REPORT OF SEDIMENTATION
1999 RESURVEY
CARLYLE RESERVOIR
UPPER MISSISSIPPI RIVER BASIN
KASKASKIA RIVER, ILLINOIS

Submitted to

U.S. Army Engineer District, St. Louis
Corps of Engineers
St. Louis, Missouri

Submitted by

Resource Technology, Inc.
1720-B Randolph Rd. SE
Albuquerque, New Mexico 87106

RTI Project Number 00-130

September 2000

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CONVERSION FACTORS, U.S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

U.S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
inches	25.4	millimeters
feet	0.3048	meters
miles (U.S. statute)	1.609344	kilometers
square miles	2.589988	square kilometers
cubic yards	0.7645549	cubic meters
acre-feet	1233.482	cubic meters
feet per second	0.3048	meters per second
cubic feet per second	0.2831685	cubic meters per second

PERTINENT DATA SUMMARY
CARLYLE RESERVOIR

Item	Unit	
DRAINAGE AREA	sq. mi.	2,680
INACTIVE STORAGE POOL		
Elevation	NGVD	429.5
Area	acres	6,392
Storage	acre-feet	17,982
Storage (runoff)	inches	0.13
JOINT-USE POOL		
Elevation	NGVD	429.5 – 445.0
Area	acres	24,527
Storage	acre-feet	224,600
Storage (runoff)	inches	1.57
Regulated Outflow (min.)	c.f.s.	50
Regulated Outflow (max.)	c.f.s.	4,000
FLOOD CONTROL POOL		
Elevation	NGVD	445.0 – 462.5
Area	acres	58,447
Storage	acre-feet	675,259
Storage (runoff)	inches	4.72
Regulated Outflow (min.)	c.f.s.	50
Regulated Outflow (max.)	c.f.s.	10,000
INDUCED SURCHARGE		
Elevation	NGVD	462.5 – 465.5
Area	acres	67,000
Storage	acre-feet	136,659
Storage (runoff)	inches	0.96
Outflow (max.)	c.f.s.	149,000
SURCHARGE POOL (TOTAL)		
Elevation	NGVD	462.5 – 467.2
Area	acres	72,500
Storage	acre-feet	256,919
Storage (runoff)	inches	1.80
Outflow (max.)	c.f.s.	160,000

PERTINENT DATA SUMMARY (Continued)

Item	Unit	
FREEBOARD		
Elevation	NGVD	467.2 – 472.0
Area	acres	111,600
Storage	acre-feet	409,000
Storage (runoff)	inches	2.71
Height	feet	4.8
STANDARD PROJECT FLOOD		
Peak Inflow	c.f.s.	104,550
Peak Outflow	c.f.s.	7,000
Design Storm	inches	11.54
Runoff (includes baseflow)	acre-feet	1,157,321
Runoff (includes baseflow)	inches	8.10
DAM		
Elevation, Top of Dam	NGVD	472.00
Height above Streambed	feet	67
Length of Crest	feet	6,610
SPILLWAY		
Width		
Gross	feet	179
Net	feet	152
Elevation of Crest	NGVD	425
Tainter Gates		
Number	each	4
Size	feet	38 ft. W. x 39 ft. H.
Top Elevation, Closed	NGVD	463.5
OUTLET STRUCTURE		
Number of Sluices	each	1
Size	inches	30-in. and 24-in. diameter conduits joined by a Venturi tube and a regulating valve
Intake Invert Elevation	NGVD	417.0
Outlet Invert Elevation	NGVD	404.0

REPORT ON RESURVEY OF SEDIMENTATION
CARLYLE RESERVOIR
KASKASKIA RIVER, ILLINOIS, 1999

1. INTRODUCTION

This report is prepared according to instructions in EM 1110-2-4000, Sedimentation Investigations of Rivers and Reservoirs dated December 15, 1989, and represents the results of the 1999 resurvey of Carlyle Reservoir sedimentation ranges. The purpose of the investigation was to analyze the 1999 resurvey data to determine the distribution of sediment depletion of storage in the reservoir and trap efficiency of the reservoir. Initial operation of the reservoir began on April 1, 1967.

2. LOCATION OF RESERVOIR

Carlyle Reservoir is located in Clinton County, Illinois, on the Kaskaskia River. The dam is approximately 100 miles* above the confluence of the Kaskaskia River and the Mississippi River, and approximately 1 mile upstream of the Town of Carlyle, Illinois. The watershed for the reservoir is 2,680 square miles, or about 46 percent of the total Kaskaskia River Basin. The basin is shown on Plate 1.

3. PURPOSE OF RESERVOIR

Carlyle Reservoir is part of the Kaskaskia River Basin development plan. This plan provides flood control, water supply, storage for navigation releases, recreation, and fish and wildlife conservation. The reservoir is operated jointly with the other projects in the Kaskaskia River Basin.

4. RESERVOIR PERTINENT DATA – DAM AND APPURTENANT STRUCTURES

The Pertinent Data Summary, shown on Page v - vi, contains pertinent data concerning the dam, outlet, and spillway structures; and the elevations, areas, and capacities of the inactive, joint-use, flood control, and surcharge pools.

5. WATERSHED CHARACTERISTICS

The watershed has a total area of 2,680 square miles. The reservoir occupies approximately 90 square miles of this area at flood-control pool (elevation 462.5**). The watershed has a median length of about 120 miles, an extreme width of 57 miles, and an average width of about 22.3 miles. The course of the river contains many bends. The topography of the basin is flat to gently rolling terrain. The principal occupation in the watershed is agricultural with approximately 86 percent of the watershed being cultivated annually.

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*A table of factors for converting U.S. customary units of measurement to metric (SI) units is presented on Page iv.

**All elevations (el) cited herein are in feet referred to National Geodetic Vertical Datum.

6. CLIMATE

The climate in the area is relatively moderate. The summers are usually mild with occasional temperatures of 100° F or higher. The winters are generally short and moderate, although temperatures below zero are not uncommon. The minimum and maximum temperatures of record are -34° F during the winter and 115° F during the summer. The average annual temperature is about 55° F. The average monthly temperature ranges from a maximum of 78° F during July, to a minimum of 30° F during January. Summaries of the monthly and annual precipitation and runoff for the watershed are given in Tables 1 and 2.

7. RESERVOIR OPERATION

Carlyle Reservoir was designed to operate jointly with Shelbyville Reservoir in a way that their design-flood outflows can be safely and economically handled by authorized levees downstream. The reservoir outflows are regulated to reduce flood peaks downstream, to affect maximum flood control benefits, and to empty the flood control pool during the normal May through November low-water season. Usually, normal operational outflow does not exceed 4,000 cfs. The monthly reservoir pool hydrograph for the period 1967 through 1999 is shown on Figure 1.

8. RESERVOIR INFLOW

Summaries of the monthly and annual precipitation and runoff data for the watershed are given in Tables 1 and 2. One inch of runoff equals 142,933 acre-feet. Average annual precipitation and inflow for the sediment survey period are tabulated in Items 34 and 35 of ENG. Form 1787, a data summary of reservoir sediment. The average monthly inflow hydrograph for the period 1966 through 1999 is shown on Figure 2.

9. ORIGINAL RESERVOIR SURVEY

Reservoir area and volume were determined from U.S. Geological Survey quadrangle sheets and River and Lakes Commission topographic survey sheets of 1908. The area and volume curves were checked from 1956 topographic reservoir survey sheets. A tabulation of the reservoir storage for 5-foot intervals is shown in Tables 3. Item 46 of ENG Form 1787, gives area and storage (capacity) tabulation at 15-foot intervals for the original survey. Elevations versus capacity curves are shown in Figure 3.

10. TYPE AND SCOPE OF THE INITIAL SEDIMENT SURVEY

There were nine sediment ranges established and surveyed by direct leveling during the period of July 1965 through January 1967 for the purpose of observing sediment distribution and the approximate rate of reservoir storage depletion. Plate 2 shows the locations of the sediment ranges. The cross sections of the ranges for the original survey and each of the resurveys are shown on Plates 3 through 11. Appendix B shows detailed locations of the nine sediment ranges.

11. TYPE AND SCOPE OF SEDIMENT RESURVEYS

Detailed sediment resurveys of the nine sediment ranges by direct leveling and by a Ratheon Recording Depth Sounder, Model EE-119 were made during 1971, 1976, 1982, 1984 and 1999. The 1971 sediment resurvey was conducted from May to August 1971. The average elevation of the reservoir pool during the measurements was about 443.0. The 1976 sediment resurvey was conducted from January to March 1976. The average elevation of the reservoir pool during the measurements was about 440.5. The 1982 resurvey was conducted from September 1982 to February 1983, with most of it being in September 1982. The average pool elevation at this time was about 445.5. The 1984 resurvey was conducted in August and September 1984. The average pool elevation was about 445.0. The 1999 resurvey was conducted in September 1999 with an average pool elevation of 444.5.

Additional ranges were added in the 1982 resurvey and in the 1984 resurvey to better understand the sediment trends throughout the entire reservoir. In 1982, Ranges 3.1A and 3.2A were added, located about 7 miles and 9 miles upstream of the dam, respectively. Ranges 4.1A through 4.5A cross the Kaskaskia River channel only and were first surveyed in 1984. They are located between Ranges 4A and 7A with Range 4.1A about 1,400 feet upstream of Range 4A and Range 4.5A about 2,600 feet upstream of Range 4A. Ranges 4.1A through 4.5A cross only the river channel because of excessive brush, logs, etc. in the overbank areas, which would make surveying impossible. Plotted cross sections of these seven ranges are shown in Appendix A. Plate 1 shows the locations of the ranges in the reservoir, and Appendix B shows their detailed locations.

These additional ranges were not used in the 1999 resurvey. Whenever future reservoir volumes are calculated with data from the additional ranges, comparison cannot be made with any survey done prior to the inclusion of the additional ranges. This is because calculations performed with the additional range data will yield a result different from that obtained without the additional data. Consistency in comparison must be maintained.

12. METHODS OF SEDIMENT COMPUTATIONS

All previous resurveys used the prismoidal formula developed by the U.S. Soil Conservation Service (SCS).

This study however used the average end area method to determine the volume of sediment deposition for the period of 1967 to 1999. For this period calculation, common cross sections (sedimentation ranges) were compared. The area of sediment, in square feet, was determined for each resurveyed cross section at each one-foot elevation interval and the volume of sediment in each horizontal slice was determined by the average of the end area multiplied by the average length between the sections. The equation is expressed as:

$$V = (L*(A1 + A2)/2)/43560$$

Symbols used in the above equation are defined as:

V = sediment volume between ranges for a survey period in acre-feet.

A = area at 1-foot interval.

L = average length between the cross sections.

Results of the analysis displaying the differences of area at each one-foot interval are presented in Table 5.

13. SEDIMENT QUANTITIES

A summary of the volume of sediment deposited between each range in the reservoir for the periods 1967-1999 is presented in Figure 4 and Tables 6A, 6B, and 6C. In addition, Figure 5 presents sedimentation by elevation. A summation of the volume of sediment deposited in each reach indicates that during the period 1967-1999 about 2.4 percent of the total reservoir capacity was lost to sedimentation. This is a depletion rate of about 0.07 percent per year.

The 1999 resurvey data show that of the 22,167 acre-feet of sediment calculated to be deposited from 1967 to 1999, about 17,653 acre-feet was deposited within the inactive pool (below elevation 429.5). This decreased the amount of storage in the inactive pool by approximately 50 percent. In the joint-use pool (elevation 429.5 to 445.0), about 8,199 acre-feet of sediment accumulated. This reduced the joint-use pool capacity by 3.5 percent. The flood-control pool experienced a storage increase of about 3,685 acre-feet. The following table summarizes the sediment deposition in Carlyle Lake based on the 1999 resurvey. A 32.5-year time period (April 1, 1967 to September 30, 1999) was used to compute the rates of sediment deposition.

SUMMARY OF CARLYLE RESERVOIR SEDIMENTATION

RESERVOIR PORTION	AMOUNT OF SEDIMENT DEPOSITED 1999-1967 (ACRE-FEET)	ANNUAL RATE OF DEPOSITION 1999-1967 (ACRE-FEET/YR)
Entire Reservoir	22,167	682
Inactive Storage	17,653	543
Joint-Use Storage	8,199	252
Flood-Control Storage	-3,685	-113

The 1999 resurvey also showed that, for the entire reservoir, the greatest amount of sediment was deposited between Ranges 3A and 4A. This section accounted for about 31 percent of the total sediment accumulation. The distance between Ranges 3A and 4A is approximately 5.25 miles, making it the largest section in the reservoir. Almost 59 percent of the total sedimentation was

deposited in the upper part of the reservoir, upstream of Range 3A. The reservoir is approximately 15.1 miles long at the joint-use pool elevation and the distance to Range 3A from the dam is approximately 5 miles.

14. TRAP EFFICIENCY OF THE RESEROIR

For the period of operation from 1967 to 1999, Carlyle Reservoir has a trap efficiency of 78 percent. This value was determined using Gunnar M. Brune's median curve of Figure F-2 presented in EM 1110-2-4000, Sedimentation Investigations of Rivers and Reservoirs, pgs. F-2, F-4. A capacity-inflow ratio of 0.56 was computed (Item 33, ENG Form 1787) using an average reservoir capacity over the period of operation of approximately 928,900 and an average annual inflow of 1,673,400 acre-feet. Appendix C provides the sediment size distributions based on sediment samples collected in the 1982 resurvey. No sediment samples were collected in 1999.

15. DOWNSTREAM CHANNEL AND RESERVOIR OPERATION

A series of nine retrogression ranges were established downstream of Carlyle Dam to assist in monitoring downstream changes due to reservoir operation. They cover from the U.S. 50 Highway Bridge at River Mile 105.7 to River Mile 102.75 (see Appendix B). A thalweg profile, illustrating the changes in riverbed elevation since reservoir operation began in 1967, is shown in Figure 6. Cross sections of the retrogression ranges are shown in Plates 12 through 20. The 1999 resurvey data indicate that an increase of 17.8 percent was experienced over the river reach between Ranges 1C and 9C. Examination of the cross-sectional plots reveals that most of the volume changes are due to lateral bank movement and erosion, not in bed elevation changes. This bank erosion should continue to be monitored.

16. EFFECT ON WATER SUPPLY CONTRACT

The joint-use pool originally had 232,800 acre-feet of storage, of which 32,692 acre-feet was allocated for water supply. Of the total joint-use storage, only 8,214 acre-feet had been depleted by 1999, a reduction of approximately 3.5 percent. Due to the small amount of storage depleted, the existing Water Supply Contract should not be changed. In the future, if sediment distribution decreases the amount of joint-use storage to the extent that any project purpose is affected, the District Engineer shall make an equitable redistribution of the storage allocations served by the project. Information concerning future sedimentation and any redistribution of storage allocations shall be made available to the Illinois Department of Transportation, Division of Water Resources.

17. SUMMARY

The computed rate of sediment deposition, 682 acre-feet per year is near the predicted rate of 746 acre-feet per year, which was the expected yearly sedimentation rate computed before the operation of the project. This predicted rate was obtained from the suspended sediment and bed-load capacity of the river at the nearest sedimentation station to Carlyle Dam, located at Shelbyville, Illinois. It was also based upon information furnished by the U.S. Department of Agriculture, Soil Conservation Service, in a letter, dated February 28, 1954. The results show that a significant amount of sedimentation is occurring in the inactive storage pool. For the period 1967-1999, 80 percent of the sedimentation occurred below the joint-use pool.

Based on the results of the 1999 resurvey, in 20 years (2019) the inactive pool will have lost approximately 28,513 acre-feet of storage to sediment accumulation, or about 80 percent of its original capacity; the joint-use pool will have lost approximately 13,239 acre-feet of capacity, or about 5.7 percent; while due to an increase in storage, a prediction concerning the flood-control pool is not made at this time. A summary of reservoir sedimentation is shown on ENG. Form 1787.

18. RECOMMENDATION

Current budgeting guidance limits potential funding for future sediment surveys. Funding will be requested to conduct another resurvey in the next five to ten years. However, until the sediment deposition is anticipated to have a significant impact on project operations, funding will be unlikely. At the current rate of sedimentation, in 15 to 20 years the level of funding could justifiably be raised. The decision to do so should be based on an evaluation of the flood events that have occurred and their estimated contribution to loss of available storage.

TABLE 1. Monthly Precipitation and Runoff for Carlyle Reservoir (Jan. 1966 – Dec. 1999).

Month	Maximum Rainfall (inches)	Minimum Rainfall (inches)	Average Rainfall (inches)	Average Runoff (inches)	Runoff (percent)
January	5.04	0.03	1.83	0.50	27.3
February	4.50	0.00	1.71	0.70	40.9
March	7.41	0.33	3.05	0.91	29.8
April	7.73	0.18	3.30	0.82	24.8
May	11.75	0.02	4.01	0.49	12.2
June	8.56	0.31	3.80	0.44	11.6
July	23.46	0.38	4.22	0.29	6.9
August	5.25	0.49	2.53	0.23	9.1
September	6.54	0.00	2.86	0.15	5.2
October	5.73	0.00	2.72	0.15	5.5
November	7.27	0.00	2.76	0.21	7.6
December	8.65	0.00	2.74	0.55	20.1

February data based upon 34 years; January, March, and April data based upon 33 years; May, June, July, August, October, November, and December data based upon 32 years; and September data based upon 31 years.

TABLE 2. Annual Precipitation and Runoff for Carlyle Reservoir (Jan. 1966 – Dec. 1999).

Year	Rainfall* (inches)	Runoff (inches)	Runoff (percent)	Average Daily Runoff (cfs)
1966	31.89	14.89	46.7	2,940
1967	45.81	14.04	30.6	2,772
1968	34.73	9.00	25.9	1,777
1969	44.01	12.57	28.6	2,482
1970	37.98	10.40	27.4	2,053
1971	35.88	5.76	16.1	1,137
1972	39.13	9.62	24.6	1,899
1973	47.92	19.45	40.6	3,840
1974	44.17	21.33	48.3	4,211
1975	42.25	14.33	33.9	2,829
1976	25.65	4.08	15.9	806
1977	42.15	7.38	17.5	1,457
1978	36.38	12.31	33.8	2,430
1979	40.86	16.17	39.6	3,192
1980	30.62	5.48	17.9	1,082
1981	38.44	7.33	19.1	1,447
1982	52.34	19.54	37.3	3,858
1983	46.10	16.30	35.4	3,218
1984	**	**	**	**
1985	17.79	14.93	83.9	2,948
1986	30.23	7.47	24.7	1,475
1987	36.99	6.61	17.9	1,305
1988	26.95	8.06	29.9	1,591
1989	28.25	7.26	25.7	1,433
1990	41.22	11.64	28.2	2,298
1991	30.38	9.54	31.4	1,883
1992	26.13	5.97	22.8	1,179
1993	48.27	21.60	44.7	4,264
1994	**	**	**	**
1995	32.01	11.03	34.5	2,178
1996	27.62	12.55	45.4	2,478
1997	11.18	7.35	65.7	1,451
1998	37.35	14.19	38.0	2,802
1999	25.35	11.39	44.9	2,249
Maximum	52.34	21.33	83.9	4,264
Minimum	11.18	4.08	15.9	806
Average	35.24	11.55	33.9	2,280

* Data from following months is missing: Mar-Dec 1984, Sept 1990, June 1991, and May 1994 -Jan 1995. The monthly average rainfall from Table 1 for Sept, June, and Jan is added to the 1990 data, the 1991 data, and the 1995 data respectively.

** Not enough data to determine.

TABLE 3. Elevation Versus Capacity for Carlyle Reservoir. Values in Acre-Feet.

ELEVATION (FEET, NGVD)	CAPACITY					
	ORIGINAL 1966*	1971*	1976**	1984**	ORIGINAL 1966***	1999‡
405	0	0	0	0	0	0
410	0	0	0	0	4	0
415	5,156	5,041	4,500	2,200	294	0
420	13,088	12,608	11,000	7,000	1,019	0
425	27,762	26,138	23,000	17,000	6,554	903
430	53,739	49,206	45,450	38,607	35,635	17,982
435	101,133	96,097	92,000	81,000	88,049	66,817
440	175,297	166,424	163,500	151,000	157,524	131,406
445	280,595	268,644	270,096	255,374	268,434	242,582
450	421,388	408,657	410,000	395,000	415,852	392,693
455	605,212	592,481	591,000	578,000	595,838	573,940
460	837,421	824,690	824,000	798,000	804,232	781,173
462.5	974,645	961,914	957,290	927,113	940,008	917,841
465	1,127,534	1,114,803	1,107,000	1,072,500	1,075,800	1,054,500

* As reported in the Report on Sedimentation, 1976 Resurvey.

** As reported in the Report on Sedimentation, 1982 and 1984 Resurveys. The1976 capacity was listed as Adjusted. Three values at elevations 430, 445, and 462.5 were computed, while other values were interpolated from elevation – capacity curves.

*** The original capacity was re-determined in 1999 using the average end area method instead of the prismoidal method used in the previous surveys. In addition several cross sections were extended based upon intermediate resurveys that included area that was inaccessible in the original survey. Capacity for elevation 465 was extrapolated.

‡ Capacity for elevation 465 was extrapolated.

TABLE 3A. Elevation Versus Change in Capacity for Carlyle Reservoir. Values in Acre-Feet.

ELEVATION (FEET, NGVD)	CHANGE IN CAPACITY				
	1976-1967*	1982-1967*	1984-1967*	1984-1976*	1999-1967
405					0
410					-4
415					-294
420					-1,018
425					-5,650
430	-8,289	-16,374	-15,132	-6,843	-17,653
435					-21,232
440					-26,117
445	-10,499	-30,460	-25,221	-14,722	-25,852
450					-23,158
455					-21,897
460					-23,059
462.5	-17,355	-57,628	-47,532	-30,177	-22,167

* As reported in the Report on Sedimentation, 1982 and 1984 Resurveys.

TABLE 4. Change in Range Width by Elevation for Carlyle Reservoir (1999-1965). Values in Feet.

ELEVATION (FEET, NGVD	1A	2A	3A	4A	5B	6B	7A	8B	9A
400	--	--	--	--	--	--	--	--	-
401	--	--	--	--	--	--	--	--	-
402	--	--	--	--	--	--	--	--	-
403	--	--	--	--	--	--	--	--	-
404	--	--	--	--	--	--	--	--	-
405	--	--	--	--	--	--	--	--	-
406	--	--	--	--	--	--	--	--	-
407	--	--	--	--	--	--	--	--	-
408	--	--	--	--	--	--	--	--	-
409	--	-5	0	--	--	--	--	--	-
410	-15	-12	0	--	--	--	--	--	-
411	-40	-18	0	--	--	--	--	--	-
412	-59	-25	-58	--	--	--	--	--	-
413	-87	-31	-111	--	--	--	--	--	-
414	-121	-37	-131	--	--	--	--	--	-
415	-154	-44	-148	--	--	--	--	--	-
416	-175	-50	-163	--	--	--	--	--	-
417	-187	-57	-178	--	--	--	--	--	-
418	-199	-63	-193	--	--	--	--	--	-
419	-210	-70	-208	--	--	--	--	--	-
420	-265	-76	-223	-45	--	--	--	--	-
421	-345	-45	-238	-149	--	--	--	--	-
422	-1873	-5	-253	-227	--	--	--	--	-
423	-3288	8	-270	-298	--	--	--	--	-
424	-4509	17	-287	-382	--	--	--	--	-
425	-2720	-3290	-306	-440	--	--	--	--	-
426	-2828	-4978	-205	-497	--	--	--	--	-
427	-1970	-5048	-376	-620	--	--	--	--	-
428	-894	-3111	-2607	-680	--	--	-8	--	-
429	-525	-589	-6080	-738	--	--	-36	--	-
430	-418	-396	-1890	-797	--	--	-26	--	-
431	-278	-204	291	-854	--	--	-10	--	-
432	-360	-134	53	-911	--	--	10	--	-
433	-311	-50	-20	-895	--	--	16	--	-
434	-340	-42	-444	-749	--	--	16	--	-
435	-279	-30	44	-583	--	-13	16	--	-
436	-321	-27	190	-605	--	-33	13	--	-
437	-282	-11	319	-596	1	-49	6	--	-
438	-269	21	-122	-1692	4	-53	-2	--	-

TABLE 4 (Continued). Change in Range Width by Elevation for Carlyle Reservoir (1999-1965). Values in Feet.

ELEVATION (FEET, NGVD	1A	2A	3A	4A	5B	6B	7A	8B	9A
439	-263	49	-208	-3542	-8	-57	2	--	-
440	-202	156	-364	-983	-4	-36	2	-24	5
441	-52	336	-803	32	38	5	-1	-42	7
442	349	439	-769	-566	68	46	-14	-47	4
443	310	535	439	224	97	99	-47	-29	2
444	184	274	475	50	103	177	51	-5	-
445	170	177	590	-163	100	-63	841	0	2
446	118	272	506	-371	50	213	1043	3	2
447	57	180	659	-101	3	-139	469	3	2
448	140	267	573	-184	130	7	273	1	2
449	96	280	403	-130	660	-2	-126	5	2
450	103	60	1070	-94	1245	-3	-150	50	2
451	88	90	765	-95	417	-15	-86	-368	1
452	44	90	1081	-107	13	-32	-50	-334	1
453	15	105	911	-218	11	-51	-31	-16	-1
454	4	160	403	-10	9	-54	-18	-24	-20
455	1	91	300	37	8	-27	4	-1	-28
456	-2	28	411	53	6	-32	4	-3	-86
457	-121	-38	395	3	5	-34	4	-10	-253
458	-352	22	287	-64	-5	-4	4	-7	-44
459	-164	-9	429	5	-5	3	3	0	-14
460	31	12	416	9	-5	21	2	0	-4
461	16	504	490	12	1	21	0	-6	-3
462	16	328	552	15	5	13	-1	-13	-1
462.5	14	315	541	12	16	9	-2	-12	-1

TABLE 5 (Continued). Change in Cross Sectional Area by Elevation for Carlyle Reservoir (1999-1965). Values in Feet.

ELEVATION (FEET, NGVD	1A	2A	3A	4A	5B	6B	7A	8B	9A
439	-266	35	-165	-2617	-2	-55	0	--	-
440	-233	103	-286	-2263	-6	-47	2	-12	2
441	-127	246	-584	-476	17	-16	1	-33	7
442	149	388	-786	-267	53	26	-8	-45	6
443	330	487	-165	-171	83	73	-31	-38	3
444	247	405	457	137	100	138	2	-17	
445	177	226	533	-57	102	57	446	-3	
446	144	225	548	-267	75	75	942	2	2
447	88	226	583	-236	27	37	756	3	2
448	99	224	616	-143	67	-66	371	2	2
449	118	274	488	-157	395	3	74	3	2
450	100	170	737	-112	953	-3	-138	28	2
451	96	75	918	-95	831	-9	-118	-159	1
452	66	90	923	-101	215	-24	-68	-351	1
453	30	98	996	-163	12	-42	-41	-175	-
454	10	133	657	-114	10	-53	-25	-20	-11
455	3	126	352	14	9	-41	-7	-13	-24
456	-1	60	356	45	7	-30	4	-2	-57
457	-62	-5	403	28	6	-33	4	-7	-169
458	-237	-8	341	-31	0	-19	4	-9	-148
459	-258	7	358	-30	-5	-1	4	-4	-29
460	-67	2	423	7	-5	12	3	0	-9
461	24	258	453	11	-2	21	1	-3	-3
462	16	416	521	14	3	17	-1	-10	-2
462.5	15	322	547	14	11	11	-2	-13	-1

TABLE 6A. Sediment Deposition by Reach for Carlyle Reservoir. Values in Acre-Feet. Elevation = 430 Feet.

ELEVATION (FEET, NGVD)	CHANGE IN CAPACITY				
	1976-1967*	1982-1967*	1984-1967*	1984-1976*	1999-1967
Dam-1A	222	830	803	581	2,658
1A-2A	1,024	3,762	3,158	2,134	4,584
2A-3A	1,606	3,791	3,024	1,418	3,419
3A-4A	4,919	7,306	7,411	2,492	5,550
4A-7A	518	685	736	218	1,425
5B-END	0	0	0	0	0
6B-END	0	0	0	0	0
7A-9A	0	0	0	0	18
8B-END	0	0	0	0	0
9A-END	0	0	0	0	0
TOTAL	8,289	16,374	15,132	6,843	18,083

* As reported in the Report on Sedimentation, 1982 and 1984 Resurveys.

TABLE 6B. Sediment Deposition by Reach for Carlyle Reservoir. Values in Acre-Feet. Elevation = 445 Feet.

ELEVATION (FEET, NGVD)	CHANGE IN CAPACITY‡				
	1976-1967*	1982-1967*	1984-1967*	1984-1976*	1999-1967
Dam-1A	701	1,336	1,389	688	2,945
1A-2A	222	4,749	4,212	3,990	4,707
2A-3A	1,708	5,187	4,123	2,415	3,459
3A-4A	5,118	15,355	10,517	5,399	9,912
4A-7A	2,727	3,808	4,766	2,039	5,100
5B-END	0	0	0	0	-68
6B-END	0	0	0	0	-10
7A-9A	23	25	214	191	-194
8B-END	0	0	0	0	26
9A-END	0	0	0	0	-26
TOTAL	10,499	30,460	25,221	14,722	26,297

* As reported in the Report on Sedimentation, 1982 and 1984 Resurveys.

‡ Negative sign indicates an increase in volume.

TABLE 6C. Sediment Deposition by Reach for Carlyle Reservoir. Values in Acre-Feet.
Elevation = 462.5 Feet.

ELEVATION (FEET, NGVD)	CHANGE IN CAPACITY‡					
	1976-1967*	1982-1967*	1984-1967*	1984-1976*		1999-1967
Dam-1A	500	1,683	1,830	1,330		2,923
1A-2A	1,329	4,490	4,096	2,767		4,365
2A-3A	2,285	5,848	4,247	1,962		2,023
3A-4A	7,669	21,406	16,246	8,577		7,082
4A-7A	4,620	13,102	10,175	5,555		4,959
5B-END	134	-167	-41	-175		-544
6B-END	31	-56	190	159		16
7A-9A	932	9,154	8,434	7,502		651
8B-END	-90	-204	-17	73		157
9A-END	-55	2,372	2,372	2,427		535
TOTAL	17,355	57,628	47,532	30,177		22,629

* As reported in the Report on Sedimentation, 1982 and 1984 Resurveys.
‡ Negative sign indicates an increase in volume.

TABLE 7. Volume Changes Downstream of Carlyle Dam on Kaskaskia River. Values in Acre-Feet.

REACH	VOLUME CHANGE*			
	1976-1967**	1982-1967**		1999-1967
1C-2C	0.0	-3.4		-24.6
2C-3C	3.0	0.7		0.1
3C-4C	0.3	3.6		5.6
4C-5C	1.2	12.8		34.3
5C-6C	8.5	1.7		41.3
6C-7C	18.5	29.5		37.8
7C-8C	15.0	31.0		28.6
8C-9C	20.3	60.0		70.1
TOTAL	66.8	135.9		193.1

* Average end area method. Negative indicates a decrease in volume.
** As reported in the Report on Sedimentation, 1982 and 1984 Resurveys.

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS

RESERVOIR SEDIMENT DATA SUMMARY

Carlyle Lake
NAME OF RESERVOIR

1
DATA SHEET NO.

DAM

1. OWNER D.A. Corps of Engineers	2. STREAM Kaskaskia River	3. STATE Illinois
4. SEC. 17-18 TWP. 2N RANGE 2W	5. NEAREST P.O. Carlyle, Ill.	6 COUNTY Clinton
7. LAT ° ' " LONG. ° ' "	8. TOP OF DAM ELEVATION 472.0	9. SPILLWAY CREST ELEV. 463.5 1/

RESERVOIR

10. STORAGE ALLOCATION	11. ELEVATION TOP OF POOL	12. ORIGINAL SURFACE AREA, ACRES	13. ORIGINAL CAPACITY, ACRE-FEET	14 GROSS STORAGE, ACRE-FEET	15. DATE STORAGE BEGAN
a. FLOOD CONTROL	462.5	58,447	671,574 2/	940,008 2/	Apr. 1967
b. MULTIPLE USE	445.0	24,583	232,799 2/ 3/	268,434 2/	
c. POWER	---	---	---	---	
d. WATER SUPPLY	---	---	---	---	16. DATE NORMAL OPER. BEGAN
e. IRRIGATION	---	---	---	---	
f. CONSERVATION	---	---	---	---	Apr. 1970
g. INACTIVE	429.5	6,672	35,635 2/	35,635 2/	

17. LENGTH OF RESERVOIR Joint-Use Pool: 15.1 MILES | AV. WIDTH OF RESERVOIR 2.5 MILES

WATERSHED

18. TOTAL DRAINAGE AREA 2,680 SQ. MI.		22. MEAN ANNUAL PRECIPITATION 35.5	(32) INCHES
19. NET SEDIMENT CONTRIBUTING AREA 1,535 SQ.MI.		23. MEAN ANNUAL RUNOFF 11.7	(32) INCHES
20. LENGTH 120 MILES	AV. WIDTH 22.3 MILES	24. MEAN ANNUAL RUNOFF 1,673,400	AC.FT.
21. MAX. ELEVATION 725	MIN. ELEV. 405	25. ANNUAL TEMP. MEAN 55.°	RANGE -34° to 115°

SURVEY DATA

26. DATE OF SURVEY	27. PERIOD YEARS	28. ACCL. YEARS	29. TYPE OF SURVEY	30. NO. OF RANGES OR CONTOUR INT.	31. SURFACE AREA, ACRES	32. CAPACITY, ACRE-FEET	33. C/I. RATIO, AC.-FT. PER AC.-FT.
Apr. 1967	8.9	8.9	Range (D)	9 (R)	58,447	940,008 2/	0.85 4/
Mar. 1976	8.5	17.4	Range (D)	9 (R)	58,447	957,290	0.89 4/
Sept. 1984	15.0	32.4	Range (D)	16 (R)	58,447	927,113	0.85 4/
Sept. 1999			Range (D)	9 (R)	58,447*	917,841	0.90 4/

26. DATE OF SURVEY	34. PERIOD ANNUAL PRECIPITATION	35. PERIOD WATER INFLOW, ACRE-FEET			36. WATER INFL. TO DATE, AC.-FT.	
		a. MEAN ANNUAL	b. MAX. ANNUAL	c. PERIOD TOTAL	a. MEAN ANNUAL	b. TOTAL TO DATE
Apr. 1967						
Mar. 1976	411	1,805,630	3,048,744	16,100,200	1,805,630	16,100,200
Sept. 1984	39.6 5/	1,665,220	2,792,218	14,154,363	1,737,104	30,254,563
Sept. 1999	29.98	1,578,300	2,972,658	23,674,500	1,663,549	53,929,063

26. DATE OF SURVEY	37. PERIOD CAPACITY LOSS ACRE-FEET			38. TOTAL SED. DEPOSITS TO DATE, ACRE-FEET		
	a. PERIOD TOTAL	b. Av. ANNUAL	c. PER SQ. MI-YEAR	a. TOTAL TO DATE	b. AV. ANNUAL	c. PER SQ. MI-YEAR
Apr. 1967						
Mar. 1976	17,355 6/	1,946	1.268	17,355	1,946	1.268
Sept. 1984	30,177	3,550	2.313	47,532	2,729	1.778
Sept. 1999	22,167 7/	682 7/	0.44 7/	22,167 7/	682 7/	0.44 7/

26. DATE OF SURVEY	39. AV. DRY WGT. LBS. PER CU. FT.	40. SED. DEP. TONS PER SQ. MI.-YR.		41. STORAGE LOSS, PCT.		42. SED. INFLOW, PPM	
		a. PERIOD	b. TOTAL TO DATE	a. AV. ANN.	b. TOT. TO DATE	a. PERIOD	b. TOT.TO DATE
Apr. 1967							
Mar. 1976	8/	8/	8/	0.20	1.78	8/	8/
Sept. 1984	36.8	1,854	1,425	0.28	4.88	1,257	927
Sept. 1999	8/	8/	8/	0.007	2.36	8/	8/

*Assumed

26. DATE OF SURVEY	43. DEPTH OF DESIGNATION RANGE IN FEET BELOW, AND ABOVE, CREST ELEVATION										
	55-50	50-45	45-40	40-35	35-30	30-25	25-20	20-15	15-10	10-5	5-Crest
	PERCENT OF TOTAL SEDIMENT LOCATED WITHIN DEPTH DESIGNATION										
Apr. 1967	12.1	13.8	10.9	8.6	6.3	4.0	3.5	6.9	27.0	6.9	0.0
Mar. 1976	4.0	5.3	5.6	6.0	6.3	8.0	9.9	15.2	36.4	3.3	0.0
Sept. 1984											
Sept. 1999	1.3 7/	3.3 7/	21.0 7/	54.1 7/	16.1 7/	22.1 7/	-1.2 7/	-12.2 7/	-5.7 7/	5.2 7/	-4.0 7/

26. DATE OF SURVEY	44. REACH DESIGNATION PERCENT OF TOTAL ORIGINAL LENGTH OF RESERVOIR									
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
	PERCENT OF TOTAL SEDIMENT LOCATED WITHIN DEPTH DESIGNATION									
Apr. 1967	7.2	14.4	18.6	18.9	15.0	11.5	9.8	2.3	2.3	0.0
Mar. 1976	10.3	8.9	11.6	12.6	9.9	8.1	8.9	10.6	10.9	8.2
Sept. 1984										
Sept. 1999	25.1	8.0	11.4	24.0	5.8	15.5	0.9	2.4	4.0	2.9

45. RANGE IN RESERVOIR OPERATION

WATER YEAR	MAX. ELEV.	MIN. ELEV.	INFLOW, AC.-FT.	WATER YEAR	MAX. ELEV.	MIN. ELEV.	INFLOW, AC.-FT.
1967	435.9	425.2	2,005,901	1984	451.3	444.0	2,478,474
1968	451.2	429.8	1,342,311	1985	455.1	443.3	1,993,821
1969	450.2	429.6	1,796,562	1986	449.7	442.8	1,270,147
1970	455.0	433.1	1,485,455	1987	447.9	442.9	861,110
1971	446.1	440.3	821,865	1988	449.9	442.3	1,447,071
1972	448.9	440.0	927,602	1989	448.5	442.5	1,104,081
1973	455.5	442.2	3,021,705	1990	454.8	442.7	1,282,645
1974	455.1	442.7	3,179,291	1991	453.1	442.9	1,653,045
1975	446.4	439.9	2,090,527	1992	448.4	442.9	586,917
1976	445.4	439.7	802,991	1993	455.5	443.4	2,562,040
1977	445.2	440.3	595,482	1994	452.7	442.7	2,673,114
1978	448.7	443.0	2,097,059	1995	457.4	442.5	1,671,116
1979	453.5	443.1	2,369,944	1996	452.2	442.4	1,734,631
1980	445.1	443.0	801,213	1997	448.2	442.9	1,119,600
1981	445.8	443.0	908,162	1998	450.2	442.8	2,001,554
1982	449.2	443.5	2,181,586	1999	451.7	442.9	1,678,645
1983	449.9	443.4	2,450,410	2000	447.1	442.8	

46. ELEVATION-AREA-CAPACITY DATA

ELEVATION	AREA	CAPACITY	ELEVATION	AREA	CAPACITY	ELEVATION	AREA	CAPACITY
Capacity–1967			450		415,852	440		131,406
405		0	455		595,838	445		242,582
410		4	460		804,232	450		392,693
415		294	462.5		940,008	455		573,940
420		1,019	465		1,075,800	460		781,173
425		6,554	Capacity–1999			462.5		917,841
430		35,635	420		0	465		1,054,500
435		88,049	425		903			
440		157,524	430		17,982			
445		268,434	435		66,817			

47. REMARKS AND REFERENCES

1/ Top of movable gates in closed position, includes 1 ft. freeboard. Flood control pool (el. 462.5) used for items 19, 31, 32, 33, 41, 43.
2/ Redetermined in 1999 Resurvey, using average end area method.
3/ Includes 32,692 acre-feet for water supply, remainder for navigation.
4/ Adjusted to reflect that Lake Shelbyville controls 39% of the watershed.
5/ Precipitation data for period extends through Dec. 1983.
6/ 1971 resurvey results were presented in the Report of Sedimentation, 1976 resurvey, and are not shown here due to space limitations.
7/ Period used is 1967-1999.
8/ No sediment samples taken in 1976 and 1999.

