FACT SHEET FOR NDPDES PERMIT ND0025232

PERMIT REISSUANCE

BASIN ELECTRIC POWER COOPERATIVE STANTON, ND

DATE OF THIS FACT SHEET – NOVEMBER 2026

INTRODUCTION

The Federal Clean Water Act (CWA, 1972, and later amendments in 1977, 1981, and 1987, etc.) established water quality goals for the navigable (surface) waters of the United States. One mechanism for achieving the goals of the CWA is the National Pollutant Discharge Elimination System (NPDES), which the US Environmental Protection Agency (EPA) oversees. In 1975, the State of North Dakota was delegated primacy of the NPDES program by EPA. The North Dakota Department of Environmental Quality (NDDEQ), hereafter referred to as "department", has been designated the state water pollution control agency for all purposes of the Federal Water Pollution Control Act, as amended [33 U.S.C. 1251, et seq.], and is authorized to take all action necessary or appropriate to secure to this state the benefits of the act and similar federal acts. The department's authority and obligations for the wastewater discharge permit program is in the North Dakota Administrative Code (NDAC) 33.1-16 which was adopted under North Dakota Century Code (NDCC) chapter 61-28. In North Dakota, these permits are referred to as North Dakota Pollutant Discharge Elimination System (NDPDES) permits.

The following rules or regulations apply to NDPDES permits:

- Procedures the department follows for issuing NDPDES permits (NDAC chapter 33.1-16-01),
- Standards of Quality for Waters of the State (NDAC chapter 33.1-16-02.1).

These rules require any treatment facility operator to obtain an NDPDES permit before discharging wastewater to state waters. They also define the basis for limits on each discharge and for other requirements imposed by the permit.

According to NDAC section 33.1-16-01-08, the department must prepare a draft permit and accompanying fact sheet, and make it available for public review. The department must also publish an announcement (public notice) during a period of thirty days, informing the public where a draft permit may be obtained and where comments regarding the draft permit may be sent (NDAC section 33.1-16-01-07). For more information regarding preparing and submitting comments about the fact sheet and permit, please see Appendix A - Public Involvement. Following the public comment period, the department may make changes to the draft NDPDES permit. The department will summarize the responses to comments and changes to the permit in Appendix D - Response to Comments.

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BACKGROUND INFORMATION

Table 1: General Facility Information

Permittee:	Basin Electric Power Cooperative
Facility Name and Address:	Leland Olds Station 3901 Hwy 200A Stanton, ND 58571
Permit Number:	ND0025232
Permit Type:	Major Industrial, Permit Reissuance
Type of Treatment:	Once-Through Non-Contact Cooling Water, Discharge to Surface Water, Flocculation, Sedimentation
SIC Code:	4911
NAICS Code:	221112
Discharge Location:	Missouri River, Class I stream Latitude: 47.287 Longitude: -101.320 Alderin Creek, Class III stream Latitude: 47.248 Longitude: -101.351
Cooling Water Intake Structure Location:	Missouri River, Class I stream Latitude: 47.2859 Longitude: -101.3206
Hydrologic Code:	10130101 – Painted Woods-Square Butte

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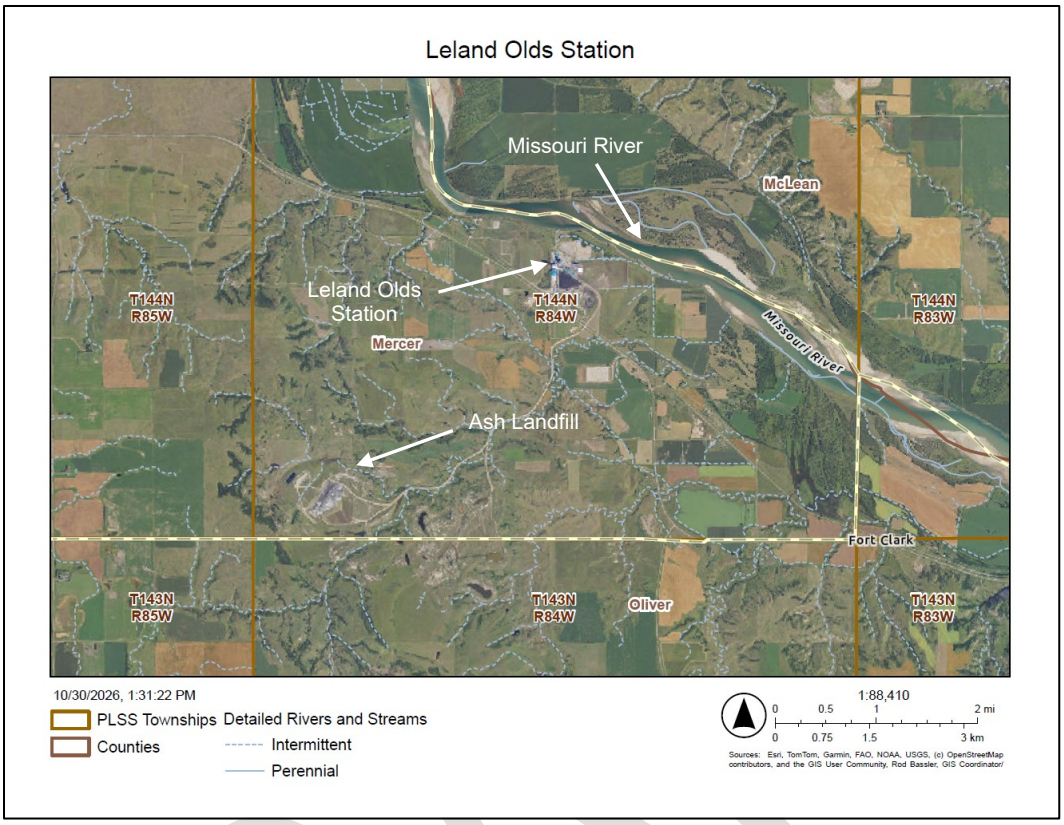


Figure 1: Aerial photograph of Basin Electric Power Cooperative, Leland Olds Station (North Dakota Geographic Information System, Maps Generated October 2026)

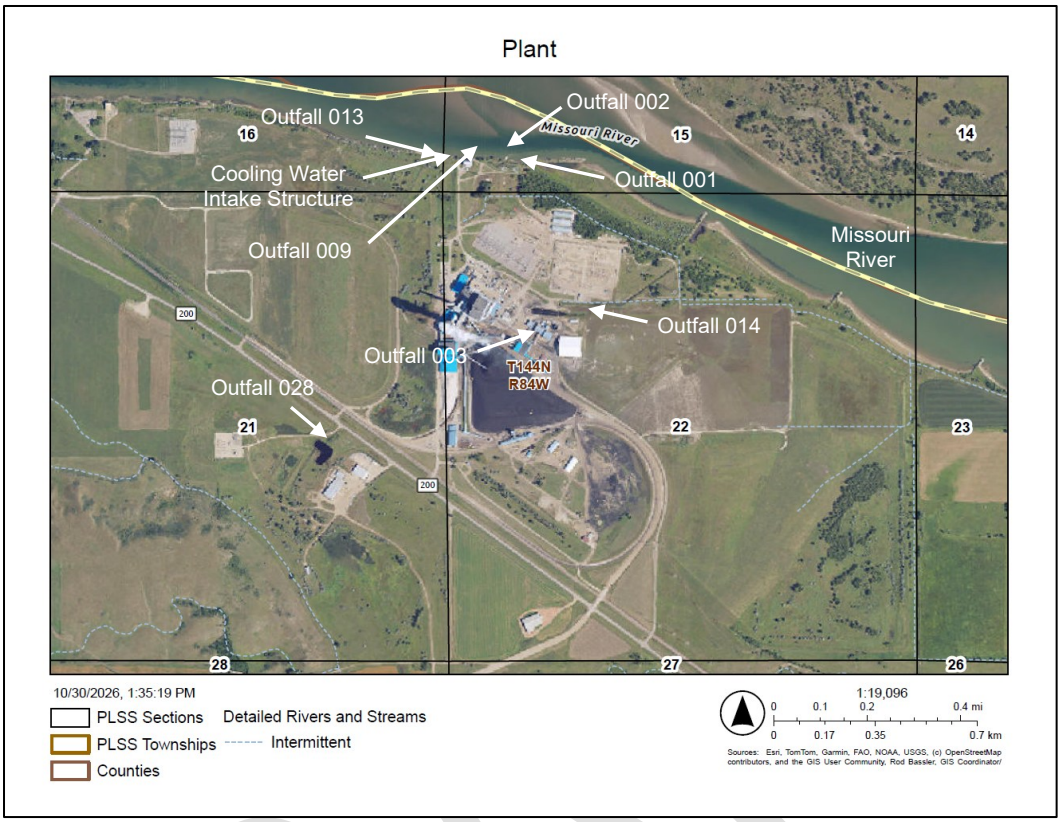


Figure 2: Aerial photograph of Basin Electric Power Cooperative, Leland Olds Station (North Dakota Geographic Information System, Maps Generated October 2026)

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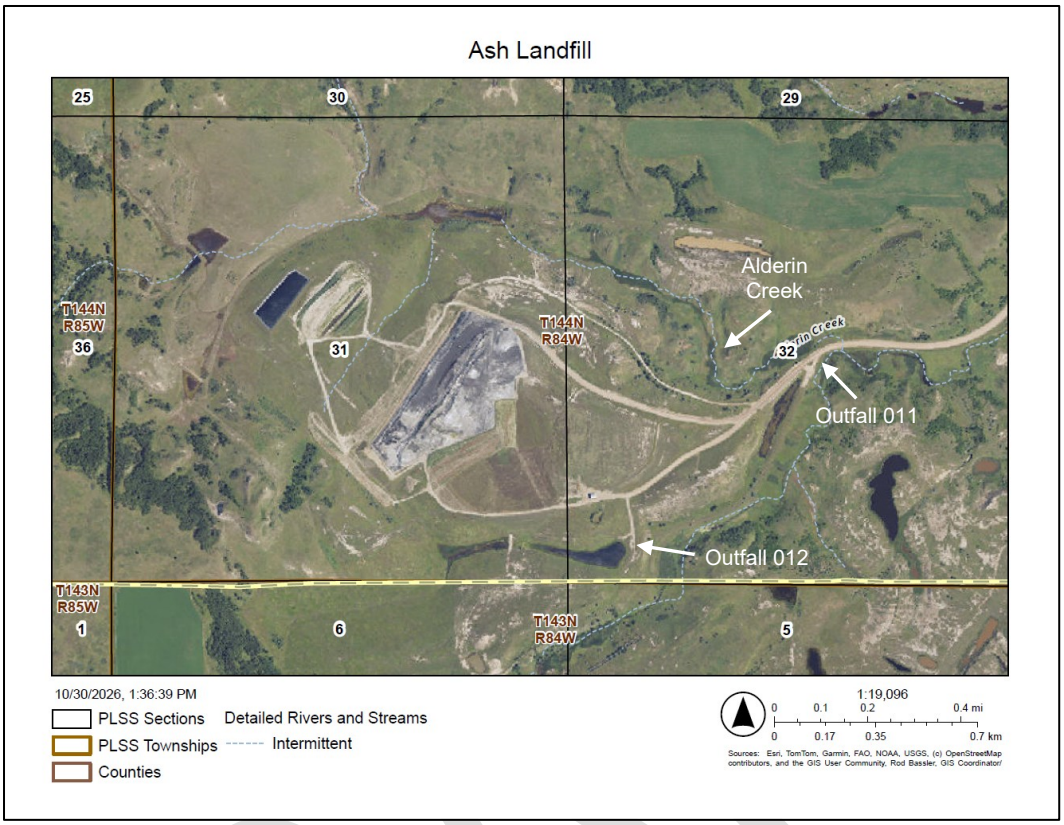


Figure 3: Aerial photograph of Basin Electric Power Cooperative, Leland Olds Station (North Dakota Geographic Information System, Maps Generated October 2026)

FACILITY DESCRIPTION

Basin Electric Power Cooperative's Leland Olds Station (LOS) is a two-unit, lignite coal-fired steam electric generating plant. The station is located in the NW1/4 of Section 22, Township 144 North, Range 84 West, approximately four miles southeast of the city of Stanton. The ash landfill is located in Sections 31 and 32, Township 144 North, Range 84 West. Discharges are to the Missouri River, a Class I stream and Alderin Creek, a Class III stream.

Unit 1 started operation in 1966 and has a 220 net megawatt capacity. Unit 2 began commercial operation in 1975 and has a 440 net megawatt capacity. Lignite coal comes from the Coteau Properties Company Freedom Mine located near Beulah, ND.

The generating units utilize once-through cooling water for heat rejection. Cooling water is drawn from the Missouri River adjacent to the facility. LOS does not have the ability to add chlorine to the cooling water system. Make-up water used in plant processes is drawn from the cooling water intake structure wet wells. Potable water is provided by Southwest Water Authority. Water from the cooling system is discharged back to the Missouri River approximately 350 feet downstream from the intake pump house. Intake traveling screen wash water discharges directly to the Missouri River.

Flue gas desulfurization (FGD) and fly ash handling occur in the Unit 1 and 2 absorbers. The Unit 1 and 2 absorbers are dry scrubber systems used to remove sulfur dioxide (i.e., FGD) and fly ash from stack gases. Plant process water is added to the collected FGD and fly ash material to condition the material for easier handling. Collected material is sent to the gypsum load out facility where it is loaded on to haul trucks and taken to the active ash landfill. No FGD or fly ash wastewater is generated in the process.

Plant process water is used in the selective non-catalyst reduction (SNCR) process. The SNCR process is used to reduce the emission of nitrogen oxides (NO_x). The SNCR process uses urea as a reagent to convert NO_x into nitrogen (N_2) and water (H_2O). Water generated in the process either evaporates or is sent to the Unit 1 and 2 floor drains where it mixes with other wastewaters before discharging to the clarifier.

Bottom ash is handled in a closed-loop, submerged flight conveyor system that moves bottom ash to a loadout building. As the conveyor moves bottom ash to the loadout building, the bottom ash is partially dewatered as excess water returns to the conveyor system. The excess water is consumed in the conveyor system and plant process water is used for make-up water. No bottom ash transport water is discharged from the system. From the loadout building, the bottom ash is loaded on to haul trucks and taken to the active ash landfill.

LOS uses microfiltration treatment to produce ultra-purified plant process water from intake water. The wastewater generated from the water treatment process is discharged to the LOS clarifier. Ultra-purified water is used as make-up water for the Unit 1 and 2 boilers, and as seal water used for cooling, lubricating, and flushing pump seals and rubber bearings.

The LOS clarifier was built during the 2017 permit cycle as part of the retrofit to the bottom ash handling system and closing of the coal combustion residual surface impoundments. The clarifier was added to provide additional treatment for wastewater streams. Water enters the clarifier from the Unit 1 and 2 floor drains and is a combination of water from the SNCR, water treatment plant, seal water, boiler makeup water from Units 1 and 2, and groundwater. Water is discharged from the clarifier through the once-through cooling water system to the Missouri River.

Plant process water is used for dust suppression in the coal train unloading area. This water collects in the V-slot located below the train unloading system. Groundwater also collects in the V-slot. Collected water is discharged from a well sump in the V-slot to the coal yard pond. This water was identified as a low volume waste when first permitted in 2018.

Discharges from the north stormwater outfall ditch are a combination of stormwater runoff from the eastern part of the plant and discharges from the coal yard pond which includes coal pile runoff, plant site runoff, and water from the V-slot. Discharges from the ditch are to the Missouri River. Stormwater runoff from the western part of the plant discharges through a stormwater pond in the northwestern part of the plant to the Missouri River. All stormwater runoff is covered by the proposed permit. Coverage under the industrial stormwater general permit, NDR05-0000, is not required for LOS.

The active ash landfill is located three miles southwest of the LOS plant. Leachate from the landfill is collected in a surface impoundment that does not discharge. Runoff from closed areas of the landfill (vegetated areas) and the landfill cover storage area are directed to stormwater

ponds. Any discharge from the ponds would be to Alderin Creek. The active ash landfill is permitted by the department's Division of Waste Management under solid waste permit number 0143.

In 2018, LOS discontinued discharging bottom ash transport water to the coal combustion residual (CCR) surface impoundments. The CCR impoundments have since been capped. The capped surface impoundments are permitted under solid waste permit 0038.

The discharge of metal cleaning waste from the boiler bottom was redirected to the fly ash and bottom ash handling systems during the 2017 permit cycle and landfilled. Metal cleaning waste from the boiler bottom is not allowed to discharge under this permit.

Sanitary waste is burned within the LOS boiler. Sanitary waste is not allowed to discharge under this permit.

Outfall Description

There are nine active discharge outfalls at the facility. The descriptions for the active outfalls and former outfalls are as follows:

Outfall 001. Active. Final Outfall. Once through cooling water.			
Latitude: 47.28582	Longitude: -101.31888	County: Mercer	
Township: 144N	Range: 84W	Section: 15	QQ: SW SW
Receiving Stream: Missouri River		Classification: Class I	
Outfall Description: This discharge consists of once-through cooling water from Unit No. 1 and effluent from Outfall 003. Outfall 001 has a design flow of 134 MGD. Discharges are to the Missouri River.			

Outfall 002. Active. Final Outfall. Once through cooling water.			
Latitude: 47.28587	Longitude: -101.31926	County: Mercer	
Township: 144N	Range: 84W	Section: 15	QQ: SW SW
Receiving Stream: Missouri River		Classification: Class I	
Outfall Description: This discharge consists of once-through cooling water from Unit No. 2 and effluent from Outfall 003. Outfall 002 has a design flow of 271 MGD. Discharges are to the Missouri River.			

Outfall 003. Active. Internal Point. Clarifier.			
Latitude: 47.28073	Longitude: -101.31670	County: Mercer	
Township: 144N	Range: 84W	Section: 22	QQ: SW NW
Receiving Stream: Missouri River		Classification: Class I	
Outfall Description: This discharge consists of low volume wastes. This is an interior point that mixes with Outfall 001 and/or Outfall 002.			

Outfall 009. Active. Final Outfall. Screen washings and intake maintenance dewatering.			
Latitude: 47.28574	Longitude: -101.32047	County: Mercer	
Township: 144N	Range: 84W	Section: 15	QQ: SW SW
Receiving Stream: Missouri River		Classification: Class I	

Outfall Description: An intermittent discharge of Unit Nos. 1 and 2 intake screen washings. The discharge also includes dewatering of the intake structure clear wells during maintenance. The discharge is located in the northeast corner of the intake building. Any discharge is to the Missouri River.

Outfall 011. Active. Final Outfall. Settling pond for ash landfill site.			
Latitude: 47.24771	Longitude: -101.35322	County: Mercer	
Township: 144N	Range: 84W	Section: 32	QQ: NE SW
Receiving Stream: Alderin Creek		Classification: Class III	
Outfall Description: Discharges consist of runoff water from the exterior portions of the ash landfill and construction associated with landfill expansion. Any discharge is to Alderin Creek.			

Outfall 012. Active. Final Outfall. Settling pond for ash landfill site.			
Latitude: 47.24254	Longitude: -101.36146	County: Mercer	
Township: 144N	Range: 84W	Section: 32	QQ: SW SW
Receiving Stream: Alderin Creek		Classification: Class III	
Outfall Description: Discharges consist of runoff water from the exterior portions of the ash landfill and construction associated with landfill expansion. Any discharge is to Alderin Creek.			

Outfall 013. Active. Final Outfall. Site Runoff.			
Latitude: 47.28563	Longitude: -101.32124	County: Mercer	
Township: 144N	Range: 84W	Section: 15	QQ: SW SW
Receiving Stream: Missouri River		Classification: Class I	
Outfall Description: The settling pond is for managing stormwater runoff from the west plant area, Units 1 and 2 roof drains, and former Glenharold Mine office/shop complex (Outfall 028). Any discharge enters the Missouri River to the west of the cooling water intakes.			

Outfall 014. Active. Final Outfall. Site Runoff.			
Latitude: 47.28110	Longitude: -101.31646	County: Mercer	
Township: 144N	Range: 84W	Section: 22	QQ: SW NW
Receiving Stream: Missouri River		Classification: Class I	
Outfall Description: This discharge consists of coal pile runoff, plant site runoff, and low volume wastes. Any discharge flows through an open ditch before entering the Missouri River northeast of the facility.			

Outfall 028. Active. Internal Point. Settling Pond.			
Latitude: 47.27715	Longitude: -101.32689	County: Mercer	
Township: 144N	Range: 84W	Section: 21	QQ: NW SE
Receiving Stream: Missouri River		Classification: Class I	
Outfall Description: This is an internal discharge consisting of runoff from the former Glenharold Mine office/shop complex located in the NW1/4, SE1/4, Section 21, T144N, R84W. Any discharge is to settling pond 013.			

Outfall 004 - Inactive. No discharge point. Originally, this point consisted of domestic wastewater from an extended aeration wastewater treatment plant. Wastewater is collected in

the treatment building and pumped to the boiler for incineration. The treatment plant was taken out of service in May 1993.

Outfall 005 - Inactive. No discharge point as of March 1, 1983. It was originally used for boiler blowdown, which was included in the low volume wastes that went to the ash pond.

Outfall 006 - Inactive. No discharge point as of March 1, 1983. It was originally used for boiler blow down, which was included in the low volume wastes that went to the ash pond.

Outfall 007 - Inactive. No discharge point. Originally, this discharge consisted of flash evaporated boiler steam from Unit 1 or 2 and was used to heat the former coal processing facility. The system went out of service in June 1993 and was subsequently removed.

Outfall 008 - Inactive. No discharge point as of January 1, 2022. An internal point for the discharge of metal cleaning waste from the boiler bottom. Boiler metal cleaning waste is combined with coal combustion residuals (fly ash or bottom ash) and landfilled.

Outfall 010 - Inactive. No discharge point as of January 1, 1997. Originally, this internal point was used to monitor site runoff from the west side of the plant site which drained to outfall 003 prior to 2018. Runoff has since been redirected to Outfall 013.

PERMIT STATUS

The department issued the current permit for this facility on January 1, 2023. The permit has effluent monitoring requirements for:

- Temperature
- pH
- Total residual chlorine
- Chloride
- Total suspended solids (TSS)
- Oil and Grease
- Total Nitrogen
- Total Phosphorus
- Flow
- Total Flow
- Total Drain

The permit is scheduled to expire at midnight on December 31, 2026.

SUMMARY OF COMPLIANCE WITH PREVIOUS PERMIT ISSUED

The department conducts annual inspections of the facility. The department's assessment of the compliance is based on review of the facility's Discharge Monitoring Reports (DMRs) and inspections conducted by department staff.

Bypasses

The facility reported four bypasses since January 2023. The bypasses were caused by valve failure, expansion joint failure, or operator error.

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Past Discharge Data

The concentration of pollutants in discharges was reported using discharge monitoring report (DMR) forms. The effluent is characterized as shown in Table 2. Outfalls 009 and 028 are limited by the use of best management practices so data was not required to be collected and submitted to characterize the quality of discharges from the outfalls.

