ATTACHMENT 2

Catawba Standby Nuclear Service Water Pond Physical Testing Conducted During February 1995

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Catawba SNSWP Stratification Testing

Testing was conducted at Catawba during the time period of February 12-14, 1995. The purpose of the testing was to examine the stratification effects of a heated discharge into the SNSWP. The SNSWP is assumed to be a series of stratified layers in the computer simulation described in CNC-1150.01-00-0001. This testing was possible because the SNSWP was aligned for cooling during this time period due to RN valve work.

The objectives of this testing were to:

- Verify existence of stratification.
- Verify heated surface layer spreads out over the SNSWP.
- Verify heated layer is not withdrawn at intake.
- Verify the flow is not short-circuiting between the short-arm discharge and the intake.

Test Conditions

- The SNSWP was aligned for cooling flow at 0200 on 2/12 and realigned at approximately 1300 on 2/14.
- Flow during the test period was approximately 11,400 gpm (25.4 cfs) for the first 7 hours and 10,700 gpm (23.8 cfs) for the remaining time period.
- The associated ΔT (difference between intake and discharge temperatures) was 15 - 20°F.
- The heat load rejected to the SNSWP during this time period was approximately 40% of that described in CNC-1150.01-00-0001.
- During the first day of testing (2/12), the prevailing wind direction was from the northeast (Lake Wylie towards the short-arm discharge structure).

Testing Methods

Temperature

Surface temperature measurements were continuously collected (at 1 m depth) during the test period at the following locations (see Figure 1):

- Short Arm -1
- Short Arm - 2
- Long Arm - 1
- Intake

A temperature profile at the Intake (from a raft) was continuously collected at the following depths (and are labeled on the attached graphs as noted):

- 1 m (Raft-1)
- 3 m (Raft-3)
- 5 m (Raft-5)
- Bottom (approximately 8 m) (Bottom)

Additional (grab sample) temperature measurements (resulting in profiles) were taken at other locations (see Figure 1) as follows:

- D - Discharge structure in short-arm
- 3 - Point in short-arm between discharge and intake
- 7 - Point in long-arm
- 8 - Point in long-arm
- I - Intake

<u>Dye Testing</u>

A slug addition of Rhodamine WT dye was made between 0945 and 1030 on 2/12 and the dye movement through the pond was analyzed using fluorometer measurements.

A fluorometer was used at the intake (approximately 25 ft deep) to continuously sample pond effluent to determine the first presence of dye being returned to the plant.

Dye measurements (grab samples/depth profiles) were taken at the locations previously described (D, 3, 7, 8, I).

Transects were run at three different depths (0.3 m, 1 m, and 3 m) across the short-arm to analyze the spread of the dye.

Photographs were taken to show the surface spread of the dye to record visual observations of the testing results.

Results

Flow

No flow was observed from the long-arm discharge structure which resulted in a conservative testing scenario with regard to the spreading of the heated discharge layer. A higher flowrate from the station would result in flow from the long-arm discharge which would aid in ensuring a complete surface spread of the heated water.

Temperature

Temperatures at the intake remained stratified for the duration of the testing period as shown in Figures 2 and 3. The surface temperature increased from an initial temperature of 42 - 43°F (prior to alignment of the SNSWP for cooling) to a temperature of up to 48°F (Figure 2). The temperature at 1 m depth (see Figure 3) remained greater than 46°F while the temperature at the depth of the intake (8 meters) remained below 43°F.

Figure 4 shows the similarity of the continuous surface temperature measurements (collected at 1 m depths) located at:

- Short arm - 1
- Short arm - 2
- Raft -1
- Long Arm -1

Before the start of the testing period (2/11 @1900 - 2/12 @0200), the four probes had similar temperatures of 43 - 44°F. After discharge (and recirculation) of the SNSWP began at 0200, the first probe in the short-arm (Short Arm-1) measured an increasing temperature. In a series, the other probes (Short Arm-2, Raft-1, and Long Arm-1) measured increasing temperatures. These temperature increases demonstrate the surface spread of the heated layer.

Figure 5 shows the stratification of the water column at Location 3 (see Figure 1). The surface temperature increased approximately 9°F while the temperature at the bottom remained unchanged. The surface temperature remained elevated during the testing period while the bottom layer temperature remained unchanged from initial conditions.

Figure 6 shows the temperature stratification at the discharge structure in the short-arm of the SNSWP. The data shows that the heated discharge remains in the upper 2 ft of the water column as it enters the SNSWP. Again, the water column at this point remained stratified for the duration of the test.

Figure 7 shows a combination of the grab sample results at locations 7 and 8 (see Figure 1). These two sets of results were combined because of the close proximity of the locations. The observed stratification at these locations further demonstrates the complete surface spread of the heated layer and the associated stratified layers.

Dye Testing

Figure 8 shows the observed dye concentrations at the intake during the test period. The surface dye concentrations increased from 12 ppb on 2/12 to 48 ppb on 2/13. After this observed maximum concentration, the dye concentrations showed movement down through the water column as a layer (see 2/13 @1324 data). This downward moving layer was also observed during the last sampling period (2/14 @1211). These measurements demonstrate the surface spread of the heated layer to the intake and stratification of the water column.

Figures 9 and 10 show the stratifed layers at location 3 (see Figure 1). Again, after the maximum dye concentration was observed, the dye moved down through the water column as a stratified layer.

Figure 11 shows the observed dye concentrations at locations 7 and 8. The location 7 data (2/12) demonstrates the surface spread of the heated discharge layer into the long-arm and the associated stratification while the location 8 data (2/13) shows the movement of the stratified layer down through the water column.

Dye concentrations collected at various depths along Transect 1 (see location on Figure 1) in the short-arm (see Figures 12, 13 and 14) show that dye covered the entire width of the short-arm. Note, the data shown in Figure 12 exceeded the instrument range of 1000 ppb. The comparison of dye concentrations Figure 13 (3 ft depth) and Figure 14 (6 ft depth) demonstrates the stratification of the water column.

Additionally, the complete dye spread over the entire SNSWP surface is presented in the attached photographs. (See attachments)

Evaluation of Results

Observed Results during Physical Testing

The similarity of the surface temperatures (Figure 4) in comparison to the differences of the intake temperatures (Figure 3) demonstrate the existence of a stratified flow pattern instead of a plug-flow pattern.

The continued stratification at the intake and the complete surface spread demonstrates that there is not a short-circuiting effect caused by the short distance between the short-arm discharge and intake in comparison to the distance between the long-arm discharge and intake. The stratification allowed for surface cooling of the heated discharge layer prior to its shifting down and replacement by additional heated discharge flow. Thus, the heated layer was prevented from being withdrawn at the intake.

Heated Layer Thickness

Information from the dye testing and temperature monitoring can be used to determine the depth of the heated layer. The dye spread completely over the SNSWP surface in less than 24 hours. The flowrates during the test period were lower than the values described in CNC-1150.01-00-0001. The flowrate for the first 7 hours was 25.4 cfs and 23.8 cfs for the remaining time period. These flowrates can be used to determine the total volume of heated water discharge to the SNSWP in a given time period. Since the dye addition began at 0945 and ended at 1030, the 23.8 cfs value can be used to determine the total volume discharged at the time the leading edge was observed to reach certain points (see table below). These values can be used to determine a depth of the heated layer.

Heated Layer Thickness Based on Dye Testing

Location	*Time Dye Reached Location after Start of (0945) Dye Addition (hours)*	*Total Volume Discharged to SNSWP (cf.)*	*Area to Location (sf)*	*Depth of Heated Layer (ft)*
Short Arm-2	3	257,040	335,663	0.8
Intake	4	342,720	461,738	0.8
Entire Surface	<22	1,884,960	1,529,392	1.2

Note, the time for the dye to cover the entire surface was actually less than 22 hours, but the exact time cannot be established.

A similar approach can be used to determine the heated layer depths based on the time for the temperature to start rising at different locations.

Heated Layer Thickness Based on Temperature

Location	*Time of First Temperature at LocationDye Reached Location after Start of (0200) Dye Addition (hours)*	*Total Volume Discharged to SNSWP (cf.)*	*Area to Location (sf)*	*Depth of Heated Layer (ft)*
Short Arm-2	4.5	411,480	335,663	1.2
Intake	5.5	502,920	461,738	1.1
Long Arm-1	12	1,068,480	963,429	1.1

From these two methods, the heated layer thickness is less than 2 ft which is in close agreement with assumptions used in CNC-1150.01-00-0001.

Type of Flow Model

The SNSWP cooling effectiveness can be evaluated using average February meteorological conditions, reduced heat loads to account for only one unit being cooled during the February testing period, and an initial SNSWP temperature of 42°F in the SNSWP model (stratified flow) described in CNC-1150.01-00-0001 and comparing the output with results from a plug-flow model. The following table summarizes the results of the two flow types modeled and the physical testing results.

Flow Model Comparison

Point	*Distance from SA Discharge (ft)*	*Predicted Plug-Flow Model Temperature*	*Observed Maximum Temperature During Physical Testing (1 m depth from Figure 3)*	*SNSWP Model (Stratified) Temperature after Surface Cooling*	*Observed Maximum Temperatures at 1 ft depth (after 22 hours)*
SA Discharge	0	62	62 (Fig. 6)	51	59
SA-1	480	59.7	52	51	50
SA-2	850	58.2	51.5	51	-
Intake	1111	57.7	49.5	51	50
LA-1	1800	54.9	47.5	51	45

Observations from the two models

The plug-flow model temperatures are always greater than the observed values during the physical testing while the stratified-flow results are similar to the observed values for both the maximum observed temperature values and the 1 ft depth maximums after 22 hours. From this comparison of model output, the stratified model is providing reasonable results.

Conclusions

Stratification exists in the SNSWP even with low ΔT conditions tested.

There is no short-circuiting of flow between the discharge and intake on the short-arm. The heated discharge spreads completely over the SNSWP to achieve maximum surface cooling, and the SNSWP remained stratified during the testing period.

The heated surface layer is approximately 1 ft thick, and this value is in agreement with CNC-1150.01-00-0001.

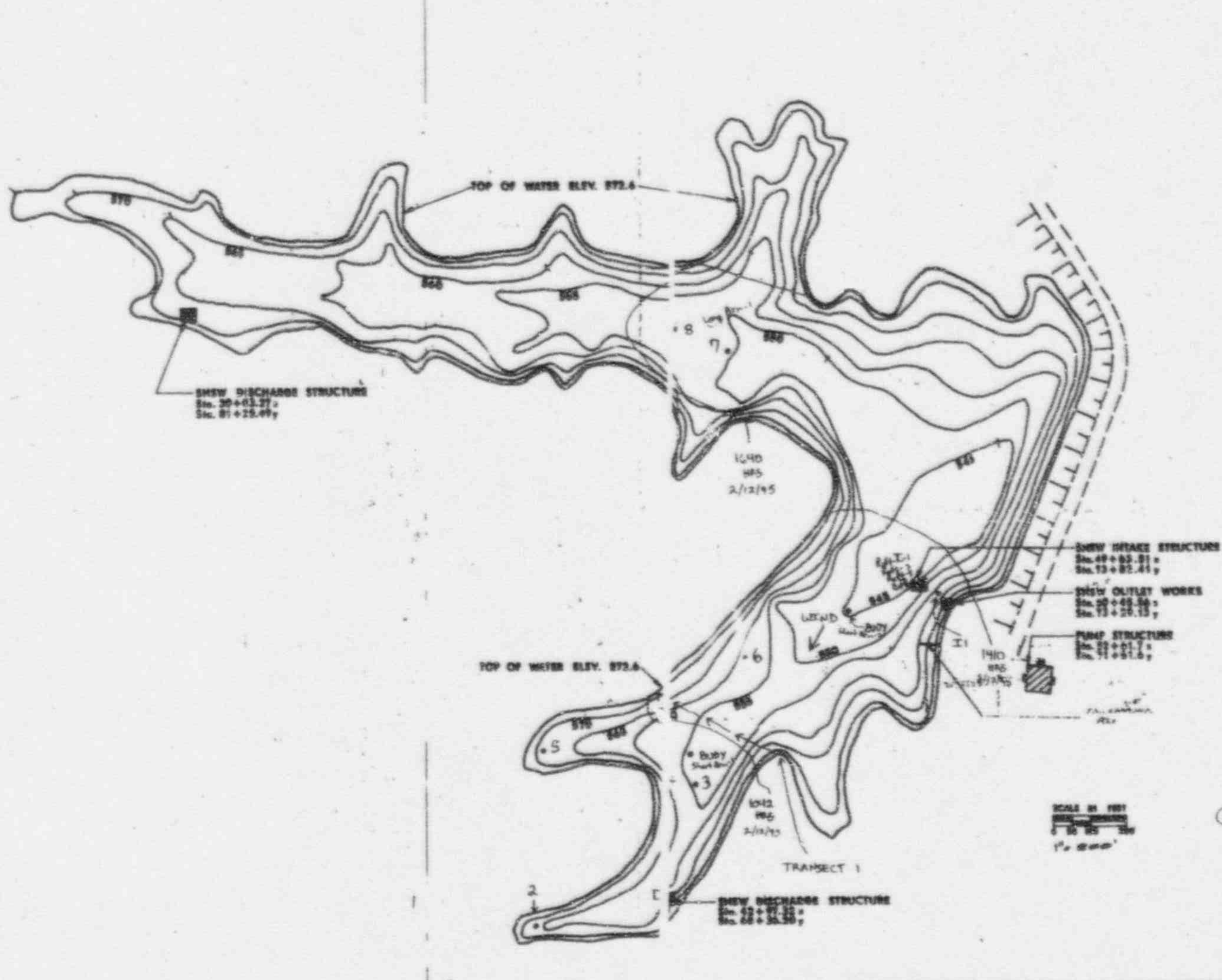
The existing assumptions in the Catawba SNSWP model (reference CNC-1150.01-00-0001) are valid and no corrections to the model are necessary.

List of Attachments

Figures
Data Tables
Photographs
Stratified Flow Model Results
Plug Flow Model Results

List of Figures

5 copies



CNS SNSW DYE STUDY
2/12-14/95

Figure 1 - Test Locations

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
STAND-BY NUCLEAR SER. WATER POND
UNDERWATER CONTOURS
YORK COUNTY, S. C.
MAY, 1982

Figure 2 - CNS SNSWP - Location I - Variation of Temperature with Depth

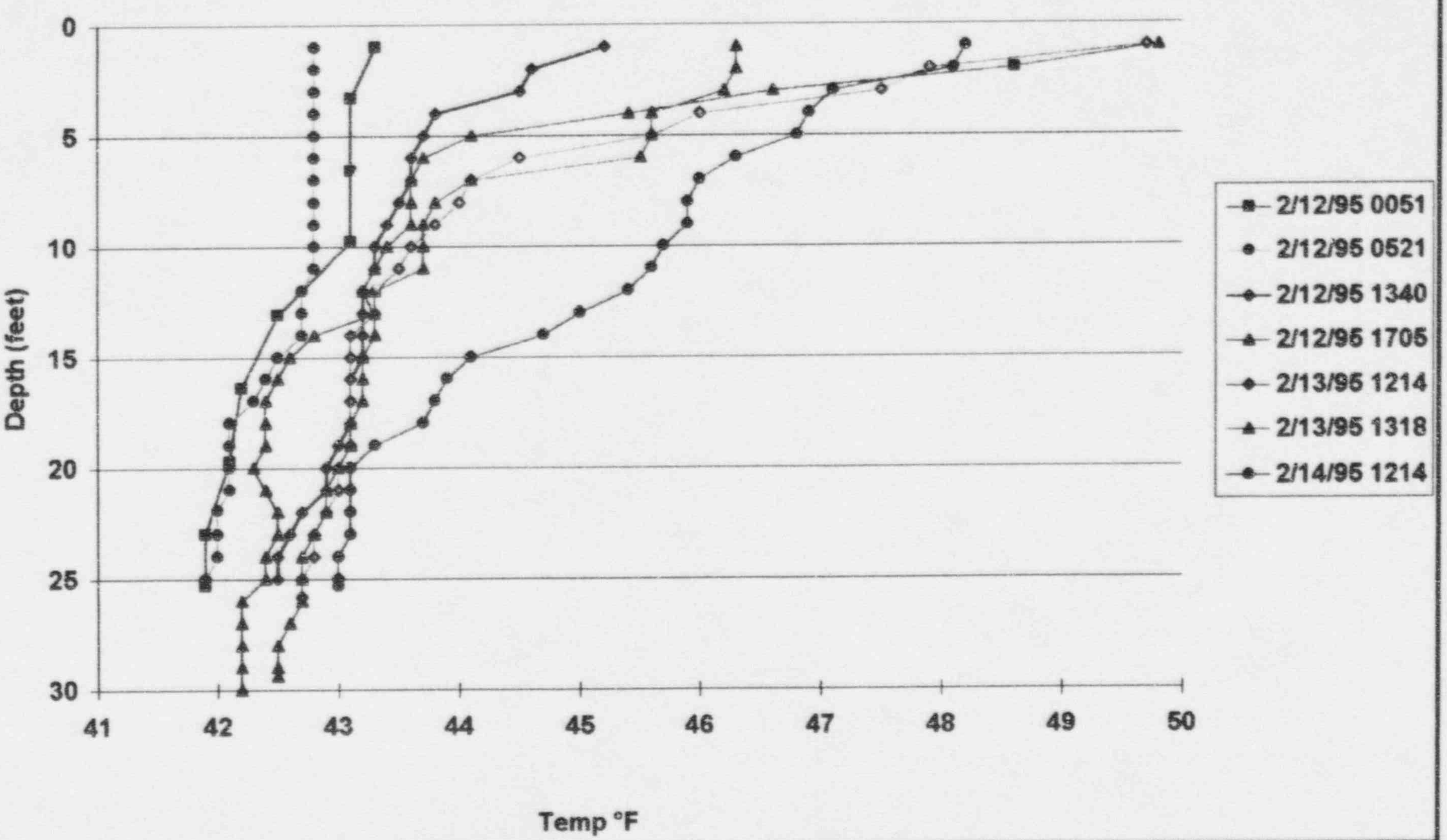


Figure 3 - Catawba Nuclear Station - SNS Variation of Temperature with Depth at Intake

Figure 4 - Catawba Nuclear Station - SNSWP - Variation of Surface Temperature with Distance from Short-Arm Discharge

