Commonwealth Edison
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Address Reply to: Post Office Box 767
Chicago, Illinois 60690

March 8, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Braidwood Station Units 1 and 2
Additional FSAR Information
NRC Docket Nos. 50-456/457

References (a): B. J. Youngblood letter to L. O. DelGeorge dated January 14, 1983

(b): B. J. Youngblood letter to L. O. DelGeorge dated February 1, 1983

Dear Mr. Denton:

The above References requested that the Commonwealth Edison Company provide certain additional information concerning our FSAR for Braidwood Station Units 1 and 2.

The Attachment to this letter provides our response to Questions 10.60, 10.62, 361.1 thru 361.5, 362.1, 362.10, 371.9, 371.10, 371.19 and 372.23. Our FSAR will be amended to include the information contained in the Attachment to this letter as appropriate. Additionally, our schedule for submittal of the remaining open items is currently being discussed with Ms. Janice A. Stevens.

Please address any questions that you or your staff may have concerning this matter to this office.

One (1) signed original and fifteen (15) copies of this letter with Attachment are provided for your use. For the purposes of clarity, one (1) set of 11" x 17" figures referenced in our responses to the above questions and three (3) full size copies of drawing S-127-BR (Figure 2.5-39) are being sent directly to Ms. Janice A. Stevens.

Very truly yours,

E. Douglas Swartz
Nuclear Licensing Administrator

Attachment

cc: J. G. Keppler - RIII
RIII Inspector - Braidwood
6150N

B001

QUESTION 010.60

"Assuming continued operation of the circulating water and nonessential service water pumps following a seismic event, describe the means provided for assuring that this does not result in reducing the level of the essential cooling pond to the point where less water is available than that assumed in the analysis for the 30-day cooling capability of the pond. The pond level should be assumed to be at its minimum elevation (590'-0") following the seismic event. Justify any assumptions in the above evaluation."

RESPONSE

Following a seismic event the essential cooling pond will be at its minimum elevation (590 feet 0 inch) only if the retaining dikes of the main cooling pond have failed. As described in Subsection 10.4.5, the circulating water pumps will not operate satisfactorily with a submergence of less than 2 feet. This corresponds to a pond elevation of 590 feet 0 inch. As a result, the circulating water pumps will not operate after the postulated event.

The nonessential service water pumps require 8 feet of submergence of the intake to operate properly. This corresponds to a level of 591 feet 10 inches. As a result, the nonessential service water pumps will not operate after the postulated event.

The analysis in Subsection 9.2.5 is valid for any potential event. As discussed above, the only pump which would take suction from essential cooling pond after the level is reduced to elevation 590 feet 0 inch is the essential service water pump.

QUESTION 010.62

"Describe the differences in the circulating water system failure flooding analysis between the Byron and Braidwood Stations. Verify that the resulting flooding does not affect safe shutdown of the plant assuming a concurrent single failure in essential equipment. Relate your response to that provided in response to Byron Question 010.50."

RESPONSE

There is no significant difference between the circulating water system failure flooding analyses for Byron and Braidwood Stations. The response to Question 10.50 is applicable to both stations. The source of circulating water at Braidwood, the cooling pond, is 5 feet lower than the Byron cooling tower flume. The only effects of this difference are a slightly slower inflow rate due to reduced head at Braidwood, and a slightly lower final flood level at Braidwood. Both of these differences result in the Byron analysis being conservative for both stations.

QUESTION 361.1

"The inset note on Figure 2.5-12 states that structural details of the area on Fig. 2.5-12 are shown in Fig. 2.5-9a. Fig. 2.5-9a apparently has not been submitted yet. Please provide the figure."

RESPONSE

The figure referred to on the inset note on Figure 2.5-12 should be Figure 2.5-11, not Figure 2.5-9a. Figure 2.5-12 has been revised and will be included in the next amendment.

QUESTION 361.2

"The following both refer to Figure 2.5-33, Contours on top of the Colchester No. 2 Coal Member:

"(a) In the vicinity of the heater bay, elevations of the top of the #2 Coal from boreholes MP-31 and MP-36, 496.5' and 497.3', are located between the 498 and 500 ft contour lines. Either the elevations are incorrect, or the contour configuration must change. Please explain or correct.

"(b) The configuration of the contours on the map suggest that the surface of the Colchester #2 Coal bed is not as planar as might be expected from undisturbed flat lying rock. Although the contour interval is small there still appears to be an elongated trough-like depression at the north end of the map enclosed by contours 494 and 496 (which, if continued on the basis of the two elevations at the northeast and parallels 494 to its end). A second more irregular, heart-shaped depression delineated by contour line 500 underlies parts of the auxiliary and turbine buildings. This depression coincides with a U-shaped trough at the top of the Ft. Atkinson Limestone of Fig. 2.5-34, sheet 2. Please explain these configurations in view of the fact that the Colchester #2 Coal bed is used in the FSAR as a persistent marker bed assuring there is no deformation (faulting, etc.) in the plant site."

RESPONSE

Item a: The contour configuration in Figure 2.5-33 has been revised and will be included in the next amendment.

Item b: As discussed in Subsection 2.5.1.2.5.2, the tops of both the Colchester No. 2 Coal Member (shown in Figure 2.5-33) and the Ft. Atkinson Limestone (shown in Figure 2.5-34, Sheet 2 of 2) are erosional surfaces. Therefore, the minor warping configuration shown on each of these units may be due as much to erosion as to tectonic activity and the fact that structures shown on one unit are similar to structures shown on another unit may be coincidental. However, it is possible that minor warping of the two geologic units may be due to tectonic forces acting on the La Salle Anticlinal Belt.

Clegg (1965, Page 93) indicates that structural and stratigraphic relationships in northern Illinois show that a second phase of deformation of the La Salle Anticlinal Belt began after the deposition of the Colchester No. 2 Coal and possibly continued to the end of or after Pennsylvanian time.

QUESTIONS 361.3

"The second line in p. 2.5-47 of the FSAR refers to Figures 2.5-36 and 2.5-46 as maps showing all known coal mines within 1 mi surrounding the plant site and cooling pond areas. However, Fig. 2.5-46 is a graph correlating earthquake intensity with acceleration. Do you mean to refer to Fig. 2.5-36A as the other map of known mines?"

RESPONSE

The second line on Page 2.5-47 has been corrected to reference Figures 2.5-36 and 2.5-36A, and will be included in the next amendment.

QUESTION 361.4

"Fig. 2.5-39 is a detailed topographic map of the plant site.

"a. The scale of this map is too small to be of use. Please provide either the original or a larger copy that is legible.

"b. Please indicate the significance of the 'cloud-like' symbols. Do they indicate vegetation, or have they some other meaning?"

RESPONSE

A full-size copy of Sargent & Lundy drawing S-127-BR (Figure 2.5-39) will be provided under separate cover. The "cloud-like" symbols indicate vegetation.

QUESTION 361.5

"The following address Section 2.5.4.3.1, Excavation mapping:

"(a) Figure 2.5-55 indicates the location of excavation mapping reported on in the FSAR. Three locations are indicated as having been mapped, with Figures 2.5-49-2.5-54 illustrating these three localities. In view of the fact that these three locations represent a very small portion of the exposed bedrock in the excavations, and there is well-developed jointing evidence in two of the photographs, the staff would like to examine the 190 photographs of the 145 locations in the excavations referred to in Section 2.5.4.3.1.1.2, p. 2.5-68. Please mark them clearly as to location and direction of viewing on the photos and on the excavation location map.

"(b) Please explain why detailed study of joints in the excavations was not possible (compare with section 2.5.1.2.5.1 on jointing). If you have joint data from the excavations, please put it into some tabulated form (Rose diagram, etc.) and submit it for review, with a discussion of its significance.

"(c) A note on Figures 2.5-72 and 2.5-73 states that 'excavation mapping of Category I structures is presented in Attachment 2.5A'. However, 2.5A is a letter from the Illinois Geological Survey that describes a visit by IGS staff to the excavation. Please clarify."

RESPONSE

Item a: A map showing the locations of the photographs is given in revised Figure 2.5-55. One set of these photos is presently available. The NRC is welcome to view these photographs at any time.

Item b: The primary purpose of the geologic mapping of the excavations for Category I structures at the site was to confirm that the site stratigraphy as exposed in the excavations was in agreement with that evaluated by the boring program and presented in the PSAR. Another purpose of the excavation mapping program was to ascertain that no faults were present in any of these excavations. Faulting is discussed in Subsection 2.5.1.2.5.3. No data on joint orientation or spacing was collected during the excavation mapping program. A discussion of site jointing is presented in Subsection 2.5.1.2.5.1.

Item c: The geologic mapping of the excavations for the Category I structures is discussed in Subsection 2.5.4.3.1.1. The note on Figures 2.5-72 and 2.5-73 has been changed to give the proper reference, and will be included in the next amendment.

QUESTION 362.1

"Submit time-settlement plots for all Category I structures where settlements are being monitored. The plots should be up-to-date. Tabulate values of measured maximum differential settlemetns and anticipated differential settlements assumed in the analysis of these structures and appurtenances such as connecting pipes and conduits. Evaluate the impact of any differences between the measured and the anticipated settlements on the design and construction of these facilities. Unless the applicant can demonstrate that adequate settlement margins are presently available and that future settlement will be negligible, the staff will require that the total and differential settlement of the safety related structures be monitored for a period of 5 years after issuance of the Operating License. The impact of observed settlement, if any, on the design limits of Category I structures and appurtenances should be evaluated annually during this period and reported to the NRC."

RESPONSE

A system of construction settlement monuments was established for the foundations of Category I structures during 1977 and 1979 as shown in Figure Q362.1-1. These monuments were installed and monitored by the contractor for the purpose of construction control and settlement monitoring. Seven of these monuments (U, V, N, R4, Z, KK, and XX) have been monitored continuously from the beginning of construction in 1977 to August 1980. Many of the other original monuments were discontinued because of construction interferences, and some were replaced in February 1979 by new monuments at similar locations within the same building. Other new monuments were also added at this time. In August 1980, monitoring was halted because settlement was complete under approximately 95% of the plant static load with measurements within the accuracy of the surveying equipment and methods used. Time settlement plots for all the construction settlement monuments are shown in Figure Q362.1-1 and presented in Figures Q362.1-2 through Q362.1-19.

In September 1981, a new set of operational settlement monuments was established throughout the plant. The intent of monitoring these monuments was to provide additional data to show that plant settlement under full static load is complete. The new monuments were installed on two floor levels which will reduce errors introduced into survey circuits by eliminating excessive traveling between different building levels. The locations of the operational settlement monuments are shown in Figure Q362.1-20. Time settlement plots for all the operational settlement monuments are presented in Figures Q362.1-21 through Q362.1-31.

Table Q362.1-1 is a summary of the maximum measured differential settlements for all construction and operational monuments. Table Q362.1-2 is a summary of projected maximum total and differential settlements for each Category I structure. These total and differential settlements have been calculated after reviewing the stabilized elevations of key Category I monuments. The stabilized elevations have been identified on the settlement plots. Some allowance has been made in the total settlement due to the small amount of building load that still remains to be placed. The new operational phase monuments, installed in September 1981, clearly show that their maximum differential settlement is less than or equal to -0.01 feet (-0.011 feet maximum). This settlement is considered negligible and indicates that settlement has stabilized.

The differential settlements given in Table Q362.1-2 are all less than or equal to -0.03 feet. This is significantly less than 1/2-inch or more which was assumed in the design of ~~all structures.~~ THE AUXILIARY BUILDING AND FUEL HANDLING BUILDING. The only safety-related pipe or conduit that is not suspended is the essential service water pipeline. This pipeline travels beneath the heater bay building and enters the turbine room mat. Beneath the heater bay, it is encased in reinforced concrete and supported on till or rock. The point of maximum differential settlement occurs as the encased pipeline enters the turbine room mat. The pipeline is designed to take with adequate margin the 1/2-inch estimated differential settlement.

It is concluded that all Category I structures have been designed to account for the maximum total and differential settlement IN THIS AREA.

TABLE Q362.1-1

TABULATED DIFFERENTIAL SETTLEMENTS FOR SURVEY MONUMENTS

BUILDING	MONUMENT NUMBER	PERIOD OF MEASUREMENT	MAXIMUM MEASURED DIFFERENTIAL MOVEMENT (Feet)
Fuel	9	2/79 to 12/81	+0.002
	10	2/79 to 8/80	-0.012
	New 10	9/81 to 10/82	0.000
	New 9	9/81 to 10/82	-0.002
	51	9/81 to 10/82	+0.002
	52	9/81 to 10/82	0.000
Refueling Water Storage Tanks	40	2/79 to 8/80	-0.025
	New 40	9/81 to 10/82	+0.003
	55	9/81 to 10/82	0.000
Auxiliary Building	KK	2/77 to 8/80	-0.059
	LL	2/77 to 8/77	-0.013
	JJ	2/77 to 5/77	-0.010
	21	2/79 to 8/80	-0.020
	22	2/79 to 8/80	-0.013
	23	2/79 to 8/80	-0.015
	24	2/79 to 8/80	-0.020
	26	2/79 to 8/80	-0.021
	27	2/79 to 8/80	-0.027
	28	2/79 to 8/80	-0.025
	New 21	9/81 to 10/82	+0.006
	New 26	9/81 to 10/82	+0.013
	New 27	9/81 to 10/82	0.000
	New 29	9/81 to 10/82	+0.001
	53	9/81 to 10/82	-0.002
	54	9/81 to 10/82	-0.001
Unit 1 Containment	U	2/77 to 8/80	-0.061
	V	2/77 to 8/80	-0.052
	N	2/77 to 8/80	-0.080
	N_2	3/77 to 6/77	-0.014
	N_4	3/77 to 6/77	-0.014
	P	2/77 to 8/77	-0.004
	13	2/79 to 2/80	-0.012
	14	2/79 to 8/80	-0.005
	15	2/79 to 8/80	-0.010
	36	2/79 to 8/80	-0.003
	39	2/79 to 8/80	-0.018
	New U	9/81 to 10/82	-0.002
	New V	9/81 to 10/82	+0.018
	New N	9/81 to 10/82	-0.001
	New 3	9/81 to 10/82	-0.001
	New 37	9/81 to 10/82	-0.004
	New 39	9/81 to 10/82	+0.002

TABLE Q362.1-1 (Cont'd)

BUILDING	MONUMENT NUMBER	PERIOD OF MEASUREMENT	MAXIMUM MEASURED DIFFERENTIAL MOVEMENT (Feet)
Unit 1 Safety Valve Room	1 (Northeast Room)		-0.011
	3 (Northwest Room)	2/79 to 8/80	-0.027
Unit 2 Safety Valve Room	42	2/79 to 8/80	-0.024
Unit 2 Containment	AA	2/77 to 6/77	+0.005
	BB	2/77 to 6/77	+0.006
	R	2/77 to 8/77	-0.001
	R_1	2/77 to 8/77	-0.014
	R_2	2/77 to 5/77	-0.020
	R_3	2/77 to 8/77	-0.013
	R_4	2/77 to 8/80	-0.078
	Z	2/77 to 8/80	-0.064
	18	2/79 to 8/80	-0.020
	19	2/79 to 8/80	-0.024
	20	2/79 to 8/80	-0.020
	43	2/79 to 8/80	-0.017
	44	2/79 to 5/80	-0.027
	Z1	9/81 to 10/82	-0.001
	New R4	9/81 to 10/82	-0.006
	New 17	9/81 to 10/82	-0.009
	New 18	9/81 to 10/82	-0.004
	New 41	9/81 to 10/82	-0.011
	New Z	9/81 to 10/82	+0.002
Units 1&2 Turbine Room	CC	2/77 to 5/77	-0.001
	HH	2/77 to 8/77	-0.033
	T	2/77 to 8/77	-0.002
	W	3/77 to 8/77	-0.013
	X	2/77 to 8/77	+0.001
	4	2/79 to 8/80	-0.010
	5	2/79 to 8/80	-0.001
	6	2/79 to 8/82	+0.003
	33	2/79 to 8/82	-0.005
	New 4	9/81 to 10/82	-0.006
	New 33	9/81 to 10/82	-0.005
	New 34	9/81 to 10/82	0.000
	56	9/81 to 10/82	-0.010
	58	9/81 to 10/82	-0.004
	59	9/81 to 10/82	-0.007
Heater Bay	57	9/81 to 10/82	-0.009
Radwaste/Service Building	DD	2/77 to 8/77	-0.003
	XX	2/77 to 8/80	-0.013
	34	2/79 to 8/80	-0.008

