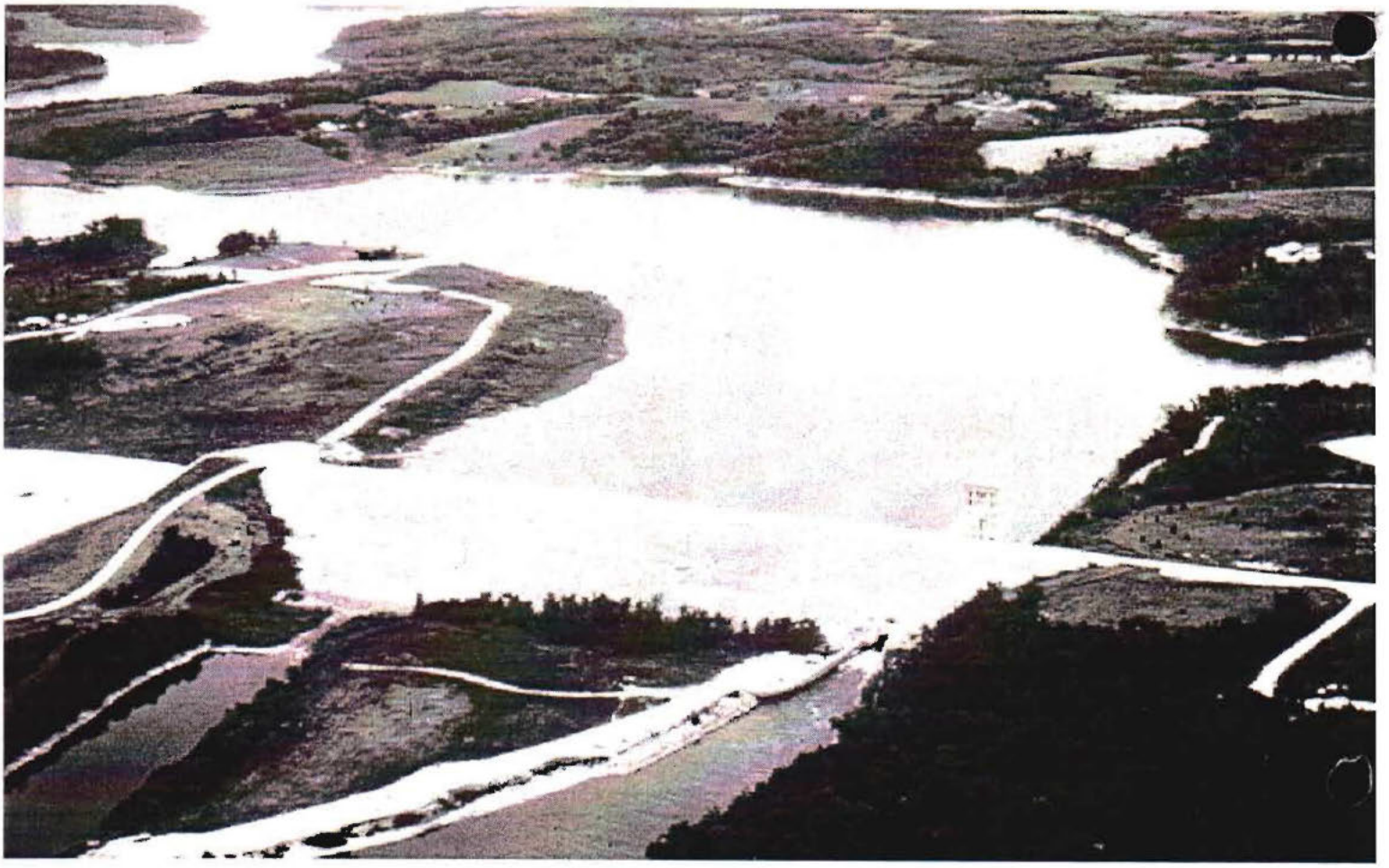
WATER CONTROL MANUAL

CORALVILLE LAKE

Iowa River Basin
Coralville, Iowa

U.S. Army Corps of Engineers
Rock Island District
Rock Island, Illinois

1959
Revised January 2001



Upper Mississippi River Basin
Iowa River, Iowa
Master Reservoir Regulation Manual

Coralville Lake

TABLE OF CONTENTS

	Page
TITLE PAGE	i
PHOTOGRAPH	ii
NOTICE TO USERS OF THE MANUAL	iii
REGULATION ASSISTANCE PROCEDURES	iii
TABLE OF CONTENTS	iv
PERTINENT DATA	x
TEXT OF MANUAL	1-1

Paragraph	Title	PAGE
	I - INTRODUCTION	
1-01	Authorization	1-1
1-02	Purpose and Scope	1-1
1-03	Related Manuals and Reports	1-1
1-04	Project Owner	1-1
1-05	Operating Agency	1-2
1-06	Regulating Agency	1-2
	II - DESCRIPTION OF PROJECT	
2-01	Location	2-1
2-02	Purpose	2-1
2-03	Physical Components	2-1
	a. Embankment	2-1
	b. Spillway	2-2
	c. Outlet Works	2-2
2-04	Related Control Facilities	2-2
	a. Lake McBride	2-2
	b. Amana Colony	2-3

Paragraph	Title	PAGE
	c. Downstream from the Reservoir to Iowa City	2-3
	d. Downstream of Iowa City	2-3
2-05	Real Estate Acquisition	2-4
2-06	Public Facilities	2-6
	a. General	2-6
	b. Recreation Areas	2-7
	c. Recreation Facilities	2-8
	d. Services	2-9
	e. Additional Recreation	2-9
	III - HISTORY OF PROJECT	
3-01	Authorization	3-1
3-02	Planning and Design	3-1
3-03	Construction	3-2
3-04	Related Projects	3-3
3-05	Modification to Regulation	3-3
3-06	Principal Regulation Problems	3-8
	IV - WATERSHED CHARACTERISTICS	
4-01	General Characteristics	4-1
4-02	Topography	4-1
4-03	Geology and Soils	4-2
4-04	Sediment	4-2
4-05	Climate	4-2
4-06	Storms and Floods	4-4
4-07	Runoff Characteristics	4-6
4-08	Water Quality	4-7
4-09	Channel and Floodway Characteristics	4-9
4-10	Upstream Structures	4-10
4-11	Downstream Structures	4-10
4-12	Economic Data	4-10
	a. Population	4-10
	b. Agriculture	4-11
	c. Industrial, Commercial, Public	4-12
	d. Flood Damage	4-12
	V - DATA COLLECTION AND COMMUNICATION NETWORKS	
5-01	Hydrometeorological Stations	5-1
	a. Facilities	5-1
	b. Reporting	5-2
	c. Maintenance	5-2

Paragraph	Title	PAGE
5-02	Water Quality Stations	5-2
5-03	Sediment Stations	5-3
5-04	Recording Hydrologic Data	5-3
5-05	Communication Networks	5-4
5-06	Communication with Project	5-4
	a. Regulating office with Project office	5-4
	b. Between Project office and Others	5-5
5-07	Project Reporting Instructions	5-5
5-08	Warnings	5-5
	VI - HYDROLOGIC FORECASTS	
6-01	General	6-1
	a. Role of Corps of Engineers	6-1
	b. Role of Other Agencies	6-1
6-02	Flood Condition Forecasts	6-1
6-03	Conservation Purpose Forecasts	6-2
6-04	Long Range forecasts	6-3
6-05	Drought Forecasts	6-3
	VII - WATER CONTROL PLAN	
7-01	General Objectives	7-1
7-02	Constraints	7-1
7-03	Overall Plan for Water Control	7-2
7-04	Standing Instructions to Project Personnel	7-2
7-05	Flood Control	7-3
7-06	Recreation	7-5
7-07	Water Quality	7-6
7-08	Fish and Wildlife	7-6
7-09	Drought Contingency Plan	7-6
7-10	Flood Emergency Action Plan	7-7
7-11	Other	7-7
7-12	Deviations from Normal Regulation	7-8
	a. Emergencies	7-8
	b. Unplanned Minor Deviations	7-8
	c. Planned Deviations	7-9
7-13	Rate of Release Change	7-9
	VIII - EFFECT OF WATER CONTROL PLAN	
8-01	General	8-1
8-02	Flood Control	8-1
	a. Spillway Design Flood	8-1

Paragraph	Title	PAGE
	b. Standard Project Flood	8-1
	c. Other	8-2
8-03	Recreation	8-2
8-04	Water Quality	8-2
8-05	Fish and Wildlife	8-2
8-06	Drought Contingency Plan	8-3
8-07	Flood Emergency Action Plan	8-3
8-08	Frequencies	8-3
	a. Peak Inflow Probability	8-3
	b. Pool Elevation Duration and Frequency	8-3
	c. Key Control Points	8-3
8-09	Other Studies	8-4

IX - WATER CONTROL MANAGEMENT

9-01	Responsibilities and Organization	9-1
	a. Corps of Engineers	9-1
	b. State and County Agencies	9-2
9-02	Interagency Coordination	9-2
	a. Local Press and Corps Bulletins	9-2
	b. National weather Service	9-2
	c. U.S. Geological service	9-3
	d. Contractors	9-3
9-03	Reports	9-3

TABLES

Tables

2-1	Coralville Lake Surface Area	T-1
2-2	Coralville Lake Storage Volume	T-4
4-1	Minimum Temperatures	4-2
4-2	Maximum Temperatures	4-3
4-3	Precipitation: Average, Maximum, Minimum	4-3
4-4	Snow: Average, Maximum, Minimum	4-4
4-5	Pan Evaporation	4-4
4-6	Monthly Inflow Frequency	4-6
4-7	Average Monthly Runoff at Coralville Res.	4-7
4-8	Marengo Flow Duration	4-7
4-9	Lone Tree Flow Duration	4-8
4-10	Wapello Flow Duration	4-8
4-11	Iowa Upstream Rating Curves	T-7
4-12	Iowa River Tributaries: Upstream Rating Curves	T-8

Tables	Title	Page
4-13	Downstream Rating Curves: Coralville Reservoir to Lone Tree	T-9
4-14	Downstream Rating Curves: Below Lone Tree	T-10
4-15	Population and Employment	4-11
4-16	County Agricultural Description	4-12
4-17	Stage/Damage and Stage/Acres Relationships	4-13
4-18	Average Annual Damage and Benefits	4-13
5-1	Coralville Gage Stations	5-1

EXHIBITS

Exhibit	Title	Page
A	Supplemental Pertinent Data	A-1
B	Coralville Lake Project and Design Memoranda	B-1
C	Standing Instructions to Reservoir Personnel	C-1

PLATES

	Plate
General Arrangement, Location & Vicinity Maps	2-1
Area-Capacity Curve	2-2
Storage Chart; Elevation vs. % of Storage	2-3
Spillway Monolith 7L; Plan, Elevation & Sections	2-4
Spillway Rating Curve	2-5
Outlet Works; General Plan & Sections	2-6
Outlet works; General Arrangement of Equipment	2-7
Outlet Works; Assembly - Gate & Rollers	2-8
Outlet Rating Curve	2-9
Outlet Rating Nomogram; Gate Opening from 0.1 to 10 Feet	2-10
Outlet Rating Nomogram; Gate Opening from 5.0 to 60 Feet	2-11
Lake Macbride; Remedial Works	2-12
Amana, Iowa; Remedial Works	2-13
Sediment Ranges	2-14
Recreation Areas; General Location Plan	2-15
Water Surface Profile, Iowa River; Mouth to Coralville Dam	4-1
Water Surface Profile, Iowa River; Mouth to Coralville Dam	4-2
Iowa River Profile Upstream of Coralville Dam	4-3
Iowa / Cedar Basin Topography	4-4
Coralville Lake Inflow frequency Curve	4-5

	Plate
Iowa River at Iowa City Mean Monthly Flow 1903-1930	4-6
Iowa River at Iowa City Mean Monthly Flow 1931-1958	4-7
Iowa River at Iowa City Mean Monthly Flow 1959-1987	4-8
Iowa River at Iowa City Mean Monthly Flow 1988-1996	4-9
Average Time of Water Travel in Days	4-10
Coralville Lake Gage Location	5-1
Water Quality Sampling Stations	5-2
Organization for Reservoir Regulation	7-1
Emergency Drawdown Curves for Various Inflow Conditions	7-2
Coralville Spillway Design Flood	8-1
Routing Standard Project Flood Through a Half-Filled Pool	8-2
Effect of Reservoir Regulation at Wapello and Lone Tree Flood of 1947	8-3
Effect of Reservoir Regulation at Wapello and Lone Tree Flood of 1993	8-4
Coralville Lake Inflow Frequency, Volume Duration	8-5
Coralville Lake Elevation Frequency	8-6
Coralville Lake Non-Exceedance Elevation Frequency	8-7
Coralville Lake Elevation Duration	8-8
Coralville Lake Reservoir Levels 1904-1915	8-9
Coralville Lake Reservoir Levels 1916-1927	8-10
Coralville Lake Reservoir Levels 1928-1939	8-11
Coralville Lake Reservoir Levels 1940-1951	8-12
Coralville Lake Reservoir Levels 1952-1958	8-13
Coralville Lake Reservoir Levels 1959-1970	8-14
Coralville Lake Reservoir Levels 1971-1982	8-15
Coralville Lake Reservoir Levels 1983-1994	8-16
Coralville Lake Reservoir Levels 1995-1999	8-17
Maximum 1 Day Regulated Frequency Curve, Coralville Lake	8-18
Maximum 1 Day Regulated Frequency Curve, Iowa City	8-19
Maximum 1 Day Regulated Frequency Curve, Lone Tree	8-20
Maximum 1 Day Regulated Frequency Curve, Wapello	8-21

PERTINENT DATA

Location	County - Johnson State - Iowa River - Iowa River at river mile 83.2 above mouth
Drainage area above dam	3,115 square miles 1 inch of runoff = 166,000 acre-feet
Uncontroled Drainage area	
Above Iowa City	156 square miles
Above Lone Tree	1,178 square miles
Above Wapello	9,384 square miles
Type of Dam	Rolled earthfill
Length of Dam	1,400 feet
Heigth of Dam	100 feet
Crest Elevation of Dam	743 feet, NGVD
Top Width of Dam	22 feet
Spillway	
Type	Chute spillway with uncontrolled concrete weir
Crest Elevation	712 feet, NGVD
Length	500 feet
Outlet Works	
Type	1 circular concrete conduit
Size	23 foot diameter
Service Gates (3)	Electric drum hoist operated slide gates
Real estate guide taking line	
Fee	702 feet, NGVD (Authorized 1977)
Flowage easment	702-717 feet, NGVD

Pertinent Reservoir Elevations and Information

Elevation (feet, NGVD)	Discription	Area (acres)	Incremental storage (acre-feet)	Storage (acre-ft)	Discharge Capacity Outlet (cfs)	Discharge Capacity Spillway (cfs)
679	Top Spring Cons. Pool	2,380	15,700	15,700	10,500	0
683	Top Cons. Pool	4,050	12,400	28,100	11,800	0
686	Top Fall Cons. Pool	5,370	14,500	42,600	13,000	0
712	Top Flood Control Pool	25,040	378,400	421,000	20,000	0
737.9	Max. SDF	44,000	633,800	1,054,800	22,100	244,000

UPPER MISSISSIPPI RIVER BASIN
IOWA RIVER, IOWA
MASTER RESERVOIR REGULATION MANUAL

CORALVILLE LAKE

I-INTRODUCTION

1-01 Authorization.

This reservoir regulation manual has been prepared in accordance with directives contained in:

a. ER 1110-2-240, Water *Control Management*, U.S. Army Corps of Engineers, March, 1994

b. ER 1110-2-8156, *Preparation of Water Control Manuals*, U.S. Army Corps of Engineers, August 1995.

1-02 Purpose and Scope.

This manual contains a description of the Coralville Lake project. It discusses all pertinent information relative to the project features and collection and analysis of hydrometeorologic data associated with a detailed plan of regulation for conservation, flood control and water resource management of the Coralville Lake project. This report does not discuss maintenance.

1-03 Related Manuals and Reports.

This manual represents the *Master Reservoir Regulation Manual* for the Coralville Lake project on the Iowa River, Iowa. Appendix A of the *Master Regulation Manual* is the *Drought Contingency Plan: Coralville Reservoir*, October 1996. The other pertinent report to the project is the *Emergency Plan for Coralville Dam and Lake: Iowa River, Iowa*, April 1995.

1-04 Project Owner.

The United States Army Corps of Engineers (USACE), Rock Island District owns this project.

1-05 Operating Agency.

The dam is operated by the USACE from the Coralville project office located near the dam. The office is open Monday through Friday from 7:30 a.m. till 4:00 p.m. The telephone number is [redacted] During weekends and holidays the project office is staffed for regular communication with the Water Control Section and to make changes on an as needed basis. The dam is operated manually at the site and maintenance is done or contracted by the USACE personnel.

1-06 Regulating Agencies.

The USACE, Rock Island District, as the owner of the project, has direct responsibility for regulating the project including hydrologic forecasts, drought management and flood control. The Water Control Section issues operating instructions and hydrologic forecasts. The office is open 7:00 a.m. to 4:00 p.m. Monday through Friday. Employees are on duty Saturday and Sunday mornings. The telephone number is [redacted] [redacted] The forecaster can be reached by either pager or home telephone during non-duty hours. Those numbers are available from project staff or the duty forecaster.

II-DESCRIPTION OF PROJECT

2-01 Location.

The dam is located on the Iowa River, 83.3 miles above its mouth and 5 miles upstream of Iowa City. The dam and lake are primarily in Johnson County with portions extending upstream into Linn and Iowa counties. The general arrangement, location, and vicinity maps are shown on Plate 2-1. The Cedar River, its largest tributary, joins the Iowa River downstream of the dam. The Iowa-Cedar basin is a tributary to the Mississippi.

2-02 Purpose.

The reservoir was authorized for flood control and water conservation by Public Law 75-761 in 1938. Recreation and fish and wildlife enhancement were authorized by Public Law 78-534 and by Public Law 94-587.

2-03 Physical Components.

a. Embankment. The area and capacity versus elevation for the reservoir upstream of the dam is plotted on Plate 2-2. Table 2-1 lists the detailed area versus elevation data while Table 2-2 lists the capacity versus elevation data. Both these table follow the text. The percent of total flood control storage as a function of elevation appears on Plate 2-3.

The embankment is a rolled-fill earth structure, containing approximately 1,000,000 cubic yards of material, with an impervious core and pervious flanks. The height above the riverbed is about 100 feet. The length at the crest is about 1,400 feet and the maximum base width is approximately 650 feet. The crest elevation is 743 feet, NGVD. The upstream face slopes one on three from the crest to elevation 696, and one on four from that elevation to natural ground. The downstream face slopes one on two and one-half from the crest to elevation 698, and one on three and one-half from elevation 698 to natural ground. A berm 10 feet wide is provided on the downstream slope at

elevation 698. The entire upstream face and the downstream face up to elevation 698 are covered with 2 feet of dumped riprap on 9 inches of gravel, and 1 foot of riprap on 6 inches of gravel covers the remainder of the downstream slope. Beneath the entire length of the earth dam at its axis is an impervious earth cut-off extending to bedrock, designed to prevent under seepage through the pervious materials beneath the valley floor.

b. Spillway. The saddle spillway is located in the right bluff. The weir is curved, has an ogee section, is 500 feet in length, and its crest is at elevation 712.0 feet, NGVD. The spillway channel downstream from the weir for a distance of approximately 600 feet is paved with concrete and concrete training walls protect the sides of the channel. The spillway is designed to pass a flow of 244,000 cfs. With this discharge the water level in the reservoir would be 25.9 feet above the spillway crest. The plan and elevation views of the spillway are shown on Plate 2-4 while the spillway discharge elevation curve is on Plate 2-5.

c. Outlet works and stilling basin. Normal discharge from the reservoir is accomplished by means of a gated conduit beneath the earth embankment at the toe of the left bluff. The outlet works are detailed on Plates 2-6, 2-7, and 2-8. The conduit is a single reinforced-concrete tube 23 feet in diameter. The length, including the intake structure and transition section, is 410 feet. Three gates, each 8.33 feet wide by 19 feet high, and operated by electrically driven drum hoists, are located in the intake structure. High velocities of the discharge from the conduit are reduced in a stilling basin, which is 180.33 feet in length and 75.35 feet wide at the sill (downstream end). The capacity of the outlet structure is about 20,000 cfs when the reservoir is filled to spillway crest level. The outlet discharge capacity curve is shown on Plate 2-9 while the outlet rating nomograms are on Plates 2-10 and 2-11.

2-04 Related Control Facilities.

a. Lake Macbride. The dam forming Lake Macbride was raised to elevation 712.0 feet, NGVD. Operation for the standard project flood obtains a pool elevation of 717.0

feet. At this elevation minor inconveniences to some recreational areas occur in Lake Macbride. The crest of the riprap protected earth embankment section of the dam was established at elevation 721.0 feet, providing four feet of freeboard above the standard project flood level in Coralville Pool. Lake Macbride remedial works are shown on Plate 2-12.

b. Amana Colony. The protective works for the community of Amana are described in Appendix VI, *Relocations, Revised Definite Project Report, Coralville Reservoir* and shown on Plate 2-13. Protective works to an elevation of 719.0 feet are provided the community of Amana from Coralville Pool. This also extends along Price Creek in the Amana area. The annual loss in generated output through the abandonment of the hydroelectric station on Price Creek, due to flooding from Coralville's pool, is estimated at 2,450 kW-hr. The levee along the right bank of Price Creek offsets any loss in electric energy due to reservoir operation and flash flooding.

c. Downstream from the reservoir to Iowa City. Some protection is afforded the State University of Iowa property by low levees and riprapped banks. After the flood in 1993 both the University of Iowa and the city of Iowa City improved the protection of their water treatment plants from flooding. The City of Coralville did extensive channel clearing and levee protection along the lower 3 miles of Clear Creek.

d. Downstream of Iowa City. Between Iowa City and the confluence with the Cedar River, two organized levee districts protect approximately 3,450 acres on the left bank of the Iowa River. Downstream from the confluence with the Cedar River three organized levee districts provide protection against Iowa River floods for approximately 6,400 acres. After the 1993 flood, one levee district was purchased during the "buy out" period by FEMA for wetlands. Several private levees near the mouth of the Iowa River protect a much more extensive area of Mississippi River bottomland and the unincorporated town of Oakville, Iowa. These levees do not have the height to withstand major floods similar in magnitude to 1993 without a major flood fight by the levee districts.

2-05 Real Estate Acquisition.

The guide contour taking line for the reservoir project was established at elevation 717.0 feet, NGVD, or 5 feet above the elevation of the uncontrolled spillway crest. The 5-foot freeboard is for surcharge storage above the spillway crest, adverse effects due to ground saturation, wave action or shoreline erosion, and adverse backwater effects on several small tributaries to the reservoir. The acquisition area extends upstream to approximately sediment range No. 33 the location of which can be seen on Plate 2-14. When maximum reservoir elevation is attained during the standard project flood, the backwater curve intersects the natural river profile approximately at sediment range No. 33. For all flows lower in magnitude than the standard project flood, maximum backwater effects are dissipated downstream from sediment range No. 33. Upstream from sediment range No. 33; the only areas lower than elevation 712 are within the bank of the stream, sloughs, and oxbows. These areas are subject to natural flooding as in the past.

The tentative real property taking line, as applied to the acquisition of fee title, was established to enclose the guide contour elevation 696.0 with modifications within reasonable limits, in order to incorporate in the reservoir boundary, land and property lines, and natural or artificial boundaries. Real estate problems, including severance damage, ownership, and accessibility were also considered in establishing the taking line. The upper guide taking line for flowage easements was elevation 717.0. For flowage easements, generally the above-mentioned modifications were not applied as the taking line closely approximates the guide contour. In some instances, the flowage easement boundary encompasses land above the guide contour line. In these instances it was considered that a variation of a few feet in the elevation of the taking line would not materially increase the cost to the United States or the acreage of the lands in which an interest was acquired.

The final real property taking line closely follows the tentative taking line with refinements and modifications based on sound real estate practices and requirements of construction, operation, maintenance and management of the authorized project. The original real estate program consisted of acquisition of approximately 24,000 acres in

fee simple title and 9,567 acres in flowage easements with occasional overflow and a 5-year flood elevation frequency.

The dam was completed and placed in operation in 1958 under a Regulation Plan called Plan 7. Shortly after Coralville Lake was regulated using Plan 7, downstream farm owners could not tolerate the continuous bank full outflow during the crop season. The results were a restudy of the Coralville Regulation Plan. In 1963, the reservoir began operation under Regulation Plan 8. Additional information is located in Chapter 3. In 1967, a Real Estate Design study was initiated to determine the effect of the regulation change and was completed in 1976. It was determined that the five-year flood frequency elevation (fee title elevation) should be 702.0 feet and that greater interest should be acquired in the occasional flowage easement properties.

In 1977 authority was granted for the acquisition of an additional 1,800 acres in fee simple title and to obtain perpetual flowage easements for 6,875 acres above elevation 702 where only occasional flowage easements were held previously. This included approximately 5,000 acres owned by the Amana Society.

In 1982, funds were authorized for this purpose and acquisitions were made between 1982 and 1988. Fee simple title was actually acquired for only a portion of the lands between elevation 696.0 and 702.0 feet, NGVD. For the majority of these lands, at owner option, the United States acquired perpetual permanent flowage easements, including approximately 800 acres owned by the Amana Society. For lands situated between the blocked out 702 and 717 foot, NGVD contour lines the United States also acquired perpetual permanent flowage easements. Only occasional flowage easements were held there previously. In addition, flowage easements were obtained for 91 acres not held previously. The easements grant the Corps of Engineers the right to either occasionally or permanently overflow lands between 696 and 717 feet, NGVD. The owners retain fee simple title to the land and all such rights as may be used and enjoyed without interfering with the easement acquired. No structures for human habitation are permitted in the flowage easement area. Except for fences, the officer in charge of the project must approve any other proposed structures in the easement area in writing, in advance. The acquisition costs for fee simple title purchase and

flowage easement purchases including severance damages to the remainder, totaled $5,005,961.00 for the 1982 acquisition program.

2-06 Public Facilities.

a. General. In the development of a master plan for resource management, consideration was given to the authorized project purposes, indigenous project resources, and the recreational use potential. In determining the recreation potential and facility needs, topographic features of project lands, the road network, anticipated water conditions, population dynamics, and existing facilities were all considered. The master plan for resource management, and the resulting plan for recreation facilities, were fully coordinated with Federal, State, and County conservation agencies. The plan was also coordinated with local communities and groups.

b. Recreation Areas. Coralville Lake has 15 areas available for public use. The Corps of Engineers manages 11 of these areas; the Iowa Department of Natural Resources manages the Hawkeye Wildlife area and Lake Macbride State Park, located around Lake Macbride, a subimpoundment of Coralville Lake. The Macbride Field Campus and Mehaffey bridge areas are also for public use and are managed by the Iowa Department of Natural Resources. In addition to these areas, the Corps manages two marinas and one camping facility, which operate as commercial concessions. Maps detailing Corps areas are a part of the body of the Resource Master Plan. Plate 2-15 is a general location plan of the recreation areas and their descriptions are as follows:

(1) Office & Visitor Center - Located on the overlook at the east end of the dam, it is approximately 2 1/4 miles north of Interstate 80 at Iowa City. Access to the center is from Prairie Du Chien Road. Features of the facility include interpretive displays, activities and items of interest. Displays include a working model of Coralville Dam. The administration building as well as maintenance facilities are also located here.

(2) Turkey Creek Picnic Ground - This recreational area is located south of the Office and Visitors Center off Prairie Du Chien Road. Recreational attractions include camper camping, sheltered picnic areas, and one of two interpretive trails managed by the Corps. These attractions are supported by waterborne sanitary facilities. To the near north is one of three marina concessions supplying this area with boat launching and dock rental.

(3) G. S. Marine - Located on the near-east side of the Visitors Center and the near north side of Turkey Creek Picnic ground, this commercial concession supports the area with boat launching and dock rental. This and adjacent facilities combine to create a major recreational attraction at the east edge of the dam.

(4) Tailwater East - Accessed from the Visitors Center, it is south of Turkey Creek on the east shore of the Iowa River. It provides camper and tent camping with boat launching on the Iowa River, supported by both waterborne and vault type restroom facilities.

(5) Tailwater West & Cottonwood - Located at the foot of the Coralville Dam on the west shore of the Iowa River, this area is accessed from County Highway W66. Separated by a backwater pool, they are two distinct areas with their only real central facility being a boat-launching ramp on the Iowa River. Tailwater West, almost completely surrounded by water, in addition to the boat ramp offers no fee camping and picnicking, supported by vault type restroom facilities, whereas Cottonwood, in addition to these, offers waterborne restroom facilities.

(6) West Overlook - Located on the overlook at the west-end of the dam, it is accessed from County Highway W66. This area offers Class A camping, swimming, boat launching, hiking trails, and picnicking with covered shelters available. Support facilities include trailer dumping, vault and waterborne sanitary facilities and showers.

(7) Linder Point - This area is located just west of West of Overlook and is also accessible from Highway W66. This area offers Class A camping for tents and campers, a hiking trail, and it has one of the project's

three winter ski trails. This area also provides showers and waterborne restroom facilities.

(8) Sugar Bottom - The largest recreation facility in the Coralville lake area, it is located 4 1/2 miles north of Iowa City on the east side of the lake. It is accessed from County Highway W70. Recreational provisions include camper and tent camping, swimming, picnic facilities, a boat ramp, hiking trails, one of two area snowmobile trails, and it is the only area with an equestrian trail. Support facilities at the site include showers, waterborne sanitary facilities, trailer dumping, and one of two area fish cleaning stations. This area is one of two operated by the Corps where electrical hookups are being proposed.

(9) Mid River Marina- Located on County Highway 218, approximately 5 3/4 miles north of Interstate 80, it is one of the project's three commercial concessions.

(10) Curtis Bridge - This recreational area is accessed from County Highway 218, and is approximately one mile north of the Mid River area. Its main provision is boat launching, but a small camping area and a vault type restroom facility support it.

(11) Sandy Beach - Located on County Highway W4F, it is approximately three miles southeast of Shueyville on the north shore of the lake. Being the only Corps managed area on the north shore, it offers camper and tent camping, swimming, boat launching and picnicking with shelters available. Support facilities include both vault and waterborne restrooms and one of two project fish cleaning stations.

c. Recreation Facilities. The facilities provided vary from site to site to meet the objective for each area. Campground facilities consist of surfaced roadways, parking spurs, central sanitary and water facilities, picnic tables, fire rings, and refuse containers. Day-use facilities consist of access roadways, parking space, sanitation facilities, potable water, picnic tables, fireplaces, refuse containers, and shelter houses. Launching sites provide a ramp, turning area, parking, a loading/unloading dock, and in some locations public tables, sanitation, and water. All areas and sites are

landscaped with native as well as exotic trees and shrubs. The impact of operation of the Lake at conservation pool elevation 683.0 on the recreational facilities around the lake is generally limited to the boat ramps and beaches. The impact for each recreational area is given in the *Draft Water Control Plan* for Coralville Reservoir, Iowa, dated March 1990.

d. Services. Three commercial concession sites are outgranted to private interests. They are G. S. Marine located at the near east side of the Office and Visitors Center, Mid River Marine located on County Highway 218 just north of the Mid River recreation facility, and Jolly Roger located 3 1/2 miles north of North Liberty and accessible from a secondary road off County Highway 218. These concessionaires provide recreational services required by the public.

e. Additional Recreation Facilities.

(1) Lake Macbride State Park - Located west of Solon, the Park is accessible from West 5th Street and County Highway 382. The park is comprised of land surrounding Lake Macbride, which is a subimpoundment of Coralville Lake. The lake and park are a unit of the Iowa Conservation Commission. Summer recreational facilities include camper and tent camping, picnicking, swimming, and hiking trails. It also provides boat launching and docking, but because the lake is small, boat motors are limited to ten horsepower from 1 May to 1 September. During the remainder of the year horsepower is unlimited with no wake. Winter recreational facilities offer cross country skiing and snowmobile trails. Support services include showers, trailer dumping, waterborne sanitary facilities, and is the only facility presently offering electrical hookups.

(2) Hawkeye Wildlife Area - Consisting of more than 13,000 acres of land and water, it surrounds the northern 2 1/2 miles of the lake and over 6 miles of the Iowa River Basin at the north end of the lake. The area offers boat launching and is one of the most popular waterfowl hunting areas in the State of Iowa. Though hunting in this area is permitted, there are restrictions. This area includes 1,200 acres of refuge where hunting and trapping are not permitted. At this time, there are no support facilities available.

III-HISTORY OF PROJECT

3-01 Authorization.

The Coralville Lake project on the Iowa River was selected and approved by the following laws as a unit in the general comprehensive plan for flood control in the Upper Mississippi River Basin. An investigation of a reservoir for flood control on the Iowa River was first authorized by the River and Harbor Act, 69th Congress, First Session (approved 21 January 1927) and also by the Flood Control Act (approved 15 May 1928). The investigation report was printed in House Document 134, 71st Congress, Second Session. A later investigation was also authorized by the Flood Control Act (approved 15 May 1928) and was printed in House Document 259, 74th Congress, First Session, entitled *Comprehensive Report on Reservoirs in the Mississippi River Basin*. This investigation considered a plan of development of a system of reservoirs (including the Coralville Reservoir) on the Mississippi River tributary basins, for the purpose of controlling floods on the Lower Mississippi River. A comprehensive plan was presented in House Committee Report No. 2353, dated 13 May 1938. The comprehensive plan for flood control was authorized in Public Law 761, 75th Congress, Third Session, (approved 28 June 1938) and in accordance with Flood Control Committee Document 1, 75th Congress, First Session. Recreation and fish and wildlife facilities were subsequently authorized in Public Law 534, 78th Congress (approved 22 December 1944) and Section III of the Water Resources Development Act of 1976 (Public Law 94-587).

3-02 Planning and Design.

The Rock Island District, Corps of Engineers, Office of Chief of Engineers, and the Upper Mississippi Valley Division conducted preliminary planning for the Coralville Dam project. A Definite Project Report (U.S. Army Corps of Engineers, 1939) was submitted to the Chief of Engineer's office by the District Engineer in December 1939 recommending construction of a dam and reservoir on the

Iowa River near Coralville, Iowa at a site 10 miles downstream from Lake Macbride State Park designated as the Turkey Creek site. The reservoir was to have a full flood pool elevation at 708 feet, NGVD and was to contain 400,000 ac-ft of storage.

In January 1940 the State of Iowa informed the Corps of Engineers that the Iowa State Conservation Commission (now the Iowa Department of Natural Resources) was opposed to construction of the dam on the basis of conservation practices. After a number of conference and public hearings, a Revised Definite Project Report, dated 1 April 1948, was prepared embodying features acceptable to the State interests. The Chief of Engineers approved this revised report, pending certain minor modifications in September 1948. Under the revised Definite Project Report the project would provide for a full pool elevation of 712 ft., and contain 492,000 ac-ft of total storage. It would also have a conservation pool at elevation 670.0 ft., NGVD, to store 17,000 ac-ft of water for low-flow augmentation. The low-flow augmentation pool would serve such uses as conservation of fish and wildlife and sanitary purposes. A listing of design memoranda and related documents is presented in Exhibit B.

A conservation pool of 680.0 feet, NGVD, was recommended by Design Memorandum #17 entitled *Conservation Storage*. The conservation pool elevation of 680.0 was maintained from the time operation began in September 1958 until June 1989. At that time the Rock Island District got temporary permission from North Central Division to raise the conservation pool to 683.0 feet because of a loss of conservation storage due to sedimentation. A permanent change of the conservation pool to elevation 683.0 feet was recommended in the U. S. Army Corps of Engineer's *Water Control Plan*, dated November 1991, and was subsequently approved.

3-03 Construction.

Construction of the first phase of the project was begun in July of 1949. Phase I included construction of a portion of the cut-off core and a portion of the embankment, excavation to bedrock for the outlet works, and construction of a field office. Phase II consisting of

construction of the outlet works and a portion of the embankment was begun in the spring of 1950. The initial operation of the reservoir began on 17 September 1958. Relocation work was accomplished concurrently with the construction of the dam.

3-04 Related Projects.

Existing local protective works in the basin above Coralville Lake are few. These consist of low levees, channel straightening and bank protection. Downstream from the reservoir, at Iowa City, some protection is afforded the State University property by low levees and riprapped banks. Between Iowa City and the mouth of the Cedar River, two organized levee districts protect approximately 3,450 acres. Downstream from the mouth of the Cedar River three organized levee districts provide protection against Iowa River floods for approximately 6,400 acres. Several private levees near the mouth of the Iowa River protects a much more extensive area of Mississippi River bottomland and the town of Oakville, Iowa. None of these levees has the height or section necessary to protect against the more severe floods of record.

3-05 Modification to Regulations.

A Revised Definite Project Report was submitted to the Chief of Engineers on April 1, 1948 (U. S. Army Corps of Engineers, 1948) and recommended construction of the Coralville Dam and Reservoir at the Turkey Creek site. The frequency and magnitude of damaging floods, which occurred since House Document 259, 74th Congress, 1st Session was published (1928), dictated that greater storage be provided than the 400,000 ac-ft recommended in the 1928 report. The Revised Definite Project Report (1948) therefore recommended that the reservoir be designed to store 492,000 ac-ft of water at the spillway crest elevation 712 feet, NGVD and have a conservation pool elevation 670 feet, NGVD. The reservoir storage was to be subdivided as follows:

475,000 ac-ft - Flood Control
17,000 ac-ft - Conservation, Recreation, Low-Flow Augmentation, and related purposes

The flood control storage allocation (1948) was equivalent to 2.89 inches of runoff from the basin above the dam. The conservation pool would provide water for such purposes as low-flow augmentation, conservation of fish and wildlife and recreation. The *Revised Detailed Project Report* was approved by the Chief of Engineers on 27 September 1948. Construction began in 1949 but was interrupted by the Korean conflict between 1950 and 1954, and completion of the project was delayed until 1958. Prior to completion of the project it was determined that the conservation pool at elevation 670 feet, NGVD, would not provide the necessary storage for low-flow augmentation. The droughts that had been experienced during the period from 1903 to 1956 would require more than the 17,000 ac-ft of water to maintain a minimum release of 150 cfs. Design Memorandum No. 17, entitled *Conservation Storage*, justified the need for additional storage for low-flow augmentation. This design memorandum recommended a conservation pool level of 680.0 feet, NGVD and contained 53,750 ac-ft of storage. The 680.0 conservation pool level was approved and was the summer conservation pool level from the time regulation of the reservoir commenced in September 1958 until 1991.

Initially, several regulation plans were studied, but after careful study using landowner and public input, a regulation plan called Plan 7 was recommended, approved and was used to begin regulation in October 1958. Under this plan the conservation pool was held at elevation 680 from 1 July to 1 February. It was then lowered on 1 February to elevation 670 feet, NGVD in advance of the normal flood season to provide greater flood control storage. Under Plan 7, a maximum outflow from the reservoir was 10,000 cfs during the non-growing season of 15 December to 1 May and 8,500 cfs during the growing season from 1 May to 15 December.

Coralville Lake was first regulated for flood control during the minor spring flood of 1959 and again during a major flood that occurred in the spring of 1960. Downstream landowners objected to the high growing season release rates of 8,500 cfs. They said that this flow flooded much of their marginal and submarginal cropland between the dam and Columbus Junction, Iowa. With both public concerns and congressional involvement, the Corps of Engineers initiated a study to determine the effects of various release rates. While these studies of reservoir

regulation were being made (1961-1962), the reservoir was regulated under an interim regulation plan. This interim plan established the maximum growing season releases between 5,000 and 6,500 cfs depending on the available flood control storage remaining in the reservoir.

As a result of these studies and public input, a revised regulation plan was recommended to the Chief of Engineers and implemented in the spring of 1963. This plan was designated Plan 8 and was approved by the Chief of Engineers on 10 April 1963.

Plan 8 provided for a non-growing season release rate of up to 10,000 cfs from 15 December to 21 April. It provided for a transition period from 21 April to 1 May when the maximum release rate was set between 6,000 and 10,000 cfs depending on the reservoir elevation on 21 April. In addition, it provided for a growing season maximum release rate between 4,000 and 6,000 cfs from 1 May to 15 December, which depended on the reservoir elevation on 1 May. The pool regulation schedule for Plan 8 is as follows:

DATE	CONSERVATION POOL REGULATION
1 Feb - 15 Feb	Lower from 680 to 670
15 Feb - 15 Jun	Hold elevation 670
15 Jun - 25 Sep	Hold 680
25 Sep - 15 Dec	Hold 683
15 Dec - 1 Feb	Hold 680

The 683 pool level from 25 September - 15 December was implemented to provide habitat for migratory waterfowl during their fall migration. This portion of the plan was suggested by the Iowa Department of Natural Resources and was to be implemented as long as the 683 pool would not affect flood control.

By 1968 the reservoir had been in operation almost 10 years and recreation-use of the reservoir and of public lands along the reservoir shoreline increased at a tremendous rate. Recreational users wanted higher pool levels, which would provide better conditions for boating and more

desirable aesthetic conditions. The lake users sought congressional action to provide for a pool level restudy. The poor aesthetic condition of the lake is nowhere more apparent than at the U.S. Highway No. 218 crossing of the reservoir where the lake met the natural river. A restudy of the reservoir regulation plan, Plan 8, was directed and funded by Congress. The results of this study were given to the public through a public hearing arranged by the Iowa Natural Resources Council (now the Iowa Department of Natural Resources) at Iowa City during September 1969. After testimony by both interested groups and individuals, the Council recommended no change be made in the regulation plan. The Corps concurred with the recommendation of the Council and Plan 8 remained the approved plan of regulation.

In 1982, the 15 February to 15 June spring conservation pool was changed from elevation 670 to 675 and the drawdown date was delayed from 1 February until 15 February (to be drawn down by 1 March). This change was made due to recurring water quality problems, which had resulted as a part of the timing of the 670 spring drawdown. The conservation pool volume below elevation 670 had been reduced from 17,000 acre-feet to 9,000 acre-feet by sediment accumulation during the first 25 years of reservoir operation. This change in pool volume was documented by a sediment survey. The regulation plan change was necessary in order to sustain sufficient aquatic habitat and good water quality throughout the drawdown period. This change was an attempt to prevent the killing of fish and other aquatic life.

The reservoir was regulated under the above-modified Plan 8 until 1993. This modification provided for a change in conservation pool to elevation 683 feet, NGVD and was authorized based on the *Water Control Plan*, prepared by the Rock Island District and dated November 1991. The *Water Control Plan* recommended the following changes be made:

1. Extend the non-growing season from 21 April to 1 May, eliminating the variable release rate provided for in the previous regulation schedule and allowing a maximum release of 10,000 cfs throughout the non-growing season.

2. Allow a maximum release rate of 6,000 cfs at all times during the growing season, eliminating the variable release provided for in the previous schedule.

3. Change location of control point for regulation of Coralville Lake for Mississippi River flooding. The location for control of release from Coralville Lake would be based on the Burlington, IA, gage. The new control stage at Burlington would be 18.0 feet.

4. Reduce release to 1,000 cfs for "seven days" corresponding to Mississippi River crest instead of "several days."

5. Begin intermediate magnitude flood regulation at elevation 707 feet, NGVD. This allows for evacuation of flood storage at moderate release rates earlier in the event, preventing the pool from rising to elevations requiring much higher, damaging outflows. This regulation included outflows in the 7,000 to 10,000 cfs range.

6. Begin large magnitude flood regulation at elevation 710.0. Going to higher releases at a lower elevation will prevent larger release rates when the reservoir fills to elevation 712.0 and uncontrolled spillway flow begins. This regulation begins with outflows at 10,000 cfs and increases to full conduit flow at spillway level of 712.0 feet, NGVD.

7. Implement a drought contingency plan, which is implemented when inflow is at, or forecast to fall below outflow. Reduced releases will occur when pool level recedes to the elevation of 678.0 feet, NGVD.

8. Use stage rather than discharge for the Lone Tree and Wapello control parameters.

9. Implement a Major Flood Emergency Schedule, which is well defined in both rising and falling reservoir pool conditions.

Using the above modifications, regulation Plan B was developed and studied in detail in the *Water Control Plan*. Plan B provided a regulated conservation pool of elevation 683, with a spring drawdown to elevation 679 and a variable fall pool raise to elevation 686. Coralville Lake is currently regulated under Plan B. The Drought Contingency Plan was approved and implemented in October 1996.

The Coralville Regulation Study published in January 1999 and a public workshop in March 1999 recommended several changes to plan B. The changes recommended were as follows.

1. Formalize the flash flood operation and put it in the regulation plan.

2. Change the summer release rate from 6,000 cfs to 8,000 cfs.

3. Eliminate the spring draw down to 679.0.

The change to 8,000 cfs for maximum summer release was later rejected by Iowa DNR, downstream communities and landowners, and the spring draw down to 679 was made variable instead of eliminated.

3-06 Principal Regulation Problems.

Coralville Spillway was overtopped for the first time in the 1993 flood. The downstream corridor from the spillway to the Iowa River is a natural valley that was heavily eroded during the flood. This area will be closely monitored next flood to make sure that upstream cutting will not threaten the structural integrity of the spillway.

Two problems affected the Rock Island District's ability to accurately regulate the Dam during times of low-flow. The outlet structure has three vertical slide gates. Over the years the bottom seal on the gates have worn resulting in leakage when the gate is closed or in a near closed position. In addition, the side seals continue to leak. The repair of the seals is part of the District's maintenance backlog and they will be repaired when the repair reaches a high enough priority to be completed with the money available. At its worse this has resulted in flows of just less than 150 cfs with all the gates closed. Another problem during low-flow periods is the backwater effects from the old power dam, five miles downstream of Coralville Lake. The backwater makes it difficult to accurately rate the tailwater gage at low-flows. Both these problems mean the Rock Island District must get extra flow measurements during low-flows to make sure it is releasing enough water to satisfy water quality

requirements while not wasting valuable water for future conservation purposes. This problem was greatly reduced with the instillation of a new side looking doppler radar flow gage in June 2000.

The stilling basin at the outlet structure to the dam is designed to dissipate the energy from the water as it leaves the dam. The resulting hydraulic jump is contained within the spilling basin so it will not cause erosion near the toe of the dam and threaten the integrity of the dam. Visitors to the dam have thrown large pieces of riprap into the outlet-stilling basin. The riprap gets trapped and tossed about, causing damage to the concrete, exposing reinforcing bar, and damaging the baffle blocks. This damage must be periodically repaired to ensure the integrity of the structure but it can only be repaired at times of low-flow after routing the water away from the stilling basin.

IV -WATERSHED CHARACTERISTICS

4-01 General Characteristics.

Most of the Iowa River Basin is naturally well drained. The upper 1,300 square miles of the Iowa River watershed lie in the area covered by the most recent glacial drift, which is relatively poorly drained, and from which runoff is relatively light. The remaining portion of the basin above the Coralville Lake Dam is covered by the wind blown loess soil that overlies the maturely dissected drift of older glaciations. Runoff from this mature terrain is relatively high. Maximum difference in elevation between uplands and streams is in the neighborhood of 150 feet. Profiles of the Iowa River are shown on Plates 4-1, 4-2,and 4-3. Most of the land in the watershed is cultivated and is therefore vulnerable to erosion, resulting in rather high sediment loads for the streams.