Table 2: Basin Electric Power Cooperative – LOS (January 2023 to June 2026)

Parameter	Units	Range	Average	Permit Limit	Number of Excursions
Outfall 001					
Temperature	^{O}F	30.3 – 97.5	63.6	99	0
pH	S.U.	7.3 – 8.82	N/A	6.5 – 9.0	0
Flow	MGD	115 (max)	97	N/A	N/A
Total Flow	Mgal	1498 – 3439	2934	N/A	N/A
Outfall 002					
Temperature	^{O}F	31.4 – 102.7	66.5	99	1
pH	S.U.	7.19 – 8.33	N/A	6.5 – 9.0	0
Flow	MGD	212 (max)	182	N/A	N/A
Total Flow	Mgal	3200 – 6526	5507	N/A	N/A
Outfall 003					
TSS	mg/L	64.5 (max)	2.8	30 Monthly avg 100 Daily max	0 0
Oil & Grease	mg/L	1.7 (max)	1.4	15 Monthly avg 20 Daily max	0 0
pH	S.U.	7.6 – 8.99	N/A	N/A	N/A
Flow	MGD	1.13 (max)	0.5	N/A	N/A
Total Flow	Mgal	8.4 – 19.2	15	N/A	N/A
Total Nitrogen	mg/L	5 – 5.2	5	N/A	N/A
Total Nitrogen	lbs/day	49.2 (max)	19.2	N/A	N/A
Total Phosphorus	mg/L	0.17 – 0.8	0.5	N/A	N/A
Total Phosphorus	lbs/day	6.39	2.09	N/A	N/A

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Parameter	Units	Range	Average	Permit Limit	Number of Excursions
Chlorides	mg/L	16.7 (max)	12.9	N/A	N/A
Outfall 011					
TSS	mg/L	2 – 38	17	70 Daily max	0
pH	S.U.	7.55 – 8.35	N/A	6.0 to 9.0	0
Flow	MGD	1.01 (max)	0.44	N/A	N/A
Drain	Mgal	0.73 – 2.26	1.33	N/A	N/A
Days per Month	Days	1 – 5	3	N/A	N/A
Outfall 012					
TSS	mg/L	0 – 10	4	70 Daily max	0
pH	S.U.	7.36 – 8.32	N/A	6.0 to 9.0	0
Flow	MGD	1.01 (max)	0.5	N/A	N/A
Drain	Mgal	1.97 – 6.45	3.99	N/A	N/A
Days per Month	Days	3 – 9	5	N/A	N/A
*Outfall 013 **					
TSS	mg/L	6	6	N/A	N/A
O&G – Vis	N/A	No Sheen	No Sheen	N/A	N/A
Oil & Grease	mg/L	<1.4	<1.4	N/A	N/A
pH	S.U.	7.37	7.37	N/A	N/A
Flow	MGD	0.008	0.004	N/A	N/A
Drain	Mgal	0.017	0.017	N/A	N/A
Days per Month	Days	4	4	N/A	N/A
Outfall 014					
TSS	mg/L	110 (max)	10.4	30 Monthly avg 50 Daily max	2 4
O&G	mg/L	3.5	1.5	15 Monthly avg 20 Daily max	0 0
pH	S.U.	7.08 – 8.37	N/A	6.5 – 9.0	0
Flow	MGD	21.3 (max)	1.03	N/A	N/A

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Parameter	Units	Range	Average	Permit Limit	Number of Excursions
Total Flow	Mgal	9.04 – 52.74	31.23	N/A	N/A
N/A Not Applicable					
*. Only one discharge event occurred during the monitoring period.					

PROPOSED EFFLUENT LIMITATIONS

Discharges from steam electric power generating facilities are regulated by national effluent guidelines which establish technology-based effluent limitations. The technology-based effluent limitations may be found in Title 40 of the Code of Federal Regulations, Part 423 – or 40 CFR 423. The department may generate additional limitations using Best Professional Judgment (BPJ) to ensure reasonable control technologies are used to prevent potential harmful effects from the discharge. The department also must consider and include limitations necessary to protect water quality standards applicable to receiving waters.

Temperature limits for the discharge of once-through cooling water through Outfalls 001 and 002 are based on the 1973 Quirk, Lawler & Matusky Engineers study titled “Missouri River Temperature Survey near United Power Association Stanton, North Dakota Plant” and best professional judgment. Refer to the “Evaluation of Surface Water Quality-Based Effluent Limits for Numeric Criteria” section for the basis of the determination.

LOS was not designed or built to add chlorine to the once-through cooling water system. The permit includes a condition stating total residual chlorine shall be limited should a chlorination system be added to the once-through cooling water system and includes the technology-based effluent limitations for total residual chlorine found in 40 CFR 423.13(b) as required by 40 CFR 122.44(b). Appendix C of this fact sheet shows the calculation used to determine the quantity of total residual chlorine that could be discharged should a chlorination system be added. The quantity was calculated in accordance with 40 CFR 423(b)(2). Because LOS is not designed to use chlorine, the department does not have the appropriate information to calculate a water-quality based effluent limitation.

Limitations based on numeric nutrient criteria are not being included in the proposed permit. Narrative nutrient criteria have been developed for the state of North Dakota that require discharges to be free from nutrients that cause objectionable growth of aquatic vegetation or algae or threaten public health, welfare, or impair beneficial uses.

Technology-based and water quality-based effluent limitations for pH are not included for Outfall 013. As allowed by 40 CFR 122.44(k)(2) & (4), best management practices (BMPs) may be used for the control of stormwater discharges and when they are reasonably necessary to achieve effluent limitations and standards. LOS has used BMPs to control or abate pollution from Outfall 013 in previous permits. Discharge monitoring data has shown pH remains within technology-based and water quality-based effluent limitations.

Outfalls 011, 012, and 014 contain language that waives the TSS limitation if the pond is designed, constructed, operated, and maintained to treat the runoff from a 10-year, 24-hour precipitation event or equivalent snowmelt in 24 hours. The precipitation amount for Outfalls 011 and 012 is based on best professional judgment in previous permits and the technical paper *Rainfall Frequency Atlas of the United States* (1961). The precipitation amount for Outfall 014 (first permitted in 2018) is based on 40 CFR 423.12(b)(10) and the *National Oceanographic and Atmospheric Administration Atlas 14* (*NOAA Atlas 14*).

For Outfalls 011 and 012, the "Conditions for Construction Phase of Landfill Expansion" provisions were updated to clarify the department may extend the effluent limitations and monitoring requirements of Outfalls 011 and 012 should significant erosion be evident on site. The update is consistent with the original intent of the provision.

The proposed effluent limitations shall take effect upon the effective date of the proposed permit. The effluent limitations and the basis for the limitations are provided in Tables 3 through 9. The notations used in the tables for the basis of the effluent limitations are as follows:

"BPJ" refers to best professional judgment.

"Previous Permit" refers to limitations in the previous permit. The NPDES regulations 40 CFR Part 122.44(l)(1) *Reissued permits* require that when a permit is renewed or reissued, interim limitations, standards or conditions must be at least as stringent as the final effluent limitations, standards, or conditions in the previous permit unless the circumstances on which the previous permit was issued have materially and substantially changed since the previous permit was issued and would constitute cause for permit modification or revocation and reissuance under 40 CFR Part 122.62.

"WQS" refers to effluent limitations based on the State of North Dakota's "Standards of Quality for Waters of the State", NDAC Chapter 33.1-16-02.1.

"CFR" refers to the Code of Federal Regulations.

Table 3: Effluent Limitations for Outfall 001 and 002

Effluent Parameter	Units	Daily Maximum	Basis
pH	S.U.	Shall remain between 6.5 to 9.0	WQS
Temperature [a, b]	°C (°F)	37.2 (99)	1973 QL&M Study; BPJ; Previous Permit
Total Residual Chlorine [c]	mg/L	0.20	40 CFR 423.13(b)
Total Residual Chlorine (Outfall 001) [c]	lb/day	13.5	40 CFR 423.13(b)
Total Residual Chlorine (Outfall 002) [c]	lb/day	24.7	40 CFR 423.13(b)

Effluent Parameter	Units	Daily Maximum	Basis
There shall be no discharge of floating solids, visible foam in other than trace amounts, or oily wastes that produce sheen on the surface of the receiving water.			Previous Permit
There shall be no batch discharges resulting from intermittent intake cleaning.			Previous Permit
There shall be no discharge of polychlorinated biphenyl compounds.			Previous Permit; 40 CFR 423.12(b)(2); 40 CFR 423.13(a)
The discharge shall consist only of uncontaminated cooling water and low volume waste.			Previous Permit; BPJ
Notes:			
a. For the purpose of reporting excursions above the temperature limit, a single test will be considered to include the rise and fall of temperature or multiple peaks occurring within a one (1) hour period.			
b. The thermal mixing zone shall not present a thermal shock or stressor, affect spawning, or block the migration of aquatic organisms.			
c. Monitoring for Total Residual Chlorine shall be waived at outfalls 001 and 002 on the condition that the once-through cooling system not have the capability to add chlorine to the system; this is in accordance with 40 CFR 122.44(a)(2), *Monitoring waivers for certain guideline-listed pollutants*. Should a chlorination system or chlorine be added to the once-through cooling water system, the waiver shall no longer be valid, and Total Residual Chlorine shall be limited in the discharge and monitored in accordance with this permit. Total Residual Chlorine shall not be discharged from any single generating unit for more than two hours per day unless the discharger demonstrates to the permitting authority that the discharge for more than two hours is required for macroinvertebrate control.			

Table 4: Effluent Limitations for Outfall 003

Effluent Parameter	Units	30-Day Average	Daily Maximum	Basis
TSS	mg/L	30	100	40 CFR 423.12(b)(3)
Oil & Grease	mg/L	15	20	40 CFR 423.12(b)(3)
pH	S.U.	*		Previous Permit
There shall be no discharge of domestic wastewater.				Previous Permit
There shall be no discharge of floating solids or visible foam in other than trace amounts.				Previous Permit
There shall be no discharge of polychlorinated biphenyl compounds.				Previous Permit; 40 CFR 423.12(b)(2); 40 CFR 423.13(a)
There shall be no discharge of industrial chemicals used for plant operation or maintenance without prior department permission.				Previous Permit

Notes:	
*	This parameter is not limited. However, the department may impose limitations based on sample history and to protect the receiving waters.

Table 5: Effluent Limitations for Outfall 009

Best Management Practice	**Basis**
Best Management Practices shall be utilized at all times.	Previous Permit; 40 CFR 122.44(k)(3) [a]
There shall be no discharge of floating solids or visible foam in other than trace amounts.	Previous Permit; 40 CFR 122.44(k)(3) [a]
The quality of the discharge shall be the best which is presently attainable.	Previous Permit; 40 CFR 122.44(k)(3) [a]
There shall be no change in operation that will deteriorate the quality of the discharge.	Previous Permit; 40 CFR 122.44(k)(3) [a]
No fuel, lubricating oils, chemicals, or process water shall be discharged.	Previous Permit; 40 CFR 122.44(k)(3) [a]
Any clear well dewatering shall be done in a manner which, to the extent possible, directs the pumped water to the adjacent clear well for intake into the plant.	Previous Permit; 40 CFR 122.44(k)(3) [a]
There shall be no discharge of polychlorinated biphenyl compounds.	40 CFR 423.12(b)(2); 40 CFR 423.13(a)
Notes:	
a. Best Management Practices may be used to control or abate the discharge of pollutants when numeric effluent limitations are infeasible provided in 40 CFR 122.44(k)(3).	

Table 6: Effluent Limitations for Outfall 011 and 012

Effluent Parameter	**Units**	**30-Day Average**	**Daily Maximum**	**Basis**
TSS [a]	mg/L	*	70	BPJ
pH	S.U.	Shall remain between 6.0 to 9.0		Previous Permit; BPJ; WQS
The settling ponds and other erosion control features of the facility must be operated and maintained in accordance with Best Management Practices.				Previous Permit; Stormwater [b]
The ponds shall not be used to discharge water which has come into contact with ash.				Previous Permit

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The department must be notified prior to the start of new construction on the ash disposal site. A landfill expansion phase is considered to be the period beginning with the start of construction of a new disposal cell and lasting through the close of construction and re-establishment of BMPs. Construction does not include capping and similar earthmoving activities associated with the day-to-day operation of the landfill. The department may extend or reinstate the effluent limitations and monitoring requirements for Outfalls 011 and 012 should significant erosion be evident at the site.	Previous Permit
There shall be no discharge of polychlorinated biphenyl compounds.	40 CFR 423.12(b)(2); 40 CFR 423.13(a)
Notes:	
a. If the facility is designed, constructed, operated, and maintained to treat the runoff from a 10-year, 24-hour precipitation event, the daily maximum limitation for total suspended solids shall be waived for any discharge overflow caused by a rainfall in excess of 3.2 inches in a 24-hour period. The permittee shall have the burden of proof that all of these conditions have been met. The precipitation shall be monitored by gauge and recorded daily by the permittee.	
b. Stormwater associated with industrial activity as defined in 40 CFR 122.26(b)(14)(vii) regulated by best management practices as provided in 40 CFR 122.44(k)(2)&(3).	
* This parameter is not limited. However, the department may impose limitations based on sample history and to protect the receiving waters.	

Table 7: Effluent Limitations for Outfall 013

Effluent Parameter	Units	30-Day Average	Daily Maximum	Basis
TSS	mg/L	*	*	Previous Permit
Oil & Grease	mg/L	*	*	Previous Permit
pH	S.U.	*		Previous Permit
The discharge shall not have a visible sheen or floating oil.				Previous Permit; 40 CFR 122.44(k)(3) [a]
The quality of the discharge shall be the best attainable through the use of Best Management Practices. The pond and discharge structures shall be inspected regularly and maintained appropriately to ensure that the structure and discharge do not deteriorate.				Previous Permit; 40 CFR 122.44(k)(3) [a]
There shall be no discharge of floating solids or visible foam in other than trace amounts.				Previous Permit; 40 CFR 122.44(k)(3) [a]
No fuel, lubricating oils, chemicals, or process wastewaters shall be discharged.				Previous Permit; 40 CFR 122.44(k)(3) [a]
There shall be no discharge of polychlorinated biphenyl compounds.				40 CFR 423.12(b)(2); 40 CFR 423.13(a)
Notes:				

a.	Best Management Practices may be used to control or abate the discharge of pollutants when numeric effluent limitations are infeasible provided in 40 CFR 122.44(k)(3).
*.	This parameter is not limited. However, the department may impose limitations based on sample history and to protect the receiving waters.

Table 8: Effluent Limitations for Outfall 014

Effluent Parameter	Units	30-Day Average	Daily Maximum	Basis
TSS [a]	mg/L	30	50	40 CFR 423.12(b)(3), (9), (10)
pH	S.U.	Within the range 6.5 to 9.0		40 CFR 423.12(b)(1); WQS
Oil & Grease	mg/L	15	20	40 CFR 423(b)(3)
There shall be no discharge of floating solids or visible foam in other than trace amounts.				WQS
There shall be no discharge of polychlorinated biphenyl compounds.				40 CFR 423.12(b)(2); 40 CFR 423.13(a)
a. If the facility is designed, constructed, operated, and maintained to treat the runoff from a 10-year, 24-hour precipitation event, this limitation shall be waived for any discharge overflow caused by a rainfall in excess of 2.99 inches (or equivalent snowmelt) in 24 hours. The permittee shall have the burden of proof that all of these conditions have been met. The precipitation shall be monitored by gauge and recorded daily by the permittee.				

Table 9: Effluent Limitations for Stormwater Runoff [a]

Best Management Practice	Basis
The quality of the stormwater discharge shall be the best attainable through the implementation of Best Management Practices.	Previous Permit; 40 CFR 122.44(k)(3) [b]
No fuel, lubricating oils, chemicals, or process wastewater shall be discharged.	Previous Permit; 40 CFR 122.44(k)(3) [b]
Spill prevention and response procedures must be employed to minimize the potential for spilled material to discharge with stormwater. A Spill Prevention Control and Countermeasure (SPCC) Plan developed to satisfy 40 CFR 112 also serves as a stormwater pollution prevention measure.	Previous Permit; 40 CFR 122.44(k)(3) [b]
Any areas that do not drain to a pond shall be operated and maintained to minimize, to the extent reasonably practicable, stormwater contact with raw materials, intermediate products, finished products, byproducts, or waste materials. Good housekeeping practices should be employed to keep these areas clean and orderly.	Previous Permit; 40 CFR 122.44(k)(3) [b]

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Best Management Practice	**Basis**
The haul road to the ash landfill site must be inspected at least annually. The haul road and drainage ditches to the ash landfill shall be inspected for evidence of material spillage, erosion, sedimentation, and deterioration or ineffectiveness of structural controls. If necessary, the stormwater pollution prevention practices shall be revised based on the observations noted during the inspection. The inspection records for the haul road corridor, and any other areas of support activity, shall be kept on site and available for review for at least three (3) years.	Previous Permit; 40 CFR 122.44(k)(3) [b]
The retention pond and transfer equipment for Outfall 028 must be inspected regularly and maintained appropriately to ensure that the structure, including inlet and outlets, do not deteriorate.	Previous Permit; 40 CFR 122.44(k)(3) [b]
There shall be no discharge of polychlorinated biphenyl compounds.	40 CFR 423.12(b)(2); 40 CFR 423.13(a)

Notes:

a. Applicable to runoff from the ash landfill haul road corridor, equipment storage and other support areas at the plant site, and the surplus and salvage property yard including the settling pond (Outfall 028).

b. Best Management Practices may be used to control or abate the discharge of pollutants when numeric effluent limitations are infeasible provided in 40 CFR 122.44(k)(3).

SURFACE WATER QUALITY-BASED EFFLUENT LIMITS

The North Dakota Standards of Quality for Waters of the State (NDAC Chapter 33.1-16-02.1), or Water Quality Standards (WQS), are designed to protect existing water quality and preserve the beneficial uses of North Dakota's surface waters. Wastewater discharge permits must include conditions that ensure the discharge will meet the surface water quality standards. Water quality-based effluent limits may be based on an individual waste load allocation or on a waste load allocation developed during a basin wide total maximum daily load (TMDL) study. TMDLs result from a scientific study of the water body and are developed in order to reduce pollution from all sources.

The Missouri River is listed as a class I stream in the Standards of Quality for Waters of the State. The quality of water in class I streams must be suitable for the propagation and/or protection of resident fish species and other aquatic biota, and for swimming, boating, and other water recreation. The quality also must be suitable for irrigation, stock watering, and wildlife without injurious effects. The quality must be able to meet the bacteriological, physical, and chemical requirements for municipal or domestic use after treatment.

The Missouri River is not listed as impaired in the 2020-2022 North Dakota Section 303(d) List of Waters Needing Total Maximum Daily Loads (303(d) List). All beneficial uses are attained in this section of the Missouri River.

Alderin Creek is not specifically mentioned in the Standards of Quality for Waters of the State and is considered a class III stream. The quality of water in class III streams must be suitable for agricultural and industrial uses. Streams in this class generally have low average flows with prolonged periods of no flow. During periods of no flow, they are of limited value for recreation, and fish and aquatic biota. The quality of these waters must be maintained to protect secondary contact recreation uses (e.g., wading), fish and aquatic biota, and wildlife uses.

Alderin Creek is not listed as impaired in the 2020-2022 North Dakota Section 303(d) List of Waters Needing Total Maximum Daily Loads (303(d) List). There currently are no TMDLs for Alderin Creek.

Numerical Criteria for the Protection of Aquatic Life and Recreation

Numerical water quality criteria are listed in the water quality standards for surface waters (NDAC Chapter 33.1-16-02.1). They specify the maximum levels of pollutants allowed in receiving water to protect aquatic life and recreation in and on the water. The department uses numerical criteria along with chemical and physical data for the wastewater and receiving water to derive the effluent limits in the discharge permit. When surface water quality-based limits are more stringent or potentially more stringent than technology-based limits, the discharge must meet the water quality-based limits.

Numerical Criteria for the Protection of Human Health

The U.S. EPA has published numeric water quality criteria for the protection of human health that are applicable to dischargers. These criteria are designed to protect humans from exposure to pollutants linked to cancer and other diseases, based on consuming fish and shellfish and drinking contaminated surface waters. The WQS also include radionuclide criteria to protect humans from the effects of radioactive substances.

Narrative Criteria

Narrative water quality criteria (NDAC Chapter 33.1-16-02.1-08) limit concentrations of pollutants from exceeding applicable standards of the receiving waters. The department adopted a narrative biological goal solely to provide an additional assessment method that can be used to identify impaired surface waters.

Antidegradation

The purpose of North Dakota's Antidegradation Policy (NDAC Chapter 33.1-16-02 (Appendix IV)) is to:

- Provide all waters of the state one of three levels of antidegradation protection.
- Determine whether authorizing the proposed regulated activity is consistent with antidegradation requirements.

The department's fact sheet demonstrates that the existing and designated uses of the receiving water will be protected under the conditions of the proposed permit. There are no new or expanded discharges with this permit.

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Mixing Zones

The department's WQS contain a Mixing Zone and Dilution Policy and Implementation Procedure, NDAC Chapter 33.1-16-02.1 (Appendix III). This policy addresses how mixing and dilution of point source discharges with receiving waters will be addressed in developing chemical-specific and whole effluent toxicity discharge limitations for point source discharges. Depending upon site-specific mixing patterns and environmental concerns, some pollutants/criteria may be allowed a mixing zone or dilution while others may not. In all cases, mixing zone and dilution allowances shall be limited, as necessary, to protect the integrity of the receiving water's ecosystem and designated uses.

EVALUATION OF SURFACE WATER QUALITY-BASED EFFLUENT LIMITS FOR NUMERIC CRITERIA

Temperature

North Dakota's Water Quality Standards limit the maximum increase in river temperature caused by point source discharges to less than 5° Fahrenheit above background conditions (NDAC 33.1-16-02.1-09, Table 1) unless a regulatory mixing zone is granted in accordance with North Dakota's Mixing Zone and Dilution Policy (NDAC 33.1-16-02.1-09(2) and NDAC 33.1-16-02.1, Appendix III).

Discharges from the LOS once-through cooling water system (Outfalls 001 and 002) do not mix with the Missouri River at a near instantaneous and complete rate and can exceed the temperature water quality standard without a regulatory mixing zone. North Dakota's Mixing Zone and Dilution Policy allows an appropriate mixing zone to be designated when dilution is available and discharges do not mix at a near instantaneous and complete rate with the receiving water. Regulatory mixing zones are limited in size based on the requirements found in the policy. Temperatures within a regulatory mixing zone may exceed the numeric criteria of the temperature water quality standard; however temperatures may not exceed acute standards. In addition, the regulatory mixing zone must meet the general water quality standards found in NDAC 33.1-16-02.1-08; the mixing zone cannot present a thermal shock or stressor, affect spawning, or block the migration of aquatic organisms.

The department granted LOS a temperature regulatory mixing zone for discharges of once-through cooling water to the Missouri River based on the field study conducted by Quirk, Lawler & Matusky (QLM) Engineers titled, "Missouri River Temperature Survey near United Power Association Stanton, North Dakota Plant" January 1973; QL & M Project No. 215-3. The department determined the regulatory mixing zone presented in the study meets the requirements of North Dakota's Mixing Zone and Dilution Policy and included a regulatory mixing zone in the permit. The study can be found in Appendix F of this fact sheet. The study meets the Field Study Method found in North Dakota's Mixing Zone and Dilution Policy for determining mixing zone characteristics between temperature and receiving stream. The study delineated the temperature patterns in the Missouri River downstream of the once-through cooling water discharge from the former United Power Association (UPA) station.

The UPA station was located 3000 feet upstream of LOS. The discharge rate from the UPA station during the study was 222 cubic feet per second (cfs). The average discharge rates from

LOS Unit 1 and Unit 2 from January 2012 to September 2026 were 150 cfs and 275 cfs, respectively – or 425 cfs, total. Discharges from the once-through cooling water system at the former UPA station were discontinued when it was decommissioned in 2017 (then known as the Great River Energy Stanton Station).

The field survey was conducted October 12-14, 1972. The U.S. Army Corps of Engineers agreed to reduce flow from Garrison Dam to 13,000 cfs on October 13, 1972, in order to provide measurements during low flow periods during the study. The 7Q10 critical low flow (or the lowest 7-day average flow that occurs on average once every 10 years) of the Missouri River recorded between 2015 and 2025 at Bismarck, ND (USGS Station 06342500) was 12,710 cfs which is comparable to the simulated low flows in the field study.

North Dakota's Mixing Zone and Dilution Policy requires mixing zones to be less than 50 percent of the cross-sectional area of the river and no longer than ten times the stream width at critical low flows, whichever is more limiting. According to the study:

- The 4°F isotherm (which encompasses the 5°F isotherm) did not exceed 7.7 percent of the cross-sectional area during the study (Table S-1 of the study). The allowable mixing zone is up to 50 percent of the cross-sectional area of the river.

- The longitudinal extent of the 4°F isotherm (which encompasses the 5°F isotherm) at 13,000 to 14,000 cfs was approximately 500 feet (Figures 13 and 14 of the study). The width of the river at the furthest longitudinal extent of the 4°F isotherm was slightly greater than 760 feet (Figures 4, 7, 8, 12, 13, 14, 15, 16 of the study). The allowable regulated longitudinal extent of the mixing zone would be up to 7600 feet (or ten times the stream width).

LOS Unit 2 began operation in 1975 following the release of the study in 1973 (Unit 1 was in operation prior to the release of the study). Since the release of the study, the average flow per month from Units 1 and 2 has increased; however the average temperature per month has been declining since the early 2000's.

Operations at Garrison Dam have changed since 1973 and are expected to continue to change based on the latest revision of the U.S. Army Corps of Engineers' (USACE) Missouri River Basin, Mainstem Reservoir System, Water Control Manual. As stated in the December 2018 revision to Volume 3 of the manual (or the Garrison Dam – Lake Sakakawea volume), "The manual… prescribes the policies and procedures to be followed by the Corps in carrying out water management activities, including establishment and the updating of water control plans for Corps and non-Corps projects, as required by federal laws and directives." Subsequently, long-term river flows have changed since 1973 as river flows in the Garrison Reach of the Missouri River are mainly affected by operations at the Garrison Dam with some influence from the Knife River.

