of the margin are found *Acer rubrum, Rosa palustris, Micranthemum umbrosum, Ludvigia palustris, Ranunculus laxicaulis*. During the growing season the water surface is almost completely covered by emergent and floating plants. The following species have been noted. Floating plants: *Sagittaria subulata lorata, Callitriche heterophylla, Potamogeton diversifolius, Utricularia inflata, Hydrochloa carolinensis,* and *Lemna valdiviana*. Emergent plants: *Hydrolea quadrivalis, Hydrocotyle umbellata, Polygonum hydropiperoides, Carex glaucescens, Cyperus virens,* and *Eleocharis obtusa*.

TABLE 5.—*Botanical communities in pond 8 (Wolf Pond)*

[Emergent community under cypress and gum]

Legend: (*), Very sparsely present; cover negligible. 1, Present but of very small cover value. 2, Covering at least 1/20 of the area. 3, Covering 1/4 to 1/2 of the area. 4, Covering 1/2 to 3/4 of the area. 5, Covering more than 3/4 of the area.

Plant species	Relative abundance and cover for indicated quadrat																														Frequency (percent)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Saururus cernuus	5	1	3	2	(*)	1	2		2	3		3							(*)		1	2	5	1	5	5	3	1	2	1	70
Juncus repens	3		(*)	2			(*)														1		1	1	2	1	2	(*)	2		40
Lycopus rubellus					1				(*)	(*)						(*)	(*)	(*)	1	(*)								(*)			30
Rhynchospora corniculata	(*)	(*)		(*)	(*)		2	4	4	1	5	1	5	5	4	5	1	1	2	1	1	1		1	1	(*)	1	2	(*)	2	90
Juncus sp		(*)		(*)		(*)	1			1										(*)	1		(*)								27
Ludvigia sphaerocarpa		3	2	3	2	1	1	(*)	1	(*)	2	4	1	(*)	1	1	2	2	3	2	2	3		4	1		2	3	3	2	90
Carex walteriana (?)			(*)		(*)				2	2		(*)				(*)					1				1		(*)				30
Pluchea foetida					(*)	2	2	1	2		1		(*)	1		(*)			1	(*)									(*)	1	43
Sagittaria graminea						1																									3
Eriocaulon sp														1	1																7
Eleocharis sp															(*)			(*)													7
Sabatia foliosa	1	(*)	(*)	(*)	2	(*)	2	1	1	3	(*)	(*)		2	2	2		1	1	1	1	1					1			1	73
Proserpinaca pectinata																			(*)												3
Lycopus rubellus (?)																									(*)		(*)		1		10
Cyperus pseudovegetus																							(*)				(*)		(*)		10
Utricularia purpurea																							(*)	1		1					10
Panicum sp																												(*)			3
Ludvigia pilosa																													(*)	(*)	7
Erianthus (giganteus)																														(*)	3

TABLE 6.—*Botanical communities in pond 9 (Moccasin Pond)*

Legend: (*), Very sparsely present; cover negligible. 1, Present but of very small cover value. 2, Covering at least 1/20 of the area. 3, Covering 1/4 to 1/2 the area. 4, Covering 1/2 to 3/4 of the area. 5, Covering more than 3/4 of the area.

Plant species	Relative abundance and cover for indicated quadrat																						Frequency (percent)
	Mat layer under cypress and gum												Emergent community										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Myriophyllum heterophyllum	4	5	5	5	5	5	5	5	5	1	1	1											100
Juncus repens	2	(*)							1	5	5	5											50
Ludvigia sphaerocarpa							(*)																
Saururus cernuus													2	2	3	2	3	3	3	3	3		90
Pluchea foetida													2	1	2	1	1	2	1	2	1	(*)	100
Hypericum galioides fasciculatum													1	(*)	(*)	1	1	(*)	1		1	(*)	90
Rhynchospora corniculata														2	2	3	2	1	(*)		(*)	1	80
Lycopus rubellus														1	(*)				(*)	(*)		(*)	50
Juncus sp													1		1	(*)		(*)					40
Ludvigia pilosa																				(*)	(*)	(*)	30
Prosperpinaca pectinata																					(*)	1	20
Pontederia cordata													(*)								2		20
Polygala cymosa														(*)							(*)		20
Panicum sp													(*)										10
Sagittaria graminea																						(*)	10
Eriocaulon sp																2							10
Incident grass																(*)							10
Eleocharis sp																	1						10
Polygonum hydropiperiodes																			1				10
Xyris sp																					(*)		10
Woodwardia virginica																					(*)		10
Ludvigia sphaerocarpa																	1	(*)		1		1	40

TABLE 7.—*Botanical communities on pond 12 (Mossy Pond)*

Legend: (*), Very sparsely present; cover negligible. 1, Present but of very small cover value. 2, Covering at least ½ of the area. 3, Covering ¼ to ½ the area. 4, Covering ½ to ¾ of the area. 5, Covering more than ¾ of the area.

Plant species	Relative abundance and cover for indicated quadrant																														Frequency (per cent)
	Saururus union of *Taxodium* community																														
	4	5	6	8	9	10	11	21	23	26	29	31	35	37	38	39	40	41	45	46	47	49	53	54	56	57	58	60	61	63	
Saururus cernuus	1	4	3	4	5	3	5	3	2	3	4	4	4	4	2	4	2	3	5	4	5	4	4	5	4	4	3	4	5	5	100
Polygonum setaceum	2	(*)	1	1	1	1	1	3	2	1	1	1	1		1	1	2	1		1	(*)	1		1	1	1	1	(*)	1	1	90
Wolfiella floridana	5	5	5		4		4			5	5	5	3	5	3	1	1	5	5	5	5	4	5	5		5	4	5	5	4	83
Ricciocarpus natans	(*)	(*)	(*)	(*)	(*)		(*)		(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)		(*)	(*)	(*)	(*)	(*)	(*)	(*)		(*)		(*)	(*)	(*)	83
Lemna valdiviana							(*)			1	(*)	(*)	1						1	(*)	(*)	1						(*)	(*)	(*)	40
Hydrocotyle umbellata					1		1			(*)			1			1									1				1	1	27
Bacopa caroliniana							1	2			(*)	1				(*)								1						1	23
Cephalanthus occidentalis						2				3			2		2				2										2		20
Ludvigia sphaerocarpa											(*)	1												1			(*)			1	17
Juncus repens					1																1				1		(*)			(*)	17
Myriophyllum heterophyllum									3													1				2	1				13
Utricularia purpurea	1															3	3										1				13
Potamogeton pulcher								2							1		1														10
Lycopus rubellus										1	1															1					10
Nymphaea odorata	1																														3
Brasenia schreberi																	1														3
Ludvigia palustris																	1														3
Pontederia cordata																1															3
Utricularia biflora									1																						3
Sagittaria graminea					1																										3
Smilax walteri						1																									3
Taxodium ascendens																					1										3

***Myriophyllum* union of *Taxodium* community**

	7	12	13	14	15	16	17	18	22	24	25	42	51	52	
Myriophyllum heterophyllum	4	5	5	1	3	5	1	4	5	5	5	5	5	5	100
Ricciocarpus natans	(*)		(*)	(*)	(*)	(*)	(*)	1	1		(*)	(*)	(*)	(*)	86
Wolffiella floridans	1	1		2	(*)	(*)	1					1	(*)	(*)	64
Lemna valdiviana		(*)	(*)					(*)		(*)	(*)	(*)	(*)	(*)	57
Polygonum setaceum				3	(*)	(*)		1	1		1			1	50
Saururus cernuus	1	1	1	1	(*)						1				43
Utricularia biflora			1	1		1				1	1				36
Cephalanthus occidentalis	1						2	4			2				29
Hypericum sp.	(*)		(*)												14
Lycopus rubellus			(*)	(*)											14
Riccia fluitans							(*)								7
Ceratophyllum echinatum								1							7
Nymphoides acquaticum											1				7
Bacopa caroliniana								(*)							7
Utricularia purpurea								1							7
Potamogeton pulcher							(*)								7
Hydrocotyle umbellata				1											7

Wolffiella-Myriophyllum* union under *Cephalanthus

	27	28	32	33	43	44	50	
Wolffiella floridana	5	5	1	4	1	1	1	100
Myriophyllum heterophyllum	(*)		5		5	5	5	71
Ricciocarpus natans	1	(*)	(*)	(*)	(*)	(*)	(*)	100
Lemna valdiviana	1	1	(*)	1	1	1	1	100
Cephalanthus occidentalis	5	5	5	5	5	5	3	100
Ceratophyllum echinatum				(*)				14
Polygonum setaceum							1	14
Panicum hemitomon					1			14

FIGURE 22.—Pond 1 (Springfield Pond). Shelters house water-level recorder (left) and water thermograph (right). The rain gage can be seen near the board walk leading to the instrument shelters.

Pond 2, Hilburn's Hammock.—Cut-over cypress pond covering about 8 acres. The pond bottom is virtually covered with logs and limbs remaining from previous lumbering operations. Large stumps of cypress remain and most of the pond is covered by regrowth of pond cypress (*Taxodium ascendens*). The water surface is covered during the summer by a dense growth of *Myriophyllum heterophyllum* and other emergent plants. The entire area is densely wooded and the surrounding land surface contains a luxuriant growth of terrestrial trees and shrubs.

Pond 4, Putney Pond (fig. 23).—A large, open cypress pond covers approximately 12 acres. A deep circular basin, about 1 acre in extent, is usually free of vegetation except for floating algal mats (*Spirogyra* sp.). The periphery of the basin is circled with a heavy stand of *Myriophyllum heterophyllum* which extends almost to the margin of the pond. A new growth of cypress (*Taxodium ascendens*) shades about 40 percent of the entire pond area. The margin of the pond contains a variety of trees, the following species being most prominent: *Quercus nigra, Quercus virginiana, Liquidambar styraciflua, Nyssa sylvatica biflora,* and *Diospyros virginiana.* In addition, the following were noted.

Emergent plants: *Cephalanthus occidentalis, Crataegus aestivalis,* *Ludvigia glandulosa*, and *Rhynchospora corniculata*. Floating or submerged plants: *Myriophyllum heterophyllum*, *Juncus repens*, and *Ludvigia palustris*. (See table 4 for a more complete list of species.)

Pond 5, Whitehead Pond.—A shallow, oval pond containing several deep spots. The more prominent basin covers about 4 acres. The margin is fringed with willow trees (*Salix caroliniana*) and sparse growth of button bush (*Cephalanthus occidentalis*). The outer edge of the pond contains a few gum trees (*Nyssa sylvatica biflora*). The button bush invades the central portion of the pond to a slight extent. About one-third of the basin is shaded by the trees and shrubs. The open water contains a growth of *Myriophyllum heterophyllum*. Beyond the open basin a dense growth of semiaquatic plants occurs, including *Ludvigia sphaerocarpa*, *Juncus repens*, *Potamogeton diversifolius*, and *Utricularia* sp. The pond is surrounded by pine-covered sand hills sparsely studded with live oaks (*Quercus virginiana*). A few live oaks are located near the margin of the pond.

Pond 6, Dave Freeman Pond.—Cut-over cypress pond covering about 13 acres. A few scattered cypress remain in the circular portion, most of which are less than 10 in. in diameter. The margin is fringed by *Nyssa sylvatica biflora* and a few scattered trees grow in

FIGURE 23.—Pond 4 (Putney Pond). Insert shows group of instruments. Water thermograph is in the shelter at left. On top is the anemometer. The center shelter contains the water-level recorder and the recording rain gage is on the platform at right.

the pond. The watered area is fairly well covered with button bush (*Cephalanthus occidentalis*). There are open areas of 400 sq ft or more throughout the pond. *Myriophyllum heterophyllum* is the most prominent plant in these areas. The shallow areas contain *Juncus repens, Potamogeton diversifolius,* and other submerged and emergent plants.

Pond 8, Wolf Pond (fig. 24).—A gum pond covering about 12.5 acres, located in a dense mesic hammock. The pond is virtually covered by a heavy canopy of trees, predominantly gum (*Nyssa sylvatica biflora*). Some cypress were also observed. A portion of the pond has been cut-over and large cypress stumps occur in the central area. The dominant emergent plant is *Saururus cernuus.* Other prominent plants are *Rhynchospora corniculata, Ludgivia sphaerocarpa,* and *Sabatia foliosa.* Button bush (*Cephalanthus occidentalis*) and *Ilex myrtifolia* grow in the marginal areas. (See table 5.)

Pond 9, Moccasin Pond (fig. 25).—A densely shaded gum pond ordinarily covering about 1.5 acres. Shade is provided by a dense stand of gum trees (*Nyssa sylvatica biflora*). The shallow basin is usually covered by a matted growth of *Myriophyllum heterophyllum.*

FIGURE 24.—Pond 8 (Wolf Pond). In this section of the pond, the water surface is almost obscured by dense vegetation. The staff gage can be seen in the center of the photograph.

FIGURE 25.—Pond 9 (Moccasin Pond). This portion of the pond is shaded intermittently by the tall cypress trees. The staff gage appears left of the center of the photograph.

The shallow marginal zone contains a growth of *Juncus repens*. Scattered button bush (*Cephalanthus occidentalis*) grows in the marginal area. Scattered pond cypress (*Taxodium ascendens*) grows throughout the pond. A low flat area, which is filled during high water, contains dense growth of emergent vegetation, primarily *Scirpus cyperinus eriophorum*, *Pluchea foetida*, and *Hypericum* sp. (See table 6.)

Pond 11, Mackey Pond (fig. 26).—A low grassy pond ordinarily about 4.5 acres in extent. The marginal zone contains a very sparse growth of gum trees (*Nyssa sylvatica biflora*) and a few scattered shrubs of button bush (*Cephalanthus occidentalis*) are located throughout the pond. The open-water area is usually covered with a heavy algal mat. A variety of marginal grasses covers two-thirds of the area.

Pond 12, Mossy Pond (fig. 27).—This densely vegetated cypress pond covers about 15.2 acres, and contains diverse and profuse emergent, floating, and submerged vegetation. Types and density of vegetation are shown in table 7.

Pond 13, Big Cypress Pond.—This extensive cypress pond covers approximately 538 acres. The vegetation is varied but dense stands

FIGURE 26.—Pond 11 (Mackey Pond). A representative of the permanent open ponds in the area.

FIGURE 27.—Pond 12 (Mossy Pond). An old pond with long-established vegetation. Such ponds are the source of the greatest *Anopheles*-mosquito production.

of one species may cover a wide area. The dominant tree is *Taxodium ascendens* but along the marginal areas there are many species of terrestrial trees and *Salix nigra* and *Styrax americana*. Much of the shallow-water area is covered by dense growth of *Juncus effusus*. Other plants noted in the pond are as follows: Floating plants; *Nymphaea odorata, Limnobium spongia, Potamogeton diversifolius, Utricularia biflora, Wolfiella floridana, Lemna valdiviana, Riccia fluitans*, and *Ricciocarpus natans*. Emergent plants; *Typha latifolia, Scirpus cyperinus eriophorum, Sagittaria latifolia, Polygonum hydropiperoides, Woodwardia areolata, Jussiaea decurrens, Dulichium arundinaceum, Juncus scirpoides, Xyris fimbriata, Xyris smalliana, Xyris iridifolia*, and *Carex walteriana*.

Pond 15.—This woodland pond covers about 1 acre in a dense climax hammock. The water area is entirely shaded by a dense stand of *Carex* sp., *Rhynchospora corniculata*, and *Polygonum hydropiperoides*. Small stands of *Juncus repens* grow in the shallow portions. This pond is very densely vegetated.

Pond 16.—An open, grassy pond with uniform scattering of small cypress. There is no well-defined basin. The pond area ranges from 25 acres to the vanishing point. The dominant vegetation is *Panicum* sp. with scattered plants of *Rhexia* and other emergents.

Pond 17.—This open, grassy pond covers about 4.9 acres. Most of the area is covered with dense growth of maiden cane (*Panicum hemitomon*). The margin of the pond contains a sparse growth of willows and small cypress. Occasional cypress (*Taxodium ascendens*) and gum (*Nyssa sylvatica biflora*) occur throughout the pond. *Rhexia virginica stricta* and *Ludvigia sphaerocarpa* also occur sparsely. *Juncus repens* was noted in the shallow areas.

FACTORS INFLUENCING POND-STAGE VARIATIONS

The first objective of the study was to determine what factors effect changes in pond stage, and then to attempt mathematical expression of the relationships of these factors. Preliminary observations indicated wide variations in the way stages of different ponds reacted even where the factors affecting them appeared to be uniform. In figure 28 representative annual hydrographs of stage for ponds 1, 4, and 12 are shown together with amounts of daily precipitation for the same year.

Because of its shallowness, pond 1 goes dry (at elevation 127.5 ft) frequently and is dry for brief periods during most years. Ponds 12 and 4, on the other hand, are seldom dry because of their greater depth below the overflow point. Generally, shallow ponds are dry more frequently and for longer periods than those with deeper basins. The size of the land area contributing runoff is of relative minor im-

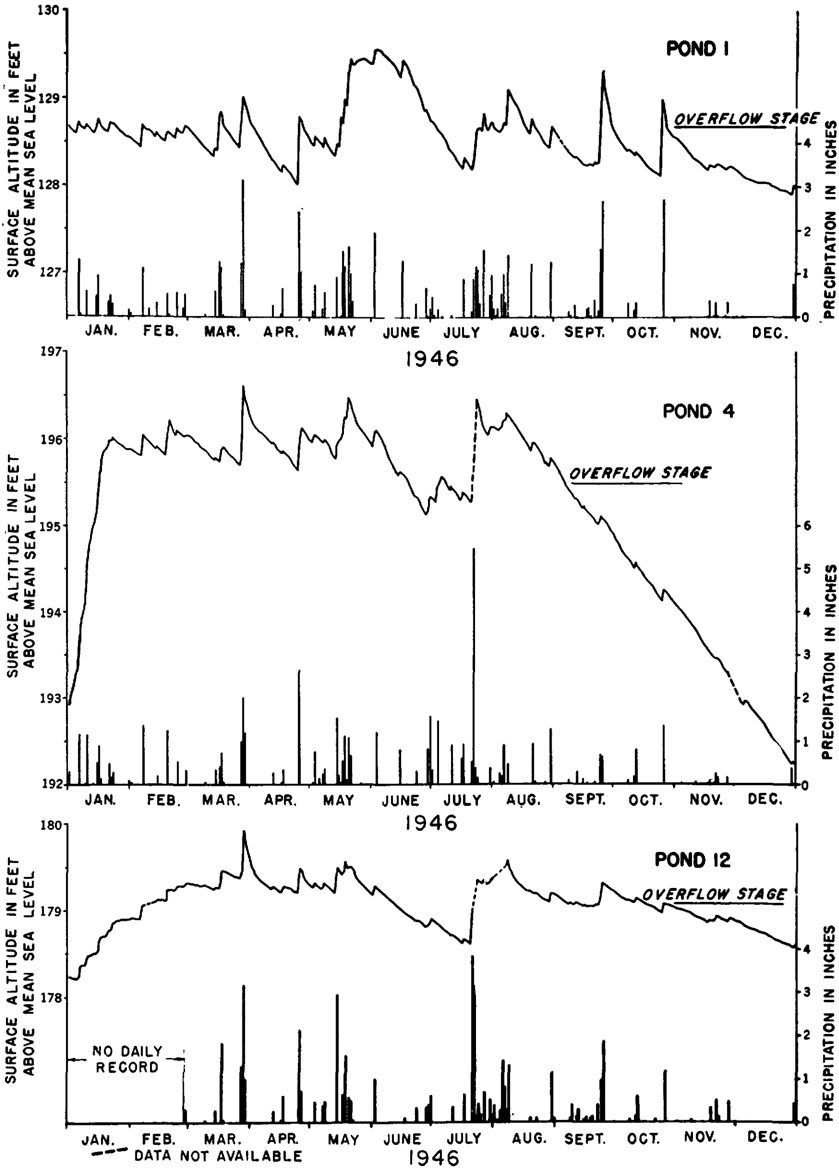

FIGURE 28.—Hydrographs of daily stages in ponds 1, 4, and 12 and bar graphs of daily precipitation at each pond during 1946.

portance because nearly all ponds in the region are filled to capacity during each wet season regardless of the size of the pond or of the tributary area, or of the relative size of the two areas.

The porosity of bottom material also influences the water-holding characteristics of ponds. Ponds included in this study are from 1 to 25 ft above the water table during most of each year and, consequently, some water is lost by seepage through the bottom. The amount of this loss is determined principally by area of the pond, perviousness of the bottom materials, and depth of water in the pond.

A comparison of recession rates, when pond stage was below the overflow point in June and July with those when pond stage was below the overflow point in November and December shows that this rate is considerably greater in summer than in winter (fig. 28). This difference is attributed to the greater evaporation and transpiration losses in summer. The effect of overflow stages on recession rates is shown in figure 28 also. The effect is noticeable particularly for pond 1 where the reduction in rate of decline was quite sudden whenever pond stage receded below the overflow point. In pond 1 a notable exception to this pattern was observed in the fairly straight-line recession following high stages in June. During all other high-water periods in 1946 the level of pond 1 was observed to be several feet above the water table. Overflow then drained into a nearby sink hole with a pervious bottom and rapidly percolated to the water table. When the pond receded below the overflow point and was contained in its normal basin having a highly impervious bottom (coefficient of permeability about 0.005 in. per day under gradient of one foot per foot), the rate of recession was controlled mainly by evapotranspiration losses. At the time of the high stages in June, however, the water table was high (see fig. 29). This impeded, or on some days prevented, percolation of overflow water and thus retarded the rate of recession of the pond level.

The response of ponds to the same amount of rainfall varies widely inasmuch as the effect of factors that determine the amount of rise is not the same in every pond. Each pond will experience a rise in height equivalent to the depth of rainfall falling directly on its surface, irrespective of the area of the surface, plus an additional height determined by the runoff received from land drainage. The size of the tributary area that determines the volume of this runoff is different for each pond. Stage change resulting from a given volume of land runoff is determined by the surface area of the pond at the time; the larger the surface area, the smaller the change. In natural surface reservoirs, water-surface area increases at a rapidly accelerating rate as stage increases. The boundary of the land area tributary to a pond is constant and, therefore, an increase in pond area results in a decrease

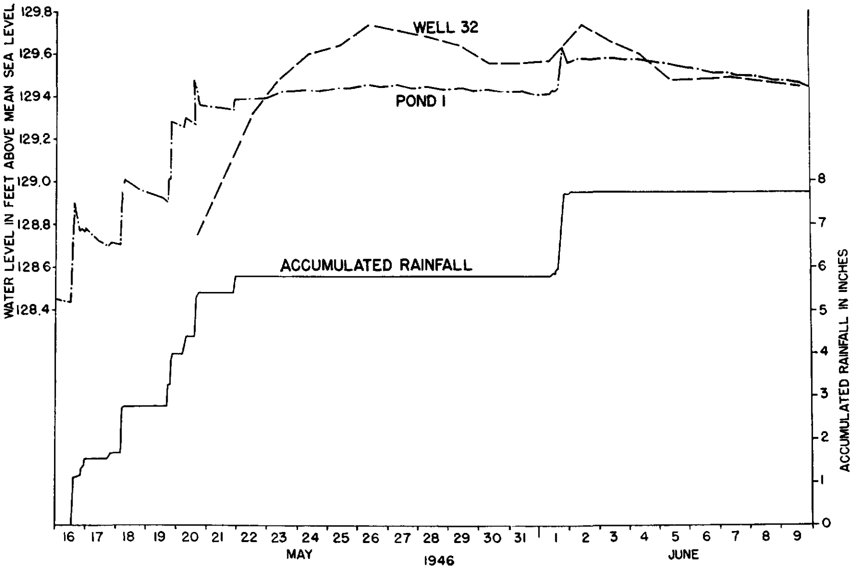

FIGURE 29.—Hydrograph of water levels in pond 1 and in nearby well 32 and mass diagram of accumulated rainfall May 16 to June 9, 1946.

in tributary area. Thus, as stage increases the volume of land runoff resulting from a given depth of rainfall decreases.

In figure 29, hydrographs of water level in pond 1, and in an observation well about 100 ft from pond edge, are plotted concurrently with a mass diagram of rainfall for a short period in May and June 1946. On May 16 the water in the pond reached the overflow elevation of 128.7 ft and spilled into an adjacent sinkhole. At that time, the pond and sinkhole constituted, in effect, one pond. With additional precipitation the pond eventually reached a stage on May 20 high enough to spill into another large basin with no surface outlet. There was an initial rapid recession on May 20 during which this large basin filled rapidly. On May 21 the large basin was nearly full and further recession was greatly reduced in rate. Throughout the period of heavy rain on May 16–21 the water table in the area of the pond rose steadily. On May 22 the water table reached an elevation equal to the pond surface and for several days thereafter was observed to be higher than the pond. Under this condition ground water flowed into the pond. This accounts for the rise in the pond from May 22 to about May 26. It was established by field observations that there was no surface inflow from other ponded areas and that small rivulets of seepage flow originated on the hillsides and flowed into the pond.

The effect of evapotranspiration losses are shown in the diurnal fluctuations in the level of pond 1 for the period May 22–31. Figure 30, drawn from the water-stage recorder chart from pond 1 for the period 10:20 a. m. May 25 to 10:05 a. m. May 26, 1946, shows that during the daytime, accretion from ground water about balanced evapotranspiration losses and the stage leveled off or receded slightly. At night, when evapotranspiration losses were very low, accretion

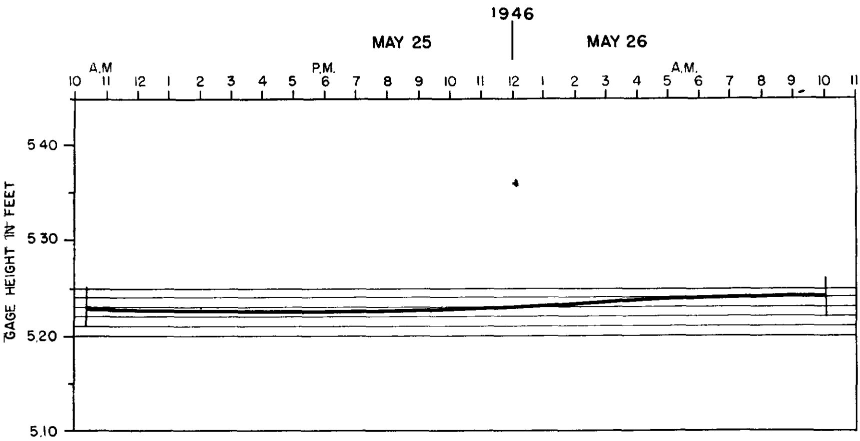

FIGURE 30.—Drawing of water-stage recorder chart showing diurnal fluctuation in water level in pond 1 from 10:20 a. m. May 25 to 10:05 a. m. May 26, 1946.

from ground water was sufficient to cause an increase in stage. It will be noted from figure 29 that for the period May 27–31 the general stage trend was downward in spite of the fact that the water table was still higher than the pond. It is likely that recession during this period resulted from the accretion from ground water being reduced to the point where it was exceeded by evapotranspiration, and possible out seepage losses in areas contiguous to the pond where the water table may have been below pond level.

The preceding paragraphs indicate that it is possible to identify the factors which influence pond stage; in many instances, the sign and magnitude of individual influences can be appraised under various conditions. Following are listed the primary factors causing change in pond stage:

1. Losses by evaporation and transpiration.
2. Losses by surface outflow.
3. Losses to, or increment from, ground water.
4. Increment from precipitation on the pond.
5. Increment from surface or subsurface inflow.

The relations of these factors are shown diagrammatically in figure 31.

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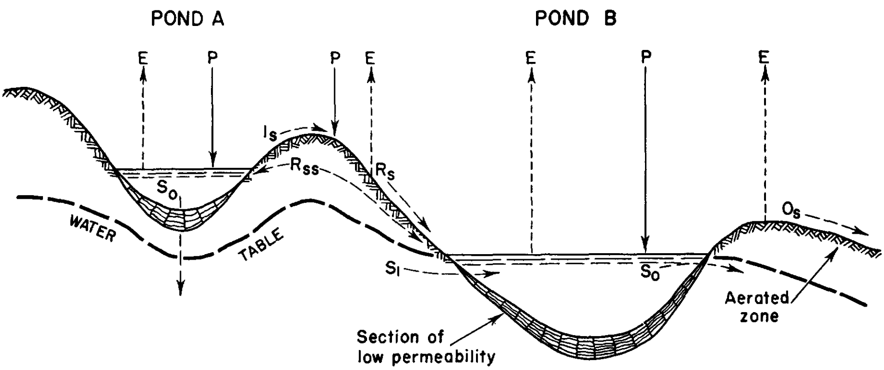

EXPLANATION

E	Evaporation and transpiration	R_s	Surface runoff
P	Precipitation	R_{ss}	Subsurface runoff
I_s	Surface flow to pond B when pond A overflows	S_I	Inflow seepage
O_s	Surface outflow	S_O	Outflow seepage

FIGURE 31.—Diagrammatic representation of gains and losses to pond storage.

DEVELOPMENT OF FORMULAS FOR POND-STAGE CHANGE

METHODS OF COMPUTATION

The best way to segregate the effect of the various hydrologic factors on change in pond level and to determine the relative importance of each is to develop formulas for pond-stage change. The efforts made to express both mathematically and graphically the relationships observed and to test the accuracy and applicability of formulas devised are described below.

The first step was to formulate a generalized expression for the relations of hydrologic factors that were observed to affect pond levels. Assuming no surface outflow, the following equation for the relation of factors that affect pond stage during a specific interval of time was devised. Each factor is expressed in linear dimensions except as otherwise defined.

$$H_1-H_0=P+\frac{R}{A}-E-S+\frac{R_g}{A} \qquad (1)$$

Where

H_1=pond stage at the end of a specific period.
H_0=pond stage at the beginning of the period.
P=precipitation.
R=volume of runoff from the tributary land area.
R_g=volume of ground-water flow into pond.
A=average pond area during the period.
E=evapotranspiration losses.
S=seepage losses.