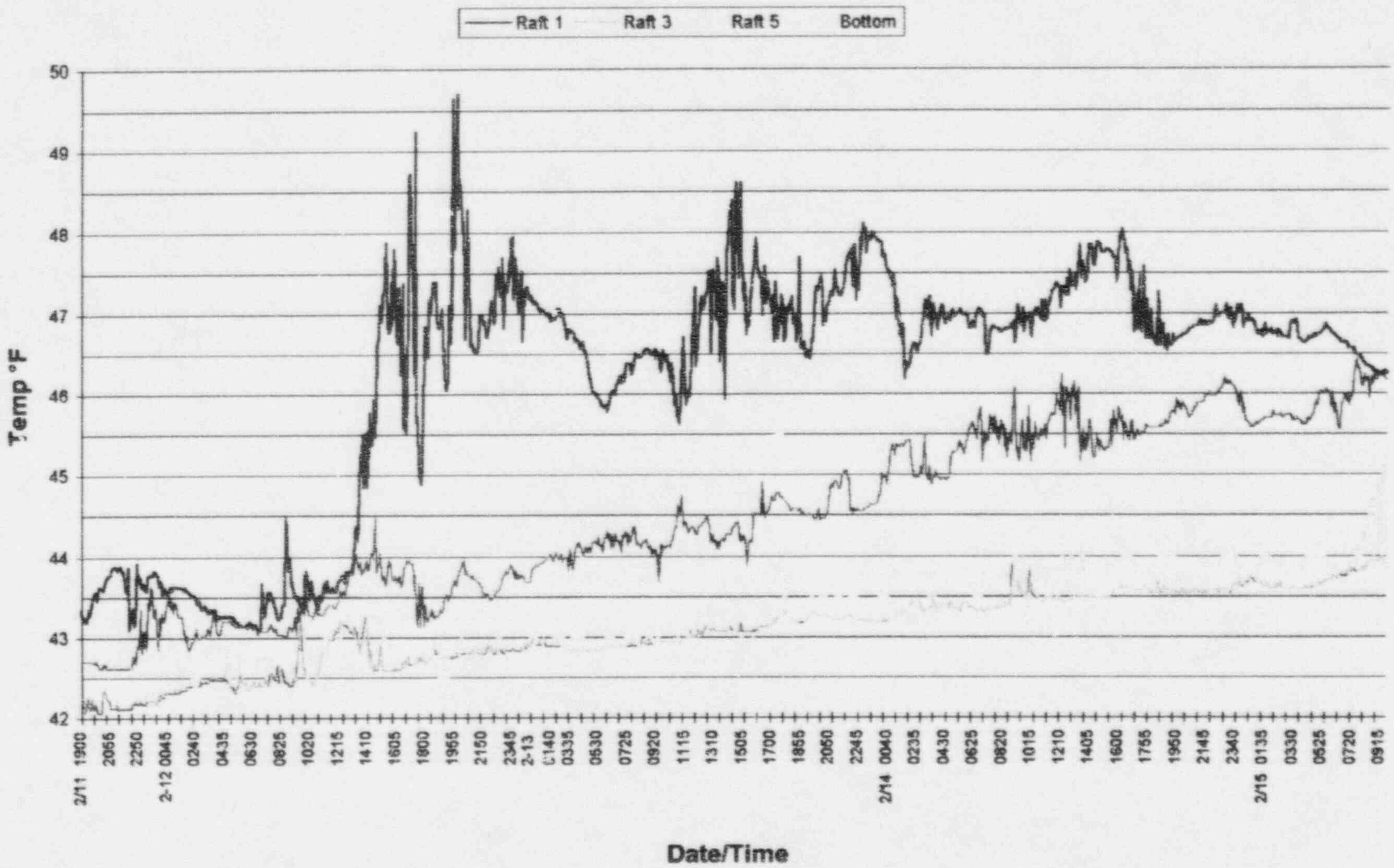


Figure 5 - CNS SNSWP - Location 3 - Variation of Temperature with Depth

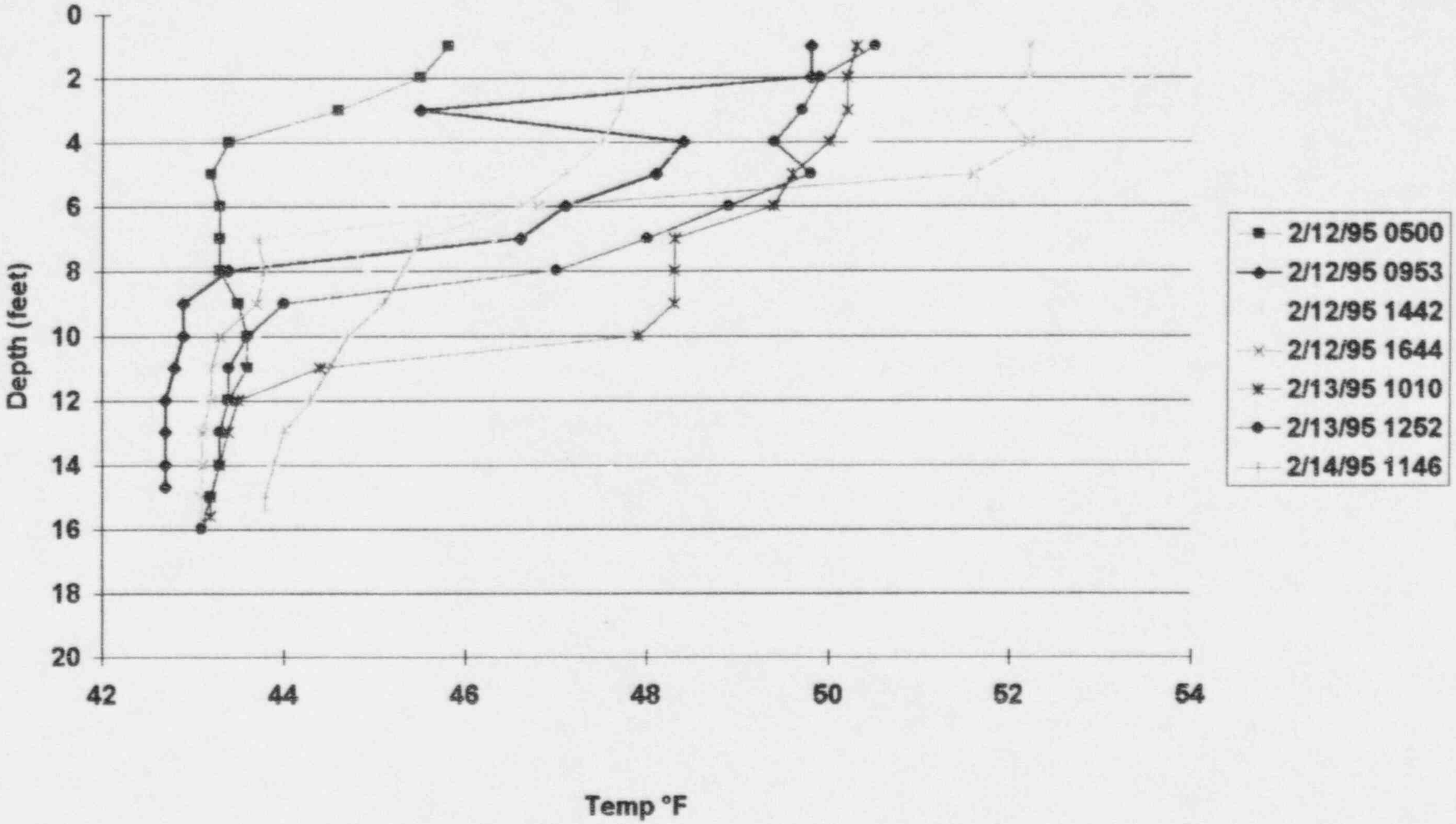


Figure 6 - CNS SNSWP - Location D - Variation of Temperature with Depth

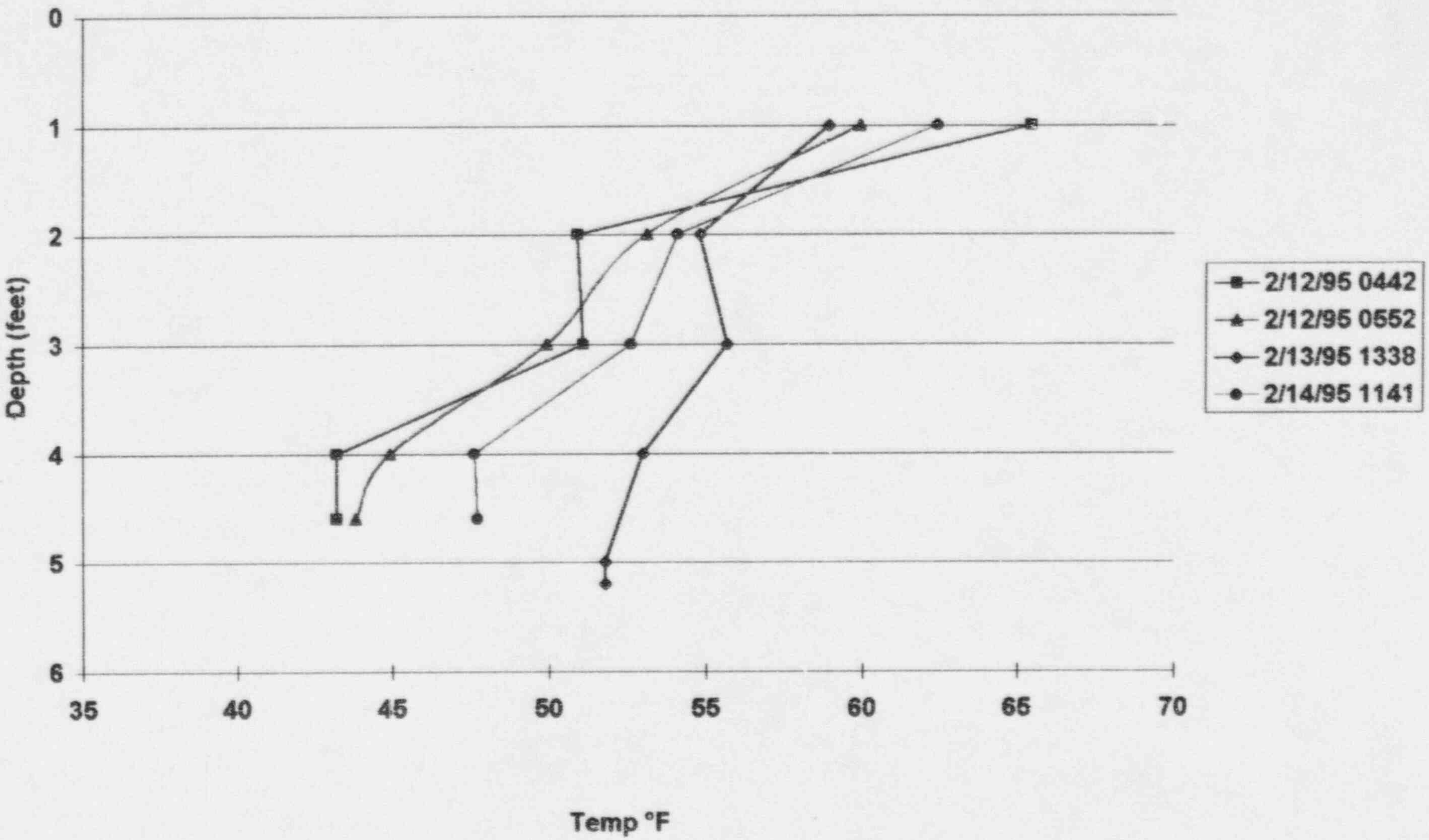


Figure 7 - CNS SNSWP - Locations 7 & 8 - Variation of Temperature with Depth

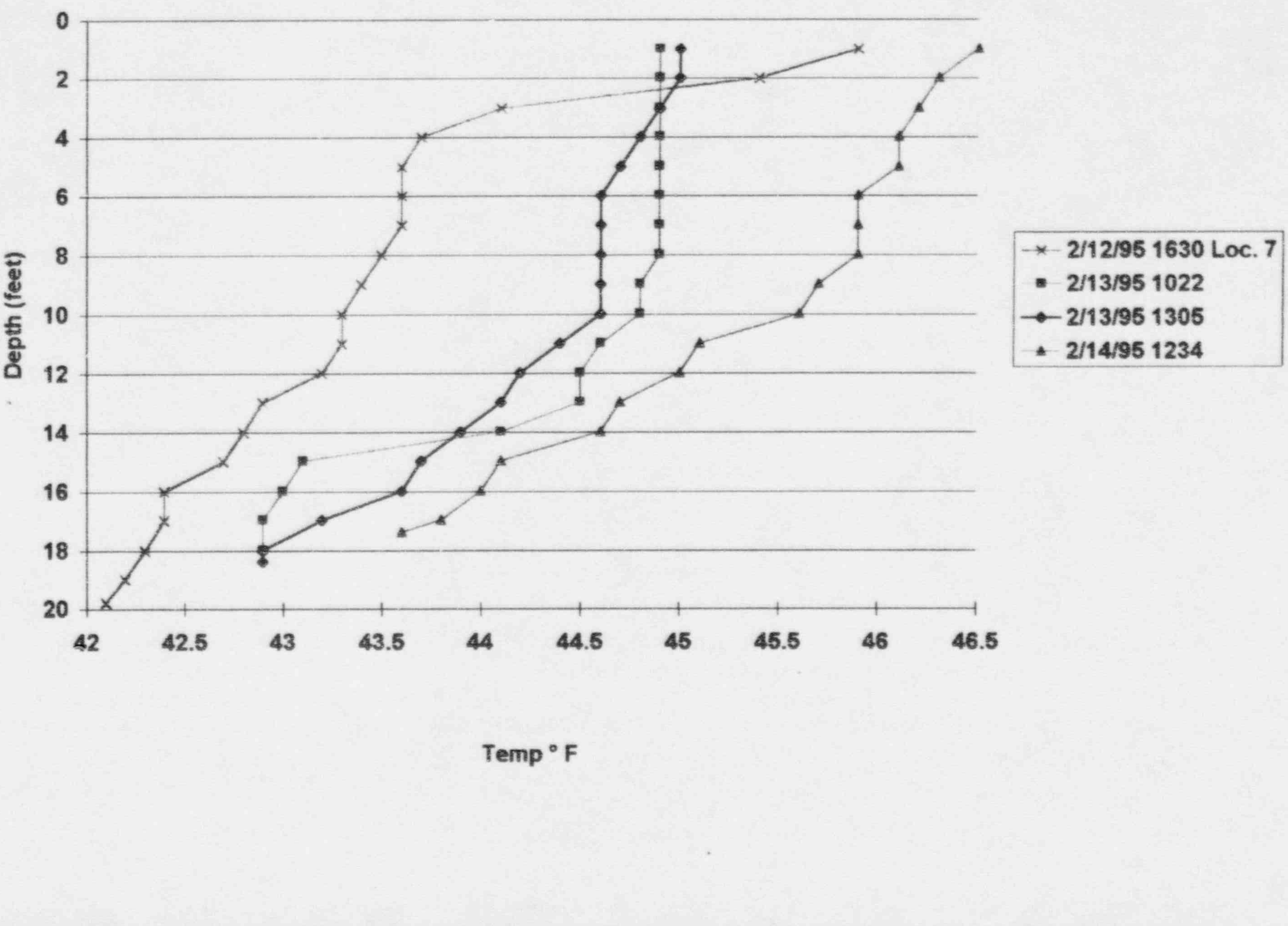


Figure 8 - CNS SNSWP - Location I - Variation of Dye Concentration with Depth

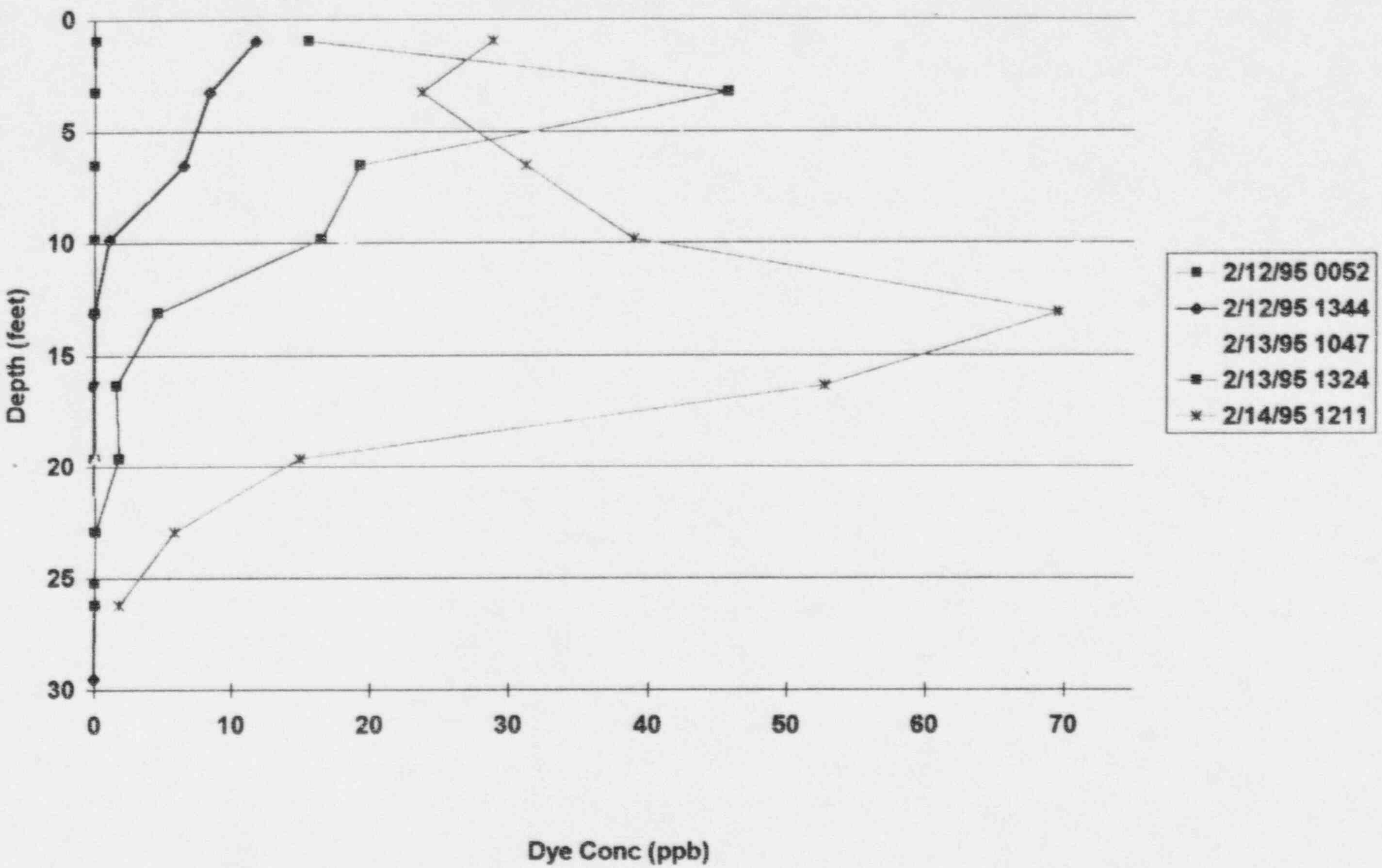


Figure 9 - CNS SNSWP - Location 3 (Abbreviated Dye Concentration Scale) - Variation of Dye Concentration with Depth

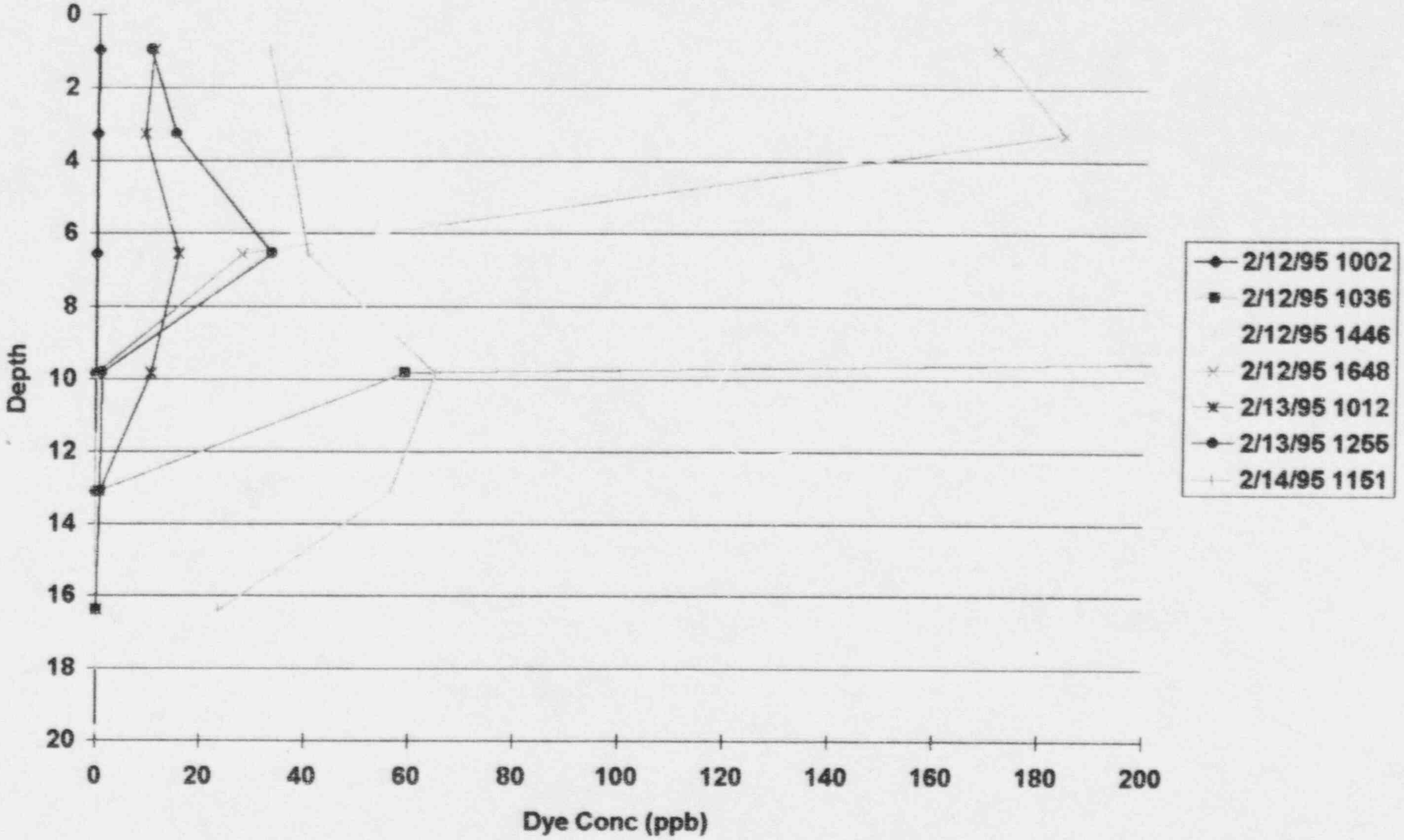


Figure 10 - CNS SNSWP - Location 3 - Variation of Dye Concentration with Depth

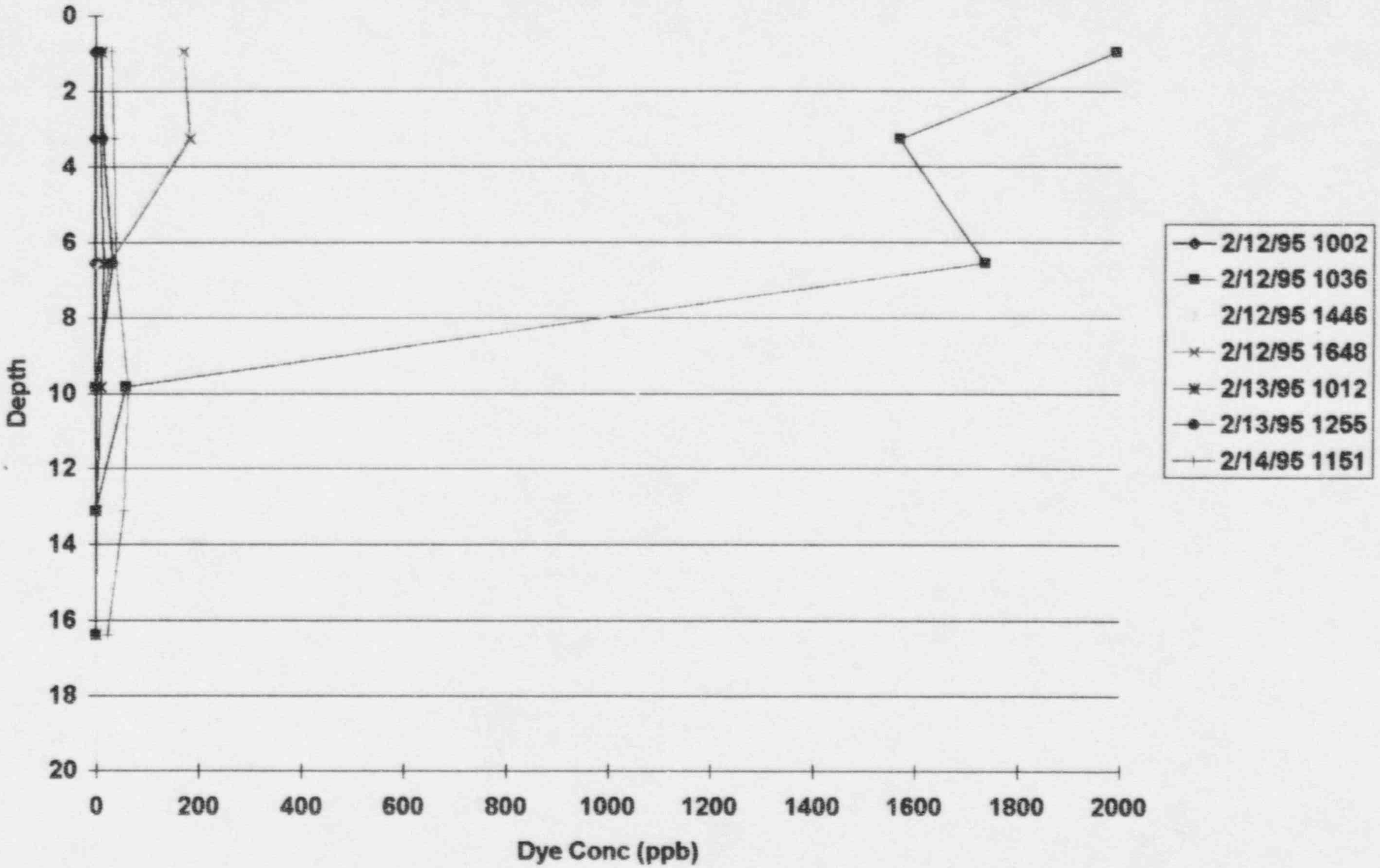


Figure 11 - CNS SNSWP - Locations 7 & 8 - Variation of Dye Concentration with Depth

