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January 14, 2020

VIA E-FILING

Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Subject: 1989 Field Investigations at the Bypassed Reaches of the Rumford Falls Project (FERC No. 2333)

Dear Secretary Bose:

Rumford Falls Hydro LLC (RFH), a subsidiary of Brookfield Renewable, is the licensee for the Rumford Falls Hydroelectric Project (FERC No. 2333) (Project). RFH is providing the 1989 report titled "Field Investigations at the Bypassed Reaches of the Rumford Falls Project" as requested via email dated January 8, 2020 from the Federal Energy Regulatory Commission (FERC). The provided study report was taken from the License Application filed with FERC on December 30, 1991.

The purpose of this study was to address agency comments regarding the bypassed reaches including: 1) characterization of the flows passed through the bypassed reaches, 2) characterization of the existing and potential habitat, 3) proposed changes in flow, and 4) evaluation of the need for additional releases, if any, to improve habitat for aquatic resources.

If there are any questions regarding this request, please contact me by phone at (207) 755-5613 or by email at Luke.Anderson@BrookfieldRenewable.com.

Sincerely,

Luke Anderson
Licensing Specialist
Brookfield Renewable

cc: Mr. Ryan Hansen, FERC
Ms. Ingrid Brofman, FERC

Document Accession #: 20200114-5042 Filed Date: 01/14/2020

FIELD INVESTIGATIONS AT THE BYPASSED REACHES OF THE RUMFORD FALLS PROJECT FERC NO. 2333

Prepared for:

RUMFORD FALLS POWER COMPANY
Rumford, Maine

Prepared by:

CHAS. T. MAIN, INC.
Boston, Massachusetts

July 1989

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EXECUTIVE SUMMARY

The four turbines at the Upper Station enable up to 4500 cfs to pass through the turbines before spillage occurs at the Upper Station Bypassed Reach. Based on a detailed review of River flow data from 1983 to 1987, spillage will occur over the Upper Dam on 20.8% of the days. Flow through the Upper Station Bypassed Reach will occur most frequently during April (81.3% occurrence), May (54.8% occurrence) and March (33.5% occurrence). Spillage over the Upper Dam will occur least frequently (less than 10% occurrence) during July, August, September and January.

The infrequent spillage at the Upper Dam has no adverse effect on the habitat within the Upper Station Bypassed Reach because it is unsuitable for most species of fish and invertebrates. This reach (approx. 650' long) consists of exposed bedrock over which water flows at a steep gradient when there is spillage. The few small pools that exist within this reach would be scoured of most organisms during all but the most minimal spillage events. Therefore, aquatic organisms within this reach are transient and would eventually be washed into the Middle Dam Pool.

The two turbines at the Lower Station accommodate 2900 cfs of the total river flow, along with mill process water, vs. 4500 cfs at the Upper Station. Consequently, spillage over the Middle Dam into the Lower Station Bypassed Reach occurs much more frequently than at the Upper Dam -- 45.3% of the days during the five year period examined during this study. As at the Upper Dam, spillage occurs most often during March, April and May. The frequency increases from 78.1% in March to over 90% in April and May,.

The Lower Station Bypassed Reach immediately below the Middle Dam contains a relatively long and narrow pool ranging from 3 to 15 feet in depth. The substrate consists primarily of cobbles and boulders. No evidence of large fish inhabiting this pool was observed but it is possible that this area could represent marginal habitat for fish and invertebrates. All inhabitants of this pool spill over the Middle Dam or are life-long residents, since access to this

pool from downstream habitats is blocked by steep cascades. Attempting to enhance the attractiveness of this pool as a fisheries resource is inappropriate due to the possibility of unexpected sudden Lower Station flows over the Middle Dam. Such a diversion could sweep anglers from the shoreline, since the steep rocky banks along both sides of the narrow pool would prevent hasty escape. The cascades below this large pool consist primarily of steep gradient, bedrock outcroppings, and additional spillage would not enhance this barren habitat. The downstream-most segment of this reach consists primarily of boulders and cobbles. Small fish may currently find this marginal habitat. However, increasing the spillage beyond that which currently occurs would only serve to increase the turbulence within this area and create a harsher environment.

It is concluded that there would be no benefit to increasing the frequency of spillage in the Upper Station Bypassed Reach because this entire reach represents poor habitat for aquatic organisms either with or without spillage. Similarly, increasing the frequency of spillage in the Lower Station Bypass Reach would not have any appreciable benefit to the biological community, yet would result in substantial costs due to lost generation. In addition, attempting to enhance the fisheries potential of the pool within this reach is not recommended due to safety considerations.

1.0 INTRODUCTION

1.1 BACKGROUND

Rumford Falls Power Company (RFPC), a wholly-owned subsidiary of Boise Cascade Corporation (BCC), is licensee for the Rumford Falls Project, a multi-development hydroelectric facility located on the Androscoggin River in Rumford, Maine. The project's Federal Energy Regulatory Commission (FERC) License, No. 2333, issued on 14 May 1965, expires on 31 December 1993. Pursuant to FERC regulations regarding prefiling consultation requirements, 18 CFR Section 4.38(b)(1), RFPC submitted an Initial Consultation Document (BCC 1988) for the relicensing of the project in March 1988 to appropriate federal and state agencies for review and comments. RFPC is at stage II of the relicensing process [18 CFR 4.38(b)(2)] which involves the collection of additional information and evaluation requested as by the agencies.

1.2 PURPOSE

The purpose of this report is to address agency comments regarding the bypassed reaches. The agencies requested characterization of the flows presently passed through the bypassed reaches, characterization of the existing and potential habitat, any proposed changes in flows, and an evaluation of the need for additional releases, if any, to improve habitat for aquatic resources (MDIFW 1988a, USFWS 1988a). The resultant proposed bypassed reach study plan (MAIN 1988) was submitted to and reviewed by the appropriate agencies and determined to be adequate in scope (MDIFW 1988b, USFWS 1988b). Information to enable a detailed assessment of the volume of water passed through the bypassed reaches when spillage occurs was requested by MDIFW (1988b) in response to the study plan. Consequently this report includes a more detailed flow characterization as requested.

1.3 OBJECTIVES

The aforementioned initial consultation comments were used to develop the bypassed reaches study objectives.

The objectives of the bypassed reach study are:

1. To analyze United States Geological Survey (USGS) discharge data to show durations and levels of flows experienced in the bypassed reaches;

2. To determine via habitat mapping, the quantity and quality of aquatic habitat available in each bypassed reach;

3. Using the above results, to evaluate the need for additional releases, if any, to improve habitat for aquatic resources.

2.0 STUDY AREA AND OPERATIONAL MODE

2.1 STUDY AREA

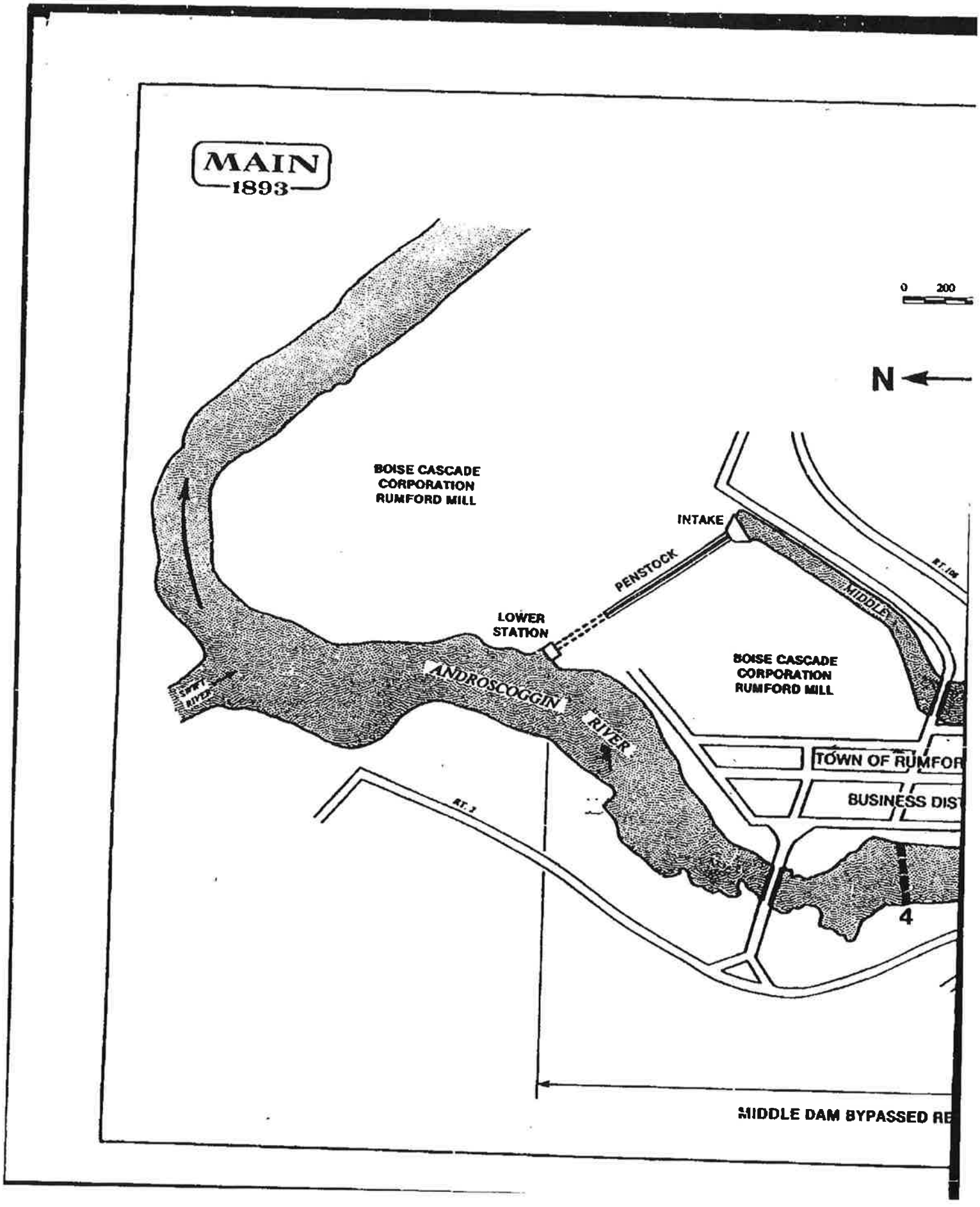
The Rumford Falls Project consists of an existing Upper Station and Lower Station hydroelectric development on the Androscoggin River at Rumford, Maine. Bypassed reaches are present below the Upper and Middle Dams as shown in Figure 2-1.

2.2 OPERATIONAL MODE

Both the Upper Station and Lower Station project works are operated as run-of-the-river plants with no appreciable water storage. The Upper Station has a small pond with a surface area of 419 acres and under normal conditions operates at an automatically controlled elevation of 601.14 feet with 30 inch break-away flash boards (elevation 601.24 feet). Normal operating water elevation for the Lower Station is 502.74 feet utilizing 12 inch flash boards at the Middle Dam. The waste weir, located in the middle canal adjacent to the head gates and Middle Dam, utilizes 10 inch flashboards for a normal operating elevation of 502.57 feet. The pond area of the Middle Dam is only 21 acres. The normal Lower Station tailwater elevation is 423.24 feet, resulting in a total drop of 178 feet at the Rumford Falls project. The drop in water elevation at the Upper and Lower Stations is 98.5 feet and 79.5 feet, respectively.

The Upper Station has four units with a capacity to utilize flow up to 4,500 cubic feet per second (cfs). There is no canal diversion of river flow at the Upper Station because the powerhouse is an integral part of the dam. Flows greater than 4,500 cfs spill over the dam.

The Lower Station has two units with a capacity to utilize flows up to 2,800 cfs. River flows up to 2,900 cfs are diverted into the middle canal. Approximately 100 cfs of the canal flow is used by Boise Cascade for mill process water. River flows in excess of 2,900 cfs spill over the Middle Dam. The canal is about 2,500 feet long and flows to a gate house (Lower Station Intake) at the end of the canal. Water flows through the gate house racks to two penstocks which lead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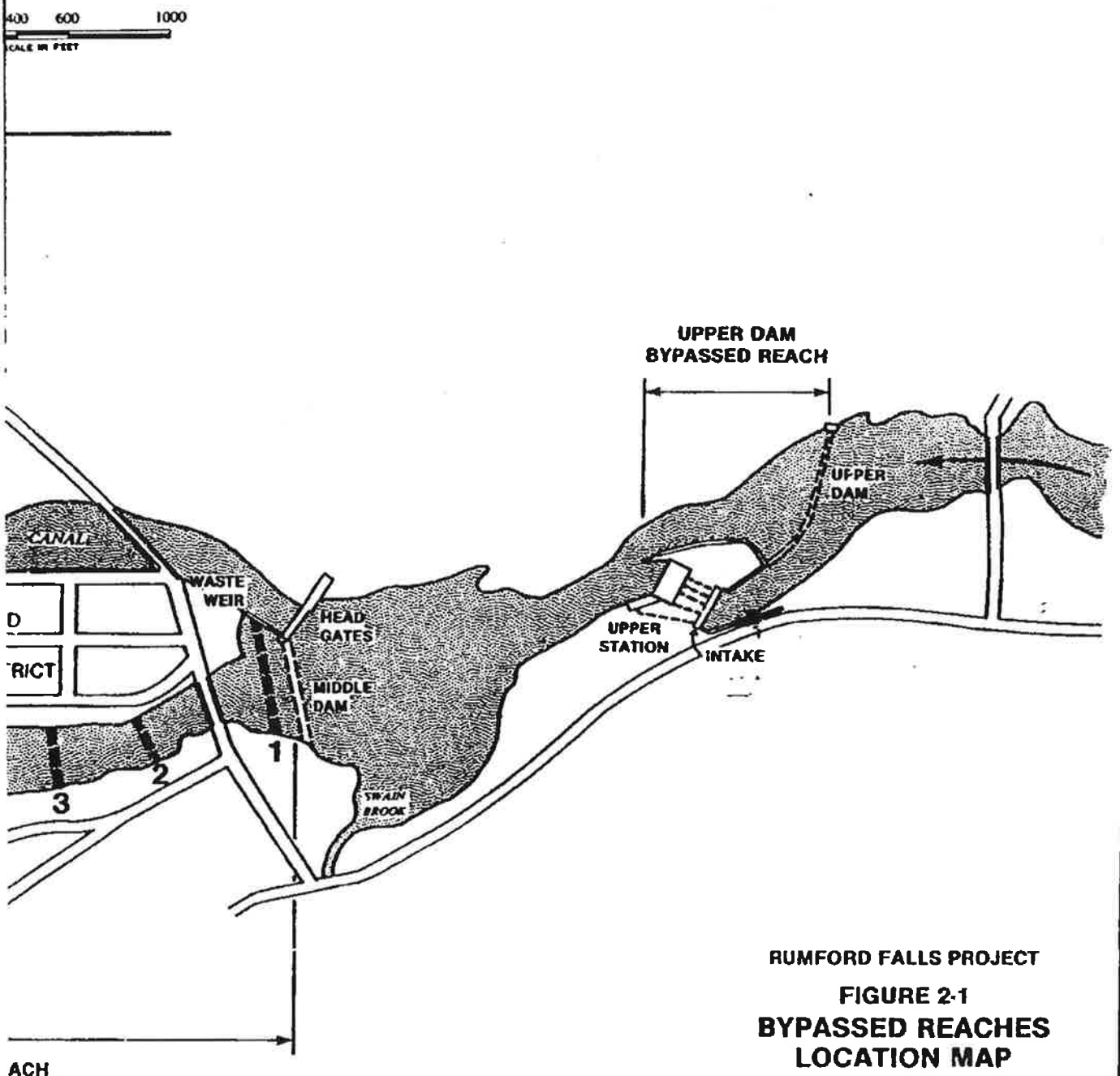

RUMFORD FALLS PROJECT

FIGURE 2-1

BYPASSED REACHES LOCATION MAP

to the Lower Station. In the event of a malfunction in the lower unit, the unit is automatically shut down and the entire river flow allowed to pass over the Middle Dam.

Upper Station flow capacity (4,500 cfs) and Lower Station flow capacity (2,800 cfs excluding mill process water) is somewhat higher than the capacities specified in the Initial Consultant Document (BCC 1988). These revised capacity values were derived from statistical comparisons conducted by Boise Cascade between the United States Geological Survey Androscoggin River discharge data from the Rumford gage with plant operational data from 1 October 1986 - 30 September 1988 (USGS 1988, 1989; Stickney 1989).

The Upper Station is manned 24 hours per day, seven days per week. A crew of maintenance specialists is also located at the Upper Station. The Lower Station is operated by remote supervisory control and is periodically inspected by the maintenance specialists. The supervisory control has an automatic headwater level control system. The station operator is responsible for optimizing the power generation by selecting the most efficient wheels for a given river flow. This is especially important during summer months when flows are at their lowest and wheels have to be shut down. Maximum head is maintained at both dams by controlling the output of the generators. This method of control ensures optimum electrical output at all times.

3.0 MATERIALS AND METHODS

3.1 BYPASS SPILLAGE CHARACTERIZATION

The characterization of spillage at the Upper and Middle Dams is based on discharge records at the USGS gaging station at Rumford over the last five available water years from 1983 to 1987 (USGS 1984-1988). The gage is located on the right bank of the Androscoggin River below the Lower Station and 1,000 feet upstream from Swift River, encompassing a drainage area of 2,069 miles.

Daily mean discharge values were compared to the Upper (4,500 cfs) and Lower Station (2,900 cfs: 2,800 cfs plant plus 100 cfs mill process water) generating capacities in order to determine the percentage of time, duration (seasonality) and volume of spillage on a monthly basis during this period.

3.2 HABITAT MAPPING

A base map of each bypassed reach showing existing aquatic habitat was prepared from observations obtained during field reconnaissance during low flow, no spillage conditions. Each bypassed reach was inspected on foot by MAIN ecologists and habitat characterizations sketched on scaled (approximate) field base maps derived from Exhibit K maps (sheets 1 and 2) presented in the Initial Consultation Document (BCC 1988). Habitat within the bypassed reaches was classified as either pool, run, riffle, cascades, or exposed. Within each habitat type, the dominant substrate (silt, sand, gravel, cobble, boulder, bedrock) was also characterized, if observable, and recorded on the base map. Significant field observations (shoreline and instream cover, aquatic plants, etc;), if any, were also recorded and retained for use in the evaluation of the aquatic resources. Cover can be provided by rocks, aquatic plants and vegetation. The habitat mapping observations were supplemented with still photo documentation (2 x 2 slides) of existing conditions.

In addition, the Middle Dam bypassed reach pool received further investigation in order to characterize the existing habitat. The Middle Dam bypassed reach

pool was waded using wet suits and substrate characterized with the aid of a face mask along four transects (Figure 2-1).

The transect width was obtained by stretching a rope from shore to shore and measuring the distance. In the deeper areas, a petite ponar grab sampler, deployed from a canoe, was used to assess the presence of silt, sand, and/or gravel at each transect. Seven water depths, at equally spaced stations (1/8, 1/4, 3/8, 1/2, 5/8, 3/4, 7/8 of the river width distance), were obtained along each transect using a weighted calibrated line in order to develop a cross-sectional profile of the pool. In order to calculate average transect river depths, the total of the seven water depth measurements were divided by eight to account for the zero depths at the stream shore where the water surface and the bank meet (Platts et al. 1983).

Measurements of temperature and dissolved oxygen (DO) were obtained to further assist in the evaluation and characterization of the aquatic habitat available. DO and temperature profiles were conducted at the four transects in the Middle Dam bypassed pool. Water quality measurements were taken near surface, mid-depth, and near bottom at a mid-channel station and at a station near each shore (1/4 transect width) at each transect. Temperature and DO were measured using a calibrated Yellow Springs Instrument (YSI) Model 57 dissolved oxygen meter with cable, probe and weighted calibrated line.

4.0 RESULTS AND DISCUSSION

4.1 BYPASS SPILLAGE CHARACTERIZATION

4.1.1 Hydrology

Flowage in the Androscoggin River is regulated primarily in the upper reaches by a series of six natural lakes and storage dams at the source of the river near the Maine - New Hampshire border. In 1909 the James River Company, Rumford Falls Power Company, International Power Company, and Union Water Power Company signed an agreement forming the Androscoggin Reservoir Company. The agreement provides for a minimum flow of 1550 cfs to be maintained at Berlin, New Hampshire which yields approximately 1600 cfs at Rumford, Maine. Flows at the Rumford Falls Project have been greater than 1600 cfs 97 percent of the time for the past fifty years because of the system regulation (BCC 1988).

The river flow cycles annually and based on the monthly flow duration curves for the Androscoggin River at Rumford has its greatest flow in April and May during the spring snow melt and subsequent run-off (BCC 1988). The lowest monthly flows typically occur during the summer months of August and September. The average discharge over the 95 year period of record from 1892 to 1987 is 3727 cfs (USGS 1988). The maximum discharge of 74,000 cfs occurred on 20 March 1936 and the minimum daily discharge of 625 cfs occurred on 27 March 1911. The 7Q10 flow based on records from 1901-1981 is 1295 cfs (personal communication, W. P. Bartlett Jr., Maine USGS, 8 March 1989).

The characterization of spillage at the Upper and Middle Dams is based on discharge records over the last five available published water years from 1983-1987 (USGS 1984-1988). The mean daily discharge for the respective water years are graphically presented in Figure 4-1. The yearly average, maximum and minimum mean daily discharge in cfs were:

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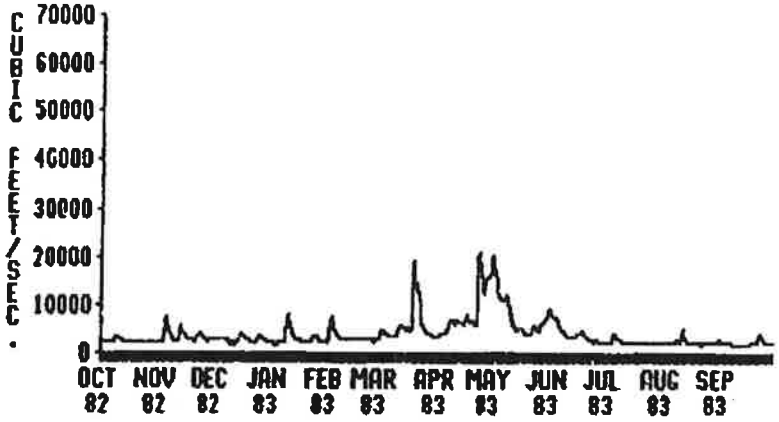

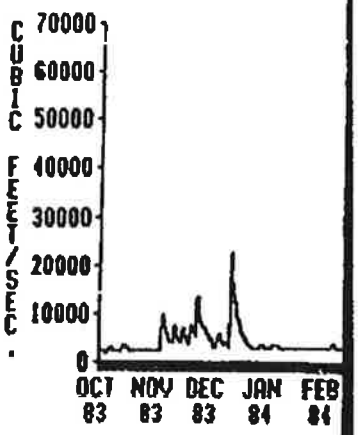

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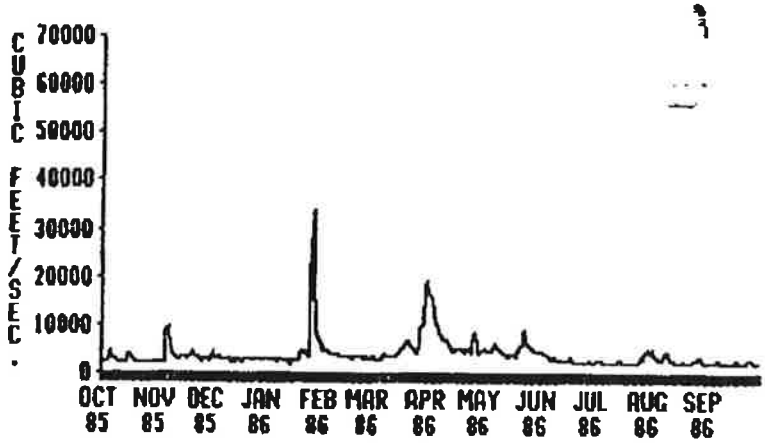

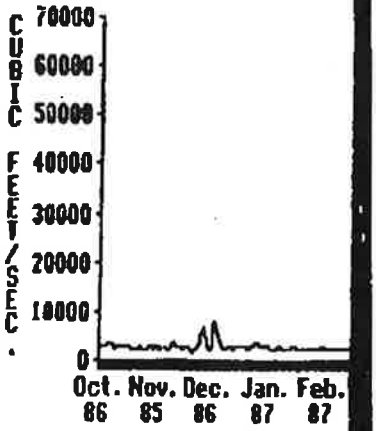

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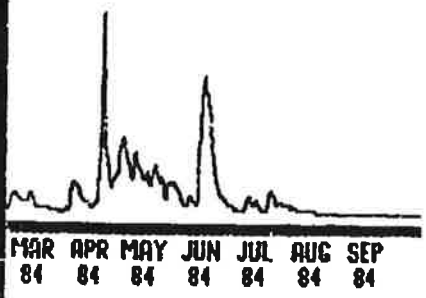

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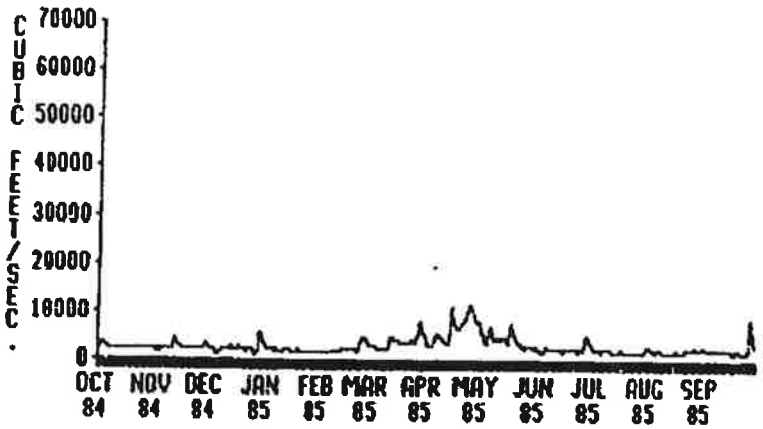

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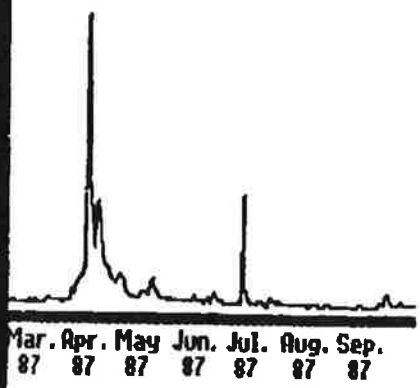

RUMFORD FALLS PROJECT

FIGURE 4-1

ANNUAL HYDROLOGY (CFS) OF THE ANDROSCOGGIN RIVER AT RUMFORD

Water Year	Yearly Average	Maximum Daily/Date	Minimum Daily/Date
1983	4,022	21,100/26 Apr. 1983	1,830/ 5 Jan. 1983
1984	5,259	44,000/6 Apr. 1984	2,040/ 4 Oct. 1984
1985	2,923	11,500/27 Apr. 1985	1,370/27 Dec. 1984
1986	3,959	33,700/28 Jan. 1986	1,910/15 Jan. 1986
1987	3,714	61,100/1 Apr. 1987	1,620/21 Nov. 1986

Three of the water years (1983, 1984, 1986) exhibited yearly averages greater than the long term average while two of the water years (1985 and 1987) exhibited yearly averages less than the long term average of 3727 cfs, respectively. The greatest flows generally occurred during April and May. The maximum daily discharge was recorded in April for four of the five water years. The minimum daily discharge occurred during the fall and winter months. The natural variations in discharge observed over the water years analyzed for the characterization of bypass spillage were considered typical in relation to long-term hydrological trends.