The watershed above Coralville Lake has a total area of 3,115 square miles, of which the reservoir occupies about 39 square miles when the water level is at the top of the flood control pool, or at 712 feet, NGVD. The watershed is long and narrow: its length is about 180 miles, its greatest width about 38 miles, and its average width about 18.5 miles. The Cedar River, having a watershed area of about 7,870 square miles, but considered a tributary of the Iowa River, joins the latter 29.6 miles above its mouth. The total drainage area for the Iowa River and its tributaries is approximately 12,640 square miles.

4-02 Topography.

The upper end of the Coralville Lake drainage area is in north central Iowa near Crystal Lake at an elevation near 1350 feet, NGVD. This area was covered by the last ice sheet and has been only slightly affected by fluvial erosion and is consequently nearly flat. The rest of the drainage area was either unglaciated or of older glaciations. It is underlain by older drift that has been moderately dissected by streams and is in a stage of maturity. The ground level at the dam is 645 feet, NGVD, while the mouth is at elevation 530 feet, NGVD at Mississippi River Mile 433.5. A topographic map of the basin is shown on Plate 4-4.

4-03 Geology and Soils.

The Iowa Cedar basin lies in the Dissected Till Plains of the Central Lowland Province of the United States. Characteristic of this province is that the surface bedrock is almost entirely sedimentary and of Paleozoic age. The general regional structure is that of broad basins separated by intervening low domes. The bedrock is made up of limestone, shale, and sandstone. Limestone greatly predominates. The strata have a slight dip to the southwest. This dip approximates 10 feet per mile. The strike is northwest southeast; this gives the shape of a band to the areas outcrop of each formation.

4-04 Sediment.

Total reservoir volume below elevation 712.0 feet, NGVD has gone from an estimated 492,000 acre-feet in 1958 to 421,000 acre-feet in 2000, which is a reduction of 14.4 percent. The average yearly sediment accumulation occurring in Coralville Lake since operation began in 1958 has been approximately 1,700 acre-feet per year.

4-05 Climate.

TABLE 4-1
Minimum Temperatures (average monthly)
Average, Maximum, Minimum
(degree Fahrenheit)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Iowa City	12.0	17.4	27.7	39.7	50.6	60.4	64.7	62.4	53.7	42.6	30.0	18.6	40.7
Max	24	28	38	45	59	66	69	71	59	50	37	27	44
Min	0	7	13	33	44	54	59	57	47	30	20	3	37
Cedar Rapids	9.4	14.8	26.1	38.7	49.8	59.4	63.6	61.3	52.3	41.1	28.3	15.9	38.6
Max	22	25	37	45	57	65	69	69	56	49	35	26	42
Min	-3	3	8	32	43	54	59	55	47	33	18	0	35
Marshalltown	8.9	12.9	24.9	37.4	48.6	58.4	62.4	59.8	51.2	39.7	26.6	14.8	37.4
Max	24	26	35	45	57	67	68	67	60	50	36	28	44
Min	-9	-5	10	28	39	52	57	53	44	28	18	-2	33

The Iowa-Cedar River Basin has an average temperature of 49 degrees Fahrenheit, ranging from 23 degrees during the winter to about 73 degrees during the summer, with extremes of -35 degrees F. and 112 degrees F.

TABLE 4-2
Maximum Temperatures (average monthly)
Average, Maximum, Minimum
(degree Fahrenheit)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Iowa City	29.9	35.7	47.8	62.9	74.1	83.3	86.8	85.0	77.4	66.4	48.7	34.9	61.9
Max	42	50	58	71	82	90	94	94	83	78	56	44	65
Min	17	24	32	54	68	75	81	79	71	60	40	21	59
Cedar Rapids	26.2	31.9	44.0	59.7	71.6	80.9	84.4	82.2	74.3	62.9	45.9	31.8	58.2
Max	39	45	55	67	79	88	91	90	79	76	53	41	62
Min	14	20	28	51	65	75	78	76	68	56	37	19	55
Marshalltown	28.4	32.7	45.3	60.4	72.1	81.3	86.2	84.0	75.9	64.4	46.8	32.7	59.5
Max	42	46	62	72	85	92	98	95	86	75	56	44	64
Min	15	15	30	51	65	74	77	77	67	49	37	17	55

The annual precipitation over the basin is approximately 34 inches with extremes recorded as 62.89 inches and 17.25 inches. About 69 percent of the precipitation occurs during the six-month period from April through September, inclusive, and 19 percent during March, October and November. Heavy thunderstorms occur occasionally, particularly during the summer months, throughout the Iowa River Basin.

TABLE 4-3
Precipitation
Average, Maximum, Minimum
(inches)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Iowa City	1.05	1.02	2.30	3.56	4.09	4.48	4.77	3.94	3.44	2.60	2.26	1.45	35.22
Max	3.62	3.09	6.13	8.32	13.30	10.75	13.40	12.33	10.56	8.24	8.08	4.50	62.89
Min	0.02	0.09	0.18	1.19	0.49	0.05	0.17	0.43	0.44	0.00	0.09	0.24	22.06
Cedar Rapids	1.02	1.01	2.15	3.40	3.77	4.34	4.22	4.05	3.61	2.33	2.05	1.46	33.87
Max	4.21	3.52	6.09	6.33	8.68	11.55	17.03	13.09	10.25	5.68	6.44	3.58	60.46
Min	0.04	0.04	0.14	0.73	0.34	0.15	0.44	0.42	0.39	0.03	0.11	0.24	19.31
Marshalltown	1.15	1.11	2.17	3.08	4.23	4.70	3.97	3.81	3.92	2.40	1.78	1.19	33.96
Max	3.96	5.12	7.15	6.89	10.04	13.93	13.64	14.92	16.01	7.03	7.96	4.78	59.85
Min	0.01	0.05	0.00	0.55	0.81	0.59	0.19	0.46	0.28	0.02	0.02	0.11	17.25

Average annual amount of snowfall for the basin is approximately 30 inches.

TABLE 4-4
Snow
Average, Maximum, Minimum
(inches)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Iowa City	7.06	5.70	4.69	1.35	0	0	0	0	0	0.24	1.40	6.58	26.79
Max	20.50	17.00	20.90	14.30	0	0	0	0	0	4.00	12.00	19.50	53.60
Min	0	0	0	0	0	0	0	0	0	0	0	0	9.20
Cedar Rapids	6.77	6.44	4.90	1.20	0.01	0	0	0	0	0.08	2.22	6.89	28.73
Max	20.10	27.90	18.30	14.50	0.30	0	0	0	0	2.00	11.60	21.30	50.40
Min	0	0	0	0	0	0	0	0	0	0	0	0	12.20
Marshalltown	8.77	7.50	6.32	1.11	0.03	0	0	0	0	0.22	2.55	7.81	34.39
Max	40.20	30.50	30.30	13.40	1.00	0	0	0	0.20	7.30	17.20	43.90	68.30
Min	0	0	0	0	0	0	0	0	0	0	0	0	8.50

The seasonal pan evaporation is about 40 inches.

TABLE 4-5
Pan Evaporation
Average, Maximum, Minimum
(inches)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Iowa City	--	--	--	4.13	5.64	6.83	7.27	6.19	4.63	3.31	1.5	--	--
Max	--	--	--	5.95	7.75	8.54	9.24	9.56	7.37	4.82	1.81	--	--
Min	--	--	--	2.84	4.24	4.84	4.63	4.64	2.95	2.14	0.88	--	--

The 7-day, 10-year low-flow into the dam is about 78 cfs. Representative summaries of precipitation, temperature, snowfall and pan evaporation within the Iowa-Cedar Basin are shown in Tables 4-1 through 4-5.

4-06 Storms and Floods.

Damaging flows on the Iowa River occur almost yearly. Spring floods are generally associated with runoff of accumulated ice and snow resulting from thawing. The magnitudes of such floods depend on the depth of accumulated ice and snow over the watershed and on the amount of precipitation, if any, occurring during the thaw. Following winters during which the mean daily temperatures are above the freezing point for long or frequent periods, spring floods do not occur or are not serious. Occasionally floods caused by thaws occur in winter. These are generally local in character, and are usually the result of ice gorges. Summer floods are caused by storms

resulting from intense localized disturbances along fronts separating polar and tropical air masses. The duration of such storms may extend over three or four days, but most of the precipitation occurs during periods of 24 hours or less.

Pre-record floods of major proportions occurred on the Iowa River in March 1840, June 1851, June 1858, July 1881, and June 1892. That of June 1851 stands as probably the greatest ever to have occurred on the Iowa River. Records of flood heights have been kept at several points along the Iowa River for varying periods. Two gaging stations downstream from the reservoir, at Iowa City, Iowa, and at Wapello, Iowa, have the longest record.

The 1947 flood was fresh in the minds of the hydrologists as they finalized the regulation plan for Coralville before it went into operation in 1959. It was a relatively low volume summer rain flood. After a fairly wet April with 6.38 inches of precipitation, late May and early June rains brought heavy flooding to the Iowa River basin. In a ten-day period beginning at the end of May and extending into early June the basin got hit with 6.4 inches of rain (at the Cedar Rapids airport). The resulting flood peaked at 33,800 cfs in Iowa City with a stage of 18.6 feet. Wapello had a peak flow of 94,000 cfs with a peak stage of 16.85 feet a day earlier then the Iowa City peak, just before a major levee broke.

March of 1960 was an extremely cold month with the snow covering the entire basin being the heaviest since 1912. In late March, a rapid temperature rise into the 50's and rains of 1.36 inches at Marshalltown on the 28th, 29th, and 30th produced a rapid snowmelt adding approximately another 1.5 inches of runoff. A crest stage of 19.21 feet with a flow of 30,800 cfs was recorded at Marengo on March 31. The flood crested April 1st at Lone Tree with a stage of 17.9 feet and a flow of 28,100 cfs. Wapello crested at 17.02 feet and 69,000 cfs on April 5th. Coralville reservoir crested at 706.67 feet, NGVD with an outflow of 9,600 cfs.

The "great flood" of 1993 was the largest flood on the Iowa River since the dam was placed into operation. It was the result of continuous heavy rains that inundated Iowa all summer long, culminating in the only flood to date to go over the spillway. The total runoff into Coralville Lake

was 29.33 inches, all going into a reservoir that has flood control storage equal to 2.6 inches of runoff. The resulting peak pool of 716.75 feet, NGVD and outflow of 25,800 cfs were both records. A record peak flow at Marengo of 38,000 cfs was recorded on July 19. This flow was reduced by the reservoir to 28,200 cfs at Iowa City. This is the record flow since the reservoir has been in operation. The pre-reservoir peak flow was 40,500 cfs in 1918. Coralville Lake only controls a quarter of Wapello's drainage area and hence doesn't affect the flow there as much as it does at Iowa City. Because of this, the peak flow at Wapello of 111,000 cfs on July 11 was the overall record flow for the station.

4-07 Runoff Characteristics.

The average annual runoff of the Iowa River at Coralville Lake for the 93-year period of record ending in 1996 is 1,304,000 acre-feet. This is equivalent to about 7.8 inches from the 3,115 square mile drainage area. The annual inflow frequency curve is shown on Plate 4-5. The monthly inflow frequency data is shown on Table 4-6.

TABLE 4-6
Monthly Inflow Frequency
(cfs)
Percent Chance Exceedance

Month	0.2	0.5	1.0	2.0	5.0	10.0	20.0	50.0	80.0	99.0
Jan	22500	16500	12800	9660	6300	4280	2670	1060	409	72
Feb	24400	20700	17800	15000	11200	8480	5830	2550	957	113
Mar	31800	29000	26500	23700	19500	15900	11900	5910	2380	271
Apr	52500	40400	32400	25500	17700	12700	8470	3840	1700	382
May	35200	30000	25900	21900	16500	12600	8750	3910	1510	189
Jun	52500	42500	35400	28800	20700	15200	10200	4410	1730	256
Jul	42200	33300	27300	21700	15300	11000	7260	3110	1230	200
Aug	48700	32900	23900	17000	10300	6640	3970	1540	631	147
Sep	43000	30000	22300	16200	10100	6650	4040	1590	642	138
Oct	31300	21300	15600	11200	6860	4480	2710	1080	452	109
Nov	19900	15300	12300	9570	6550	4630	3000	1270	507	89
Dec	16000	12400	9950	7820	5390	3840	2520	1080	444	81
Year	52100	45700	40900	35900	29300	24200	18900	11300	6320	1940

Runoff fluctuates considerably from year to year. Average monthly runoff is shown on Table 4-7 and Plates 4-6 through 4-9. Average travel time of flow on the Iowa River is shown on Plate 4-10.

TABLE 4-7
Average Monthly Runoff
At Coralville Reservoir

Month	Average Flow (cfs)	Average Runoff (inch)
JAN	826	0.31
FEB	1438	0.48
MAR	3208	1.19
APR	2990	1.07
MAY	2683	0.99
JUN	3041	1.09
JUL	2090	0.77
AUG	1224	0.45
SEP	1079	0.39
OCT	983	0.36
NOV	1049	0.38
DEC	828	0.31
Annual	1801	7.85

The Marengo gage is the main inflow station for Coralville Lake. Lone Tree and Wapello are key downstream control points.

TABLE 4-8
Marengo Flow Durations
(% of time equal to or exceeded v. cfs)

%	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
99	28	52	146	224	160	104	85	86	107	73	84	48	73
95	72	135	240	292	255	248	172	170	147	101	117	78	133
90	112	160	332	422	392	382	432	256	202	146	148	99	199
85	165	190	420	605	579	564	537	315	244	177	200	163	262
80	200	210	605	775	796	777	649	364	271	200	259	202	336
75	234	290	840	892	977	1030	756	414	308	246	297	260	419
70	266	353	1100	1180	1130	1160	875	462	359	330	416	309	500
60	370	470	1600	1630	1550	1510	1110	565	473	464	559	452	705
50	480	690	2180	2060	1990	2110	1350	710	574	628	766	630	1000
40	640	920	2820	2750	2520	2800	1710	895	732	765	1060	920	1340
30	841	1150	3760	3810	3560	3750	2280	1160	927	1100	1540	1240	1890
25	1030	1400	4480	4490	4150	4220	2590	1320	1060	1310	1690	1370	2250
20	1250	1700	5240	5300	4710	4810	3090	1530	1210	1610	1850	1560	2760
15	1500	2300	6440	6460	5470	5800	3910	2030	1510	1980	2110	1850	3600
10	2000	3500	7760	8090	7090	7340	5740	3230	2170	2440	2660	2260	4900
5	2640	5860	10000	10700	8740	10200	9690	6730	4330	3610	3410	2900	7390

Tables 4-8 through 4-10 show monthly and annual stream flow distribution at these three locations.

4-08 Water Quality.

Most of the drainage area to Coralville Lake is agricultural with Marshalltown as the only city with a population greater than 25,000. Agricultural land use is mostly devoted to the production of soybeans and corn with

TABLE 4-9
Lone Tree Flow Durations
(% of time equal to or exceeded v. cfs)

%	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
99	148	150	246	379	216	142	83	148	169	183	176	154	160
95	180	280	503	718	406	290	247	250	209	193	190	185	212
90	215	434	779	1020	644	602	430	319	234	208	217	218	313
85	260	582	1020	1310	956	760	711	415	260	223	336	380	440
80	340	730	1290	1540	1150	1180	888	531	312	266	415	468	589
75	390	858	1690	1780	1430	1500	1060	634	363	451	578	598	740
70	470	1000	1990	2050	1840	1860	1310	708	418	541	744	688	895
60	720	1250	2720	2730	2600	2860	1800	845	564	790	1030	1040	1260
50	940	1550	3550	3550	3930	4260	2700	1070	741	988	1400	1360	1800
40	1200	1950	4590	5300	5090	5130	4260	1470	1200	1240	1860	1790	2500
30	1600	2400	6350	7050	6100	6170	5240	2960	1950	1750	2450	2380	3820
25	1800	2930	7480	8290	6700	6640	6030	4450	2570	2080	2780	2700	4560
20	2100	3400	8370	9420	7290	7090	6440	4990	3770	2490	3520	3120	5340
15	2440	4190	9300	10400	7910	7800	7420	5440	4740	3140	4270	3800	6380
10	3400	5820	10100	11100	9410	9200	8580	6380	5140	3810	4870	4570	7650
5	6000	8520	11600	12200	11700	12000	12400	9280	7300	4740	5990	5910	10200

TABLE 4-10
Wapello Flow Durations
(% of time equal to or exceeded v. cfs)

%	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yr
99	488	540	1200	2110	1610	935	930	827	880	871	800	620	749
95	819	1050	2290	3070	2740	1820	190	1180	1140	1020	1050	800	1150
90	1120	1500	2800	4130	3790	3020	2250	1620	1620	1290	1280	1050	1650
85	1400	2000	3300	4960	4530	3660	2950	2120	1890	1410	1600	1500	2200
80	1700	2250	4610	5950	5150	4620	3370	2510	2100	1660	2040	2000	2660
75	1960	2450	5750	6700	5840	5360	4030	2800	2340	2200	2950	2500	3060
70	2200	2650	6640	7600	6490	6450	4740	3080	2560	2770	3280	2730	3500
60	2700	3300	8460	9710	8250	8700	6280	3740	3110	3500	3950	3400	4580
50	3280	4020	10800	11900	10800	10600	8590	4850	3700	4290	4760	4000	5990
40	4000	4900	13500	15600	13000	13300	10900	6350	4690	5270	6280	5360	7730
30	4800	6040	17000	20300	16200	15800	12900	8150	6510	6770	7810	6410	10000
25	5400	6990	19800	22300	18400	17400	13900	9030	7480	7330	8430	7120	11500
20	6000	8000	22400	24900	20700	19400	15300	9930	8410	8210	9150	8000	13600
15	7200	9370	25600	28200	23400	21900	16600	11500	10100	9620	10300	9530	16500
10	9000	13000	29000	33200	27200	26800	19900	15800	12400	11200	11900	11300	20800
5	13000	20800	34100	42500	32900	34100	32800	23100	20400	14200	15000	15000	28200

some pastureland on steeper slopes. Small areas are devoted to producing vegetables, poultry, and hogs. Non-point pollution from this agricultural runoff consisting of pesticide, herbicide, and fertilizer residue is the main source of pollution to the lake. This runoff has episodically caused some pollution in the lake. At these times commercial fishing has been banned. The other

problem for the reservoir is the topsoil erosion from the farm fields that settles out in the reservoir. This excessive sedimentation into the reservoir caused the District to raise the conservation pool in 1991, sooner than was originally planed.

4-09 Channel and Floodway Characteristics.

The Iowa River flows generally southeastward 83.3 miles from Coralville Lake to the mouth. The streambed slope varies from about 1.4 feet per mile near the mouth to about 2 feet per mile below Iowa City. Below Coralville Lake, bottom widths vary from about 200 to 500 feet and the banks average about 7 feet in height. Plates 4-1 and 4-2 show the Iowa River profiles from Coralville Lake to the mouth.

In the reach of the Iowa River from Coralville Lake to the mouth, the channel capacity increases from 13,500 cfs to 30,000 cfs as registered on the Lone Tree and Wapello gages respectively. These discharges provide a small margin of bank freeboard to minimize saturation damage associated with prolonged periods of bankfull flow. The regulated release rates from Coralville Lake, adjusted for downstream local inflow, are keyed to these channel capacities. Periodic resurveys of established ranges downstream from the dam will provide information on channel cross-sections and profile data to indicate changes, if any, in channel capacities.

Tables 4-11 and 4-12 summarize the stage-discharge relationship for upstream gaging stations to Coralville Lake and follow the text. On the Iowa River, Marengo is the main-stem inflow station. Other upstream Iowa gages are found at Rowan, Steamboat Rock, Marshalltown, Tama, and Belle Plaine. Tributary gages include Timber Creek gage near Marshalltown, Deer Creek gage near Toledo, Richland Creek gage near Haven, Walnut Creek gage near Hartwick, Salt Creek gage near Elberon, and Bear Creek near Ladora.

Tables 4-13 and 4-14 show the stage-discharge relationship for the downstream stations. The outflow measuring station is located about 500 feet below the dam at the tailwater gage. The other Iowa River gages are at Iowa City, Lone Tree, Columbus Junction and Wapello. The Cedar River is the largest tributary to the Iowa. It converges with the

Iowa River near river mile 30 with a drainage area of 7,819 square miles. Cedar River gaging stations are located at Waterloo, Cedar Rapids, and Conesville, along with Prairie Creek near Blairstown, a Cedar River tributary. Other downstream Iowa River tributary gages are located on Clear Creek near Coralville, Rapid Creek near Iowa City, Old Man's Creek at Iowa City, North Fork English River at Parnell, and English River at Kalona. Tables 4-11 through 4-14 appear after the text.

4-10 Upstream Structures.

There are no significant upstream structures in the Iowa Basin.

4-11 Downstream Structures.

The power dam in Coralville is an old low head power dam that is out of service. It is located at Iowa River Mile 78.1, five miles down stream of Coralville Lake. The City of Iowa City is planning on rehabilitating it as a fixed head dam to assure its water intakes for the new water treatment plant. It has a drainage area of approximately 3,166 square miles

The University Dam is located in Iowa City at Iowa River Mile 74.2. It has a drainage area of 3,271 square miles. It is operated by the University of Iowa to provide cooling water for its steam plant.

4-12 Economic Data.

Information is presented below concerning the three Iowa counties (Johnson, Washington, Louisa) in the valley below Coralville Dam and Reservoir.

a. Population. The 1995 total population for the 3-county area downstream of the project is 133,592. This is a 17-percent increase over the 1980 population. The majority of this growth has been in Johnson County (specifically in the Iowa City metropolitan statistical area, MSA). Washington County experienced a minor population increase, while Louisa County had a minor decrease during this period. Non-farm employment in the 3-county area is dominated by the Iowa City MSA, where the University of Iowa and its Hospital and Clinics have a major influence. Table 4-15 summarizes population and employment information for this downstream area.

TABLE 4-15
POPULATION AND EMPLOYMENT

Item	Reference Date	Johnson County	Washington County	Louisa County
Population	1995	101,291	20,508	11,793
	1980	81,717	20,141	12,055
Per Capita Income	1993	$19,578	$17,337	$16,331
Business Establishments (non-farm)	1993	2,298	608	233
Unemployment Rate	Jun-99	2.40%	2.30%	3.50%
Employment by Sector (number employed)	1997			
Farm employment		1,519	1,354	643
Private non-farm:				
Agri-services		581	311	n/a
Mining		88	n/a	n/a
Construction		3,292	830	201
Manufacturing		5,198	1,461	1,465
Transport & utilities		2,541	377	210
Wholesale trade		1,621	641	210
Retail trade		13,258	1,883	705
Finance, insurance, real estate		3,084	458	236
Service industry		19,976	2,760	936
Government:				
Federal civilian		1,540	100	57
Military		514	100	57
State and local		25,394	1,206	667

b. Agriculture. Land use analysis of the 500-year floodplain downstream of the Coralville Dam indicates that about 62% (25,100 acres) of the total area (40,600 acres) is in agricultural usage. Corn and soybeans are the predominant crops produced in this area. Using the area's approximate 50% corn, 50% soybean cropping mix, floodplain crop values can be estimated. Corn acreage production value (12,600 acres, 135 bushels per acre) is estimated at $4,338,000 using the 1998 normalized price of $2.55 per bushel. Soybean production value (12,500 acres, 52 bushels per acre) is estimated at $4,030,000 using the 1998 normalized price of $6.20 per bushel. Table 4-16 describes agricultural characteristics in the 3-county area in which the downstream corridor lies.

TABLE 4-16
COUNTY AGRICULTURAL DESCRIPTION

	Johnson County	Washington County	Louisa County
County Area (acres)	393,000	364,000	257,000
Farm Land as % of Total Area	72%	85%	74%
Number of Farms (1992)	1,242	1,078	554
Acres Planted in Corn (1998)	106,200	120,400	78,600
Yield Per Acre (bushel)	135	135	123
Acres Planted in Soybeans (1998)	81,000	104,000	73,000
Yield Per Acre (bushel)	52	51	51
Agricultural Land Value			
County Average Per Acre	$2,197	$2,031	$1,953

c. Industrial, Commercial, Public. Industrial properties in the downstream floodplain valley include meat processing and concrete products. Commercial concerns include vehicle sales and service, electronics and appliances, engineering, construction, banking, real estate, insurance, wholesale and retail food supply, restaurants and bars, paint and hardware, furniture, domestic services, utilities, storage, recycling, medical and professional offices. Public properties in the downstream corridor are very significant. Municipal properties include water treatment facilities, public works and transportation facilities, and parks/recreational sites. University of Iowa facilities have a dominant presence in the upper reaches of this corridor. The value of public facilities in the floodplain exceeds $40,000,000.

d. Flood Damages. Stage/damage and stage/crop acreage relationships for the floodplain corridor below Coralville Dam are presented in Table 4-17. Average annual damages with and without the reservoir project, and annual damages prevented (benefits) are presented in Table 4-18. For Tables 4-17 and 4-18, damages for the following Iowa River reaches are estimated based on stages at the indicated gage stations:

Gage Station: **River Reach**
Iowa City, IA: Coralville Lake to State Highway 22 Bridge
Lone Tree, IA: Highway 22 Bridge to Cedar River Confluence
Wapello, IA: Cedar River confluence to Mississippi River

TABLE
4-17
STAGE/DAMAGE AND STAGE/ACRES RELATIONSHIPS

Iowa City Gage Stage	($) Non-Crop Damage	Crop Acres Flooded	Lone Tree Gage Stage	($) Non-Crop Damage	Crop Acres Flooded	Wapello Gage Stage	($) Non-Crop Damage	Crop Acres Flooded
19	0	0	14	0	0	18	0	0
20	0	0	15	0	1,000	19	0	1,500
21	0	0	16	0	2,200	20	0	1,600
22	12,530	900	17	800	3,400	21	0	1,700
23	294,250	2,000	18	5,900	4,000	22	0	1,800
24	805,500	2,500	19	11,000	4,700	23	0	1,900
25	2,216,000	2,900	20	53,200	5,500	24	13,000	2,000
26	6,567,600	3,300	21	122,500	6,100	25	610,000	2,050
27	12,589,600	3,800	22	191,900	6,300	26	1,200,000	2,100
28	22,588,000	4,200	23	438,000	6,500	27	1,812,800	2,200
29	35,096,000	4,800	24	610,000	6,800	28	2,500,000	12,600
30	48,152,000	5,400	25	736,700	7,000	29	2,716,000	13,000

TABLE
4-18
AVERAGE ANNUAL DAMAGE AND BENEFITS

		Without Reservoir Condition (Natural Flow) ($)	With Reservoir Condition (Regulated) ($)	Average Annual Benefits ($)
Iowa City:	Non-Crop	6,103,000	634,500	5,468,500
	Crop	155,100	21,800	133,300
Lone Tree:	Non-Crop	13,000	7,000	6,000
	Crop	79,300	42,900	36,400
Wapello:	Non-Crop	167,300	122,700	44,600
	Crop	162,100	114,500	47,600
Totals:	Non-Crop	6,283,300	764,200	5,519,100
	Crop	396,500	179,200	217,300

5-01 Hydrometerological Stations.

a. Facilities. The locations and types of all the gaging stations used for the regulation of Coralville Lake are shown on Plate 5-1.

TABLE 5-1
Coralville Gage Stations

Station ID	USGS Gage Number	Station Location	Parameters Collected				Gage Type
BRLI4	N/A	Mississippi River at Burlington, IA	HG	PC	TA		DCP
ROWI4	05449500	Iowa River nr Rowan, IA	HG	PC	TA		DCP
STBI4		Iowa River nr Steamboat Rock, IA	HG	PC	TA		DCP
MIWI4	05451500	Iowa River nr Marshalltown, IA	HG	PC	TA		DCP
MTWI4	05451700	Timber Creek nr Marshalltown, IA	HG	PC	TA		DCP
TOLI4		Deer Creek nr Marshalltown, IA	HG	PC	TA		DCP
TAMI4		Iowa River nr Tama, IA	HG	PC	TA		DCP
HAVI4	05451900	Richland Creek nr Haven, IA	HG	PC	TA		DCP
HRTI4	05452200	Walnut Creek nr Hartwick, IA	HG	PC	TA		DCP
EBRI4	05452000	Salt Creek nr Elberon, IA	HG	PC	TA		DCP
BPLI4		Iowa River nr Belle Plaine, IA	HG	PC	TA		DCP
LADI4	05453000	Bear Creek nr Ladora, IA	HG	PC	TA		DCP
MROI4	05453100	Iowa River nr Marengo, IA	HG	PC	TA		DCP
CRVI4	05453510	Coralville Reservoir nr Coralville, IA	HP				DCP
CTWI4	05453520	Iowa River nr Coralville, IA	HG				DCP
CMTI4		Coralville Reservoir Met Station nr Coralville, IA	PC	TA	UD	US	DCP
CRAI4	05454300	Clear Creek nr Coralville, IA	HG	PC	TA		DCP
IRCI4	05454000	Rapid Creek nr Iowa City, IA	HG	PC	TA		DCP
IOWI4	05454500	Iowa River at Iowa City, IA	HG	PC	TA		DCP
IOCI4	05455100	Old Man's Creek at Iowa City, IA	HG	PC	TA		DCP
NEPI4		North Fork English River nr Parnell, IA	HG	PC	TA		DCP
KALI4	05455500	English River nr Kalona, IA	HG	PC	TA		DCP
LNTI4	05455700	Iowa River nr Lone Tree, IA	HG	PC	TA		DCP
CJTI4		Iowa River nr Columbus Junction, IA	HG	PC	TA		DCP
WAPI4	05465500	Iowa River at Wapello, IA	HG	PC	TA		DCP
ALOI4	05464000	Cedar River at Waterloo, IA	HG	PC	TA		DCP
BLRI4		Prairie Creek nr Blairstown, IA	HG	PC	TA		DCP
CIDI4	05464500	Cedar River at Cedar Rapids, IA	HG	PC	TA		DCP
CNEI4	05465000	Cedar River nr Conesville, IA	HG	PC	TA		DCP

Note: HG-Stage, HP-pool elevation, TA-air temperature, PC-cumulative precipitation, UD-wind direction, US-wind speed

b. Reporting. Table 5-1 shows a list of the stations used to regulate Coralville Reservoir. They all collect data every 30 minutes and transmit the data every hour by GOES satellite.

c. Maintenance. Water Control Section (WCS) personnel monitor the gages every day. Maintenance is the primary responsibility of the WCS. There are four people dedicated to keeping both the data collection platforms and the gaging equipment working properly across the District. In the event a station goes down for any reason and a WCS employee cannot get to it in a timely manner, then the U.S. Geological Survey (USGS), with whom the WCS has a cooperative agreement, is the primary back up.

5-02 Water Quality Stations.

a. Facilities. There are three water quality stations within the drainage area of Coralville Lake. Their locations are shown on Plate 5-2. The upstream station is located at Johnson County Road W-48 on the Iowa River above the limits of the normal conservation pool. During periods when high lake levels prevent sampling at this point, samples are taken at state highway 220 near South Amana. The lake station is located downstream from Lake Macbride at Johnson County Road F-28 Bridge (known as the Mehaffey Bridge). The downstream station is located at the University of Iowa Water Treatment Plant. Samples are analyzed for temperature, turbidity, suspended solids, dissolved oxygen, carbon dioxide, alkalinity, pH, hardness, ammonia, nitrate, BOD, chlorophyll and pheophytin, fecal coliform and streptococcus. Determination of temperature, dissolved oxygen, carbon dioxide, alkalinity, and pH are made in the field. Other parameters are determined in the laboratory. The data is collected approximately once a week in the summer time and once a month in the winter. Collection can take place more frequently if conditions warrant it.

b. Reporting. The collection of water quality data is contracted out. The contractor reports to the District's Water Quality Section once a week with that week's field determined data. They report once a month with the laboratory analyzed data. Each year, the contractor gives a summarized report and the data is published in a report titled similar to *Coralville Water Quality Study, Water*

Year October 1, 1997 to September 30, 1998, prepared by Iowa Institute of Hydraulic Research, University of Iowa. In addition, the Iowa Department of Natural Resources adds the data yearly to the STORET water quality computer system.

c. Maintenance. The contractor is responsible for all the equipment used in the sampling and collection of water quality data.

5-03 Sediment Stations.

a. Facilities. The District has one sediment sampling station used in the regulation of Coralville Lake, on the Iowa River at Marengo, Iowa. It has been in use since 1957 with estimated data going back to 1946. The District contracts with a local observer who takes one sample a day. The sediment bottles are collected approximately once every two months when new sediment bottles are delivered. The samples are then delivered directly to a laboratory in Iowa City for analysis.

b. Reporting. The sediment observer reports to the District once a month with the number of days samples were taken that month. The laboratory reports approximately once every two months with the results of their analysis of the samples.

c. Maintenance. If the sediment collection equipment needs repair, the sediment contractor calls the Water Quality Section. Depending on the nature of the problem the contractor will be instructed how to fix it, or personnel from the office will go out and fix it, or the field crew from the Water Control Section will fix it.

5-04 Recording Hydrologic Data.

All data is stored in yearly databases in 30-minute intervals in the Hydrologic Engineering Center's Data Storage System (HEC-DSS) database format. These files are stored on computers in the Water Control Section's computer room. The stage data is stored on a daily basis in the HEC-DSS annual gage database and can be accessed through the WCS home page on the Internet. The data is brought

into the WCS's computers every hour and is edited on a daily basis by the forecaster for the main project the given gage is used by. The data is automatically backed up every day and is used automatically in daily bulletins for each structure and for various reports. In addition to the automatic storing of 30-minute data, a yearly report is made of the stage for each gage station and stored in the Water Control Section's file cabinets. The daily hard copy data is maintained forever.

5-05 Communication Network.

There are three paths for data or communication. One network is used to transmit data from the data collection platform to the Water Control Section database. This network is discussed in paragraph 5-04.

An internal computer network allows all computers within the Water Control Section to share information or access the database.

A third communication network enables the Water Control Section to communicate with the Coralville Lake Office or other agencies. Communication can be through Internet via computer, commercial telephone, or if necessary police radio. See 5-06a for more information on police radio contact. The Water Control Section uses computer modems and telephone lines to exchange information with the NWS using FTP (file transfer protocol).

5-06 Communication With Project

a. Regulating Office With Project Office. For normal day-to-day activity, the Water Control Section sends a written summary of river and lake levels, releases and gate setting instructions directly to the Coralville Lake Office. If lines to transfer written documents are not functioning, verbal instructions are issued over the telephone. When the Water Control Section is unable to telephone the Coralville Lake Office or the Operations Manager's home, arrangements have been made to communicate through the Johnson County Sheriff's office. The Sheriff's office has agreed to relay messages by radio or in person. The Water Control Section and the Coralville Lake Office

can share information by Internet, e-mail, and cellular telephone. Coralville Lake personnel and Water Control Section staff can also use telephone pagers to reach each other during non-work hours.

b. Between Project Office and Others. The Coralville Lake Office maintains a list of public agencies and camp directors that it notifies by telephone when the pool or reservoir release exceeds a predetermined value. This allows them to close certain roads or campsites in a timely manner. In addition, if the NWS is unable to issue a flood warning, the Operations Manager can provide information on discharge changes to private or public organizations impacted by Coralville Lake.

5-07 Project Reporting Instructions.

The Coralville Lake Office sends data summarizing temperature, wind speed and direction, and precipitation at the project to the Water Control Section. This data is used to verify readings taken in real time from a meteorological DCP station at Coralville Lake.

The Coralville Lake Office confirms changes in releases to the Water Control Section. It reports complaints, operating machinery failure, and out-of-service times for maintenance over the telephone or by e-mail to the Water Control staff.

5-08 Warnings.

The National Weather Service (NWS) has responsibility for issuing flood warnings for all rivers within the Iowa River Basin.

VI-HYDROLOGIC FORECASTS

6-01 General.

The National Weather Service (NWS) prepares flood forecasts for the Iowa River. The Rock Island District Water Control Section prepares predictions of pool elevation and outflow at Coralville Lake. No water quality predictions are made for the reservoir.

a. Role of Corps. The Water Control Section (WCS) has the responsibility to provide forecasts of flood pools and outflows. The WCS utilizes an HEC-1F rainfall runoff model of the Iowa-Cedar Basin to predict lake elevation and release rates. The NWS provides, prepares, and issues all official flood forecasts. The District cooperates with the NWS by providing them with forecasts of reservoir releases. After the model is executed the results are transmitted to the North Central River Forecast Center (NCRFC) at Chanhassen, MN.

b. Role of Other Agencies. The National Weather Service is provided all gage heights and rainfall data so they can develop and issue river forecasts in a timely manner. The NWS provides inflow forecasts to the Water Control Section so the Water Control Section can prepare a lake level elevation forecast. The NWS is responsible for weather, flood, and drought forecasts. Coordination with other state agencies who have the need for hydrologic forecasts is made when their structures or elements are affected.

6-02 Flood Control Forecasts.

a. Requirements. The time required to compute a hydrologic forecast during flood time varies from a few minutes to an hour or more depending on the rainfall distribution and timing. Ten percent of the drainage area above Coralville Lake is ungaged. This area along with Marengo's forecast is critical for the first day's inflow hydrograph. Long-range forecasts depend on upstream stations that give a long lead-time. Rain events at

Marshalltown, Rowan, and Steamboat Rock can be routed down to the lake for the long-range forecast and corrected as the flood crest comes closer. The travel times to the reservoir are 5, 6, and 7 days from Marshalltown, Rowan, and Steamboat Rock, respectively. Downstream forecasts at Lone Tree and Wapello are important in determining the release rates that can be made. Timing is critical as the regulation plan reduces the outflow in order to take just the top three days off the flood crest at both gages. Lone Tree is one-day travel time below the reservoir and Wapello is two.

b. Methods. Forecasting for all stations within the Coralville network is done with an HEC-1F unit hydrograph model of the basin that gets rainfall and stage data from the real time (hourly downloads) data collection network. Heavy rainfalls generally demand some resetting of parameters as the rainfall distribution is never uniform from one storm to another and spot rainfall varies greatly in the mid-west with convective storms. The flow forecasts generated from the HEC-1F model are compared graphically with the forecasts provided by the NWS and the forecaster can pick the best forecast for each station. These inflow and local flow forecasts are then used to forecast the outflow and pool elevation along with stages of downstream control points.

6-03 Conservation Purpose Forecasts

a. Requirements. Conservation purpose forecasts are typically done to determine expected water temperature or other water quality parameters at down stream locations from a reservoir. Water temperature forecasts require hourly or thirty-minute data. Other water quality parameters can be run on longer time frame from daily to weekly or monthly data.

b. Methods. The Tail Water Quality Model (TWQM) is a Waterways Experiment Station supported program used by MVR to forecast downstream water quality parameters. Conservation purpose forecasts are rarely done at Coralville Lake because the outflow is from a single level outlet structure and hence there is little opportunity to affect water quality downstream or in the reservoir using regulation changes.

6-04 Long-Range Forecasts

a. Requirements. Long-range forecasts are done at Coralville to determine snowmelt runoff flood potential and for long term drought forecasting. Typically both are done using daily inflow data although weekly or monthly data can be used. Snow melt flood potential forecasting requires snow amounts on the ground collected as equivalent water content and comes from either the NWS or MVR surveys done with spot checks by county. Estimating the runoff resulting from snowmelt requires an estimate of temperature and rainfall. Usually a range of expected temperatures and rainfall around the 20-year average are used to give an estimated range of flows. Long term drought forecasting requires period of record non-exceedance probability inflow data by month.

b. Methods. Snowmelt flood forecasts are typically run on an as needed basis starting in mid-February and rerun after new snow fall or snow melt changes the situation. Snowmelt flooding is forecast using the Hydrologic Engineering Center's Hydrologic Modeling System (HEC-HMS). Long-term drought or low water forecasting is done using the District's Coralville routing model, COR-RES, a Stella-based object oriented model. The model is run monthly in periods of very low-flow and more often as needed in drought situations.

6-05 Drought Forecast

a. Requirements. Requirements include current inflow and the long-term monthly inflow non-exceedance probability from the District period of record along with the Climate Prediction Center's three-month seasonal precipitation outlooks.

b. Methods. The situation at the start of the forecast is evaluated using the latest month's average inflow to determine the non-exceedance probability. A three-month history of precipitation is compared to normal to determine what level of precipitation caused the current low-flow level. The CPC's seasonal precipitation outlooks are used to determine the probability of precipitation and that is used to estimate the future non-exceedance probability of the inflow. The period-of-record non-exceedance record is then used to forecast the expected

monthly inflow. This data is then routed through the reservoir using the Stella model COR-RES. Drought forecasts are run monthly or weekly depending on the severity of the drought and changing conditions.

c. Reference Documents. Appendix A: Master Reservoir Regulation Manual, Drought Contingency Plan, Coralville Reservoir, published October 1996, is located in the Water Control Section's regulation library. The Drought Contingency Plan is a basic reference for water management decisions and responses to a water shortage in the Iowa River Basin.

VII-WATER CONTROL PLAN

7-01 General Objectives.

The Coralville Lake project was originally authorized for the primary purpose of flood control, with recreation and fish and wildlife facilities subsequently authorized. Operation of the Coralville Lake project provides flood control benefits at the communities downstream of the lake, as well as along the Mississippi River below the confluence with the Iowa River. Low-flow release agreements have been reached between the Iowa City Water Works and the State of Iowa to provide a minimum flow of 150 cfs at Iowa City, IA. Also, a drought contingency plan constructively rations water during extreme drought periods. The drought contingency plan is presented in Section 7-12 with the discharge regulation plan presented in Schedule C, Table C-2 of Exhibit C.

The responsibility for regulation of storage in Coralville Lake rests with the Rock Island District Commander. Within the District Office, the principal responsibility for planning and administration of reservoir regulation is assigned to the Water Control Section of the Hydrology and Hydraulics Branch, Engineering Division, with support from other branches of the Engineering Division. The Water Control Section issues verbal and written regulation orders to the Project Operations Manager. Plate 7-1 shows the District organization pertinent to reservoir regulation.

7-02 Constraints.

The adopted regulation plan for Coralville Lake considers several constraints in determining outflow. Among these are the downstream channel capacity, flood stages at Lone Tree and Wapello on the Iowa River and at Burlington, Iowa on the Mississippi River. Consideration is also given to the pool level, the maximum rate that the reservoir outflow may be changed, and the minimum low-flow requirements. Low-flow augmentation has priority over recreation needs.

7-03 Overall Plan for Water Control.

The overall plan for water control for the Coralville Lake project is to implement a regulation plan with due regard to various constraints to provide a part of the comprehensive scheme for conservation and flood control in the Iowa River Basin. The Coralville Lake, Saylorville Lake, and Lake Red Rock projects are part of the comprehensive system for flood control on the Upper Mississippi River Basin. Other components of the overall plan for water control in the Iowa River Basin are the Lake Macbride Remedial Works and the Amana, Iowa Remedial Works. For conservation storage, the plan of regulation is to provide a minimum low-flow in the downstream reaches.

Integrated Project Components. Integrated components of the Coralville Lake project are as follows:

(1) Coralville Lake for flood control.

(2) Amana, Iowa, Remedial Works for flood control.

(3) Lake Macbride Remedial Works for flood control and recreation.

(6) Coralville conservation pool for water supply and low-flow augmentation.

7-04 Standing Instructions to Operations Manager.

These instructions, as listed in Exhibit C of this manual, are furnished to the Park Manager. They outline the steps to be taken by the Operations Manager for collecting and transmitting hydrologic data and reading and recording of all gages and gate settings on the dam when communication with the District Office is disrupted. It is the responsibility of the Operations Manager to understand the Standing Instructions for reservoir regulation.

An "emergency" is considered to exist when communication either by e-mail, telephone, or radio cannot be established between the Operations Manager and the Regulation Section. Emergency situations can be minor in nature or of a magnitude demanding immediate action. During such

situations, the operation of the reservoir is in accordance with provisions contained in the Standing Instructions listed in Exhibit C of this manual. An overview can be found in Section C-1. Off duty operation can be found in C-2. Normal pool operation is outlined in C-3-a. Large magnitude flood operation is in C-3-b and drought operation is in C-3-c. Emergency flood control is covered in C-4. Section C-5 details flood warning procedures.

7-05 Flood Control.

Techniques pertaining to the regulation of storage allocated to flood control in Coralville Lake may be classified as method C as defined in EM 1110-2-3600. This provides for maximum damage reduction during ordinary flood events until the lower part of the storage is filled and then provides a fixed schedule of releases to assure greater control of larger flood volumes of approximate design magnitude. The regulation schedule for flood control is presented in Schedule A of Table C-2 in Exhibit C. Extra flood control storage is made available in the spring by lowering the conservation pool as much as four feet from 683 to 679 feet, NGVD.

The object of the regulation plan for Coralville Lake is to operate with the downstream control points at Lone Tree, and Wapello, Iowa, on the Iowa River and Burlington, Iowa, on the Mississippi River, within the framework of operational constraints.

Major flood constraint: The major flood pool level is 707.0 feet, NGVD or a forecast exceeding elevation 707.0 feet. Above this level, the emergency regulation Schedule B, Table C-2, will be followed, and all other constraints will be disregarded.

Control point constraints: At Lone Tree the control stage is 14.0 feet for the growing season and 16.0 feet for the non-growing season which corresponds to discharges of 12,000 cfs and 18,000 cfs respectively. At Wapello the control stage is 21.0 feet for the growing season and 22.0 feet for the non-growing season, which corresponds to discharges of 40,000 cfs and 48,000 cfs respectively. The control stage on the Mississippi is 18.0 feet at Burlington, Iowa. If the lake level is between the conservation pool level (683.0 feet, NGVD) and 707.0 feet, NGVD, and a downstream constraint is exceeded, a reduction

of the release rate to 1000 cfs is made. This reduction is made for the peak three days of the expected crest at Lone Tree and Wapello and the peak 7 days at Burlington. The reduction is made to keep the control point below its constraint while not letting the release drop below 1,000 cfs.

Downstream channel constraint: In the reach of the Iowa River from Coralville Lake to the mouth, the channel capacity increases from 12,000 cfs to 40,000 cfs as registered at the Lone Tree and Wapello gages, respectively. During the non-growing season (15 December through 01 May) larger discharges can be tolerated through the two reaches without causing excessive damage. If the lake level is between the conservation pool (683 feet, NGVD) and 707 feet, NGVD, inflows will be released up to a maximum outflow of 6,000 cfs in the growing season (01 May through 15 December), and a maximum of 10,000 cfs in the non-growing season (15 December through 01 May).

The reservoir regulation schedule has been prepared to achieve the objectives outlined in paragraph 7-01 insofar as possible. Maximum reduction in discharge at downstream control stations is provided during periods when there is less utilization of flood control storage. As more storage capacity is utilized, the degree of downstream protection is reduced. For reduction of flooding along Iowa River during the growing and non-growing seasons approximately 72 percent of the reservoir flood control capacity is utilized prior to reaching the major flood level of 707 feet, NGVD. The reservoir regulation schedule is Table C-1 in the Standing Instructions in Exhibit C of this manual.