Reference: "Report of Sedimentation, 1976 Resurvey, Carlyle Lake," U.S. Army Corps of Engineers, St. Louis District, St. Louis, Missouri.
Reference: "Report of Sedimentation, 1982 and 1984 Resurveys, Carlyle Lake," U.S. Army Corps of Engineers, St. Louis District, St. Louis, Missouri

48. AGENCY MAKING SURVEY
49. AGENCY SUPPLYING DATA U.S. Army Corps of Engineers, SLD 50. DATE _____

FIGURE 1. CARLYLE RESERVOIR AVERAGE MONTHLY POOL ELEVATIONS
KASKASKIA RIVER, ILLINOIS

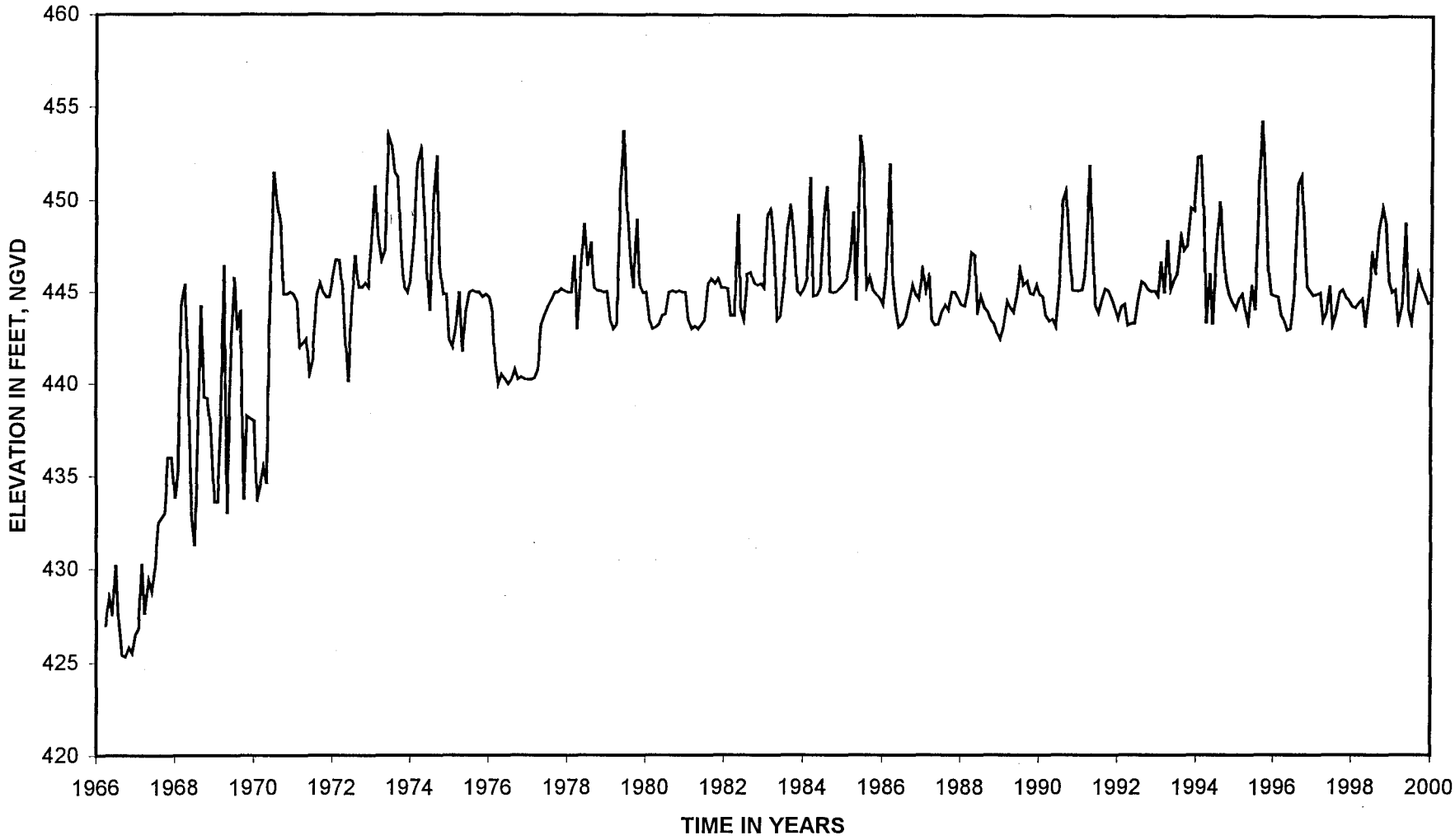


FIGURE 2. CARLYLE RESERVOIR MONTHLY INFLOW
KASKASKIA RIVER, ILLINOIS
PEAK INFLOW 773,100

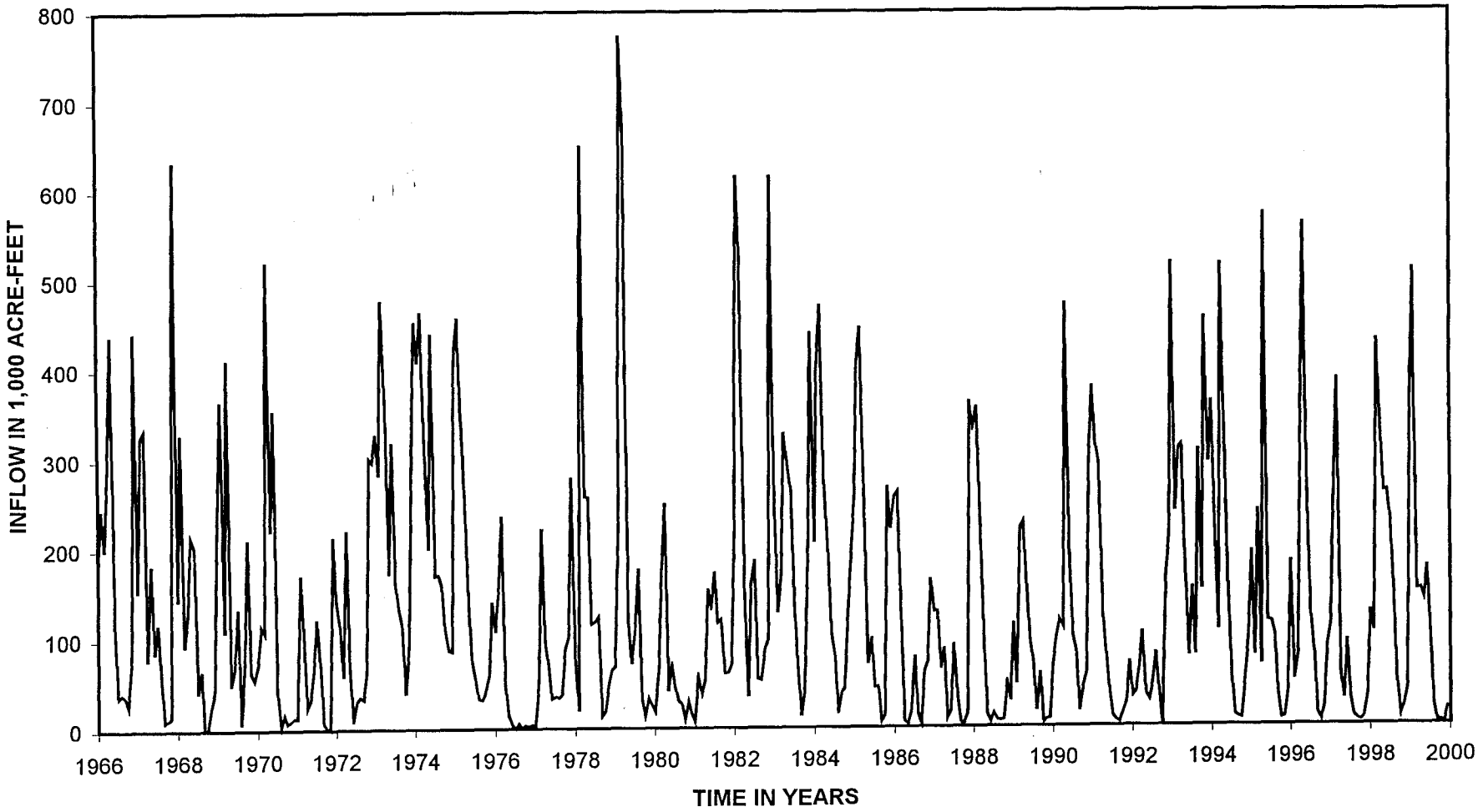


FIGURE 3. CARLYLE RESERVOIR CAPACITY vs. ELEVATION

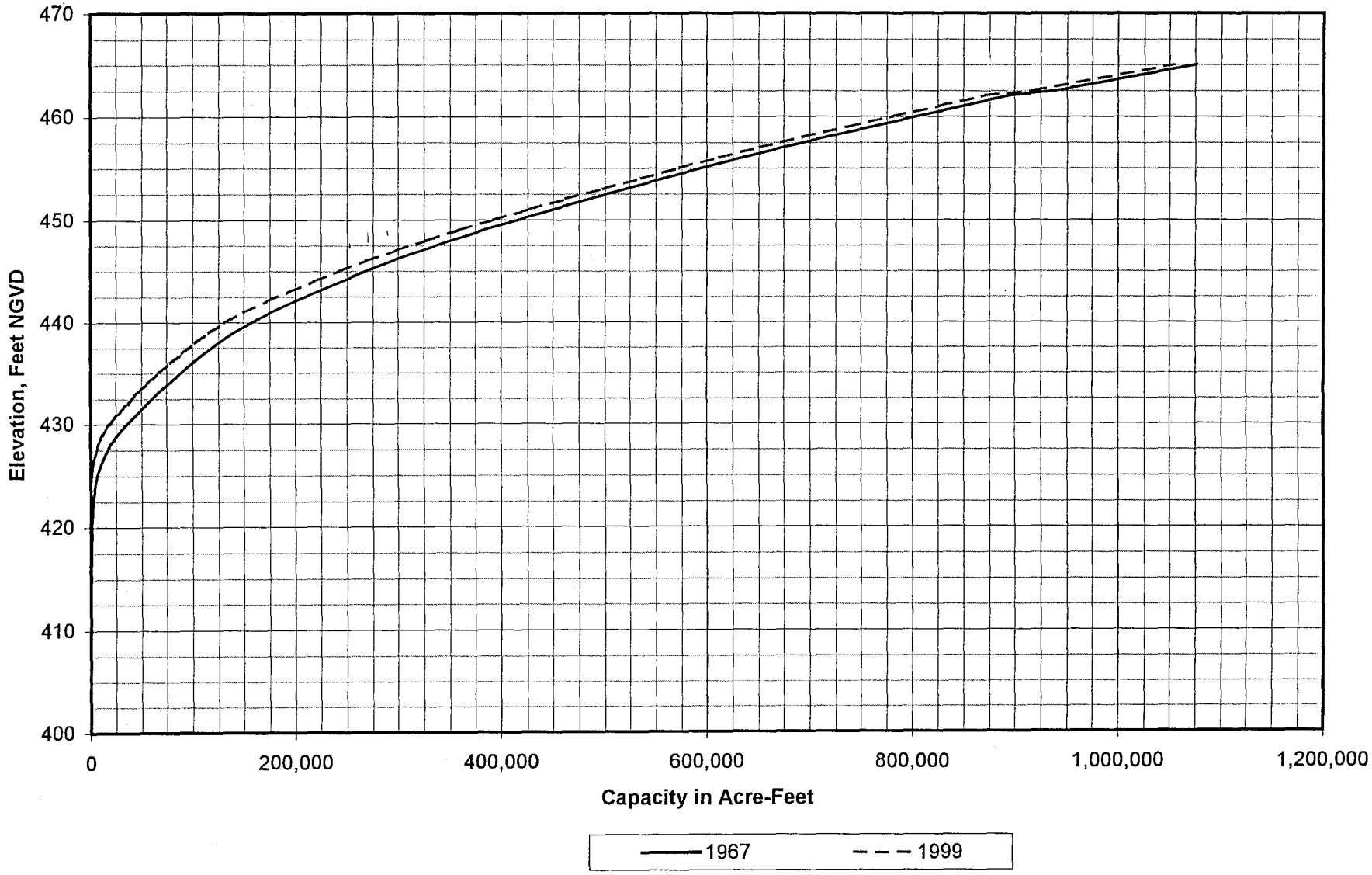


FIGURE 4. CARLYLE RESERVOIR SEDIMENTATION BY REACH

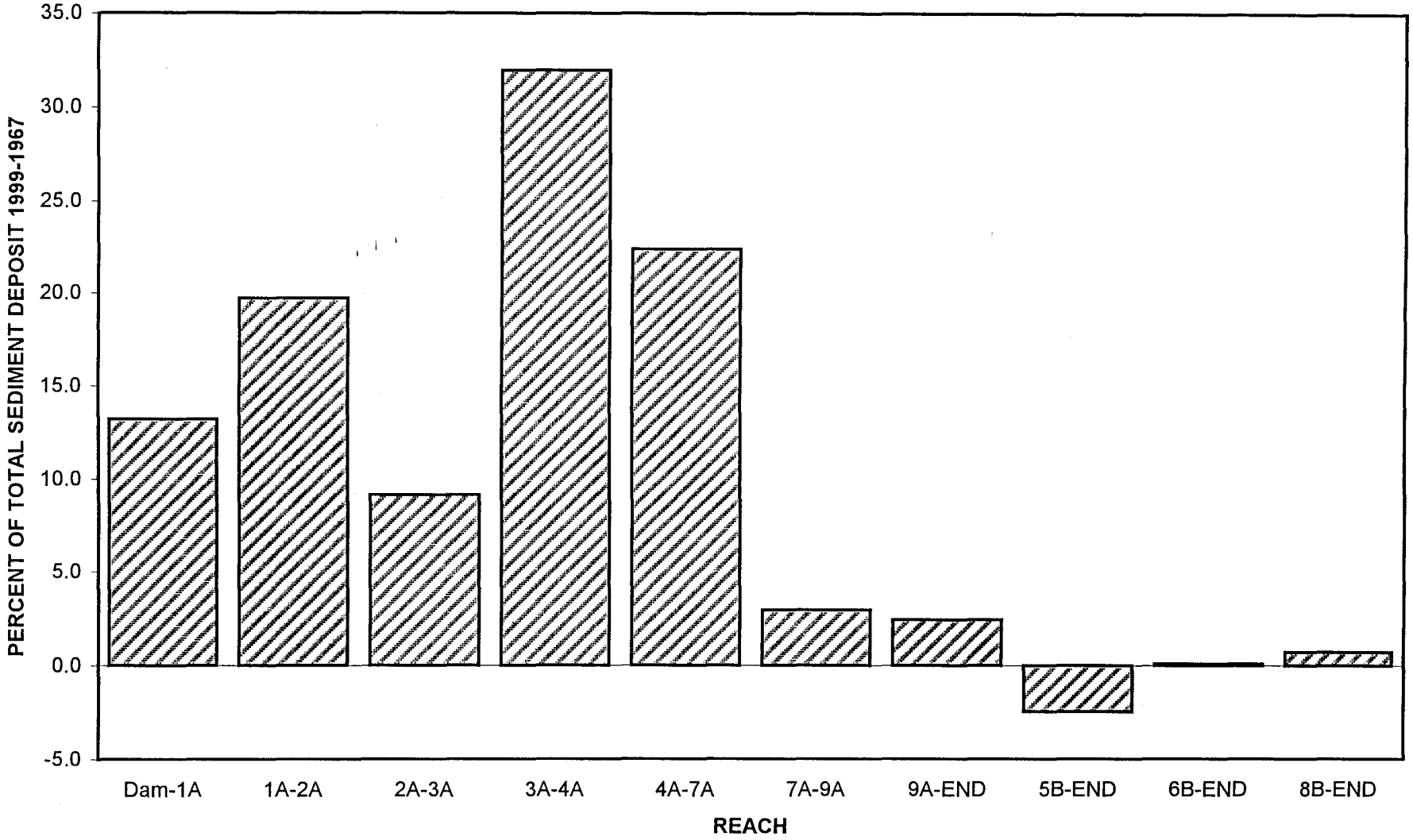


FIGURE 5. CARLYLE RESERVOIR SEDIMENTATION BY ELEVATION

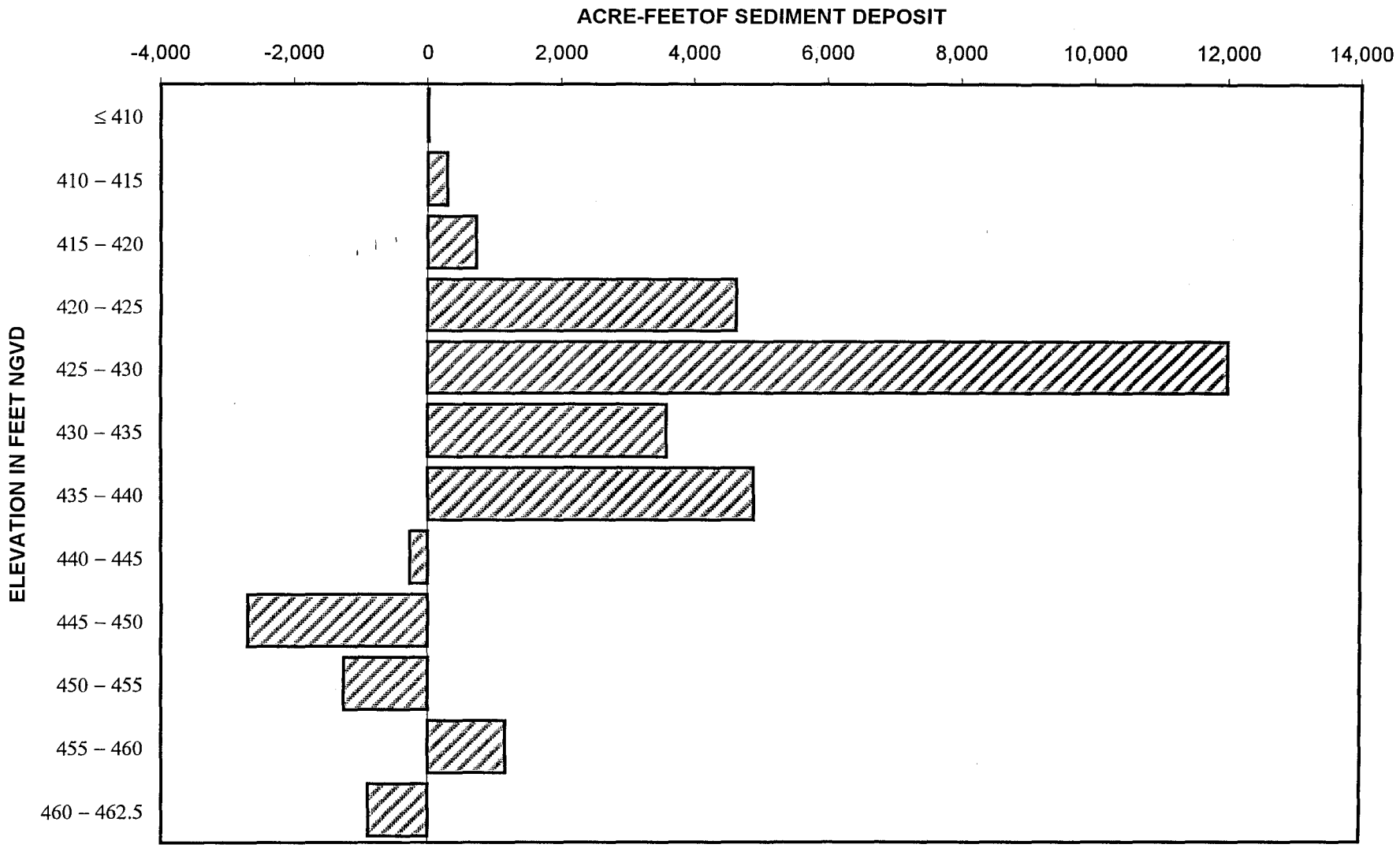
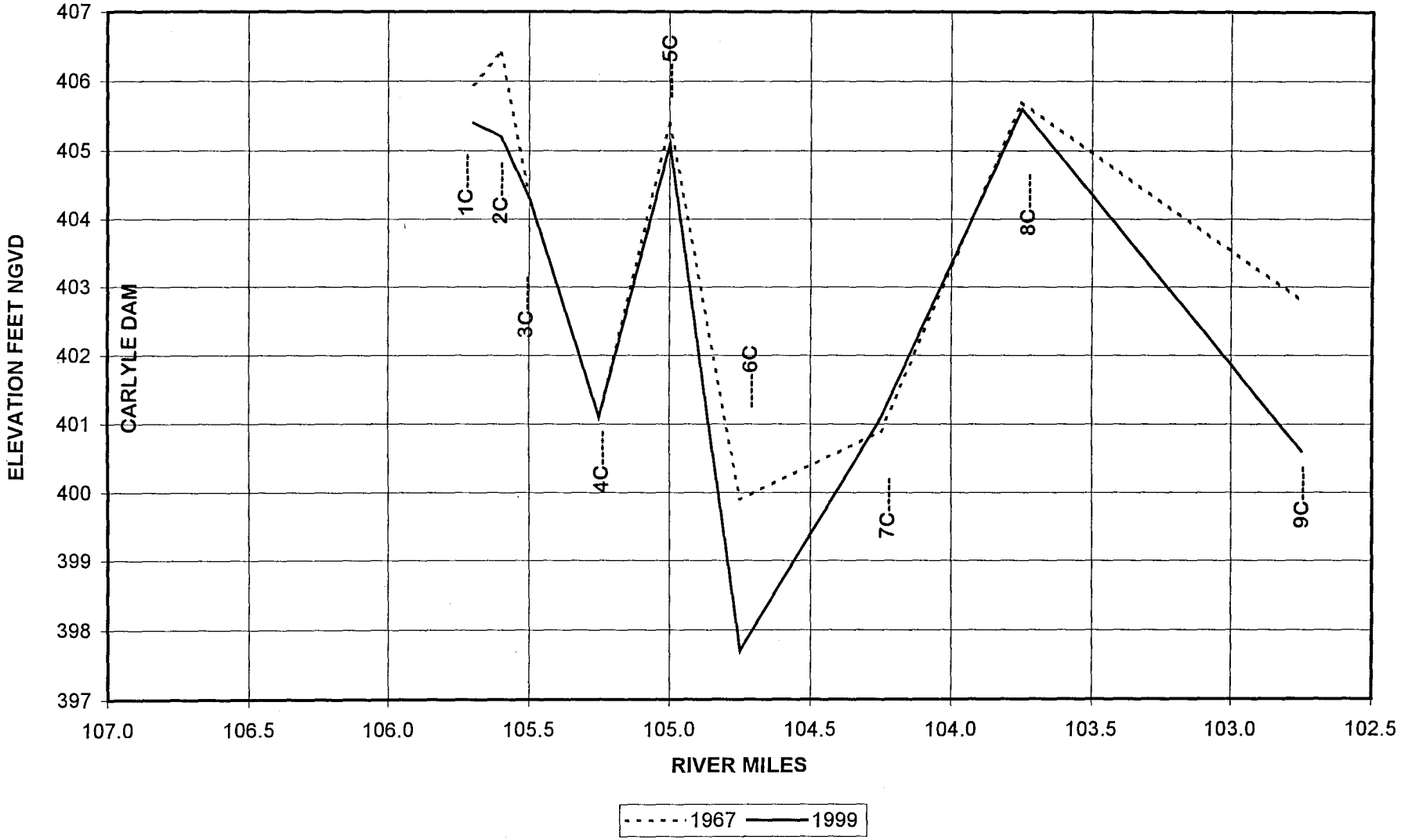
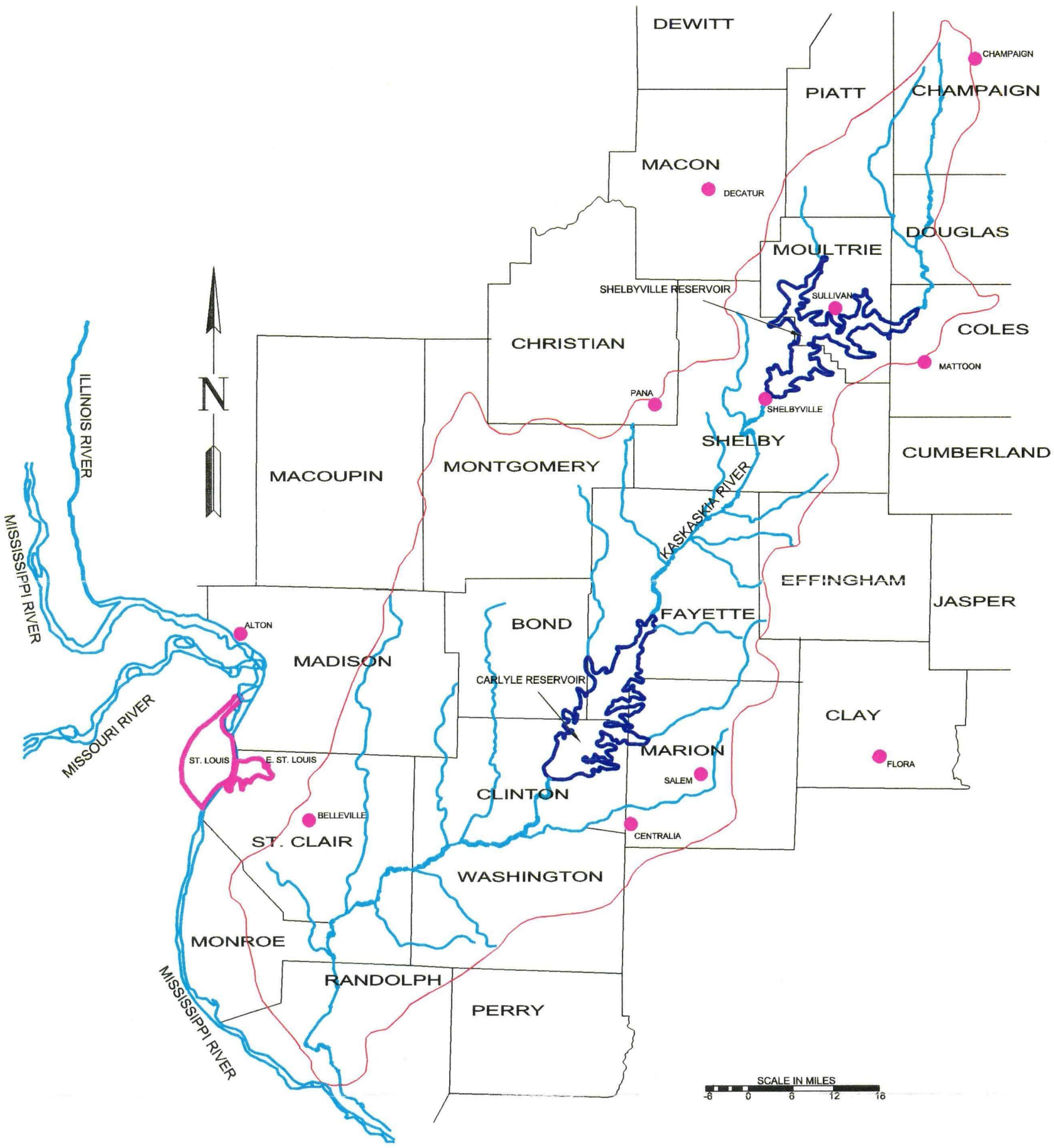


FIGURE 6. CARLYLE RESERVOIR DOWNSTREAM THALWEG





LEGEND

DRAINAGE BASIN BOUNDARY

PLATE NO. 1

UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE RESERVOIR

REPORT OF SEDIMENTATION, 1999 RESURVEY

Resource Technology, Inc.

File Name:

Plot Scale: Shown | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

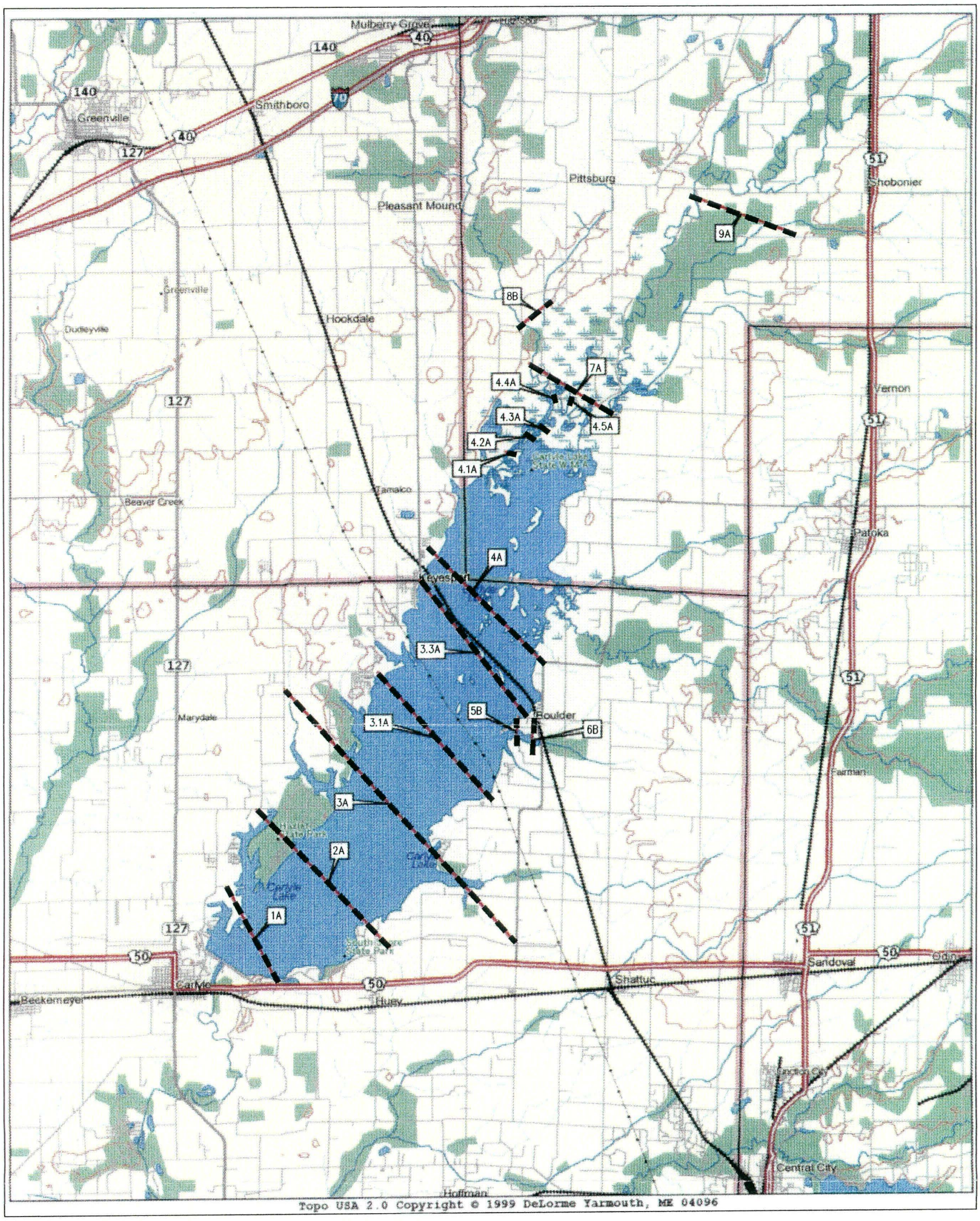


PLATE NO. 2

UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE

REPORT OF SEDIMENTATION, 1999 RESURVEY

Resource Technology, Inc.

File Name:

Plot Scale: Shown | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

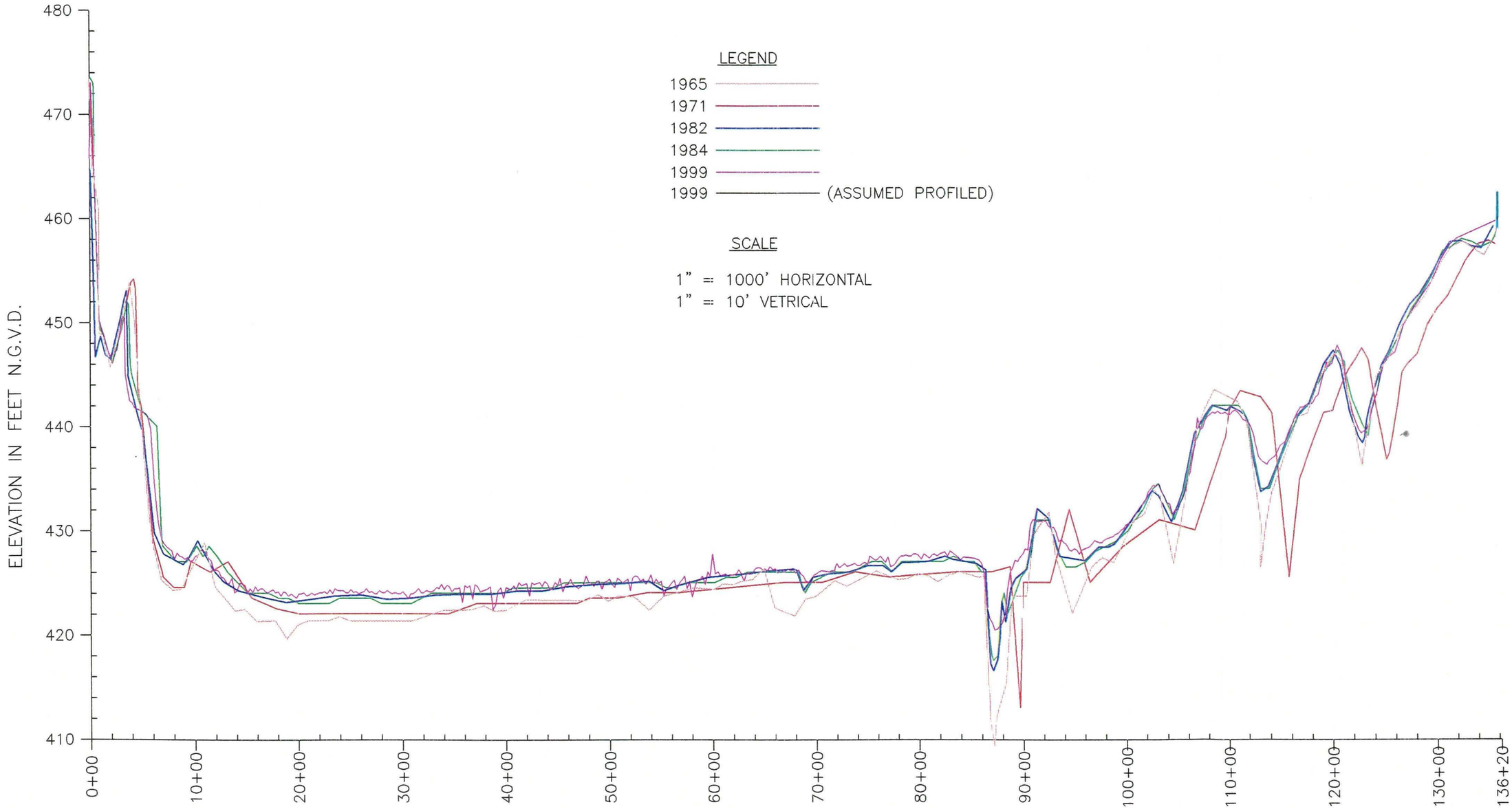
SEDIMENTATION RANGE 1A

LEGEND

1965
1971
1982
1984
1999
1999 (ASSUMED PROFILED)

SCALE

1" = 1000' HORIZONTAL
1" = 10' VETRICAL



US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

Resource Technology, Inc.

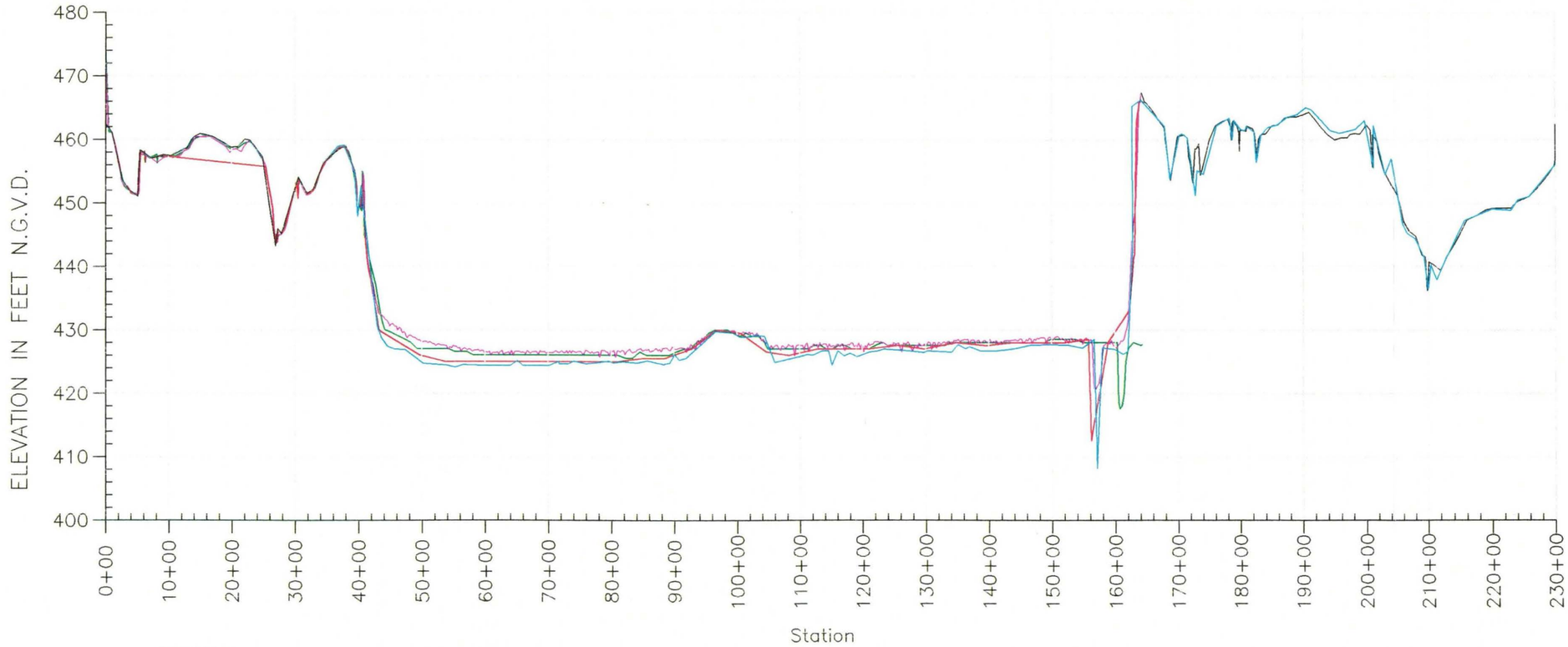
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

SR-1A

PLATE NO.
3

SEDIMENTATION RANGE 2A



LEGEND

1965
1965 (ASSUMED PROFILE)
1971
1984
1999
1999 (ASSUMED PROFILE)

SCALE

1" = 2000' HORIZONTAL
1" = 20' VETRICAL

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

Resource Technology, Inc.