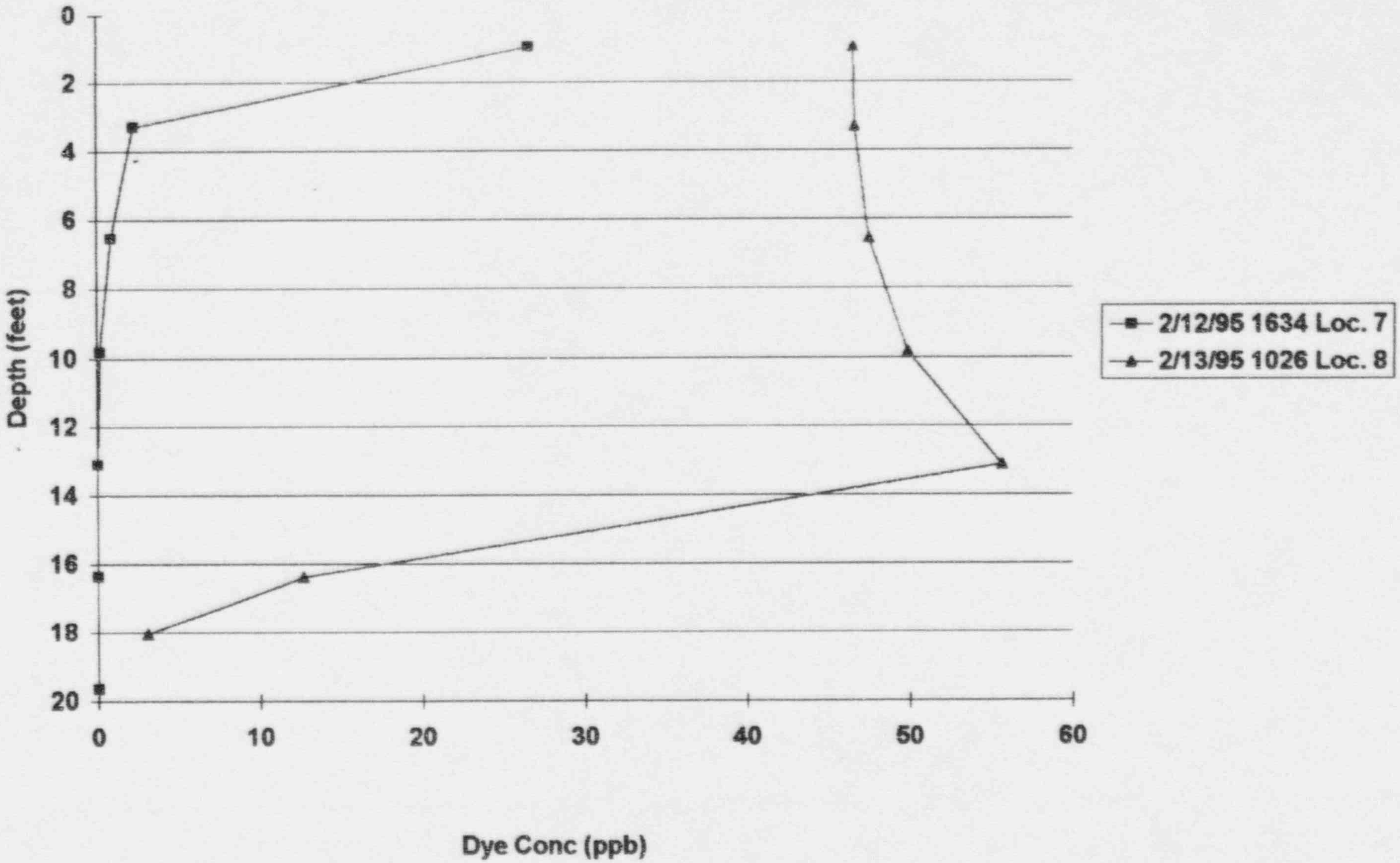


Figure 12

TRANSECT 1 (ONE-FOOT)

February 12, 1995

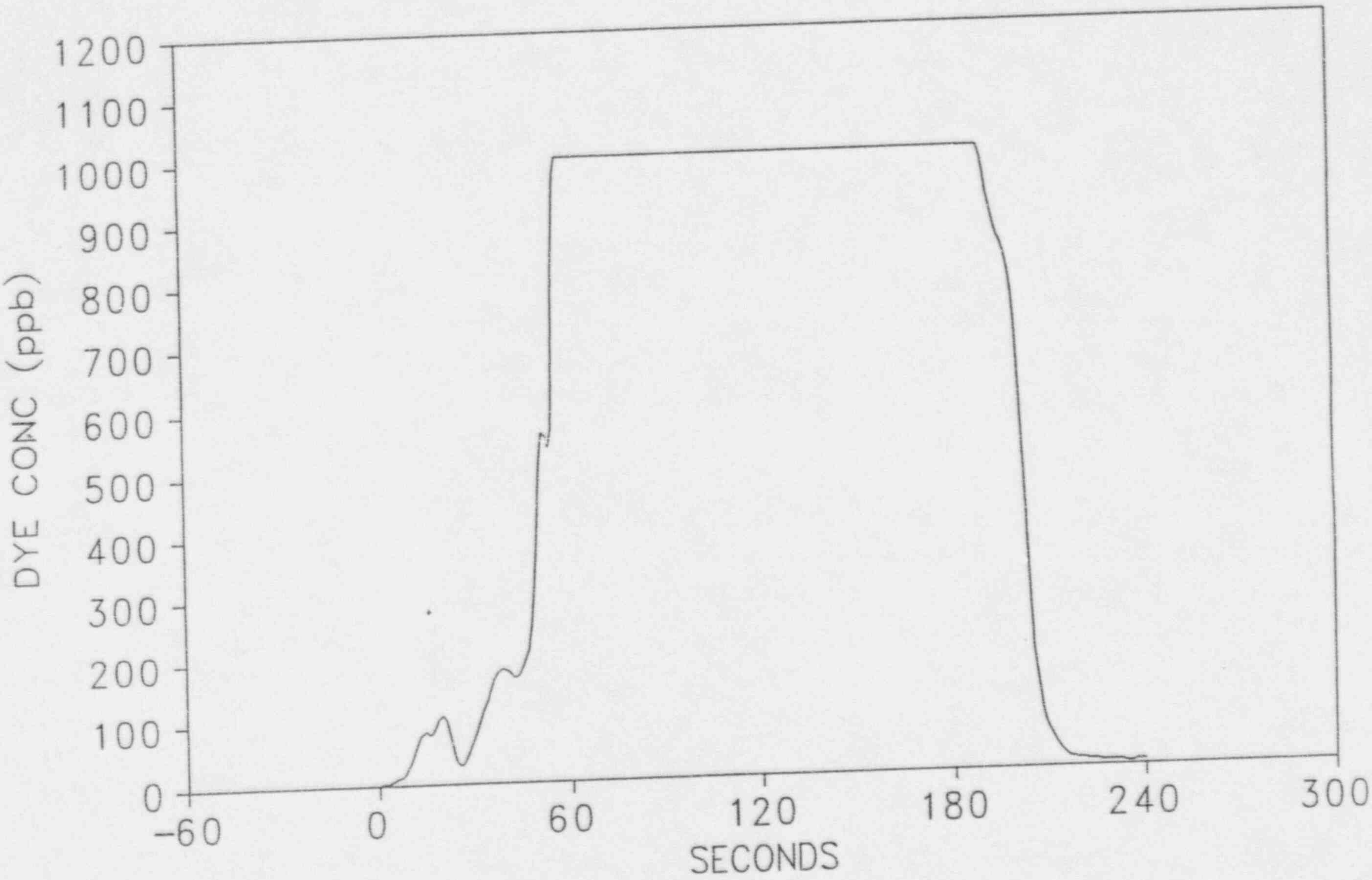


Figure 13

TRANSECT 1 (THREE-FOOT)

February 12, 1995

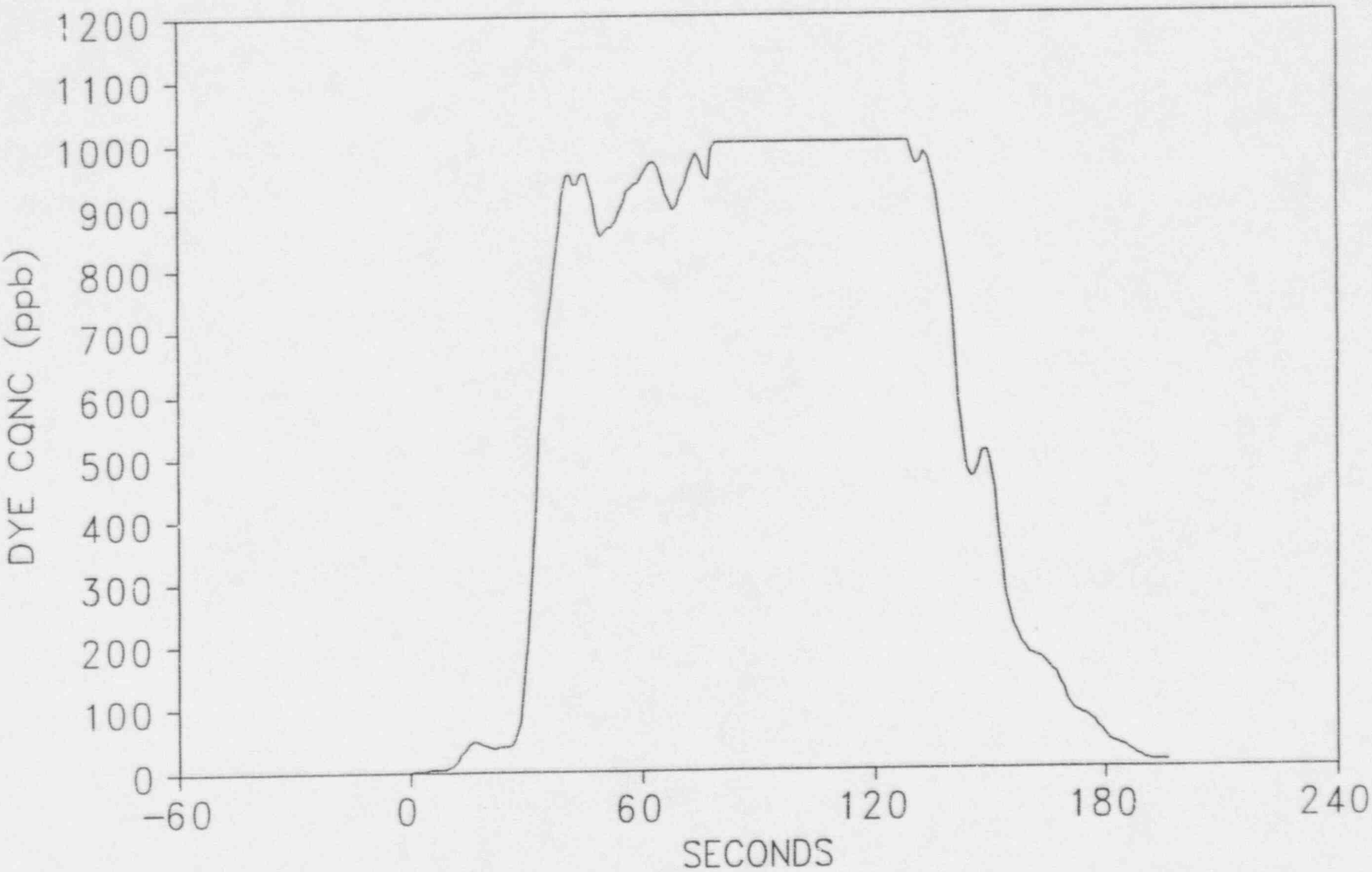
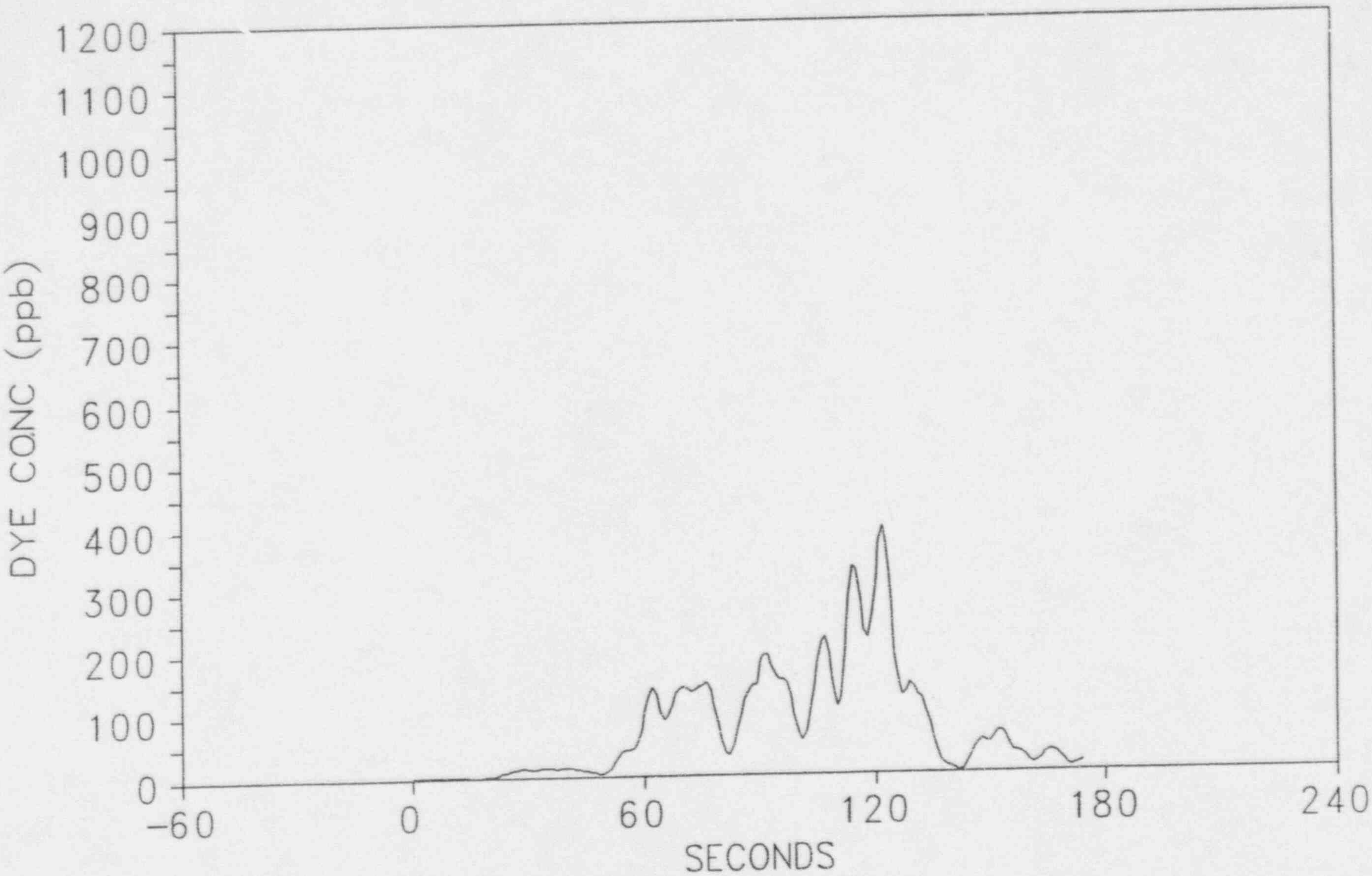


Figure 14

TRANSECT 1 (SIX-FOOT)

February 12, 1995



LOC (no)	DATE (dd-m-yy)	TIME (hhmmss)	TEMP (deg-F)	DEPTH (ft)
=	=	=	=	=
I	12-Feb-95	4541	43.3	1
I	12-Feb-95	4621	43.1	3.3
I	12-Feb-95	4656	43.1	6.6
I	12-Feb-95	4751	43.1	9.8
I	12-Feb-95	4836	42.5	13.1
I	12-Feb-95	4921	42.2	16.4
I	12-Feb-95	5001	42.1	19.7
I	12-Feb-95	5046	41.9	23
I	12-Feb-95	5121	41.9	25.3
I	12-Feb-95	52112	42.8	1
I	12-Feb-95	52137	42.8	2
I	12-Feb-95	52157	42.8	3
I	12-Feb-95	52217	42.8	4
I	12-Feb-95	52232	42.8	5
I	12-Feb-95	52252	42.8	6
I	12-Feb-95	52317	42.8	7
I	12-Feb-95	52337	42.8	8
I	12-Feb-95	52357	42.8	9
I	12-Feb-95	52417	42.8	10
I	12-Feb-95	52442	42.8	11
I	12-Feb-95	52502	42.7	12
I	12-Feb-95	52522	42.7	13
I	12-Feb-95	52537	42.7	14
I	12-Feb-95	52557	42.5	15
I	12-Feb-95	52612	42.4	16
I	12-Feb-95	52627	42.3	17
I	12-Feb-95	52647	42.1	18
I	12-Feb-95	52707	42.1	19
I	12-Feb-95	52722	42.1	20
I	12-Feb-95	52742	42.1	21
I	12-Feb-95	52802	42	21.9
I	12-Feb-95	52817	42	23
I	12-Feb-95	52837	42	24
I	12-Feb-95	52852	41.9	25
I	12-Feb-95	134018	45.2	1
I	12-Feb-95	134053	44.6	2
I	12-Feb-95	134113	44.5	3
I	12-Feb-95	134133	43.8	4
I	12-Feb-95	134153	43.7	5
I	12-Feb-95	134218	43.6	6
I	12-Feb-95	134233	43.6	7
I	12-Feb-95	134258	43.5	8

LOC (no)	DATE (dd-m-yy)	TIME (hhmmss)	TEMP (deg-F)	DEPTH (ft)
I	12-Feb-95	134318	43.4	9
I	12-Feb-95	134333	43.3	10
I	12-Feb-95	134348	43.3	11
I	12-Feb-95	134408	43.2	12
I	12-Feb-95	134428	43.2	13
I	12-Feb-95	134448	43.2	14
I	12-Feb-95	134508	43.2	15
I	12-Feb-95	134523	43.1	16
I	12-Feb-95	134538	43.1	17
I	12-Feb-95	134553	43.1	18
I	12-Feb-95	134608	43	19
I	12-Feb-95	134633	42.9	20
I	12-Feb-95	134648	42.9	21
I	12-Feb-95	134708	42.7	22
I	12-Feb-95	134728	42.6	23
I	12-Feb-95	134748	42.5	24
I	12-Feb-95	134808	42.5	25

I1	12-Feb-95	165604	49.8	1
I1	12-Feb-95	165629	48.6	2
I1	12-Feb-95	165704	46.6	3
I1	12-Feb-95	165729	45.4	4
I1	12-Feb-95	165749	44.1	5
I1	12-Feb-95	165809	43.7	6
I1	12-Feb-95	165829	43.6	7
I1	12-Feb-95	165854	43.6	8
I1	12-Feb-95	165914	43.6	9
I1	12-Feb-95	165934	43.4	10
I1	12-Feb-95	165949	43.3	11
I1	12-Feb-95	170004	43.2	12
I1	12-Feb-95	170024	43.3	13
I1	12-Feb-95	170044	42.8	14
I1	12-Feb-95	170104	42.6	15
I1	12-Feb-95	170124	42.5	16
I1	12-Feb-95	170144	42.4	17
I1	12-Feb-95	170159	42.4	18
I1	12-Feb-95	170219	42.4	19
I1	12-Feb-95	170234	42.3	20
I1	12-Feb-95	170254	42.4	21
I1	12-Feb-95	170309	42.5	22
I1	12-Feb-95	170329	42.5	23
I1	12-Feb-95	170354	42.4	24
I1	12-Feb-95	170414	42.4	25
I1	12-Feb-95	170434	42.2	26
I1	12-Feb-95	170454	42.2	27
I1	12-Feb-95	170509	42.2	28

LOC (no)	DATE (dd-m-yy)	TIME (hhmmss)	TEMP (deg-F)	DEPTH (ft)
I1	12-Feb-95	170529	42.2	29
I1	12-Feb-95	170544	42.2	30
I	13-Feb-95	131829	49.7	1
I	13-Feb-95	131844	47.9	2
I	13-Feb-95	131914	47.5	3
I	13-Feb-95	131934	46	4
I	13-Feb-95	131949	45.6	5
I	13-Feb-95	132009	44.5	6
I	13-Feb-95	132034	44.1	7
I	13-Feb-95	132059	44	8
I	13-Feb-95	132119	43.8	9
I	13-Feb-95	132139	43.6	10
I	13-Feb-95	132159	43.5	11
I	13-Feb-95	132219	43.3	12
I	13-Feb-95	132234	43.3	13
I	13-Feb-95	132259	43.1	14
I	13-Feb-95	132324	43.1	15
I	13-Feb-95	132344	43.1	16
I	13-Feb-95	132404	43.1	17
I	13-Feb-95	132419	43.1	18
I	13-Feb-95	132434	43.1	19
I	13-Feb-95	132509	43	20
I	13-Feb-95	132529	43	21
I	13-Feb-95	132549	42.9	22
I	13-Feb-95	132609	42.8	23
I	13-Feb-95	132624	42.8	24
I	13-Feb-95	132644	42.7	25
I	13-Feb-95	132659	42.7	25.8
I1	13-Feb-95	93748	46.3	1
I1	13-Feb-95	93813	46.3	2
I1	13-Feb-95	93828	46.2	3
I1	13-Feb-95	93848	45.6	4
I1	13-Feb-95	93908	45.6	5
I1	13-Feb-95	93928	45.5	6
I1	13-Feb-95	93943	44.1	7
I1	13-Feb-95	93958	43.8	8
I1	13-Feb-95	94023	43.7	9
I1	13-Feb-95	94043	43.7	10
I1	13-Feb-95	94058	43.7	11
I1	13-Feb-95	94113	43.3	12
I1	13-Feb-95	94133	43.3	13
I1	13-Feb-95	94158	43.3	14
I1	13-Feb-95	94218	43.2	15
I1	13-Feb-95	94233	43.2	16