Normal flood control operation is accomplished by regulation of releases through operation of 3 conduit gates. The basic objective is to release the maximum permissible outflow as limited by the conduit capacity and other constraints outlined in this section. At full flood control pool elevation 712, the total capacity of the conduit when in the fully opened position, is approximately 20,000 cfs. During conditions when the reservoir level is rising, and approaching or exceeding elevation 707 and in addition, inflow is at or forecast to exceed the volume remaining to reach full flood control pool level 712 based on conduit outflow capacity, the outflow will be increased as necessary through use of spillway discharge as discussed in the following paragraph.

Large Magnitude Flood Operation: During extremely large hydrologic events, similar to 1993, the volume of which will exceed the capacity of the reservoir with release rates limited only to the capacity of the outlet conduit, Large Magnitude Flood Operation is invoked. When floods of such magnitude are forecast, or are in progress, and the reservoir level exceeds or is forecast to exceed the emergency level of 707 feet, NGVD, emergency flood release rates as specified in the Regulation Schedule B, Table C-2, will be accomplished by incremental opening of the three gates on the outlet conduit. The gated outlet conduit will be utilized, insofar as possible, to contain the flood volume within the top limit of the flood control pool. The transition from normal operation to operation for floods of large magnitude will occur as the reservoir level approaches elevation 707 feet, NGVD, and forecasts of inflow or observed upstream flow indicate that conduit capacity will no longer be capable of regulating outflow to the extent necessary to contain the flood pool at or below elevation 712. Unrestricted discharge through the outlet conduit and spillway will occur when the pool rises above elevation 712.0 feet, NGVD.

7-06 Recreation.

Coralville Lake has many recreational opportunities that are supplied by the Corps of Engineers including boat ramps, beaches, group camping sites, family campgrounds and trails. The Corps constructs, operates and maintains these facilities but doesn't specifically regulate the reservoir for them.

Constraints: Long-term drought may separate boat ramps from the reservoir and reduced outflows can provide poor fishing conditions in the tailwater area. Floods can inundate boat ramps, parking lots, picnic areas, campgrounds and trails. While high velocity outflows can improve fishing downstream of the reservoir, it also produces dangerous turbulence. This can be a life-threatening situation for boaters and people on the shore who may be knocked into the water by waves or slip while trying to walk on wet riprap with algae growth.

7-07 Water Quality.

Conservation objectives are to augment Iowa River flows during low-flow periods while maintaining a conservation pool elevation of 683.0 feet, NGVD, during the summer months. Water quality objectives are a part of the authorized project purpose with an established standard of 95 percent compliance. The objectives are met by maintaining a minimum flow of 150 cfs at Iowa City.

Constraints: Continued low inflow may result in a situation where the downstream water quality releases cannot be met. See section 7-09 for drought contingency plan.

7-08 Fish and Wildlife.

The conservation pool is raised up to three feet in the fall to improve migratory waterfowl habitat. The area around the normal summer conservation pool of 683 feet, NGVD is either seeded or the natural grasses are allowed to grow. This area is then flooded up to elevation 686 feet, NGVD, on or about 15 September. The end result is prime waterfowl habitat. This area remains inundated until 15 December when the pool is lowered back to 683 feet, NGVD.

Constraints: Fall or late summer flooding in the pool area can restrict the growth of plants in the 683-to 686-foot, NGVD area around the pool making the pool raise pointless even if the pool recedes to 683 before 15 September. In drought, it may be impossible to release 150 cfs for water quality and raise the pool for waterfowl habitat.

7-09 Drought Contingency Plan.

Coralville has a four-level drought contingency plan outlined in *Appendix A, Master Reservoir Regulation Manual, Drought Contingency Plan, Coralville Reservoir*, dated October 1996. The plan can be found in the Water Control regulation library. Copies have been furnished to the Operations Manager and the chiefs of Engineering and Operations Divisions. The first level is the monitoring level. The second level is when inflows drop below 150 cfs and consists of monitoring and increased water conservation

activities. The third level starts when the pool drops below 678 feet, NGVD, and the release rate is reduced to 100 cfs. The fourth level starts when the pool drops below 677 feet, NGVD, and the release rate is reduced to 75 cfs.

7-10 Flood Emergency Plan.

The project's flood emergency plan is contained in a document entitled, *Emergency Plan for Coralville Dam and Lake*, dated April 1995, by Rock Island District. It can be found in the Water Control Section's regulation library as well as the office of the Dam Safety Officer and the Emergency Management Office.

7-11 Other.

At times, the reservoir may have to be regulated for health or safety reasons or to aid construction efforts upstream or downstream of the dam. No deviations in operation will be allowed for construction efforts that conflict with the authorized purposes of the dam. Deviations will be discussed in the following chapters. If emergency drawdown is warranted, the basic guidelines for such operations will be in accordance with ER 1110-2-50, dated 7 August 1972. Drawdown time requirements, assuming average inflow rates are shown on Plate 7-2.

Periodically, it is necessary to keep local interests affected by reservoir operation informed of forecasted water levels. Downstream areas are affected by major changes in release rates. Persons living in areas surrounding the reservoir are interested in major changes in reservoir levels. The Public Affairs Office for the District is responsible for issuing information releases to the area news media for public dissemination. The Regulation Section furnishes basic information for the releases. Under certain emergency conditions, as described under flood warnings in the Standing Instructions listed in Exhibit C of this manual, the Park Manager will keep the public informed of changes in reservoir outflow rates.

7-12 Deviation From Normal Regulation.

The District Commander is occasionally requested to deviate from normal regulation of the reservoir. Prior approval is required from the Division Engineer except as noted in subparagraph "a" below. Depending on the time frame, a formal request for a deviation from normal regulation should be sent to the Division Engineer by letter or electronic mail. The communication should tell what the desired deviation is, why it is needed, for how long it will last, and the impact both upstream and downstream. In the case of a dire emergency, notification of the deviation should be sent to the Division Engineer as soon as possible before, during, or after the deviation has taken place.

a. Emergencies - Some emergencies such as drownings, search and recovery efforts, chemical spills or other temporary pollution problems, require water control actions be taken immediately unless such actions would create equal or worse conditions. The Division Engineer must be informed of the nature of the deviation as soon as practicable. A written description of the deviation, how long it was or will be in effect, the reason it was needed, and the impact of the deviation should be sent to the Division Water Control Manager.

b. Unplanned Minor Deviations - There are unplanned instances that create a temporary need for minor deviations from the normal regulation plan, although they are not considered emergencies. Construction accounts for the major portion of these incidents and typical examples include utility stream crossings, bridgework, and major construction contracts. Deviations are sometimes necessary to carry out maintenance and inspection of facilities. Requests for changes in release rates generally involve time periods ranging from a few hours to a few days. Each request is analyzed on its own merits. In evaluating these proposed deviations, consideration must be given to upstream watershed conditions, potential flood threat, condition of the lake, and alternative measures that can be taken. In the interest of maintaining good public relations, requests generally are complied with provided that there are no foreseen adverse effects on the overall regulation of Coralville Lake for its authorized purposes. Approval for these minor deviations normally will be obtained from the Division Office by telephone.

Written confirmation explaining the deviation and its cause will be furnished by letter or electronic mail to the Division Water Control Manager.

c. Planned Deviations - Each condition should be analyzed on its merits. Sufficient data on flood potential, lake and watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes, together with the District recommendation, will be presented by letter or electronic mail to the Division for review and approval.

7-13 Rate of Release Change.

There is no formal rate of release change constrain on Coralville Lake. An informal practice is to limit changes in the release, both increases and decreases, to 3,000 cfs per day.

VIII-EFFECT OF WATER CONTROL PLAN

8-01 General.

Coralville Lake with its conservation pool and flood control storage offers many benefits to central and eastern Iowa. The conservation pool stores water that can be used to maintain a minimum water quality flow in the downstream channel during a drought along with recreational opportunities from swimming and boating to camping and hiking. Flood storage is used to reduce the peaks of large floods downstream. In the fall, the lake is managed to optimize migratory waterfowl habitat. The enhanced duck and goose habitat provides hunting opportunities.

8-02 Flood Control

a. Spillway Design Flood - The spillway design storm was based on studies of maximum probable precipitation over the Iowa River Basin prepared by the hydrometerological section of the National Weather Service. The flood routing was done on the full flood control pool of 712 feet, NGVD, with the conduit closed. Peak inflow into the reservoir was computed to be 326,000 cfs, resulting in a peak outflow of 244,000 cfs and a peak elevation of 737.9 feet, NGVD. The total inflow volume was 2,490,000 acre-feet of which 760,000 acre-feet were stored. Plate 8-1 is a hydrograph of the spillway design flood.

b. Standard Project Flood - The Standard project flood developed for the definite Project Report dated 1 April 1948 is based on a storm of 28-31 August 1941 (UMV-22) transposed to the Iowa River Basin above the dam. This storm, when transposed, had an estimated 5.43 inches of runoff. The peak inflow to Coralville Lake was estimated to be 83,200 cfs. The storm was routed through the reservoir starting at an elevation of 702.0 feet, NGVD, using the non-growing season regulation plan. This resulted in a peak pool elevation of 719.3 feet and a peak discharge of 50,000 cfs. The hydrographs are shown on Plate 8-2. The total inflow volume was 902,100 acre-feet of which 409,600 acre-feet were stored.

c. Other Floods. The flood of 1947 was used as a test flood during original formulation of the regulation plan. It was a high peak low volume storm with a peak inflow of 32,400 cfs and a total volume of 1,319,000 acre-feet. The storm was routed using the current regulation plan. The resultant inflow, outflow, and pool hydrographs are shown on Plate 8-3. The 1993 flood is by far the flood of record by volume. It was a high volume flood with a relatively low peak. The peak one-day inflow was 36,200 cfs with a total volume of 1,502,000 acre-feet. The inflow, outflow, and pool elevation hydrographs are shown on Plate 8-4.

8-03 Recreation.

The regulation plan enhances recreation in many ways. The stilling basin aerates the tailwater flow increasing the dissolved oxygen used by fish and other aquatic life, thus improving recreational fishing in the tailwater area. Similarly, the conservation pool is used for swimming, fishing, and boating as well as a backdrop for bicycling, hiking and camping. The fall pool raise enhances migratory waterfowl habitat, which increases opportunities for hunting.

8-04 Water Quality.

The State of Iowa sets low-flow levels at stations around the state. The level for the Iowa River at Iowa City is 150 cfs. The water stored in the conservation pool is used to augment the flow when Iowa City flow drops below 150 cfs. This improves downstream water quality for aquatic and riverine habitat at a time that it is greatly stressed.

8-05 Fish and Wildlife.

The reservoir provides varied habitat in the area around Johnson County Iowa. The lake itself provides habitat for fish, waterfowl, and aquatic plants. The fringe area around the lake has good wetlands habitat for plants and animals. The fringe area of the reservoir pool is seeded with grasses, and then flooded in the fall. This creates ideal habitat for migrating waterfowl. Low-flow regulation

of the reservoir provides a minimum amount of water to the downstream corridor preserving the riverine habitat.

8-06 Drought Contingency Plan.

The normal regulation of the reservoir provides stored water to use for the various parts of the drought contingency plan.

8-07 Flood Emergency Action Plan.

The flood emergency action plan specifies what actions must be taken in the case of a major emergency flood such as the spillway design flood or a dam break situation. The water control plan, with its increased outflows in the emergency operation section, protects the dam from a dam break caused by overtopping.

8-08 Frequencies

a. Peak Inflow Probability. Volume-duration-frequency studies for the Iowa River at Coralville are summarized on Plate 8-5. The period of record is 93 years from 1904 through 1996 for this study.

b. Pool Elevation Duration Frequency. Pool elevation and duration curves were developed using the adopted plan of regulation and sequential routing procedures from 1904 through 1996. The pool elevation frequency curves are shown on Plates 8-6 and 8-7, while the pool elevation duration is on Plate 8-8. The period-of-record pool hydrograph is shown on Plates 8-9 through 8-17. From 1904 through 1958, the record is simulated; from 1959 on, the record is the historic pools.

c. Key Control Points. Lone Tree and Wapello are the two primary downstream control points. Iowa City is a control for the flash flood procedure and the tailwater of the dam is regulated. Plates 8-18 through 8-21 show the regulated and unregulated flow frequency for the Iowa River at the tailwater, Iowa City, Lone Tree, and Wapello.

8-09 Other Studies

A Section 216 study of Coralville Lake was conducted in 1996 that evaluated several different regulation plans. In 1998 an extensive regulation study done by the Hydraulics and Hydrology Branch of the Rock Island District considered over 20 different regulation plans. Currently the Rock Island District is under contract with the University of Iowa for an optimization study of how to best operate the reservoir. This study is called the Comprehensive flood Impact Response Management System or CFIRMS. This is a long-term study that will not produce final results for many years. Any regulation changes that it recommends will have to be approved by the Rock Island District and then go through the coordination process before they are implemented. This would include public review for environmental and social concerns and include coordination with all appropriate state and federal agencies, environmental groups, and concerned citizens.

IX-WATER CONTROL MANAGEMENT

9-01 Responsibilities and Organization

a. Corps of Engineers. The Coralville Lake project is owned by the Federal Government and is operated and maintained by the U.S. Army Engineer District, Rock Island, Illinois. Responsibility for the regulation of storage in Coralville Lake rests with the District Engineer. Within the District Office, the principle responsibility for the planning and administration of the reservoir regulation is assigned to the Water Control Section, Hydrology and Hydraulics Branch, Engineering Division, with support from other branches within Engineering Division. The organization chart is shown in Plate 7-1. The Project Operations Manager in charge of the project is [redacted] le. The office phone number at the dam site is [redacted] The dam is attended during regular working hours on a daily basis. During the recreation season, park rangers are on duty on weekends and evenings, and may be reached by cellular phone. The park rangers make gate operations during those periods. In an emergency, the Project Manager, or any of his subordinates, may be called by telephone to make gate operations as necessary. Regulation instructions and hydrologic forecasts will be furnished to the Project Manager or his subordinates by a forecaster from the Water Control Section. This will be done on a daily basis except on those weekends when hydrologic conditions are stable enough to not warrant special attention at the dam site. These forecasts are available to the Operations Manager on the Rock Island District Water Control web site. The Standing Instructions to the Project Operations Manager are shown in exhibit C in the back of this manual. The Standing Instructions outline the steps to be taken by the Manager for collecting and transmitting hydrologic data, reading and recording of all gages and gate settings on the dam when communication with the District office is disrupted. Coordination with other agencies concerning the water control plan is outlined in Chapter V and paragraph 9-02. Any deviation from the authorized regulation plan must be approved by the U.S. Army Engineer Mississippi Valley Division (MVD), Vicksburg, Mississippi.

b. State and County Agencies. The state of Iowa, through the Department of Natural Resources, the Emergency Management Office, and the Governor's Office, is involved in an advisory capacity in both flood and drought emergencies. The downstream counties coordinate with the state and the Corps in writing their flood evacuation plans for large flood events like the spillway design flood (SDF), the SDF with failure, and the full flood control pool with failure.

9-02 Interagency Coordination.

a. Local Press and Corps Bulletins. Periodically it is necessary to keep local interests affected by reservoir operation informed of forecasted water levels. Downstream areas are affected by major changes in release rates. Persons living in areas surrounding the reservoir are interested in major changes in reservoir levels. The Public Affairs Office for the District is responsible for issuing such information releases to the area news media for public dissemination. The Water Control Section furnishes basic information for the releases. Under certain emergency conditions, as described under flood warnings in the Standing Instructions listed in Exhibit C of this manual, the Project Manager will keep the public informed of changes in reservoir outflow rates.

b. National Weather Service. The Water Control Section (WCS) has access to the National Weather Service Quantitative Precipitation forecasts, stage forecasts and weather forecasts through the Internet. The Water Control Section also exchanges flow forecasts through direct links with the NWS. The NWS sends the WCS an inflow forecast for Coralville every morning. This forecast is automatically picked up by the WCS's HEC-1F river forecast model. The WCS forecasters are then free to use the NWS inflow forecast or their own rainfall runoff results. After the forecaster analyzes the results of the hydrologic forecast, and an inflow forecast is determined, the HEC-1F model is finalized. After completing the inflow forecast to Coralville Lake, the pool elevation and release rate forecast is determined. When all forecasts are completed and finalized, the forecaster will send the release forecast back to the NWS so they can use it to forecast downstream locations such as Lone Tree, Columbus Junction, and Wapello.

c. U.S. Geological Survey. The U.S. Geological Survey (USGS) measures and reports the flows at several gage stations that the Water Control Section uses to regulate Coralville. If a gage does not operate or remains constant for an extended period of time, the WCS coordinates with the USGS so that the USGS can visit the station and fix the problem. The Corps of Engineers field staff coordinates with the USGS field staff to determine whose agency should repair the gaging station or the electronic sensors or Data Collection Platform. The USGS also makes extra measurements at the tailwater gage for the WCS on an as needed basis.

d. Contractors. The Water Control Section (WCS) contracts with a private A/E contractor to measure, rate each station, and finalize stream flow records of several gaging stations. Extra measurements are obtained during floods and drought periods. These extra measurements are used to assure the WCS that the stream flow ratings are accurate so they can properly forecast downstream impacts from flooding and make sure the releases from the reservoir meet water quality release constraints during droughts.

9-03 Reports.

During normal operation, a "flood" briefing is available on the Districts intranet web site. It consists of Corps forecasts for its projects and National Weather Service forecasts. During flood situations the Water Control Section produces situation reports (sitreps) on an as needed basis for the District and/or Division Engineer.

TABLE 2-1
CORALVILLE LAKE
Surface Area (2000)
(Acres)

ELEVATION	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
646	0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
647	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
648	1.	1.	1.	1.	1.	1.	1.	1.	2.	2.
649	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
650	2.	2.	2.	2.	2.	3.	3.	3.	3.	3.
651	3.	3.	3.	3.	3.	4.	4.	4.	4.	4.
652	4.	4.	4.	4.	5.	5.	5.	5.	5.	5.
653	5.	5.	6.	6.	6.	6.	6.	6.	6.	7.
654	7.	7.	7.	7.	7.	7.	7.	8.	8.	8.
655	8.	8.	9.	9.	10.	10.	11.	11.	12.	12.
656	12.	13.	13.	14.	14.	15.	15.	15.	16.	16.
657	17.	17.	18.	18.	19.	19.	19.	20.	20.	21.
658	21.	22.	22.	23.	23.	23.	24.	24.	25.	25.
659	26.	26.	26.	27.	27.	28.	28.	29.	29.	30.
660	30.	35.	40.	45.	50.	55.	60.	65.	70.	75.
661	80.	85.	90.	95.	100.	105.	110.	115.	120.	125.
662	130.	135.	140.	145.	150.	155.	160.	165.	170.	175.
663	180.	185.	190.	195.	200.	205.	210.	215.	220.	225.
664	230.	235.	240.	245.	250.	255.	260.	265.	270.	275.
665	280.	288.	296.	304.	312.	320.	328.	336.	344.	352.
666	360.	368.	376.	384.	392.	400.	408.	416.	424.	432.
667	440.	448.	456.	464.	472.	480.	488.	496.	504.	512.
668	520.	528.	536.	544.	552.	560.	568.	576.	584.	592.
669	600.	608.	616.	624.	632.	640.	648.	656.	664.	672.
670	680.	693.	706.	718.	731.	744.	757.	770.	782.	795.
671	808.	821.	834.	846.	859.	872.	885.	898.	910.	923.
672	936.	949.	962.	974.	987.	1000.	1013.	1026.	1038.	1051.
673	1064.	1077.	1090.	1102.	1115.	1128.	1141.	1154.	1166.	1179.
674	1192.	1205.	1218.	1230.	1243.	1256.	1269.	1282.	1294.	1307.
675	1320.	1347.	1373.	1400.	1426.	1453.	1480.	1506.	1533.	1559.
676	1586.	1613.	1639.	1666.	1692.	1719.	1746.	1772.	1799.	1825.
677	1852.	1879.	1905.	1932.	1958.	1985.	2012.	2038.	2065.	2091.

ELEVATION	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
678	2118.	2145.	2171.	2198.	2224.	2251.	2278.	2304.	2331.	2357.
679	2384.	2411.	2437.	2464.	2490.	2517.	2544.	2570.	2597.	2623.
680	2650.	2697.	2743.	2790.	2837.	2883.	2930.	2977.	3023.	3070.
681	3117.	3163.	3210.	3257.	3303.	3350.	3397.	3443.	3490.	3537.
682	3583.	3630.	3677.	3723.	3770.	3817.	3863.	3910.	3957.	4003.
683	4050.	4093.	4135.	4178.	4220.	4263.	4305.	4348.	4390.	4433.
684	4475.	4518.	4560.	4603.	4645.	4688.	4730.	4773.	4815.	4858.
685	4900.	4947.	4994.	5041.	5088.	5135.	5182.	5229.	5276.	5323.
686	5370.	5437.	5505.	5572.	5639.	5706.	5774.	5841.	5908.	5975.
687	6043.	6110.	6177.	6244.	6312.	6379.	6446.	6513.	6581.	6648.
688	6715.	6782.	6850.	6917.	6984.	7051.	7119.	7186.	7253.	7320.
689	7388.	7455.	7522.	7589.	7657.	7724.	7791.	7858.	7926.	7993.
690	8060.	8125.	8189.	8254.	8318.	8383.	8448.	8512.	8577.	8641.
691	8706.	8771.	8835.	8900.	8964.	9029.	9094.	9158.	9223.	9287.
692	9352.	9417.	9481.	9546.	9610.	9675.	9740.	9804.	9869.	9933.
693	9998.	10063.	10127.	10192.	10256.	10321.	10386.	10450.	10515.	10579.
694	10644.	10709.	10773.	10838.	10902.	10967.	11032.	11096.	11161.	11225.
695	11290.	11356.	11423.	11489.	11556.	11622.	11688.	11755.	11821.	11888.
696	11954.	12020.	12087.	12153.	12220.	12286.	12352.	12419.	12485.	12552.
697	12618.	12684.	12751.	12817.	12884.	12950.	13016.	13083.	13149.	13216.
698	13282.	13348.	13415.	13481.	13548.	13614.	13680.	13747.	13813.	13880.
699	13946.	14012.	14079.	14145.	14212.	14278.	14344.	14411.	14477.	14544.
700	14610.	14694.	14777.	14861.	14944.	15028.	15112.	15195.	15279.	15362.
701	15446.	15530.	15613.	15697.	15780.	15864.	15948.	16031.	16115.	16198.
702	16282.	16366.	16449.	16533.	16616.	16700.	16784.	16867.	16951.	17034.
703	17118.	17202.	17285.	17369.	17452.	17536.	17620.	17703.	17787.	17870.
704	17954.	18038.	18121.	18205.	18288.	18372.	18456.	18539.	18623.	18706.
705	18790.	18880.	18969.	19059.	19148.	19238.	19328.	19417.	19507.	19596.
706	19686.	19776.	19865.	19955.	20044.	20134.	20224.	20313.	20403.	20492.
707	20582.	20672.	20761.	20851.	20940.	21030.	21120.	21209.	21299.	21388.
708	21478.	21568.	21657.	21747.	21836.	21926.	22016.	22105.	22195.	22284.
709	22374.	22464.	22553.	22643.	22732.	22822.	22912.	23001.	23091.	23180.
710	23270.	23359.	23447.	23536.	23624.	23713.	23801.	23890.	23978.	24067.
711	24155.	24244.	24332.	24421.	24509.	24598.	24686.	24775.	24863.	24952.
712	25040.	25136.	25232.	25328.	25424.	25520.	25616.	25712.	25808.	25904.

ELEVATION	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
713	26000.	26096.	26192.	26288.	26384.	26480.	26576.	26672.	26768.	26864.
714	26960.	27056.	27152.	27248.	27344.	27440.	27536.	27632.	27728.	27824.
715	27920.	27934.	27948.	27962.	27976.	27990.	28004.	28018.	28032.	28046.
716	28060.	28074.	28088.	28102.	28116.	28130.	28144.	28158.	28172.	28186.
717	28200.	28267.	28333.	28400.	28467.	28533.	28600.	28667.	28733.	28800.
718	28867.	28933.	29000.	29067.	29133.	29200.	29267.	29333.	29400.	29467.
719	29533.	29600.	29667.	29733.	29800.	29867.	29933.	30000.	30067.	30133.
720	30200.									

TABLE 2-2
CORALVILLE LAKE
Storage Capacity (2000)
(Acre-Feet)

ELEVATION	0.0	0.1	.02	0.3	0.4	0.5	0.6	0.7	0.8	0.9
646	0.	0.	0.	1.	1.	1.	1.	1.	1.	1.
647	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
648	1.	1.	1.	1.	1.	1.	1.	1.	2.	2.
649	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
650	2.	2.	3.	3.	3.	3.	4.	4.	4.	4.
651	5.	5.	5.	5.	6.	6.	6.	6.	7.	7.
652	7.	8.	8.	9.	9.	10.	11.	11.	12.	12.
653	13.	14.	14.	15.	15.	16.	17.	17.	18.	18.
654	19.	20.	20.	21.	21.	22.	23.	23.	24.	24.
655	25.	27.	28.	30.	31.	33.	34.	36.	37.	39.
656	40.	42.	43.	45.	46.	48.	49.	51.	52.	54.
657	55.	57.	58.	60.	61.	63.	64.	66.	67.	69.
658	70.	72.	73.	75.	76.	78.	79.	81.	82.	84.
659	85.	87.	88.	90.	91.	93.	94.	96.	97.	99.
660	100.	113.	126.	140.	153.	166.	179.	192.	206.	219.
661	232.	245.	258.	272.	285.	298.	311.	324.	338.	351.
662	364.	377.	390.	404.	417.	430.	443.	456.	470.	483.
663	496.	509.	522.	536.	549.	562.	575.	588.	602.	615.
664	628.	641.	654.	668.	681.	694.	707.	720.	734.	747.
665	760.	807.	854.	902.	949.	996.	1043.	1090.	1138.	1185.
666	1232.	1279.	1326.	1374.	1421.	1468.	1515.	1562.	1610.	1657.
667	1704.	1751.	1798.	1846.	1893.	1940.	1987.	2034.	2082.	2129.
668	2176.	2223.	2270.	2318.	2365.	2412.	2459.	2506.	2554.	2601.
669	2648.	2695.	2742.	2790.	2837.	2884.	2931.	2978.	3026.	3073.
670	3120.	3215.	3309.	3404.	3498.	3593.	3688.	3782.	3877.	3971.
671	4066.	4161.	4255.	4350.	4444.	4539.	4634.	4728.	4823.	4917.
672	5012.	5107.	5201.	5296.	5390.	5485.	5580.	5674.	5769.	5863.
673	5958.	6053.	6147.	6242.	6336.	6431.	6526.	6620.	6715.	6809.
674	6904.	6999.	7093.	7188.	7282.	7377.	7472.	7566.	7661.	7755.
675	7850.	8047.	8245.	8442.	8640.	8837.	9034.	9232.	9429.	9627.
676	9824.	10021.	10219.	10416.	10614.	10811.	11008.	11206.	11403.	11601.

ELEVATION	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
677	11798.	11995.	12193.	12390.	12588.	12785.	12982.	13180.	13377.	13575.
678	13772.	13969.	14167.	14364.	14562.	14759.	14956.	15154.	15351.	15549.
679	15746.	15943.	16141.	16338.	16536.	16733.	16930.	17128.	17325.	17523.
680	17720.	18065.	18410.	18755.	19100.	19445.	19790.	20135.	20480.	20825.
681	21170.	21515.	21860.	22205.	22550.	22895.	23240.	23585.	23930.	24275.
682	24620.	24965.	25310.	25655.	26000.	26345.	26690.	27035.	27380.	27725.
683	28070.	28532.	28993.	29455.	29916.	30378.	30839.	31301.	31762.	32224.
684	32685.	33147.	33608.	34070.	34531.	34993.	35454.	35916.	36377.	36839.
685	37300.	37826.	38352.	38878.	39404.	39930.	40456.	40982.	41508.	42034.
686	42560.	43264.	43969.	44673.	45377.	46081.	46786.	47490.	48194.	48898.
687	49603.	50307.	51011.	51715.	52420.	53124.	53828.	54532.	55237.	55941.
688	56645.	57349.	58054.	58758.	59462.	60166.	60871.	61575.	62279.	62983.
689	63688.	64392.	65096.	65800.	66505.	67209.	67913.	68617.	69322.	70026.
690	70730.	71691.	72653.	73614.	74576.	75537.	76498.	77460.	78421.	79383.
691	80344.	81305.	82267.	83228.	84190.	85151.	86112.	87074.	88035.	88997.
692	89958.	90919.	91881.	92842.	93804.	94765.	95726.	96688.	97649.	98611.
693	99572.	100533.	101495.	102456.	103418.	104379.	105340.	106302.	107263.	108225.
694	109186.	110147.	111109.	112070.	113032.	113993.	114954.	115916.	116877.	117839.
695	118800.	120098.	121396.	122695.	123993.	125291.	126589.	127887.	129186.	130484.
696	131782.	133080.	134378.	135677.	136975.	138273.	139571.	140869.	142168.	143466.
697	144764.	146062.	147360.	148659.	149957.	151255.	152553.	153851.	155150.	156448.
698	157746.	159044.	160342.	161641.	162939.	164237.	165535.	166833.	168132.	169430.
699	170728.	172026.	173324.	174623.	175921.	177219.	178517.	179815.	181114.	182412.
700	183710.	185372.	187033.	188695.	190356.	192018.	193680.	195341.	197003.	198664.
701	200326.	201988.	203649.	205311.	206972.	208634.	210296.	211957.	213619.	215280.
702	216942.	218604.	220265.	221927.	223588.	225250.	226912.	228573.	230235.	231896.
703	233558.	235220.	236881.	238543.	240204.	241866.	243528.	245189.	246851.	248512.
704	250174.	251836.	253497.	255159.	256820.	258482.	260144.	261805.	263467.	265128.
705	266790.	268908.	271026.	273143.	275261.	277379.	279497.	281615.	283732.	285850.
706	287968.	290086.	292204.	294321.	296439.	298557.	300675.	302793.	304910.	307028.
707	309146.	311264.	313382.	315499.	317617.	319735.	321853.	323971.	326088.	328206.
708	330324.	332442.	334560.	336677.	338795.	340913.	343031.	345149.	347266.	349384.
709	351502.	353620.	355738.	357855.	359973.	362091.	364209.	366327.	368444.	370562.
710	372680.	375094.	377508.	379922.	382336.	384750.	387164.	389578.	391992.	394406.
711	396820.	399234.	401648.	404062.	406476.	408890.	411304.	413718.	416132.	418546.

ELEVATION	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
712	420960.	423650.	426341.	429031.	431721.	434412.	437102.	439792.	442483.	445173.
713	447863.	450554.	453244.	455934.	458625.	461315.	464005.	466696.	469386.	472076.
714	474767.	477457.	480147.	482838.	485528.	488218.	490909.	493599.	496289.	498980.
715	501670.	504410.	507150.	509890.	512630.	515370.	518110.	520850.	523590.	526330.
716	529070.	531810.	534550.	537290.	540030.	542770.	545510.	548250.	550990.	553730.
717	556470.	559403.	562337.	565270.	568203.	571137.	574070.	577003.	579937.	582870.
718	585803.	588737.	591670.	594603.	597537.	600470.	603403.	606337.	609270.	612203.
719	615137.	618070.	621003.	623937.	626870.	629803.	632737.	635670.	638603.	641537.
720	644470.									

TABLE 4-11

Iowa River Upstream Rating Curves
Flow (cfs)

Station	Rowan	Steamboat Rock	Marshalltown	Tama	Belle Plaine	Marengo
Datum FT N.G.V.D.	1143.35	951.46	853.1	794.34	749.82	720.52
River Mile	316.4	258.1	222.8	188.5	154.0	139.1
Stage in Feet						
1						
2						
3		0				
4	70	180			0	0
5	200	570			150	140
6	390	1180			410	470
7	610	1900	30		760	980
8	860	2660	70		1060	1530
9	1150	3500	350	520	1430	2100
10	1590	4430	820	1090	1900	2660
11	2260	5430	1350	1560	2450	3270
12	3080	6490	1920	1800	3050	3960
13	4080	7620	2540	2260	3750	4800
14	5240	8780	3180	2800	4500	5900
15	6730		3870	3450	6000	7100
16			5030	4260	8500	8820
17			6930	5340	15000	11500
18			9210	7050	25000	16000
19			11900	9780	41000	24300
20			15100	13200		35500
21			19000	18500		50000
22				26000		
23						
24						
25						
26						
27						
28						

TABLE 4-12

Iowa River Tributaries
Upstream Rating Curves
Flow (cfs)

River	Timber Creek	Deer Creek	Richland Creek	Walnut Creek	Salt Creek	Bear Creek
Station	Marshalltown	Toledo	Haven	Hartwick	Elberon	Ladora
Datum FT N.G.V.D.	849.44	794.34	788.69	786.59	781.58	744.94
River Mile	3.0	188.5	2.8	6.5	9.0	8.1
Stage in Feet						
1						
2	20					
3	80	0		6		
4	150	8		70		
5	250	110		160	10	
6	350	300		300	70	
7	480	610		460	160	
8	620	1060		630	280	
9	770	1670		840	410	0
10	930	2470	10	1060	570	1
11	1120	3460	70	1300	750	40
12	1300	4550	160	1580	940	160
13	1580		260	1970	1160	340
14	1850		380	2750	1450	590
15	3460		510	4140	1860	890
16	5060		660	5950	2820	1250
17	8530		830	8050	5120	1630
18	12000		1010		8950	2050
19			1210		15500	2500
20			1540		25200	3000
21			2350		39000	3530
22			3550			4100
23			5200			5000
24						6050
25						7400
26						10000
27						
28						

TABLE 4-13

Downstream Rating Curves
Coralville Reservoir to Lone Tree
Flow (cfs)

River	Rapid Creek	Clear Creek	Iowa River	Old Man's Creek	English River	Iowa River
Station	Iowa City	Coralville	Iowa City	Iowa City	Kalona	Lone Tree
Datum FT N.G.V.D.	673.72	647.48	617.27	637.49	633.45	588.16
River Mile	4.7	2.7	74.2	8.6	14.5	47.2
Stage in Feet						
1		1		0		
2		50		40		0
3	0	130		130	30	130
4	10	240		250	130	590
5	70	380		390	290	1240
6	210	580		550	510	2030
7	360	720		730	800	2950
8	510	910		930	1140	3980
9	710	1110	130	1140	1540	5110
10	980	1350	540	1390	1970	6330
11	1380	1700	1120	1690	2450	7650
12	1970	2280	1810	2060	2980	9040
13	2820	3750	2600	2580	3550	10500
14	4030	5400	3480	3330	4190	12100
15	5570	7200	4370	4440	4950	14800
16	7500	9300	5250	6160	6000	18000
17		11700	6120	9230	7250	22000
18		14000	7100		9200	26300
19		16500	8220		12300	31000
20		19000	9400		17500	36600
21		21500	10600		24600	42900
22			12000		33900	49900
23			13500		46000	57600
24			15400			65400
25			17400			
26			19700			
27			22500			
28			26000			
29			30400			
30			37500			
31			50000			

TABLE 4-14

Downstream Rating Curves
Below Lone Tree
Flow (cfs)

River	Cedar River	Prairie Creek	Cedar River	Cedar River	Iowa River	Iowa River
Station	Waterloo	Blairstown	Cedar Rapids	Conesville	Columbus Junction	Wapello
Datum FT N.G.V.D.	824.14		700.47	581.95		538.17
River Mile	158.8		83.6	10.7	28.6	16
Stage in Feet						
1						
2						
3			430	0		
4			2890	480		
5	560		5950	1220		
6	2380		9340	2270		
7	5340		12900	3640	290	
8	8560	8	16500	5380	1050	
9	12000	80	19600	7520	2960	
10	15400	190	2300	9940	4870	1970
11	18800	360	26900	12800	6780	3650
12	22200	620	31400	16200	8690	5700
13	25800	1000	36100	21200	10600	8060
14	29500	1550	41000	30000	13600	10700
15	33200	2250	46000	41000	16900	13600
16	37200	3120	51100	54500	20600	16700
17	42000	4170	56400	70800	24200	20000
18	47000	5410	62700	94000	27600	23600
19	53000	6840	69300	125000	31000	27500
20	59500		76400		34600	33000
21	67500				38400	39700
22	77000				43700	47700
23					49200	56500
24					55100	66300
25					61300	77100
26					67700	88800
27						101500
28						115200

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

GENERAL INFORMATION

ITEM	DESCRIPTION OR QUANTITY & UNITS
Official name for project	Coralville Dam and Coralville Lake
Other names of project	Coralville Reservoir
Location	Des Moines River Basin; Des Moines River 83.3 miles from the mouth; Johnson County, Iowa Latitude 41 degrees 43' N, Longitude 91 degrees 31' W
Type of Project	Dam and reservoir
Objects of regulation	Flood Control, conservation, environmental, and recreation
Project owner	United States Army Corps of Engineers (USACE) – Rock Island District
Operating agency	Operations Division, Rock Island District; Seven days a week from 8 hours to 24 hours per day.
Regulating agency	Water Control Section, Rock Island District
Project cost	$15,744,320 (1968) includes Mehaffey Bridge Project
Closure date	July 1958
Special project features	Remedial Protective Works at Lake Macbride, Amana and Iowa City, Iowa

RESERVOIR LAKE OR POOL

Top of dam — 743 feet, NGVD

Maximum Pool — 716.71 feet, NGVD on 24 July 1993

Incremental Storage

	Elevation (feet, NGVD)	Runoff (inches)	Capacity (ac-feet)	Area (acres)
Flood Pool (Standard Project Flood)	737.9	4.45	738,800	43,100
Flood Control Pool (Spillway)	712.0	2.28	378,400	25,040
Fall Conservation Pool	686.0	0.09	14,500	5,370
Summer Conservation Pool	683.0	0.07	12,400	4,050
Spring Conservation Pool	679.0	0.09	15,700	2,380

Real Estate taking line for Fee Title — 702.0 feet, NGVD (Authorized 1977)

Real Estate flowage easements — 702.0 – 717.0 feet NGVD

Reservoir Length at 712 feet, NGVD — 27.0 Valley Miles
Reservoir Length at 686 feet, NGVD — 19.5 Valley Miles
Reservoir Length at 683 feet, NGVD — 18.7 Valley Miles
Reservoir Length at 679 feet, NGVD — 17.1 Valley Miles

Shoreline length at 683 Feet, NGVD — 45 miles

Safety aspects, possibly requiring warning

Emergency drawdown — 683 to 646.0 feet NGVD invert elevation, approx. 61,900 acre-feet of storage, 4 day minimum, assumes 1,00 cfs inflow

Project Area Data

Reservoir Area

Pool Elevation	Location Closed or Flooded
690.0	County road east of Sandy Beach inundated
692.0	Boat ramp at Sandy Beach closed
693.0	Sandy Beach day use area closed
693.5	County road W4F west of ATV area and Sugar Bottom access road to mountain bike area flooded.
694.0	Boat ramp at Sugar Bottom campground closed
695.0	Parking lot at Curtis Bridge campground starts to flood
697.0	Mid River Marina closed
701.0	Boat ramp at West Overlook day use area flooded. Flooding of Sugar Bottom campsites begins.
702.0	Flooding of flowage easement land begins. Entrance to Macbride State Park is inundated. Flooding of West Overlook campsites begins.
707.5	Entrance road to Jolly Roger Recreation Area inundated.
710.0	Flooding of two historic sites begins
712.0	Emergency spillway crest elevation. Closure of road across spillway and all recreation areas below the dam.
713.0	West Overlook Campground closed.
714.2	Entrance road to Mehaffey Boat Ramp inundated.
717.0	Upper guide taking line for flowage easements.

Downstream

When release exceeds (cfs)	Description
8,000	Bank full. Agriculture fields can't drain. City park in Iowa City begins to flood.
10,000	Property along Riverside Drive begins to be inundated.
12,000	Homes along Edgewood Drive in Coralville begin to be flooded, North bound lanes of Dubuque Street in Iowa City inundated
16,000	Normandy Drive and S bound lane of Dubuque Street inundated
20,000	Down stream recreation areas closed.
28,000	Water begins to reach support beams of Iowa City bridges.

HYDROLOGY

Drainage Area	3,115 square miles
Standard Project Flood	
Maximum elevation	719.3 feet, NGVD
Peak inflow	83,200 cfs
Peak outflow	50,000 cfs
Runoff	5.43 inches
Volume of runoff	902,104 acre-feet
Initial condition	Half-filled pool, 702.0 feet, NGVD
Spillway Design Flood	
Maximum elevation	737.9 feet, NGVD
Peak inflow	326,000 cfs
Peak outflow	244,000 cfs
Initial condition	Spillway elevation, 712.0 feet, NGVD
Climate	Mid-continental, temperate
1" runoff	166,000 acre-feet
Storm types	Winter snow, spring and summer thunderstorms, spring, summer, and fall storm fronts with widely distributed rain.
Flood season	Spring and summer
Low flow season	Fall and winter

	Coralville Inflow	
	Pre-construction	Post-construction
Minimum daily flow	29 cfs October 21, 1916	24 cfs February 1, 1977
Minimum monthly flow	49 cfs February 1940	31 cfs January 1977

Minimum annual flow	204 cfs 1934	282 cfs 1989
Average annual flow	1470 cfs	2,270 cfs
Maximum annual flow	3,400 cfs 1947	8,110 cfs 1993
Maximum daily flow	42,500 June 8, 1918	36,200 cfs July 18, 1993
Maximum instantaneous flow	40,500 June 8, 1918	36,200 cfs July 18, 1993
Maximum flood volume	1,180,000 ac-ft 1947	3,100,000 ac-ft 1993

Name and location of key Stream-flow stations	Upstream stations on the Iowa River at Marshalltown and Marengo. Downstream constraints on the Iowa River at Lone Tree and Wapello.
Type of hydrometeorological data recorded at dam site	Pool, tailwater, precipitation, air temperature, wind speed, and wind direction.
Number of precipitation stations used in hydrologic forecasting	25 precipitation stations

DAM ENBANKMENT

Location	River Mile 83.3,
Purpose	Flood protection and conservation
Type	Earth dam with spillway and outlet works
Type of Fill	Rolled earthfill
Slope protection	Riprap

Height	100 feet
Length	1,400 feet
Top elevation	743.0 feet, NGVD
Percent exceedance frequency flood which will overtop structure	Flood magnitude is 7.0 times larger than the 1 percent exceedance frequency flood
Design flood	1 percent
Freeboard	8.6 feet above the spillway design flood
Used for roadway	Access road closed when spillway is overtopped.
Elevation of toe	680 feet, NGVD

SPILLWAY

Location	West end of earth dam
Type	Chute spillway with uncontrolled concrete weir
Crest elevation	712.0 feet, NGVD
Net overflow length	500 feet
Design head	25.9 feet
Maximum discharge capacity	244,000 cfs
Type energy dissipater	Stilling basin
Recurrence interval of pool reaching crest elevation	About once in 30 years
Spillway Activation	Once

OUTLET FACILITIES

Location	Through the base of the earth dam
Purpose	Conservation and flood control release
Type of Outlet	One circular concrete conduit
Size of Outlet	23 feet diameter
Type of Service Gate	Sluice gates (3) with electric hoist
Number and Size of Gates	Three, each 8ft 4 in (H) by 20 ft (V)
Entrance Invert Elevation	646 feet NGVD

Maximum Outlet Discharge

Description	Elevation (feet, NGVD)	Discharge (cfs)
Conservation Pool	683.0	11,800
Top fall Conservation pool	686.0	12,800
Spillway Crest	712.0	20,000

Minimum pool elevation when Outlet is inoperative	646 feet NGVD
Minimum time required to Open / close service gates	1 Hour
Type emergency closure and time requirement	one emergency gate lowered in 1 hour from a traveling hoist.
Type energy dissipater	Stilling basin with baffle blocks

CONTROL POINTS

Name	Iowa River at Lone Tree	Iowa River at Wapello	Mississippi River at Burlington
Location	River Mile 47.2	River Mile 16.0	Miss. RM 403.1
Purpose of Control	Damage Center Dam to Cedar River Confluence	Damage Center Cedar River Confluence to Mouth	Damage Center Mississippi River
Uncontrolled Drainage Area	1,178 Square Miles	9,384 Square Miles	111,000 square miles
Treatment of uncontrolled target flow	Contributes to both flood control and conservation runoff	Contributes to both flood control and conservation runoff	Contributes to flood control runoff
Target Flow Rates	12,000 cfs growing sea. 18,0000 cfs nongrowing	40,000 cfs growing sea. 48,000 cfs nongrowing	18.0 foot stage
Time of Water Travel	One day	Two days	3.5 days
Flood Stage	15.0 feet (15,200 cfs)	20.0 (31,500 cfs)	15.0
Maximum stage (w/prj)	22.94 feet (July 7, 1993)	29.53 feet (July 7, 1993)	24.98 feet (Jul 10, 1993)
Maximum Flow (w/prj)	57,100 cfs	111,000 cfs (est.)	N/A
Minimum Stage (w/prj)	2.80 feet (Aug 4, 1977)	9.11 feet (several 1977)	6.76 feet (July 16, 1989)
Minimum Flow (w/prj)	69 cfs	460 cfs	N/A
Monitoring Provisions	Data Collection Platforms w/ automatic reporting using satellite	Data Collection Platforms w/ automatic reporting using satellite	Data Collection Platforms w/ automatic reporting using satellite

EXHIBIT B

CORALVILLE LAKE

PROJECT & DESIGN MEMORANDA

Design Memorandum No.	Subject	Date
1	Spillway – Hydraulic Design	17 September 1954
2	Spillway – Structural Design	1 October 1954
3	Service Bridge	5 October 1954
4	Relocations – Johnson County Routes E and O	31 March 1955
5	Relocations – Chicago, Rock Island and Pacific Railroad	5 May 1955
6A	Relocations – Utilities – Natural Gas Pipe Line	1 April 1955
6B	Relocations – Underground Telephone Cable	5 May 1955
6C-1	Electric Transmission Lines (Iowa Electric Light and Power Company)	24 April 1956
6C-2	Electric Transmission Lines (Linn County Rural Electric Cooperative Association	20 July 1956
6D	Telephone Line	29 May 1957
7	Diversion	11 May 1955
8	General Design Memo – Lake Macbride State Park and Cottage Reserve	27 July 1955
8A	Lake Macbride State Park – Dam	23 August 1955
8B	Lake Macbride State Park – Remedial Works	19 September 1955
8C	Lake Macbride State Park – Utilities	6 January 1956

8D	Lake Macbride State Park – Roads	18 October 1955
9	Protection for Amana, Iowa	16 December 1955
10	Remedial Works for Chicago, Milwaukee, St. Paul And Pacific Railroad	17 January 1956
11	Johnson County Route E at Swisher Creek	16 March 1956
12	Reservoir Clearing	14 December 1955
12A	Reservoir Clearing Supplement	12 September 1957
13	Housing for Dam Tenders	11 August 1955
14	Soil Erosion Control	31 January 1957
15	Recreational Development	2 August 1957
15A	Recreational Development Supplement	6 October 1958
16	Administration Building	7 June 1957
18	Real Estate Memorandum – Real Estate Requirements For Automatic Reporting Gages and Radio Telemetering Equipment	17 May 1957
1	Mehaffey Bridge	7 December 1962

OTHER PROJECT DOCUMENT

Definite Project Report	June 1938
Definite Project Report	December 1939
Definite Project Report	June 1947
Definite Project Report	April 1948
Master Recreation Plan	March 1950
Preliminary Regulation Manual	30 April 1951
Coralville Reservoir Stage II Construction	

Completion Report	1958
Supplement #1 to Updated Master Plan- Shoreline Zoning	26 February 1963
D-M 15C – Revision to Master Plan	31 January 1964
A Study of Flood Control Benefits and Related Recreation Benefits with Seasonal Changes in Seasonal Water Level Elevations	7 November 1965
Johnson County Roads	July 1975
Final Environmental Impact Statement for Coralville Lake and the downstream Area of Influence to Columbus Junction, Iowa	April 1977
Resources Master Plan, Vol. I Design memorandum #15C	April 1977
Master Plan Study – Lake Macbride By Iowa Conservation Commission	Rev. 1977
Water Control Plan	July 1990

EXHIBIT C

STANDING INSTRUCTIONS TO RESERVOIR PERSONNEL

C-01. Instructions to Reservoir Operations Manager.