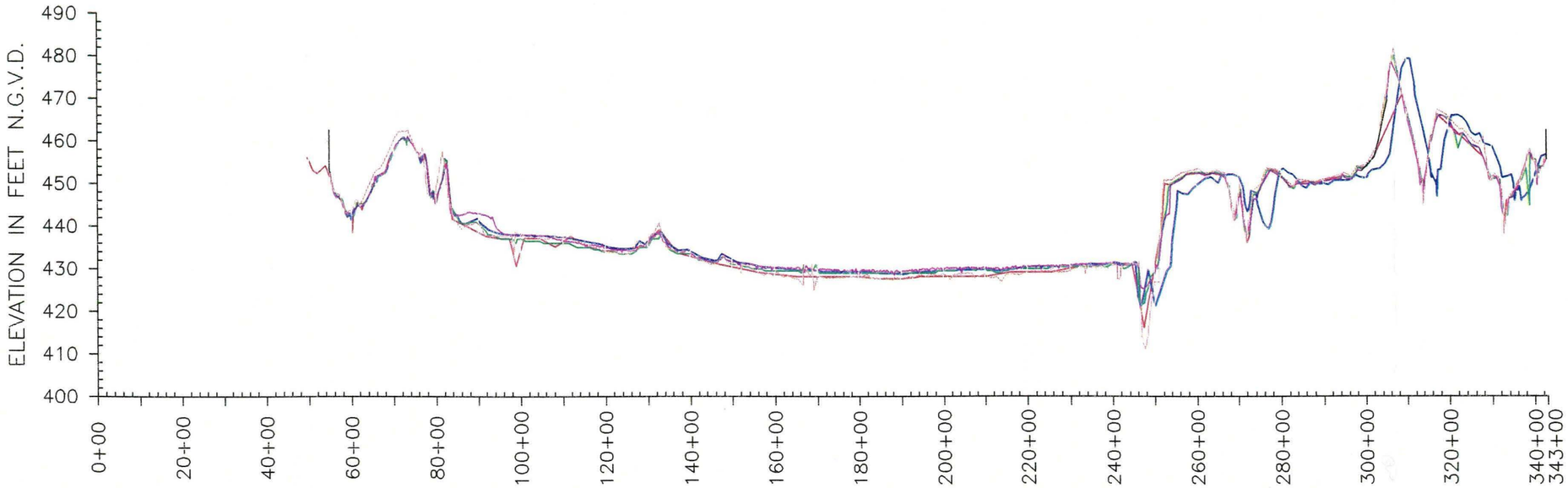
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

SR-2A

PLATE NO.
4

SEDIMENTATION RANGE 3A



SCALE

1" = 3000' HORIZONTAL
1" = 30' VETRICAL

LEGEND

1965
1971
1982
1984
1999
1999 (ASSUMED PROFILE)

NOTE: UNABLE TO OBTAIN PROFILE DATA STATION 299+16 TO STATION 305+22 DUE TO STANDING CORN CROP IN THIS AREA AT DATE OF SURVEY.

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

Resource Technology, Inc.

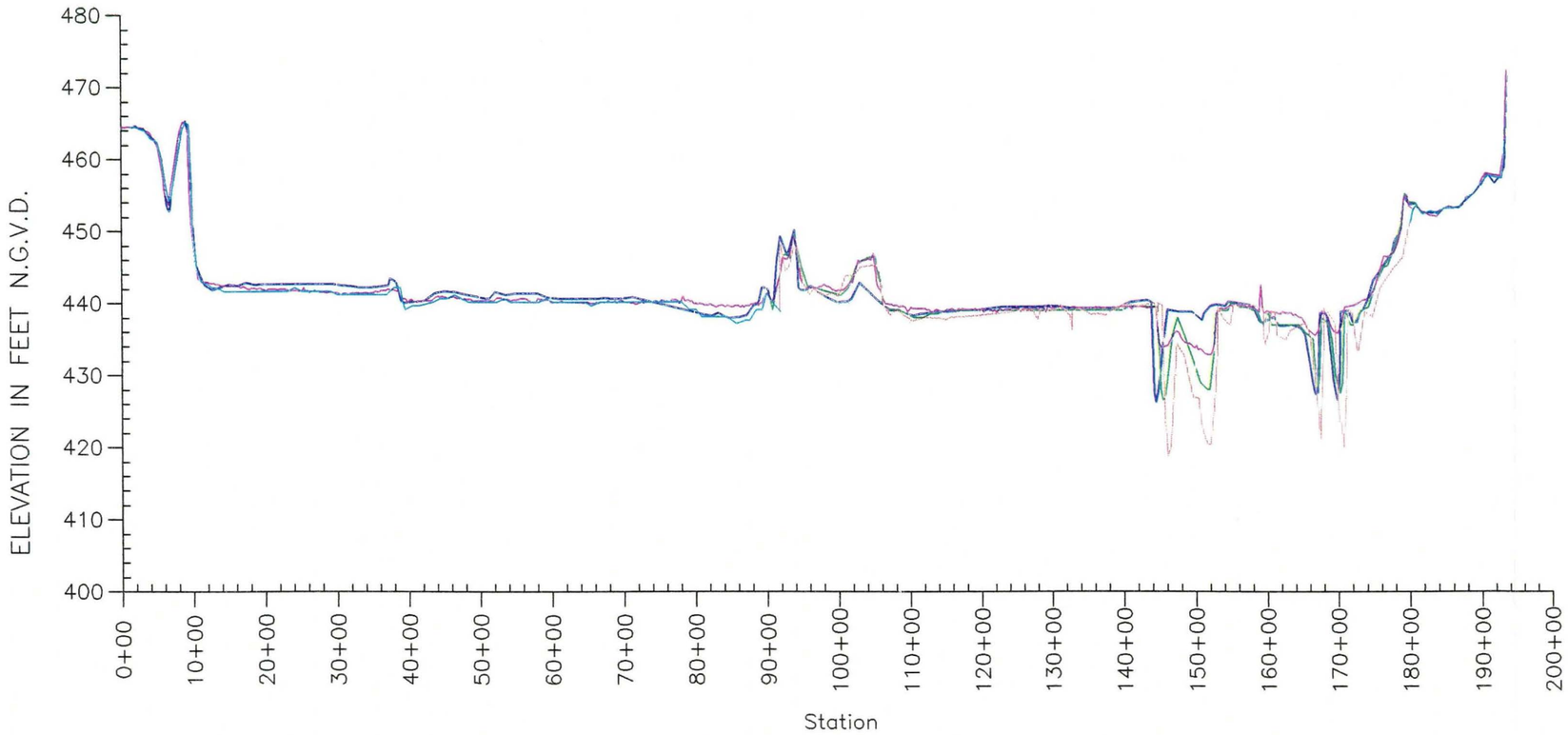
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

SR-3A

PLATE NO.
5

SEDIMENTATION RANGE 4A



LEGEND

1965
1965 (ASSUMED PROFILE)
1971
1982
1984
1999

SCALE

1" = 2000' HORIZONTAL
1" = 20' VETRICAL

NOTE: NO PROFILE DATA WAS RECORDED FROM STATION 13+00 TO STATION 91+61 FOR 1971 SURVEY.

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: 20scm | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

Resource Technology, Inc.

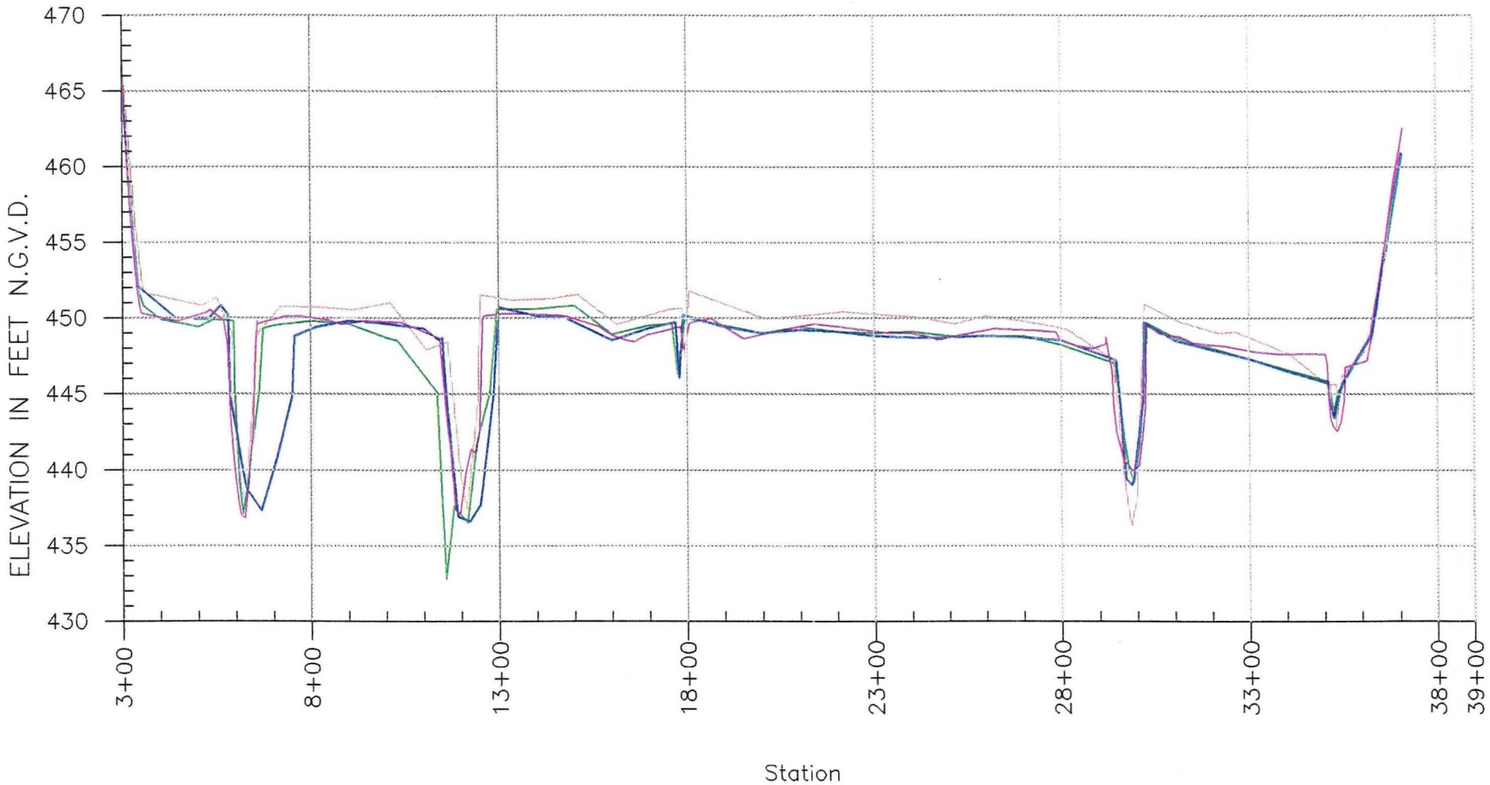
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION, 1999 RESURVEY

RS-4A

PLATE NO.
6

SEDIMENTATION RANGE 5B



LEGEND

1965
1982
1984
1999

SCALE

1" = 400' HORIZONTAL
1" = 10' VETRICAL

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: 50wm | Plot Date: 8/2000

ero Accidents
ero Tolerance

Resource Technology, Inc.

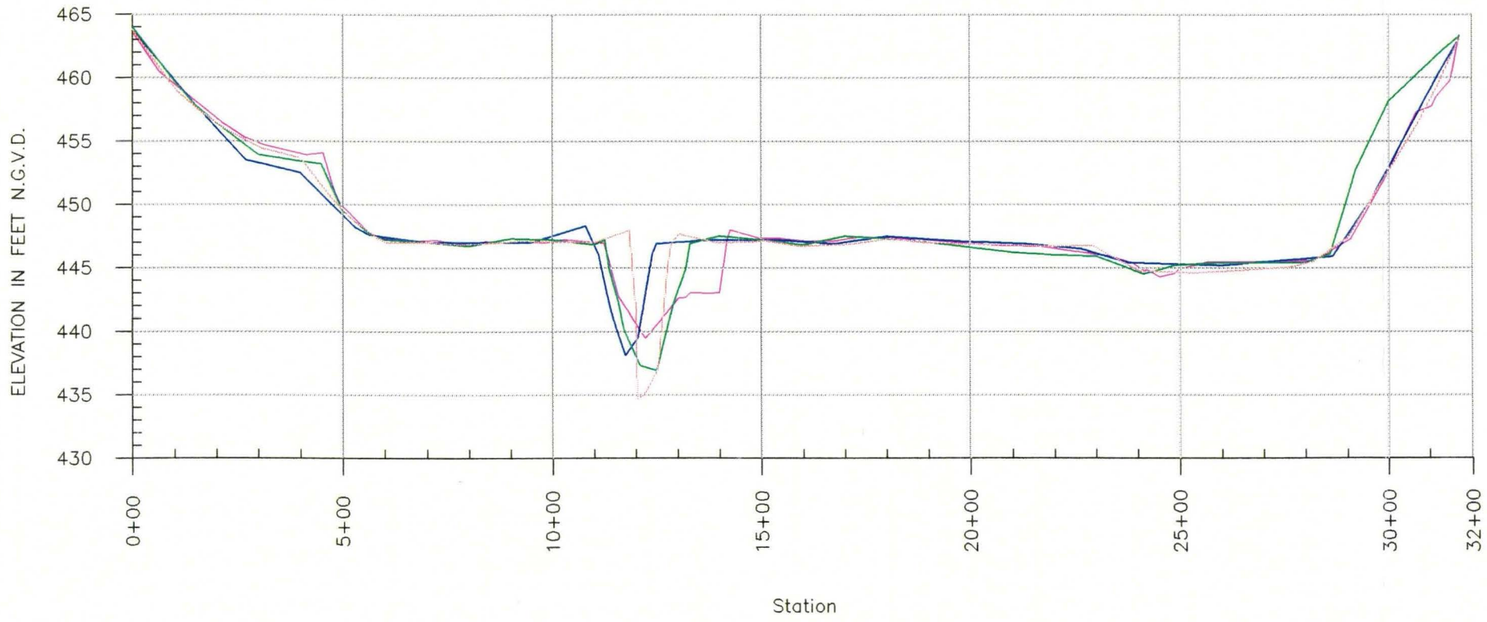
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

SR-5B

PLATE NO.
7

SEDIMENTATION RANGE 6B



LEGEND

1965
1982
1984
1999

SCALE

1" = 300' HORIZONTAL
1" = 10' VETRICAL

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 6/2000

ero Accidents
ero Tolerance

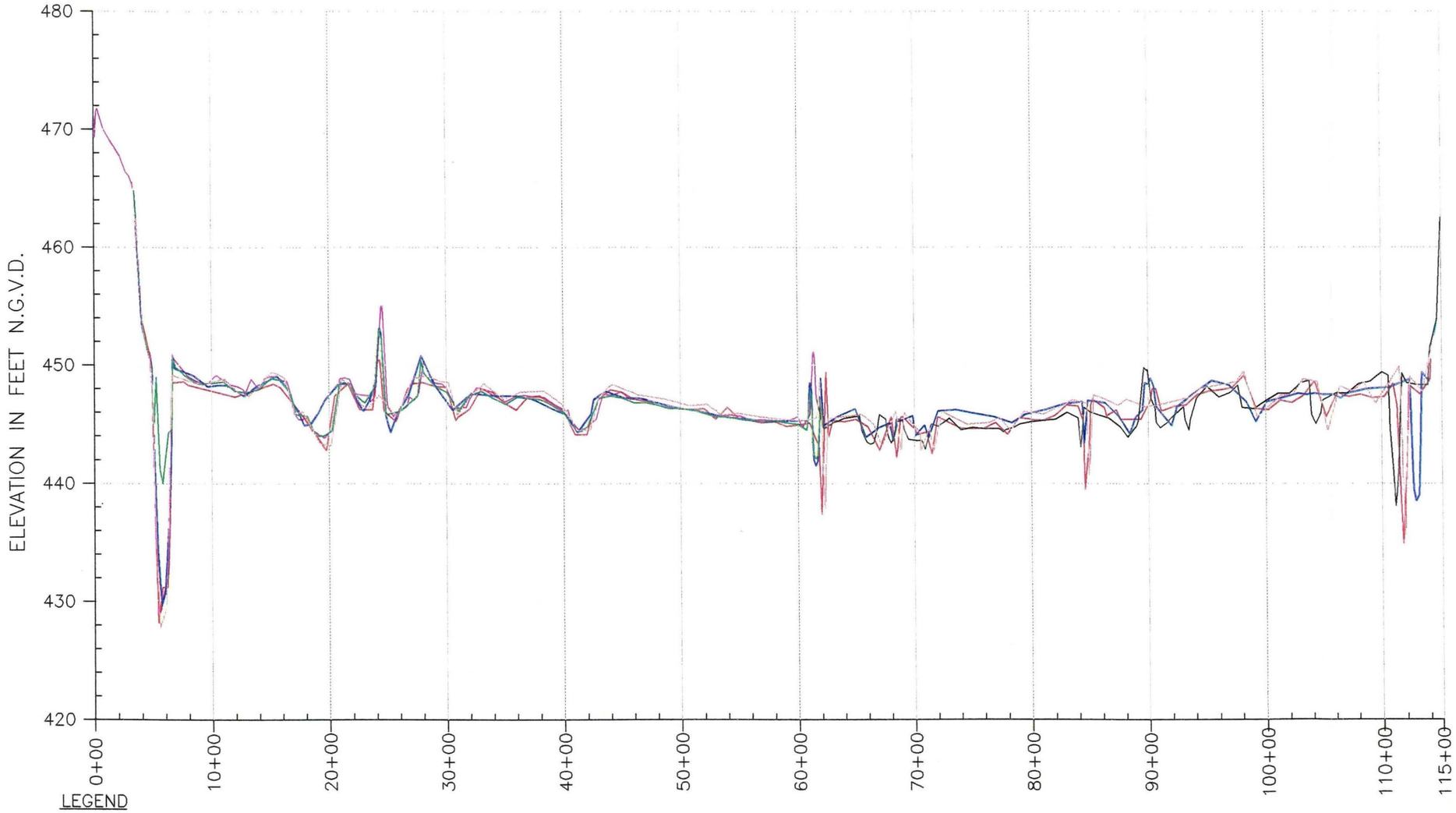
Resource Technology, Inc.

UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS
CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

SR-6B

PLATE NO.
8

SEDIMENTATION RANGE 7A



LEGEND

1965
1965 (ASSUMED PROFILE)
1971
1982
1984
1999
1999 (ASSUMED PROFILE)

SCALE

1" = 1000' HORIZONTAL
1" = 10' VETRICAL

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 6/2000
ero Accidents
ero Tolerance

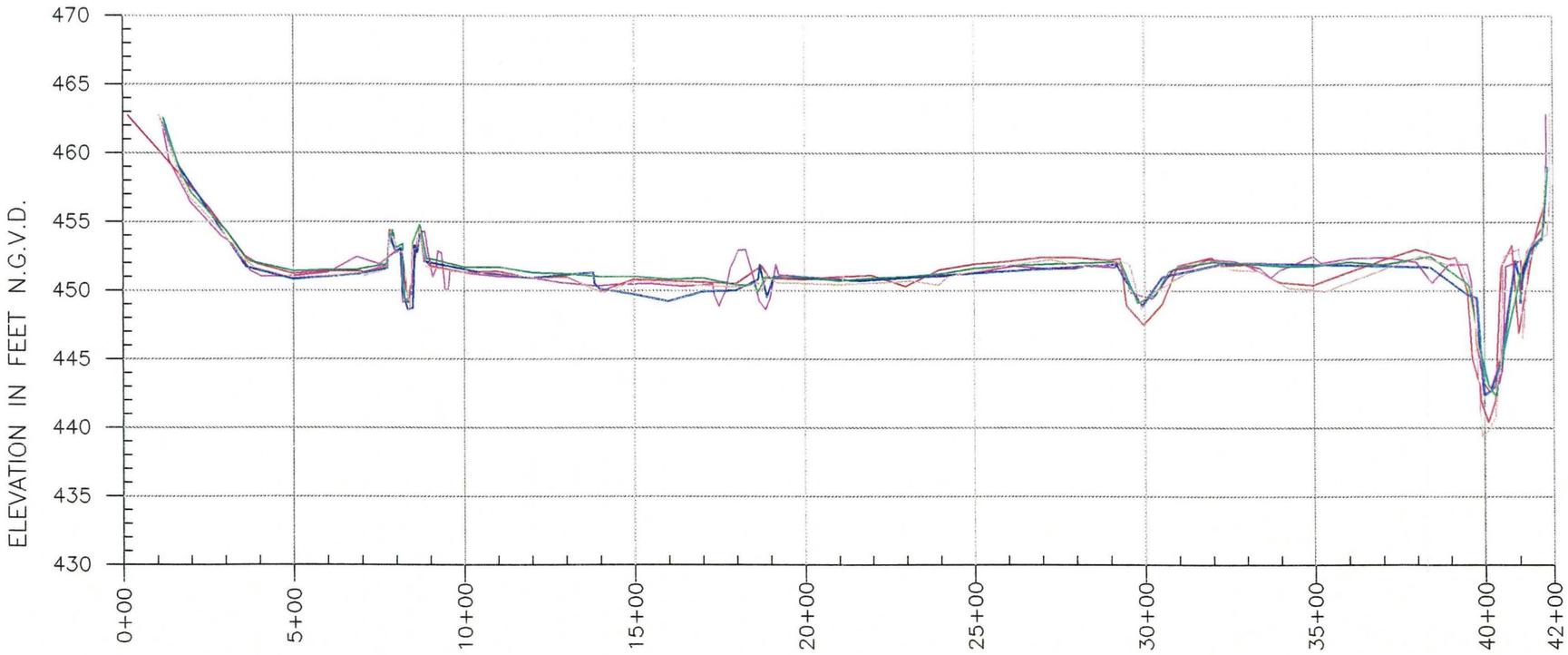
Resource Technology, Inc.

UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS
CARLYLE LAKE
REPORT OF SEDIMENTATION, 1999 RESURVEY

SR-7A

PLATE NO.
9

SEDIMENTATION RANGE 8B



LEGEND

1965
1971
1982
1984
1999

SCALE

1" = 400' HORIZONTAL
1" = 10' VETRICAL

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

Resource Technology, Inc.

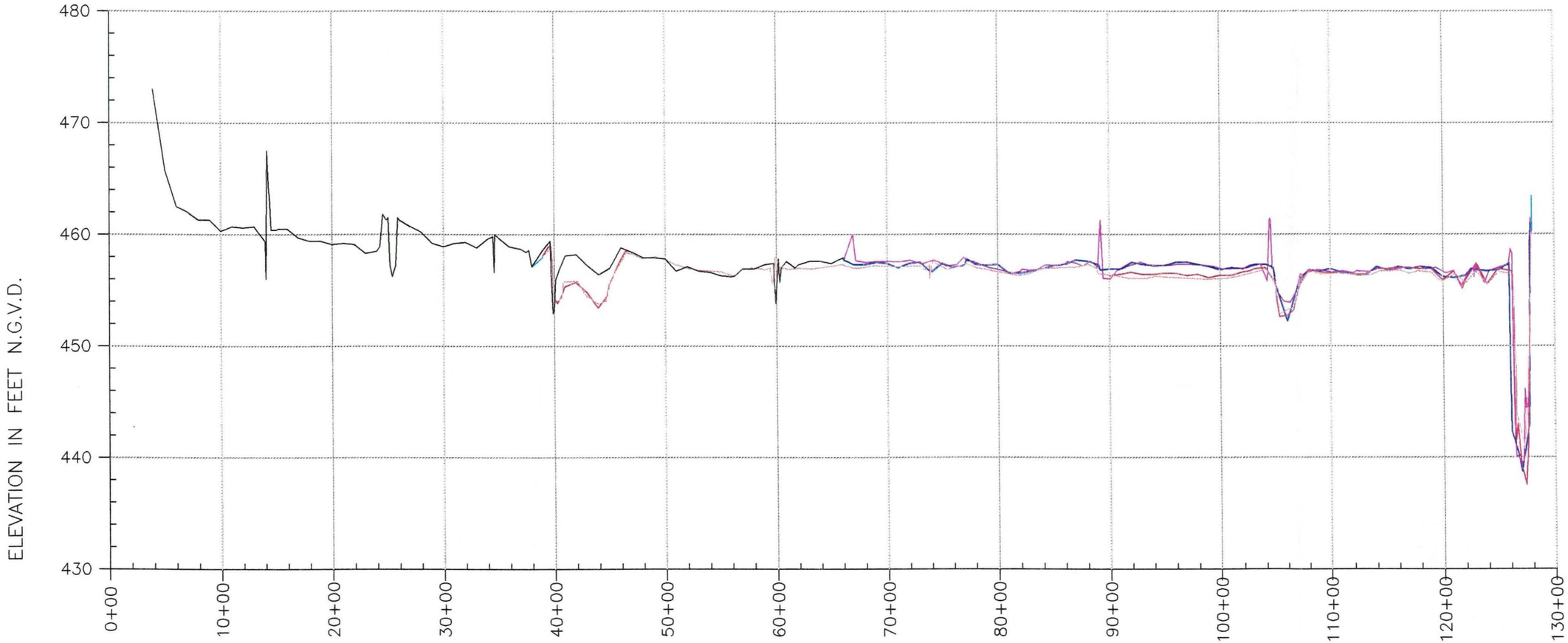
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

SR-8B

PLATE NO.
10

SEDIMENTATION RANGE 9A



LEGEND

1965
1965 (ASSUMED PROFILE)
1971
1982
1999
1999 (ASSUMED PROFILE)

SCALE

1" = 1000' HORIZONTAL
1" = 10' VETRICAL

NOTE: NO PROFILE DATA WAS RECORDED FROM STATION 46+46 TO STATION 90+00 FOR 1971 SURVEY.

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: 50wm | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

Resource Technology, Inc.

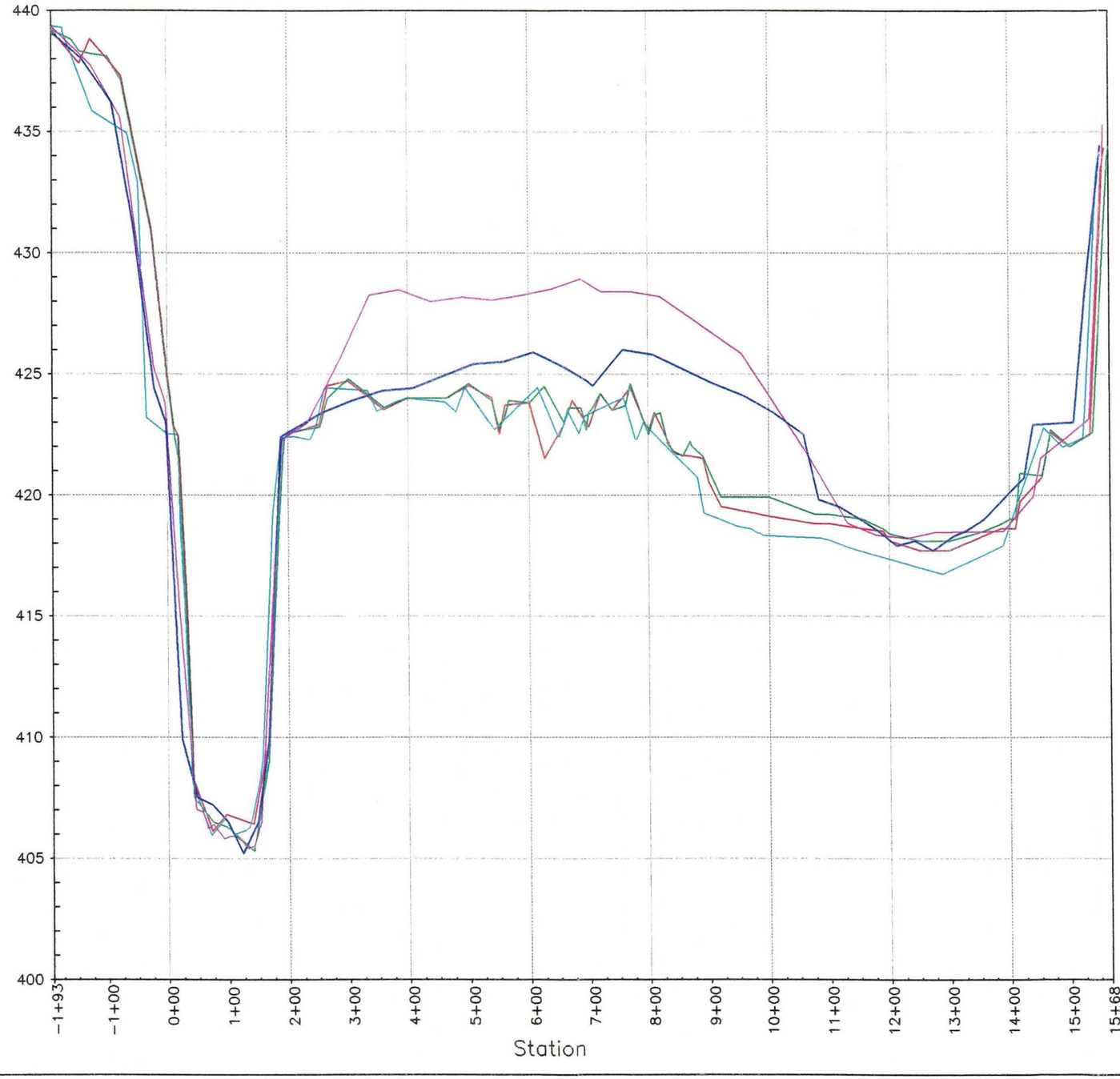
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION, 1999 RESURVEY

SR-9A

PLATE NO.
11

RETROGRESSION RANGE 1C



LEGEND

1965
1971
1976
1982
1999

SCALE

1" = 200' HORIZONTAL
1" = 5' VERTICAL

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

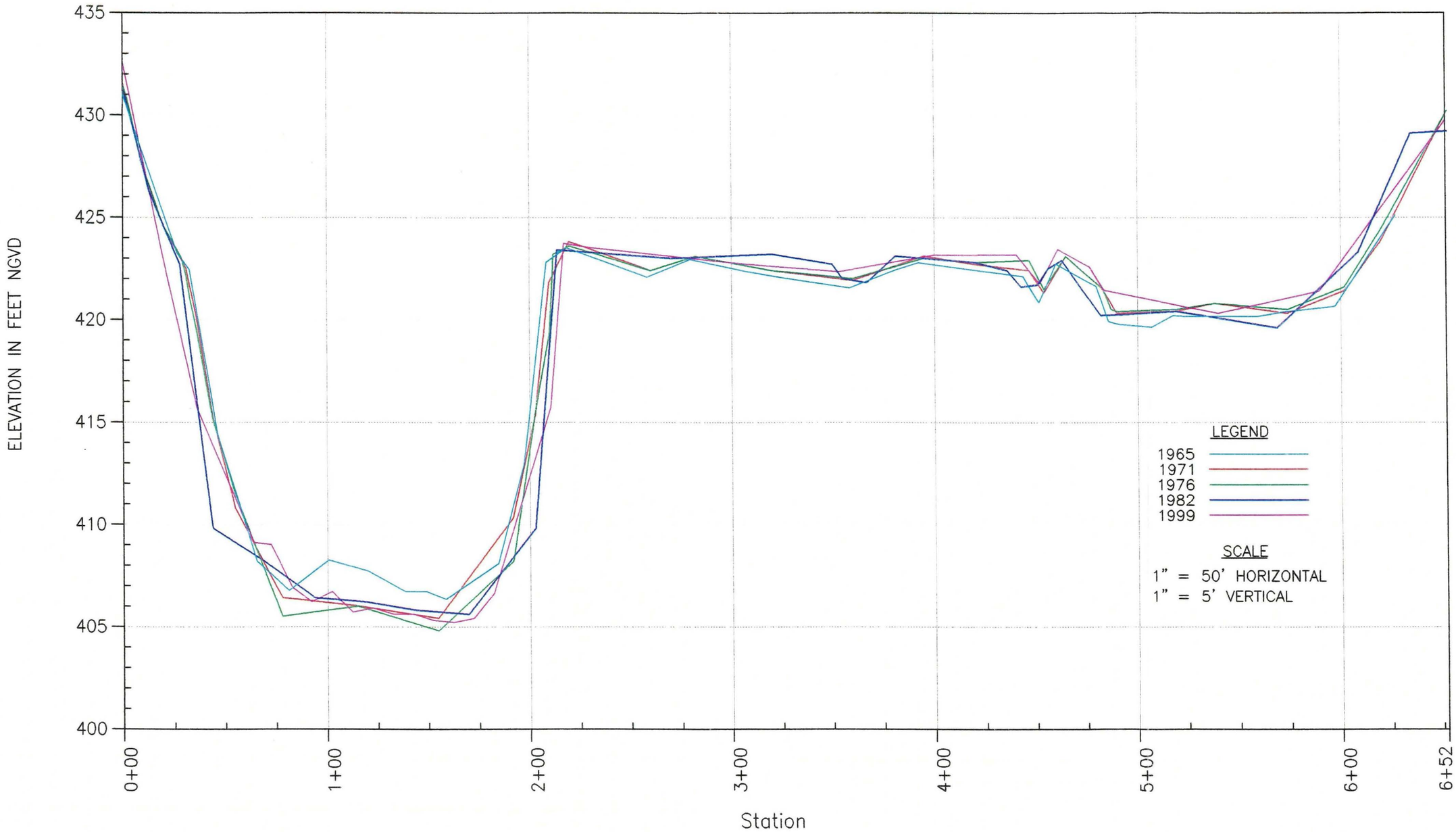
Resource Technology, Inc.

UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS
CARLYLE LAKE
REPORT OF SEDIMENTATION, 1999 RESURVEY

RR-1C

PLATE NO.
12

RETROGRESSION RANGE 2C



US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

Resource Technology, Inc.

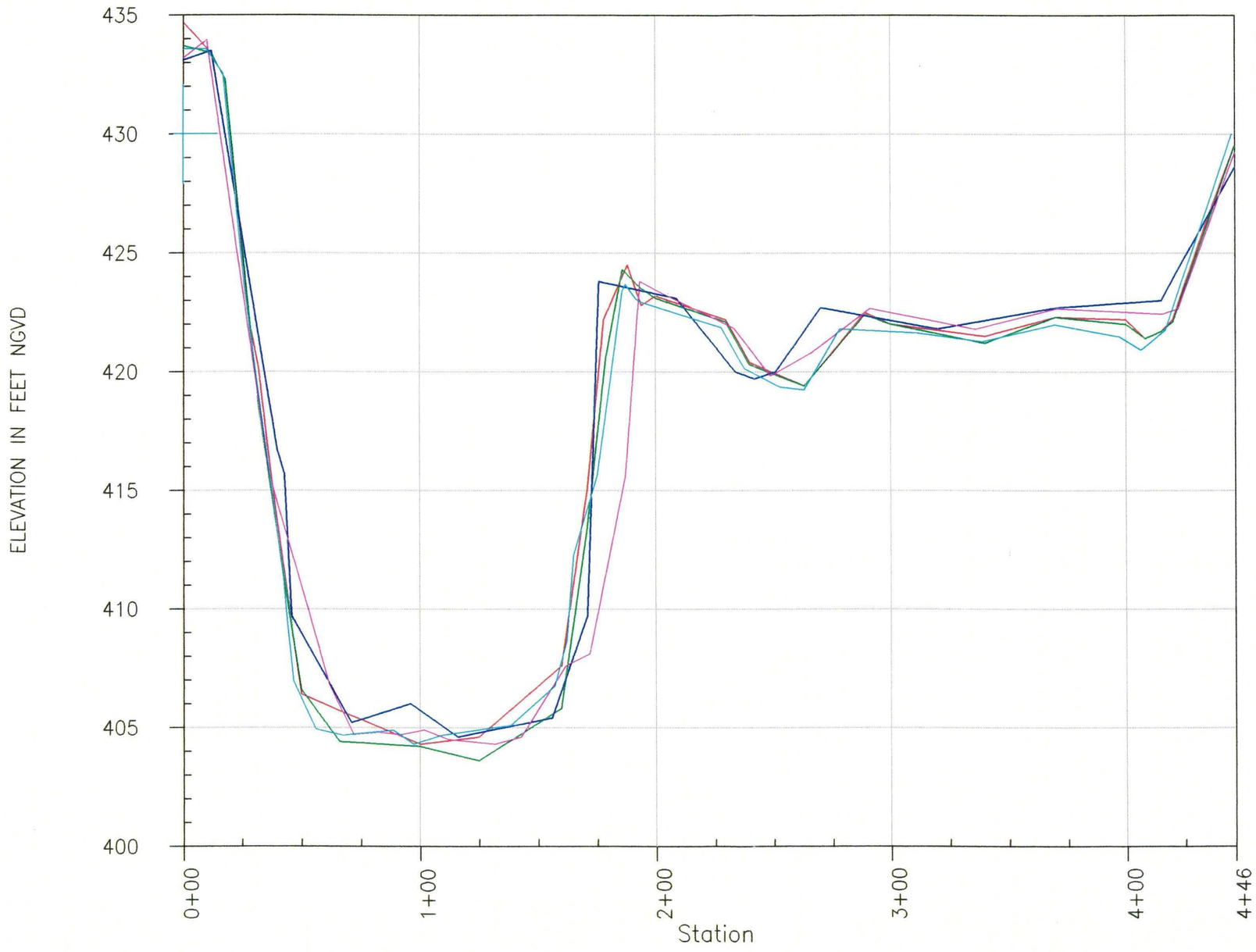
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

RR-2C

PLATE NO.
13

RETROGRESSION RANGE 3C



LEGEND

1965
1971
1976
1982
1999

SCALE

1" = 50' HORIZONTAL
1" = 5' VERTICAL

US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 8/2000

ero Accidents
ero Tolerance

Resource Technology, Inc.

