50-358 DMB/50.55(e)

THE CINCINNATI GAS & ELECTRIC COMPANY

CINCINNATI, OHIO 45201

August 28, 1981
QA-9470

RECEIVED SEP 14 1981 U.S. NUCLEAR REGULATORY COMMISSION

E. A. BORGMANN
SENIOR VICE PRESIDENT

U. S. Nuclear Regulatory Commission
Region III
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Attention: Mr. J. G. Keppler
Director

RE: WM. H. ZIMMER NUCLEAR POWER STATION
UNIT 1 - SERVICE WATER INTAKE FLUME
50.55(e) FILE M-12, W.O. #57300-957,
JOB E-5590

Gentlemen:

On July 23, 1979, we submitted our letter QA-1168, canceling a 10CFR50.55(e) condition, M-12. This situation involved river silt deposited in the intake flume of our Service Water Pump Structure.

As requested by Mr. Paul Barrett of the NRC in his July 1, 1981, telephone conversation with Mr. Harlan Sager of the Cincinnati Gas & Electric Company, Quality Assurance Dept., a copy of Cincinnati Gas & Electric Company plans for silt monitoring and removal as outlined in Appendix J of our FSAR are attached.

We trust that the above will be found acceptable as a final report under the requirements of 10CFR50.55(e).

Very truly yours,

THE CINCINNATI GAS & ELECTRIC COMPANY

By E. A. Borgmann

E. A. BORGMANN
SENIOR VICE-PRESIDENT

EAB/FKP/ejc

Attachment

IE27 S/1

cc: NRC Resident Inspector
Attn: F. T. Daniels
NRC Director, Office of Inspection & Enforcement
Washington, D.C. 20555

SEP 9 1981

J.8 SILT SITUATION

J.8.1 Source of Siltation

The sediment in the flume is the result of runoff in the Ohio River drainage basin. The Ohio River drainage basin consists of parts of Ohio, Pennsylvania, New York, West Virginia, Maryland, Virginia, North Carolina, and Kentucky. As previously discussed, a significant buildup of silt occurred in the intake flume and pump bay during plant construction. During this period, water velocities in the flume were lower than normal because only 1/2 to 1/3 normal plant service water flow was being pumped through the system.

The Ohio River carries heavy loads of suspended sediment during floods. The suspended sediment consists of clay, silt, and fine sand. The material requires a long detention time for the sediment to deposit; therefore, a major part of the suspended sediment should not deposit in the flume during normal operation of the plant but will be carried through the pumps back into the river or the cooling tower basin. Some of the larger diameter particles of sediment will settle in the flume and service water pump bay. The intake and service water pump structure (SWPS) will require monitoring and periodic dredging. This is normally considered a part of maintenance and operations of a power plant. 69

The Wm. H. Zimmer Nuclear Power Station is located on the right bank of the Ohio River, 0.3 mile downstream from Moscow, Ohio, at river mile 443. The Captain Anthony Meldalh Dam is 7 miles upstream from Zimmer. Zimmer is in the Markland Dam pool and the dam is 88 miles downstream from Zimmer.

The service water pump structure consists of a concrete caisson sitting on rock. The intake flume is a steel sheetpile structure with the piles driven to rock. The intake flume is approximately 150 feet long and 30 feet wide and is angled downriver at 45° to prevent barge impact. The flume has three levels of braces at elevations 458 ft 11½ in., 473 ft 5½ in., and 506 ft 5 in. The top of the sheetpile walls is at elevation 510 ft 0 in. The flume has a concrete slab at the bottom at elevation 437 ft 0 in. A floating trash boom will be located at the entrance of the flume to prevent large floating objects from entering the flume. A bar grill is located at the entrance to the SWPS to prevent smaller objects from entering the pump bay (see Figure J.2-1).

The normal pool elevation of the Ohio River is 455 ft 0 in. The 1937 modified flood of record is elevation 508 ft 6 in. The design maximum probable flood is at elevation 546 ft 0 in. (see Figure J.8-1).

The service water pump structure has four service water pumps, two on each side, located at elevation 435 ft 0 in. The two cooling tower makeup pumps are also located at this elevation. There are four traveling screens in this area.

The intake flume was constructed in 1976. A temporary sheetpile cut-off wall was installed at the entrance to the flume and the top of the

cut-off wall is at elevation 463 ft 0 in. The flume was dewatered and the concrete slab at elevation 437 ft 0 in. was placed in mid-September of 1976. This was the beginning of the sediment deposition in the intake flume whenever the river exceeded elevation 463 ft. The concrete plugs that held water out of the service water pump structure were removed on February 16, 1978. This was the beginning of sediment deposition in the service water pump structure pump bay. Two pieces of the sheetpile cutoff wall were lifted up in March 1978 to ensure flow of river water to the flume when the river was below elevation 463 ft. The balance of the sheetpile cutoff wall was removed in September 1979. One service water pump, with a capacity of 12,500 gpm, has been pumping water intermittently from the service water pump structure since March 1978.