4.1.2 Upper Dam Bypass Spillage

Characterization of the daily bypass spillage at the Upper Dam over the last five published water years (1983-1987) is summarized in Table 4-1, illustrated in Appendix A, analyzed by month in Appendix B and tabulated in Appendix D. In general, the five year study period showed that spillage can be expected to occur at the Upper Dam 20.8 percent of the time. In a typical year this amounts to 76 days. Most of these days (57) will occur during the period March through June. Spillage occurences during this period may be characterized as frequent and coincide with the annual spring snow melt. Spillage will typically occur on 16 days throughout the period November through February. The remaining three days of spillage in a typical year will occur during the period July through October. The longest period of time without spillage during the five year study period was July 14, 1984 to November 12, 1984 (123 days). As would be expected yearly spillage trends corresponded to yearly average river discharge patterns

ranging from 40 days during 1985, the water-year with the lowest average discharge (2923 cfs), to 125 days during 1984, the water-year with the highest average discharge (5,259 cfs).

4.1.3 Middle Dam Bypass Spillage

Characterization of the daily bypass spillage at the Middle Dam over the last five published water years (1983-1987) is summarized in Table 4-2, illustrated in Appendix A, analyzed by month in Appendix C and tabulated in Appendix D. In general, the five year study period showed that spillage can be expected to occur at the Middle Dam 45.3% of the time. In a typical year this amounts to 165 days. The majority of these days (98) will occur during the period March through June. Spillage occurences during this period may be characterized as very frequent (80% of the time) and coincide with the annual spring run-off. Spillage will typically occur on 50 days throughout the period November through February. and on 17 days throughout the period July through October. The longest period of time without spillage during the five-year study period was July 30, 1984 to October 2, 1984 (65 days). As at the Upper Dam, yearly spillage trends corresponded to yearly average river discharge patterns, ranging from 27.1% or 99 days during 1985 to 63.9% or 234 days during 1984.

4.2 HABITAT MAPPING

The habitats of the Upper and Lower Station bypassed reaches were mapped on 10-12 October 1988 under low-flow, no spillage conditions. The approximate length, width, and maximum areas of each bypassed reach from bank to bank are presented in Table 4-3. The respective lengths and maximum widths were estimated from the scaled field base maps. The Lower Station bypassed reach was divided into three sections based on general habitat types (see Section 4.2.2), the sum of the sections approximating the total area.

TABLE 4-1
UPPER DAM BYPASS SPILLAGE SUMMARY
1983-1987

MONTH	WATER YEAR 1983 NO.DAYS[a]	1983 PERCENT[b]	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
OCTOBER	0	-	0	-	0	-	1	3.2	0	-	1	0.6
NOVEMBER	3	10.0	20	66.7	1	3.3	5	16.7	3	10.0	32	21.3
DECEMBER	0	-	11	35.5	2	6.5	1	3.2	3	9.7	17	11.0
JANUARY	3	9.7	0	-	0	-	7	22.6	0	-	10	6.5
FEBRUARY	2	7.1	12	41.4	1	3.6	4	14.3	0	-	19	13.5
MARCH	17	54.8	9	29.0	5	16.1	14	45.2	7	22.6	52	33.5
APRIL	25	83.3	27	90.0	19	63.3	28	93.3	23	76.7	122	81.3
MAY	26	83.9	24	77.4	9	29.0	20	64.5	6	19.4	85	54.6
JUNE	7	23.3	16	53.3	1	3.3	2	6.7	1	3.3	27	18.0
JULY	0	-	6	19.4	0	-	2	6.5	0	-	8	5.2
AUGUST	1	3.2	0	-	0	-	2	6.5	0	-	3	1.9
SEPTEMBER	0	-	0	-	2	6.7	0	-	2	6.7	4	2.7
TOTAL	84	23.0	125	34.2	40	11.0	86	23.6	45	12.3	380	20.8

[a] Number of days with spillage in month, water year or total study period of 1826 days.

[b] Percentage of days with spillage in month, water year or total study period of 1826 days.

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TABLE 4-2
MIDDLE DAM BYPASS SPILLAGE SUMMARY
1983-1987

MONTH	WATER YEAR 1983 NO.DAYS[a]	1983 PERCENT[b]	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
OCTOBER	2	6.5	3	9.7	2	6.5	5	16.1	7	22.6	19	12.3
NOVEMBER	16	53.3	26	86.7	4	13.3	18	60.0	10	33.3	74	49.3
DECEMBER	8	25.8	29	93.5	3	9.7	14	45.2	15	48.4	69	44.5
JANUARY	7	22.6	16	51.6	1	3.2	17	54.8	0	-	41	26.5
FEBRUARY	11	39.3	26	89.7	4	14.3	28	100.0	0	-	69	48.9
MARCH	30	96.8	25	80.6	21	67.7	30	96.8	15	48.4	121	78.1
APRIL	30	100.0	30	100.0	28	93.3	30	100.0	30	100.0	148	98.7
MAY	31	100.0	31	100.0	26	83.9	31	100.0	23	74.2	142	91.6
JUNE	22	73.3	27	90.0	4	13.3	16	53.3	10	33.3	79	52.7
JULY	2	6.5	21	67.7	1	3.2	5	16.1	4	12.9	33	21.3
AUGUST	4	12.9	0	-	1	3.2	13	41.9	0	-	18	11.6
SEPTEMBER	3	10.0	0	-	4	13.3	2	6.7	5	16.7	14	9.3
TOTAL	166	45.5	234	63.9	99	27.1	209	57.3	119	32.6	827	45.3

[a] Number of days with spillage in month, water year or total study period of 1826 days.

[b] Percentage of days with spillage in month, water year or total study period of 1826 days.

TABLE 4-3

MAXIMUM AREAS (BANK TO BANK) OF RUMFORD FALLS PROJECT BYPASSED REACHES, ANDROSCOGGIN RIVER

SITE	APPROX. LENGTH (ft)	MAXIMUM WIDTH (ft)	DESCRIPTION	AREA[a] (ft^2)	TOTAL AREA[a] (ft^2)
Upper Station	650	300 55	Upper Dam Junction with tailwater	123,340	123,340
Lower Station	1400	300	Middle Dam to natural cascades (Middle Dam bypassed reach pool)	310,000	
	1000	300	Natural cascades to boulder field	269,600	
	465	400	Boulder field to junction with tailwater	244,000	823,600

[a] Areas determined by using a planimeter.

4.2.1 Upper Station (Upper Dam) Bypassed Reach

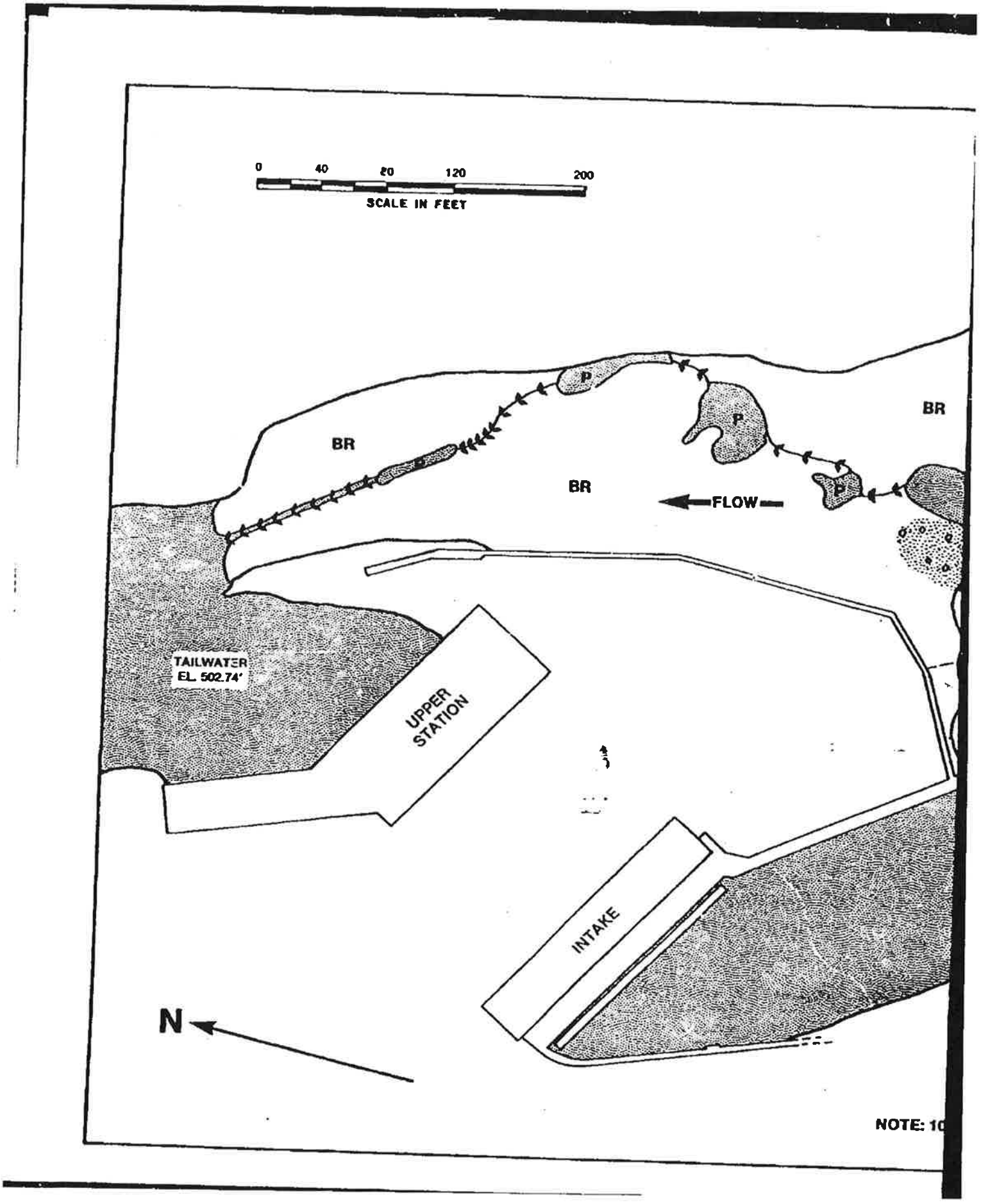
The habitat of the Upper Station bypassed reach mapped during no spillage conditions is shown in Figure 4-2. The bypassed reach is essentially all exposed bedrock, encompassing one of the two large areas of cascades within this area of the river historically known as Rumford Falls.

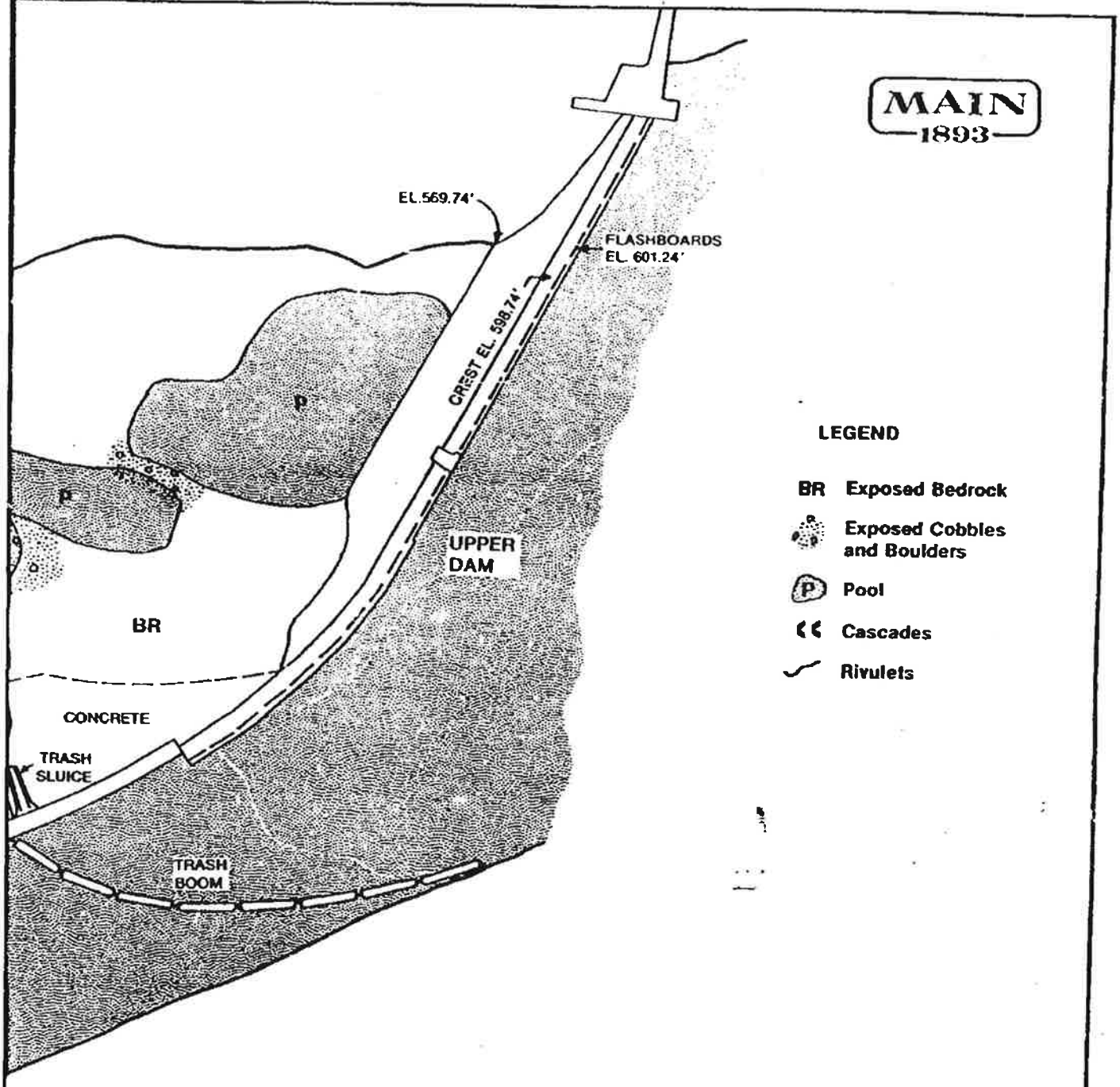
In the upper section of this reach, there exist two small pools that are partially separated by bedrock and exposed cobble and boulder outcrops. The largest pool is immediately below the dam. The midsection of this bypassed reach consists of a series of smaller pools joined together by narrow, shallow rivulets over bedrock. The lower end of the bypassed reach exhibits the steepest gradient and consists of a series of cascades separated by a narrow pool. The water plunges approximately 15-20 feet from the tail of this pool to its junction with the tailwater of the Upper Station.

The substrate overlying the bedrock river bottom of this bypassed reach, when present, is limited to cobbles and boulders. Instream cover is rated as poor to none (bedrock only) and no aquatic macrophytes (plants) were observed. No fish were noted in the bypassed reach except within the pool adjacent to the spillway where a school of minnows (approximately 50 to 100, 1 1/2 to 2 1/2 in. long) was observed in a backwater area.

4.2.2 Lower Station (Middle Dam) Bypassed Reach

The habitat of the Lower Station bypassed reach mapped during no spillage conditions is shown in Figure 4-3. The bypassed reach is partitioned into three general habitat areas as indicated in Table 4-3: 1) the longest is the Middle Dam bypassed reach pool which extended from the spillway to the start of the natural cascades area; 2) the second longest is the natural cascades area that extended from the downstream end of the Middle Dam bypassed reach pool past Memorial Bridge, to the base of the natural cascades at the start of the 'boulder field; and 3) the 'boulder field' area which extended from the base of the natural cascades to its junction with the tailwater of the Lower Station.


0 40 80 120 200
SCALE IN FEET
BR
BR
BR
P
P
P
FLOW
TAILWATER
EL. 502.74'
UPPER
STATION
INTAKE
N
NOTE: 1

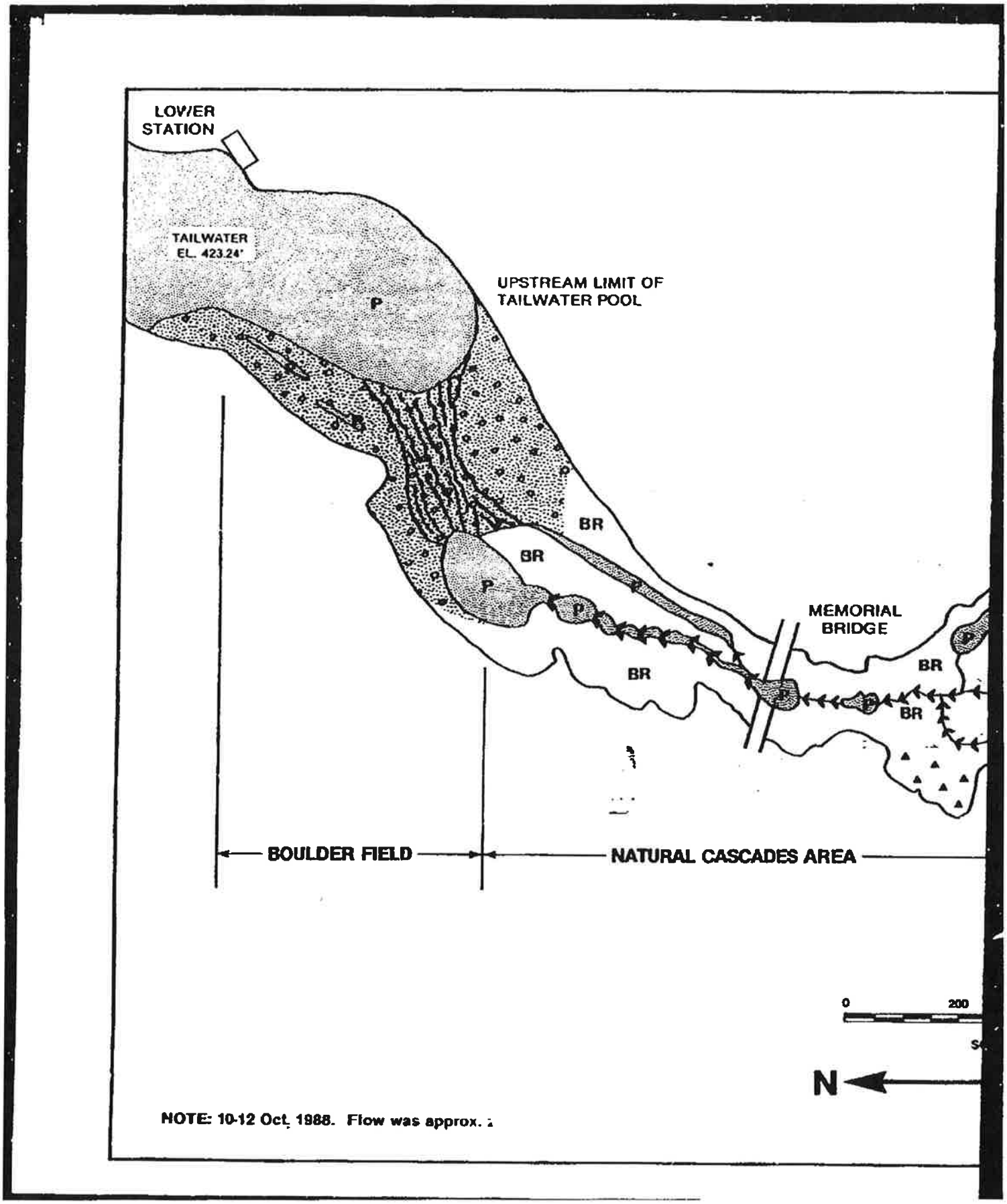


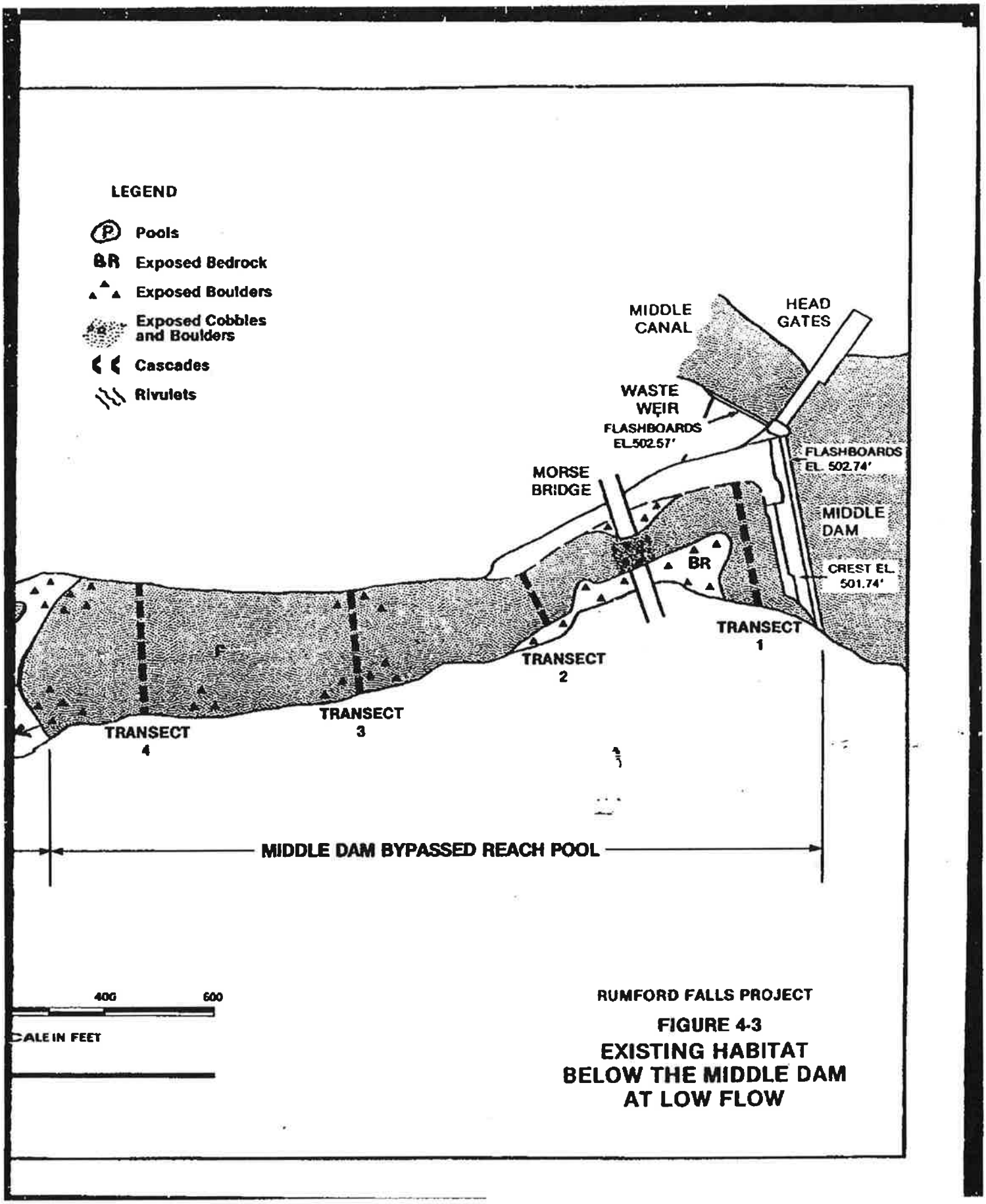
RUMFORD FALLS PROJECT

FIGURE 4-2

EXISTING HABITAT BELOW THE UPPER DAM AT LOW FLOW

12 Oct. 1988. Flow was approx. 2600 cfs.


LOWER STATION
TAILWATER EL. 423.24'
P
UPSTREAM LIMIT OF TAILWATER POOL
BR
BR
P
P
MEMORIAL BRIDGE
BR
BR
BR
P
P
BOULDER FIELD
NATURAL CASCADES AREA
0
200
N
NOTE: 10-12 Oct. 1988. Flow was approx.


LEGEND
P Pools
BR Exposed Bedrock
Exposed Boulders
Exposed Cobbles and Boulders
Cascades
Rivulets
MIDDLE CANAL
HEAD GATES
WASTE WEIR
FLASHBOARDS EL.502.57'
FLASHBOARDS EL. 502.74'
MORSE BRIDGE
MIDDLE DAM
CREST EL. 501.74'
BR
TRANSECT 1
TRANSECT 2
TRANSECT 3
TRANSECT 4
MIDDLE DAM BYPASSED REACH POOL
400
600
CALE IN FEET
RUMFORD FALLS PROJECT
FIGURE 4-3
EXISTING HABITAT BELOW THE MIDDLE DAM AT LOW FLOW

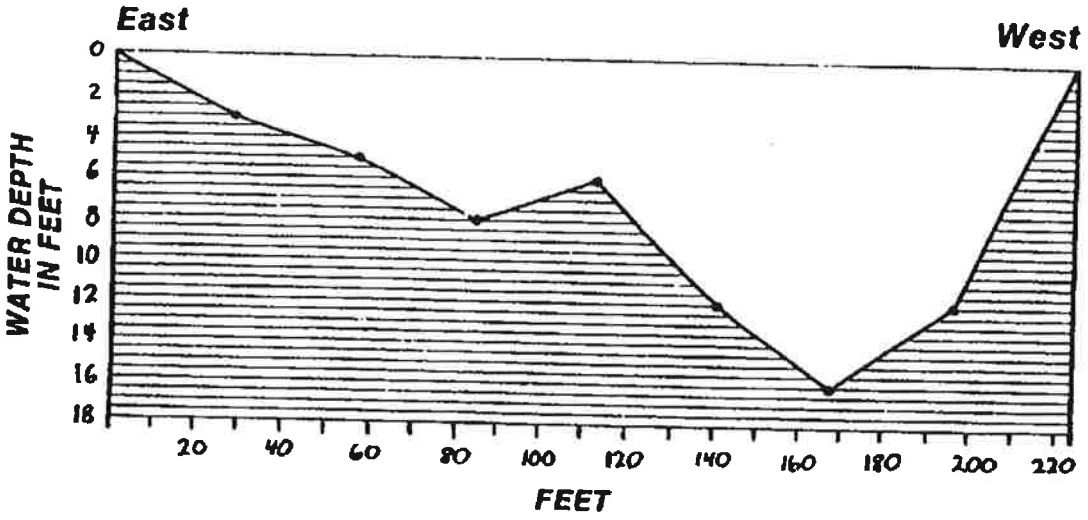
The boulder field is primarily riffle habitat, although there is a plunge pool at the base of the cascades which form the upstream limit of this segment of the bypassed reach. The downstream limit of this segment is the Lower Station tailwater pool, which extends into the center of the boulder field. The dominant substrate, boulders along with some cobble, overlays a bedrock base. Instream cover is rated fair to poor and no aquatic macrophytes or fish were observed. Gravel bars are not present within the riffle section.