Letting

$H_1 - H_0 = \Delta H$, change in stage during the period.

$R = f(P)$, assuming that size and condition of tributary land area is constant.

$A = f(H)$, where H is pond stage.

$S = f(H)$ on the assumption that the seepage loss is a function of the head acting to force water through the pond bottom when there is discontinuity between pond level and water table, or, $S = f(H - H_g)$, where H_g is stage of water table, on the assumption that seepage loss is a function of the difference in elevation between the pond level and some point in the water table when there is no discontinuity.

$R_g = f(H - H_g)$ assuming that ground water accretions to pond storage are a function of the head acting to force water into the pond. In this form $H - H_g$ would be a negative quantity under conditions of gain from the water table and a positive quantity under conditions of loss to the water table.

By substitution equation 1 is changed to:

$$\Delta H = P + \frac{f(P)}{f(H)} - E - [f(H),\ f(H - H_g)] + \frac{f(H - H_g)}{f(H)} \qquad (2)$$

From equation 2 it is apparent that measurements of the following hydrologic factors are necessary if pond-stage change is to be computed by formulary means:

1. Precipitation.
2. Pond stage.
3. Ground-water stage.
4. A factor proportional to combined evaporation and transpiration losses.

The variables listed below were chosen as measurable expressions of these factors.

X_1 = Stage change in feet.
X_2 = Precipitation in inches.
X_3 = Pond stage in feet above an arbitrary datum.
X_4 = Average pan evaporation in inches.
X_5 = Pond level minus ground-water level in feet.
(These factors will be referred to subsequently by symbols X_1, X_2, X_3, X_4, X_5, or as variables one, two, three, four, or five.)

In these analyses, change in stage during a weekly period has been considered as the dependent factor; that is, the period between H_1 and H_0, ΔH in equation 2, is 1 week. Tests were made of the influence of each factor on the change in pond stage for the period of the study. The simplest possible approach was to derive linear equations expressing the relationship between the pertinent factors. Equations of this type, which may be derived by many accepted methods, are of the form:

$$X_1 = a + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5$$

Where X_1 is the dependent variable, and X_2, X_3, X_4, and X_5 are independent variables.

a is the equation constant.

b_2 b_3, b_4, b_5, are partial-regression coefficients on X_2, X_3, X_4, and X_5, respectively.

The use of statistical methods in deriving these equations eliminates the possibility of bias in determining the relative effects of each variable. In the first analysis, all adequate data available for each pond were used including that obtained during periods of overflow. Thus no influence due to selection of data was introduced and the full range of natural occurrence was included.

EXPECTED INFLUENCES OF INDEPENDENT FACTORS

On the basis of accepted information concerning pond behavior, and from preliminary studies of the data collected on this program, conjectures were made of the influence of the variables listed on pond-stage change. The expected deviation effect, the nature of the influence, and character of the curve of relation are shown in table 8. The positive and negative effects listed in the second column of table 8 indicate that increments of pond-stage change are expected to become greater or smaller, respectively, as the factor listed in the first column of the table increases. For example, the effect of initial pond stage is said to be negative, owing to the stage-volume relation. As stage increases the volume capacity of a pond increases and increments of stage change resulting from constant volumes of runoff decrease. Thus the stage-volume effect would be expected to cause the line of relation between stage change and initial stage to have a negative slope. The last column in table 8 indicates whether or not this line of relation is expected to be curvilinear.

TABLE 8.—*Expected effects of precipitation, initial pond stage, pan evaporation, and difference between pond level and ground-water level on pond-stage change*

Factor	Effect	Remarks	Curvilinear
Precipitation (X_2)	Positive	Possible seasonal effect on magnitude	Yes.
Initial stage (X_3)	Negative	Owing to stage-volume relation	Yes.
	Positive	Owing to indirect relation to soil moisture and hence to runoff from precipitation.	
	Negative	Owing to effect on seepage rate	Yes.
	do	Owing to increased availability of water for transpiration.	
	do	Owing to decreasing land-drainage area with increasing stage.	Yes.
Pan evaporation (X_4)	do	Owing to direct effect by draft from water storage for water-surface evaporation and for transpiration.	No.
	do	Owing to indirect effect on soil moisture	
Pond level minus ground-water level (X_5).	do	No effect is likely for some ponds when ground-water level is below bottom of pond.	Yes.
	do	Owing to indirect effect on soil moisture	

An important indication in table 8 is that the lines of relation between pond-stage change and each of the factors listed, except precipitation, are expected to have negative slope.

DETAILS OF ANALYSES

Periods of 1 week were used in these analyses as this was the usual interval between observations. Variables three (X_3) and five (X_5) are for the beginning of the period. Average figures during the period might have been a better measure but the figures at the beginning of the week were used to simplify computations. Except during weeks of extreme changes, little error is introduced by this procedure. Variable five was computed from pond levels and ground-water levels, both were expressed in terms of mean sea level. One ground-water level measurement was used as representative of conditions in the area of each pond. Variable two (X_2) was computed by taking the sum of the daily precipitation amounts for the preceding 7 days from the rain gage nearest the pond being studied. The distance from pond to rain gage ranged from 1 to 4 miles at the sites investigated. Precipitation records were available at the sites of ponds 1, 4, and 12 subsequent to January 1946.

Pan-evaporation data have been collected at one location in the area since October 1945. As it was necessary to have a figure for evaporation for use in computations of data collected as far back as 1939, average evaporation for the respective weeks of the year based on records October 1945 to September 1947 was used in the computation of X_4. In cases where the information based on this short-term record was obviously not representative of a longer period, adjustments made on the basis of records from the Tifton evaporation station located about 60 miles east of the study area were applied to obtain the average evaporation used as X_4. This average evaporation was used for X_4 even for the period during which observational data were obtained for it is believed that this average evaporation is as good an indication of actual evapotranspiration potential as the observed pan evaporation for the week.

For each week that complete data were available, the observational data on X_1, X_2, X_3, and X_5 at each of the 13 ponds and the average weekly evaporation for X_4 were assembled. All data available for the period studied at each pond were used with the exception that most data based on observation made at intervals longer or shorter than 1 week were eliminated. In a few cases, time periods as short as 6 days or as long as 8 days were used. The basic data used for each pond are given in the appendix.

As indicated previously, relationships between the various factors become more complicated when a pond reaches the surface outflow stage. When overflow is occurring the recession rates are usually accelerated greatly. The stage change due to rainfall under these circumstances cannot be compared to responses which occur when the pond is a self-contained basin. Consequently, additional analyses were made for 7 of the 13 ponds eliminating the weeks during which overflow occurred. The data were treated analytically and graphically in 5 cases. Results were compared with those obtained using all the observations. Linear equations were calculated arithmetically. The analytical solutions were based on assumed linearity of relation between pond-stage change and each of the other variables. The graphical analyses were made for the purpose of determining if the relations were actually linear, or in cases where they were not if the departure from linearity was of significance. Graphical solutions were made according to short-cut methods described by Ezekiel (1941).

Much of the basic work preparatory to calculations was done mechanically by International Business Machines. Data for each pond were punched in cards and all squares and cross products computed, repunched, tabulated, and totaled automatically. Statistical solutions to determine the regression equations were done by methods outlined by Ezekiel (1941) and Snedecor (1946). The simultaneous equations to determine the regression coefficients were solved by the Doolittle method. The standard deviation of the regression coefficients was computed at the same time.

For each analytical solution the usual statistical measures of accuracy were computed. The multiple-correlation coefficient computed for each solution permits appraisal of the combined influences of the independent factors on stage change. The square of the multiple-correlation coefficient represents the percent of the original variation in X_1 that is explained by the computed regression formula. The standard error of estimate computed for each solution is a measure of the deviation of the values of X_1, as computed by the formula, from observed values. Approximately two-thirds of the computed values lie within one standard error of estimate of the observed figures.

The standard error of each regression coefficient (S_b) was computed for each solution. This permitted a computation of a t value

$$\left(t=\frac{b}{S_b}\right)$$

for each variable. Using a table of t values, the probability of having obtained the computed figure for b by chance alone was determined. If in this first solution one of the independent variables was found to be nonsignificant (t value showing a probability level above 0.05) this variable was eliminated and a new regression computed using the remaining independent variables.

RESULTS

A summary of the results obtained by both the analytical and graphical solutions from all adequate data, including those from which weeks having overflow were eliminated and those from which nonsignificant variables were eliminated, is given in table 9. Column 2 in table 9 indicates whether the solution was analytical or graphical. Columns 4, 6, 8, and 10 list the coefficients (b's) for each independent variable and, when combined with the equation constant in column 3, furnish the figures necessary to compose the hydrologic equations for each pond. For example, the equation for pond 1, based on all available data and including all independent variables, where the X's are variables as previously defined, is:

$$X_1=0.922+0.158X_2-0.281X_3-0.079X_4-0.004X_5$$

Columns 5, 7, 9, and 11 list the standard error (S_b) of the coefficient of each variable and may be used to appraise the probable accuracy of the coefficients. For example, for pond 1 there was one sample of 212 weeks from which to compute the coefficients. Based on this sample there are two chances out of three that the true coefficient for X_2 lies between 0.158−0.008 and 0.158+0.008, or between 0.150 and 0.166. Column 12 lists the standard deviation of X_1. The mean weekly stage change for pond 1 for 212 weeks was 0.000 ft. Approximately two-thirds of the 212 weekly figures for observed stage change were within the range 0.000+0.265 ft. Standard deviations for other ponds have a similar meaning.

Figures for standard error of estimate in column 13 represent a measure of the deviation of observed stage change from that computed by the equations. If the respective equations for each pond were used to compute values of stage change, based on observations of the independent factors (X_2, X_3, X_4, X_5), approximately two-thirds of the results would be expected to agree with observed stage change within the limit of the standard error of estimate shown in column 13. Figures for standard deviation of X_1, column 12, represent a measure of the deviation in observed stage changes before relationships were developed to delineate the influence of the causative factors. Comparison of these two measures of variation, standard deviation of X_1 and standard error of estimate, provides a means of appraising approximately the accuracy of the equations developed. For example, the standard deviation of X_1 for pond 8 is 0.19 ft, whereas the standard error of estimate is 0.07 ft. A more general statistical measure is the multiple-correlation coefficient, shown in column 14, which, when squared, indicates the proportion of variation in observed stage change accounted for by the other variables. The proportion of the variation in stage change not associated with the independent variables

TABLE 9.—*Results of analytical and graphical analyses of factors affecting pond-stage change*

Pond no.	Type of solution	Equation constant	Variable X_2		Variable X_3		Variable X_4		Variable X_5		Standard deviation of X_1	Standard error of estimate	Multiple-correlation coefficient	Sample size	Remarks
			b_2	Sb_2	b_3	Sb_3	b_4	Sb_4	b_5	Sb_5					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	
1	Analytical	0.922	0.158	0.008	−0.281	0.032	−0.079	0.029	−0.004	0.002	0.265	0.145	0.840	212	All available data included.
	do	.729	.158	.008	−.251	.029	−.044	.024			.265	.146	.836	212	Do.
	do	.595	.195	.008	−.193	.029	−.128	.019			.235	.099	.909	165	Weeks having overflow not used.
	Graphical		[1]		[2]		[1]		[3]		.235	.101	.907	165	Do.
2	Analytical	1.805	.169	.008	−.282	.035	−.212	.032	−.021	.005	.287	.147	.863	177	All available data included.
	Graphical		[1]		[2]		[1]		[2]		.287	.139	.879	177	Do.
4	Analytical	.621	.244	.012	−.086	.011	−.227	.036	−.078	.008	.390	.200	.862	205	Do.
	do	.607	.278	.016	−.080	.014	−.238	.042	−.082	.009	.420	.206	.875	149	Weeks having overflow not used.
	Graphical		[2]		[2]		[1]		[2]		.420	.166	.923	149	Do.
5	Analytical	.200	.245	.024	−.056	.032	−.250	.081	−.060	.031	.503	.380	.664	177	All available data included.
	do	.254	.344	.031	.014	.035	−.526	.095	−.076	.034	.531	.333	.787	116	Weeks having overflow not used.
	do	.277	.342	.030			−.506	.081	−.082	.030	.531	.332	.786	116	Do.
	do	.264	.343	.031			−.574	.080			.531	.342	.770	116	Do.
	Graphical		[1]		[3]		[1]		[2]		.531	.339	.773	116	Do.
6	Analytical	.348	.127	.008	−.010	.011	−.208	.027	−.010	.003	.213	.118	.836	149	All available data included.
8	do	.419	.137	.005	−.080	.028	−.125	.016	−.006	.008	.190	.070	.932	155	Do.
	do	.326	.137	.005	−.063	.018	−.122	.015			.190	.069	.932	155	Do.
9	do	.294	.186	.009	−.074	.028	−.226	.028	−.006	.016	.298	.154	.860	178	Do.
	do	.258	.187	.009	−.065	.016	−.224	.028			.298	.154	.859	178	Do.
11	do	.227	.151	.005	−.059	.029	−.114	.016	.002	.002	.223	.088	.921	196	Do.
	do	.370	.151	.005	−.083	.012	−.119	.016			.223	.088	.921	196	Do.
	do	.291	.158	.008	−.075	.040	−.110	.021	.002	.004	.166	.068	.916	84	Weeks having overflow not used.
	do	.361	.158	.008	−.085	.030	−.114	.019			.166	.068	.916	84	Do.
12	do	.141	.099	.004	−.023	.011	−.127	.014	−.004	.002	.154	.072	.888	188	All available data included.
	do	.073	.099	.005	−.007	.008	−.123	.013			.154	.072	.885	188	Do.
	do	.055	.099	.004			−.130	.014	−.001	.001	.154	.072	.885	188	Do.
	do	.050	.099	.004			−.127	.013			.154	.072	.884	188	Do.
	do	.064	.126	.006	−.010	.012	−.117	.013	−.004	.002	.146	.060	.917	126	Weeks having overflow not used.
	do	.028	.126	.006			−.116	.013	−.003	.001	.146	.059	.916	126	Do.
	Graphical		[2]		[3]		[1]		[2]		.146	.058	.922	126	Do.
13	Analytical	.480	.125	.006	−.073	.022	−.102	.018	−.010	.005	.187	.097	.860	196	All available data included.
	do	.217	.126	.006	−.033	.012	−.111	.018			.187	.097	.856	196	Do.
	do	.765	.185	.022	−.156	.055	−.041	.051	−.002	.012	.233	.144	.801	59	Weeks having overflow not used.
	do	.006	.186	.022			.096	.050			.233	.152	.767	59	Do.

15	do	.233	.160	.009	−.132	.034	−.073	.042	−.170	.027	.256	.115	.898	93	All available data included.
16	do	.318	.114	.006	−.161	.071	−.077	.017	−.019	.020	.154	.061	.921	95	Do.
	do	.181	.116	.005	−.100	.026	−.080	.017			.154	.061	.920	95	Do.
17	do	.250	.168	.014	−.159	.054	−.105	.051	−.085	.036	.283	.169	.812	92	Do.
	do	.158	.173	.032	−.049	.062	−.194	.053	−.106	.076	.182	.125	.767	34	Weeks having overflow not used.
	do	.022	.154	.028			−.204	.056			.182	.125	.748	34	Do.
	Graphical		(2)		(2)		(1)		(2)		.182	.118	.820	34	Do.

[1] Linear relationship found for this variable in graphical solution.
[2] Curvilinear relationship found for this variable in graphical solution.
[3] No effect for this variable found in graphical solution.

considered may be attributed to other factors not measured in this study, to errors of measurement, or to mathematical inadequacy of the analyses made; that is, curves of relation not linear as assumed.

Column 15 lists the number of weeks of data used in making each of the respective solutions.

If the standard error of a regression coefficient (columns 5, 7, 9, and 11) was greater than about one-half the regression coefficient applicable to a variable, that variable was considered to have no significant effect on change in pond stage. The difference in elevation between pond level and ground-water level (X_5) was the independent variable most frequently found to have no significance. Of the 13 linear solutions that included all available data, 4 showed X_5 to be nonsignificant and 5 indicated that it was significant. In four instances the information was not conclusive. This suggests that for 8 of the 13 ponds tested, ground-water level has no important effect on pond stage. Similarly, the effect of initial pond stage (X_3) in the determination of pond-stage change was found to have no significance for 4 of the 13 ponds. The effects of evaporation and precipitation, however, are significant in all cases.

As a verification of the results obtained by linear analyses, relationships between each of the four independent variables and stage change for five ponds were developed by graphical methods using observations made in weeks having no overflow. Figures 32–35 show the curves developed for these relationships. Curves for a particular pond were not shown on figures 32–35 if the independent factor had been found not to be significant. In the method of development of these curves, precipitation was considered the principal independent factor. The curves on figure 32 represent the net value of stage change associated with precipitation when values of the other independent variables are held constant. Curves on figures 33–35 delineate adjustments to be made to the net stage change obtained from figure 32 for the various values of the other independent variables.

As an example of the application of these curves it will be helpful to consider a week for pond 4 in which the precipitation was 0.30 in., initial pond stage 3.24 ft, pan evaporation 1.11 in., and pond level 5.31 ft above the ground-water level. Entering figure 32 with precipitation of 0.30 in. the curve for pond 4 shows a net stage change of −0.16 ft. The successive adjustments to this value for stage change are obtained from the curves for pond 4 on figures 33–35 by entering each with the appropriate values for the sample week. The adjustments are found to be −0.08 ft for pond stage, −0.01 ft for evaporation, and −0.01 ft for ground-water level. The calculated value of stage change for the sample week, then, is the algebraic sum of −0.16,

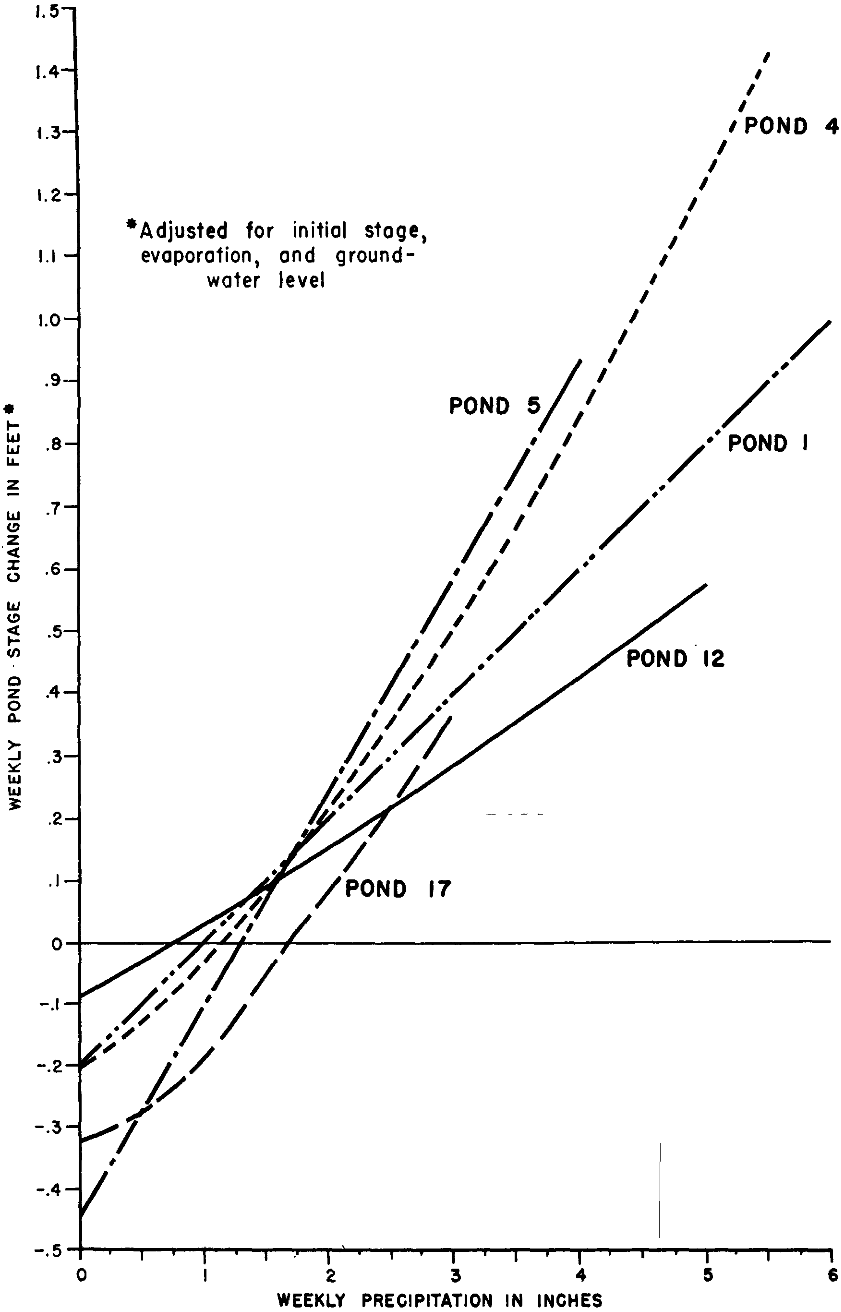

FIGURE 32.—Lines of relation between weekly pond-stage change and precipitation for ponds 1, 4, 5, 12, and 17.

−0.08, −0.01 and −0.01 or −0.26 ft. The actual stage change observed during the sample week was −0.32 ft.

It will be noted that although the origins of coordinates used in figures 32–35 depend on the method of graphical development, each curve depicts both qualitatively and quantitatively how the weekly rate of stage change is associated with each of the several factors shown.

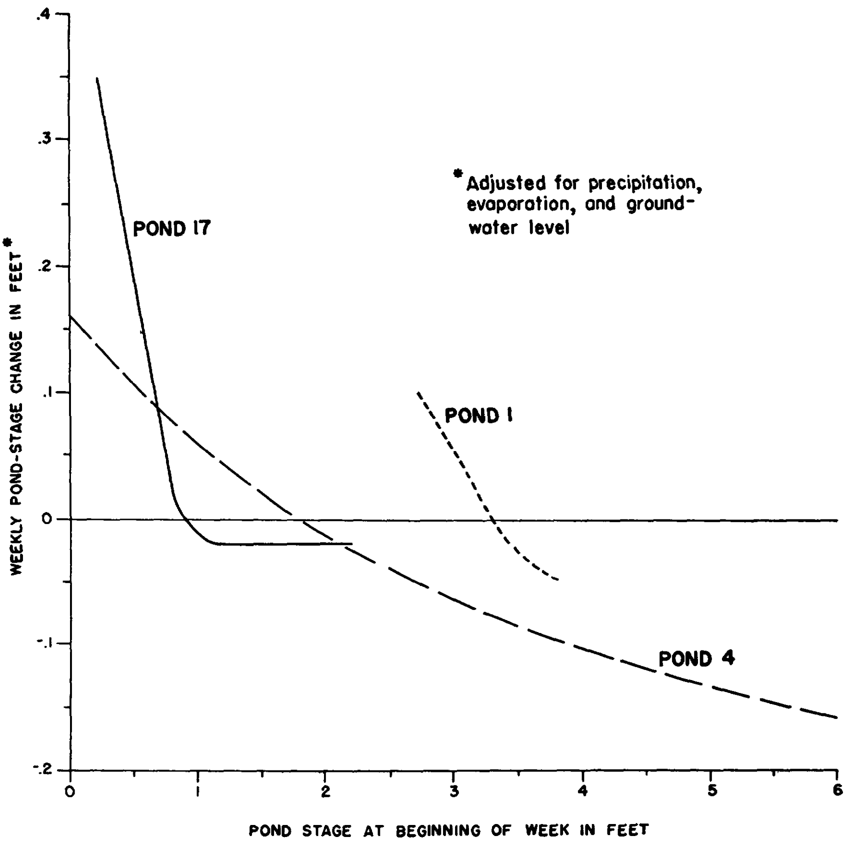

FIGURE 33.—Lines of relation between weekly pond-stage change and initial pond stage for ponds 1, 4, and 17

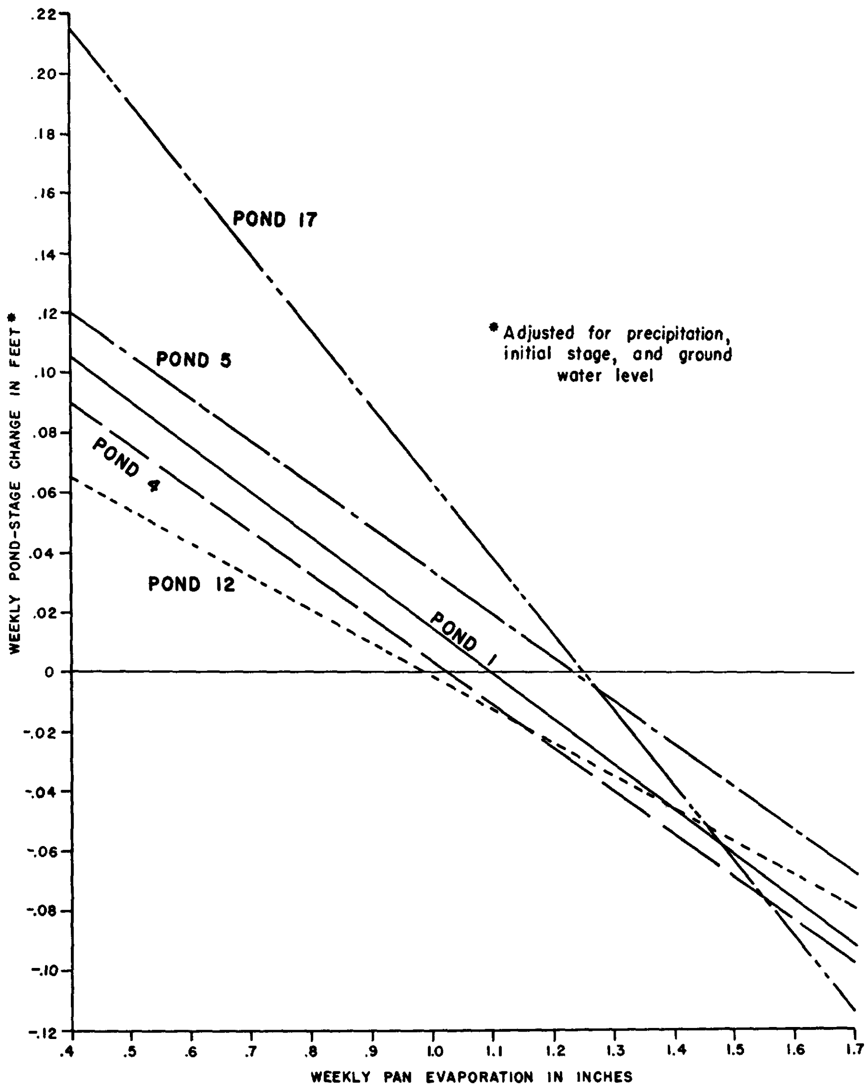

FIGURE 34.—Lines of relation between weekly pond-stage change and average weekly pan evaporation for ponds 1, 4, 5, 12, and 17.

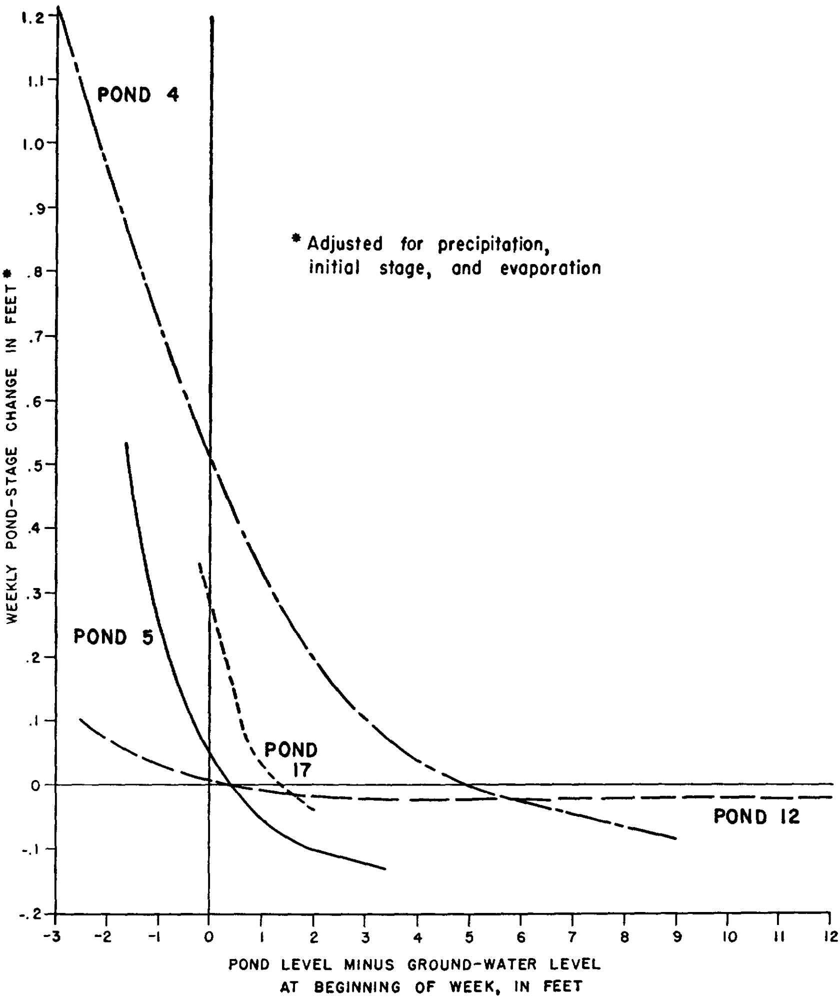

FIGURE 35.—Lines of relation between weekly pond-stage change and pond level minus ground-water level at the beginning of the week for ponds 4, 5, 12, and 17.