The siltation was discovered in April 1979 as part of a pump field test investigation. The depth of the sediment was approximately 12 feet at the mid-point of the flume. The sediment tapered to an approximate 5-foot depth at the service water pump structure and at the river end of the flume. The coarser material and fine sand was deposited at the river end of the intake flume. The finer material, with longer detention times, was carried further into the flume and into the service water pump structure. The very fine sedimentation material was pumped through the system and back into the river. This is documented in the Harza Engineering Company Report attached hereto as Attachment J1. 69

The Harza Engineering Company was retained in May 1979 to investigate the siltation and estimate future sedimentation rates. The siltation estimates were based on two river sampling surveys. The survey at low water was conducted in June 1979 and the survey at high water in March 1980. The March 1980 survey consisted of obtaining suspended sediment samples and bed material samples above and below Meldahl Dam and the Zimmer intake flume. No appreciable difference in suspended sediment above or below Meldahl Dam or the Zimmer intake flume was observed.

The final Harza Report for a flume discharge of 31,000 gpm predicts an annual sedimentation rate in the intake flume under average annual flow conditions of 12.8 feet and 16.6 feet under 25-year annual flow conditions. The corresponding sedimentation rates in the service water pump structure would be 6.8 feet and 8.7 feet, respectively. The corresponding maximum monthly sedimentation rates in the intake flume would be 2.2 feet and 2.4 feet, respectively. Twenty-five year annual flow conditions and 40-year annual flow conditions would be 2.2 feet, 2.4 feet, and 3.8 feet, respectively. The corresponding sedimentation rates in the service water pump structure would be 1.2 feet, 1.3 feet, and 2.0 feet. The sedimentation in the intake flume during a 100-year flood would be 4.2 feet and 4.4 feet for a 200-year flood. The corresponding sedimentation rates in the service water pump structure for the 100-year flood and 200-year flood would be 2.2 feet and 2.3 feet, respectively. Approximately 75% of the annual sedimentation will be deposited in the December-May time frame. The largest sedimentation buildup would be expected in the month of March.

J.8.2 Silt Prevention

After consideration of the quantity of silt expected to accumulate annually, a permanent continuous monitoring system was developed. This monitoring system makes use of five ultrasonic transducers located in strategic locations in the intake flume and pump bay (see Figures J.8-2 and J.8-3). Similar devices are now in use throughout the plant to measure sludge levels in tanks. Although there are five transducers, only four indicators will be used. Due to the difficulty in reaching the transducers in the pump bay, redundant transducers will be installed for maintenance. However, only one indicator will be used at a time. The monitoring panel will be located in the service water pump structure. Alarms will sound in the main control room as well as locally. Installation of this system is proceeding and successful operation will be demonstrated prior to fuel load.

Because traditional silt removal devices could not be used in the pump bay area, a system of spray nozzles was designed. These nozzles (shown in Figures J.8-4 and J.8-5) use the cooling tower makeup pumps for their water source. The objective is to keep the silt in suspension to prevent deposition. It is anticipated this spray piping will be operated periodically as needed to resuspend any sediment that may have settled since the last jetting period. The silt that is resuspended will be pumped through the service water system in the normal flow paths. The pump vendor has been contacted and no severe wear problems are expected due to this higher concentration of silt. This piping will be installed and operating in the fall of 1980 and any adverse effects on the pumps will be discovered prior to fuel load. Any occurrence of deterioration or accelerated wear should be discovered with the vibration monitors to be added to the pumps and by the monthly inservice inspection (performance) checks (vibration, flow, pressure, temperature, and speed). Although this piping is not essential, it is designed to withstand a seismic event without causing damage to an essential component. 69

When this silt accumulation was discovered, there was between 5 and 12 feet of sediment in the intake flume and pump strucutre. Several methods were used to remove the sediment. The initial cleanout of the pump structure was by divers and pumps. This cleanout was accomplished by a diver using a small jetting pump to loosen large accumulations of silt and then using a larger centrifugal pump like a vacuum cleaner to pump the resuspended silt out of the flume. The initial cleanout of the intake flume was accomplished primarily by the use of a clamshell bucket. The silt was put directly into a truck and transported to the settling basin located approximately 1/2 mile north of the plant. The initial silt remaining after the clamshell operation in the intake flume was removed by divers using a method similar to the method used to clean the pump bay.

Subsequent long-term cleanout of the pump bay should not be required. Operation of the spray header piping will not allow the silt to accumulate.

Subsequent cleanout of the intake flume could be accomplished using several different types of devices. The first type is an airlift type device shown pictorially in Figure J.8-6 and schematically in Figure J.8-7.

The device works by sequentially applying vacuum and high pressure air to three separate chambers. As vacuum is applied, the chamber fills with a high density slurry. When the chamber is full, air pressure is applied and the slurry is discharged. This device would be supported by a portable crane and moved to various locations within the flume until the flume was clear. This device has been demonstrated in the flume. Other types of pumping devices are under investigation and will be demonstrated during the next flood season. Each device currently under investigation would use an intermediate pumping station located at the top of the flume walls (see Figure J.8-8) to serve several purposes. The intermediate pumping station would allow mixing of the high density slurry with clean water for dilution, if necessary. It would also serve as a booster station so the slurry could be pumped the 1/2 mile north of the plant to the settling basin (see Figure J.8-9). During construction, the settling basin has served as a borrow pit for fill, as required, and will be used as a settling basin for cooling tower blowdown and demineralizer backwash during plant operation. The settling basin has a volume of approximately 1000 acre-feet. A distance of approximately 1200 feet from input to overflow will allow for approximately 40 days detention time. This basin has already been approved and discharges to the river (if any) will be in accordance with the NPDES permit. It is not anticipated that this basin will have any discharge to the Ohio River for 5 to 7 years and possibly longer if the effects of groundwater seepage and evaporation are included. 69