Although there have been changes in both the operation of the once-through cooling water system at LOS and operations at Garrison Dam since 1973, these changes have not had an observed or known affect that would necessitate a new field study to establish an updated mixing zone. The study is still relevant to cooling water discharges from LOS for the following reasons:

1. UPA discharged to the same stretch of the Missouri River as LOS (UPA was 3000 feet upstream of LOS).

2. Although the river is wider downstream of LOS compared to UPA, the cross-sectional area is expected to be similar to allow for movement of the same amount of water.

3. Although the combined average discharge rates of Units 1 and 2 at LOS are almost twice the discharge rate of UPA during the study, the projected regulatory mixing zone would be within mixing zone limitations expressed in North Dakota's Mixing Zone and Dilution Policy.

pH

Discharges to Class I streams shall have an instantaneous limitation between 6.5 (s.u.) and 9.0 (s.u.). Discharges to Class III streams shall have an instantaneous limitation between 6.0 (s.u.) and 9.0 (s.u.).

Whole Effluent Toxicity

Testing requirements and limitations for whole effluent toxicity (WET) testing are specified in 40 CFR 122.44(d)(1)(iv) & (v) for discharges that may have the reasonable potential to contribute to an in-stream excursion above a numeric or narrative criterion for whole effluent toxicity. The state water quality standards include a narrative standard related to whole effluent toxicity. The narrative standard listed in NDAC 33.1-16-02.1-08(1)(a)(4) states that waters of the state shall be "[f]ree from substances attributable to municipal, industrial or other discharges or agricultural practices in concentrations which are toxic or harmful to humans, animals, plants, or resident aquatic biota. For surface water, this standard will be enforced in part through appropriate whole effluent toxicity requirements in North Dakota pollutant discharge elimination system permits."

The department conducted a reasonable potential analysis for whole effluent toxicity for Outfalls 003 and 014 (Appendix D). Since the facility was not required to conduct WET testing in the current permit, the analysis used default statistical values. The analysis showed no reasonable potential for acute or chronic toxicity from Outfalls 003 and 014 based on the default statistical values. The analysis also showed no reasonable potential for acute or chronic toxicity from Outfall 014 based on the default statistical values. The department determined the waste streams and runoff discharged from the facility are monitored and limited for parameters present and recognizable in the discharge.

Human Health

North Dakota's water quality standards include numeric human health-based criteria that the department must consider when writing NDPDES permits. These criteria were established in 1992 by the U.S. EPA in its National Toxics Rule (40 CFR 131.36). The National Toxics Rule allows states to use mixing zones to evaluate whether discharges comply with human health criteria. The department has not identified any chemicals in the applicant's discharges for regulation based on the human heath criteria. The department will re-evaluate this discharge for impacts to human health at the next permit reissuance.

Toxic Metals, Cyanide, and Total Phenols

The proposed permit does not include monitoring for toxic metals, cyanide, and total phenols at Outfalls 001, 002, 003, and 014. Discharges from the outfalls do not have the potential to exceed water quality standards for toxic metals, cyanide, and total phenols for class I streams based on the department's review of the permit application.

A reliable review could not be conducted to determine whether the concentration of total thallium has the potential to exceed the human health water quality standard criterion. This is because the detection/report limits for thallium in the permittee's application was larger than the applicable water quality standard. In addition, the surface water quality data collected from the Missouri River also had a detection limit larger that the applicable water quality standard. This results in an inaccurate assessment of the potential to exceed a water quality standard since the detection limits are both above the standard.

A reliable review could not be conducted to determine whether the concentration of total cyanide has the potential to exceed the human health water quality standard criterion. This is because the detection/report limits for cyanide in the permittee's application was larger than the applicable water quality standard and no surface water quality data has been collected from the Missouri River. This results in an inaccurate assessment of the potential to exceed a water quality standard since these variables are now assumed.

Organic Compounds

As provided in the permittee's application, there were thirty-nine organic compounds analyzed at Outfalls 001, 002, 003, and 014. For each outfall, all thirty-nine analytes were believed absent in the effluent and results of analyses were below detection/report levels. The detection/report levels for thirty-two of the compounds at each outfall were below the most stringent water quality standard for Class I streams or did not have a corresponding water quality standard. The department determined the reported detection/report levels for these parameters were acceptable. The department determined there was no reasonable potential for the organic compounds to be present in detectable amounts.

Sample results of the remaining seven compounds at each outfall (Table 10) were reported below detection levels but those levels were above the most stringent water quality standard for Class I streams.

Table 10 – List of Organic Compounds Above Class I Stream Water Quality Standards

Volatile Compounds	**Acid Compounds**
1,1,2,2- tetrachloroethane	2,4-dinitrophenol
1,3-dichloropropylene	2,4,6-trichlorophenol
Acrylonitrile	Pentachlorophenol*
Vinyl chloride*	
*U.S. banned or restricted chemical or pesticide (not all-inclusive)	

Four volatile compounds (Table 10) were analyzed with results below detection/report levels. The department determined there is no reasonable potential for these organic compounds to be present in the discharge. The compound 1,1,2,2-tetrachloroethane is used as a precursor to make another chemical and would not be present in the discharge. The compound 1,3-

dichloropropylene is used as a pesticide for crops and would not be present in the discharge. The compounds acrylonitrile and vinyl chloride are used in the manufacture of things like plastic and are no longer used as a pesticide. Because of this, the department will not include the parameters reported as non-detect in the proposed permit.

Three acid compounds (Table 10) were analyzed with results below detection/report levels but above applicable water quality standards. The compound pentachlorophenol has restricted uses and is not present in the discharge. The compound 2,4-dinitrophenol is no longer used as an active ingredient in pesticides and is not present in the discharge. The compound 2,4,6-trichlorophenol is not registered for use as a pesticide in the U.S. and is not present in the discharge. The department determined there was no reasonable potential for the compounds to be present in the discharge and will not include the parameters in the proposed permit.

SELF-MONITORING REQUIREMENTS

Effluent parameters are sampled at the outfalls prior to leaving company property and mixing with receiving waters. The monitoring requirements for each outfall are provided in Tables 11 through 15.

Monitoring for total residual chlorine (40 CFR 423.13(b)) at Outfalls 001 and 002 is waived in the proposed permit (40 CFR 122.44(A)(2)) on the condition that the once-through cooling system not have the capability to add chlorine to the system. Basin Electric Power Cooperative submitted a request to waive monitoring for total residual chlorine in once-through cooling water in accordance with 40 CFR 122.44(a)(2). Should a chlorination system or chlorine be added to the once-through cooling water system, the waiver will no longer be valid, and Total Residual Chlorine will be monitored in accordance with this permit.

Nutrient monitoring will continue at Outfalls 003 and 014 in the proposed permit to coincide with the state's nutrient reduction strategy. Sources of nutrients from Outfall 003 include discharges from the SNCR which utilizes urea in the process. Sources of nutrients from Outfall 014 include organically bound nutrients in coal pile runoff.

Chloride monitoring will continue at Outfall 003 to monitor the waste stream from the microfiltration water treatment system.

Monitoring for acute and chronic whole effluent toxicity (WET) will not be required in the proposed permit. The low volume waste streams present in the discharge from Outfalls 003 (SNCR wastewater, microfiltration wastewater, seal water, boiler makeup water, and groundwater) and 014 (plant process water and groundwater) will be monitored and limited in the proposed permit for parameters present and recognizable in those waste streams. Refer to Whole Effluent Toxicity in the Evaluation of Surface Water Quality-Based Effluent Limits for Numeric Criteria section of the fact sheet for more information.

Table 11: Self-Monitoring Requirements for Outfall 001 and 002

Effluent Parameter	Frequency	Sample Type [a]
Temperature	Continuous	Recorder
pH	1/Week	Instantaneous
Flow	1/Day	Instantaneous

Total Flow	1/Month	Calculated
Total Residual Chlorine [b]	1/Week	Grab
Samples taken in compliance with the monitoring requirements shall be taken prior to leaving company property or entering the receiving stream. Temperature shall be measured by continuous recorder at the outfall of the condenser water box outlet.		
Notes:		
a.	Refer to Appendix B for definitions.	
b.	Monitoring for Total Residual Chlorine shall be waived at outfalls 001 and 002 on the condition that the once-through cooling system not have the capability to add chlorine to the system; this is in accordance with 40 CFR 122.44(a)(2), *Monitoring waivers for certain guideline-listed pollutants*. Should a chlorination system or chlorine be added to the once-through cooling water system, the waiver shall no longer be valid, and Total Residual Chlorine shall be limited in the discharge and monitored in accordance with this permit.	

Table 12: Self-Monitoring Requirements for Outfall 003

Effluent Parameter	**Frequency**	**Sample Type** [a]
TSS	1/Week	Grab
Oil & Grease	1/Month	Grab
pH	1/Week	Instantaneous
Flow	1/Week	Instantaneous
Total Flow	1/Month	Calculated
Total Nitrogen [b]	1/Month	Grab/Calculated
Total Phosphorus	1/Month	Grab/Calculated
Chlorides	1/Year	Grab
Samples shall be taken after the clarifier but prior to mixing with once-through cooling water.		
Notes:		
a.	Refer to Appendix B for definitions.	
b.	Total nitrogen is a combination of nitrate, nitrite, and Total Kjeldahl Nitrogen (TKN).	

Table 13: Self-Monitoring Requirements for Outfall 011 and 012

Effluent Parameter	**Frequency**	**Sample Type** [a]
TSS	1/Week	Grab
pH	1/Week	Instantaneous
Flow	1/Day	Calculated
Total Drain	1/Quarter	Calculated
Total Days Discharge	1/Quarter	Calculated
The dewatering samples must be taken prior to the discharge leaving company property or entering any receiving streams. Upon completing a landfill construction phase, any dewatering information shall be submitted to the department as an attachment to the Discharge Monitoring Report for the respective monitoring period. The attachment must include sample results, dates of discharges, frequency of analyses, total number of gallons discharged, and discharge flow rates.		

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Effluent Parameter	Frequency	Sample Type [a]
Notes:		
a. Refer to Appendix B for definitions.		

Table 14: Self-Monitoring Requirements for Outfall 013

Effluent Parameter	Frequency	Sample Type [a]
TSS	1/Quarter	Grab
Oil and Grease [b]	1/Quarter	Visual/Grab
pH	1/Quarter	Instantaneous
Flow	1/Day	Calculated
Total Drain	1/Quarter	Calculated
Total Days Discharge	1/Quarter	Calculated
Samples shall be taken prior to the discharge water leaving company property or entering any receiving streams. Dates of discharges, frequency of monitoring, estimate of the total number of gallons discharged, and estimated average discharge flow rate shall also be included on the Discharge Monitoring Reports.		
Notes:		
a. Refer to Appendix B for definitions.		
b. The discharge shall not have a visible sheen or floating oil. If detected, the department shall be notified, and a grab sample shall be analyzed.		

Table 15: Self-Monitoring Requirements for Outfall 014

Effluent Parameter	Frequency	Sample Type [a]
TSS	1/Week	Grab
Oil & Grease	1/Month	Grab
pH	1/Week	Instantaneous
Flow	1/Week	Calculated
Total Flow	1/Month	Calculated
Total Nitrogen [b]	1/Month	Grab/Calculated
Total Phosphorus	1/Month	Grab/Calculated
Samples shall be taken prior to the discharge water leaving company property or entering any receiving streams.		
Notes:		
a. Refer to Appendix B for definitions.		
b. Total nitrogen is a combination of nitrate, nitrite, and Total Kjeldahl Nitrogen (TKN).		

COOLING WATER INTAKE STRUCTURE REQUIREMENTS

Cooling Water Intake Structure

The cooling water intake structure (CWIS) for LOS is subject to the final Clean Water Act section 316(b) rule. The rule requires facilities to minimize environmental impact associated with

the use of the CWIS. The rule requires facilities to utilize appropriate technology to minimize impingement and entrainment of aquatic species at the CWIS. The rule does not authorize take, as defined by the Endangered Species Act, for the purposes of compliance.

On July 9, 2026, the department emailed the 316(b) application to the USFWS more than 60 days prior to the public notice date of November 12, 2026. The USFWS responded on August 4, 2026, that the application was consistent with the Programmatic Biological Opinion on the U.S. Environmental Protection Agency's Issuance and Implementation of the Final Regulations Section 316(b) of the Clean Water Act and that the permit will have no more than minor detrimental effects on federally-listed species and critical habitat; no further considerations were necessary.

LOS uses a noncontact, once-through cooling water system to dissipate waste heat to the Missouri River. Water drawn from the Missouri River by the CWIS passes through trash racks and traveling screens before being pumped through 60-inch pipes to the main condensers and discharged back to the Missouri River.

The CWIS for the once-through cooling water system is located on the south bank of the Garrison Reach of the Missouri River, roughly four miles south and east of Stanton, ND. The CWIS is contained within a single CWIS building on the north side of the LOS site. The CWIS includes two short concrete forebays for each unit (a total of four forebays) that are flush with the riverbank and perpendicular to the river flow. Spray nozzles are mounted across the base of the forebays to wash accumulated silt back into the river to prevent blockage of inlets. The spray nozzles operate at least twice per day. The Unit 1 intake is located in about 11 feet of water and the Unit 2 intake is located in about 15 feet of water. Both intakes withdraw water from the surface to a low water level elevation of 1,656.5 feet (MSL).

The CWIS consists of trash racks and four circulating water pumps (two for each unit). The trash racks are mechanically cleared when necessary. Water passes through the trash racks, then the traveling screens prior to entering the pump wet well. Unit 1 traveling screens are 10 feet wide and Unit 2 traveling screens are 12 feet wide. The traveling screens have 3/8-inch mesh openings that are cleaned with 125 psi (pound per square inch) wash sprays. The wash sprays can be operated manually or automatically. Wash water from the screens travels through a sluiceway that discharges to the Missouri River downstream of the CWIS. Material that is washed off the screens is collected in a mesh basket for off-site disposal. There is no separate fish handling or return system associated with the intake.

LOS is a base load power plant that operates continuously (except for planned maintenance or unplanned outages). Because of this, the circulating water system operates 24 hours a day, year-round. Less than 1.65 percent of the Missouri River flow is withdrawn at the CWIS on an average monthly basis. A higher percentage of river flow is drawn in the winter when the river flow is low, and a lower percentage is drawn in the summer when river flow rates are high.

From 2022 to 2025, the net capacity factor of Unit 1 averaged 61 percent and the net capacity factor of Unit 2 averaged 51 percent (40 CFR 125.94(c)(12)). The maximum Design Intake Flow (DIF) of Units 1 and 2 are 105 million gallons per day (MGD) and 225 MGD, respectively. The four-year combined Actual Intake Flow (AIF) from January 2023 through June 2026 averaged 271 MGD (40 CFR 125.92(a)). More than 99 percent of the AIF is used as non-contact cooling water. Plant process water and traveling screen wash water use 2.19 MGD and 0.61 MGD,

respectively. CWIS flows reported to the department in discharge monitoring reports are summarized in Table 16.

Table 16: Cooling Water Intake Structure DMR Data (January 2023 to June 2026)

Parameter	Units	Maximum	Average
Flow	MGD	336	271

LOS continuously monitors the CWIS from station operations. Intake flows are monitored by station operations. The flow of each pump at the CWIS also is monitored by station operations. Station operations also monitor whether the pumps are “off” or “on.” Station operations also monitor whether the traveling screens are “off” or “on.” The monitoring system displays alarms when issues or failures occur. In addition to the remote monitoring system, LOS personnel visually inspect the major components of the CWIS as part of regular maintenance.

Basin Electric Power Cooperative worked with three other power companies to collect data on the baseline biology of the Garrison Reach of the Missouri River. Along with data collected at the LOS CWIS, two of the other three companies operated cooling water intake structures in the vicinity of the LOS CWIS when the data was collected. One CWIS has since been removed with the decommission of a steam electric power generating facility. This CWIS was located immediately upstream of LOS.

Fragile species that inhabit the Garrison Reach of the Missouri River include rainbow smelt and gizzard shad. These species are likely to be present and impinged at the LOS CWIS.

The only Federally-listed aquatic species with a potential for occurrence near the LOS CWIS is the pallid sturgeon. While the pallid sturgeon is known to occur in the Missouri River, it is likely to be rarely found in the Garrison Reach. Pallid sturgeon are large fish and strong swimmers and could avoid the LOS CWIS. There has been no record of impingement of a pallid sturgeon at any CWIS.

The CWIS is within the critical habitat area for one Federally-listed threatened species (the piping plover); however, the CWIS is not likely to influence the habitat of this species since its habitat is more directly affected by the operation of the Garrison Dam than the CWIS.

An entrainment characterization study was completed by Basin Electric Power Cooperative at LOS in 2015 and 2016. Entrainment monitoring was conducted from April through September in each of the study years. The number and types of organisms entrained can be found in Appendix E of this statement of basis (40 CFR 125.98(f)(2)(i)). Predominantly early life stages of carps, minnows, redhorse, and suckers were collected during the study (96 percent of collected samples in 2015 and 90 percent of collected samples in 2016). The most common early life stages were yolk-sac larvae. Eggs accounted for about 2 percent of collected samples in 2015 and 10 percent in 2016. Early life states of recreational species (i.e., white bass, walleye, and percidae) accounted for one percent of samples collected during the two-year study. No larval pallid sturgeon or shovelnose sturgeon were collected during the two-year study. Based on the 2015-2016 entrainment study, approximately 7.8 million specimens were estimated to have been entrained in 2015 at LOS and approximately 10.8 million specimens were estimated to have been entrained in 2016. Entrainment estimates followed seasonal patterns with over 90 percent of estimated entrainment occurring from June to August of each study year.

Impingement and Entrainment

Upon review of the site-specific data provided in the permit application required by 40 CFR 122.21(r) and consultation with the U.S. Fish and Wildlife Service, the department has determined the rate of impingement to be *de minimis* (40 CFR 125.94(b)(11)).

The department must establish site-specific BTA standards for entrainment based on best professional judgment (40 CFR 125.94(d) and 125.98(f)). The standards must reflect the department's determination of the maximum reduction in entrainment warranted.

Determination Factors

The department reviewed the information submitted as part of the permittee's application. Basin Electric Power Cooperative expects both LOS units to operate through 2040 (40 CFR 125.98(f)(2)(iv)). Basin Electric Power Cooperative submitted technical feasibility and cost information for the following entrainment control technologies as part of the permit application: closed-cycle recirculating system, fine-mesh screens, alternate cooling sources, and variable speed pumps. Of these technologies, the closed-cycle recirculation system would require land to utilize the technology (40 CFR 125.98(f)(2)(iii)). Alternate cooling sources were determined to be infeasible so were not carried forward to determine the social benefit of the technology. Variable speed pumps were determined to be an impractical and ineffective way to reduce entrainment. The closed-cycle recirculating system and fine-mesh screens were determined to be feasible and considered for the social benefit of the technology versus the current operation.

As provided in Basin Electric Power Cooperative's permit application, the cost of a closed-cycle cooling tower or fine-mesh screen exceeded the social benefit of the technologies (40 CFR 125.98(f)(2)(v)). The monetized value of the recreational and commercial social benefit of a closed-cycle cooling tower would be large but the cost to implement negates the benefit. The cost to implement fine-mesh screens, although not as large as the cost of a closed-cycle cooling tower, also negates the monetized value of the recreational and commercial social benefit of implementing the technology.

The addition of a closed-cycle cooling tower would increase the amount of NO_X, SO_2, and CO_2 generated by LOS by increasing the amount of electricity generated by the plant to provide treatment (40 CFR 125.98(f)(2)(ii)). Technology is in place to reduce the emission of NO_X and SO_2 from LOS; however, there is no technology in place at LOS to reduce the emission of CO_2. The amount of CO_2 generated by LOS is estimated to increase by 68,921 tons per year with the implementation of the technology based on capacity utilization rate. The operation of the cooling tower also would increase the emission of dissolved solids created during evaporation that would drift on to surrounding land. Other pollutant concerns that would be created include increased sulfate, chloride, and sodium concentrations in wastewater discharges from the cooling tower recirculating system to a receiving water.

The addition of fine-mesh screens would increase the amount of electricity generated by the plant to operate the screens which would increase the amount of NO_X, SO_2, and CO_2 generated by LOS (40 CFR 125.98(f)(2)(ii)). The amount of NO_X and SO_2 emitted would be reduced by current technology in place. The amount of CO_2 generated is estimated to increase by 681 tons per year with the implementation of the technology based on capacity utilization rate.

The operation of fine-mesh screens also may be affected by cottonwood seeds and naturally occurring coal particles and other debris. These items can overlay the fine-mesh screens reducing through screen velocity and head loss affecting station reliability and potentially increasing temperature of the once-through cooling water above what is currently established.

Permit Requirements

The proposed permit will contain the following language as required by 40 CFR 125.98(b)(1), "Nothing in this permit authorizes take for the purpose of a facility's compliance with the Endangered Species Act."

The proposed permit requires LOS to monitor the CWIS with remote monitoring devices or conduct weekly visual inspections in instances where the remote monitoring devices are not in operation (40 CFR 125.96(e)).

The proposed permit requires the facility to continue to operate at a *de minimis* rate of impingement in accordance with 40 CFR 125.94(a)(1) and 125.94(c)(11).

The department has determined the operation of the CWIS as it exists on the effective date of the permit is the best technology available for minimizing adverse environmental impacts at LOS. The factors presented in the permit application provide adequate grounds for determining the best technology available to minimize environmental impacts at LOS to maximize the reduction in entrainment. The department has determined that the addition of other technology, such as adding fine-mesh screens to the cooling water intake structure, will not benefit organisms in the Missouri River ecosystem and that the social cost of other technologies heavily outweighs the social benefit of the technology. This reflects the Director's determination of the maximum reduction in entrainment warranted after consideration of factors relevant for determining the best technology available for minimizing adverse environmental impact at the facility in accordance with 40 CFR 125.94(a)(1), 125.94(d), and 125.98(f)).

The proposed permit requires the facility to monitor the actual intake flow (AIF) daily. Monitoring of the AIF must be representative of normal operating conditions. In order to determine compliance with the proposed permit, the permittee will be required to submit intake flow monitoring results with the discharge monitoring report (40 CFR 125.97(a)).

The proposed permit requires the facility to submit an annual certification statement and report regarding the operation of the cooling water system. The report must summarize any changes made related to the cooling water system. If the information contained in the previous statement is still relevant, then the facility may simply state that in the certification statement. The certification statement must be signed by a responsible corporate officer. Also, any revision related to the information required by 40 CFR 122.21(r) must be submitted with the next permit application (40 CFR 125.97(c), 125.98(b)(4)).

The proposed permit requires all discharge monitoring reports, and annual certification statements and reports related to cooling water intake operation and closed-cycle recirculating system to be retained until the subsequent permit is issued (40 CFR 125.97(d), 125.98(b)(4)).

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The proposed permit includes a statement requiring any revisions to the requirements of 40 CFR 122.21(r) to be included with the next permit application (40 CFR 125.98(b)(6)).

The proposed permit requires all of the information submitted with the permit application used to satisfy the requirements of 40 CFR 122.21(r) to be retained until the subsequent permit is issued (40 CFR 125.95(e)).

The proposed permit requires all records supporting the department's determination of the best technology available for entrainment be retained until the next permit is issued (40 CFR 125.97(f)).

The proposed permit includes a requirement for the facility to notify department of any proposed changes to the cooling water intake structure or operation of the cooling water intake. Any changes must be included with the annual certification statement and report.

The proposed permit allows the department and EPA representatives to inspect the cooling water intake structure and operation of the cooling water intake structure, and request information needed to determine permit compliance (40 CFR 125.98(i)).

MONITORING REQUIREMENTS

The department requires monitoring, recording, and reporting (NDAC Chapter 33.1-16-01-(21 through 23) and 40 CFR 122.41) to verify that the treatment process is functioning correctly and that the discharge complies with the permit's limits.

Discharge Monitoring Report (DMR) and Cooling Water Intake Requirements

The proposed permit requires the permittee to monitor discharges and submit discharge monitoring reports (DMRs) to the department. DMRs summarize monitoring results obtained during specified monitoring periods. If no discharge occurs during a monitoring period, "no discharge" must be reported.

The proposed permit includes specified intervals for submitting monthly and quarterly DMRs (Table 17). DMRs must be submitted electronically to the department in accordance with 40 CFR 127 unless otherwise waived and in compliance with 40 CFR 3. The requirement to submit the 'A' reports quarterly is similar to other major coal-fired steam electric generating plants.