All regulation instructions shall be furnished to the Reservoir Project Manager by the reservoir forecaster, Water Control Section, Hydrology and Hydraulics Branch. The Reservoir Forecaster is designated to receive and analyze the meteorological and hydrologic data and issue instructions to the Reservoir Project Manager for all gate operations. Normally, regulation instructions will be furnished primarily by FAX or secondarily by telephone. An "emergency" exists, by definition, when communications cannot be established between the Reservoir Project Manager and the Water Control Section. Under such emergency conditions, the Reservoir Project Manager is authorized to operate the gates as outlined in the regulation schedule of this exhibit, normal operation in Schedule A, and record all the details of operation. In addition to this exhibit, all information pertinent to regulation shall be furnished to the Reservoir Project Manager.

C-02. Off-Duty Hours of Operation.

Gate changes will be made during working hours, insofar as possible. In the event that conditions require immediate action, gate instructions may be given for any hour. If unusual conditions arise during non-duty hours, reservoir personnel should contact one of the following reservoir forecasters.

[redacted]

[redacted]				[redacted]				[redacted]			
[redacted]				[redacted]				[redacted]			
[redacted]				[redacted]				[redacted]			
[redacted]				[redacted]				[redacted]			
[redacted]				[redacted]				[redacted]			
[redacted]				[redacted]				[redacted]			
[redacted]				[redacted]				[redacted]			
[redacted]				[redacted]				[redacted]			

C-03. Pool Regulation.

a. Normal Operation. The seasonal conservation pool level of 683 feet NGVD, will be maintained, insofar as possible, except as described in section 7 of this regulation manual which allows a seasonal conservation level to be maintained up to 3 feet above the authorized conservation pool in the fall for waterfowl migration and up to

4 feet below the authorized conservation pool in the Spring to provide additional flood storage capacity.

b. Large Magnitude Flood Operation. When a large magnitude flood is in progress and the pool level is above or is forecast to go above 707 feet, NGVD, the Major Flood Schedule B will be followed

c. Inflow Less than 150 cfs. For all inflows below 150 cfs, a minimum release of 150 cfs will be made from the conservation storage at Coralville Lake. This release rate will continue until the pool is at or forecast to be below 678.0 feet NGVD, at which time release rates will be made in accordance with the Drought Schedule C.

C-04 Emergency Flood Control Operation.

An "emergency" exists when communication cannot be established between the Reservoir Operations Manager and the Water Control Section. When an emergency exists the Reservoir Project Manager will follow the standing instructions contained in the Regulation Schedule. He will keep records of all gate changes, pool levels, and all other hydrologic data collected. He will continue to provide public information on reservoir releases.

C-05 Flood Warning.

It is the responsibility of the National Weather Service River Forecast Center at Chanhassen, Minnesota (through the Des Moines office) to issue flood forecasts. Pertinent information pertaining to Coralville Lake regulation will be made available to the National Weather Service by the Water Control Section. Under emergency conditions, when there is insufficient time available for the National Weather Service to issue flood warnings through normal channels, the Reservoir Project Manager is responsible for issuing warnings to the public regarding sudden changes in release rates, which may adversely affect downstream interests.

TABLE C-2

Coralville Lake
Regulation Schedule

Schedule A Normal Flood Control Operation Pool elevation at or forecast between 683 and 707	Conservation pool Schedule Date — Operation 15 Feb - 20 Mar — 683 to 679^ 20 Mar - 20 May — Hold 679^ 20 May - 15 Sep — Hold 683 15 Sep - 15 Dec — Hold 683-686* 15 Dec - 15 Feb — Hold 683 Notes: ^ *Variable draw down based on snow cover, ice, and 30 day climatic conditions coordinated with IDNR* * *Dates and elevation of fall pool raise coordinated with the IDNR*

Condition	Operation
A-1 All Dates	Regulated pool level as nearly as possible without adversely affecting downstream conditions. Do not release less than minimum outflow of 150 cfs
A – 2 15 December through 1 May	Maintain conservation pool according to schedule without exceeding release of 10,000 cfs except as limited by conditions A-3, A-6 or A7
A-3 15 December through 1 May Stage at above or forecast to exceed.... Lone Tree 16.0 feet 18 Wapello 22.0 feet 47.7	Reduce release to not less than 1,000 cfs to control flow to those discharges as near as possible during three days of crest at the respected station with due allowance to travel times.
A-4 1 May through 15 December	Maintain conservation pool according to schedule without exceeding release of 6,000 cfs except as limited by conditions A-5, A-6 or A7
A-5 1 May through 15 December Stage at above or forecast to exceed.... Lone Tree 14.0 feet 12.1 Wapello 21.0 feet 39.7	Reduce release to not less than 1,000 cfs to control flow to those discharges as near as possible during three days of crest at the respected station with due allowance to travel times.
A-6 All Dates Stage at above or forecast to exceed... Mississippi River at Burlington - 18.0	Reduce release to 1,000 cfs during seven days corresponding to the crest flow on the Mississippi River with due allowance for travel time. Not less than
A-7 Flash Flood: Any date flow at above or forecast to exceed 16,000 cfs at Iowa City	Reduce release to not less than 1,000 cfs to keep flow at or below 16,000 cfs at Iowa City

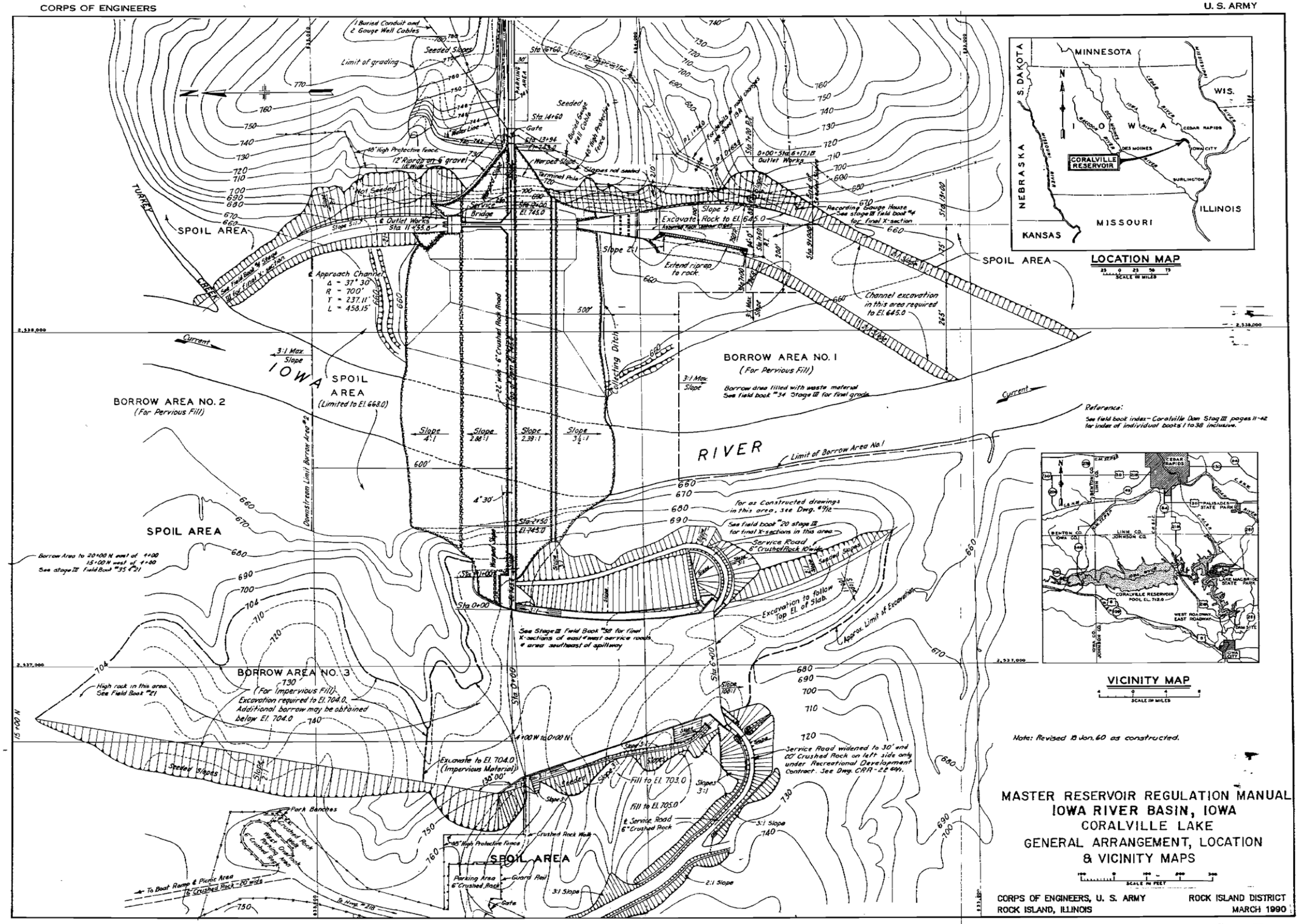
Schedule B **Major Flood** **Pool Elevation at above or forecast to exceed 707 feet NGVD**	

Condition	Operation
B-1 Inflow has not Peaked	Determine the pool elevation that would occur at the peak of the inflow hydrograph. Release not more than allowed on table below:

15 Dec – 1 May		**1 May – 15 Dec**	
Elev.	**Outflow**	**Elev.**	**Outflow**
707	10000	707	7000
708	10000	708	8000
709	10000	709	9000
710	10000	710	10000
711	11000	711	11000
711.1	12000	711.1	12000
711.2	13000	711.2	13000
711.3	14000	711.3	14000
711.4	15000	711.4	15000
711.5	16000	711.5	16000
711.6	17000	711.6	17000
711.7	18000	711.7	18000
711.8	19000	711.8	19000
711.9	20000	711.9	20000
712.0 and above - Gates Fully open			

B-2 Inflow has Peaked	Determine the minimum outflow required to utilize the remaining storage below 712.0. Release that flow or the present outflow – whichever is higher.
B-3 Reservoir Pool Falling	Release outflow established by B-2 until elevation 707 is reached then gradually reduce flows to Schedule A
B-4 Emergency: flow forecast to exceed the control flow established by the U.S. Army Corps of Engineers for public exigency downstream	Reduce release to keep flow at or below the control flow established by the "Corps".

Schedule C **Drought -- All Dates** **Any time pool below conservation according to Schedule A and inflow not sufficient to get to conservation pool.**	
C-1 Pool between Conservation and 678.0	Release 150 cfs
C-2 Pool between 677.0 and 678.0	Reduce release to 100 cfs
C-3 Pool below 677.0	Reduce release to 75 cfs


LOCATION MAP
MINNESOTA
S. DAKOTA
NEBRASKA
KANSAS
MISSOURI
ILLINOIS
WIS.
IOWA
CORALVILLE RESERVOIR
CEDAR RAPIDS
IOWA CITY
DES MOINES
BURLINGTON
VICINITY MAP
SPOIL AREA
BORROW AREA NO. 1
(For Pervious Fill)
BORROW AREA NO. 2
(For Pervious Fill)
BORROW AREA NO. 3
(For Impervious Fill)
RIVER
Current
Approach Channel
Δ = 37° 30'
R = 700'
T = 237.11'
L = 458.15'
Outlet Works
Service Bridge
Recording Gauge House
Channel excavation in this area required to El. 645.0
Excavate Rock to El. 645.0
Extend riprap to rock.
Limit of grading
Seeded Slopes
Not Seeded
Limit of Borrow Area No. 1
Downstream Limit Borrow Area #2
Reference:
See field book index - Coralville Dam Stage III pages 11-42 for index of individual books 1 to 38 inclusive.
Note: Revised 18 Jan. 60 as constructed.
Excavation to follow Top El. of Slab.
Approx. Limit of Excavation
Excavate to El. 704.0 (Impervious Material)
Fill to El. 703.0
Fill to El. 705.0
Service Road widened to 30' and 20' Crushed Rock on left side only under Recreational Development Contract. See Dwg. CRR-22 641.
Park Benches
Crushed Rock Walk
Crushed Rock Walk
Parking Area
Parking Area 6" Crushed Rock
Guard Rail
Gate
To Boat Ramp & Picnic Area
To Hwy. #218
MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN, IOWA
CORALVILLE LAKE
GENERAL ARRANGEMENT, LOCATION
& VICINITY MAPS
CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS
ROCK ISLAND DISTRICT
MARCH 1990

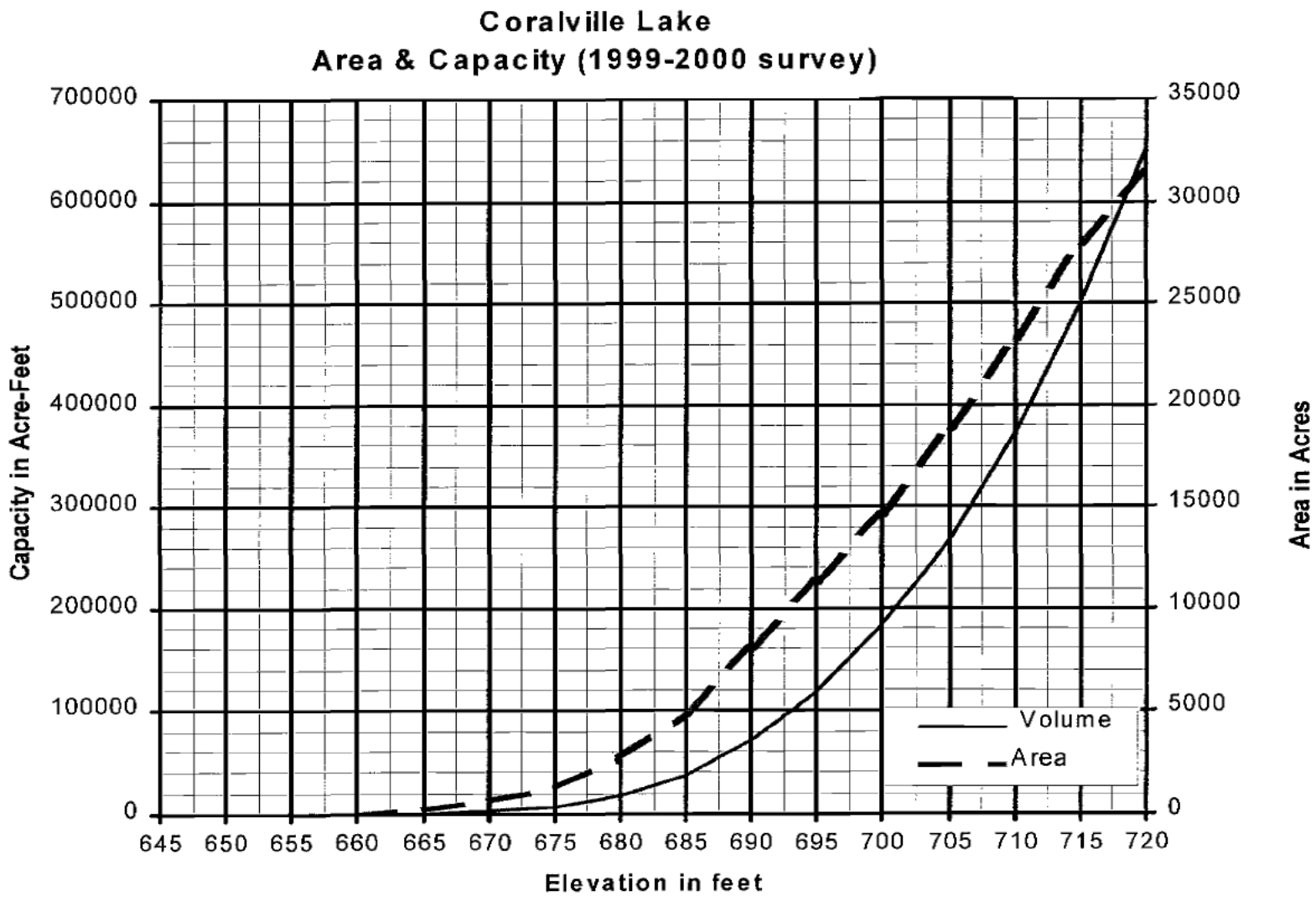
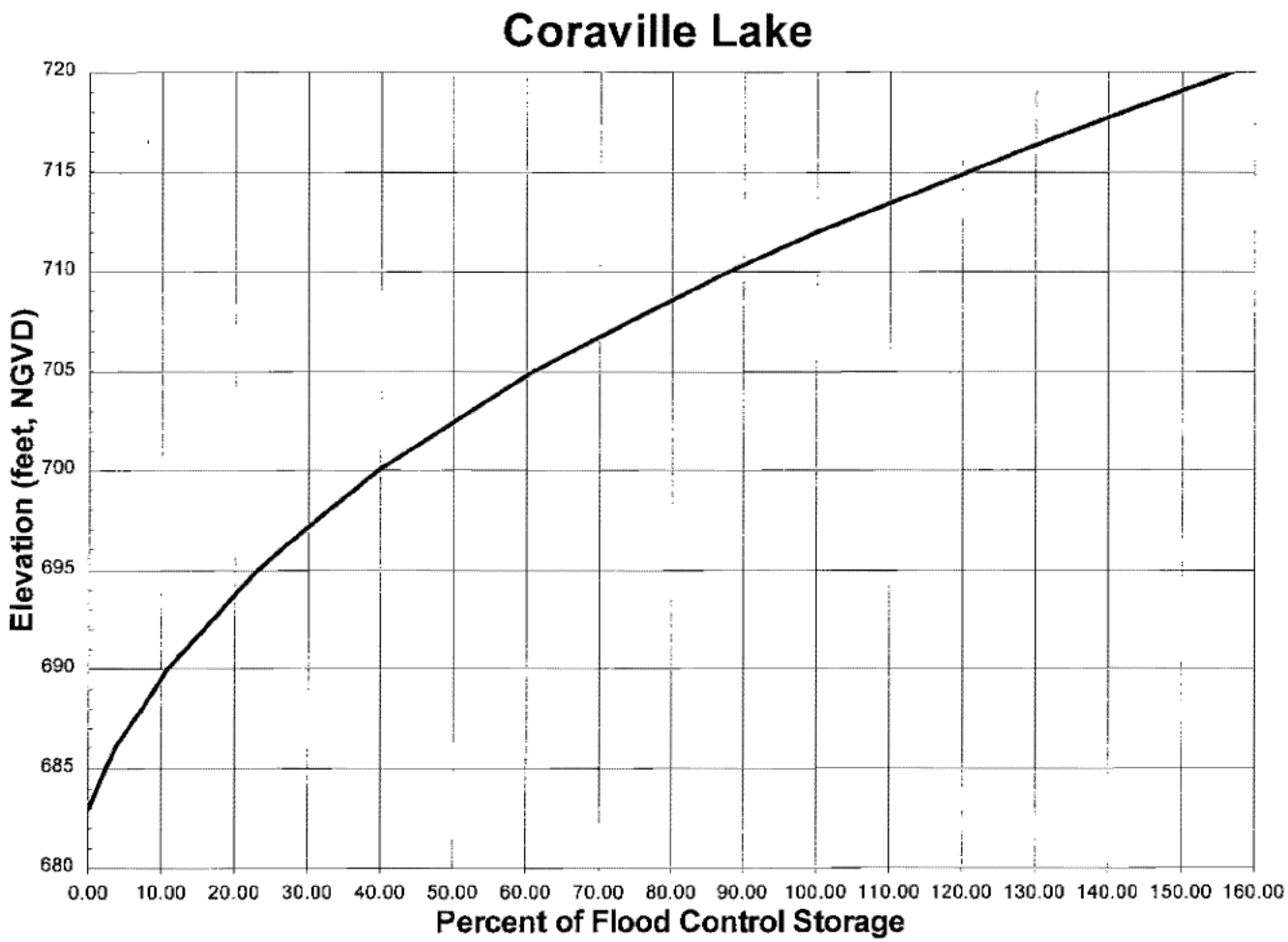

Coralville Lake
Area & Capacity (1999-2000 survey)
Capacity in Acre-Feet
700000
600000
500000
400000
300000
200000
100000
0
Area in Acres
35000
30000
25000
20000
15000
10000
5000
0
645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720
Elevation in feet
Volume
Area

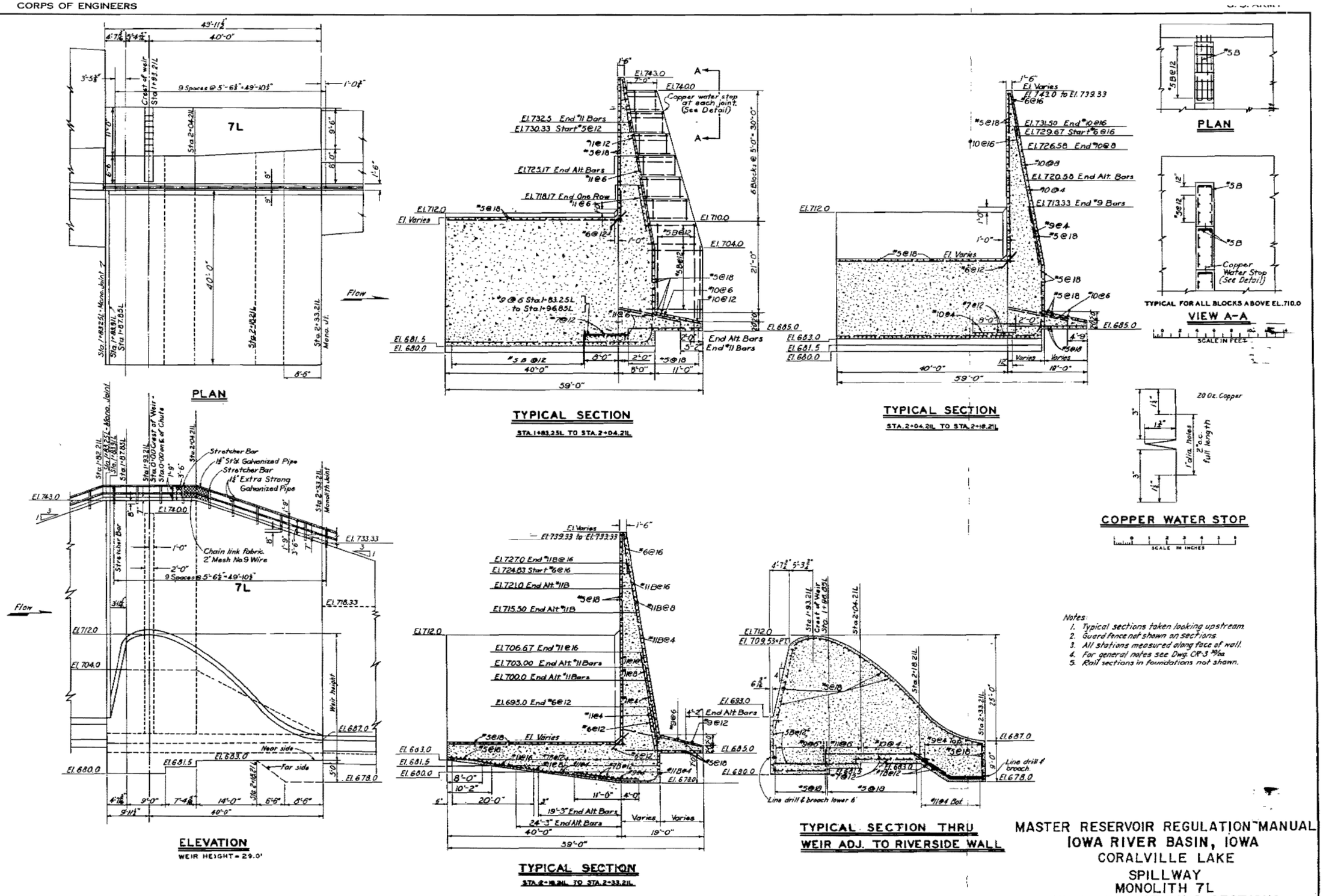
PLATE 2-2



Percent of Flood Control Storage

Based on 683 Summer Conservation Pool

And 2000 survey



Notes:
1. Typical sections taken looking upstream.
2. Guard fence not shown on sections.
3. All stations measured along face of wall.
4. For general notes see Dwg. CR-3 #6a.
5. Rail sections in foundations not shown.

MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN, IOWA
CORALVILLE LAKE
SPILLWAY
MONOLITH 7L
PLAN, ELEVATION & SECTIONS

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

Coralville Reservoir
Spillway Discharge Rating Curve

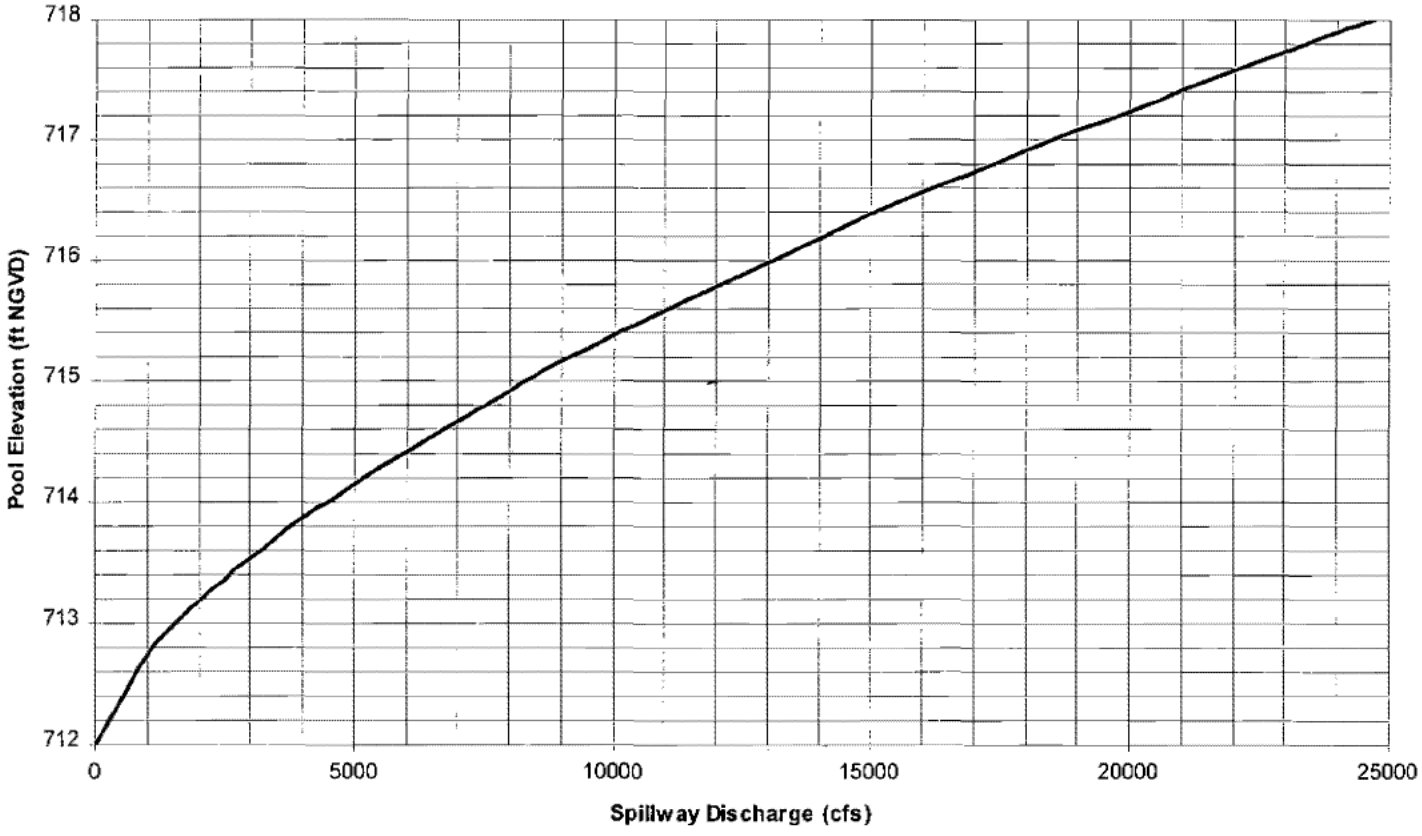
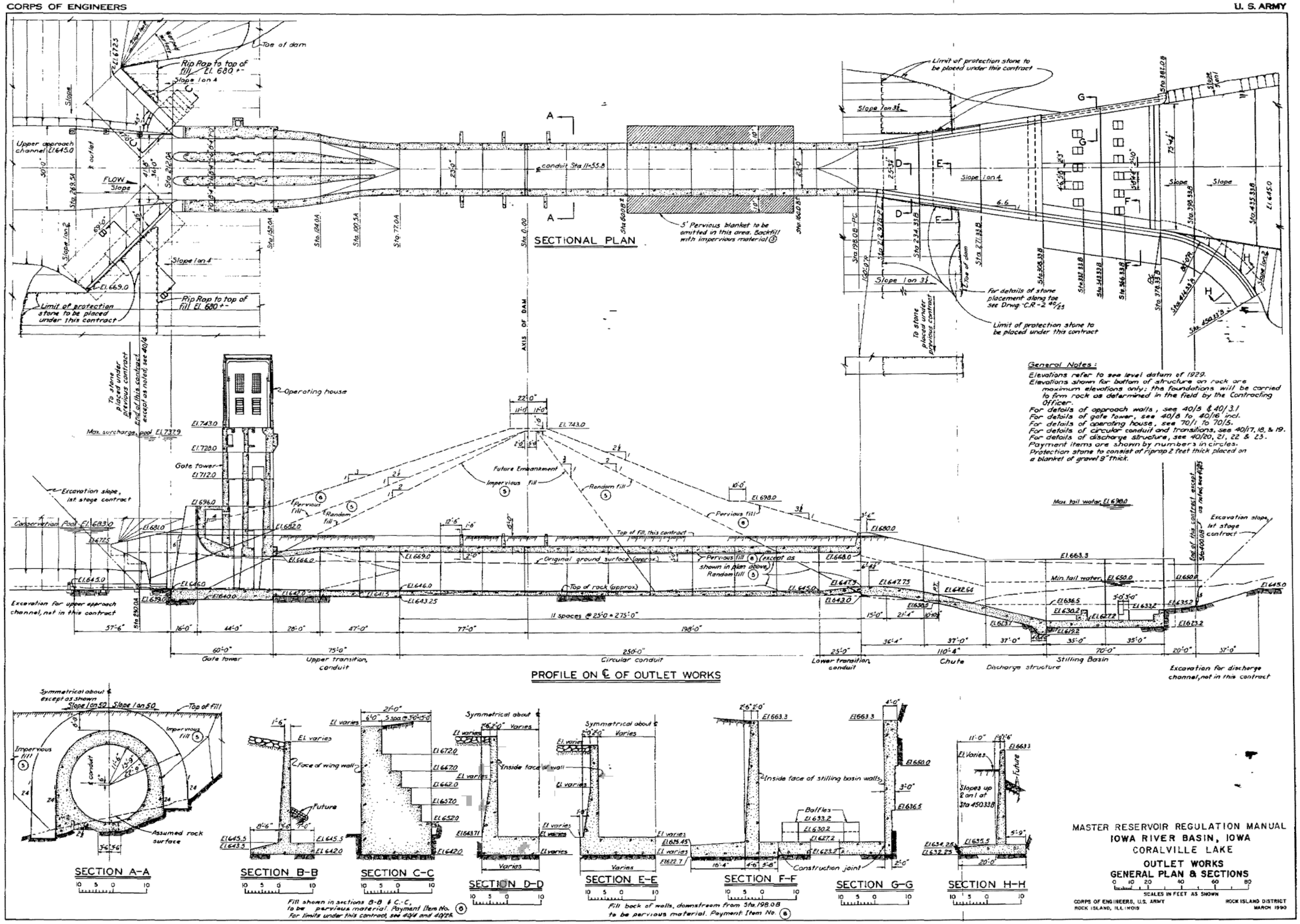
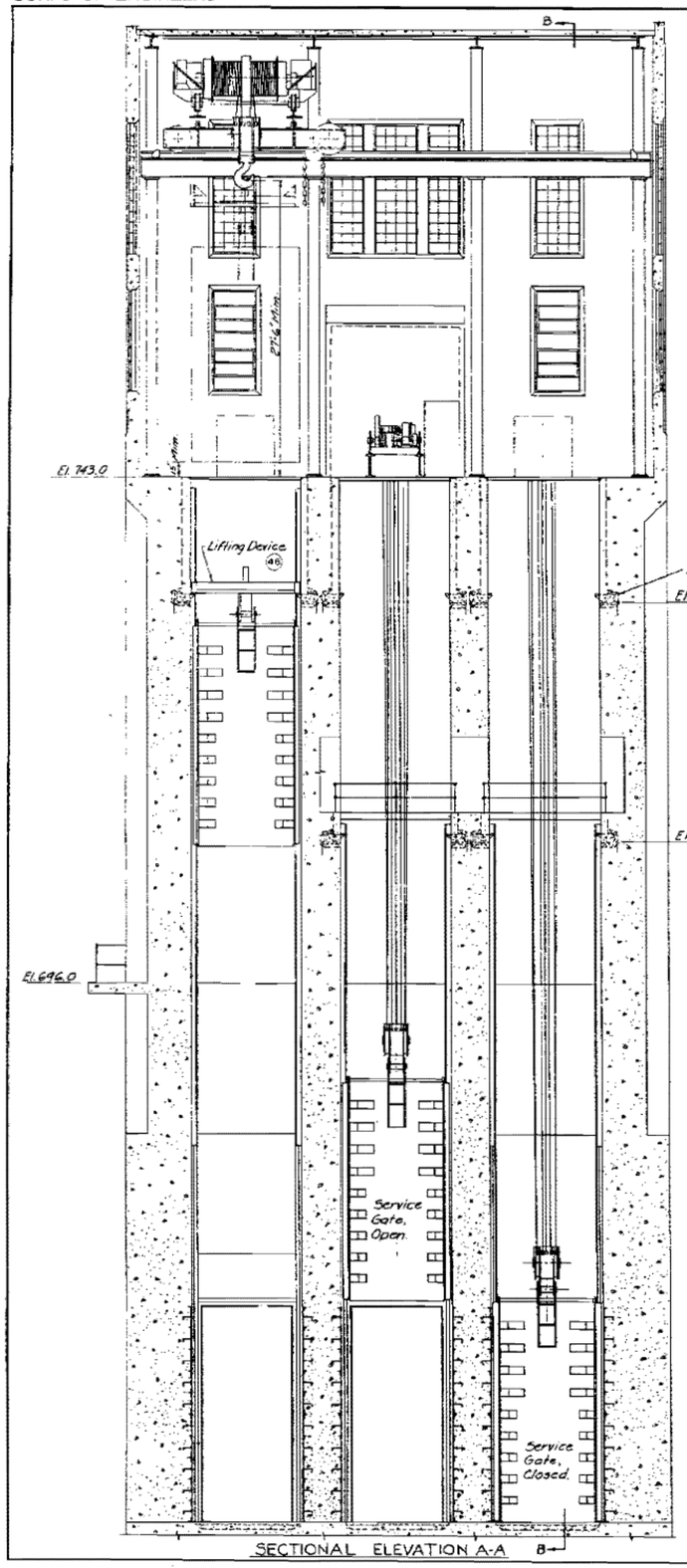
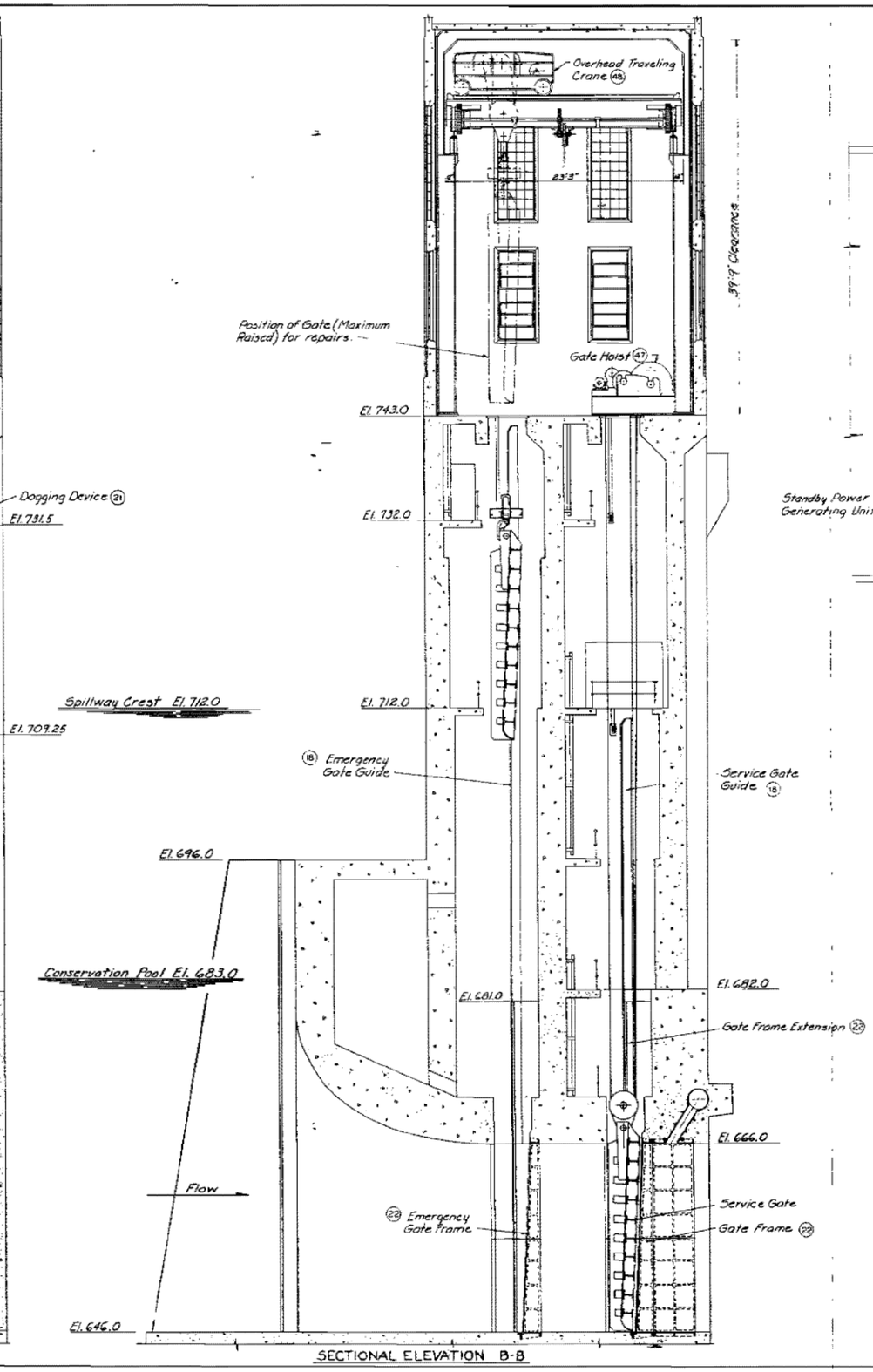


PLATE 2-5

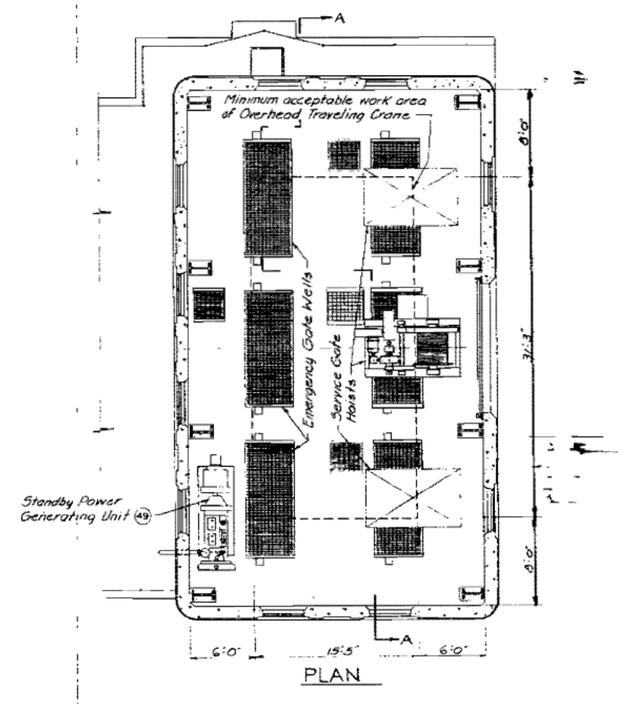

SECTIONAL PLAN
PROFILE ON ℄ OF OUTLET WORKS
SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D
SECTION E-E
SECTION F-F
SECTION G-G
SECTION H-H
General Notes:
Elevations refer to sea level datum of 1929.
Elevations shown for bottom of structure on rock are maximum elevations only; the foundations will be carried to firm rock as determined in the field by the Contracting Officer.
For details of approach walls, see 40/5 & 40/3.1
For details of gate tower, see 40/8 to 40/16 incl.
For details of operating house, see 70/1 to 70/5.
For details of circular conduit and transitions, see 40/17, 18, & 19.
For details of discharge structure, see 40/20, 21, 22 & 23.
Payment items are shown by numbers in circles.
Protection stone to consist of riprap 2 feet thick placed on a blanket of gravel 9" thick.
Fill shown in sections B-B & C-C, to be pervious material. Payment Item No. 6
Fill back of walls, downstream from Sta. 198.08 to be pervious material. Payment Item No. 6
MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN, IOWA
CORALVILLE LAKE
OUTLET WORKS
GENERAL PLAN & SECTIONS
SCALES IN FEET AS SHOWN
CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS
ROCK ISLAND DISTRICT
MARCH 1990



SECTIONAL ELEVATION A-A



SECTIONAL ELEVATION B-B



PLAN

For Sections through Gate Frame, Track and Dogging Device, see ---------- 40/11
For Assembly of Gate and Rollers, see ---------- 50/3
For General Arrangement of Standby Power Generating Unit, see ---------- 71/1

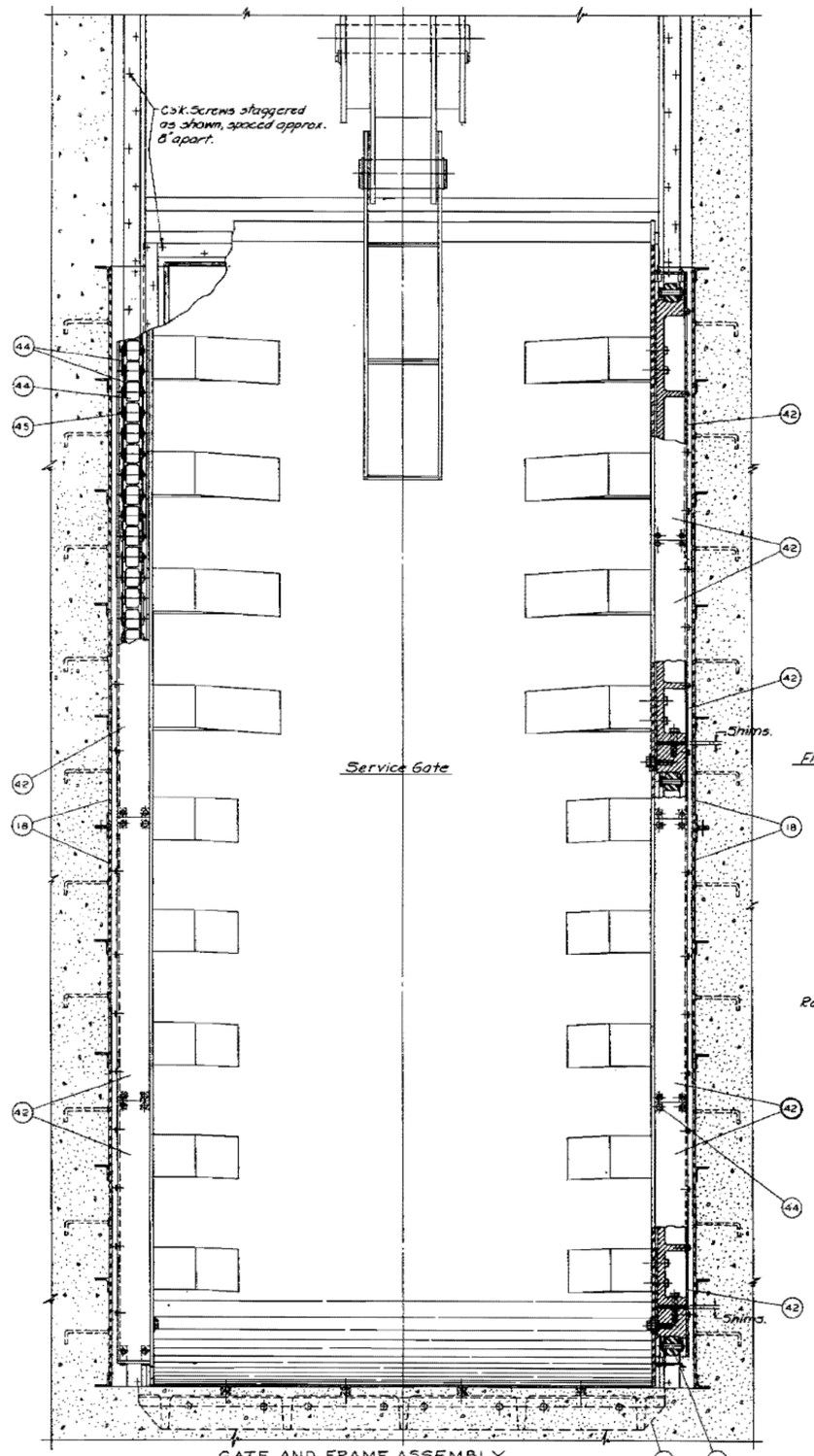
Payment items are shown by number in circles

MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN, IOWA
CORALVILLE LAKE

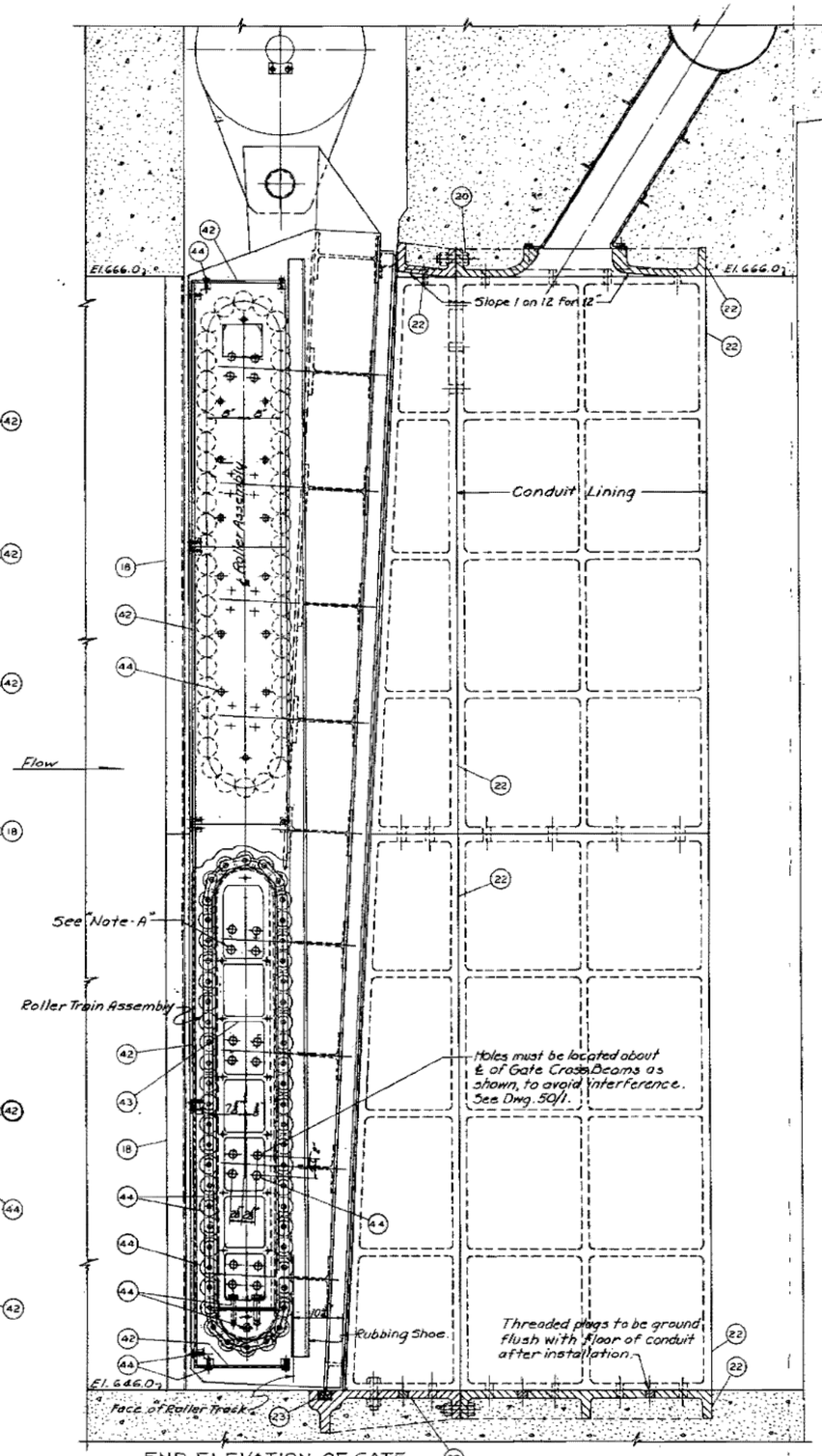
OUTLET WORKS
GENERAL ARRANGEMENT OF EQUIPMENT

SCALE IN FEET

CORPS OF ENGINEERS, U. S. ARMY ROCK ISLAND DISTRICT
ROCK ISLAND, ILLINOIS MARCH 1990



GATE AND FRAME ASSEMBLY
Showing Gate Fully Closed.