TABLE Q362.1-2

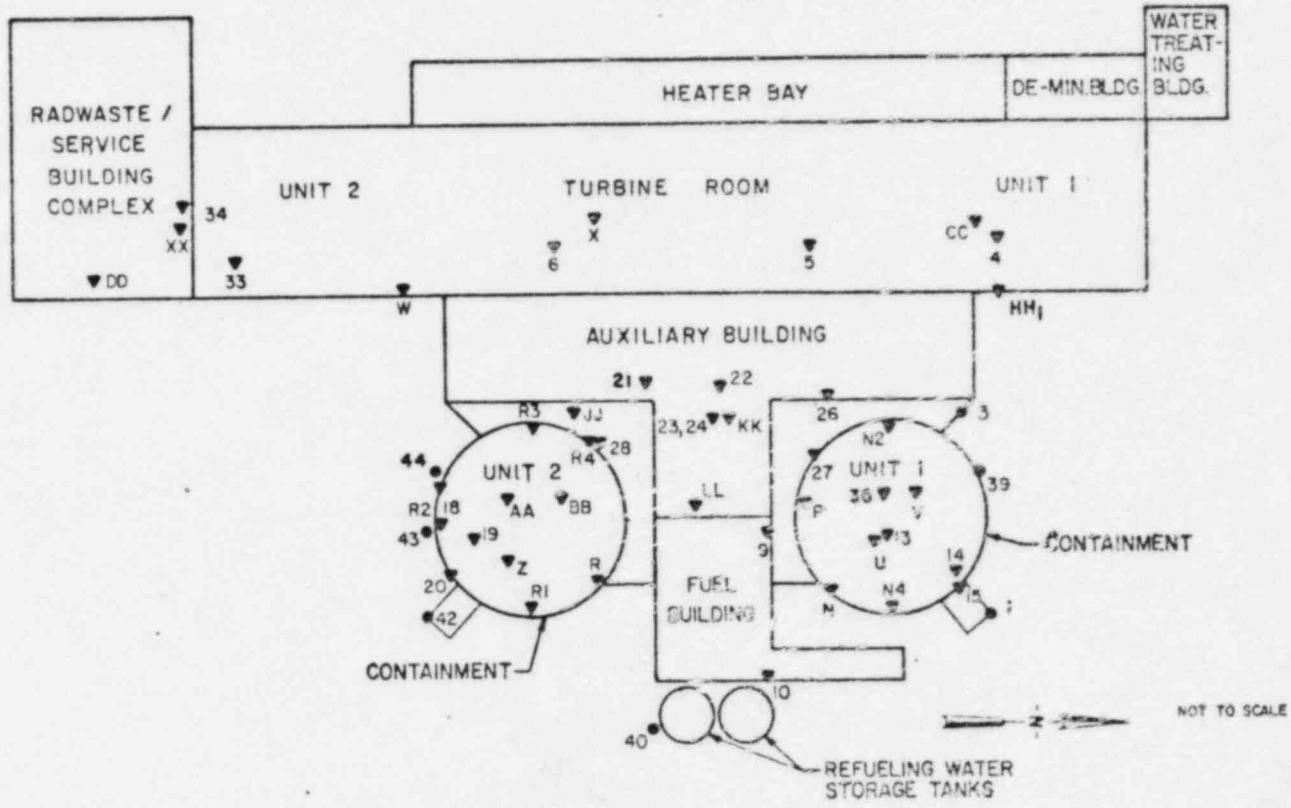
PROJECTED MAXIMUM TOTAL AND DIFFERENTIAL

SETTLEMENTS

CATEGORY I STRUCTURE	PROJECTED MAXIMUM* TOTAL SETTLEMENT (Feet)	MAXIMUM DIFFERENTIAL SETTLEMENT (Feet)
Unit 1 Containment	-0.074	-0.01
Unit 2 Containment	-0.078	-0.01
Auxiliary Building	-0.041	-0.03
Fuel Building	-0.04**	-0.02**
Refueling Water Tanks	-0.04**	-0.02**

* Projected maximum total settlement determined by increasing by 5% the difference between stabilized monument elevations and the monument initial elevations.

**Settlement values given here are estimated conservatively because a significant amount of construction occurred before monuments were installed. Actual measurements indicate less than or equal to -0.025 feet total settlement.



LEGEND

- ● EXTERIOR SETTLEMENT MONUMENT
- ▼ INTERIOR SETTLEMENT MONUMENT

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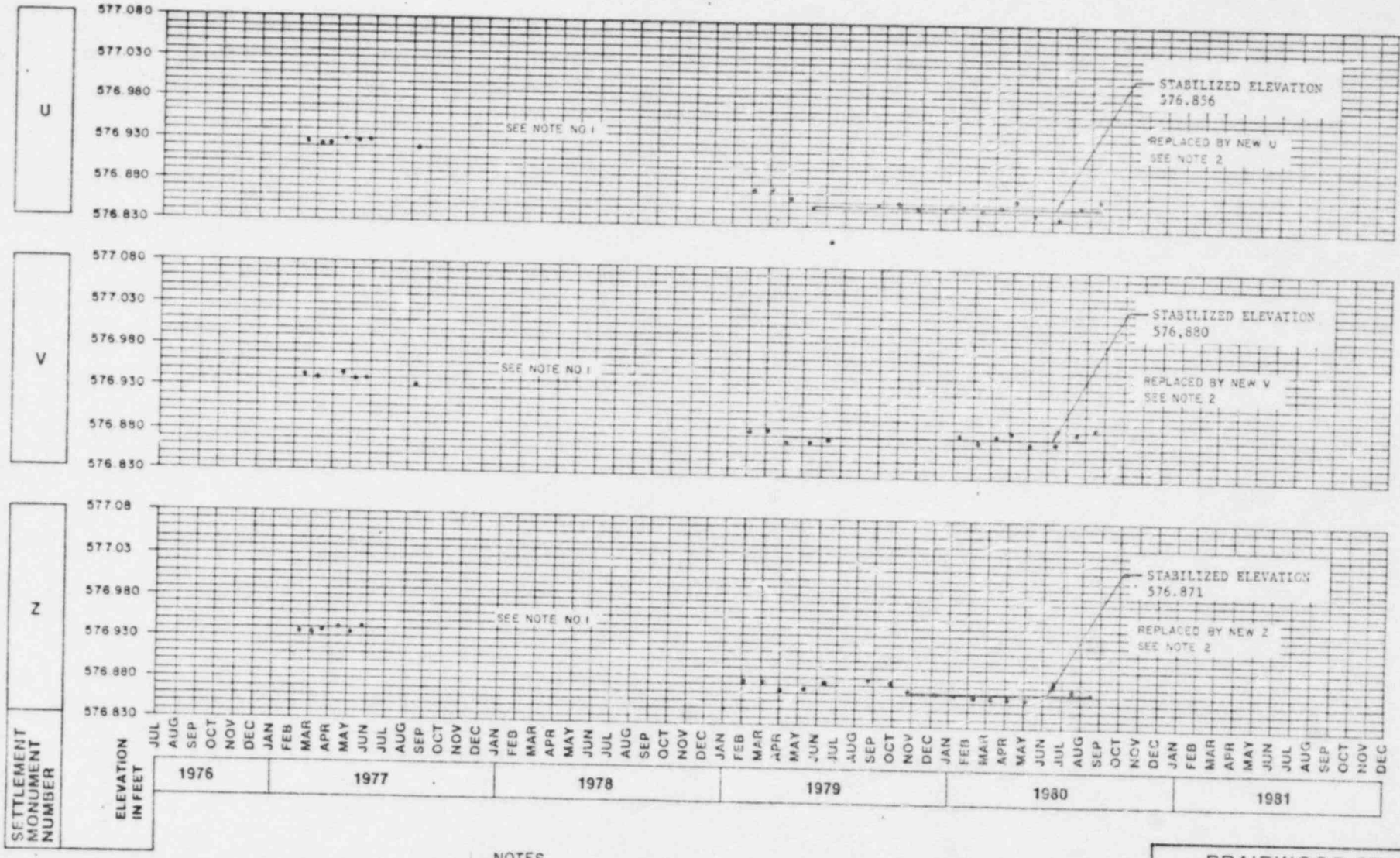
FIGURE Q362.1-1

LOCATIONS OF CONSTRUCTION SETTLEMENT MONUMENTS



NOTES

1. SURVEYS DURING THIS PERIOD WERE DISCONTINUED DUE TO CONSTRUCTION INTERFERENCES.
2. SURVEYS WERE INTERUPTED TO ESTABLISH PERMANENT OPERATIONAL MONUMENTS.
3. NOTES 1 AND 2 APPLY FOR FIGURES Q362.1-2 THROUGH FIGURE Q362.1-9