Table 17: DMR Submittal Requirements

Coverage Point	Report Designator	Report Type	Report Interval
001	A	Conventional and Non-Conventional Pollutants, Flow Information	1/quarter
002	A	Conventional and Non-Conventional Pollutants, Flow Information	1/quarter
003	A	Conventional and Non-Conventional Pollutants, Flow Information, Nutrient Monitoring	1/quarter

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Coverage Point	Report Designator	Report Type	Report Interval
011	A	Conventional and Non-Conventional Pollutants, Flow and Volume Information	1/quarter
012	A	Conventional and Non-Conventional Pollutants, Flow and Volume Information	1/quarter
013	A	Conventional and Non-Conventional Pollutants, Flow and Volume Information	1/quarter
014	A	Conventional and Non-Conventional Pollutants, Flow Information, Nutrient Monitoring	1/quarter
Cooling Water Intake Structure	-	Actual Cooling Water Intake Flow	1/quarter

Test Procedures

The collection and transportation of all samples shall conform to EPA preservation techniques and holding times found in 40 CFR 136. All laboratory tests shall be performed by a North Dakota certified laboratory in conformance with test procedures pursuant to 40 CFR 136, unless other test procedures have been specified or approved by EPA as an alternate test procedure under 40 CFR 136.5. The method of determining the total amount of water discharged shall provide results within 10 percent of the actual amount.

OTHER PERMIT CONDITIONS

Discharge of Bottom Ash Transport Water Prohibited

The permit contains language stating all bottom ash transport water generated on or after December 31, 2023 shall comply with effluent limitation guidelines found in 40 CFR 423.13(k)(1)(i). The guideline requires no discharge of pollutants in bottom ash transport water by a date determined by the department as soon as possible beginning October 13, 2021, but no later than December 31, 2025. When the current permit was issued, the requirement was to comply by a date determined by the department as soon as possible beginning November 1, 2020, but no later than December 31, 2023. Bottom ash transport water is no longer discharged from the facility; therefore, the department determined December 31, 2023 was a reasonable date to meet 40 CFR 423.13(k)(1)(i).

DMR QA Study

The permittee participates in the Discharge Monitoring Report – Quality Assurance (DMR-QA) Study as a requirement outlined in Section 308 of the CWA. Language was added to the proposed permit reiterating the permittees requirement to participate in and discontinue the DMR-QA Study.

PERMIT ISSUANCE PROCEDURES

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Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause. This includes the establishment of limitations or prohibitions based on changes to Water Quality Standards, the development and approval of waste load allocation plans, the development or revision to water quality management plans, changes in sewage sludge practices, or the establishment of prohibitions or more stringent limitations for toxic or conventional pollutants and/or sewage sludges. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

Proposed Permit Issuance

This proposed permit meets all statutory requirements for the department to authorize a wastewater discharge. The permit includes limits and conditions to protect human health and aquatic life, and the beneficial uses of waters of the State of North Dakota. The department proposes to issue this permit for a term of five years.

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APPENDIX A – PUBLIC INVOLVEMENT INFORMATION

The department proposes to reissue a permit to **Basin Electric Power Cooperative – Leland Olds Station** located near Stanton, North Dakota. The permit includes wastewater discharge limits and other conditions. This fact sheet describes the facility and the department's reasons for requiring permit conditions.

The department will place a Public Notice on **November 12, 2026** in the **Hazen Star** to inform the public and to invite comment on the proposed draft North Dakota Pollutant Discharge Elimination System permit and fact sheet. The facility will be provided a copy of the public notice and draft permit at the beginning of the public comment period. Note, the public notice number placed in the newspaper and used as part of this public notice (ND-2026-003) was also used for the public notice of a different NDPDES permit (ND0025208) earlier in 2026.

The Notice –

- Indicates where copies of the draft Permit and Fact Sheet are available for public evaluation.
- Offers to provide assistance to accommodate special needs.
- Urges individuals to submit their comments before the end of the comment period.
- Informs the public that if there is significant interest, a public hearing will be scheduled.

You may obtain further information from the department by telephone, 701.328.5210, or by writing to the address listed below.

North Dakota Department of Environmental Quality
Division of Water Quality
4201 Normandy Street – 3rd Floor
Bismarck, ND 58503-1324

The primary author of this permit and fact sheet is Dallas Grossman.

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North Dakota Department of Environmental Quality Public Notice:
Reissue of an NDPDES Permit

Public Notice Date: November 12, 2026 Public Notice Number: ND-2026-003

Purpose of Public Notice

The Department intends to reissue the following North Dakota Pollutant Discharge Elimination System (NDPDES) Discharge Permit under the authority of Section 61-28-04 of the North Dakota Century Code.

Permit Information

Application Date: June 30, 2026
Application Number: HQK-GHH1-ZEF83
Permit Number: ND0025232
Applicant Name: Basin Electric Power Lolds
Mailing Address: 3901 Hwy 200A Stanton, ND 58571
Telephone Number: (701) 557-5488
Proposed Permit Expiration Date: December 31, 2031

Facility Description

The reapplication is for a 660 megawatt, lignite coal-fired steam electric power generating plant located in the NW 1/4, Section 22, Township 144 North, Range 84 West and the associated ash landfill located in Sections 31 and 32, Township 144 North, Range 84 West. Discharges from the plant consist of once-through cooling water, wastewater, and stormwater to the Missouri River adjacent to the plant, and stormwater runoff from the closed areas of the ash landfill to Alderin Creek adjacent to the landfill. The reapplication includes the Missouri River cooling water intake for the plant.

Tentative Determinations

Proposed effluent limitations and other permit conditions have been made by the department. They assure that State Water Quality Standards and applicable provisions of the Federal Water Pollution Control Act (FWPCA) will be protected.

Information Requests and Public Comments

Copies of the application, draft permit, and related documents are available for review. For further information on making public comments/public comment tips please visit: https://deq.nd.gov/PublicCommentTips.aspx. Comments or requests should be directed to the North Dakota Department of Environmental Quality, Division of Water Quality, 4201 Normandy Street, Bismarck ND 58503-1324 or by calling 701.328.5210.

All comments received by December 12, 2026 will be considered prior to finalizing the permit. If there is significant interest, a public hearing will be scheduled. Otherwise, the Department will issue the final permit within sixty (60) days of this notice.

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The NDDEQ will consider every request for reasonable accommodation to provide an accessible meeting facility or other accommodation for people with disabilities, language interpretation for people with limited English proficiency (LEP), and translations of written material necessary to access programs and information. Language assistance services are available free of charge to you.

Requests for accommodation should be made as soon as possible and ideally at least 5 business days prior to a scheduled program, service or activity. Depending on the nature and complexity of the request, requests may take longer than 5 days to fulfill. Requests may be directed to the NDDEQ staff responsible for the program, service, or activity, or to the Nondiscrimination Coordinator directly. Contact the NDDEQ Nondiscrimination Coordinator directly at 701-328-5150 or deqEJ@nd.gov. TTY users may use Relay North Dakota at 711 or 1-800-366-6888.

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APPENDIX B – GLOSSARY

DEFINITIONS Standard Permit BP 2025.03.13

1. "**Act**" means the Clean Water Act.

2. "**Best management practices**" (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the United States. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage areas.

3. "**Bypass**" means the intentional diversion of waste streams from any portion of a treatment facility.

4. "**Composite**" sample means a combination of at least 4 discrete sample aliquots, collected over periodic intervals from the same location, during the operating hours of a facility not to exceed a 24-hour period. The sample aliquots must be collected and stored in accordance with procedures prescribed in the most recent edition of Standard Methods for the Examination of Water and Wastewater.

5. "**Continuous Discharge**" means a "discharge" which occurs without interruption throughout the operating hours of the facility, except for infrequent shutdowns for maintenance, process changes, or other similar activities.

6. "**Daily discharge**" means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

7. "**Daily maximum discharge limitation**" means "maximum daily discharge limitation" which is the highest allowable "daily discharge."

8. "**Department**" means the North Dakota Department of Environmental Quality, Division of Water Quality.

9. "**DMR**" means discharge monitoring report.

10. "**EPA**" means the United States Environmental Protection Agency.

11. "**Geometric mean**" means the n^{th} root of a product of n factors, or the antilogarithm of the arithmetic mean of the logarithms of the individual sample values.

12. "**Grab**" for monitoring requirements, means a single "dip and take" sample collected at a representative point in the discharge stream.

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13. "**Instantaneous**" for monitoring requirements, means a single reading, observation, or measurement. If more than one sample is taken during any calendar day, each result obtained shall be considered.

14. "**Monthly average discharge limitation**" means "average monthly discharge limitation" which is the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month.

15. "***Oncorhynchus***" means of, belonging to, or characteristic of the genus *Oncorhynchus* in the family *Salmonidae*, which includes salmon and trout.

16. "**Sanitary Sewer Overflows (SSO)**" means untreated or partially treated sewage overflows from a sanitary sewer collection system.

17. "**Severe property damage**" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

18. "**Total drain**" means the total volume of effluent discharged.

19. "**Upset**" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

20. "**Weekly average discharge limitation**" means "average weekly discharge limitation" which is the highest allowable average of "daily discharges" over a calendar week, calculated as the sum of all "daily discharges" measured during a calendar week divided by the number of "daily discharges" measured during that week.

DEFINITIONS Cooling Water Intake BP 2025.03.13

See 40 CFR 423.11

See 40 CFR 125.92

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APPENDIX C – DATA AND TECHNICAL CALCULATIONS

The North Dakota Department of Environmental Quality reviewed DMR information and applicable water quality standards for class I and III streams to determine the appropriate requirements to be placed in the permit.

Temperature

The development of the permit required the use of USGS SW Toolbox 1.1.3 to determine the 75th-percentile flow and the 7Q10 flow of the Missouri River at USGS gauging station 06342500 Missouri River at Bismarck, ND from January 2015 through December 2025 (Figure 4). The statistical flows were used to characterize the effects of once-through cooling water mixing with the Missouri River.

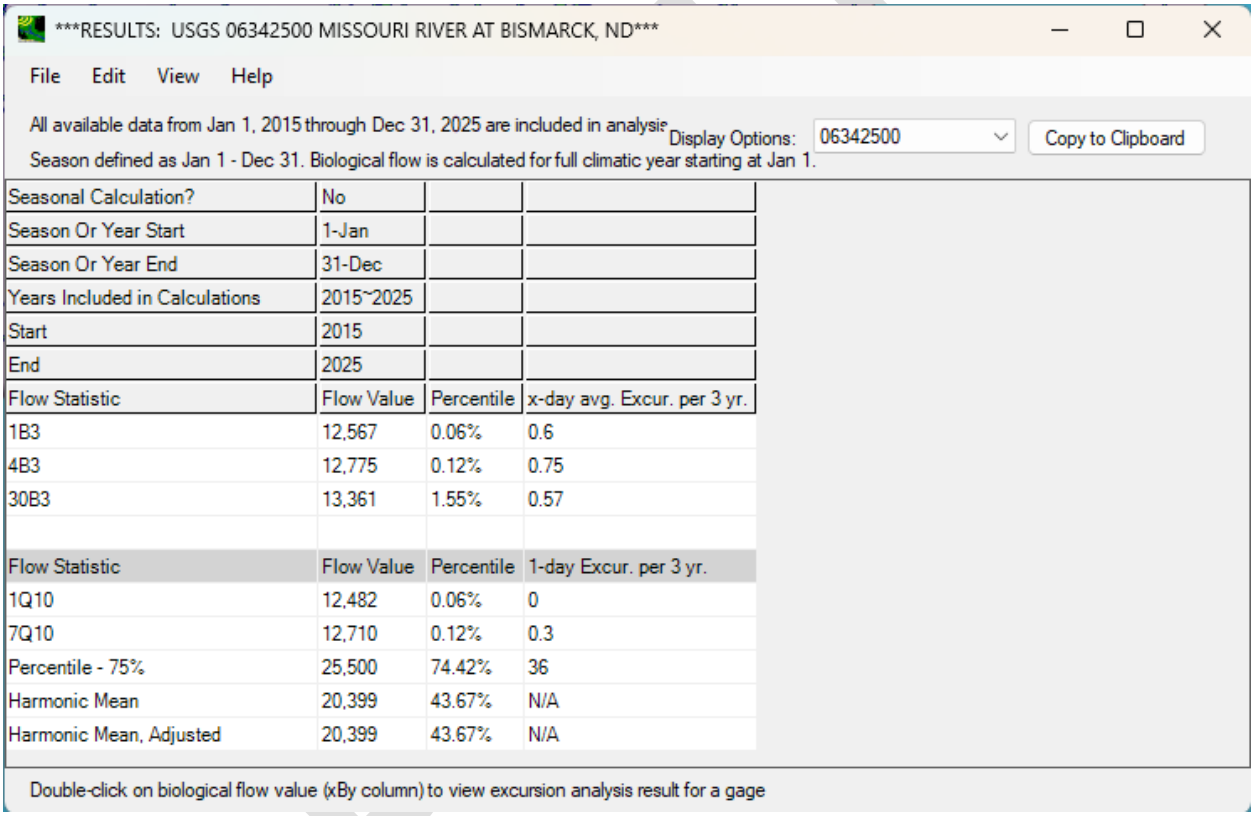


Figure 4

Whole Effluent Toxicity (WET)

The development of the permit required the use of USGS SW Toolbox 1.1.3 to determine the 1B3, 4B3, 1Q10, and 7Q10 flows for the Missouri River at USGS gauging station 06342500 Missouri River at Bismarck, ND from January 2005 through December 2025 (Figure 5). The statistical flows were used to conduct a reasonable potential analysis for WET at Outfalls 003 and 014 since both discharge low volume waste. Outfall 003 is an internal point that discharges through Outfall 002 and 001. Outfall 014 discharges directly to the Missouri River through a stormwater ditch.

The reasonable potential (RP) determination was conducted utilizing the Technical Support Document For Water Quality-based Toxics Control, EPA/505/2-90-001, March 1991 (TSD; March 1991). The data set did not include any samples since the facility is not required to conduct WET testing at outfalls 003 and 014.

The maximum acute toxicity unit was set to 1.0. An acute-to-chronic ratio was set to the default value of 10:1. The coefficient of variation was set to the default value of 0.6. Since no samples needed to be collected, the statistical multiplier was determined to be 6.2 based on the 95th-percentile probability occurrence at a 99 percent confidence level. The maximum effluent flow used in the analysis for Outfall 003 was based on the highest daily maximum value. The maximum effluent flows used in the analysis for Outfall 014 were based on the highest daily maximum value and the highest monthly value.

The analysis found no reasonable potential for discharges from Outfall 003 to be acutely toxic (Figure 4). The analysis found no reasonable potential for discharges from Outfall 014 to be acutely toxic (Figure 5) or chronically toxic (Figure 6).

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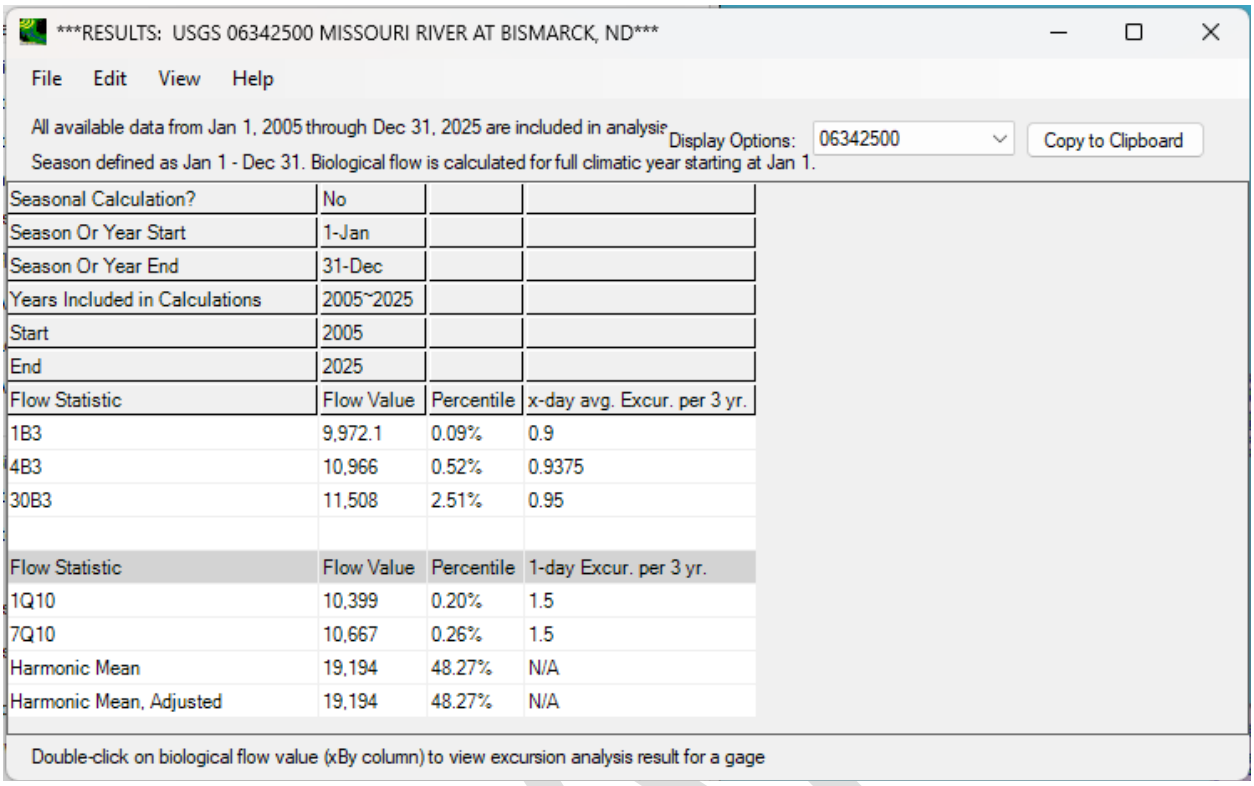

RESULTS: USGS 06342500 MISSOURI RIVER AT BISMARCK, ND
File
Edit
View
Help
All available data from Jan 1, 2005 through Dec 31, 2025 are included in analysis
Season defined as Jan 1 - Dec 31. Biological flow is calculated for full climatic year starting at Jan 1.
Display Options:
06342500
Copy to Clipboard
Seasonal Calculation? No
Season Or Year Start 1-Jan
Season Or Year End 31-Dec
Years Included in Calculations 2005~2025
Start 2005
End 2025
Flow Statistic | Flow Value | Percentile | x-day avg. Excur. per 3 yr.
1B3 | 9,972.1 | 0.09% | 0.9
4B3 | 10,966 | 0.52% | 0.9375
30B3 | 11,508 | 2.51% | 0.95
Flow Statistic | Flow Value | Percentile | 1-day Excur. per 3 yr.
1Q10 | 10,399 | 0.20% | 1.5
7Q10 | 10,667 | 0.26% | 1.5
Harmonic Mean | 19,194 | 48.27% | N/A
Harmonic Mean, Adjusted | 19,194 | 48.27% | N/A
Double-click on biological flow value (xBy column) to view excursion analysis result for a gage

Figure 5

Whole Effluent Toxicity (WET)
Resonable Potential (RP)
Determination

Technical Support Document (TSD) For Water Quality-based Toxics Control
EPA/505/2-90-001; March 1991

Facility Name:	Leland Olds Station	Receiving Stream:	Missouri River	
NDPDES Permit:	ND0025232	1Q10 Acute	10399	cfs
Effluent Flow (mgd):	1.133	1B3 Acute	9972	cfs
Stream Design Mixing:	10.0%	7Q10 Chronic	10667	cfs
WET TUa (max):	1.00	4B3 Chronic	10966	cfs
ACR:	10.00			
Statistical Multiplier:	6.2			

$$RWC = \frac{StatQeCe}{Qe+(pmf)Qs}$$

Outfall:
003 (through 002 and 001)

RWC = Receiving water concentration, the resultant magnitude of toxicity in the receiving water after effluent discharge in TUs (also known as the in-stream waste concentration)
Stat = Statistical multiplier for effluent parameter (Table 3-1 and 3-2; page 57 of the TSD)
Qe = Effluent Design Flow
Ce = Highest Toxicity Unit (TU) reported. (Use 1 if no WET data is available.)
pmf = Partial mix factor, percent of Qs allowed for mixing by State authority.
Qs = Receiving Water Flow (1Q10 or 1B3 for acute and 7Q10 or 4B3 for chronic)

Qe	1.133	mgd	Qs - Acute	6717.754	mgd
Ce	1.00	TU	Qs - Acute 1B3	6441.912	mgd
pmf	10.0%		Qs - Chronic	6890.882	mgd
Stat	6.2		Qs - Chronic 4B3	7084.036	mgd
ACR	10.00				

Acute RP			Chronic RP		
RWC - 1Q10	0.01	TUa	RWC - 7Q10	0.10	TUc
RWC - 1B3	0.01	TUa	RWC - 4B3	0.10	TUc

Criterion Maximum Concentration (CMC)			Criterion Continuous Concentration (CCC)		
Acute Criterion	0.3	TUa	Chronic Criterion	1.0	TUc

If the calculated RWC is greater than its respective criterion then there is RP and if RWC is less than the criterion then there is no RP.

CMC RP Present:		**CCC RP Present:**	
1Q10 Acute OR	**NO**	**7Q10 Chronic OR**	**NO**
1B3 Acute	**NO**	**4B3 Chronic**	**NO**

The North Dakota State Water Quality Standards (WQS) Chapter 33-16-02.1 use biologically based design flows to determine Whole Effluent Toxicity (WET) limits for acute and chronic endpoints.

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Figure 6

Whole Effluent Toxicity (WET)
Resonable Potential (RP)
Determination

Technical Support Document (TSD) For Water Quality-based Toxics Control
EPA/505/2-90-001; March 1991

Facility Name:	Leland Olds Station	Receiving Stream:	Missouri River	
NDPDES Permit:	ND0025232	1Q10 Acute	10399	cfs
Effluent Flow (mgd):	21.261	1B3 Acute	9972	cfs
Stream Design Mixing:	10.0%	7Q10 Chronic	10667	cfs
WET TUa (max):	1.00	4B3 Chronic	10966	cfs
ACR:	10.00			
Statistical Multiplier:	6.2			

$$RWC = \frac{StatQeCe}{Qe+(pmf)Qs}$$

Outfall:
014 (Acute)

RWC = Receiving water concentration, the resultant magnitude of toxicity in the receiving water after effluent discharge in TUs (also known as the in-stream waste concentration)
Stat = Statistical multiplier for effluent parameter (Table 3-1 and 3-2; page 57 of the TSD)
Qe = Effluent Design Flow
Ce = Highest Toxicity Unit (TU) reported. (Use 1 if no WET data is available.)
pmf = Partial mix factor, percent of Qs allowed for mixing by State authority.
Qs = Receiving Water Flow (1Q10 or 1B3 for acute and 7Q10 or 4B3 for chronic)

Qe	21.261	mgd	Qs - Acute	6717.754	mgd
Ce	1.00	TU	Qs - Acute 1B3	6441.912	mgd
pmf	10.0%		Qs - Chronic	6890.882	mgd
Stat	6.2		Qs - Chronic 4B3	7084.036	mgd
ACR	10.00				

Acute RP			Chronic RP		
RWC - 1Q10	0.19	TUa	RWC - 7Q10	1.86	TUc
RWC - 1B3	0.20	TUa	RWC - 4B3	1.81	TUc

Criterion Maximum Concentration (CMC)			Criterion Continuous Concentration (CCC)		
Acute Criterion	0.3	TUa	Chronic Criterion	1.0	TUc

If the calculated RWC is greater than its respective criterion then there is RP and if RWC is less than the criterion then there is no RP.

CMC RP Present:		**CCC RP Present:**	
1Q10 Acute OR	**NO**	**7Q10 Chronic OR**	**YES**
1B3 Acute	**NO**	**4B3 Chronic**	**YES**

The North Dakota State Water Quality Standards (WQS) Chapter 33-16-02.1 use biologically based design flows to determine Whole Effluent Toxicity (WET) limits for acute and chronic endpoints.