LOC (no)	DATE (dd-m-yy)	TIME (hhmmss)	TEMP (deg-F)	DEPTH (ft)
I1	13-Feb-95	94253	43.2	17
I1	13-Feb-95	94313	43.1	18
I1	13-Feb-95	94328	43.1	19
I1	13-Feb-95	94343	43	20
I1	13-Feb-95	94358	42.9	21
I1	13-Feb-95	94413	42.9	22
I1	13-Feb-95	94428	42.8	23
I1	13-Feb-95	94448	42.7	24
I1	13-Feb-95	94508	42.7	25
I1	13-Feb-95	94528	42.7	26
I1	13-Feb-95	94543	42.6	27
I1	13-Feb-95	94603	42.5	28
I1	13-Feb-95	94618	42.5	29
I1	13-Feb-95	94628	42.5	29.4
I	14-Feb-95	120218	48.2	1
I	14-Feb-95	120248	48.1	2
I	14-Feb-95	120328	47.1	3
I	14-Feb-95	120348	46.9	4
I	14-Feb-95	120428	46.8	5
I	14-Feb-95	120448	46.3	6
I	14-Feb-95	120513	46	7
I	14-Feb-95	120603	45.9	8
I	14-Feb-95	120633	45.9	9
I	14-Feb-95	120703	45.7	10
I	14-Feb-95	120733	45.6	11
I	14-Feb-95	120753	45.4	12
I	14-Feb-95	120813	45	13
I	14-Feb-95	120843	44.7	14
I	14-Feb-95	120918	44.1	15
I	14-Feb-95	120943	43.9	16
I	14-Feb-95	121008	43.8	17
I	14-Feb-95	121043	43.7	18
I	14-Feb-95	121128	43.3	19
I	14-Feb-95	121158	43.1	20
I	14-Feb-95	121223	43.1	21
I	14-Feb-95	121308	43.1	22
I	14-Feb-95	121328	43.1	23
I	14-Feb-95	121353	43	24
I	14-Feb-95	121413	43	25
I	14-Feb-95	121443	43	25.3

LOC (no)	DATE (dd-m-yy)	TIME (hhmmss)	TEMP (deg-F)	DEPTH (ft)
D	14-Feb-95	113713	62.4	1
D	14-Feb-95	113828	54.1	2
D	14-Feb-95	113943	52.6	3
D	14-Feb-95	114058	47.6	4
D	14-Feb-95	114148	47.7	4.6
D	13-Feb-95	133554	58.9	1
D	13-Feb-95	133614	54.8	2
D	13-Feb-95	133639	55.7	3
D	13-Feb-95	133659	53	4
D	13-Feb-95	133734	51.8	5
D	13-Feb-95	133804	51.8	5.2
D	12-Feb-95	44047	65.4	1
D	12-Feb-95	44117	50.9	2
D	12-Feb-95	44137	51.1	3
D	12-Feb-95	44152	43.2	4
D	12-Feb-95	44212	43.2	4.6
D	12-Feb-95	55107	59.9	1
D	12-Feb-95	55132	53.1	2
D	12-Feb-95	55207	49.9	3
D	12-Feb-95	55227	44.9	4
D	12-Feb-95	55247	43.8	4.6

LOC (no)	DATE (dd-m-yy)	TIME (hhmmss)	TEMP (deg-F)	DEPTH (ft)
3	12-Feb-95	50032	45.8	1
3	12-Feb-95	50047	45.5	2
3	12-Feb-95	50112	44.6	3
3	12-Feb-95	50132	43.4	4
3	12-Feb-95	50152	43.2	5
3	12-Feb-95	50207	43.3	6
3	12-Feb-95	50227	43.3	7
3	12-Feb-95	50252	43.3	8
3	12-Feb-95	50312	43.5	9
3	12-Feb-95	50327	43.6	10
3	12-Feb-95	50342	43.6	11
3	12-Feb-95	50402	43.4	12
3	12-Feb-95	95359	49.8	1
3	12-Feb-95	95429	49.8	2
3	12-Feb-95	95539	45.5	3
3	12-Feb-95	95909	48.4	4
3	12-Feb-95	95944	48.1	5
3	12-Feb-95	100009	47.1	6
3	12-Feb-95	100024	46.6	7
3	12-Feb-95	100044	43.4	8
3	12-Feb-95	100109	42.9	9
3	12-Feb-95	100124	42.9	10
3	12-Feb-95	100149	42.8	11
3	12-Feb-95	100204	42.7	12
3	12-Feb-95	100229	42.7	13
3	12-Feb-95	100244	42.7	14
3	12-Feb-95	100259	42.7	14.7

LOC (no)	DATE (dd-m-yy)	TIME (hhmmss)	TEMP (deg-F)	DEPTH (ft)
3	12-Feb-95	144239	53.4	1
3	12-Feb-95	144259	53.3	2
3	12-Feb-95	144314	53.4	3
3	12-Feb-95	144409	50.4	4
3	12-Feb-95	144449	45.6	5
3	12-Feb-95	144509	45.2	6
3	12-Feb-95	144534	44.7	7
3	12-Feb-95	144604	44.9	8
3	12-Feb-95	144629	44.5	9
3	12-Feb-95	144649	43.7	10
3	12-Feb-95	144709	43.5	11
3	12-Feb-95	144729	43.1	12
3	12-Feb-95	144749	43.1	13
3	12-Feb-95	144809	43.1	14
3	12-Feb-95	144824	43	14.8
3	12-Feb-95	164444	52.2	1
3	12-Feb-95	164459	52.2	2
3	12-Feb-95	164519	51.9	3
3	12-Feb-95	164539	52.2	4
3	12-Feb-95	164554	51.6	5
3	12-Feb-95	164619	46.8	6
3	12-Feb-95	164639	43.7	7
3	12-Feb-95	164659	43.8	8
3	12-Feb-95	164714	43.7	9
3	12-Feb-95	164729	43.3	10
3	12-Feb-95	164749	43.2	11
3	12-Feb-95	164804	43.2	12
3	12-Feb-95	164819	43.1	13
3	12-Feb-95	164834	43.1	14
3	12-Feb-95	164854	43.1	15
3	12-Feb-95	164909	43.1	15.7

3	13-Feb-95	100818	50.3	1
3	13-Feb-95	100833	50.2	2
3	13-Feb-95	100848	50.2	3
3	13-Feb-95	100903	50	4
3	13-Feb-95	100923	49.6	5
3	13-Feb-95	100948	49.4	6
3	13-Feb-95	101008	48.3	7
3	13-Feb-95	101028	48.3	8
3	13-Feb-95	101043	48.3	9
3	13-Feb-95	101058	47.9	10

LOC (no)	DATE (dd-m-yy)	TIME (hhmmss)	TEMP (deg-F)	DEPTH (ft)
3	13-Feb-95	101213	44.4	11
3	13-Feb-95	101238	43.5	12
3	13-Feb-95	101258	43.4	13
3	13-Feb-95	101313	43.3	14
3	13-Feb-95	101338	43.2	15
3	13-Feb-95	101353	43.2	15.6
3	13-Feb-95	125219	50.5	1
3	13-Feb-95	125239	49.9	2
3	13-Feb-95	125304	49.7	3
3	13-Feb-95	125319	49.4	4
3	13-Feb-95	125339	49.8	5
3	13-Feb-95	125359	48.9	6
3	13-Feb-95	125414	48	7
3	13-Feb-95	125429	47	8
3	13-Feb-95	125444	44	9
3	13-Feb-95	125504	43.6	10
3	13-Feb-95	125524	43.4	11
3	13-Feb-95	125539	43.4	12
3	13-Feb-95	125554	43.3	13
3	13-Feb-95	125614	43.3	14
3	13-Feb-95	125629	43.2	15
3	13-Feb-95	125644	43.1	16
3	14-Feb-95	114638	48	1
3	14-Feb-95	114728	47.8	2
3	14-Feb-95	114758	47.7	3
3	14-Feb-95	114823	47.5	4
3	14-Feb-95	114908	47.1	5
3	14-Feb-95	114933	46.6	6
3	14-Feb-95	115008	45.5	7
3	14-Feb-95	115103	45.3	8
3	14-Feb-95	115133	45.1	9
3	14-Feb-95	115208	44.7	10
3	14-Feb-95	115238	44.5	11
3	14-Feb-95	115318	44.3	12
3	14-Feb-95	115343	44	13
3	14-Feb-95	115413	43.9	14
3	14-Feb-95	115433	43.8	15
3	14-Feb-95	115453	43.8	15.4

LOC (no)	DATE (dd-m-yy)	TIME (hhmmss)	TEMP (deg-F)	DEPTH (ft)
8	13-Feb-95	102258	44.9	1
8	13-Feb-95	102313	44.9	2
8	13-Feb-95	102338	44.9	3
8	13-Feb-95	102358	44.9	4
8	13-Feb-95	102418	44.9	5
8	13-Feb-95	102433	44.9	6
8	13-Feb-95	102458	44.9	7
8	13-Feb-95	102513	44.9	8
8	13-Feb-95	102528	44.8	9
8	13-Feb-95	102538	44.8	10
8	13-Feb-95	102553	44.6	11
8	13-Feb-95	102608	44.5	12
8	13-Feb-95	102628	44.5	13
8	13-Feb-95	102638	44.1	14
8	13-Feb-95	102653	43.1	15
8	13-Feb-95	102708	43	16
8	13-Feb-95	102723	42.9	17
8	13-Feb-95	102733	42.9	18
8	13-Feb-95	130519	45	1
8	13-Feb-95	130534	45	2
8	13-Feb-95	130604	44.9	3
8	13-Feb-95	130624	44.8	4
8	13-Feb-95	130639	44.7	5
8	13-Feb-95	130704	44.6	6
8	13-Feb-95	130724	44.6	7
8	13-Feb-95	130744	44.6	8
8	13-Feb-95	130809	44.6	9
8	13-Feb-95	130829	44.6	10
8	13-Feb-95	130849	44.4	11
8	13-Feb-95	130919	44.2	12
8	13-Feb-95	130949	44.1	13
8	13-Feb-95	131009	43.9	14
8	13-Feb-95	131024	43.7	15
8	13-Feb-95	131044	43.6	16
8	13-Feb-95	131104	43.2	17
8	13-Feb-95	131124	42.9	18
8	13-Feb-95	131139	42.9	18.4

LOC (no)	DATE (dd-m-yy)	TIME (hhmmss)	TEMP (deg-F)	DEPTH (ft)
8	14-Feb-95	123443	46.5	1
8	14-Feb-95	123523	46.3	2
8	14-Feb-95	123628	46.2	3
8	14-Feb-95	123653	46.1	4
8	14-Feb-95	123718	46.1	5
8	14-Feb-95	123733	45.9	6
8	14-Feb-95	123808	45.9	7
8	14-Feb-95	123833	45.9	8
8	14-Feb-95	123853	45.7	9
8	14-Feb-95	123918	45.6	10
8	14-Feb-95	123953	45.1	11
8	14-Feb-95	124018	45	12
8	14-Feb-95	124053	44.7	13
8	14-Feb-95	124123	44.6	14
8	14-Feb-95	124143	44.1	15
8	14-Feb-95	124213	44	16
8	14-Feb-95	124238	43.8	17
8	14-Feb-95	124258	43.6	17.4
7	12-Feb-95	163034	45.9	1
7	12-Feb-95	163059	45.4	2
7	12-Feb-95	163124	44.1	3
7	12-Feb-95	163144	43.7	4
7	12-Feb-95	163204	43.6	5
7	12-Feb-95	163224	43.6	6
7	12-Feb-95	163244	43.6	7
7	12-Feb-95	163259	43.5	8
7	12-Feb-95	163319	43.4	9
7	12-Feb-95	163339	43.3	10
7	12-Feb-95	163354	43.3	11
7	12-Feb-95	163409	43.2	12
7	12-Feb-95	163429	42.9	13
7	12-Feb-95	163449	42.8	14
7	12-Feb-95	163509	42.7	15
7	12-Feb-95	163529	42.4	16
7	12-Feb-95	163549	42.4	17
7	12-Feb-95	163614	42.3	18
7	12-Feb-95	163634	42.2	19
7	12-Feb-95	163649	42.1	19.8

Date (ddmmyy)	Loc	Time (hhmm)	Dye Conc (ppb)	Depth (meters)	Dye Conc (ppb)	Depth ft
12-Feb-95	I	52	0.09	0.3	0.09	0.98424
12-Feb-95	I	53	0.04	1	0.04	3.2808
12-Feb-95	I	54	0.03	2	0.03	6.5616
12-Feb-95	I	55	0.05	3	0.05	9.8424
12-Feb-95	I	56	0.05	4	0.05	13.1232
12-Feb-95	I	57	0.05	5	0.05	16.404
12-Feb-95	I	58	0.04	6	0.04	19.6848
12-Feb-95	I	59	0.03	7	0.03	22.9656
12-Feb-95	I	100	0.06	7.7	0.06	25.26216
12-Feb-95	I	1344	11.78	0.3	11.78	0.98424
12-Feb-95	I	1345	8.44	1	8.44	3.2808
12-Feb-95	I	1346	6.61	2	6.61	6.5616
12-Feb-95	I	1347	1.2	3	1.2	9.8424
12-Feb-95	I	1348	0.05	4	0.05	13.1232
12-Feb-95	I	1349	0.05	5	0.05	16.404
12-Feb-95	I	1350	0.04	6	0.04	19.6848
12-Feb-95	I	1351	0.1	7	0.1	22.9656
12-Feb-95	I	1352	0.03	8	0.03	26.2464
12-Feb-95	I	1353	0.02	9	0.02	29.5272
13-Feb-95	I	1047	48.4	0.3	48.4	0.98424
13-Feb-95	I	1048	45.66	1	45.66	3.2808
13-Feb-95	I	1049	39.43	2	39.43	6.5616
13-Feb-95	I	1050	18.68	3	18.68	9.8424
13-Feb-95	I	1051	4.79	4	4.79	13.1232
13-Feb-95	I	1052	0.49	5	0.49	16.404
13-Feb-95	I	1053	0.13	6	0.13	19.6848
13-Feb-95	I	1054	0.04	7	0.04	22.9656
13-Feb-95	I	1055	0.04	8	0.04	26.2464
13-Feb-95	I	1323	15.55	0.3	15.55	0.98424
13-Feb-95	I	1324	45.82	1	45.82	3.2808
13-Feb-95	I	1325	19.25	2	19.25	6.5616
13-Feb-95	I	1326	16.45	3	16.45	9.8424
13-Feb-95	I	1327	4.66	4	4.66	13.1232
13-Feb-95	I	1328	1.68	5	1.68	16.404
13-Feb-95	I	1329	1.83	6	1.83	19.6848
13-Feb-95	I	1330	0.12	7	0.12	22.9656
13-Feb-95	I	1331	0.07	8	0.07	26.2464

Date (ddmmyy)	Loc	Time (hhmm)	Dye Conc (ppb)	Depth (meters)	Dye Conc (ppb)	Depth ft
14-Feb-95	I	1207	28.83	0.3	28.83	0.98424
14-Feb-95	I	1208	23.74	1	23.74	3.2808
14-Feb-95	I	1209	31.25	2	31.25	6.5616
14-Feb-95	I	1210	39.01	3	39.01	9.8424
14-Feb-95	I	1211	69.62	4	69.62	13.1232
14-Feb-95	I	1212	52.74	5	52.74	16.404
14-Feb-95	I	1213	14.94	6	14.94	19.6848
14-Feb-95	I	1214	5.86	7	5.86	22.9656
14-Feb-95	I	1215	1.85	8	1.85	26.2464

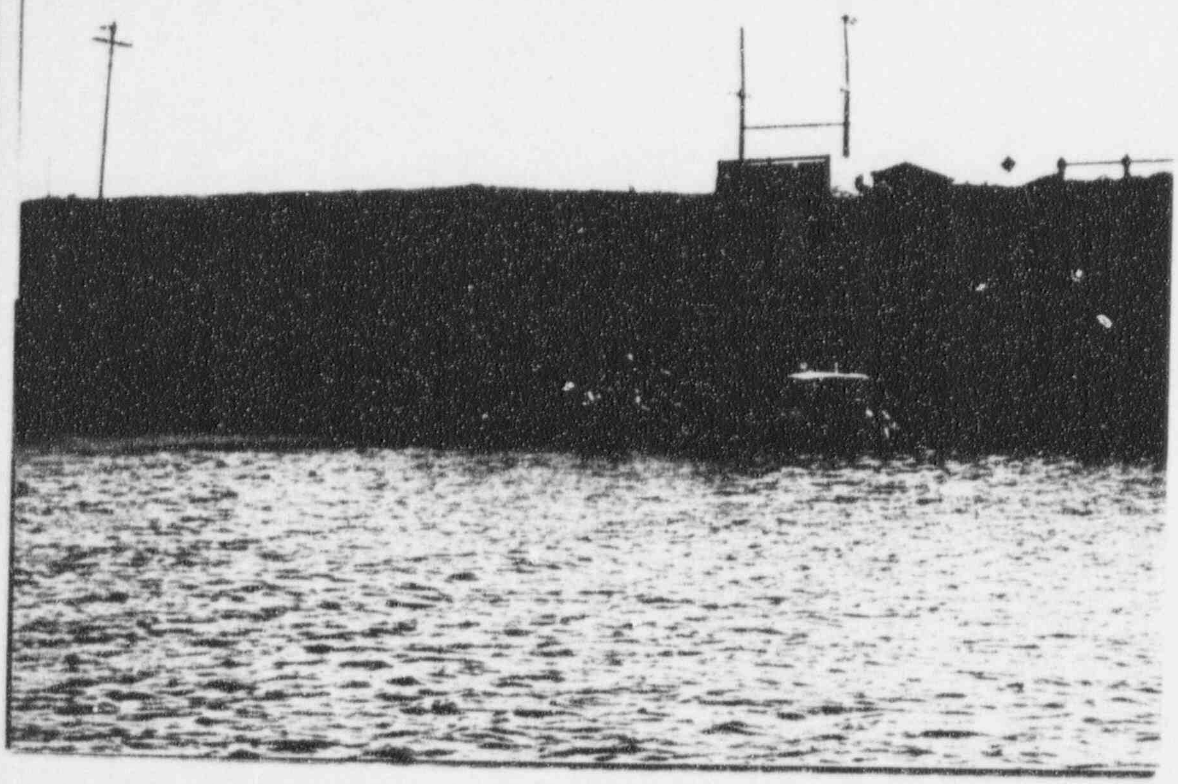
DATE	LOC	TIME	DYE CONC		DEPTH
(ddmmyy)		(hhmm)	(ppb)	(feet)	(meters)
				2/12/95 1002	
12-Feb-95	3	1002	0.08	0.98424	0.3
12-Feb-95	3	1003	0.05	3.2808	1
12-Feb-95	3	1004	0.03	6.5616	2
12-Feb-95	3	1005	0.02	9.8424	3
12-Feb-95	3	1006	0.07	13.1232	4
				2/12/95 1036	
12-Feb-95	3	1036	1988.63	0.98424	0.3
12-Feb-95	3	1037	1568.07	3.2808	1
12-Feb-95	3	1038	1735.18	6.5616	2
12-Feb-95	3	1039	59.12	9.8424	3
12-Feb-95	3	1040	0.49	13.1232	4
			2/12/95	/12/95 1446	
12-Feb-95	3	1446	170.71	0.98424	0.3
12-Feb-95	3	1447	183.68	3.2808	1
12-Feb-95	3	1448	8.43	6.5616	2
12-Feb-95	3	1449	0.24	9.8424	3
12-Feb-95	3	1450	0.12	13.1232	4
12-Feb-95	3	1451	0.1	16.404	5
12-Feb-95	3	1452	0.32	19.6848	6
				2/12/95 1648	
12-Feb-95	3	1648	171.61	0.98424	0.3
12-Feb-95	3	1649	184.57	3.2808	1
12-Feb-95	3	1650	28.07	6.5616	2
12-Feb-95	3	1651	0.16	9.8424	3
12-Feb-95	3	1652	0.04	13.1232	4
12-Feb-95	3	1653	0.08	16.404	5
				2/13/95 1012	
13-Feb-95	3	1012	10.74	0.98424	0.3
13-Feb-95	3	1013	9.15	3.2808	1
13-Feb-95	3	1014	15.68	6.5616	2
13-Feb-95	3	1015	10.6	9.8424	3
13-Feb-95	3	1016	0.82	13.1232	4
13-Feb-95	3	1017	0.21	16.404	5
				2/13/95 1255	
13-Feb-95	3	1255	10.07	0.98424	0.3
13-Feb-95	3	1256	15.02	3.2808	1
13-Feb-95	3	1257	33.65	6.5616	2
13-Feb-95	3	1258	1.13	9.8424	3
13-Feb-95	3	1259	0.74	13.1232	4
13-Feb-95	3	1300	0.14	16.404	5
				2/14/95 1151	
14-Feb-95	3	1151	32.88	0.98424	0.3
14-Feb-95	3	1152	36.48	3.2808	1
14-Feb-95	3	1153	40.55	6.5616	2
14-Feb-95	3	1154	65.05	9.8424	3
14-Feb-95	3	1155	56.6	13.1232	4
14-Feb-95	3	1156	23.88	16.404	5

Date (ddmmyy)	Loc	Time (hhmm)	Dye Conc (ppb)	Depth (feet)	Depth (meters)
12-Feb-95	7	1634	26.63	0.98424	0.3
12-Feb-95	7	1635	2.3	3.2808	1
12-Feb-95	7	1636	0.91	6.5616	2
12-Feb-95	7	1637	0.22	9.8424	3
12-Feb-95	7	1638	0.03	13.1232	4
12-Feb-95	7	1639	0.04	16.404	5
12-Feb-95	7	1640	0.04	19.6848	6
13-Feb-95	8	1026	46.55	0.98424	0.3
13-Feb-95	8	1027	46.62	3.2808	1
13-Feb-95	8	1028	47.54	6.5616	2
13-Feb-95	8	1029	49.9	9.8424	3
13-Feb-95	8	1030	55.67	13.1232	4
13-Feb-95	8	1031	12.09	16.404	5
13-Feb-95	8	1032	3.11	18.0444	5.5

Photographs and Descriptions

Number	Description
1	2/12/95 9:40 am (Taken just before dye addition) Short-arm discharge structure
2	2/12/95 10:00 am (15 min after start of dye injection) Taken from short-arm discharge structure
3	2/12/95 10:00 am (15 min after start of dye injection) Taken from bank opposite short-arm discharge structure
4	2/12/95 10:30 am (45 min after start of dye injection) Taken from pier looking up short-arm
5	2/12/95 12:45 am (3 hour after start of dye injection) Taken from dam looking up short-arm
6	2/12/95 12:45 am (3 hour after start of dye injection) Taken from pump-house hill looking up short-arm
7	2/12/95 12:45 am (3 hour after start of dye injection) Taken from pier stairway looking up short-arm
8	2/12/95 12:45 am (3 hour after start of dye injection) Taken from pump-house hill looking up short-arm
9	2/12/95 12:45 am (3 hour after start of dye injection) Taken from pump-house hill looking up short-arm
10	2/12/95 1:45 pm (4-hr after dye added) From dam looking up short-arm of pond
11	2/12/95 1:45 pm (4-hr after dye added) From dam looking up short-arm of pond
12	2/12/95 1:45 pm (4-hr after dye added) Picture taken from pier looking at short-arm of pond
13	2/12/95 1:45 pm (4-hr after dye added) Picture of short-arm of pond taken from top of hill near pump house
14	2/12/95 2:45 pm (5-hr after dye added) Picture taken from dam. Short-arm of pond in foreground. Long-arm of pond in background.
15	2/12/95 2:45 pm (5-hr after dye added) Picture taken from dam. Short-arm of pond in foreground. Long-arm of pond in background.
16	2/12/95 2:45 pm (5-hr after dye added) Picture taken from dam. Short-arm of pond in foreground. Long-arm of pond in background.
17	2/12/95 2:45 pm (5-hr after dye added) Picture taken from dam. Short-arm of pond in foreground. Long-arm of pond in background.
18	2/12/95 3:45 pm (6-hr after dye added) Picture taken from dam. Looking at boat ramp. Long-arm of pond in background.
19	2/12/95 3:45 pm (6-hr after dye added) Picture taken from dam. Looking at boat ramp. Long-arm of pond in background.
20	2/12/95 3:45 pm (6-hr after dye added) Picture taken from boat house roof. Looking towards boat ramp. Long-arm of pond in background.
21	2/12/95 3:45 pm (6-hr after dye added) Picture taken from boat house roof.