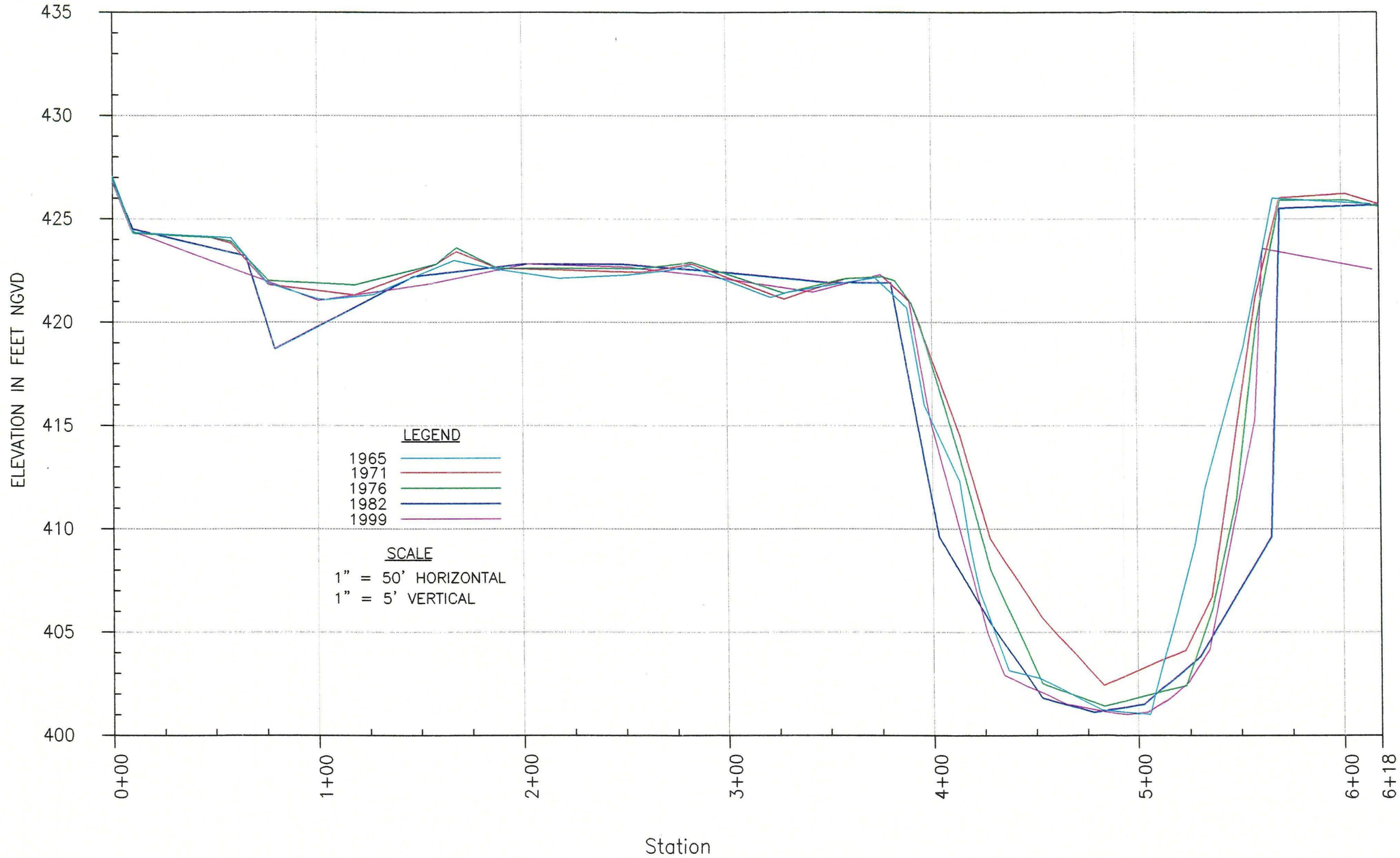
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

RR-3C

PLATE NO.
14

RETROGRESSION RANGE 4C



US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Names
Plot Scale: Shown | Plot Date: 8/2000

Zero Accidents
Zero Tolerance

Resource Technology, Inc.

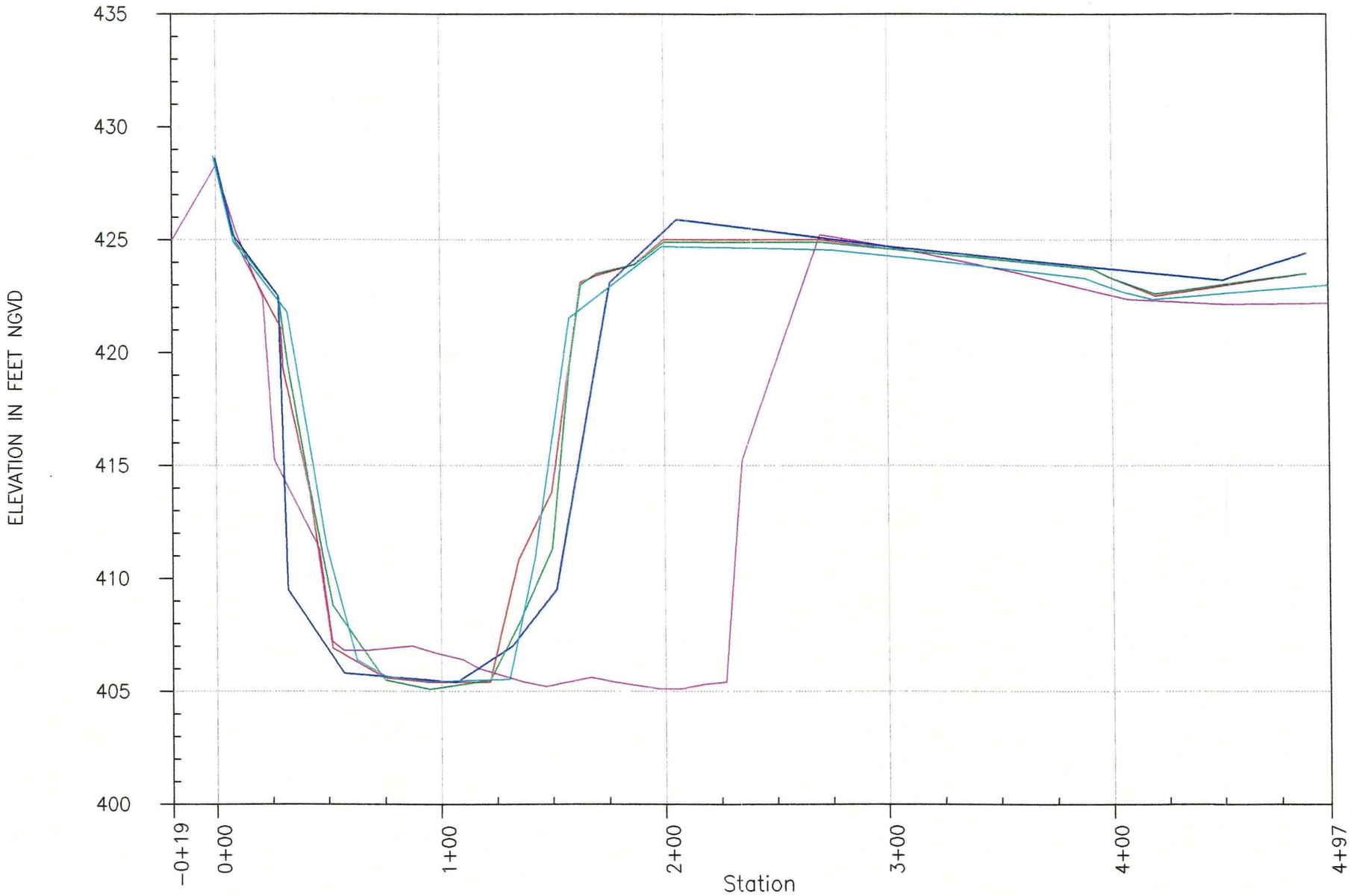
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

RR-4C

PLATE NO.
15

RETROGRESSION RANGE 5C



US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 8/2000
Zero Accidents
Zero Tolerance

Resource Technology, Inc.

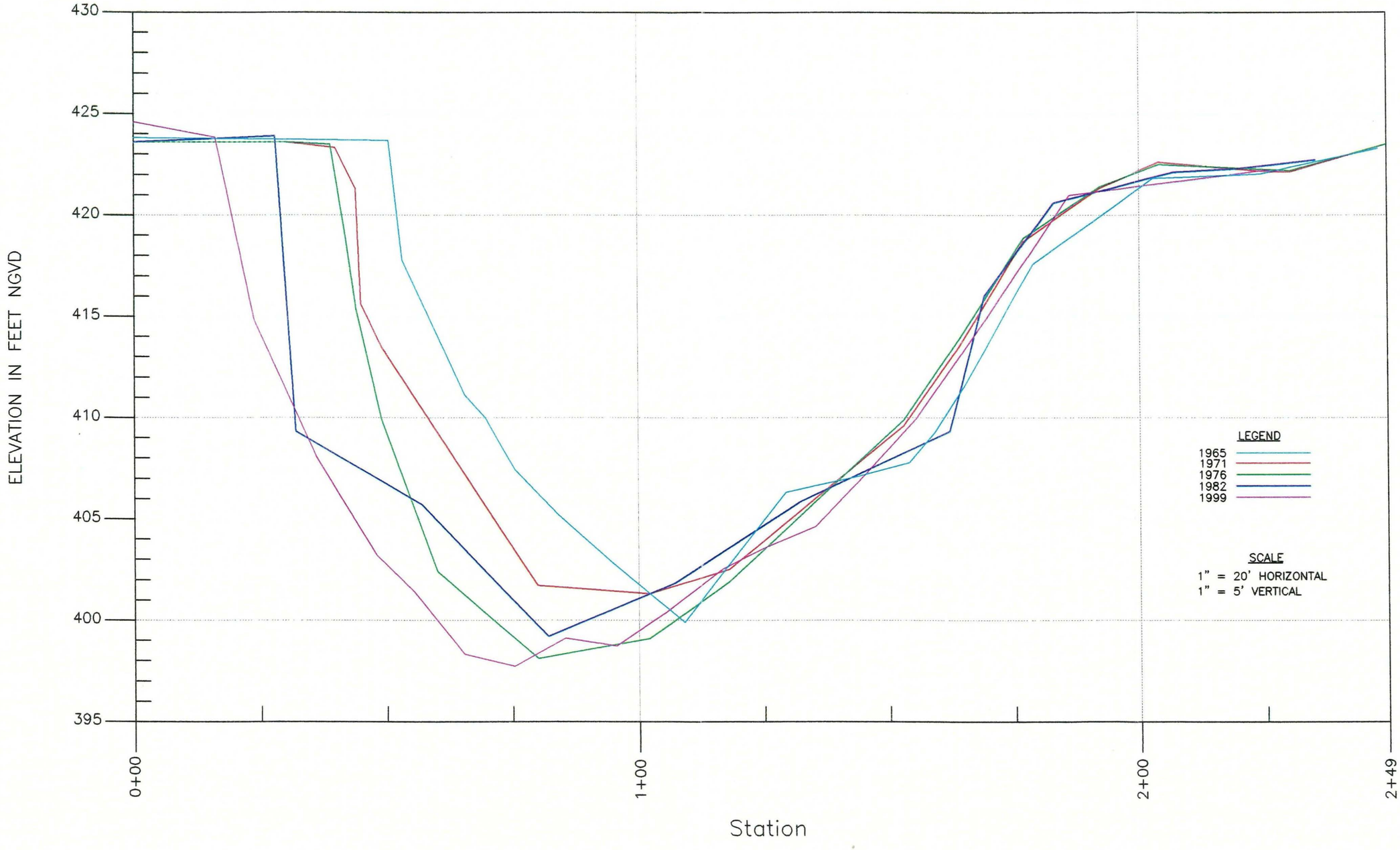
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

RR-5C

PLATE NO.
16

RETROGRESSION RANGE 6C



US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown
Plot Date: 8/2000

Zero Accidents
Zero Tolerance

Resource Technology, Inc.

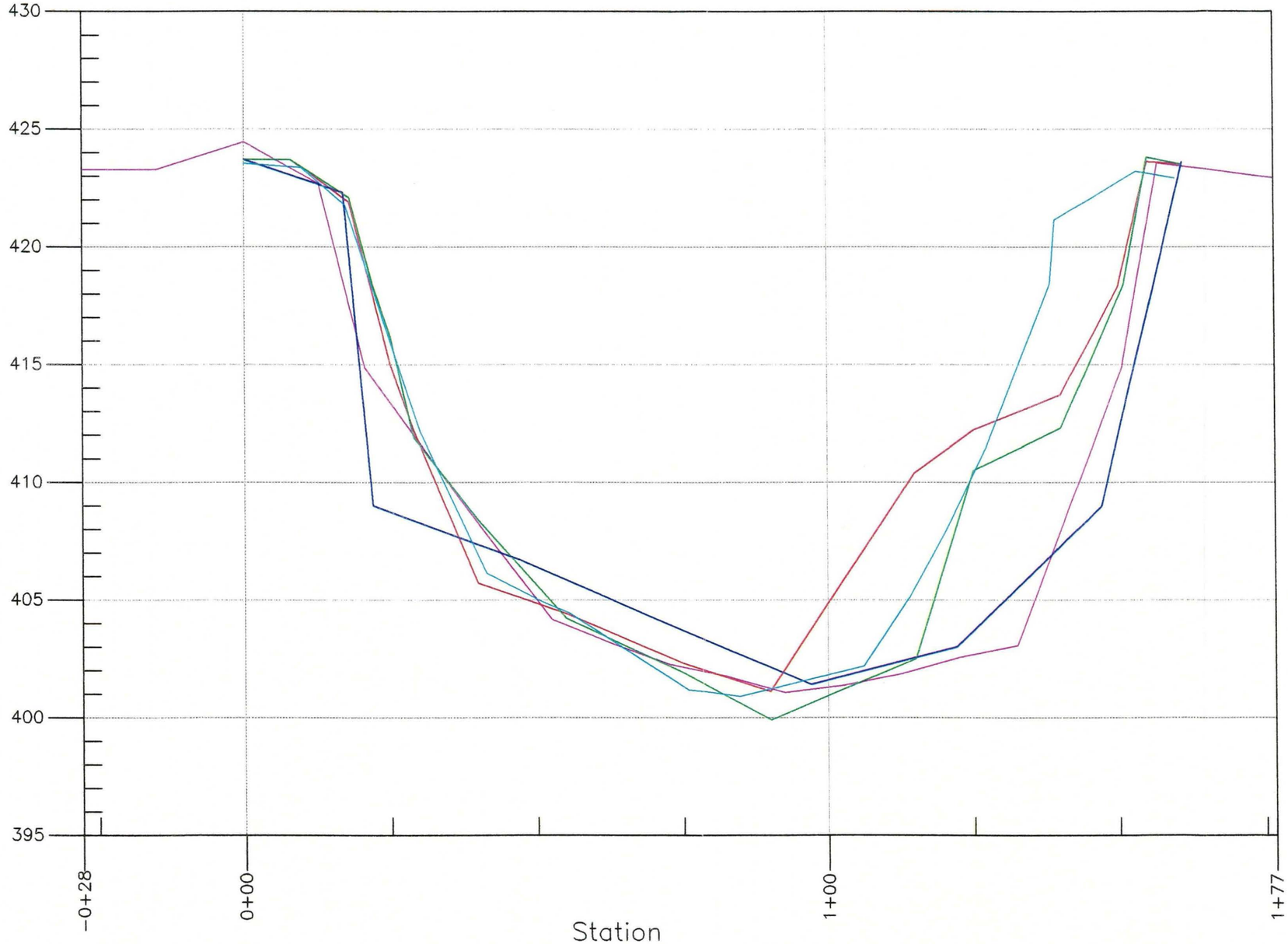
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

RR-6C

PLATE NO.
17

RETROGRESSION RANGE 7C



US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown
Plot Date: 8/2000
ero Accidents
ero Tolerance

Resource Technology, Inc.

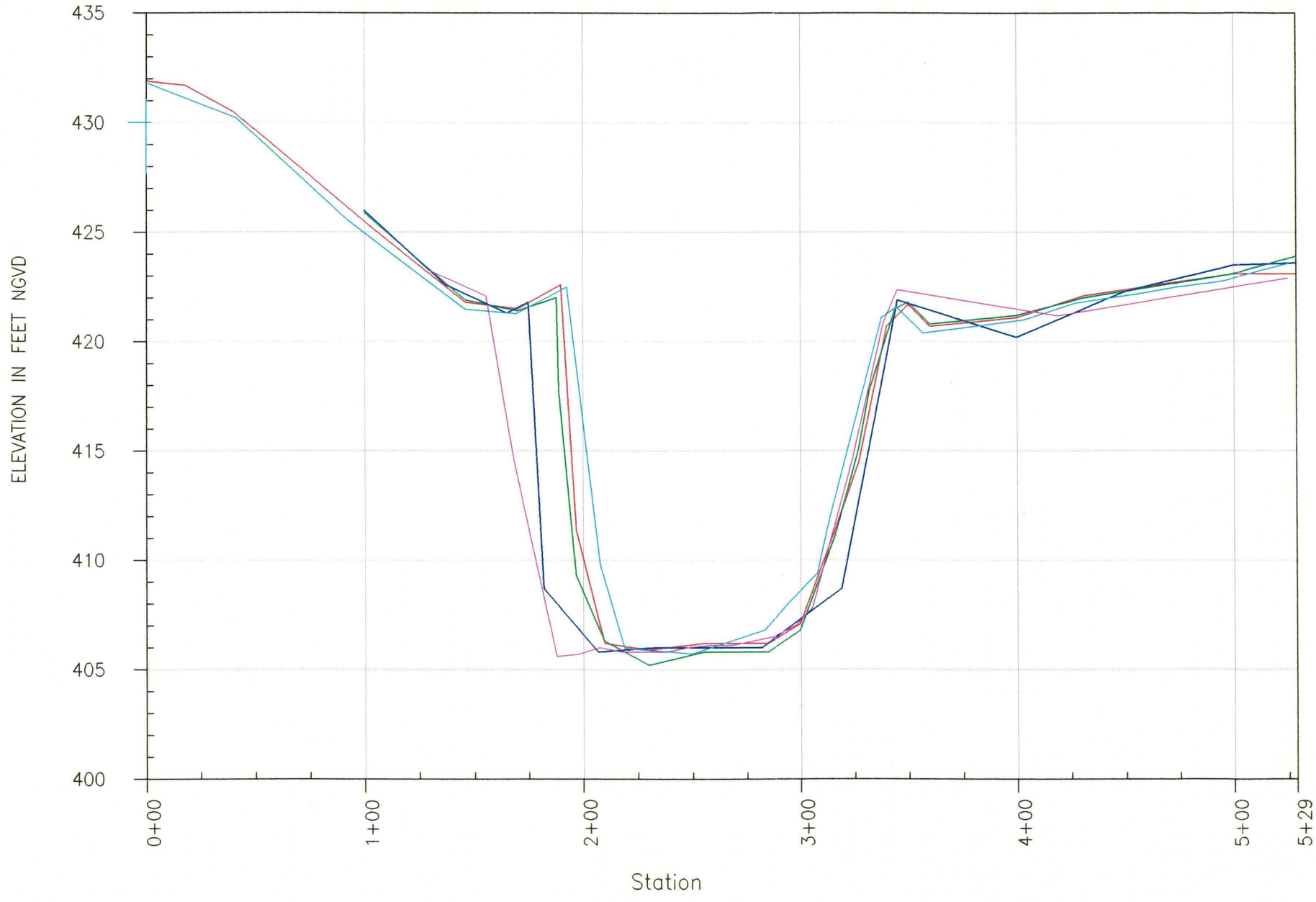
UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

RR-7C

PLATE NO.
18

RETROGRESSION RANGE 8C



US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 8/2000
Zero Accidents
Zero Tolerance

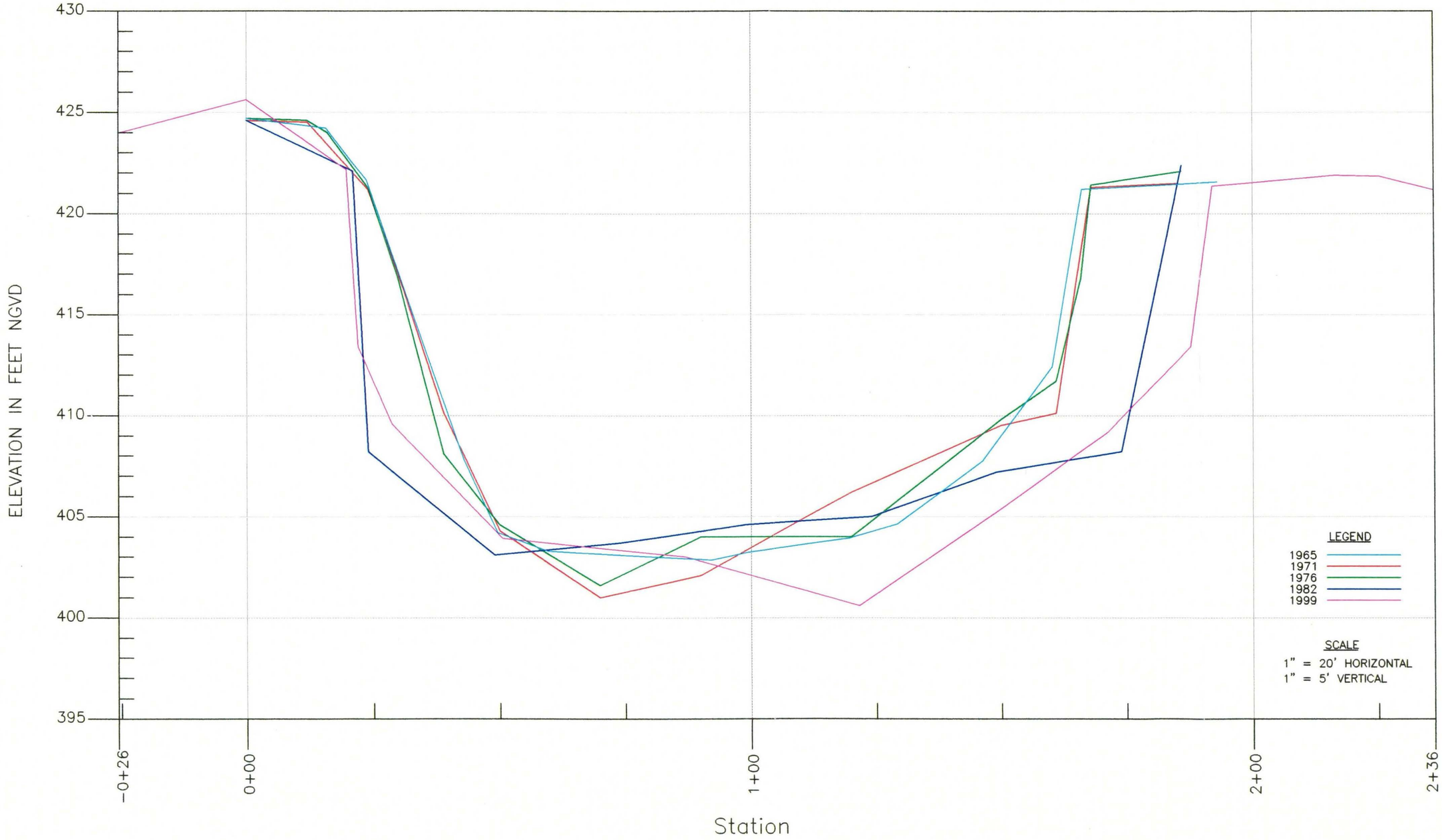
Resource Technology, Inc.

UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS
CARLYLE LAKE
REPORT OF SEDIMENTATION, 1999 RESURVEY

RR-8C

PLATE NO.
19

RETROGRESSION RANGE 9C



US Army Corps of Engineers
ST. LOUIS DISTRICT
St. Louis, Missouri

File Name:
Plot Scale: Shown | Plot Date: 6/2000

Zero Accidents
Zero Tolerance

Resource Technology, Inc.

UPPER MISSISSIPPI RIVER BASIN KASKASKIA RIVER, ILLINOIS

CARLYLE LAKE
REPORT OF SEDIMENTATION,
1999 RESURVEY

RR-9C

PLATE NO.
20

APPENDIX A.

Sedimentation Ranges Not Surveyed in 1999

And Other Relevant Plates from Report on Sedimentation, 1984

LAKE CARLYLE

SEDIMENTATION RANGE : 3.1A

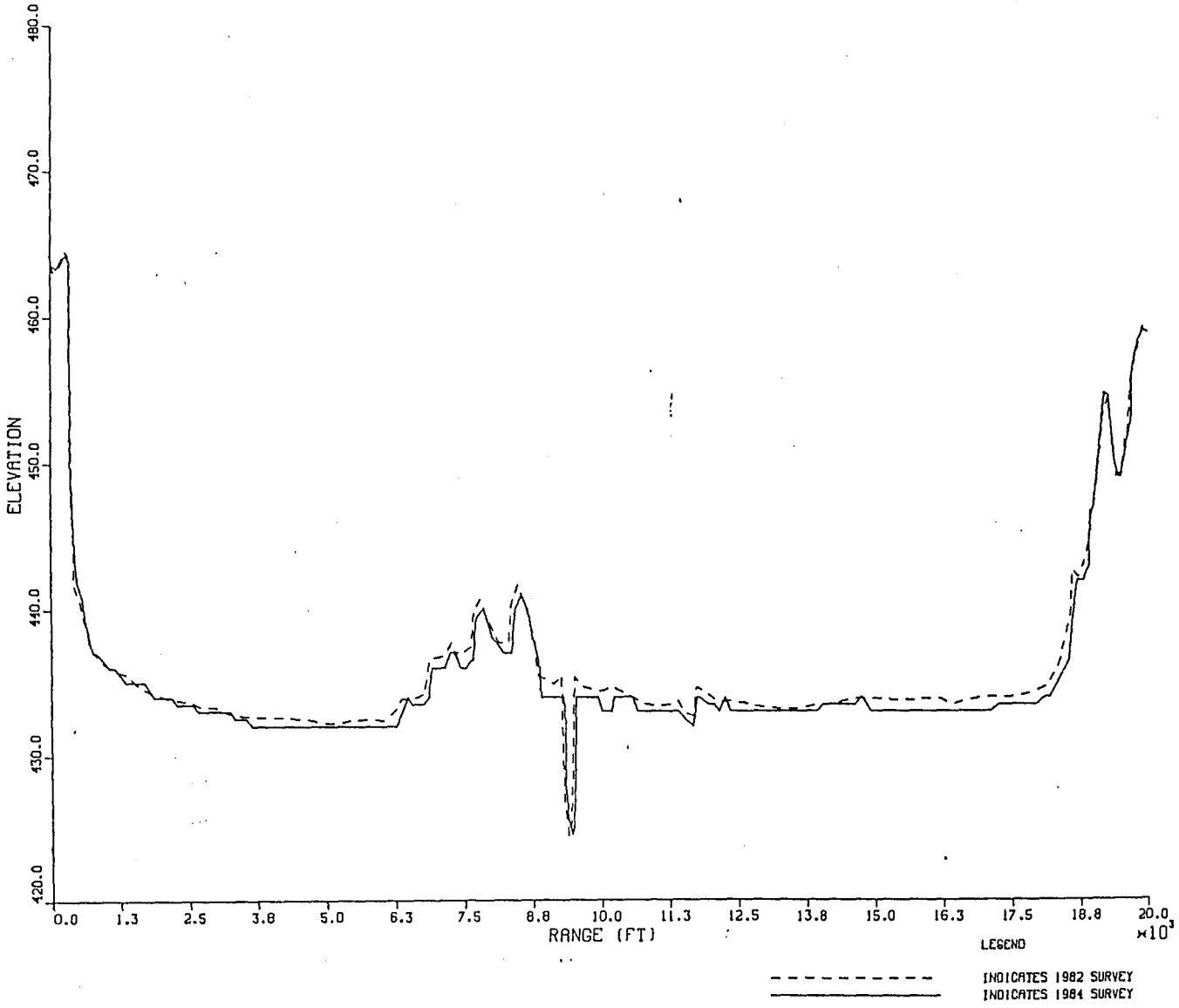
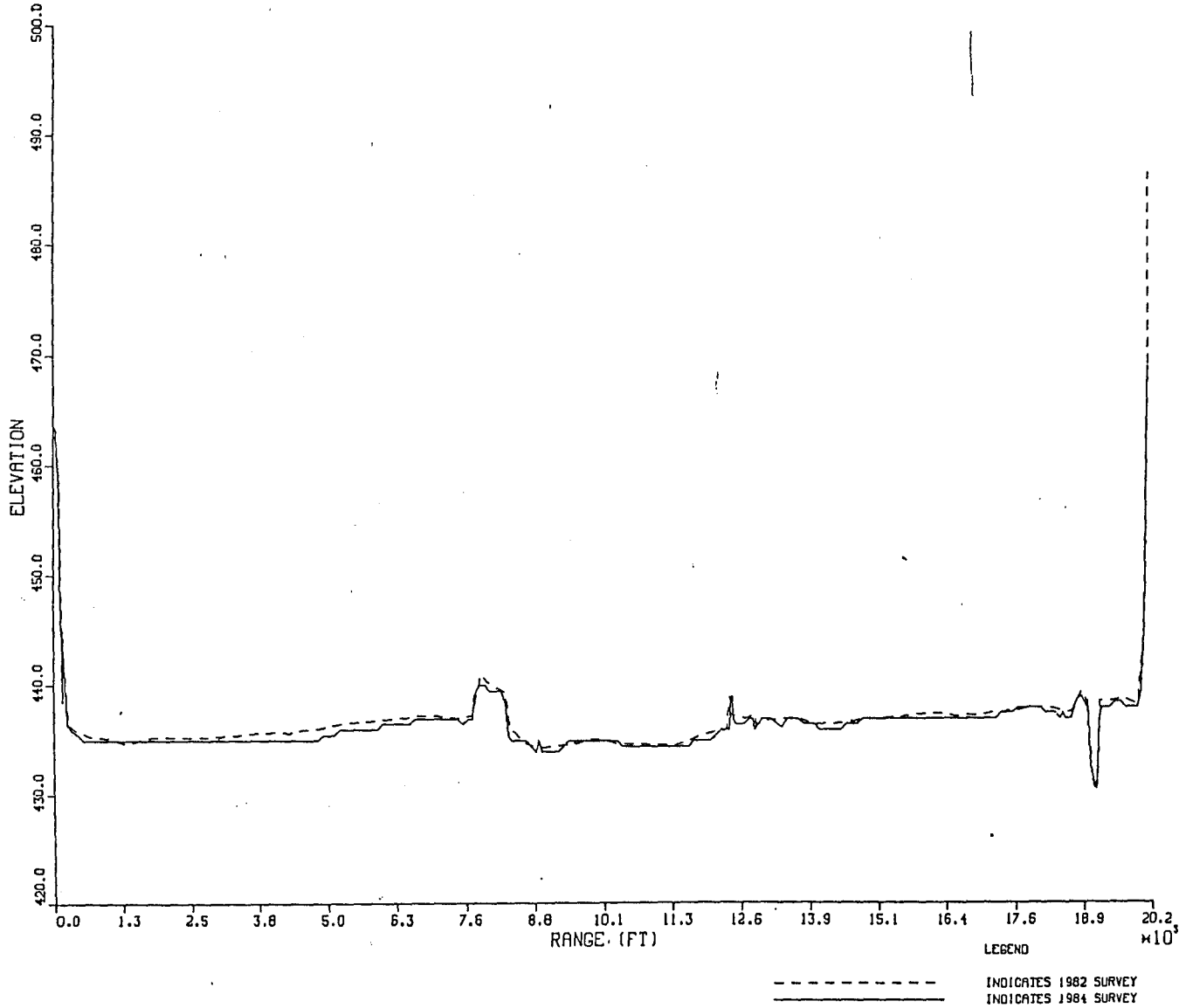