Page 1 of 4

Figure 7

Whole Effluent Toxicity (WET)
Resonable Potential (RP)
Determination

Technical Support Document (TSD) For Water Quality-based Toxics Control
EPA/505/2-90-001; March 1991

Facility Name:	Leland Olds Station	Receiving Stream:	Missouri River	
NDPDES Permit:	ND0025232	1Q10 Acute	10399	cfs
Effluent Flow (mgd):	1.701	1B3 Acute	9972	cfs
Stream Design Mixing:	10.0%	7Q10 Chronic	10667	cfs
WET TUa (max):	1.00	4B3 Chronic	10966	cfs
ACR:	10.00			
Statistical Multiplier:	6.2			

$$RWC = \frac{StatQeCe}{Qe+(pmf)Qs}$$

Outfall:
014 (Chronic)

RWC = Receiving water concentration, the resultant magnitude of toxicity in the receiving water after effluent discharge in TUs (also known as the in-stream waste concentration)
Stat = Statistical multiplier for effluent parameter (Table 3-1 and 3-2; page 57 of the TSD)
Qe = Effluent Design Flow
Ce = Highest Toxicity Unit (TU) reported. (Use 1 if no WET data is available.)
pmf = Partial mix factor, percent of Qs allowed for mixing by State authority.
Qs = Receiving Water Flow (1Q10 or 1B3 for acute and 7Q10 or 4B3 for chronic)

Qe	1.701	mgd	Qs - Acute	6717.754	mgd
Ce	1.00	TU	Qs - Acute 1B3	6441.912	mgd
pmf	10.0%		Qs - Chronic	6890.882	mgd
Stat	6.2		Qs - Chronic 4B3	7084.036	mgd
ACR	10.00				

Acute RP			Chronic RP		
RWC - 1Q10	0.02	TUa	RWC - 7Q10	0.15	TUc
RWC - 1B3	0.02	TUa	RWC - 4B3	0.15	TUc

Criterion Maximum Concentration (CMC)			Criterion Continuous Concentration (CCC)		
Acute Criterion	0.3	TUa	Chronic Criterion	1.0	TUc

If the calculated RWC is greater than its respective criterion then there is RP and if RWC is less than the criterion then there is no RP.

CMC RP Present:		**CCC RP Present:**	
1Q10 Acute OR	**NO**	**7Q10 Chronic OR**	**NO**
1B3 Acute	**NO**	**4B3 Chronic**	**NO**

The North Dakota State Water Quality Standards (WQS) Chapter 33-16-02.1 use biologically based design flows to determine Whole Effluent Toxicity (WET) limits for acute and chronic endpoints.

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Figure 8

Total Residual Chlorine

The quantity of total residual chlorine (TRC) discharged in once-through cooling water was calculated by multiplying the average flow of the once-through cooling water from outfalls 001 and 002 times 0.20 mg/L for the maximum load (see 40 CFR 423.13(b)). The average flow from 2012 through 2026 was 96.8 million gallons per day for outfall 001 and 177.4 million gallons per day for outfall 002. Since TRC cannot be discharged for more than two hours in one day, the calculation includes a two-hour time factor.

$$TRC_{Max\,001} = 13.5 lb/d = 0.20 mg/L \times 96.8 mgal/d \times \left(\frac{2hr}{24hr}\right) \times \left(\frac{2.21\ lb}{1 \times 10^6 mg}\right) \times \left(\frac{3.785\ L}{1\ gal}\right) \times \left(\frac{1 \times 10^6 gal}{1 mgal}\right)$$

$$TRC_{Max\,002} = 24.7 lb/d = 0.20 mg/L \times 177.4 mgal/d \times \left(\frac{2hr}{24hr}\right) \times \left(\frac{2.21\ lb}{1 \times 10^6 mg}\right) \times \left(\frac{3.785\ L}{1\ gal}\right) \times \left(\frac{1 \times 10^6 gal}{1 mgal}\right)$$

DRAFT

Sulfate, Total

The RP determination for total sulfate at Outfall 003 is provided below. The determination was conducted utilizing the Technical Support Document For Water Quality-based Toxics Control, EPA/505/2-90-001, March 1991 (TSD; March 1991).

The data set for the RP analysis included one sample of the effluent included in the application and all available data from USGS Monitoring Station 06342500-Missouri River at Bismarck, ND. A default coefficient of variation (CV) of 0.6 was used since less than ten samples were included in the data set. The statistical multiplier based on the 95th-percentile probability occurrence at a 99 percent confidence level was 6.2. The upstream concentration used in the RP analysis was 202 mg/L based on the 75th percentile of instream data. The maximum effluent concentration used in the RP analysis was 259 mg/L. Based on the RP analysis, the department found there to be no reasonable potential for total sulfate to be above the water quality standard criterion for municipal and domestic drinking water sources prior to treatment (Figure 7).

DRAFT

Receiving Water Concentration (RWC)
Reasonable Potential (RP)
Determination

Technical Support Document (TSD) For Water Quality-based Toxics Control
EPA/505/2-90-001; March 1991

Facility Name:	Leland Olds Station	Receiving Stream:	Missouri River	
NDPDES Permit:	ND0025232	1Q10 Acute	10399	cfs
Daily Maximum Flow (mgd):	1.13	1B3 Acute	9792	cfs
Daily Average Flow (mgd):	0.50	7Q10 Chronic	10667	cfs
Stream Design Mixing:	10.0%	4B3 Chronic	10966	cfs
Statistical Multiplier:	6.2			
Upstream Concentration:	202.0000	mg/l	**Parameter:**	
Effluent Concetration (max):	259.0000	mg/l	**Sulfate**	

$$RWC = \frac{(StatQeCe)+(Cs(pmf)Qs)}{Qe+(pmf)Qs}$$

Outfall: **003**

RWC = Receiving water concentration, the resultant magnitude of concentration in the receiving water after effluent discharge concentration (also known as the in-stream waste concentration)
Stat = Statistical multiplier for effluent parameter (Table 3-1 and 3-2; page 57 of the TSD)
Qe = Effluent Design Flow
Ce = Highest effluent concentration reported.
pmf = Partial mix factor, percent of Qs allowed for mixing by State authority.
Qs = Receiving Water Flow (1Q10 or 1B3 for acute and 7Q10 or 4B3 for chronic)
Cs = Background concentration of the receiving water.

Qe - Acute	1.13	mgd	Qs - 1Q10	6717.75	mgd
Qe - Chronic	0.50	mgd	Qs - 1B3	6325.63	mgd
Ce	259.0000	mg/l	Qs - 7Q10	6890.88	mgd
Cs	202.0000	mg/l	Qs - 4B3	7084.04	mgd
Stat	6.20				
pmf	10.0%				

Acute RP			Chronic RP		
RWC - 1Q10	204.3636	mg/l	RWC - 7Q10	203.0077	mg/l
RWC - 1B3	204.5099	mg/l	RWC - 4B3	202.9802	mg/l

Criterion Maximum Concentration (CMC)			Criterion Continuous Concentration (CCC)		
Acute Criterion	250	mg/l	Chronic Criterion	250.0000	mg/l

If the calculated RWC is greater than its respective criterion then there is RP and if RWC is less than the criterion then there is no RP.

CMC RP Present:		**CCC RP Present:**	
1Q10 Acute OR	**NO**	**7Q10 Chronic OR**	**NO**
1B3 Acute	**NO**	**4B3 Chronic**	**NO**

The North Dakota State Water Quality Standards (WQS) Chapter 33-16-02.1 use biologically based design and harmonic mean flows to determine Water Quality Based Effluent Limits (WQBELs) and Whole Effluent Toxicity (WET) limits.

Page 1 of 4

Figure 9

APPENDIX D – RESPONSE TO COMMENTS

Comments received during the public comment period will be placed and addressed here.

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APPENDIX E – NUMBER AND TYPES OF ORGANISMS ENTRAINED

The number and types of organisms entrained as part of the Basin Electric Power Cooperative, Leland Olds Station, Entrainment Characterization Study (EA Engineering, Science, and Technology Inc., 2017) are provided below (40 CFR 125.98(f)(2)(i)).

Scientific Name	Common Name	Life Stage[1]	2015		2016	
			#	%	#	%
Dorosoma cepedianum	Gizzard Shad	PYSL	2	0.7	--	--
Coregonus sp.	Cisco	YSL	3	1.1	6	1.4
Osmerus mordax	Rainbow Smelt	Eggs	2	0.7	1	0.2
		Larvae	--	--	5	1.1
		PYSL	--	--	3	0.7
Osmerus mordax type	Rainbow Smelt type	Eggs (non-viable)	--	--	1	0.2
		Eggs	--	--	7	1.6
Cyprinus carpio	Common Carp	YSL	1	0.4	--	--
Pimephales type	--	YSL	--	--	1	0.2
Cyprinidae type	Minnow type	Eggs	2	0.7	5	1.1
Catostomus sp.	Sucker	YSL	22	7.7	--	--
Ictiobus sp.	Buffalo	YSL	1	0.4	--	--
Moxostoma/Catostomus	Redhorse/Sucker	Larvae	33	11.6	--	--
		PYSL	12	4.2	4	0.9
		YSL	172	60.4	339	77.8
Catostomidae type	Sucker type	Eggs (non-viable)	--	--	2	0.5
		Eggs	--	--	8	1.8
Ictiobinae sp.	Carpsucker/Buffalo	Eggs	1	0.4	--	--
		YSL	27	9.5	13	3.0
Catostomidae sp.	Sucker	Larvae	--	--	2	0.5
		YSL	--	--	6	1.4
Morone type	White Bass	Eggs (non-viable)	--	--	2	0.5
Sander vitreum	Walleye	YSL	2	0.7	1	0.2
Percidae type	Perch type	YSL	--	--	2	0.5
Percidae sp.	Perch	Larvae	1	0.4	--	--
Cyprinidae/Catostomidae	Minnow/Sucker	Egg	--	--	11	2.5
Cyprinidae/Catostomidae type	Minnow/Sucker type	Larvae	1	0.4	--	--
Unidentified	Unidentified	Eggs (non-viable)	--	--	8	1.8
		Eggs	1	0.4	9	2.1
		Larvae	2	0.7	--	--
		Total Ichthyoplankton	285	100.0	436	100.0

[1]Life Stages: YSL = yolk-sac larvae; PYSL = post-yolk-sac larvae; Larvae = damaged; unable to identify life stage.

Figure 10

APPENDIX F – MISSOURI RIVER TEMPERATURE SURVEY NEAR UNITED POWER ASSOCIATION STANTON, NORTH DAKOTA PLANT

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9-15

MISSOURI RIVER TEMPERATURE SURVEY

NEAR

UNITED POWER ASSOCIATION STANTON, NORTH DAKOTA PLANT

JANUARY 1973

QL&M Project No. 215-3

For

United Power Association
Elk River, Minnesota

Prepared by

QUIRK, LAWLER & MATUSKY ENGINEERS
415 Route 303
Tappan, New York 10983

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SUMMARY AND CONCLUSIONS

The Environmental Protection Agency (EPA) Region VIII Office has suggested that the following guidelines for allowable mixing zone be applied to the United Power Association (UPA) Stanton, North Dakota plant cooling water discharge:

1. The cross-sectional area enclosed by the 4°F temperature rise isotherm should be less than 10% of the river cross-sectional area;

2. The lateral extent of the 4°F surface temperature rise isotherm should be less than 25% of the river width, and;

3. The longitudinal length of the 4°F surface temperature rise isotherm should be less than five (5) times the maximum surface width of the 4°F surface temperature rise isotherm or less than 1.25 times the river width, whichever is greater.

A field survey was conducted in October, 1972 to delineate temperature patterns in the Missouri River in the area of the UPA cooling water discharge. The objectives of this field survey were to investigate:

- Variation of temperature patterns with changes in Missouri River flow
- Contribution of the Knife River to the temperature patterns
- Compliance of the UPA cooling water discharge with respect to the EPA guidelines, and

- Influence of the UPA cooling water discharge on temperatures in the BEC intake area.

Analysis of results of the survey indicate that the cooling water discharge from the UPA plant becomes elongated in the longitudinal direction and confined close to shore during periods when Missouri River flows approach 30,000 cfs. During lower flow conditions of approximately 14,000 cfs, the UPA cooling water discharge is shorter in the longitudinal direction and extends farther out into the river.

Measurements of temperature change with depth showed little or no stratification in the UPA plume.

The effect of the Knife River on temperature distribution in the Missouri River was found to be small, although the Knife River was 10°F cooler than the Missouri at the time of the survey. A maximum of 0.5°F cooler water was observed just upstream of the UPA intake, indicating that the Knife River had become mixed with the Missouri River at this point.

Measurements conducted at the BEC intake structure indicate temperatures 2°F to 3°F above river ambient on the surface and 1°-2°F above ambient below the surface, but these are attributed to recirculation of BEC cooling water discharged from the winter discharge just upstream of the intake.

Table S-1 summarizes the results of the temperature survey and compares these results with guidelines suggested by the EPA for allowable mixing zones for the UPA cooling water discharge.

Survey results indicate that the UPA cooling water discharge is within the width and cross-sectional area guidelines for all flow conditions observed. The 4°F isotherm never exceeded 8.8% of the rivers' width nor 7.7% of the cross-sectional area.

TABLE S-1

TEMPERATURE SURVEY RESULTS - COMPARISON WITH EPA SUGGESTED ALLOWABLE MIXING ZONE GUIDELINES

Run	Missouri River Flow 1000 cfs	Extent of 4°F Isotherm				
		Cross-Sectional Area %	Longitudinal ft. %		Width Ft. %	
EPA Suggested Guidelines for Mixing Zone	--	<10	<1000	<125	<200	<25
A	13.4-14.7	5.8	510	64	60	7.5
B	20-30	4.9	580	73	50	6.3
C	13.4-18.2	7.7	490	62	70	8.8
D	25.6-31.0	3.1	1040	130	45	5.6
E	30.6-31.4	2.3	1070	134	40	5.0

An examination of the longitudinal extent of the 4°F isotherm at the different flows show the plume to slightly exceed the longitudinal guidelines at the high flow conditions. Although the survey results indicate that the UPA cooling water discharge does exceed the suggested guideline for the longitudinal extent of the 4°F isotherm, the degree to which these guidelines are exceeded is negligible.

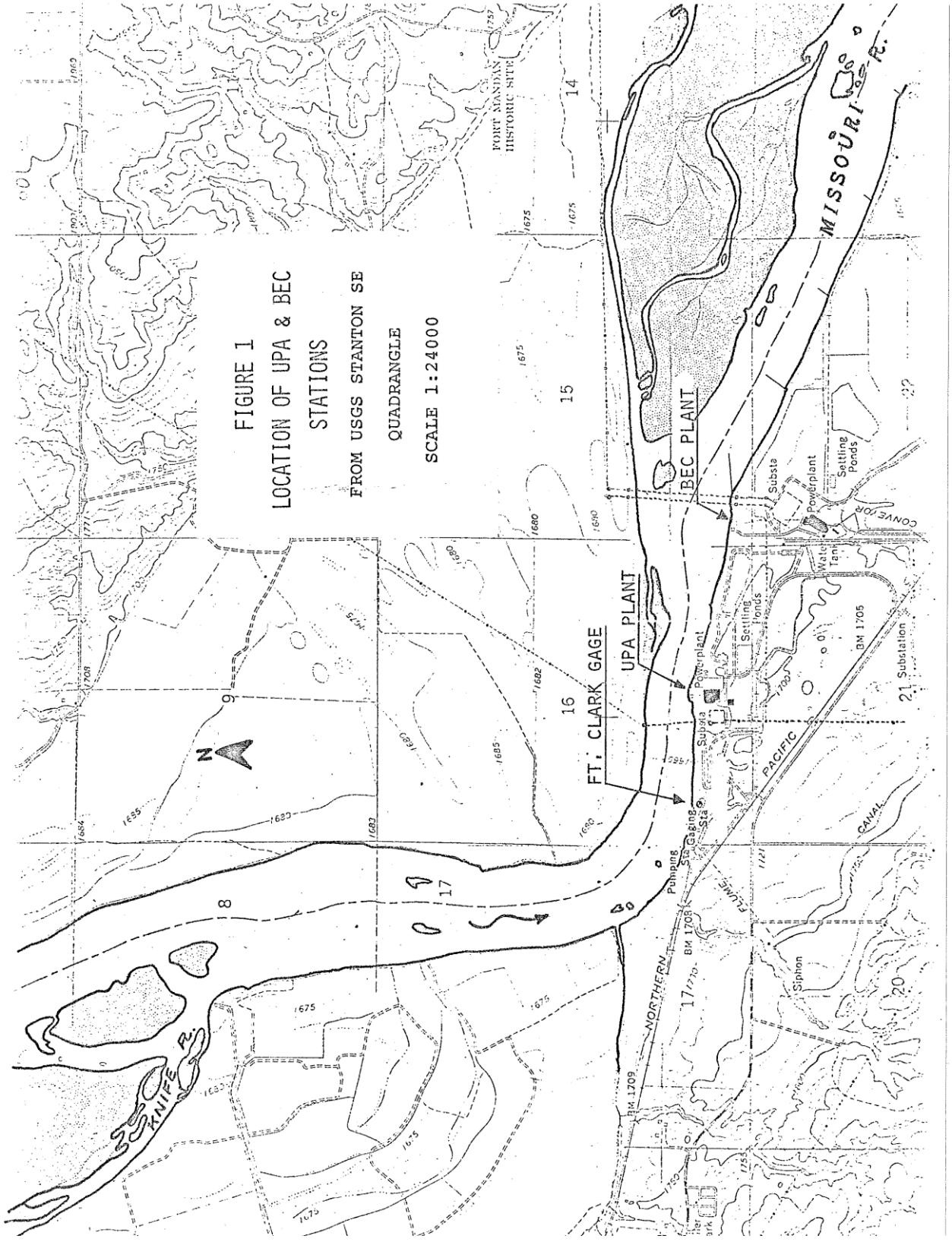
I. INTRODUCTION, PURPOSE AND SCOPE

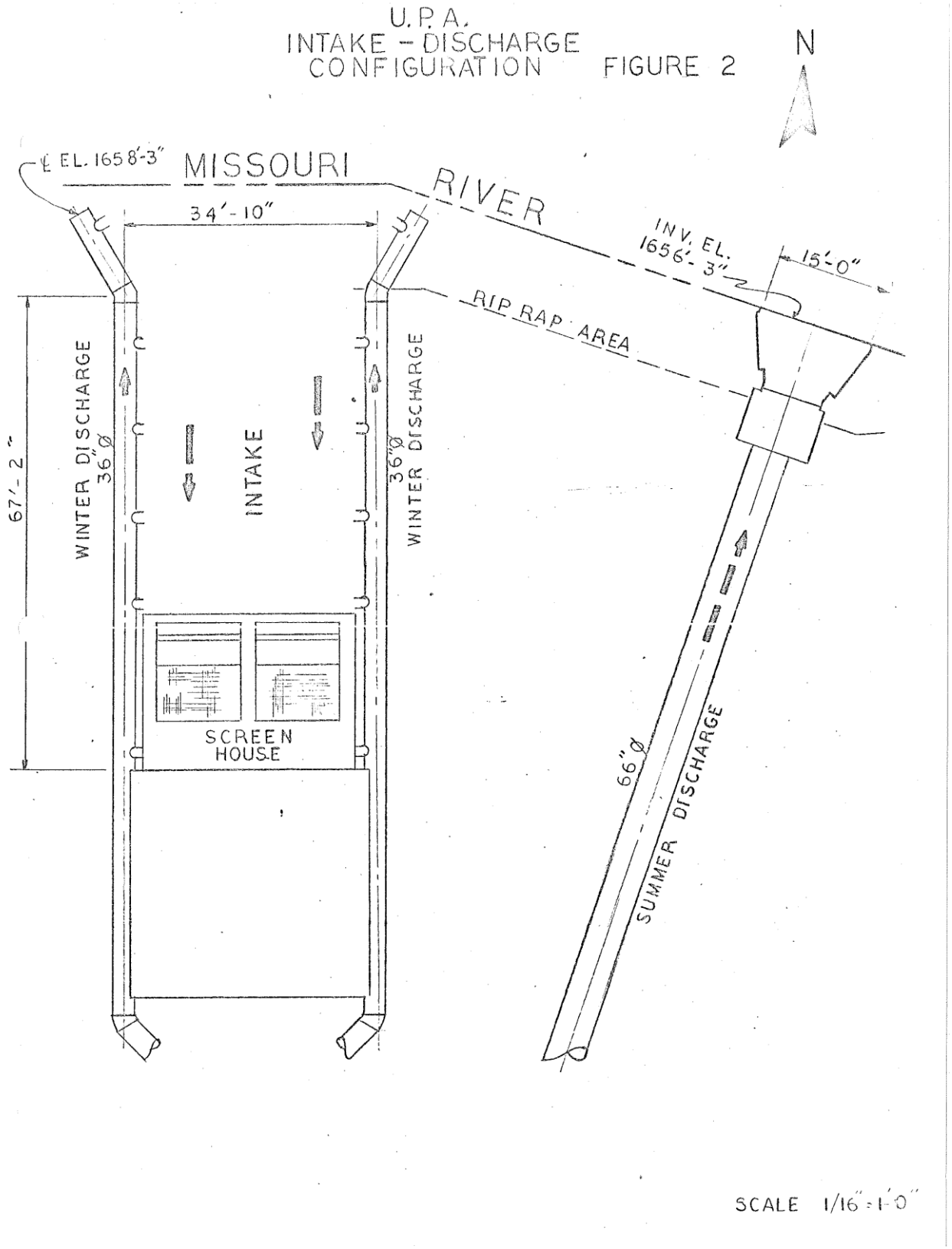
The United Power Association (UPA) operates a 172 MW lignite fueled generating station near Stanton, North Dakota. The plant, as shown in Figure 1, is located on the southern bank of the Missouri River and is approximately 17.8 miles below Garrison Dam and 57.5 miles upstream of Bismark, North Dakota. The plant is located below a sharp bend in the river to the east.

Garrison Dam impounds waters of Lake Sakakawea and is a regulated release operated by the Corps of Engineers for hydro-electric power production and downstream river flow control. Water for release is withdrawn from the lower portions of Lake Sakakawea and may, due to thermal stratification, be cooler than lake surface temperatures. Average daily releases from the Dam are on the order of 25,000 cfs with instantaneous and daily average extremes as high as 44,000 cfs.

As shown in Figure 1, the Knife River enters the Missouri River approximately 3 miles upstream of the UPA facility. Flow from the Knife River averages 177 cfs with recorded extremes of 0 and 35,300 cfs. Temperatures in the Knife River may be several degrees warmer than the Missouri during the summer months due to the lower layer releases to the Missouri from Lake Sakakawea.

The UPA Stanton facility utilizes water from the Missouri for condenser cooling. The water is withdrawn and returned to the Missouri through intake and discharge structures as shown schematically in Figure 2. The winter discharge configuration involves the discharge of all or a portion of the circulating water through submerged pipes on both sides of the intake structure. This induces


FIGURE 1
LOCATION OF UPA & BEC STATIONS
FROM USGS STANTON SE QUADRANGLE
SCALE 1:24000
BEC PLANT
UPA PLANT
FT. CLARK GAGE
MISSOURI R.
KNIFE R.
NORTHERN PACIFIC
PORT MANDAN HISTORIC SITE
Powerplant
Substa
Settling Ponds
Water Tank
Pumping Sta
Gaging Sta
Siphon
BM 1709
BM 1705
BM 1708
CANAL
FLUME
CONVEYOR
N


U.P.A.
INTAKE - DISCHARGE
CONFIGURATION
FIGURE 2
N
℄ EL. 1658'-3"
MISSOURI
RIVER
34'-10"
INV. EL. 1656'-3"
15'-0"
RIP RAP AREA
67'-2"
WINTER DISCHARGE
36"ø
INTAKE
36"ø
WINTER DISCHARGE
SCREEN HOUSE
66"ø
SUMMER DISCHARGE
SCALE 1/16"=1'-0"

recirculation of the cooling water to the intake to maintain an efficient cooling water inlet temperature during extreme low Missouri River temperatures.

Under normal operation, the station subjects 100,000 gallons per minute (222 cfs) of Missouri River water to a rise of 15.5°F above intake temperatures.

Approximately 3000 feet downstream from the UPA facility (Figure 1), the Basin Electric Cooperative (BEC) operates a 216 MW generating facility. The BEC station withdraws from and returns to the river approximately 72,000 gpm (160 cfs) at an average temperature rise of 30°F. The BEC facility also has a winter discharge which enters the river just upstream of the intake, and is utilized to maintain efficient intake temperatures by recirculating the cooling water.

The Environmental Protection Agency (EPA) Region VIII Enforcement Division has suggested certain guidelines for establishment of an allowable mixing zone for the UPA Stanton Plant cooling water discharge. The suggested guidelines are as follows:

1. The cross-sectional area enclosed by the 4°F temperature rise isotherm should be less than 10% of the river cross-sectional area.

2. The lateral extent of the 4°F surface temperature rise isotherm should be less than 25% of the river width, and

3. The longitudinal length of the 4°F surface temperature rise isotherm should be less than five (5) times the maximum surface width of the

$4^{o}F$ surface temperature rise isotherm or less than 1.25 times the river width, whichever is greater.

The purpose of this study was to evaluate temperature patterns in this area of the Missouri River. Particular attention was paid to:

- Variation of temperature patterns with changes in Missouri River flow
- Contribution of the Knife River to the temperature patterns
- Evaluation of the UPA cooling water discharge with respect to the EPA guidelines, and
- Influence of the UPA cooling water discharge on temperatures in the BEC intake area.