1



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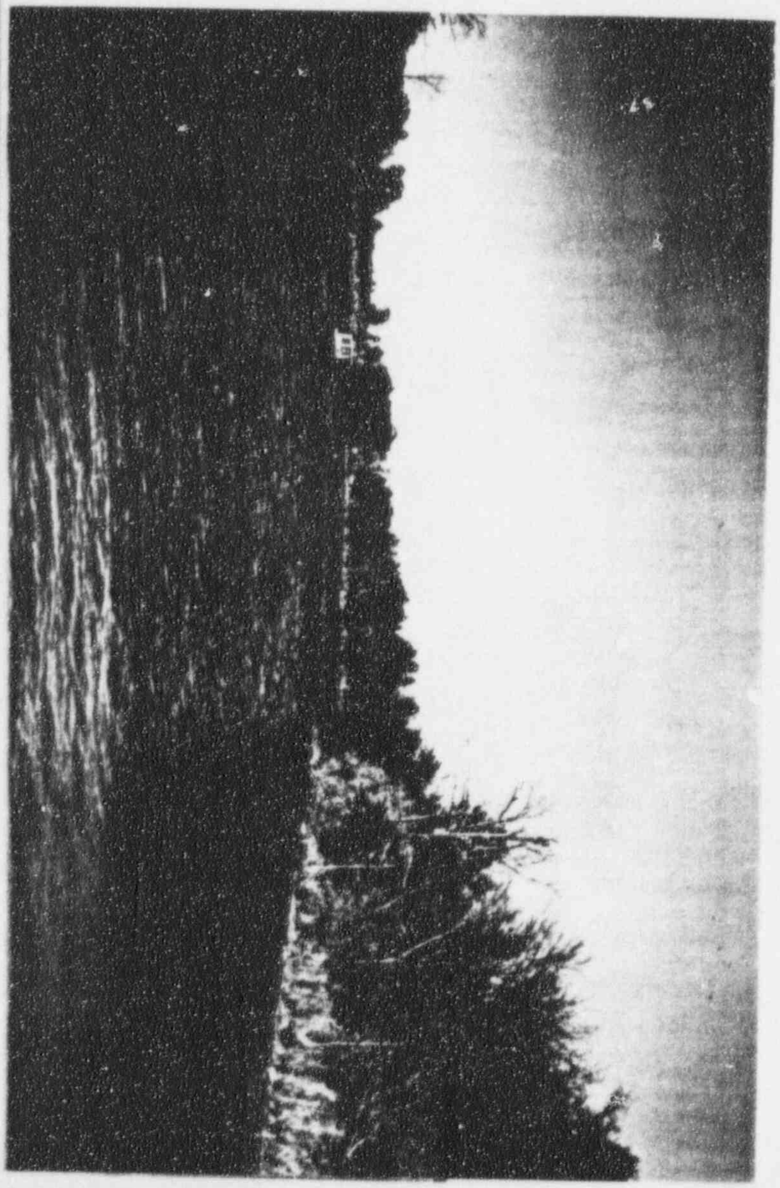

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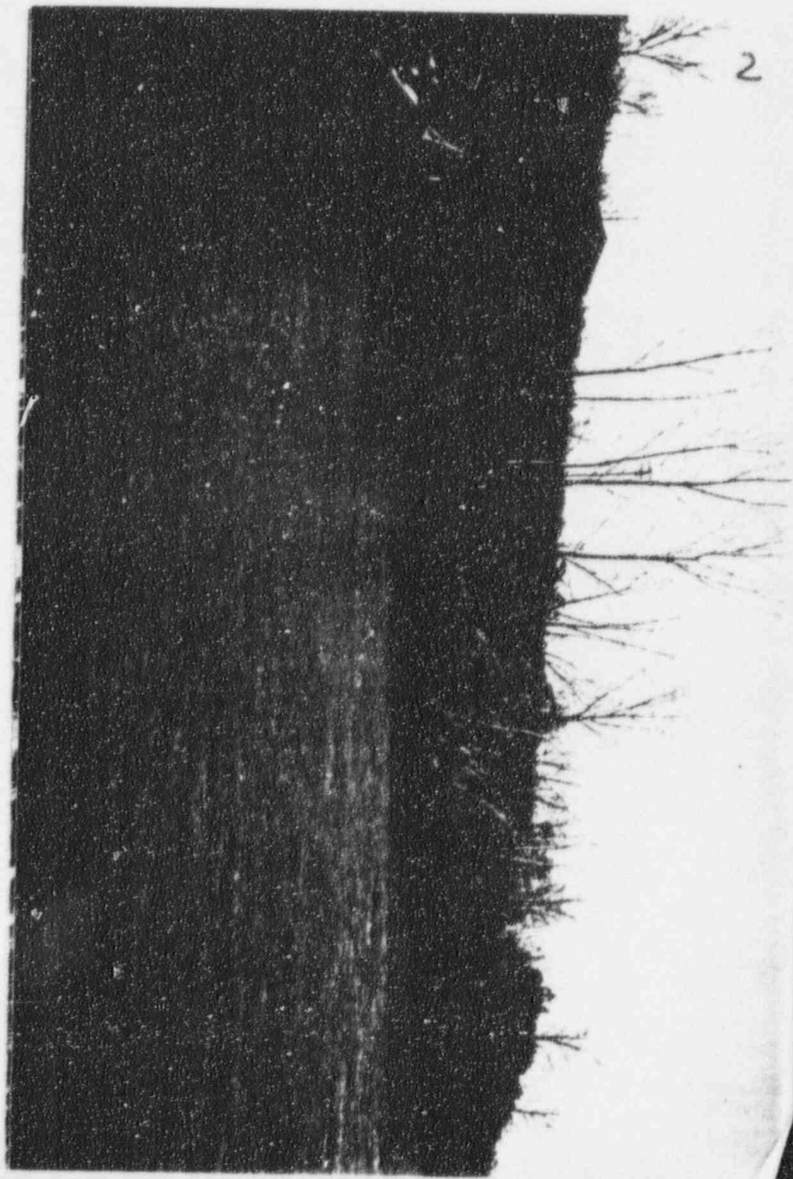

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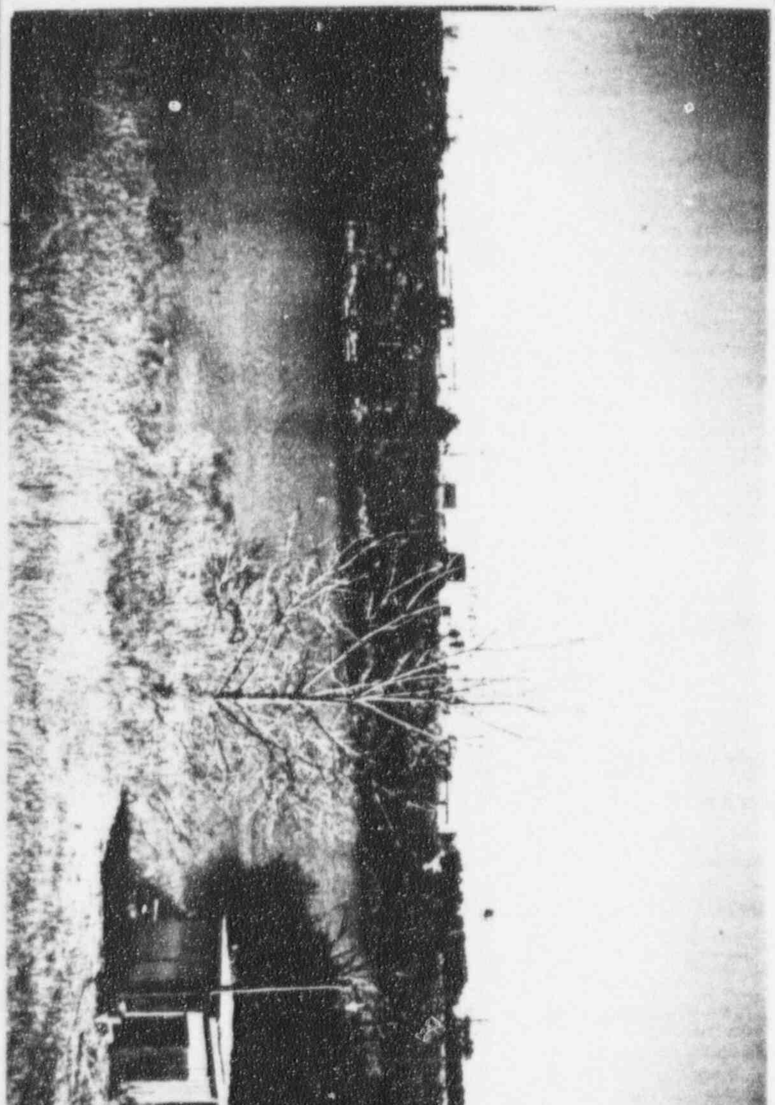

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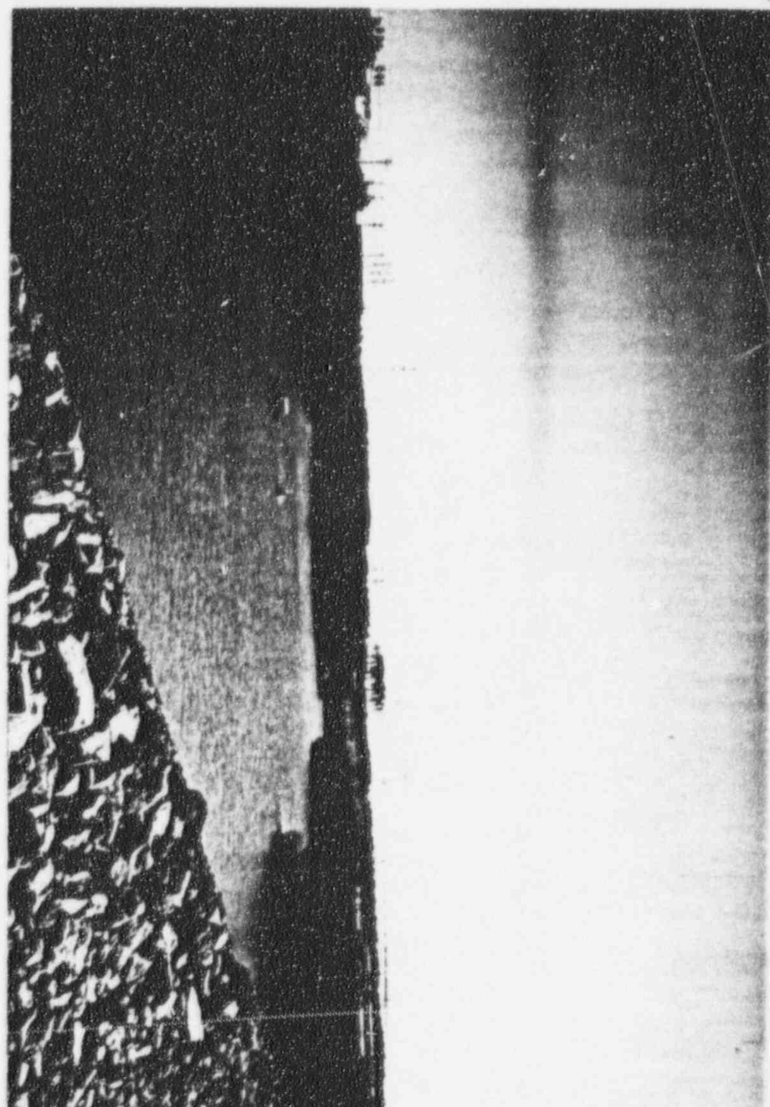

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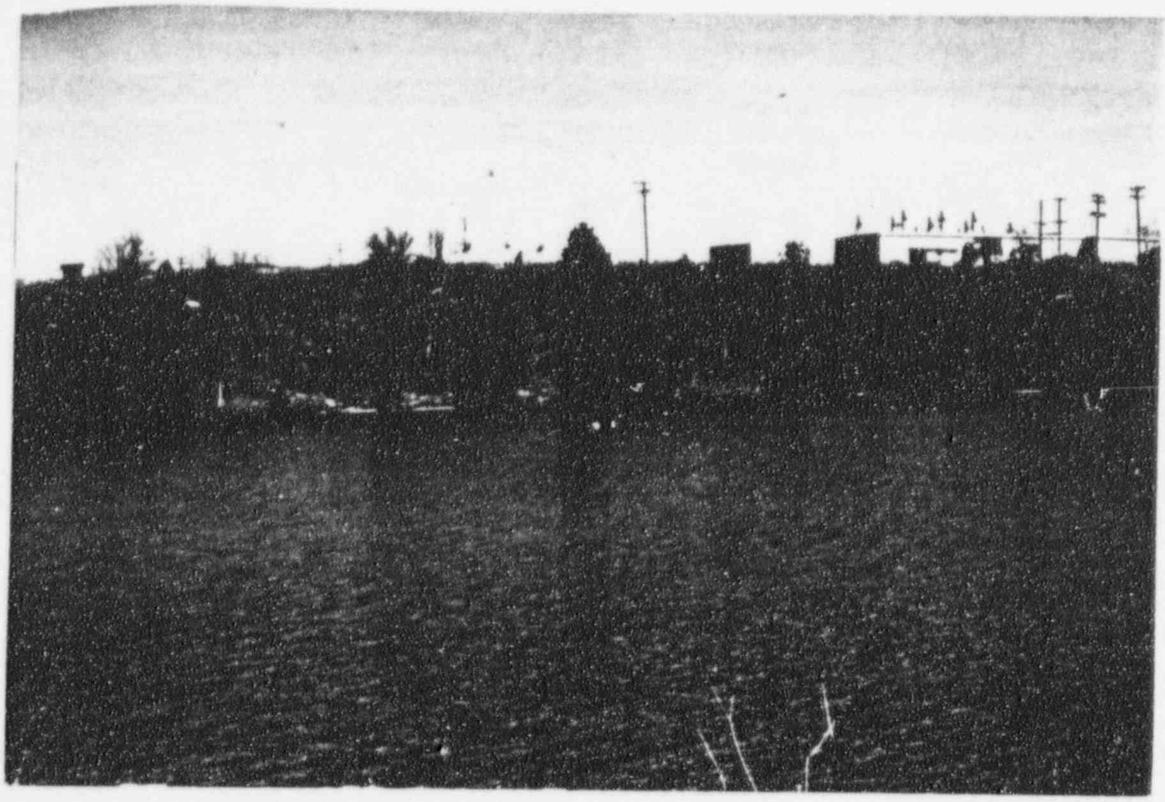

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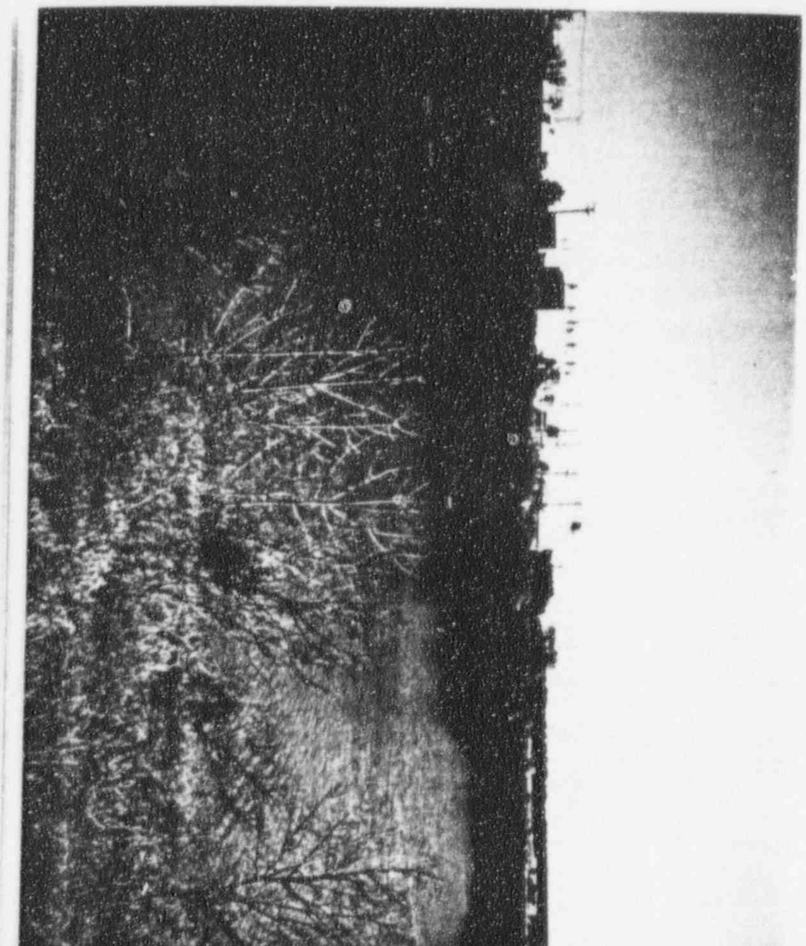

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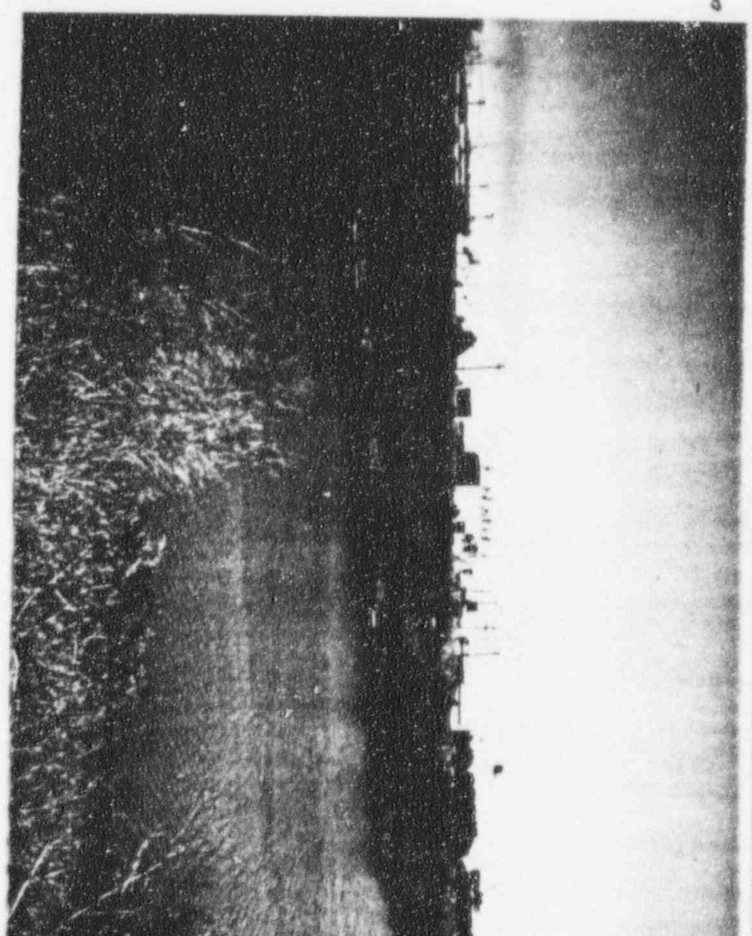