PLATE 15

LAKE CARLYLE

SEDIMENTATION RANGE : 3.2A



PLATE

LAKE CARLYLE

SEDIMENTATION RANGE : 4.1A

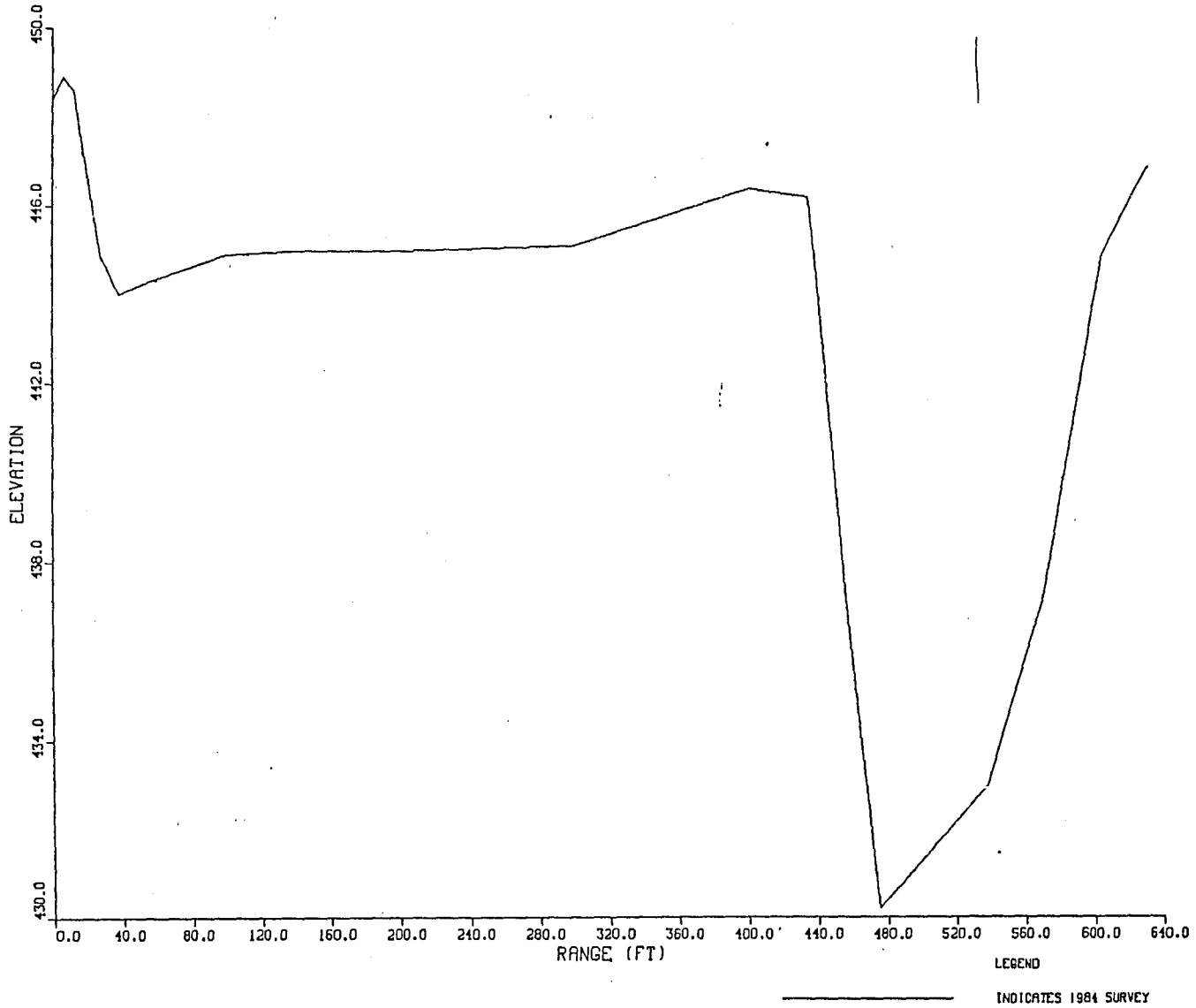


PLATE 17

LAKE CARLYLE

SEDIMENTATION RANGE : 4.2A

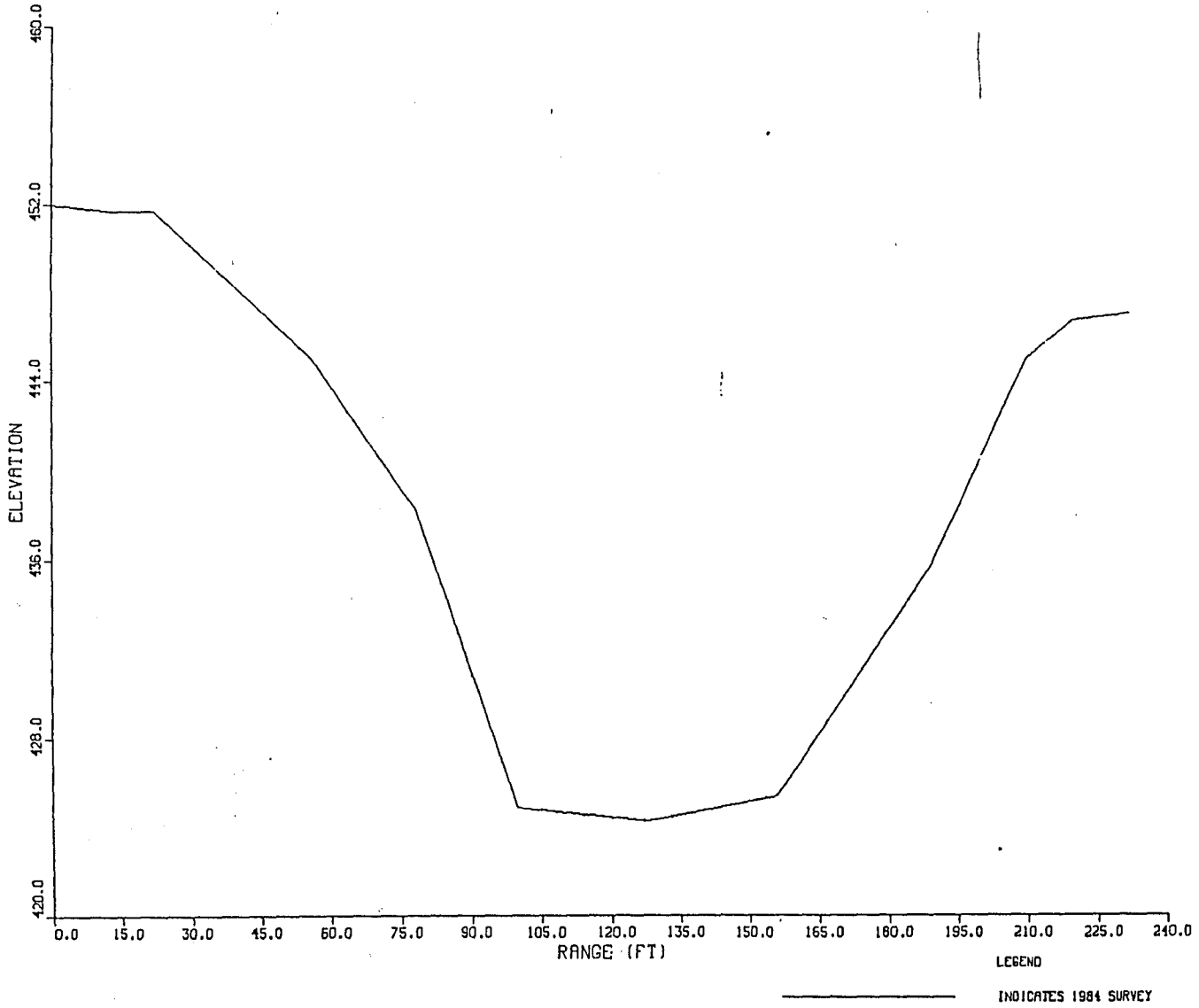


PLATE 18

LAKE CARLYLE

SEDIMENTATION RANGE : 4.3A

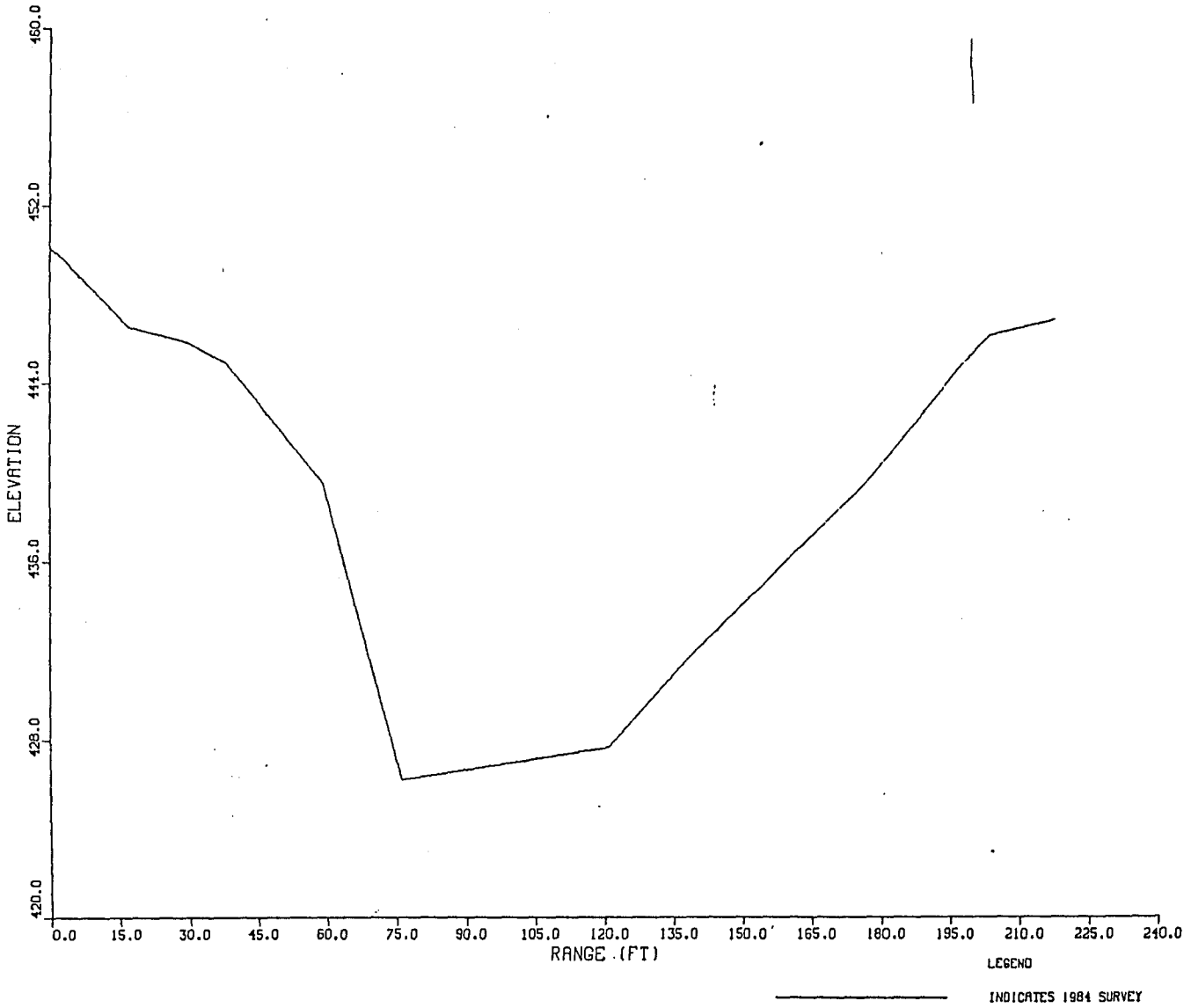


PLATE 10

LAKE CARLYLE

SEDIMENTATION RANGE : 4.4A

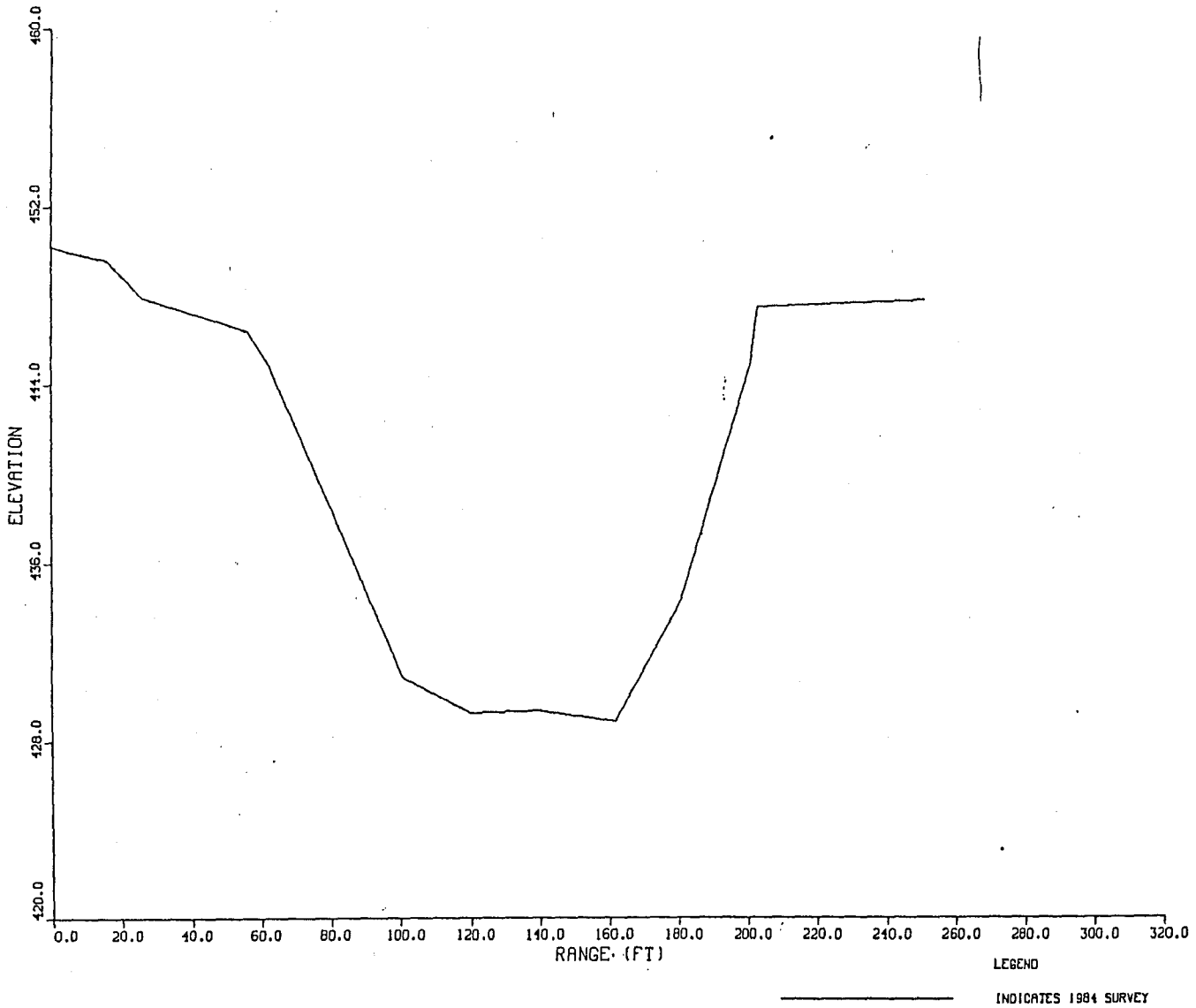


PLATE 20

LAKE CARLYLE

SEDIMENTATION RANGE : 4.5A

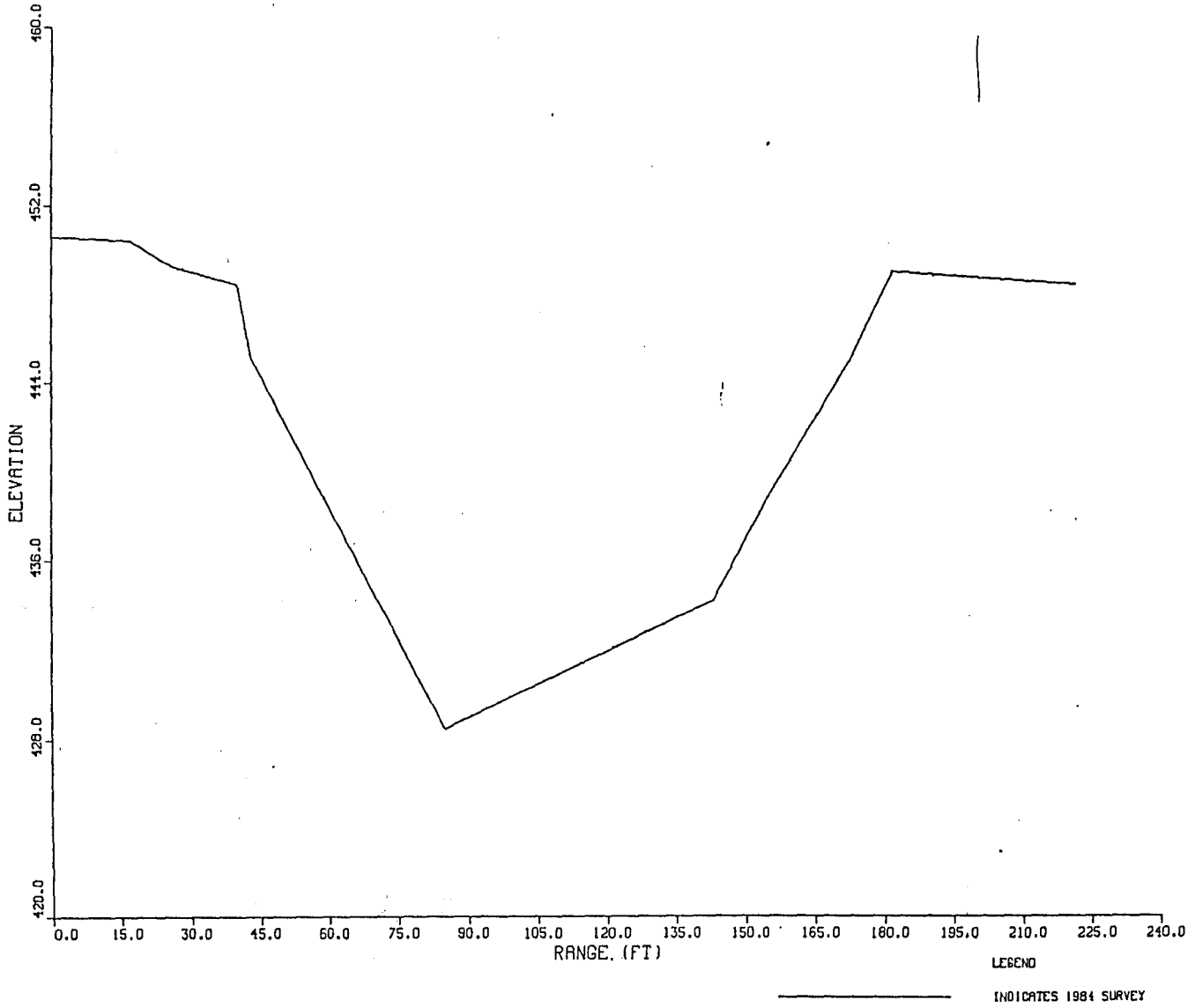
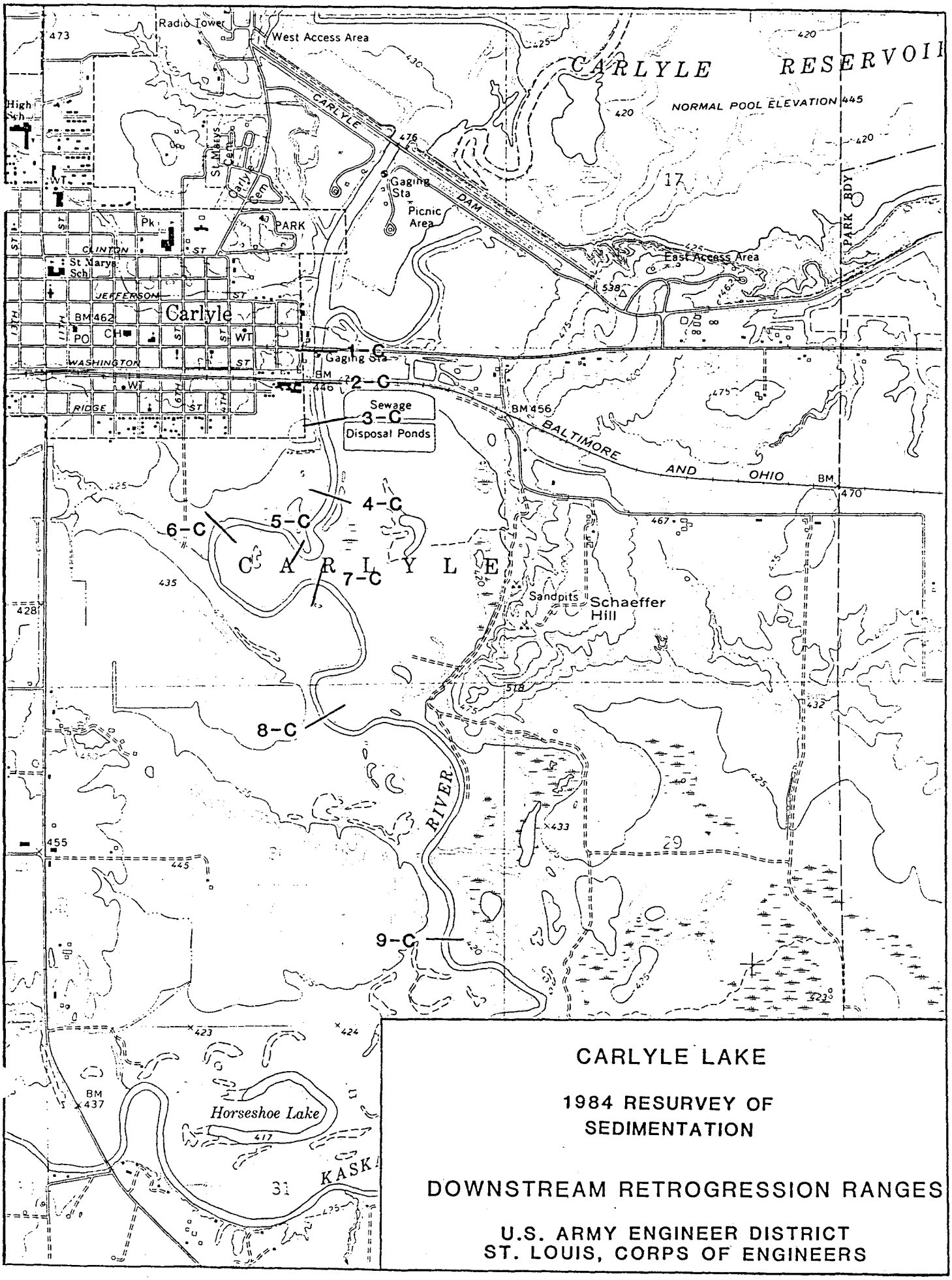


PLATE 21



CARLYLE LAKE

1984 RESURVEY OF SEDIMENTATION

DOWNSTREAM RETROGRESSION RANGES

U.S. ARMY ENGINEER DISTRICT
ST. LOUIS, CORPS OF ENGINEERS

PLATE 22

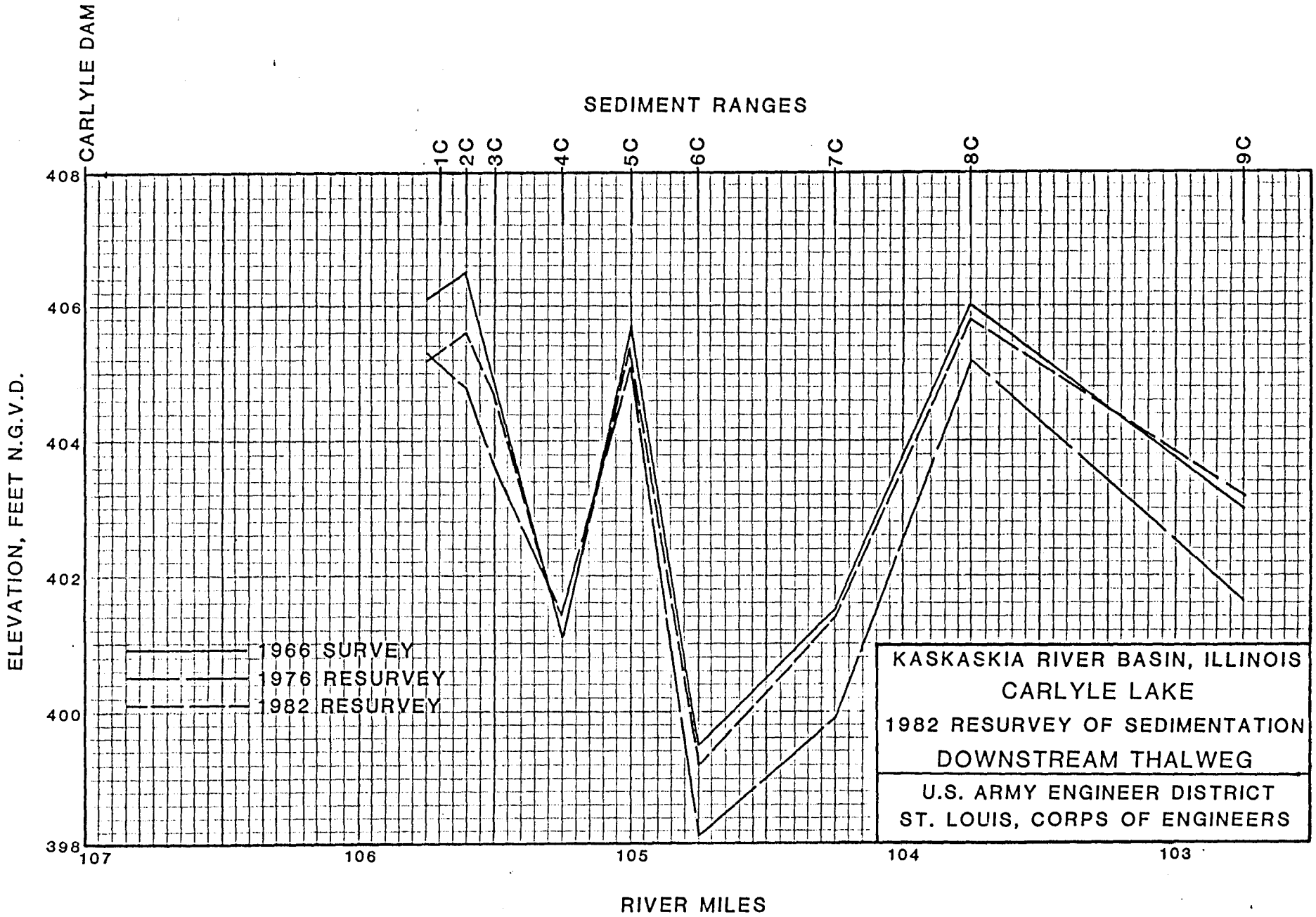

CARLYLE DAM
SEDIMENT RANGES
1C
2C
3C
4C
5C
6C
7C
8C
9C
408
406
404
402
400
398
ELEVATION, FEET N.G.V.D.
1966 SURVEY
1976 RESURVEY
1982 RESURVEY
107
106
105
104
103
RIVER MILES
KASKASKIA RIVER BASIN, ILLINOIS
CARLYLE LAKE
1982 RESURVEY OF SEDIMENTATION
DOWNSTREAM THALWEG
U.S. ARMY ENGINEER DISTRICT
ST. LOUIS, CORPS OF ENGINEERS

PLATE 23

LAKE CARLYLE

RETROGRESSION RANGE : 1C

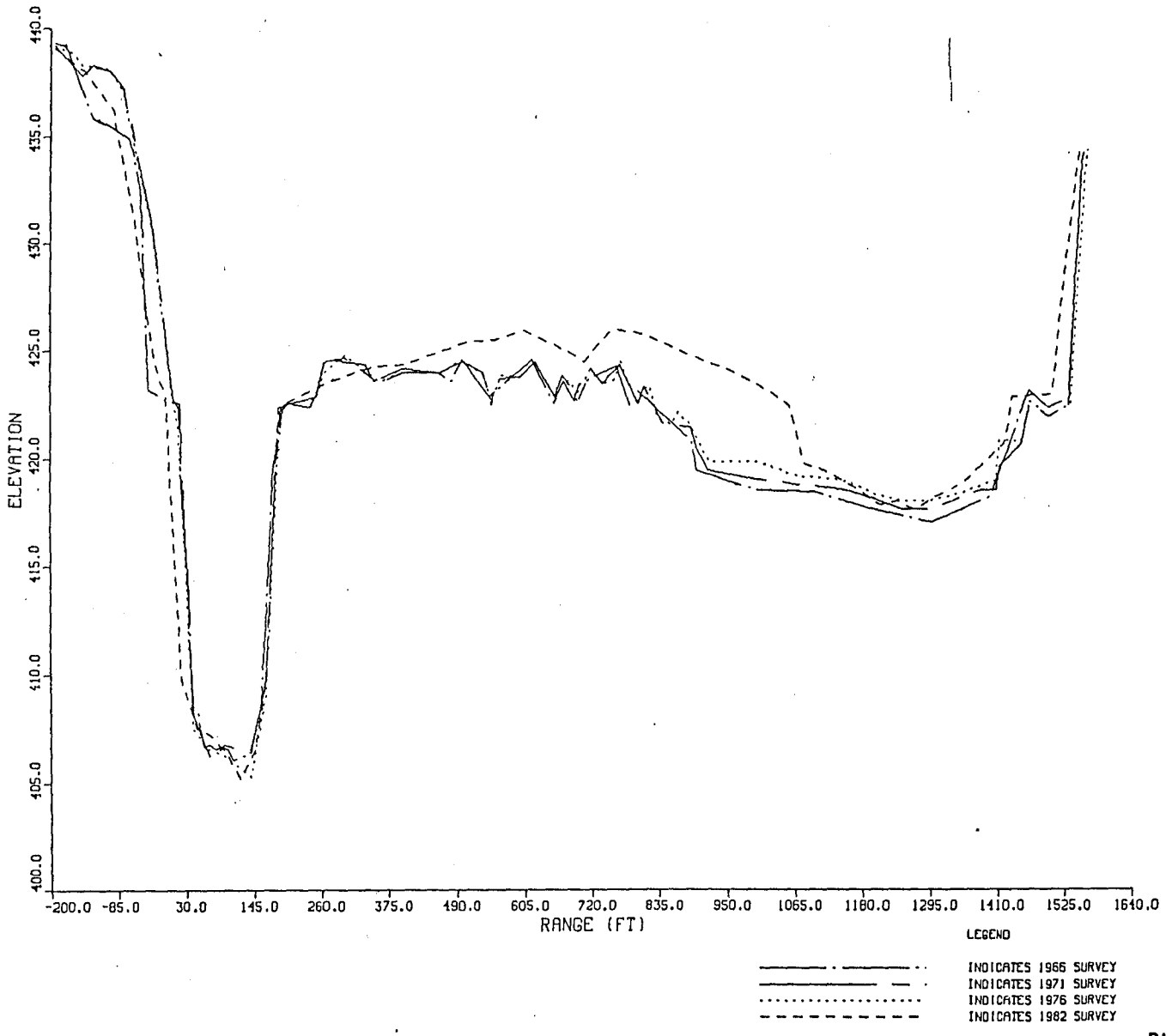
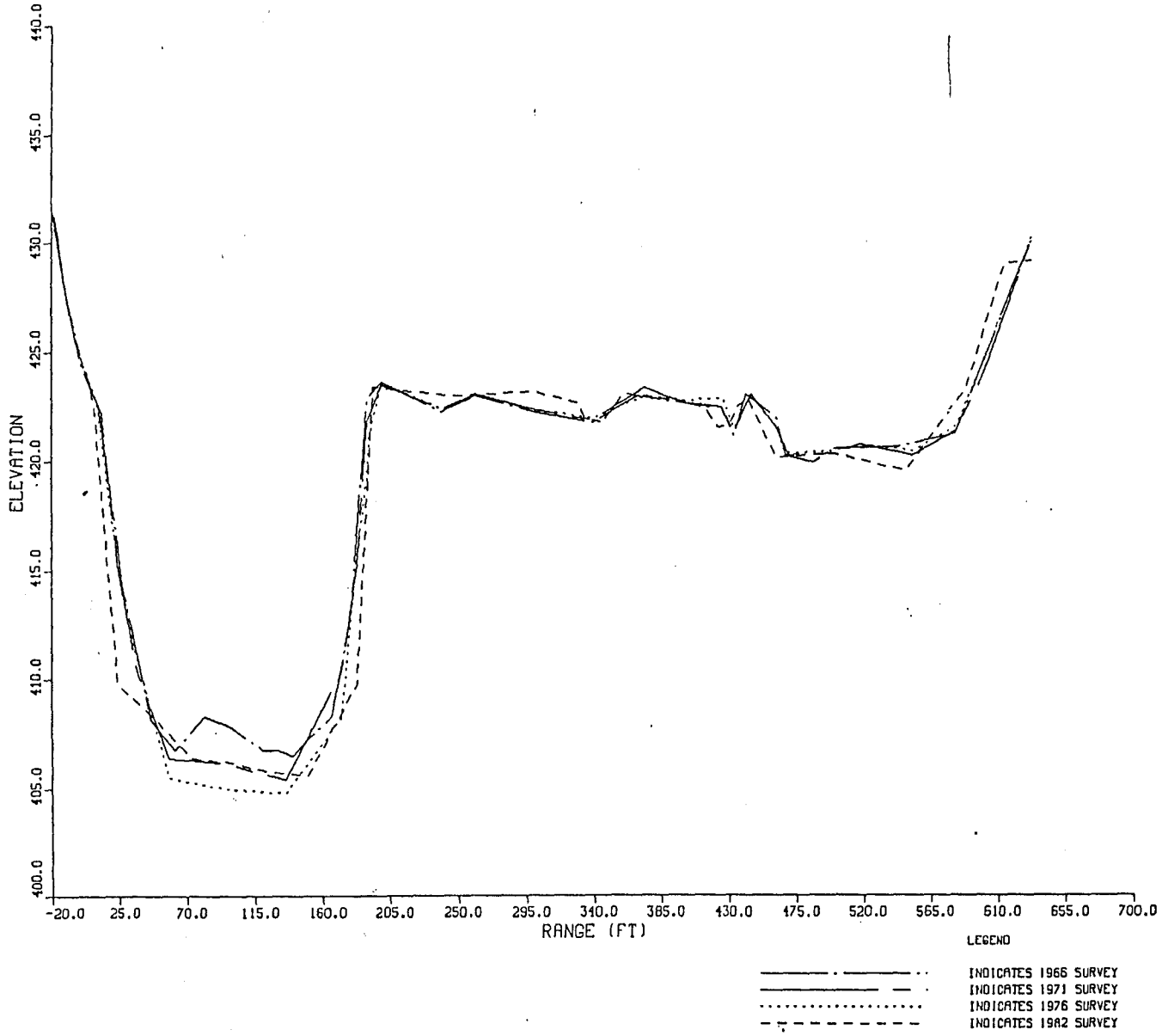


PLATE 25

LAKE CARLYLE

RETROGRESSION RANGE : 2C



LAKE CARLYLE

RETROGRESSION RANGE : 3C

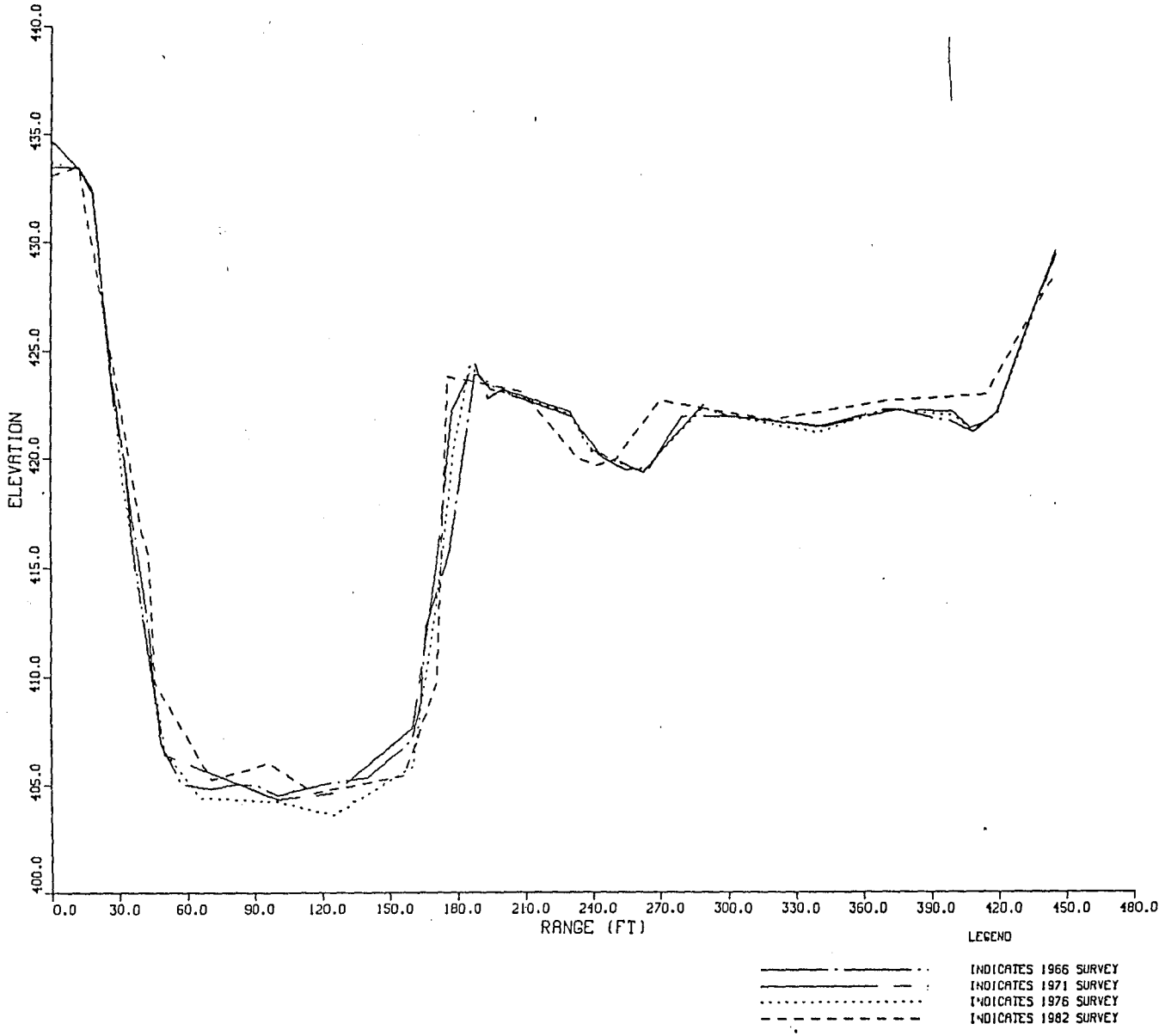


PLATE 27

LAKE CARLYLE

RETROGRESSION RANGE : 4C

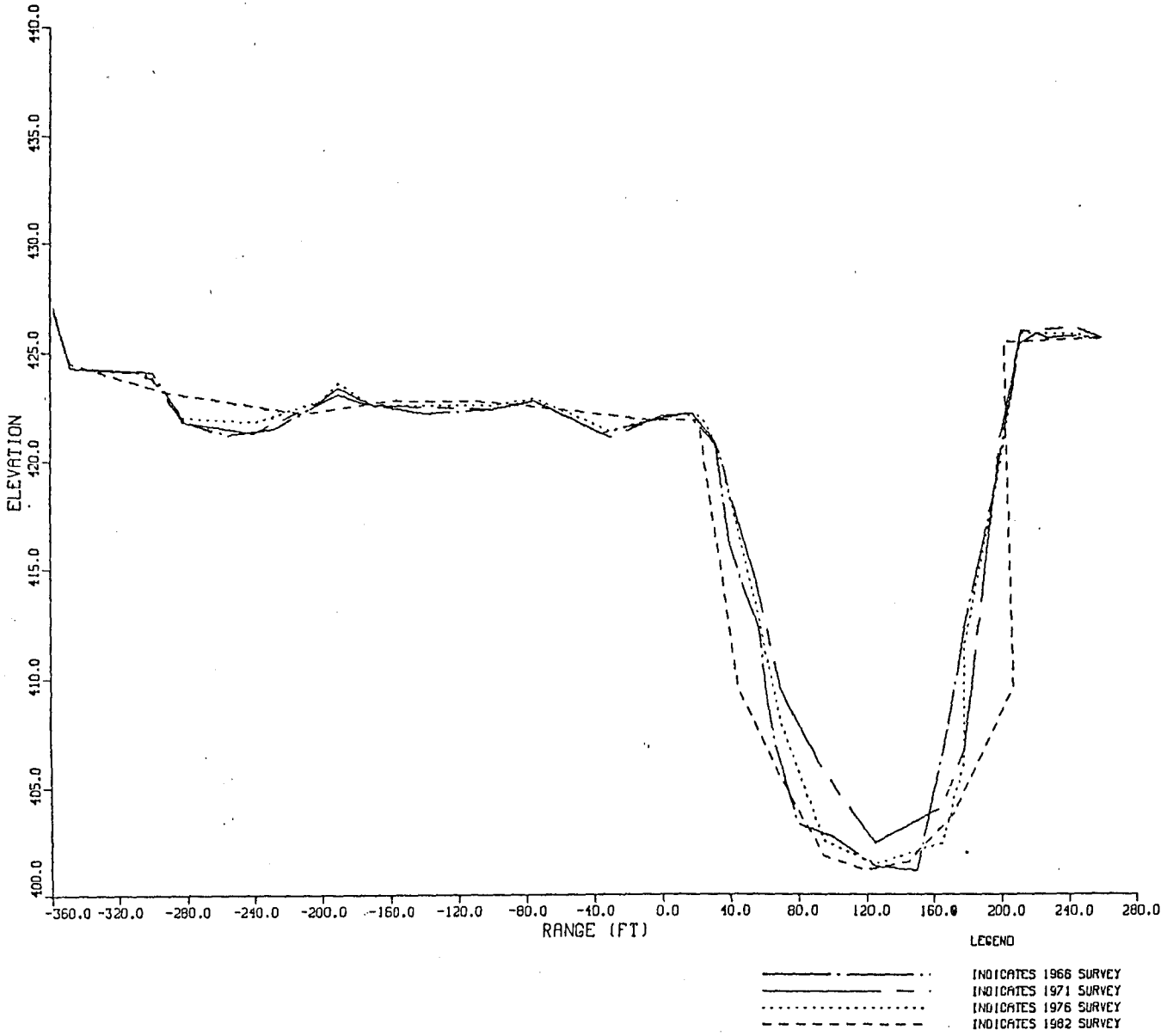
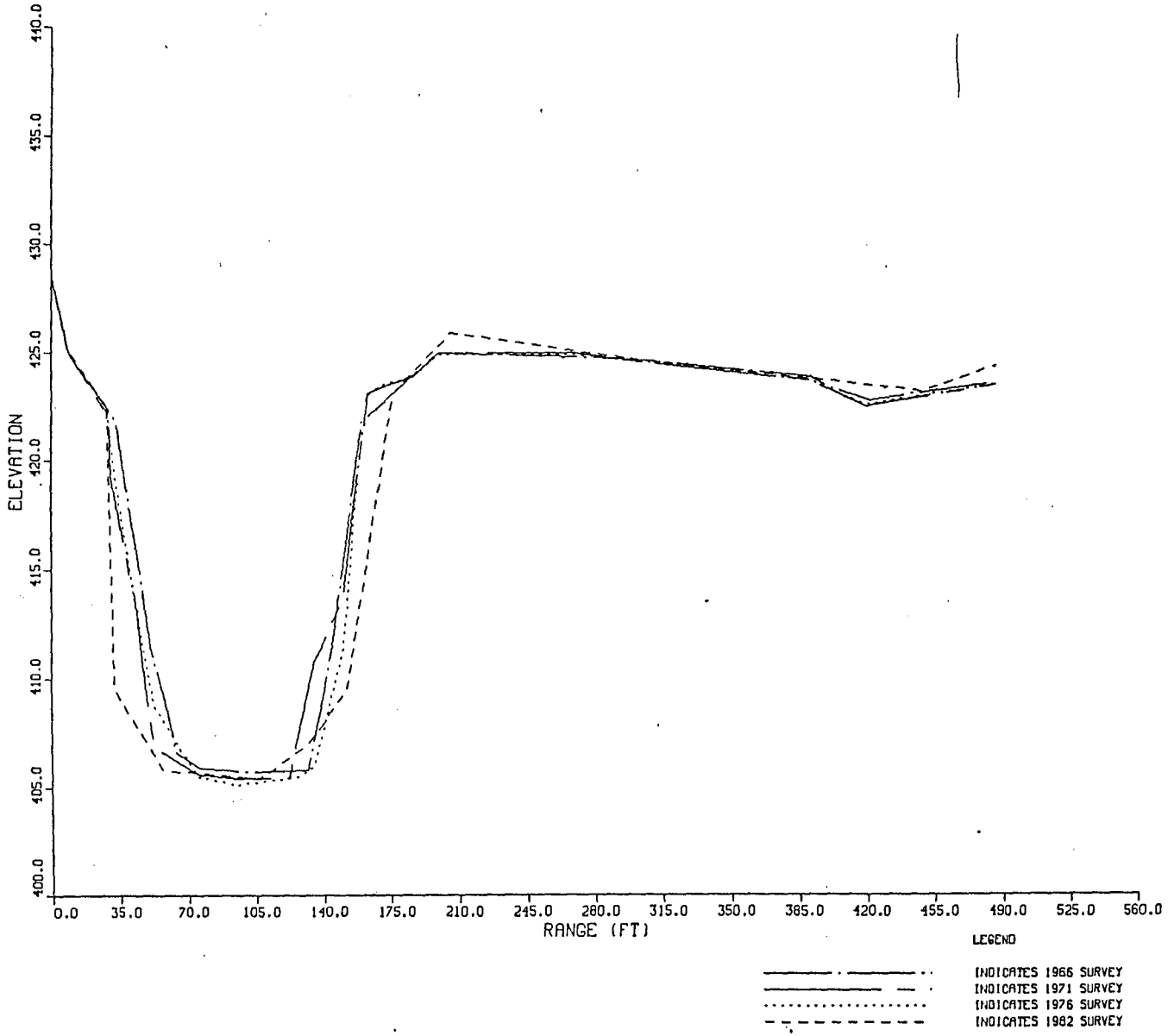