In order to fulfill these objectives, a field survey was conducted in October of 1972 by Quirk, Lawler & Matusky Engineers (QL&M). Information from the field survey was utilized to determine existing temperature profiles resulting from the UPA cooling water discharge and to analyze the results in terms of the allowable mixing zone guidelines suggested by the EPA. This report presents the results of the survey and interpretation of the results in terms of these guidelines.

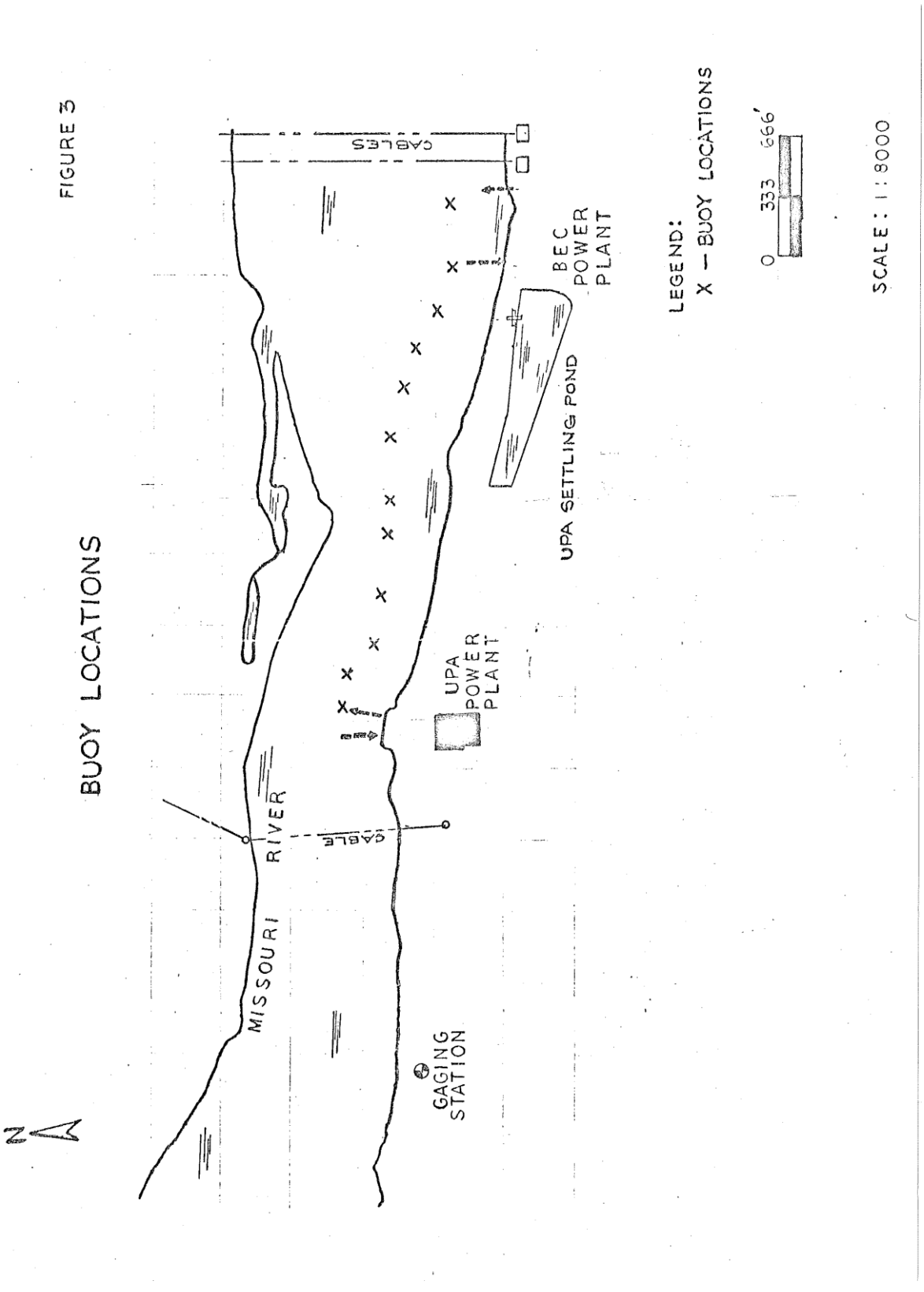
II. TEMPERATURE SURVEY PROCEDURES AND PRESENTATION OF RESULTS

Field Procedures

The field procedures employed in delineating temperature patterns in the area of the UPA cooling water discharge are summarized in this section. The field survey was conducted during the period October 12-14, 1972. In order to provide measurements during a low flow period, the Corps of Engineers agreed to reduce flow from Garrison Dam to 13,000 cfs on October 13, 1972.

Numbered buoys were placed in the river as shown in Figure 3 on a line extending from the UPA intake to the BEC discharge. Preliminary temperature measurements were used to insure that the buoys were placed outside that portion of the river which was subject to temperature rises due to the UPA cooling water discharge. The buoys were then located by a survey crew using known shore points.

Temperature measurements were obtained using a platinum temperature probe connected by 55 feet of calibrated oceanographic cable to a Leeds & Northrup Speedomax strip-chart recorder. The temperature instrument was periodically calibrated in the field using an ASTM certified thermometer and was also calibrated using precision resistors before and after the field survey. For surface temperature measurements, the probe was suspended from a boom, extending five feet outward from the side of the boat. The probe was suspended from the end of the boom and the height adjusted so that it traveled in only the top 2 inches of water.


FIGURE 3
BUOY LOCATIONS
CABLES
BEC POWER PLANT
UPA SETTLING POND
LEGEND:
X – BUOY LOCATIONS
0 333 666'
SCALE: 1:8000
UPA POWER PLANT
CABLE
MISSOURI RIVER
GAGING STATION
N

In order to measure temperature variation with depth, the probe was weighted, and lowered at a constant rate until reaching bottom, then raised at a constant rate to the surface. This procedure provided duplicate, continuous measurements of vertical temperature profiles.

Surface temperature mapping runs were conducted by traveling along a zig-zag path, utilizing the buoys and the shoreline as turning points, beginning at the BEC discharge downstream of UPA and ending at the overhead transmission lines, upstream of the UPA intake. This assured a complete measurement of both the plume from the UPA discharge and the river ambient surface temperature upstream of the discharge. By placing the buoys outside the area affected by the UPA discharge, surface ambient was also measured each time the boat traveled along a leg of the zig-zag pattern, thus assuring that any change in ambient during a run would be monitored.

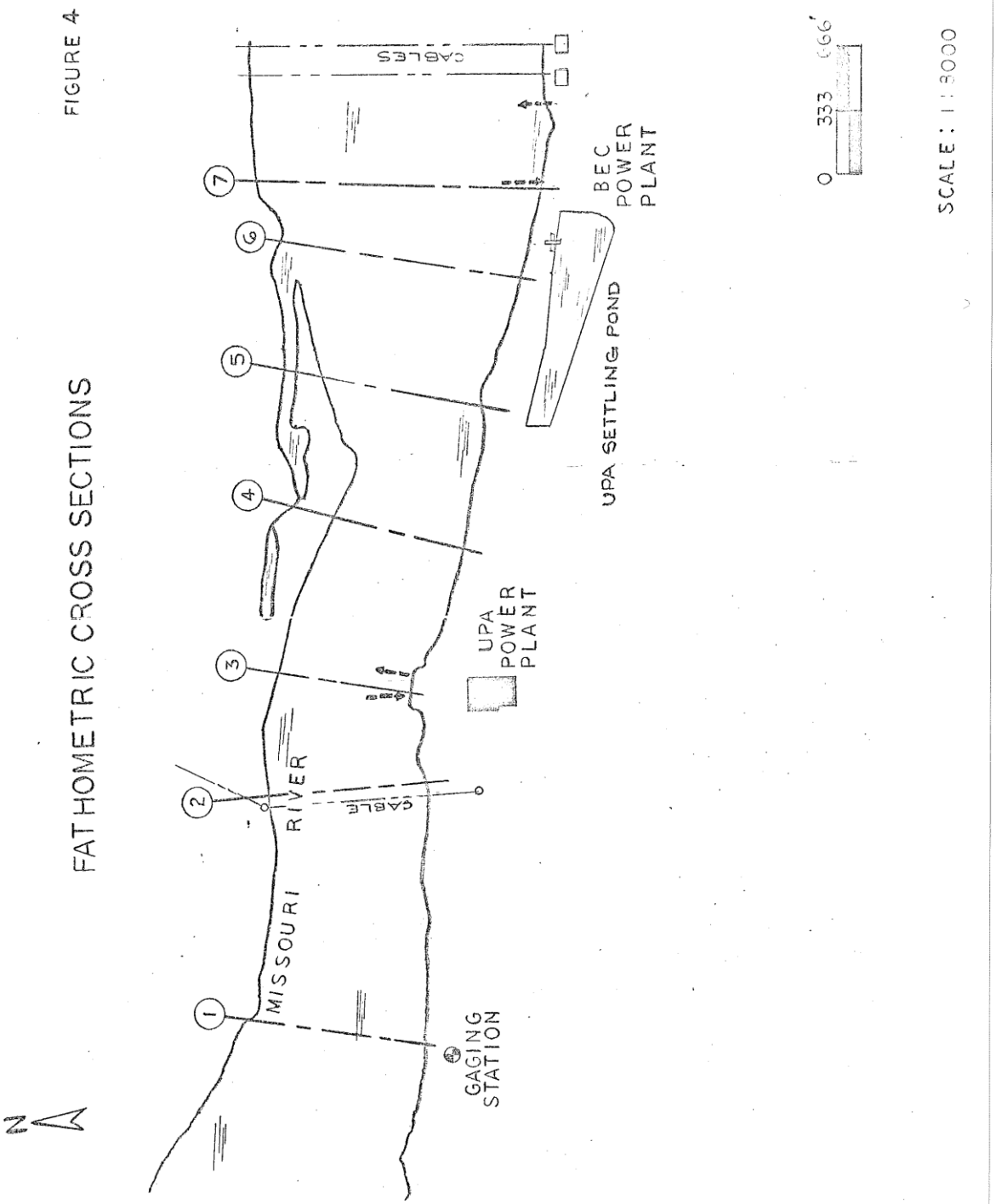
The time and location of each leg of the run was recorded on the chart paper, as well as on a tape recorder. To facilitate data reduction, each run was designated by a letter and each leg of a run by a number.

The measurements of temperature variation with depth were conducted by holding the boat at selected locations and lowering the probe as described above. These depth measurements were conducted both in the plume itself and upstream of the discharge, to determine both plume and natural river thermal stratification.

A continuously recording fathometer was used to measure bottom contours along the transects shown in Figure 4. Each transect was done twice, once from north to south, once from south to north. This procedure was employed to minimize distortions which could be caused by variations in boat speed as the boat traveled from shore to shore.

FIGURE 4

FATHOMETRIC CROSS SECTIONS



The initial work plan for the field survey incorporated current measurements in various areas of the Missouri and Knife Rivers in order to determine flow and current distributions. Subsequent conversations with Mr. Orlo A. Crosby of the U.S. Geological Survey (USGS) in Bismark, North Dakota indicated that flow and/or gage records would be available for the following locations:

1. Garrison Dam - Corps of Engineers
2. Below Garrison Dam - USGS
3. Knife River at Hazen - USGS
4. Fort Clark Gage (0.4 mile upstream of UPA) - USGS
5. Missouri River at Bismark - USGS

Initial attempts at measuring currents in the area indicated that the high river velocities encountered necessitated an extremely complicated anchoring system. In view of the flow information that would be available and the difficulties encountered, the current measurement phase of the program was abandoned.

The initial work plan also provided for temperature measurements conducted with the winter discharge configuration. When the plant personnel switched over to this mode of operation, difficulties in plant efficiency were encountered due to excessive recirculation. These difficulties made it impossible to maintain this mode of operation long enough to reach a steady state in the river and conduct temperature measurements. Temperature measurements were therefore not obtained for this discharge configuration.

Field Survey Results

Figures 5 through 11 show cross-sections of the Missouri River in the vicinity of the UPA plant. Locations of the transects are shown in Figure 4. The river

FIGURE 5
BOTTOM PROFILE
TRANSECT 1

DATE: 10/14/72
TIME: 1625
LOCATION: Fort Clark Gage
WIDTH: 920'

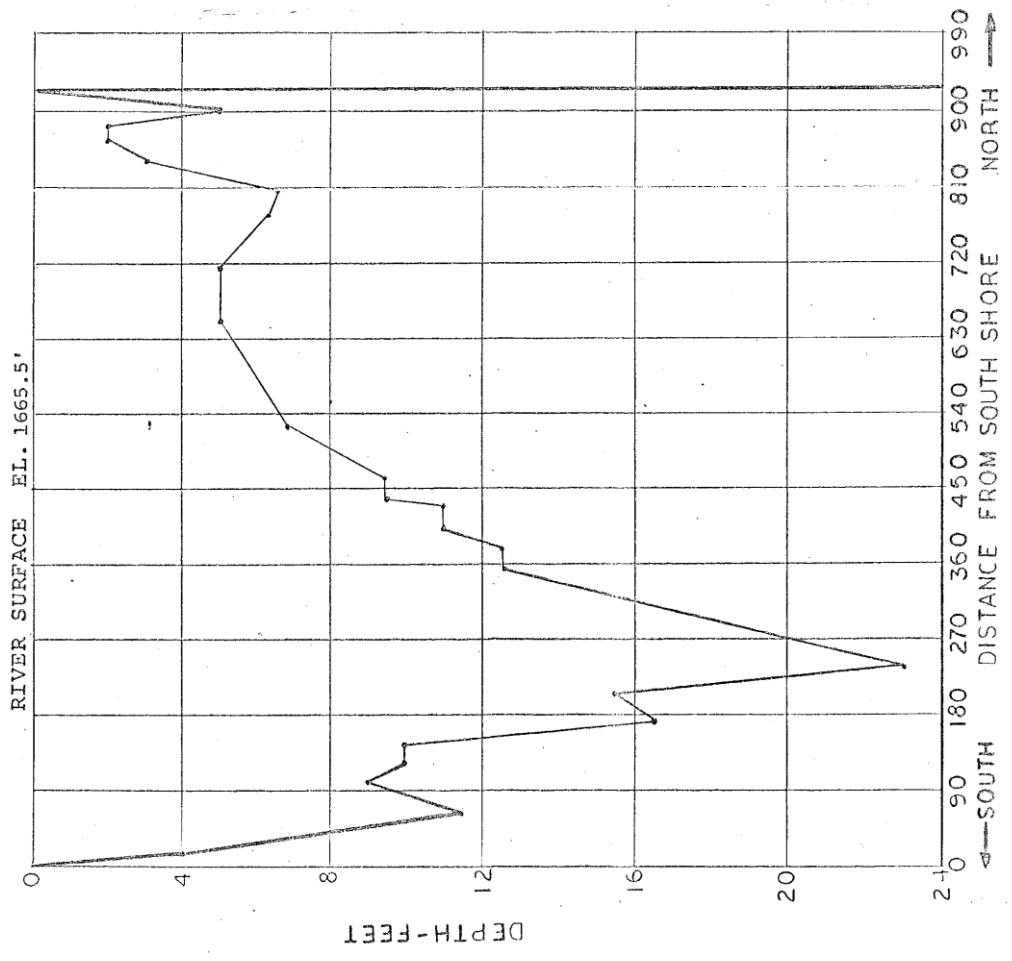


FIGURE 6
BOTTOM PROFILE
TRANSECT 2

DATE: 10/13/72
TIME: 1220
LOCATION: Transmission Towers
WIDTH: 840'

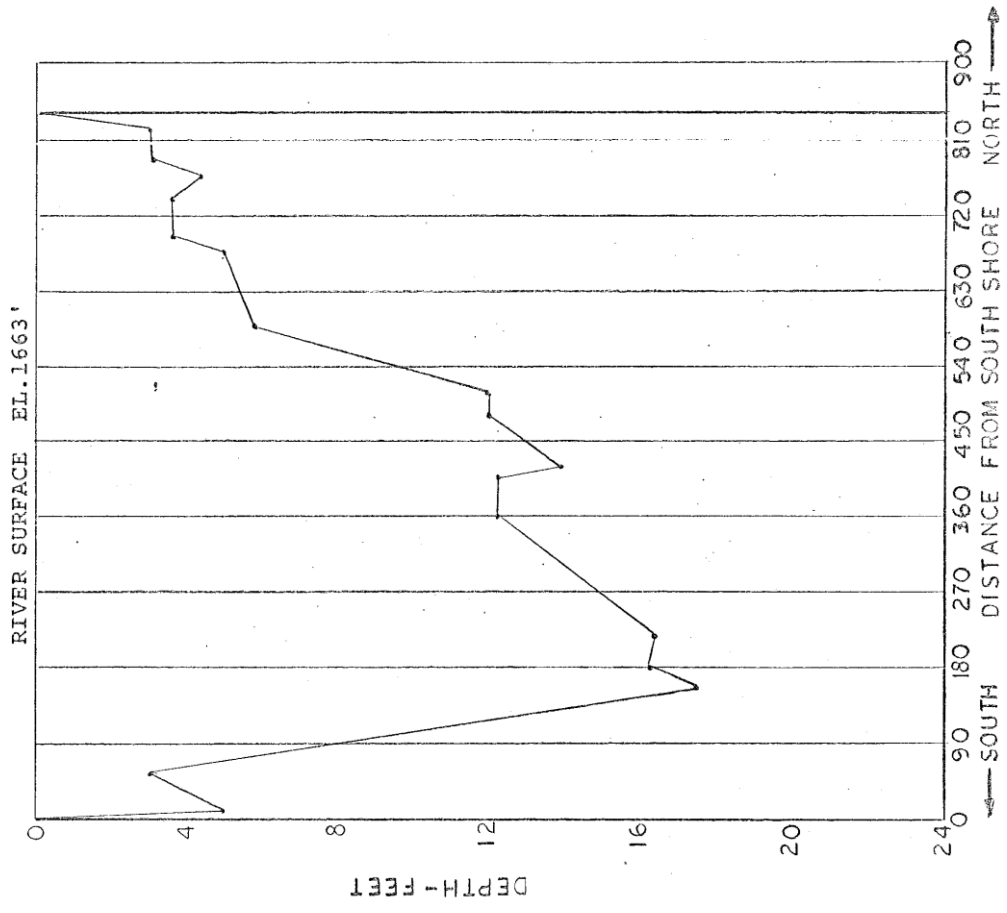


FIGURE 7
BOTTOM PROFILE
TRANSECT 3

DATE: 10/14/172
TIME: 1635
LOCATION: UPA INTAKE
WIDTH: 760'

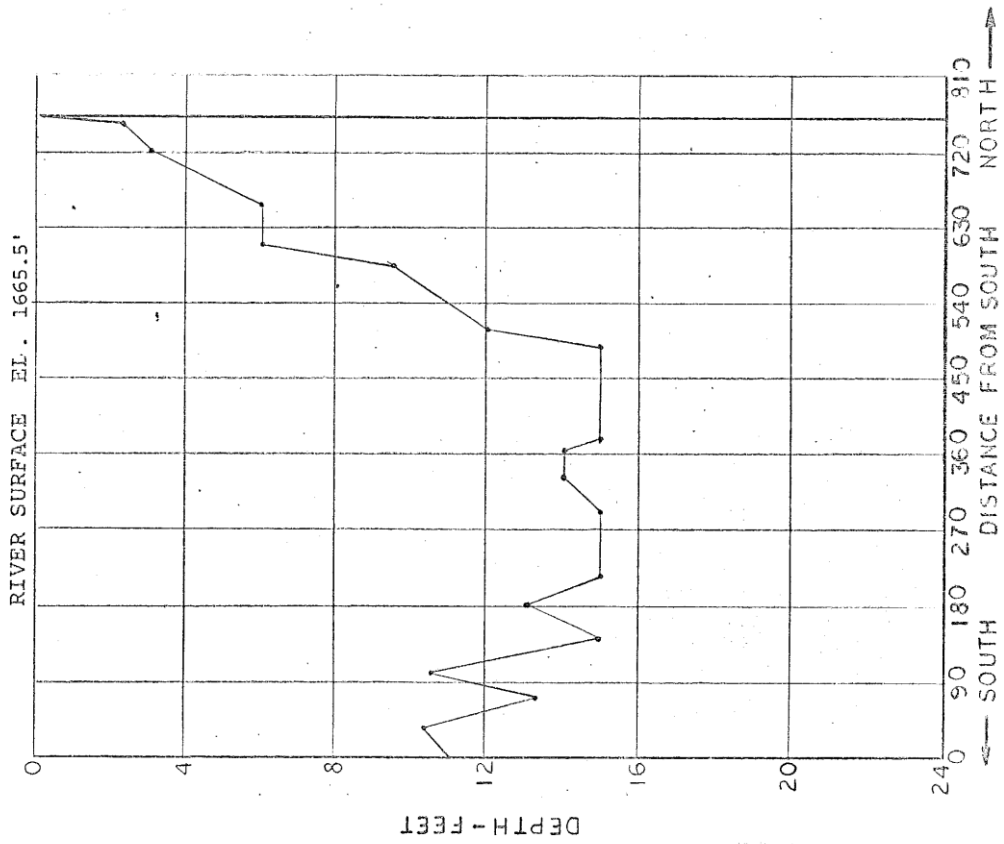


FIGURE 8
BOTTOM PROFILE
TRANSECT 4

DATE: 10/14/72
TIME: 1645
LOCATION: Buoy 3
WIDTH: 764'