The intermediate pumping station which is normally located at the top of the intake flume will be moved to higher elevations if the river should approach the 510 ft "Top of Flume" elevation. It will be returned to the top of the flume after the river has receded sufficiently to permit. During such periods when the pump has been removed, intake flume cleanout operations will not occur. 73

A second backup pump will be available and stored so as to be protected from the 546 ft elevation maximum probable flood. This second pump may be used during periods of maintenance on the "normal" pump.

Thus, several methods have already demonstrated their capability to remove silt. The biggest safety factor involved is the time available to remove the silt before it becomes a problem. Figure J.8-10 shows the relative pertinent elevations. Given that the spray nozzles will keep the pump bay, travelling screen, and bar grille areas clear, then all that is needed is to be ensured that the silt will not accumulate such that, a low river elevation would allow the silt to act as a dam. It is anticipated that the silt level at which cleaning operations begin will be below this level. Actual values will be determined from experience and will be included in a technical specification. 69

Normally, with the river in pool, there is 18 feet of water over the flume bottom. During spring run-off, this depth would, of course, be greater. Starting at river pool (elevation 455 feet), if Markland dam would somehow disappear, the water level could theoretically drop to elevation 445 feet leaving 8 feet of water above the flume bottom. If this loss of the dam is concurrent with the all-time historic low flow of the Ohio River, the

water level could theoretically drop to elevation 442 feet leaving 5 feet of water over the flume bottom.

To give some idea of the time required for silt removal, a test was conducted. One diver was able to clear a 6-foot wide path through 1 to 2 feet of silt in a 6-hour period.

During the postulated drought that would allow the river to drop to elevation 442 feet, practically no silt would accumulate. With the river at pool, with normal rainfall, it would take approximately 7 months to deposit 5 feet of silt (see the Harza Report, Attachment J1). Thus, since normal silt deposition occurs at a slow rate, there is ample time to clean the silt before any depth of consequence develops. 69

Silt deposition occurs more rapidly during the spring runoff. Even during these conditions, approximately 3 months is required to deposit 8 feet of silt (see the Harza Report, Attachment J1). Again, ample time is available to clean the silt before any depth of consequence occurs.

The highest siltation rate occurs during the maximum probable flood (elevation 546 feet). During the maximum probable flood, approximately 5.9 feet and 3.0 feet would accumulate in the intake flume and pump bay, respectively (see the Harza Report, Attachment J1). An accumulation of this amount of silt would be well below the river pool and would not adversely affect the safety performance of the service water system. There would be approximately 12 feet of water above the top of the silt when the river returned to pool. Past experience has shown that the pumps are able to meet the flow requirements even with silt 2 feet above the suction pipe. Three feet of silt in the pump bay would still be approximately 2 feet below the top of the suction pipe. 69