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FIGURE Q362.1-2

SETTLEMENT PLOTS FOR MONUMENTS U, V, Z

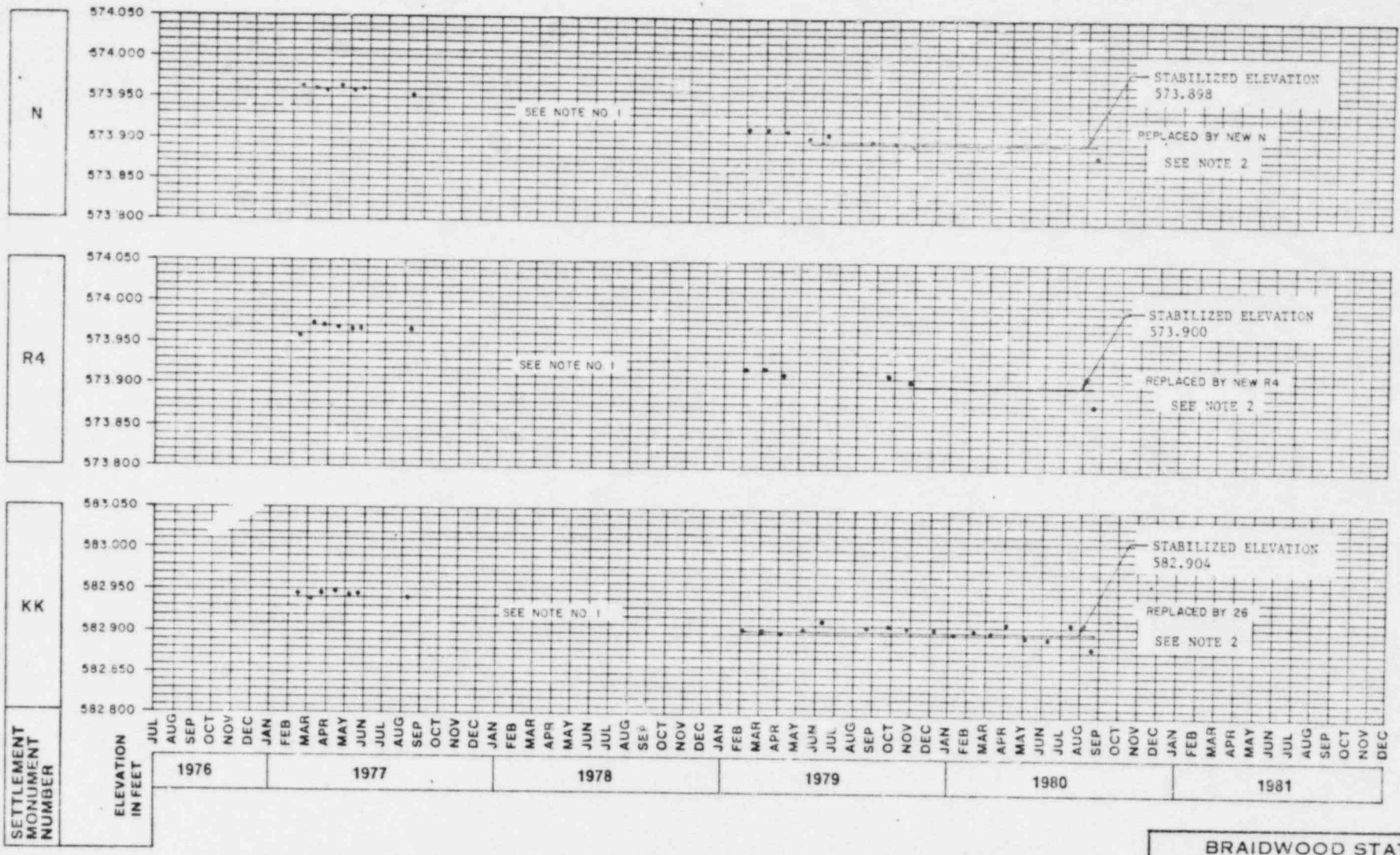

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FIGURE Q362.1-3

SETTLEMENT PLOTS FOR MONUMENTS N, R4, KK

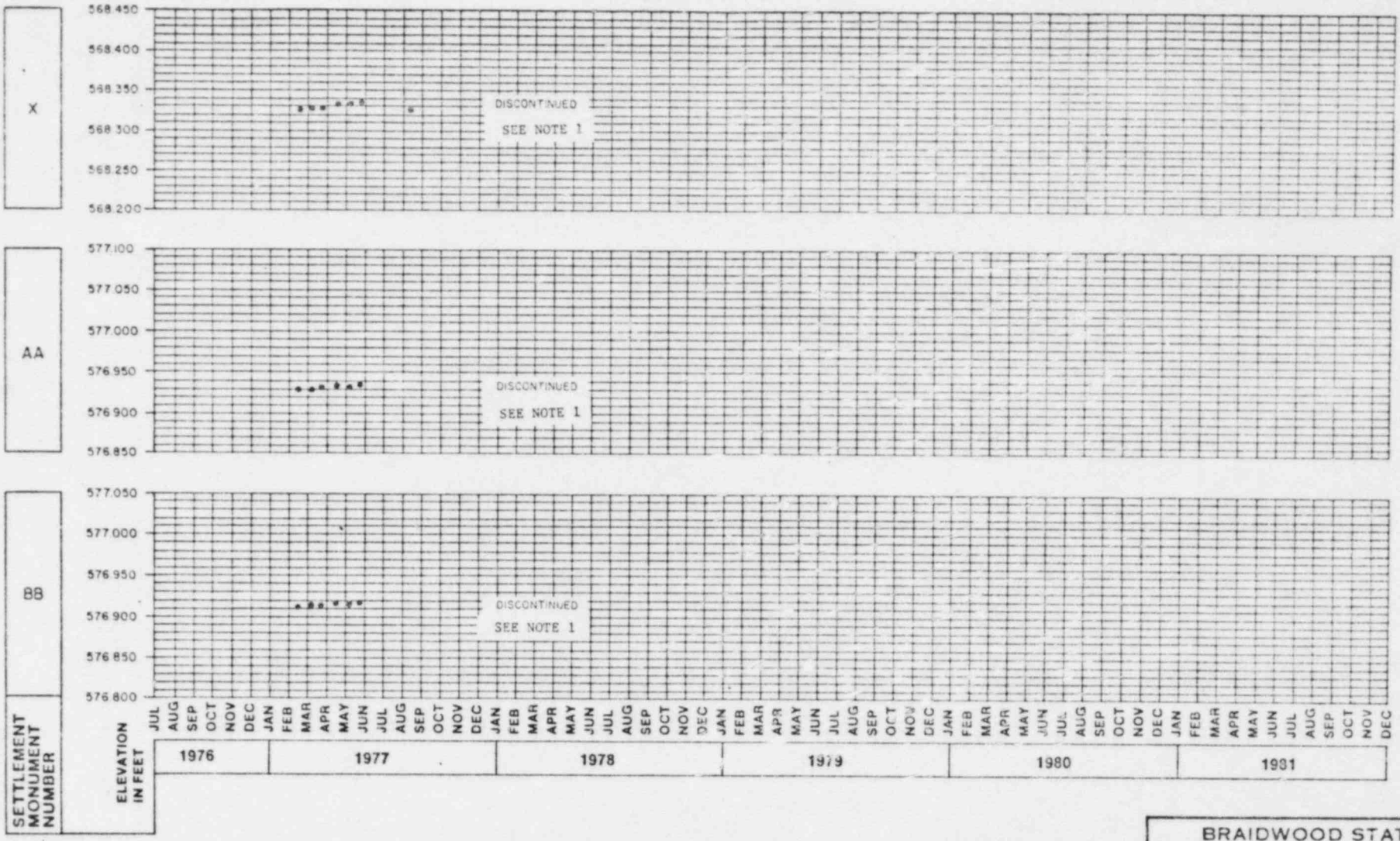

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FIGURE Q362.1-4

SETTLEMENT PLOTS FOR
MONUMENTS X, AA, BB

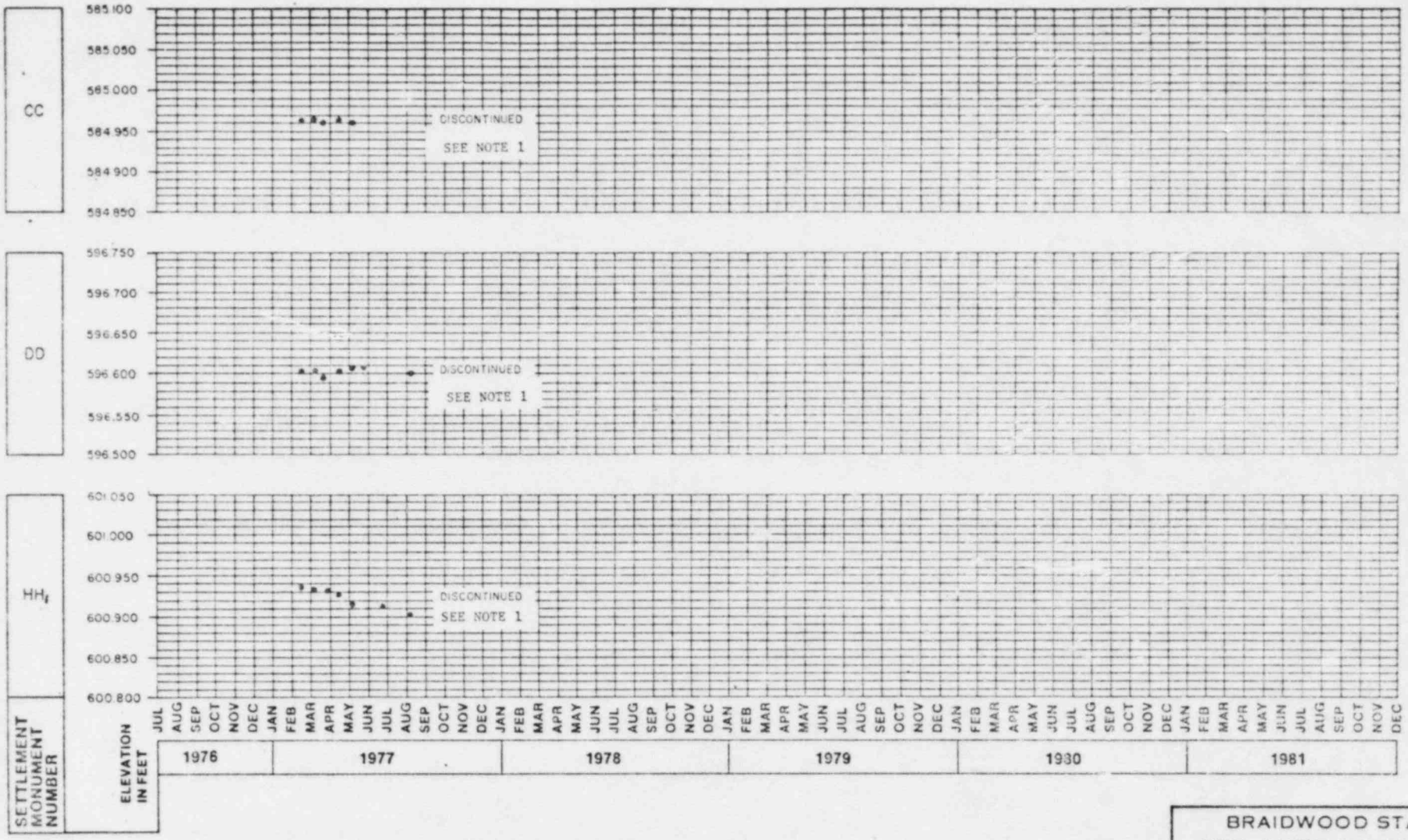

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FIGURE Q362.1-5

SETTLEMENT PLOTS FOR MONUMENTS CC, DD, HH_1

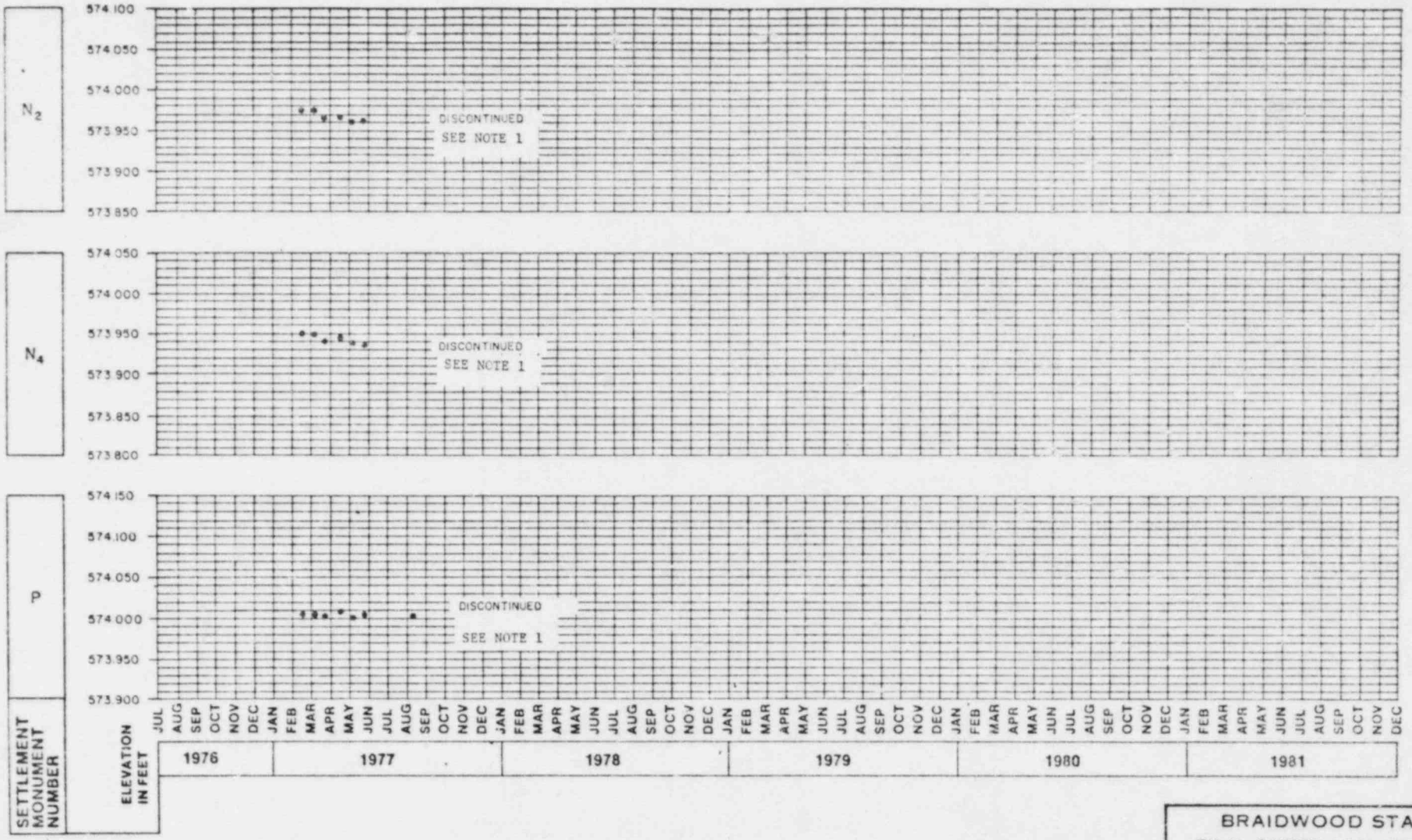

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FIGURE Q362.1-6

SETTLEMENT PLOTS FOR
MONUMENTS N2, N4, P

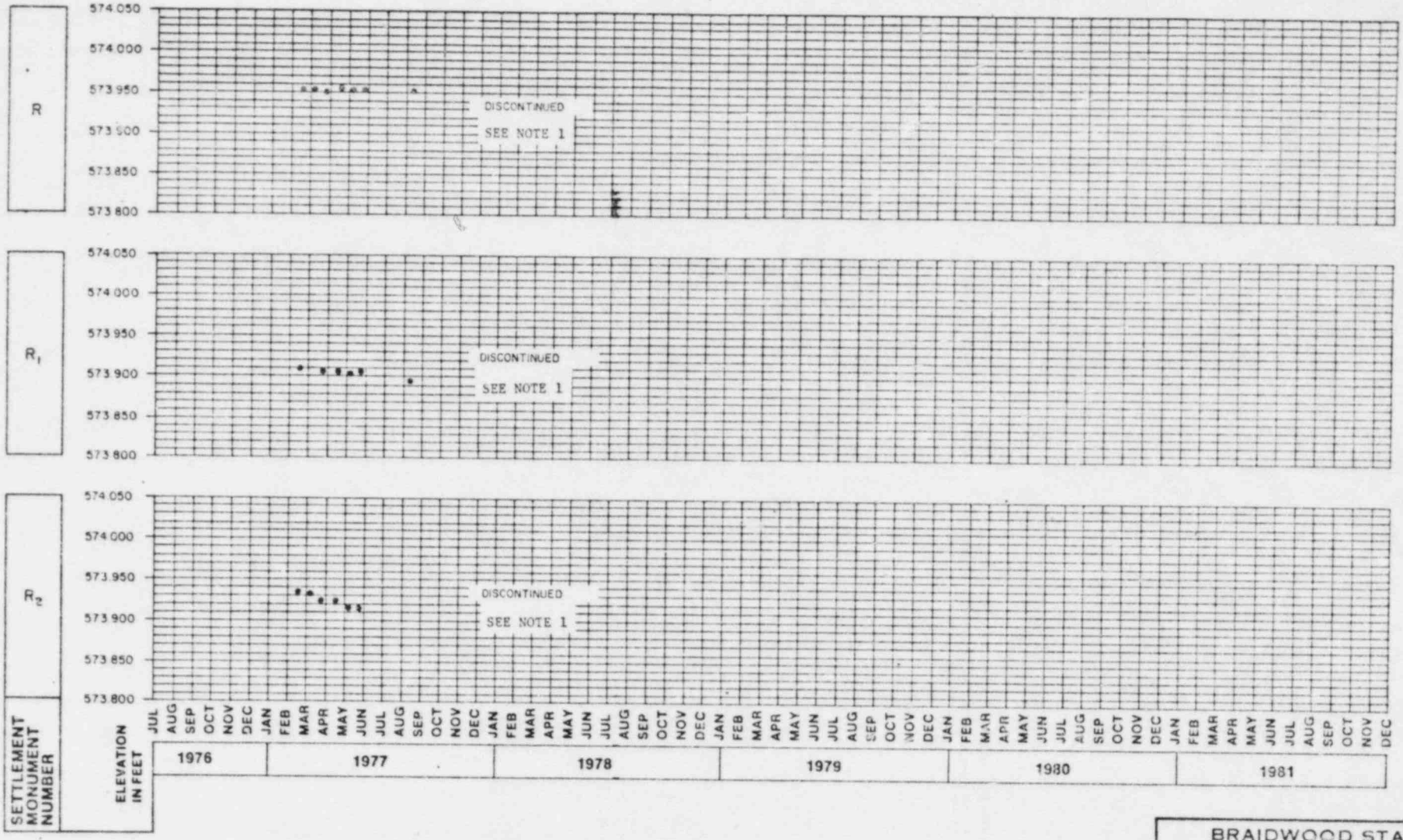

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FIGURE Q362.1-7