The natural cascades area consists of exposed bedrock and large boulder outcrops interspersed with cascades and pools. The largest pool within this section is located at the base of the sloped bedrock outcropping. The substrate overlying the bedrock river bottom of this high gradient natural cascades area, when present, is limited to cobbles and boulders. Instream cover is rated as poor to none (bedrock only) and no aquatic macrophytes or fish were observed during the field reconnaissance.

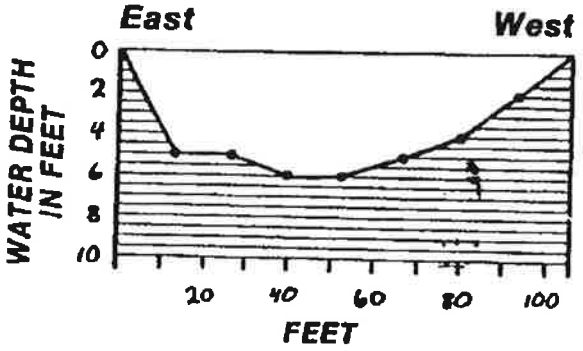
As noted in Section 3.2, the Middle Dam bypassed reach pool received further habitat investigation. The pool is divided into two basins, the upper basin (Transect 1) or plunge pool located immediately below the Middle Dam spillway and extending to Memorial Bridge, and the lower basin (Transects 2-4) or main pool extending from Memorial Bridge to the start of the natural cascades area (Figure 4-3). The pool basins are connected by a narrow (50 ft wide) and shallow (1-2 ft deep) section located in the vicinity immediately below Memorial Bridge. Water depth is highly variable due to the exposed cobbles and boulders that penetrated the water surface throughout the Middle Dam bypass pool including the constricted region between the basins. Cross-sectional profiles at the representative transects (Figure 4-4) indicate that the maximum depth ranges from 6 feet (Transect 2) to 15 feet (Transect 1). Average river depths at transects 1-4 is 7.8, 4.1, 6.0, and 5.4 feet, respectively.

The dominant substrate overlying the bedrock river bottom at all transects consists of boulders with lesser amounts of cobble. Sand is present in the near shore area of Transect 3 along the east bank where a municipal storm drain is located. Underwater visibility was limited to about 1 to 2 feet at the time of

Transect #1

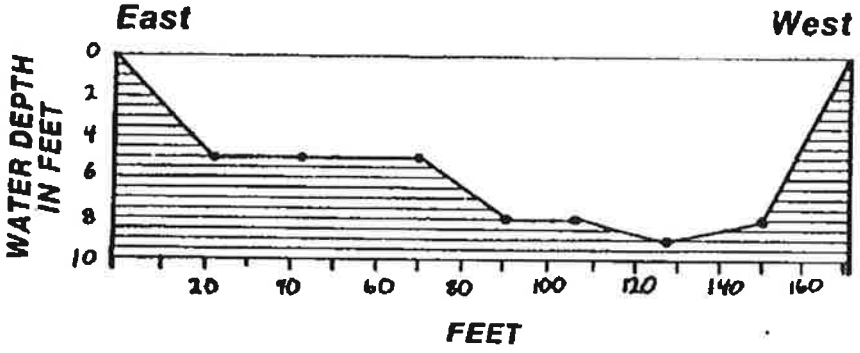


Transect #2

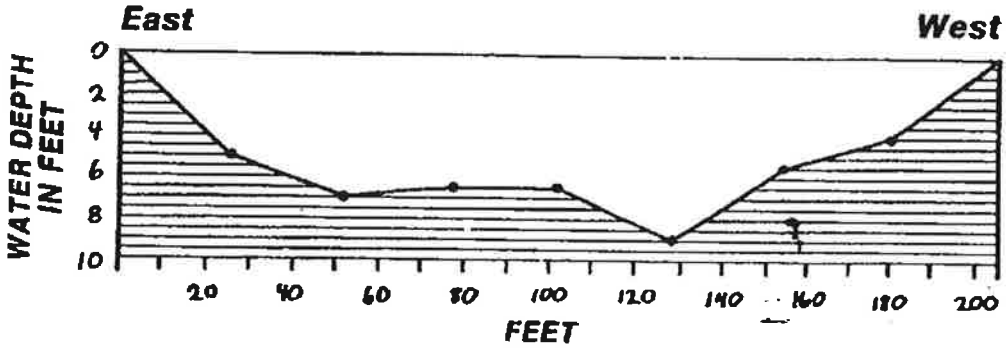


NOTE: See Figure 4-2 for Transect Locations

Transect #3



Transect #4



RUMFORD FALLS PROJECT

FIGURE 4-4

REPRESENTATIVE LOW FLOW PROFILES
MIDDLE DAM BYPASS REACH POOL
11 OCTOBER 1988

AIN
393

the survey. No fish were observed along the transects except for some minnows along the east bank of Transect 4. No aquatic macrophytes were noted. Instream cover is rated as fair as a result of the varied bottom topography due to the presence of cobbles and boulders throughout the entire pool. Terrestrial cover is limited by the rocky shorelines bordering the pool.

Temperature and dissolved oxygen (DO) were measured at three stations along four transect in the Middle Dam bypassed pool on 11 October 1988 between 0945 and 1130 hours under 100% cloud cover and during intermittent rain. River flow was approximately 2700 cfs (USGS 1989) and no spillage was observed over the Middle Dam flashboards during the recording of the measurements.

Temperature and DO values measured during this survey are presented in Appendix E. Temperatures and DO were relatively consistent among all transect, stations and sample depths, ranging from 8.8 to 9.3°C and 10.8 to 11.0 mg/l DO, respectively. DO saturation ranged from 95 to 98% among transect stations.

4.3 BYPASS HABITAT EVALUATION

Historically, Rumford Falls was a barrier to upstream movement of fish (MDIFW 1988a). The Rumford Falls Project, located over 80 river miles above tidewater, was the historic upstream migration limit for Atlantic salmon on the main stem of the Androscoggin River (MDMR 1988). Lewiston Falls, located approximately 58 river miles below Rumford Falls and 22 miles above tidewater, was the upstream migration limit on the main stem Androscoggin for American shad, alewife, and other anadromous fish species, with the exception of Atlantic salmon (MDMR 1988). The Rumford Falls Project has been part of the Rumford, Maine environment for 97 years. Rumford Falls Power Company does not at this time envision a change in project works or mode of operation (BCC 1988). Thus, no changes in flows are proposed. Both the Upper and Lower Station project works are operated as run-of-the river plants with no appreciable water storage (see Section 2.2). Since the operating mode is run-of-the-river, the request for the prescribed instantaneous Aquatic Base Flow (ABF) of 1,034 cfs (0.5 CFSM or historical unregulated median August flow) or inflow to the project impoundments, whichever

is less, should be accommodated downstream of the project (ASRSC 1988, MDIFW 1988a, MDMR 1988, USEPA 1988, USFWS 1988a).

However, the bypassed reaches do not receive continuous flows when river discharge (inflow) is less than the respective station capacities (see Section 4.1). This evaluation will focus on whether additional flow requirements over what the bypassed reaches presently receive are warranted to protect/improve the existing and potential habitat of these stream reaches.

4.3.1 Upper Station Bypassed Reach Habitat Evaluation

The physical habitat of the Upper Station bypassed reach during low flow conditions is essentially all exposed bedrock, encompassing one of the two large areas of natural cascades within this area of the River. The other large area of natural cascades is located within the Lower Station bypassed reach. Bedrock is generally considered to be poor quality habitat for aquatic life, especially macroinvertebrates and fish. The natural cascades area acts as a barrier to upstream movement of resident fish from the 21 acre Middle Dam Impoundment. Therefore, recruitment of fish to this area must be from upstream sources and over the Upper Dam during spillage.

The several small pools that exist within this bypassed reach represent marginal fish habitat, at best. It is likely that for the few fish that may inhabitat these pools, food is a limiting factor, due to the paucity of suitable macroinvertebrate habitat. Because of the isolated nature of the pools (most are separated by cascades) food that may be present in one pool may not be available to organisms in another pool. Since most of the pools are small, space also limits the size of fish and macroinvertebrate populations that could inhabitat these pools. The exposed nature of the pools and relatively shallow depth (most are no deeper than three feet) would make the water within them susceptible to extreme daily temperature fluctuations, especially during the summer. Therefore, these pools are not suited for most species of fish. When spillage does occur, it is likely that it serves to flush nearly all organisms within these pools downstream into the Middle Dam pool.

It is concluded that under the present flow regime those few organisms that may inhabitat the Upper Station bypassed reach are transitory in nature and will eventually be swept downstream. Introducing a spillage regime that would create spillage when presently there is none would serve no positive biological purpose and would actually eliminate those few small pools that may presently serve as marginal habitat for limited quantities of minnows and perhaps invertebrates.

4.3.2 Lower Station Bypassed Reach Habitat Evaluation

The Lower Station Bypassed Reach represents an area of more habitat diversity than that found within the Upper Station Bypassed Reach. Approximately half of the linear distance of this bypassed reach consists of a relatively long and narrow pool which extends from the base of the Middle Dam to an area of cascades at the downstream limits of this pool. This pool is relatively deep (up to 15 feet in places) and the presence of boulders and cobbles does offer potential cover for fish and invertebrates. The cascades form an effective barrier to any fish moving upstream into this pool. Therefore, fish would enter this pool by being washed over the Middle Dam during periods of spillage.

Although the Middle Dam Bypassed Reach Pool may presently offer suitable habitat for certain species of fish both with and without spillage, it does not represent a habitat in which development of fishery should be encouraged. There are steep, rocky slopes on both sides of this pool, making angler access to this pool difficult. This situation could be dangerous in the event of unexpected sudden flows over the Middle Dam with little advance warning. A sudden rise in water level could imperil anglers since the steep and rocky slopes would restrict escape along both banks of the pool and could result in tragic consequences. Besides hampering angler access, the steep slopes also serve to limit the amount of additional habitat that could be gained if a Middle Dam spillage regime other than that which is presently in place, were to be implemented.

The area of cascades below the Middle Dam Bypassed Reach Pool, represents poor habitat for fish and invertebrates for the same reason that the entire Upper Dam Bypassed Reach represents poor habitat. Steep gradient, exposed bedrock, aquatic

environments are not suitable for most species of plants and animals. The small pool at the base of the cascades may contain some transient fish and/or invertebrates (even through none were observed). These organisms, if present, would probably be washed downstream during periods of Middle Dam spillage.

Habitat within the "boulder field" can be characterized as marginal for most fish and invertebrate species. Under certain conditions of Middle Dam spillage, fish may be able to move from the Lower Station tailrace pool into the spaces between cobbles and boulders. However, high flow conditions would restrict this type of movement because of turbulence. Low flow conditions would restrict movement into the boulder field to relatively small fish due to shallow water (generally only several inches deep). Under the existing flow regime, it is possible that some small fish (such as minnows and darters) and invertebrates may reside within this segment of the Middle Dam Reach. During periods of Middle Dam spillage, refuge from severe turbulence may be found on the downstream side of boulders as well as close to the River banks where turbulence would not be as severe. During periods of little or no Middle Dam spillage, fish and invertebrates within the boulder field are probably better able to forage for food in scour pools and other areas of quiet water. It is, therefore, concluded that although organisms inhabiting the boulder field have undoubtedly adapted to tolerating periods of high flow, modifying the present bypass reach flow regime to require Middle Dam spillage where presently there is none would not serve a beneficial biological purpose.

5.0 SUMMARY AND CONCLUSIONS

The existing flows through the Upper Station and Lower Station Bypassed reaches were characterized by using USGS discharge data from 1983 to 1987 in conjunction with Upper and Lower Station flow capacities. River and bypassed reach flows during this period are likely to be representative of future conditions. Spillage occurs most frequently over the Middle Dam, since the Lower Station (along with mill process water) accommodates a total of 2900 CFS of River flow. The four turbines at the Upper Station can utilize up to 4500 CFS of the total River flow, resulting in less frequent spillage over the Upper Dam.

Based on the five years of River discharge data that was examined in detail, the greatest flows generally occur during April and May. Consequently, this is when spillage is most likely to occur. Minimum River flows occur during the summer and winter months.

Spillage at the Upper Dam occurred on 20.8% of the days within the five year period based on mean daily flow data. During April, spillage occurred on an average of 81.3% of the days, tapering off to 54.8% in May and 33.5% during March. Spillage occurred on less than 10% of days evaluated during July, August, September, October and January.

As indicated above, spillage occurred more often at the Middle Dam - 45.3% of the days during the five year study. Spillage occurred on over 90% of the days during both April and May and 78.1% during March. Similar to the Upper Dam, spillage occurred the least number of days (from 9.3 to 26.5%) during July, August, September, October and January.

The relative infrequency of spillage at the Upper Dam will not have an adverse affect on the habitat within the Upper Dam bypassed reach because this habitat is, for the most part, unsuitable for fish and invertebrates. It consists mostly of bedrock cascades of such a gradient that habitation by such organisms would be virtually impossible. There are several small pools within this bypassed reach, at least one of which contains minnows. However, organisms inhabiting

these pools are more than likely transitory and during periods of spillage, probably washed into the Middle Dam Pool. Additional spillage beyond that which presently occurs at the Upper Dam would not be appropriate.

The Lower Station Bypassed Reach immediately below the Middle Dam contains a relatively long and narrow pool ranging from 3 to 15 feet in depth. This comparatively long and narrow pool offers the most likely habitat for fish and invertebrates within this reach even though no evidence of large fish was observed during the habitat mapping survey. Fish can only enter this pool by spilling over the Middle Dam because of the effective barrier below the pool. Spillage over the Middle Dam occurs more frequently than at the Upper Dam. However, promoting the use of this pool as a fisheries resource for anglers is not recommended because of the possibility of a sudden and unexpected increase in flow over the Middle Dam. The resultant flow could imperil anglers since the steep, rocky slopes would restrict escape along both banks of this pool. The steep gradient cascades that are the downstream border of the pool offer little habitat for most organisms. What little habitat that does exist in this segment for aquatic organisms is found in a pool at the base of the cascades. However, increasing the flow water within this segment beyond that which presently occurs would not enhance this environment. The downstream-most segment of this reach is a boulder field which presently may serve as limited habitat for small fish. Increasing the frequency and volume of flow within this segment is not recommended since it would create turbulent conditions which would reduce the suitability of this segment to accommodate small fish and restrict the movement of larger fish from the tailwater pool into this segment.

In conclusion, the Upper Dam Bypassed Reach offers virtually no habitat for fish either with or without spillage. It would be difficult to defend a decision to increase the spillage over the Middle Dam to a frequency greater than the present approximately 50% occurrence. The cost of lost generation revenue that would be incurred by spilling will not result in any appreciable benefit to the biological community.

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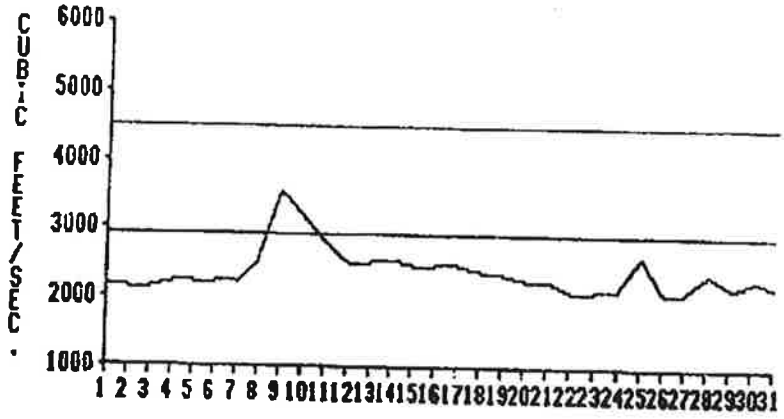
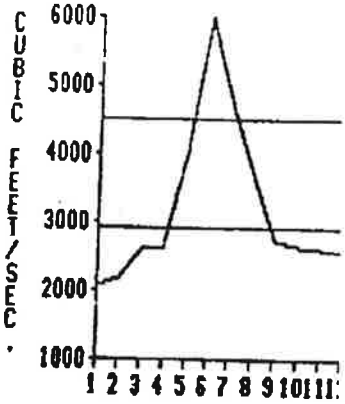
APPENDIX A

OCT. 82





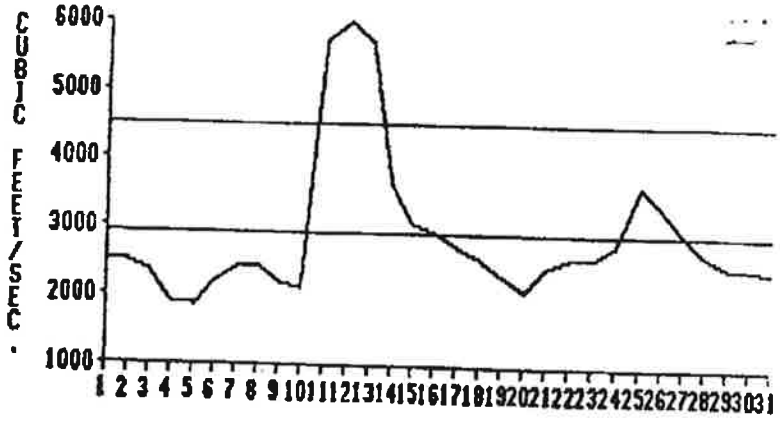
RUMFORD F

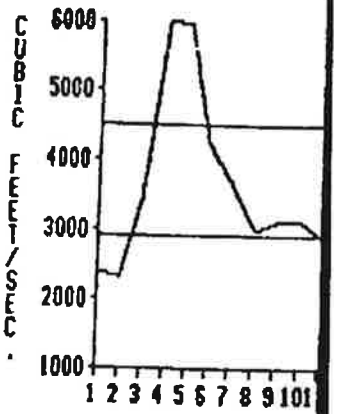
APPENDIX A

BYPASS MONTHLY SPILLAGE (CFS

NOTE: Spillage over the Upper Dam occurs when river
when river flow exceeds 2900 CFS. For graphic
Refer to Appendix A for actual spillage by mon

JAN. 83





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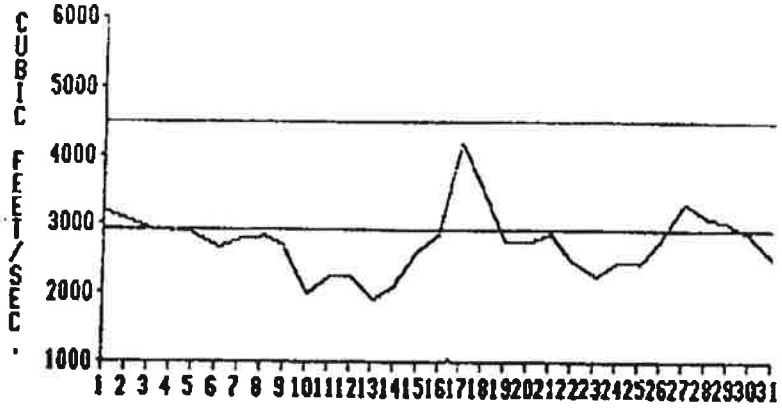

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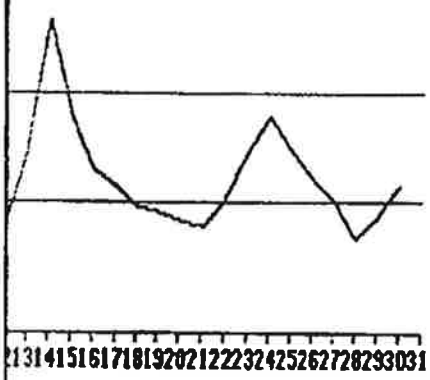


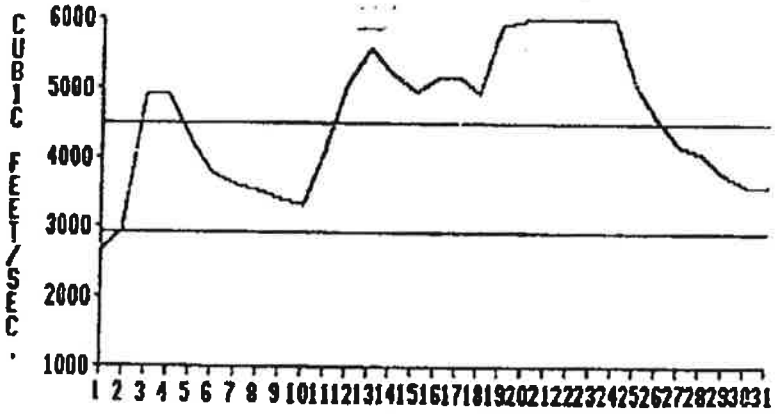
ALLS PROJECT

1982 - 1983 Page 1

S) AT THE UPPER AND MIDDLE DAMS

flow exceeds 4500 CFS. Spillage over the Middle Dam occurs
presentation, river flows have been capped at 6000 CFS.
th.

MAR. 83



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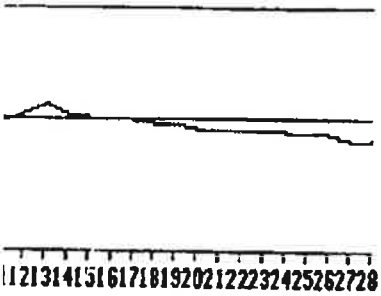

MAIN
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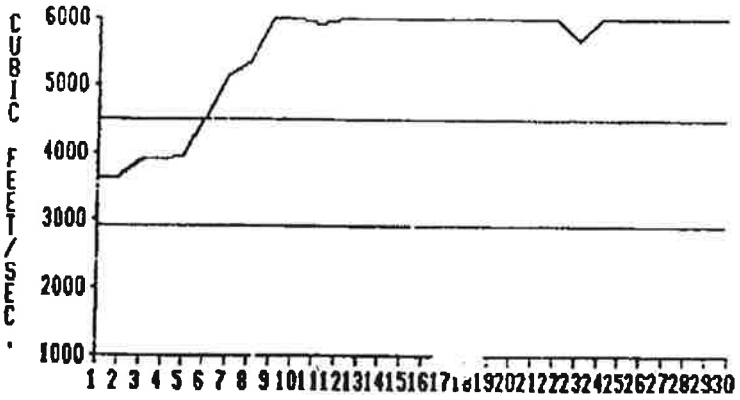
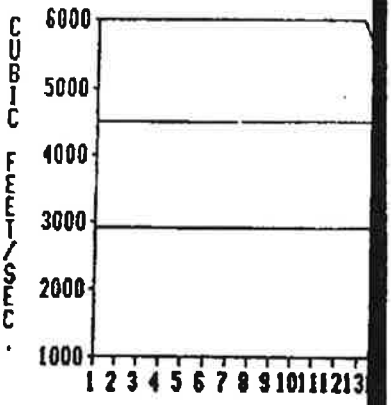
APR. 83





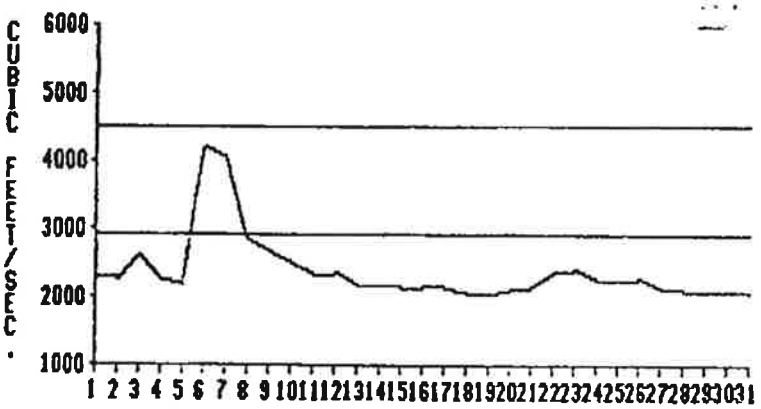
RUMFORD F

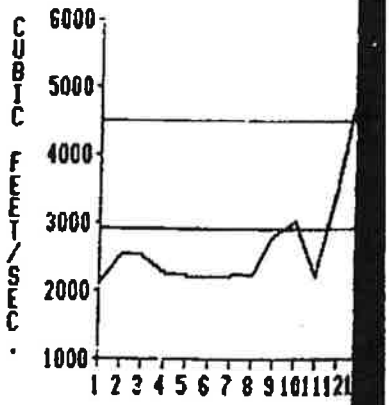
APPENDIX A

BYPASS MONTHLY SPILLAGE (CFS

NOTE: Spillage over the Upper Dam occurs when river
when river flow exceeds 2900 CFS. For graphic
Refer to Appendix A for actual spillage by mon

JUL. 83





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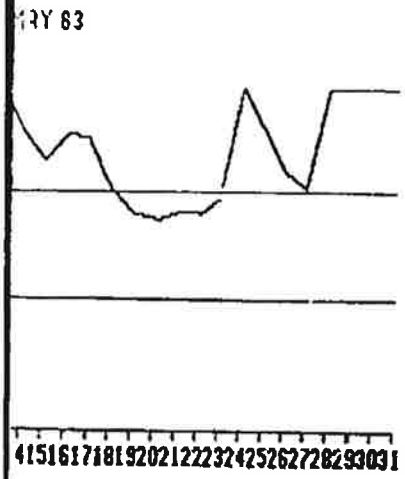
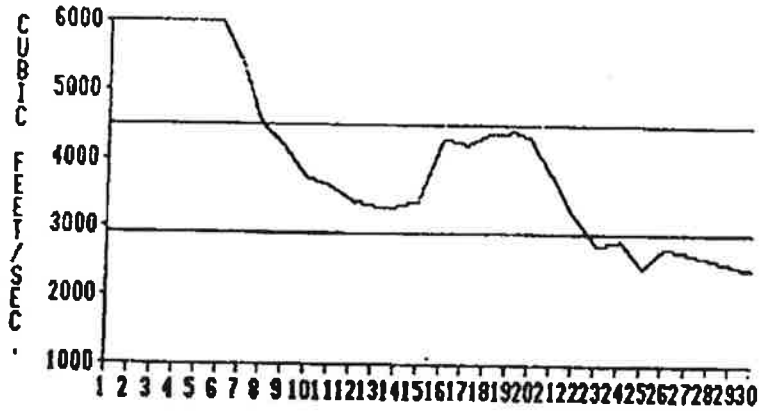




ALLS PROJECT

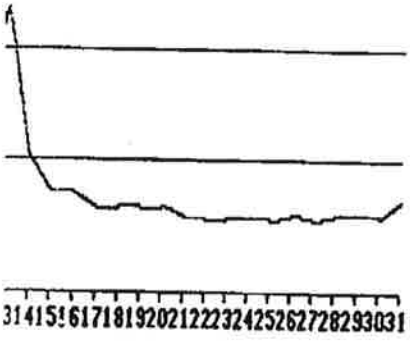
1982 - 1983 Page 2

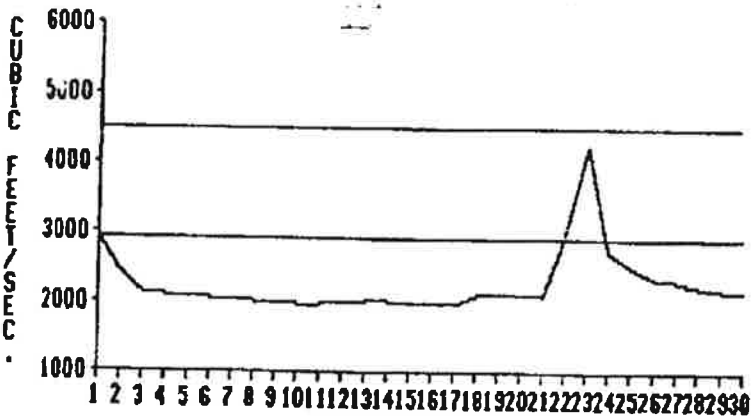
S) AT THE UPPER AND MIDDLE DAMS

flow exceeds 4500 CFS. Spillage over the Middle Dam occurs
presentation, river flows have been capped at 6000 CFS.
th.