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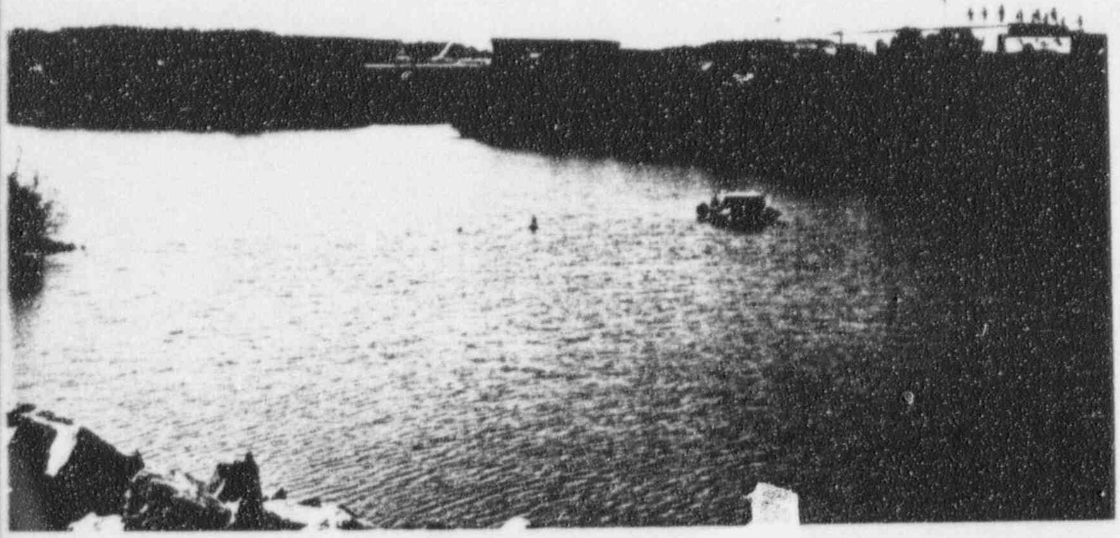

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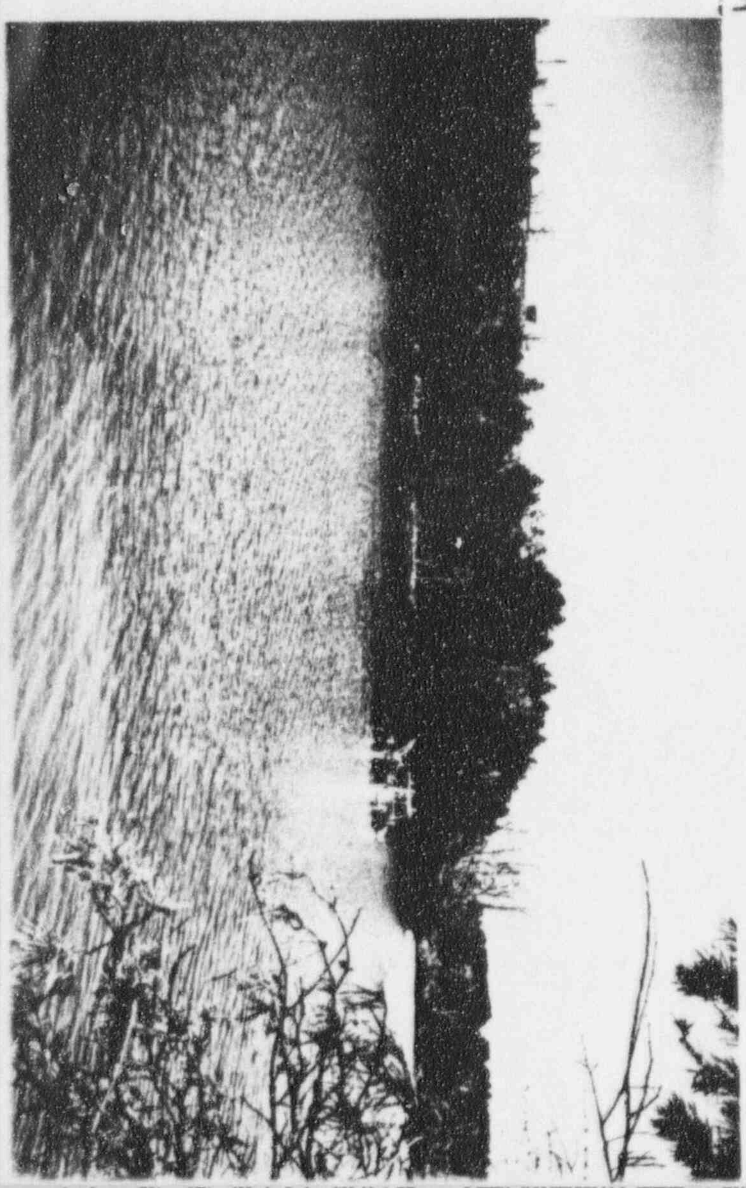

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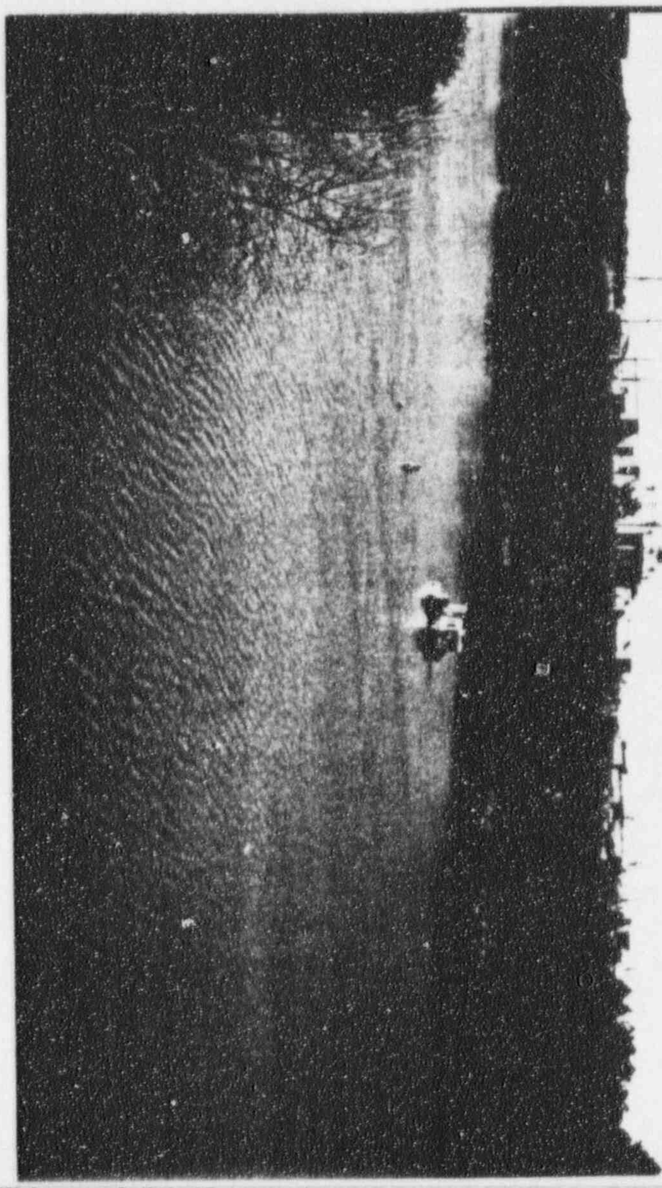

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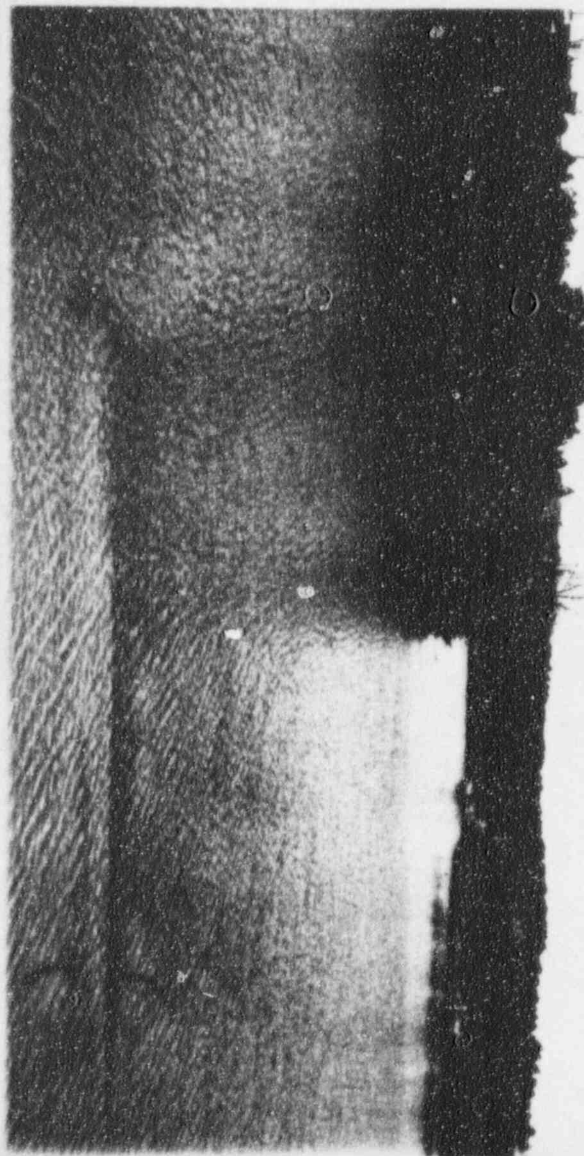

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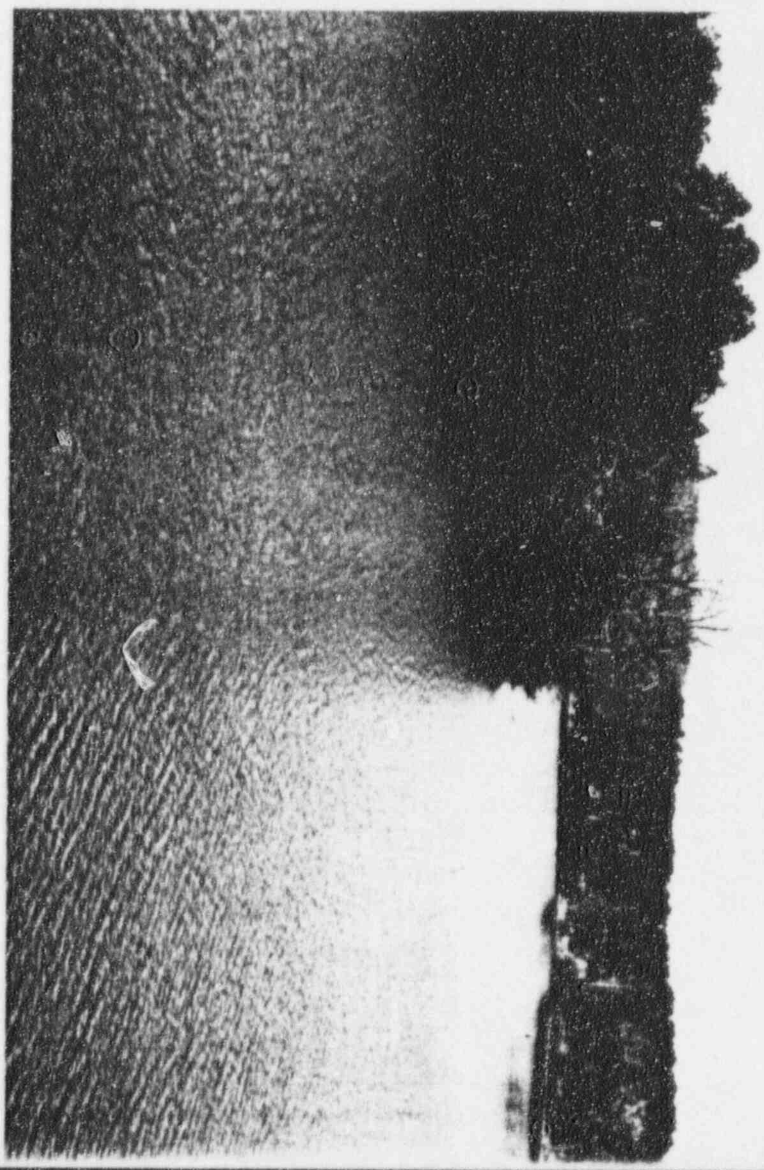

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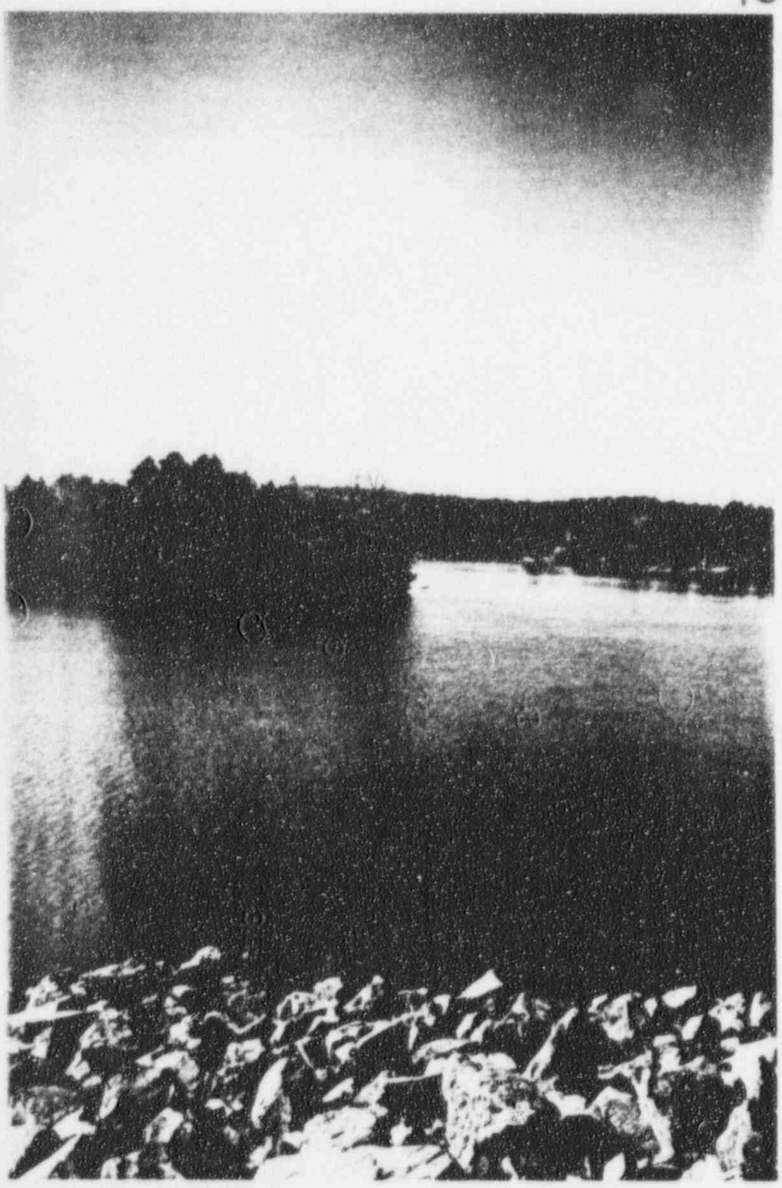

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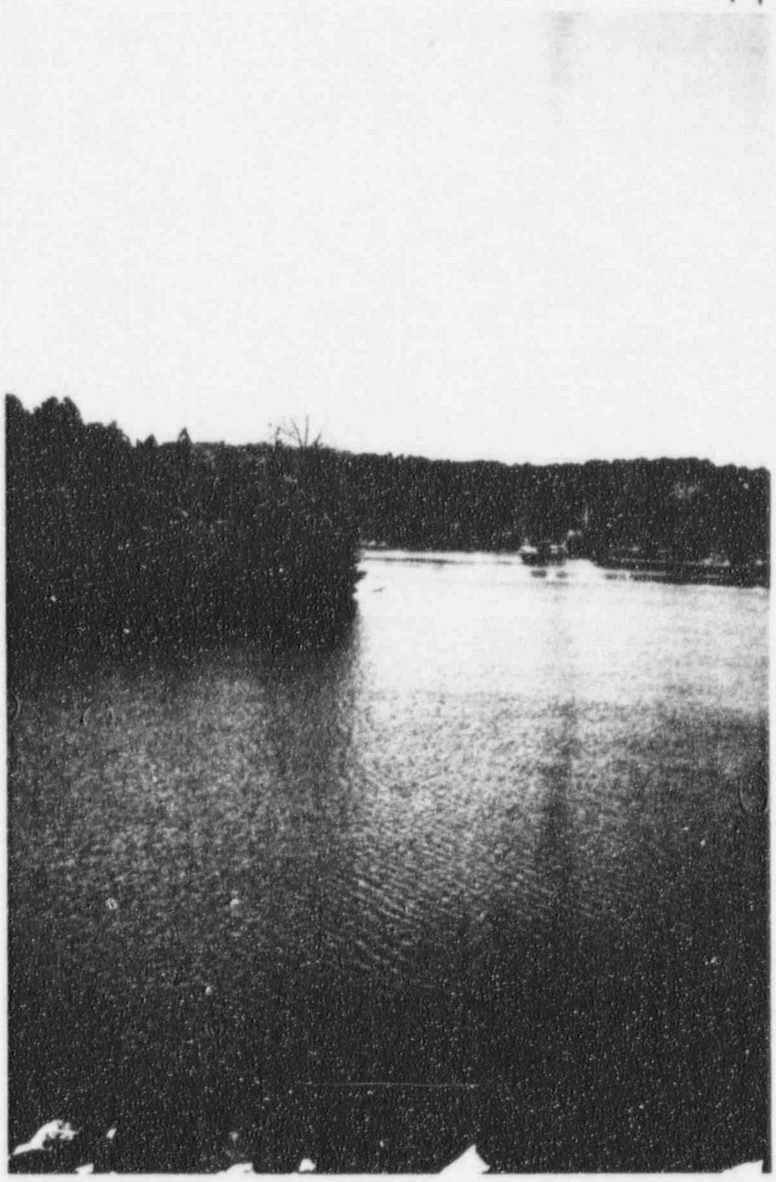

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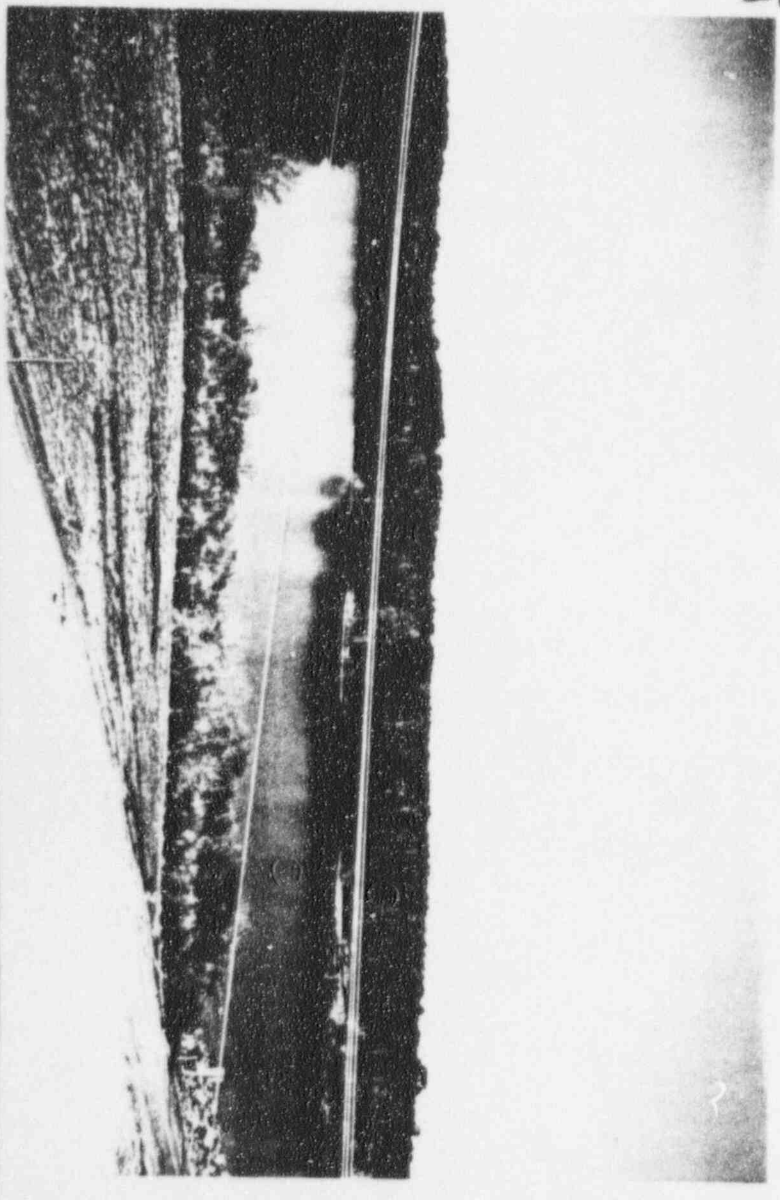