END ELEVATION OF GATE
Showing Roller Assembly

General Notes:
Arrangement as shown for Service Gates; Emergency Gate arrangement similar except for conduit lining & pickup device, as shown on Dwg. 55/1.

"Note-A." Mounting holes in roller race casting to be drilled slightly undersize, and shall be used as a template for drilling gate side plates. Reaming for turned mounting bolts shall be done after locating assembled roller trains in accurate alignment with gate side seals and roller track.

For General Arrangement of Equipment, see ___ 55/1.
For Sections Through Gate Frame, Track and Dogging Devices, see _____ 40/11.
For Tractor Gate, see _____ 30/1.

Payment Items are shown by number in circles.

MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN, IOWA
CORALVILLE LAKE
OUTLET WORKS
ASSEMBLY - GATE & ROLLERS

SCALE IN FEET

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

Coralville Outlet Rating Curve

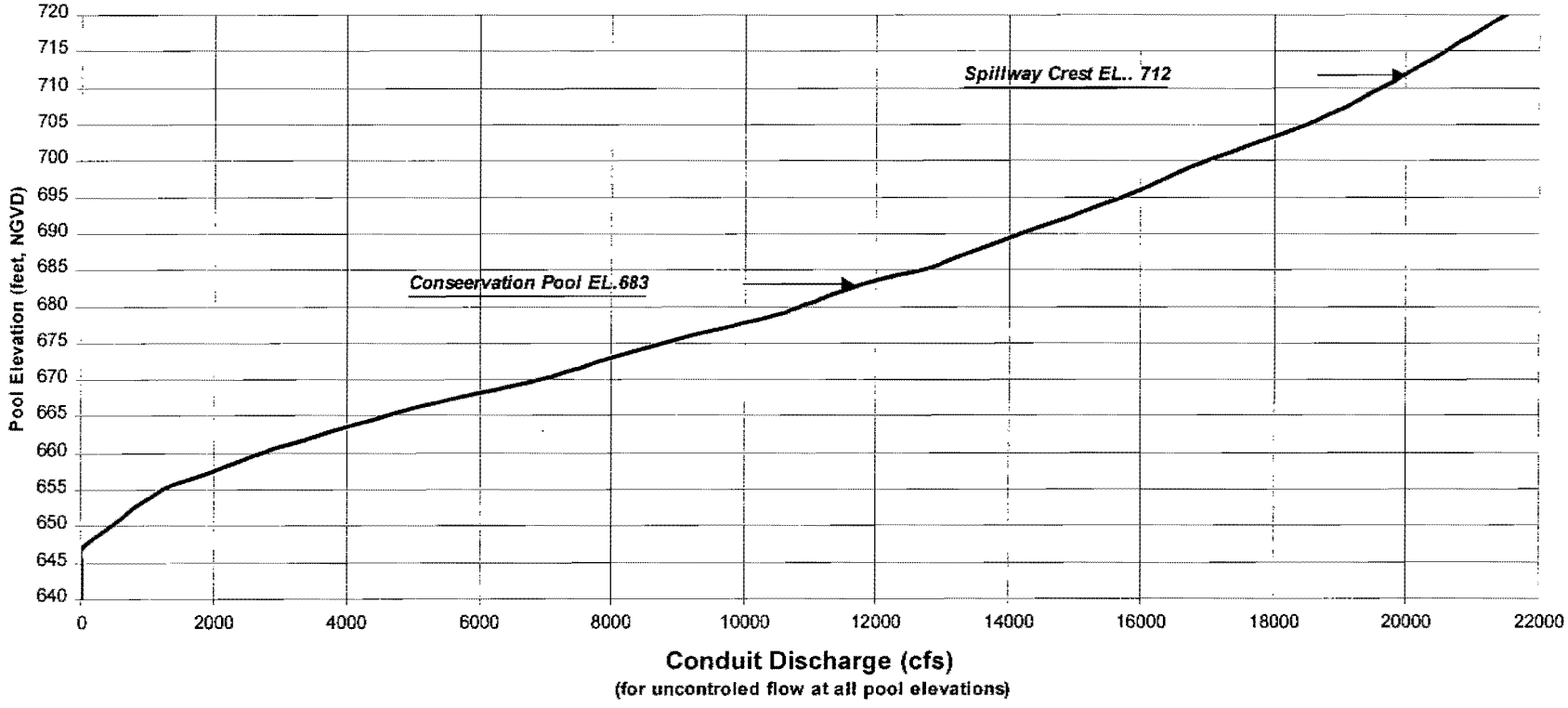
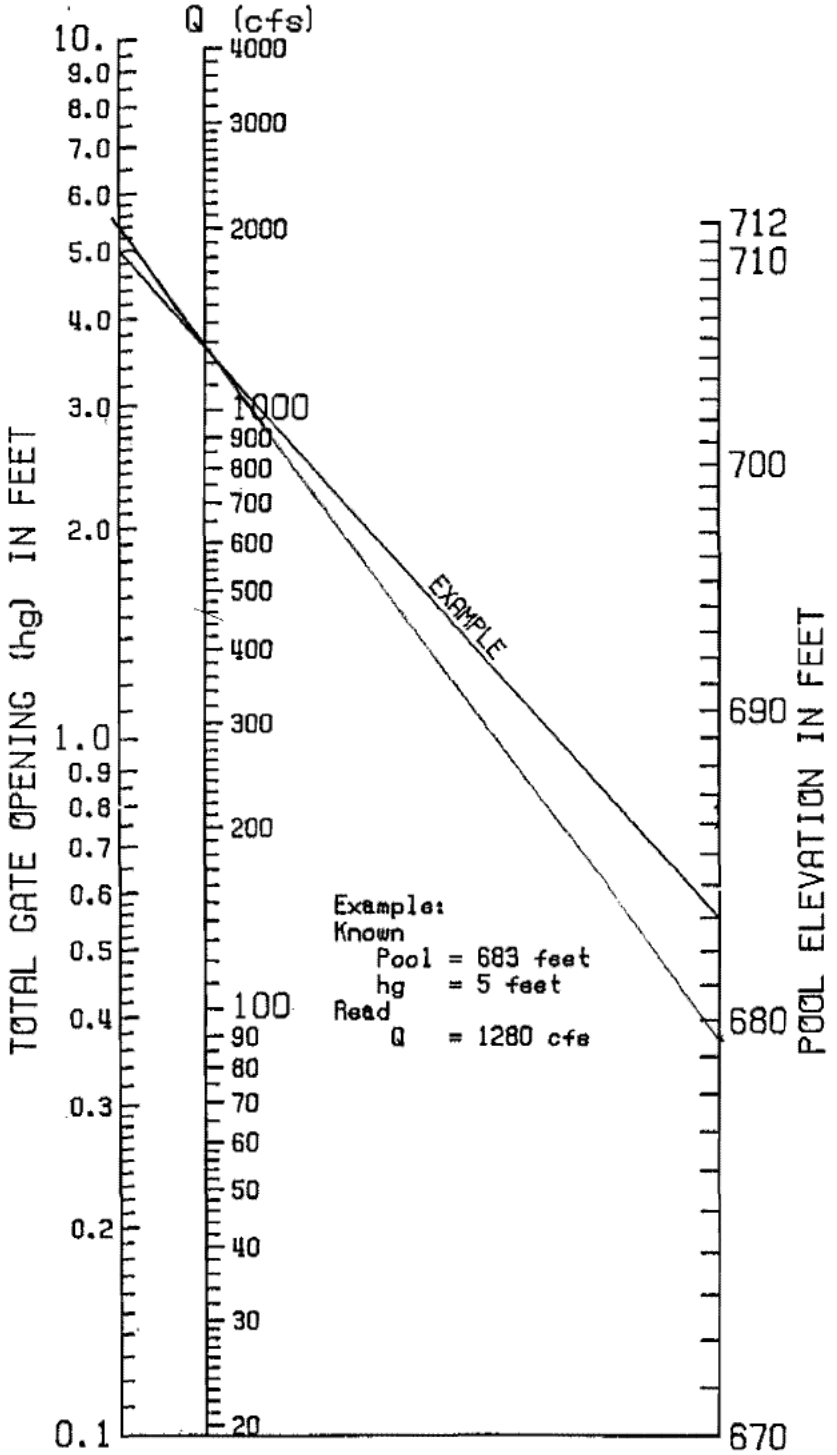


PLATE 2-9

Coralville Dam



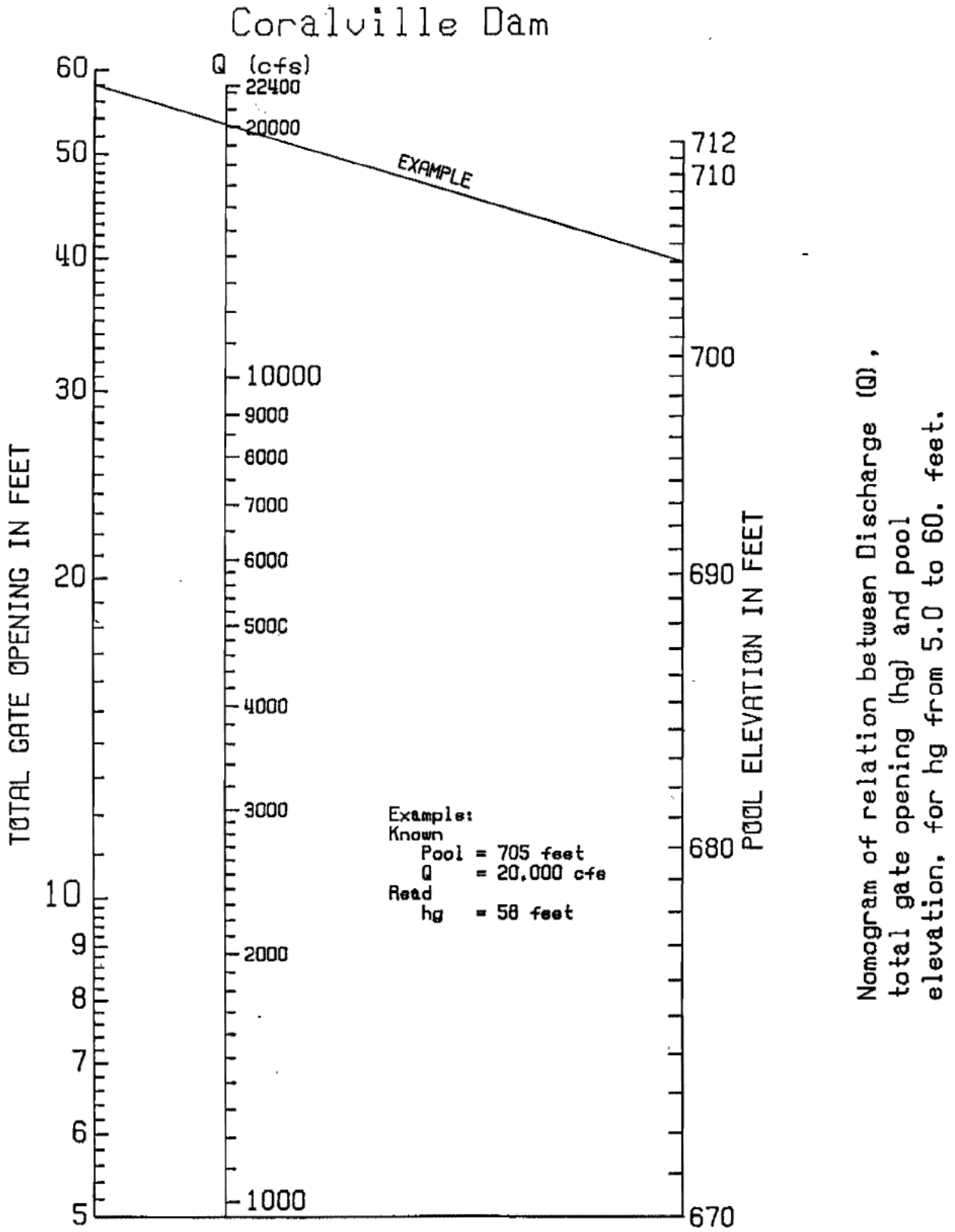
Nomogram of relation between Discharge (Q), total gate opening (hg) and pool elevation, for hg from 0.1 to 10. feet.

MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN IOWA
CORALVILLE LAKE

OUTLET RATING NOMOGRAM
GATE OPENING FROM 0.1 TO 10 FEET

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

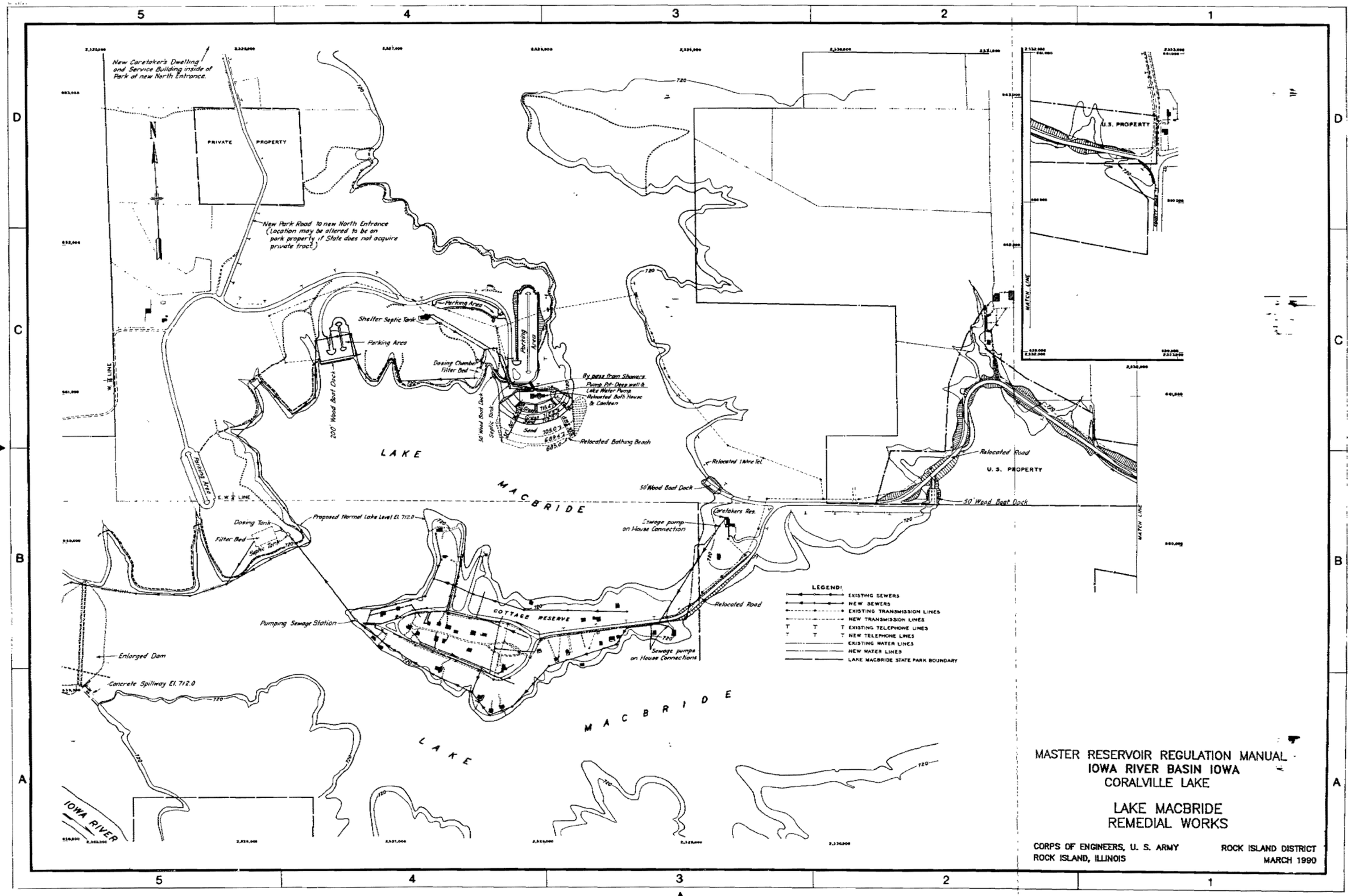


MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN IOWA
CORALVILLE LAKE

OUTLET RATING NOMOGRAM
GATE OPENING FROM 5.0 TO 60 FEET

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

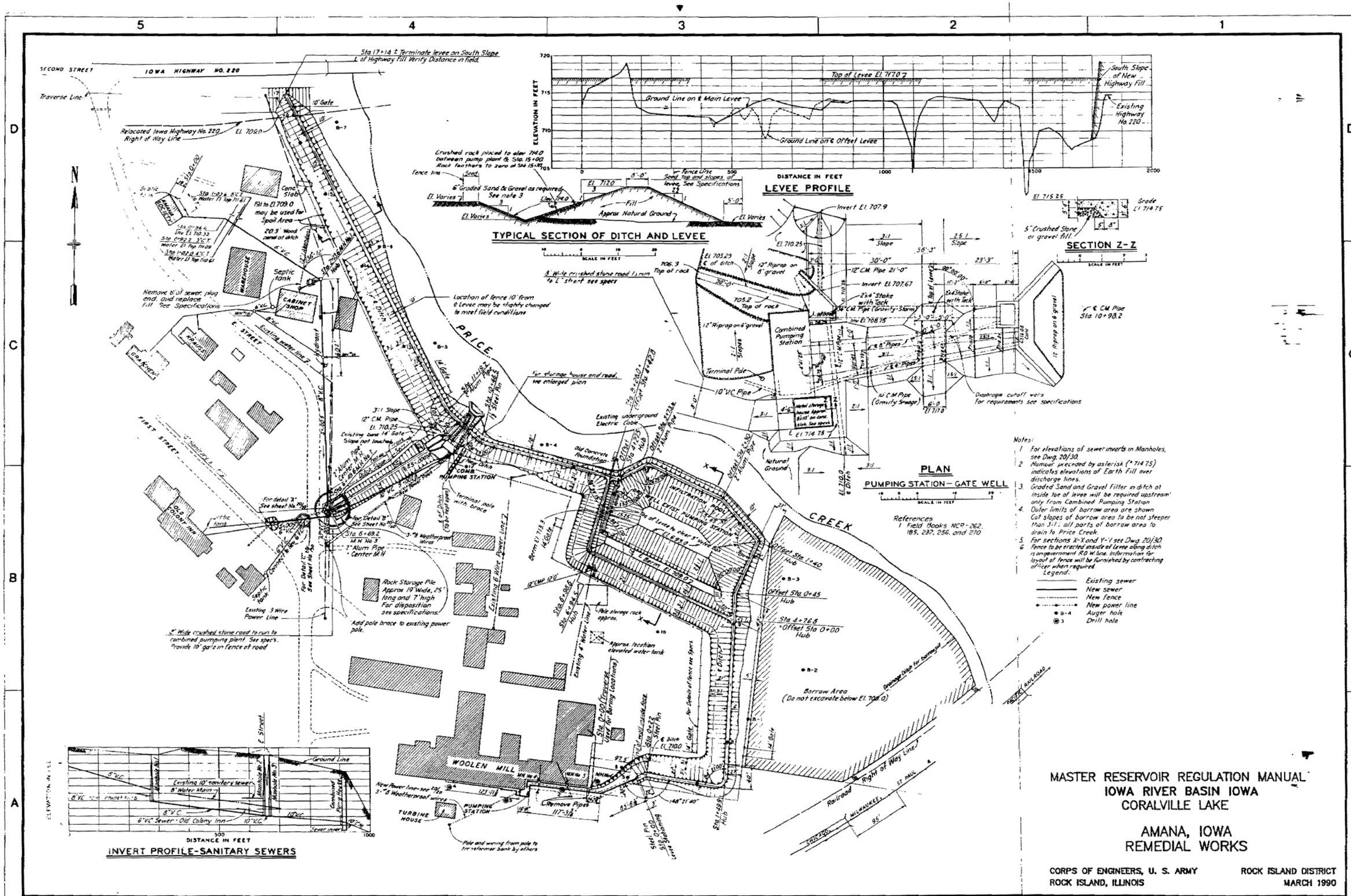


MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN IOWA
CORALVILLE LAKE

LAKE MACBRIDE
REMEDIAL WORKS

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

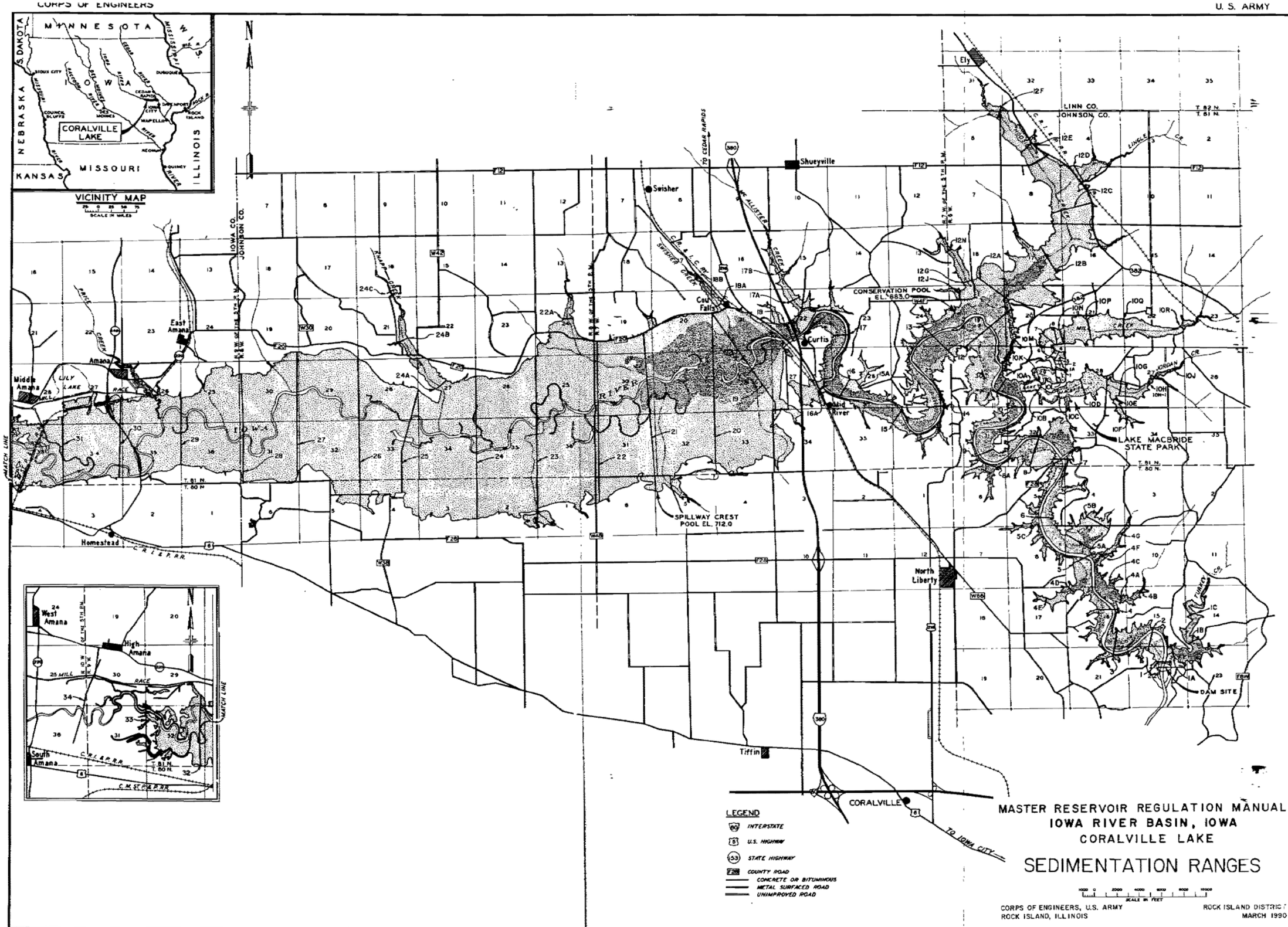


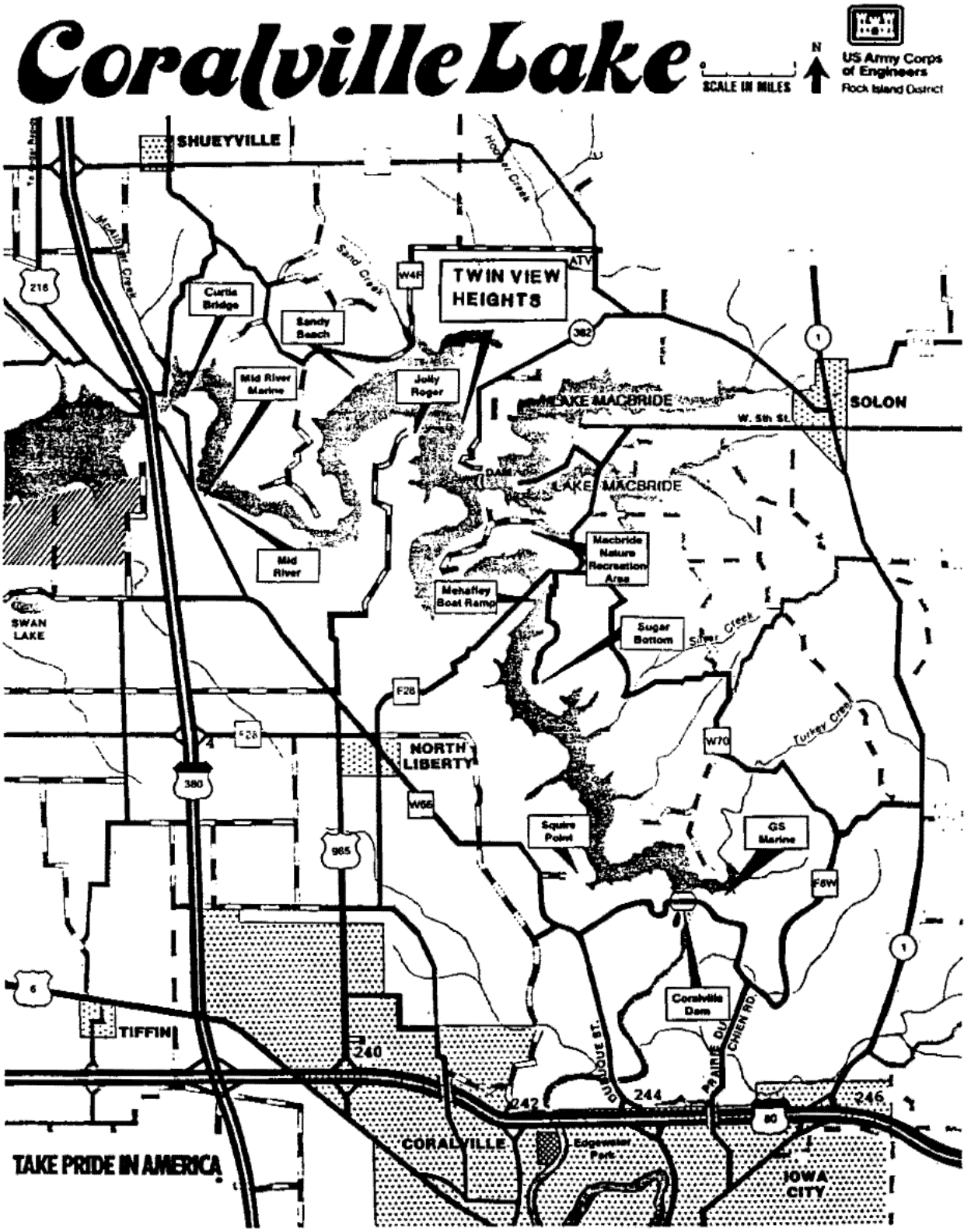
MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN IOWA
CORALVILLE LAKE

AMANA, IOWA
REMEDIAL WORKS

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990


VICINITY MAP
CORALVILLE LAKE
MINNESOTA
WIS.
S. DAKOTA
NEBRASKA
IOWA
ILLINOIS
KANSAS
MISSOURI
SCALE IN MILES
N
Swisher
Shueyville
Ely
Cedar Falls
Curtis
Mid River
East Amana
Amana
Middle Amana
Homestead
West Amana
High Amana
South Amana
North Liberty
Tiffin
CORALVILLE
LAKE MACBRIDE STATE PARK
DAM SITE
CONSERVATION POOL EL. 683.0
SPILLWAY CREST POOL EL. 712.0
LINN CO.
JOHNSON CO.
IOWA CO.
TO CEDAR RAPIDS
TO IOWA CITY
MATCH LINE
C.R.I.&P.R.R.
C.M.St.P.&P.R.R.
LEGEND
INTERSTATE
U.S. HIGHWAY
STATE HIGHWAY
COUNTY ROAD
CONCRETE OR BITUMINOUS
METAL SURFACED ROAD
UNIMPROVED ROAD
MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN, IOWA
CORALVILLE LAKE
SEDIMENTATION RANGES
SCALE IN FEET
CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS
ROCK ISLAND DISTRICT
MARCH 1990



MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN IOWA
CORALVILLE LAKE

RECREATION AREAS
GENERAL LOCATION PLAN

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

Iowa River Historic Water Surface Profiles

Coralville Dam to Lone Tree

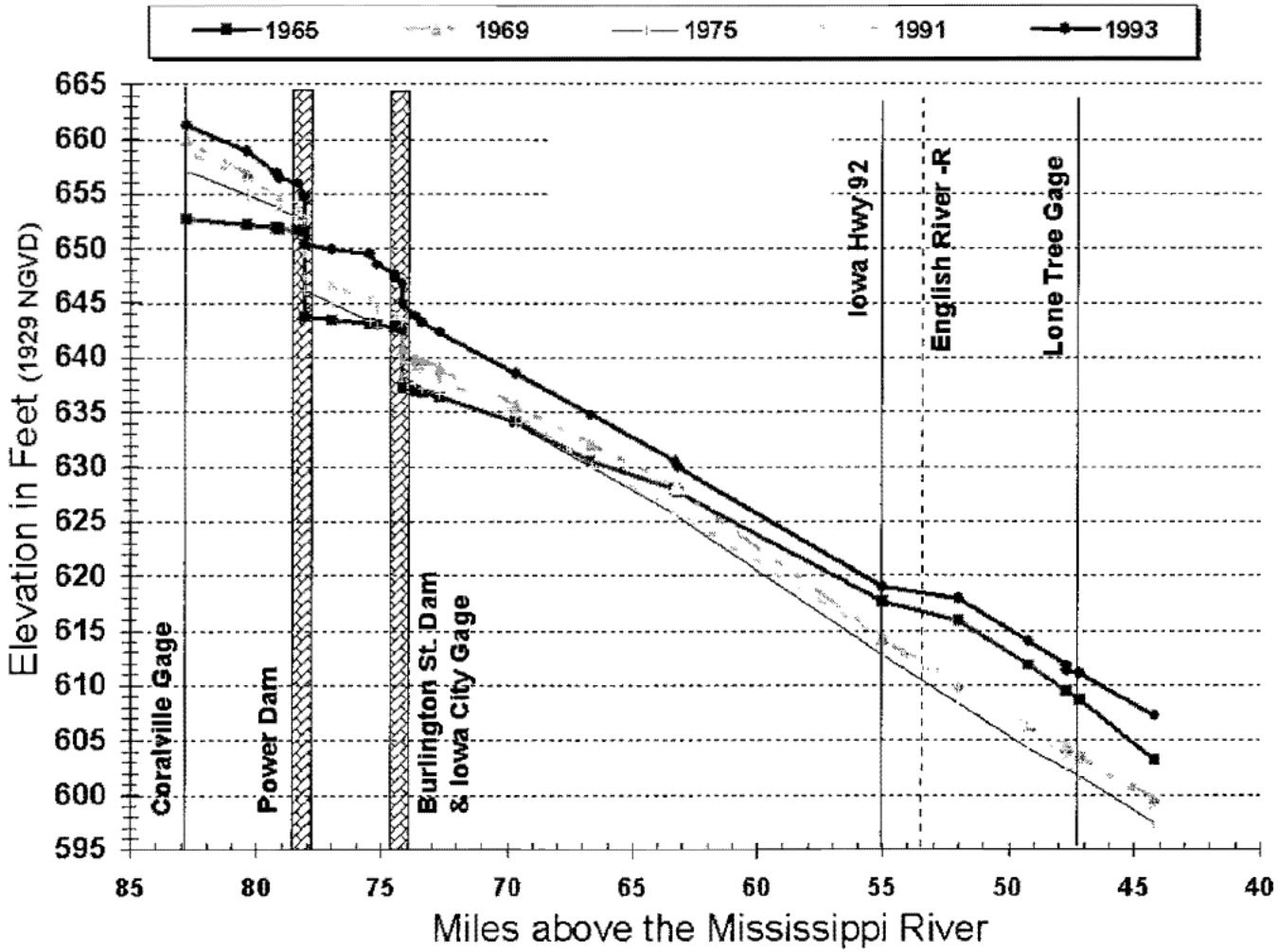


PLATE 4-1

Iowa River Historic Water Surface Profiles

Lone Tree to Mouth

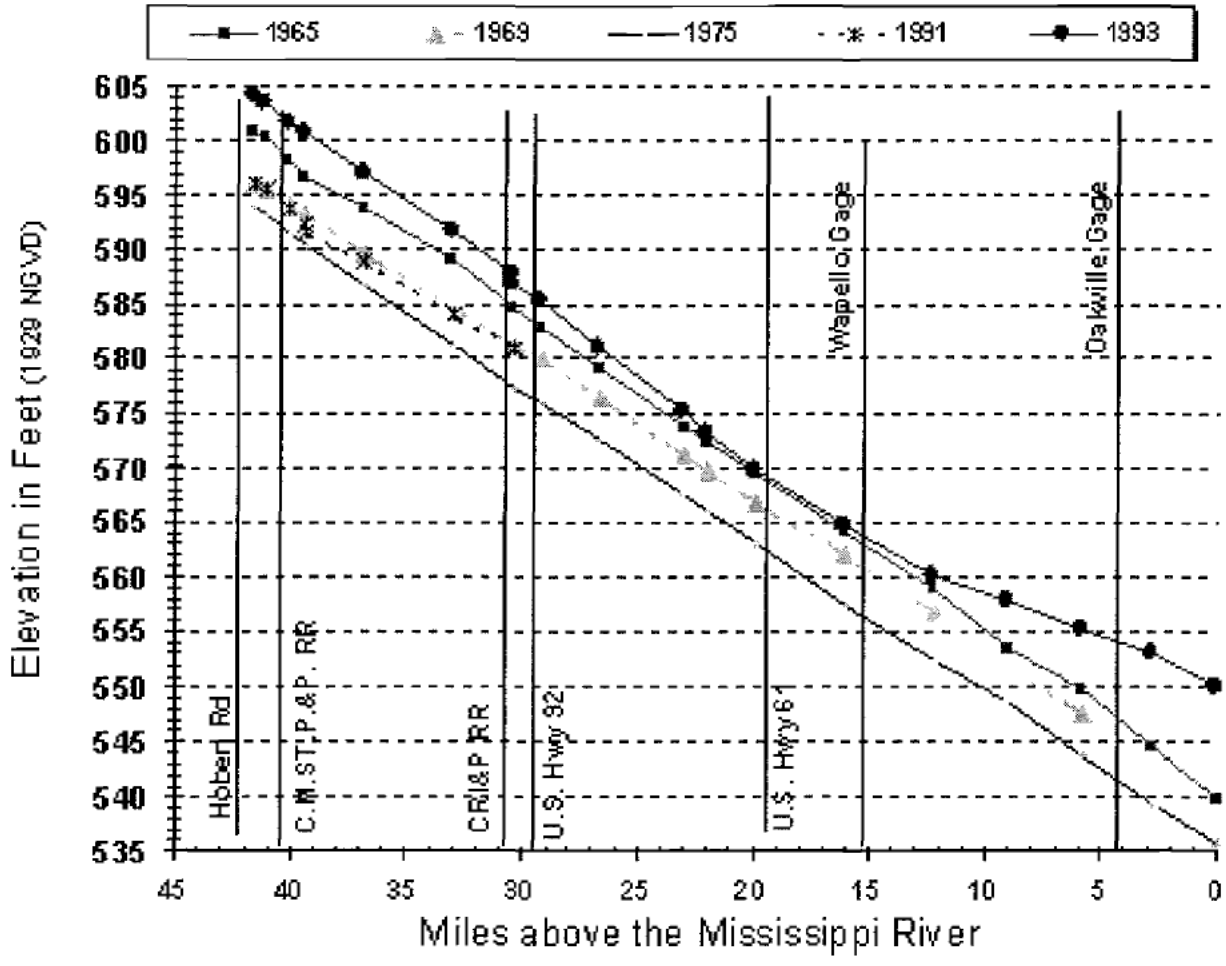


PLATE 4-2

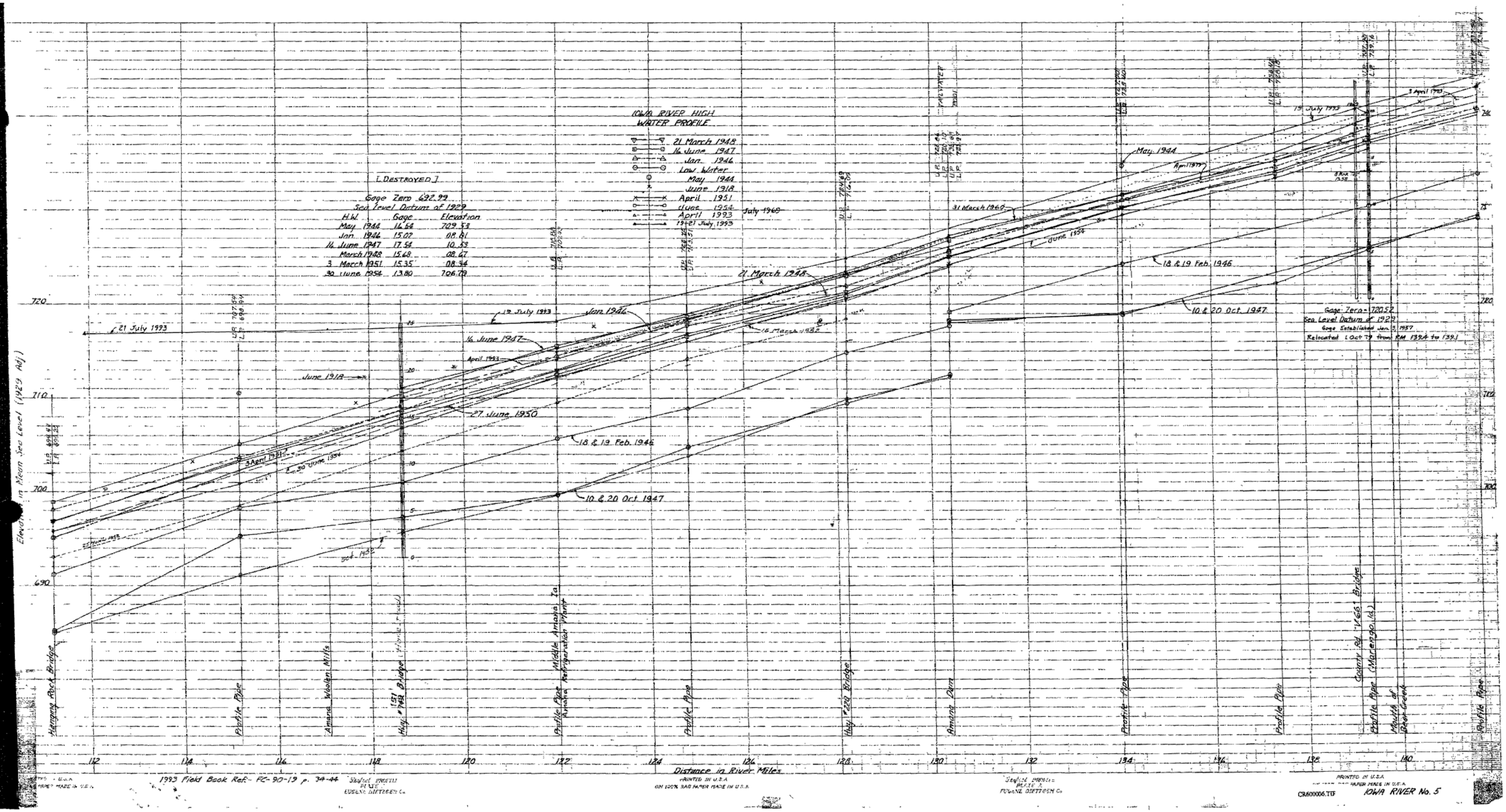

IOWA RIVER HIGH WATER PROFILE
21 March 1948
16 June 1947
Jan. 1946
Low Water
May 1944
June 1918
April 1951
June 1954
April 1993
19-21 July 1993
[DESTROYED]
Gage Zero 692.99
Sea Level Datum of 1929
H.W. Gage Elevation
May 1944 16.64 709.53
Jan. 1946 15.02 08.61
16 June 1947 17.54 10.53
March 1948 15.68 08.67
3 March 1951 15.35 08.34
30 June 1954 13.80 706.79
21 July 1993
19 July 1993
Jan 1946
16 June 1947
April 1993
June 1918
27 June 1950
3 April 1951
30 June 1954
18 & 19 Feb. 1946
10 & 20 Oct. 1947
21 March 1948
16 March 1952
31 March 1960
June 1954
May 1944
April 1944
July 1960
Gage Zero = 720.52
Sea Level Datum of 1929
Gage Established Jan. 3, 1957
Relocated 1 Oct 79 from RM 139.4 to 139.1
Elevation in Mean Sea Level (1929 Adj.)
720
710
700
690
Hanging Rock Bridge
Profile Pipe
Amana Woolen Mills
Hwy #148 Bridge
Middle Amana, Ia
Amana Refrigeration Plant
Hwy #220 Bridge
Amana Dam
County Rd V66 Bridge
Mouth of Rock Creek
112
114
116
118
120
122
124
126
128
130
132
134
136
138
140
Distance in River Miles
1993 Field Book Ref.- FC-90-19 p. 34-44
IOWA RIVER No. 5