PLATE 28

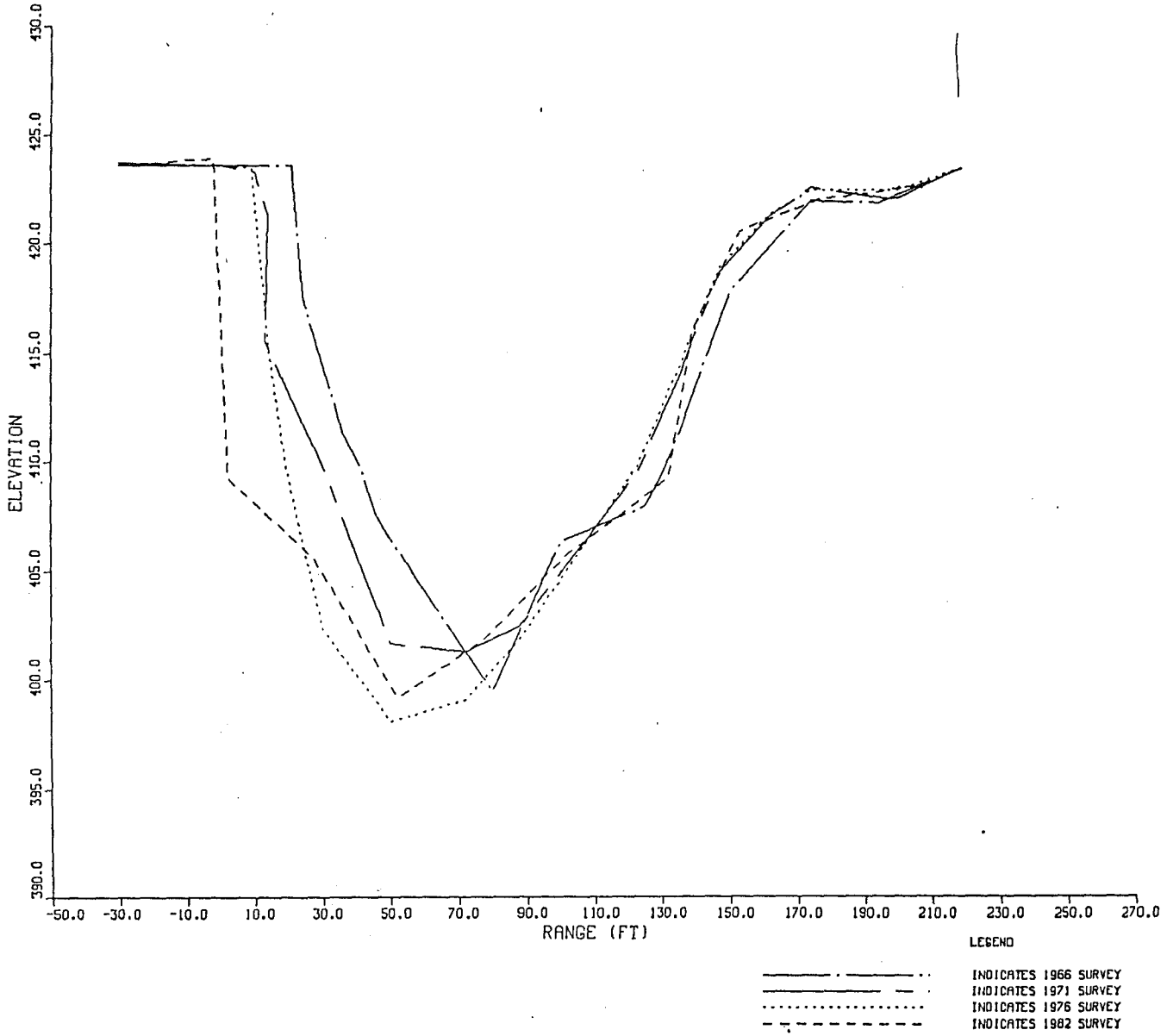
LAKE CARLYLE

RETROGRESSION RANGE : 5C



LAKE CARLYLE

RETROGRESSION RANGE : 60



LAKE CARLYLE

RETROGRESSION RANGE : 7C

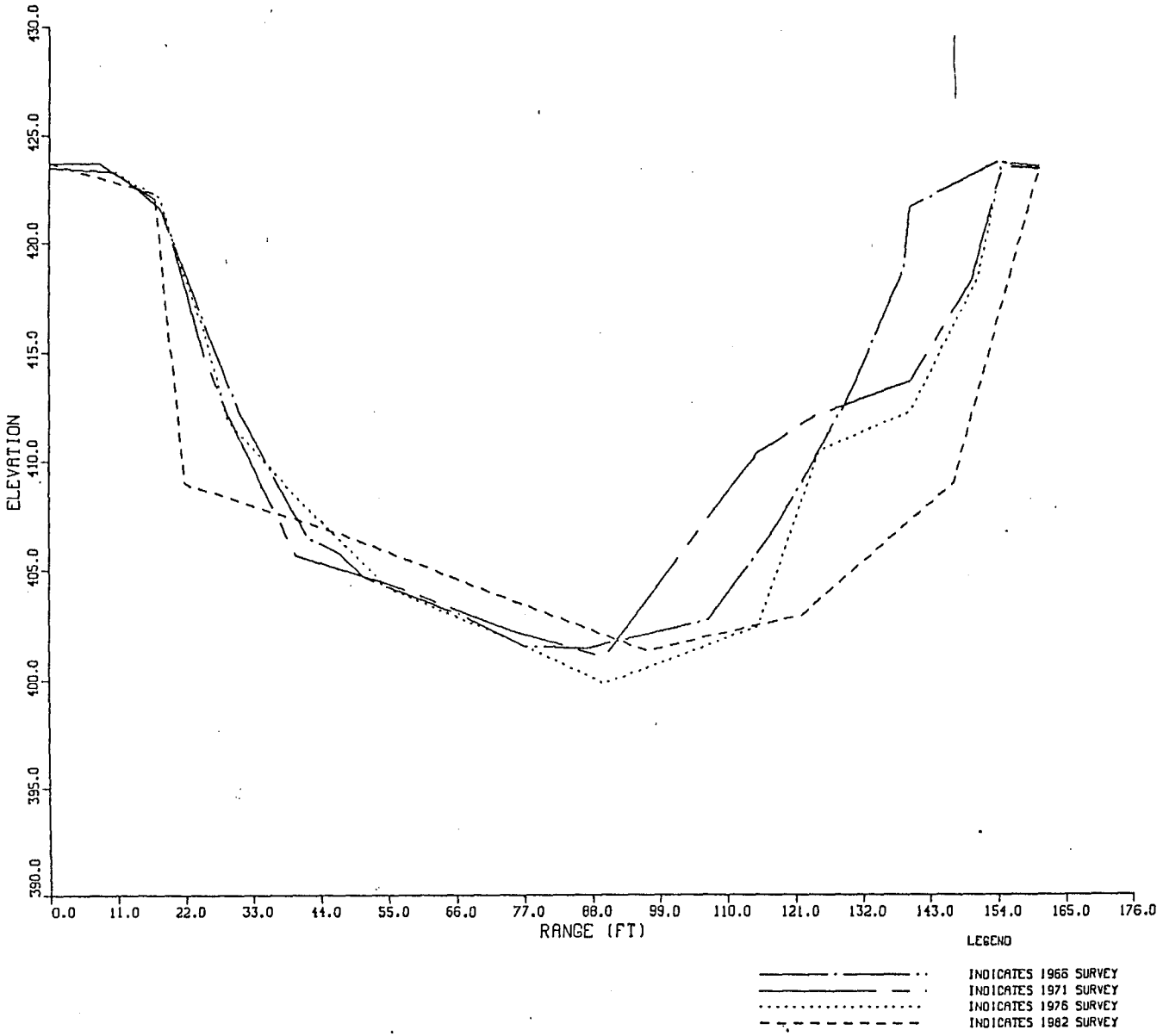


PLATE 31

LAKE CARLYLE

RETROGRESSION RANGE : 8C

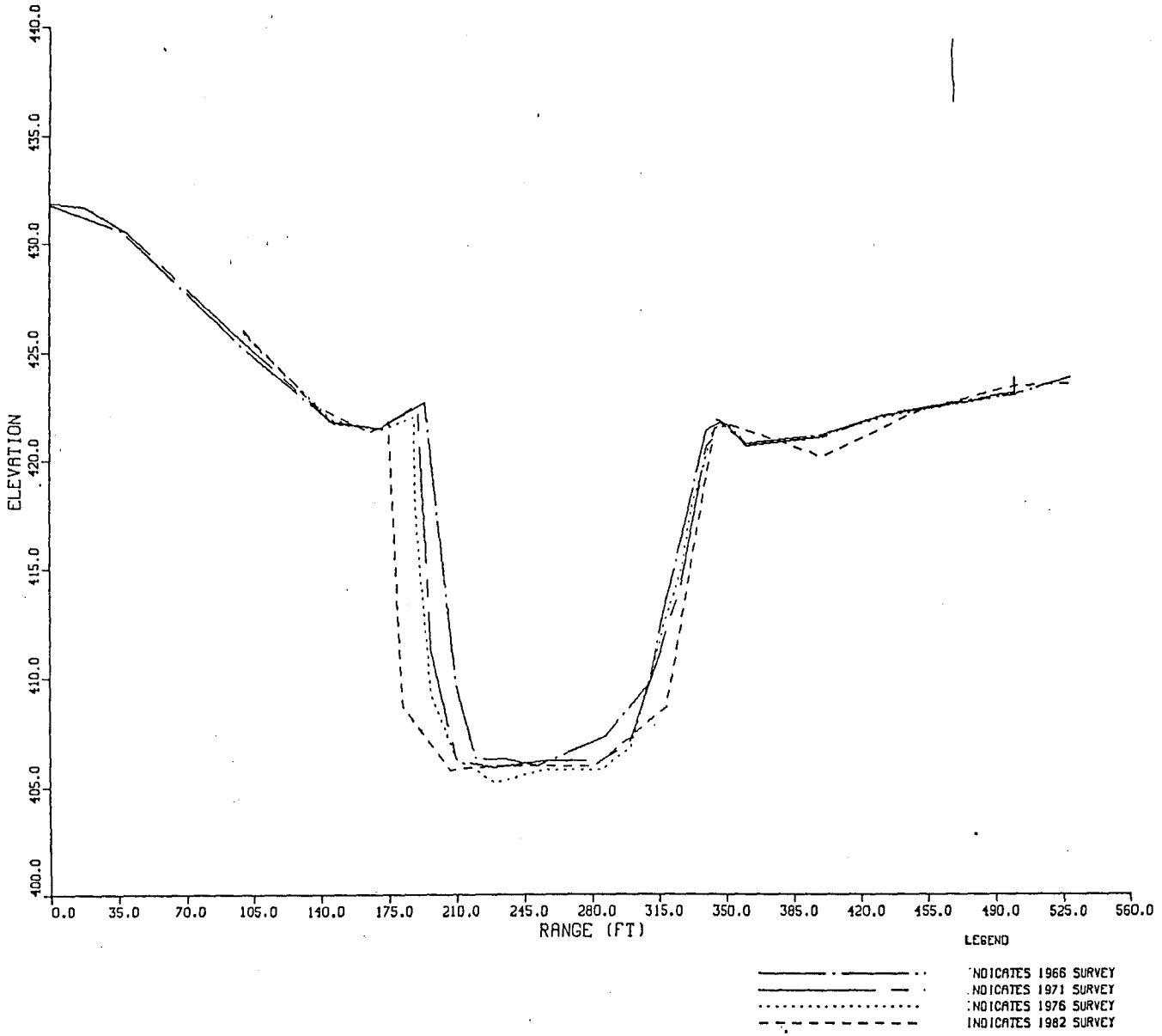
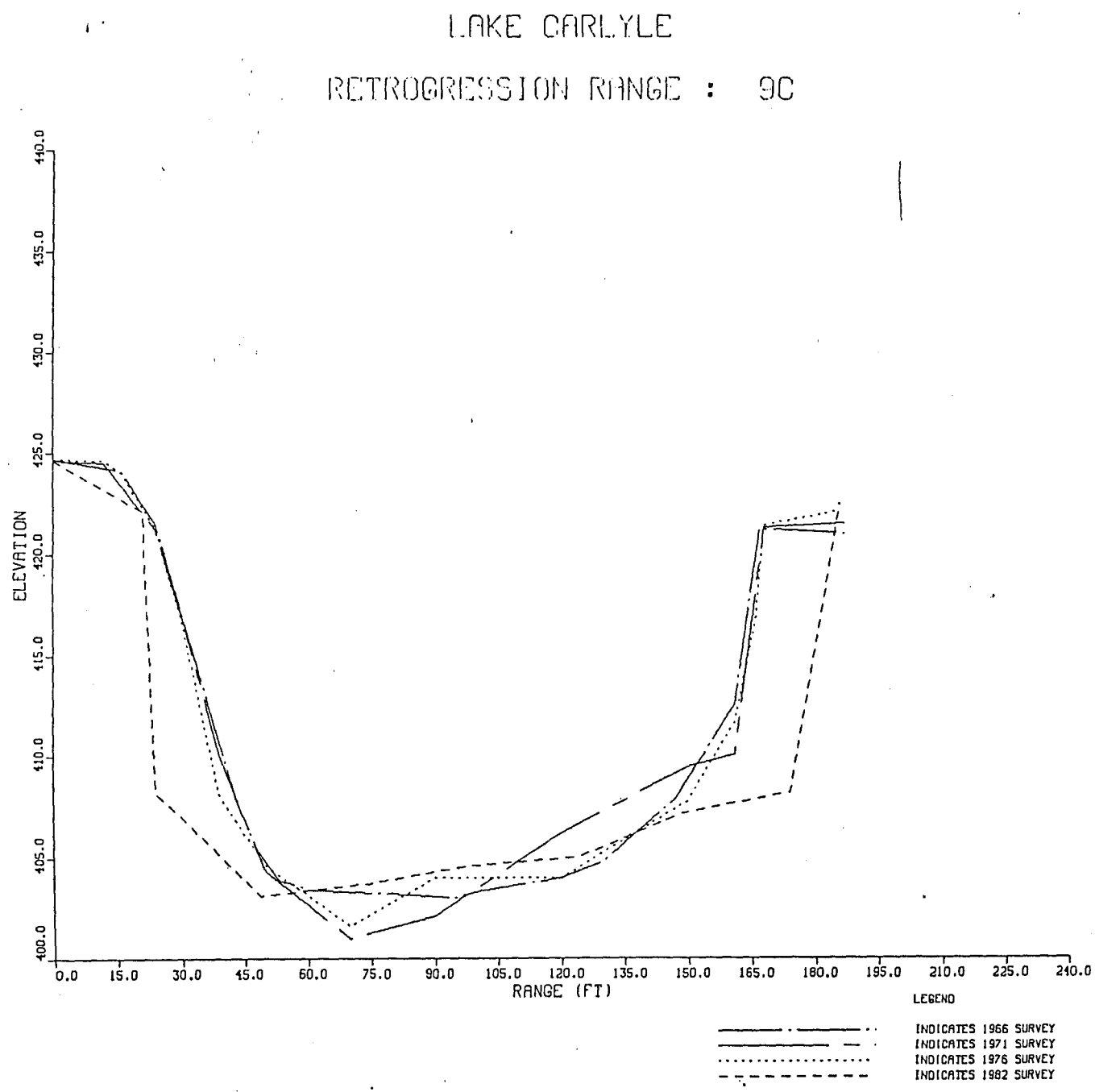


PLATE 32


LAKE CARLYLE
RETROGRESSION RANGE : 9C
ELEVATION
400.0
405.0
410.0
415.0
420.0
425.0
430.0
435.0
440.0
0.0
15.0
30.0
45.0
60.0
75.0
90.0
105.0
120.0
135.0
150.0
165.0
180.0
195.0
210.0
225.0
240.0
RANGE (FT)
LEGEND
INDICATES 1966 SURVEY
INDICATES 1971 SURVEY
INDICATES 1976 SURVEY
INDICATES 1982 SURVEY

APPENDIX B.

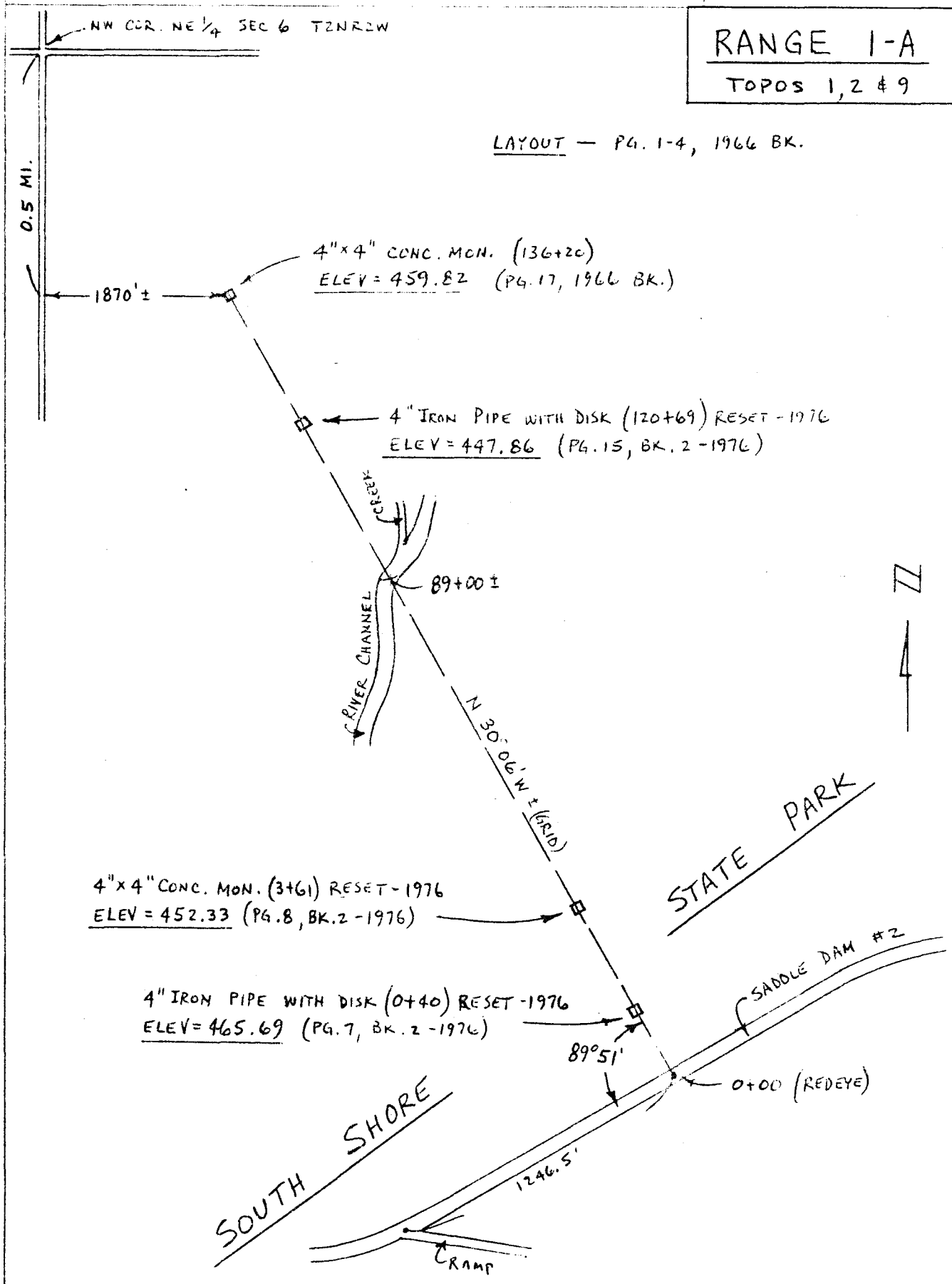
Detailed Sedimentation Range Location Map

PROJECT CARLYLE LAKE | Page 1 | COMPUTED WJM | 3-15-82

SUBJECT SEDIMENTATION RANGE CONTROL | CHECKED

RANGE 1-A

TOPOS 1, 2 & 9



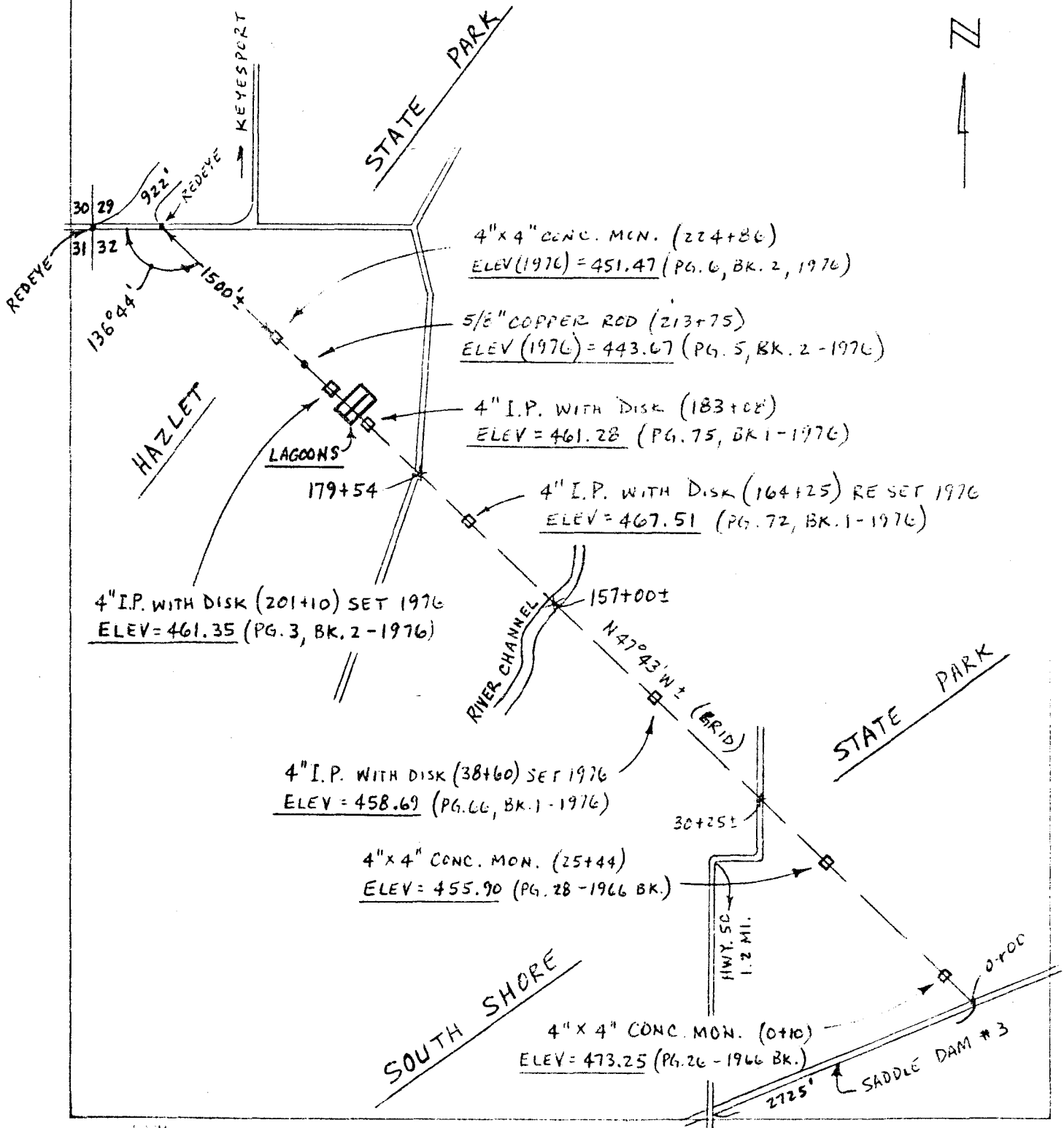
PROJECT CARLYLE LAKE Page 2 3-16-82

SUBJECT SEDIMENTATION RANGE CONTROL

LAYOUT – PG. 21-24, 1966 BK.

RANGE 2-A

TOPOS 2,3,8,10 & 11



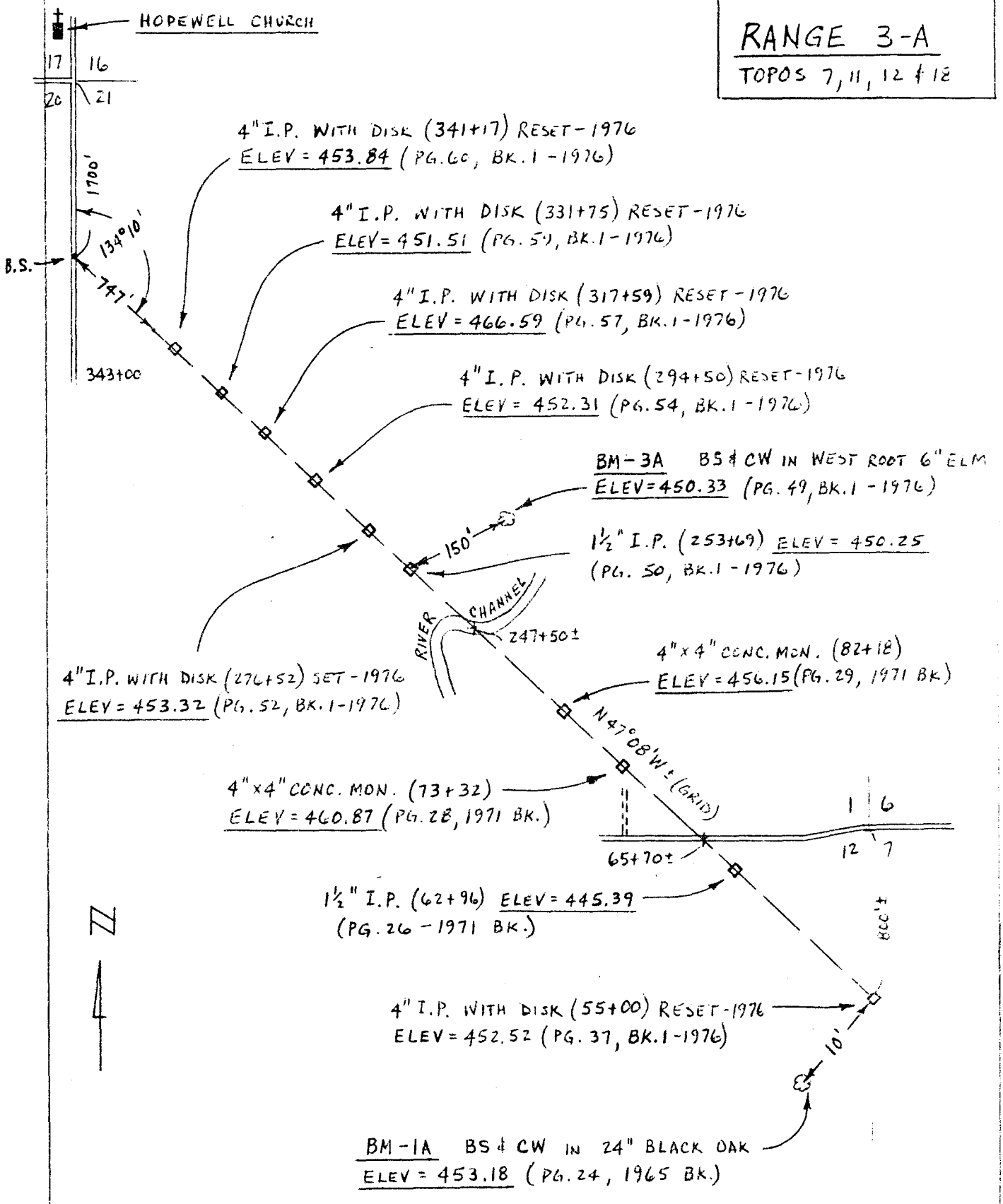
LMV 107e–R COMPUTATION SHEET

ORIGINAL

PROJECT	CARLYLE LAKE	Page 3	COMPUTED	3-16 [illegible]
SUBJECT	SEDIMENTATION RANGE CONTROL		CHECKED	

RANGE 3-A

TOPOS 7, 11, 12 & 18

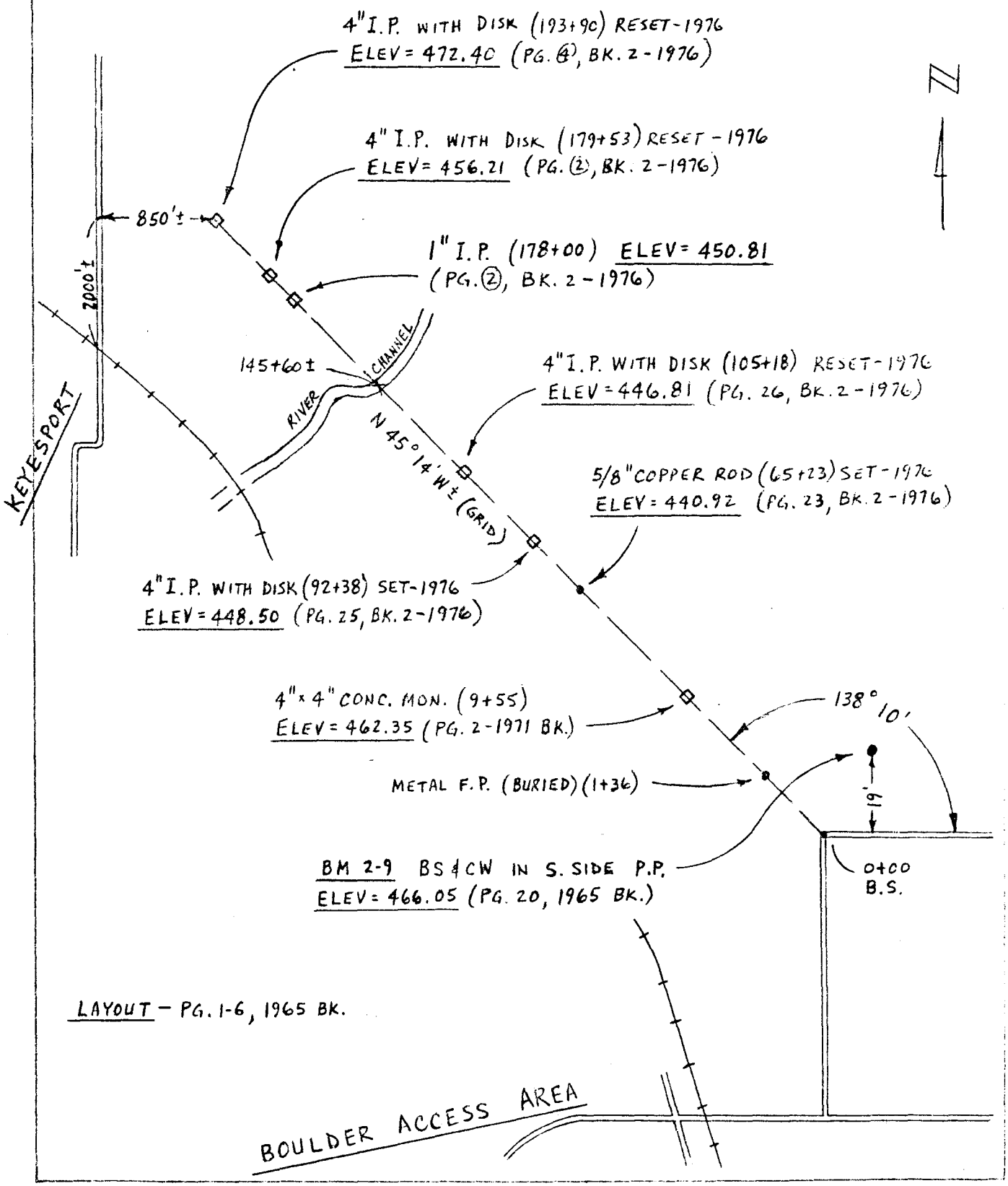


LAYOUT — PG. 2-6, 1965 BK.

PROJECT	CARLYLE LAKE	Page 4	COMPUTED	3-17-82
SUBJECT	SEDIMENTATION RANGE CONTROL		CHECKED	

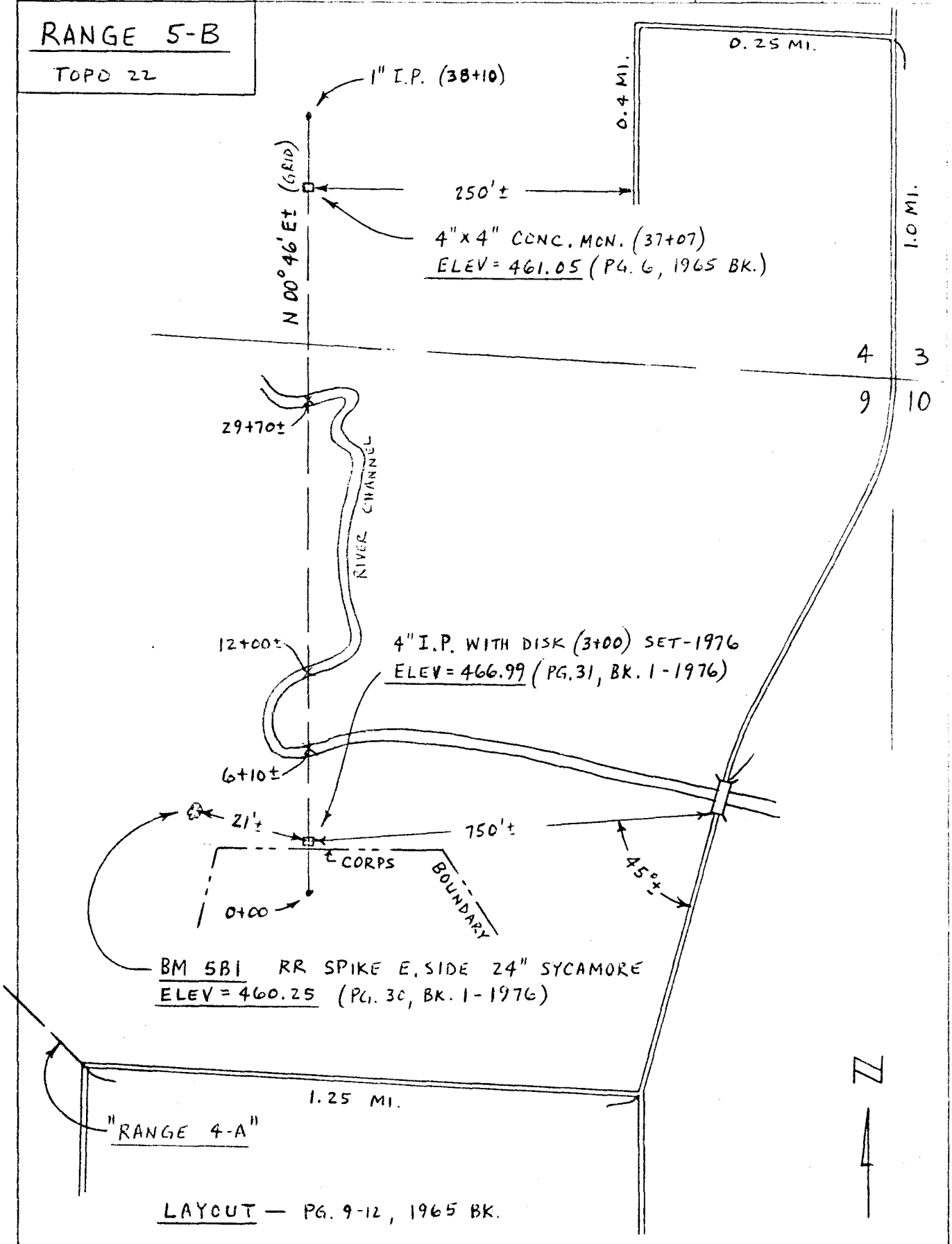
NOTE: "PG. ②" = LOOSE LEAF PAGES.

RANGE 4-A
TOPOS 21, 22 & 28



PROJECT CARLYLE LAKE | Page 5 | COMPUTED BY WSM 3-18-82

SUBJECT SEDIMENTATION RANGE CONTROL | CHECKED BY

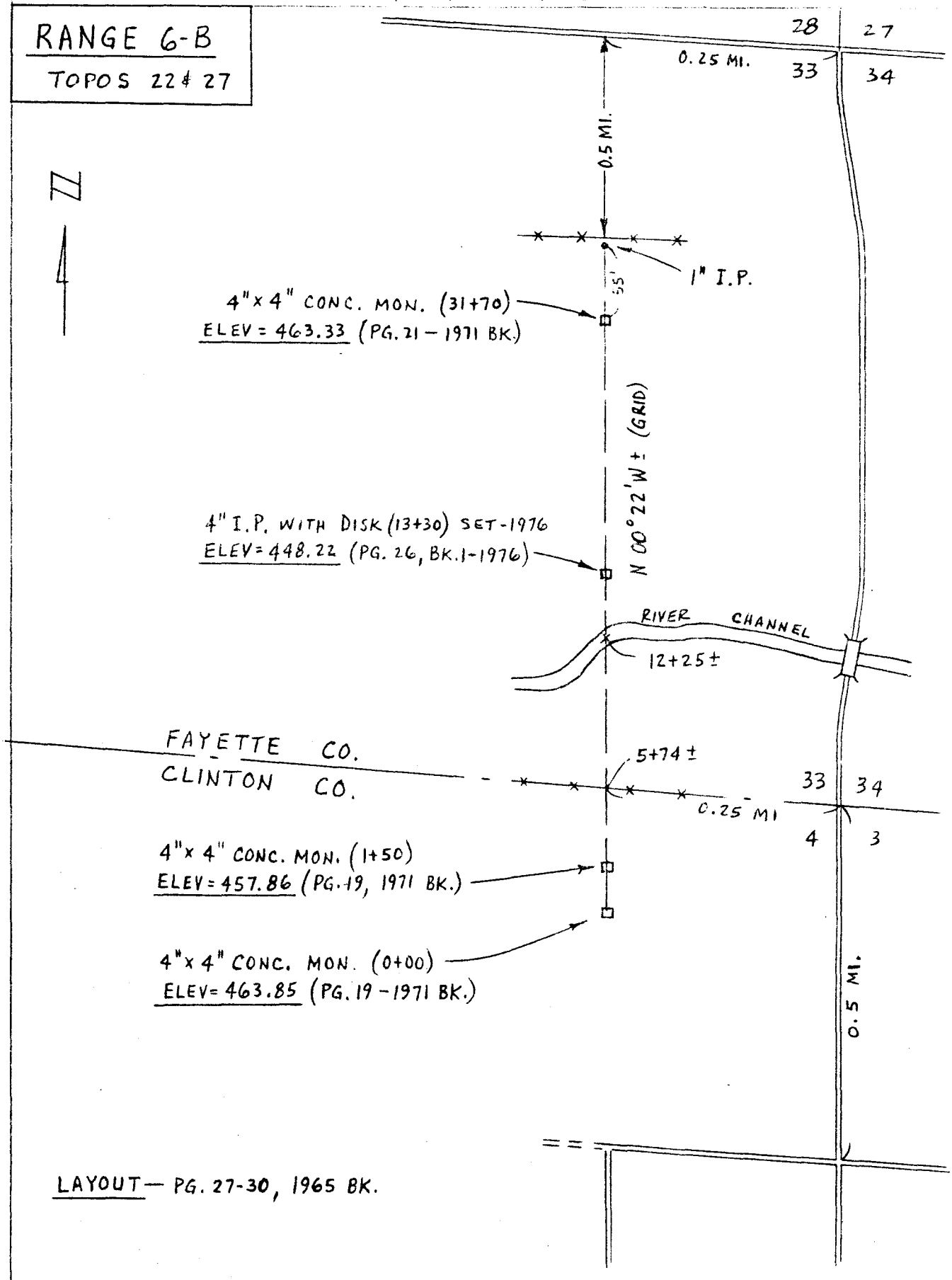


PROJECT CARLYLE LAKE Page 6 WSH 3-18-82

SUBJECT SEDIMENTATION RANGE CONTROL CHECKED

RANGE 6-B

TOPOS 22 & 27

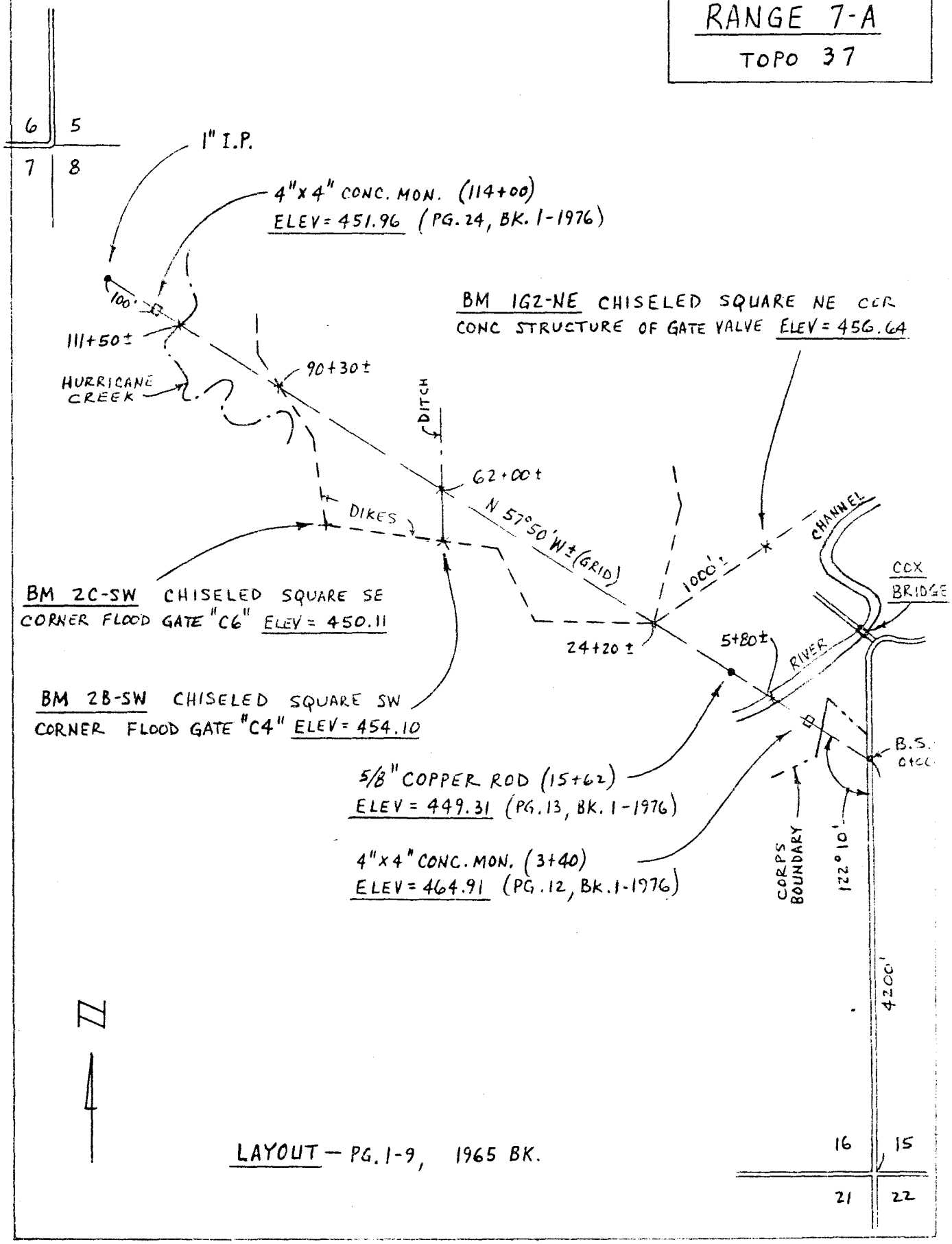


LAYOUT — PG. 27-30, 1965 BK.