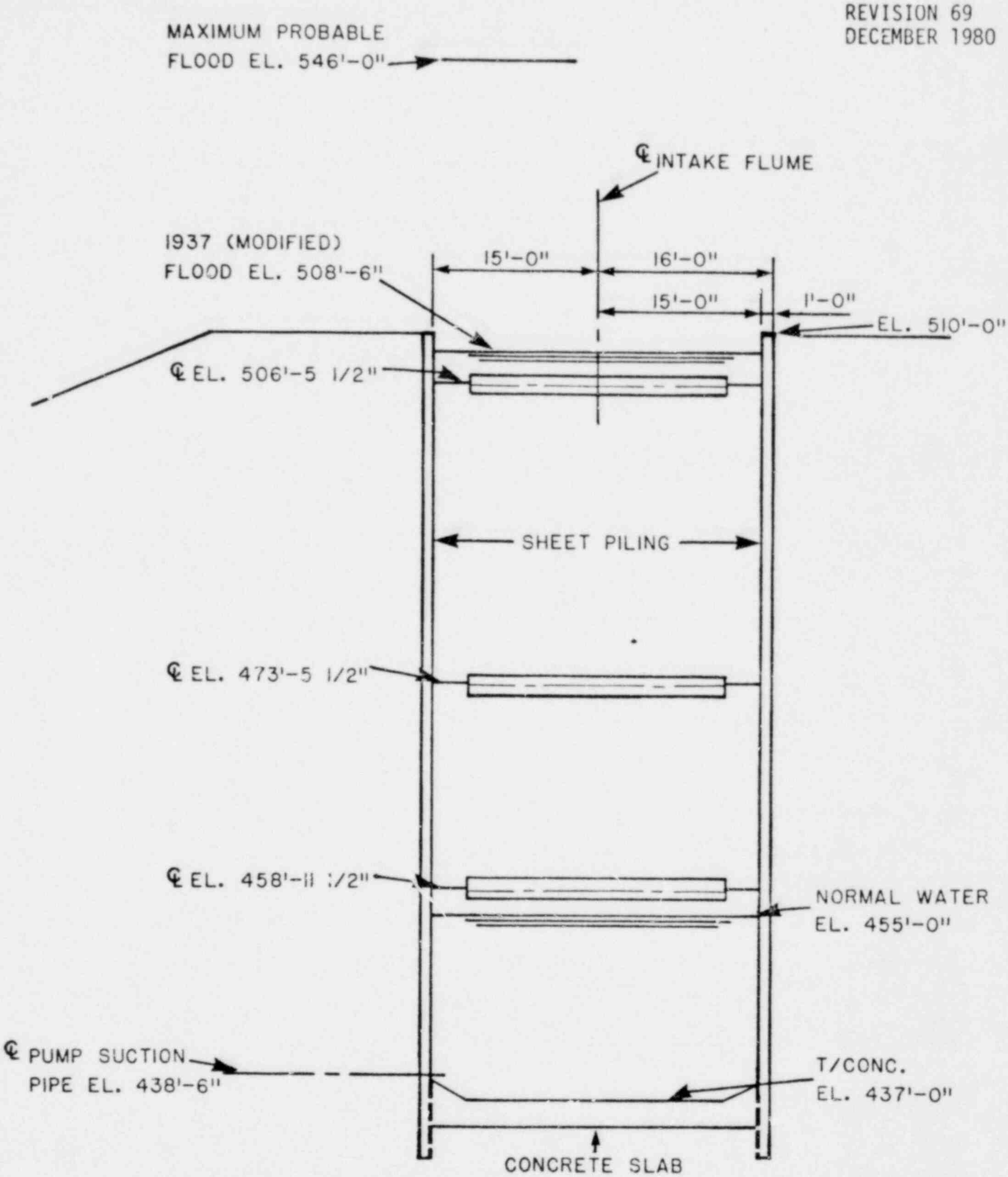

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FIGURE J.8-1

INTAKE FLUME (SECTION)