PLATE 4-3

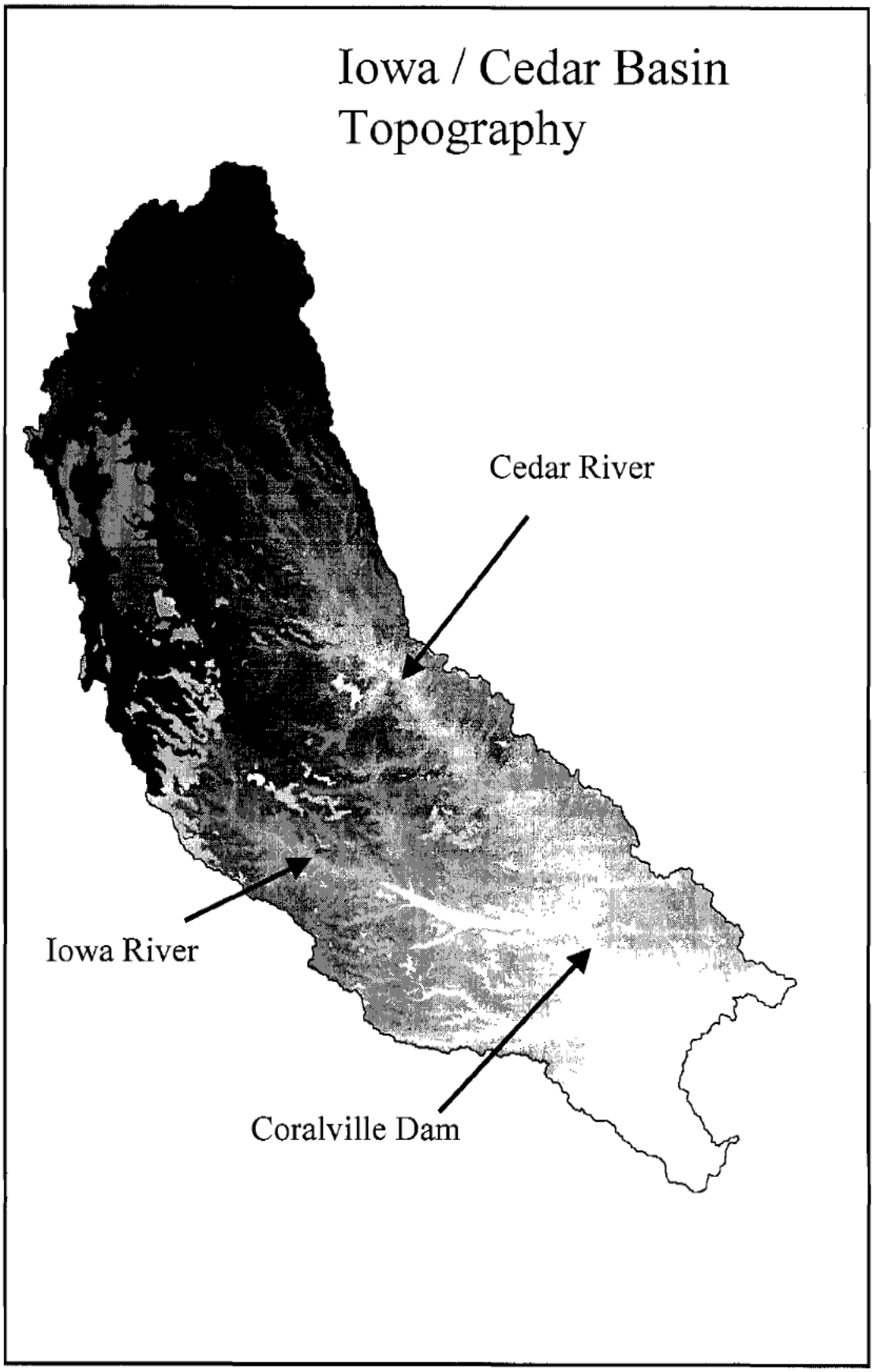

Iowa / Cedar Basin
Topography
Cedar River
Iowa River
Coralville Dam

PLATE 4-4

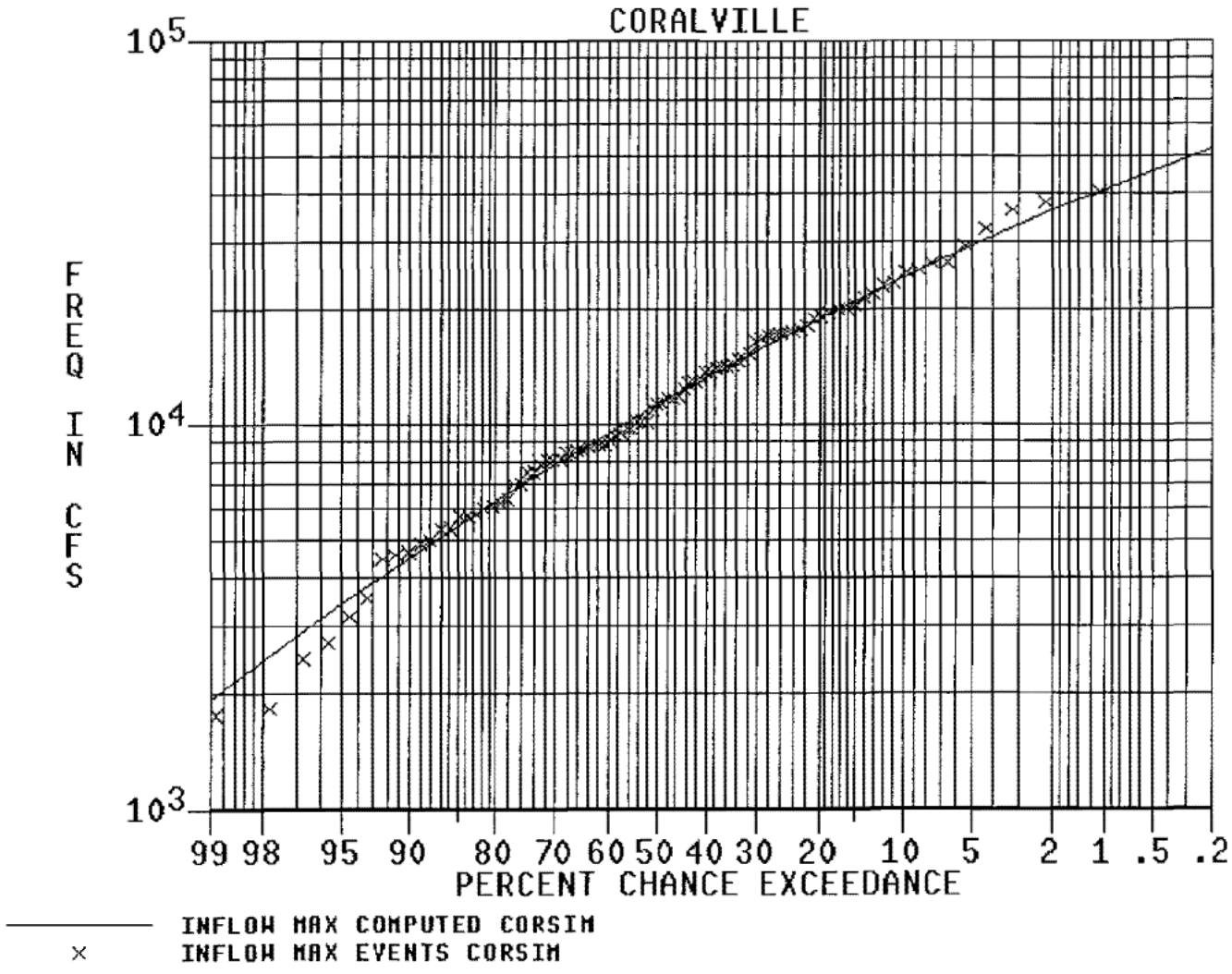
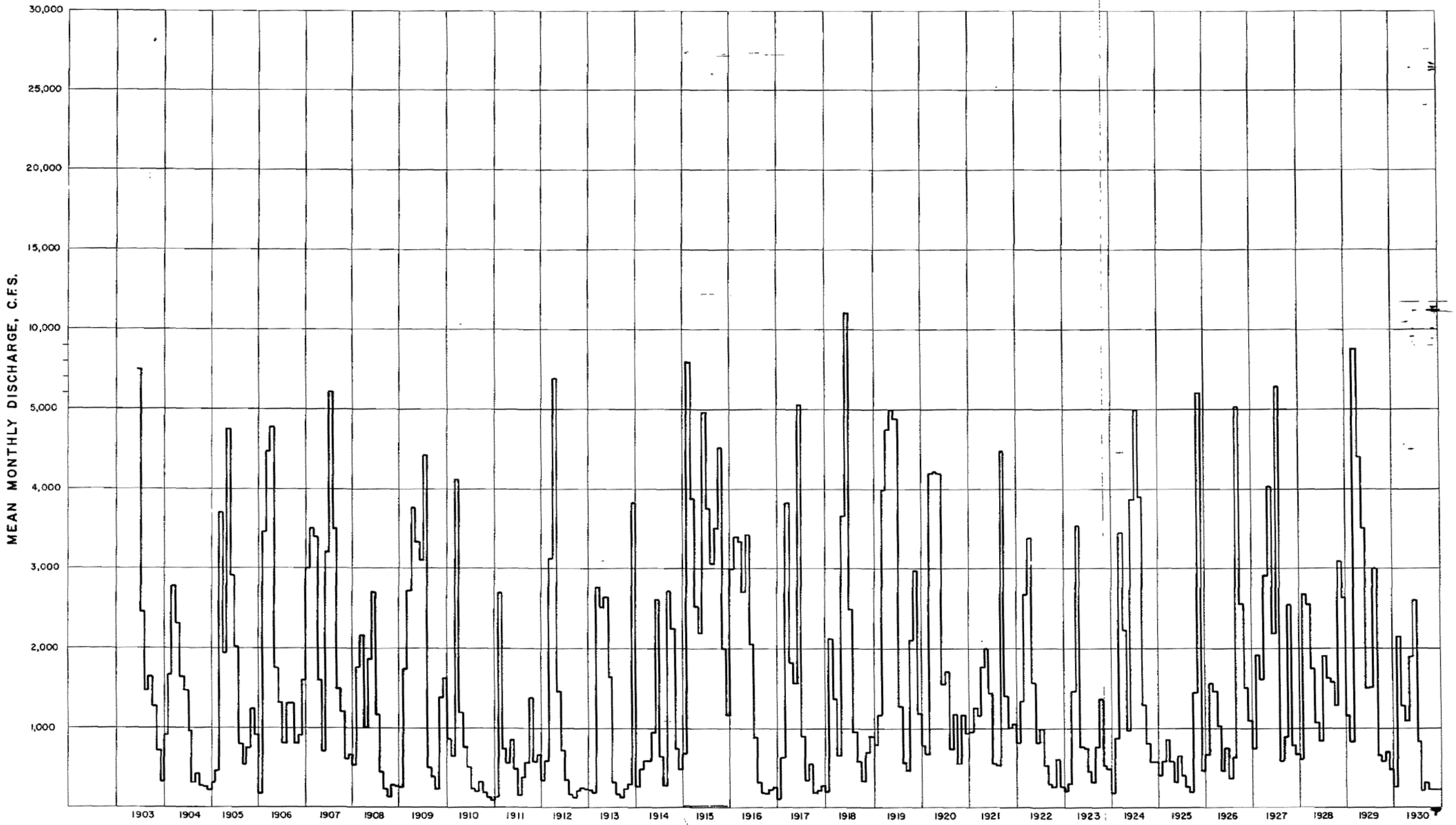

CORALVILLE
FREQ IN CFS
10^5
10^4
10^3
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2
PERCENT CHANCE EXCEEDANCE
INFLOW MAX COMPUTED CORSIM
INFLOW MAX EVENTS CORSIM

PLATE 4-5



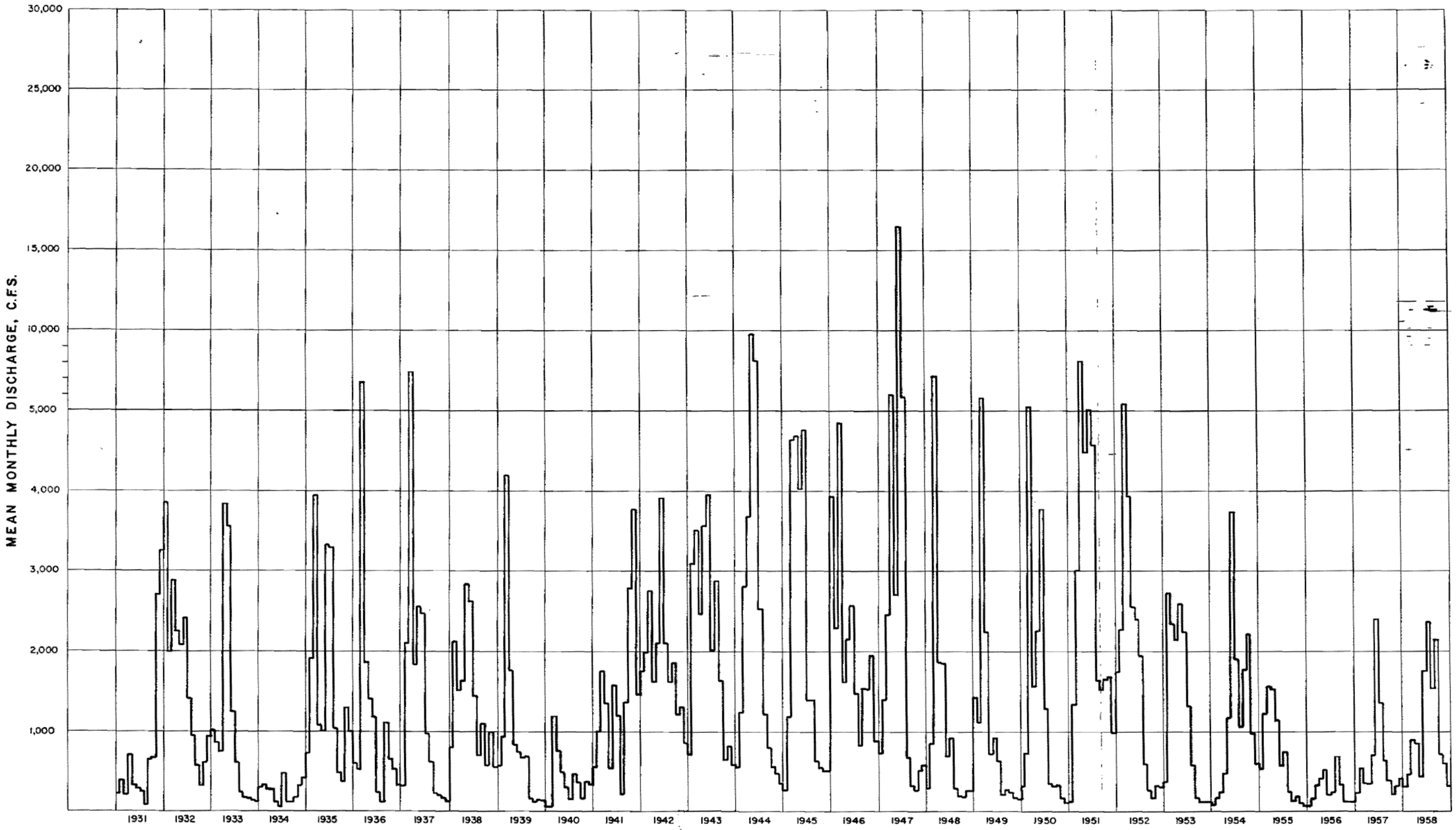
MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN, IOWA
CORALVILLE LAKE

IOWA RIVER AT IOWA CITY, IOWA
MEAN MONTHLY FLOW

SCALE AS SHOWN

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990



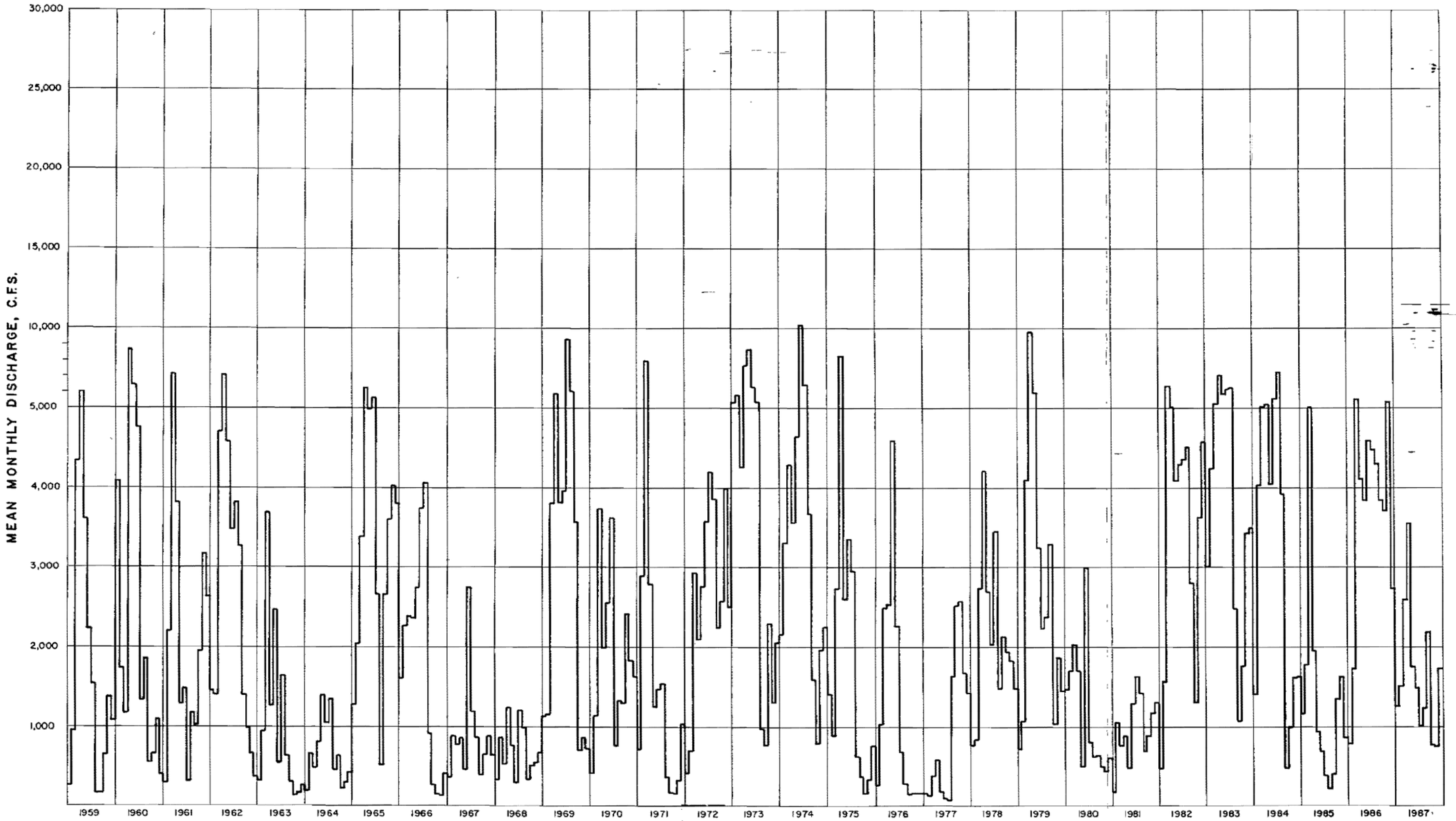
MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN, IOWA
CORALVILLE LAKE

IOWA RIVER AT IOWA CITY, IOWA
MEAN MONTHLY FLOW

SCALE AS SHOWN

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990



MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN, IOWA
CORALVILLE LAKE

IOWA RIVER AT IOWA CITY, IOWA
MEAN MONTHLY FLOW

SCALE AS SHOWN

CORPS OF ENGINEERS, U.S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

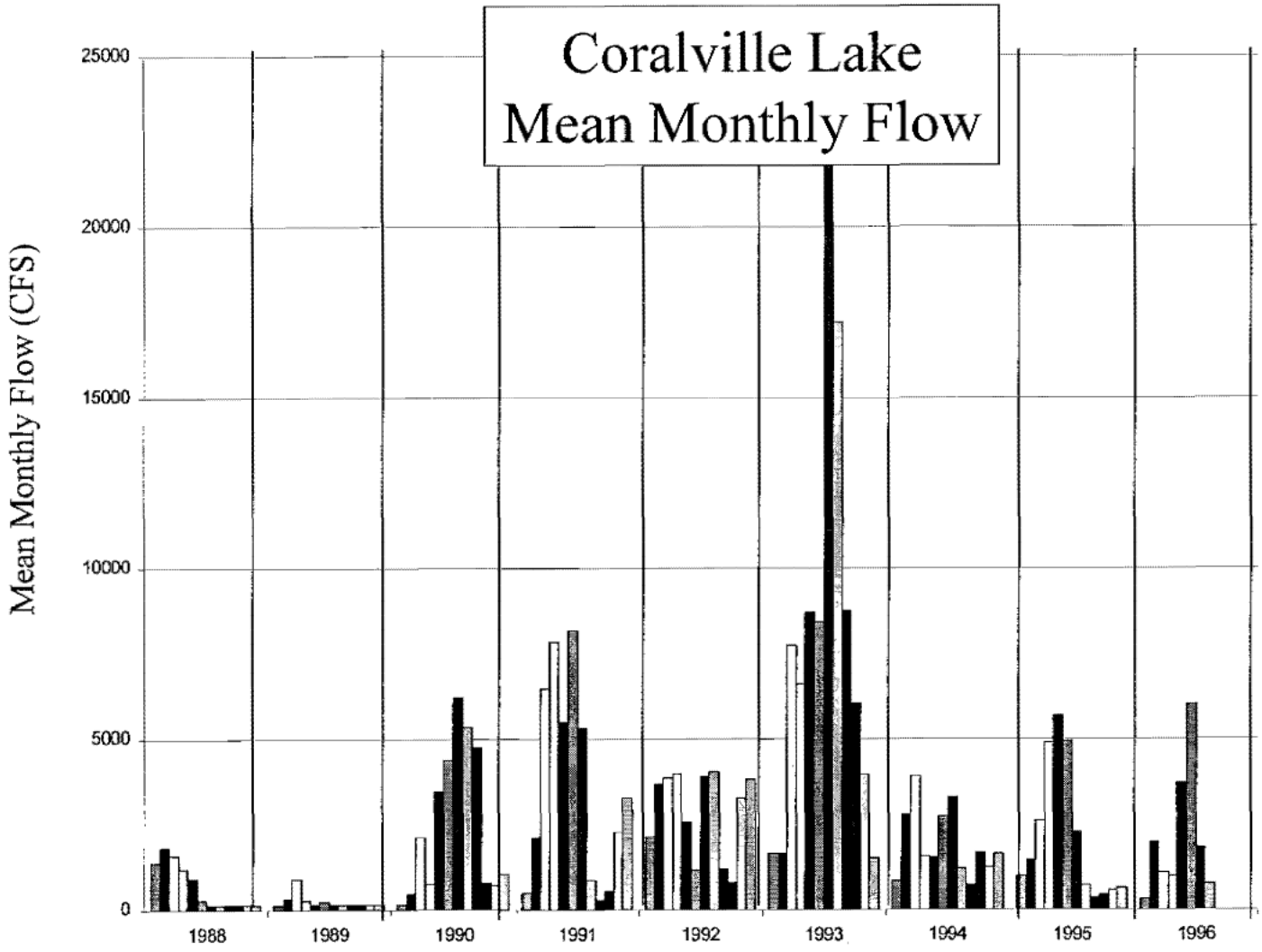
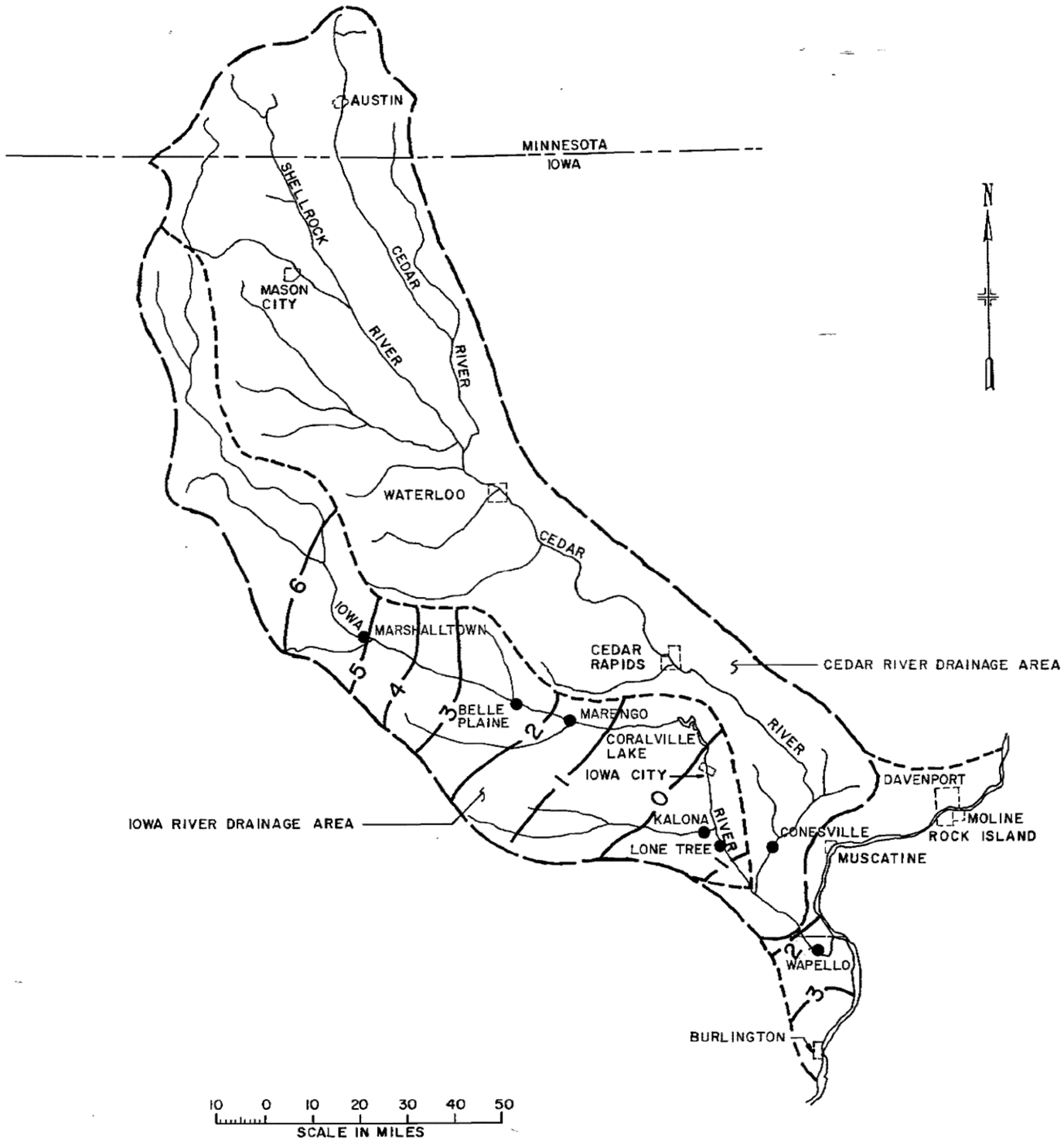
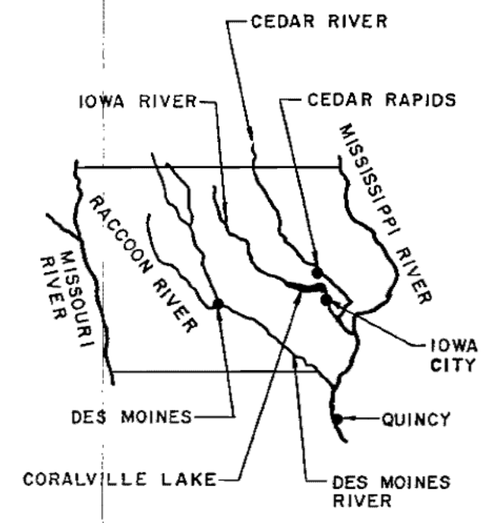

Coralville Lake
Mean Monthly Flow
Mean Monthly Flow (CFS)
25000
20000
15000
10000
5000
0
1988
1989
1990
1991
1992
1993
1994
1995
1996

PLATE 4-9





VICINITY MAP

25 0 50 100

SCALE IN MILES

LEGEND

- ● GAGING STATION
- — — IOWA RIVER BASIN
- - - - BASIN DIVIDE
- —0— AVERAGE TIME OF WATER TRAVEL IN DAYS

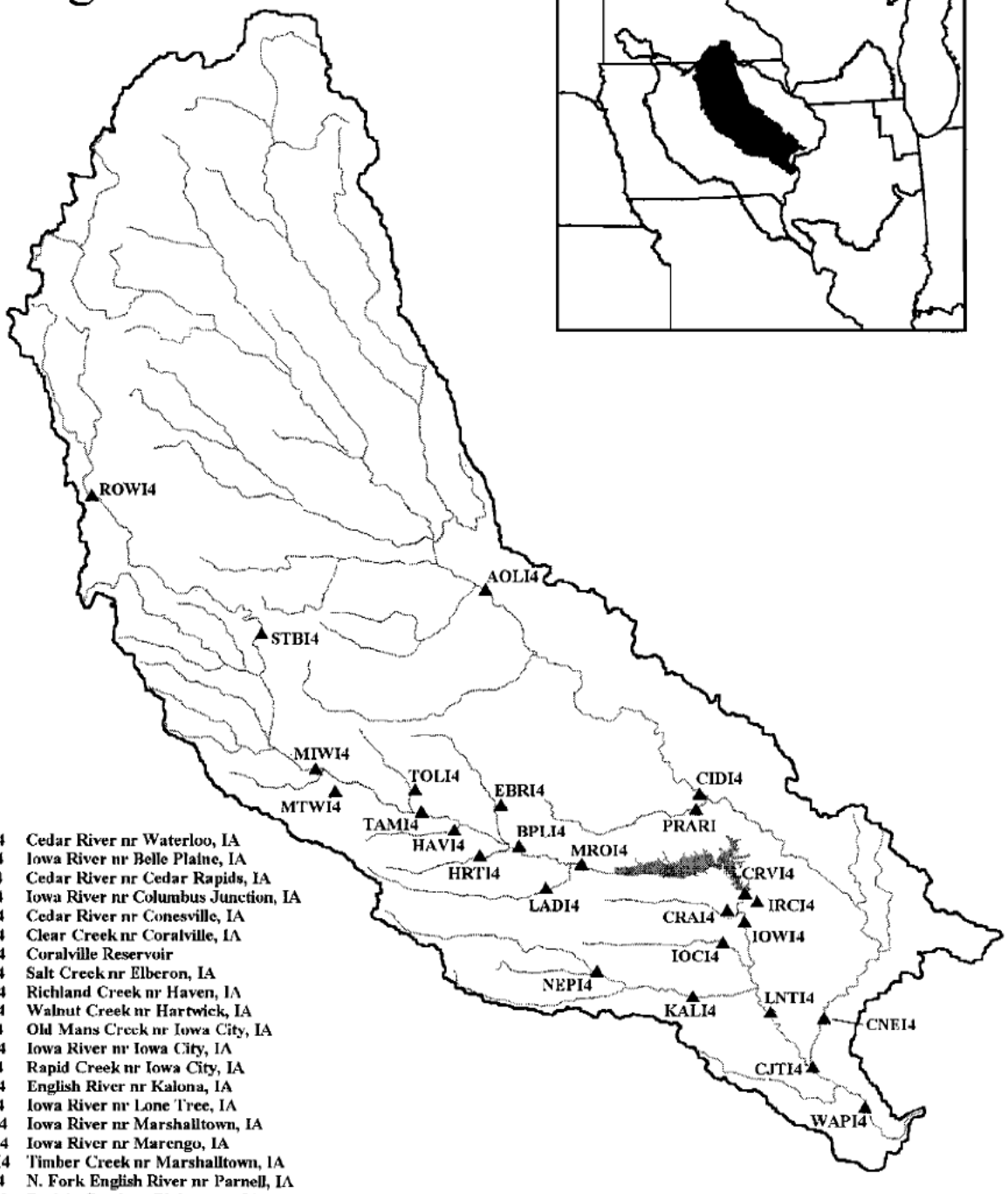
MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN, IOWA
CORALVILLE LAKE

AVERAGE TIME OF WATER TRAVEL IN DAYS

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

Coralville Lake Gage Location



ALOI4	Cedar River nr Waterloo, IA
BPLI4	Iowa River nr Belle Plaine, IA
CIDI4	Cedar River nr Cedar Rapids, IA
CJTI4	Iowa River nr Columbus Junction, IA
CNEI4	Cedar River nr Conesville, IA
CRAI4	Clear Creek nr Coralville, IA
CRVI4	Coralville Reservoir
EBRI4	Salt Creek nr Elberon, IA
HAVI4	Richland Creek nr Haven, IA
HRTI4	Walnut Creek nr Hartwick, IA
IOCI4	Old Mans Creek nr Iowa City, IA
IOWI4	Iowa River nr Iowa City, IA
IRCI4	Rapid Creek nr Iowa City, IA
KALI4	English River nr Kalona, IA
LNTI4	Iowa River nr Lone Tree, IA
MIWI4	Iowa River nr Marshalltown, IA
MROI4	Iowa River nr Marengo, IA
MTWI4	Timber Creek nr Marshalltown, IA
NEPI4	N. Fork English River nr Parnell, IA
PRARI	Prairie Creek nr Blairstown, IA
ROWI4	Iowa River nr Rowan, IA
STBI4	Iowa River nr Steamboat Rock, IA
TAMI4	Iowa River nr Tama, IA
TOLI4	Deer Creek nr Toledo, IA
WAPI4	Iowa River nr Wapello, IA

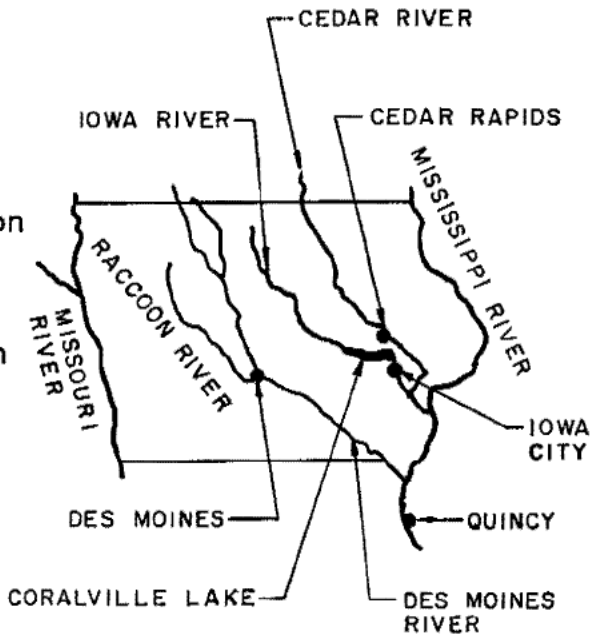
WATER QUALITY SAMPLING STATIONS

SAMPLING STATIONS

a. The upstream station is located at Johnson County Road W–48, (formerly "O") on the Iowa River above the limits of the normal conservation pool. During periods when high lake levels prevent sampling at this upstream station, samples will be taken at State Highway 220 near South Amana.

b. The Lake station is located downstream from Lake Macbride at Johnson County Road F–28 Bridge (known as the Mehaffey Bridge).

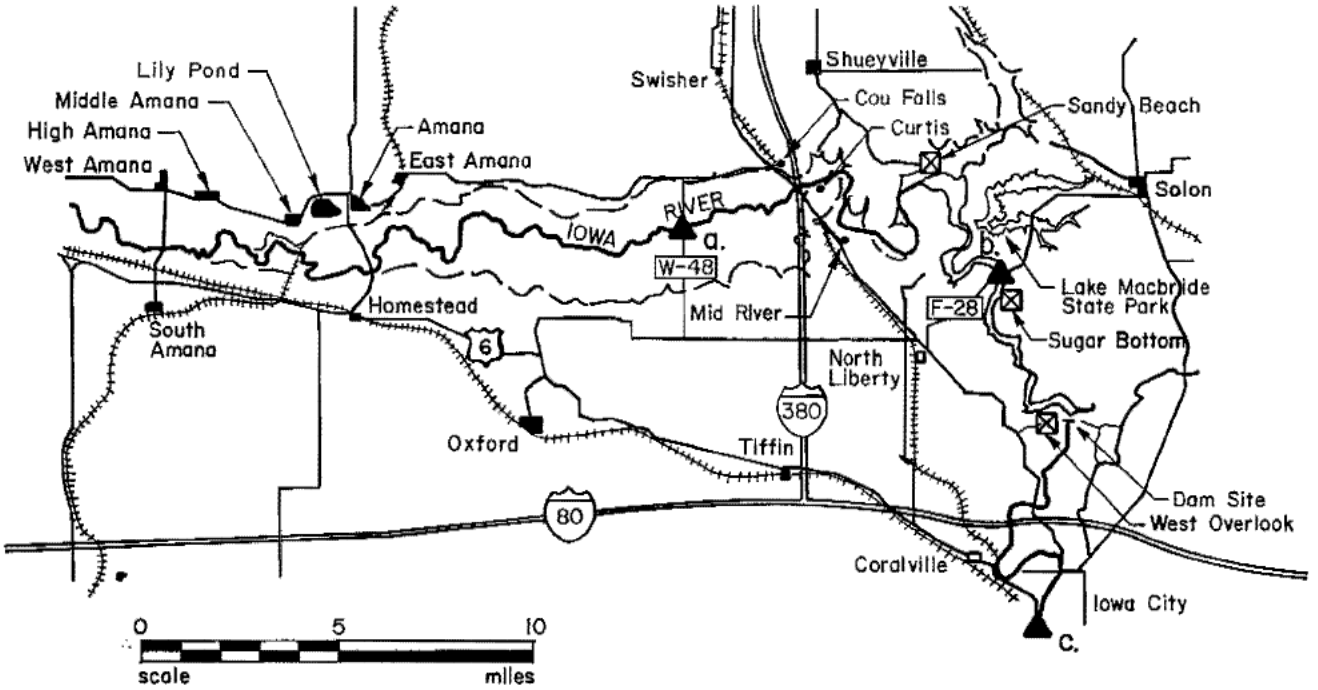
c. The downstream station is located at the University of Iowa Water Treatment Plant.



VICINITY MAP

25 0 50 100

SCALE IN MILES



MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN IOWA
CORALVILLE LAKE

▲ ROUTINE SAMPLING LOCATIONS

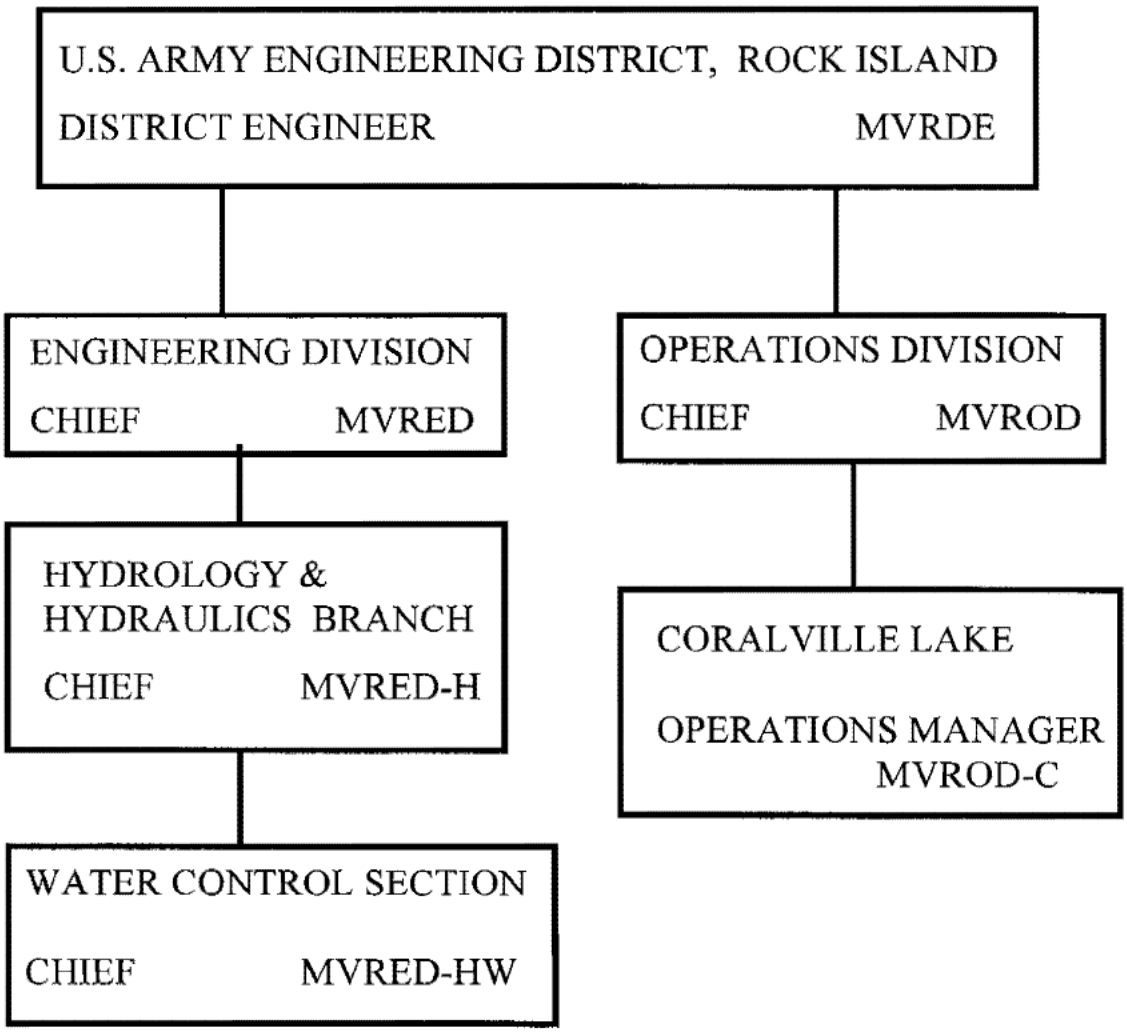
⊠ SPECIAL BACTERIAL SAMPLING

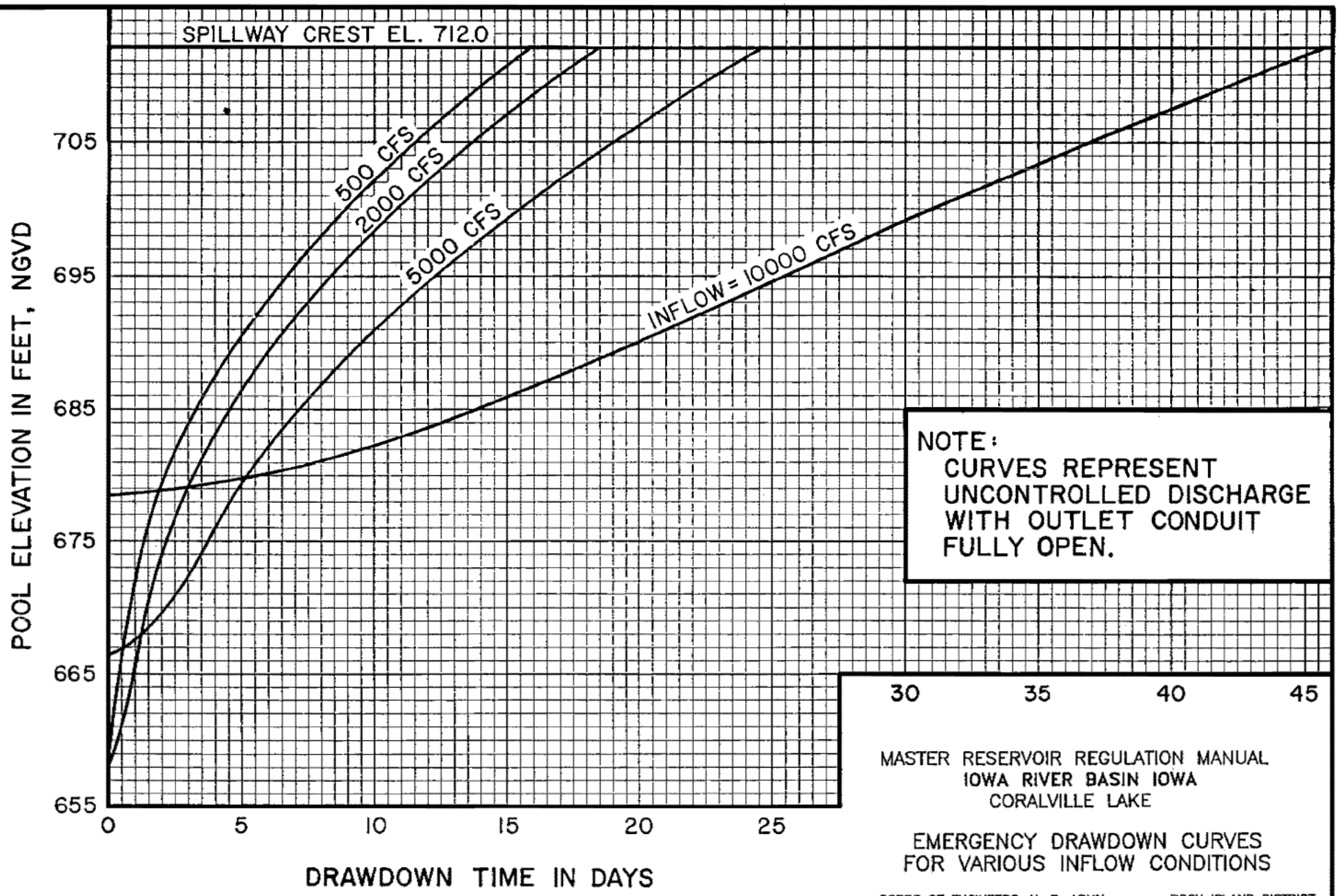
WATER QUALITY SAMPLING STATIONS

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

ORGANIZATION FOR RESERVOIR REGULATION





MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN IOWA
CORALVILLE LAKE

EMERGENCY DRAWDOWN CURVES
FOR VARIOUS INFLOW CONDITIONS

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

Coralville Spillway Design Flood

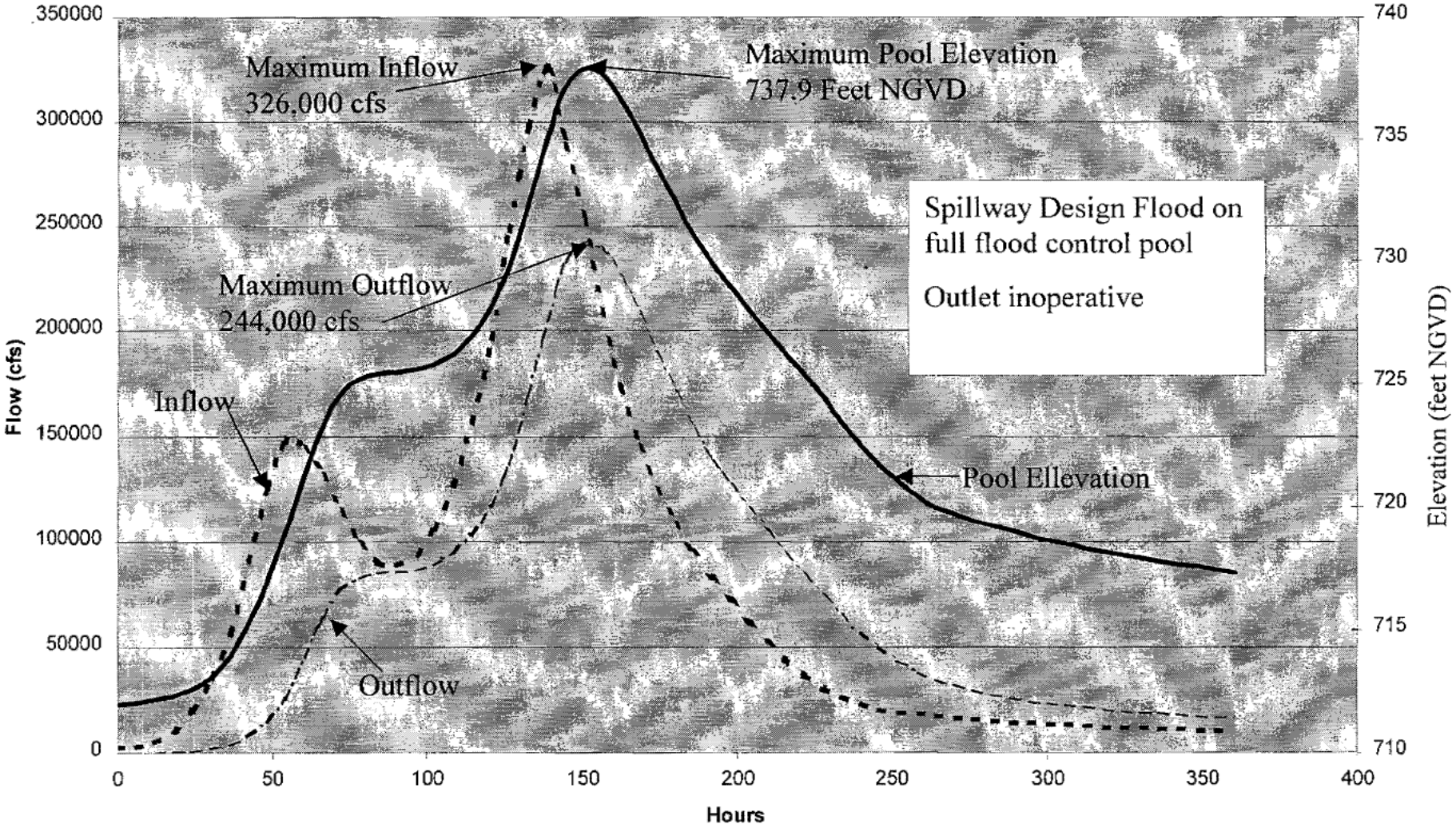
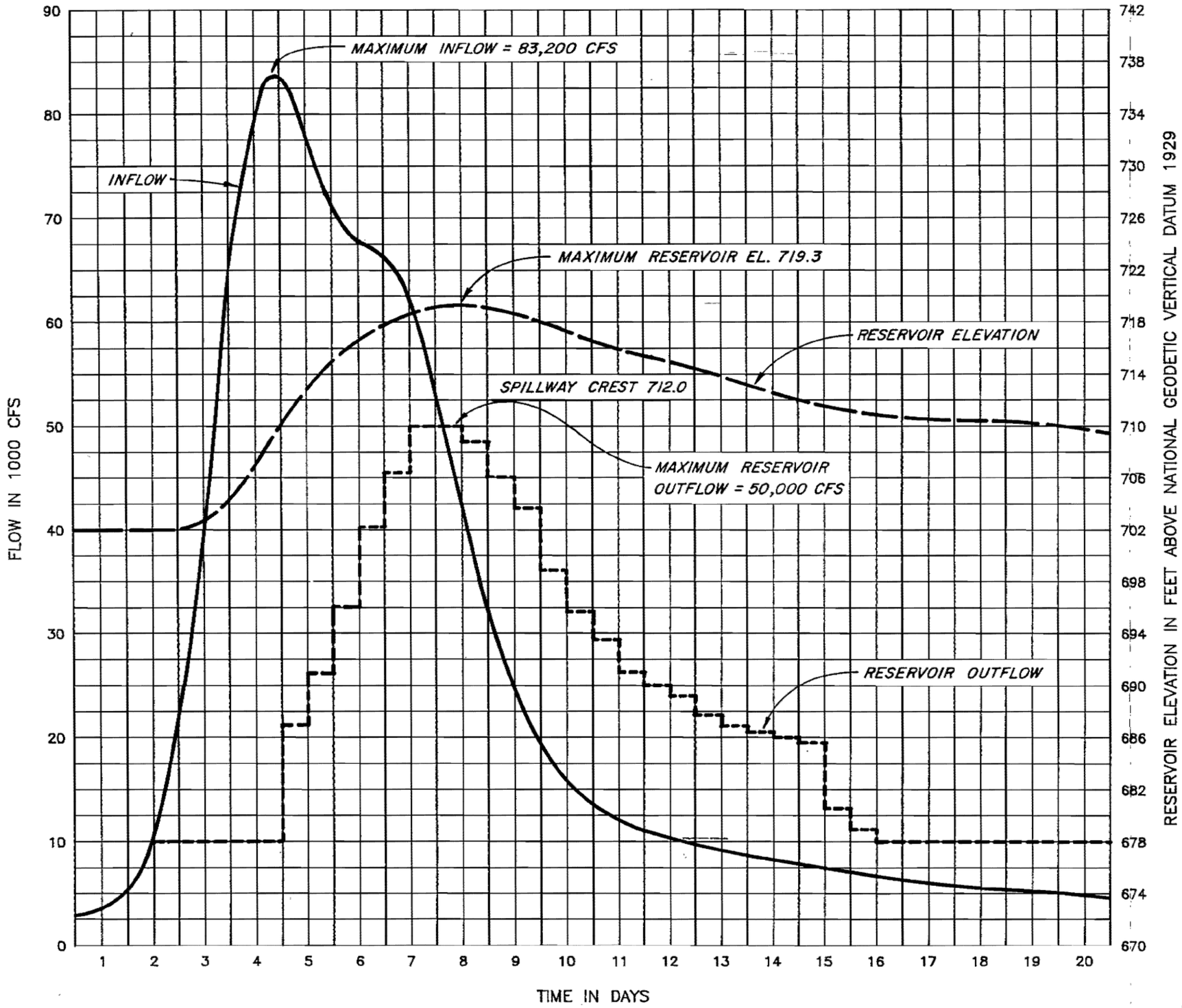