PROJECT CARLYLE LAKE Page 7 WBM 3-19-82

SUBJECT SEDIMENTATION RANGE CONTROL CHECKED BY DATE

RANGE 7-A
TOPO 37



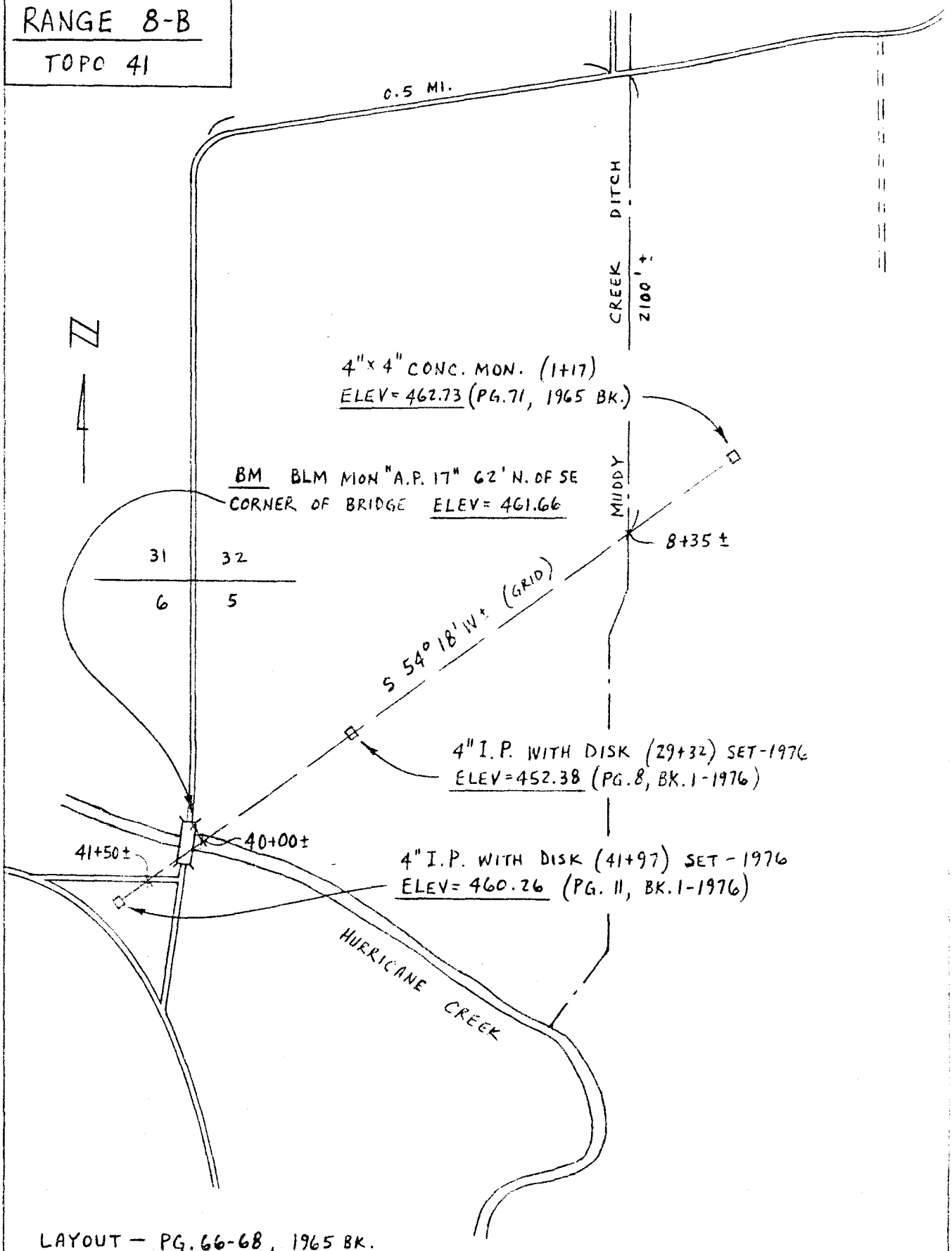
LAYOUT — PG. 1-9, 1965 BK.

CARLYLE LAKE 8 WSM 3-19-82

SUBJECT SEDIMENTATION RANGE CONTROL

RANGE 8-B

TOPO 41



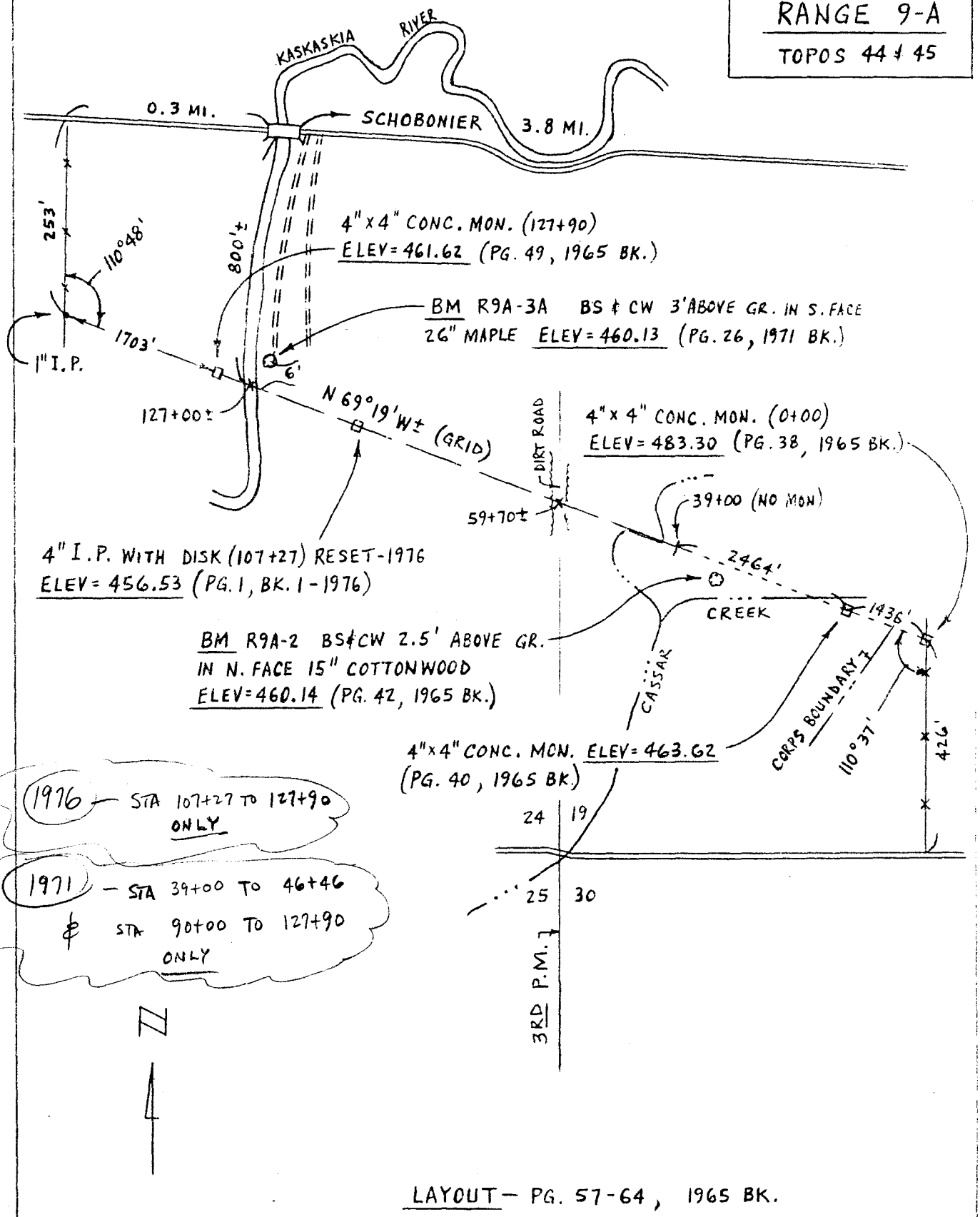
LAYOUT — PG. 66-68, 1965 BK.

PROJECT CARLYLE LAKE | Page 9 | COMPUTED [illegible] 3-22-82

SUBJECT SEDIMENTATION RANGE CONTROL | CHECKED BY

RANGE 9-A

TOPOS 44 & 45

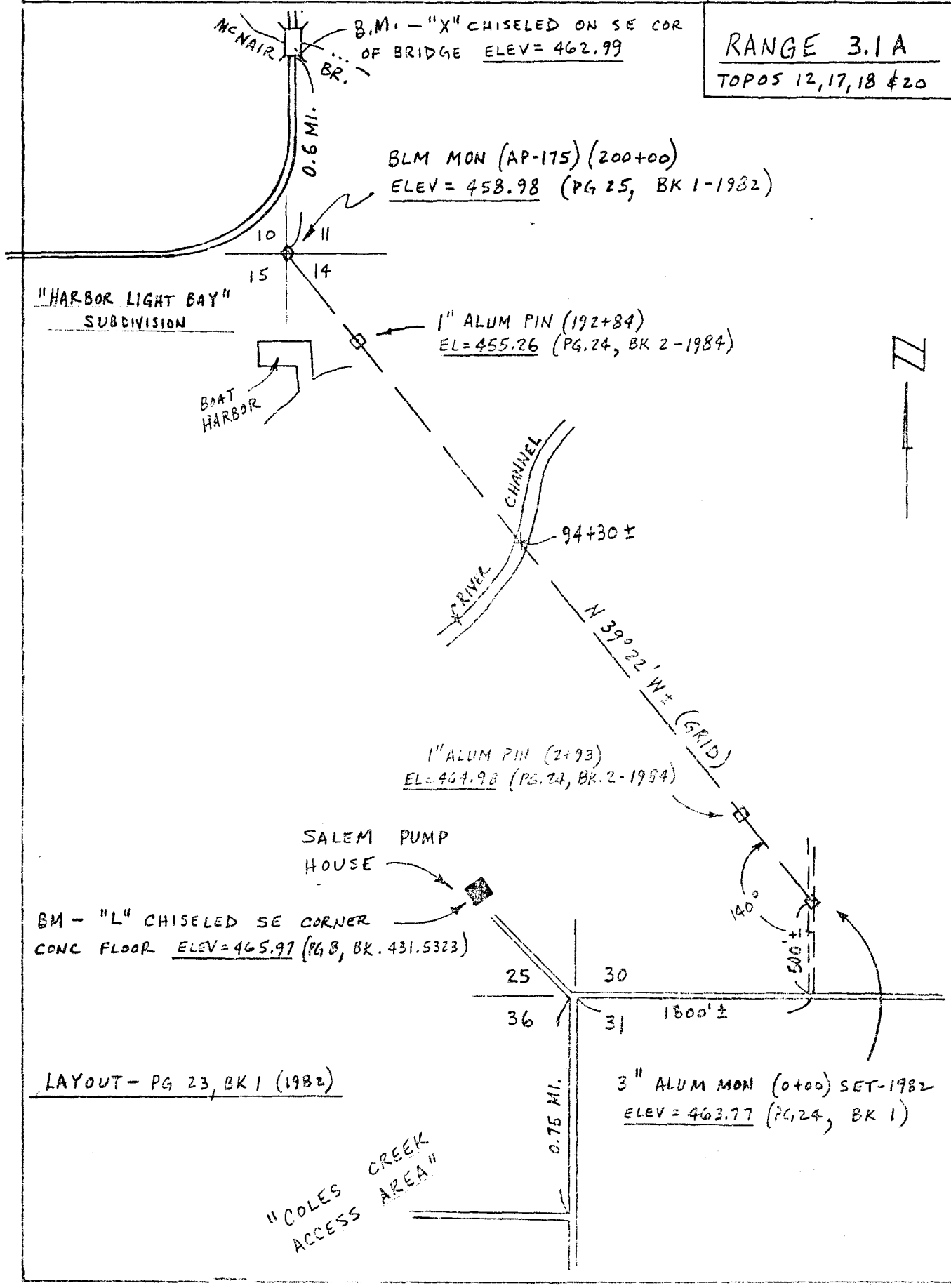


LAYOUT — PG. 57-64, 1965 BK.

PROJECT CARLYLE LAKE	Page 10 of 13	COMPUTED BY	DATE 6-30-82
SUBJECT SEDIMENTATION RANGE CONTROL		CHECKED BY	DATE

RANGE 3.1 A

TOPOS 12, 17, 18 & 20

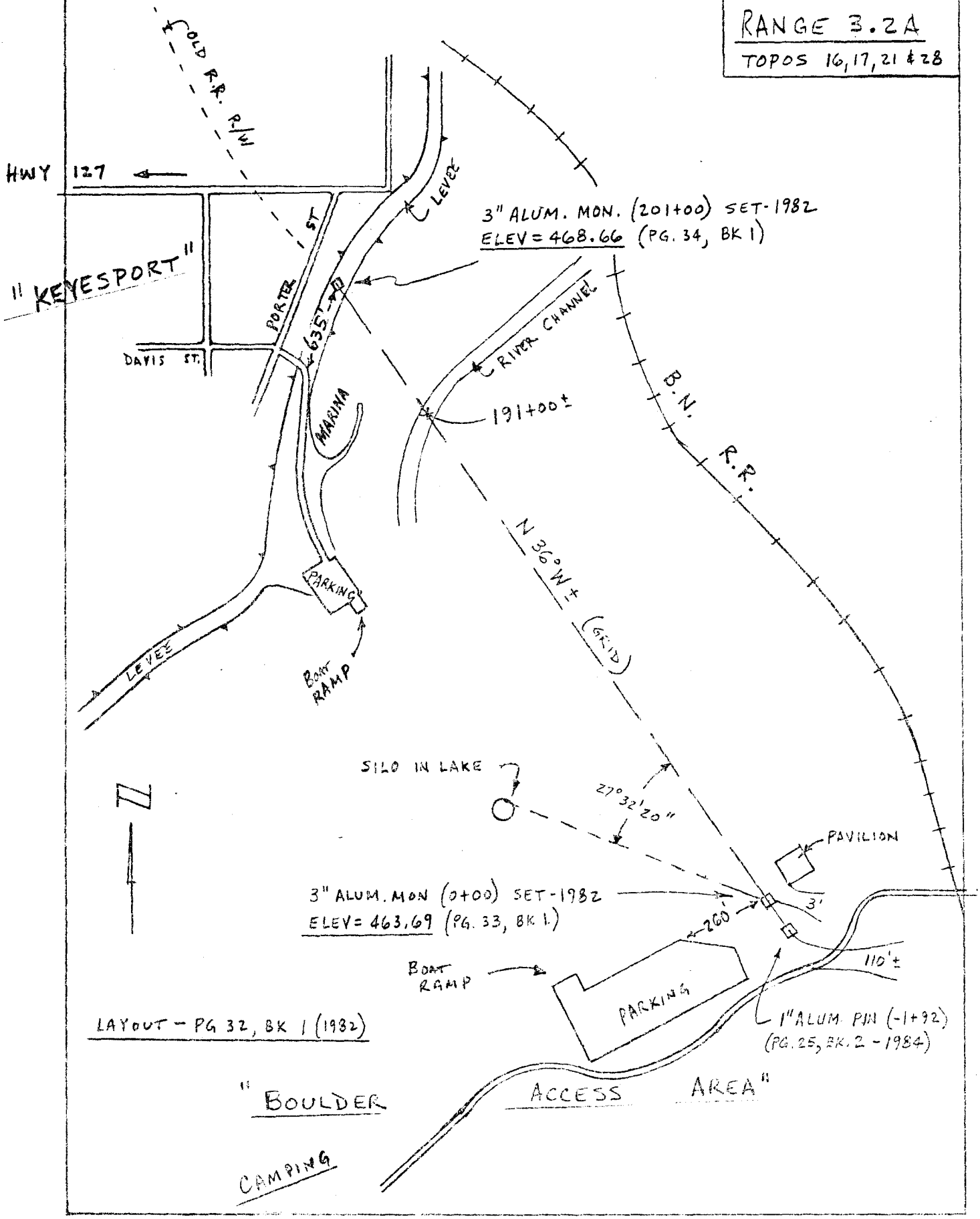


LMV FORM 1970-8 COMPUTATION SHEET

ORIGINAL

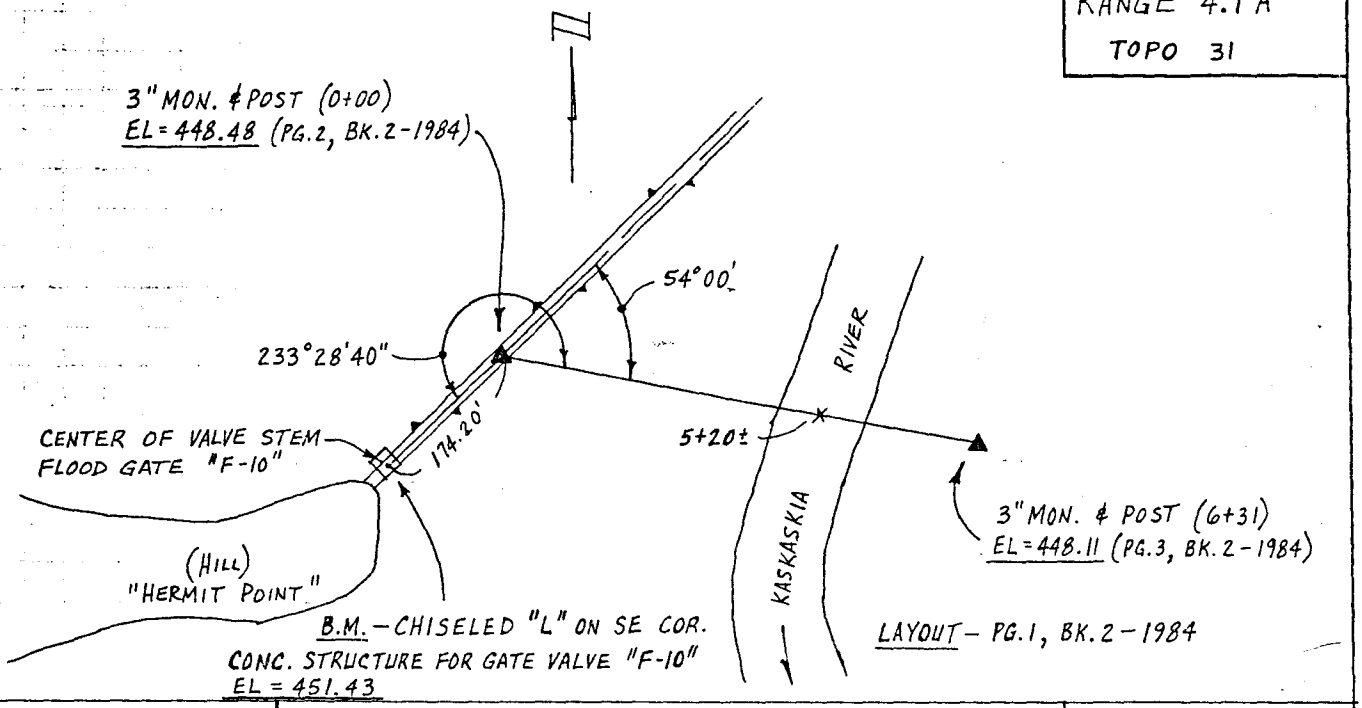
PROJECT	CARLYLE LAKE	Page 11 of 13	COMPUTED BY	DATE 6-29-82
SUBJECT	SEDIMENTATION RANGE CONTROL		CHECKED BY	DATE

RANGE 3.2A
TOPOS 16, 17, 21 & 28



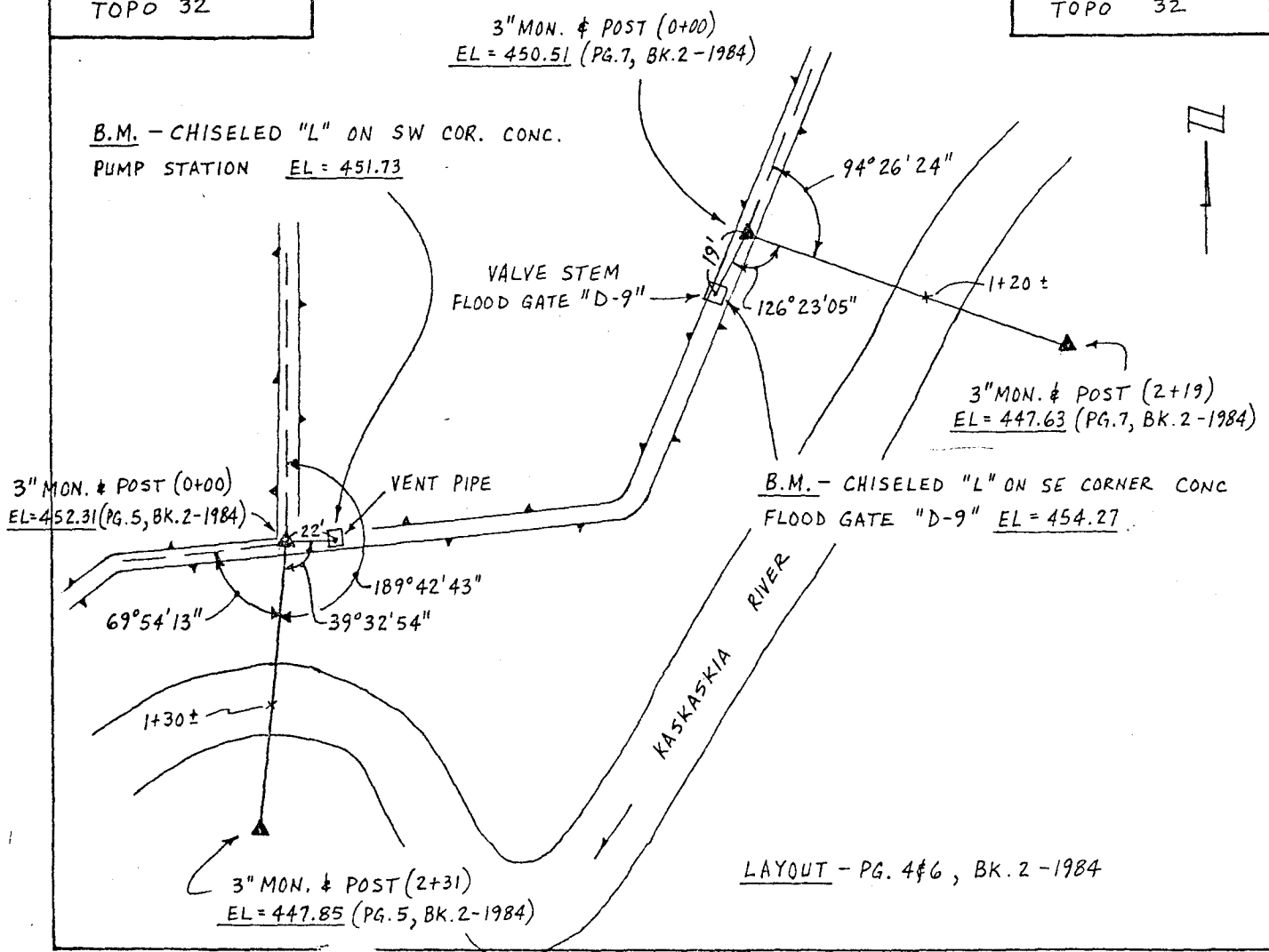
PROJECT			COMPUTED BY	DATE
CARLYLE LAKE	Page 12 of 13		WJM	10-02-84
SUBJECT			CHECKED BY	DATE
SEDIMENTATION RANGE CONTROL				

RANGE 4.1 A
TOPO 31



RANGE 4.2A
TOPO 32

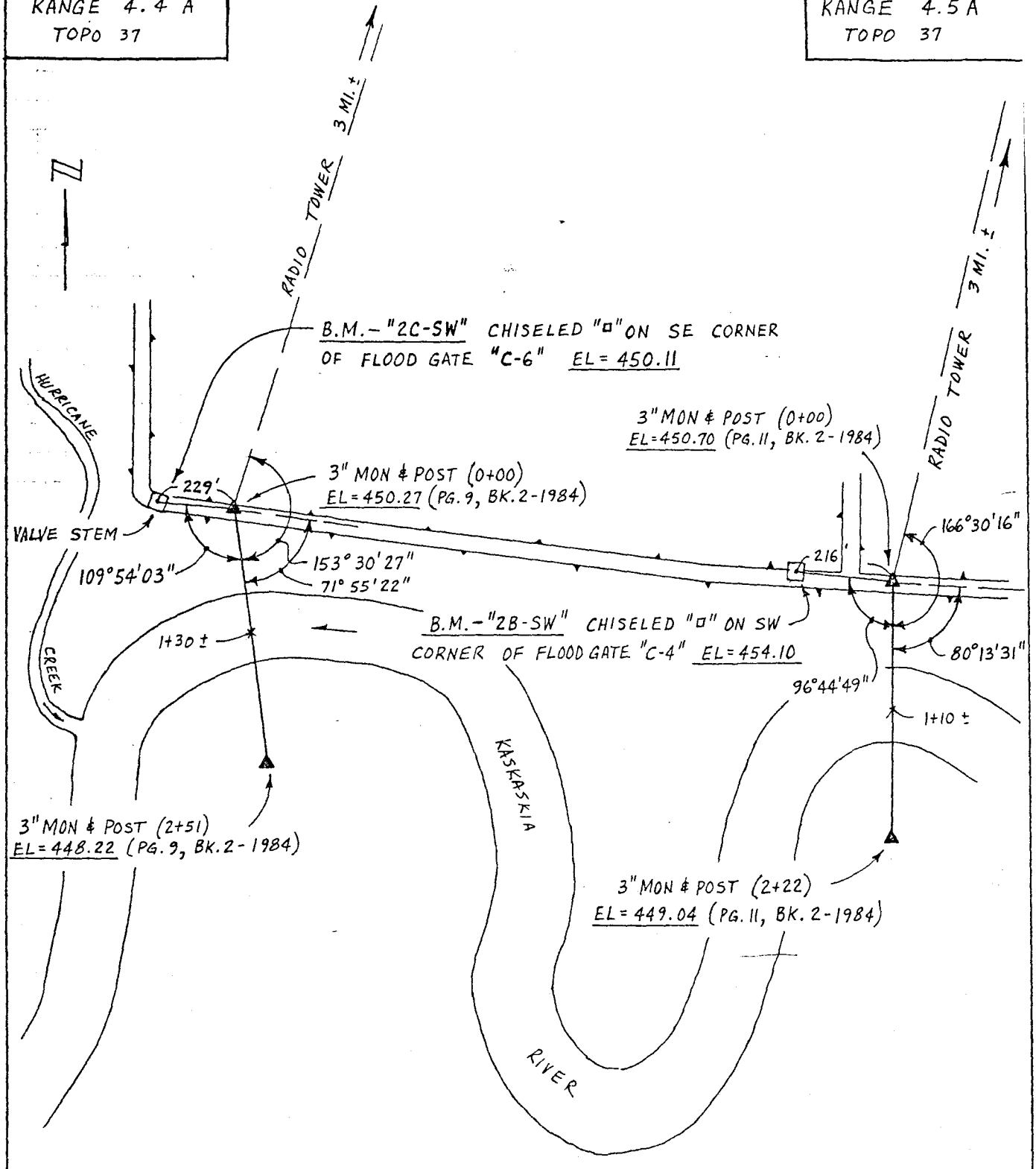
RANGE 4.3A
TOPO 32



PROJECT CARLYLE LAKE	Page 13 of 13	COMPUTED BY WJM	DATE 10-03-84
SUBJECT SEDIMENTATION RANGE CONTROL		CHECKED BY	DATE

RANGE 4.4 A
TOPO 37

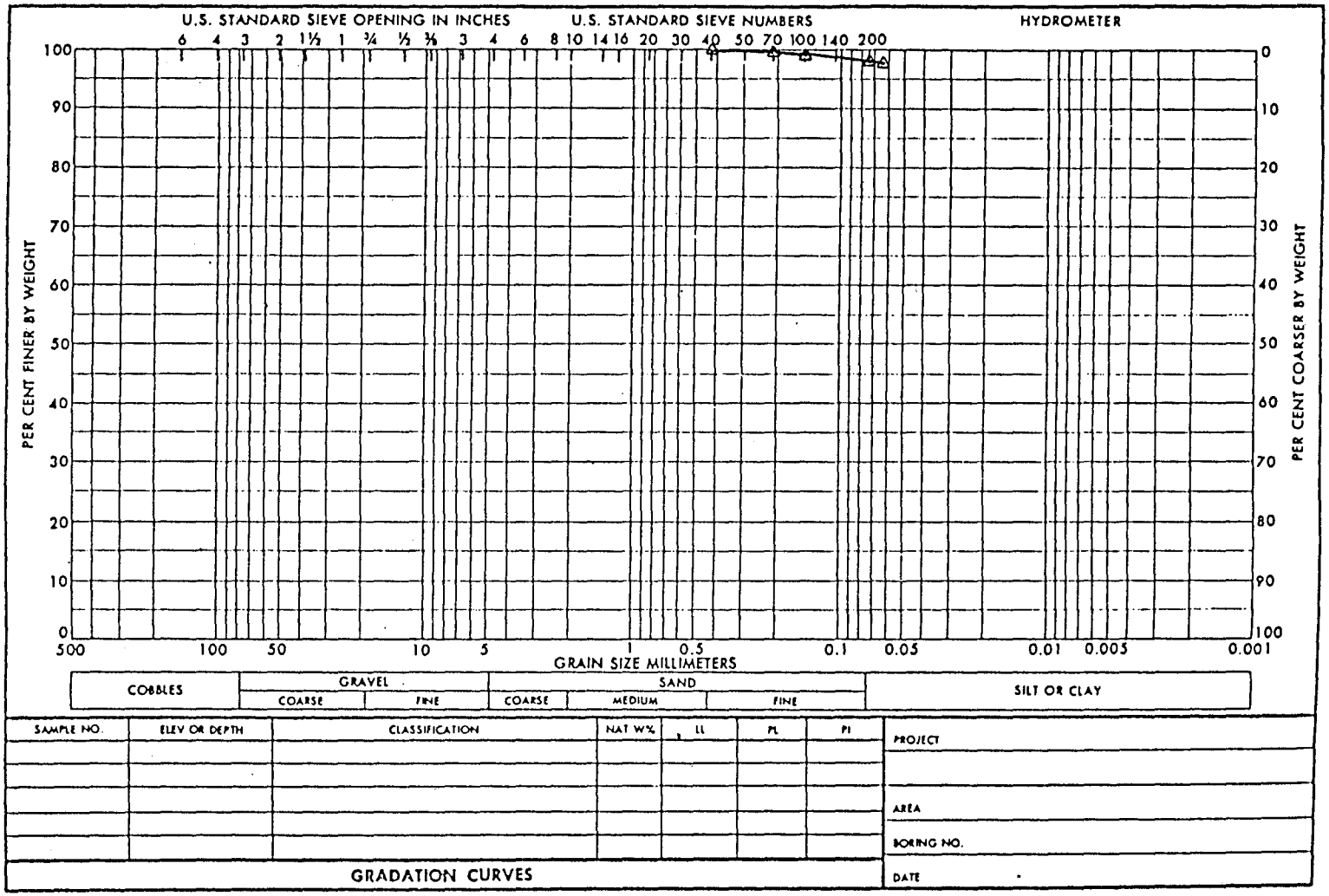
RANGE 4.5 A
TOPO 37



LAYOUT — PG. 8 & 10, BK. 2-1984

APPENDIX C.

Sediment Size Distributions



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

BORING NO.

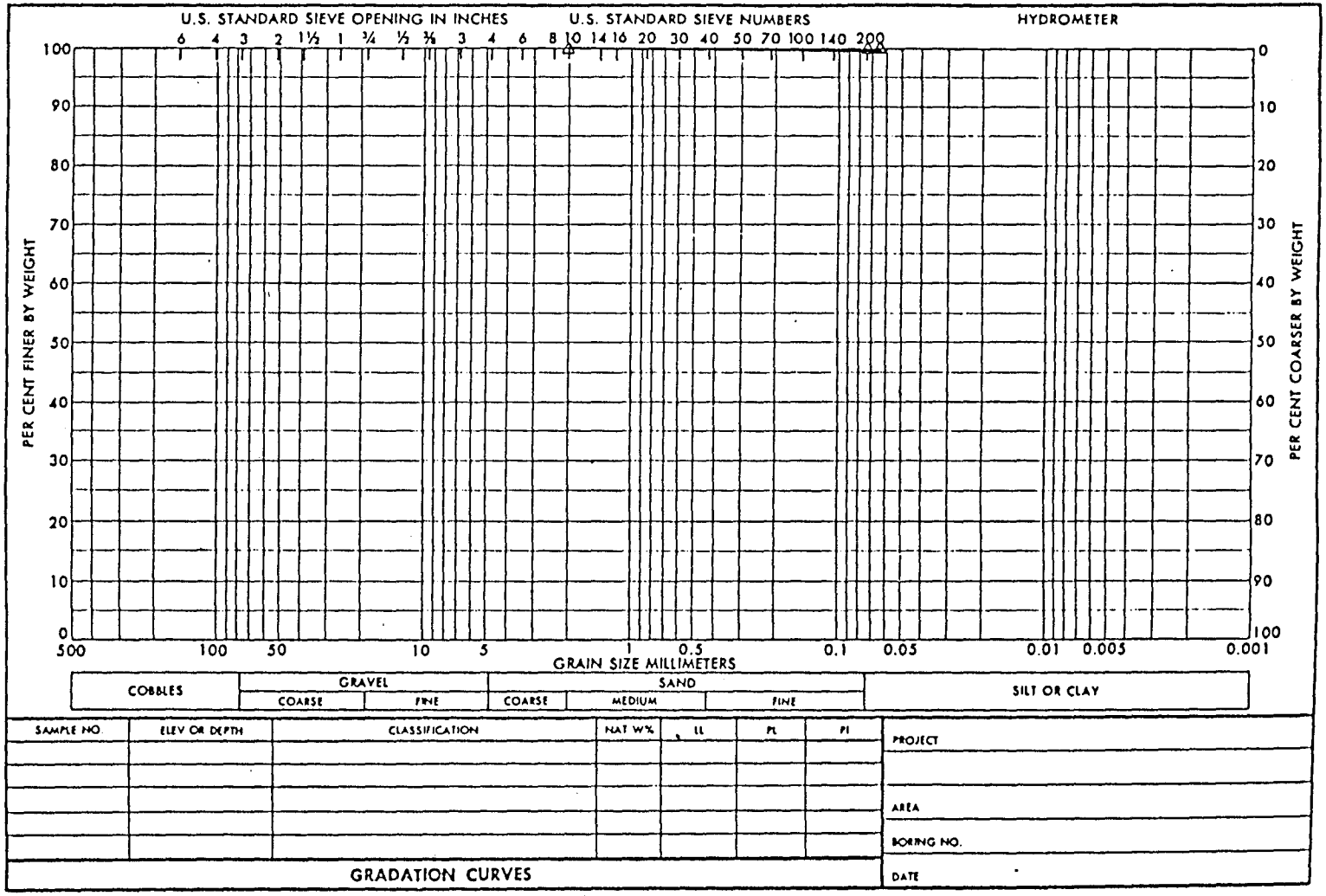
DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 1A, (East), 1982 RESURVEY

PLATE 36



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

BORING NO.

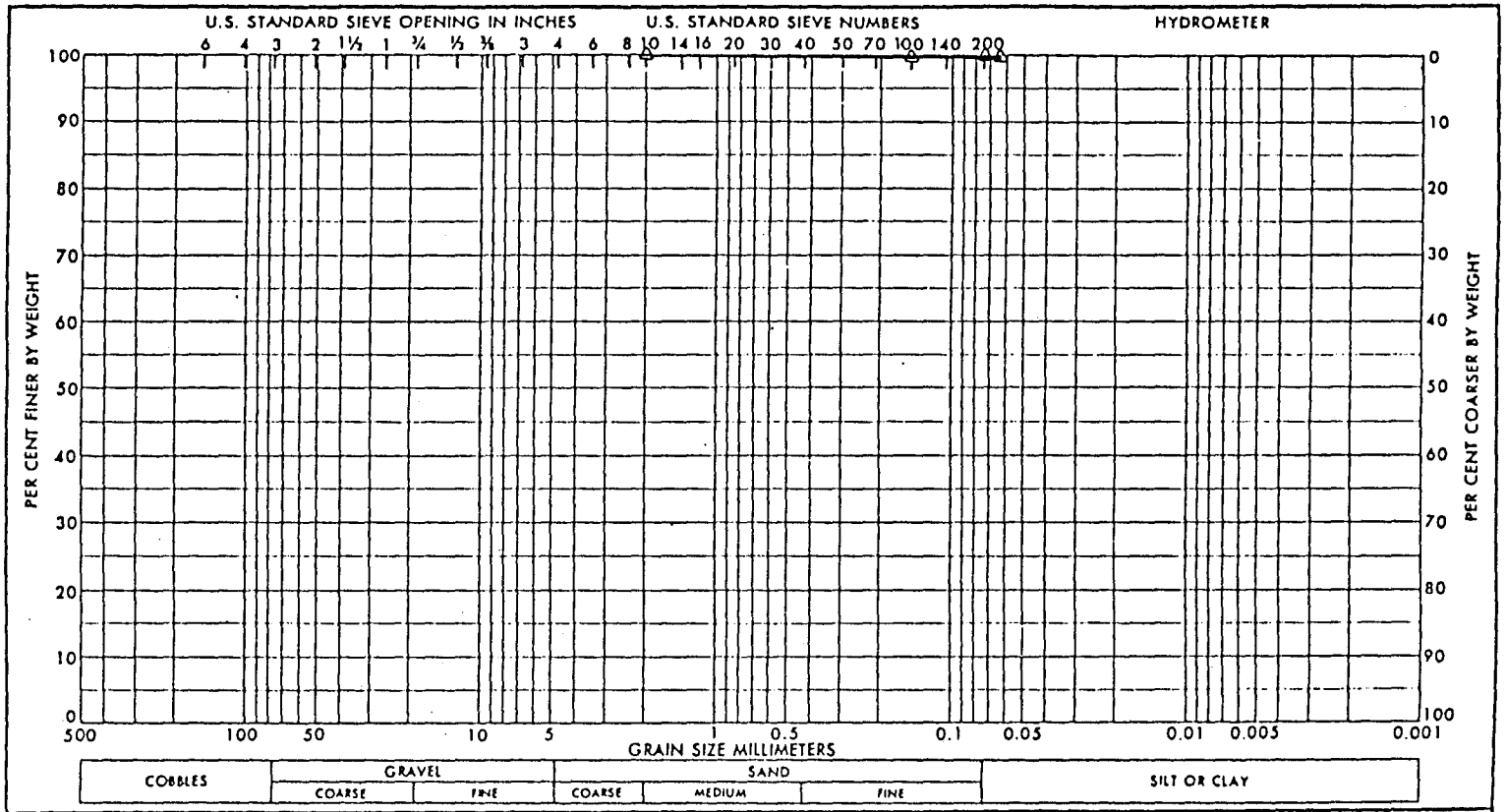
DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 1A (West), 1982 RESURVEY

PLATE 37



SAMPLE NO	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

BORING NO.