DISCUSSION

SOURCES OF ERROR

All data used in these analyses are subject to the usual observational errors.

Pond and ground-water stages at the beginning of the week were used while the other two independent factors, precipitation and evaporation, were expressed by summation for the period. The error introduced by this procedure should be small if the range in pond stage during the week was small. If, however, the range in stage during the week was great, an appreciable error might be introduced by using the beginning stage. Better correlation might have been obtained by using the average stage for each week that was available for some periods from water-level recorders. Use of observational data of pan evaporation instead of average weekly evaporation for X_4 might also have resulted in better correlation.

Probably the greatest source of error is in the precipitation data. Except for a short period at ponds 1, 4, and 12, the rainfall was measured at points from 1 to 4 miles distant from the ponds. It is believed, however, that the inaccuracies tend to balance out in the large number of observations analyzed, although individual measurements may be in error.

Strictly, the methods employed apply only when each independent variable affects the dependent variable individually. Actually, it is unlikely that such relations exist. It is recognized that the reliability of any line or curve of relationship varies inversely with the extent to which independent variables are correlated with each other. Hence, the interrelation of independent variables in this study influences significantly the limits of interpretation of the results obtained. In cases where two variables are correlated so closely that the relation to the dependent variable may be ascribed to either one of them, or to proportionate influences of both, the individual effects cannot be determined.

For example, in the analytical solutions computed for the 13 ponds, it was found that the intercorrelation between initial pond stage (X_3), and difference in elevation between pond level and groundwater level (X_5) was very high for most of the ponds; that is, changes in X_3 were associated with similar changes in X_5. Accordingly, the coefficients computed for variables X_3 and X_5, shown in table 9, probably do not represent the actual individual effects. This does not, however, detract from the accuracy of the analyses. While the measure of the individual effects may not be strictly accurate, any deviation of one variable will tend to be compensated by the other.

As another example: The term

$$\frac{f(P)}{f(H)}$$

where P is precipitation and H is pond stage, was included in equation 2. This indicates that stage change is a function not only of P and H individually, but may also be a function of the quotient of the two; that is, that

$$\Delta H = f\left(\frac{P}{H}\right).$$

To test the importance of intercorrelation of these independent variables, the data for a representative pond (pond 4) obtained by subtracting the stage change computed by the developed relation from the stage change actually observed were plotted against the quotient obtained by dividing precipitation by pond stage for each week. This plotting indicated no systematic relation and within limits of the available data it was assumed that the joint variation was not significant, although the possibility that such joint variation exists is not discounted.

ACCURACY OF SOLUTIONS BASED ON ALL AVAILABLE DATA

All multiple-correlation coefficients obtained when all available data were used, including that for periods of pond stages above the overflow point, were highly significant statistically. Probability statistics indicate that, multiple-correlation coefficients ranging from 0.35 to 0.25, for five variable problems with sample sizes ranging from 100 to 200, would be derived from uncorrelated data only about once in a hundred such problems. The lowest correlation coefficient obtained in these solutions was 0.66 (pond 5).

Graphical treatment of portions of the data was made to determine if some of the low correlations obtained were a result of linear analyses applied to curvilinear relationships. In the case of pond 5, where correlations were poorest, the graphical work disclosed considerable scatter in the plotting of the individual data, which accounts for the low correlation obtained. A possible explanation is that precipitation data used for this pond were obtained at a gage nearly 4 miles away.

For pond 2, the linear-correlation coefficient is average, and all of the independent variables apparently contribute significantly to the relationship. The plotting showed a detectable curvilinear relation of X_3 and X_5 with stage change but the relation of X_2 and X_4 appeared to be linear. The graphical solution yielded a slight improvement over the linear solution. The correlation coefficient was increased from 0.86 to 0.88 and the standard error of estimate reduced from 0.15 to 0.14 ft. Analysis of variance indicated that the improvement was highly significant statistically, although it is apparent that the working accuracy was increased only slightly.

Graphical analysis of pond 12 revealed no apparent departure from linearity.

ACCURACY OF SOLUTIONS BASED ON DATA OBTAINED IN WEEKS WITHOUT OVERFLOW

Because of the pronounced effect of overflow stages on recession rates, analytical solutions for seven ponds were made excluding all weeks during which overflow occurred. As shown in table 9, ponds

1, 4, 5, and 12 showed higher correlations of the variables, but in ponds 11, 13, and 17 the correlations were not improved.

With data during periods of overflow eliminated, the effect of ground-water level was found to be significant in one pond only (pond 4). With all data included this factor was found to be significant in five ponds. Field observations, as well as these analyses, indicate that pond storage is not generally affected by the water table, except for the brief periods when ground-water stages are high. In cases where the surrounding water table is higher than a pond, the effect is noticeable, as indicated previously for pond 1. It has also been shown for the same pond, however, that water-table level may be higher than pond level and not contribute significantly to pond storage.

Graphical solutions with data during overflow weeks eliminated were made on ponds 1, 4, 5, 12, and 17. Ponds 1 and 5 showed slightly less uniformity by the graphical method than by the analytical method. In the case of pond 1, variable X_3 was found to be slightly curvilinear and X_5 had no effect. The diffusion of plottings for pond 5 does not permit the derivation of accurate relationships. Graphical solution improved the results for ponds 4, 12, and 17; only for pond 4, however, can it be demonstrated that the improvement is significant.

RELATION OF INDIVIDUAL FACTORS TO CHANGE IN POND STAGE

The relations are shown more clearly, if not always more accurately, by the graphical method. Discussions of the effects of the different factors on pond-stage change will be explained from the graphs and references will be made to the analytical material for comparisons.

RAINFALL

Figure 32 shows the relation of precipitation to change in stage for five ponds. Generally the relationship is curvilinear. In two instances, ponds 1 and 5, a straight line was drawn as data in these cases were not sufficiently uniform for the definition of a curve. The parabolic curves derived for ponds 4, 12, and 17 are believed to be characteristic of the relation of rainfall to stage change. This type of curve indicates that the ratio of pond-stage change to precipitation is less for small amounts of rainfall than for large amounts. As a pond will rise an amount at least equal to the depth of precipitation, the minimum ratio of stage change to precipitation should be 1:1. Accretions from surface or subsurface inflow increases this ratio. The variable effect of rainfall under different conditions accounts partially for the character of the curve. As is commonly recognized, small amounts of precipitation are absorbed by surface detention, interception by plants, and in the replenishment of soil moisture.

Except for torrential rains, little runoff occurs until the infiltration capacity of the soil is exceeded. Thus, the effect of runoff is not apparent ordinarily, unless the duration is appreciable or unless the water requirement of the environs of the pond are already satisfied. If these conditions are met, the accretions due to runoff are significant. That this pattern does exist is shown by the increase in the slope of the X_2 curve for large amounts of precipitation. This indicates that water requirements of soil and vegetation are satisfied and that a larger proportion of rainfall on the land area runs off into the pond than when the amounts of rainfall are insufficient to wet thoroughly the soil and plants.

When a pond is above overflow stage, however, the effective area of the pond can be considered to be much larger and the rise resulting from a given amount of rainfall is not as great as when the stage is below the overflow point. Thus, weeks with overflow tend to plot lower on the curve of relation than do those without overflow. As this effect is greater for large amounts of rainfall than for small amounts, the net effect on the precipitation-stage change curve is towards linearity. Seven ponds were recomputed analytically with overflow weeks left out and the slope of the line of relation was increased for each pond.

Data from the linear analyses indicate that yield from precipitation contributes appreciably to pond storage. Coefficients for the precipitation variable (X_2), calculated from the data with overflow weeks eliminated, ranged from 0.126 for pond 12 to 0.344 for pond 5. When the same unit of measurement is used for both variable X_1 and X_2, their regression coefficients indicate ratios of pond rise to rainfall ranging from 1.51 to 4.13. The excess of these ratios above 1.00 represents the average effect of yield from the tributary area. This yield from the tributary area, whether by surface runoff or subsurface runoff permits the ponds to persist even though evapotranspiration losses exceed the amount of rainfall.

Runoff characteristics of the areas tributary to the ponds vary widely and determination of the particular factors responsible for the variations in amounts of runoff under the same general conditions would be difficult. Size and shape of drainage area, land slopes, soil, and plant cover all have varying degrees of influence in each pond. It is apparent, however, that size of drainage area is a primary determinant. The effect of runoff from the tributary area on pond-stage change may be expressed as a function of the ratio of land area to water area. Figure 36 shows the relation between rainfall regression slope (b_2) and the ratio of tributary land area to pond-surface area.

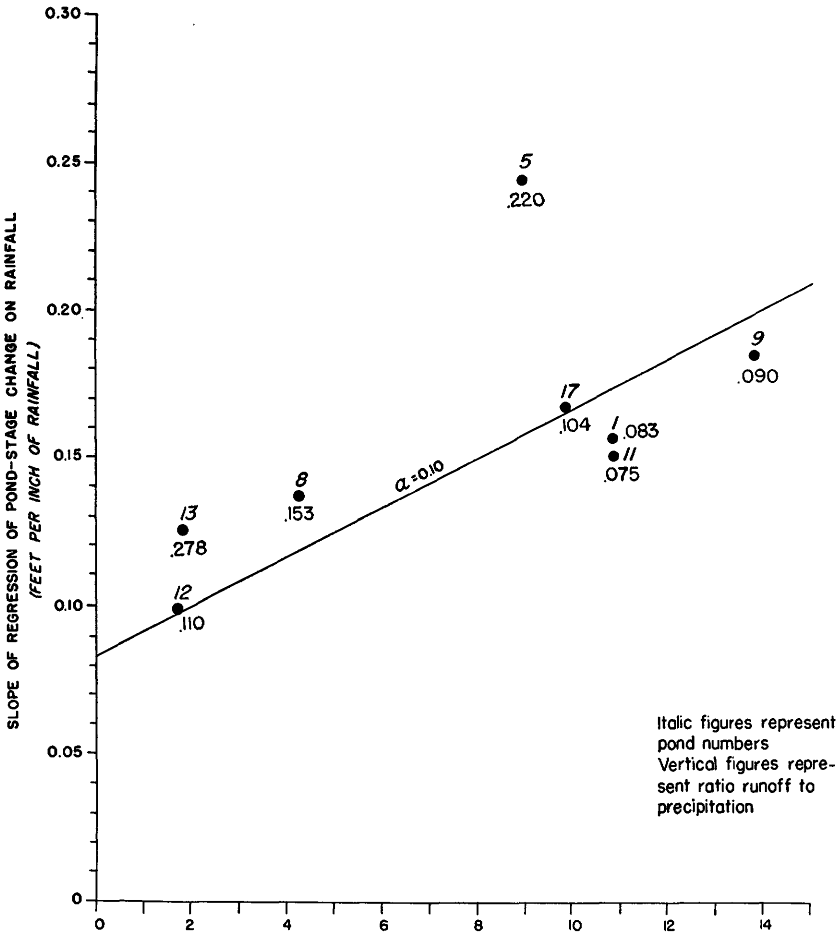

FIGURE 36.—Dot chart showing relation between slope of regression o pond stage change on rainfall, ratio of tributary land area to pond-surface area, and ratio of runoff to precipitation.

The following generalized equation for pond-stage change resulting from rainfall and runoff demonstrates the applicability of this ratio.

$$\Delta H = P + \frac{aPA_2}{A_1} \tag{3}$$

Where

ΔH=pond-stage change resulting from precipitation.
P=precipitation.
A_2=tributary land area.
A_1=pond area.
a=average ratio of runoff depth to precipitation.

Areas of ponds, at the point where overflow begins, are known for 8 of the 13 ponds. These are listed in table 10, together with the computed area ratios, the regression coefficients of stage change on rainfall computed in the analytical solutions based on all available data, and the average ratio of runoff depth from the land area to precipitation.

Generalizations from this relation cannot be made as the area ratio is not constant for all pond stages. As the water area increases, the tributary land area decreases. Furthermore, the effects of other factors are ignored.

TABLE 10.—*Pond areas, tributary-land areas, area ratios, regression coefficients of pond-stage change on precipitation, and runoff ratios for eight ponds*

Pond no.	A_1 Pond area in acres	A_2 Tributary land area in acres	A_2/A_1 Area ratio	Regression coefficients (feet/inch)	a Average ratio of runoff depths to precipitation
1	0.5	5.4	10.8	0.158	0.083
5	.9	7.9	8.8	.245	.220
8	12.5	52.8	4.2	.137	.153
9	1.5	20.5	13.7	.186	.090
11	4.6	49.5	10.8	.151	.075
12	15.2	26.3	1.7	.099	.110
13	538	953	1.8	.125	.278
17	4.9	47.8	9.8	.168	.104

INITIAL POND STAGE

Figure 33 shows the curves of relation obtained for the effect of initial pond stage on the change of stage for three ponds. Only data from periods without overflow were used. In the case of ponds 5 and 12 this variable had no discernible effect. This was confirmed by the analytical solutions.

Increase in pond stage is accompanied by a decrease in runoff owing to reduction of size of the tributary area. Moreover, decrease in tributary area with increase in stage is exactly complementary to the increase in ponded area that results in a change in volume characteristics. As stage increases both the decrease in drainage area and the increase in pond area act to reduce the rate of stage changes resulting from rainfall and runoff. These factors, the decrease in tributary area and the increase in pond area, are exclusively a function of stage. The influence of the volume characteristic of a pond on the relation between pond stage and pond-stage change is shown by the following example:

Stage-area and stage-volume curves for ponds 1, 5, and 11, the only ponds on which volume data were obtained, are shown on figure 37. The parabolic shape of the stage-volume curves indicates that for a constant rate of volume change, stage change becomes less as stage increases. This effect is evident from figure 37 and is also shown

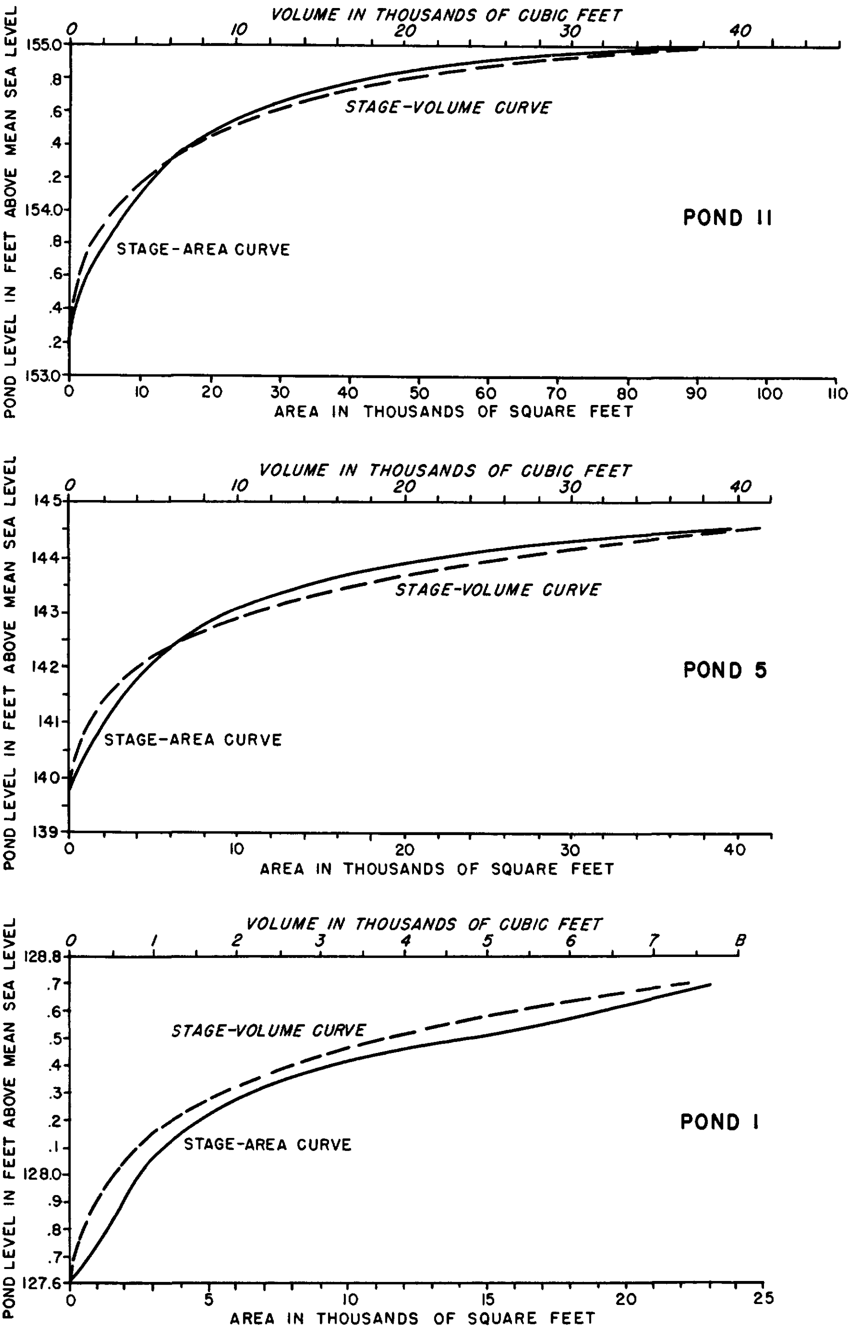

FIGURE 37.—Stage-volume and stage-area curves for ponds 1, 5, and 11.

in figure 38 where the slope of the stage-volume curve has been plotted against stage for pond 1, so that the stage change to be expected from a constant volume change of 500 cu ft at different stages can be determined. Comparison of figure 20 for pond 1 with figure 33 indicates a striking similarity. This suggests that the stage-volume characteristic is the principal determinant of the slope and shape of the curve of relation between pond-stage change and initial pond stage.

In table 8 are listed several other possible influences which may be exerted directly or indirectly by initial pond stage. From the above example, however, it is apparent that they are of minor conse-

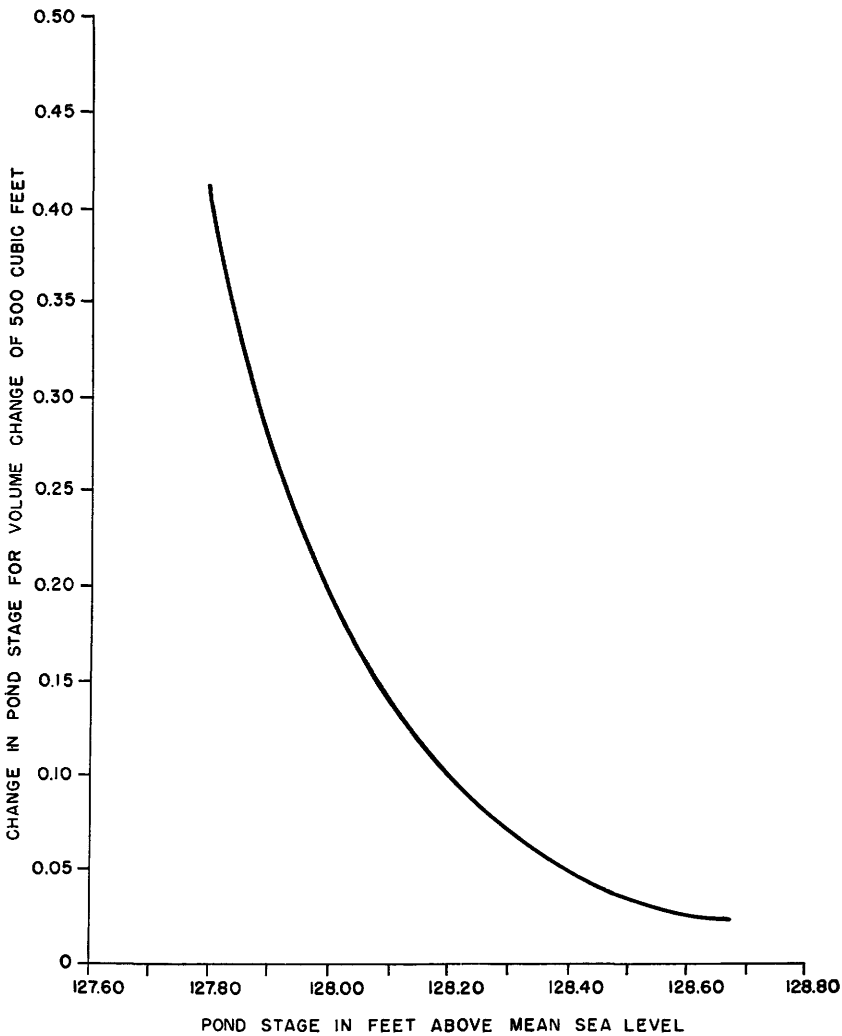

FIGURE 38.—Change in stage of pond 1 per 500 cu ft change in volume at different stages.

quence. Too, as indicated previously, the high intercorrelation between X_3 and X_5 prevents the precise differentiation of the effect of these variables. It has been shown also, however, that the effect of the water table is negligible except for some high conditions.

PAN EVAPORATION

The relation of stage change to average weekly pan evaporation for the five ponds, based on data with weeks having overflow eliminated, is shown in figure 34. In all these instances the relations were linear. Slopes of the lines of relation obtained by the graphical method and by the analytical method are in table 11. Results obtained by the two methods compare favorably, except in the case of pond 5, and possibly pond 4. In the case of pond 5 the intercorrelation between X_4, X_3, and X_5, was high. Intercorrelation with X_4 was lower in each of the other three ponds than for ponds 4 and 5.

TABLE 11.—*Slope of lines of relation between average weekly pan evaporation and pond-stage change*

Pond no.	Slope of relation		Pond no.	Slope of relation	
	Analytical	Graphical		Analytical	Graphical
1	0.128	0.152	12	.116	.104
4	.238	.145	17	.194	.254
5	.506	.145			

Some intercorrelation between pan evaporation and both pond stage and ground-water stage are shown by practically all of the analytical solutions. This intercorrelation is probably due to the seasonal association of high-evaporation rates with low ground-water and pond stages and also with low soil moisture. Because of the reasonably consistent answers obtained by the graphical and analytical solutions, the intercorrelation between pan evaporation and the other independent variables is considered not to be significant. In these analyses, there was no appreciable difference between coefficients obtained when all available data were used and when data from weeks in which overflow occurred were eliminated.

The regression coefficients for change in pond stage to pan evaporation obtained using all available data were converted to apply when both pond stage and pan evaporation were measured in feet (table 12). The regression coefficient, or the slope of the line of relation, represents the ratio of evapotranspiration loss to evaporation from the Class *A* pan.

From data given in table 12, it is calculated that annual evaporation and transpiration losses from the ponds studied ranges from 53 to 180 in., as the average annual Class *A* pan evaporation is about 60 in.

TABLE 12—*Ratio of evapotranspiration losses to pan evaporation for 13 ponds*

Pond no.	Evaporation ratio	Pond no.	Evaporation ratio	Pond no.	Evaporation ratio
1	0.95	8	1.50	15	0.88
2	2.54	9	2.71	16	.92
4	2.72	11	1.37	17	1.26
5	3.00	12	1.52		
6	2.50	13	1.22		

To check the accuracy of calculations which gave these extremely high ratios, an analysis of the ratio of evapotranspiration losses to pan evaporation was made for pond 1 from daily information obtained by recording instruments. Daily pond recession in inches was determined for all days on which no precipitation occurred and when the water table was below pond bottom. These were related to daily evaporation from the Class *A* pan. Daily pond stage was used as a third variable. The equation thus derived was:

$$\Delta H = -0.048 - 1.21E - 0.162H \tag{4}$$

Where

ΔH=daily change of pond stage, in inches.
E=daily pan evaporation, in inches.
H=pond stage, in feet, above an arbitrary datum.

The ratio of evapotranspiration loss to pan evaporation determined from this equation is 1.21. This compares favorably with the figure of 0.95 determined from the analysis of weekly data. Standard error of the former ratio is 0.06 and for the latter is 0.35.

Of the many factors that influence the evapotranspiration losses from ponds, the kind and abundance of plants is probably the most critical. Plants obtain water from the pond for transpiration. They also shade the water surface, thereby affecting the water temperature. Emergent plants determine the extent of exposure to wind; hence they affect the extent to which mixing of the water can occur.

GROUND-WATER LEVEL

The lines of relation obtained for the variation of pond-stage change with the X_5 factor, difference between pond and ground-water levels, for four of the five ponds that were analyzed graphically, with data from weeks having overflow eliminated, are shown on figure 35.

The negative slope indicates that when the water table is higher than the pond level, water flows into the pond from ground water; conversely, when the pond level is above ground-water level, water seeps into the water table from the pond. The curvilinear relation is in accord with similar hydraulic phenomena where the volume of flow is a function of the head acting to produce the flow. The relationship of this variable indicates that interchange of water between ponds and the ground water occurs. Most of the ponds included in these analyses evolved from sinkholes with porous bottoms to water-retaining basins lined with relatively impervious material. The porosity of the bottom deposits varies greatly among the ponds. Even in tightly compacted basins ground water may contribute to pond storage by rising above the height of the resistant materials. On the other hand, the water table may not contribute materially to pond storage even when high, if the bottom has low permeability. It is doubtful, however, if the material ever prevents all flow.

Observations of wells around ponds made in connection with this study, indicate that the pond bottom may retain water so effectively that when the water table is below the bottom of the pond, seepage is not sufficient to maintain contact between the pond and water table. There is, however, enough seepage in some instances to create a dome in the water table high enough to keep the pond and water table in contact.

The influence of variable X_5 can only be considered when pond and water table are in contact. Curves in figure 35 for ponds 4, 5, and 17 illustrate the relation when this contact is evident. The curve for pond 12, which, presumably, has a relatively impervious bottom indicates the lack of influence when distance between pond and water table becomes more than about 2 ft. The nonsignificance of this variable for several ponds may be due to the preponderance of data obtained when the water table was not in contact with the pond. Further graphical solutions might have shown that the condition of pond 12, where ground water was effective only above a certain height, was evident in other ponds as well. It should be noted, however, that under the conditions observed, ground water has no important effect on pond-stage change in 8 of the 13 ponds studied.

TESTS FOR SEASONAL AND ANTECEDENT INFLUENCES

Complete analyses of seasonal variations of the relations for the variables were not attempted. Analyses were made, however, to determine by months the deviations from the average relations developed in order that seasonal influence could be detected if it existed. Calculations of weekly pond stage were made from the relations developed for ponds 1, 2, 4, 5, and 12. The difference between these figures and those actually observed were determined. Figure 39 shows the monthly average of weekly deviations of computed from observed pond-stage change. With the exception of pond 2, deviations were computed from graphical solutions of data with weeks having overflow eliminated. The deviation of ponds 1 and 12 and ponds 2, 4, and 5 are roughly similar. There is not, however, a consistent seasonal pattern of deviation. This suggests that improve-

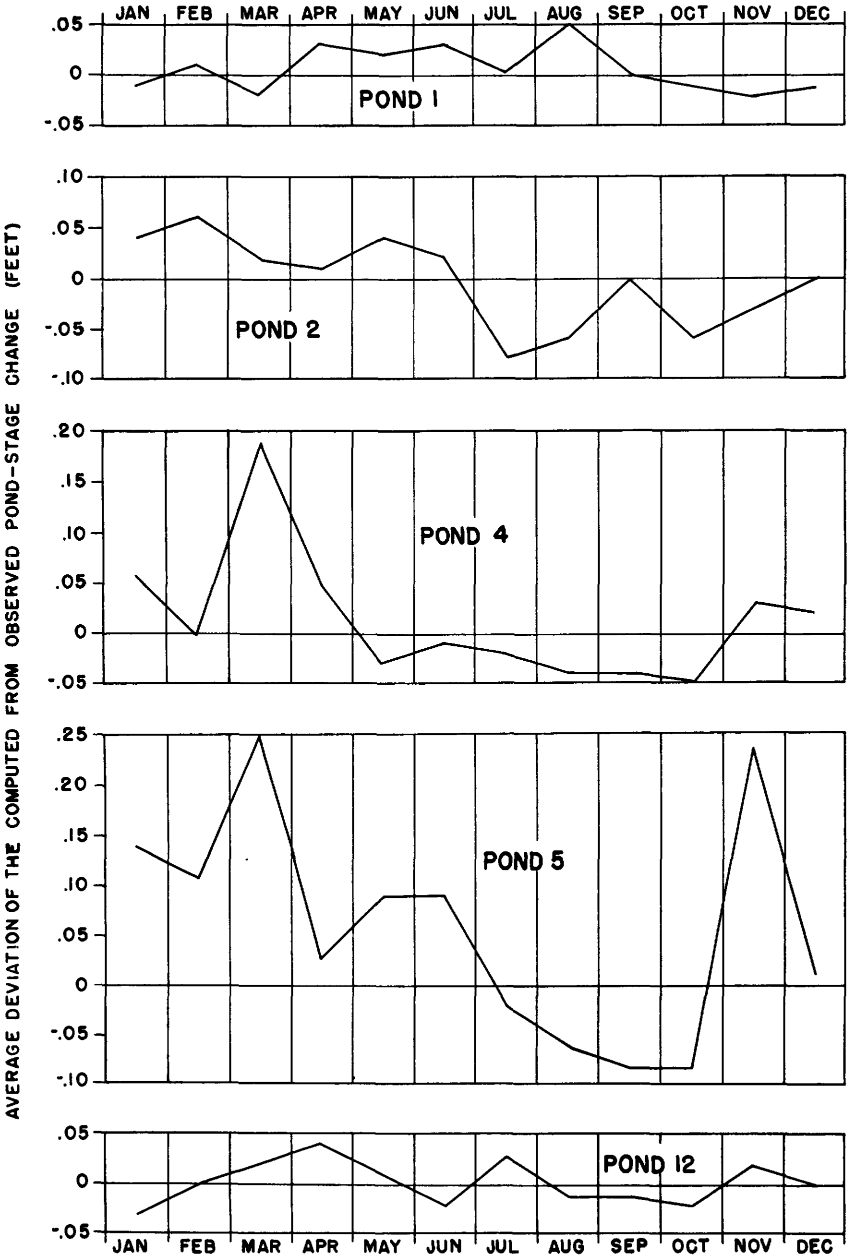

FIGURE 39.—Monthly average of weekly deviations of computed from observed pond-stage changes for ponds 1, 2, 4, 5, and 12.

ment would not have resulted from treatment of data by seasons, and that the use of evaporation, initial pond stages, and ground-water levels in these analyses was adequate consideration of the effect of antecedent and seasonal conditions on the relations developed.