SEPT. 83

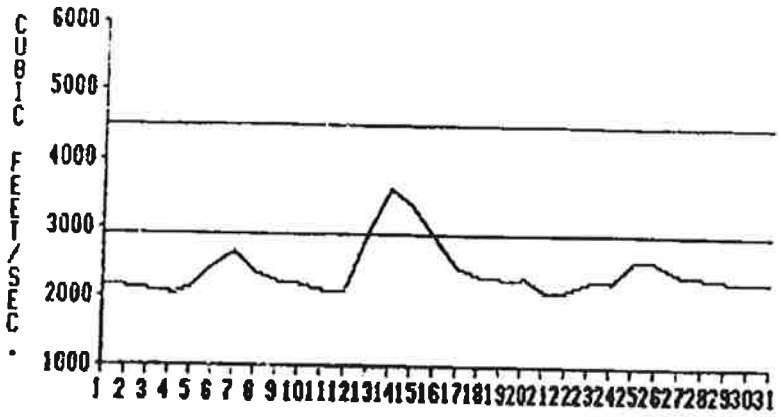
AUG. 83

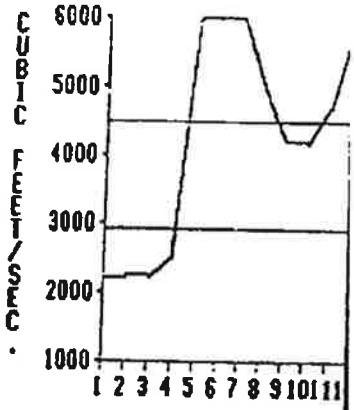




MAIN
1893

OCT. 83





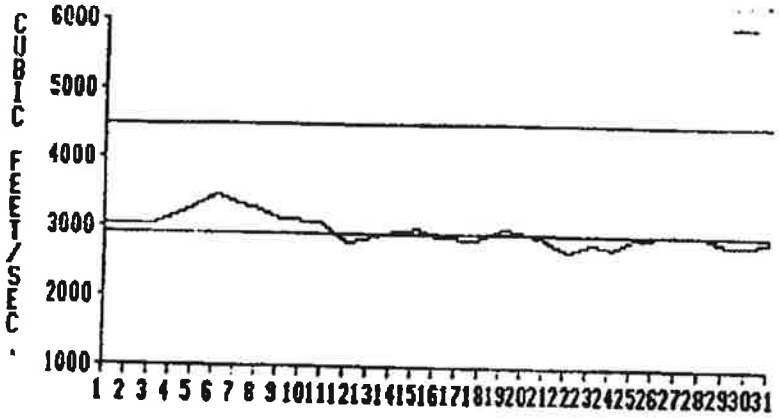
RUMFORD

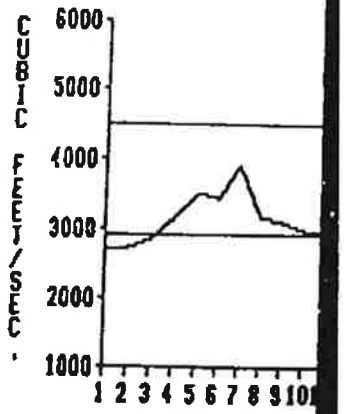
APPENDIX A

BYPASS MONTHLY SPILLAGE (CF

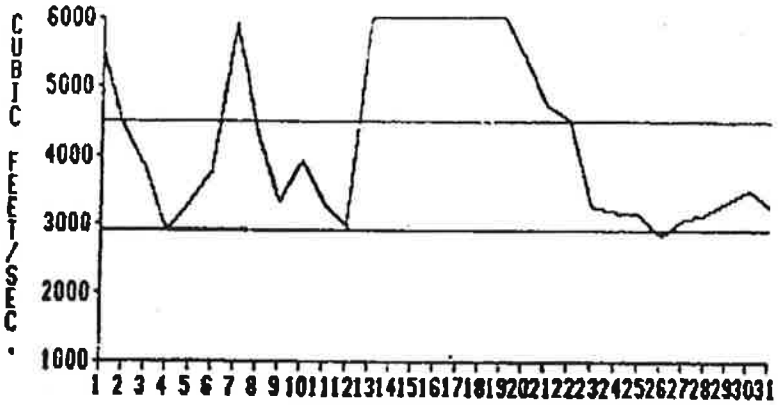
NOTE: Spillage over the Upper Dam occurs when river
when river flow exceeds 2900 CFS. For graphic
Refer to Appendix A for actual spillage by mon

JAN. 84

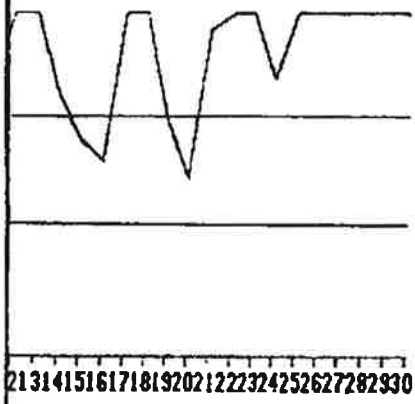




DEC. 83



NOV. 83



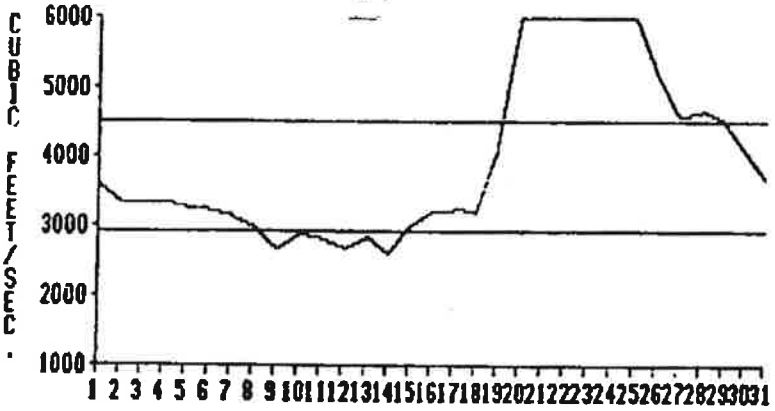
FALLS PROJECT

1983 - 1984 Page 1

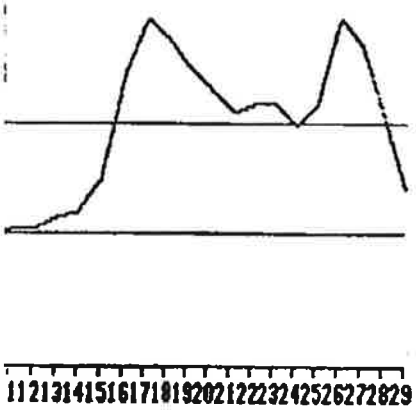
S) AT THE UPPER AND MIDDLE DAMS

flow exceeds 4500 CFS. Spillage over the Middle Dam occurs
presentation, river flows have been capped at 6000 CFS.
h.

MAR. 84

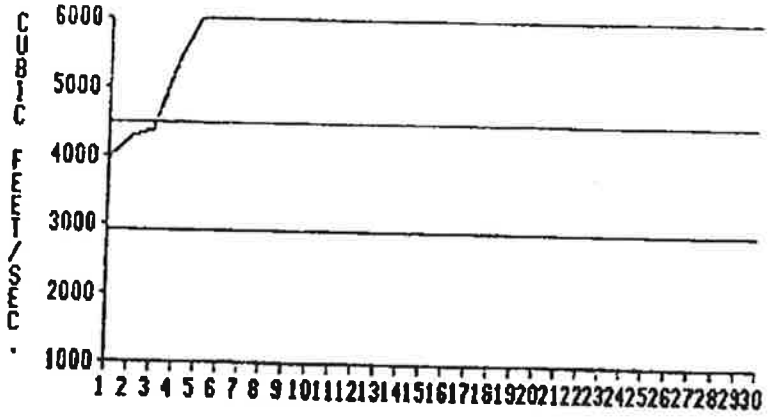


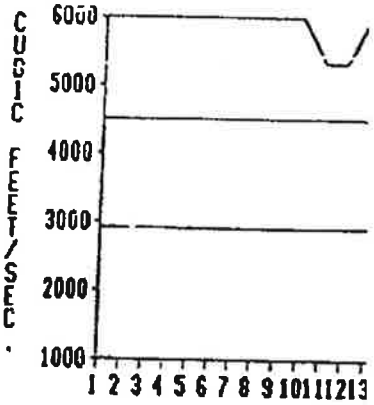
FEB. 84



MAIN
1893

APR. 84





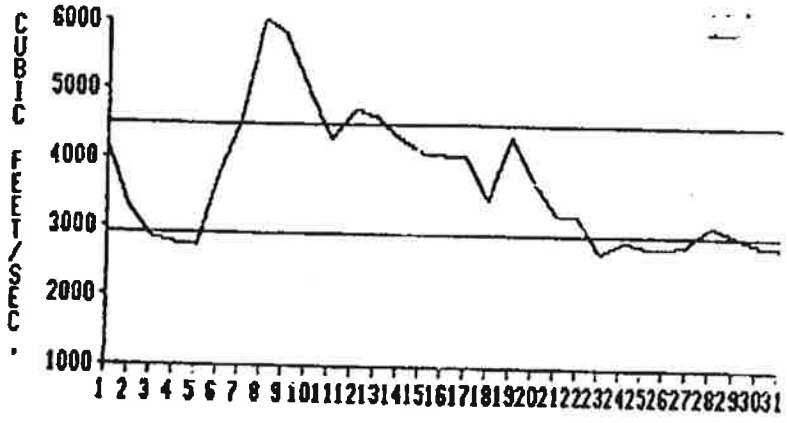
RUMFORD

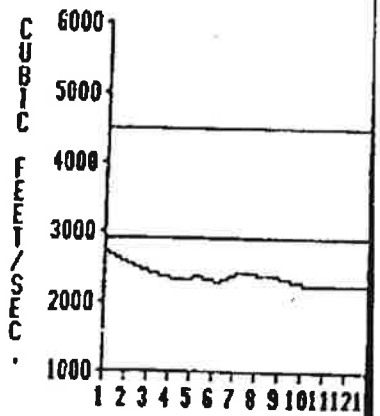
APPENDIX A

BYPASS MONTHLY SPILLAGE (CF

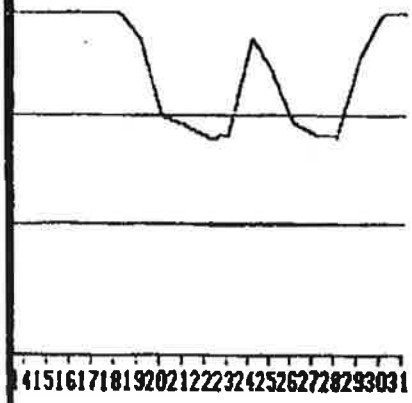
NOTE: Spillage over the Upper Dam occurs when river
when river flow exceeds 2900 CFS. For graphic
Refer to Appendix A for actual spillage by mon

JUL. 84





MAY 84



1 4 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

JUN. 84

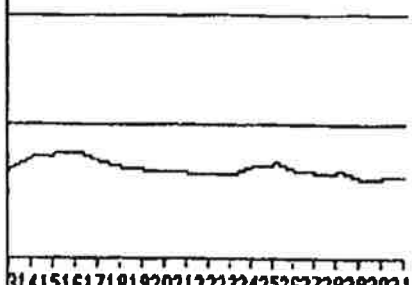
FALLS PROJECT

1983 - 1984 Page 2

S) AT THE UPPER AND MIDDLE DAMS

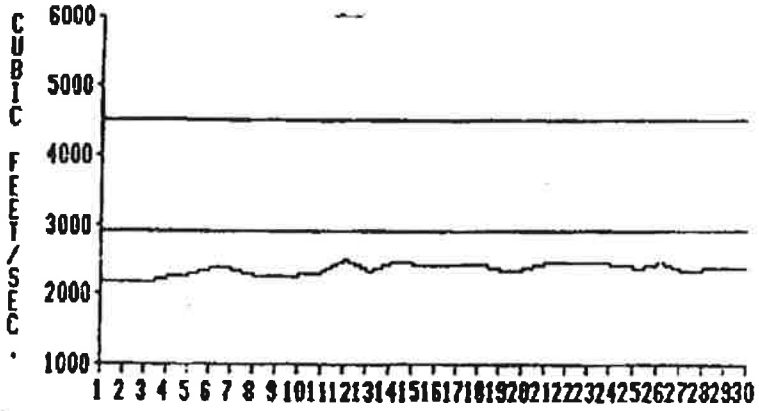
flow exceeds 4500 CFS. Spillage over the Middle Dam occurs presentation, river flows have been capped at 6000 CFS. h.

AUG. 84



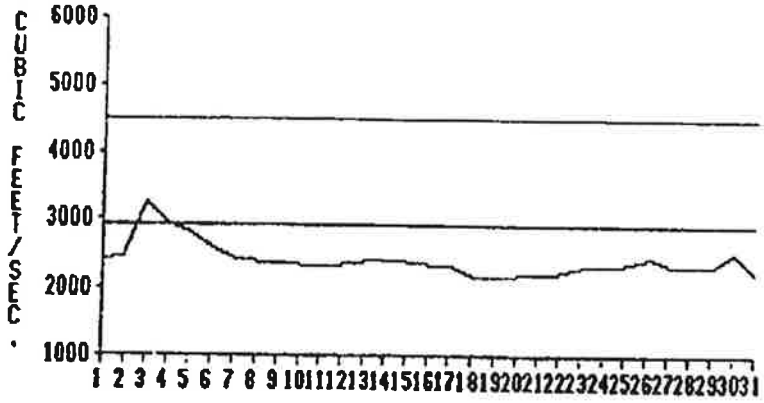
31 4 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

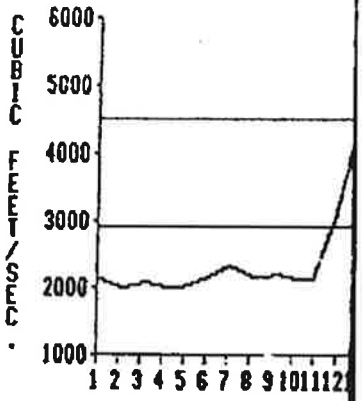
SEPT. 84



MAIN
1893

OCT. 84





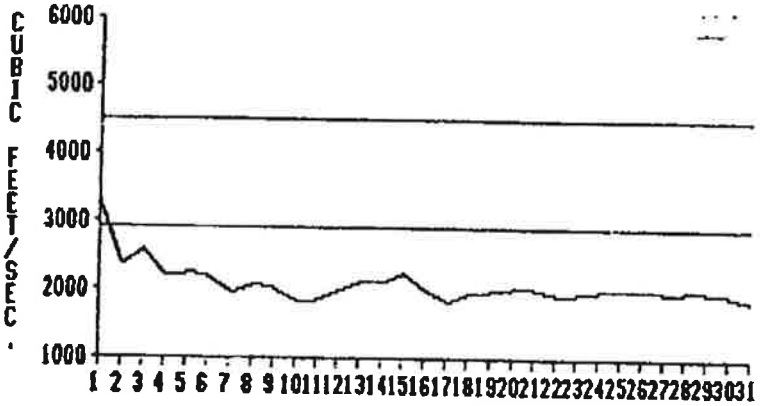
RUMFORD F

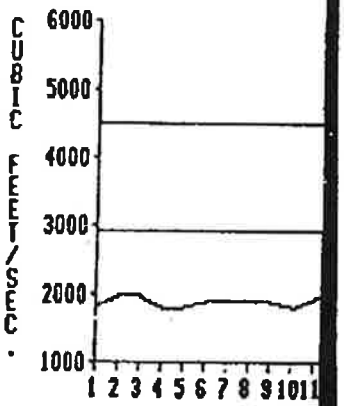
APPENDIX A

BYPASS MONTHLY SPILLAGE (CFS

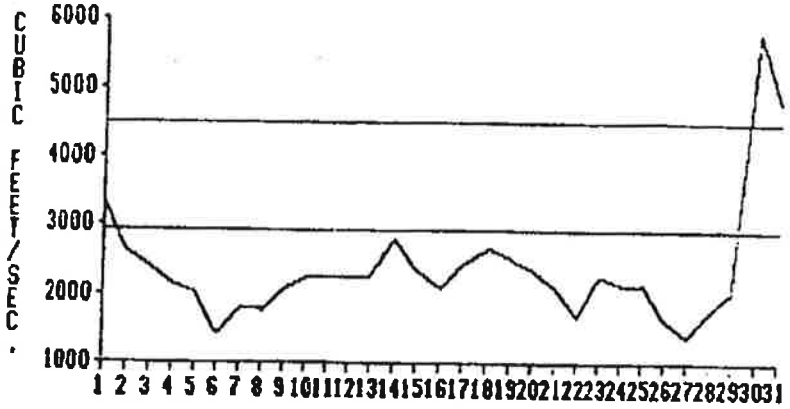
NOTE: Spillage over the Upper Dam occurs when river l
when river flow exceeds 2900 CFS. For graphic p
Refer to Appendix A for actual spillage by month

JAN. 85

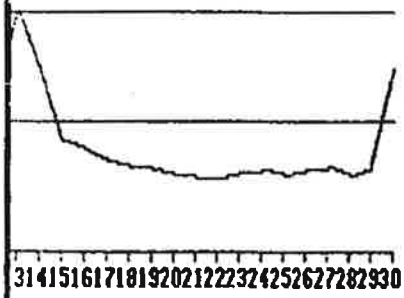




DEC. 84



NOV. 84



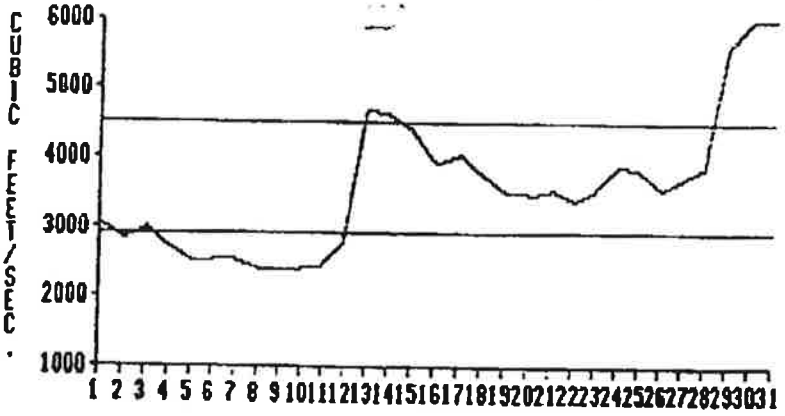
ALLS PROJECT

1984 - 1985 Page 1

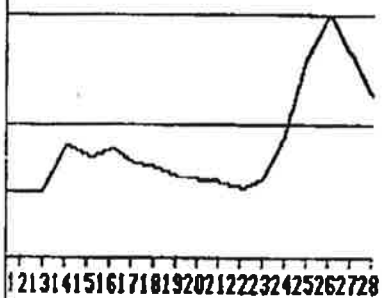
) AT THE UPPER AND MIDDLE DAMS

ow exceeds 4500 CFS. Spillage over the Middle Dam occurs
resentation, river flows have been capped at 6000 CFS.

MAR. 85

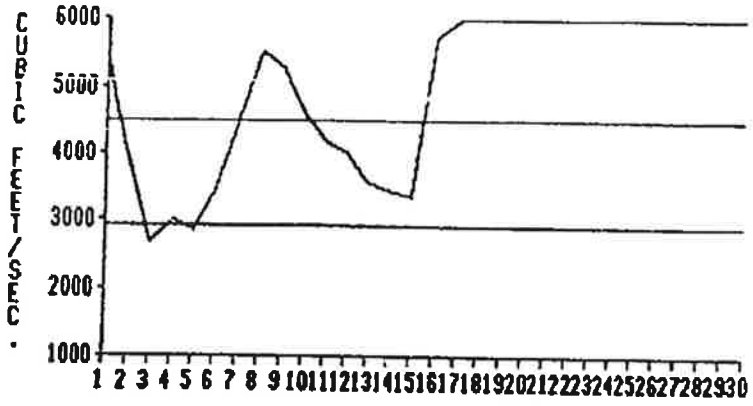


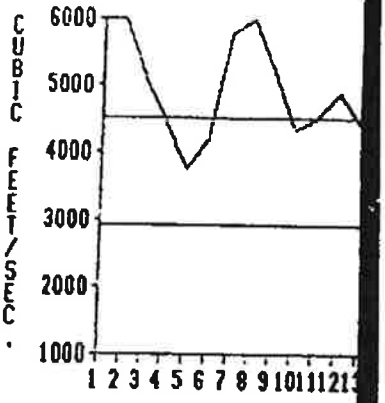
FEB. 85



MAIN
1893

APR. 85





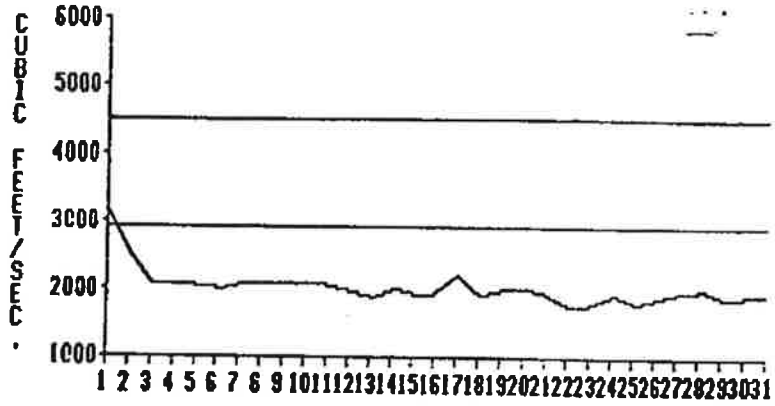
RUMFORD

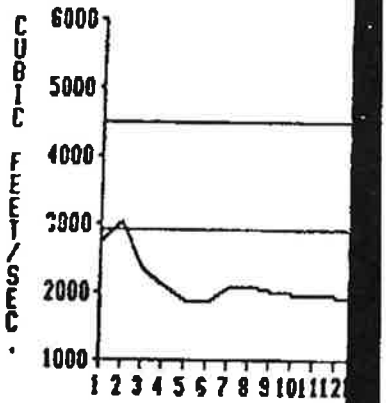
APPENDIX A

BYPASS MONTHLY SPILLAGE (CF

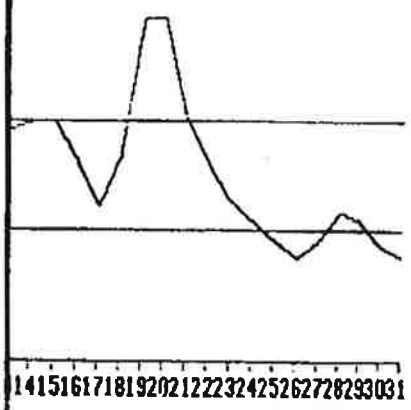
NOTE: Spillage over the Upper Dam occurs when river
when river flow exceeds 2900 CFS. For graphic
Refer to Appendix A for actual spillage by mon

JUL. 85

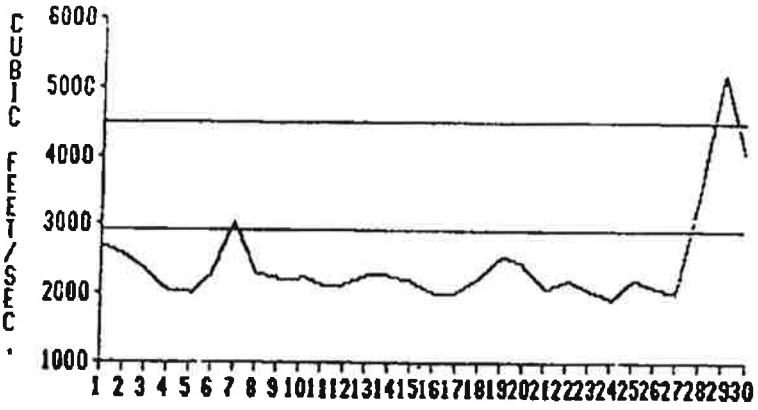




MAY 85



JUN. 85



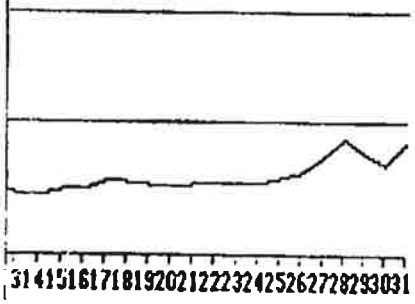
FALLS PROJECT

1984 - 1985 Page 2

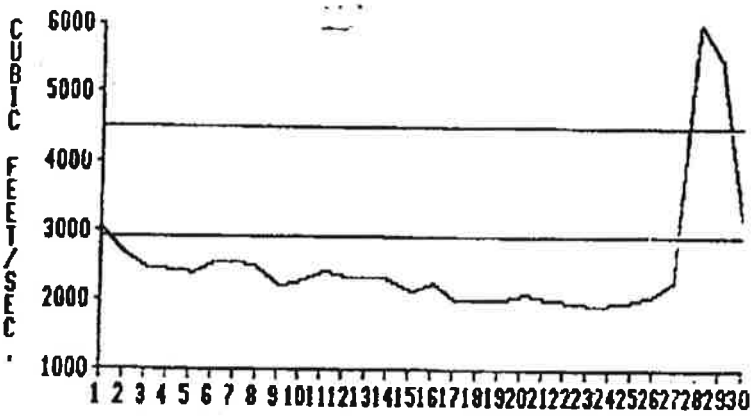
S) AT THE UPPER AND MIDDLE DAMS

flow exceeds 4500 CFS. Spillage over the Middle Dam occurs
presentation, river flows have been capped at 6000 CFS.
th.