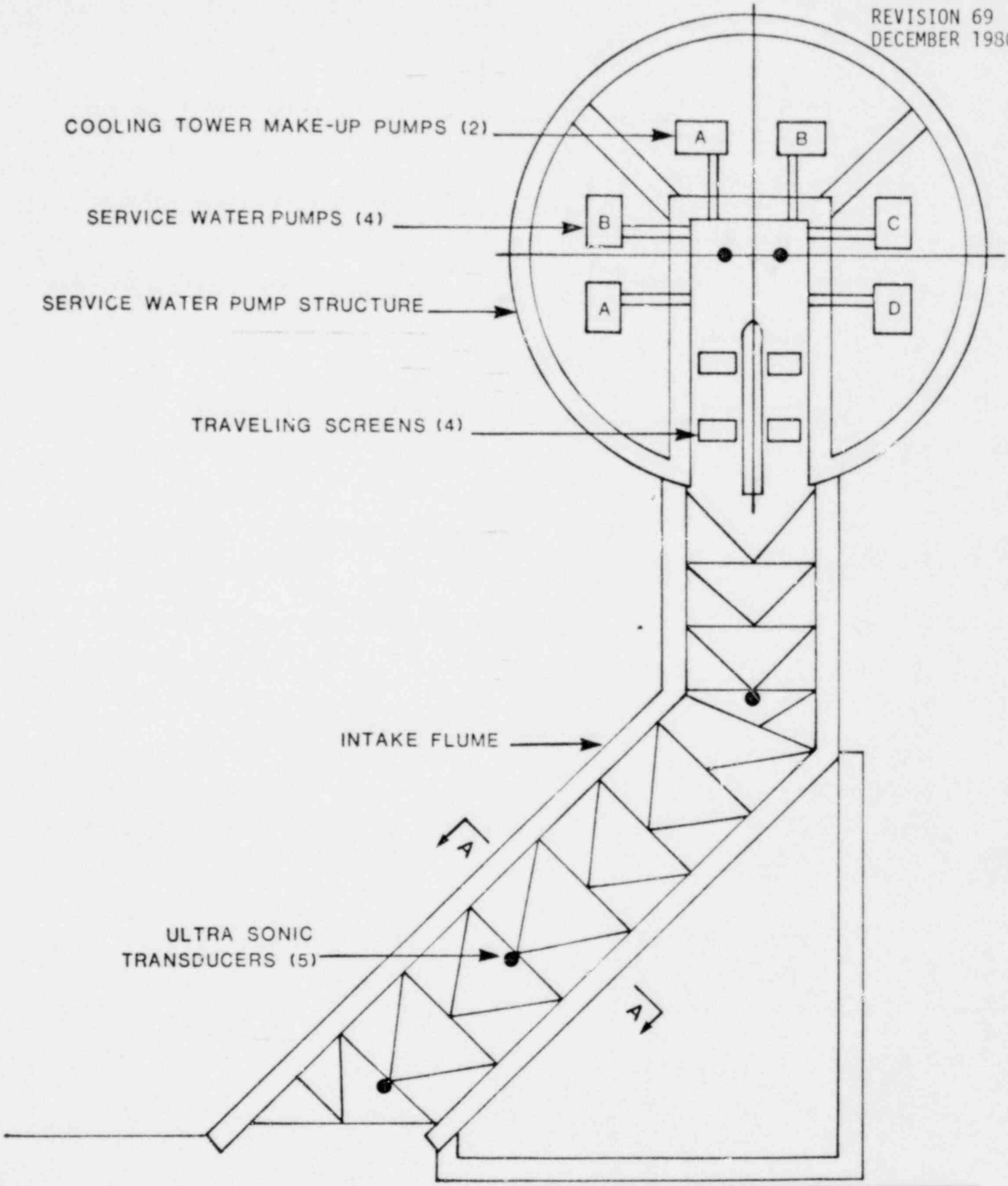

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FIGURE J.8-2

LOCATION OF TRANSDUCERS

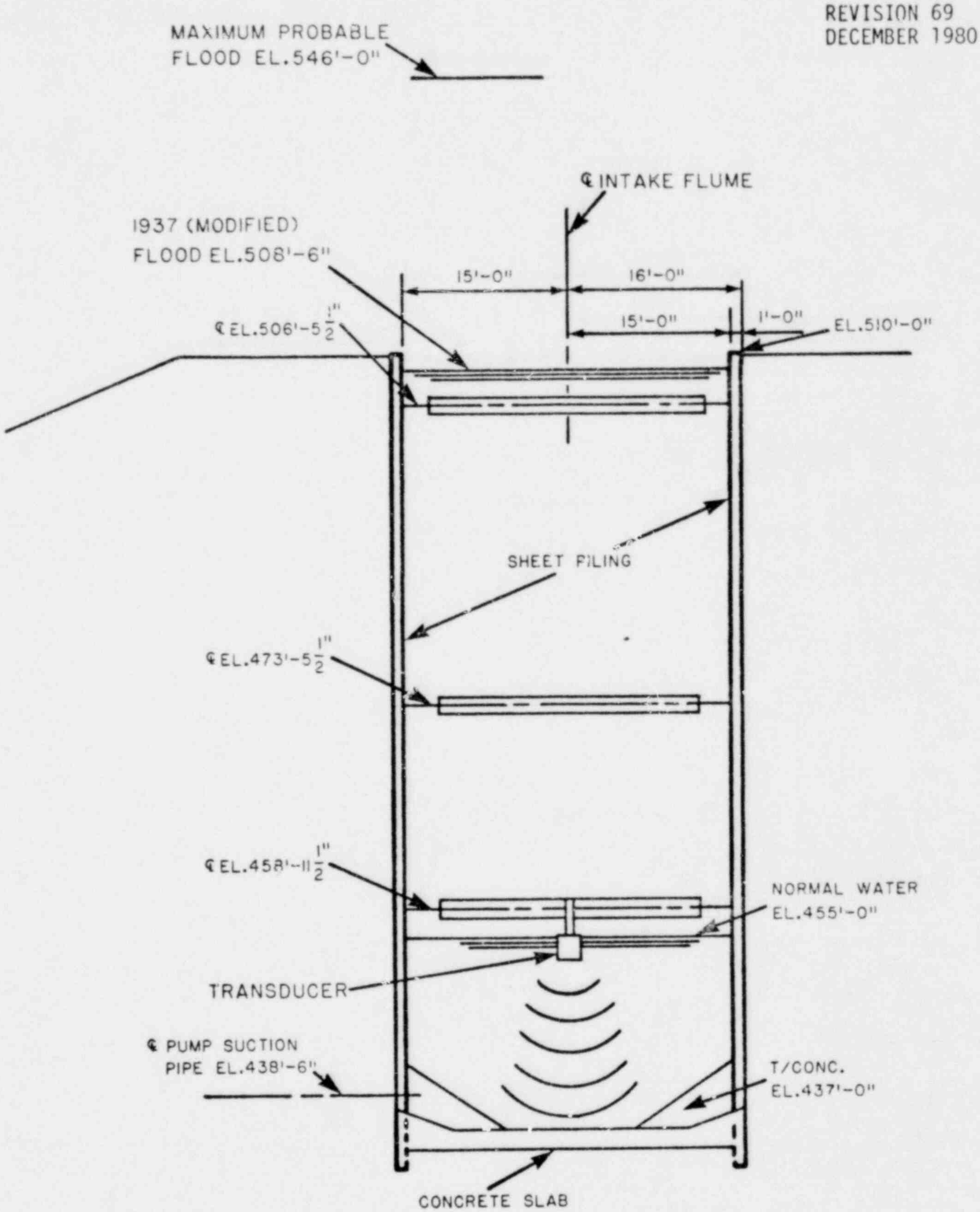