SETTLEMENT PLOTS FOR MONUMENTS R, R1, R2

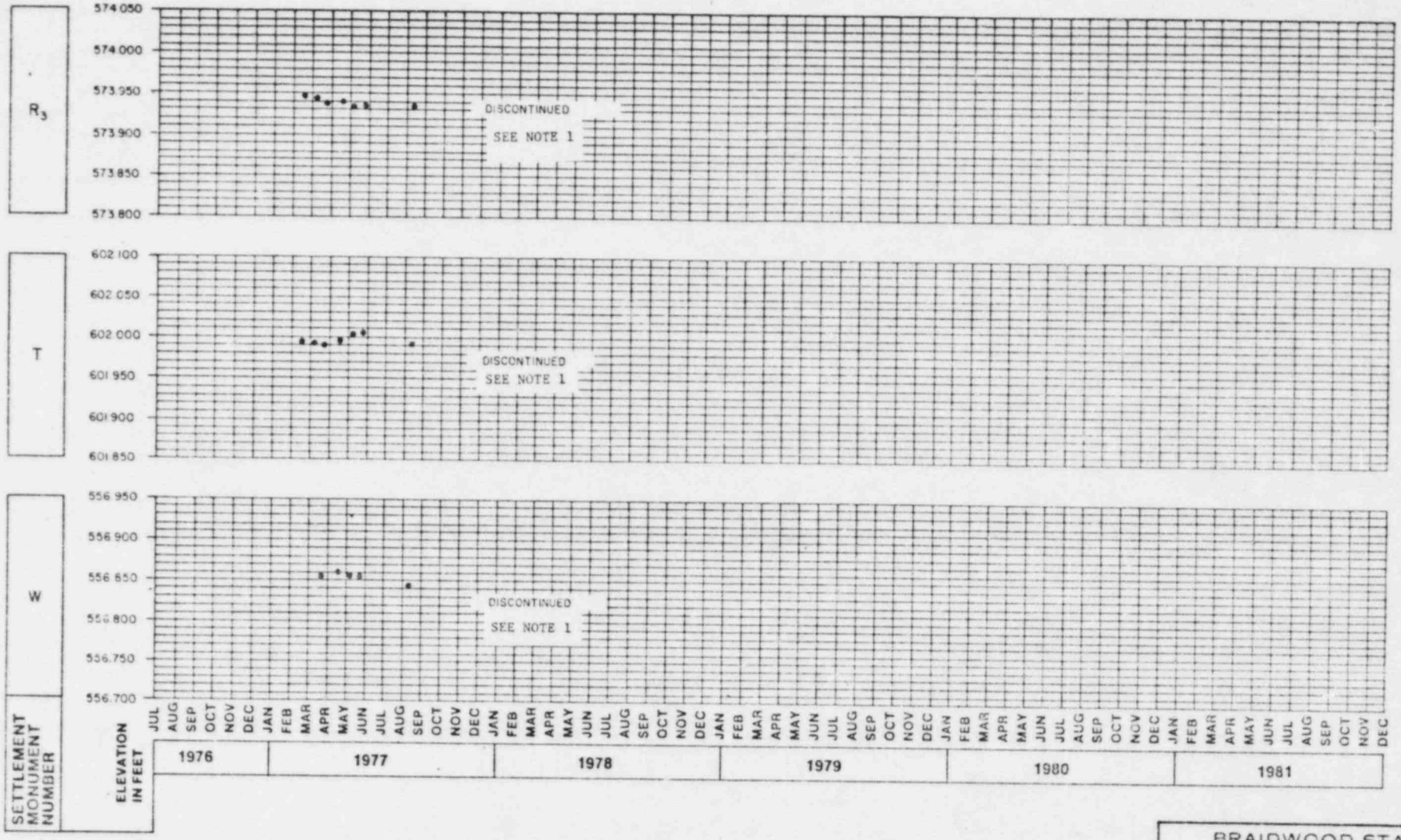

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FIGURE Q362.1-8

SETTLEMENT PLOTS FOR MONUMENTS R3, T, W

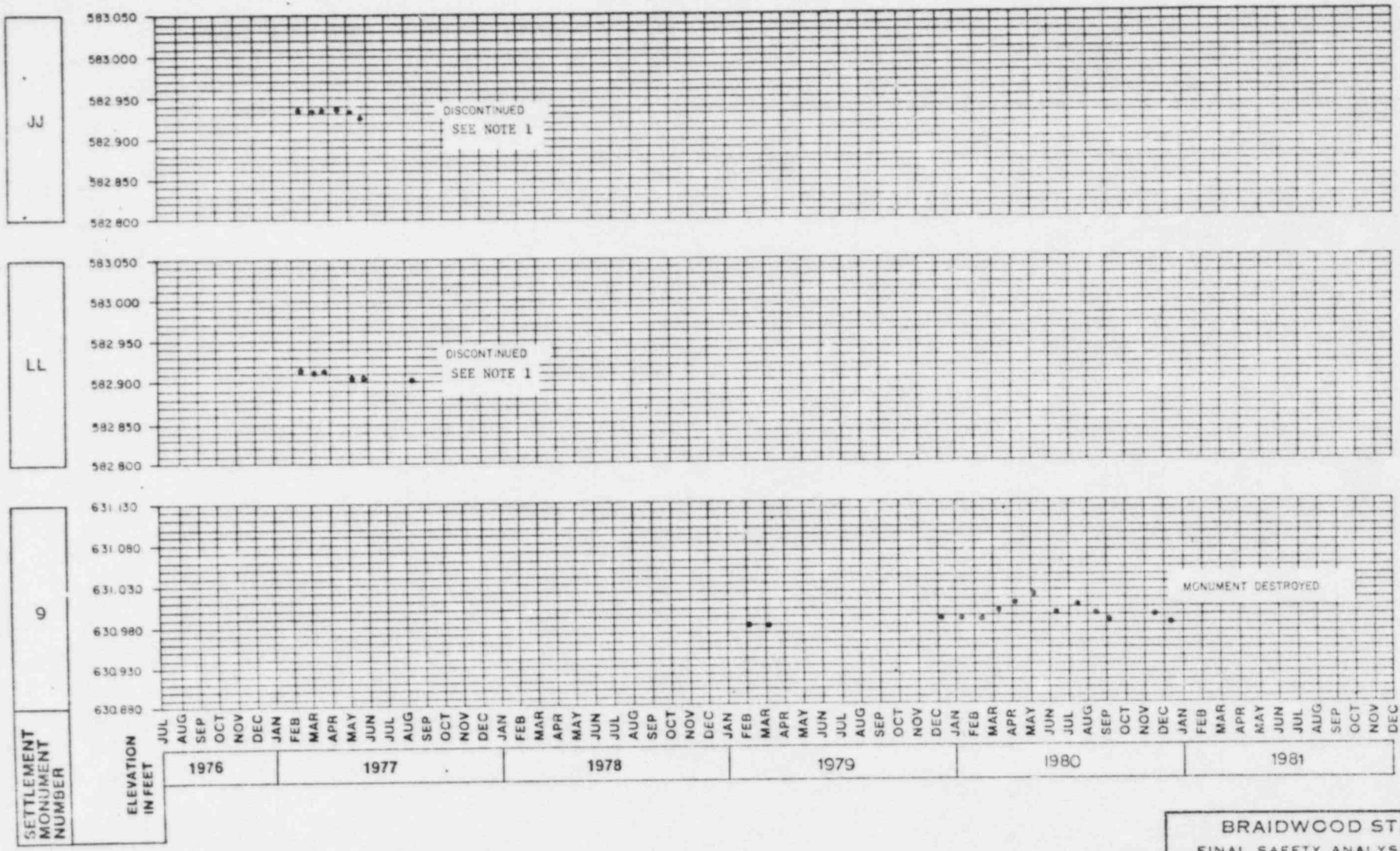

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FIGURE Q362.1-9

SETTLEMENT PLOTS FOR MONUMENTS JJ, LL, 9

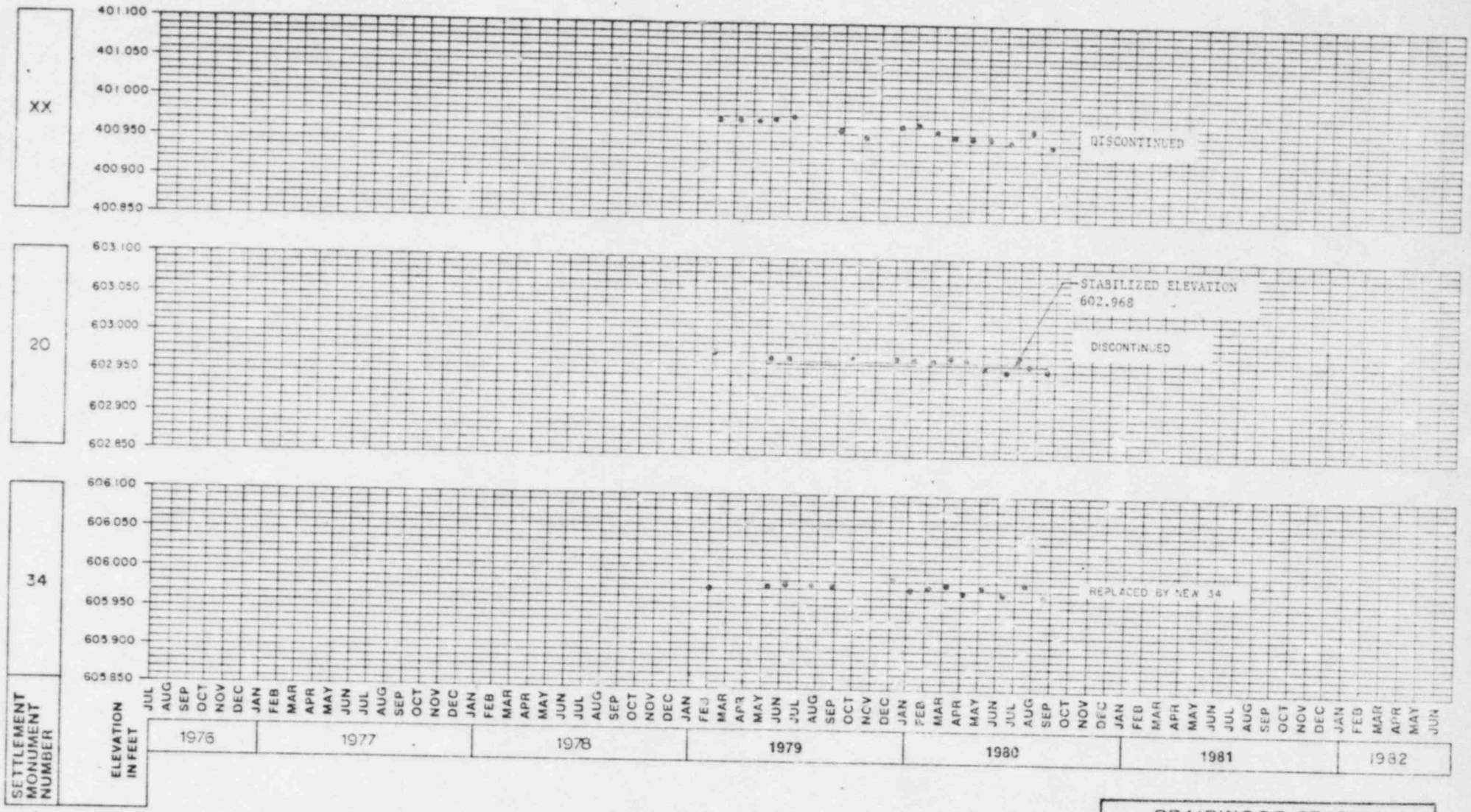

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FIGURE Q362.1-10

SETTLEMENT PLOTS FOR
MONUMENTS XX, 20, 34

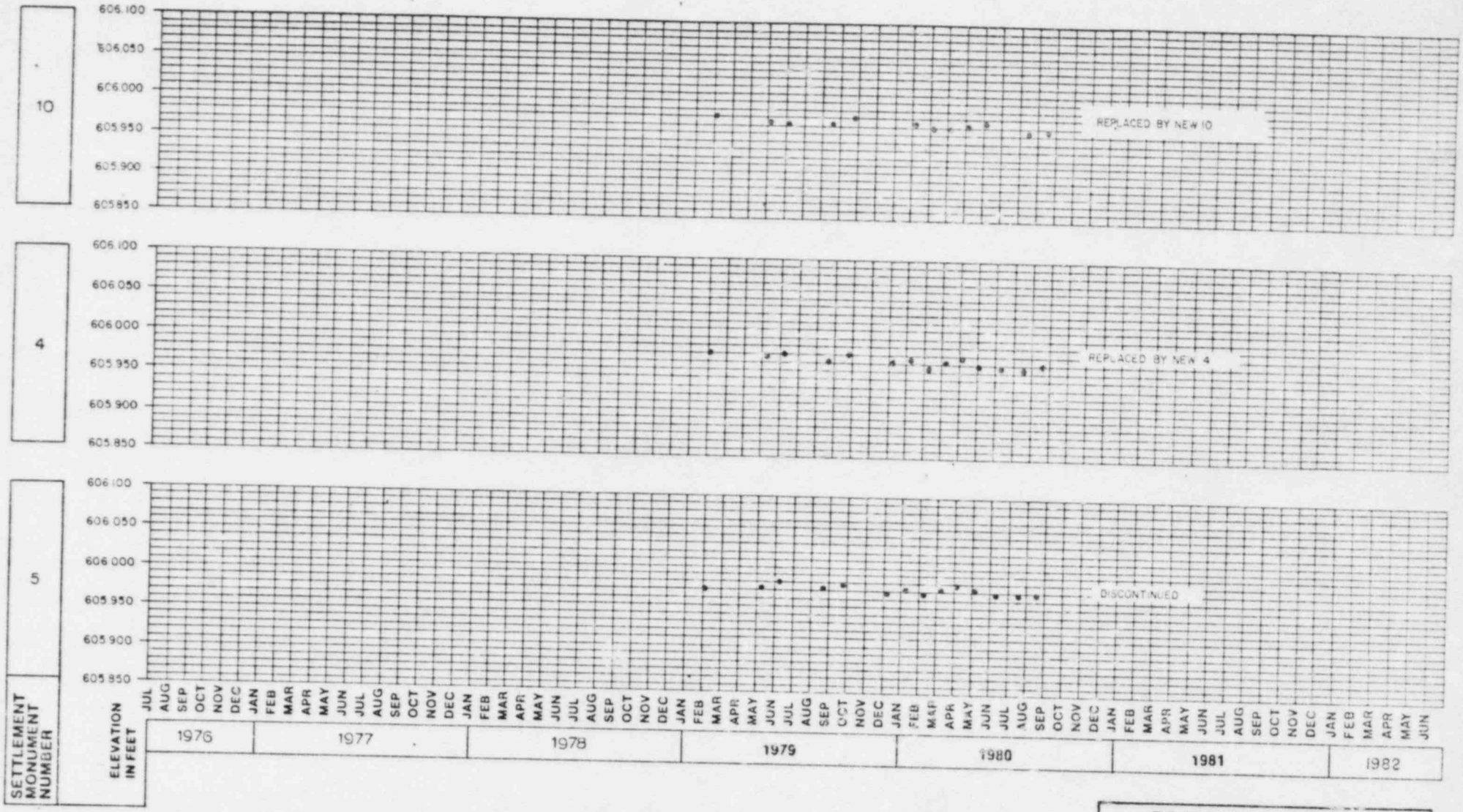

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FIGURE Q352.1-11

SETTLEMENT PLOTS FOR MONUMENTS 10, 4, 5

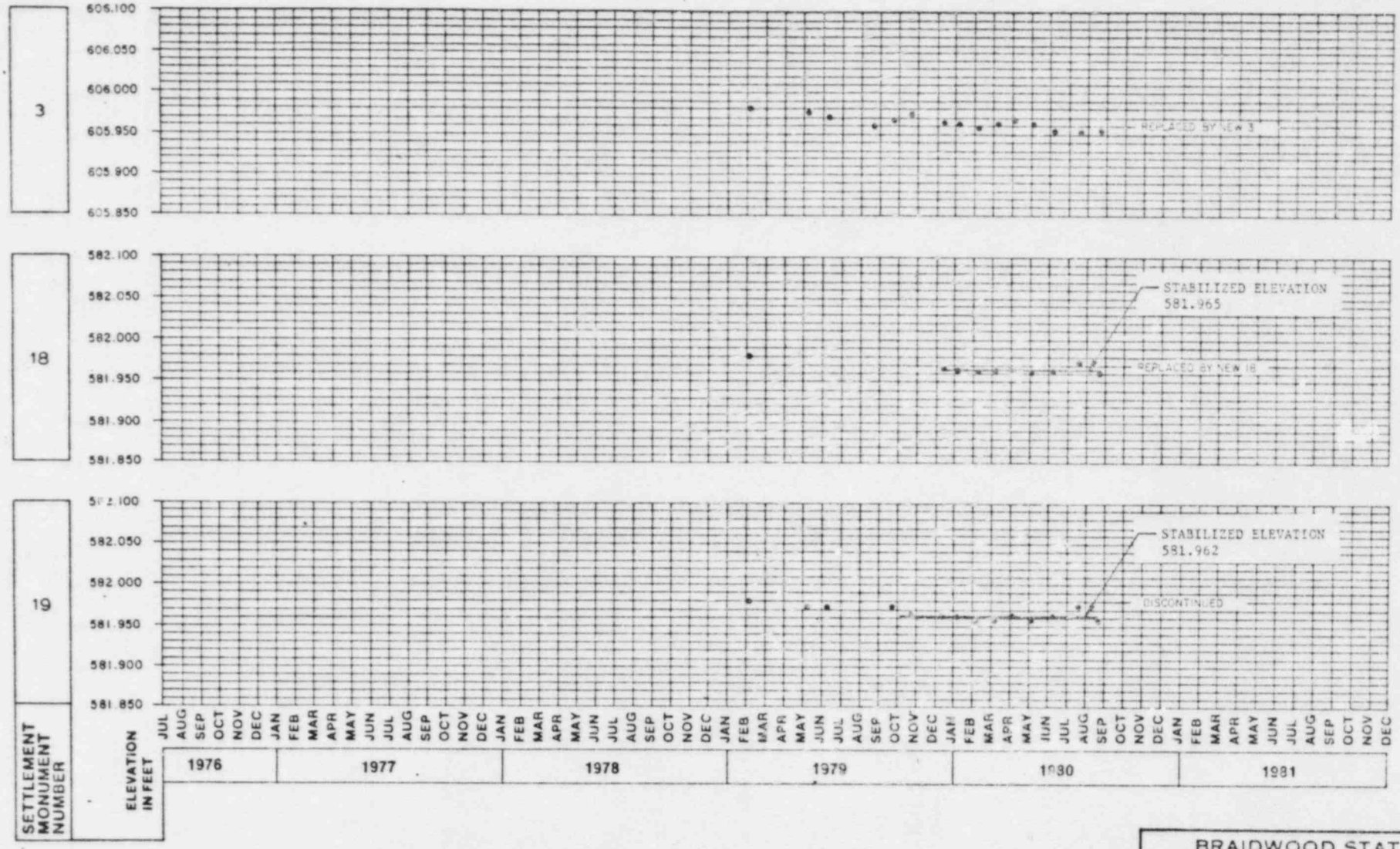

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FIGURE Q362.1-12

SETTLEMENT PLOTS FOR MONUMENTS 3, 18, 19