NEED FOR INDIVIDUAL CALIBRATION OF PONDS

The variations apparent from these analyses suggest that direct application of the coefficients calculated in this study to similar ponds for the purpose of predicting stage cannot be made with accuracy. No single factor or simple combination of factors is accurately indicative of pond-stage change. As shown below, the equations evolved can be used with considerable accuracy for the specific ponds for which they were derived. The wide range of regression coefficients for each variable as reported in table 9, indicates that even in the same region ponds are not sufficiently homogeneous to permit use of average results from all of the ponds treated in this study for purposes of prediction. The methods used here are proposed, however, as a reliable procedure for calibrating the hydrologic characteristics of specific ponds.

SAMPLE SYNTHETIC HYDROGRAPHS

Figure 40 shows hydrographs from observed stages and synthetic hydrographs calculated from the equations developed for ponds 1, 4, and 12, for the year 1946. The equations used were derived by the linear analyses of all data. Beginning with the stage for the first week of the year, change during the subsequent week was computed by using the observed figures for the independent variables in the equations developed for each pond. The computed change was added algebraically to the initial stage to get the stage for the beginning of the next week. Stages for subsequent weeks were computed in the same manner, except that computed-stage change was added to the computed initial stage for each week. Computed stages were not at any time adjusted to observed stages.

Variables of negligible effect were eliminated from these calculations. The measurements of ground water in pond 1 and initial stage and ground water for pond 12 were not used. As shown in figure 40, there is close similarity and lack of deviation of the observed and synthetic hydrographs for pond 1, except during the month of June when ground-water stages were unusually high. It was believed that the discrepancies during June were due to additions to stage by inflow from ground water, which was not used in the computations. A recomputation of the synthetic hydrograph using a formula which included the ground-water factor did not, however, improve the relation significantly as provision could not be made in the formula

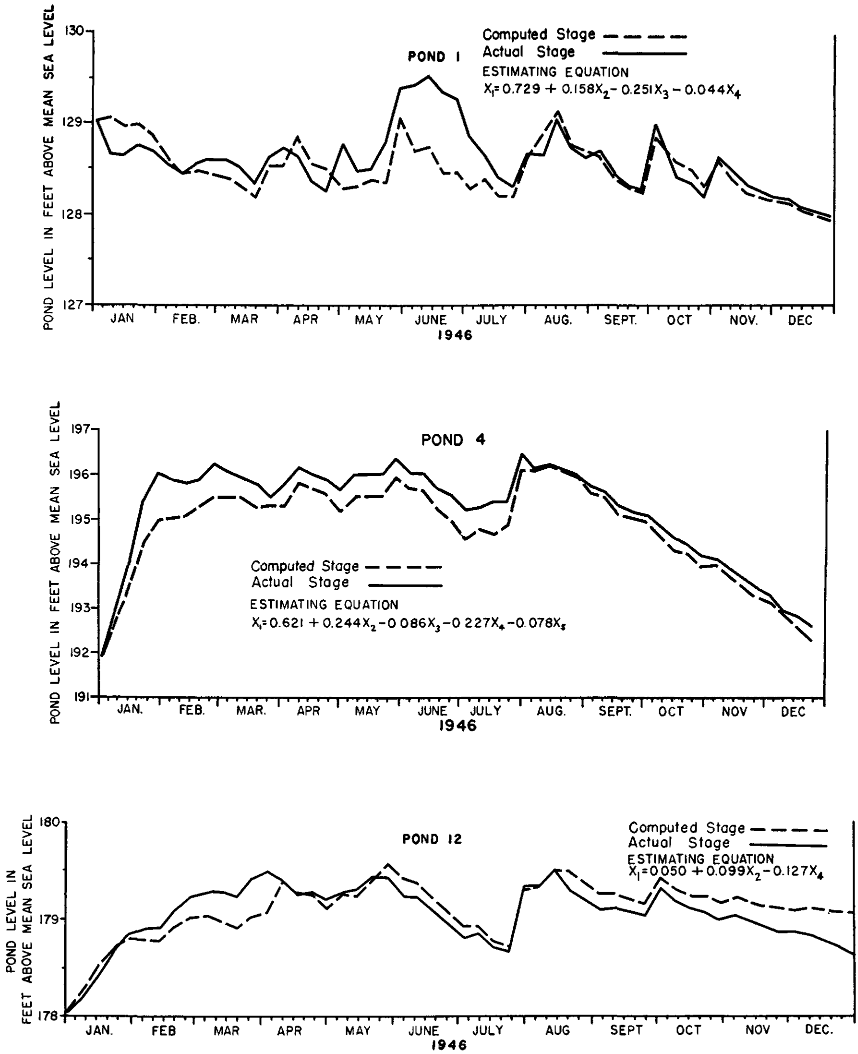

FIGURE 40.—Hydrographs of observed stages and stages computed using linear equations for ponds 1, 4, and 12.

based on all data to treat adequately the brief period during which ground water had a significant influence.

For pond 4 the relation between the calculated and observed hydrograph was close except during the period of rise in January. The lag of calculated stage is probably caused by using differential elevations between pond level and ground-water level for the beginning of the week instead of an average value for the week. Error from this source is not significant except for weeks during which stage change is great.

The use of only average weekly pan evaporation and observed precipitation in calculating the stage for pond 12 provides a hydrograph which conformed closely to that observed.

SUMMARY

In connection with a malaria-research program, hydrologic characteristics of ponds in limestone sinks in southwestern Georgia were studied. On 13 representative ponds observations were made of pond levels, ground-water levels, and precipitation from 1939 to 1947. Evaporation data and other climatological information were obtained concurrently. The purposes of the study were: (1) to determine which of these factors were related to pond-level changes and to appraise their effects quantitatively, and (2) attempt predictions of pond levels from the relationships thus disclosed.

Statistical analyses were made to determine relation of the following variables to pond-stage change.

1. Precipitation.
2. Initial pond stage.
3. Average weekly Class A pan evaporation.
4. Pond level minus ground-water level.

Analyses were made of all data available and, for seven ponds, of the data after eliminating periods in which pond overflow occurred. Analyses were based on the assumption of linear relationships. Graphical treatment of representative segments of the data showed that the slight curvilinear relations of rainfall, initial pond-stage, and the difference between pond level and ground-water level to stage change did not affect the results appreciably. With data from weeks with overflow eliminated, the graphical solutions indicated significantly higher correlations for only one pond (pond 4). Multiple-correlation coefficients calculated from all data ranged from 0.664 to 0.932. With data during periods of overflow eliminated, the coefficients varied from 0.767 to 0.917. For four of the seven ponds tested the correlations obtained under these conditions were better than those obtained using all data. The high degrees of correlation obtained indicate that the principal determinants of pond stage were considered.

Hydrographs developed for three ponds from the equations derived by these analyses corresponded closely with the observed hydrographs. In the data analyzed, no seasonal variations of influence of the various factors were found.

Following are some relations observed between the various factors considered and pond-stage change.

Precipitation.—The ratio of pond-stage change to precipitation varied from 1.51 to 4.13 for the 13 ponds. The excess over 1.00 is due to runoff from the contiguous land area. Water obtained by runoff permits ponds to persist even though evaporation and transpiration losses exceed the amount of rainfall. It was found that the precipitation-stage change relation is influenced largely by the ratio of land drainage area to pond area. The stage change to precipitation ratio is smaller for low rainfall than for high rainfall due to the detention by soil and vegetation on the water shed. The average ratio of runoff depth to precipitation on the land area was found to be approximately 0.10.

Initial Stage.—It was found in these analyses that the principal influence which the initial-stage factor exerted on pond-stage change was through stage-volume characteristics of the pond basin.

Evaporation.—The ratio of evapotranspiration losses from ponds to Class A pan evaporation ranged from 0.88 to 3.00. On the basis of 60 in. annual evaporation, loss from evapotranspiration in the ponds studied ranges from 53 to 180 in. per year. Variations in these losses can be ascribed to the effects of vegetation. In some instances evaporation losses are decreased by shading of the pond or by protection from wind movement; in others heavy losses result from water used by plants.

Ground water.—For 8 of the 13 ponds, linear analyses using all available data showed ground water to have no significant effect on pond-stage change. However, graphical analysis using only the data for weeks without overflow indicated that for 4 of the 5 ponds analyzed there was some effect at times of high ground-water stages at which times flow into the ponds does occur. The flow of ground water into the pond is significant only when the water table is above the relatively impervious part of the bottom and sides of the pond. Most of the time, the interchange of ground and pond water is restricted by the resistance to flow through the pond bottom. This resistance may vary from filter-like characteristics to near imperviousness, but in none of the ponds studied is the bottom highly permeable.

CONCLUSIONS

From the above summary it is evident that precipitation and evapotranspiration are the two most important factors affecting pond levels in the region studied during most periods of the year. The effect of ground water is confined to relatively short periods of extremely high water-table levels. Antecedent pond level is a primary factor which influences greatly pond-stage response to volume additions in subsequent periods. As the effect of these ponds upon recharge of ground-water aquifers appears to be of minor importance, it is unlikely that these ponds are important in the hydrologic economy of the area.

These ponds are, however, of great importance since they are a primary source of disease-carrying mosquito production. The information present here should be useful in further studies of pond ecology and may enable some advances in knowledge of the natural history of pond-breeding mosquitoes.

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APPENDIX

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BASIC DATA FOR PONDS

In the following tables the basic data used in these analyses are given. The following symbols have been used for column headings:

X_1 Pond-stage change, in feet, during the week.

X_2 Precipitation in inches.

X_3 Pond stage, in feet above arbitrary datum, at the beginning of the week.

X_4 Average weekly evaporation from Class *A* evaporation pan in inches.

X_5 Pond level minus ground-water level in feet.

To convert pond stage, shown as X_3, to elevation above mean sea level, the following number of feet should be added:

Pond	*Feet*	*Pond*	*Feet*
1	125	11	150
2	175	12	175
4	190	13	210
5	140	15	210
6	145	16	215
8	210	17	220
9	210		

Basic data for ponds

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 1						
1	10- 2-40	-0.01	1.77	2.84	1.12	19.37
2	10- 9-40	.01	.91	2.83	1.06	19.79
3	10-16-40	-.08	0	2.84	1.00	20.05
4	11-13-40	.23	1.71	3.15	.76	[e] 23.00
5	11-20-40	.16	1.98	3.38	.70	[e] 23.00
6	11-27-40	-.06	.41	3.54	.65	[e] 23.00
7	12- 4-40	-.10	.24	3.48	.60	[e] 23.00
8	12-11-40	-.14	0	3.38	.55	[e] 23.00
9	12-18-40	-.04	.36	3.24	.51	[e] 23.00
10	12-26-40	.20	1.26	3.20	.47	[e] 23.00
11	1- 1-41	.20	1.66	3.40	.46	[e] 23.00
12	1- 8-41	-.02	.94	3.60	.45	[e] 23.00
13	1-15-41	-.14	0	3.58	.47	[e] 23.00
14	1-22-41	0	.61	3.44	.49	[e] 23.00
15	1-29-41	-.13	.02	3.44	.51	[e] 23.00
16	2- 5-41	-.07	.45	3.31	.56	[e] 23.00
17	2-12-41	.20	1.05	3.24	.61	[e] 23.00
18	2-19-41	.16	1.06	3.44	.67	[e] 23.00
19	2-26-41	-.12	.22	3.60	.75	[e] 23.00
20	3- 5-41	-.12	.06	3.48	.86	[e] 23.00
21	3-12-41	.26	2.67	3.36	.96	[e] 23.00
22	3-19-41	-.04	.70	3.62	1.03	[e] 23.00
23	3-26-41	.02	.94	3.58	1.10	[e] 23.00
24	4- 2-41	-.18	.28	3.60	1.18	[e] 23.00
25	4- 9-41	.04	.85	3.42	1.25	[e] 23.00
26	4-16-41	-.31	.18	3.46	1.33	[e] 23.00
27	4-23-41	-.20	.42	3.15	1.40	[e] 23.00
28	4-30-41	-.13	.03	2.95	1.45	[e] 23.00
29	6-25-41	-.08	2.19	3.14	1.65	[e] 23.00
30	7- 2-41	-.15	2.24	3.06	1.66	[e] 23.00
31	7- 9-41	.29	2.69	2.91	1.65	[e] 23.00
32	7-16-41	-.28	.21	3.20	1.63	[e] 23.00
33	7-23-41	.36	1.90	2.92	1.60	[e] 23.00
34	7-30-41	.28	1.49	3.28	1.56	[e] 23.00

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 1—Continued						
35	8- 6-41	-.38	.02	3.56	1.52	e 23.00
36	8-13-41	.06	.54	3.18	1.48	e 23.00
37	8-20-41	-.18	.35	3.24	1.43	e 23.00
38	8-27-41	.62	3.05	3.06	1.39	e 23.00
39	9- 3-41	-.25	.12	3.68	1.34	e 23.00
40	9-10-41	-.27	0	3.43	1.28	e 23.00
41	9-17-41	-.06	.68	3.16	1.23	e 23.00
42	9-24-41	-.18	0	3.10	1.17	e 23.00
43	10- 1-41	.24	1.59	2.92	1.12	e 23.00
44	10- 8-41	.86	5.05	3.16	1.07	e 23.00
45	10-15-41	-.49	0	4.02	1.01	e 23.00
46	10-22-41	-.17	.07	3.53	.95	e 23.00
47	10-29-41	-.14	.36	3.36	.88	e 23.00
48	11- 5-41	-.08	.47	3.22	.83	e 23.00
49	11-12-41	-.14	0	3.14	.77	e 23.00
50	11-19-41	-.08	0	3.00	.71	e 23.00
51	11-26-41	-.10	.06	2.92	.66	e 23.00
52	12- 3-41	0	.60	2.82	.60	e 23.00
53	12-10-41	.61	2.75	2.82	.56	e 23.00
54	12-17-41	-.03	.54	3.43	.52	e 23.00
55	12-24-41	.34	3.15	3.40	.47	e 23.00
56	12-31-41	-.10	1.17	3.74	.46	e 23.00
57	1- 7-42	.16	6.29	3.64	.45	e 23.00
58	1-14-42	-.20	.03	3.80	.47	e 23.00
59	1-21-42	-.12	0	3.60	.49	21.06
60	1-28-42	-.10	.02	3.48	.51	19.43
61	2- 4-42	-.05	.45	3.38	.56	18.29
62	2-11-42	.04	.74	3.33	.61	17.83
63	2-18-42	.37	3.10	3.37	.67	17.31
64	2-25-42	-.06	.73	3.74	.75	17.29
65	3- 4-42	.02	1.09	3.68	.84	16.01
66	3-11-42	-.02	2.70	3.70	.95	15.16
67	3-18-42	.08	1.94	3.68	1.03	12.20
68	3-25-42	-.07	2.37	3.76	1.10	10.00
69	4- 1-42	-.12	.57	3.69	1.18	4.98
70	4- 8-42	-.21	0	3.57	1.25	4.17
71	4-15-42	.23	2.03	3.36	1.33	4.05
72	4-22-42	-.28	.12	3.59	1.40	3.10
73	4-29-42	-.26	0	3.31	1.45	3.00
74	5- 6-42	-.18	.01	3.05	1.50	3.73
75	5-13-42	.25	1.76	2.87	1.56	4.73
76	6-11-42	.92	5.54	3.10	1.63	8.95
77	6-18-42	-.34	1.77	4.02	1.65	7.17
78	6-25-42	-.10	1.53	3.68	1.65	6.66
79	7- 1-42	-.12	.73	3.58	1.66	6.52
80	7- 8-42	-.14	.88	3.46	1.65	6.99
81	7-15-42	-.20	1.32	3.32	1.63	7.78
82	7-22-42	-.12	.16	3.12	1.60	7.68
83	7-29-42	-.08	1.24	3.00	1.57	9.26
84	8- 5-42	-.10	.24	2.92	1.53	10.03
85	8-12-42	.62	3.57	2.82	1.49	10.89
86	4-18-45	.92	3.32	2.80	1.34	18.31
87	4-25-45	.19	3.03	3.72	1.42	19.35
88	5-16-45	.30	2.50	3.53	1.57	15.08
89	5-23-45	-.37	0	3.83	1.59	14.37
90	5-30-45	-.30	0	3.46	1.61	13.00
91	6- 6-45	-.25	.24	3.16	1.62	13.39
92	6-13-45	-.18	.44	2.91	1.64	12.37
93	6-20-45	.79	1.83	2.73	1.65	12.53
94	6-27-45	-.19	.55	3.52	1.66	13.67
95	7- 4-45	.35	1.17	3.33	1.66	12.86
96	7-11-45	-.08	3.80	3.68	1.64	15.24
97	7-18-45	-.08	1.12	3.60	1.62	14.92
98	7-24-45	.02	1.14	3.52	1.58	15.34
99	8- 1-45	-.24	.42	3.54	1.56	15.81
100	8- 8-45	-.17	.38	3.30	1.50	15.72
101	8-15-45	.42	2.29	3.13	1.47	15.89
102	8-22-45	-.25	.21	3.55	1.43	16.78
103	8-29-45	-.24	0	3.30	1.39	16.83
104	9- 5-45	-.08	.69	3.06	1.34	17.08
105	9-12-45	-.06	.62	2.98	1.27	17.30
106	9-19-45	.52	3.00	2.92	1.21	17.71
107	9-26-45	-.22	.29	3.44	1.16	18.55
108	10- 3-45	-.13	.45	3.22	1.10	18.69
109	10-10-45	-.15	.09	3.09	1.05	18.87
110	10-17-45	-.13	0	2.94	.99	18.64
111	10-24-45	-.01	.62	2.81	.92	19.08

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 1—Continued						
112	10-31-45	.05	.71	2.80	.86	19.17
113	11- 7-45	-.04	.29	2.85	.81	19.60
114	11-14-45	-.09	0	2.81	.75	20.07
115	11-28-45	.08	.95	2.66	.64	20.38
116	12- 5-45	.15	1.03	2.74	.59	20.50
117	12-12-45	-.06	.13	2.89	.54	21.00
118	12-19-45	.83	3.23	2.83	.50	21.50
119	12-26-45	.36	3.31	3.66	.47	22.00
120	1- 2-46	-.36	2.14	4.02	.45	22.50
121	1- 9-46	-.02	1.35	3.66	.46	21.09
122	1-16-46	.12	1.96	3.64	.47	19.54
123	1-23-46	-.06	1.10	3.76	.50	18.20
124	1-30-46	-.15	0	3.70	.53	16.16
125	2- 6-46	-.11	.23	3.55	.57	13.93
126	2-13-46	.12	1.29	3.44	.62	12.40
127	2-20-46	.05	.89	3.56	.68	11.87
128	2-27-46	-.01	.75	3.61	.77	11.66
129	3- 6-46	-.08	.51	3.60	.85	11.12
130	3-13-46	-.18	.06	3.52	.97	11.25
131	3-20-46	.30	3.06	3.34	1.05	11.07
132	3-27-46	.10	1.26	3.64	1.12	9.67
133	4- 3-46	-.10	3.31	3.74	1.20	9.11
134	4-10-46	-.28	0	3.64	1.27	1.99
135	4-17-46	-.11	1.03	3.36	1.35	1.69
136	4-24-46	-.22	0	3.25	1.42	1.97
137	5- 2-46	-.32	1.22	3.80	1.47	3.16
138	5- 9-46	.03	1.53	3.48	1.53	1.47
139	5-16-46	.30	.94	3.51	1.57	1.75
140	5-23-46	.61	5.74	3.81	1.59	2.57
141	5-30-46	.01	0	4.42	1.61	-.06
142	6- 6-46	.10	1.98	4.43	1.62	-.13
143	6-13-46	-.18	0	4.53	1.64	.05
144	6-20-46	-.07	1.34	4.35	1.65	.19
145	6-27-46	-.40	.31	4.28	1.65	.50
146	7- 4-46	-.22	1.65	3.88	1.66	.74
147	7-11-46	-.26	.08	3.66	1.65	1.80
148	7-18-46	-.09	.89	3.49	1.62	3.00
149	7-25-46	.38	3.64	3.31	1.59	4.41
150	8- 1-46	0	3.31	3.69	1.55	4.89
151	8- 9-46	.41	3.59	3.67	1.50	2.39
152	8-16-46	-.34	0	4.08	1.46	.55
153	8-23-46	-.10	1.34	3.74	1.42	.05
154	8-30-46	.07	1.31	3.64	1.37	.11
155	9- 6-46	-.26	0	3.71	1.32	.27
156	9-13-46	-.13	.51	3.45	1.26	1.45
157	9-20-46	-.06	.52	3.32	1.21	2.85
158	9-27-46	.77	4.93	3.26	1.15	4.40
159	10- 4-46	-.51	0	4.03	1.10	3.73
160	10-14-46	-.06	.89	3.42	1.02	5.59
161	10-21-46	-.16	0	3.36	.96	7.64
162	10-28-46	.46	2.71	3.20	.89	8.86
163	11- 4-46	-.16	0	3.66	.84	9.89
164	11-11-46	-.17	.02	3.50	.78	10.15
165	11-18-46	-.07	.42	3.33	.72	10.68
166	11-25-46	-.05	.40	3.26	.67	11.59
167	12- 2-46	-.03	.41	3.21	.61	12.22
168	12- 9-46	-.10	0	3.18	.57	13.20
169	12-16-46	-.04	0	3.08	.52	13.50
170	12-23-46	-.06	0	3.04	.48	14.10
171	12-30-46	.04	.76	2.98	.46	14.50
172	1- 6-47	.36	1.61	3.02	.45	15.00
173	1-13-47	.40	2.80	3.38	.47	15.90
174	1-20-47	-.13	.85	3.78	.49	16.40
175	1-27-47	-.13	.02	3.65	.51	15.37
176	2- 3-47	.13	1.45	3.52	.55	15.10
177	2-10-47	-.13	.14	3.65	.60	14.98
178	2-17-47	-.11	.02	3.52	.66	14.71
179	2-24-47	-.08	.33	3.41	.74	14.22
180	3- 3-47	.28	1.37	3.33	.83	14.29
181	3-10-47	.46	6.06	3.61	.94	14.84
182	3-17-47	-.37	1.26	4.07	1.02	8.30
183	3-24-47	-.07	.81	3.70	1.09	3.62
184	3-31-47	-.07	.60	3.63	1.17	2.52
185	4- 7-47	.04	.98	3.56	1.24	2.74
186	4-14-47	.08	.64	3.60	1.32	2.64
187	4-21-47	.37	3.52	3.68	1.39	2.75
188	4-28-47	-.13	.18	4.05	1.44	-.35

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 1—Continued						
189	5- 5-47	−.11	.64	3.92	1.49	−.31
190	5-12-47	.02	1.32	3.81	1.55	.46
191	5-19-47	−.29	.02	3.83	1.58	.46
192	5-26-47	.15	2.41	3.54	1.60	.79
193	6- 2-47	.10	1.31	3.69	1.62	.86
194	6- 9-47	−.28	0	3.79	1.63	.84
195	6-16-47	−.19	.30	3.51	1.65	1.35
196	6-23-47	.80	3.92	3.32	1.65	2.39
197	6-30-47	−.56	.07	4.12	1.66	3.65
198	7- 7-47	−.20	.71	3.56	1.65	4.08
199	7-14-47	−.09	.88	3.36	1.63	4.29
200	7-21-47	−.05	.89	3.27	1.60	5.62
201	7-29-47	−.01	1.48	3.22	1.57	7.00
202	8- 5-47	−.15	.05	3.21	1.53	8.21
203	8-12-47	.49	2.30	3.06	1.49	9.05
204	8-19-47	.07	2.35	3.55	1.44	10.56
205	8-26-47	−.10	1.41	3.62	1.40	11.14
206	9- 2-47	−.22	.30	3.52	1.35	11.26
207	9- 9-47	−.13	.54	3.30	1.29	11.67
208	9-16-47	−.04	.76	3.17	1.24	12.20
209	9-23-47	−.07	.30	3.13	1.18	12.83
210	9-30-47	.10	2.14	3.06	1.13	13.34
211	10- 7-47	−.01	.96	3.16	1.08	14.06
212	10-14-47	−.06	.41	3.15	1.02	14.50
Pond 2						
1	1-15-41	−0.04	0	5.87	0.47	8.29
2	1-22-41	.06	.93	5.83	.49	4.79
3	1-29-41	−.02	0	5.89	.52	6.04
4	2- 5-41	.02	.53	5.87	.57	8.08
5	2-12-41	.06	.85	5.89	.62	9.54
6	2-19-41	.06	1.00	5.95	.68	10.09
7	2-26-41	−.04	.48	6.01	.87	8.02
8	3- 5-41	−.04	.17	5.97	.73	6.49
9	3-12-41	.28	2.54	5.93	.96	7.64
10	3-19-41	.02	1.12	6.21	1.04	1.05
11	3-26-41	.10	1.02	6.23	1.10	−.03
12	4- 2-41	−.04	.03	6.33	1.18	−1.14
13	4- 9-41	.02	.85	6.29	1.25	−1.03
14	4-16-41	−.08	0	6.31	1.33	−.90
15	4-23-41	−.14	.43	6.23	1.40	−.47
16	4-30-41	−.10	.35	6.09	1.45	.10
17	5- 7-41	−.10	1.10	5.99	1.50	.82
18	5-14-41	−.18	0	5.89	1.56	1.96
19	5-21-41	−.18	0	5.71	1.59	3.86
20	5-28-41	−.22	.09	5.53	1.60	5.31
21	6- 4-41	−.22	.05	5.31	1.62	8.47
22	6-11-41	−.20	.25	5.09	1.63	9.94
23	1- 7-42	1.24	4.09	5.45	.45	2.90
24	1-14-42	−.20	0	6.69	.47	−3.79
25	1-21-42	−.08	0	6.49	.49	−3.54
26	1-28-42	−.04	.14	6.41	.51	−2.99
27	2- 4-42	.04	.45	6.37	.56	−2.53
28	2-11-42	.18	1.64	6.41	.61	−2.28
29	2-18-42	.94	3.75	6.59	.67	−2.36
30	2-25-42	−.34	.98	7.53	.75	−4.06
31	3- 4-42	−.08	1.06	7.19	.84	−4.46
32	3-11-42	.26	2.50	7.11	.95	−4.24
33	3-18-42	−.28	1.03	7.37	1.03	−4.47
34	3-25-42	.30	3.39	7.09	1.10	−4.38
35	4- 1-42	−.62	.16	7.39	1.18	−4.76
36	4- 8-42	−.26	0	6.77	1.25	−4.71
37	4-15-42	.24	1.98	6.51	1.33	−4.24
38	4-22-42	−.34	0	6.75	1.40	−3.91
39	4-29-42	−.18	0	6.41	1.45	−3.64
40	5- 6-42	−.14	0	6.23	1.50	−3.07
41	5-13-42	.02	2.07	6.09	1.56	−2.44
42	5-20-42	0	.35	6.11	1.58	−2.00
43	5-27-42	.04	.52	6.11	1.60	−1.94
44	6- 3-42	−.14	.50	6.15	1.62	−2.10
45	6-10-42	1.00	5.66	6.01	1.63	−1.64
46	6-17-42	−.40	.79	7.01	1.65	−3.64
47	6-24-42	−.12	1.07	6.61	1.65	−3.68
48	7- 1-42	−.14	1.50	6.49	1.66	−3.18