AUG. 85

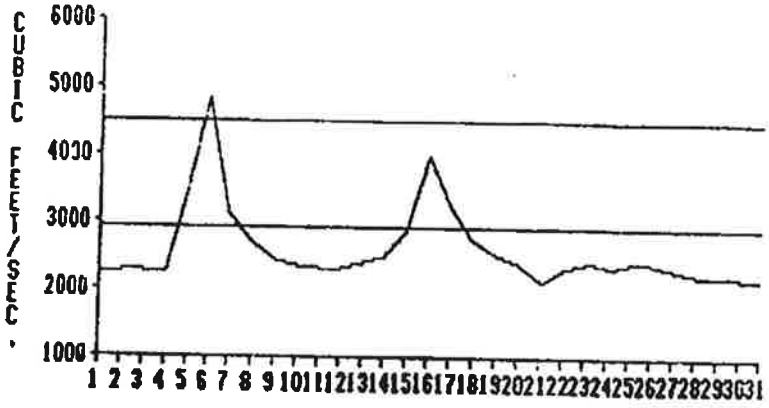


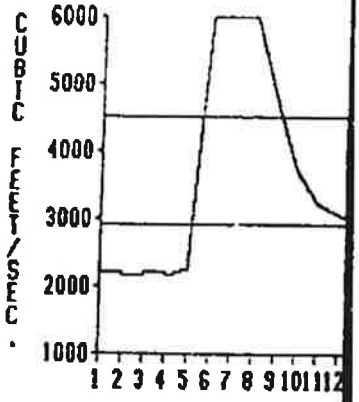
SEPT. 85



MAIN
1893

OCT. 85





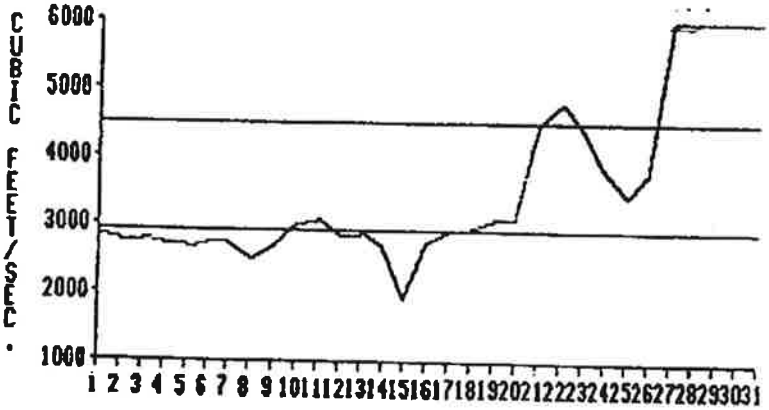
RUMFORD F

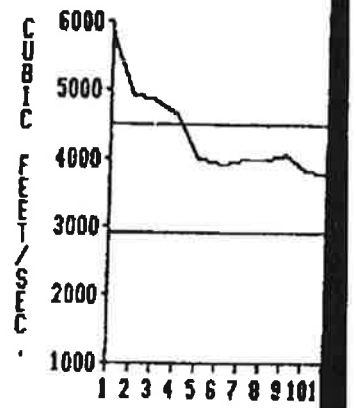
APPENDIX A

BYPASS MONTHLY SPILLAGE (CFS

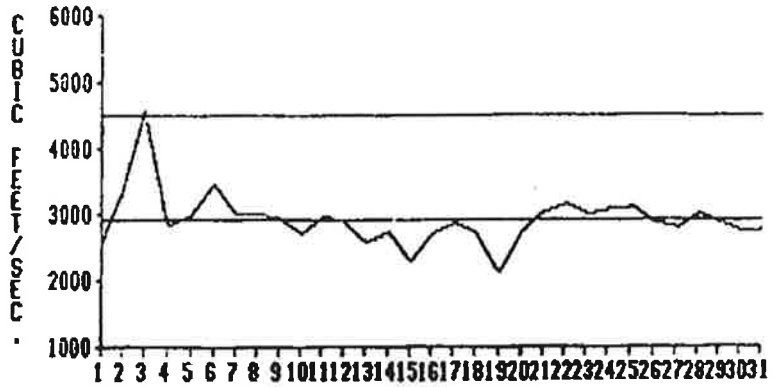
NOTE: ***Spillage over the Upper Dam occurs when river***
when river flow exceeds 2900 CFS. For graphic
Refer to Appendix A for actual spillage by mon

JAN. 86

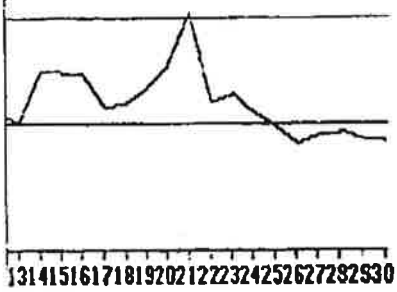




DEC. 85



NOV. 85



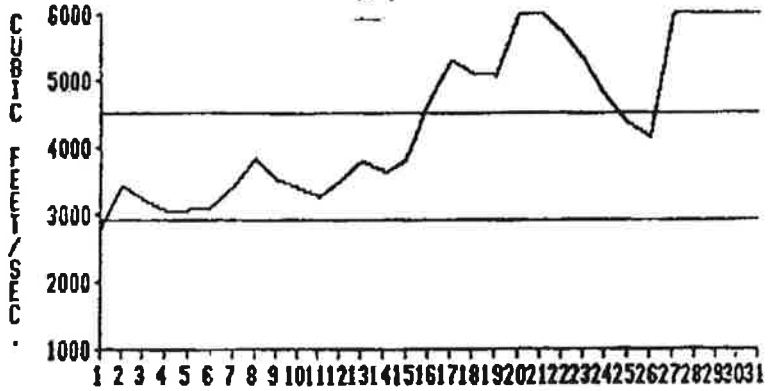
ALLS PROJECT

1985 - 1986 Page 1

) AT THE UPPER AND MIDDLE DAMS

flow exceeds 4500 CFS. Spillage over the Middle Dam occurs
presentation, river flows have been capped at 6000 CFS.
h.

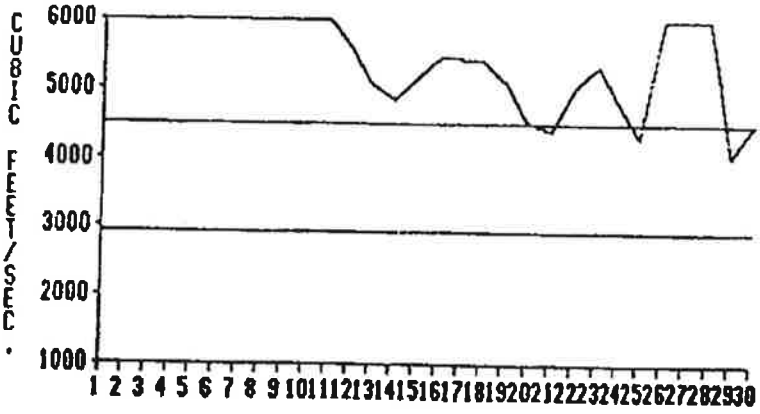
MAR. 86

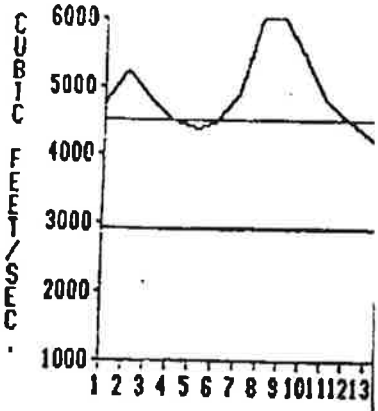


FEB. 86

MAIN
1893

APR. 86





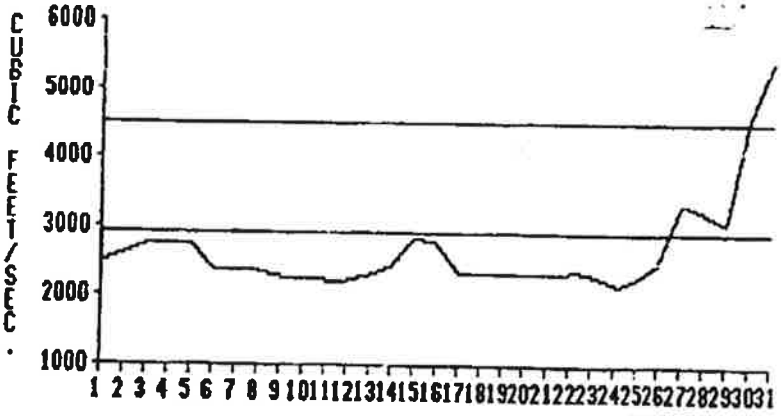
RUMFORD

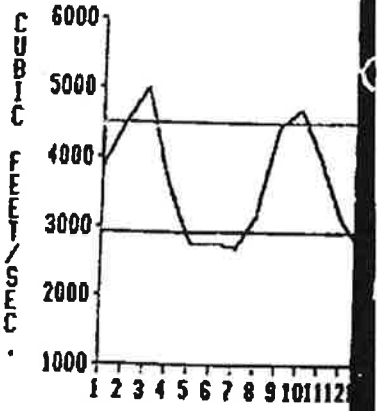
APPENDIX A

BYPASS MONTHLY SPILLAGE (CFS

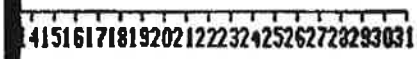
NOTE: Spillage over the Upper Dam occurs when river
when river flow exceeds 2900 CFS. For graphic
Refer to Appendix A for actual spillage by mon

JUL. 86



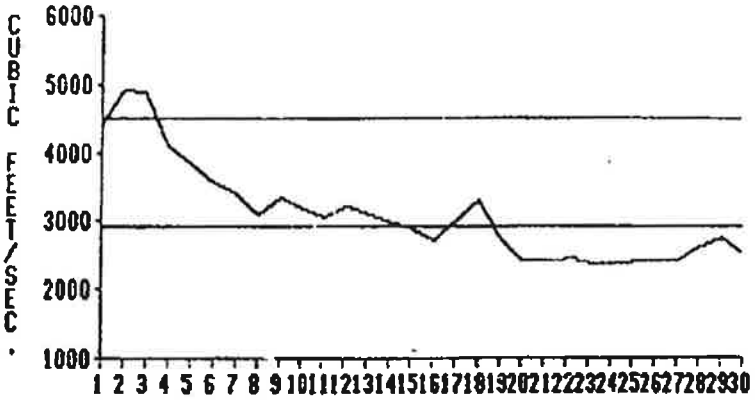


MAY 86



1 4 1 5 1 6 1 7 1 8 1 9 2 0 2 1 2 2 2 3 2 4 2 5 2 6 2 7 2 8 2 9 3 0 3 1

JUN. 86



FALLS PROJECT

1985 - 1986 Page 2

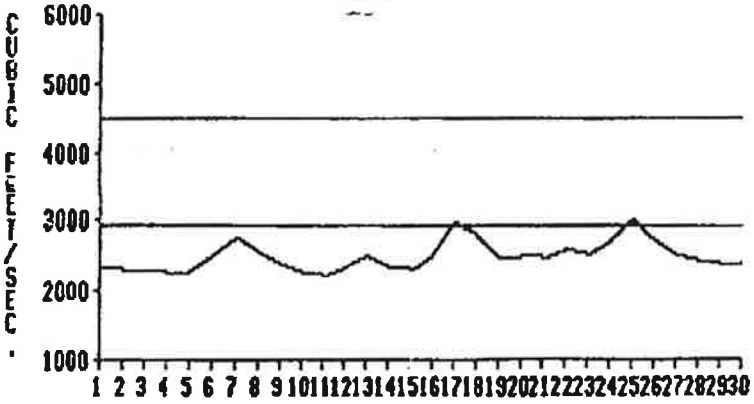
S) AT THE UPPER AND MIDDLE DAMS

flow exceeds 4500 CFS. Spillage over the Middle Dam occurs presentation, river flows have been capped at 6000 CFS. th.

AUG. 86

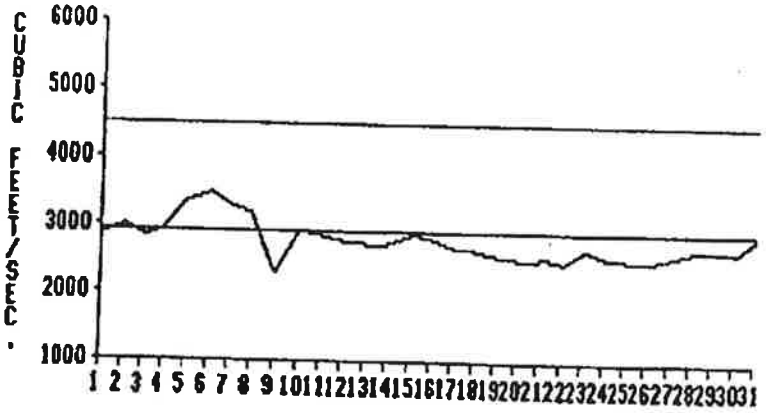
3 1 4 1 5 1 6 1 7 1 8 1 9 2 0 2 1 2 2 2 3 2 4 2 5 2 6 2 7 2 8 2 9 3 0 3 1

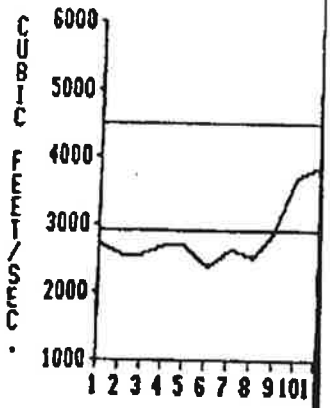
SEPT. 86



MAIN
1893

OCT. 86





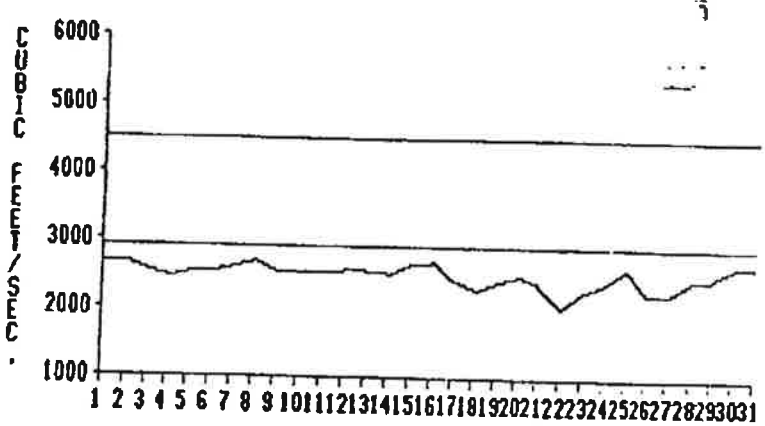
RUMFORD

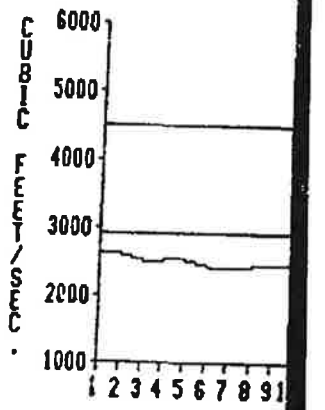
APPENDIX A

BYPASS MONTHLY SPILLAGE (CF

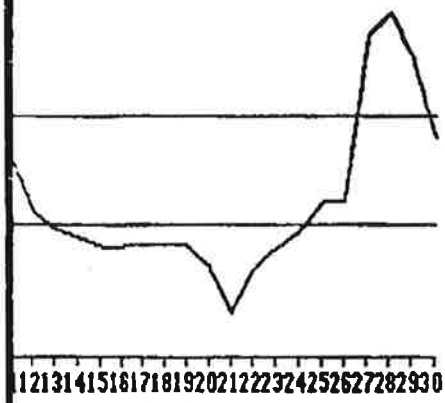
NOTE: Spillage over the Upper Dam occurs when
when river flow exceeds 2900 CFS. For graph
Refer to Appendix A for actual spillage by m

JAN. 87





NOV. 86



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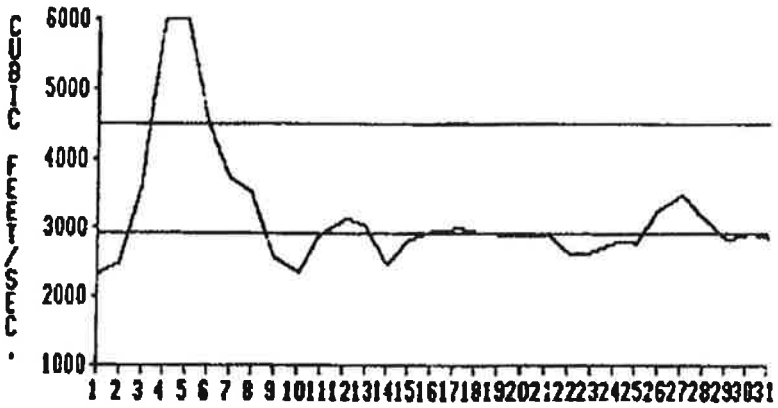
DEC. 86



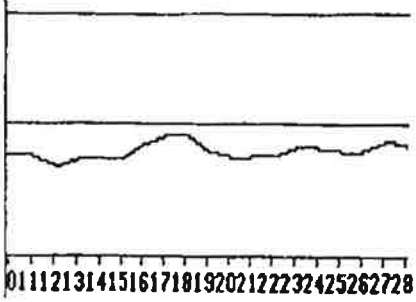
FALLS PROJECT

1986 - 1987 Page 1

FS) AT THE UPPER AND MIDDLE DAMS

er flow exceeds 4500 CFS. Spillage over the Middle Dam occurs
ic presentation, river flows have been capped at 6000 CFS.
onth.

FEB. 87



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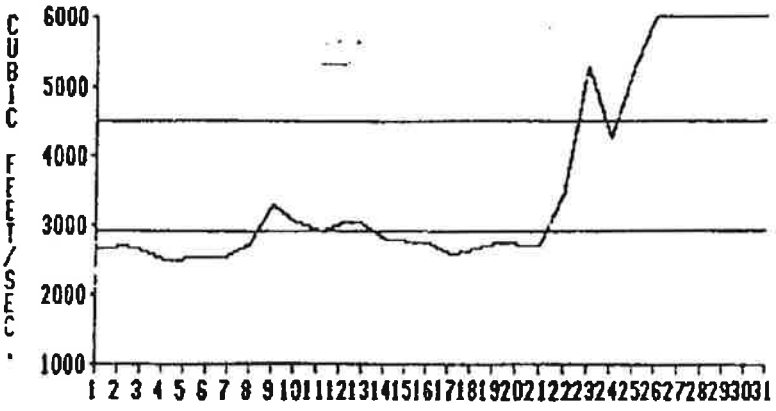
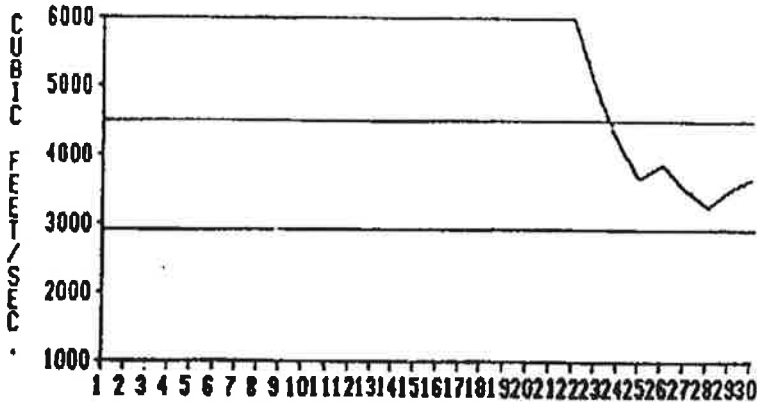
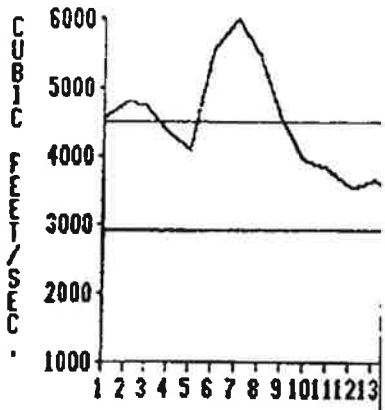
MAR. 87



MAIN
1893

APR. 87





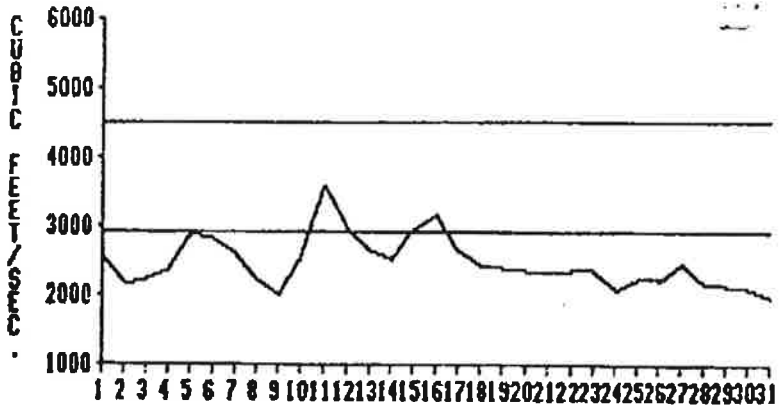
RUMFORD

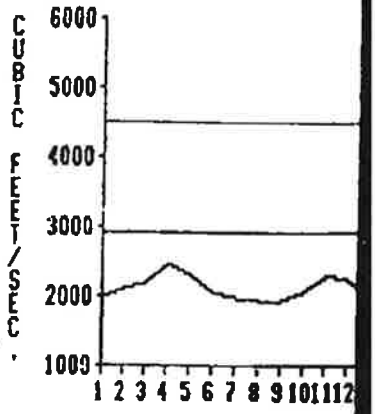
APPENDIX A

BYPASS MONTHLY SPILLAGE (CFS

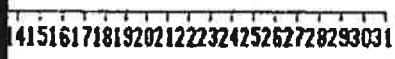
NOTE: Spillage over the Upper Dam occurs when river
when river flow exceeds 2900 CFS. For graphic
Refer to Appendix A for actual spillage by mon

JUL. 87



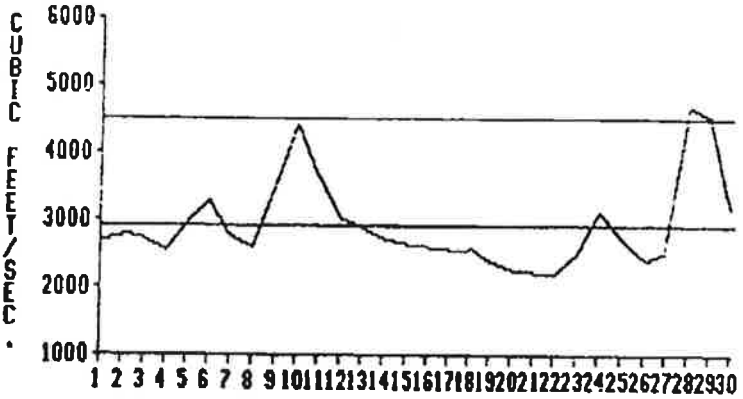


MAY 87



4151617181920212223242526272829303 1

JUN. 87



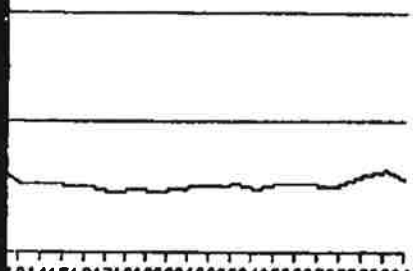
FALLS PROJECT

1986 - 1987 Page 2

S) AT THE UPPER AND MIDDLE DAMS

flow exceeds 4500 CFS. Spillage over the Middle Dam occurs presentation, river flows have been capped at 6000 CFS. th.