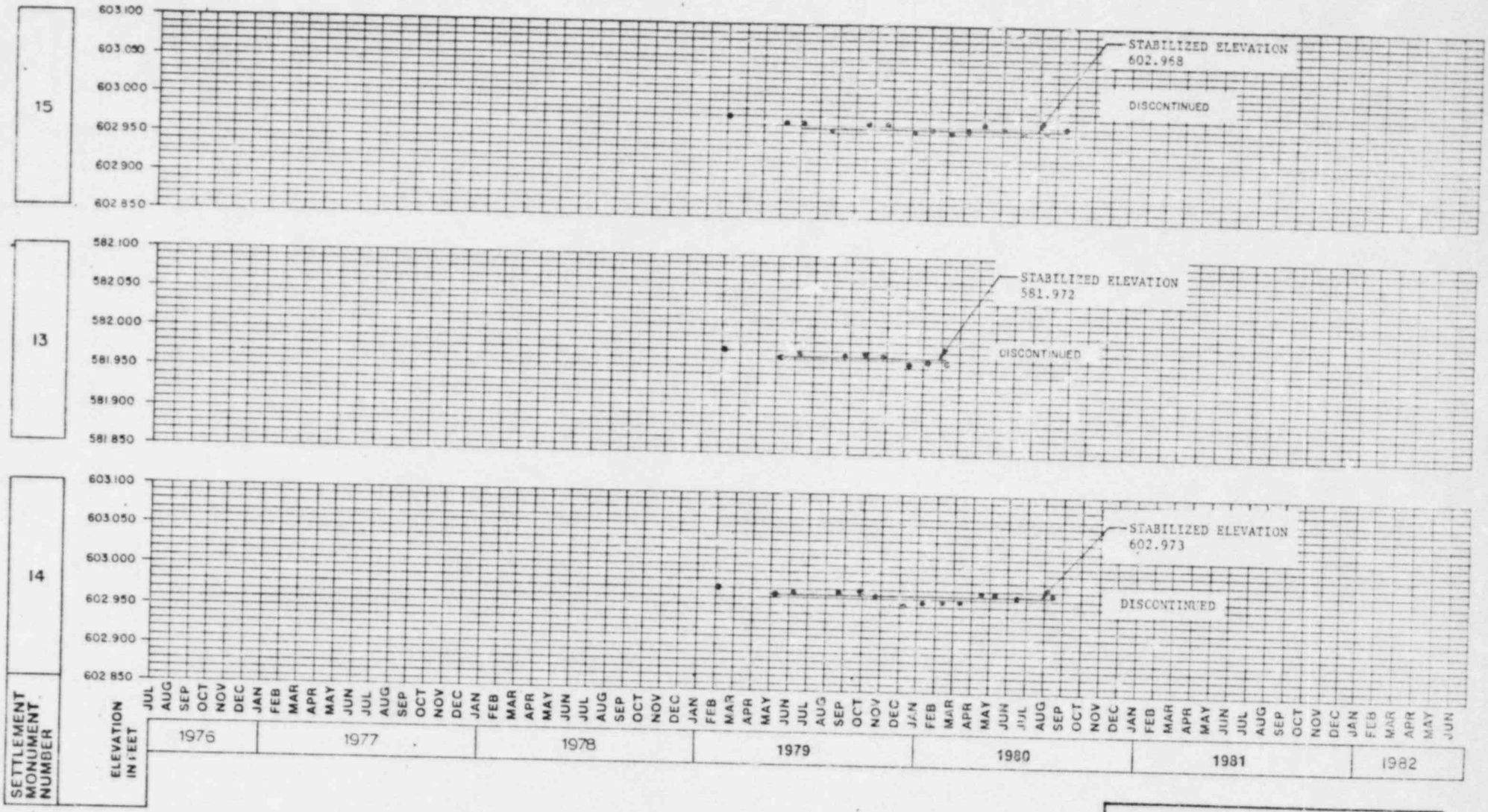

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FIGURE Q362.1-13

SETTLEMENT PLOTS FOR MONUMENTS 15, 13, 14

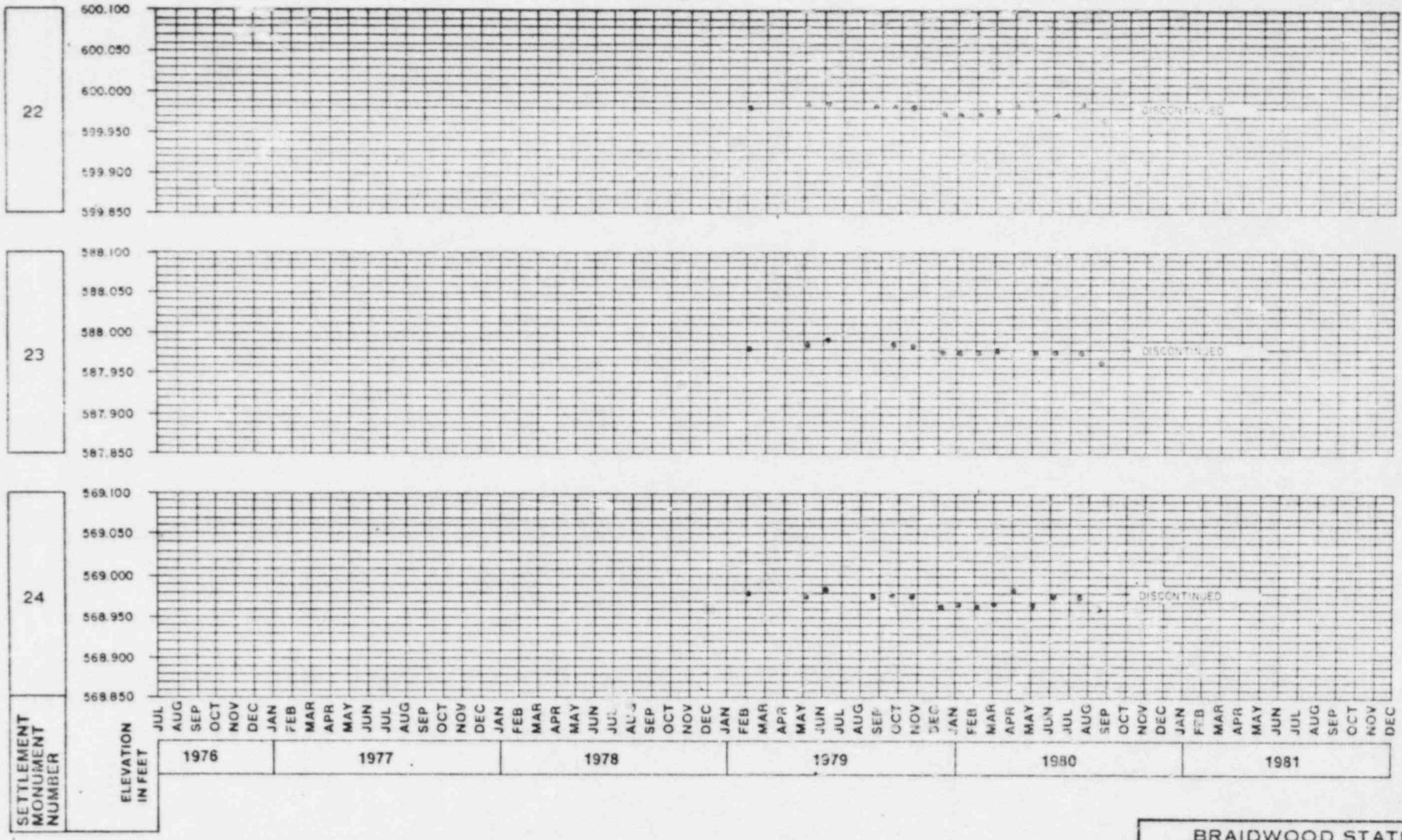

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FIGURE Q362.1-14

SETTLEMENT PLOTS FOR MONUMENTS 22, 23, 24

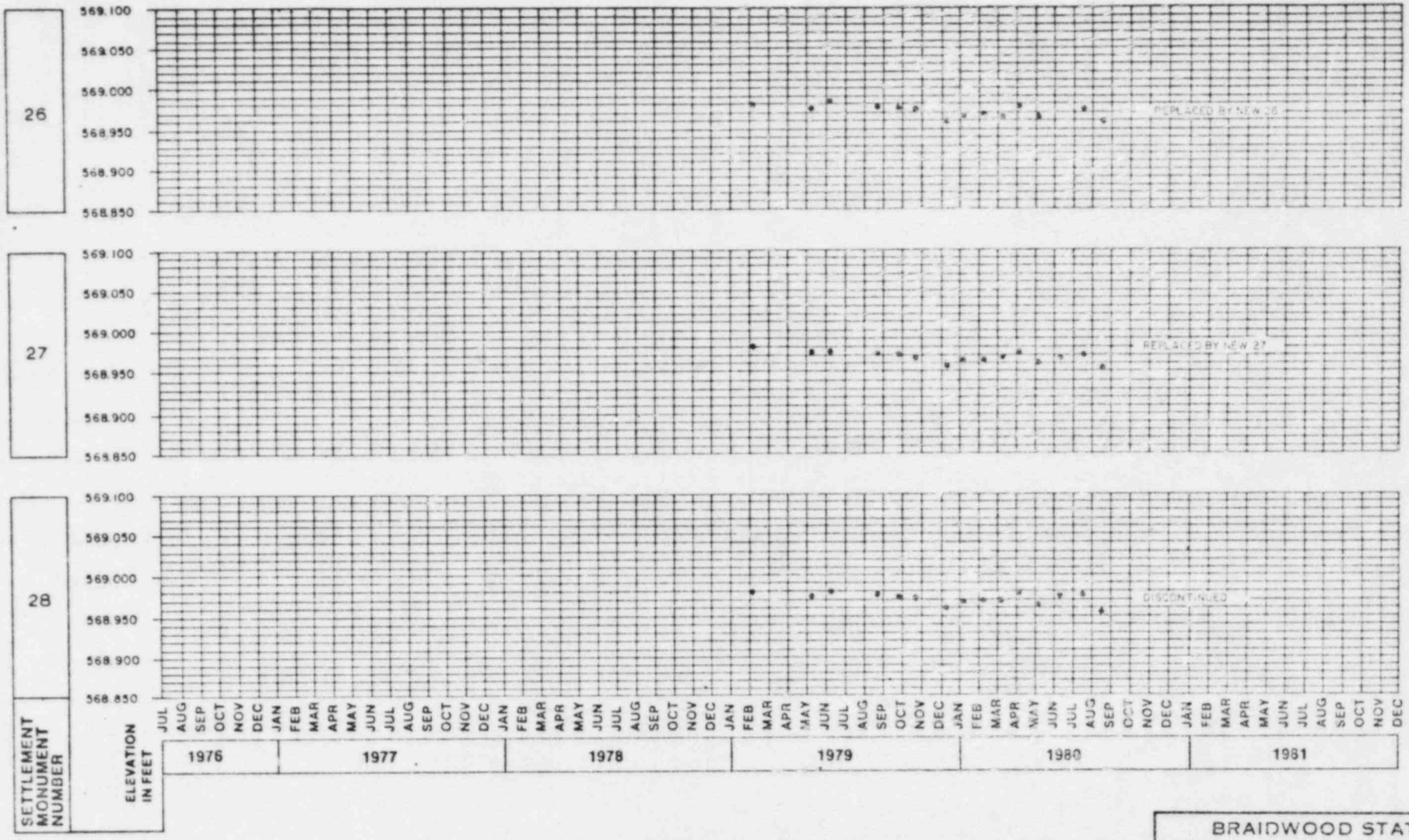

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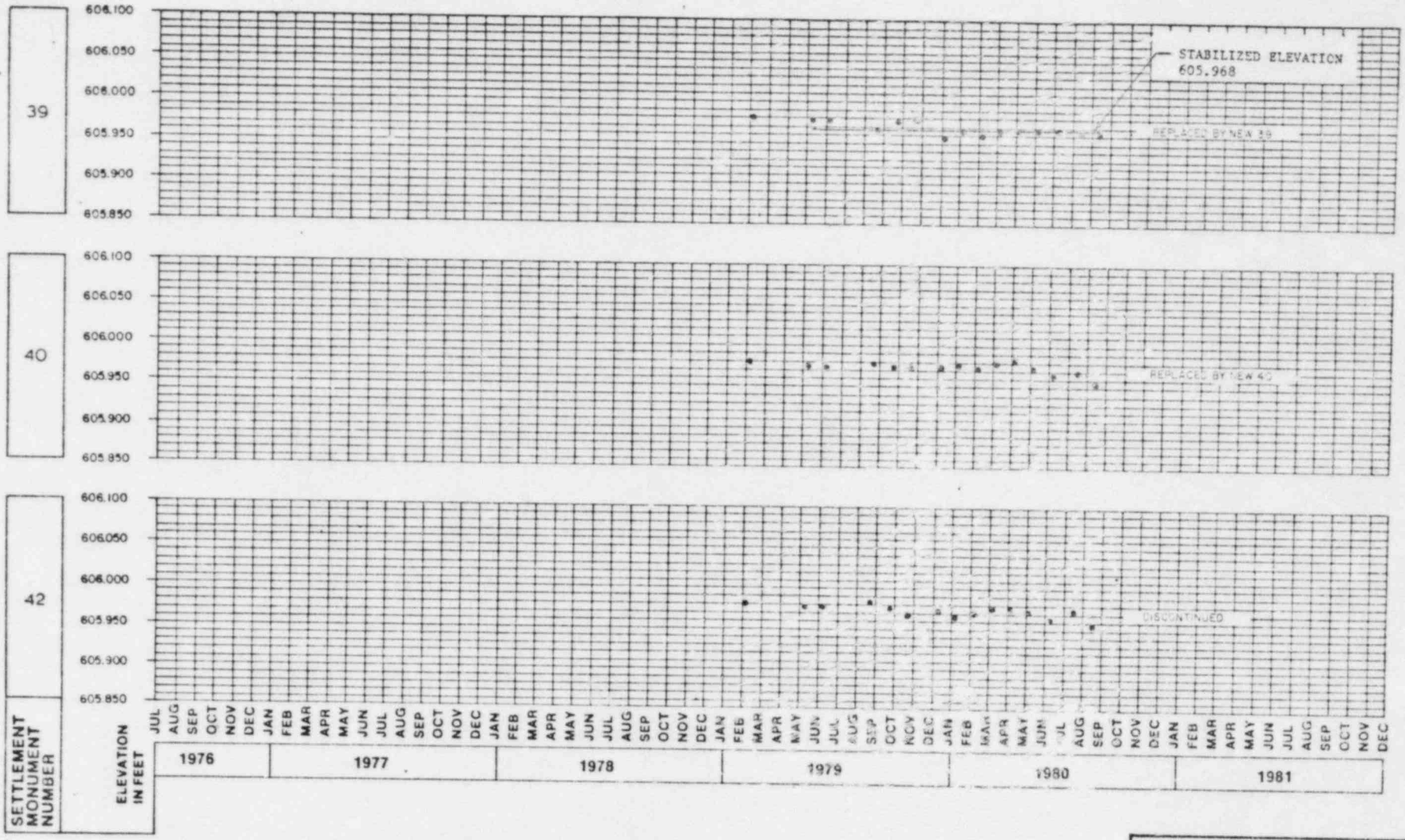
FIGURE Q362.1-15

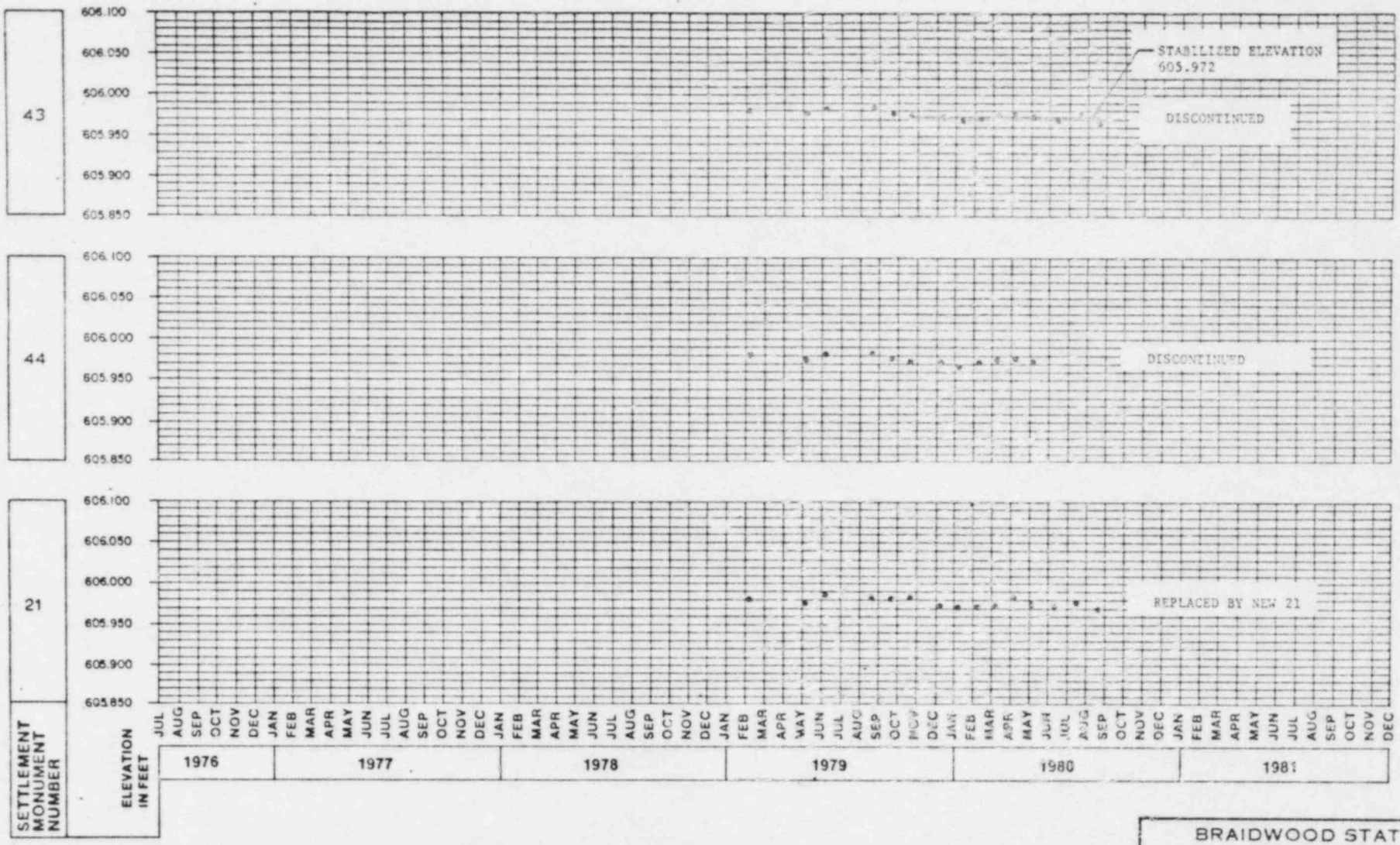
SETTLEMENT PLOTS FOR MONUMENTS 26, 27, 28



BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-16

SETTLEMENT PLOTS FOR MONUMENTS 39, 40, 42



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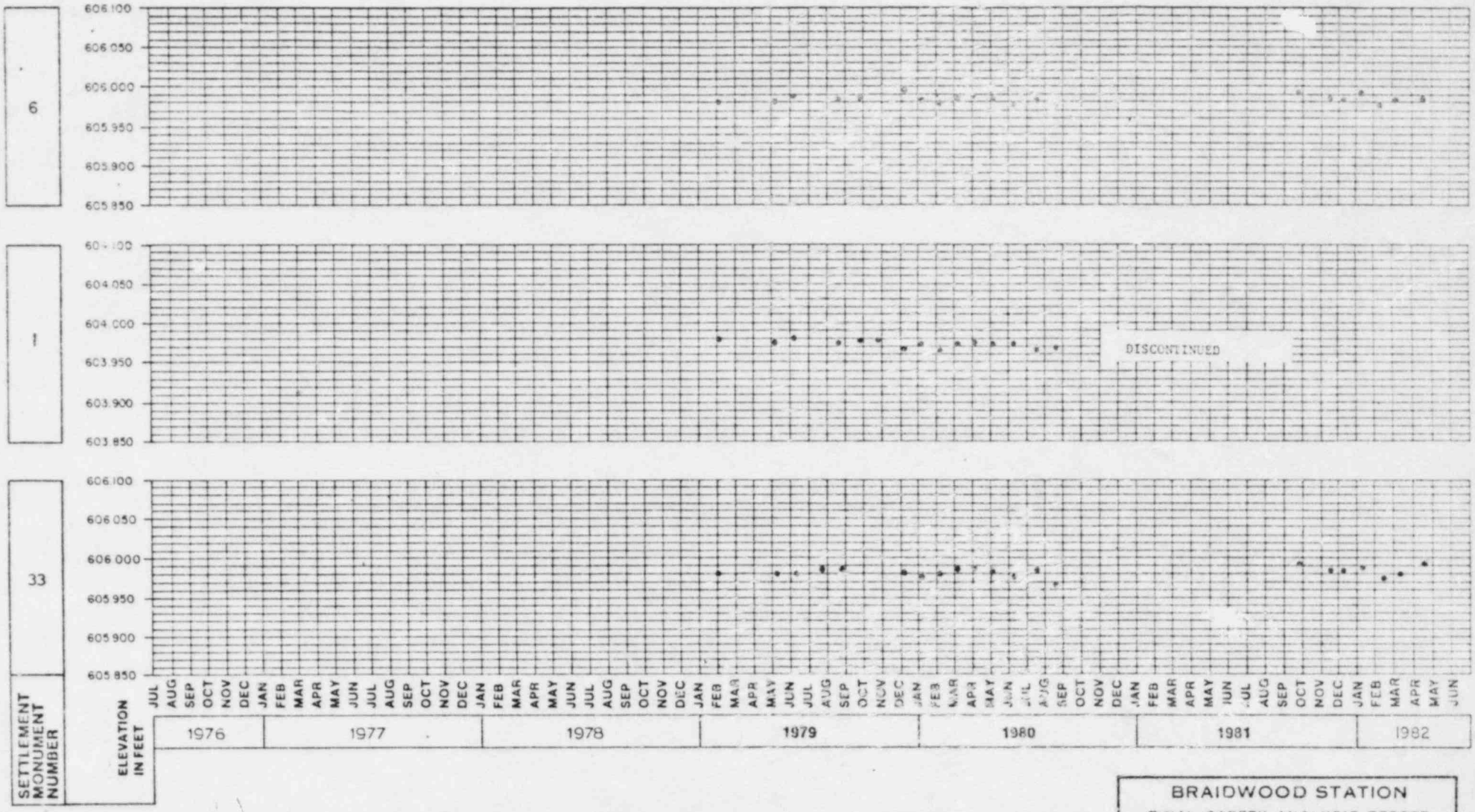
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-17