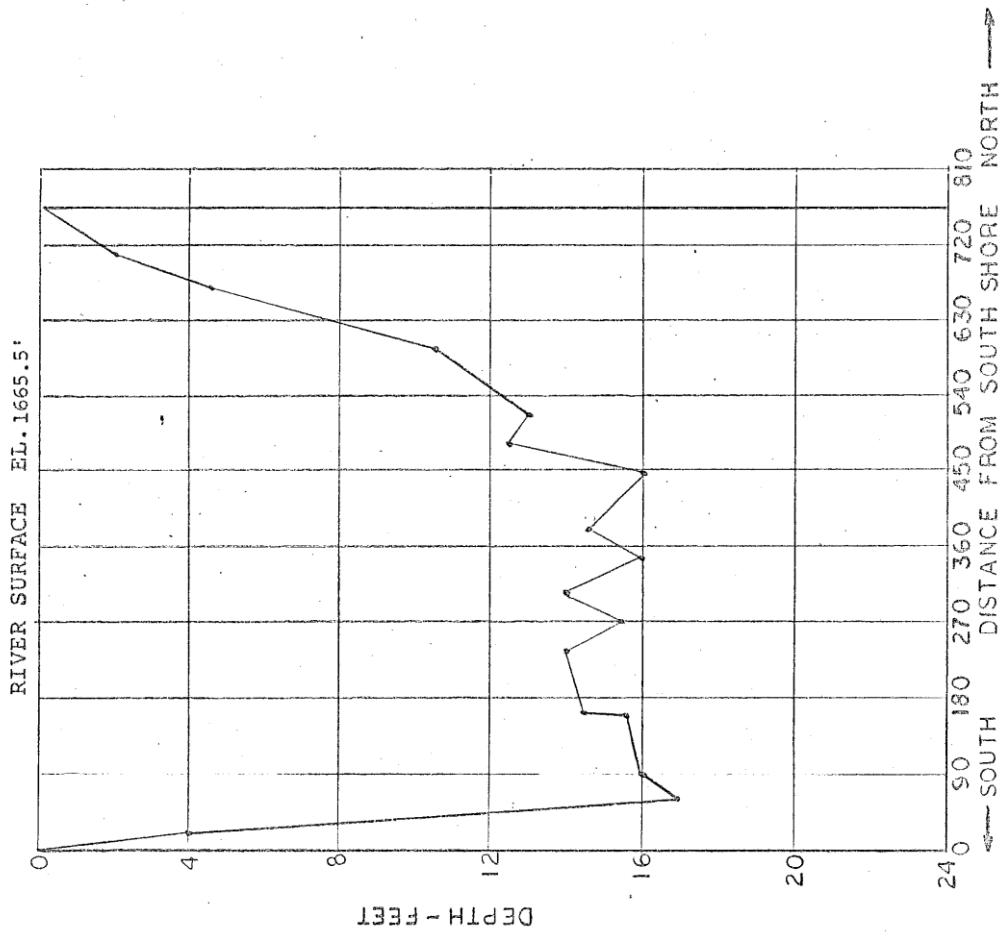
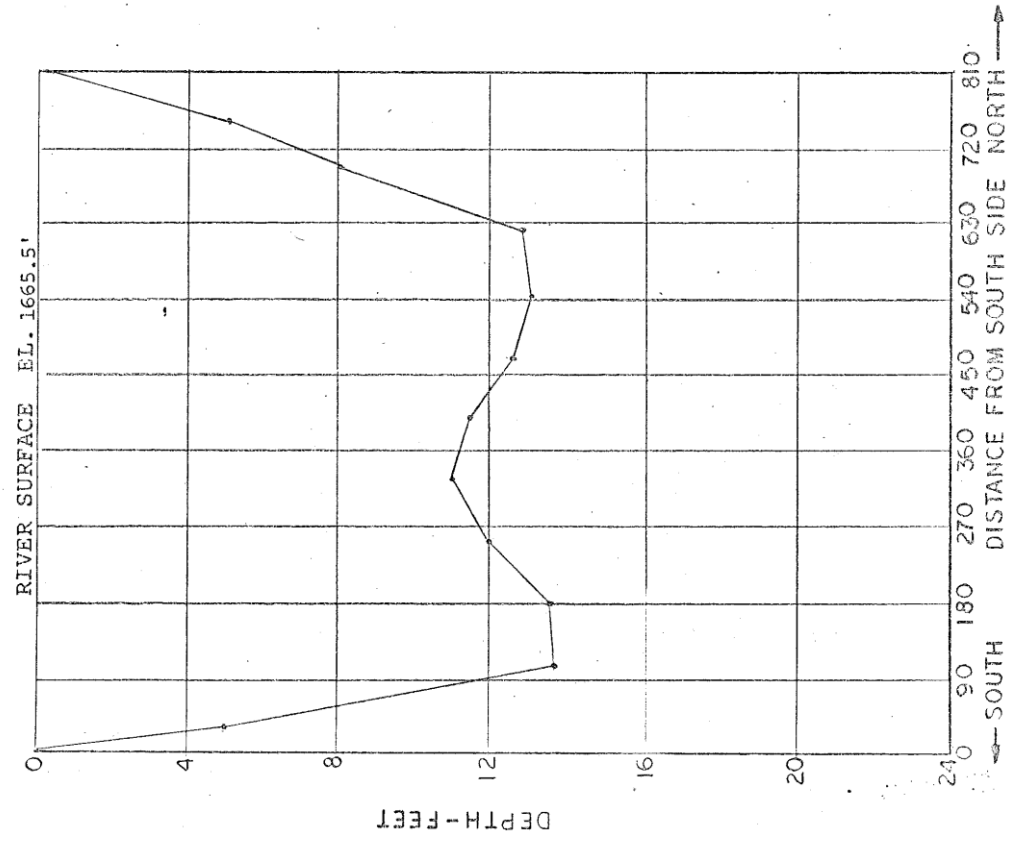
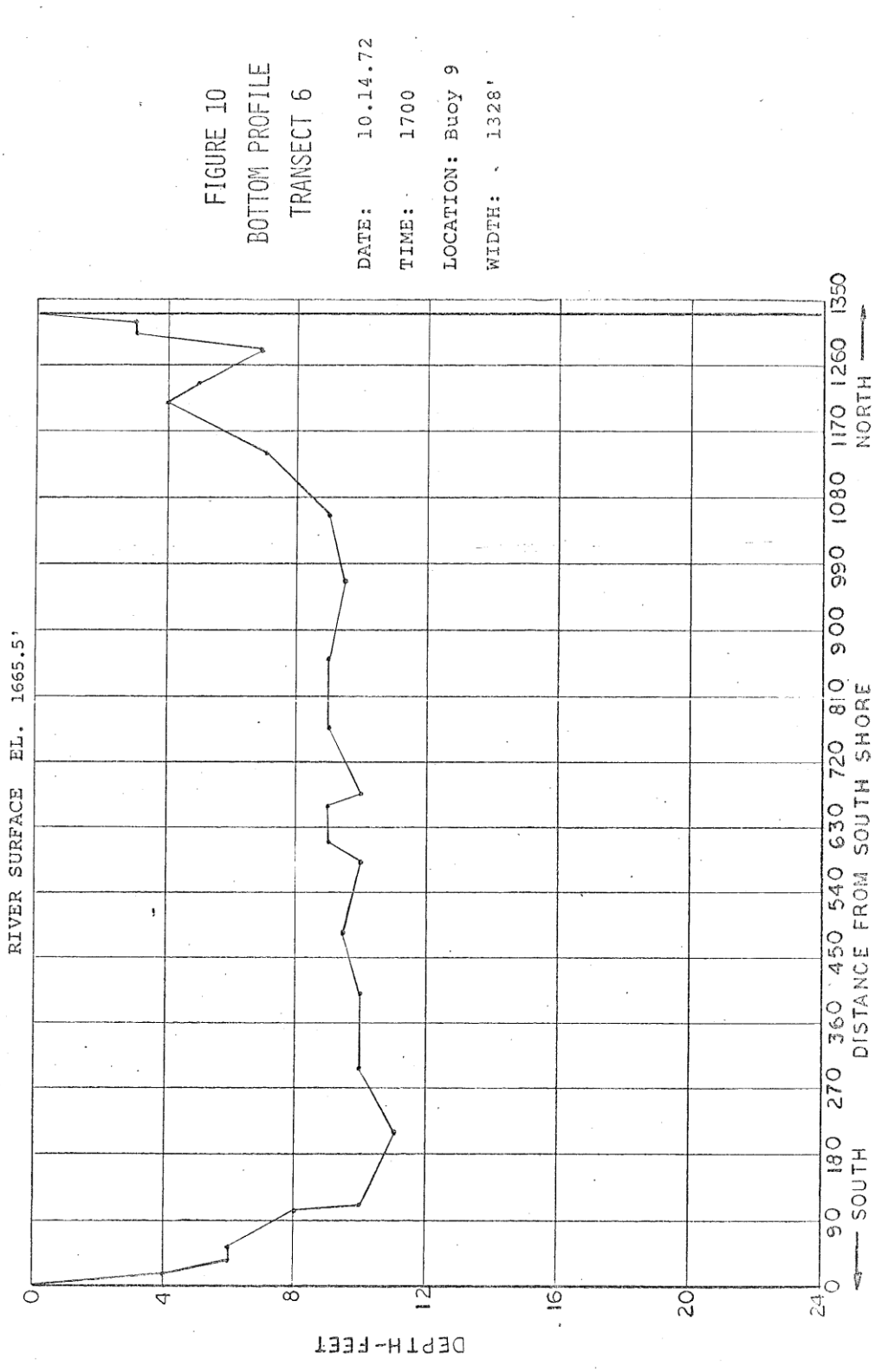
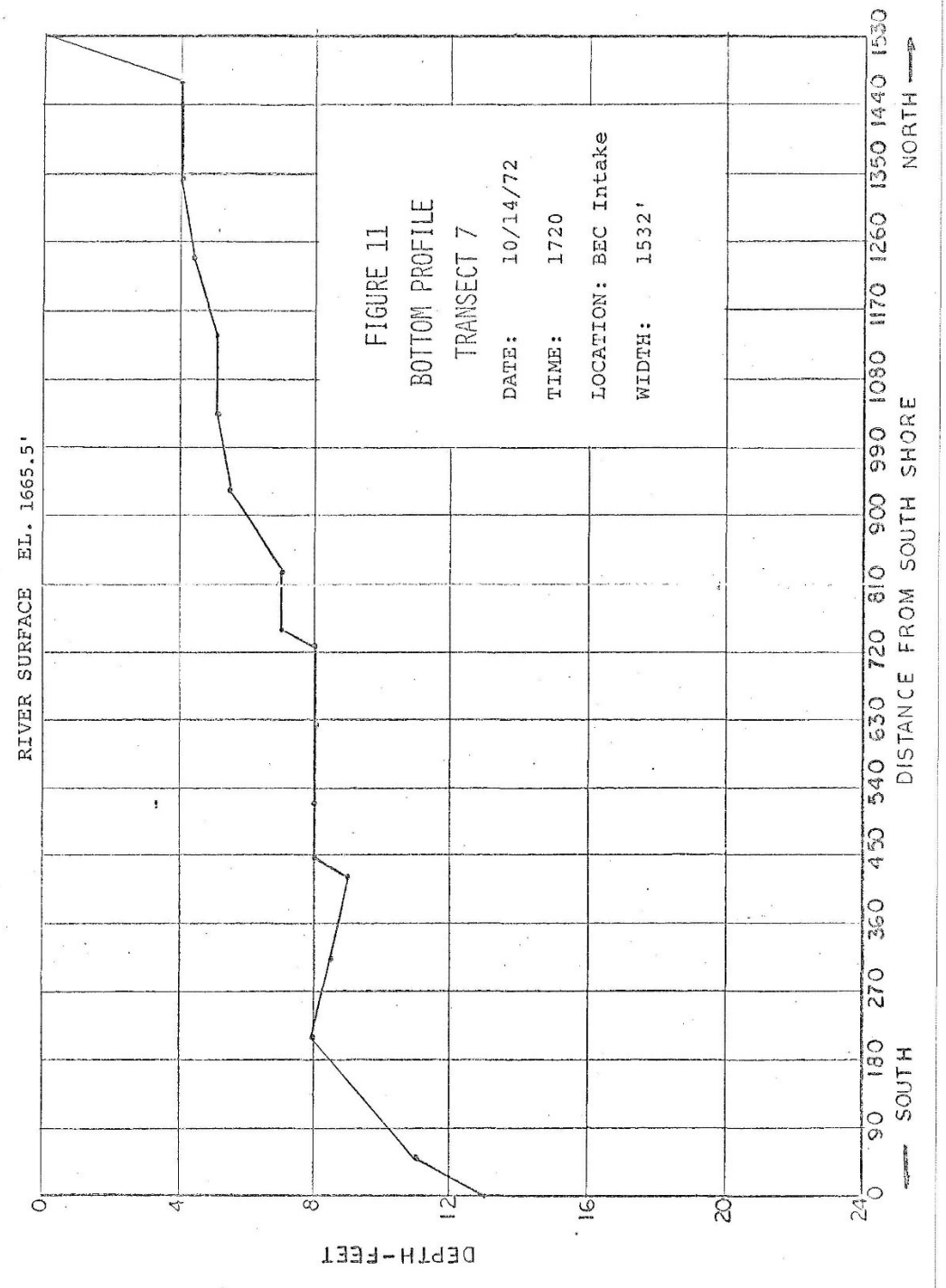


FIGURE 9
BOTTOM PROFILE
TRANSECT 5

DATE: 10/14/72
TIME: 1650
LOCATION: Buoy 6
WIDTH: 812'




FIGURE 10
BOTTOM PROFILE
TRANSECT 6
DATE: 10.14.72
TIME: 1700
LOCATION: Buoy 9
WIDTH: 1328'
RIVER SURFACE EL. 1665.5'
DEPTH-FEET
0
4
8
12
16
20
24
0 90 180 270 360 450 540 630 720 810 900 990 1080 1170 1260 1350
SOUTH
DISTANCE FROM SOUTH SHORE
NORTH


FIGURE 11
BOTTOM PROFILE
TRANSECT 7
DATE: 10/14/72
TIME: 1720
LOCATION: BEC Intake
WIDTH: 1532'
RIVER SURFACE EL. 1665.5'
DEPTH-FEET
0
4
8
12
16
20
24
0 90 180 270 360 450 540 630 720 810 900 990 1080 1170 1260 1350 1440 1530
SOUTH
DISTANCE FROM SOUTH SHORE
NORTH

surface elevation was 1665.5 feet above mean sea level during all transects except transect 2 (Figure 6) for which the elevation was 1663.0'. The river increases in width downstream of UPA, expanding from 800 feet at the UPA discharge to approximately 1500 feet at the BEC intake. The average depth decreases from 14 feet to 7 feet as the width increases, thus the cross-sectional area remains fairly constant. Cross-sectional area at the UPA intake is approximately 8700 ft^2 at a surface elevation of 1665.5'.

Isothermal maps for the five surface temperature runs are presented in Figures 12 to 16. The isotherms were drawn through the points of maximum extent of each temperature rise. Some temperature rises less than the isotherm value may be present inside the particular isotherm boundary, hence the labeled isotherm represents the maximum extent of that particular temperature rise. Plant operating conditions, river ambient temperature and estimated Missouri River flows are shown in Table 1. Methods for estimating river flows and the difficulties encountered in the estimation are described below.

The wide variation of flow measured at Garrison Dam during the survey period, as shown in Figure 17, made the determination of flow at UPA difficult. For this reason, the flow ranges shown in Table 1 are estimates based on three methods of determining flow. The three methods were:

- Assumption of a constant delay time between Garrison Dam and UPA
- Gage measurement at Fort Clark, and
- A mathematical model of the flow behavior.

Table 2 shows the predictions of the three methods for the time periods during which temperature measurements were conducted.

FIGURE 12

UNITED POWER ASSOCIATION

STANTON STEAM STATION

QUIRK, LAWLER & MATUSKY ENGINEERS

RUN	B
TIME	1200-1420
DATE	10/12/72
AMBIENT TEMP	52.5°F
FLOW RANGE	20,000 - 30,000 cfs

SCALE: 1"= 310'

LEGEND

—0— ISOTHERM

——— SHORE LINE

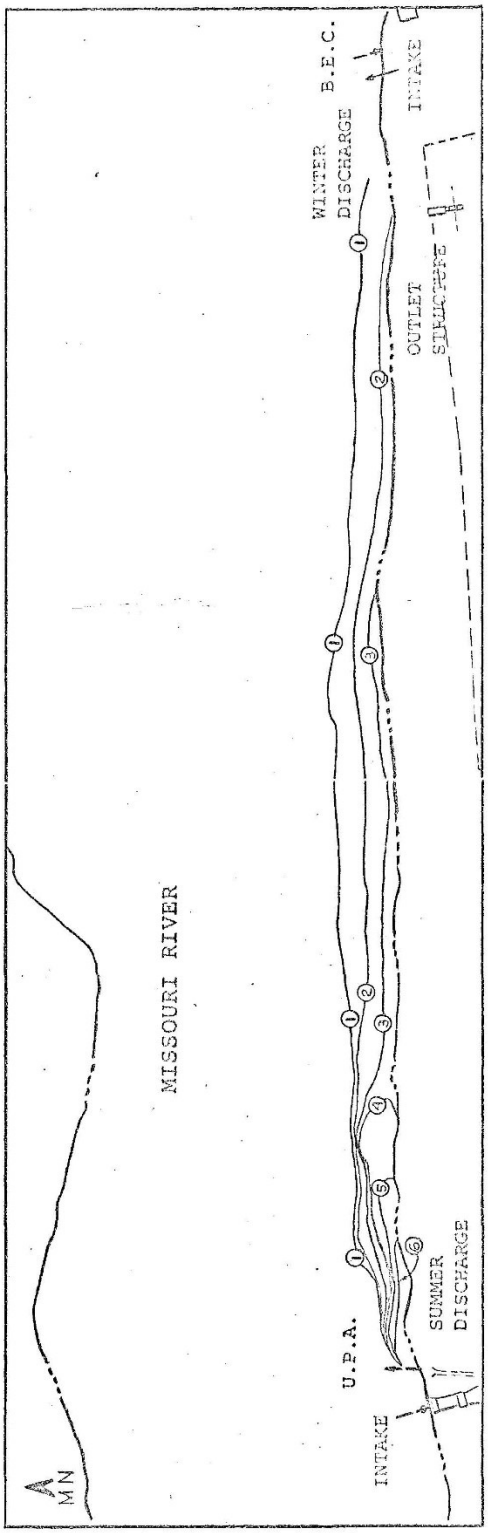


FIGURE 13

UNITED POWER ASSOCIATION
STANTON STEAM STATION
ISOTHERMAL MAP

QUIRK, LAWLER & MATUSKY ENGINEERS

SCALE: 1" = 310'

LEGEND

—○— ISOTHERM
——— SHORE LINE

RUN	A
TIME	0915-1100
DATE	10/13/72
AMBIENT TEMP	52.5°F
FLOW RANGE	13400 - 14700 cfs

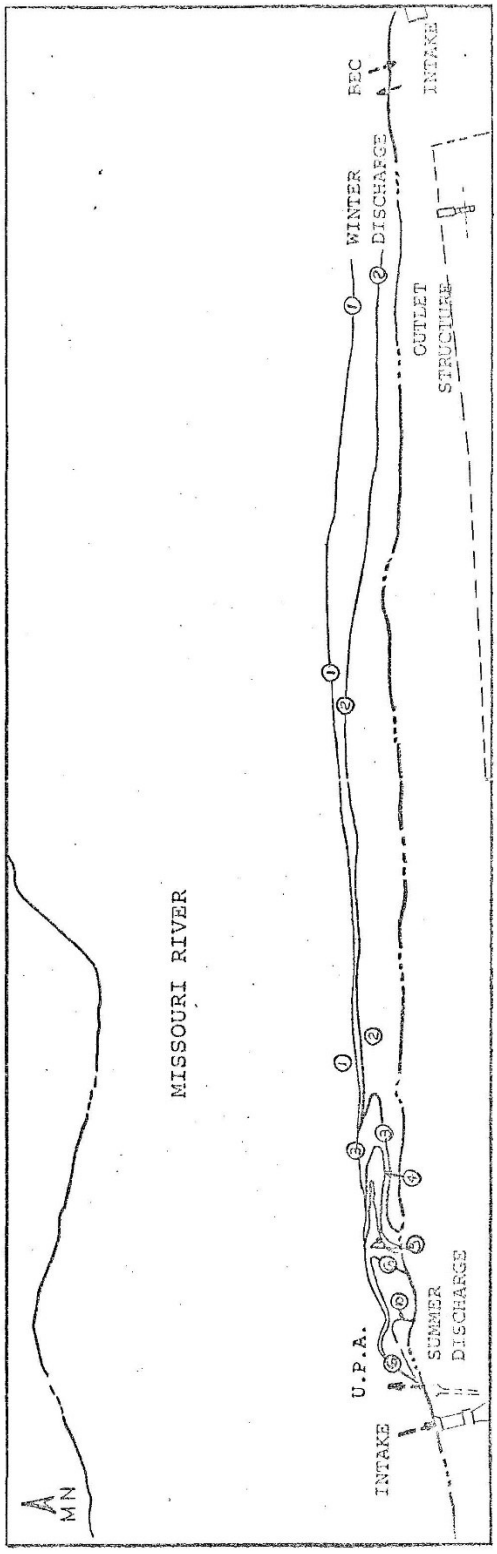


FIGURE 14

UNITED POWER ASSOCIATION
STANTON STEAM STATION
ISOTHERMAL MAP

QUIRK, LAWLER & MATUSKY ENGINEERS

SCALE: 1" = 310'

LEGEND

—○— ISOTHERM
---- SHORE LINE

RUN	C
TIME	1345-1500
DATE	10/13/72
AMBIENT TEMP	53.3°F
FLOW RANGE	13400 - 18200 cfs

FIGURE 15

UNITED POWER ASSOCIATION
STANTON STEAM STATION
ISOTHERMAL MAP

QUIRK, LAWLER & MATUSKY ENGINEERS

SCALE: 1" = 310'

LEGEND

—○— ISOTHERM
——— SHORE LINE

RUN	D
TIME	1500-1630
DATE	10/14/72
AMBIENT TEMP	52.5°F
FLOW RANGE	25600 - 31000 cfs

FIGURE 16

UNITED POWER ASSOCIATION
STANTON STEAM STATION

QUIRK, LAWLER & MATUSKY ENGINEERS

RUN	E
TIME	1730-1820
DATE	10/14/72
AMBIENT TEMP	53.5°F
FLOW RANGE	30600 - 31400 cfs

SCALE: 1" = 310'

LEGEND

ISOTHERM
SHORE LINE

TABLE 1

MISSOURI RIVER AND UPA PLANT OPERATING CONDITIONS

DATE	RUN	TIME	ESTIMATED MISSOURI RIVER FLOW, 1000 cfs	MISSOURI RIVER AMBIENT °F	UPA PLANT LOAD MW
October 12	B	1200	20-30	52.5-53.5	156
October 13	A	1000	13.4-14.7	52.5	156
October 13	C	1400	13.4-18.2	53.5	155
October 13	D	1600	25.6-31.0	52.5	157
October 14	E	1700	30.6-31.4	53.5	159

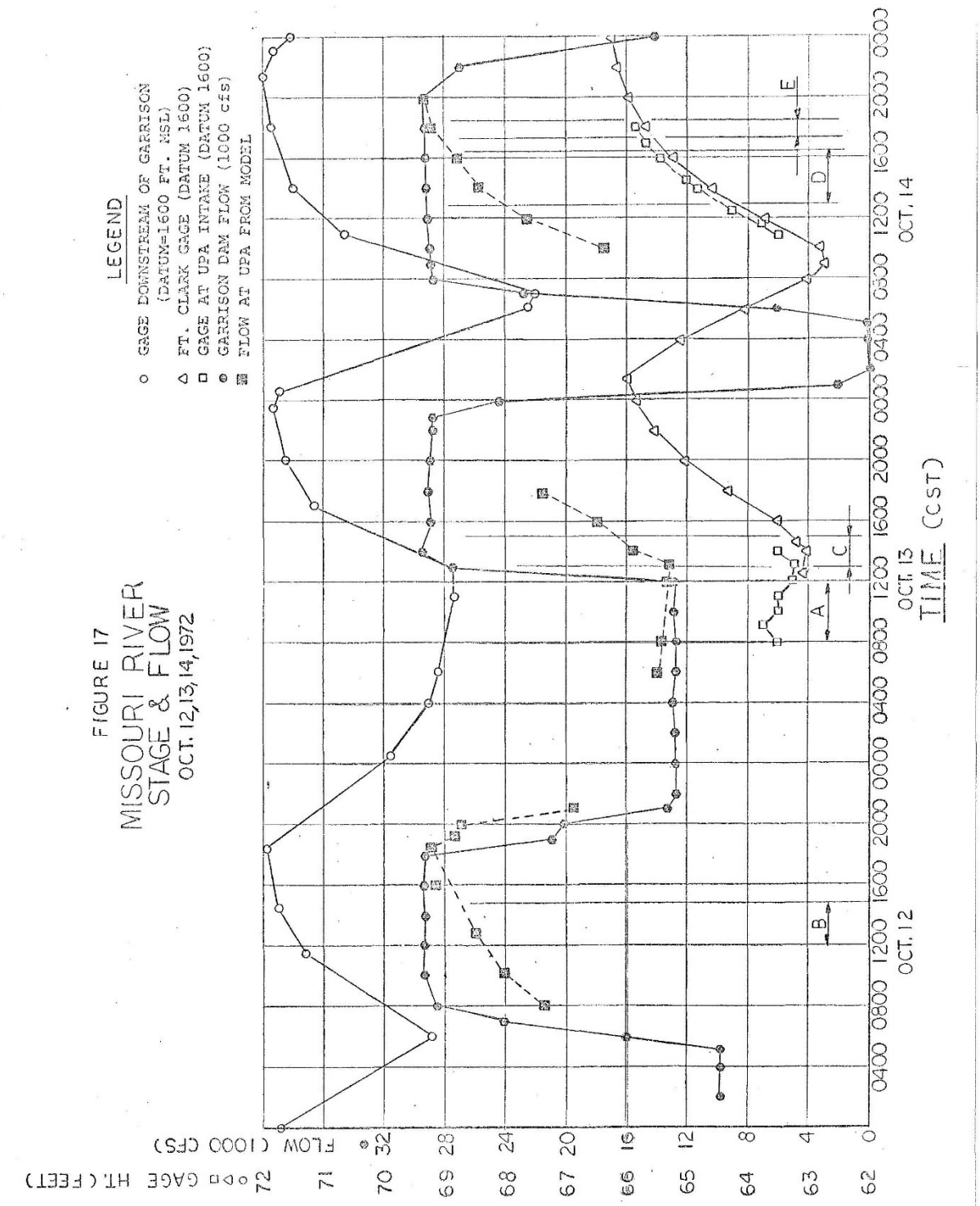

LEGEND
GAGE DOWNSTREAM OF GARRISON (DATUM=1600 FT. MSL)
FT. CLARK GAGE (DATUM 1600)
GAGE AT UPA INTAKE (DATUM 1600)
GARRISON DAM FLOW (1000 cfs)
FLOW AT UPA FROM MODEL
FIGURE 17
MISSOURI RIVER
STAGE & FLOW
OCT. 12, 13, 14, 1972
GAGE HT. (FEET)
FLOW (1000 CFS)
TIME (CST)
OCT. 12
OCT. 13
OCT. 14
A
B
C
D
E

TABLE 2

MISSOURI RIVER FLOW ESTIMATES

RUN	DATE	TIME	Flow Estimates, 1000 cfs: 5.7 HR. DELAY FROM GARRISON + 7%*	FT. CLARK GAGE READINGS	MATH MODEL + 7%*	CURRENT BEST ESTIMATE
B	October 12	1200	19.8	--	27.0	20-30
		1420	31.0	--	29.5	
A	October 13	0915	13.6	14.7	14.5	13.4-14.7
		1100	13.6	13.4	14.0	
C	October 13	1345	13.6	13.4	16.5	13.4-18.2
		1500	13.6	13.4	18.2	
D	October 14	1500	26.8	16.3	25.6	25.6-31.0
		1630	31.0	24.8	29.5	
E	October 14	1730	30.6	25.8	30.6	30.6-31.4
		1830	31.4	27.0	31.2	

*The USGS has found that flows measured downstream of Garrison Dam are 7 per cent greater than the reported values at the dam.**

**"Water Resources Data for North Dakota, Part 1: Surface Water Records", United States Department of the Interior, 1970.