AUG. 87



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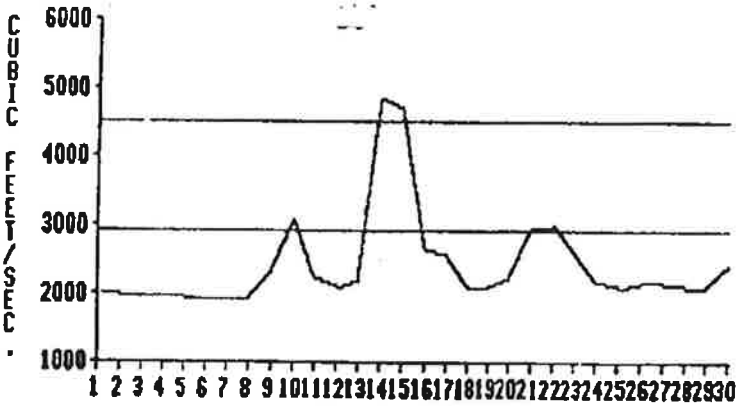
SEPT. 87



MAIN
1893

APPENDIX B

APPENDIX B (PAGE 1 OF 12)

UPPER DAM MONTHLY BYPASS SPILLAGE - OCTOBER

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO. DAYS	1983 PERCENT	1984 NO. DAYS	1984 PERCENT	1985 NO. DAYS	1985 PERCENT	1986 NO. DAYS	1986 PERCENT	1987 NO. DAYS	1987 PERCENT	TOTAL NO. DAYS	TOTAL PERCENT
NONE	31	100.0	31	100.0	31	100.0	30	96.8	31	100.0	154	99.4
10-100												
110-200												
210-300												
310-400							1	3.2			1	0.6
410-500												
510-600												
610-700												
710-800												
810-900												
910-1000												
1010-2000												
2010-3000												
3010-4000												
4010-5000												
5010-6000												
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	0	-	0	-	0	-	1	3.2	0	-	1	0.6

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APPENDIX B (PAGE 2 OF 12)
UPPER DAM MONTHLY BYPASS SPILLAGE - NOVEMBER

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	27	90.0	10	33.3	29	96.7	25	83.3	27	90.0	118	78.7
10-100					1	3.3	1	3.3			2	1.3
110-200	1	3.3					1	3.3			2	1.3
210-300			1	3.3							1	0.7
310-400			1	3.3							1	0.7
410-500												
510-600			2	6.7							2	1.3
610-700												
710-800									1	3.3	1	0.7
810-900												
910-1000												
1010-2000	1	3.3	5	16.7					1	3.3	7	4.7
2010-3000			5	16.7			1	3.3	1	3.3	7	4.7
3010-4000	1	3.3	2	6.7							3	2.0
4010-5000			1	3.3			1	3.3			2	1.3
5010-6000			1	3.3			1	3.3			2	1.3
6010-7000												
7010-8000												
8010-9000			2	6.7							2	1.3
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	3	10.0	20	66.7	1	3.3	5	16.7	3	10.0	32	21.3

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UPPER DAM MONTHLY BYPASS SPILLAGE - DECEMBER

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO. DAYS	1983 PERCENT	1984 NO. DAYS	1984 PERCENT	1985 NO. DAYS	1985 PERCENT	1986 NO. DAYS	1986 PERCENT	1987 NO. DAYS	1987 PERCENT	TOTAL NO. DAYS	TOTAL PERCENT
NONE	31	100.00	20	64.5	29	93.5	30	96.8	28	90.3	138	89.0
10-100							1	3.2	1	3.2	2	1.3
110-200			1	3.2							1	0.6
210-300					1	3.2					1	0.6
310-400												
410-500												
510-600												
610-700												
710-800												
810-900			1	3.2							1	0.6
910-1000			1	3.2							1	0.6
1010-2000			1	3.2	1	3.2					2	1.3
2010-3000			1	3.2					1	3.2	2	1.3
3010-4000			2	6.5					1	3.2	3	1.9
4010-5000			1	3.2							1	0.6
5010-6000												
6010-7000			1	3.2							1	0.6
7010-8000												
8010-9000												
9010-10000												
10010-15000			1	3.2							1	0.6
15010-20000			1	3.2							1	0.6
20010-25000												
>25000												
SPILLAGE DAYS	0	-	11	35.5	2	6.5	1	3.2	3	9.7	17	11.0

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UPPER DAM MONTHLY BYPASS SPILLAGE - JANUARY

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	28	90.3	31	100.0	31	100.0	24	77.4	31	100.0	145	93.5
10-100							1	3.2			1	0.6
110-200												
210-300							1	3.2			1	0.6
310-400												
410-500												
510-600												
610-700												
710-800												
810-900												
910-1000												
1010-2000	2	6.5									2	1.3
2010-3000							1	3.2			1	0.6
3010-4000	1	3.2					1	3.2			2	1.3
4010-5000												
5010-6000												
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000							1	3.2			1	0.6
15010-20000							1	3.2			1	0.6
20010-25000												
>25000							1	3.2			1	0.6
SPILLAGE DAYS	3	9.7	0	-	0	-	7	22.6	0	-	10	6.5

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UPPER DAM MONTHLY BYPASS SPILLAGE - FEBRUARY

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	26	92.9	17	58.6	27	96.4	24	100.0	28	100.0	122	86.5
10-100			1	3.4	1	3.6					2	1.4
110-200			1	3.4			1	3.6			2	1.4
210-300			3	10.3							3	2.1
310-400							1	3.6			1	0.7
410-500			1	3.4			1	3.6			2	1.4
510-600												
610-700			1	3.4							1	0.7
710-800			1	3.4							1	0.7
810-900												
910-1000												
1010-2000	1	3.6	4	13.8			1	3.6			6	4.3
2010-3000												
3010-4000	1	3.6									1	0.7
4010-5000												
5010-6000												
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	2	7.1	12	41.4	1	3.6	4	14.3	0	-	19	13.5

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UPPER DAM MONTHLY BYPASS SPILLAGE - MARCH

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	14	45.2	22	71.0	26	83.9	17	54.8	24	77.4	103	66.5
10-100	1	3.2	1	3.2	1	3.2					3	1.9
110-200			1	3.2	1	3.2	1	3.2			3	1.9
210-300							1	3.2			1	0.6
310-400	1	3.2									1	0.6
410-500	3	9.7									3	1.9
510-600	2	6.5					2	6.5			4	2.6
610-700	3	9.7	1	3.2							4	2.6
710-800							2	6.5	1	3.2	3	1.9
810-900												
910-1000												
1010-2000	3	9.7			2	6.5	2	6.5			7	4.5
2010-3000			2	6.5			2	6.5	1	3.2	5	3.2
3010-4000			3	9.7	1	3.2			3	9.7	7	4.5
4010-5000			1	3.2							1	0.6
5010-6000	1	3.2					2	6.5	1	3.2	4	2.6
6010-7000												
7010-8000												
8010-9000												
9010-10000	1	3.2									1	0.6
10010-15000	2	6.5					2	6.5			4	2.6
15010-20000												
20010-25000									1	3.2	1	0.6
>25000												
SPILLAGE DAYS	17	54.8	9	29.0	5	16.1	14	45.2	7	22.6	52	33.5

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UPPER DAM MONTHLY BYPASS SPILLAGE - APRIL

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	5	16.7	3	10.0	11	36.7	2	6.7	7	23.3	28	18.7
10-100	1	3.3			1	3.3	2	6.7			4	2.7
110-200												
210-300							1	3.3			1	0.7
310-400							1	3.3			1	0.7
410-500									1	3.3	1	0.7
510-600							4	13.3			4	2.7
610-700	1	3.3					1	3.3			2	1.3
710-800					1	3.3					1	0.7
810-900	1	3.3	1	3.3	2	6.7	2	6.7			6	4.0
910-1000							2	6.7			2	1.3
1010-2000	7	23.3			2	6.7	2	6.7	3	10.0	14	9.3
2010-3000	8	26.7			2	6.7	4	13.3	3	10.0	17	11.3
3010-4000	1	3.3	1	3.3	5	16.7	2	6.7	3	10.0	12	8.0
4010-5000			4	13.3	2	6.7	2	6.7	2	6.7	10	6.7
5010-6000			4	13.3	1	3.3			1	3.3	6	4.0
6010-7000			5	16.7	3	10.0	1	3.3	1	3.3	10	6.7
7010-8000	1	3.3									1	0.7
8010-9000			2	6.7			1	3.3			3	2.0
9010-10000	1	3.3	1	3.3					2	6.7	4	2.7
10010-15000	2	6.7	6	20.0			3	10.0	3	10.0	14	9.3
15010-20000	2	6.7	1	3.3					1	3.3	4	2.7
20010-25000									1	3.3	1	0.7
>25000			2	6.7					2	6.7	4	2.7
SPILLAGE DAYS	25	83.3	27	90.0	19	63.3	28	93.3	23	76.7	122	81.3

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UPPER DAM MONTHLY BYPASS SPILLAGE - MAY

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	5	16.1	7	22.6	22	71.0	11	35.5	25	80.6	70	45.2
10-100	2	6.5					3	9.7	1	3.2	6	3.9
110-200												
210-300	1	3.2					1	3.2	2	6.5	4	2.6
310-400					1	3.2	2	6.5			3	1.9
410-500	1	3.2					2	6.5			3	1.9
510-600												
610-700			1	3.2	2	6.5	2	6.5			5	3.2
710-800	1	3.2					1	3.2			2	1.3
810-900	2	6.5	2	6.5							4	2.6
910-1000	1	3.2	1	3.2			1	3.2	1	3.2	4	2.6
1010-2000	3	9.7	2	6.5	2	6.5	6	19.4	1	3.2	14	9.0
2010-3000	2	6.5	2	6.5	2	6.5					6	3.9
3010-4000	1	3.2	5	16.1	2	6.5	1	3.2	1	3.2	10	6.5
4010-5000	1	3.2	3	9.7			1	3.2			5	3.2
5010-6000			3	9.7							3	1.9
6010-7000	4	12.9	2	6.5							6	3.9
7010-8000	2	6.5	1	3.2							3	1.9
8010-9000												
9010-10000												
10010-15000	4	12.9	1	3.2							5	3.2
15010-20000	1	3.2									1	0.6
20010-25000			1	3.2							1	0.6
>25000												
SPILLAGE DAYS	26	83.9	24	77.4	9	29.0	20	64.5	6	19.4	85	54.8

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UPPER DAM MONTHLY BYPASS SPILLAGE - JUNE

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	23	76.7	14	46.7	29	96.7	28	93.3	29	96.7	123	82.0
10-100			1	3.3							1	0.7
110-200									1	3.3	1	0.7
210-300												
310-400							1	3.3			1	0.7
410-500							1	3.3			1	0.7
510-600			1	3.3							1	0.7
610-700			2	6.7	1	3.3					3	2.0
710-800												
810-900												
910-1000	1	3.3									1	0.7
1010-2000			3	10.0							3	2.0
2010-3000	3	10.0	1	3.3							4	2.7
3010-4000	1	3.3									1	0.7
4010-5000	1	3.3									1	0.7
5010-6000	1	3.3	1	3.3							2	1.3
6010-7000												
7010-8000			1	3.3							1	0.7
8010-9000												
9010-10000			1	3.3							1	0.7
10010-15000			1	3.3							1	0.7
15010-20000			1	3.3							1	0.7
20010-25000			2	6.7							2	1.3
>25000			1	3.3							1	0.7
SPILLAGE DAYS	7	23.3	16	53.3	1	3.3	2	6.7	1	3.3	27	18.0

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UPPER DAM MONTHLY BYPASS SPILLAGE - JULY

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	31	100.0	25	80.6	31	100.0	29	93.5	31	100.0	147	94.8
10-100			2	6.5			1	3.2			3	1.9
110-200			1	3.2							1	0.6
210-300												
310-400												
410-500			1	3.2							1	0.6
510-600												
610-700												
710-800												
810-900												
910-1000							1	3.2			1	0.6
1010-2000			1	3.2							1	0.6
2010-3000			1	3.2							1	0.6
3010-4000												
4010-5000												
5010-6000												
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	0	-	6	19.4	0	-	2	6.5	0	-	8	5.2

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UPPER DAM MONTHLY BYPASS SPILLAGE - AUGUST

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	30	96.8	31	100.0	31	100.0	29	93.5	31	100.0	152	98.1
10-100												
110-200												
210-300							1	3.2			1	0.6
310-400												
410-500												
510-600							1	3.2			1	0.6
610-700	1	3.2									1	0.6
710-800												
810-900												
910-1000												
1010-2000												
2010-3000												
3010-4000												
4010-5000												
5010-6000												
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	1	3.2	0	-	0	-	2	6.5	0	-	3	1.9

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UPPER DAM MONTHLY BYPASS SPILLAGE - SEPTEMBER

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	30	100.0	30	100.0	28	93.3	30	100.0	28	93.3	146	97.3
10-100												
110-200									1	3.3	1	0.7
210-300												
310-400									1	3.3	1	0.7
410-500												
510-600												
610-700												
710-800												
810-900												
910-1000					1	3.3					1	0.7
1010-2000												
2010-3000												
3010-4000												
4010-5000					1	3.3					1	0.7
5010-6000												
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	0	-	0	-	2	6.7	0	-	2	6.7	4	2.7

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - OCTOBER

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	29	93.5	28	90.3	29	93.5	26	83.9	24	77.4	136	87.7
10-100			1	3.2	1	3.2			3	9.7	5	3.2
110-200							1	3.2			1	0.6
210-300	1	3.2					1	3.2	1	3.2	3	1.9
310-400					1	3.2			1	3.2	2	1.3
410-500			1	3.2					1	3.2	2	1.3
510-600							1	3.2	1	3.2	2	1.3
610-700	1	3.2	1	3.2							2	1.3
710-800												
810-900												
910-1000												
1010-2000							2	6.5			2	1.3
2010-3000												
3010-4000												
4010-5000												
5010-6000												
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	2	6.5	3	9.7	2	6.5	5	16.1	7	22.6	19	12.3

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - NOVEMBER

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	14	46.7	4	16.7	26	86.7	12	40.0	20	66.7	76	50.7
10-100	2	6.7							1	3.3	3	2.0
110-200							2	6.7	1	3.3	3	2.0
210-300	2	6.7			1	3.3	2	6.7			5	3.3
310-400	1	3.3					1	3.3	2	6.7	4	2.7
410-500	1	3.3					1	3.3			2	1.3
510-600							1	3.3			1	0.7
610-700			1	3.3			2	6.7			3	2.0
710-800	4	13.3			2	6.7	2	6.7			8	5.3
810-900									1	3.3	1	0.7
910-1000			1	3.3			1	3.3	1	3.3	3	2.0
1010-2000	4	13.3	6	20.0	1	3.3	3	10.0	1	3.3	15	10.0
2010-3000	1	3.3	3	10.0					2	6.7	6	4.0
3010-4000			5	16.7			1	3.3			6	4.0
4010-5000	1	3.3	6	20.0					1	3.3	8	5.3
5010-6000			1	3.3							1	0.7
6010-7000							1	3.3			1	0.7
7010-8000			1	3.3			1	3.3			2	1.3
8010-9000												
9010-10000												
10010-15000			2	6.7							2	1.3
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	16	53.3	26	86.7	4	13.3	18	60.0	10	33.3	74	49.3

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - DECEMBER

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	23	74.2	2	6.5	28	90.3	17	54.8	16	51.6	86	55.5
10-100	2	6.5	1	3.2			6	19.4	3	8.7	12	7.7
110-200	2	6.5	1	3.2			3	9.7	2	6.5	8	5.2
210-300	1	3.2	3	9.7			2	6.5	2	6.5	8	5.2
310-400	1	3.2	3	9.7					1	3.2	5	3.2
410-500			3	9.7	1	3.2	1	3.2			5	3.2
510-600	1	3.2	1	3.2			1	3.2	1	3.2	4	2.6
610-700									1	3.2	1	0.6
710-800									2	6.5	2	1.3
810-900			1	3.2							1	0.6
910-1000			2	6.5							2	1.3
1010-2000	1	3.2	4	12.9	1	3.2	1	3.2	1	3.2	8	5.2
2010-3000			3	9.7	1	3.2					4	2.6
3010-4000									1	3.2	1	0.6
4010-5000			2	6.5							2	1.3
5010-6000			1	3.2					1	3.2	2	1.3
6010-7000			1	3.2							1	0.6
7010-8000												
8010-9000			1	3.2							1	0.6
9010-10000												
10010-15000			1	3.2							1	0.6
15010-20000												
20010-25000			1	3.2							1	0.6
>25000												
SPILLAGE DAYS	8	25.8	29	93.5	3	9.7	14	45.2	15	48.4	69	44.5

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - JANUARY

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	24	77.4	15	48.4	30	96.8	14	45.2	31	100.0	114	73.5
10-100			4	12.9			3	9.7			7	4.5
110-200	1	3.2	6	19.4			2	6.5			9	5.8
210-300			2	6.5			1	3.2			3	1.9
310-400			2	6.5							2	1.3
410-500	1	3.2	1	3.2	1	3.2	1	3.2			4	2.6
510-600			1	3.2							1	0.6
610-700	1	3.2									1	0.6
710-800	1	3.2									1	0.6
810-900							2	6.5			2	1.3
910-1000												
1010-2000							3	9.7			3	19
2010-3000	2	6.5									2	1.3
3010-4000												
4010-5000							1	3.2			1	0.6
5010-6000	1	3.2					1	3.2			2	1.3
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000							1	3.2			1	0.6
15010-20000												
20010-25000							1	3.2			1	0.6
>25000							1	3.2			1	0.6
SPILLAGE DAYS	7	22.6	16	51.6	1	3.2	17	54.8	0	-	41	26.5

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - FEBRUARY

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	PERCENT	1984 NO.DAYS	PERCENT	1985 NO.DAYS	PERCENT	1986 NO.DAYS	PERCENT	1987 NO.DAYS	PERCENT	TOTAL NO.DAYS	PERCENT
NONE	17	60.7	3	10.3	24	85.7			28	100.0	72	51.1
10-100	2	7.1	3	10.3							5	3.5
110-200	1	3.6	1	3.4			3	10.7			5	3.5
210-300	3	10.7	3	10.3			1	3.6			7	5.0
310-400			1	3.4			1	3.6			2	1.4
410-500			1	3.4	1	3.6					2	1.4
510-600	1	3.6	1	3.4			3	10.7			5	3.5
610-700			1	3.4			1	3.6			2	1.4
710-800	1	3.6	1	3.4			5	17.9			7	5.0
810-900							4	14.3			4	2.8
910-1000			1	3.4			1	3.6			2	1.4
1010-2000	1	3.6	6	20.7	3	10.7	7	25.0			17	12.1
2010-3000			5	17.2			2	7.1			7	5.0
3010-4000	1	3.6	2	6.9							3	2.1
4010-5000	1	3.6									1	0.7
5010-6000												
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	11	39.3	26	89.7	4	14.3	28	100.0	0	-	69	48.9

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - MARCH

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	1	3.2	6	19.4	10	32.3	1	3.2	16	51.6	34	21.9
10-100	1	3.2	2	6.5	1	3.2			2	6.5	6	3.9
110-200					1	3.2	2	6.5	3	9.7	6	3.9
210-300			3	9.7			3	9.7			6	3.9
310-400	1	3.2	3	9.7					1	3.2	5	3.2
410-500	1	3.2	3	9.7	1	3.2	1	3.2			6	3.9
510-600					1	3.2	3	9.7			4	2.6
610-700	4	12.9	1	3.2	4	12.9	1	3.2	1	3 2	11	7.1
710-800			1	3.2	1	3.2	1	3.2			3	1.9
810-900	2	6.5			2	6.5	1	3.2			5	3.2
910-1000					2	6.5	2	6.5			4	2.6
1010-2000	6	19.4	5	16.1	5	16.1	4	12.9	1	3.2	21	13.5
2010-3000	9	29.0	1	3.2	1	3.2	5	16.1	1	3.2	17	11.0
3010-4000	2	6.5	2	6.5	1	3.2	3	9.7	1	3.2	9	5.8
4010-5000			2	6.5					2	6.5	4	2.6
5010-6000			2	6.5	1	3.2			1	3.2	4	2.6
6010-7000							1	3.2			1	0.6
7010-8000	1	3.2					1	3.2	1	3.2	3	1.9
8010-9000												
9010-10000												
10010-15000	2	6.5					1	3.2			3	1.9
15010-20000	1	3.2					1	3.2			2	1.3
20010-25000									1	3.2	1	0.6
>25000												
SPILLAGE DAYS	30	96.8	25	80.6	21	67.7	30	96.8	15	48.4	121	78.1

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - MARCH

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO. DAYS	1983 PERCENT	1984 NO. DAYS	1984 PERCENT	1985 NO. DAYS	1985 PERCENT	1986 NO. DAYS	1986 PERCENT	1987 NO. DAYS	1987 PERCENT	TOTAL NO. DAYS	TOTAL PERCENT
NONE					2	6.7					2	1.3
10-100					1	3.3					1	0.7
110-200												
210-300												
310-400									1	3.3	1	0.7
410-500					2	6.7					2	1.3
510-600					1	3.3			2	6.7	3	2.0
610-700					1	3.3					1	0.7
710-800	2	6.7							2	6.7	4	2.7
810-900												
910-1000	1	3.3			1	3.3			1	3.3	3	2.0
1010-2000	3	10.0	3	10.0	4	13.3	6	20.0	1	3.3	17	11.3
2010-3000	3	10.0	1	3.3	4	13.3	10	33.3	1	3.3	19	12.7
3010-4000	13	43.3			3	10.0	2	6.7	4	13.3	22	14.7
4010-5000	1	3.3	1	3.3	2	6.7	4	13.3	4	13.3	12	8.0
5010-6000	1	3.3	2	6.7	4	13.3	2	6.7	2	6.7	11	7.3
6010-7000			3	10.0	2	6.7	1	3.3	2	6.7	8	5.3
7010-8000			4	13.3	1	3.3	1	3.3			6	4.0
8010-9000			4	13.3	2	6.7			1	3.3	7	4.7
9010-10000	1	3.3									1	0.7
10010-15000	3	10.0	8	26.7			4	13.3	3	10.0	18	12.0
15010-20000	2	6.7	2	6.7					2	6.7	6	4.0
20010-25000									2	6.7	2	1.3
>25000			2	6.7					2	6.7	4	2.7
SPILLAGE DAYS	30	100.0	30	100.0	28	93.3	30	100.0	30	100.0	148	98.7

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - MAY

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE					5	16.1			8	25.8	13	8.4
10-100									2	6.5	2	1.3
110-200					2	6.5			2	6.5	4	2.6
210-300					1	3.2			2	6.5	3	1.9
310-400					1	3.2			1	3.2	2	1.3
410-500					1	3.2			1	3.2	2	1.3
510-600									1	3.2	1	0.6
610-700									1	3.2	1	0.6
710-800									1	3.2	1	0.6
810-900					1	3.2	3	9.7	1	3.2	5	3.2
910-1000					2	6.5	2	6.5	1	3.2	5	3.2
1010-2000	8	26.7	7	22.6	10	32.3	12	38.7	7	22.6	44	28.4
2010-3000	5	16.7	6	19.4	3	9.7	8	25.8	2	6.5	24	15.5
3010-4000	4	13.3	1	3.2	3	9.7	4	12.9			12	7.7
4010-5000	1	3.3	1	3.2	1	3.2	1	3.2	1	3.2	5	3.2
5010-6000	1	3.3	7	22.6	1	3.2					9	5.8
6010-7000	1	3.3	3	9.7			1	3.2			5	3.2
7010-8000	2	6.7	3	9.7							5	3.2
8010-9000	2	6.7									2	1.3
9010-10000	2	6.7	1	3.2							3	1.9
10010-15000	3	10.0	1	3.2							4	2.6
15010-20000	2	6.7									2	1.3
20010-25000												
>25000			1	3.2							1	0.6
SPILLAGE DAYS	31	100.0	31	100.0	26	83.9	31	100.0	23	74.2	142	91.6

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - JUNE

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	8	26.7	3	10.0	26	86.7	14	46.7	20	66.7	71	47.3
10-100							2	6.7	1	3.3	3	2.0
110-200			2	6.7	1	3.3	3	10.0	1	3.3	7	4.7
210-300	1	3.3	1	3.3			2	6.7	2	6.7	6	4.0
310-400	1	3.3					1	3.3	1	3.3	3	2.0
410-500	3	10.0	1	3.3	1	3.3	2	6.7			7	4.7
510-600									1	3.3	1	0.7
610-700	1	3.3	1	3.3			1	3.3			3	2 0
710-800									1	3.3	1	0.7
810-900	2	6.7									2	1.3
910-1000			1	3.3			1	3.3			2	1.3
1010-2000	7	23.3	6	20.0	1	3.3	3	10.0	3	9.7	20	13.3
2010-3000	1	3.3	5	16.7	1	3.3	1	3.3			8	5.3
3010-4000	1	3.3	1	3.3							2	1.3
4010-5000	3	10.0	1	3.3							4	2.7
5010-6000	1	3.3									1	0.7
6010-7000	1	3.3									1	0.7
7010-8000			1	3.3							1	0.7
8010-9000			1	3.3							1	0.7
9010-10000												
10010-15000			2	6.7							2	1.3
15010-20000			1	3.3							1	0.7
20010-25000			2	6.7							2	1.3
>25000			1	3.3							1	0.7
SPILLAGE DAYS	22	73.3	27	90.0	4	13.3	16	53.3	10	33.3	79	52.7

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - JULY

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	29	93.5	10	32.3	30	96.8	26	83.9	27	87.1	122	78.7
10-100			1	3.2					2	6.5	3	1.9
110-200			1	3.2			1	3.2			2	1.3
210-300			1	3.2	1	3.2			1	3.2	3	1.9
310-400			2	6.5			1	3.2			3	1.9
410-500							1	3.2			1	0.6
510-600			1	3.2							1	0.6
610-700									1	3.2	1	0.6
710-800			1	3.2							1	0.6
810-900			1	3.2							1	0.6
910-1000												
1010-2000	2	6.5	10	32.3			1	3.2			13	8.4
2010-3000			2	6.5			1	3.2			3	1.9
3010-4000												
4010-5000			1	3.2							1	0.6
5010-6000												
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	2	6.5	21	67.7	1	3.2	5	16.1	4	12.9	33	21.3

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - AUGUST

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	27	87.1	31	100.0	30	96.8	18	58.1	31	100.0	137	88.4
10-100	1	3.2									1	0.6
110-200	1	3.2			1	3.2	3	9.7			5	3.2
210-300							1	3.2			1	0.6
310-400							1	3.2			1	0.6
410-500							1	3.2			1	0.6
510-600												
610-700	1	3.2									1	0.6
710-800							1	3.2			1	0.6
810-900												
910-1000							1	3.2			1	0.6
1010-2000							4	12.9			4	2.6
2010-3000	1	3.2					1	3.2			2	1.3
3010-4000												
4010-5000												
5010-6000												
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	4	12.9	0	-	1	3.2	13	41.9	0	-	18	11.6

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MIDDLE DAM MONTHLY BYPASS SPILLAGE - SEPTEMBER

SPILLAGE RANGE (cfs)	WATER YEAR 1983 NO.DAYS	1983 PERCENT	1984 NO.DAYS	1984 PERCENT	1985 NO.DAYS	1985 PERCENT	1986 NO.DAYS	1986 PERCENT	1987 NO.DAYS	1987 PERCENT	TOTAL NO.DAYS	TOTAL PERCENT
NONE	27	90.0	30	100.0	26	86.7	28	93.3	25	83.3	136	90.7
10-100	2	6.7					2	6.7	2	6.7	6	4.0
110-200					1	3.3			1	3.3	2	1.3
210-300					1	3.3					1	0.7
310-400												
410-500												
510-600												
610-700												
710-800												
810-900												
910-1000												
1010-2000	1	3.3							2	6.7	3	2.0
2010-3000					1	3.3					1	0.7
3010-4000												
4010-5000												
5010-6000					1	3.3					1	0.7
6010-7000												
7010-8000												
8010-9000												
9010-10000												
10010-15000												
15010-20000												
20010-25000												
>25000												
SPILLAGE DAYS	3	10.0	0	-	4	13.3	2	6.7	5	16.7	14	9.3