SETTLEMENT PLOTS FOR MONUMENTS 43, 44, 21

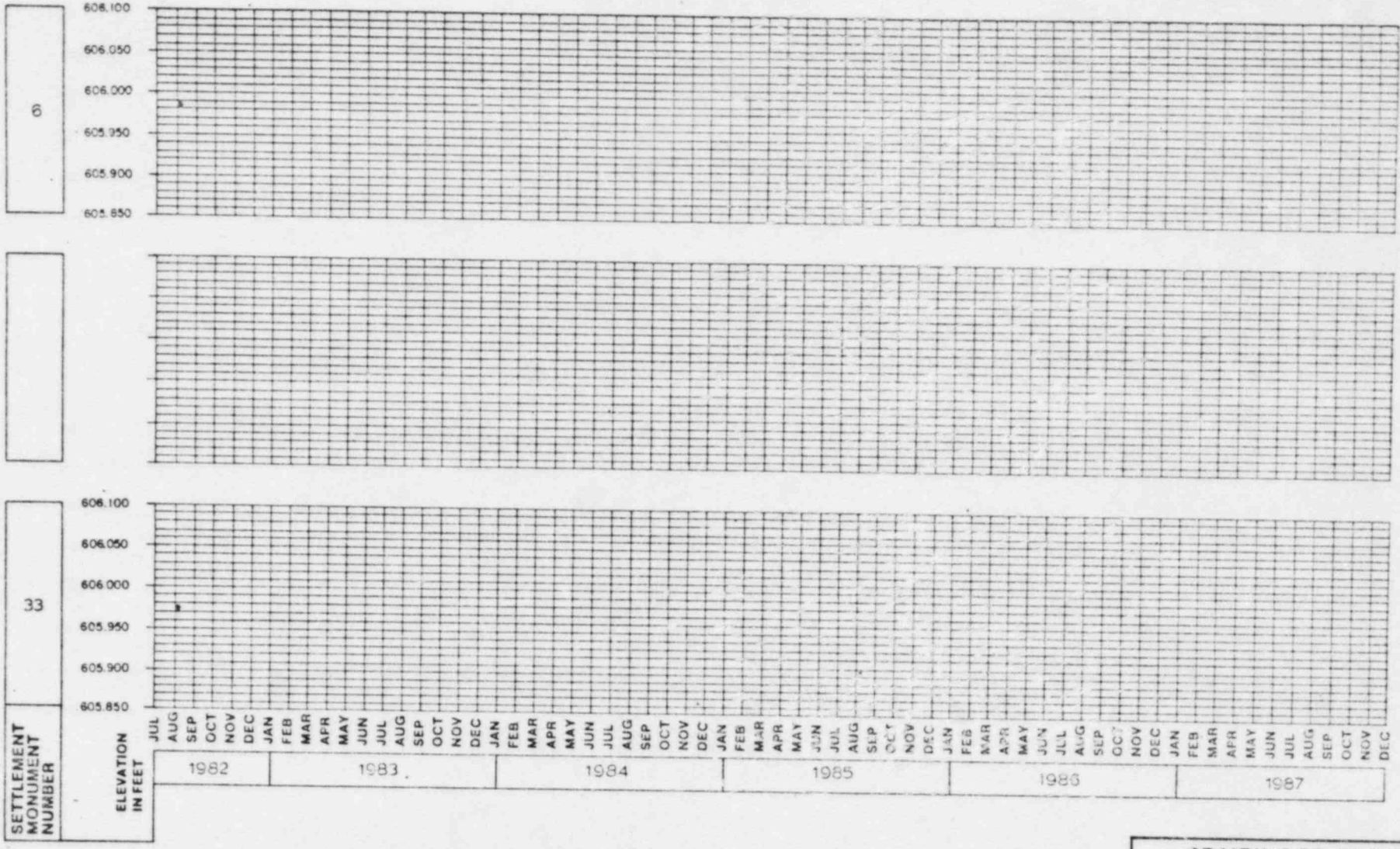


BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-18

SETTLEMENT PLOTS FOR MONUMENTS 6, 1, 33

(SHEET 1 OF 2)

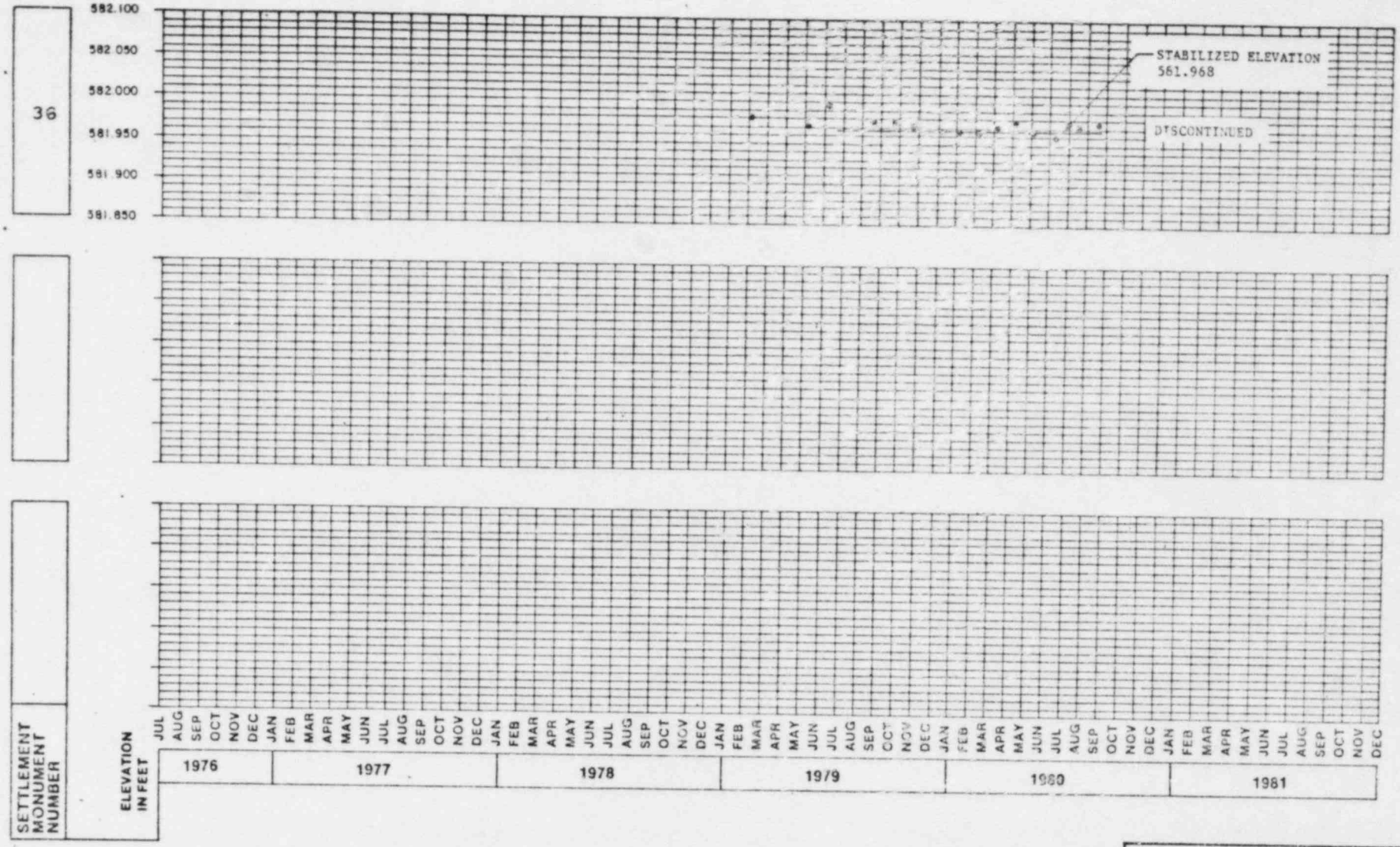


BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-18

SETTLEMENT PLOTS FOR MONUMENTS 6, 1, 33

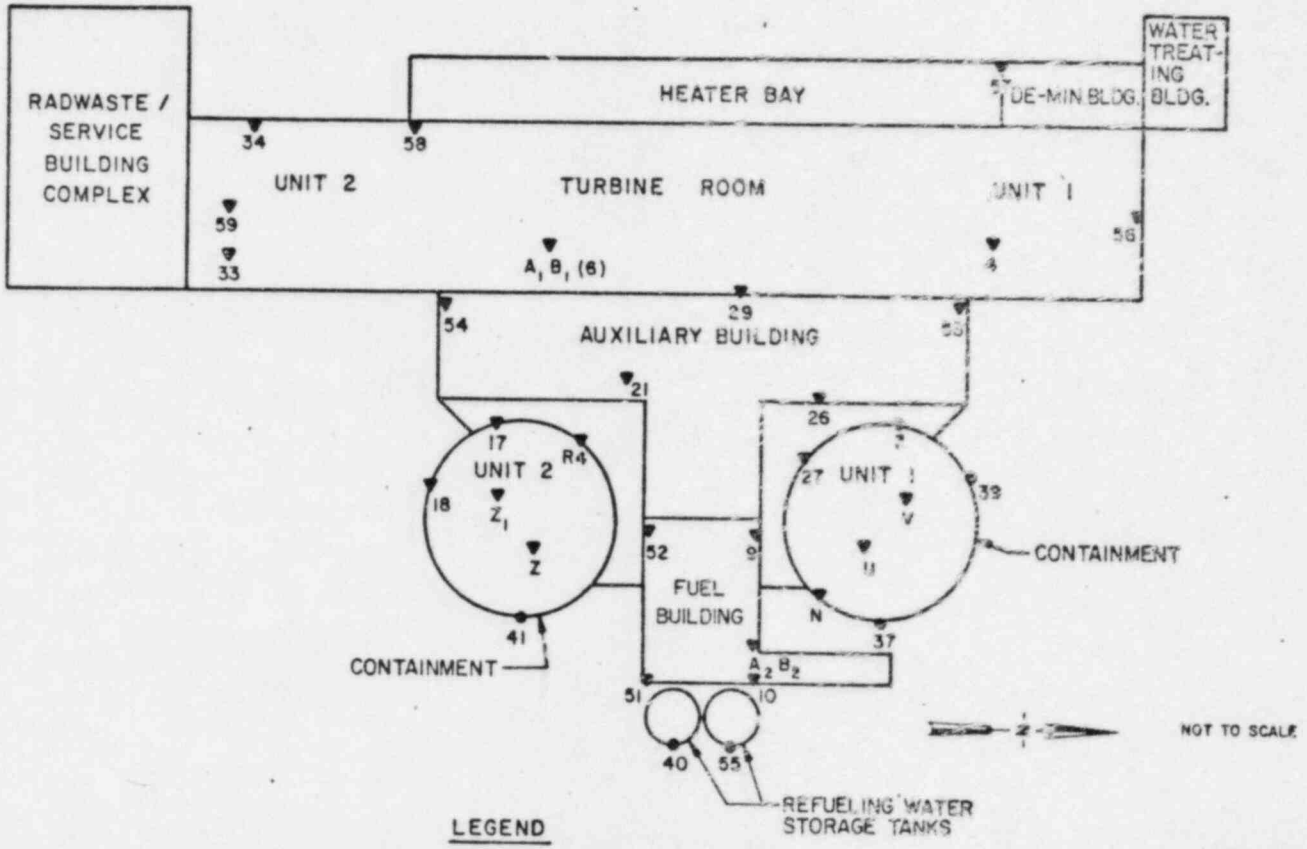
(SHEET 2 OF 2)



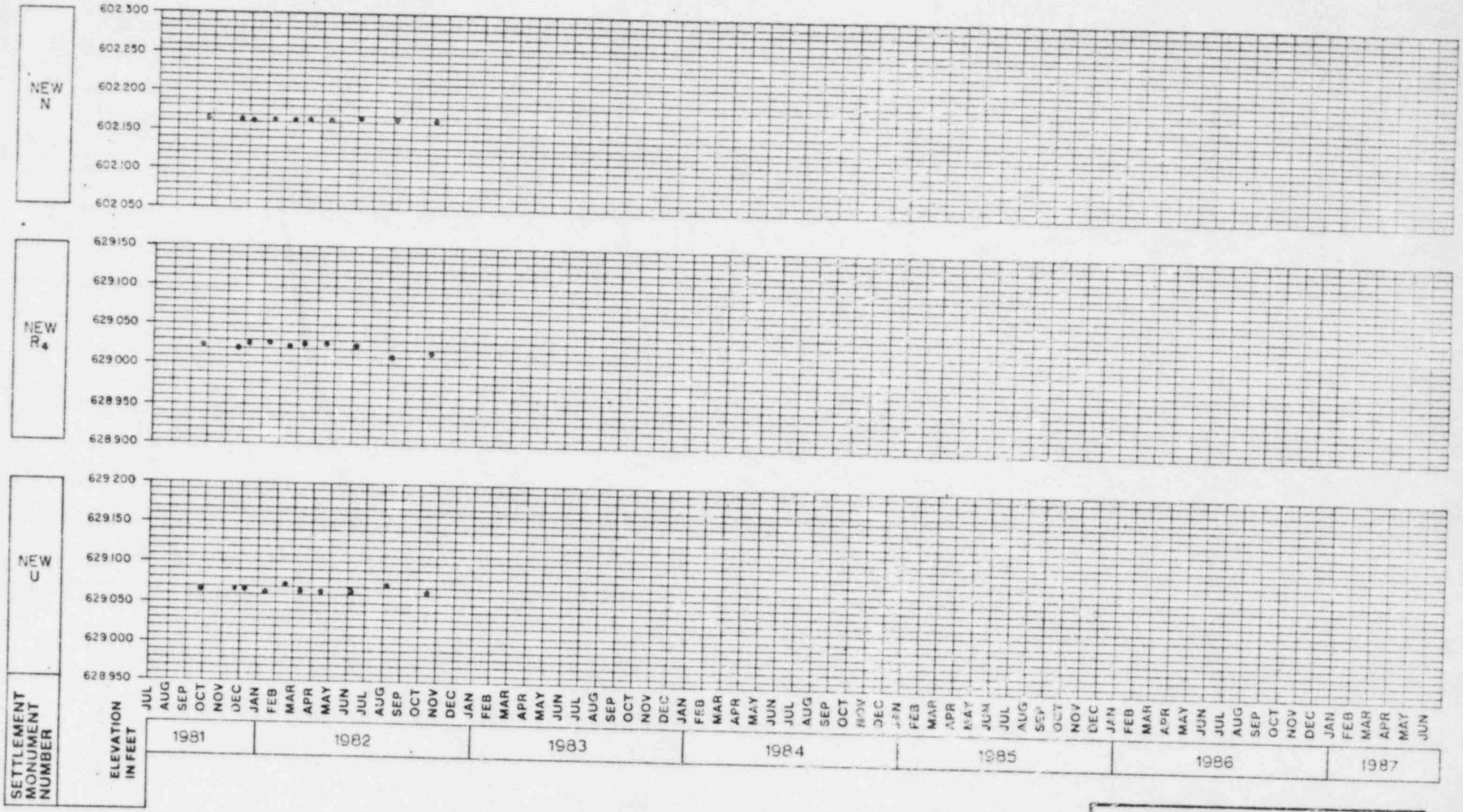
BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-19