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 2—Continued						
49	7- 8-42	−.20	1.31	6.35	1.65	−2.67
50	7-15-42	.50	1.52	6.15	1.63	−3.43
51	7-22-42	−.36	0	6.65	1.60	−3.19
52	7-29-42	.12	1.75	6.29	1.57	−2.75
53	8- 5-42	−.20	.11	6.41	1.53	−2.78
54	9- 9-42	−.08	.43	6.31	1.29	−3.44
55	4-10-45	−.12	.10	5.73	1.26	−.27
56	4-17-45	−.15	0	5.61	1.34	.50
57	4-24-45	.24	2.35	5.46	1.41	1.49
58	5- 1-45	.49	3.67	5.70	1.46	2.10
59	5- 8-45	−.01	.25	6.19	1.51	−2.73
60	5-15-45	.03	1.28	6.18	1.56	−2.41
61	5-22-45	−.05	.43	6.21	1.58	−2.04
62	5-29-45	−.17	0	6.16	1.60	−1.83
63	6- 5-45	−.20	.23	5.99	1.62	−1.32
64	6-12-45	−.18	0	5.79	1.63	−.61
65	6-19-45	−.06	.91	5.61	1.65	.05
66	6-26-45	−.16	.59	5.55	1.65	.74
67	7- 3-45	−.14	.75	5.39	1.66	3.87
68	7-10-45	.10	.72	5.25	1.65	1.67
69	7-17-45	.16	2.69	5.35	1.62	5.75
70	7-24-45	−.05	1.49	5.59	1.59	2.49
71	7-31-45	−.05	1.10	5.54	1.56	2.21
72	8- 8-45	.02	2.25	5.49	1.67	3.69
73	8-15-45	−.02	.50	5.51	1.47	2.78
74	8-22-45	−.07	0	5.49	1.42	3.36
75	8-29-45	−.15	2.09	5.42	1.38	5.06
76	9- 4-45	−.08	.15	5.27	1.32	7.12
77	9-12-45	.32	2.82	5.19	1.27	8.84
78	9-19-45	.24	2.69	5.51	1.22	8.20
79	9-26-45	−.08	.40	5.75	1.17	−.81
80	10- 3-45	−.10	.71	5.67	1.11	−.20
81	10-11-45	−.14	.15	5.57	1.16	.92
82	10-17-45	−.10	0	5.43	.90	2.89
83	10-24-45	−.04	.92	5.33	.92	5.22
84	10-31-45	.02	.64	5.29	.87	7.78
85	11- 7-45	−.09	.21	5.31	.81	9.59
86	11-14-45	−.03	0	5.22	.75	11.10
87	12-11-45	0	.35	5.35	.56	14.45
88	2- 5-46	−.12	.18	6.80	.57	−4.18
89	2-12-46	.20	1.45	6.58	.62	−3.82
90	2-19-46	−.06	2.22	6.78	.68	−3.70
91	2-26-46	.25	.56	6.71	.76	−3.39
92	3- 5-46	−.34	.38	6.96	.85	−3.53
93	3-12-46	−.18	.08	6.62	.96	−3.40
94	3-19-46	.59	1.79	6.44	1.04	−3.17
95	3-26-46	−.50	0	7.03	1.11	−3.56
96	4- 2-46	.66	5.19	6.53	1.19	−3.51
97	4- 9-46	−.60	0	7.19	1.26	−4.97
98	4-16-46	−.16	.93	6.59	1.34	−4.74
99	4-23-46	−.06	0	6.43	1.41	−4.05
100	4-30-46	.50	3.69	6.37	1.46	−3.53
101	5- 7-46	−.26	1.12	6.87	1.51	−3.90
102	5-14-46	.36	2.54	6.61	1.56	−3.60
103	5-28-46	−.90	.15	7.66	1.60	−4.55
104	6- 4-46	−.02	.81	6.76	1.62	−4.56
105	6-11-46	−.41	0	6.74	1.63	−3.92
106	6-18-46	−.20	.53	6.33	1.65	−3.31
107	6-25-46	−.13	.42	6.13	1.65	−2.80
108	7- 2-46	.04	2.45	6.00	1.66	−2.20
109	7- 9-46	−.16	.86	6.04	1.65	−2.14
110	7-16-46	−.14	.19	5.88	1.63	−1.70
111	7-23-46	.91	9.10	5.74	1.60	−.82
112	7-30-46	−.78	.93	7.65	1.56	−3.27
113	8- 6-46	.36	2.42	6.87	1.52	−4.34
114	8-13-46	−.50	1.11	7.23	1.48	−4.68
115	8-20-46	−.40	0	6.73	1.43	−4.84
116	8-27-46	−.16	.61	6.33	1.39	−4.21
117	9- 3-46	.07	1.66	6.17	1.34	−3.43
118	9-10-46	−.13	.27	6.24	1.28	−2.07
119	9-17-46	.01	.88	6.11	1.23	−2.58
120	9-24-46	.15	1.54	6.12	1.17	−2.34
121	10- 1-46	−.01	0	6.27	1.12	−2.28
122	10- 8-46	−.13	.12	6.26	1.07	−3.06
123	10-15-46	−.03	.51	6.13	1.01	−2.52
124	10-22-46	−.08	0	6.10	.95	−2.07
125	10-29-46	.10	1.12	6.02	.88	−1.66

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 2—Continued						
126	11- 5-46	-.05	.09	6.12	.83	-1.59
127	11-12-46	-.05	.03	6.07	.77	-1.23
128	11-19-46	-.03	.15	6.02	.71	-.76
129	11-26-46	.02	.78	5.99	.66	-.23
130	12- 3-46	0	.19	6.01	.60	.19
131	12-10-46	-.05	0	6.01	.56	.84
132	12-17-46	-.04	0	5.96	.52	1.73
133	12-24-46	-.04	0	5.92	.48	3.34
134	12-31-46	.01	.47	5.88	.46	5.35
135	1- 7-47	.08	1.28	5.89	.45	7.23
136	1-14-47	.48	2.59	5.97	.47	8.75
137	1-21-47	-.06	.35	6.45	.49	1.56
138	1-28-47	-.06	0	6.39	.51	-2.39
139	2- 4-47	.09	.82	6.33	.56	-2.05
140	2-11-47	-.07	.10	6.42	.61	-2.35
141	2-18-47	-.05	0	6.35	.67	-2.16
142	2-25-47	-.02	.28	6.30	.75	-1.81
143	3- 4-47	.11	1.20	6.28	.84	-1.51
144	3-11-47	.88	6.34	6.39	.95	-1.73
145	3-18-47	-.26	1.64	7.27	1.03	-5.12
146	3-25-47	-.27	.84	7.01	1.10	-5.39
147	4- 1-47	-.13	.34	6.74	1.18	-5.07
148	4- 8-47	.01	.66	6.61	1.25	-4.46
149	4-15-47	.01	1.80	6.62	1.33	-4.23
150	4-22-47	.16	2.35	6.63	1.40	-3.82
151	4-29-47	-.33	.07	6.79	1.45	-4.75
152	5- 6-47	.09	2.24	6.46	1.50	-4.25
153	5-13-47	-.20	0	6.55	1.56	-3.60
154	5-20-47	-.18	0	6.35	1.58	-3.28
155	5-27-47	.64	3.79	6.17	1.60	-2.77
156	6- 3-47	-.17	.97	6.81	1.62	-3.79
157	6-10-47	-.32	0	6.64	1.63	-3.86
158	6-17-47	-.07	.41	6.32	1.65	-3.28
159	6-24-47	.61	4.02	6.25	1.65	-2.87
160	7- 1-47	-.47	0	6.86	1.66	-3.55
161	7- 8-47	.16	3.66	6.39	1.65	-3.43
162	7-15-47	-.22	.58	6.55	1.63	-2.85
163	7-22-47	.01	1.08	6.33	1.60	-1.98
164	7-29-47	-.07	1.79	6.34	1.57	-3.00
165	8- 5-47	-.14	.21	6.27	1.53	-2.57
166	8-12-47	.04	2.83	6.13	1.49	-2.18
167	8-19 47	.25	3.12	6.17	1.44	-1.92
168	8-26-47	.07	1.29	6.42	1.40	-2.32
169	9- 2-47	-.28	0	6.49	1.35	-2.46
170	9- 9-47	-.14	0	6.21	1.29	-1.78
171	9-16-47	-.06	.48	6.07	1.24	-1.13
172	9-23-47	-.08	.73	6.01	1.18	-.45
173	9-30-47	.04	.95	5.93	1.13	.08
174	10- 7-47	-.06	.78	5.97	1.08	.28
175	10-14-47	.02	.83	5.91	1.02	1.04
176	10-21-47	-.02	.65	5.93	.96	1.86
177	10-28-47	-.06	.19	5.91	.89	3.24
Pond 4						
1	10- 2-40	-0.32	0.30	3.24	1.11	5.31
2	10- 9-40	-.26	.19	2.92	1.06	6.00
3	10-16-40	-.36	0	2.66	1.00	6.58
4	10-23-40	-.36	.60	2.30	.94	7.05
5	10-30-40	-.43	0	1.94	.88	7.40
6	11- 6-40	-.23	1.09	1.51	.82	7.44
7	11-13-40	.39	1.28	1.28	.76	7.45
8	11-20-40	.39	2.15	1.67	.70	8.09
9	11-27-40	-.06	.04	2.06	.65	5.08
10	12- 4-40	-.06	.91	2.00	.60	5.72
11	12-11-40	-.18	0	1.94	.55	6.31
12	12-18-40	-.12	.15	1.76	.51	6.71
13	12-26-40	-.11	.54	1.64	.53	6.84
14	1- 1-41	.41	2.22	1.53	.40	6.77
15	1 -8-41	.14	1.10	1.94	.45	1.63
16	1-15-41	-.06	0	2.08	.47	2.08
17	1-22-41	.16	.93	2.02	.49	3.42
18	1 29 41	-.06	0	2.18	.52	3.96
19	2- 5-41	-.02	.53	2.12	.57	4.49
20	2-12-41	-.02	.85	2.10	.62	4.95

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 4—Continued						
21	2-19-41	.04	1.00	2.08	.68	4.88
22	2-26-41	−.08	.48	2.12	.75	3.72
23	3- 5-41	−.14	.17	2.04	.73	4.20
24	3-12-41	.40	2.54	1.90	.96	4.81
25	3-19-41	.26	1.12	2.30	1.04	1.52
26	3-26-41	.44	1.02	2.56	1.10	2.08
27	4- 2-41	.02	.03	3.00	1.18	1.08
28	4- 9-41	.06	.94	3.02	1.25	2.59
29	4-16-41	−.16	0	3.08	1.33	3.90
30	4-23-41	−.18	.43	2.92	1.40	4.64
31	4-30-41	−.22	.35	2.74	1.45	5.23
32	5- 7-41	−.18	1.10	2.52	1.50	5.64
33	5-14-41	−.36	0	2.34	1.56	6.04
34	5-21-41	−.42	0	1.98	1.59	6.34
35	5-28-41	−.46	.09	1.56	1.60	6.72
36	6- 4-41	−.33	.05	1.10	1.62	7.17
37	6-11-41	−.23	.25	.77	1.63	7.49
38	6-18-41	−.09	.71	.54	1.65	7.75
39	7-30-41	−.09	1.87	1.49	1.56	2.39
40	8- 6-41	−.29	.03	1.40	1.52	4.15
41	10- 1-41	.02	1.92	.50	1.12	8.46
42	10- 8-41	.86	4.82	.52	1.07	8.60
43	10-15-41	−.30	0	1.38	1.01	4.68
44	10-22-41	−.16	.38	1.08	.95	4.12
45	10-29-41	−.10	.31	.92	.88	5.54
46	11- 5-41	.10	.69	.82	.83	6.56
47	11-12-41	−.16	0	.92	.77	6.92
48	11-19-41	−.12	0	.76	.71	7.30
49	11-26-41	−.12	.02	.64	.66	7.63
50	12- 3-41	.20	2.36	.52	.60	7.75
51	12-10-41	.24	1.05	.72	.56	7.94
52	12-17-41	0	.78	.96	.51	4.40
53	12-24-41	.76	3.05	.96	.48	5.01
54	12-31-41	.16	.33	1.72	.46	1.60
55	1- 7-42	2.39	4.09	1.88	.45	.38
56	1-14-42	.43	0	4.27	.47	−1.91
57	1-21-42	.10	0	4.70	.49	−.14
58	1-28-42	−.01	.14	4.80	.51	1.62
59	2- 4-42	−.05	.45	4.79	.56	3.18
60	2-11-42	.02	1.64	4.74	.61	4.11
61	2-18-42	.80	3.75	4.76	.67	4.58
62	2-25-42	.44	.98	5.56	.75	−.80
63	3- 4-42	−.10	1.06	6.00	.84	.19
64	3-11-42	.06	2.50	5.90	.95	.59
65	3-18-42	0	1.03	5.96	1.03	−.38
66	3-25-42	−.06	3.39	5.96	1.10	.26
67	4- 1-42	−.14	.16	5.90	1.18	−.05
68	4- 8-42	−.14	0	5.76	1.25	1.14
69	4-15-42	.08	1.98	5.62	1.33	2.29
70	4-22-42	−.20	0	5.70	1.40	2.07
71	4-29-42	−.24	0	5.50	1.45	2.79
72	5- 6-42	−.26	0	5.26	1.50	3.48
73	5-13-42	−.14	2.07	5.00	1.56	4.12
74	5-20-42	−.20	.35	4.86	1.58	4.57
75	5-27-42	−.30	.52	4.66	1.60	4.68
76	6- 3-42	−.22	.50	4.36	1.62	4.85
77	6-10-42	.16	5.66	4.14	1.63	4.15
78	7- 1-42	0	1.50	4.16	1.66	3.39
79	7- 8-42	0	1.71	4.16	1.65	3.75
80	7-15-42	−.14	1.52	4.16	1.63	3.55
81	7-22-42	−.24	0	4.02	1.60	4.08
82	7-29-42	.02	1.75	3.78	1.57	4.68
83	8- 5-42	−.30	.11	.3.80	1.53	4.56
84	5- 8-45	−.11	.25	2.29	1.52	−.20
85	5-15-45	.23	1.28	2.18	1.40	1.44
86	5-22-45	−.13	.43	2.41	1.58	3.45
87	5-29-45	−.18	0	2.28	1.60	4.22
88	6- 5-45	−.44	0	2.10	1.62	5.05
89	6-12-45	−.28	.24	1.66	1.63	5.55
90	6-19-45	−.18	.55	1.38	1.65	6.29
91	6-26-45	−.19	.41	1.20	1.65	6.81
92	7- 3-45	−.13	.65	1.01	1.66	7.22
93	7-10-45	−.12	.48	.88	1.65	7.71
94	7-17-45	−.01	1.12	.76	1.62	7.05
95	7-24-45	.18	2.33	.75	1.59	8.17
96	8-15-45	−.05	.90	.97	1.47	6.23
97	8-22-45	−.10	.48	.92	1.42	6.82

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 4—Continued						
98	8-29-45	.04	1.44	.82	1.38	7.18
99	9-19-45	.28	2.62	.86	1.22	7.05
100	9-26-45	−.08	.50	1.14	1.16	2.79
101	10- 3-45	−.13	.37	1.06	1.11	3.88
102	10-10-45	−.12	.07	.93	1.05	4.95
103	10-17-45	−.14	0	.81	.99	5.88
104	10-24-45	−.02	.83	.67	.92	6.53
105	10-31-45	−.04	.59	.65	.87	6.93
106	11- 7-45	−.09	.14	.61	.81	7.23
107	11-14-45	−.10	0	.52	.75	7.47
108	11-21-45	−.12	0	.42	.70	7.58
109	11-28-45	0	.78	.30	.64	7.69
110	12- 5-45	.05	1.08	.30	.59	7.76
111	12-12-45	−.05	.24	.35	.55	7.78
112	12-19-45	.67	2.78	.30	.50	7.85
113	12-26-45	.90	2.84	.97	.47	4.89
114	1- 2-46	1.17	2.21	1.87	.46	−.21
115	1- 9-46	1.09	1.23	3.04	.46	−2.27
116	1-16-46	1.31	2.64	4.13	.47	−1.16
117	1-23-46	.57	1.13	5.44	.50	−1.02
118	1-30-46	−.13	0	6.01	.53	−.21
119	2- 6-46	−.07	.14	5.88	.57	.77
120	2-13-46	.08	1.36	5.81	.62	2.02
121	2-20-46	.33	1.43	5.89	.68	2.12
122	2-27-46	−.19	.53	6.22	.77	.76
123	3- 6-46	−.11	.33	6.03	.85	1.14
124	3-13-46	−.15	.05	5.92	.97	2.00
125	3-20-46	.10	1.54	5.77	1.05	3.22
126	4-10-46	−.16	0	6.15	1.27	.01
127	4-17-46	−.12	.71	5.99	1.35	1.25
128	4-24-46	−.22	0	5.87	1.42	2.62
129	5- 1-46	.34	3.12	5.65	1.47	3.48
130	5- 8-46	.01	1.61	5.99	1.52	2.39
131	5-15-46	0	1.78	6.00	1.57	3.05
132	5-22-46	.35	3.62	6.00	1.59	3.13
133	5-29-46	−.31	.03	6.35	1.61	.15
134	6- 5-46	0	1.21	6.04	1.62	1.16
135	6-12-46	−.37	0	6.04	1.63	2.33
136	6-19-46	−.16	.80	5.67	1.65	3.19
137	6-26-46	−.29	.32	5.51	1.66	3.74
138	7- 3-46	.06	2.76	5.22	1.66	4.07
139	7-10-46	.14	1.46	5.28	1.64	3.76
140	7-17-46	−.02	2.48	5.42	1.62	3.21
141	7-24-46	1.08	6.60	5.40	1.59	3.21
142	7-31-46	−.33	.71	6.48	1.56	−.87
143	8- 6-46	.08	1.47	6.15	1.30	.12
144	8-14-46	−.12	.73	6.23	1.69	.51
145	8-21-46	−.14	.94	6.11	1.43	1.38
146	8-28-46	−.23	.07	5.97	1.39	2.52
147	9- 4-46	−.13	1.28	5.74	1.34	2.96
148	9-11-46	−.27	.10	5.61	1.28	3.25
149	9-17-46	−.17	.83	5.34	1.05	3.33
150	9-25-46	−.05	1.38	5.17	1.34	3.52
151	10- 2-46	−.27	0	5.12	1.12	3.76
152	10- 9-46	−.26	.08	4.85	1.06	3.82
153	10-16-46	−.16	1.00	4.59	1.00	4.18
154	10-23-46	−.23	0	4.43	.94	4.38
155	10-30-46	−.05	1.37	4.20	.88	4.67
156	11- 6-46	−.20	.03	4.15	.82	4.77
157	11-13-46	−.24	.06	3.95	.76	4.91
158	11-20-46	−.24	.16	3.71	.71	5.31
159	11-27-46	−.17	.60	3.47	.66	5.89
160	12- 4-46	−.36	0	3.30	.60	6.36
161	12-11-46	−.12	0	2.94	.56	6.68
162	12-18-46	−.23	0	2.82	.51	7.35
163	12-30-46	−.17	.39	2.43	.46	8.05
164	1-15-47	.21	2.67	2.16	.47	7.97
165	1-22-47	−.02	.33	2.37	.49	3.23
166	1-29-47	−.08	0	2.35	.52	3.11
167	2- 5-47	−.03	.63	2.27	.57	4.33
168	2-12-47	−.12	.20	2.24	.62	5.03
169	2-19-47	−.17	0	2.12	.68	5.50
170	2-26-47	−.18	.34	1.95	.76	5.83
171	3- 5-47	−.02	1.15	1.77	.73	6.16
172	3-12-47	2.48	5.74	1.75	.96	6.00
173	3-19-47	1.22	2.21	4.23	1.04	−2.57
174	3-26-47	.25	.10	5.45	1.10	−.95

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 4—Continued						
175	4- 2-47	.16	.76	5.70	1.18	.45
176	4- 9-47	-.09	.07	5.86	1.25	1.68
177	4-16-47	.48	4.40	5.77	1.33	2.29
178	4-23-47	-.27	.02	6.25	1.40	-.19
179	4-30-47	-.21	.03	5.98	1.45	.54
180	5- 7-47	-.02	1.73	5.77	1.50	1.77
181	5-14-47	-.29	0	5.75	1.56	2.90
182	5-21-47	-.25	.26	5.46	1.59	3.38
183	5-28-47	.52	4.70	5.21	1.60	3.75
184	6- 4-47	.04	1.12	5.73	1.62	1.55
185	6-11-47	-.25	0	5.77	1.63	1.15
186	6-18-47	-.12	1.48	5.52	1.65	2.22
187	6-25-47	.55	4.95	5.40	1.65	3.06
188	7- 2-47	.08	1.71	5.95	1.66	.56
189	7- 9-47	.21	2.82	6.03	1.65	1.35
190	7-16-47	-.49	.03	6.24	1.63	.98
191	7-23-47	-.12	.88	5.75	1.60	1.83
192	7-30-47	-.14	1.22	5.63	1.56	2.60
193	8- 6-47	-.27	.18	5.49	1.52	3.01
194	8-13-47	-.07	2.07	5.22	1.48	3.32
195	8-20-47	.01	2.02	5.15	1.43	3.40
196	8-27-47	-.03	1.44	5.16	1.39	3.27
197	9- 3-47	-.27	0	5.13	1.34	2.61
198	9-10-47	-.28	.04	4.86	1.28	3.11
199	9-17-47	-.20	.84	4.58	1.23	3.61
200	9-24-47	-.14	1.19	4.38	1.17	4.06
201	10- 1-47	-.26	0	4.24	1.12	4.40
202	10- 8-47	-.21	1.31	3.98	1.07	5.05
203	10-15-47	-.30	.35	3.77	1.01	5.00
204	10-22-47	-.14	.60	3.47	.95	4 78
205	10-29-47	-.23	.19	3.33	.88	4.13
Pond 5						
1	4- 3-40	0.22	1.76	4.09	1.20	0.25
2	4-11-40	-.10	.78	4.31	1.28	-.11
3	4-17-40	-.19	.24	4.21	1.35	.25
4	4-24-40	-.20	.51	4.02	1.41	.71
5	5- 1-40	-.09	.88	3.82	1.46	1.24
6	5- 8-40	-.38	.38	3.73	1.54	2.24
7	5-15-40	-.40	.01	3.35	1.57	2.58
8	5-22-40	-.52	0	2.95	1.58	3.00
9	5-29-40	-.52	.61	2.43	1.60	2.98
10	6-19-40	.21	1.46	1.96	1.65	2.59
11	6-26-40	-.34	1.54	2.17	1.65	1.65
12	7- 3-40	-.13	1.50	1.83	1.65	2.21
13	7-10-40	.19	2.04	1.70	1.64	1.47
14	7-17-40	-.03	2.32	1.89	1.62	.29
15	7-24-40	-.54	.32	1.86	1.59	.94
16	7-31-40	-.21	1.24	1.32	1.56	1.67
17	8- 7-40	-.18	1.32	1.11	1.52	1.60
18	8-14-40	-.50	2.32	.93	1.47	1.65
19	1-15-41	-.12	0	1.13	.47	-.67
20	1-22-41	-.03	.61	1.01	.49	.97
21	1-29-41	-.30	.02	.98	.51	.93
22	2- 5-42	-.27	.45	.68	.56	1.05
23	2-12-41	1.00	1.05	.41	.61	.86
24	2-19-41	.27	1.06	1.41	.67	.43
25	2-26-41	-.05	.22	1.68	.75	-.37
26	3- 6-41	-.10	.19	1.63	.86	1.13
27	3-12-41	1.50	2.67	1.53	.96	1.60
28	3-19-41	.08	.70	3.03	1.03	-.67
29	3-26-41	0	.94	3.11	1.10	-.15
30	4- 2-41	-.15	.28	3.11	1.18	-.38
31	4- 9-41	-.01	.85	2.96	1.25	.39
32	4-16-41	-.33	.18	2.95	1.33	.60
33	4-23-41	-.38	.42	2.62	1.40	1.66
34	4-30-41	-.43	.03	2.26	1.45	2.41
35	5- 7-41	-.48	.63	1.83	1.50	2.36
36	5-14-41	-.82	0	1.35	1.56	2.21
37	12-17-41	-.16	.54	2.05	.52	.29
38	12-24-41	1.41	3.15	1.89	.47	.98
39	12-31-41	.84	1.17	3.30	.46	-1.58
40	1- 7-42	.64	6.29	4.14	.45	-.59
41	1-14-42	-.22	.03	4.78	.47	-1.22

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
	Pond 5—Continued					
42	1-21-42	-.08	0	4.56	.49	-1.09
43	1-28 42	-.02	.02	4.48	.51	-1.00
44	2- 4-42	0	.45	4.46	.56	-.85
45	2-11-42	.06	.74	4.46	.61	-.67
46	2-18-42	.02	3.10	4.52	.67	-.90
47	2-25-42	-.02	.73	4.54	.75	-1.26
48	3- 4-42	0	1.09	4.52	.84	-1.03
49	3-11-42	-.08	2.70	4.52	.95	-.98
50	3-18-42	.24	1.94	4.44	1.03	-1.26
51	3-25-42	.18	2.37	4.68	1.10	-1.54
52	4- 1-42	-.15	.57	4.86	1.18	-.87
53	4- 8-42	-.20	0	4.71	1.25	-.70
54	4-15-42	-.02	2.03	4.51	1.33	-.67
55	4-22-42	-.19	.12	4.49	1.40	-.68
56	4-29-42	-.20	0	4.30	1.45	-.43
57	5- 6-42	-.30	.01	4.10	1.50	-.05
58	5-13-42	0	1.76	3.80	1.56	.45
59	5-28-42	.02	.15	3.70	1.60	.75
60	6- 4-42	-.40	.73	3.72	1.62	1.78
61	7- 8-42	-.22	.88	3.62	1.65	.82
62	7-15-42	-.40	1.32	3.40	1.63	1.62
63	7-22-42	-.54	.16	3.00	1.60	2.70
64	7-29-42	-.26	1.24	2.46	1.57	2.97
65	8- 5-42	-.61	.24	2.20	1.53	2.94
66	8-12-42-	.19	3.57	1.59	1.49	2.76
67	4-18-45	.15	3.33	1.25	1.34	1.57
68	5- 9-45	-.23	.80	4.22	1.53	.39
69	5-16-45	-.09	1.20	3.99	1.57	-.04
70	5-23-45	-.21	1.08	3.90	1.59	.05
71	6-13-45	-.67	.18	2.54	1.64	2.55
72	6-20-45	2.61	3.17	1.87	1.65	2.45
73	6-27-45	-.16	1.41	4.48	1.66	.04
74	7- 4-45	-.30	.51	4.32	1.66	.49
75	7-11-45	-.16	1.11	4.02	1.64	1.62
76	7-18-45	.58	1.73	3.86	1.62	2.30
77	7-25-45	.04	.79	4.44	1.58	3.07
78	8- 1-45	-.27	.52	4.48	1.56	-.16
79	8- 8-45	-.34	1.91	4.21	1.50	.78
80	8-15-45	.30	1.36	3.87	1.47	1.77
81	8-22-45	-.25	.25	4.17	1.43	1.17
82	8-29-45	-.46	.01	3.92	1.39	1.75
83	9- 4-45	-.38	.79	3.46	1.34	2.78
84	9-12-45	-.48	.71	3.08	1.44	3.04
85	9-19-45	.50	3.62	2.60	1.21	3.20
86	9-26-45	-.38	.02	3.10	1.16	1.60
87	10- 3-45	-.41	.17	2.72	1.10	2.00
88	10-11-45	-.66	.06	2.31	1.05	2.30
89	10-17-45	-.64	0	1.65	.99	1.98
90	10-24-45	-.63	.63	1.01	.92	1.64
91	10-31-45	-.42	.81	.38	.86	1.38
92	12-26-45	2.35	2.92	1.47	.47	-1.14
93	1- 2-46	.66	2.27	3.82	.45	-1.44
94	1- 9-46	.01	1.43	4.48	.46	-.93
95	1-16-46	-.38	2.16	4.49	.47	-1.15
96	1-23-46	.43	1.27	4.11	.50	-2.50
97	1-30-46	-.07	0	4.54	.53	-1.55
98	2- 6-46	-.05	.15	4.47	.57	-1.06
99	2-13-46	.05	1.36	4.42	.62	-.90
100	2-20-46	.04	.96	4.47	.68	-.89
101	2-27-46	-.02	.84	4.51	.77	-.98
102	3- 6-46	-.09	.60	4.49	.85	-.84
103	3-13-46	-.18	.43	4.40	.97	-.46
104	3-20-46	.24	.77	4.22	1.05	-.09
105	4-10-46	-.25	0	4.42	1.27	-.92
106	4-17-46	-.07	1.20	4.17	1.35	-.61
107	4-24-46	-.26	0	4.10	1.42	-.99
108	5- 1-46	.48	3.08	3.84	1.47	-.38
109	5- 8-46	-.01	1.49	4.32	1.52	-.42
110	5-15-46	.03	1.21	4.31	1.57	-.62
111	5-22-46	.23	5.79	4.34	1.59	-.58
112	5-29-46	-.24	.01	4.57	1.61	-1.46
113	6- 5-46	.12	2.08	4.33	1.62	-.99
114	6-12-46	-.32	0	4.45	1.63	-1.09
115	6-19-46	-.37	1.01	4.13	1.65	-.65
116	6-26-46	-.42	.32	3.76	1.66	-.27
117	7- 3-46	-.06	1.17	3.34	1.66	.23
118	7-10-46	-.24	.03	3.28	1.64	.30

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 5—Continued						
119	7-17-46	-.29	1.02	3.04	1.62	.62
120	7-24-46	1.00	3.40	2.75	1.59	1.84
121	7-31-46	.32	5.72	3.75	1.56	-.73
122	8- 6-46	.42	2.63	4.07	1.52	-.90
123	8-14-46	-.22	.80	4.49	1.47	-1.20
124	8-21-46	-.35	.02	4.27	1.43	-.14
125	8-28-46	-.39	.14	3.92	1.39	.48
126	9- 4-46	.27	2.55	3.53	1.34	1.26
127	9-11-46	-.17	.49	3.80	1.28	.84
128	9-18-46	-.24	.52	3.63	1.23	1.52
129	9-25-46	.48	2.35	3.39	1.17	2.18
130	10- 2-46	-.30	0	3.87	1.12	-.43
131	10- 9-46	-.33	.21	3.57	1.06	.36
132	10-16-46	-.30	.47	3.24	1.00	1.41
133	10-23-46	-.39	0	2.94	.94	2.17
134	10-30-46	.28	2.19	2.55	.88	2.22
135	11- 6-46	-.31	0	2.83	.82	1.75
136	11-13-46	-.39	.02	2.52	.76	1.99
137	11-20-46	.27	.75	2.13	.70	1.99
138	11-27-46	-.32	.65	2.40	.65	1.35
139	12-18-46	-.40	0	1.65	.51	1.53
140	12-30-46	-.35	.50	.88	.46	1.12
141	1- 7-47	.62	1.44	.53	.45	.72
142	1-14-47	2.51	3.31	1.15	.47	.34
143	1-22-47	.01	.42	3.66	.50	-1.42
144	1-29-47	-.12	.17	3.67	.52	-.62
145	2- 5-47	.47	1.71	3.55	.57	.05
146	2-12-47	-.15	.11	4.02	.61	-.32
147	2-19-47	-.18	0	3.87	.68	.28
148	2-26-47	-.21	.37	3.69	.76	.90
149	3- 5-47	.13	1.49	3.48	.85	1.67
150	3-26-47	-.15	.09	4.61	1.11	-1.71
151	4- 2-47	.11	1.76	4.46	1.20	-.83
152	4- 9-47	-.17	0	4.57	1.26	-1.62
153	4-16-47	.25	5.33	4.40	1.34	-.68
154	4-23-47	-.19	.22	4.65	1.40	-1.93
155	5- 1-47	-.22	.16	4.46	1.46	-.86
156	5- 7-47	.18	1.58	4.24	1.51	-.63
157	5-14-47	-.31	0	4.42	1.56	-.77
158	5-21-47	-.40	0	4.11	1.58	-.03
159	5-28-47	.21	2.78	3.71	1.60	.48
160	6- 4-47	.40	.74	3.92	1.62	.10
161	6-11-47	-.41	0	4.32	1.63	.09
162	6-18-47	-.30	.81	3.91	1.65	.77
163	6-25-47	.87	5.71	3.61	1.65	1.32
164	7- 2-47	-.22	.58	4.48	1.66	-.73
165	7- 9-47	-.34	.90	4.26	1.65	-.19
166	7-16-47	-.50	.13	3.92	1.63	.34
167	7-23-47	-.24	1.37	3.42	1.59	.88
168	7-30-47	-.38	.84	3.18	1.56	1.63
169	8- 6-47	-.59	0	2.80	1.52	2.56
170	8-13-47	-.37	1.73	2.21	1.48	2.54
171	8-20-47	-.04	2.55	1.84	1.43	2.42
172	8-27-47	-.01	1.05	1.80	1.39	2.24
173	9- 3-47	-.80	.10	1.79	1.34	1.78
174	9-10-47	-1.04	.42	.99	1.28	1.60
175	9-17-47	.60	1.38	-.05	1.23	1.19
176	9-24-47	.01	2.15	.55	1.17	1.66
177	10- 1-47	-.56	.06	.56	1.12	1.28
Pond 6						
1	1- 8-41	0.39	1.32	4.33	0.45	17.22
2	1-15-41	-.09	0	4.72	.47	17.27
3	1-22-41	.10	.81	4.63	.49	17.59
4	1-29-41	-.10	0	4.73	.51	17.71
5	2- 5-41	.04	.58	4.63	.56	18.10
6	2-12-41	.21	.99	4.67	.61	18.25
7	2-19-41	.23	.85	4.88	.67	18.27
8	2-26-41	-.05	.17	5.11	.75	18.00
9	3- 5-41	-.12	.13	5.06	.86	18.11
10	3-12-41	.58	2.49	4.94	.96	18.36
11	3-19-41	.10	.93	5.52	1.03	16.58
12	3-26-41	.18	.97	5.62	1.10	16.92
13	4- 2-41	-.07	.23	5.80	1.18	15.98