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APPENDIX D

APPENDIX D

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

OCTOBER 1982

Day	Discharge	Upper Dam	Middle Dam
1	2180	0	0
2	2130	0	0
3	2180	0	0
4	2230	0	0
5	2220	0	0
6	2230	0	0
7	2190	0	0
8	2530	0	0
9	3540	0	640
10	3170	0	270
11	2800	0	0
12	2480	0	0
13	2540	0	0
14	2540	0	0
15	2470	0	0
16	2490	0	0
17	2470	0	0
18	2370	0	0
19	2330	0	0
20	2260	0	0
21	2250	0	0
22	2070	0	0
23	2130	0	0
24	2170	0	0
25	2620	0	0
26	2080	0	0
27	2110	0	0
28	2360	0	0
29	2170	0	0
30	2280	0	0
31	2160	0	0
MEAN	2379	0	0
MAX	3540	0	640
MIN	2070	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

NOVEMBER 1982

Day	Discharge	Upper Dam	Middle Dam
1	2100	0	0
2	2220	0	0
3	2610	0	0
4	2680	0	0
5	4090	0	1190
6	7730	3230	4830
7	4700	200	1800
8	3670	0	770
9	2700	0	0
10	2610	0	0
11	2570	0	0
12	2560	0	0
13	3670	0	770
14	5590	1090	2690
15	4150	0	1250
16	3360	0	460
17	3130	0	230
18	2820	0	0
19	2760	0	0
20	2640	0	0
21	2540	0	0
22	2950	0	50
23	3660	0	760
24	4170	0	1270
25	3660	0	760
26	3270	0	370
27	2910	0	10
28	2370	0	0
29	2720	0	0
30	3150	0	250
MEAN	3325	0	0
MAX	7730	3230	4830
MIN	2100	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

DECEMBER 1982

Day	Discharge	Upper Dam	Middle Dam
1	3170	0	270
2	3050	0	150
3	2920	0	20
4	2880	0	0
5	2820	0	0
6	2680	0	0
7	2810	0	0
8	2820	0	0
9	2650	0	0
10	1980	0	0
11	2260	0	0
12	2250	0	0
13	1920	0	0
14	2120	0	0
15	2640	0	0
16	2880	0	0
17	4190	0	1290
18	3490	0	590
19	2770	0	0
20	2760	0	0
21	2860	0	0
22	2470	0	0
23	2270	0	0
24	2440	0	0
25	2430	0	0
26	2780	0	0
27	3280	0	380
28	3070	0	170
29	2990	0	90
30	2830	0	0
31	2490	0	0
MEAN	2741	0	0
MAX	4190	0	1290
MIN	1920	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JANUARY 1983

Day	Discharge	Upper Dam	Middle Dam
1	2510	0	0
2	2460	0	0
3	2330	0	0
4	1890	0	0
5	1830	0	0
6	2220	0	0
7	2430	0	0
8	2410	0	0
9	2170	0	0
10	2080	0	0
11	5730	1230	2830
12	8180	3680	5280
13	5670	1170	2770
14	3570	0	670
15	3030	0	130
16	2900	0	0
17	2720	0	0
18	2540	0	0
19	2290	0	0
20	2080	0	0
21	2450	0	0
22	2590	0	0
23	2590	0	0
24	2780	0	0
25	3610	0	710
26	3310	0	410
27	2900	0	0
28	2610	0	0
29	2460	0	0
30	2440	0	0
31	2380	0	0
MEAN	2941	0	40
MAX	8180	3680	5280
MIN	1830	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

FEBRUARY 1983

Day	Discharge	Upper Dam	Middle Dam
1	2370	0	0
2	2300	0	0
3	3450	0	550
4	7610	3110	4710
5	5920	1420	3020
6	4210	0	1310
7	3660	0	760
8	2980	0	80
9	3120	0	220
10	3140	0	240
11	2860	0	0
12	3010	0	110
13	3130	0	230
14	2960	0	60
15	2900	0	0
16	2900	0	0
17	2890	0	0
18	2840	0	0
19	2820	0	0
20	2750	0	0
21	2730	0	0
22	2740	0	0
23	2760	0	0
24	2690	0	0
25	2710	0	0
26	2680	0	0
27	2590	0	0
28	2640	0	0
MEAN	3191	0	291
MAX	7610	3110	4710
MIN	2300	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

MARCH 1983

Day	Discharge	Upper Dam	Middle Dam
1	2680	0	0
2	2940	0	40
3	4920	420	2020
4	4870	370	1970
5	4230	0	1330
6	3760	0	860
7	3580	0	680
8	3520	0	620
9	3370	0	470
10	3300	0	400
11	4140	0	1240
12	5070	570	2170
13	5580	1080	2680
14	5200	700	2300
15	4950	450	2050
16	5150	650	2250
17	5160	660	2260
18	4930	430	2030
19	5920	1420	3020
20	19100	14600	16200
21	13800	9300	10900
22	14600	10100	11700
23	10300	5800	7400
24	6200	1700	3300
25	5060	560	2160
26	4530	30	1630
27	4160	0	1260
28	4030	0	1130
29	3750	0	850
30	3600	0	700
31	3640	0	740
MEAN	5679	1179	2779
MAX	19100	14600	16200
MIN	2680	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

APRIL 1983

Day	Discharge	Upper Dam	Middle Dam
1	3620	0	720
2	3670	0	770
3	3900	0	1000
4	3920	0	1020
5	3980	0	1080
6	4560	60	1660
7	5160	660	2260
8	5390	890	2490
9	6950	2450	4050
10	6760	2260	3860
11	5930	1430	3030
12	6770	2270	3870
13	6420	1920	3520
14	6640	2140	3740
15	6620	2120	3720
16	5020	1520	3120
17	6800	2300	3900
18	7910	3410	5010
19	6660	2160	3760
20	6330	1830	3430
21	6810	2310	3910
22	5980	1480	3080
23	5660	1160	2760
24	6470	1970	3570
25	20200	15700	17300
26	21100	16600	18200
27	14900	10400	12000
28	12500	8000	9600
29	14100	9600	11200
30	16000	11500	13100
MEAN	7924	3424	5024
MAX	21100	14600	18200
MIN	3620	0	720

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

MAY 1983

Day	Discharge	Upper Dam	Middle Dam
1	16300	11800	13400
2	16800	12300	13900
3	20300	15800	17400
4	19300	14800	16400
5	15300	10800	12400
6	12500	8000	9600
7	11100	6600	8200
8	10800	6300	7900
9	11200	6700	8300
10	12100	7600	9200
11	10900	6400	8000
12	9320	4820	6420
13	7320	2820	4420
14	5390	890	2490
15	4940	440	2040
16	5330	830	2430
17	5240	740	2340
18	4530	30	1630
19	4170	0	1270
20	4070	0	1170
21	4220	0	1320
22	4180	0	1280
23	4430	0	1530
24	5980	1480	3080
25	5430	930	2530
26	4780	280	1880
27	4560	60	1660
28	6330	1830	3430
29	6550	2050	3650
30	6150	1650	3250
31	8210	3710	5310
MEAN	8636	4136	5736
MAX	20300	15800	17400
MIN	4070	0	1170

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JUNE 1983

Day	Discharge	Upper Dam	Middle Dam
1	9540	5040	6640
2	8830	4330	5930
3	7700	3200	4800
4	6930	2430	4030
5	7380	2880	4480
6	6600	2100	3700
7	5410	910	2510
8	4480	0	1580
9	4150	0	1250
10	3710	0	810
11	3580	0	680
12	3390	0	490
13	3300	0	400
14	3330	0	430
15	3430	0	530
16	4310	0	1410
17	4190	0	1290
18	4360	0	1460
19	4430	0	1530
20	4280	0	1380
21	3760	0	860
22	3160	0	260
23	2730	0	0
24	2830	0	0
25	2420	0	0
26	2690	0	0
27	2640	0	0
28	2530	0	0
29	2450	0	0
30	2360	0	0
MEAN	4363	0	1463
MAX	9540	5040	6640
MIN	2360	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JULY 1983

Day	Discharge	Upper Dam	Middle Dam
1	2300	0	0
2	2250	0	0
3	2620	0	0
4	2270	0	0
5	2150	0	0
6	4200	0	1300
7	4060	0	1160
8	2830	0	0
9	2680	0	0
10	2490	0	0
11	2340	0	0
12	2360	0	0
13	2170	0	0
14	2150	0	0
15	2120	0	0
16	2180	0	0
17	2130	0	0
18	2060	0	0
19	2050	0	0
20	2110	0	0
21	2150	0	0
22	2390	0	0
23	2430	0	0
24	2240	0	0
25	2240	0	0
26	2290	0	0
27	2130	0	0
28	2090	0	0
29	2070	0	0
30	2100	0	0
31	2050	0	0
MEAN	2377	0	0
MAX	4200	0	1300
MIN	2050	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

AUGUST 1983

Day	Discharge	Upper Dam	Middle Dam
1	2120	0	0
2	2550	0	0
3	2490	0	0
4	2270	0	0
5	2210	0	0
6	2190	0	0
7	2250	0	0
8	2230	0	0
9	2820	0	0
10	3060	0	160
11	2190	0	0
12	3540	0	640
13	5130	630	2230
14	2950	0	50
15	2450	0	0
16	2430	0	0
17	2220	0	0
18	2240	0	0
19	2210	0	0
20	2230	0	0
21	2080	0	0
22	2040	0	0
23	2090	0	0
24	2100	0	0
25	2060	0	0
26	2120	0	0
27	2060	0	0
28	2140	0	0
29	2110	0	0
30	2080	0	0
31	2340	0	0
MEAN	2419	0	0
MAX	5130	630	2230
MIN	2040	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

SEPTEMBER 1983

Day	Discharge	Upper Dam	Middle Dam
1	2920	0	20
2	2400	0	0
3	2140	0	0
4	2100	0	0
5	2100	0	0
6	2060	0	0
7	2060	0	0
8	2010	0	0
9	1980	0	0
10	1970	0	0
11	2020	0	0
12	2020	0	0
13	2040	0	0
14	2010	0	0
15	2000	0	0
16	2020	0	0
17	2020	0	0
18	2140	0	0
19	2140	0	0
20	2130	0	0
21	2100	0	0
22	2940	0	40
23	4240	0	1340
24	2720	0	0
25	2490	0	0
26	2330	0	0
27	2280	0	0
28	2220	0	0
29	2170	0	0
30	2180	0	0
MEAN	2265	0	0
MAX	4240	0	1340
MIN	1970	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

OCTOBER 1983

Day	Discharge	Upper Dam	Middle Dam
1	2150	0	0
2	2140	0	0
3	2100	0	0
4	2040	0	0
5	2150	0	0
6	2460	0	0
7	2660	0	0
8	2340	0	0
9	2220	0	0
10	2160	0	0
11	2100	0	0
12	2090	0	0
13	2920	0	20
14	3580	0	680
15	3340	0	440
16	2870	0	0
17	2420	0	0
18	2280	0	0
19	2260	0	0
20	2310	0	0
21	2070	0	0
22	2140	0	0
23	2260	0	0
24	2190	0	0
25	2550	0	0
26	2520	0	0
27	2350	0	0
28	2280	0	0
29	2270	0	0
30	2250	0	0
31	2230	0	0
MEAN	2377	0	0
MAX	3580	0	680
MIN	2040	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

NOVEMBER 1983

Day	Discharge	Upper Dam	Middle Dam
1	2210	0	0
2	2250	0	0
3	2190	0	0
4	2550	0	0
5	7710	3210	4810
6	9920	5420	7020
7	6470	1970	3570
8	5020	520	2120
9	4190	0	1290
10	4170	0	1270
11	4730	230	1830
12	7340	2840	4440
13	6140	1640	3240
14	4850	350	1950
15	4130	0	1230
16	3850	0	950
17	7270	2770	4370
18	6200	1700	3300
19	4400	0	1500
20	3600	0	700
21	5800	1300	2900
22	7700	3200	4800
23	6300	1800	3400
24	5050	550	2150
25	13500	9000	10600
26	13600	9100	10700
27	8500	4000	5600
28	6850	2350	3950
29	7000	2500	4100
30	7050	2550	4150
MEAN	6018	1518	3118
MAX	13600	9100	10700
MIN	2190	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

DECEMBER 1983

Day	Discharge	Upper Dam	Middle Dam
1	5500	1000	2600
2	4400	0	1500
3	3850	0	950
4	2900	0	0
5	3350	0	450
6	3800	0	900
7	5900	1400	3000
8	4350	0	1450
9	3350	0	450
10	3900	0	1000
11	3300	0	400
12	2950	0	50
13	8000	3500	5100
14	23000	18500	20100
15	15500	11000	12600
16	11500	7000	8600
17	9000	4500	6100
18	8000	3500	5100
19	7000	2500	4100
20	5400	900	2500
21	4700	200	1800
22	4500	0	1600
23	3250	0	350
24	3150	0	250
25	3120	0	220
26	2850	0	0
27	3100	0	200
28	3160	0	260
29	3350	0	450
30	3500	0	600
31	3230	0	330
MEAN	5627	1127	2727
MAX	23000	18500	20100
MIN	2850	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JANUARY 1984

Day	Discharge	Upper Dam	Middle Dam
1	3050	0	150
2	3050	0	150
3	3050	0	150
4	3170	0	270
5	3280	0	380
6	3450	0	550
7	3350	0	450
8	3250	0	350
9	3130	0	230
10	3070	0	170
11	3050	0	150
12	2800	0	0
13	2880	0	0
14	2940	0	40
15	3020	0	120
16	2880	0	0
17	2830	0	0
18	2860	0	0
19	3000	0	100
20	2900	0	0
21	2830	0	0
22	2680	0	0
23	2780	0	0
24	2700	0	0
25	2680	0	0
26	2920	0	20
27	2900	0	0
28	2920	0	20
29	2800	0	0
30	2800	0	0
31	2860	0	0
MEAN	2969	0	69
MAX	3450	0	550
MIN	2680	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

FEBRUARY 1984

Day	Discharge	Upper Dam	Middle Dam
1	2700	0	0
2	2770	0	0
3	2880	0	0
4	3150	0	250
5	3500	0	600
6	3400	0	500
7	3900	0	1000
8	3150	0	250
9	3100	0	200
10	2950	0	50
11	3000	0	100
12	3000	0	100
13	3150	0	250
14	3250	0	350
15	3700	0	800
16	5210	710	2310
17	6240	1740	3340
18	5710	1210	2810
19	5290	790	2390
20	5000	500	2100
21	4650	150	1750
22	4800	300	1900
23	4800	300	1900
24	4450	0	1550
25	4800	300	1900
26	6220	1720	3320
27	5600	1100	2700
28	4600	100	1700
29	3550	0	650
MEAN	4060	0	1160
MAX	6240	1740	3340
MIN	2700	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

MARCH 1984

Day	Discharge	Upper Dam	Middle Dam
1	3600	0	700
2	3340	0	440
3	3350	0	450
4	3320	0	420
5	3250	0	350
6	3220	0	320
7	3120	0	220
8	2950	0	50
9	2660	0	0
10	2880	0	0
11	2800	0	0
12	2680	0	0
13	2850	0	0
14	2600	0	0
15	3000	0	100
16	3200	0	300
17	3250	0	350
18	3150	0	250
19	4080	0	1180
20	7760	3260	4860
21	8510	4010	5610
22	8140	3640	5240
23	7660	3160	4760
24	6730	2230	3830
25	6770	2270	3870
26	5150	650	2250
27	4600	100	1700
28	4650	150	1750
29	4500	0	1600
30	4100	0	1200
31	3650	0	750
MEAN	4202	0	1302
MAX	8510	4010	5610
MIN	2600	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

APRIL 1984

Day	Discharge	Upper Dam	Middle Dam
1	3950	0	1050
2	4300	0	1400
3	4400	0	1500
4	5320	820	2420
5	14000	9500	11100
6	44000	39500	41100
7	31500	27000	28600
8	21500	17000	18600
9	15000	10500	12100
10	11400	6900	8500
11	8580	4080	5680
12	7550	3050	4650
13	8770	4270	5870
14	10300	5800	7400
15	11100	6600	8200
16	10600	6100	7700
17	16000	11500	13100
18	18300	13800	15400
19	16700	12200	13800
20	14800	10300	11900
21	13400	8900	10500
22	11300	6800	8400
23	9560	5060	6660
24	10500	6000	7600
25	15400	10900	12500
26	13000	8500	10100
27	11100	6600	8200
28	10400	5900	7500
29	9330	4830	6430
30	9130	4630	6230
MEAN	10340	5840	7440
MAX	44000	39500	41100
MIN	3950	0	1050

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

MAY 1984

Day	Discharge	Upper Dam	Middle Dam
1	10800	6300	7900
2	8190	3690	5290
3	8000	3500	5100
4	10600	6100	7700
5	12200	7700	9300
6	10500	6000	7600
7	9600	5100	6700
8	8800	4300	5900
9	9900	5400	7000
10	8000	3500	5100
11	5350	850	2450
12	5370	870	2470
13	8750	4250	5850
14	8310	3810	5410
15	8960	4460	6060
16	8440	3940	5540
17	7380	2880	4480
18	6550	2050	3650
19	5570	1070	2670
20	4460	0	1560
21	4340	0	1440
22	4180	0	1280
23	4230	0	1330
24	5610	1110	2710
25	5140	640	2240
26	4380	0	1480
27	4210	0	1310
28	4150	0	1250
29	5430	930	2530
30	17300	12800	14400
31	29200	24700	26300
MEAN	8190	3690	5290
MAX	29200	24700	26300
MIN	4150	0	1250

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JUNE 1984

Day	Discharge	Upper Dam	Middle Dam
1	30800	26300	27900
2	26900	22400	24000
3	26500	22000	23600
4	22000	17500	19100
5	17300	12800	14400
6	14000	9500	11100
7	11900	7400	9000
8	10000	5500	7100
9	7200	2700	4300
10	6100	1600	3200
11	5600	1100	2700
12	5050	550	2150
13	4550	50	1650
14	4200	0	1300
15	3900	0	1000
16	4000	0	1100
17	3600	0	700
18	3190	0	290
19	3400	0	500
20	3100	0	200
21	3100	0	200
22	2880	0	0
23	2730	0	0
24	2750	0	0
25	3950	0	1050
26	4800	1300	2900
27	5200	700	2300
28	4350	0	1450
29	4100	0	1200
30	5200	700	2300
MEAN	8438	3938	5538
MAX	30800	26300	27900
MIN	2680	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JULY 1984

Day	Discharge	Upper Dam	Middle Dam
1	4150	0	1250
2	3250	0	350
3	2850	0	0
4	2760	0	0
5	2700	0	0
6	3750	0	850
7	4550	50	1650
8	7100	2600	4200
9	5800	1300	2900
10	5000	500	2100
11	4300	0	1400
12	4700	200	1800
13	4600	100	1700
14	4300	0	1400
15	4100	0	1200
16	4050	0	1150
17	4000	0	1100
18	3430	0	530
19	4340	0	1440
20	3660	0	760
21	3210	0	310
22	3170	0	270
23	2660	0	0
24	2850	0	0
25	2770	0	0
26	2770	0	0
27	2830	0	0
28	3070	0	170
29	2930	0	30
30	2810	0	0
31	2750	0	0
MEAN	3715	0	815
MAX	7100	2600	4200
MIN	2680	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

AUGUST 1984

Day	Discharge	Upper Dam	Middle Dam
1	2700	0	0
2	2550	0	0
3	2400	0	0
4	2350	0	0
5	2370	0	0
6	2300	0	0
7	2400	0	0
8	2390	0	0
9	2320	0	0
10	2270	0	0
11	2250	0	0
12	2270	0	0
13	2280	0	0
14	2450	0	0
15	2500	0	0
16	2480	0	0
17	2380	0	0
18	2280	0	0
19	2260	0	0
20	2250	0	0
21	2220	0	0
22	2200	0	0
23	2220	0	0
24	2320	0	0
25	2360	0	0
26	2270	0	0
27	2220	0	0
28	2230	0	0
29	2110	0	0
30	2150	0	0
31	2170	0	0
MEAN	2318	0	0
MAX	2700	0	0
MIN	2110	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

SEPTEMBER 1984

Day	Discharge	Upper Dam	Middle Dam
1	2180	0	0
2	2180	0	0
3	2180	0	0
4	2270	0	0
5	2300	0	0
6	2360	0	0
7	2320	0	0
8	2270	0	0
9	2230	0	0
10	2310	0	0
11	2340	0	0
12	2510	0	0
13	2330	0	0
14	2440	0	0
15	2420	0	0
16	2410	0	0
17	2400	0	0
18	2410	0	0
19	2320	0	0
20	2370	0	0
21	2470	0	0
22	2470	0	0
23	2460	0	0
24	2420	0	0
25	2390	0	0
26	2460	0	0
27	2350	0	0
28	2390	0	0
29	2380	0	0
30	2390	0	0
MEAN	2356	0	0
MAX	2510	0	0
MIN	2180	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

OCTOBER 1984

Day	Discharge	Upper Dam	Middle Dam
1	2430	0	0
2	2500	0	0
3	3230	0	330
4	2920	0	20
5	2790	0	0
6	2580	0	0
7	2420	0	0
8	2390	0	0
9	2360	0	0
10	2330	0	0
11	2330	0	0
12	2390	0	0
13	2400	0	0
14	2430	0	0
15	2380	0	0
16	2330	0	0
17	2340	0	0
18	2170	0	0
19	2180	0	0
20	2210	0	0
21	2210	0	0
22	2270	0	0
23	2340	0	0
24	2330	0	0
25	2360	0	0
26	2450	0	0
27	2350	0	0
28	2300	0	0
29	2340	0	0
30	2540	0	0
31	2200	0	0
MEAN	2414	0	0
MAX	3230	0	330
MIN	2170	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

NOVEMBER 1984

Day	Discharge	Upper Dam	Middle Dam
1	2110	0	0
2	2020	0	0
3	2080	0	0
4	2020	0	0
5	2060	0	0
6	2180	0	0
7	2330	0	0
8	2150	0	0
9	2210	0	0
10	2120	0	0
11	2170	0	0
12	3110	0	210
13	4560	60	1660
14	3670	0	770
15	2640	0	0
16	2510	0	0
17	2320	0	0
18	2270	0	0
19	2200	0	0
20	2130	0	0
21	2070	0	0
22	2080	0	0
23	2180	0	0
24	2210	0	0
25	2120	0	0
26	2190	0	0
27	2230	0	0
28	2120	0	0
29	2250	0	0
30	3700	0	800
MEAN	2400	0	0
MAX	4560	60	1660
MIN	2020	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

DECEMBER 1984

Day	Discharge	Upper Dam	Middle Dam
1	3350	0	450
2	2580	0	0
3	2380	0	0
4	2120	0	0
5	1990	0	0
6	1430	0	0
7	1790	0	0
8	1770	0	0
9	2100	0	0
10	2230	0	0
11	2270	0	0
12	2260	0	0
13	2310	0	0
14	2800	0	0
15	2350	0	0
16	2080	0	0
17	2440	0	0
18	2650	0	0
19	2520	0	0
20	2340	0	0
21	2100	0	0
22	1670	0	0
23	2230	0	0
24	2130	0	0
25	2180	0	0
26	1640	0	0
27	1370	0	0
28	1740	0	0
29	2040	0	0
30	5780	1280	2880
31	4800	300	1900
MEAN	2369	0	0
MAX	5780	1280	2880
MIN	1370	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JANUARY 1985

Day	Discharge	Upper Dam	Middle Dam
1	3330	0	430
2	2390	0	0
3	2600	0	0
4	2190	0	0
5	2250	0	0
6	2150	0	0
7	1960	0	0
8	2090	0	0
9	2000	0	0
10	1830	0	0
11	1870	0	0
12	2000	0	0
13	2110	0	0
14	2130	0	0
15	2270	0	0
16	1990	0	0
17	1850	0	0
18	1970	0	0
19	2010	0	0
20	2050	0	0
21	1990	0	0
22	1900	0	0
23	1950	0	0
24	2020	0	0
25	2010	0	0
26	2000	0	0
27	1950	0	0
28	1990	0	0
29	1970	0	0
30	1920	0	0
31	1820	0	0
MEAN	2083	0	0
MAX	3330	0	430
MIN	1820	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

FEBRUARY 1985

Day	Discharge	Upper Dam	Middle Dam
1	1850	0	0
2	1990	0	0
3	1970	0	0
4	1790	0	0
5	1840	0	0
6	1910	0	0
7	1930	0	0
8	1910	0	0
9	1870	0	0
10	1810	0	0
11	1950	0	0
12	1950	0	0
13	2010	0	0
14	2620	0	0
15	2470	0	0
16	2570	0	0
17	2360	0	0
18	2280	0	0
19	2160	0	0
20	2140	0	0
21	2080	0	0
22	2000	0	0
23	2160	0	0
24	2810	0	0
25	3920	0	1020
26	4520	20	1620
27	3910	0	1010
28	3330	0	430
MEAN	2361	0	0
MAX	4520	20	1620
MIN	1790	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

MARCH 1985

Day	Discharge	Upper Dam	Middle Dam
1	3060	0	160
2	2840	0	0
3	3000	0	100
4	2690	0	0
5	2520	0	0
6	2540	0	0
7	2490	0	0
8	2360	0	0
9	2370	0	0
10	2410	0	0
11	2440	0	0
12	2810	0	0
13	4670	170	1770
14	4580	80	1680
15	4360	0	1460
16	3930	0	1030
17	4050	0	1150
18	3770	0	870
19	3510	0	610
20	3450	0	550
21	3530	0	630
22	3370	0	470
23	3550	0	650
24	3860	0	960
25	3800	0	900
26	3540	0	640
27	3690	0	790
28	3890	0	990
29	5610	1110	2710
30	8080	3580	5180
31	6400	1900	3500
MEAN	3651	0	751
MAX	8080	3580	5180
MIN	2360	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

APRIL 1985

Day	Discharge	Upper Dam	Middle Dam
1	5400	900	2500
2	3900	0	1000
3	2650	0	0
4	3000	0	100
5	2850	0	0
6	3420	0	520
7	4470	0	1570
8	5480	980	2580
9	5270	770	2370
10	4600	100	1700
11	4170	0	1270
12	3990	0	1090
13	3560	0	660
14	3400	0	500
15	3350	0	450
16	5760	1260	2860
17	11000	6500	8100
18	8000	3500	5100
19	6580	2080	3680
20	6270	1770	3370
21	6610	2110	3710
22	7580	3080	4680
23	8430	3930	5530
24	8490	3990	5590
25	8910	4410	6010
26	10600	6100	7700
27	11500	7000	8600
28	9900	5400	7000
29	8870	4370	5970
30	7750	3250	4850
MEAN	6192	1692	3292
MAX	11500	7000	8600
MIN	2650	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