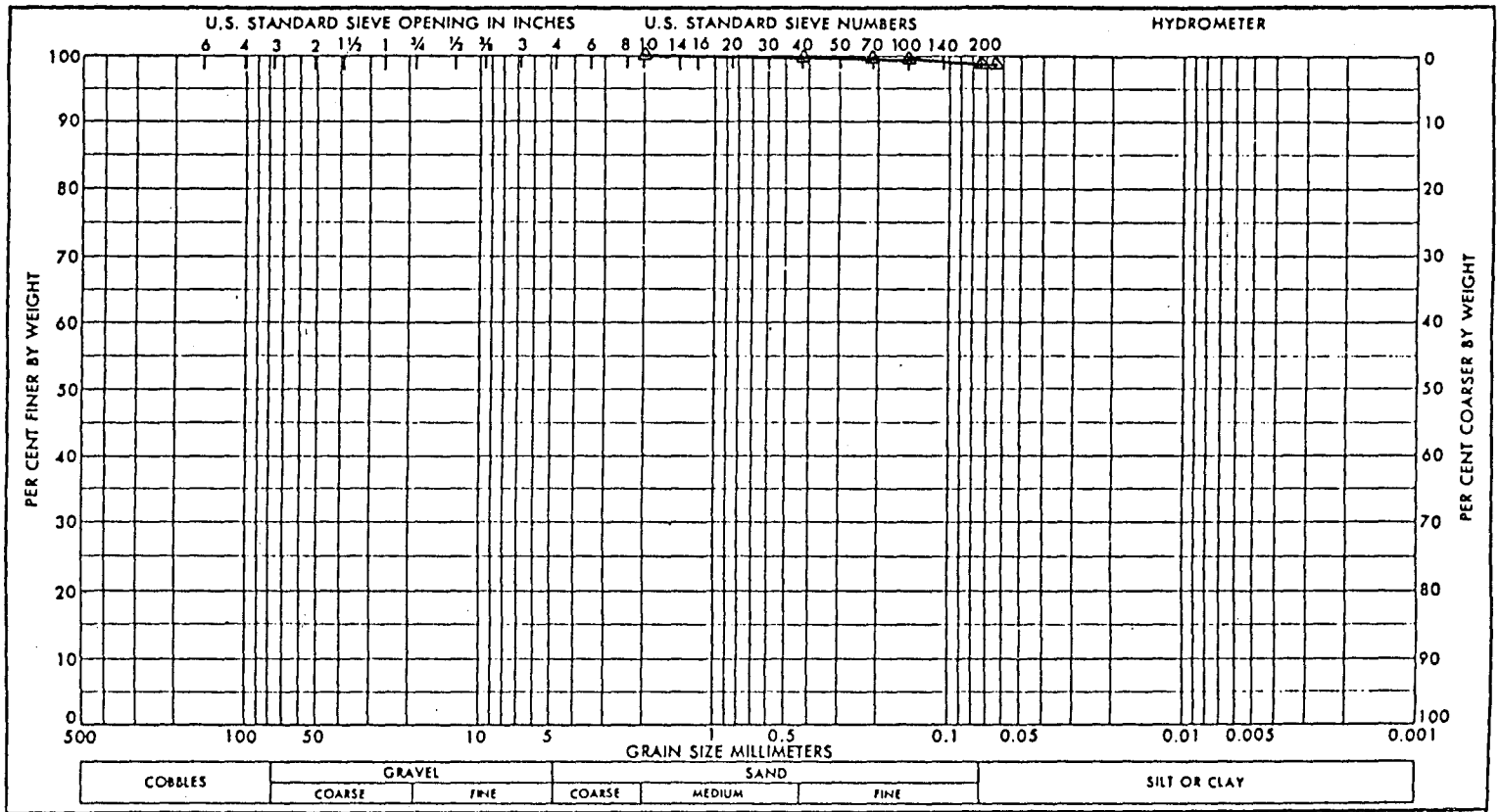
DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 2A, 1982 RESURVEY

PLATE 38



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

BORING NO.

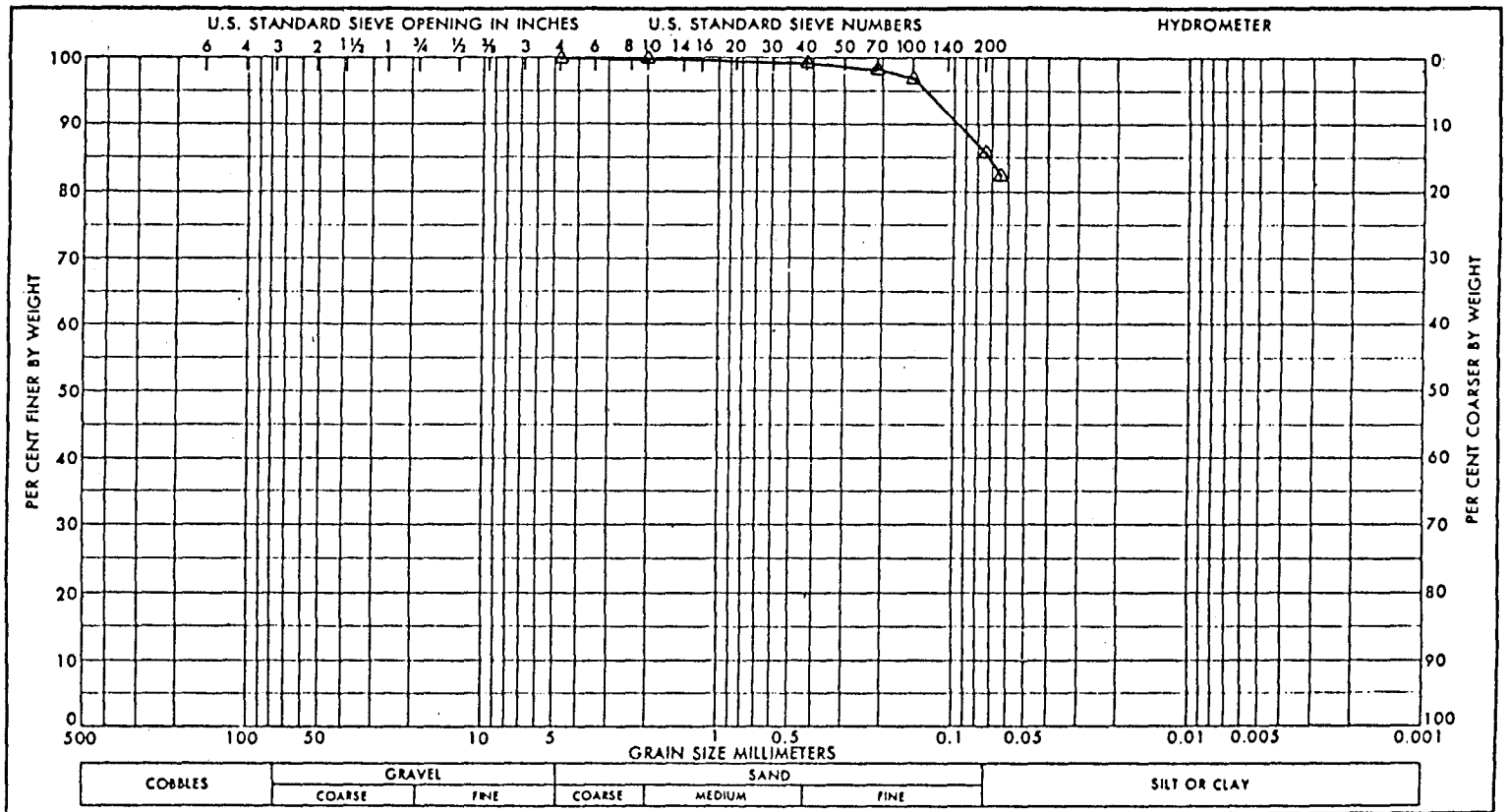
DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 3A (East), 1982 RESURVEY

PLATE 39



SAMPLE NO	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

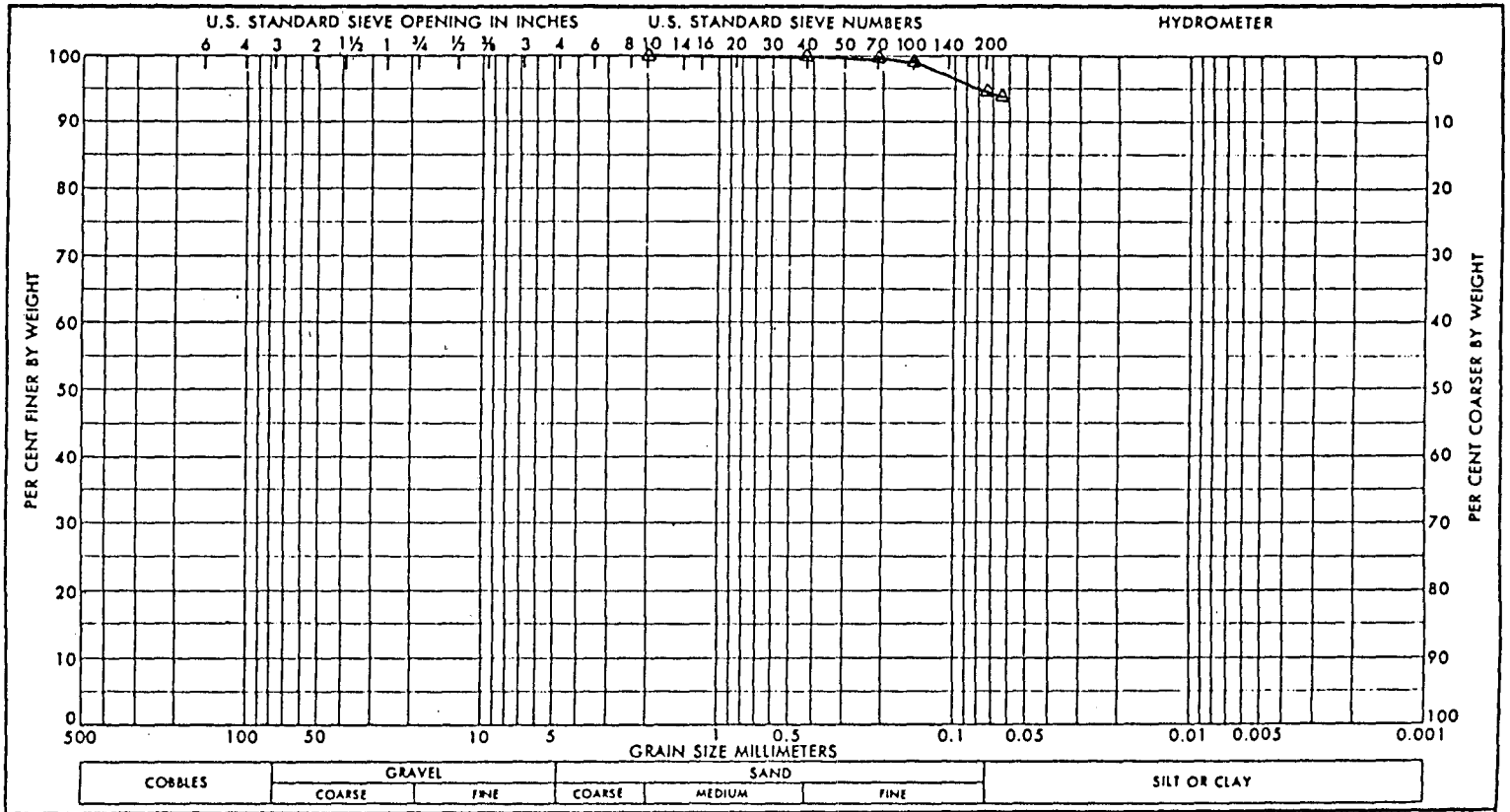
BORING NO.

DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 3A (West), 1982 RESURVEY



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

BORING NO.

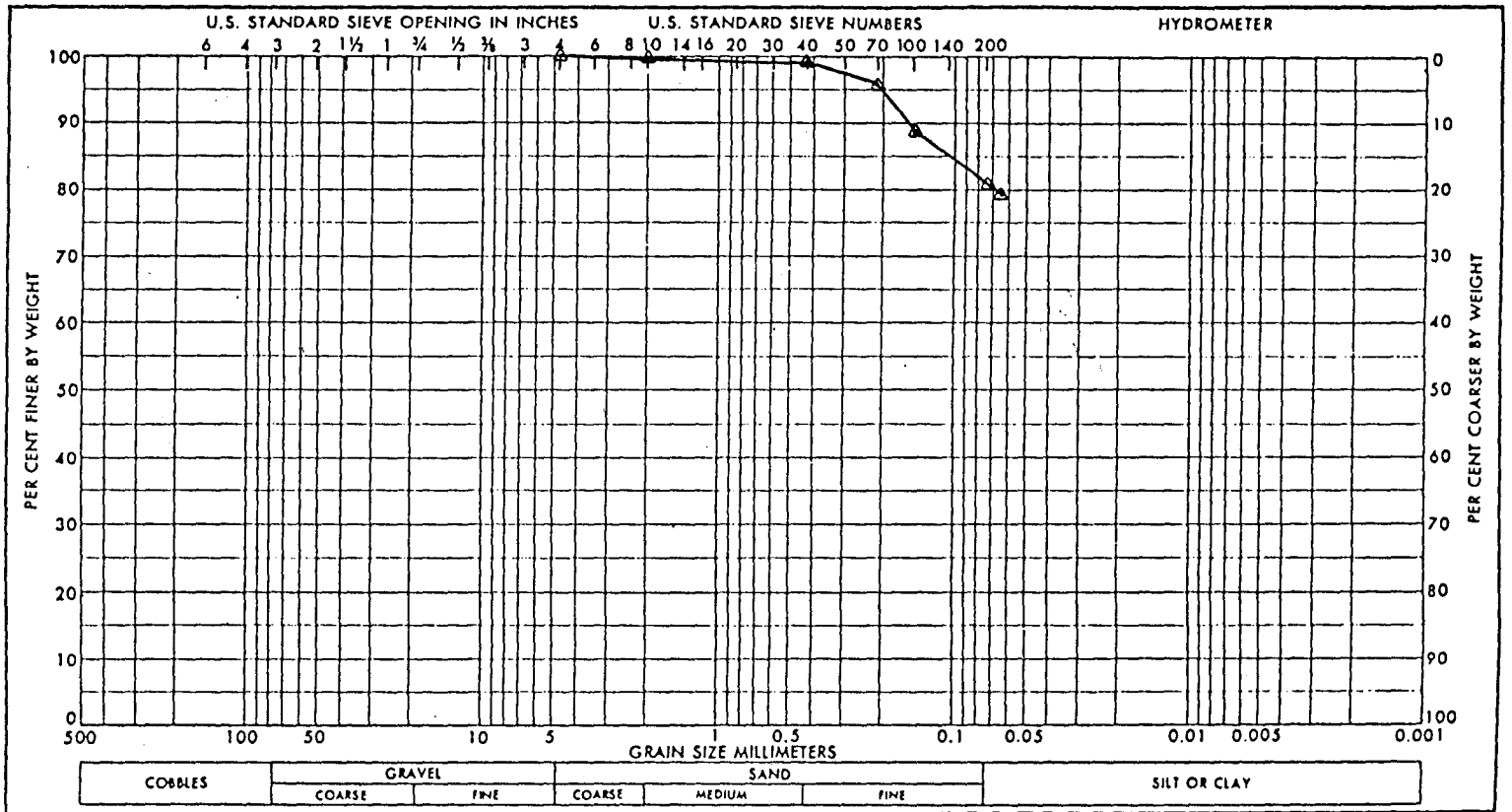
DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 3.1A, 1982 RESURVEY

PLATE 41



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

BORING NO.

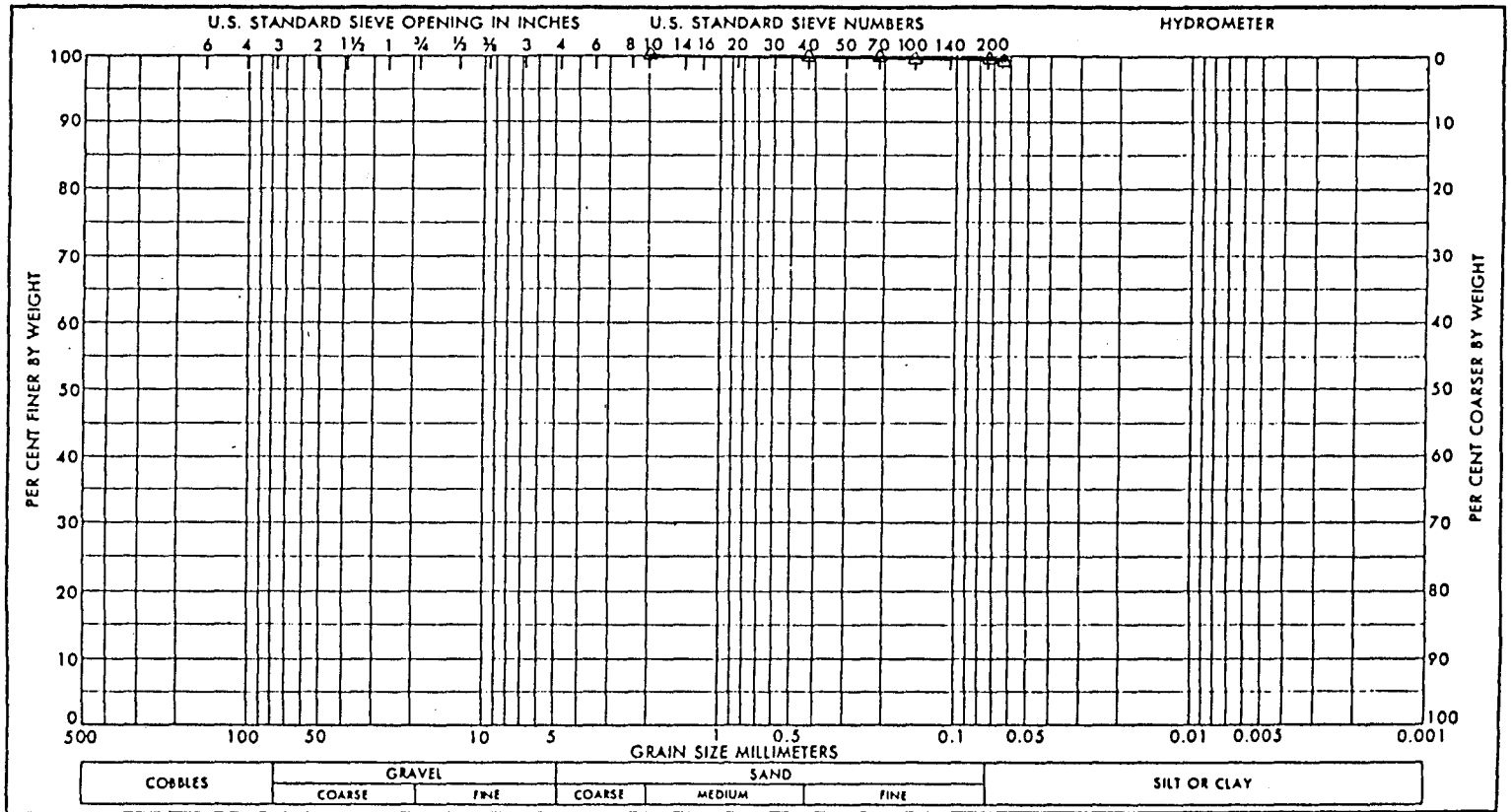
DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 3.2A, 1982 RESURVEY

PLATE 42



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

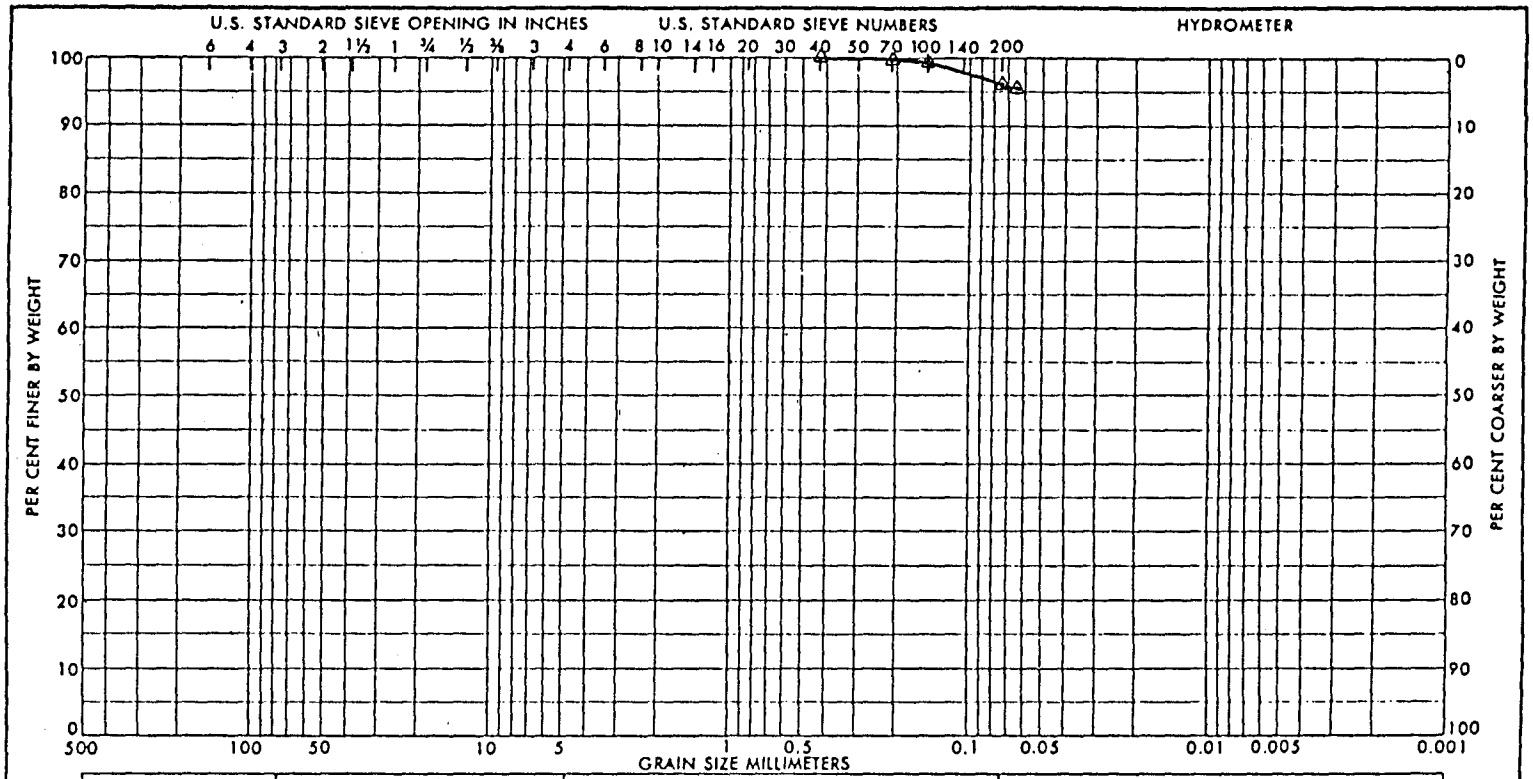
BORING NO.

DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 4A, 1982 RESURVEY



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

BORING NO.

DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 5B, 1982 RESURVEY

PLATE 44

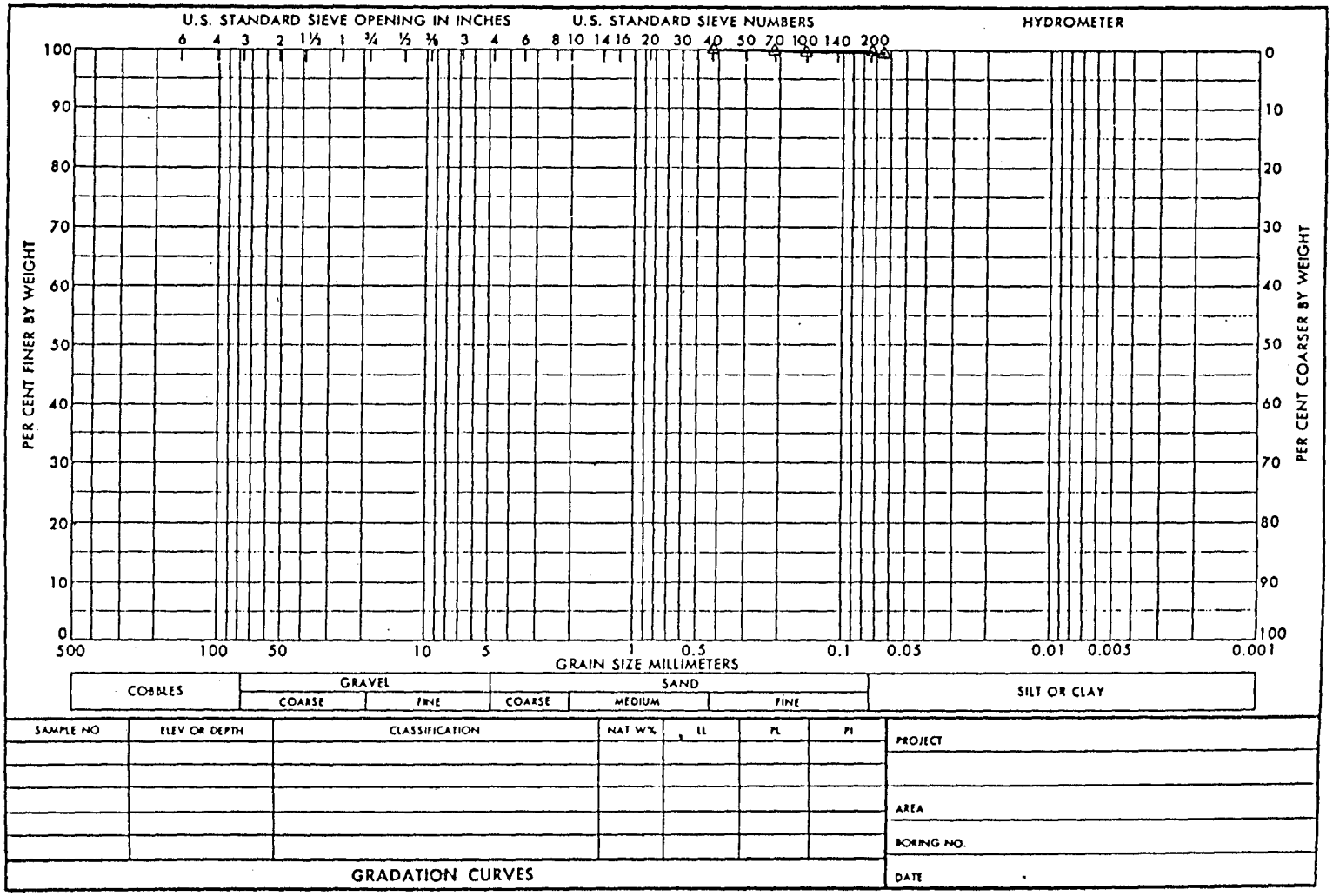
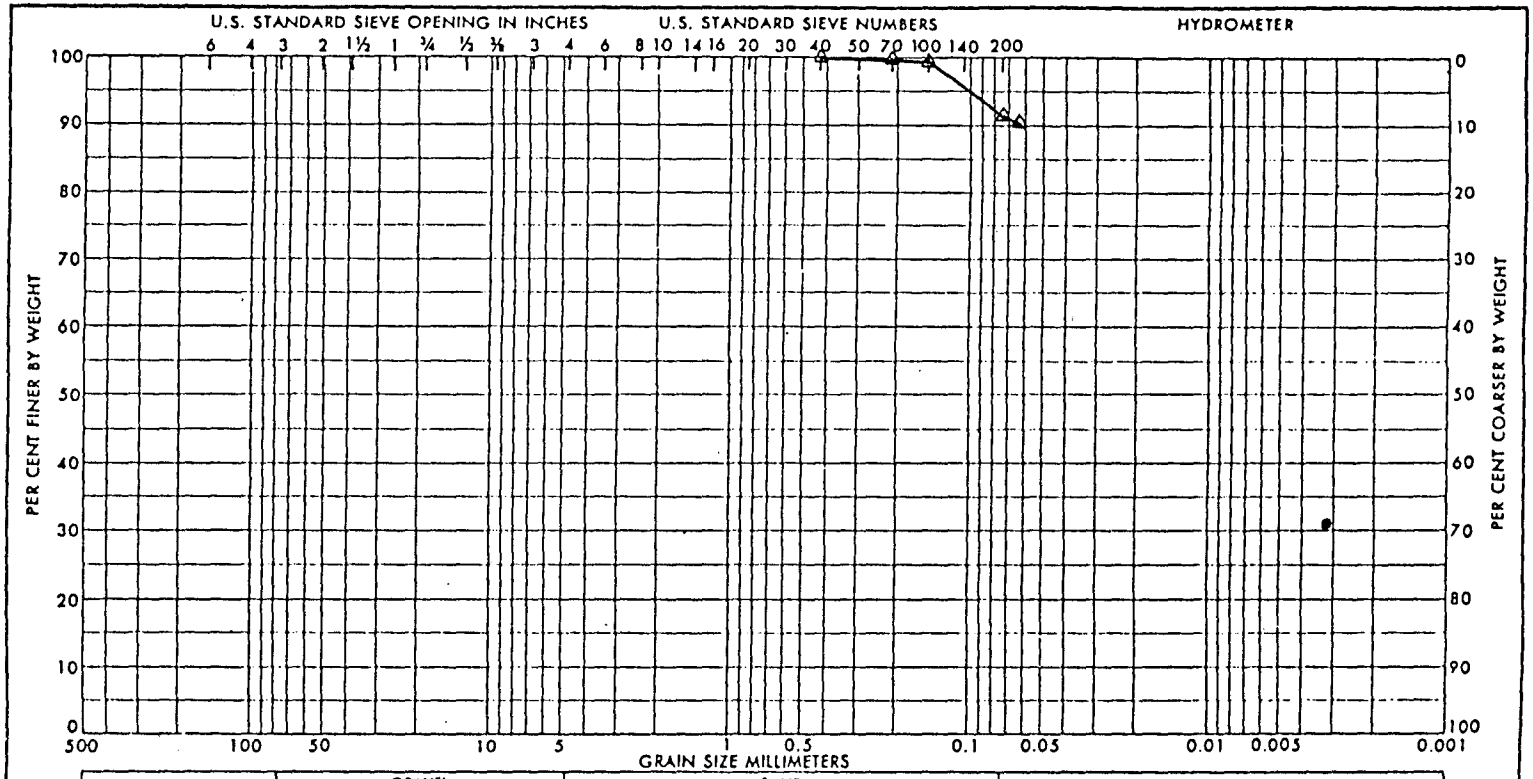


PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 6B, 1982 RESURVEY

PLATE 45



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

BORING NO.

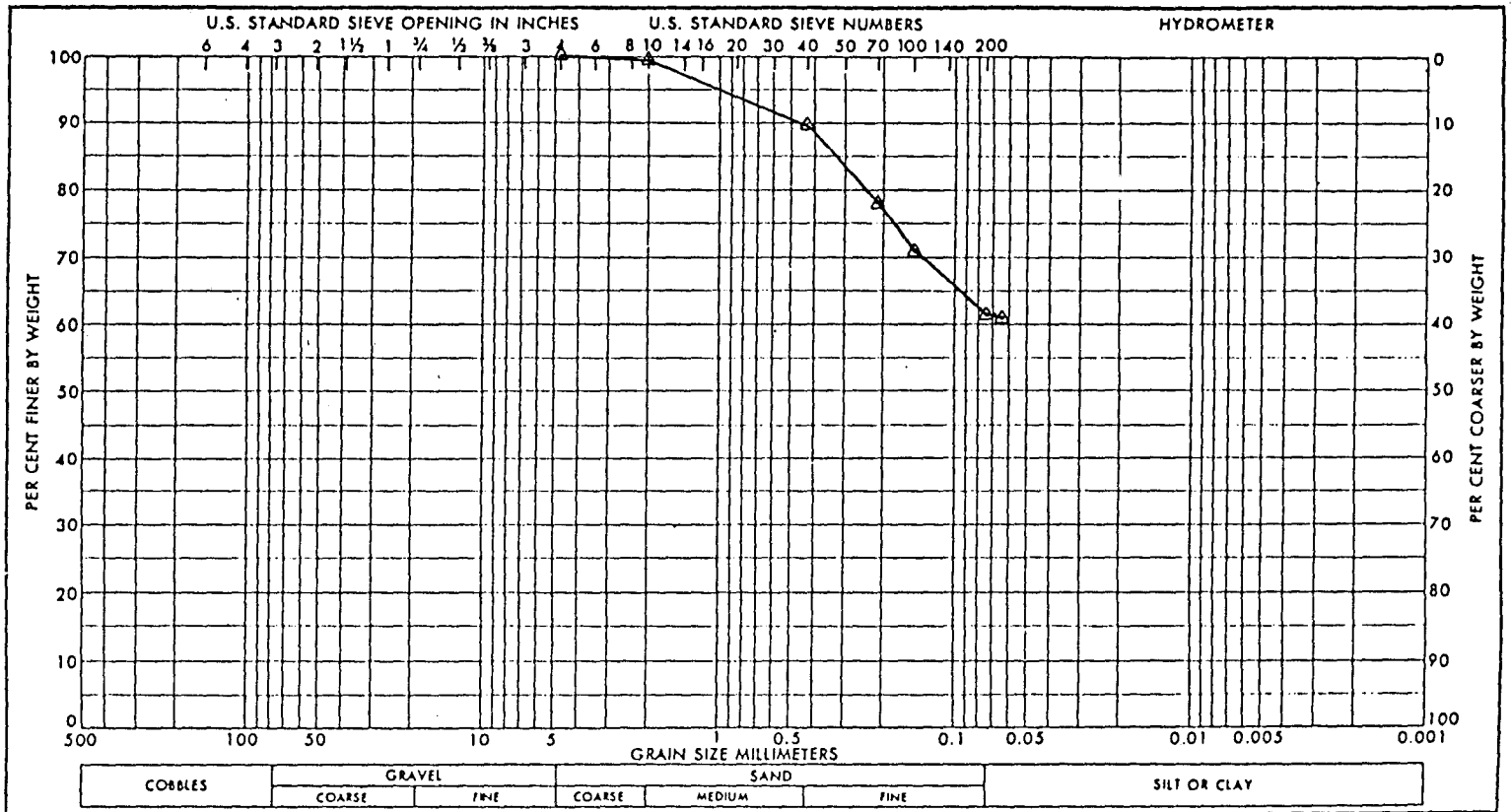
DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 7A, 1982 RESURVEY

PLATE 46



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

BORING NO.

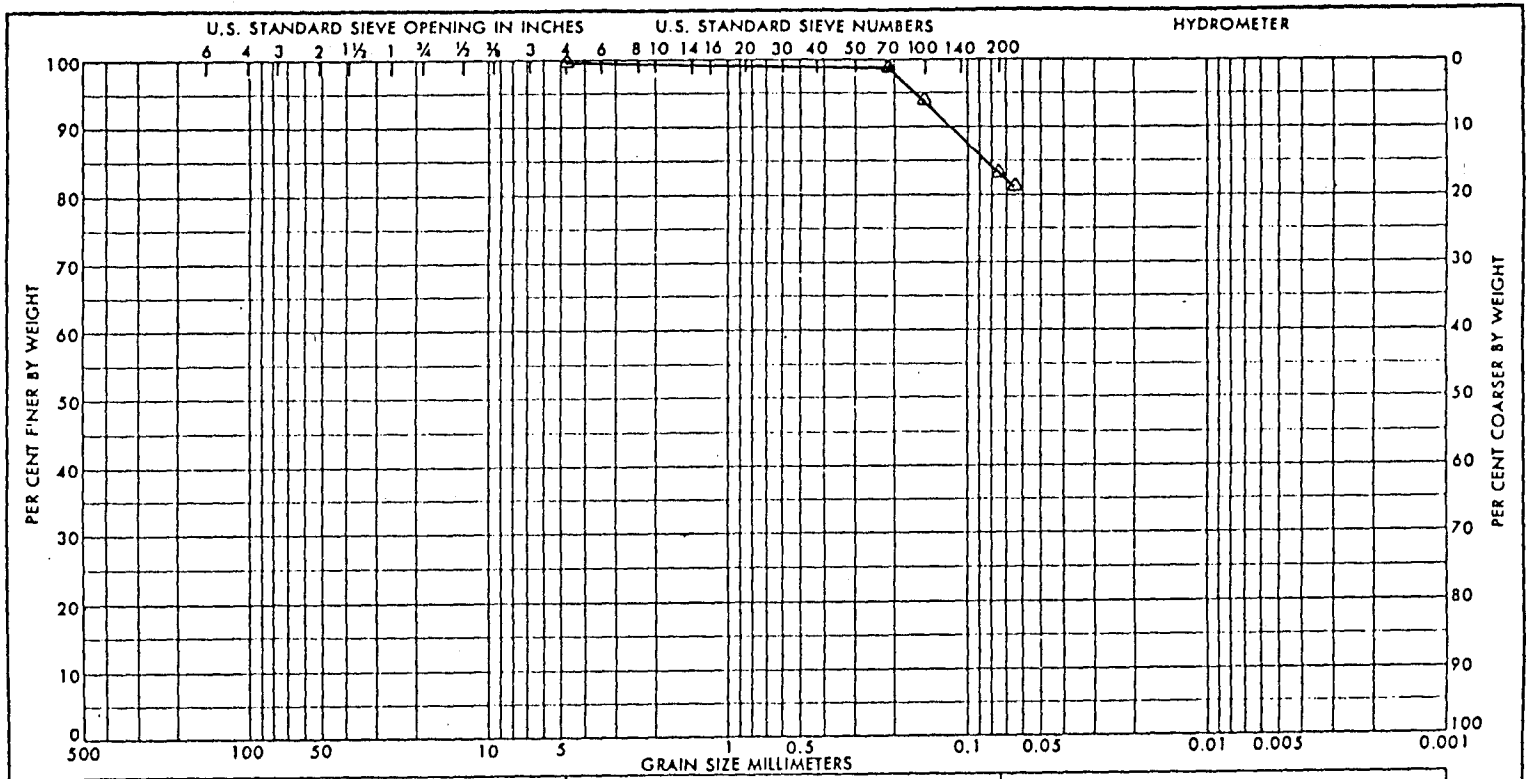
DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 8B, 1982 RESURVEY

PLATE 47



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT

AREA

BORING NO.

DATE

PLATE V-2

ENG FORM 2087
1 MAY 63

LAKE CARLYLE
SEDIMENT SIZE DISTRIBUTION
SAMPLE 9A, 1982 RESURVEY

PLATE 48