PLATE 8-1



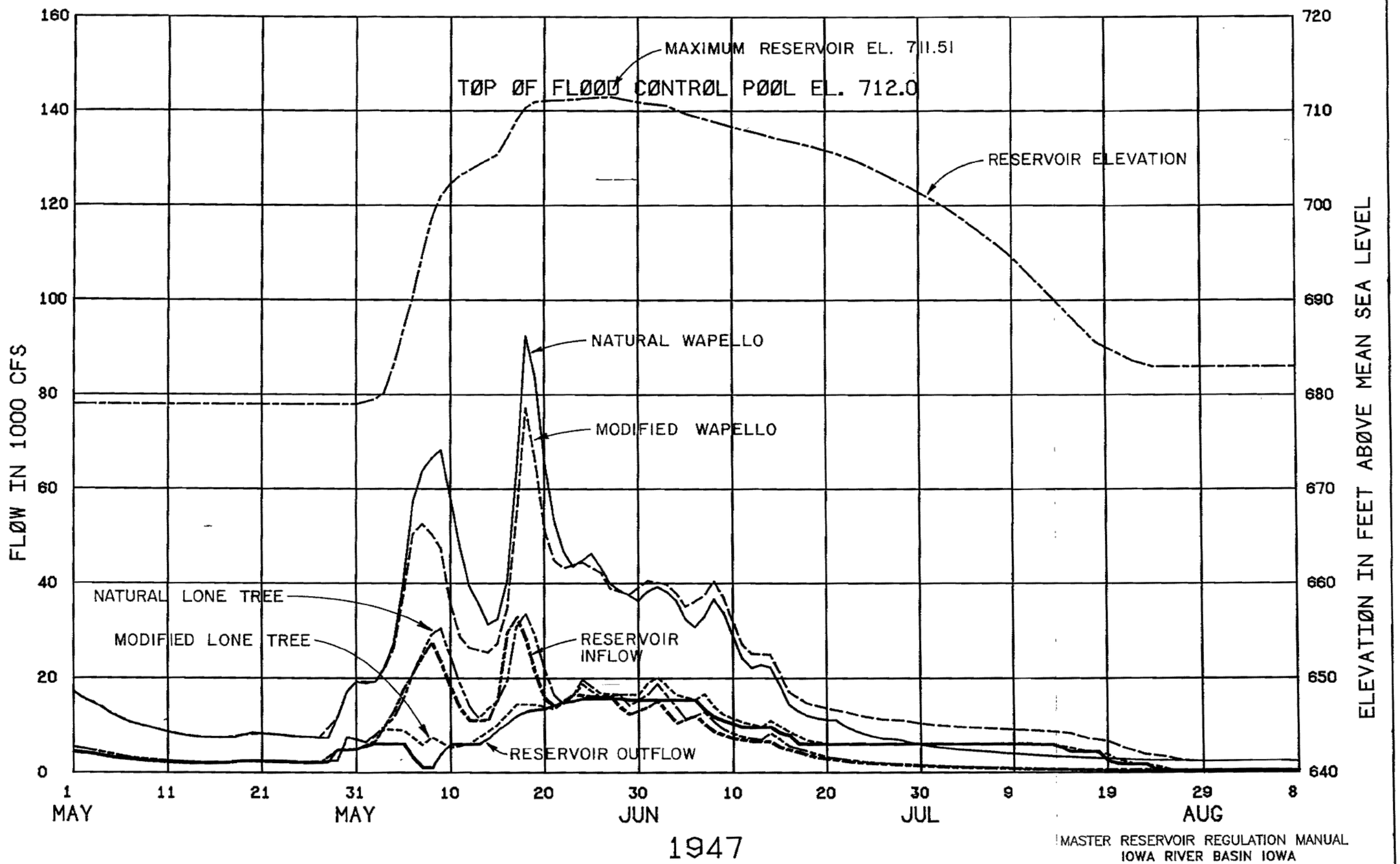
INFLOW – OUTFLOW – STAGE RELATION

MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN IOWA
CORALVILLE LAKE

ROUTING STANDARD PROJECT FLOOD
THROUGH A HALF–FILLED POOL

CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990



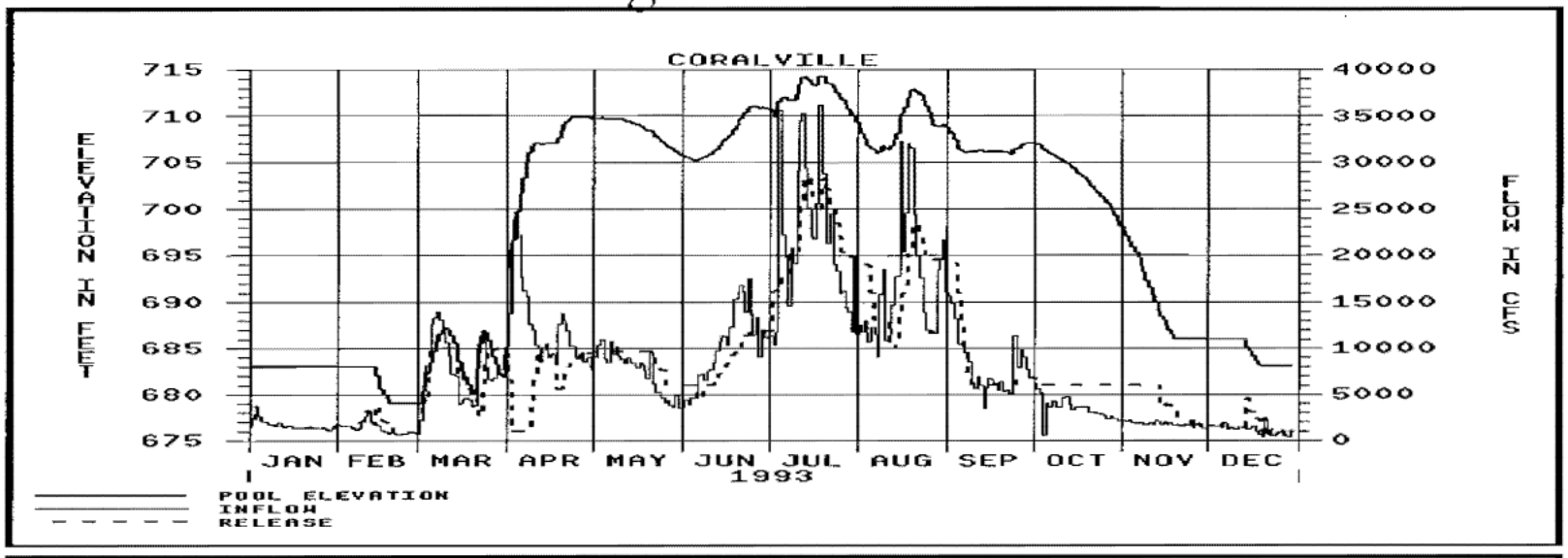
MASTER RESERVOIR REGULATION MANUAL
IOWA RIVER BASIN IOWA
CORALVILLE LAKE

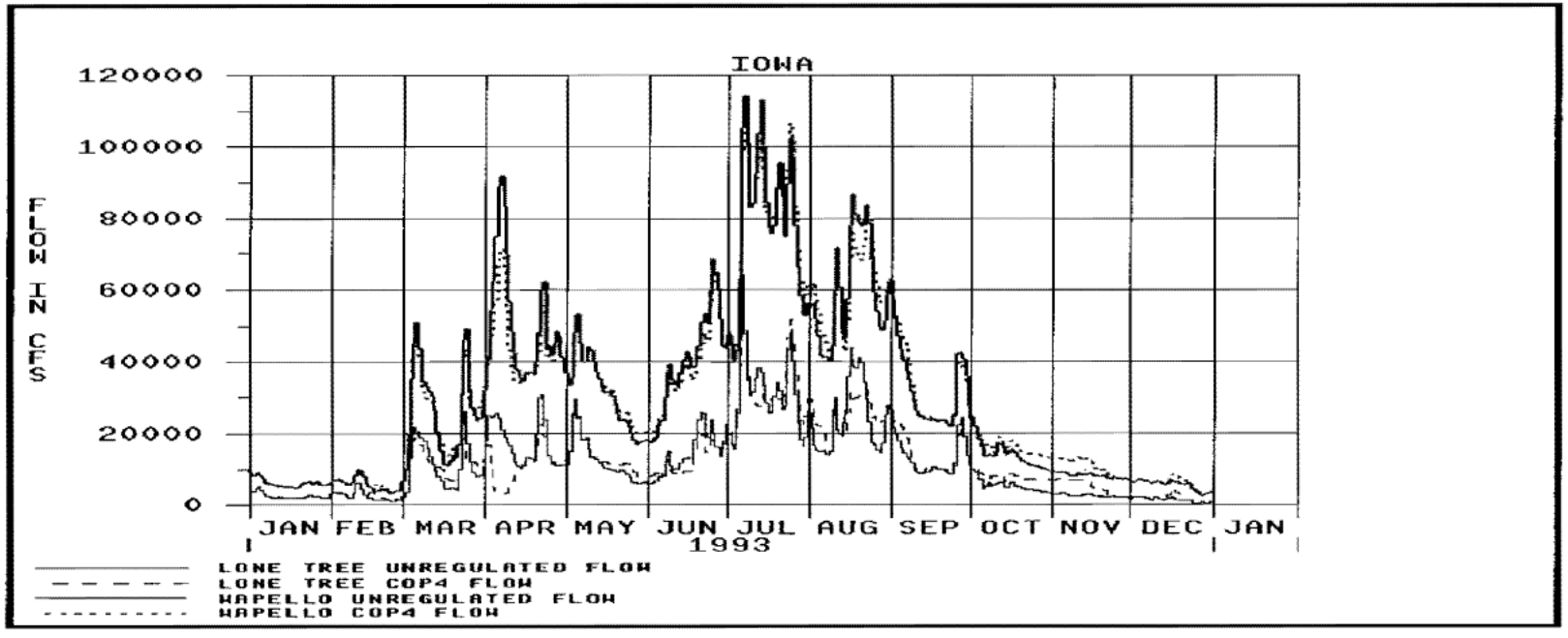
EFFECT OF RESERVOIR REGULATION AT
WAPELLO AND LONE TREE, FLOOD OF 1947

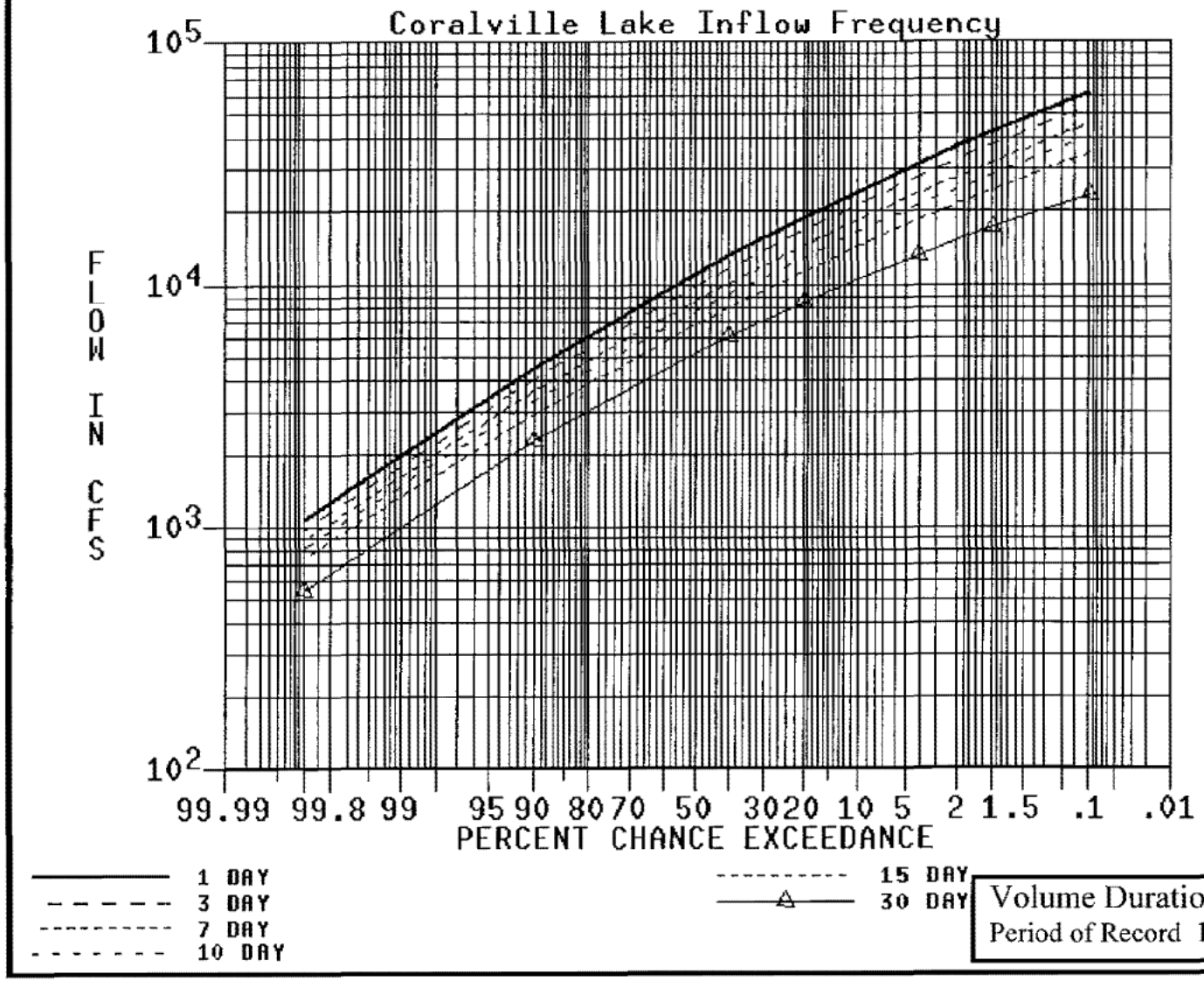
CORPS OF ENGINEERS, U. S. ARMY
ROCK ISLAND, ILLINOIS

ROCK ISLAND DISTRICT
MARCH 1990

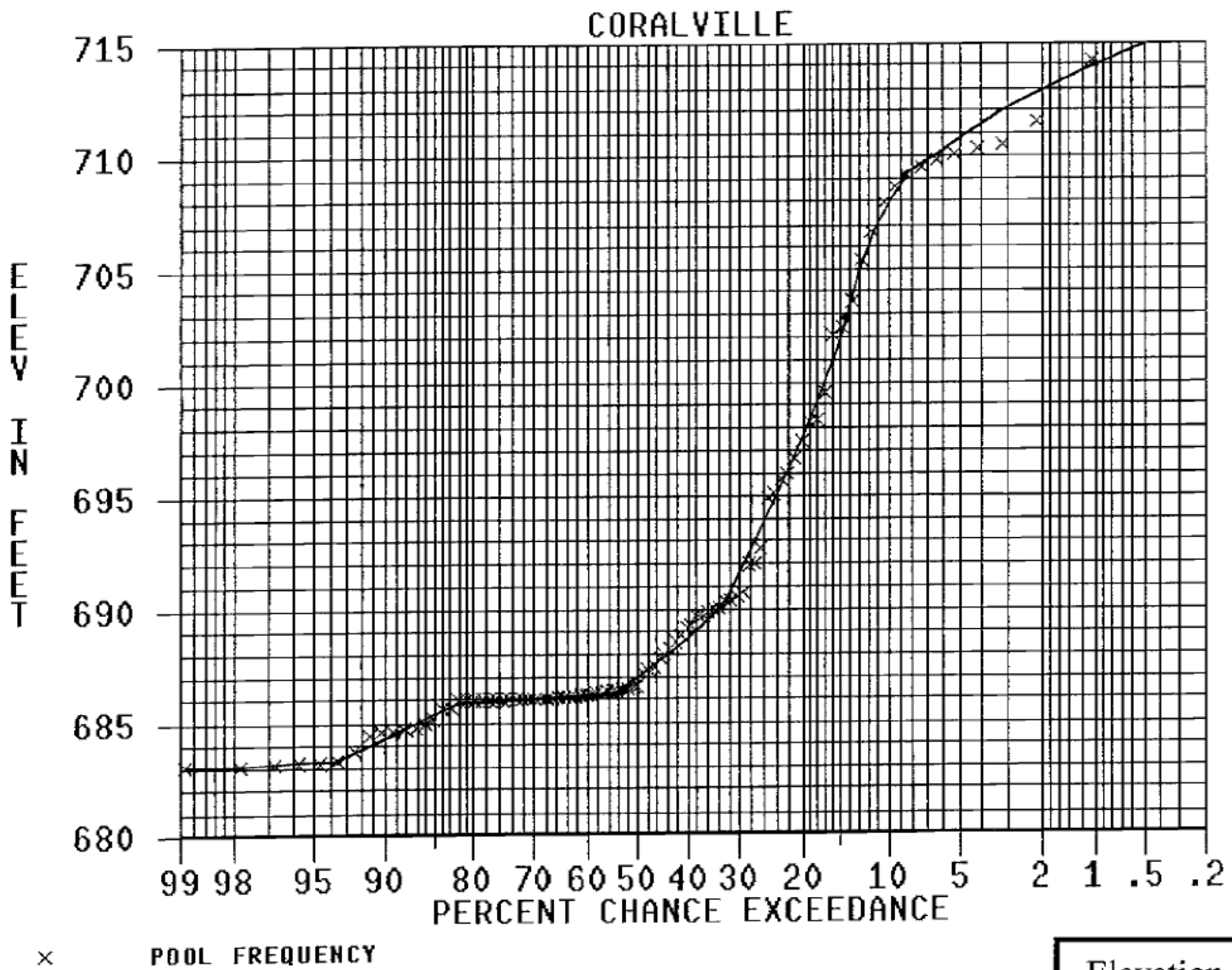
Effect of Regulation on 1993 Flood



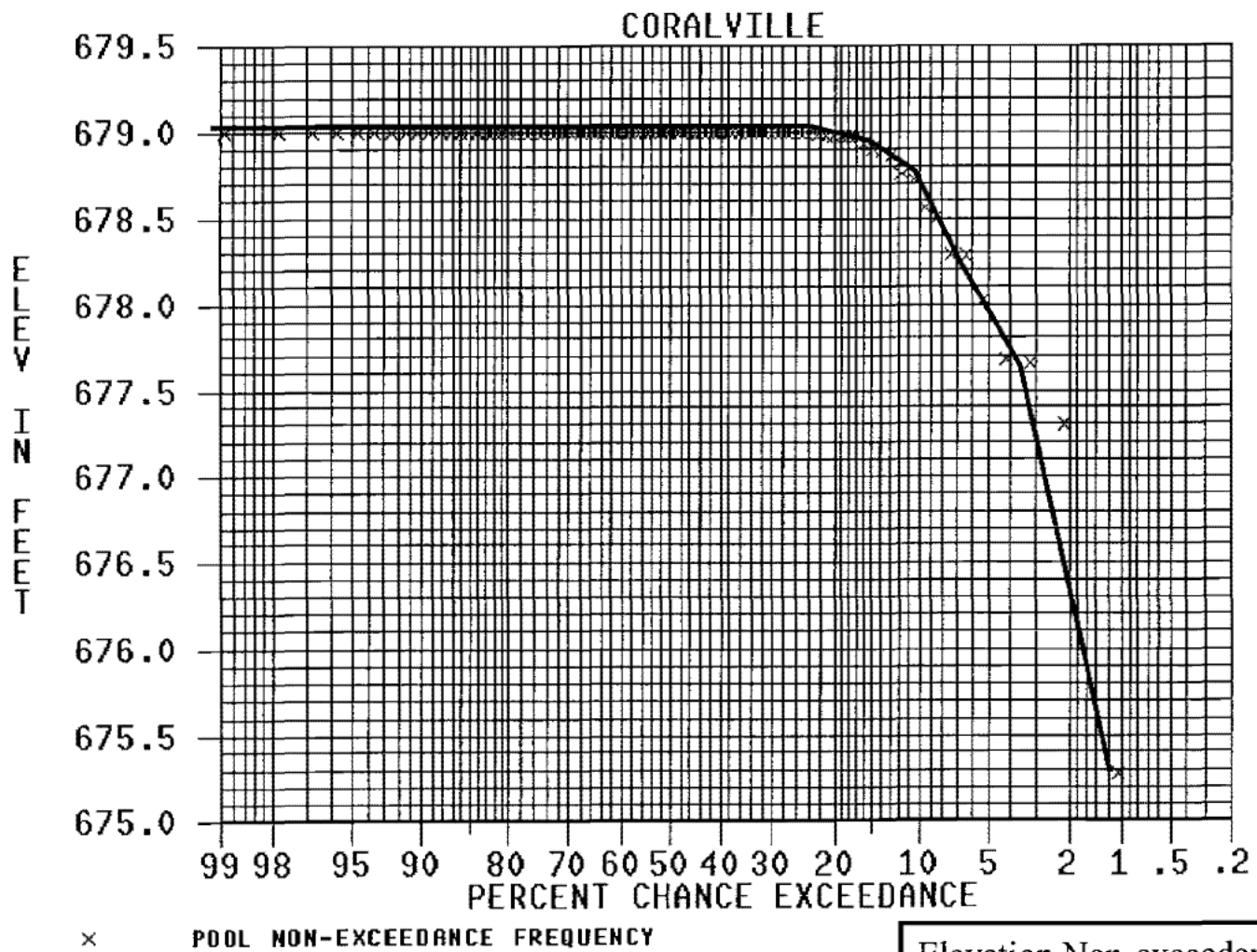




Volume Duration Frequency
Period of Record 1904-1996

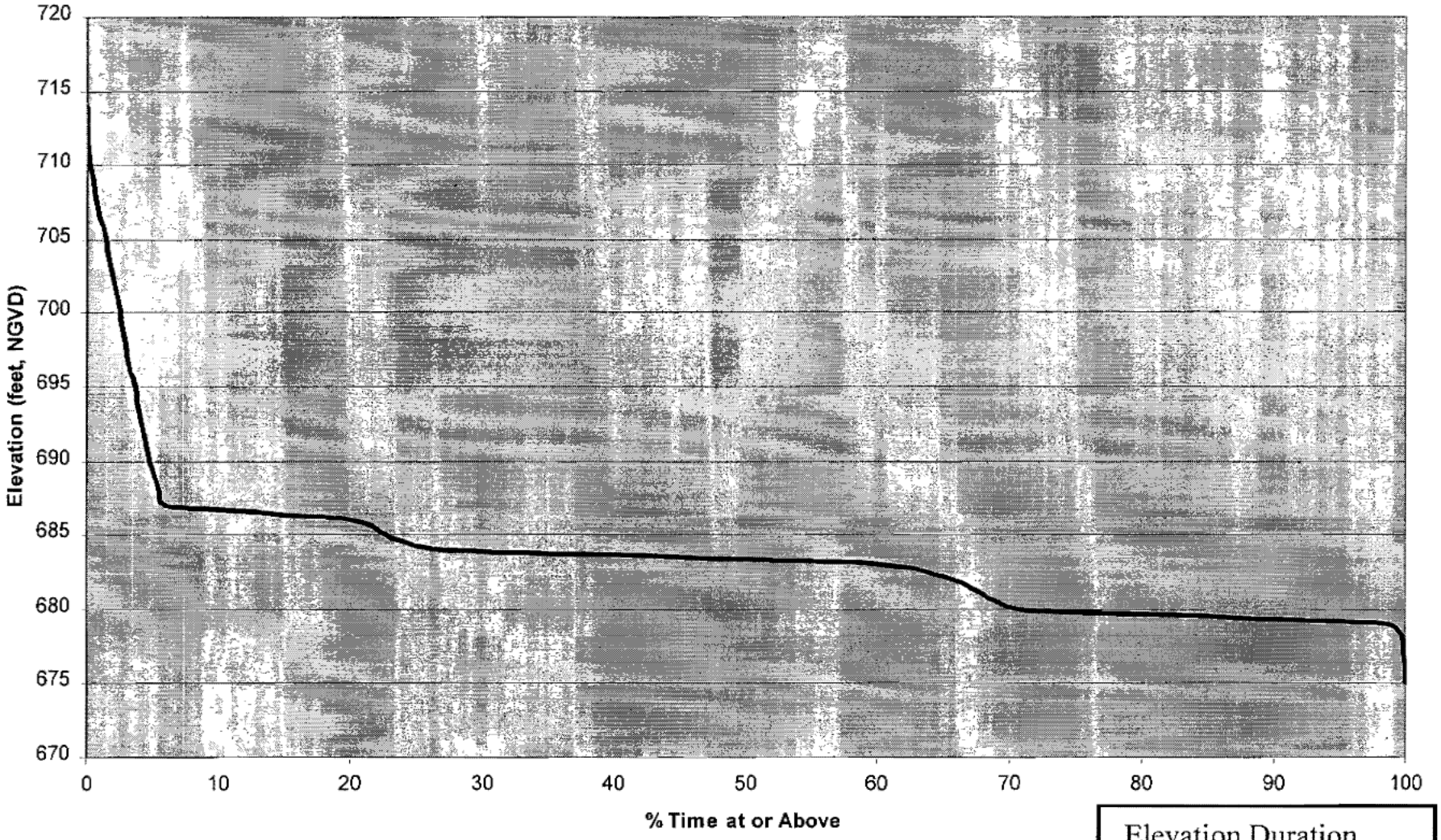


Elevation Frequency
Period of Record 1904-1996



Elevation Non-exceedance Frequency
Period of Record 1904-1996

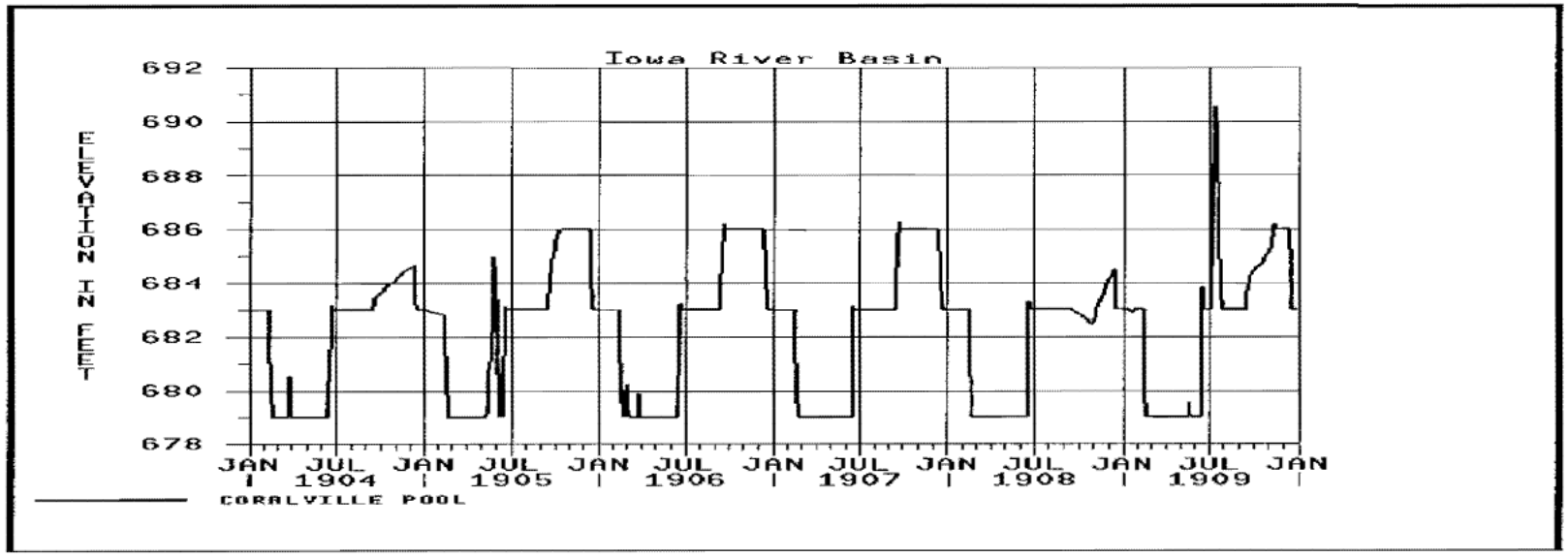
Coralville Elevation Duration

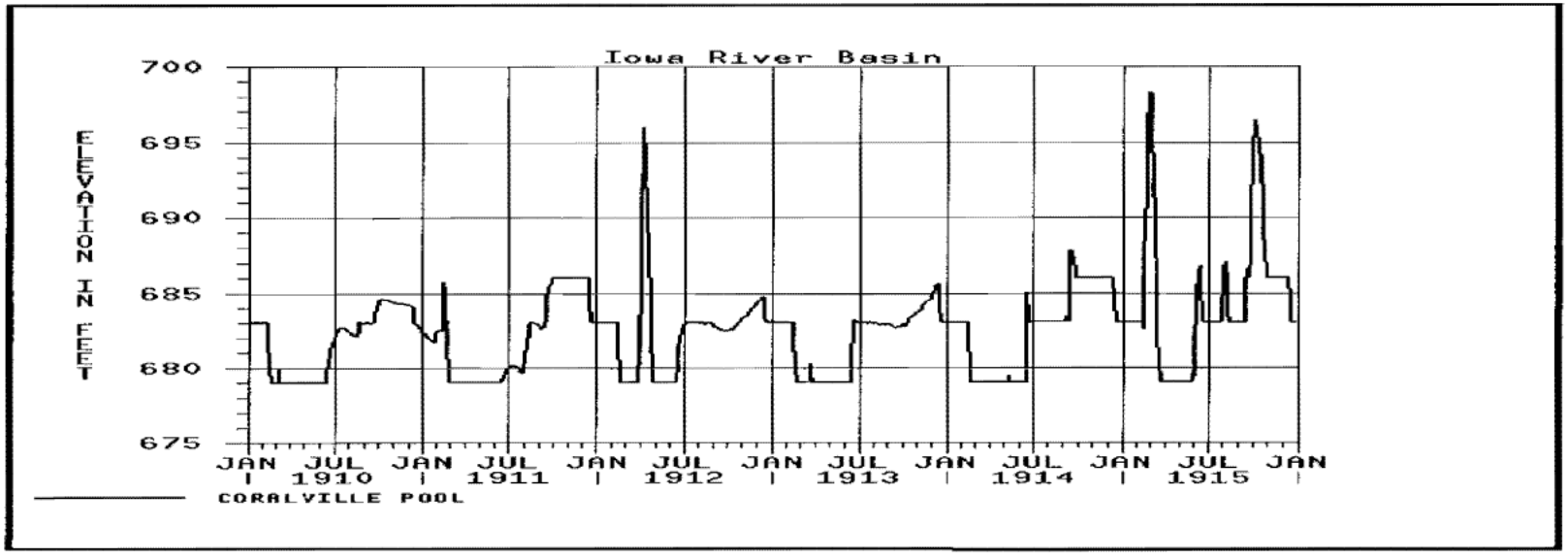


Elevation Duration
Period of Record 1904-1996

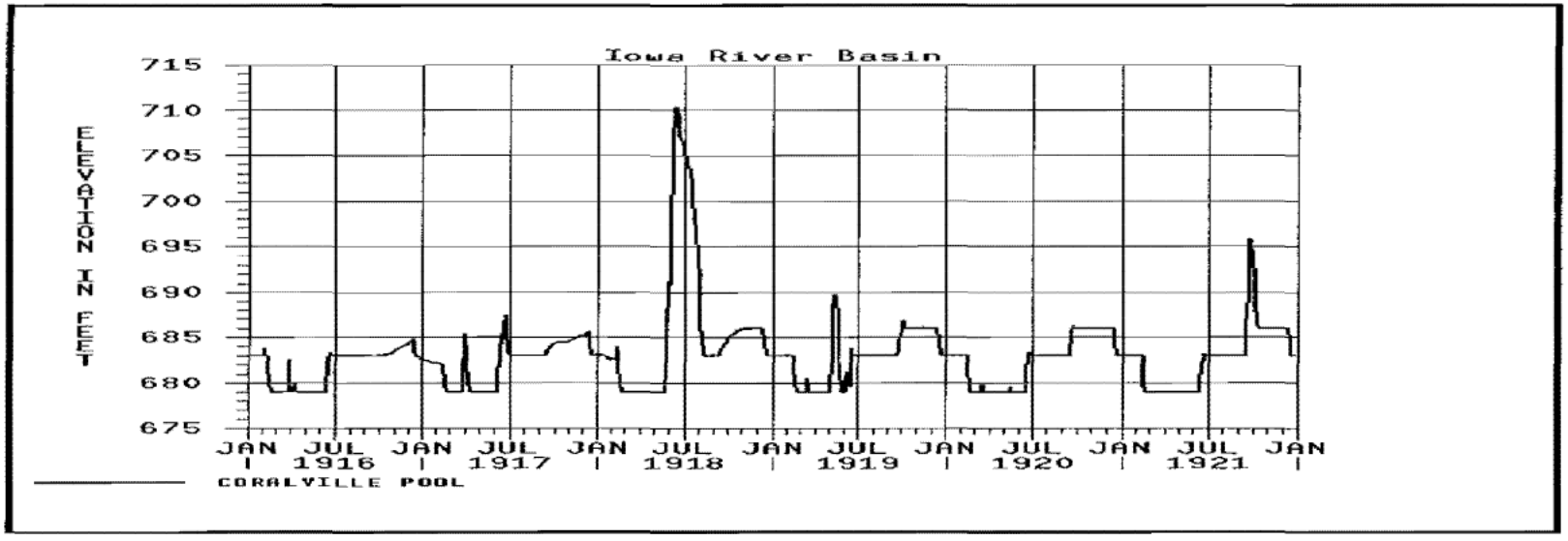
PLATE 8-8

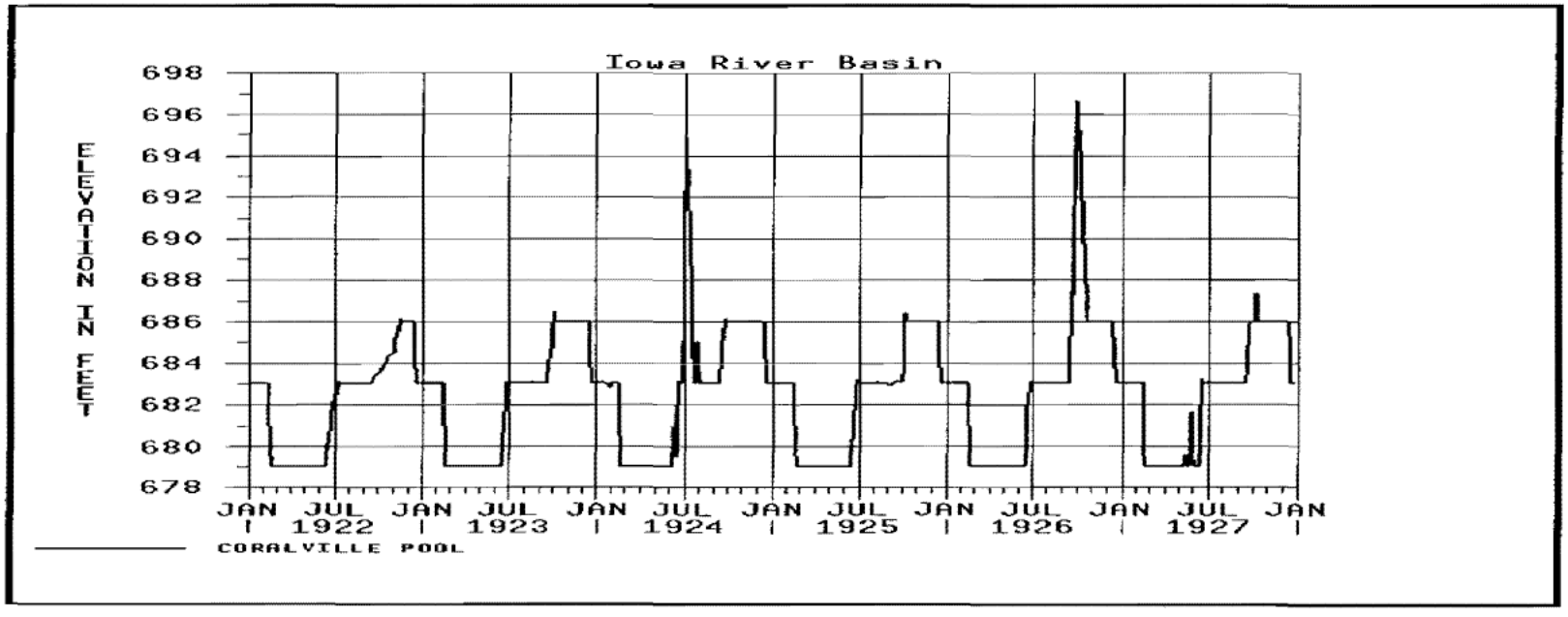
Coralville Lake Reservoir Levels 1904 - 1915



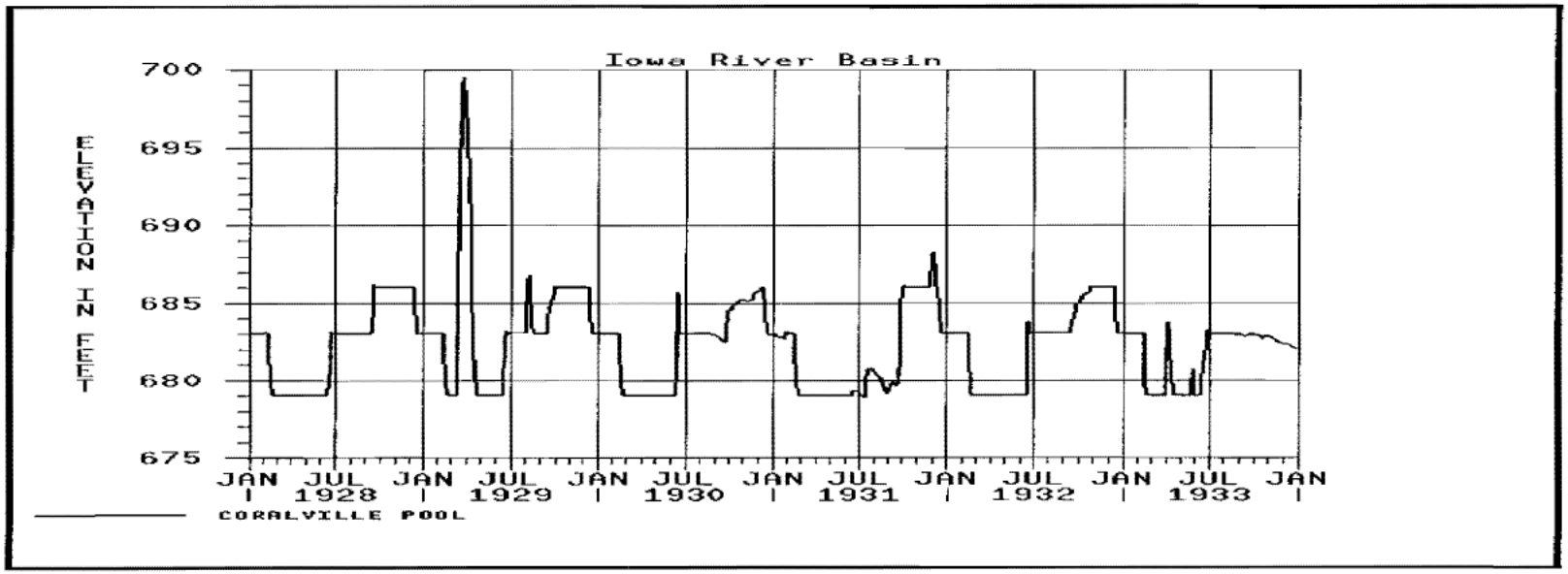


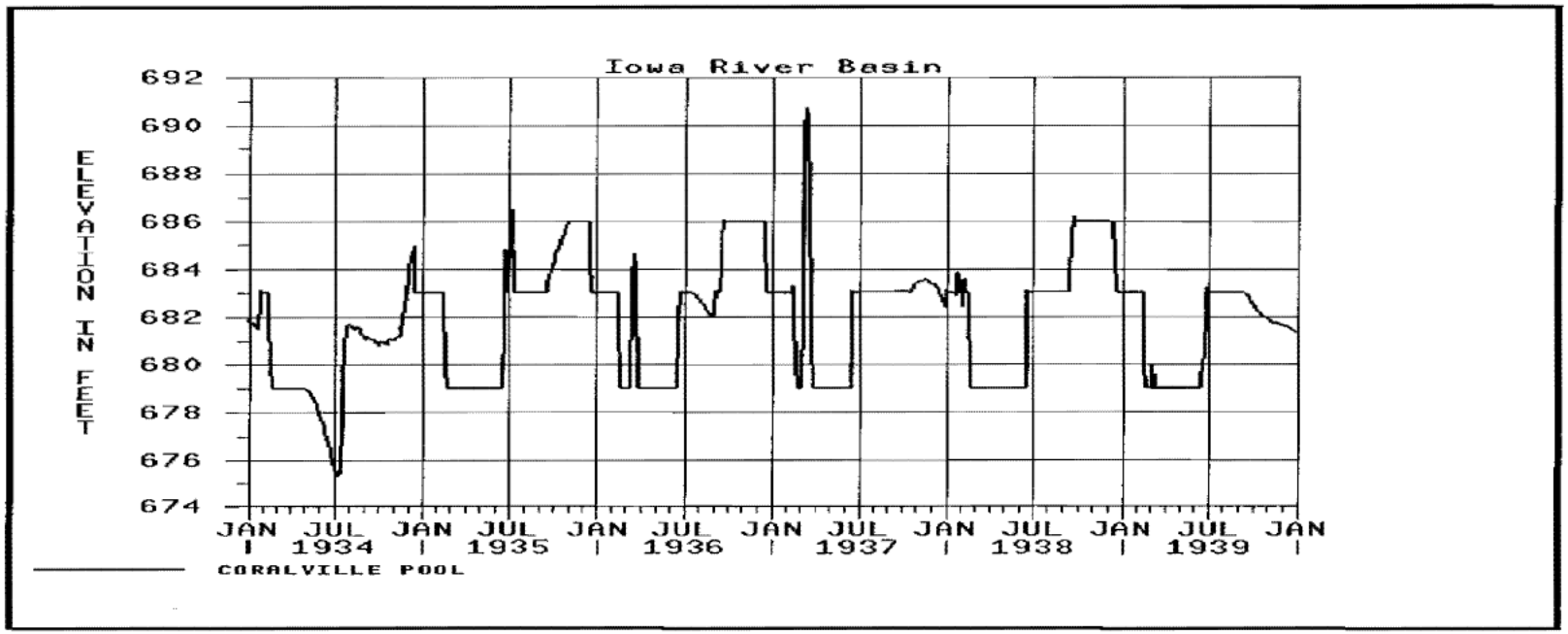
Coralville Lake Reservoir Levels 1916 - 1927