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 6—Continued						
14	4- 9-41	.09	.93	5.73	1.25	16.59
15	4-16-41	-.18	0	5.82	1.33	16.95
16	4-23-41	-.16	.87	5.64	1.40	17.51
17	4-30-41	-.26	.07	5.48	1.45	17.93
18	5- 7-41	-.29	.53	5.22	1.50	18.10
19	5-14-41	-.49	0	4.93	1.56	18.54
20	5-21-41	-.57	0	4.44	1.58	18.42
21	1-14-42	.05	0	5.19	.47	8.50
22	1-21-42	.01	0	5.24	.49	11.59
23	1-28-42	.04	.16	5.25	.51	13.28
24	2- 4-42	.06	.48	5.29	.56	14.38
25	2-11-42	.14	1.19	5.35	.61	14.92
26	2-18-42	.60	2.58	5.49	.67	15.45
27	2-25-42	.20	1.60	6.09	.75	11.35
28	3- 4-42	.14	1.09	6.29	.84	10.92
29	3-11-42	.33	2.46	6.43	.95	11.52
30	3-18-42	.20	1.11	6.76	1.03	7.99
31	4- 8-42	-.04	0	7.18	1.25	9.39
32	4-15-42	.12	1.62	7.14	1.33	11.05
33	4-22-42	-.13	0	7.26	1.40	11.48
34	4-29-42	-.16	0	7.13	1.45	12.59
35	5- 6-42	-.22	0	6.97	1.50	13.78
36	5-13-42	.02	1.60	6.75	1.56	14.77
37	6- 4-42	-.12	.62	6.57	1.62	16.25
38	6-11-42	.30	2.73	6.45	1.63	16.85
39	6-18-42	-.06	.71	6.75	1.65	15.38
40	6-25-42	-.04	.59	6.69	1.66	15.59
41	7- 2-42	-.02	.76	6.65	1.66	16.12
42	7- 9-42	.06	1.09	6.63	1.65	16.21
43	7-16-42	-.30	0	6.69	1.63	15.93
44	7-23-42	-.20	.14	6.39	1.60	16.74
45	7-31-42	-.18	3.53	6.19	1.73	17.23
46	8- 6-42	.20	2.47	6.01	1.35	17.04
47	8-12-42	.12	1.10	6.21	1.28	17.94
48	8-20-42	0	2.29	6.33	1.64	16.16
49	4-18-45	.05	1.34	7.22	1.34	19.89
50	4-25-45	.33	4.19	7.27	1.42	20.61
51	5- 2-45	.11	1.70	7.60	1.46	17.07
52	5- 9-45	-.10	.68	7.71	1.53	14.38
53	5-16-45	.03	1.95	7.61	1.57	15.98
54	5-23-45	-.01	1.14	7.64	1.59	16.10
55	6-13-45	-.24	.07	7.19	1.64	18.29
56	6-20-45	.17	3.14	6.95	1.65	18.95
57	6-27-45	-.18	.30	7.12	1.66	19.28
58	7- 4-45	-.17	1.34	6.94	1.66	19.72
59	7-11-45	.17	2.95	6.77	1.64	20.02
60	7-18-45	.23	1.10	6.94	1.62	19.36
61	7-25-45	.04	0	7.17	1.58	18.93
62	7-31-45	-.15	3.01	7.21	1.54	18.32
63	8- 8-45	-.19	.43	7.06	1.50	19.01
64	8-15-45	.10	.92	6.87	1.47	19.20
65	8-22-45	-.16	.77	6.97	1.43	19.65
66	8-29-45	-.20	2.34	6.83	1.39	19.34
67	9- 4-45	-.23	0	6.63	1.34	19.31
68	9-12-45	-.12	1.10	6.40	1.44	20.24
69	9-19-45	.15	2.10	6.28	1.25	20.13
70	9-26-45	-.21	.20	6.43	1.16	18.78
71	10- 3-45	-.20	1.06	6.22	1.10	19.45
72	10-10-45	-.13	0	6.02	1.05	19.96
73	10-31-45	-.07	0	5.44	.86	20.12
74	12-26-45	.57	2.93	5.62	.47	19.57
75	1- 2-46	.42	2.27	6.19	.45	16.26
76	1-30-46	-.02	0	7.19	.53	12.61
77	2- 6-46	-.06	.15	7.17	.57	13.00
78	2-13-46	.15	1.36	7.11	.62	14.17
79	2-20-46	.07	.96	7.26	.68	14.26
80	2-27-46	.02	.84	7.33	.77	14.97
81	3- 5-46	-.03	.60	7.35	.73	14.47
82	3-13-46	-.07	.05	7.32	1.09	15.27
83	3-20-46	.28	3.14	7.25	1.05	15.83
84	3-27-46	.05	1.40	7.53	1.12	13.41
85	4- 3-46	.53	3.48	7.58	1.20	14.10
86	4-10-46	-.13	0	8.11	1.27	6.91
87	4-17-46	.03	1.20	7.98	1.35	10.07
88	4-24-46	-.13	0	8.01	1.42	11.90
89	4-30-46	.21	3.06	7.88	1.21	12.81
90	5- 7-46	-.01	1.02	8.09	1.51	11.16

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 6—Continued						
91	5-15-46	.25	1.68	8.08	1.79	12.53
92	5-22-46	.46	5.79	8.33	1.59	11.25
93	5-29-46	−.15	.01	8.79	1.61	5.49
94	6- 5-46	.01	2.08	8.64	1.62	8.67
95	6-12-46	−.20	0	8.65	1.63	9.91
96	6-19-46	−.13	1.01	8.45	1.65	11.73
97	6-26-46	−.22	.32	8.32	1.66	13.15
98	7- 3-46	−.09	1.17	8.10	1.66	14.34
99	7-10-46	−.16	.03	8.01	1.64	14.89
100	7-17-46	−.10	1.02	7.85	1.62	15.90
101	7-24-46	.18	3.40	7.75	1.59	16.48
102	7-31-46	.03	5.72	7.93	1.56	14.99
103	8- 7-46	.22	2.63	7.96	1.52	15.49
104	8-14-46	−.08	.80	8.18	1.47	13.83
105	8-21-46	−.17	.02	8.10	1.43	13.76
106	8-28-46	−.20	.14	7.93	1.39	15.34
107	9- 4-46	.14	2.55	7.73	1.34	16.36
108	9-11-46	−.04	.49	7.87	1.28	16.22
109	9-18-46	−.04	.52	7.83	1.23	17.21
110	9-25-46	.08	2.34	7.79	1.17	17.57
111	10- 2-46	−.17	0	7.87	1.12	17.39
112	10- 9-46	−.15	.21	7.70	1.06	17.88
113	10-16-46	−.11	.47	7.55	1.00	18.38
114	10-23-46	−.14	0	7.44	.94	18.36
115	10-30-46	.14	2.19	7.30	.88	18.94
116	11- 6-46	−.09	0	7.44	.82	18.75
117	11-13-46	−.10	.02	7.35	.76	19.17
118	11-20-46	.03	.75	7.25	.70	19.36
119	11-27-46	.01	.65	7.28	.65	19.54
120	12-18-46	−.09	0	7.10	.51	19.85
121	12-30-46	−.05	.50	6.93	.46	20.27
122	1- 7-47	.06	1.44	6.88	.45	20.41
123	1-14-47	.43	3.31	6.94	.47	19.59
124	1-22-47	.02	.42	7.37	.55	16.76
125	1-29-47	−.05	.17	7.39	.52	17.19
126	2- 5-47	.09	1.71	7.34	.57	17.64
127	2-12-47	−.08	.11	7.43	.61	17.49
128	2-19-47	−.06	0	7.35	.68	17.89
129	2-26-47	−.08	.37	7.29	.76	17.28
130	3- 5-47	.14	1.49	7.21	.85	18.61
131	3-12-47	.87	6.51	7.35	.96	18.37
132	3-19-47	.34	2.01	8.22	1.04	6.67
133	3-26-47	−.04	.09	8.56	1.11	8.39
134	4- 2-47	.08	1.76	8.52	1.20	10.46
135	4- 9-47	−.01	0	8.60	1.26	11.73
136	4-16-47	.58	5.33	8.59	1.34	12.35
137	4-23-47	−.06	.22	9.17	1.40	4.97
138	5- 1-47	−.15	.16	9.11	1.67	8.18
139	5- 7-47	−.10	1.58	8.96	1.28	11.04
140	5-14-47	−.04	0	8.86	1.56	12.01
141	5-21-47	−.20	0	8.82	1.58	13.45
142	5-28-47	.17	2.78	8.62	1.60	14.50
143	6- 4-47	−.04	.74	8.79	1.62	13.37
144	6-11-47	−.22	0	8.75	1.63	13.76
145	6-18-47	−.09	.81	8.53	1.65	15.06
146	6-25-47	.39	5.71	8.44	1.65	15.70
147	7- 2-47	−.08	.58	8.83	1.66	11.33
148	7- 9-47	−.11	.90	8.75	1.65	13.28
149	7-16-47	−.21	.13	8.64	1.63	14.71
Pond 8						
1	1- 8-41	0.09	1.10	4.56	0.45	3.87
2	1-15-41	−.05	0	4.65	.47	2.90
3	1-22-41	.10	.93	4.60	.49	2.22
4	1-29-41	−.02	0	4.70	.52	2.11
5	2- 5-41	.02	.53	4.68	.57	1.94
6	2-12-41	.06	.85	4.70	.62	2.01
7	2-19-41	.10	1.00	4.76	.68	2.03
8	2-26-41	0	.48	4.86	.87	1.82
9	3- 5-41	−.06	.17	4.86	.73	1.59
10	3-12-41	.32	2.71	4.80	.96	1.58
11	3-19-41	.04	1.12	5.12	1.04	1.24
12	3-26-41	.14	1.02	5.16	1.10	.89
13	4- 2-41	−.04	.03	5.30	1.18	.44

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 8—Continued						
14	4- 9-41	.02	.94	5.26	1.25	.48
15	4-16-41	-.10	0	5.28	1.33	.39
16	4-23-41	.02	.43	5.18	1.40	.69
17	4-30-41	-.10	.35	5.20	1.45	1.01
18	5- 7-41	-.06	1.10	5.10	1.50	.77
19	5-14-41	-.18	0	5.04	1.56	1.29
20	5-21-41	-.20	0	4.86	1.59	1.43
21	12-31-41	.02	.51	4.34	.46	1.80
22	1- 7-42	.60	4.06	4.36	.45	3.46
23	1-14-42	-.02	0	4.96	.47	1.28
24	1-21-42	-.02	0	4.94	.49	.79
25	1-28-42	-.02	.12	4.92	.51	.69
26	2- 4-42	0	.40	4.90	.56	.68
27	2-11-42	.16	1.35	4.90	.61	.99
28	2-18-42	.56	3.80	5.06	.67	1.12
29	2-25-42	.02	.93	5.62	.75	-.15
30	3- 4-42	-.06	1.12	5.64	.84	-.64
31	3-11-42	.10	2.70	5.58	.95	.94
32	3-18-42	-.02	1.14	5.68	1.05	-1.34
33	3-25-42	.08	2.31	5.66	1.15	-1.53
34	4- 1-42	-.17	.16	5.74	1.25	-1.81
35	4- 8-42	-.11	0	5.57	1.30	-1.40
36	4-15-42	.14	1.98	5.46	1.35	-1.16
37	4-22-42	-.16	0	5.60	1.42	-1.32
38	4-29-42	-.14	0	5.44	1.45	-.92
39	5- 6-42	-.16	0	5.30	1.50	-.60
40	5-13-42	.26	2.07	5.14	1.56	-.24
41	5-20-42	-.22	.35	5.40	1.58	.34
42	5-27-42	-.12	.52	5.18	1.60	.03
43	6- 3-42	-.10	.50	5.06	1.62	.33
44	6-10-42	.58	5.56	4.96	1.63	.60
45	6-17-42	0	.79	5.54	1.65	-.26
46	6-24-42	-.08	.91	5.54	1.65	-.17
47	7- 1-42	-.02	1.50	5.46	1.66	0
48	7- 8-42	.18	1.71	5.44	1.65	-.17
49	7-15-42	-.06	1.52	5.62	1.63	-.58
50	7-22-42	-.14	0	5.56	1.60	-.11
51	7-29-42	-.06	1.75	5.42	1.57	.05
52	8- 5-42	-.04	.11	5.36	1.53	.07
53	8-12-42	.18	2.70	5.32	1.49	.51
54	9- 9-42	-.20	1.01	4.74	1.29	[e]-1.00
55	4-10-45	-.21	.04	4.61	1.26	[e]1.80
56	4-17-45	-.12	.58	4.40	1.34	[e]2.00
57	4-24-45	.13	2.21	4.28	1.41	[e]2.40
58	5- 1-45	.59	3.56	4.41	1.46	[e]1.60
59	5- 9-45	-.12	.29	5.00	1.66	[e]-.45
60	5-15-45	.04	1.14	4.88	1.40	[e].60
61	5-22-45	-.16	.67	4.92	1.58	[e]-.10
62	5-29-45	-.27	0	4.76	1.60	[e]1.10
63	1- 3-46	.38	2.72	4.42	.45	[e]-.60
64	1-10-46	.49	2.43	4.80	.46	[e]-1.30
65	1-17-46	.39	2.29	5.29	.48	.52
66	1-24-46	-.04	.53	5.68	.50	-.27
67	2- 5-46	-.07	.16	5.55	.57	-.59
68	2-12-46	.06	1.34	5.48	.62	-.39
69	2-19-46	.10	1.92	5.54	.68	-.71
70	2-26-46	-.05	.65	5.64	.76	-.54
71	3- 5-46	-.07	.35	5.59	.85	-1.05
72	3-12-46	-.07	.07	5.52	.96	-.75
73	3-19-46	.11	1.87	5.45	1.04	-.46
74	3-26-46	-.10	0	5.56	1.11	-1.02
75	4-16-46	-.10	.37	5.46	1.34	-1.16
76	4-23-46	-.03	.50	5.36	1.41	-.82
77	4-30-46	.17	3.75	5.33	1.46	-.61
78	5- 7-46	-.03	.78	5.50	1.51	-1.09
79	5-14-46	.12	2.54	5.47	1.56	-.75
80	5-21-46	.24	4.47	5.59	1.58	-1.00
81	5-28-46	-.34	.03	5.83	1.60	-2.16
82	6- 4-46	-.04	1.10	5.49	1.62	-1.41
83	6-11-46	-.17	0	5.45	1.63	-1.17
84	6-18-46	-.10	1.03	5.28	1.65	-.57
85	6-25-46	-.16	.29	5.18	1.65	-.16
86	7- 2-46	.02	2.45	5.02	1.66	-.80
87	7- 9-46	-.17	0	5.04	1.65	.44
88	7-16-46	-.16	.53	4.87	1.63	[e]1.70
89	7-23-46	.94	6.16	4.71	1.60	[e]2.30
90	7-30-46	-.12	1.14	5.65	1.56	-.51

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 8—Continued						
91	8- 6-46	.01	1.32	5.53	1.52	-.57
92	8-13-46	-.08	1.36	5 54	1.48	-.83
93	8-20-46	-.16	.03	5.46	1.43	-.98
94	8-27 46	-.09	.62	5.30	1.39	-.45
95	9- 3-46	.01	1.42	5.21	1.34	-.54
96	9-10-46	-.11	.24	5.22	1.28	-.26
97	9-17-46	-.04	.68	5.11	1.23	-.08
98	9-24-46	.02	.86	5.07	1.17	.11
99	10- 1-46	.04	1.64	5.09	1.12	e .60
100	10-8 -46	-.11	.10	5.13	1.07	e .70
101	10-15-46	-.06	.45	5.02	1.01	e 1.40
102	10-22-46	-.11	0	4.96	.95	e 1.60
103	10-29-46	.09	1.25	4.85	.88	e 2.10
104	11- 5-46	-.06	.01	4.94	.83	e 1.70
105	11-12-46	-.06	.19	4.88	.77	e 2.00
106	11-19-46	-.07	.11	4.82	.71	e 2.60
107	11-26-46	.01	.45	4.75	.66	e 2.90
108	12- 3-46	-.04	.19	4.76	.60	e 2.80
109	12-10-46	-.08	0	4.72	.56	e 3.10
110	12-17-46	-.05	0	4.64	.52	e 3.50
111	12-24-46	-.09	0	4.59	.48	e 4.00
112	12 31 46	.01	.70	4.50	.46	e 4.30
113	1- 7-47	.15	1.20	4.51	.45	e 4.60
114	1-14-47	.33	2.83	4.66	.47	e 3.50
115	1-21-47	.02	.43	4.99	.49	e -.30
116	1-28-47	-.04	0	5.01	.51	e .50
117	2- 4-47	.08	1.13	4.97	.56	e 1.10
118	2-11-47	-.03	.10	5.05	.61	e .65
119	2-18-47	-.04	.07	5.02	.67	e .90
120	2-25-47	-.02	.37	4.98	.75	e 1.30
121	3- 4-47	.08	1.20	4.96	.84	e 1.50
122	3-11-47	.76	5.98	5.04	.95	e .50
123	3-18-47	-.09	1.72	5.80	1.03	-.41
124	3-25-47	-.13	.75	5.71	1.10	-1.10
125	4- 1-47	-.06	.55	5.58	1.18	-1.20
126	4- 8-47	0	.94	5.52	1.25	-1.11
127	4-15-47	.10	2.17	5.52	1.33	-1.10
128	4-22-47	-.04	1.66	5.62	1.40	-.94
129	4-29-47	-.17	.08	5.58	1.45	-1.37
130	5- 6-47	.04	2.07	5.41	1.50	-.95
131	5-13-47	-.16	0	5.45	1.56	-.93
132	5-20-47	-.12	0	5.29	1.58	-.48
133	5-27 47	.31	4.07	5.17	1.60	-.22
134	6- 3-47	-.06	1.33	5.48	1.62	-.82
135	6-10-47	-.20	0	5.42	1.63	-.65
136	6-17-47	-.10	.41	5.22	1.65	-.16
137	6-24-47	.29	4.02	5.12	1.65	.21
138	7- 1-47	-.15	0	5.41	1.66	-.37
139	7- 8-47	.18	3.66	5.26	1.65	-.02
140	7-15-47	-.18	.58	5.44	1.63	-.19
141	7-22-47	-.02	1.08	5.26	1.60	-.01
142	7-29-47	.03	1.79	5.24	1.57	.30
143	8- 5-47	-.13	.21	5.27	1.53	.42
144	8-12-47	.08	2.15	5.14	1.49	.51
145	8-19-47	.15	2.85	5.22	1.44	.60
146	8-26-47	.09	2.07	5.37	1.40	.29
147	9- 2-47	-.20	.17	5.46	1.35	.37
148	9- 9-47	-.14	0	5.26	1.29	.53
149	9 16 47	-.11	.48	5.12	1.24	e 1.10
150	9-23-47	-.07	.73	5.01	1.18	e 1.40
151	9-30-47	-.08	.95	4.94	1.13	e 1.60
152	10- 7-47	-.09	.78	4.86	1.08	e 1.40
153	10-14-47	.03	.83	4.77	1.02	e 1.90
154	10-21-47	-.08	.65	4.80	.96	e 1.50
155	10-28-47	-.10	.19	4.72	.89	e 1.60
Pond 9						
1	12-11-40	-0.12	0	1.75	0.56	2.88
2	12-18-40	0	.15	1.63	.51	3.27
3	1- 8-41	.48	1.10	2.47	.45	1.91
4	1-15-41	-.10	0	2.95	.47	1.73
5	1-22-41	.08	.93	2.85	.49	2.24
6	1-29-41	-.02	0	2.93	.52	2.03
7	2- 5-41	.04	.53	2.91	.57	2.39

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 9—Continued						
8	2-12-41	.10	.85	2.95	.62	2.45
9	2-19-41	.10	1.00	3.05	.68	2.12
10	2-27-41	−.04	.48	3.15	.87	1.92
11	3- 5-41	−.10	.17	3.11	.73	2.10
12	3-12-41	.26	2.71	3.01	.96	2.23
13	3-19-41	−.02	1.12	3.27	1.04	1.04
14	3-26-41	.08	1.02	3.25	1.10	1.08
15	4- 2-41	−.12	.03	3.33	1.18	.86
16	4- 9-41	.02	.94	3.21	1.25	1.06
17	4-16-41	−.14	0	3.23	1.33	1.20
18	4-23-41	−.04	.43	3.09	1.40	1.62
19	4-30-41	−.12	.35	3.05	1.45	1.65
20	5- 7-41	−.06	1.10	2.93	1.50	1.88
21	5-14-41	−.24	0	2.87	1.56	2.17
22	5-21-41	−.26	0	2.63	1.59	2.36
23	5-28-41	−.36	.09	2.37	1.60	2.69
24	6- 4-41	−.42	.05	2.01	1.62	2.82
25	6-11-41	−.50	.25	1.59	1.63	3.10
26	10-15-41	.02	0	.55	1.01	5.90
27	10-22-41	.20	.25	.57	.95	2.39
28	12-10-41	.20	.46	.77	.56	6.70
29	12-17-41	.12	.74	.97	.51	6.32
30	12-24-41	1.00	3.36	1.09	.48	5.23
31	12-31-41	.10	.51	2.09	.46	1.69
32	1- 7-42	1.02	4.06	2.19	.45	1.60
33	1-14-42	.04	0	3.21	.47	.24
34	1-21-42	0	0	3.25	.49	.75
35	1-28-42	−.04	.12	3.25	.51	1.14
36	2- 4-42	0	.40	3.21	.56	1.36
37	2-11-42	.12	1.35	3.21	.61	1.06
38	2-18-42	.40	3.80	3.33	.67	.29
39	2-25-42	−.20	.93	3.75	.75	−.38
40	3- 4-42	0	1.12	3.55	.84	−.26
41	3-11-42	.10	2.70	3.55	.95	−.10
42	3-18-42	−.16	1.14	3.65	1.05	.02
43	3-25-42	.10	2.31	3.49	1.15	−.69
44	4- 1-42	−.26	.16	3.59	1.25	.08
45	4- 8-42	−.14	0	3.33	1.30	.35
46	4-15-42	.14	1.98	3.19	1.35	.63
47	4-22-42	−.18	0	3.33	1.42	.38
48	4-29-42	−.14	0	3.15	1.45	.87
49	5- 6-42	−.12	0	3.01	1.50	1.22
50	5-13-42	.12	2.07	2.89	1.56	1.64
51	5-20-42	−.10	.35	3.01	1.58	1.16
52	5-27-42	−.14	.52	2.91	1.60	1.36
53	6- 3-42	−.12	.50	2.77	1.62	1.81
54	6-10-42	.86	5.56	2.65	1.63	2.10
55	6-17-42	−.20	.79	3.51	1.65	−.29
56	6-24-42	−.08	.91	3.31	1.65	−.12
57	7- 1-42	0	1.50	3.23	1.66	.05
58	7- 8-42	.10	1.71	3.23	1.65	−.06
59	7-15-42	−.04	1.52	3.33	1.63	.12
60	7-22-42	−.24	0	3.27	1.60	−.26
61	7-29-42	.10	1.75	3.03	1.57	.99
62	8- 5-42	−.14	.11	3.13	1.53	.36
63	9- 9-42	−.02	1.01	3.09	1.29	.32
64	4- 3-45	.01	.61	2.95	1.19	2.27
65	4-10-45	−.13	.04	2.96	1.26	2.30
66	4-17-45	−.20	.58	2.83	1.34	2.52
67	4-24-45	.25	2.21	2.63	1.41	2.73
68	5- 1-45	.49	3.56	2.88	1.46	2.23
69	5- 9-45	−.23	.29	3.37	1.66	.87
70	5-15-45	.03	1.14	3.14	1.40	1.48
71	5-22-45	−.22	.67	3.17	1.58	.92
72	5-29-45	−.24	0	2.95	1.60	1.74
73	6- 5-45	−.32	0	2.71	1.62	2.15
74	6-12-45	−.20	.18	2.39	1.63	2.54
75	6-19-45	−.14	.88	2.09	1.65	2.83
76	6-26-45	−.38	.25	1.95	1.65	2.92
77	7- 3-45	−.60	.17	1.57	1.66	3.03
78	7-10-45	−.26	.67	.97	1.65	3.05
79	7-17-45	−.70	2.45	.71	1.62	3.43
80	7-24-45	.84	2.37	.01	1.59	2.34
81	7-31-45	−.18	.20	.85	1.56	2.38
82	8- 7-45	.10	1.89	.67	1.52	2.50
83	12-27-45	1.32	3.64	.91	.47	4.51
84	1- 3-46	.96	2.72	2.23	.45	−.01

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 9—Continued						
85	1-10-46	.41	2.43	3.19	.46	.19
86	1-17-46	.09	2.29	3.60	.48	-.59
87	1-24-46	-.06	.53	3.69	.50	-.36
88	2- 5-46	-.12	.16	3.49	.57	.17
89	2-12-46	.12	1.34	3.37	.62	.20
90	2-19-46	.09	1.92	3.49	.68	.26
91	2-26-46	.01	.65	3.58	.76	-1.11
92	3- 5-46	-.08	.35	3.59	.85	.01
93	3-12-46	-.17	.07	3.51	.96	.47
94	3-19-46	.21	1.87	3.34	1.04	.72
95	3-26-46	-.22	0	3.55	1.11	0
96	4- 2-46	.40	5.26	3.33	1.19	.69
97	4- 9-46	-.36	0	3.73	1.26	.46
98	4-16-46	-.21	.37	3.37	1.34	.83
99	4-23-46	-.07	.50	3.16	1.41	.83
100	4-30-46	.39	3.75	3.09	1.46	.94
101	5- 7-46	-.15	.78	3.48	1.51	.48
102	5-14-46	.17	2.54	3.33	1.56	.02
103	5-21-46	.42	4.47	3.50	1.58	-.92
104	5-28-46	-.49	.03	3.92	1.60	-.26
105	6- 4-46	-.12	1.10	3.43	1.62	.62
106	6-11-46	-.26	0	3.31	1.63	.26
107	6-18-46	-.13	1.03	3.05	1.65	1.09
108	6-25-46	-.19	.29	2.92	1.65	1.37
109	7- 2-46	.07	2.45	2.73	1.66	1.74
110	7- 9-46	-.21	0	2.80	1.65	.98
111	7-16-46	-.22	.53	2.59	1.63	1.71
112	7-23-46	1.32	6.16	2.37	1.60	2.10
113	7-30-46	-.15	1.14	3.69	1.56	.01
114	8- 6-46	-.05	1.32	3.54	1.52	-.93
115	8-13-46	-.12	1.36	3.49	1.48	-.92
116	8-20-46	-.28	.03	3.37	1.43	.53
117	8-27-46	-.15	.62	3.09	1.39	.99
118	9- 3-46	.03	1.42	2.94	1.34	1.24
119	9-10-46	-.10	.24	2.97	1.28	1.02
120	9-17-46	-.04	.68	2.87	1.23	1.34
121	9-24-46	.03	.86	2.83	1.17	1.21
122	10- 1-46	.08	1.64	2.86	1.12	1.08
123	10- 8-46	-.13	.10	2.94	1.07	1.15
124	10-15-46	-.09	.45	2.81	1.01	1.61
125	10-22-46	-.16	0	2.72	.95	1.73
126	10-29-46	.10	1.25	2.56	.88	2.54
127	11- 5-46	-.09	.01	2.66	.83	1.43
128	11-12-46	-.12	.19	2.57	.77	1.89
129	11-19-46	-.09	.11	2.45	.71	2.24
130	11-26-46	0	.45	2.36	.66	2.43
131	12- 3-46	-.07	.19	2.36	.60	2.31
132	12-10-46	-.11	0	2.29	.56	2.52
133	12-17-46	-.11	0	2.18	.52	2.79
134	12-24-46	-.14	0	2.07	.48	3.11
135	12-31-46	.05	.70	1.93	.46	3.23
136	1- 7-47	.17	1.20	1.98	.45	3.44
137	1-14-47	.93	2.83	2.15	.47	2.72
138	1-21-47	0	.43	3.08	.49	.65
139	1-28-47	-.05	0	3.08	.51	1.24
140	2- 4-47	.10	1.13	3.03	.56	1.68
141	2-11-47	-.04	.10	3.13	.61	1.39
142	2-18-47	-.05	.07	3.09	.67	1.57
143	2-25-47	-.03	.37	3.04	.75	1.83
144	3- 4-47	.09	1.20	3.01	.84	1.88
145	3-11-47	.67	5.98	3.10	.95	1.26
146	3-18-47	-.16	1.72	3.77	1.03	.17
147	3-25-47	-.14	.75	3.61	1.10	.34
148	4- 1-47	-.06	.55	3.47	1.18	.42
149	4- 8-47	.03	.94	3.41	1.25	.27
150	4-15-47	.17	2.17	3.44	1.33	.62
151	4-22-47	-.10	1.66	3.61	1.40	-1.03
152	4-29-47	-.17	.08	3.51	1.45	.60
153	5- 6-47	.07	2.07	3.34	1.50	.91
154	5-13-47	-.24	0	3.41	1.56	-.01
155	5-20-47	-.13	0	3.17	1.58	1.12
156	5-27-47	.43	4.07	3.04	1.60	1.52
157	6- 3-47	-.10	1.33	3.47	1.62	-.07
158	6-10-47	-.29	0	3.37	1.63	.52
159	6-17-47	-.10	.41	3.08	1.65	1.18
160	6-24-47	.40	4.02	2.98	1.65	1.33
161	7- 1-47	-.20	0	3.38	1.66	.29