MAY 1985

Day	Discharge	Upper Dam	Middle Dam
1	8060	3560	5160
2	6820	2320	3920
3	5120	620	2220
4	4460	0	1560
5	3770	0	870
6	4190	0	1290
7	5790	1290	2890
8	6870	2370	3970
9	5200	700	2300
10	4340	0	1440
11	4490	0	1590
12	4860	360	1960
13	4370	0	1470
14	4500	0	1600
15	4470	0	1570
16	3900	0	1000
17	3270	0	370
18	4000	0	1100
19	7710	3210	4810
20	5940	1440	3040
21	4500	0	1600
22	3890	0	990
23	3350	0	450
24	3030	0	130
25	2760	0	0
26	2510	0	0
27	2730	0	0
28	3150	0	250
29	3050	0	150
30	2660	0	0
31	2520	0	0
MEAN	4396	0	1496
MAX	8060	3560	5160
MIN	2510	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JUNE 1985

Day	Discharge	Upper Dam	Middle Dam
1	2670	0	0
2	2560	0	0
3	2350	0	0
4	2030	0	0
5	2000	0	0
6	2300	0	0
7	3030	0	130
8	2300	0	0
9	2200	0	0
10	2250	0	0
11	2120	0	0
12	2180	0	0
13	2280	0	0
14	2260	0	0
15	2160	0	0
16	2000	0	0
17	2050	0	0
18	2250	0	0
19	2550	0	0
20	2400	0	0
21	2100	0	0
22	2200	0	0
23	2050	0	0
24	1920	0	0
25	2200	0	0
26	2080	0	0
27	2000	0	0
28	3400	0	500
29	5200	700	2300
30	4000	0	1100
MEAN	2436	0	0
MAX	5200	700	2300
MIN	1920	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JULY 1985

Day	Discharge	Upper Dam	Middle Dam
1	3200	0	300
2	2550	0	0
3	2100	0	0
4	2080	0	0
5	2060	0	0
6	2000	0	0
7	2080	0	0
8	2100	0	0
9	2090	0	0
10	2080	0	0
11	2050	0	0
12	1960	0	0
13	1860	0	0
14	1980	0	0
15	1900	0	0
16	1950	0	0
17	2220	0	0
18	1920	0	0
19	2000	0	0
20	2000	0	0
21	1900	0	0
22	1770	0	0
23	1780	0	0
24	1910	0	0
25	1810	0	0
26	1880	0	0
27	1940	0	0
28	1980	0	0
29	1860	0	0
30	1920	0	0
31	1900	0	0
MEAN	2027	0	0
MAX	3200	0	300
MIN	1770	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

AUGUST 1985

Day	Discharge	Upper Dam	Middle Dam
1	2730	0	0
2	3030	0	130
3	2320	0	0
4	2070	0	0
5	1880	0	0
6	1870	0	0
7	2070	0	0
8	2070	0	0
9	2000	0	0
10	1940	0	0
11	1960	0	0
12	1920	0	0
13	1880	0	0
14	1860	0	0
15	1940	0	0
16	1970	0	0
17	2100	0	0
18	2040	0	0
19	2000	0	0
20	2000	0	0
21	2040	0	0
22	2060	0	0
23	2060	0	0
24	2060	0	0
25	2110	0	0
26	2200	0	0
27	2410	0	0
28	2670	0	0
29	2440	0	0
30	2300	0	0
31	2620	0	0
MEAN	2149	0	0
MAX	3030	0	130
MIN	1860	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

SEPTEMBER 1985

Day	Discharge	Upper Dam	Middle Dam
1	3040	0	140
2	2680	0	0
3	2470	0	0
4	2400	0	0
5	2360	0	0
6	2540	0	0
7	2540	0	0
8	2450	0	0
9	2200	0	0
10	2280	0	0
11	2420	0	0
12	2350	0	0
13	2320	0	0
14	2290	0	0
15	2140	0	0
16	2250	0	0
17	2020	0	0
18	1980	0	0
19	2000	0	0
20	2080	0	0
21	2000	0	0
22	1950	0	0
23	1920	0	0
24	1960	0	0
25	1990	0	0
26	2070	0	0
27	2300	0	0
28	8770	4270	5870
29	5470	970	2570
30	3140	0	240
MEAN	2613	0	0
MAX	8770	4270	5870
MIN	1920	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

OCTOBER 1985

Day	Discharge	Upper Dam	Middle Dam
1	2260	0	0
2	2290	0	0
3	2260	0	0
4	2250	0	0
5	3500	0	600
6	4850	350	1950
7	3100	0	200
8	2650	0	0
9	2400	0	0
10	2350	0	0
11	2300	0	0
12	2350	0	0
13	2420	0	0
14	2500	0	0
15	2880	0	0
16	4000	0	1100
17	3200	0	300
18	2700	0	0
19	2500	0	0
20	2380	0	0
21	2140	0	0
22	2320	0	0
23	2410	0	0
24	2340	0	0
25	2400	0	0
26	2380	0	0
27	2290	0	0
28	2210	0	0
29	2220	0	0
30	2170	0	0
31	2170	0	0
MEAN	2587	0	0
MAX	4850	350	1950
MIN	2140	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

NOVEMBER 1985

Day	Discharge	Upper Dam	Middle Dam
1	2190	0	0
2	2180	0	0
3	2200	0	0
4	2160	0	0
5	2310	0	0
6	9100	4600	6200
7	10100	5600	7200
8	6660	2160	3760
9	4700	200	1800
10	3700	0	800
11	3200	0	300
12	3050	0	150
13	2900	0	0
14	3700	0	800
15	3650	0	750
16	3650	0	750
17	3180	0	280
18	3230	0	330
19	3440	0	540
20	3810	0	910
21	4580	80	1680
22	3970	0	1070
23	3390	0	490
24	3070	0	170
25	2860	0	0
26	2620	0	0
27	2730	0	0
28	2810	0	0
29	2660	0	0
30	2640	0	0
MEAN	3681	0	781
MAX	10100	5600	7200
MIN	2160	0	0

APPENDIX D(CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

DECEMBER 1985

Day	Discharge	Upper Dam	Middle Dam
1	2540	0	0
2	3350	0	450
3	4600	100	1700
4	2840	0	0
5	2980	0	80
6	3470	0	570
7	2980	0	80
8	3020	0	120
9	2920	0	20
10	2700	0	0
11	2970	0	70
12	2880	0	0
13	2580	0	0
14	2750	0	0
15	2290	0	0
16	2720	0	0
17	2890	0	0
18	2690	0	0
19	2130	0	0
20	2750	0	0
21	3040	0	140
22	3160	0	260
23	2990	0	90
24	3090	0	190
25	3140	0	240
26	2870	0	0
27	2810	0	0
28	2990	0	90
29	2860	0	0
30	2740	0	0
31	2800	0	0
MEAN	2921	0	21
MAX	4600	100	1700
MIN	2130	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JANUARY 1986

Day	Discharge	Upper Dam	Middle Dam
1	2820	0	0
2	2760	0	0
3	2810	0	0
4	2690	0	0
5	2680	0	0
6	2750	0	0
7	2720	0	0
8	2480	0	0
9	2720	0	0
10	2980	0	80
11	3070	0	170
12	2840	0	0
13	2860	0	0
14	2670	0	0
15	1910	0	0
16	2770	0	0
17	2920	0	20
18	2940	0	40
19	3100	0	200
20	3120	0	220
21	4510	10	1610
22	4790	290	1890
23	4360	0	1460
24	3800	0	900
25	3400	0	500
26	3780	0	880
27	23500	19000	20600
28	33700	29200	30800
29	14600	10100	11700
30	8370	3870	5470
31	7240	2740	4340
MEAN	5408	908	2508
MAX	33700	29200	30800
MIN	1910	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

FEBRUARY 1986

Day	Discharge	Upper Dam	Middle Dam
1	5890	1390	2990
2	4930	430	2030
3	4830	330	1930
4	4640	140	1740
5	3990	0	1090
6	3910	0	1010
7	3980	0	1080
8	4020	0	1120
9	4070	0	1170
10	3830	0	930
11	3770	0	870
12	3710	0	810
13	3590	0	690
14	3660	0	760
15	3770	0	870
16	3780	0	880
17	3500	0	600
18	3070	0	170
19	3630	0	730
20	3630	0	730
21	3700	0	800
22	3700	0	800
23	3500	0	600
24	3280	0	380
25	3190	0	290
26	3420	0	520
27	3100	0	200
28	3080	0	180
MEAN	3827	0	927
MAX	5890	1390	2990
MIN	3070	0	170

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

MARCH 1986

Day	Discharge	Upper Dam	Middle Dam
1	2810	0	0
2	3420	0	520
3	3190	0	290
4	3060	0	160
5	3100	0	200
6	3110	0	210
7	3420	0	520
8	3850	0	950
9	3510	0	610
10	3390	0	490
11	3270	0	270
12	3500	0	600
13	3780	0	880
14	3610	0	710
15	3840	0	940
16	4680	180	1780
17	5300	800	2400
18	5090	590	2190
19	5040	540	2140
20	6850	2350	3950
21	6850	2350	3950
22	5700	1200	2800
23	5280	780	2380
24	4730	230	1830
25	4320	0	1420
26	4120	0	1220
27	6030	1530	3130
28	9650	5150	6750
29	10400	5900	7500
30	14700	10200	11800
31	19300	14800	16400
MEAN	5448	948	2548
MAX	19300	14800	16400
MIN	2810	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

APRIL 1986

Day	Discharge	Upper Dam	Middle Dam
1	17100	12600	14200
2	15800	11300	12900
3	15700	11200	12800
4	13200	8700	10300
5	10900	6400	8000
6	9120	4620	6220
7	8230	3730	5330
8	7570	3070	4670
9	6950	2450	4050
10	6920	2420	4020
11	6330	1830	3430
12	5570	1070	2670
13	5040	540	2140
14	4820	320	1920
15	5170	670	2270
16	5450	950	2550
17	5420	920	2520
18	5370	870	2470
19	5100	600	2200
20	4590	90	1690
21	4360	0	1460
22	5060	560	2160
23	5340	840	2440
24	4790	290	1890
25	4310	0	1410
26	7460	2960	4560
27	8740	4240	5840
28	6660	2160	3760
29	5030	530	2130
30	4520	20	1620
MEAN	7354	2854	4454
MAX	17100	12600	14200
MIN	4310	0	1410

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

MAY 1986

Day	Discharge	Upper Dam	Middle Dam
1	4740	240	1840
2	5250	750	2350
3	4840	340	1940
4	4500	0	1600
5	4380	0	1480
6	4510	10	1610
7	4930	430	2030
8	6000	1500	3100
9	6190	1690	3290
10	5460	960	2560
11	4810	310	1910
12	4510	10	1610
13	4270	0	1370
14	4010	0	1110
15	3760	0	880
16	3760	0	860
17	3830	0	930
18	3910	0	1010
19	3810	0	910
20	3720	0	820
21	4110	0	1210
22	5130	630	2230
23	5910	1410	3010
24	5860	1360	2960
25	9130	4630	6230
26	7680	3180	4780
27	6110	1610	3210
28	5520	1020	2620
29	5120	620	2220
30	4940	440	2040
31	4580	80	1680
MEAN	5010	510	2110
MAX	9130	4630	6230
MIN	3720	0	820

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JUNE 1986

Day	Discharge	Upper Dam	Middle Dam
1	4410	0	1510
2	4930	430	2030
3	4820	320	1920
4	4090	0	1190
5	3820	0	920
6	3530	0	630
7	3390	0	490
8	3080	0	180
9	3350	0	450
10	3180	0	280
11	3050	0	150
12	3200	0	300
13	3090	0	190
14	2940	0	40
15	2860	0	0
16	2720	0	0
17	2980	0	80
18	3300	0	400
19	2770	0	0
20	2400	0	0
21	2400	0	0
22	2460	0	0
23	2390	0	0
24	2390	0	0
25	2410	0	0
26	2420	0	0
27	2420	0	0
28	2610	0	0
29	2750	0	0
30	2490	0	0
MEAN	3088	0	188
MAX	4930	430	2030
MIN	2390	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JULY 1986

Day	Discharge	Upper Dam	Middle Dam
1	2500	0	0
2	2620	0	0
3	2730	0	0
4	2750	0	0
5	2740	0	0
6	2390	0	0
7	2370	0	0
8	2320	0	0
9	2230	0	0
10	2260	0	0
11	2220	0	0
12	2270	0	0
13	2330	0	0
14	2470	0	0
15	2850	0	0
16	2730	0	0
17	2330	0	0
18	2340	0	0
19	2330	0	0
20	2320	0	0
21	2320	0	0
22	2380	0	0
23	2290	0	0
24	2170	0	0
25	2280	0	0
26	2500	0	0
27	3320	0	420
28	3220	0	320
29	3050	0	150
30	4580	80	1680
31	5430	930	2530
MEAN	2666	0	0
MAX	5430	930	2530
MIN	2170	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

AUGUST 1986

Day	Discharge	Upper Dam	Middle Dam
1	3820	0	920
2	4500	0	1600
3	5010	510	2110
4	3630	0	730
5	2770	0	0
6	2730	0	0
7	2660	0	0
8	3170	0	270
9	4440	0	1540
10	4720	220	1820
11	3960	0	1060
12	3080	0	180
13	2640	0	0
14	2500	0	0
15	2420	0	0
16	2450	0	0
17	2430	0	0
18	2430	0	0
19	2700	0	0
20	2530	0	0
21	2520	0	0
22	2200	0	0
23	2190	0	0
24	2620	0	0
25	3060	0	160
26	3070	0	170
27	2730	0	0
28	3350	0	450
29	3290	0	390
30	2520	0	0
31	2400	0	0
MEAN	3050	0	150
MAX	5010	510	2110
MIN	2190	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

SEPTEMBER 1986

Day	Discharge	Upper Dam	Middle Dam
1	2350	0	0
2	2300	0	0
3	2280	0	0
4	2270	0	0
5	2280	0	0
6	2520	0	0
7	2740	0	0
8	2530	0	0
9	2370	0	0
10	2230	0	0
11	2210	0	0
12	2330	0	0
13	2490	0	0
14	2330	0	0
15	2280	0	0
16	2480	0	0
17	2960	0	60
18	2790	0	0
19	2450	0	0
20	2430	0	0
21	2450	0	0
22	2580	0	0
23	2520	0	0
24	2710	0	0
25	3000	0	100
26	2700	0	0
27	2520	0	0
28	2400	0	0
29	2370	0	0
30	2410	0	0
MEAN	2476	0	0
MAX	3000	0	100
MIN	2210	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

OCTOBER 1986

Day	Discharge	Upper Dam	Middle Dam
1	2870	0	0
2	2990	0	90
3	2850	0	0
4	2950	0	50
5	3390	0	490
6	3480	0	580
7	3300	0	400
8	3170	0	270
9	2290	0	0
10	2930	0	30
11	2840	0	0
12	2760	0	0
13	2720	0	0
14	2740	0	0
15	2860	0	0
16	2800	0	0
17	2660	0	0
18	2610	0	0
19	2540	0	0
20	2490	0	0
21	2530	0	0
22	2460	0	0
23	2660	0	0
24	2530	0	0
25	2510	0	0
26	2500	0	0
27	2590	0	0
28	2650	0	0
29	2660	0	0
30	2620	0	0
31	2870	0	0
MEAN	2791	0	0
MAX	3480	0	580
MIN	2460	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

NOVEMBER 1986

Day	Discharge	Upper Dam	Middle Dam
1	2720	0	0
2	2560	0	0
3	2600	0	0
4	2710	0	0
5	2670	0	0
6	2370	0	0
7	2620	0	0
8	2490	0	0
9	2920	0	20
10	3710	0	810
11	3890	0	990
12	3070	0	170
13	2830	0	0
14	2720	0	0
15	2570	0	0
16	2620	0	0
17	2630	0	0
18	2640	0	0
19	2570	0	0
20	2280	0	0
21	1620	0	0
22	2300	0	0
23	2600	0	0
24	2850	0	0
25	3260	0	360
26	3240	0	340
27	5720	1220	2820
28	6940	2440	4040
29	5300	800	2400
30	4180	0	1280
MEAN	3107	0	207
MAX	6940	2440	4040
MIN	1620	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

DECEMBER 1986

Day	Discharge	Upper Dam	Middle Dam
1	2330	0	0
2	2490	0	0
3	3610	0	710
4	8410	3910	5510
5	6760	2280	3880
6	4520	20	1620
7	3690	0	790
8	3520	0	620
9	2560	0	0
10	2330	0	0
11	2900	0	0
12	3140	0	240
13	3020	0	120
14	2460	0	0
15	2820	0	0
16	2970	0	70
17	3020	0	120
18	2900	0	0
19	2880	0	0
20	2880	0	0
21	2910	0	10
22	2610	0	0
23	2670	0	0
24	2800	0	0
25	2730	0	0
26	3300	0	400
27	3500	0	600
28	3110	0	210
29	2840	0	0
30	2930	0	30
31	2850	0	0
MEAN	3274	0	374
MAX	8410	3910	5510
MIN	2330	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JANUARY 1987

Day	Discharge	Upper Dam	Middle Dam
1	2680	0	0
2	2660	0	0
3	2530	0	0
4	2460	0	0
5	2530	0	0
6	2540	0	0
7	2620	0	0
8	2700	0	0
9	2550	0	0
10	2550	0	0
11	2560	0	0
12	2580	0	0
13	2560	0	0
14	2510	0	0
15	2670	0	0
16	2710	0	0
17	2420	0	0
18	2280	0	0
19	2430	0	0
20	2490	0	0
21	2360	0	0
22	2050	0	0
23	2280	0	0
24	2410	0	0
25	2620	0	0
26	2240	0	0
27	2230	0	0
28	2450	0	0
29	2500	0	0
30	2650	0	0
31	2660	0	0
MEAN	2499	0	0
MAX	2710	0	0
MIN	2050	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

FEBRUARY 1987

Day	Discharge	Upper Dam	Middle Dam
1	2620	0	0
2	2580	0	0
3	2510	0	0
4	2560	0	0
5	2500	0	0
6	2420	0	0
7	2430	0	0
8	2440	0	0
9	2440	0	0
10	2450	0	0
11	2430	0	0
12	2310	0	0
13	2430	0	0
14	2400	0	0
15	2420	0	0
16	2610	0	0
17	2740	0	0
18	2770	0	0
19	2510	0	0
20	2410	0	0
21	2470	0	0
22	2470	0	0
23	2590	0	0
24	2550	0	0
25	2520	0	0
26	2560	0	0
27	2650	0	0
28	2600	0	0
MEAN	2514	0	0
MAX	2770	0	0
MIN	2310	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

MARCH 1987

Day	Discharge	Upper Dam	Middle Dam
1	2660	0	0
2	2700	0	0
3	2610	0	0
4	2490	0	0
5	2540	0	0
6	2540	0	0
7	2580	0	0
8	2760	0	0
9	3280	0	380
10	3060	0	160
11	2910	0	10
12	3050	0	150
13	3020	0	120
14	2810	0	0
15	2760	0	0
16	2760	0	0
17	2590	0	0
18	2660	0	0
19	2770	0	0
20	2690	0	0
21	2710	0	0
22	2980	0	80
23	3500	0	700
24	4250	0	1350
25	5270	770	2370
26	6820	2320	3920
27	7720	3220	4820
28	7970	3470	5070
29	7810	3310	4910
30	10000	5500	7100
31	26000	21500	23100
MEAN	4525	25	1625
MAX	26000	21500	23100
MIN	2490	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

APRIL 1987

Day	Discharge	Upper Dam	Middle Dam
1	61100	56600	58200
2	46500	42000	43600
3	25900	21400	23000
4	17800	13300	14900
5	13700	9200	10800
6	18100	13600	15200
7	23200	18700	20300
8	18400	13900	15500
9	14200	9700	11300
10	11300	6800	8400
11	9680	5180	6780
12	9120	4620	6220
13	8580	4080	5680
14	7640	3140	4740
15	6780	2280	3880
16	6340	1840	3440
17	6320	1820	3420
18	7480	2980	4580
19	8120	3620	5220
20	7760	3260	4860
21	7270	2770	4370
22	6390	1890	3490
23	4990	490	2090
24	4190	0	1290
25	3670	0	770
26	3880	0	980
27	3490	0	590
28	3260	0	360
29	3480	0	580
30	3680	0	780
MEAN	12410	7910	9510
MAX	61100	56600	58200
MIN	3260	0	360

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

MAY 1987

Day	Discharge	Upper Dam	Middle Dam
1	4570	70	1670
2	4790	290	1890
3	4710	210	1810
4	4340	0	1440
5	4100	0	1200
6	5590	1090	2690
7	7710	3210	4810
8	5440	940	2540
9	4480	0	1580
10	3910	0	1010
11	3790	0	890
12	3540	0	640
13	3680	0	780
14	3410	0	510
15	3060	0	160
16	3300	0	400
17	3150	0	250
18	2940	0	40
19	2740	0	0
20	2850	0	0
21	2780	0	0
22	2760	0	0
23	2640	0	0
24	2910	0	10
25	3130	0	230
26	2880	0	0
27	2690	0	0
28	2890	0	0
29	3350	0	450
30	3810	0	910
31	3070	0	170
MEAN	3710	0	810
MAX	7710	3210	4810
MIN	2640	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JUNE 1987

Day	Discharge	Upper Dam	Middle Dam
1	2720	0	0
2	2810	0	0
3	2690	0	0
4	2530	0	0
5	2970	0	70
6	3280	0	380
7	2730	0	0
8	2580	0	0
9	3480	0	580
10	4420	0	1520
11	3620	0	720
12	3020	0	120
13	2870	0	0
14	2720	0	0
15	2620	0	0
16	2570	0	0
17	2530	0	0
18	2580	0	0
19	2360	0	0
20	2270	0	0
21	2210	0	0
22	2190	0	0
23	2500	0	0
24	3130	0	230
25	2690	0	0
26	2410	0	0
27	2550	0	0
28	4660	160	1760
29	4500	0	1600
30	3170	0	270
MEAN	2913	0	13
MAX	4660	160	1760
MIN	2190	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

JULY 1987

Day	Discharge	Upper Dam	Middle Dam
1	2550	0	0
2	2170	0	0
3	2230	0	0
4	2390	0	0
5	2880	0	0
6	2810	0	0
7	2600	0	0
8	2210	0	0
9	2020	0	0
10	2530	0	0
11	3590	0	690
12	2960	0	60
13	2630	0	0
14	2500	0	0
15	2970	0	70
16	3180	0	280
17	2620	0	0
18	2410	0	0
19	2360	0	0
20	2320	0	0
21	2320	0	0
22	2370	0	0
23	2340	0	0
24	2070	0	0
25	2260	0	0
26	2200	0	0
27	2440	0	0
28	2170	0	0
29	2110	0	0
30	2090	0	0
31	1940	0	0
MEAN	2459	0	0
MAX	3590	0	690
MIN	1940	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

AUGUST 1987

Day	Discharge	Upper Dam	Middle Dam
1	2010	0	0
2	2120	0	0
3	2190	0	0
4	2470	0	0
5	2300	0	0
6	2050	0	0
7	1960	0	0
8	1910	0	0
9	1950	0	0
10	2100	0	0
11	2310	0	0
12	2220	0	0
13	1990	0	0
14	2000	0	0
15	1950	0	0
16	1940	0	0
17	1890	0	0
18	1910	0	0
19	1870	0	0
20	1920	0	0
21	1940	0	0
22	1950	0	0
23	2000	0	0
24	1920	0	0
25	1990	0	0
26	2000	0	0
27	1970	0	0
28	1990	0	0
29	2120	0	0
30	2200	0	0
31	2030	0	0
		0	0
MEAN	2038	0	0
MAX	2470	0	0
MIN	1870	0	0

APPENDIX D (CONT.)

BYPASS SPILLAGE (CFS) AT THE UPPER AND MIDDLE DAMS

SEPTEMBER 1987

Day	Discharge	Upper Dam	Middle Dam
1	2000	0	0
2	1950	0	0
3	1940	0	0
4	1940	0	0
5	1910	0	0
6	1920	0	0
7	1930	0	0
8	1940	0	0
9	2350	0	0
10	3100	0	200
11	2220	0	0
12	2070	0	0
13	2210	0	0
14	4840	340	1940
15	4670	170	1770
16	2610	0	0
17	2550	0	0
18	2090	0	0
19	2110	0	0
20	2260	0	0
21	2970	0	70
22	2980	0	80
23	2580	0	0
24	2340	0	0
25	2170	0	0
26	2090	0	0
27	2150	0	0
28	2120	0	0
29	2100	0	0
30	2140	0	0
MEAN	2408	0	0
MAX	4840	340	1940
MIN	1910	0	0

APPENDIX E

APPENDIX E (PAGE 1 OF 2)

MIDDLE DAM BYPASSED POOL WATER QUALITY
ANDROSCOGGIN RIVER, 11 OCTOBER 1988

TRANSECT STATION	SAMPLE DEPTH[a]	DEPTH (ft)	TEMP (°C)	DO (mg/l)	SATURATION (%)
1-A	S	1.0	9.3	11.0	98
	M	2.5	9.3	11.0	98
	B	5.0	9.3	11.0	98
1-B	S	1.0	9.1	11.0	97
	M	3.0	9.1	11.0	97
	B	6.0	9.1	11.0	97
1-C	S	1.0	9.0	10.8	95
	M	8.0	9.0	10.9	96
	B	16.0	9.0	10.9	96
2-A	S	1.0	9.2	10.9	97
	M	2.5	9.1	10.9	96
	B	5.0	9.1	10.9	96
2-B	S	1.0	9.2	11.0	98
	M	3.0	9.1	11.0	97
	B	6.0	9.1	11.0	97
2-C	S	1.0	9.3	10.8	96
	M	2.0	9.2	10.9	97
	B	4.0	9.1	11.0	97
3-A	S	1.0	9.0	10.8	95
	M	2.5	9.0	10.8	95
	B	5.0	9.0	10.8	95
3-B	S	1.0	9.0	10.8	95
	M	4.0	9.0	10.8	95
	B	8.0	8.9	10.8	95
3-C	S	1.0	9.1	10.8	96
	M	4.5	9.0	10.8	95
	B	9.0	8.9	10.8	95
4-A	S	1.0	8.9	10.8	95
	M	3.5	8.8	10.8	95
	B	7.0	8.8	10.8	95
4-B	S	1.0	8.9	10.8	95
	M	3.0	8.8	10.8	95
	B	6.5	8.8	10.8	95

APPENDIX E (PAGE 2 OF 2)

MIDDLE DAM BYPASSED POOL WATER QUALITY
ANDROSCOGGIN RIVER, 11 OCTOBER 1988

TRANSECT STATION	SAMPLE DEPTH[A]	DEPTH (ft)	TEMP (°C)	DO (mg/l)	SATURATION (%)
4-C	S	1.0	8.9	10.8	95
	M	3.0	8.9	10.8	95
	B	5.5	8.9	10.8	95

[A] S - Surface
M - Middle
B - Bottom

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