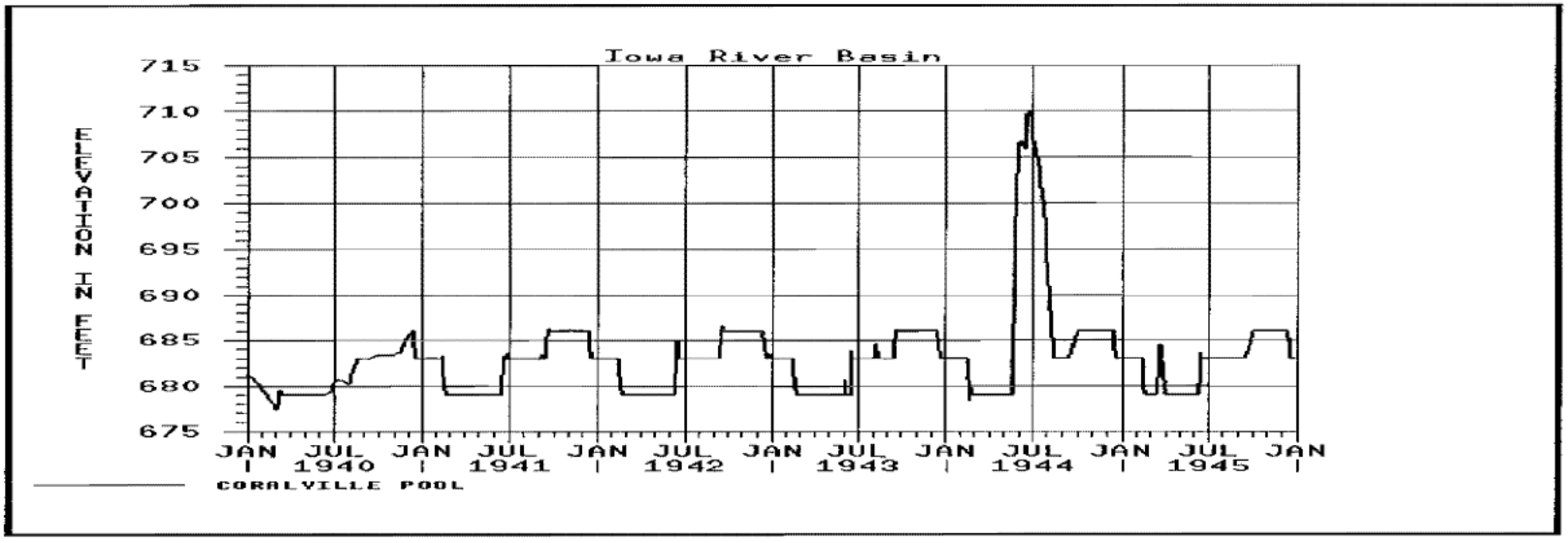


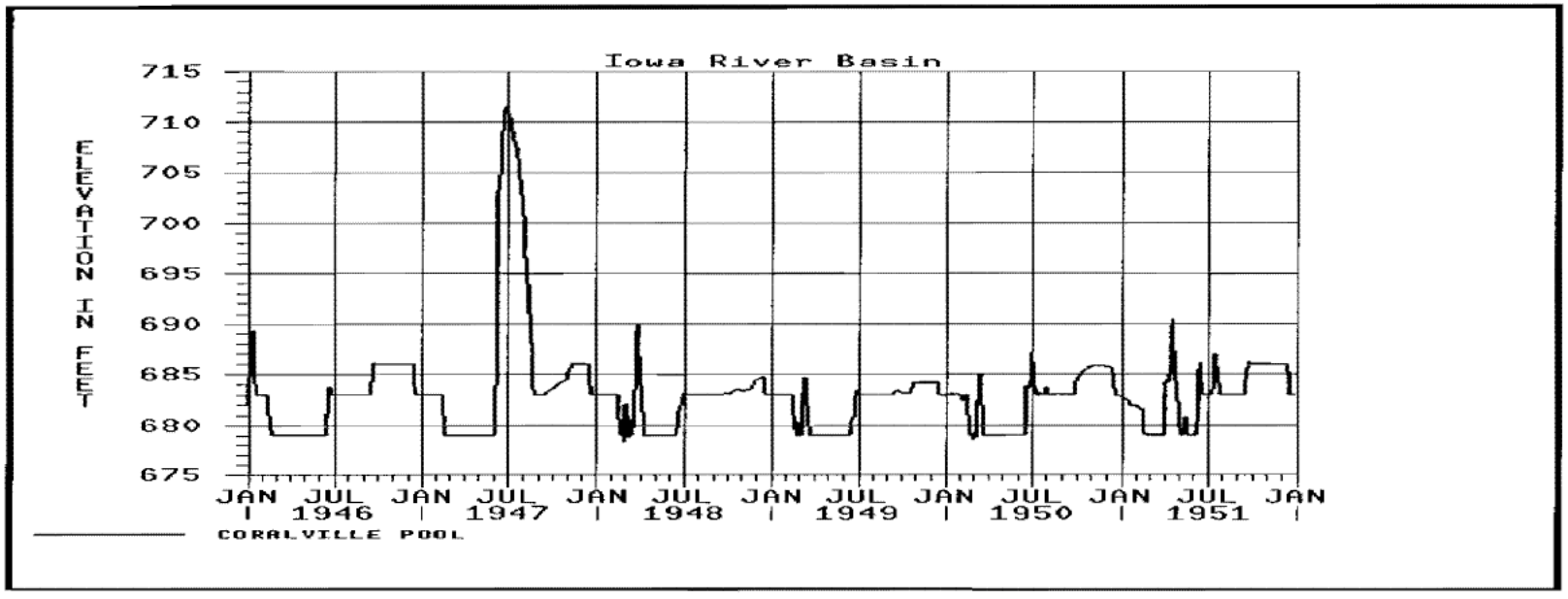
Coralville Lake Reservoir Levels 1928 - 1939



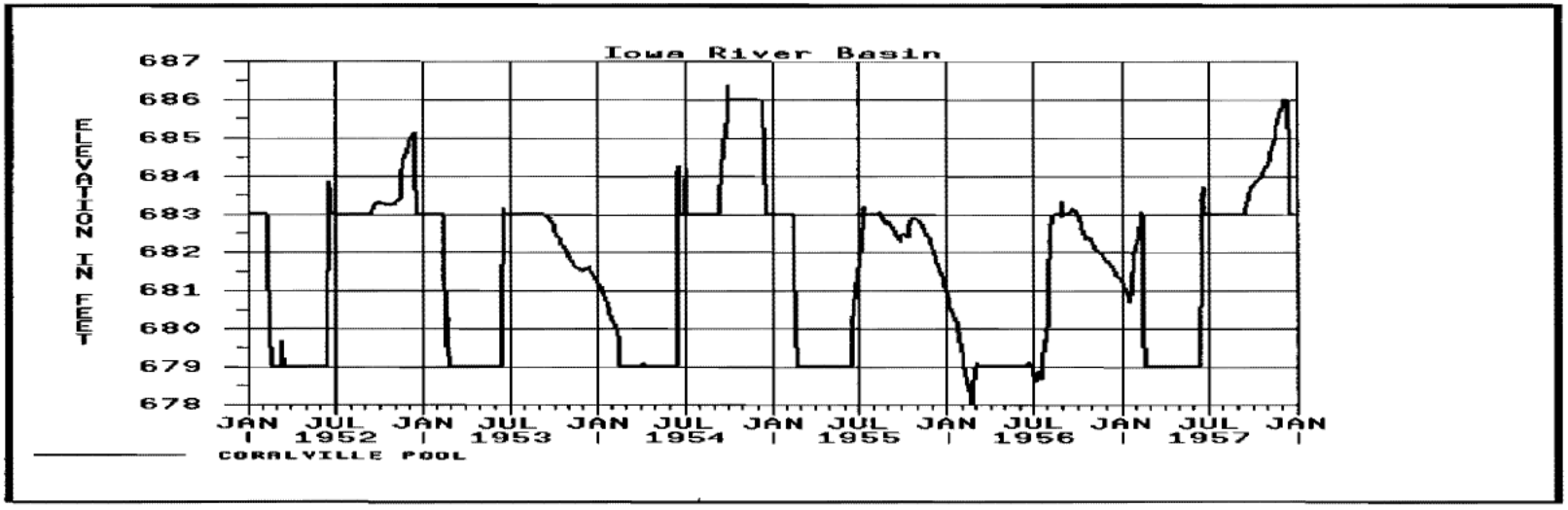


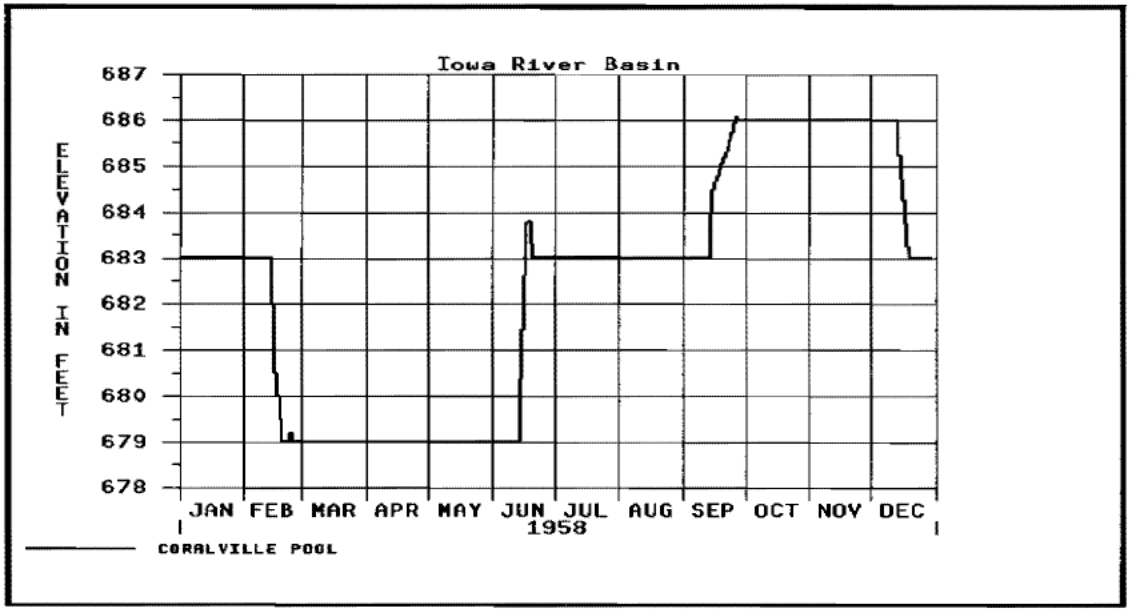
Coralville Lake Reservoir Levels 1940 - 1951



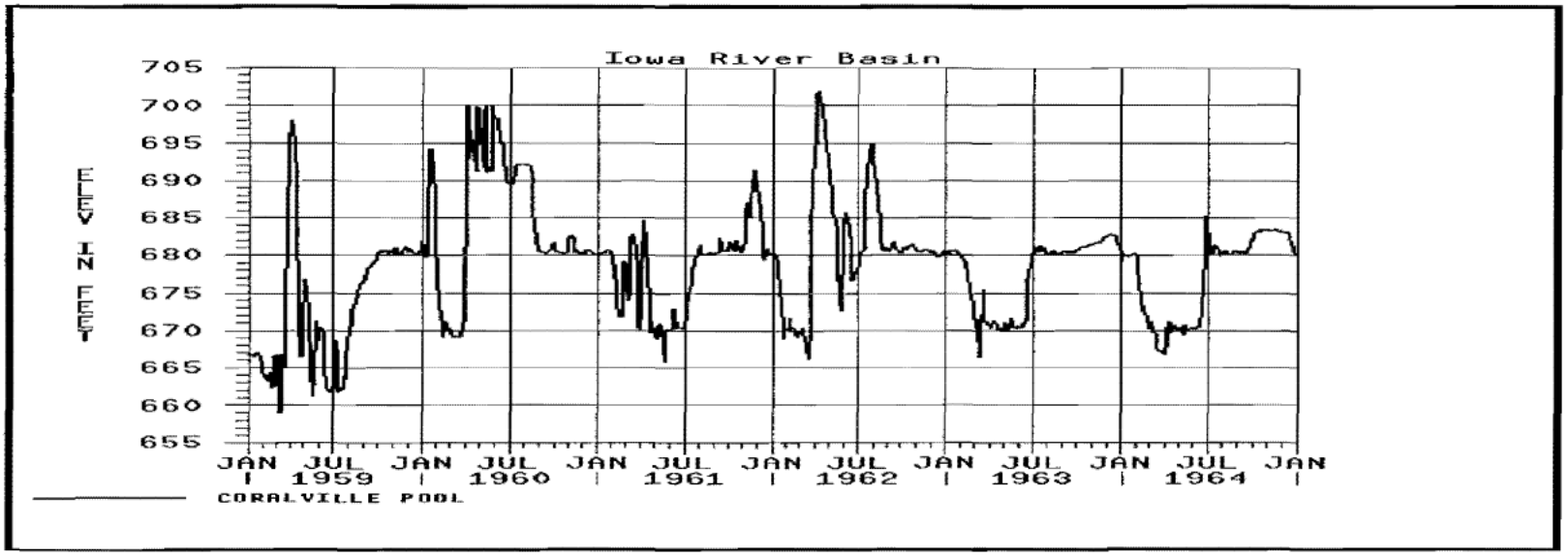


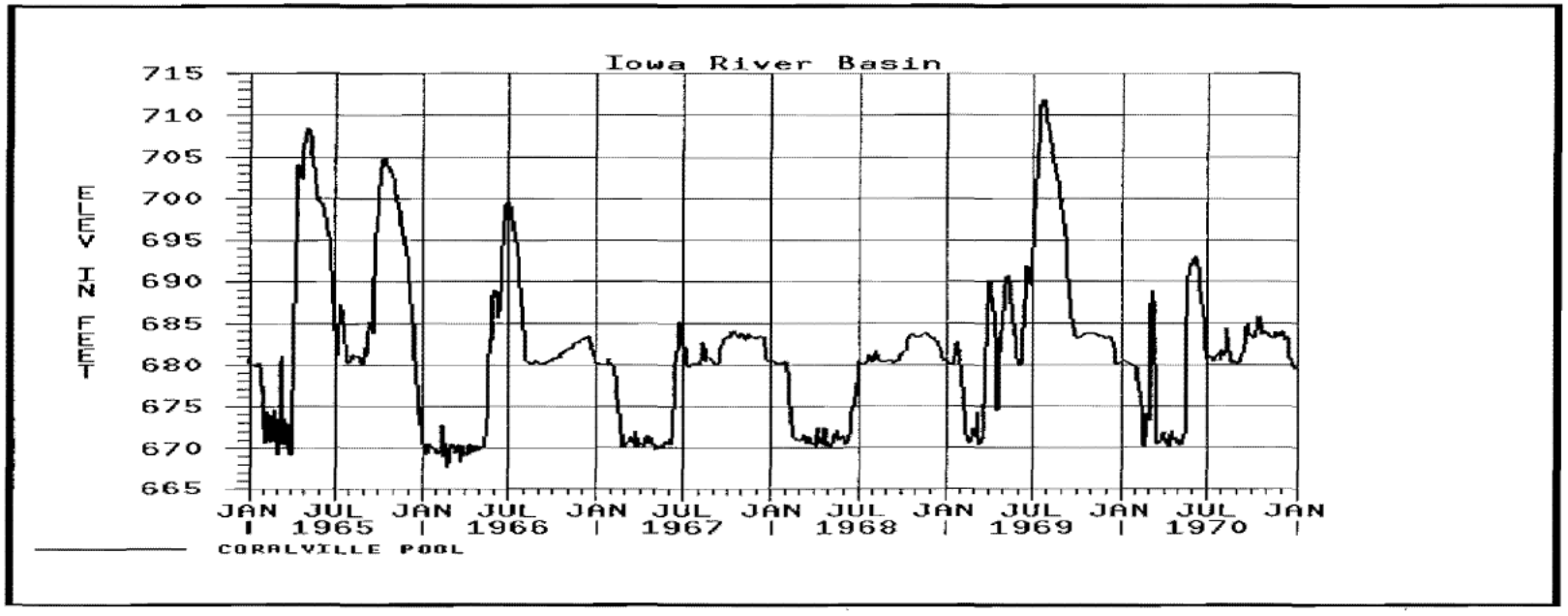
Coralville Lake Reservoir Levels 1952 - 1958



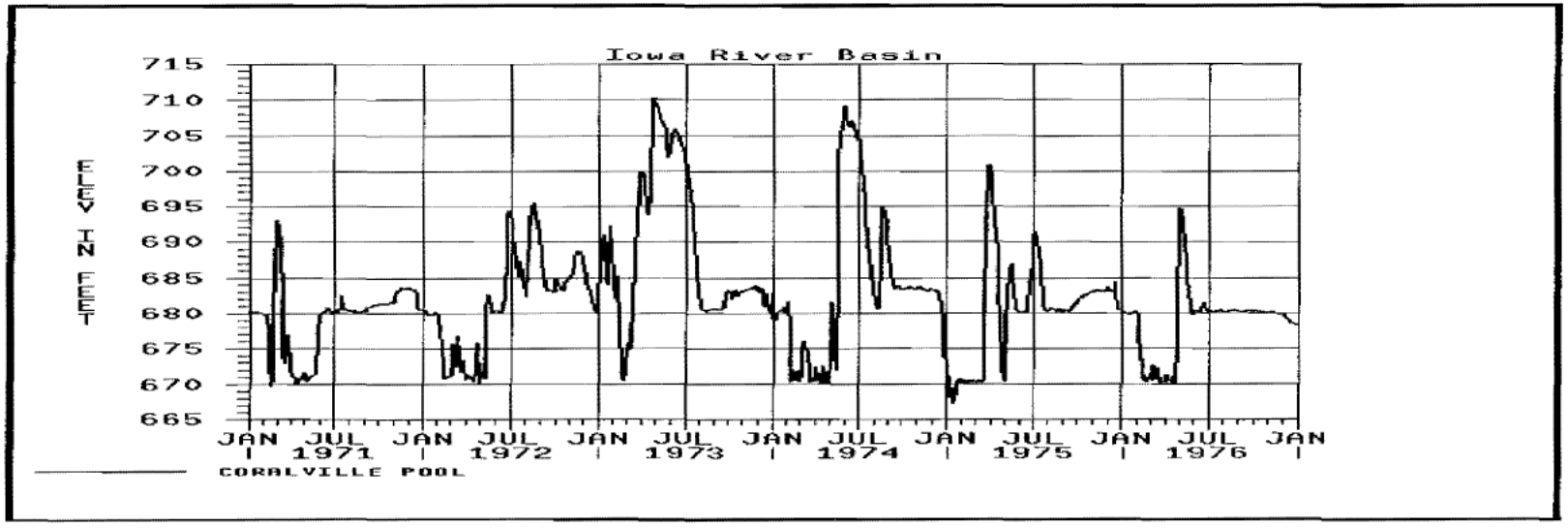


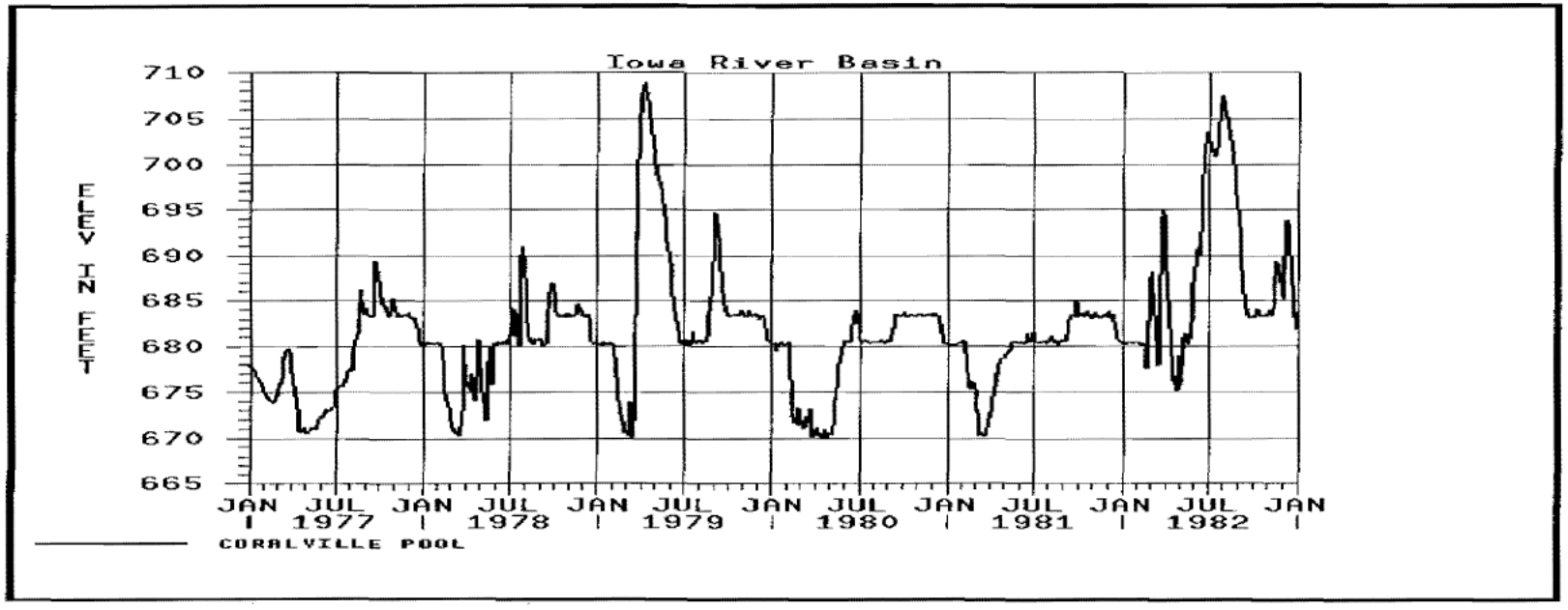
Coralville Lake Reservoir Levels 1959 - 1970



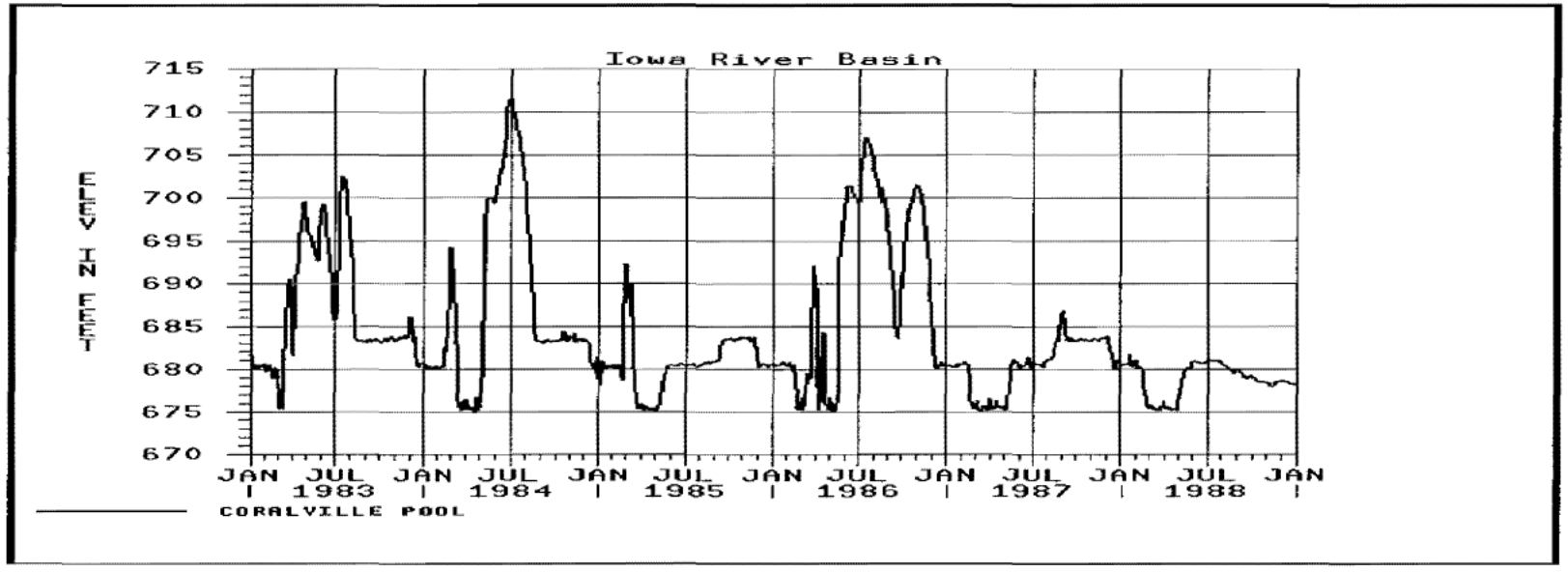


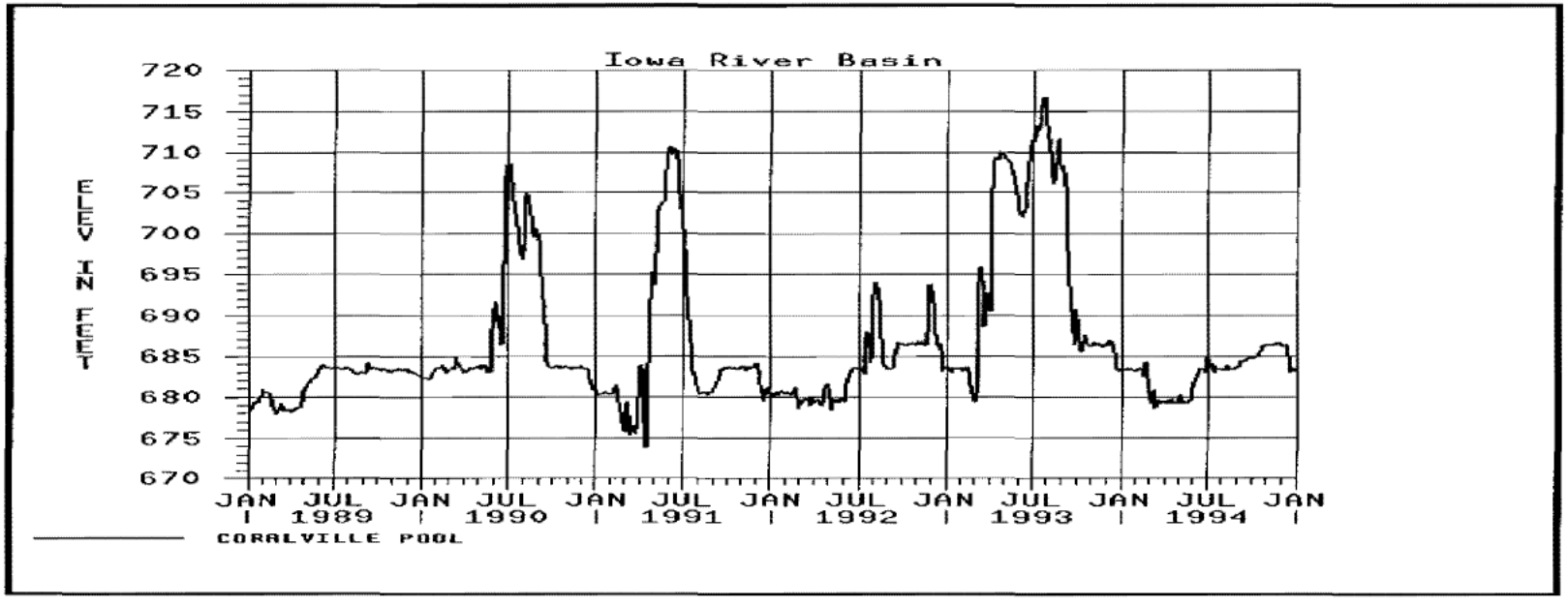
Coralville Lake Reservoir Levels 1971 - 1982



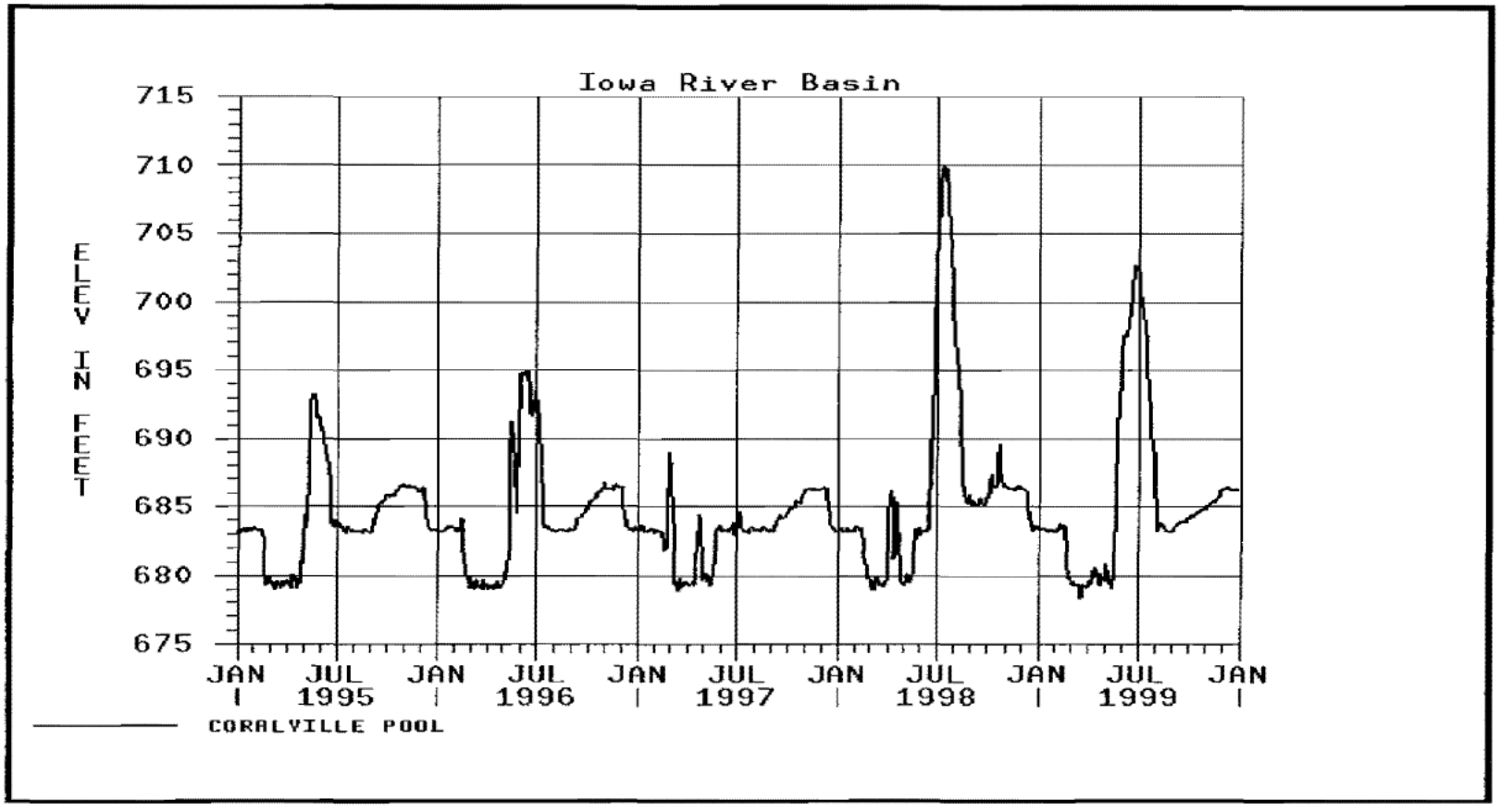


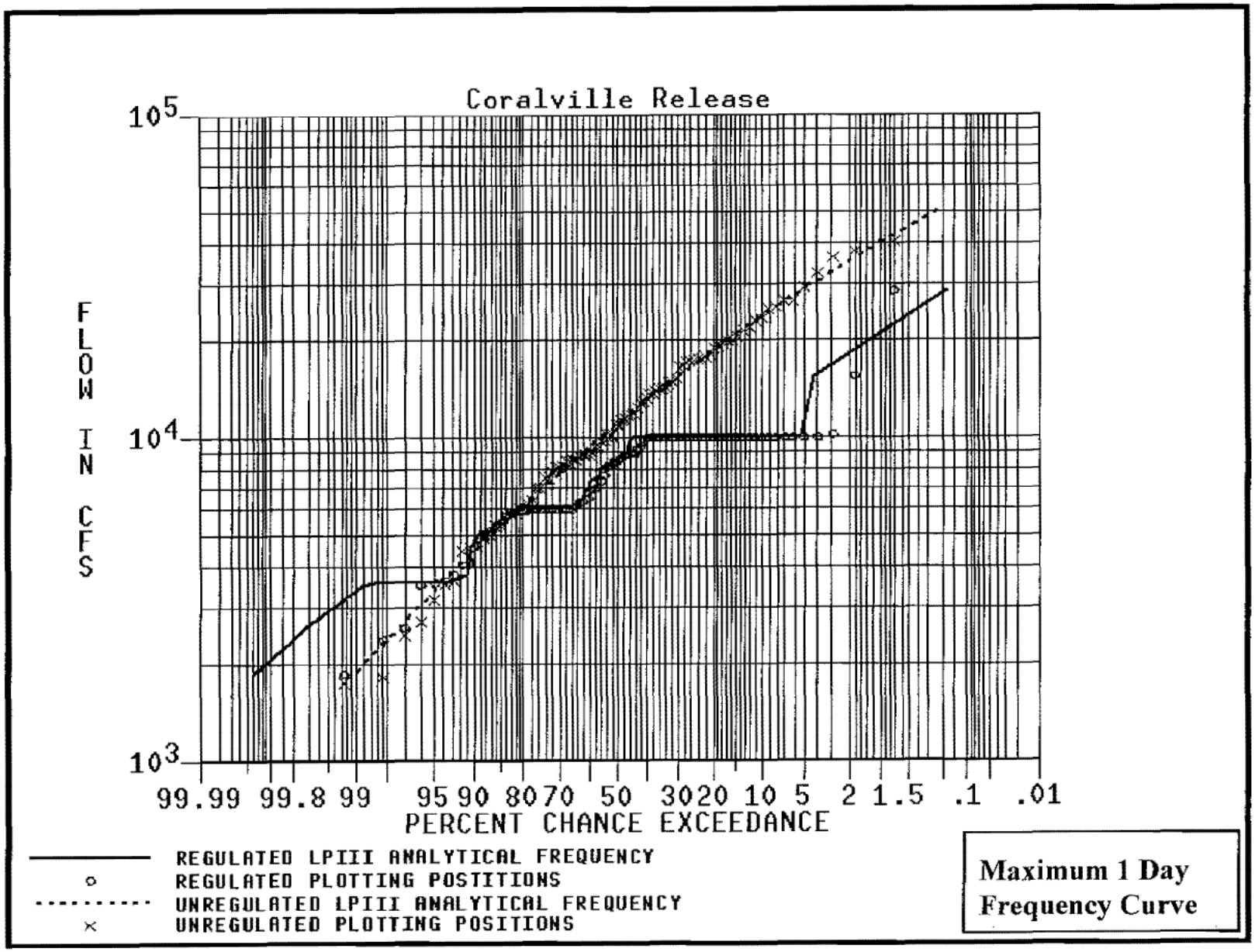
Coralville Lake Reservoir Levels 1983 - 1994



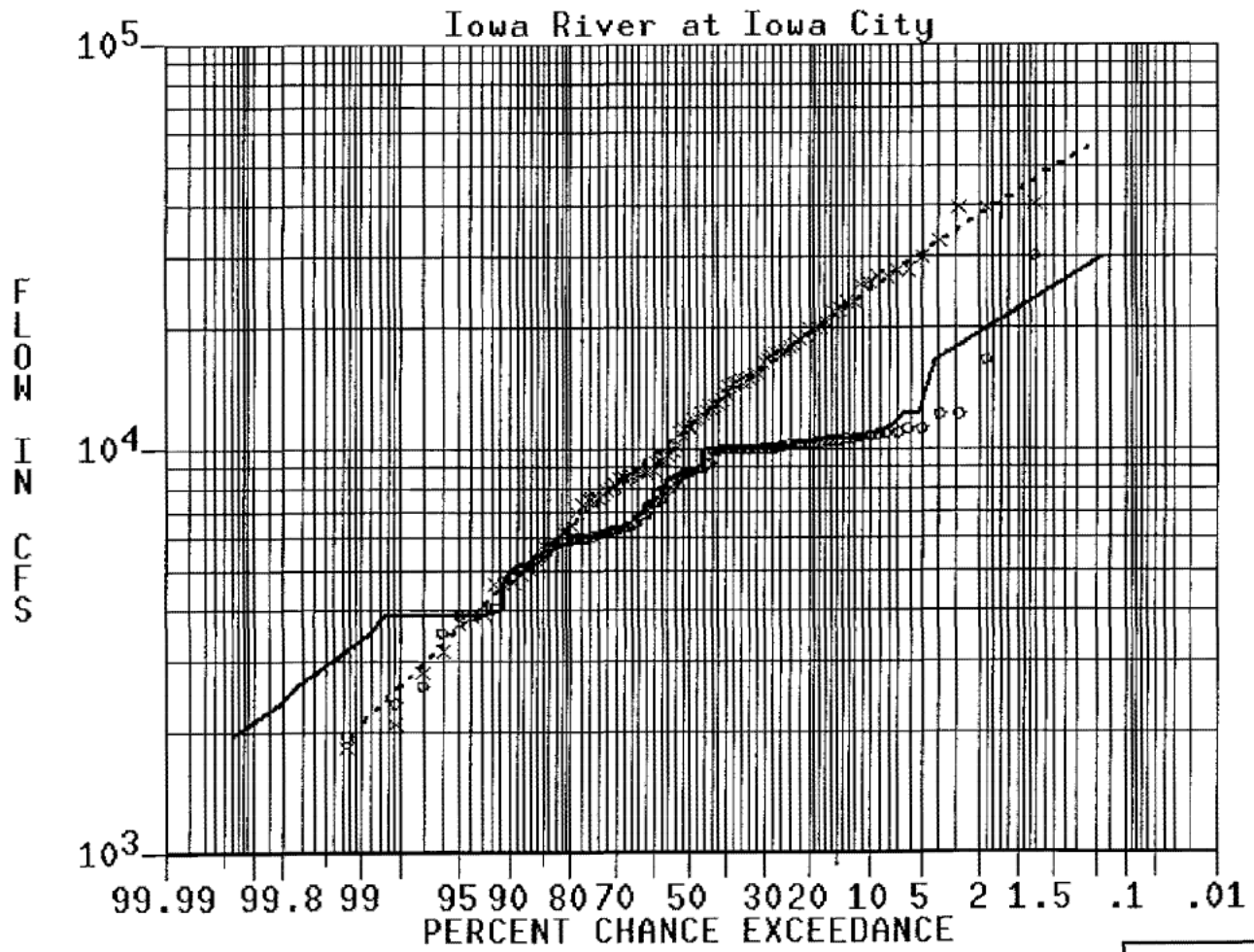


Coralville Lake Reservoir Levels 1995 - 1999



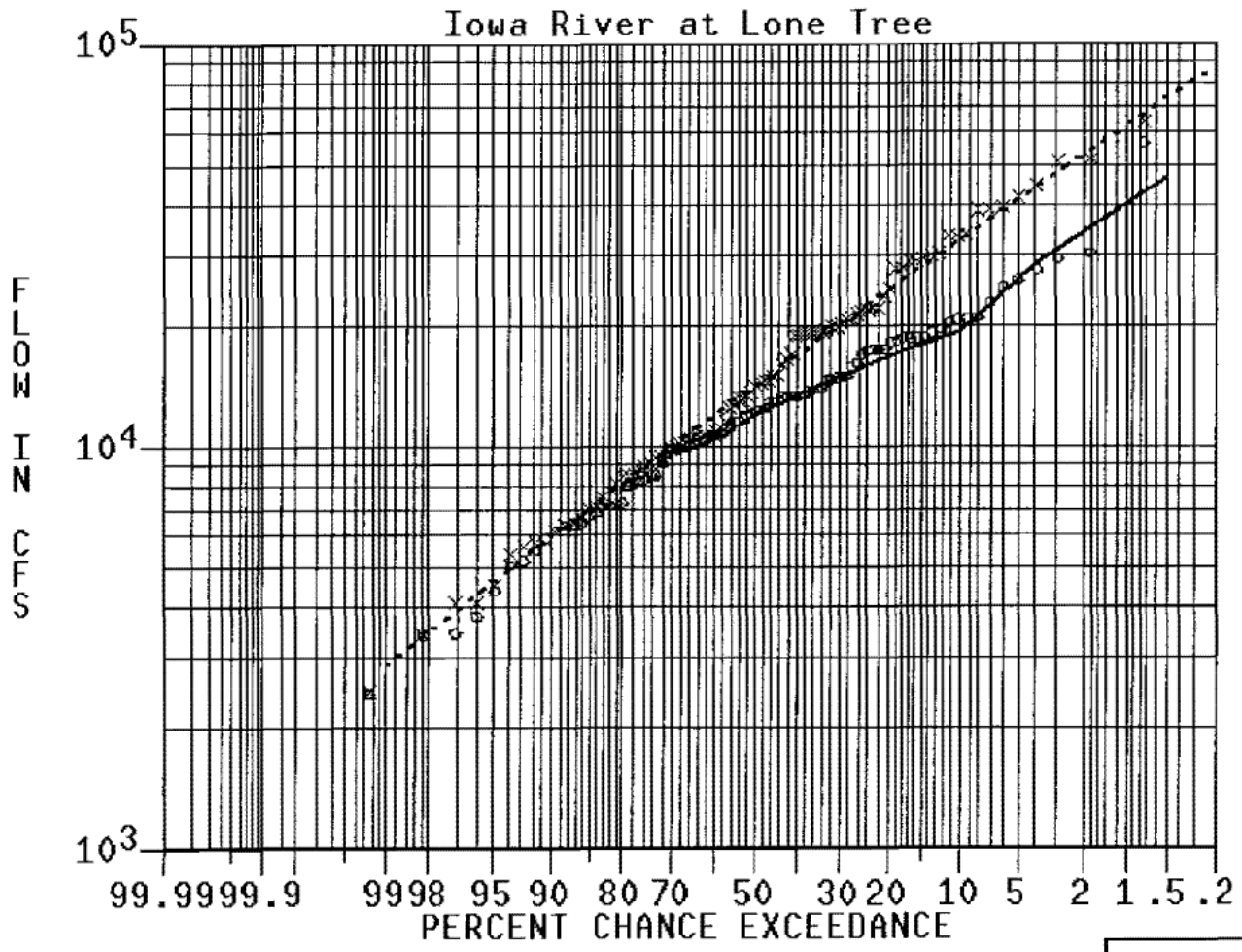


Maximum 1 Day Frequency Curve

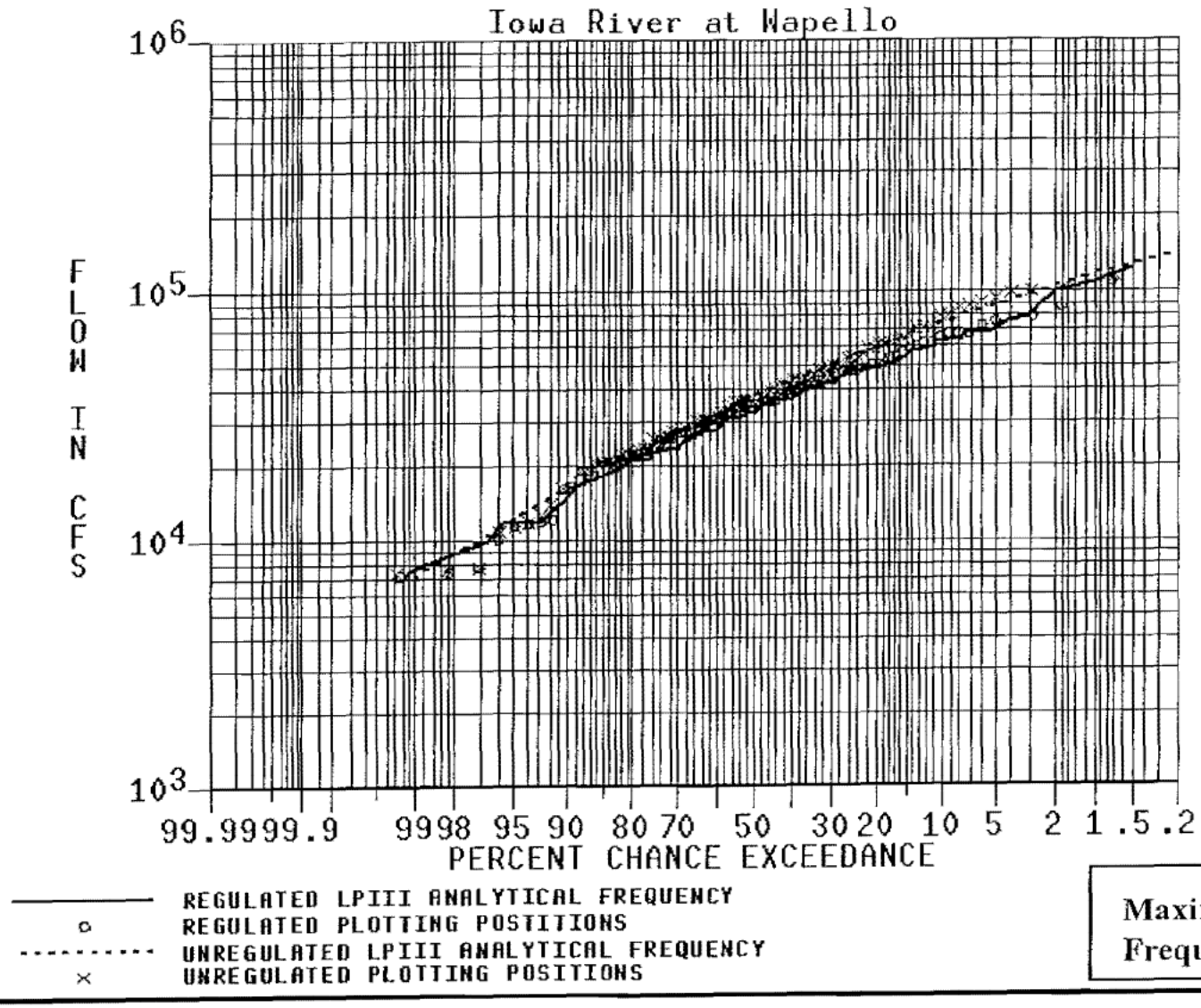


REGULATED LPIII ANALYTICAL FREQUENCY
REGULATED PLOTTING POSTITIONS
UNREGULATED LPIII ANALYTICAL FREQUENCY
UNREGULATED PLOTTING POSITIONS

Maximum 1 Day Frequency Curve



Maximum 1 Day Frequency Curve



Maximum 1 Day Frequency Curve