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
162	7- 8-47	.25	3.66	3.18	1.65	.93
163	7-15-47	−.22	.58	3.43	1.63	−.37
164	7-22-47	−.04	1.08	3.21	1.60	1.03
165	7-29-47	.06	1.79	3.17	1.57	1.10
166	8- 5-47	−.12	.21	3.23	1.53	.60
167	8-12-47	.11	2.15	3.11	1.49	1.35
168	8-19-47	.23	2.85	3.22	1.44	.57
169	8-26-47	.08	2.07	3.45	1.40	.20
170	9- 2-47	−.26	.17	3.53	1.35	.59
171	9- 9-47	−.15	0	3.27	1.29	1.25
172	9-16-47	−.11	.48	3.12	1.24	1.62
173	9-23-47	−.09	.73	3.01	1.18	1.83
174	9-30-47	−.06	.95	2.92	1.13	1.92
175	10- 7-47	−.13	.78	2.86	1.08	1.79
176	10-14-47	0	.83	2.73	1.02	2.08
177	10-21-47	−.07	.65	2.73	.96	1.73
178	10-28-47	−.04	.19	2.67	.89	1.82
	Pond 11					
1	1-22-41	0	0.61	4.74	0.49	12.73
2	1-29-41	−.08	.02	4.74	.52	12.16
3	2- 5-41	−.02	.45	4.66	.57	13.05
4	2-12-41	.06	1.05	4.64	.62	12.95
5	2-19-41	.06	1.06	4.70	.68	11.59
6	2-26-41	−.06	.22	4.76	.76	10.88
7	3- 5-41	−.10	.19	4.70	.85	12.19
8	3-12-41	.30	2.67	4.60	.96	12.93
9	3-19-41	−.08	.70	4.90	1.04	8.05
10	3-26-41	.02	.94	4.82	1.11	9.84
11	4- 2-41	−.10	.28	4.84	1.19	8.75
12	4- 9-41	0	.85	4.74	1.26	11.17
13	4-16-41	−.14	.18	4.74	1.34	10.71
14	4-23-41	— 14	.42	4.60	1.41	12.16
15	4-30-41	−.10	.03	4.46	1.46	13.11
16	5- 7-41	−.10	.63	4.36	1.51	13.43
17	5-14-41	−.18	0	4.26	1.56	13.39
18	5-21-41	−.16	0	4.08	1.58	13.37
19	5-28-41	−.18	0	3.92	1.61	13.40
20	7- 9-41	.22	2.69	3.86	1.65	13.30
21	7-16-41	0	.21	4.08	1.63	12.00
22	7-23-41	−.02	1.90	4.08	1.59	12.50
23	7-30-41	.04	1.49	4.06	1.56	12.80
24	8- 6-41	−.14	.02	4.10	1.52	14.00
25	8-13-41	−.15	.54	3.96	1.48	16.00
26	9- 3-41	−.16	.12	4.53	1.34	17.70
27	9-10-41	−.17	0	4.37	1.28	14.48
28	9-17-41	.06	.68	4.20	1.23	15.64
29	9-24-41	−.14	0	4.26	1.17	16.16
30	10- 1-41	.07	1.59	4.12	1.12	16.61
31	10- 8-41	.89	5.05	4.19	1.07	17.23
32	10-15-41	−.26	0	5.08	1.01	17.43
33	10-22-41	−.05	.07	4.82	.95	13.11
34	10-29-41	−.10	.36	4.77	.88	13.83
35	11- 5-41	−.02	.47	4.67	.83	13.87
36	11-12-41	−.10	0	4.65	.77	13.86
37	11-19-41	−.09	0	4.55	.71	13.88
38	11-26-41	−.08	.06	4.46	.66	14.00
39	12- 3-41	.02	.60	4.38	.60	14.20
40	12-10-41	.16	2.75	4.40	.56	14.57
41	12-17-41	0	.54	4.56	.51	14.48
42	12-24-41	.56	3.15	4.56	.48	13.84
43	12-31-41	−.09	1.17	5.12	.46	5.40
44	1- 7-42	.69	6.29	5.03	.45	6.59
45	1-14-42	−.24	.03	5.72	.47	−.84
46	1-21-42	−.16	0	5.48	.49	−.34
47	1-28-42	−.10	.02	5.32	.51	.52
48	2- 4-42	−.06	.45	5.22	.56	2.04
49	2-11-42	−.04	.74	5.16	.61	4.34
50	2-18-42	.26	3.10	5.12	.67	7.31
51	2-25-42	−.04	.73	5.38	.75	.90
52	3- 4-42	.02	1.09	5.34	.84	.83
53	3-11-42	.06	2.70	5.36	.95	.85
54	3-18-42	.04	1.94	5.42	1.03	−.61
55	3-25-42	.12	2.37	5.46	1.10	−1.16

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 11—Continued						
56	4- 1-42	-.20	.57	5.58	1.18	-1.28
57	4- 8-42	-.13	0	5.38	1.25	-.88
58	4-15-42	.07	2.03	5.25	1.33	-.36
59	4-22-42	-.18	.12	5.32	1.40	-.49
60	4-29-42	-.16	0	5.14	1.45	.11
61	5- 6-42	-.18	.01	4.98	1.50	1.10
62	5-13-42	-.02	1.76	4.80	1.56	2.79
63	5-21-42	0	2.51	4.78	1.58	6.02
64	5-28-42	-.18	.15	4.78	1.60	9.67
65	6- 4-42	-.02	.73	4.60	1.62	12.09
66	6-11-42	.72	5.54	4.58	1.63	13.32
67	6-18-42	-.10	1.77	5.30	1.65	-1.90
68	6-25-42	-.04	1.53	5.20	1.65	1.59
69	7- 1-42	-.08	.73	5.16	1.66	2.35
70	7- 8-42	-.02	.88	5.08	1.65	3.93
71	7-15-42	-.24	1.42	5.06	1.63	3.51
72	7-23-42	-.20	.16	4.82	1.60	6.37
73	7-31-42	-.02	1.24	4.62	1.56	11.30
74	8- 6-42	.34	1.60	4.60	1.52	13.71
75	8-13-42	-.20	2.27	4.94	1.48	13.79
76	8-20-42	.08	1.84	4.74	1.43	13.68
77	4-18-45	.30	3.33	4.52	1.36	13.75
78	4-25-45	.33	3.27	4.82	1.42	14.11
79	5- 2-45	.09	2.60	5.15	1.47	8.39
80	5- 9-45	-.12	.80	5.24	1.53	.90
81	5-16-45	-.05	1.20	5.12	1.57	2.00
82	5-23-45	-.08	1.08	5.07	1.59	3.73
83	6-13-45	-.13	.18	4.60	1.64	12.90
84	6-20-45	.01	3.17	4.47	1.65	13.92
85	6-27-45	-.10	1.41	4.48	1.65	13.80
86	7- 4-45	-.14	.51	4.38	1.66	13.76
87	7-11-45	.03	1.11	4.24	1.64	13.85
88	7-18-45	.07	1.73	4.27	1.62	14.30
89	7-25-45	0	.79	4.34	1.59	14.93
90	8- 1-45	-.08	.52	4.34	1.55	15.33
91	8- 8-45	-.19	1.91	4.26	1.51	15.79
92	8-15-45	.40	1.36	4.07	1.47	16.10
93	8-22-45	-.11	.25	4.47	1.42	16.73
94	8-29-45	-.18	.01	4.36	1.38	16.93
95	9- 4-45	.14	.79	4.18	1.32	17.10
96	9-12-45	-.04	.71	4.32	1.27	17.60
97	9-19-45	.28	3.62	4.28	1.22	17.86
98	9-26-45	-.11	.02	4.56	1.16	18.02
99	10- 3-45	-.11	.17	4.45	1.11	17.39
100	10-11-45	-.14	.06	4.34	1.05	16.72
101	10-31-45	-.01	.81	4.19	.87	17.47
102	11- 7-45	-.05	.23	4.18	.81	17.81
103	11-14-45	-.08	0	4.13	.75	17.90
104	11-23-45	.03	.96	4.05	.70	18.37
105	11-29-45	-.05	0	4.08	.64	18.73
106	12- 5-45	.12	1.07	4.03	.59	19.04
107	12-12-45	-.03	.17	4.15	.55	19.38
108	12-19-45	.38	3.20	4.12	.50	19.65
109	12-27-45	.74	2.92	4.50	.47	19.98
110	1- 2-46	.08	2.27	5.24	.45	4.68
111	1-24-46	-.01	1.21	5.42	.50	.59
112	2- 5-46	-.09	.15	5.32	.57	.87
113	2-12-46	.06	1.36	5.23	.62	2.07
114	2-19-46	-.02	.91	5.29	.68	1.92
115	2-26-46	-.05	.69	5.27	.76	3.20
116	3- 5-46	-.07	.86	5.22	.85	4.07
117	3-12-46	-.14	.05	5.15	.96	4.87
118	3-19-46	.26	3.14	5.01	1.04	6.93
119	3-26-46	-.27	0	5.27	1.11	3.33
120	4- 2-46	.67	4.88	5.00	1.19	3.43
121	4- 9-46	-.24	0	5.67	1.26	-.93
122	4-16-46	-.14	.50	5.43	1.34	-.54
123	4-23-46	-.02	.70	5.29	1.41	-.01
124	4-30-46	.13	3.06	5.27	1.46	.16
125	5- 7-46	-.06	1.02	5.40	1.51	-.72
126	5-14-46	.12	1.68	5.34	1.57	-.45
127	5-21-46	.76	5.70	5.46	1.58	-.66
128	5-28-46	-.28	.10	6.22	1.60	-1.47
129	6- 4-46	.04	2.08	5.94	1.62	-.95
130	6-11-46	-.31	0	5.98	1.63	-.94
131	6-18-46	-.30	1.01	5.67	1.65	-.33
132	6-25-46	-.21	.32	5.37	1.65	.24

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 11—Continued						
133	7-16-46	-.17	.05	4.99	1.63	4.35
134	7-23-46	.26	3.65	4.82	1.59	8.59
135	7-30-46	.45	5.48	5.08	1.56	9.46
136	8- 6-46	.16	2.99	5.53	1.52	.49
137	8-13-46	-.04	1.40	5.69	1.48	-1.20
138	8-20-46	-.27	.02	5.65	1.44	-.71
139	8-27-46	-.15	.12	5.38	1.39	-.09
140	9- 3-46	-.04	2.57	5.23	1.34	.68
141	9-10-46	-.18	.47	5.19	1.28	1.32
142	9-17-46	-.10	.37	5.01	1.23	2.86
143	9-24-46	.08	2.01	4.91	1.17	5.63
144	10- 1-46	0	.50	4.99	1.12	8.58
145	10- 8-46	-.15	.19	4.99	1.07	5.86
146	10-15-46	-.06	.49	4.84	1.01	9.46
147	10-22-46	-.14	0	4.78	.95	12.86
148	10-29-46	.31	2.19	4.64	.88	13.75
149	11- 5-46	-.12	0	4.95	.83	12.44
150	11-12-46	-.09	.02	4.83	.77	13.08
151	11-19-46	.11	.70	4.74	.71	13.77
152	11-26-46	-.05	.41	4.85	.66	13.36
153	12- 3-46	-.06	.36	4.80	.60	12.77
154	12-10-46	-.09	0	4.74	.56	12.93
155	12-17-46	-.08	0	4.65	.51	13.50
156	12-24-46	-.08	0	4.57	.48	13.61
157	12-31-46	.01	.50	4.49	.46	13.64
158	1- 7-47	.14	1.44	4.50	.45	13.71
159	1-14-47	.52	3.31	4.64	.47	13.34
160	1-21-47	-.06	.42	5.16	.49	4.52
161	1-28-47	-.12	.17	5.10	.51	5.60
162	2- 4-47	.17	1.71	4.98	.56	9.38
163	2-11-47	-.12	.11	5.15	.61	4.74
164	2-18-47	-.10	0	5.03	.67	7.34
165	2-25-47	-.08	.37	4.93	.75	10.49
166	3- 4-47	.10	1.28	4.85	.84	12.22
167	3-11-47	1.11	6.54	4.95	.95	10.81
168	3-18-47	-.02	1.31	6.06	1.03	-1.05
169	3-25-47	-.01	.79	6.04	1.10	-1.00
170	4- 1-47	-.15	.69	6.03	1.18	-.62
171	4- 8-47	-.08	1.12	5.88	1.25	-.38
172	4-15-47	-.12	1.93	5.80	1.33	-.33
173	4-22-47	.37	3.62	5.68	1.40	-.41
174	4-29-47	-.17	.08	6.05	1.45	-1.20
175	5- 6-47	-.08	1.73	5.88	1.50	-.70
176	5-13-47	-.33	.03	5.80	1.56	-.80
177	5-20-47	-.24	0	5.47	1.58	-.07
178	5-27-47	.17	2.76	5.23	1.60	.59
179	6- 3-47	-.10	.76	5.40	1.62	-.49
180	6-10-47	-.22	0	5.30	1.63	.04
181	6-17-47	-.12	.81	5.08	1.65	1.05
182	6-24-47	.46	5.70	4.96	1.65	2.50
183	7- 1-47	-.20	.18	5.42	1.66	-.41
184	7- 8-47	-.14	.80	5.22	1.65	.40
185	7-15-47	-.14	.64	5.08	1.63	1.83
186	7-22-47	-.16	1.37	4.94	1.60	4.24
187	7-29-47	-.09	.84	4.78	1.57	8.00
188	8- 5-47	-.17	0	4.69	1.53	12.42
189	8-12-47	.29	1.49	4.52	1.49	13.82
190	8-19-47	-.01	2.29	4.81	1.44	14.02
191	8-26-47	-.08	1.55	4.80	1.40	13.96
192	9- 2-47	-.16	.10	4.72	1.35	13.79
193	9- 9-47	-.18	.42	4.56	1.29	13.72
194	9-16-47	-.05	1.38	4.38	1.24	13.75
195	9-23-47	-.08	.36	4.33	1.18	14.09
196	9-30-47	.08	1.85	4.25	1.13	14.64
Pond 12						
1	1- 8-41	0.06	1.10	3.00	0.45	17.89
2	1-15-41	-.06	0	3.06	.47	8.95
3	1-22-41	.04	.93	3.00	.49	8.37
4	1-29-41	-.04	0	3.04	.52	10.04
5	2- 5-41	0	.53	3.00	.57	11.32
6	2-12-41	.04	.85	3.00	.62	12.55
7	2-19-41	.02	1.00	3.04	.68	12.11
8	2-26-41	-.04	.48	3.06	.87	9.29

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 12—Continued						
9	3- 5-41	-.06	.17	3.02	.73	9.03
10	3-12-41	.25	2.54	2.96	.96	10.68
11	3-19-41	-.03	1.12	3.18	1.04	3.07
12	3-26-41	.04	1.02	3.16	1.10	2.14
13	4- 2-41	-.04	.03	3.20	1.18	1.06
14	4- 9-41	.02	.85	3.16	1.25	1.12
15	4-16-41	-.12	0	3.18	1.33	1.09
16	4-23-41	-.08	.43	3.06	1.40	1.52
17	4-30-41	-.10	.35	2.98	1.45	2.36
18	5- 7-41	-.10	1.10	2.88	1.50	3.60
19	5-14-41	-.18	0	2.78	1.56	5.36
20	5-21-41	-.18	0	2.60	1.59	7.41
21	5-28-41	-.24	.09	2.42	1.60	9.29
22	1- 7-42	.66	4.09	2.14	.45	7.78
23	1-14-42	-.04	0	2.80	.47	-2.11
24	1-21-42	-.01	0	2.76	.49	-1.85
25	1-28-42	.02	.14	2.75	.51	-1.56
26	2- 4-42	.05	.45	2.77	.56	-1.36
27	2-11-42	.18	1.64	2.82	.61	-1.39
28	2-18-42	.48	3.75	3.00	.67	-1.39
29	2-25-42	.16	.98	3.48	.75	-2.43
30	3- 4-42	.14	1.06	3.64	.84	-1.96
31	3-11-42	.34	2.50	3.78	.95	-1.62
32	3-18-42	.18	1.03	4.12	1.03	-1.49
33	3-25-42	.28	3.39	4.30	1.10	-1.40
34	4- 1-42	-.04	.16	4.58	1.18	-1.15
35	4- 8-42	-.06	0	4.54	1.25	-.44
36	4-15-42	.08	1.98	4.48	1.33	-.51
37	4-22-42	-.10	0	4.56	1.40	-.55
38	4-29-42	-.12	0	4.46	1.45	-.24
39	5- 6-42	-.12	0	4.34	1.50	-.02
40	5-13-42	-.06	2.07	4.22	1.56	.25
41	5-20-42	-.06	.35	4.16	1.58	.23
42	5-27-42	.04	.52	4.10	1.60	.40
43	6- 3-42	-.10	.50	4.14	1.62	.37
44	6-10-42	.34	5.66	4.04	1.63	.64
45	6-17-42	-.06	.79	4.38	1.65	-.63
46	6-24-42	-.08	1.07	4.32	1.65	-.27
47	7- 1-42	-.02	1.50	4.24	1.66	-.12
48	7- 8-42	.08	1.31	4.22	1.65	1.05
49	7-15-42	-.02	1.52	4.30	1.63	-.08
50	7-22-42	-.18	0	4.28	1.60	-.10
51	7-29-42	.08	1.75	4.10	1.57	.34
52	8- 5-42	-.10	.11	4.18	1.53	.22
53	8-12-42	.30	2.70	4.08	1.49	1.47
54	9- 9-42	.12	1.01	4.32	1.29	-.09
55	4-10-45	-.13	.10	3.26	1.26	1.49
56	4-17-45	-.13	0	3.13	1.34	2.21
57	4-24-45	.23	2.35	3.00	1.41	3.25
58	5- 1-45	.27	3.67	3.23	1.46	3.31
59	5- 8-45	-.10	.25	3.50	1.51	-.48
60	5-15-45	.01	1.28	3.40	1.56	-.22
61	5-22-45	-.08	.43	3.41	1.58	-.23
62	5-29-45	-.07	0	3.33	1.60	.10
63	6- 5-45	-.28	.23	3.26	1.62	.59
64	6-12-45	-.14	0	2.98	1.63	1.08
65	6-19-45	-.10	.91	2.84	1.65	1.63
66	6-26-45	-.14	.59	2.74	1.65	2.17
67	7- 3-45	-.11	.75	2.60	1.66	3.14
68	7-10-45	.03	.72	2.49	1.65	4.35
69	7-17-45	.25	2.69	2.52	1.62	5.86
70	7-24-45	.02	1.49	2.77	1.59	4.34
71	7-31-45	-.03	1.10	2.79	1.56	4.28
72	8- 8-45	.07	2.25	2.73	1.67	4.33
73	8-15-45	.06	.50	2.80	1.47	4.52
74	8-22-45	-.11	0	2.86	1.42	3.44
75	8-29-45	-.17	2.09	2.75	1.38	5.08
76	9- 5-45	-.11	.15	2.58	1.32	7.51
77	9-12-45	.21	2.82	2.47	1.27	9.47
78	9-19-45	.19	2.69	2.68	1.22	7.70
79	9-26-45	-.12	.40	2.87	1.16	2.74
80	10- 3-45	-.11	.71	2.75	1.11	2.83
81	10-10-45	-.10	.15	2.64	1.05	4.26
82	10-17-45	-.13	0	2.54	.99	6.03
83	10-24-45	-.08	.92	2.41	.92	8.17
84	10-31-45	0	.64	2.33	.87	[e] 10.80
85	11- 7-45	-.09	.21	2.33	.81	[e] 12.20

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 12—Continued						
86	11-14-45	-.06	0	2.24	.75	e 13.40
87	11-21-45	-.07	0	2.18	.70	e 12.70
88	11-28-45	.12	.84	2.11	.64	e 14.40
89	12- 5-45	.12	1.07	2.23	.59	e 15.40
90	12-12-45	-.02	.35	2.35	.55	e 15.00
91	12-19-45	.31	2.80	2.33	.50	e 12.00
92	12-26-45	.40	3.04	2.64	.47	e 10.00
93	1- 2-46	.18	2.61	3.04	.46	.20
94	1- 9-46	.21	2.48	3.22	.46	-1.70
95	1-16-46	.25	1.80	3.43	.47	-2.09
96	1-23-46	.18	1.10	3.68	.50	-2.18
97	1-30-46	.04	.18	3.86	.53	-1.75
98	2- 6-46	.01	0	3.90	.57	-1.21
99	2-13-46	.19	1.70	3.91	.62	-1.25
100	2-20-46	.13	1.41	4.10	.68	-.89
101	2-27-46	.05	.64	4.23	.77	-3.54
102	3- 6-46	0	0	4.28	.85	-.75
103	3-13-46	-.04	.05	4.28	.97	-.49
104	3-20-46	.19	2.14	4.24	1.05	-.36
105	3-27-46	.07	1.29	4.43	1.12	-.66
106	4- 3-46	-.09	4.19	4.50	1.20	-2.90
107	4-10-46	-.15	0	4.41	1.27	-1.22
108	4-17-46	.02	.93	4.26	1.35	-.80
109	4-24-46	-.08	0	4.28	1.42	-.78
110	5- 1-46	.08	2.84	4.20	1.47	-.30
111	5- 8-46	.03	1.37	4.28	1.52	-.54
112	5-15-46	.14	2.93	4.31	1.57	-.65
113	5-22-46	-.01	3.36	4.45	1.59	-1.05
114	5-29-46	-.20	0	4.44	1.61	-1.21
115	6- 5-46	-.01	1.02	4.24	1.62	-.70
116	6-12-46	-.15	0	4.23	1.63	-.45
117	6-19-46	-.13	.12	4.08	1.65	-.19
118	6-26-46	-.13	.35	3.95	1.66	.03
119	7- 3-46	.04	1.59	3.82	1.66	.24
120	7-10-46	-.15	0	3.86	1.64	.10
121	7-17-46	-.04	1.01	3.71	1.62	.57
122	7-24-46	.68	7.59	3.67	1.59	.64
123	7-31-46	.01	1.64	4.35	1.56	-1.10
124	8- 7-46	.16	3.25	4.36	1.52	-1.09
125	8-14-46	-.22	1.31	4.52	1.47	-1.50
126	8-21-46	-.11	.12	4.30	1.43	-.91
127	8-28-46	-.09	.10	4.19	1.39	-.59
128	9- 4-46	.02	1.25	4.10	1.34	-.35
129	9-11-46	-.05	.59	4.12	1.28	-.19
130	9-18-46	-.03	.54	4.07	1.23	-.13
131	9-25-46	.28	3.41	4.04	1.17	-.01
132	10- 2-46	-.13	0	4.32	1.12	-.65
133	10- 9-46	-.09	.08	4.19	1.06	-.13
134	10-16-46	-.03	.66	4.10	1.00	.06
135	10-23-46	-.08	.05	4.07	.94	.21
136	10-30-46	.05	1.17	3.99	.88	.48
137	11- 6-46	-.06	0	4.04	.82	.40
138	11-13-46	.02	.03	3.98	.76	.78
139	11-19-46	-.05	.34	3.92	.71	1.06
140	11-26-46	0	.62	3.87	.66	1.37
141	12- 3-46	-.04	.46	3.87	.60	1.59
142	12-10-46	-.07	0	3.83	.56	1.95
143	12-17-46	-.06	0	3.76	.52	2.63
144	12-24-46	-.08	0	3.70	.48	3.77
145	12-31-46	-.03	.42	3.62	.46	5.34
146	1- 7-47	.03	.96	3.59	.45	7.38
147	1-14-47	.39	4.62	3.62	.47	8.67
148	1-21-47	-.02	.26	4.01	.49	.51
149	1-28-47	-.04	0	3.99	.51	-.08
150	2- 4-47	.07	1.18	3.95	.56	.06
151	2-11-47	-.04	.26	4.02	.61	-.16
152	2-18-47	-.04	0	3.98	.67	0
153	2-25-47	-.03	.34	3.94	.75	.37
154	3- 4-47	.07	1.38	3.91	.84	.56
155	3-11-47	.43	6.23	3.98	.95	.27
156	3-18-47	-.06	1.83	4.41	1.03	-1.55
157	3-25-47	-.07	.64	4.35	1.10	-1.38
158	4- 1-47	-.02	.54	4.28	1.18	-1.12
159	4- 8-47	0	.96	4.26	1.25	-.93
160	4-15-47	.02	1.19	4.26	1.33	-.76
161	4-22-47	.01	3.00	4.28	1.40	-.69
162	4-29-47	-.11	0	4.29	1.45	-1.00

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 12—Continued						
163	5- 6-47	.11	2.08	4.18	1.50	-.65
164	5-13-47	-.15	0	4.29	1.56	-.83
165	5-20-47	-.13	.02	4.14	1.58	-.25
166	5-27-47	.27	4.00	4.01	1.60	.01
167	6- 3-47	-.06	.86	4.28	1.62	-.58
168	6-10-47	-.15	0	4.22	1.63	-.37
169	6-17-47	-.04	.89	4.07	1.65	-.05
170	6-24-47	.36	5.26	4.03	1.65	.05
171	7- 1-47	-.20	.09	4.39	1.66	-.82
172	7- 8-47	.10	3.52	4.19	1.65	-.43
173	7-15-47	-.15	.10	4.29	1.63	-.24
174	7-22-47	-.01	1.18	4.14	1.60	-.12
175	7-29-47	-.07	.57	4.13	1.57	-.03
176	8- 5-47	-.13	.09	4.06	1.53	.13
177	8-12-47	-.01	1.10	3.93	1.49	.43
178	8-19-47	.08	1.99	3.92	1.44	.52
179	8-26-47	-.03	.97	4.00	1.40	.34
180	9- 2-47	-.13	.10	3.97	1.35	.56
181	9- 9-47	-.12	0	3.84	1.29	.99
182	9-16-47	0	1.64	3.72	1.24	1.34
183	9-23-47	-.10	.27	3.72	1.18	1.64
184	9-30-47	.01	1.52	3.62	1.13	2.10
185	10- 7-47	-.08	.32	3.63	1.08	2.26
186	10-14-47	-.03	.72	3.55	1.02	3.05
187	10-21-47	-.06	.34	3.52	.96	3.97
188	10-28-47	-.09	.06	3.46	.89	5.26
Pond 13						
1	3-26-41	0.10	1.02	6.66	1.10	-0.59
2	4- 2-41	-.06	.03	6.76	1.18	-.71
3	4- 9-41	0	.94	• 6.70	1.25	-.44
4	4-16-41	-.10	0	6.70	1.33	-.41
5	4-23-41	-.04	.43	6.60	1.40	.10
6	4-30-41	-.08	.35	6.56	1.45	.06
7	5- 7-41	-.02	1.10	6.48	1.50	.54
8	5-14-41	-.16	0	6.46	1.56	.92
9	5-21-41	-.08	0	6.30	1.59	1.30
10	5-28-41	-.12	.09	6.22	1.60	1.88
11	6- 4-41	-.12	.05	6.10	1.62	2.53
12	6-11-41	-.16	.25	5.98	1.63	[e] 3.80
13	6-18-41	0	.71	5.82	1.65	[e] 4.80
14	6-25-41	.04	.87	5.82	1.65	[e] 5.70
15	7- 2-41	-.04	.66	5.86	1.66	[e] 6.80
16	7- 9-41	.06	1.86	5.82	1.65	[e] 7.00
17	7-16-41	-.10	.77	5.88	1.63	[e] 7.00
18	7-23-41	.06	1.20	5.78	1.59	[e] 7.00
19	7-30-41	.08	1.51	5.84	1.56	[e] 7.00
20	8- 6-41	-.18	.28	5.92	1.52	[e] 7.00
21	8-13-41	-.10	.61	5.74	1.48	[e] 7.00
22	8-20-41	.18	2.00	5.64	1.44	[e] 7.00
23	8-27-41	0	.67	5.82	1.39	5.75
24	9- 3-41	.02	.45	5.82	1.34	5.52
25	9-10-41	-.30	0	5.84	1.28	5.60
26	9-17-41	.02	.89	5.54	1.23	6.20
27	10-15-41	-.12	0	5.96	1.01	6.75
28	10-22-41	-.04	.25	5.84	.95	4.07
29	10-29-41	-.10	.20	5.80	.88	4.25
30	11- 5-41	.04	.85	5.70	.83	[e] 6.70
31	11-12-41	-.14	0	5.74	.77	[e] 7.70
32	11-19-41	-.12	0	5.60	.71	5.99
33	11-26-41	-.06	.07	5.48	.66	6.72
34	12- 3-41	.40	2.33	5.42	.60	7.18
35	12-10-41	-.06	.46	5.82	.56	[e] 8.10
36	12-17-41	0	.74	5.76	.51	6.51
37	12-24-41	.32	3.36	5.76	.48	5.92
38	12-31-41	0	.51	6.08	.46	3.57
39	1- 7-42	.40	4.06	6.08	.45	1.15
40	1-14-42	0	0	6.48	.47	-.81
41	1-21-42	-.04	0	6.48	.49	-.51
42	1-28-42	-.02	.12	6.44	.51	-.32
43	2- 4-42	0	.40	6.42	.56	-.17
44	2-11-42	.14	1.35	6.42	.61	-.13
45	2-18-42	.48	3.80	6.56	.67	-.91
46	2-25-42	.12	.93	7.04	.75	-1.90