The selection of the flow ranges shown in Table 1 from the values determined by each of the three methods in Table 2 was based on an evaluation of the accuracy of each method under the flow conditions for each run.

The delay time of 5.7 hours between Garrison Dam and UPA (17.8 miles) was arrived at by proportioning the delay time between Garrison Dam and Bismark (given by the USGS as 24 hours for 75.4 miles) by the ratio of the distances between the sites.

The Fort Clark gage, 0.4 miles upstream of UPA, was not functioning during the first run (Run B) or second run (Run A). Stage readings were taken at the UPA intake structure during Run A, but no gage readings are available for Run B. Figure 18 shows the relationship between the Fort Clark gage height and river flow at the gage as determined by USGS, for steady state conditions.

The mathematical model utilized to estimate Missouri River flows is a one-dimensional continuity equation for total mass in a fluid. The model relates the water surface height above an arbitrary datum and the river volumetric flow rate to time and distance variations. Model predictions at times other than those at which runs were conducted are not shown because the model is not accurate during periods of extreme flow variation.

In estimating flow ranges for Runs D and E, the model and the 5.7 hour delay method were considered more accurate, due to the possibility of a lag in stage following a rising flow period.

This would seem reasonable at UPA since it was observed that the stage height at UPA never leveled out at the higher flow. This would indicate a non-steady state during which the stage-flow relationship of Figure 18 would not be applicable.

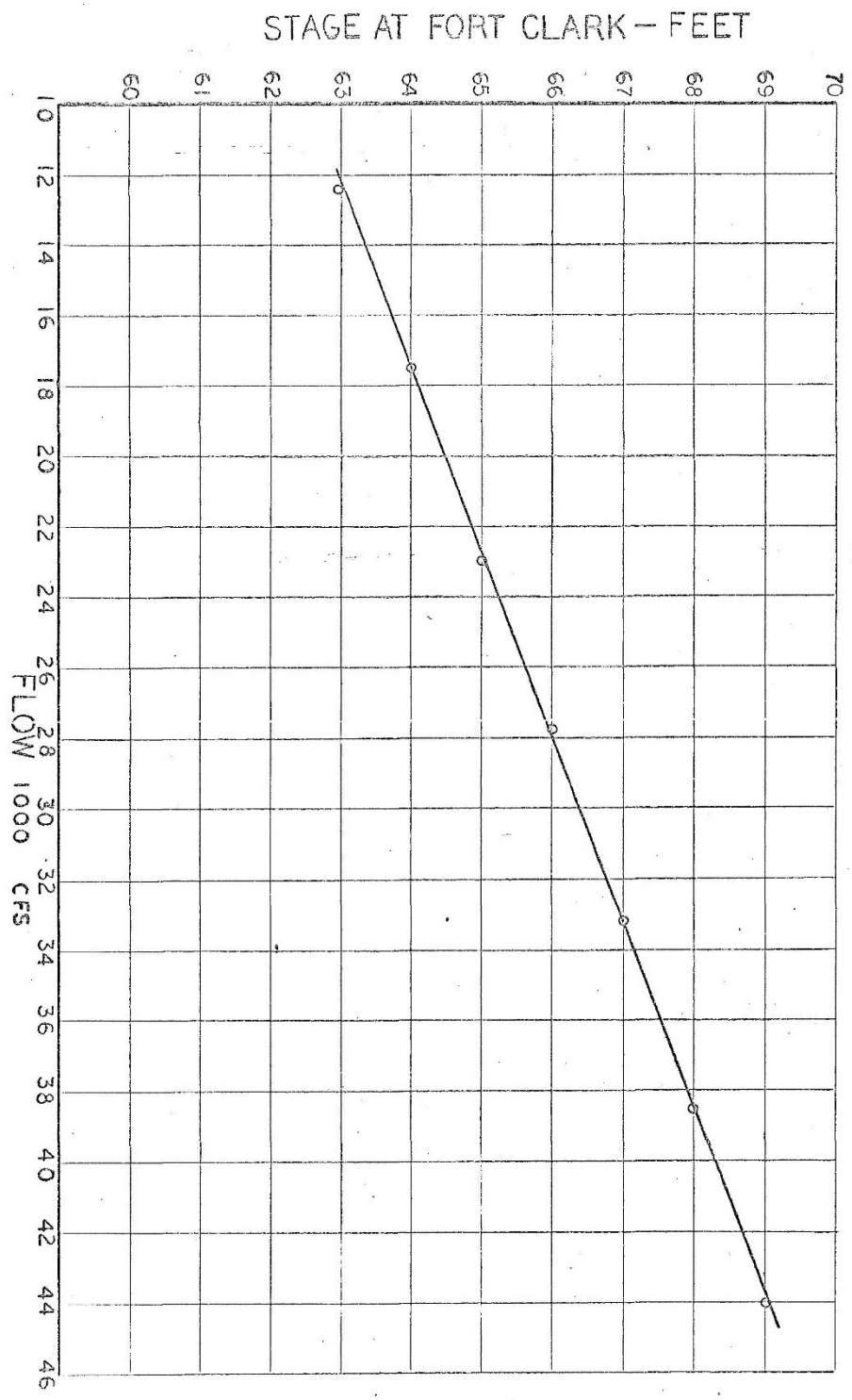


FIGURE 18
FLOW vs STAGE
FORT CLARK GAGE
DATUM 1600' AMSL

LEGEND
o USGS DATA

III. ANALYSIS AND DISCUSSION OF FIELD TEMPERATURE SURVEY RESULTS

UPA Cooling Water Discharge

The isotherm configurations shown in Figures 12 to 16 under the different flow conditions show the tendency of the isotherms to become elongated and confined close to shore under high flow conditions (Figures 15 and 16). The plots of the lower flow runs (Runs A and C, Figures 13 and 14) show the higher isotherms to be more compacted near the discharge, while the 1° and 2° isotherms enclose a greater area than high flow conditions. This behavior is caused by a decline in mixing of the discharge and ambient river flows as the river flow increases.

At a flow of 14,000 cfs (low flow Runs A and C), the discharge and river velocities are 2.1 feet per second and 2.02 feet per second, respectively, while at the higher flow of approximately 30,000 cfs (Runs D and E) the discharge and river velocities are 1.6 feet per second and 3.5 feet per second, respectively. Thus, at a low flow, the discharge and river velocities are essentially equal, while at the higher flow, the river velocity is more than twice the discharge velocity.

The calculation of the discharge velocity assumes that the flow is distributed horizontally over the entire face of the discharge structure and extends vertically from the bottom of the discharge structure to the water surface at the flow being analyzed. Therefore, as the flow rises, the cross-sectional area of the discharge increases, with the result being lower discharge velocities at higher flows. The river velocities are cross-sectional averages based on the water surface elevations at the times of the runs.

The actual river velocity at the point of discharge may be higher than calculated, due to the bend in the river just upstream of the plant, causing an uneven distribution of flow over the cross-section at the discharge. The higher flow and corresponding higher velocities in the southern portion of the river cross-section can be seen in the geometry of the cross-sections in the plant area (Figures 5, 6, 7 and 8). The higher flow has created a deep channel on the south side of the river. It would seem probable that this effect on flow distribution would be greater at higher flows than at lower flows, which would have the effect of further increasing the difference between the discharge and river velocities.

Thus, under high flows and correspondingly higher river velocities, there is a decline in the mixing of the discharge and river water due to the low discharge velocity relative to the river velocity. At the lower flows, the discharge and river velocities are approximately equal, which allows some mixing of the discharge and river flows.

Measurements of temperature with depth showed little or no stratification in the plume. Thus, the surface isotherms can be considered as extending to the river bottom. This lack of stratification is most likely due to the low mixing tendency of the discharge and the confinement of the discharge waters to the immediate vicinity of the shoreline.

The Effect of the Knife River

The effect of the Knife River on the temperature distribution in the Missouri River during the survey was found to be small, although the Knife River was $10^{\circ}F$ colder than the Missouri at the time. (The temperature and flow of the

Knife River on October 16, 1972 at Hazen was recorded as 43.5°F and 69.5 cfs by the USGS) .

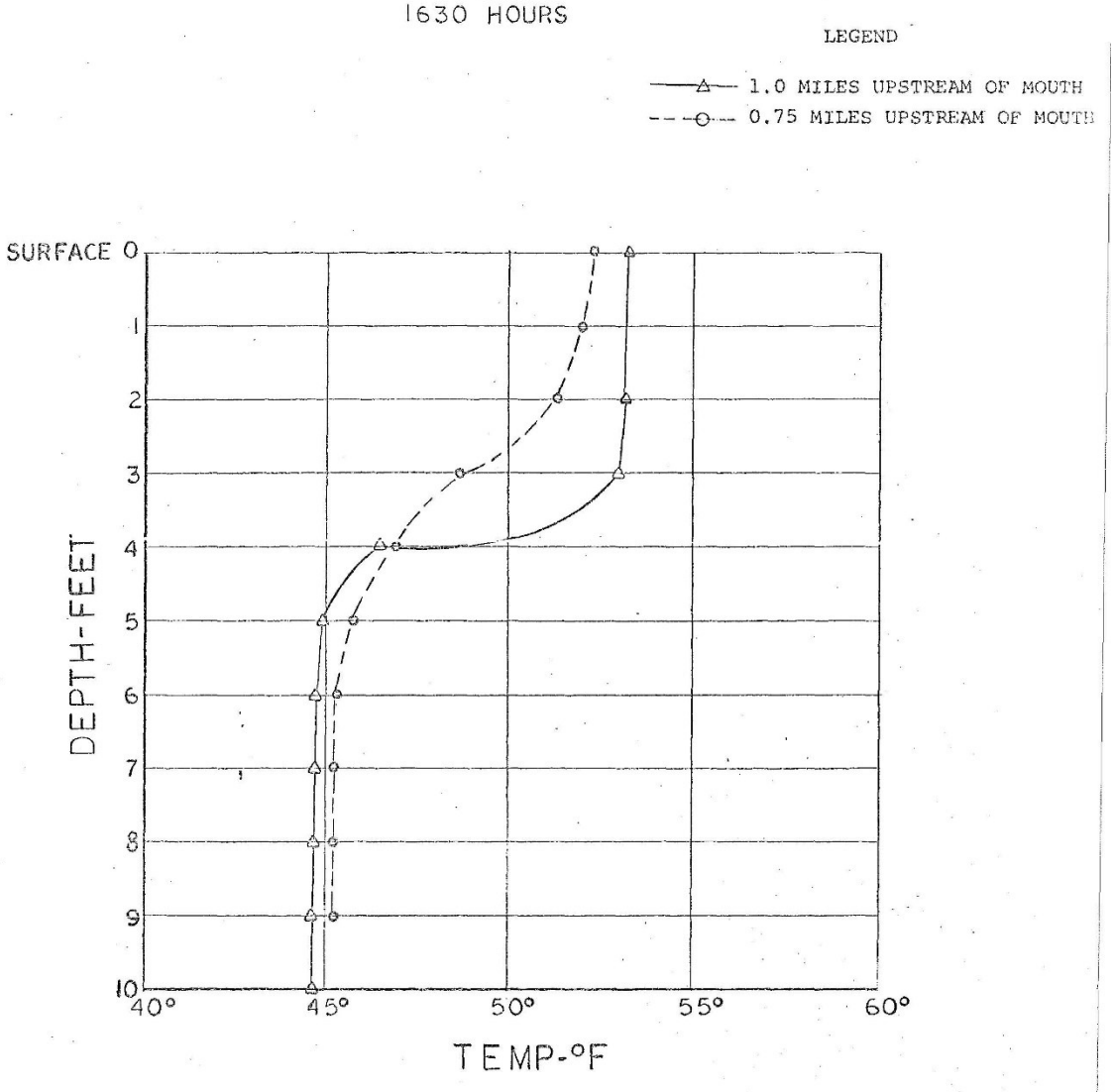
On October 12, 1972, temperature cross-sections were conducted in the Knife River at Sakakawea, approximately one (1) mile upstream of the confluence of the Knife and Missouri. Figure 19 shows the variation of temperature with depth at the above location. The stratification of the Knife is due to intrusion of warmer Missouri River water which stays above the colder Knife River water.

During the winter months (October-February), the Knife River would not be expected to have any effect on Missouri River temperatures due to the low flows in the Knife (less than 100 cfs) in comparison to the Missouri flows (greater than 25,000 cfs) and the approximately equal temperatures of the two flows during these months.

During the survey period, the Knife River may have influenced the Missouri River at UPA in the form of an observed 0.5°F cooler section of water along the northern and southern sides of the Missouri. The UPA intake water was 0.5°F cooler than the mid-river Missouri River temperature at the lower flows. This condition may, however, be due to natural cooling of the Missouri due to ambient air temperatures which were colder than the ambient river temperatures at the time of the survey.

The maximum effect of the Knife on the Missouri would be expected during high spring runoff, and during the summer, when the Knife will be warmer than the Missouri, due to the low layer releases to the Missouri from Garrison Dam. The effect of high spring runoff (March and April) would not be expected to be significant due to the short period of such runoff, and the low temperatures in the Missouri during this period (less than 40°F).

FIGURE 19
KNIFE RIVER
AT
SAKAKAWEA PARK
TEMP. STRATIFICATION
OCT. 12, 1972
1630 HOURS



In a USGS report* the thermal plume from the Knife River is shown as affecting the UPA intake temperature during summer conditions.

Figure 20 is a plot of the infrared imagery shown in the USGS report and obtained during an overflight on July 29, 1969. The flow in the Missouri was between 25,000 and 35,000 cfs at the time of the flight. It can be seen that the Knife plume may influence the UPA intake by as much as 3.7°F on the surface. The flow in the Knife at the time of the flight was 500 cfs, a considerably higher flow than at the time of the QL&M survey. Since this flow is much higher than the 222 cfs that UPA withdraws, some of the plume from the Knife must continue past the intake and shows up as part of the UPA plume. Thus, there is a compound effect of the Knife plume. By increasing the UPA intake temperature above the river ambient temperature, the Knife plume increases the UPA discharge temperature which would cause the UPA plume to appear larger. Also, the portion of the Knife plume flowing past the UPA plant will appear to be part of the UPA plume. If this combined effect is considered in examining Figure 20, the isotherm configuration shown corresponds well with the configurations shown in Figures 12 through 16, which are representative of the plume behavior without any influence of the Knife.

During each of the thermal mapping runs, temperature measurements were also conducted at the BEC intake structure. Both surface temperature and temperature variation with depth were measured. Temperatures in the BEC intake area were consistently 2°F to 3°F above river ambient on the surface, and 1°-2°F above ambient below the surface.

*"Thermal Study of the Missouri River in North Dakota Using Infrared Imagery", Orlo A. Crosby, USGS, Bismark, North Dakota, 1971.

FIGURE 20

UNITED POWER ASSOCIATION
STANTON STEAM STATION

QUIRK, LAWLER & MATUSKY, ENGINEERS

RUN USGS INFRARED IMAGERY
DATE 7/23/69
AMBIENT TEMP 52.0°F
FLOW RANGE 25,000-35,000 cfs

SCALE: 1" = 435'

LEGEND

ISOTHERM
SHORE LINE
ISOTHERM

During the survey period, temperatures of 78.7°F were measured at the BEC winter discharge, just upstream of the BEC intake. The BEC winter discharge was operational at the time, but no flow data was available. For all of the five temperature runs conducted, the 2°F surface isotherm from the UPA discharge does not extent to the BEC intake. Thus, the maximum effect that the UPA discharge could have on the BEC intake under the flow conditions analyzed is less than 2°F. Figure 21 shows a typical stratification configuration observed at the BEC intake. The additional heat shown by temperaturemeasurements at the BEC intake must be attributed to recirculation of BEC cooling water being discharged from the winter discharge.

Table 3 summarizes the results of the temperature survey and compares these results with guidelines suggested by the EPA for allowable mixing zones for the UPA cooling water discharge.

An examination of the longitudinal extent of the 4°F isotherm at the different flows shows the plume to exceed the longitudinal guideline at the high flow conditions. Figure 22 shows the extent of the 4°F isotherm as a function of flows observed during the survey period.

It should be noted, however, that although the survey results indicate that the UPA cooling water discharge does exceed the suggested guideline for the longitudinal extent of the 4°F isotherm, the degree to which these guidelines are exceeded is negligible. For example, the maximum increase above the suggested guideline of 1000 feet is 70 feet. This increase is only 7% of the suggested guideline.

FIGURE 21
TEMPERATURE PROFILE
AT
B.E.C. INTAKE
OCT. 13, 1972
1100 HOURS
AMBIENT 53°F

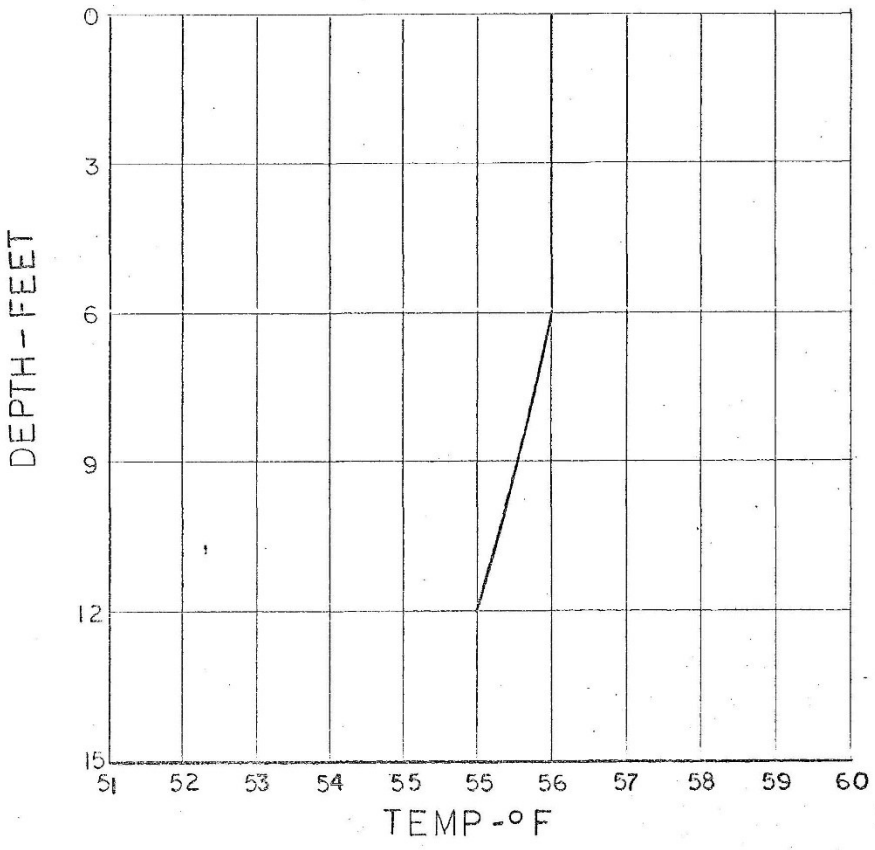


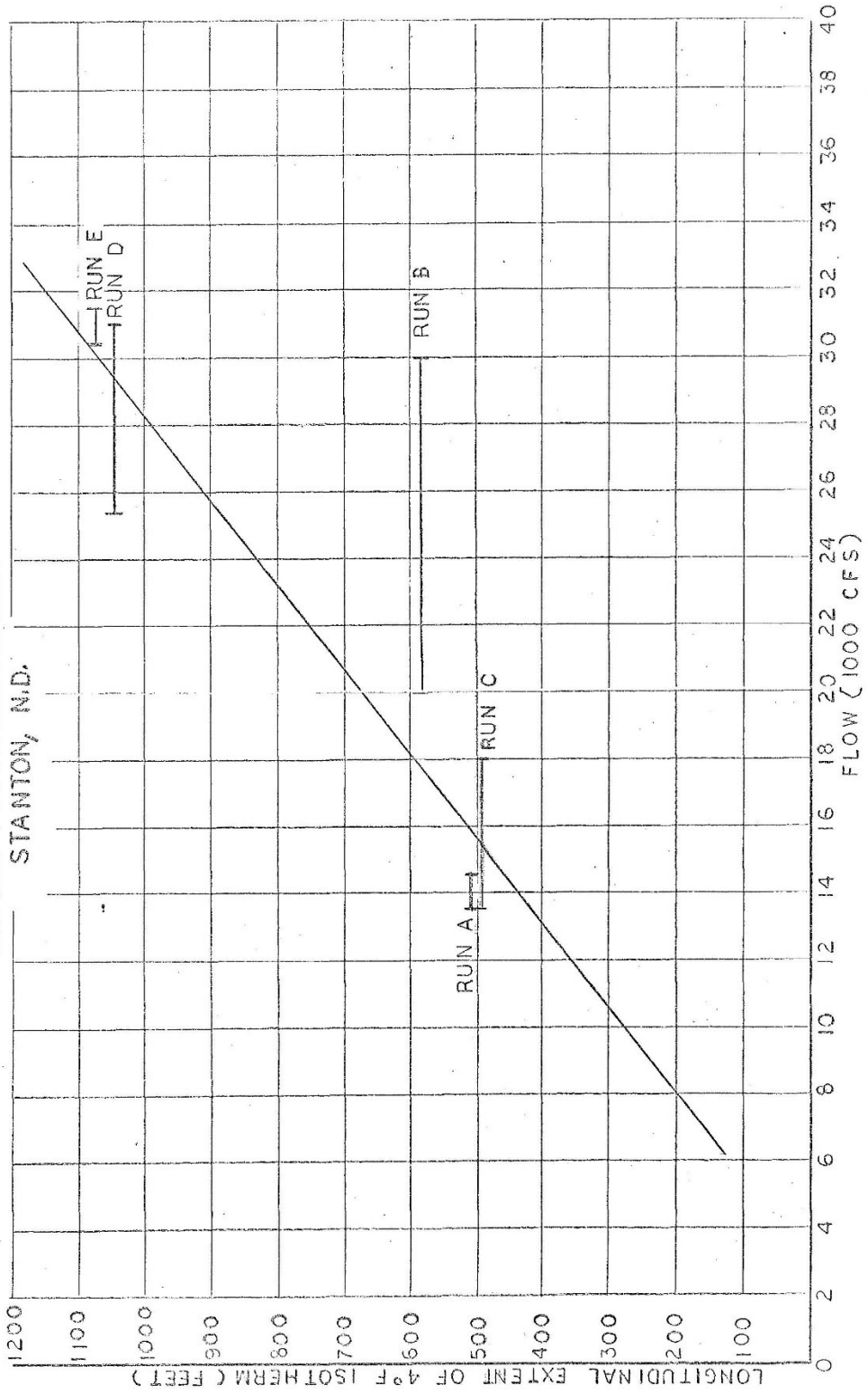
TABLE S-1

TEMPERATURE SURVEY RESULTS - COMPARISON WITH EPA SUGGESTED ALLOWABLE MIXING ZONE GUIDELINES

Run	Missouri River Flow 1000 cfs	Extent of $4^{o}F$ Isotherm					
		Cross-Sectional Area	%	Longitudinal ft.	%	Width Ft.	%
EPA Suggested Guidelines for Mixing Zone	--	<10		<1000	<125	<200	<25
A	13.4-14.7	5.8		510	64	60	7.5
B	20-30	4.9		580	73	50	6.3
C	13.4-18.2	7.7		490	62	70	8.8
D	25.6-31.0	3.1		1040	130	45	5.6
E	30.6-31.4	2.3		1070	134	40	5.0

FIGURE 22

LONGITUDINAL EXTENT OF 4°F ISOTHERM
VS
FLOW
UNITED POWER ASSOCIATION
STANTON, N.D.



It is evident from these data that the UPA cooling water discharge is well within the width guidelines for all flow conditions observed. The 4°F isotherm never exceeded 8.8% of the river's width. It is also evident that as the flow increases, the cross-sectional area enclosed by the 4°F isotherm decreases. This indicates that at flows higher than those studied (above 30,000 cfs) the plume would remain well within the width and cross-sectional area guidelines.