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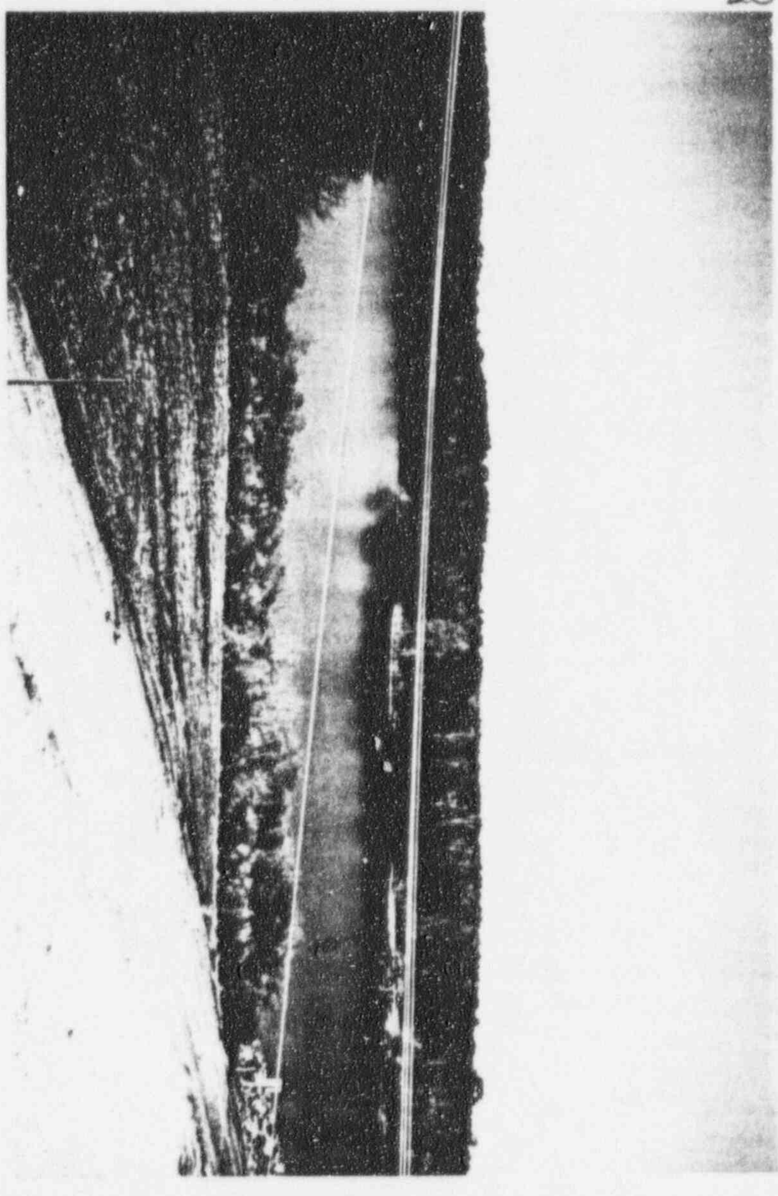

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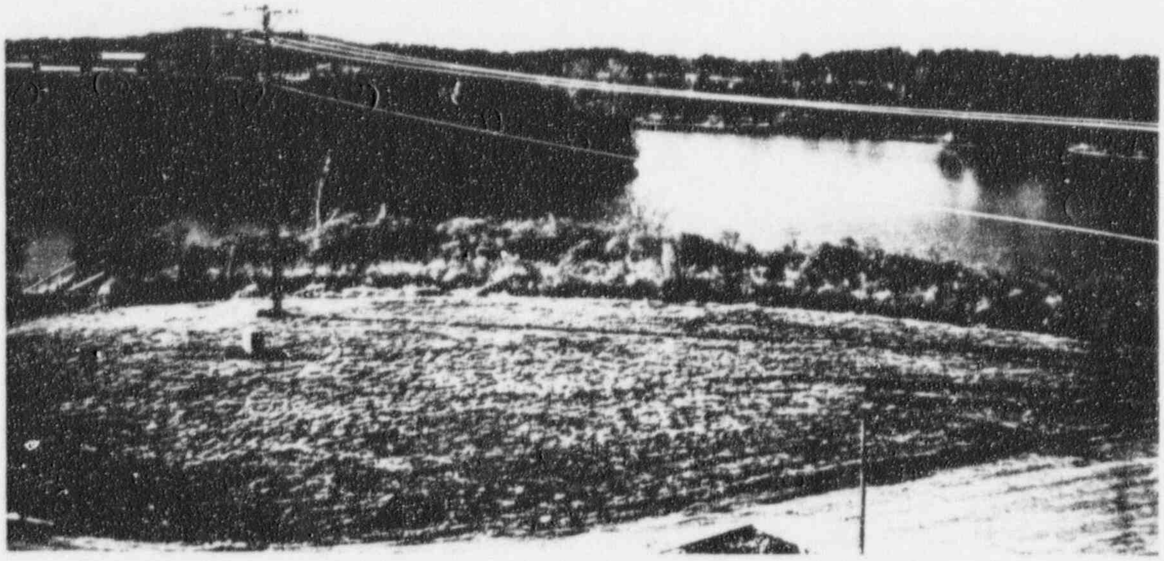

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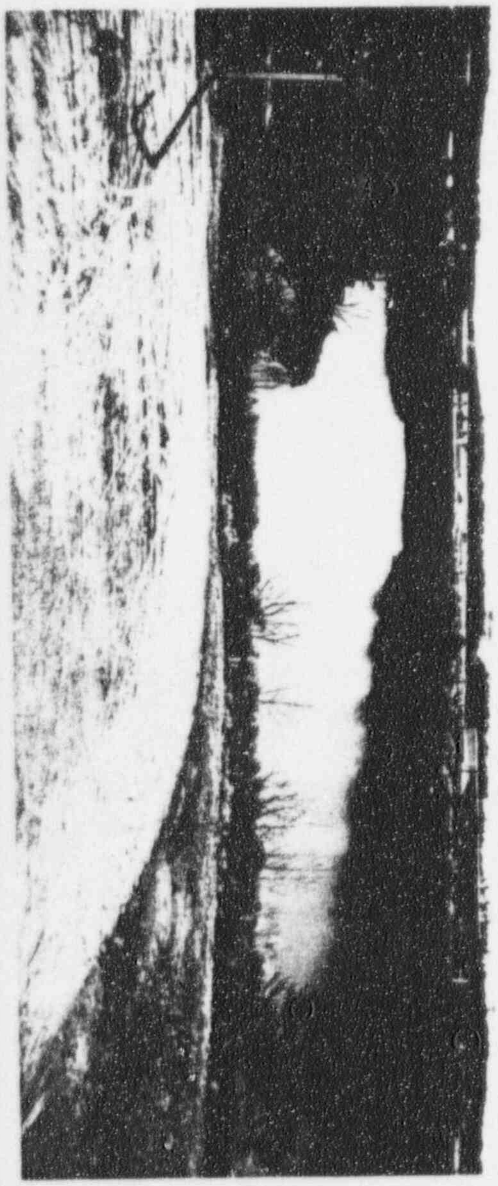

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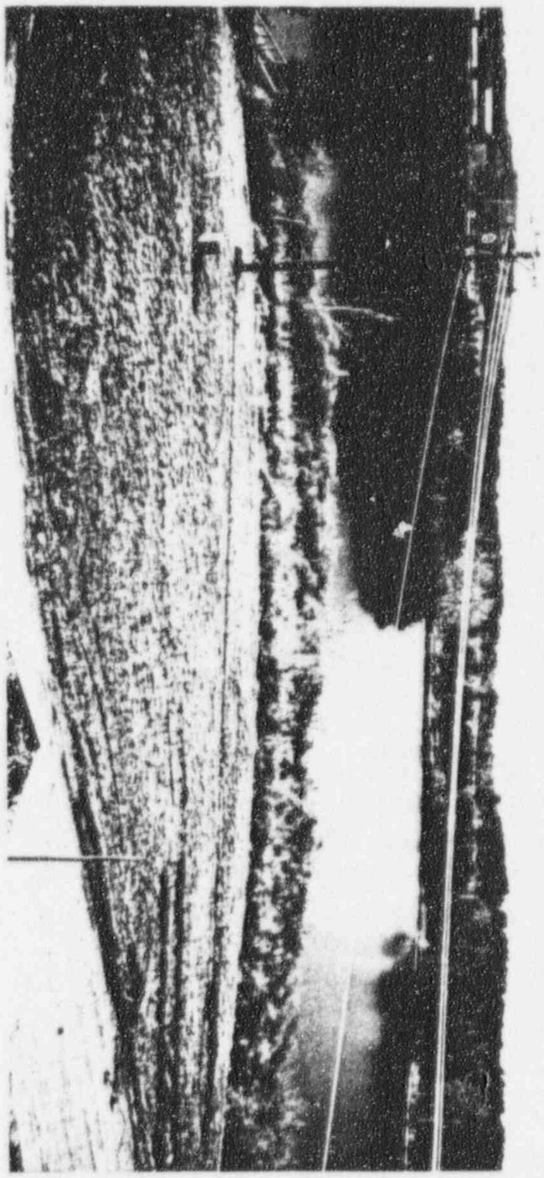

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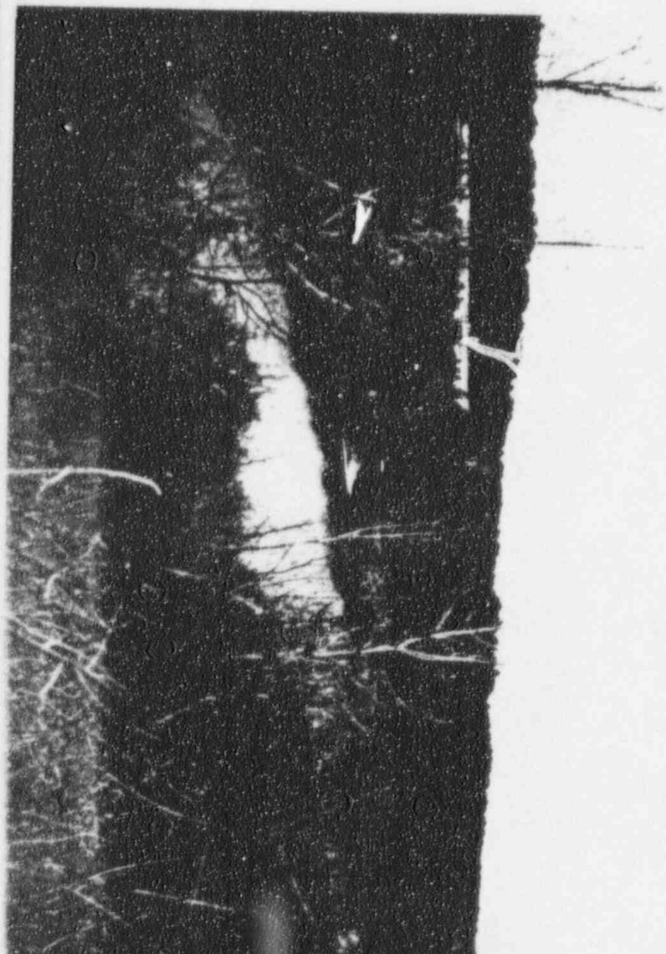

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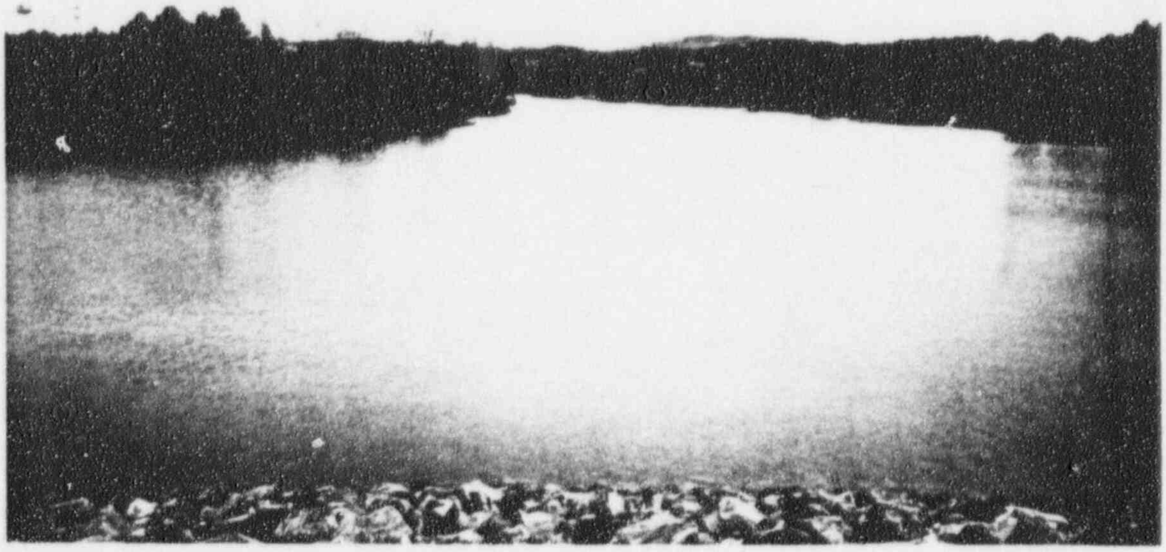

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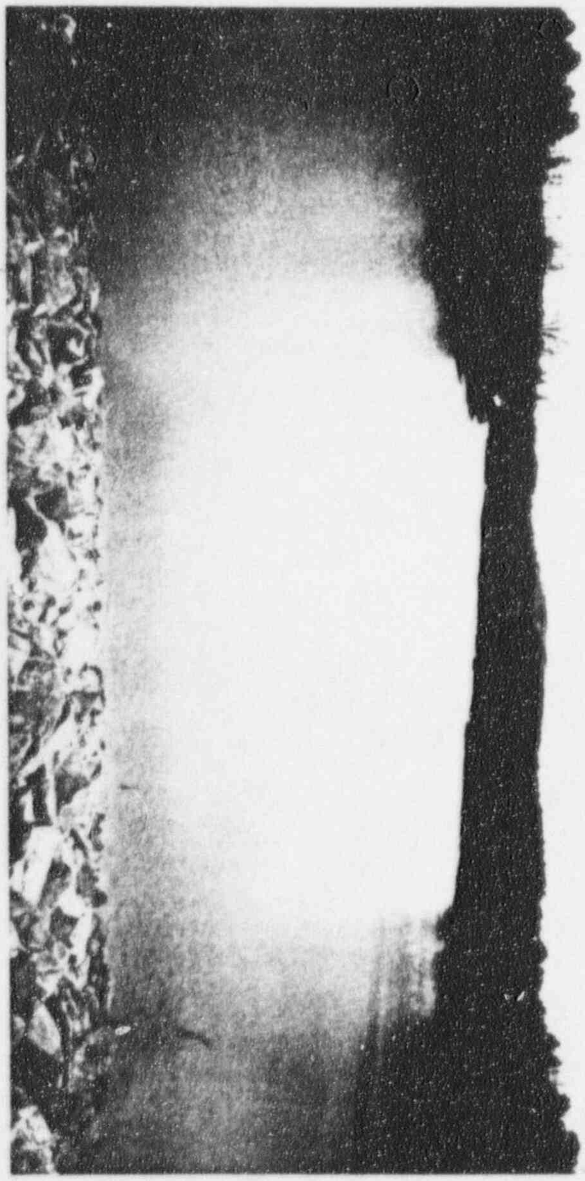

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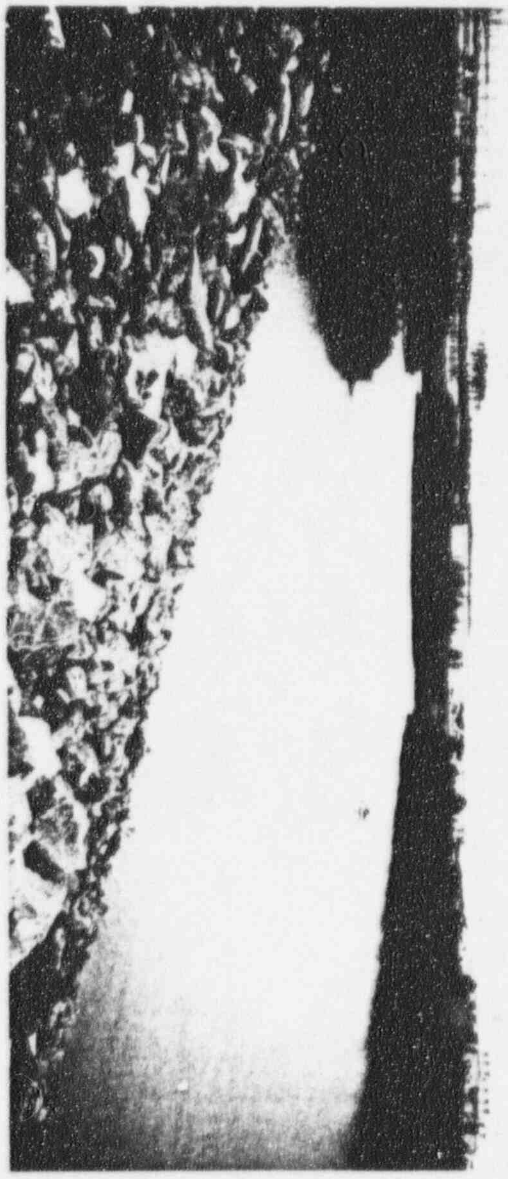

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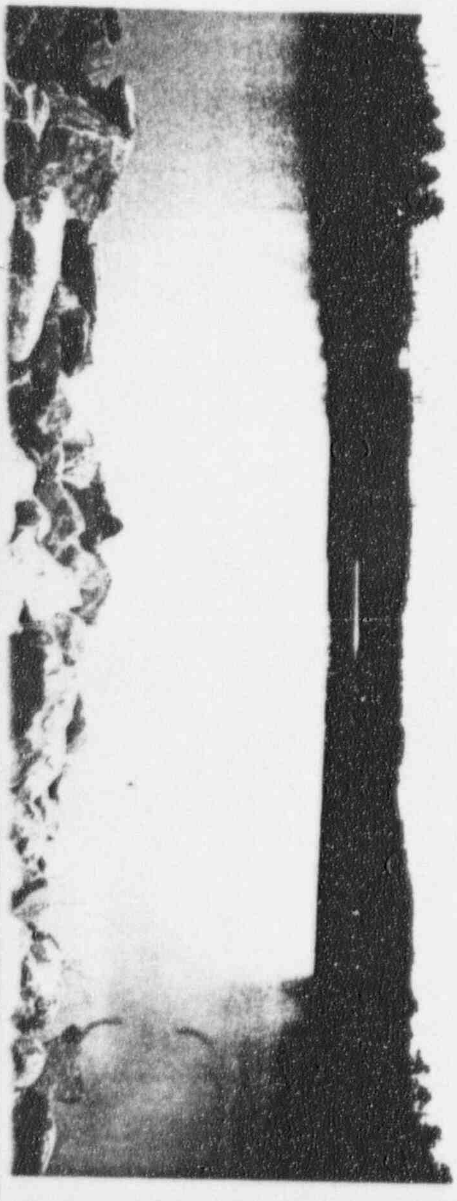

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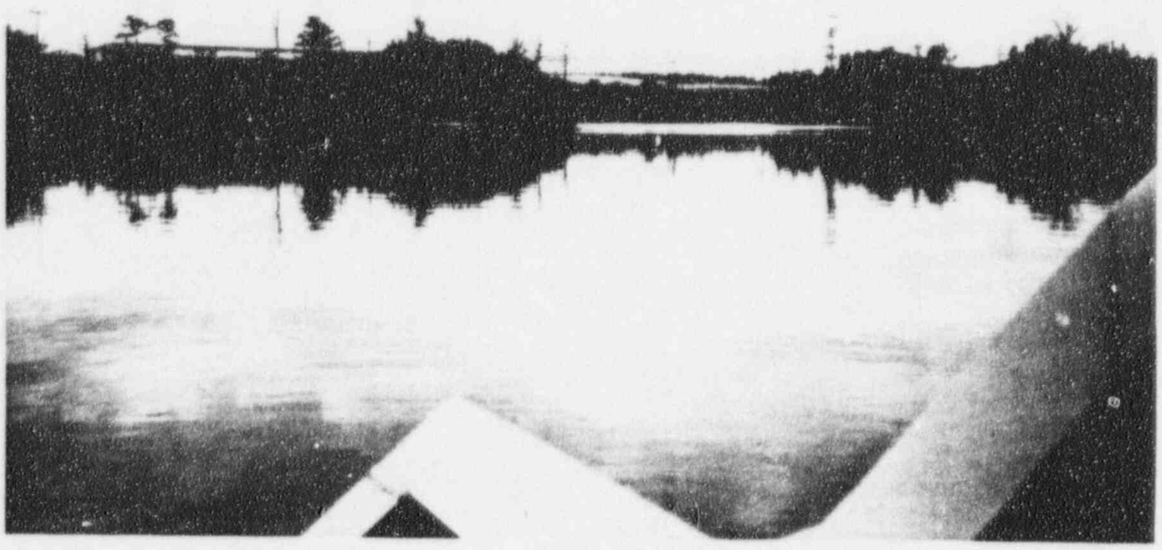

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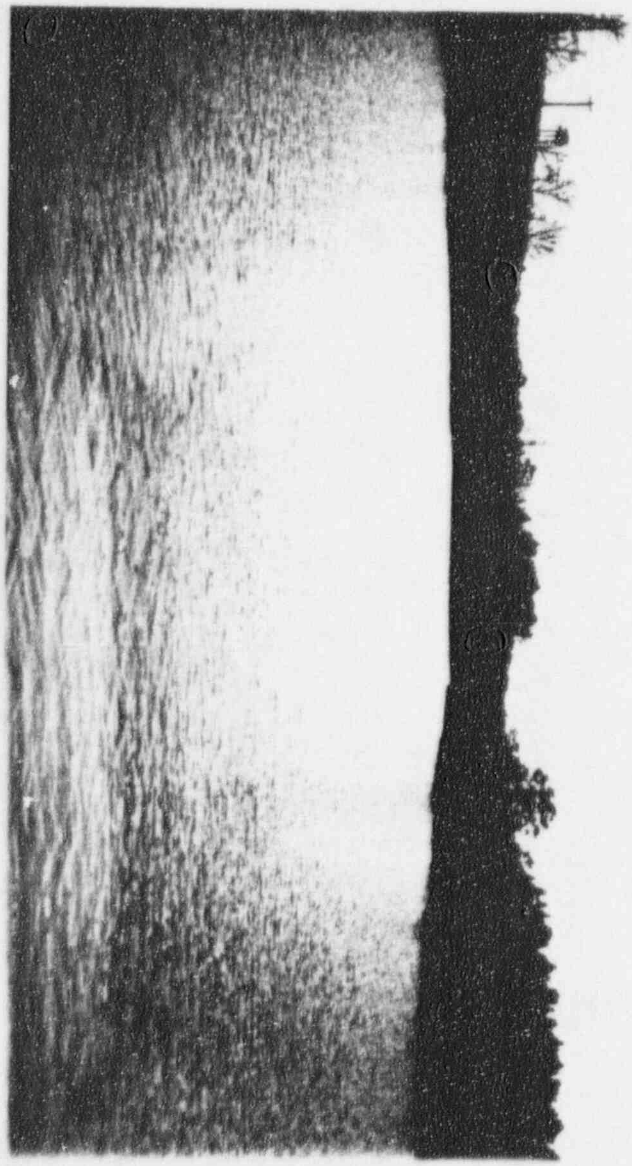