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FIGURE J.8-3

LOCATION OF TRANSDUCERS - SECTION VIEW

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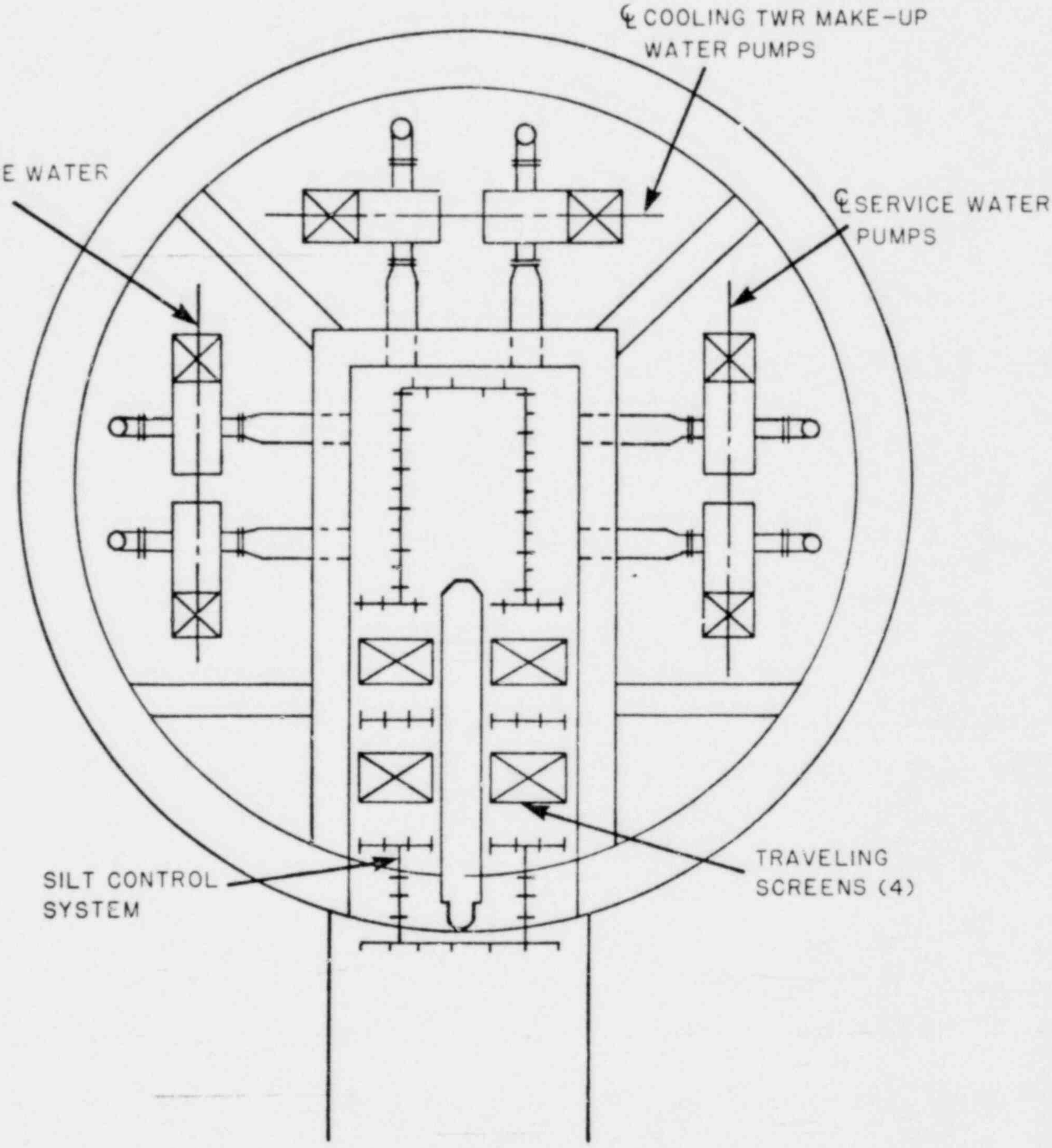
DECEMBER 1980



PLAN EL. 435'