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 13—Continued						
47	3-4-42	.04	1.12	7.16	.84	−1.46
48	3-11-42	.20	2.70	7.20	.95	−.75
49	4-29-42	−.28	0	7.12	1.45	−.04
50	5-6-42	−.02	0	6.84	1.50	.25
51	5-13-42	.06	2.07	6.82	1.56	.84
52	5-20-42	−.08	.35	6.88	1.58	.48
53	5-27-42	−.10	.52	6.80	1.60	.60
54	6-3-42	−.06	.50	6.70	1.62	1.21
55	6-10-42	.46	5.66	6.64	1.63	1.05
56	6-17-42	0	.79	7.10	1.65	[e] −.10
57	6-24-42	−.02	.91	7.10	1.65	[e] .10
58	7-1-42	0	1.50	7.08	1.66	[e] .20
59	7-8-42	.12	1.71	7.08	1.65	[e] .20
60	7-15-42	−.04	1.52	7.20	1.63	[e] −.20
61	7-22-42	−.20	0	7.16	1.60	[e] .45
62	8-12-42	.10	2.70	7.04	1.49	[e] 1.00
63	9-9-42	0	1.01	6.94	1.29	[e] .55
64	4-10-45	−.11	.04	6.13	1.26	1.52
65	4-17-45	−.04	.58	6.02	1.34	1.87
66	4-24-45	.15	2.21	5.98	1.41	2.48
67	5-1-45	.29	3.56	6.13	1.46	2.49
68	5-8-45	−.07	.29	6.42	1.51	.13
69	5-15-45	.03	1.14	6.35	1.56	.78
70	5-22-45	−.06	.67	6.38	1.58	.56
71	5-29-45	−.11	0	6.29	1.60	1.08
72	6-5-45	−.17	0	6.18	1.62	1.77
73	6-12-45	−.12	.18	6.01	1.63	2.57
74	6-19-45	−.06	.88	5.89	1.65	3.19
75	6-26-45	−.30	.25	5.83	1.65	3.76
76	7-3-45	−.31	.17	5.53	1.66	4.06
77	7-10-45	.06	.67	5.22	1.65	4.98
78	7-17-45	.28	2.45	5.28	1.62	[e] 5.10
79	7-24-45	.23	2.37	5.56	1.59	[e] 5.70
80	7-31-45	−.21	.20	5.79	1.56	[e] 6.20
81	8-7-45	.09	1.89	5.58	1.52	[e] 6.20
82	8-14-45	−.05	.42	5.67	1.48	[e] 6.40
83	8-21-45	−.21	.63	5.62	1.43	[e] 6.60
84	8-28-45	−.36	.29	5.41	1.39	[e] 6.60
85	9-4-45	−.32	.26	5.05	1.34	[e] 6.60
86	9-11-45	.96	2.31	4.73	1.28	[e] 6.30
87	9-18-45	.03	2.43	5.69	1.23	[e] 6.70
88	9-25-45	−.16	.06	5.72	1.17	[e] 1.70
89	10-2-45	−.20	.47	5.58	1.12	[e] 1.80
90	10-9-45	−.16	.05	5.38	1.07	[e] 1.90
91	10-16-45	−.27	0	5.22	1.01	[e] 2.40
92	10-23-45	.10	.57	4.95	.95	[e] 3.30
93	10-30-45	.09	.64	5.05	.88	[e] 4.40
94	11-6-45	−.18	.16	5.14	.83	[e] 5.20
95	11-13-45	−.22	0	4.96	.77	[e] 5.70
96	11-20-45	−.18	.03	4.74	.71	[e] 6.00
97	11-27-45	.38	.84	4.56	.66	[e] 6.40
98	12-4-45	−.18	.26	4.94	.60	[e] 7.20
99	12-11-45	.50	1.12	4.76	.56	[e] 7.50
100	12-18-45	.28	2.19	5.26	.51	[e] 7.70
101	12-25-45	.41	4.03	5.54	.48	[e] 7.50
102	1-3-46	.19	2.72	5.91	.45	−.38
103	1-10-46	.32	2.43	6.10	.46	−.85
104	1-17-46	.30	2.29	6.42	.48	−1.71
105	1-24-46	.18	.53	6.72	.50	−1.80
106	2-5-46	−.03	.16	6.91	.57	−.97
107	2-12-46	.12	1.34	6.88	.62	−.79
108	2-19-46	.12	1.92	7.00	.68	−.89
109	2-26-46	.05	.65	7.12	.76	−2.06
110	3-5-46	−.05	.35	7.17	.85	−1.08
111	3-12-46	−.10	.07	7.12	.96	−.67
112	3-19-46	.10	1.87	7.02	1.04	−.43
113	3-26-46	−.12	0	7.12	1.11	−.90
114	4-2-46	.39	5.26	7.00	1.19	−.36
115	4-9-46	−.21	0	7.39	1.26	−.82
116	4-16-46	−.13	.37	7.18	1.34	−.31
117	4-23-46	−.09	.50	7.05	1.41	−.16
118	4-30-46	.23	3.75	6.96	1.46	.02
119	5-7-46	−.08	.78	7.19	1.51	−.69
120	5-14-46	.05	2.54	7.11	1.56	−1.10
121	5-21-46	.30	4.47	7.16	1.58	−1.79
122	5-28-46	−.24	.03	7.46	1.60	−1.66

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
			Pond 13—Continued			
123	6- 4-46	-.08	1.10	7.22	1.62	-.49
124	6-11-46	-.22	0	7.14	1.63	-.51
125	6-18-46	-.13	1.03	6.92	1.65	.18
126	6-25-46	-.16	.29	6.79	1.65	.71
127	7- 2-46	.09	2.45	6.63	1.66	1.18
128	7- 9-46	-.16	0	6.72	1.65	.33
129	7-16-46	-.10	.53	6.56	1.63	1.19
130	7-23-46	.65	6.16	6.46	1.60	1.77
131	7-30-46	-.02	1.14	7.11	1.56	-1.18
132	8- 6-46	.01	1.32	7.09	1.52	-.92
133	8-13-46	-.05	1.36	7.10	1.48	-1.48
134	8-20-46	-.20	.03	7.05	1.43	-.42
135	8-27-46	-.11	.62	6.85	1.39	.15
136	9- 3-46	-.04	1.42	6.74	1.34	.35
137	9-10-46	-.13	.24	6.70	1.28	.38
138	9-17-46	-.05	.68	6.57	1.23	.94
139	9-24-46	.03	.86	6.52	1.17	1.15
140	10- 1-46	.05	1.64	6.55	1.12	.88
141	10- 8-46	-.12	.10	6.60	1.07	1.17
142	10-15-46	-.05	.45	6.48	1.01	1.02
143	10-22-46	-.09	0	6.43	.95	1.35
144	10-29-46	.06	1.25	6.34	.88	1.71
145	11- 5-46	-.04	.01	6.40	.83	1.09
146	11-12-46	-.04	.19	6.36	.77	1.73
147	11-19-46	-.05	.11	6.32	.71	2.11
148	11-26-46	0	.45	6.27	.66	2.36
149	12- 3-46	-.03	.19	6.27	.60	2.47
150	12-10-46	-.04	0	6.24	.56	2.61
151	12-17-46	-.04	0	6.20	.52	2.82
152	12-24-46	-.04	0	6.16	.48	3.04
153	12-31-46	.02	.70	6.12	.46	3.30
154	1- 7-47	.08	1.20	6.14	.45	3.63
155	1-14-47	.20	2.83	6.22	.47	3.38
156	1-21-47	0	.43	6.42	.49	1.37
157	1-28-47	-.06	0	6.42	.51	.81
158	2- 4-47	.05	1.13	6.36	.56	.91
159	2-11-47	-.05	.10	6.41	.61	.79
160	2-18-47	-.05	.07	6.36	.67	.71
161	2-25-47	-.02	.37	6.31	.75	.94
162	3- 4-47	.05	1.20	6.29	.84	1.02
163	3-11-47	.82	5.98	6.34	.95	.50
164	3-18-47	.08	1.72	7.16	1.03	-1.35
165	3-25-47	-.08	.75	7.24	1.10	-1.14
166	4- 1-47	-.10	.55	7.16	1.18	-.93
167	4- 8-47	0	.94	7.06	1.25	-.97
168	4-15-47	-.02	1.22	7.06	1.33	-.72
169	4-22-47	.15	2.56	7.04	1.40	-1.24
170	4-29-47	-.17	.08	7.19	1.45	-.75
171	5- 6-47	.01	2.07	7.02	1.50	-.31
172	5-13-47	-.18	0	7.03	1.56	-.88
173	5-20-47	-.17	0	6.85	1.58	.08
174	5-27-47	.26	4.07	6.68	1.60	.62
175	6- 3-47	.03	1.33	6.94	1.62	-.55
176	6-10-47	-.19	0	6.97	1.63	-.30
177	6-17-47	-.10	.41	6.78	1.65	.48
178	6-24-47	.19	4.02	6.68	1.65	.71
179	7- 1-47	-.12	0	6.87	1.66	-.08
180	7- 8-47	.17	3.66	6.75	1.65	-.25
181	7-15-47	-.15	.58	6.92	1.63	-.27
182	7-22-47	-.04	1.08	6.77	1.60	.68
183	7-29-47	-.02	1.79	6.73	1.57	.74
184	8- 5-47	-.15	.21	6.71	1.53	.77
185	8-12-47	.06	2.15	6.56	1.49	1.41
186	8-19-47	.03	2.85	6.62	1.44	1.03
187	8-26-47	.08	2.07	6.65	1.40	1.09
188	9- 2-47	-.14	.17	6.73	1.35	.57
189	9- 9-47	-.13	0	6.59	1.29	1.30
190	9-16-47	-.07	.48	6.46	1.24	1.86
191	9-23-47	-.05	.73	6.39	1.18	2.42
192	9-30-47	-.03	.95	6.34	1.13	2.78
193	10- 7-47	-.04	.78	6.31	1.08	3.01
194	10-14-47	0	.83	6.27	1.02	3.39
195	10-21-47	-.01	.65	6.27	.96	3.58
196	10-28-47	-.03	.19	6.26	.89	3.79

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 15						
1	3-18-42	0.07	1.14	2.57	1.03	−0.10
2	3-25-42	.03	2.31	2.64	1.10	−.09
3	4- 1-42	−.11	.16	2.67	1.18	−.07
4	4- 8-42	−.07	0	2.56	1.25	−.07
5	4-15-42	.06	1.98	2.49	1.33	−.10
6	4-22-42	−.13	.0	2.55	1.40	−.07
7	4-29-42	−.15	.0	2.42	1.45	−.07
8	5- 7-42	−.22	0	2.27	1.51	.14
9	5-13-42	−.03	2.07	2.05	1.56	.75
10	5-22-42	−.11	.87	2.02	1.60	−.43
11	5-29-42	−.38	.0	1.91	1.61	.39
12	6- 5-42	.08	1.74	1.53	1.62	.79
13	6-12-42	.84	4.42	1.61	1.64	.28
14	6-19-42	−.04	.99	2.45	1.65	−.08
15	6-25-42	−.06	.71	2.41	1.60	−.11
16	7-16-42	−.02	1.52	2.41	1.63	−.18
17	1-17-46	.57	2.29	1.03	.48	−1.07
18	1-24-46	.55	.53	1.60	.50	−.98
19	1-29-46	.16	0	2.15	.53	−.44
20	2- 5-46	.13	.16	2.31	.57	−.26
21	2-12-46	.07	1.34	2.44	.62	−.13
22	2-19-46	.21	1.92	2.51	.68	−.11
23	2-26-46	−.13	.65	2.72	.76	−.08
24	3- 5-46	−.05	.35	2.59	.85	−.07
25	3-12-46	−.05	.07	2.54	.96	−.10
26	3-19-46	.10	1.87	2.49	1.04	−.11
27	3-26-46	−.10	1.01	2.59	1.11	−.06
28	4- 2-46	.10	4.25	2.49	1.19	−.05
29	4- 9-46	−.12	0	2.59	1.26	−.04
30	4-16-46	−.06	.85	2.47	1.34	−.01
31	5- 7-46	.02	1.15	2.50	1.51	−.01
32	5-14-46	.25	2.17	2.52	1.56	−.11
33	5-21-46	.04	4.21	2.77	1.58	−.02
34	5-28-46	−.29	.03	2.81	1.60	0
35	6- 4-46	−.01	1.10	2.52	1.62	.03
36	6-11-46	−.22	0	2.51	1.63	.01
37	6-18-46	−.08	1.03	2.29	1.65	.33
38	6-25-46	−.21	0	2.21	1.65	.48
39	7- 2-46	.06	2.22	2.00	1.66	1.08
40	7- 9-46	−.22	0	2.06	1.65	.02
41	7-16-46	−.29	.53	1.84	1.63	1.17
42	7-23-46	1.04	6.47	1.55	1.60	1.16
43	7-30-46	−.05	1.15	2.59	1.56	−.05
44	8- 6-46	.11	1.00	2.54	1.52	−.11
45	8-13-46	−.17	1.36	2.65	1.40	−.04
46	8-20-46	−.13	.65	2.48	1.43	.07
47	8-27-46	−.16	.12	2.35	1.39	.22
48	9- 3-46	.03	1.42	2.19	1.34	.55
49	9-10-46	−.17	.24	2.22	1.28	.43
50	9-17-46	−.07	.68	2.05	1.23	.84
51	9-24-46	−.04	.78	1.98	1.17	.42
52	10- 1-46	.17	1.64	1.94	1.12	.24
53	10- 8-46	−.18	.10	2.11	1.07	.74
54	10-15-46	−.16	.45	1.93	1.01	.68
55	10-22-46	−.20	0	1.77	.95	1.07
56	10-29-46	.05	1.25	1.57	.88	1.16
57	11- 5-46	−.15	.01	1.62	.83	.65
58	11-12-46	−.18	.19	1.47	.77	.94
59	11-19-46	−.18	.11	1.29	.71	1.05
60	11-26-46	−.06	.45	1.11	.66	1.00
61	12- 3-46	−.26	.19	1.05	.60	1.01
62	1-21-47	−.01	.35	1.34	.49	.70
63	1-28-47	−.10	0	1.33	.51	.24
64	2- 4-47	.14	.82	1.23	.56	.21
65	2-11-47	−.05	.10	1.37	.61	−.34
66	2-18-47	−.07	0	1.32	.67	.06
67	2-25-47	−.03	.28	1.25	.75	.14
68	3- 4-47	.23	1.20	1.22	.84	−.84
69	3-11-47	1.22	6.34	1.45	.95	−.37
70	3-18-47	−.05	1.64	2.67	1.03	−.07
71	3-25-47	−.05	.84	2.62	1.10	−.07
72	4- 1-47	.01	.34	2.57	1.18	−.07
73	4- 8-47	−.05	.66	2.58	1.25	−.07
74	5- 6-47	.17	2.24	2.43	1.50	−.04
75	5-13-47	−.26	0	2.60	1.56	−.14
76	5-20-47	−.15	0	2.34	1.58	.05
77	5-27-47	.34	3.79	2.19	1.60	.45

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 15—Continued						
78	6- 3-47	-.08	.97	2.53	1.62	-.09
79	6-10-47	-.20	0	2.45	1.63	-.05
80	6-17-47	-.08	.41	2.25	1.65	.44
81	6-24-47	.26	4.02	2.17	1.65	1.03
82	7- 1-47	-.13	0	2.43	1.66	.03
83	7-22-47	-.06	1.08	2.27	1.60	.98
84	7-29-47	-.05	1.79	2.21	1.57	1.02
85	8- 5-47	-.24	.21	2.16	1.53	.56
86	8-12-47	.04	2.15	1.92	1.49	1.23
87	8-19-47	.20	2.85	1.96	1.44	.70
88	8-26-47	.19	2.07	2.16	1.40	-.08
89	9- 2-47	-.22	.17	2.35	1.35	.05
90	9- 9-47	-.25	0	2.13	1.29	1.05
91	9-16-47	-.19	.48	1.88	1.24	1.17
92	10- 7-47	-.29	.78	1.32	1.08	1.28
93	10-14-47	-.25	.83	1.03	1.02	1.30
Pond 16						
1	3-18-42	0.03	1.14	2.46	1.03	-0.66
2	3-25-42	0	2.31	2.49	1.10	-.80
3	4- 1-42	-.10	.16	2.49	1.18	-.59
4	4- 8-42	-.09	0	2.39	1.25	-.25
5	4-15-42	.06	1.98	2.30	1.33	-.09
6	4-22-42	-.12	0	2.36	1.40	-.31
7	4-29-42	-.12	0	2.24	1.45	.19
8	5- 7-42	-.20	0	2.12	1.51	.56
9	5-13-42	.23	2.07	1.92	1.56	.94
10	5-22-42	-.05	.87	2.15	1.60	-.47
11	5-29-42	-.16	0	2.10	1.61	.31
12	6- 5-42	0	1.74	1.94	1.62	1.05
13	6-12-42	.40	4.42	1.94	1.64	.25
14	6-19-42	-.04	.99	2.34	1.65	-.42
15	6-26-42	-.04	.71	2.30	1.60	-.24
16	7-16-42	.04	1.52	2.32	1.63	-.23
17	3-10-45	-.16	0	2.06	.94	.67
18	4- 3-45	.06	.88	1.84	1.20	1.20
19	4-10-45	-.20	.04	1.90	1.27	1.65
20	4-18-45	-.04	1.15	1.70	1.36	1.80
21	5- 8-45	-.12	.29	2.23	1.51	.40
22	5-15-45	.04	1.14	2.11	1.56	.60
23	5-22-45	-.06	.67	2.15	1.58	.65
24	1- 3-46	.16	.97	2.10	.45	-.03
25	1-10-46	.16	2.43	2.26	.46	.15
26	1-17-46	.01	2.29	2.42	.48	-.73
27	1-24-46	-.04	.53	2.43	.50	-.86
28	2- 5-46	-.01	.16	2.33	.57	-.48
29	2-12-46	.02	1.34	2.32	.62	-.28
30	2-19-46	.19	1.92	2.34	.68	-.51
31	2-26-46	-.14	.65	2.53	.76	-1.04
32	3- 5-46	-.06	.35	2.39	.85	-.70
33	3-12-46	-.07	.07	2.33	.96	-.37
34	4- 2-46	.22	4.25	2.25	1.19	-.13
35	4- 9-46	-.15	0	2.47	1.26	-.41
36	4-16-46	-.05	.85	2.32	1.34	.06
37	5- 7-46	.02	1.15	2.35	1.51	-.25
38	5-14-46	.15	2.17	2.37	1.56	-.56
39	5-21-46	.12	4.21	2.52	1.58	-.90
40	5-28-46	-.24	.03	2.64	1.60	-.68
41	6- 4-46	-.01	1.10	2.40	1.62	-.01
42	6-11-46	-.19	0	2.39	1.63	-.04
43	6-18-46	-.07	1.03	2.20	1.65	.66
44	6-25-46	-.16	0	2.13	1.65	.53
45	7- 2-46	.11	2.22	1.97	1.66	1.04
46	7- 9-46	-.18	0	2.08	1.65	.24
47	7-16-46	-.13	.53	1.90	1.63	1.22
48	7-23-46	.75	6.47	1.77	1.60	1.49
49	7-30-46	-.15	1.15	2.52	1.56	-1.06
50	8- 8-46	.11	2.21	2.37	1.55	-1.00
51	8-13-46	.20	0	2.48	1.40	-.88
52	8-20-46	-.15	.65	2.28	1.43	-.02
53	8-27-46	-.05	.12	2.13	1.39	.48
54	9- 3-46	.04	1.42	2.08	1.34	.64
55	9-10-46	-.12	.24	2.12	1.28	.53

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 16—Continued						
56	9-17-46	−.03	.68	2.00	1.23	.96
57	9-24-46	.04	.78	1.97	1.17	.36
58	10- 1-46	.09	1.64	2.01	1.12	.52
59	10- 8-46	−.11	.10	2.10	1.07	.80
60	10-29-46	.10	1.25	1.82	.88	1.66
61	11- 5-46	−.07	.01	1.92	.83	1.13
62	11-13-46	−.07	.19	1.85	.76	1.57
63	11-20-46	−.04	.32	1.78	.71	1.84
64	11-27-46	0	.43	1.74	.66	1.96
65	12-18-46	−.11	0	1.60	.52	2.28
66	1- 7-47	.15	1.28	1.47	.45	2.66
67	1-14-47	.40	2.59	1.62	.47	2.05
68	1-22-47	0	.35	2.02	.50	.64
69	1-29-47	−.03	0	2.02	.51	.96
70	2- 5-47	.07	.82	1.99	.57	1.16
71	2-12-47	−.04	.10	2.06	.62	.64
72	2-19-47	−.05	0	2.02	.68	1.01
73	2-26-47	−.03	.28	1.97	.76	1.22
74	3- 5-47	.12	1.20	1.94	.85	1.29
75	3-26-47	−.12	.10	2.48	1.11	−.97
76	4- 2-47	.14	1.44	2.36	1.19	−.46
77	4- 9-47	−.15	.05	2.50	1.26	−.86
78	4-16-47	.32	3.78	2.35	1.34	−.19
79	5-14-47	−.19	0	2.41	1.57	−.31
80	6-11-47	−.19	0	2.32	1.63	.19
81	6-18-47	−.11	.41	2.13	1.65	.74
82	7- 9-47	.08	2.64	2.32	1.65	−.09
83	7-16-47	−.20	0	2.40	1.63	−.28
84	7-23-47	−.03	1.08	2.20	1.60	.74
85	7-30-47	.05	1.79	2.17	1.56	.83
86	8- 6-47	−.15	.21	2.22	1.53	.56
87	8-13-47	.20	2.83	2.07	1.49	1.18
88	9- 3-47	−.16	0	2.32	1.34	.43
89	9-10-47	−.17	.15	2.16	1.28	.85
90	9-17-47	−.13	.54	1.99	1.23	1.25
91	9-24-47	.02	2.32	1.86	1.17	1.52
92	10- 1-47	−.16	.05	1.88	1.12	−.19
93	10- 8-47	.01	1.31	1.72	1.07	1.76
94	10-15-47	−.11	.35	1.73	1.01	1.67
95	10-22-47	.02	.60	1.62	.95	1.95
Pond 17						
1	3-18-42	−0.03	1.14	2.56	1.03	−1.12
2	3-25-42	−.03	2.31	2.53	1.10	−1.15
3	4- 1-42	−.11	.16	2.50	1.18	−.96
4	4- 8-42	−.07	0	2.39	1.25	−.44
5	4-15-42	.01	1.98	2.32	1.33	−.11
6	4-22-42	−.10	0	2.33	1.40	−.34
7	4-29-42	−.08	0	2.23	1.45	0
8	5- 7-42	−.17	0	2.15	1.51	.28
9	5-13-42	.31	2.07	1.98	1.56	.56
10	5-22-42	−.13	.87	2.29	1.60	−.46
11	5-29-42	−.16	0	2.16	1.61	.22
12	6- 5-42	−.04	1.74	2.00	1.62	.29
13	6-12-42	.44	4.42	1.96	1.64	.51
14	6-19-42	−.14	.99	2.40	1.65	−1.79
15	6-26-42	−.04	.71	2.26	1.60	−.28
16	7-16-42	.04	1.52	2.28	1.63	−.25
17	5- 8-45	−.08	.29	2.30	1.51	−.90
18	5-15-45	.03	1.14	2.22	1.56	−.43
19	5-22-45	−.09	.67	2.25	1.58	−.23
20	5-29-45	−.14	0	2.16	1.61	−.19
21	6- 5-45	−.32	0	2.02	1.62	.37
22	6-12-45	−.40	.18	1.70	1.64	.77
23	6-19-45	−.44	.88	1.30	1.65	.70
24	6-26-45	−.36	.25	.86	1.65	.96
25	7- 3-45	−.22	.17	.50	1.66	1.25
26	7-10-45	−.07	.67	.28	1.65	1.93
27	12-29-45	1.79	4.89	.58	.46	−.16
28	1- 3-46	.11	.97	2.37	.45	−1.63
29	1-10-46	.14	2.43	2.48	.46	−1.13
30	1-17-46	−.02	2.29	2.62	.48	−1.65
31	1-24-46	−.08	.53	2.60	.50	−1.49

Basic data for ponds—Continued

Week no.	Date end of week	X_1	X_2	X_3	X_4	X_5
Pond 17—Continued						
32	2- 5-46	-.06	.16	2.44	.57	-.70
33	2-12-46	.02	1.34	2.38	.62	-.43
34	2-19-46	.20	1.92	2.40	.68	-.50
35	2-26-46	-.14	.65	2.60	.76	-1.20
36	3- 5-46	-.08	.35	2.46	.85	-.52
37	3-12-46	-.09	.07	2.38	.96	-.14
38	3-19-46	.08	1.87	2.29	1.04	.11
39	3-26-46	-.09	1.01	2.37	1.11	-.33
40	4- 2-46	.15	4.25	2.28	1.19	.14
41	4- 9-46	-.10	0	2.43	1.26	-.77
42	4-16-46	-.04	.85	2.33	1.34	-.30
43	5- 7-46	-.02	1.15	2.34	1.51	-.60
44	5-14-46	.10	2.17	2.32	1.56	-.28
45	5-21-46	.15	4.21	2.42	1.58	-.83
46	5-28-46	-.25	.03	2.57	1.60	-1.29
47	6- 4-46	-.03	1.10	2.32	1.62	-.44
48	6-11-46	-.11	0	2.29	1.63	-.30
49	6-18-46	-.06	1.03	2.18	1.65	.30
50	6-25-46	-.26	0	2.12	1.65	.61
51	7- 2-46	.08	2.22	1.86	1.66	.91
52	7- 9-46	-.27	0	1.94	1.65	.53
53	7-16-46	-.32	.53	1.67	1.63	1.05
54	7-23-46	1.20	6.47	1.35	1.60	1.40
55	7-30-46	-.18	1.15	2.55	1.56	-1.49
56	8-20-46	-.08	.65	2.32	1.43	-.16
57	8-27-46	-.06	.12	2.24	1.39	.37
58	9- 3-46	-.04	1.42	2.18	1.34	.55
59	9-10-46	-.24	.24	2.14	1.28	.55
60	9-17-46	-.14	.68	1.90	1.23	.88
61	9-24-46	-.06	.78	1.76	1.17	1.12
62	10- 1-46	.04	1.64	1.70	1.12	.95
63	10- 8-46	-.25	.10	1.74	1.07	.57
64	10-29-46	.17	1.25	.61	.88	1.02
65	11- 5-46	-.40	.01	.78	.83	.76
66	1-29-47	.11	0	1.47	.51	.06
67	2- 5-47	.10	.82	1.58	.57	.43
68	2-12-47	-.08	.10	1.68	.62	.49
69	2-19-47	-.14	0	1.60	.68	.74
70	2-26-47	-.19	.28	1.46	.76	.91
71	3- 5-47	.24	1.20	1.27	.85	.99
72	3-26-47	-.07	.10	2.39	1.11	-1.32
73	4- 1-47	.10	1.44	2.32	1.19	-.30
74	4- 8-47	-.18	.05	2.42	1.26	-.76
75	4-15-47	.26	3.78	2.24	1.34	-.11
76	5-14-47	-.08	0	2.28	1.57	-.45
77	6-11-47	-.05	0	2.27	1.63	-.11
78	6-18-47	-.10	.41	2.22	1.65	-.05
79	6-25-47	.22	4.02	2.12	1.65	.63
80	7- 2-47	0	1.60	2.34	1.66	-.26
81	7- 9-47	.01	2.64	2.34	1.65	-.05
82	7-16-47	-.16	0	2.35	1.63	-.27
83	7-23-47	-.07	1.08	2.19	1.60	.51
84	7-30-47	.03	1.79	2.12	1.56	.67
85	8- 6-47	-.30	.21	2.15	1.53	.64
86	8-13-47	.23	2.83	1.85	1.49	1.09
87	9- 3-47	-.14	0	2.36	1.34	-.01
88	9-10-47	-.22	.15	2.22	1.28	.41
89	9-17-47	-.26	.54	2.00	1.23	.77
90	9-24-47	-.11	2.32	1.74	1.17	1.20
91	10-15-47	-.27	.35	.83	1.01	1.59
92	10-22-47	-.06	.60	.56	.95	1.81

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Contributions to the Hydrology of the United States 1948-52

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Oscar L. Chapman, *Secretary*

GEOLOGICAL SURVEY

W. E. Wrather, *Director*

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[The letters in parentheses preceding the titles are those used to designate the papers for separate publication]

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