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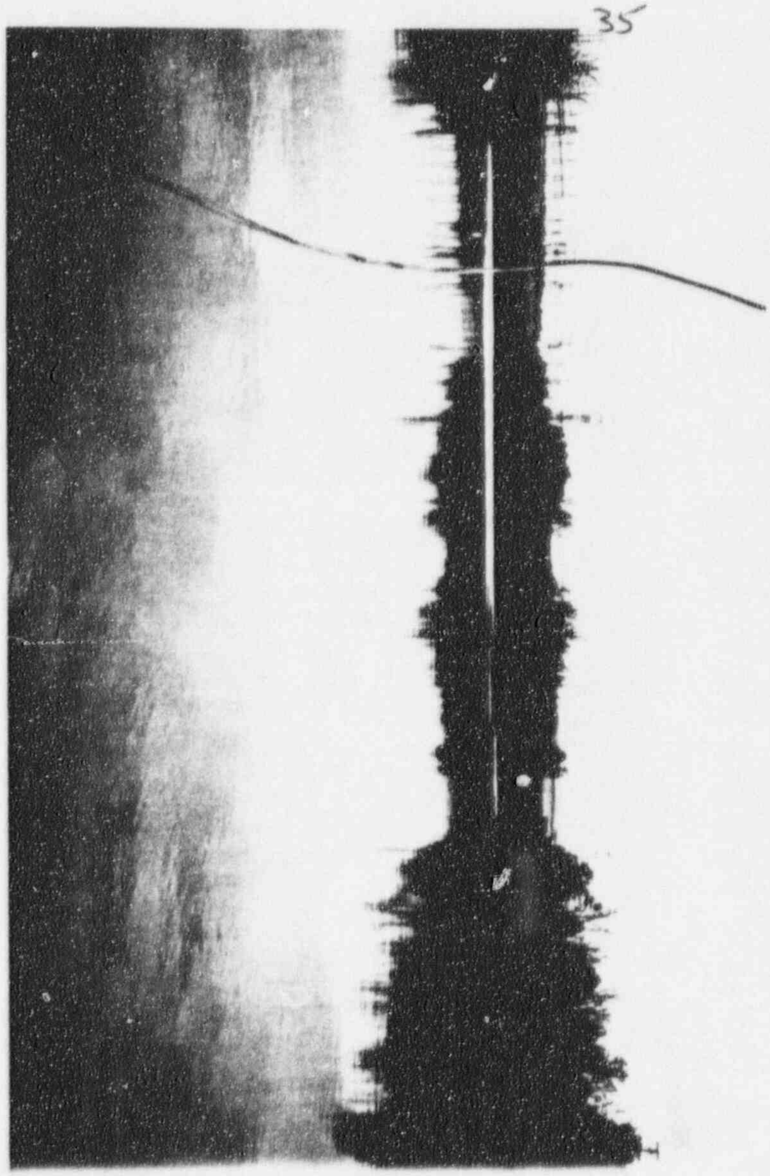

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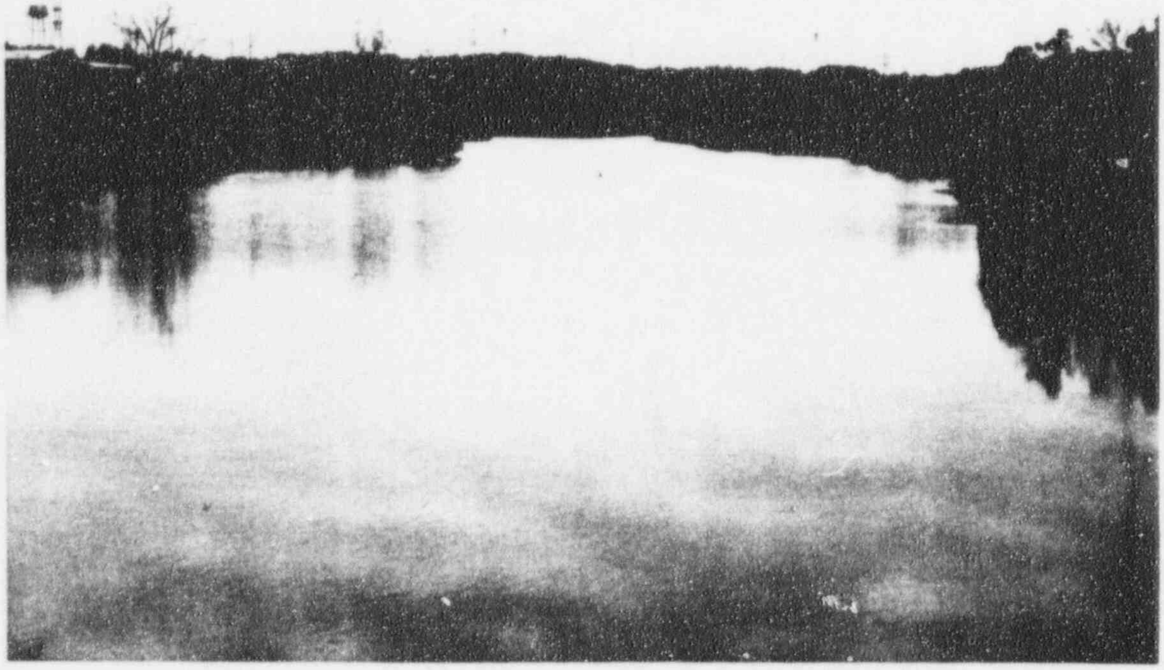

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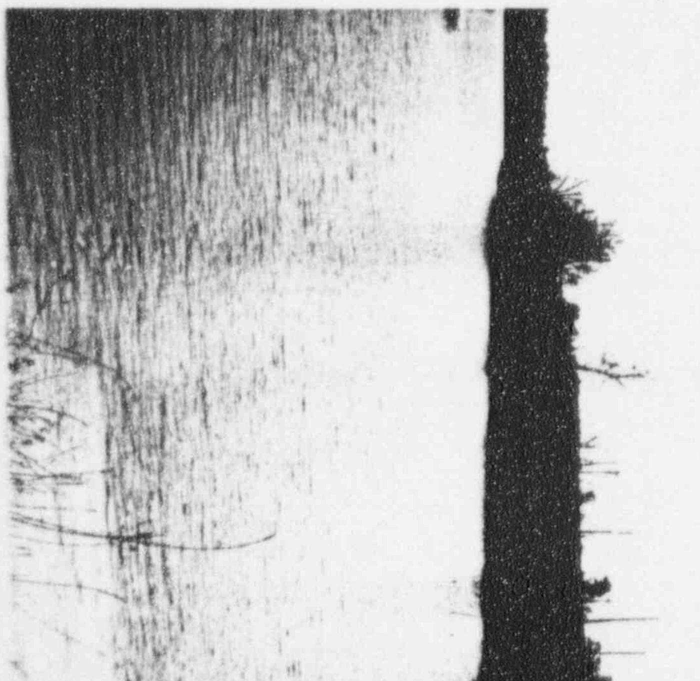

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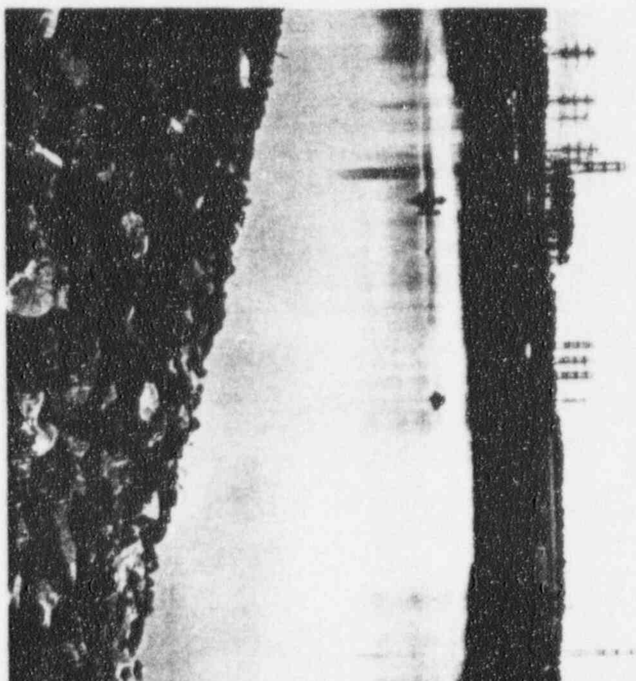

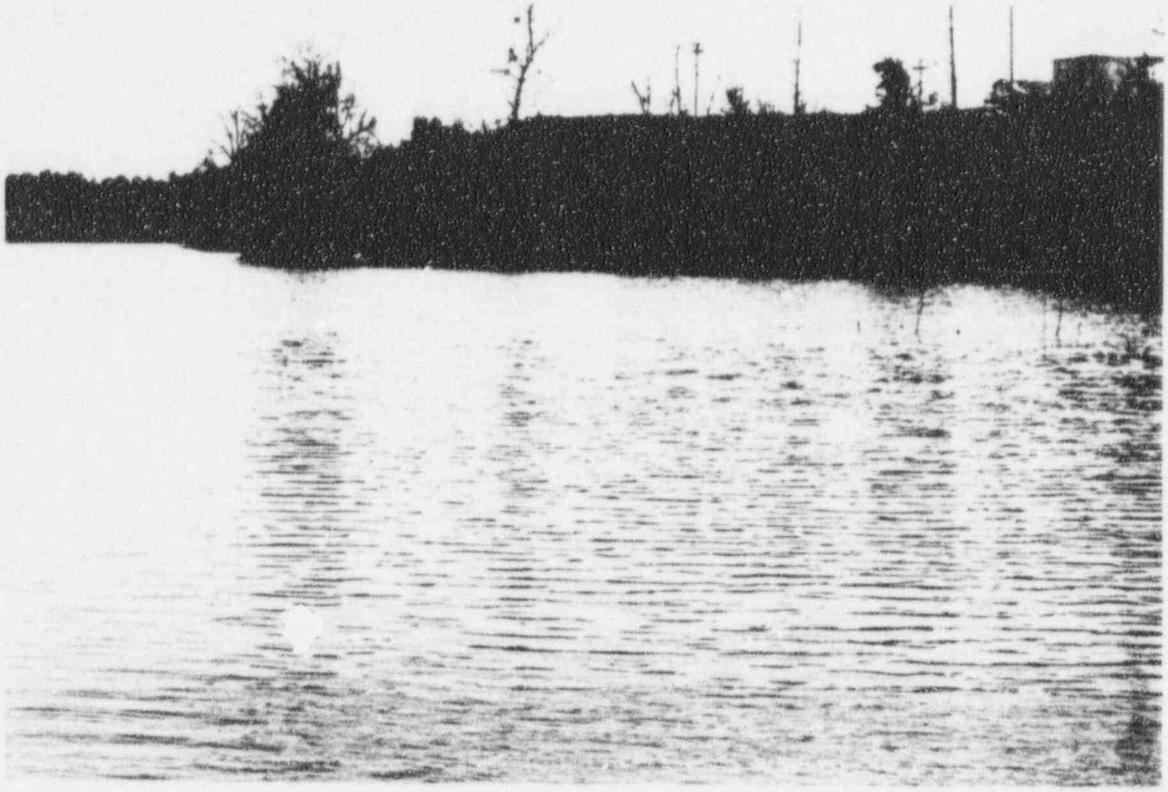

```
         1        .ASET: CNPHYTES.DATA

  CATAWBA     PLANT
       -WORST HEAT TRANSFER-       TITLE
  720         T1:   # OF HOURS INPUT
   20         L1:   # OF UNIT VOLUME LAYERS
   20         K2:   OUTPUT CHECK SPACING
C
   30         S1:   # OF VERTICAL STAGES (FT)
C
C        S(I,1):    VOLUME IN POND AT EACH STAGE (ACFT)
C
0 0 0 0 0 1 1 2 6 10 16 23 32 41
53 66 79 92 113 133 154 176 200 224 251 279 310 341
374 410
C
C        S(I,2):    INITIAL TEMPERATURE AT EACH STAGE (F)
C
   42 42 42 42 42 42 42 42
   42 42 42 42 42 42 42 42
   42 42 42 42 42 42 42 42
   42 42 42 42 42 42
C
C        LOOPING VALUES AND PLANT FLOWS FOR T(I,3) (1000*CU.FT/HR)
C
    4  91.4
  720  85.7
C
C        T(I,1):    INPUT HEAT (MBTU/HR)
C
120 120 120 120 120 120 120 120
120 120 120 120 120 120 120 120
120 120 120 120 120 120 120 120
120 120 120 120 120 120 120 120
159.3 159.3 151.0 151.0 142.0 142.0 142.0 142.0
142.0 142.0 142.0 128.5 128.5 128.5  85.5  77.1
 69.8  63.9  59.6  59.6
C
C A(J) P(J) W(J) Y(J) E(J)
C
44 30 8 83 43
44 30 8 83 43
33 30 8 83 43
89 72 2 189 94
91 71 2 198 95
83 72 5 197 85
79 71 3 142 81
83 71 3 166 86
72 61 5 154 73
73 58 3 166 82
75 60 2 163 86
77 62 4 187 84
78 63 4 167 80
72 66 3 135 77
73 69 3 133 78
77 70 2 157 86
77 68 4 159 80
```

Stratified model

.TASET: CN/HYTES.DATA

72	55	2	131	77
74	60	3	155	80
77	63	1	153	88
77	65	2	149	84
78	68	3	170	85
76	69	3	149	81
78	71	2	133	82
80	70	3	159	84
80	71	3	164	85
83	72	3	159	84
86	69	3	178	87
88	69	2	190	93
87	70	3	194	90

CATAHBA -WORST HEAT TRANSFER- PAGE

3 days modeled

TIME	REAL TIME	DISC TEMP	HEAT LOSS	COOL DOWN	UN MIX	MIXED TEMP	INTAKE TEMP	EVAP AC-FT	E	K	TEMP TCFH
1	9.8	63.04	12.30	50.74	19	42.00	42.00	0.28	43	83	91
11	20.2	64.44	13.66	50.78	19	50.74	42.00	0.60	43	83	86
21	30.6	64.44	13.66	50.78	19	50.78	42.00	0.91	43	83	86
32	41.0	64.44	13.66	50.78	18	50.78	42.00	1.23	43	83	86
42	51.4	64.44	13.66	50.78	17	50.78	42.00	1.56	43	83	86
52	61.9	64.44	13.66	50.78	16	50.78	42.00	1.90	43	83	86
63	72.3	71.79	20.01	91.79	19	50.78	42.00	1.90	94	189	86
73	82.7	71.79	20.01	91.79	19	91.79	42.00	1.90	94	189	86
84	93.1	70.24	21.40	91.74	18	91.74	42.00	1.90	94	189	86
94	103.5	70.24	22.56	92.80	19	91.74	42.00	1.90	95	198	86
105	114.0	68.55	24.09	92.72	19	92.72	42.00	1.90	95	198	86
115	124.4	68.55	14.96	90.70	15	90.70	42.00	1.90	85	197	86
125	134.8	68.55	14.96	89.67	14	89.67	42.00	1.90	85	197	86
136	145.2	68.55	10.25	88.31	13	88.31	42.00	1.90	81	142	86
146	155.6	68.55	10.25	87.26	12	87.26	42.00	1.90	81	142	86
157	166.1	68.55	10.25	86.41	11	86.41	42.00	1.90	81	142	86
167	176.5	68.55	15.15	86.17	10	86.17	42.00	1.90	86	166	86
177	186.9	66.03	17.34	85.93	9	85.93	42.00	1.90	86	166	86
188	197.3	66.03	-5.91	84.86	8	84.86	42.00	1.90	73	154	86
198	207.7	66.03	-5.91	83.93	7	83.93	50.74	1.90	73	154	86
209	218.2	66.73	13.26	83.67	6	63.67	50.78	1.9C	82	166	86
219	228.6	66.76	13.23	83.44	5	83.44	50.78	1.90	82	166	86
230	239.0	66.76	13.23	83.24	4	83.24	50.78	1.90	82	166	86
240	249.4	66.76	16.61	83.37	19	83.24	50.78	1.90	86	163	86
250	259.8	66.76	16.61	83.37	19	83.37	50.78	1.90	86	163	86
261	270.3	66.[illegible]6	15.48	83.20	1	83.20	83.20	1.90	84	187	86
271	28[illegible].7	99.19	13.64	85.55	19	83.20	83.20	2.59	84	187	86
282	291.1	99.19	16.70	84.02	19	84.02	83.20	3.21	80	167	86
292	301.5	99.19	16.70	83.51	18	83.51	83.20	3.82	80	167	86
303	311.9	97.62	15.33	83.21	17	83.21	83.20	4.40	80	167	86
313	322.4	97.62	16.66	83.09	1	83.09	83.09	4.87	77	135	86
323	332.8	97.51	16.57	82.98	1	82.98	82.98	5.34	77	135	86
334	343.2	97.40	15.58	82.93	1	82.93	82.93	5.77	78	133	86
344	353.6	97.34	15.53	82.87	1	82.87	82.87	6.21	78	133	86
355	364.0	97.29	9.63	87.66	19	82.87	82.87	6.64	86	157	86
365	374.5	97.29	9.63	87.66	19	87.66	82.87	7.07	86	157	86
375	384.9	97.29	14.81	85.93	18	85.93	82.87	7.57	80	159	86
386	39[illegible].3	97.29	[illegible].81	85.07	17	85.07	82.87	8.07	80	159	86
396	40[illegible].7	97.29	[illegible]	84.55	16	84.55	82.87	8.57	80	159	86
407	416.1	95.92	[illegible]	83.93	15	83.93	82.87	9.08	77	131	86
417	426.6	95.92	[illegible]	83.48	14	83.48	82.87	9.58	77	131	86
428	437.0	95.92	13[illegible]	83.35	13	83.35	82.87	10.12	80	155	86
438	447.4	95.92	13.[illegible]	83.24	12	83.24	82.87	10.66	80	155	86
448	457.8	95.92	6.70	89.22	19	83.24	82.87	11.11	88	153	86
459	468.2	95.92	6.70	89.22	19	89.22	82.87	11.55	88	153	86
469	478.7	95.92	6.70	89.22	18	89.22	82.87	12.00	88	153	86
480	489.1	95.92	9.99	88.40	17	88.40	82.87	12.45	84	149	86
490	499.5	95.92	9.99	87.91	16	87.91	82.87	12.90	84	149	86
501	509.9	94.82	8.59	87.63	15	87.63	82.87	13.35	85	170	86
511	520.3	94.82	8.59	87.43	14	87.43	82.87	13.81	85	170	86

TIME	REAL TIME	DISC TEMP	HEAT LOSS	COOL DOWN	UN MIX	MIXED TEMP	INTAKE TEMP	EVAP AC-FT	E	K	TEMP TCFH
521	530.8	94.82	11.58	86.90	13	86.90	82.87	14.21	81	149	86
532	541.2	94.82	11.58	86.50	12	86.50	82.87	14.61	81	149	86
542	551.6	94.82	11.58	86.17	11	86.17	82.87	15.01	81	149	86
553	562.0	94.82	10.29	86.02	10	86.02	83.24	15.34	82	133	86
563	572.4	95.19	10.59	85.90	9	85.90	83.24	15.68	82	133	86
573	582.9	95.19	9.59	85.88	8	85.88	83.24	16.09	84	159	86
584	593.3	95.19	9.59	85.86	7	85.86	83.24	16.50	84	159	86
594	603.7	95.19	8.82	86.37	19	85.86	83.24	16.91	85	164	86
605	614.1	94.39	8.12	86.32	19	86.32	83.24	17.30	85	164	86
615	624.5	94.39	8.90	86.04	18	86.04	83.24	17.65	84	159	86
626	635.0	94.39	8.90	85.90	17	85.90	83.24	18.00	84	159	86
636	645.4	94.39	8.90	85.85	2	85.85	83.24	18.35	84	159	86
646	655.8	94.39	6.55	87.84	19	85.85	85.85	18.77	87	178	86
657	666.2	96.99	8.86	88.14	19	87.84	85.85	19.23	87	178	86
667	676.6	96.99	3.60	93.39	19	88.14	85.85	19.71	93	190	86
678	687.1	96.99	3.60	93.39	19	93.39	85.85	20.18	93	190	86
688	697.5	96.99	6.34	92.48	18	92.48	85.85	20.67	90	194	86
698	707.9	96.99	6.34	92.02	17	92.02	85.85	21.16	90	194	86
709	718.3	96.99	6.34	91.75	16	91.75	85.85	21.65	90	194	86
719	728.7	96.99	6.34	91.57	15	91.57	85.85	22.15	90	194	86

plug flow model

DATE	INTAKE TEMP (F)	DISCH TEMP (F)	delta T (F)	EQUILIB TEMP (F)	TOTAL FLOW (cfs)	CCW FLOW (cfs)	BY-PASS FLOW (cfs)	DILUTION	HEAT EXCH BTU/ ft^2/hr/F	CHANNEL WIDTH (ft)		DNSTRM	SURFACE AREA (ft^2)	ISOTHERM TEMP (F)	delta T (F)
												ft.			
1/14/95	42.0	62.0	20.0	43.0	24	24	0	1.00	3.50	200		0.0	0	62.0	20.0
										200		100.0	20000	61.8	19.8
										200		200.0	40000		
										400	SA-1	500.0	200000	59.7	17.7
											SA-2	850.0	340000	58.2	16.2
											Intake	1000.0	400000	57.7	15.7
												1100.0	440000	57.3	15.3
												1500.0	600000	55.9	13.9
											LA-1	1800.0	720000	54.9	12.9
												2000.0	800000	54.3	12.3
												2500.0	1000000	52.9	10.9
												3000.0	1200000	51.7	9.7
												3500.0	1400000	50.7	8.7
												4000.0	1600000	49.7	7.7
												4500.0	1800000	48.9	6.9
												5000.0	2000000	48.2	6.2
												5500.0	2200000	47.6	5.6
												6000.0	2400000	47.0	5.0
												6500.0	2600000	46.5	4.5
												7000.0	2800000	46.1	4.1
												7500.0	3000000	45.7	3.7
												miles			
												1.5	1584000	49.8	7.8
												3.0	3168000	45.4	3.4
												4.0	4224000	44.2	2.2
												7.0	7392000	43.2	1.2

ATTACHMENT 3