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FIGURE J.8-4

SILT CONTROL SYSTEM -
PLAN VIEW

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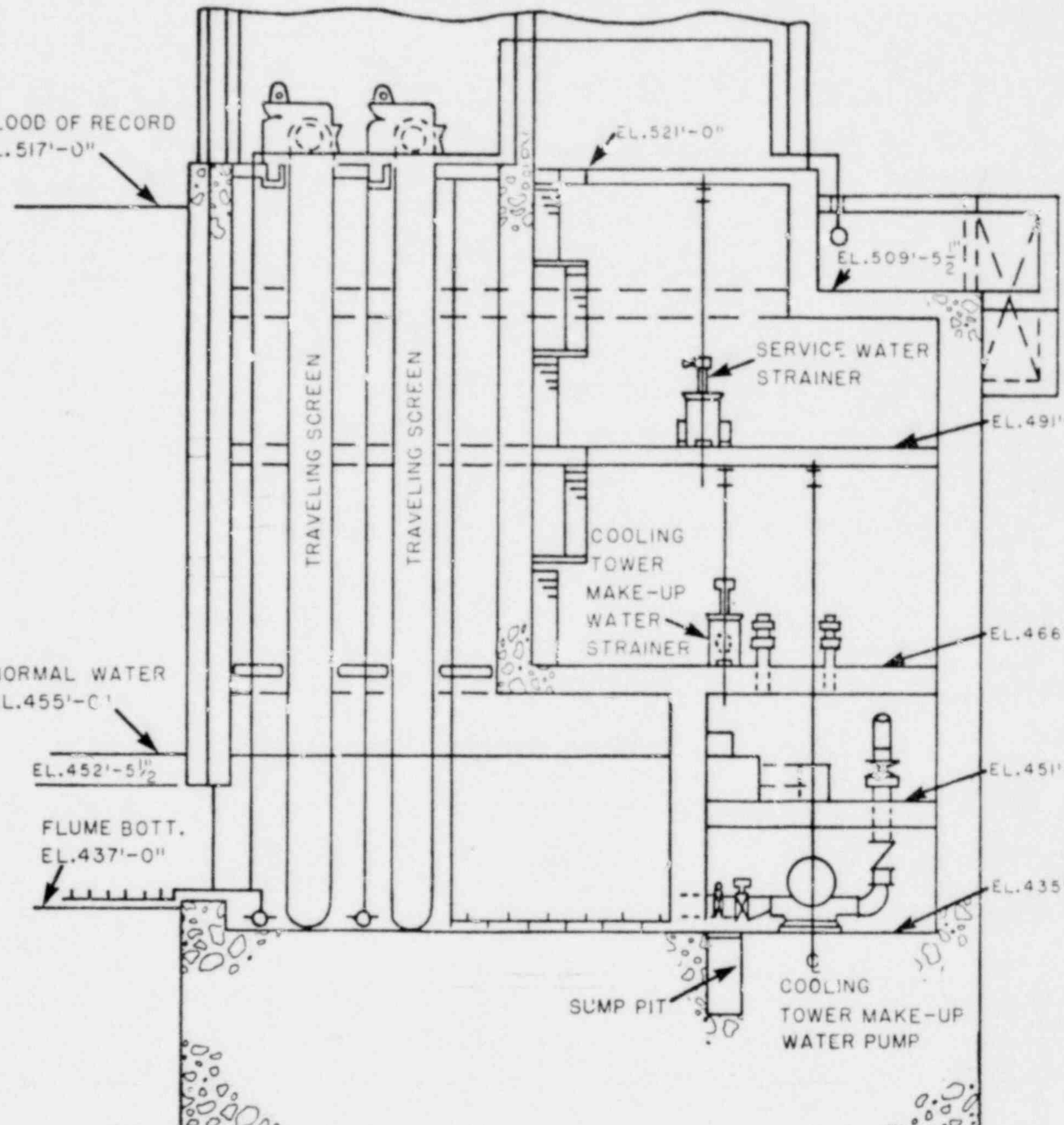

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FIGURE J.8-5

SILT CONTROL SYSTEM -
SECTION VIEW

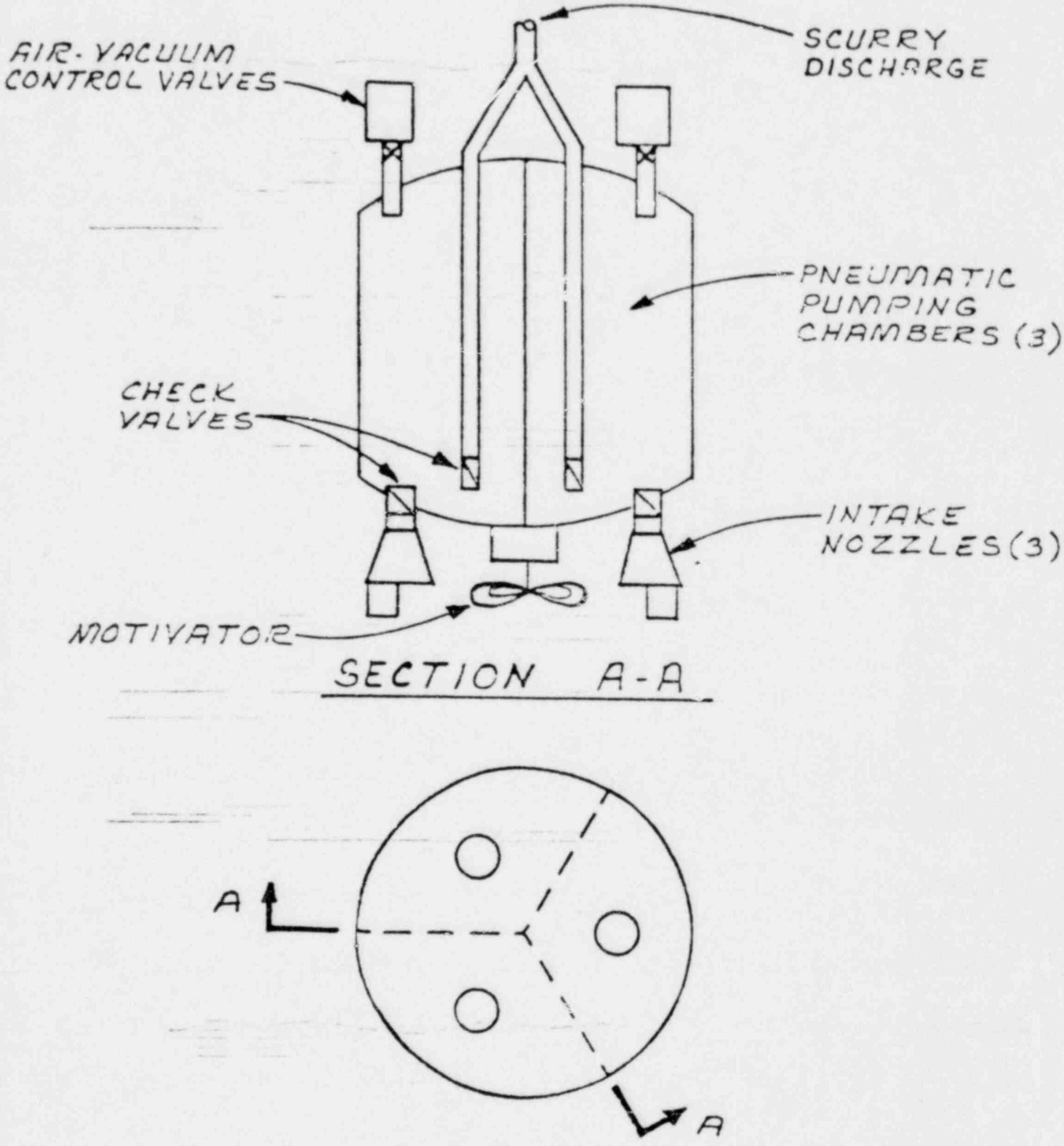

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FIGURE J.8-6

RIVER DREDGING DEVICE

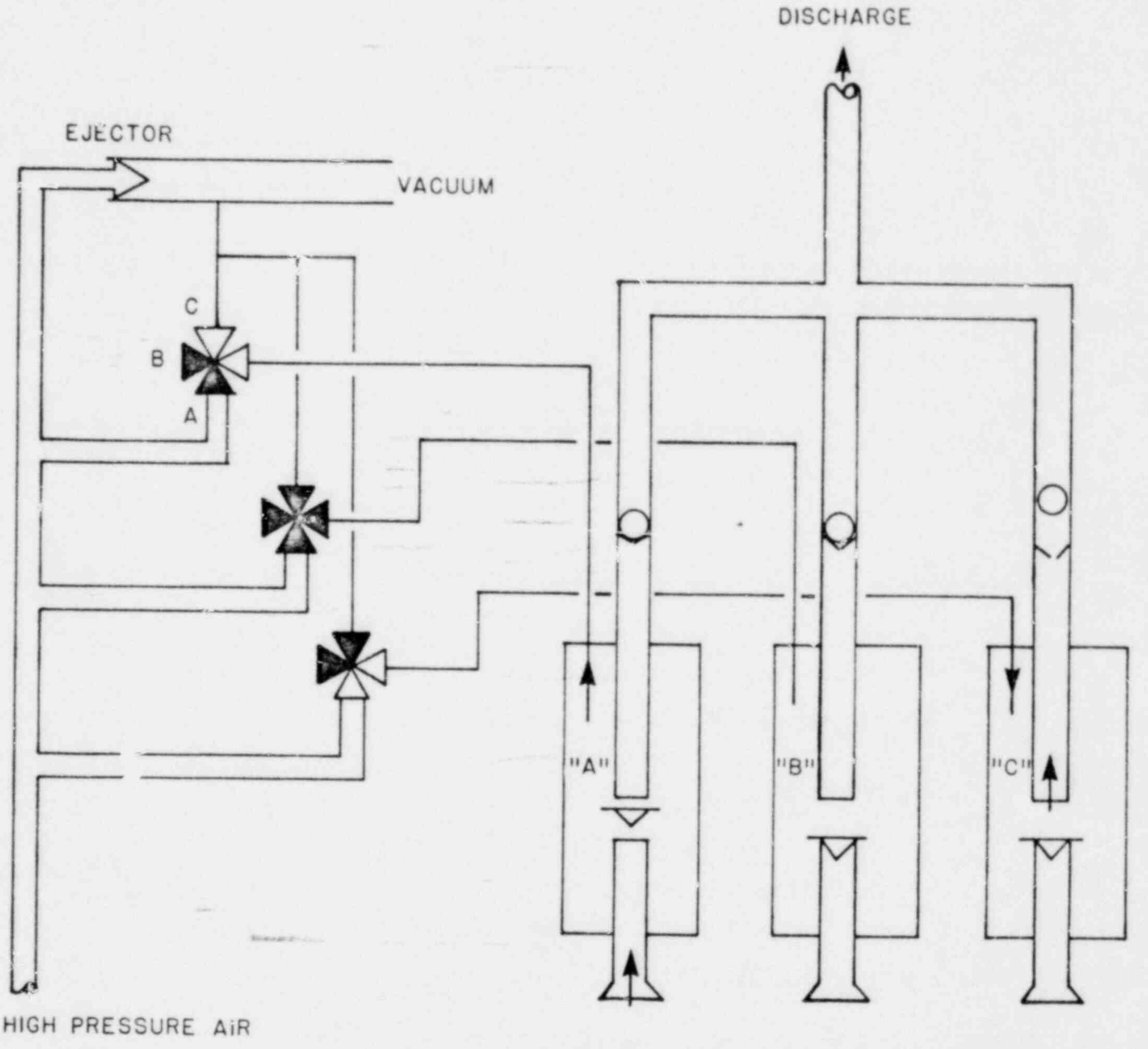

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FIGURE J.8-7

INTAKE FLUME DREDGING
DEVICE OPERATING SCHEMATIC