SETTLEMENT PLOT FOR MONUMENT 36



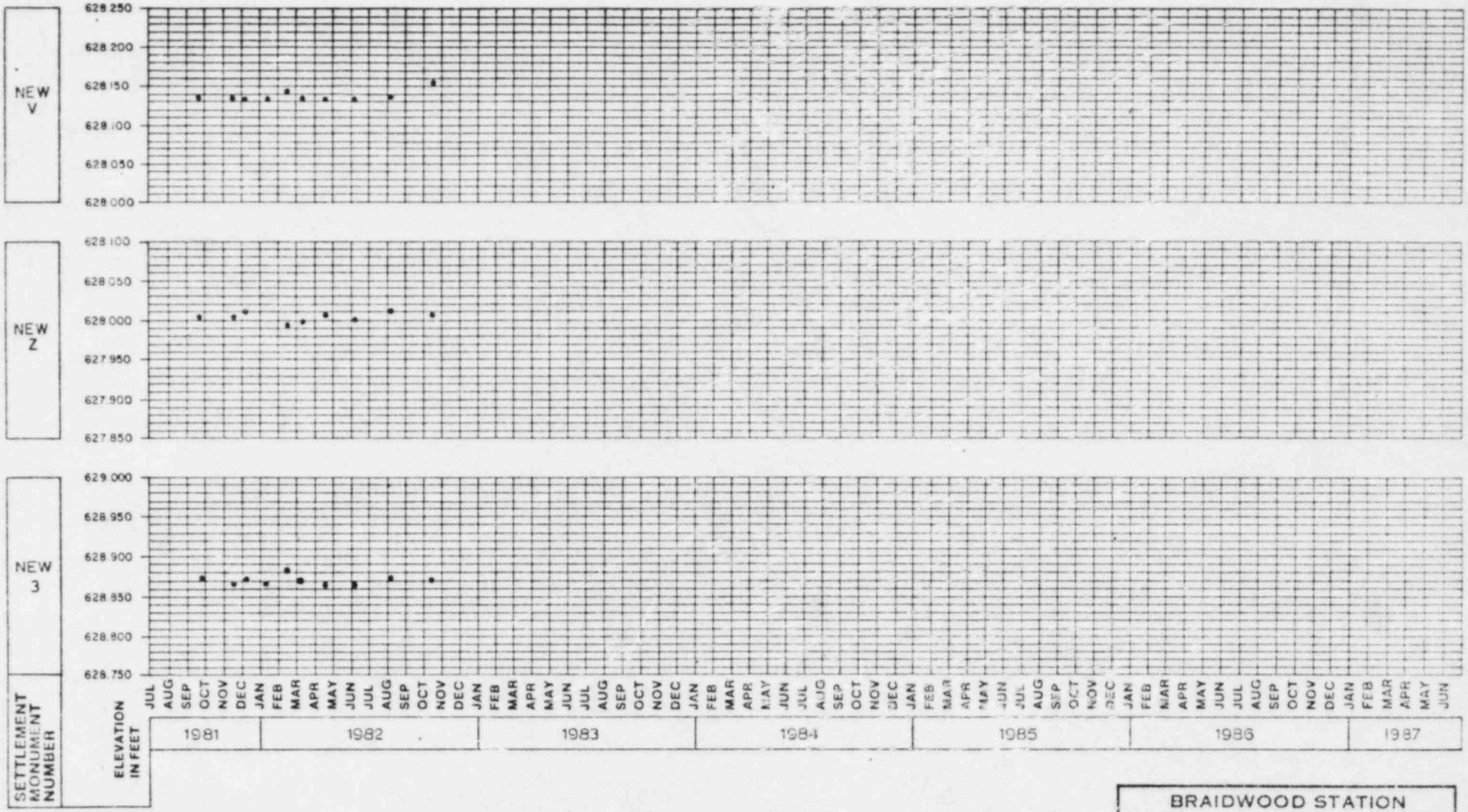
BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT
FIGURE Q362.1-20
LOCATIONS OF OPERATIONAL SETTLEMENT MONUMENTS



BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-21

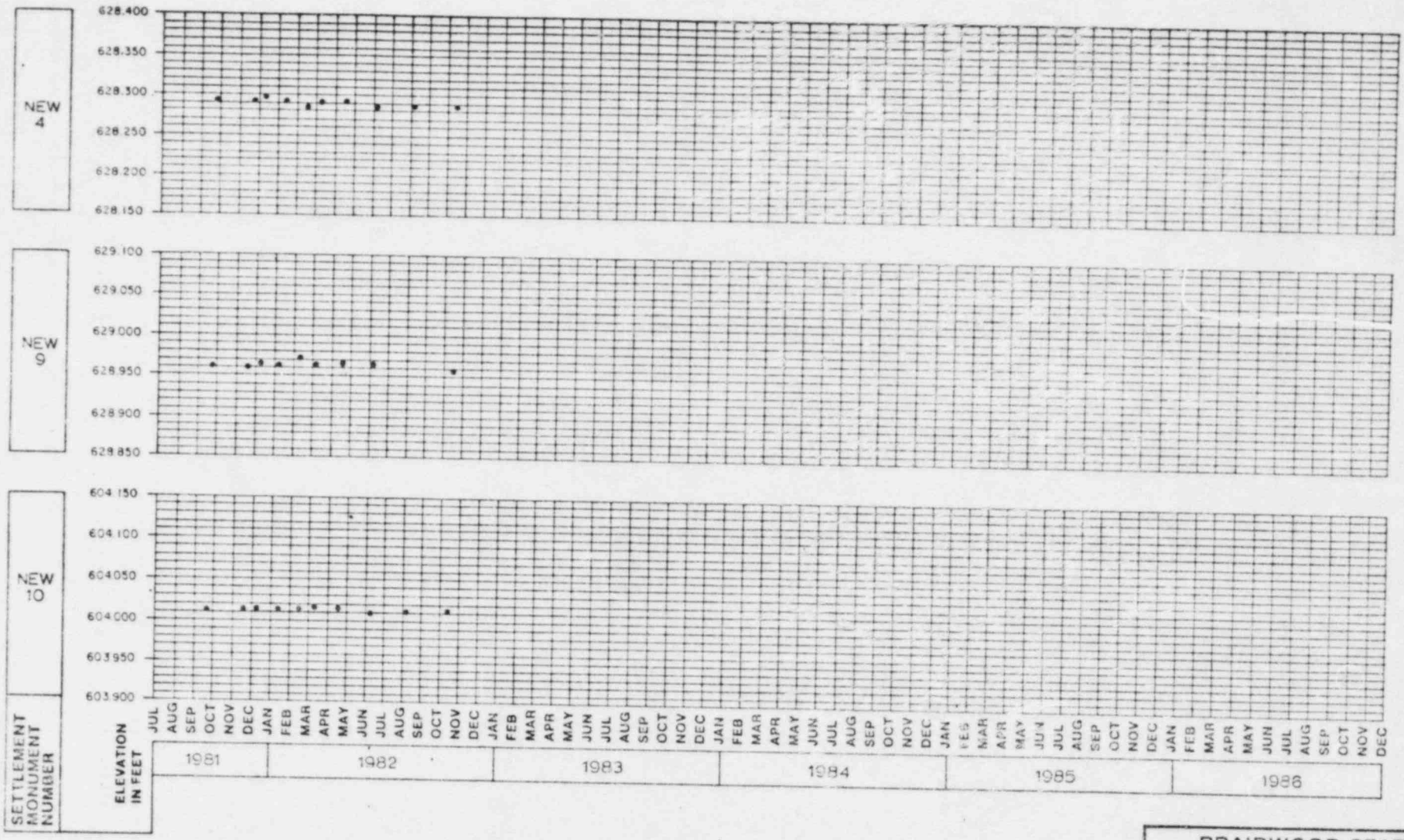
SETTLEMENT PLOTS FOR
NEW MONUMENTS N, R4, U



BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-22

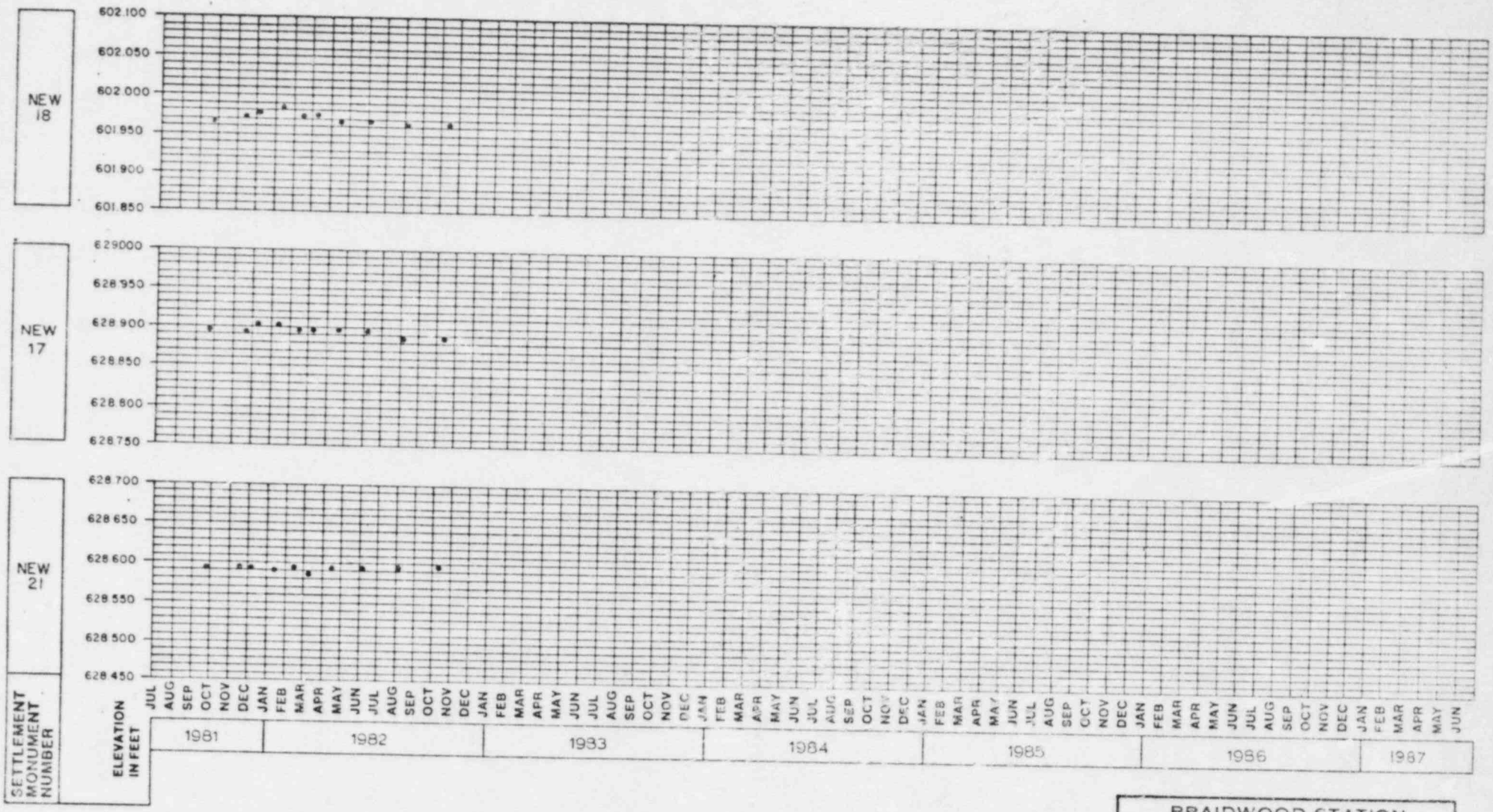
SETTLEMENT PLOTS FOR
NEW MONUMENTS V, Z, 3



BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-23

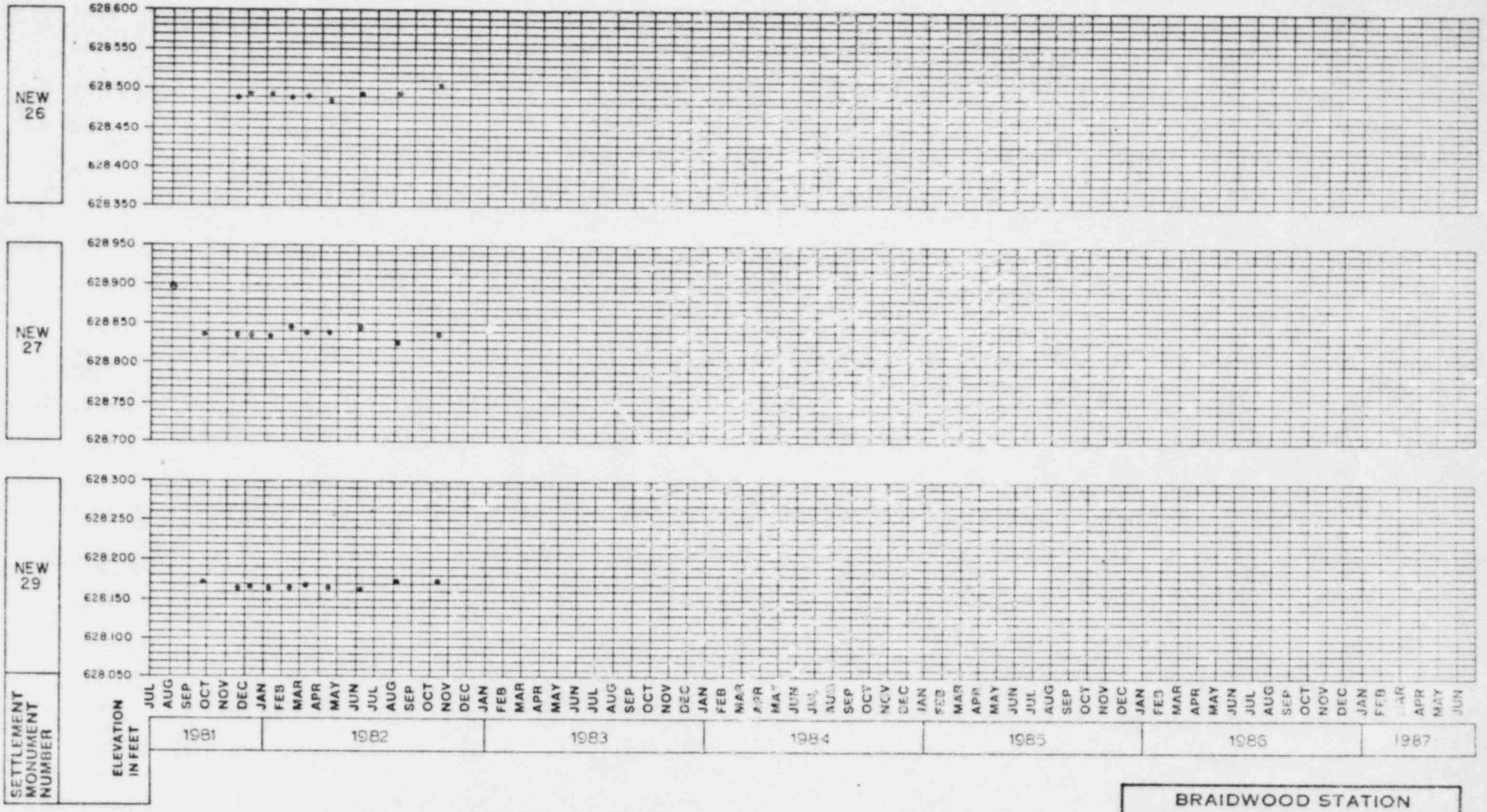
SETTLEMENT PLOTS FOR
NEW MONUMENTS 4, 9, 10



BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-24

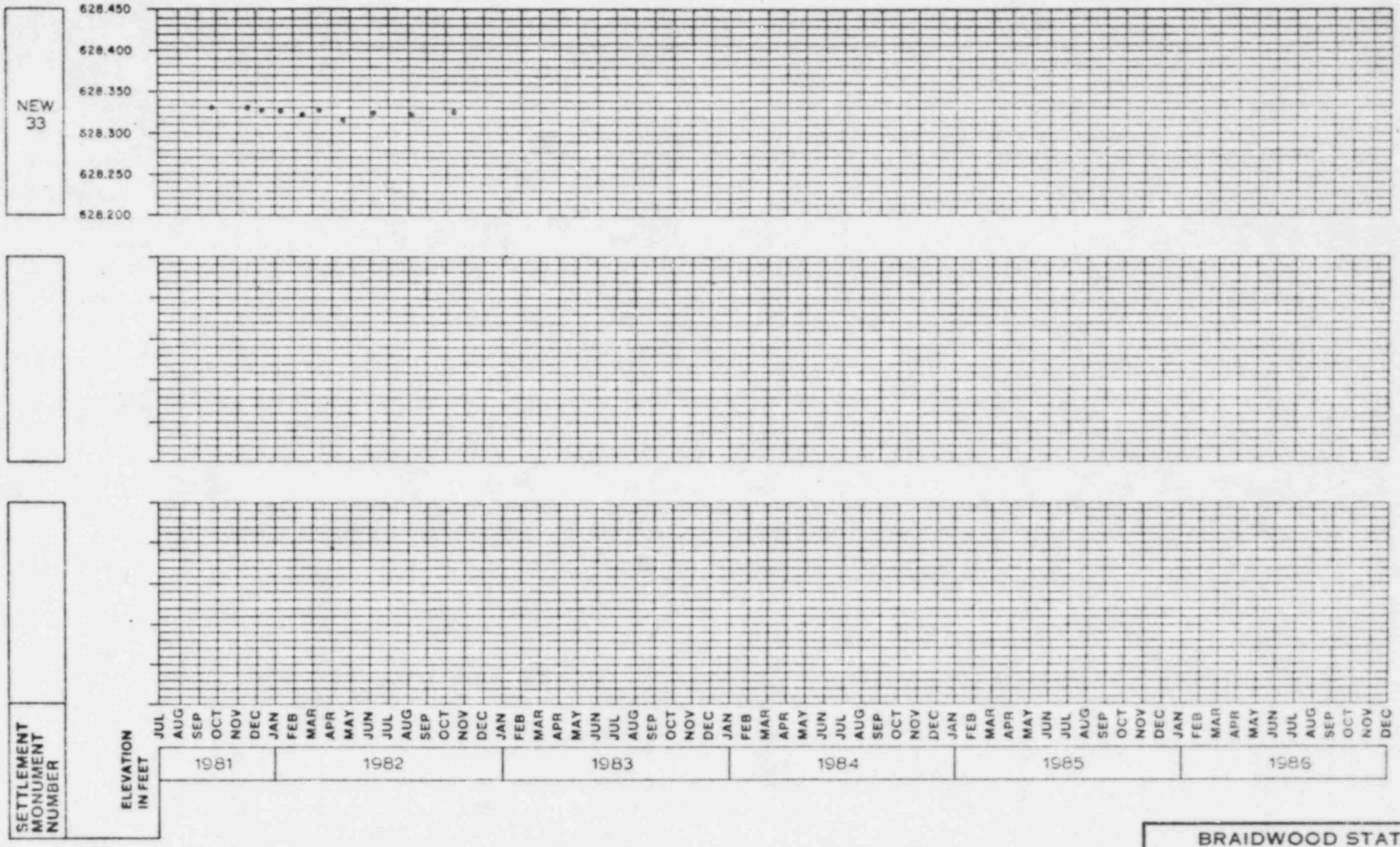
SETTLEMENT PLOTS FOR
NEW MONUMENTS 18, 17, 21



BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-25

SETTLEMENT PLOTS FOR
NEW MONUMENTS 26, 27, 29

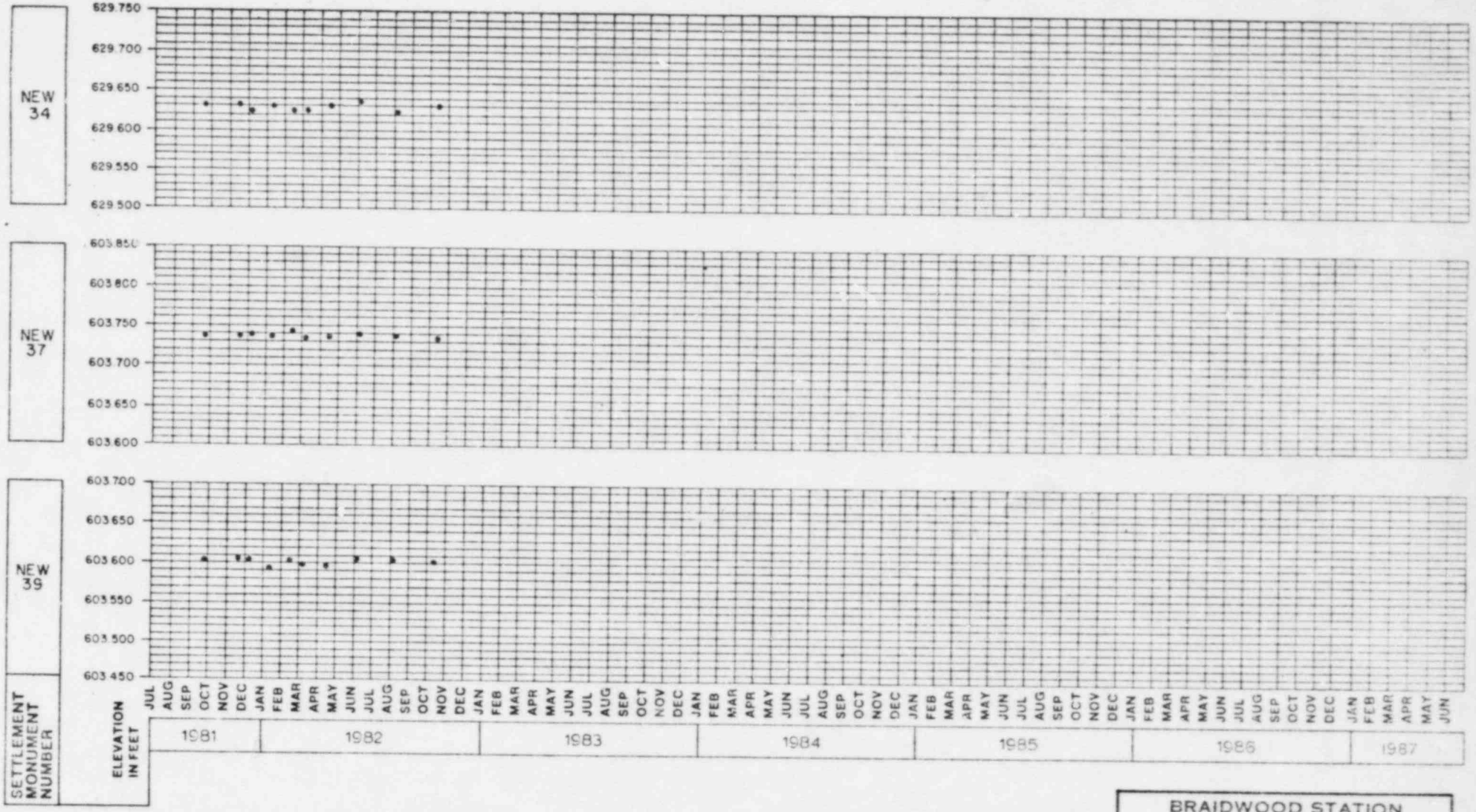


BRAIDWOOD STATION

FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-26

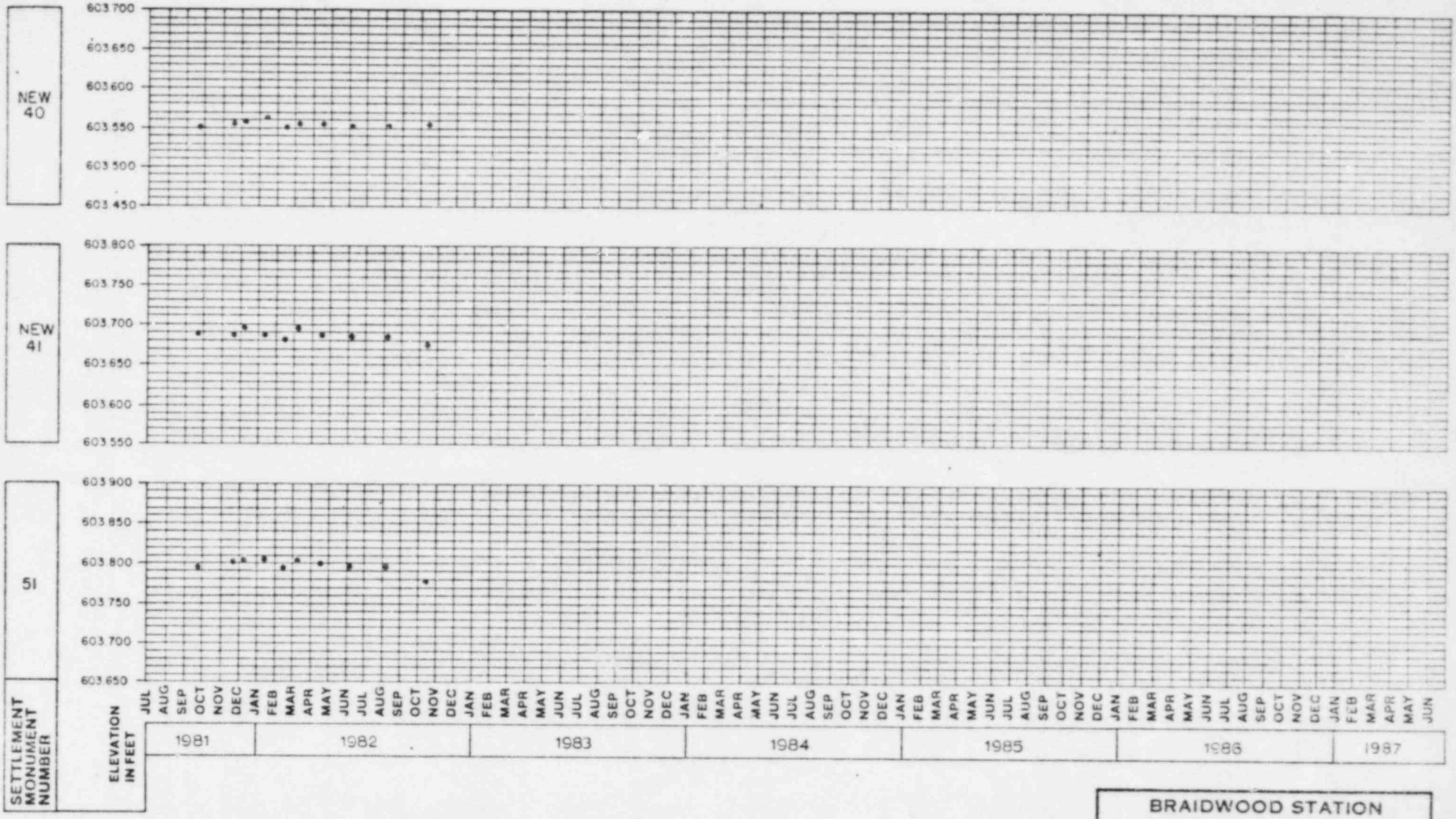
SETTLEMENT PLOT FOR
NEW MONUMENT 33



BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-27

SETTLEMENT PLOTS FOR
NEW MONUMENTS 34, 37, 39

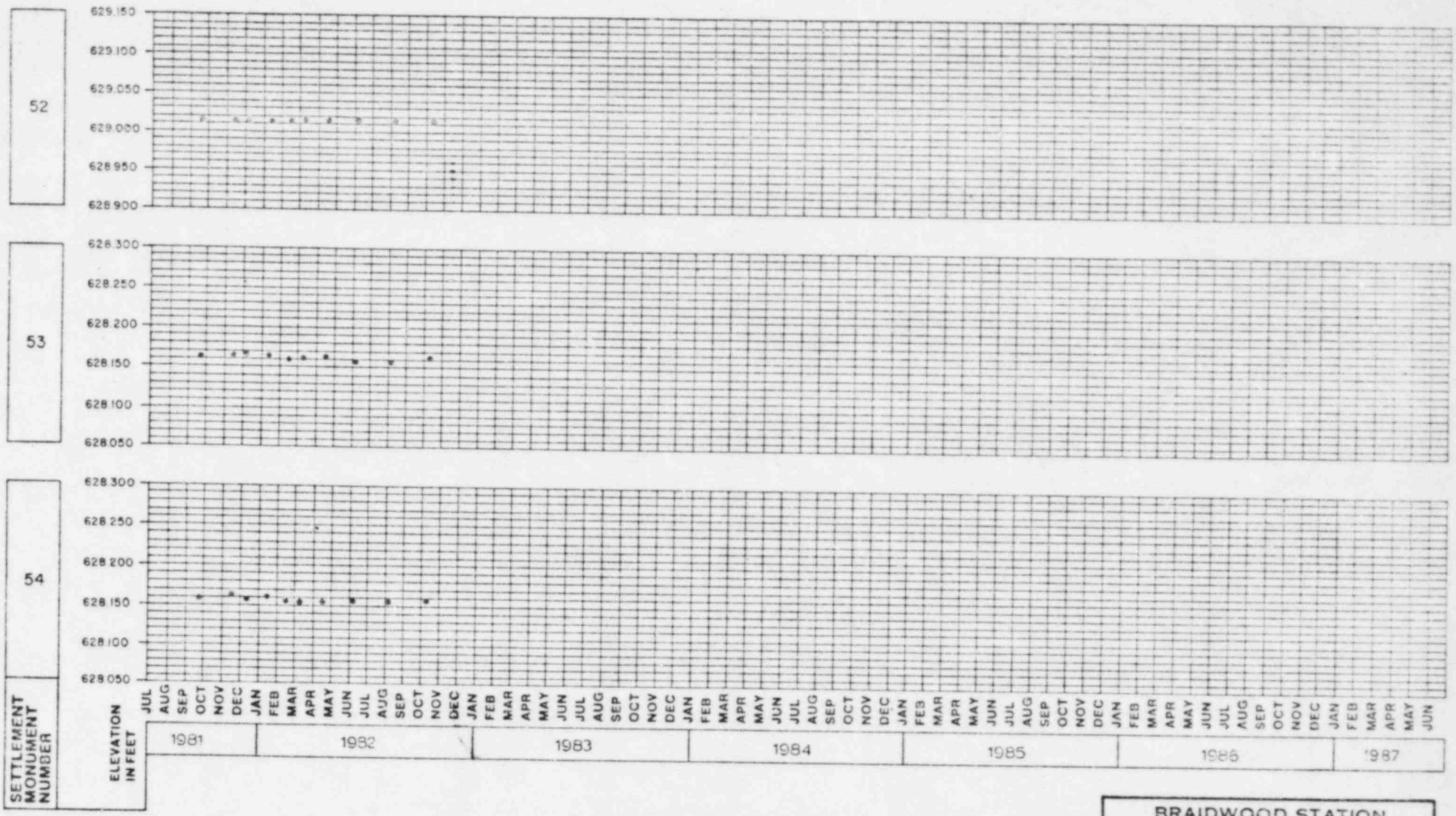


BRAIDWOOD STATION

FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-28

SETTLEMENT PLOTS FOR
MONUMENT 51 AND
NEW MONUMENTS 40, 41

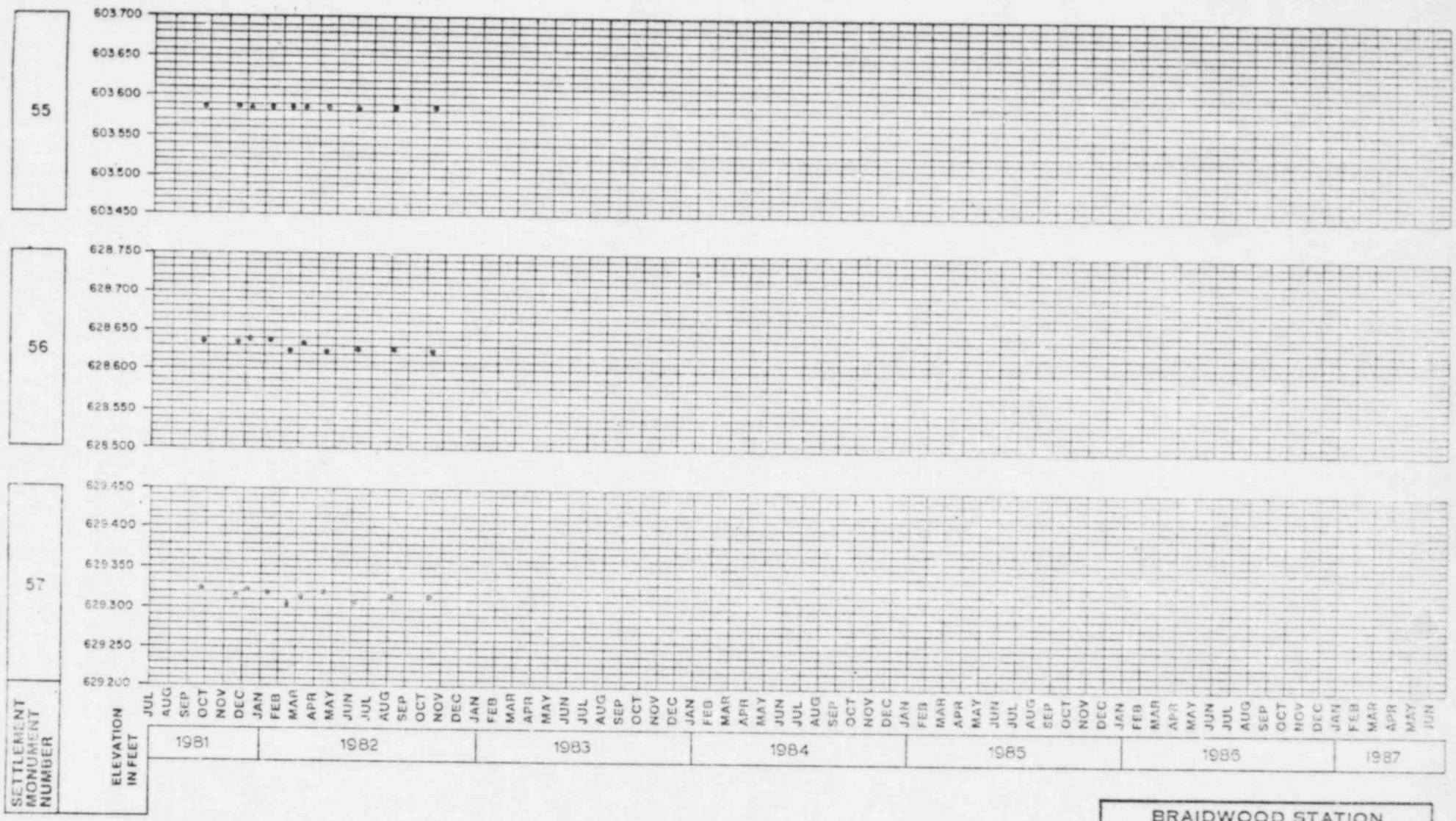


BRAIDWOOD STATION

FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-29

SETTLEMENT PLOTS FOR MONUMENTS 52, 53, 54

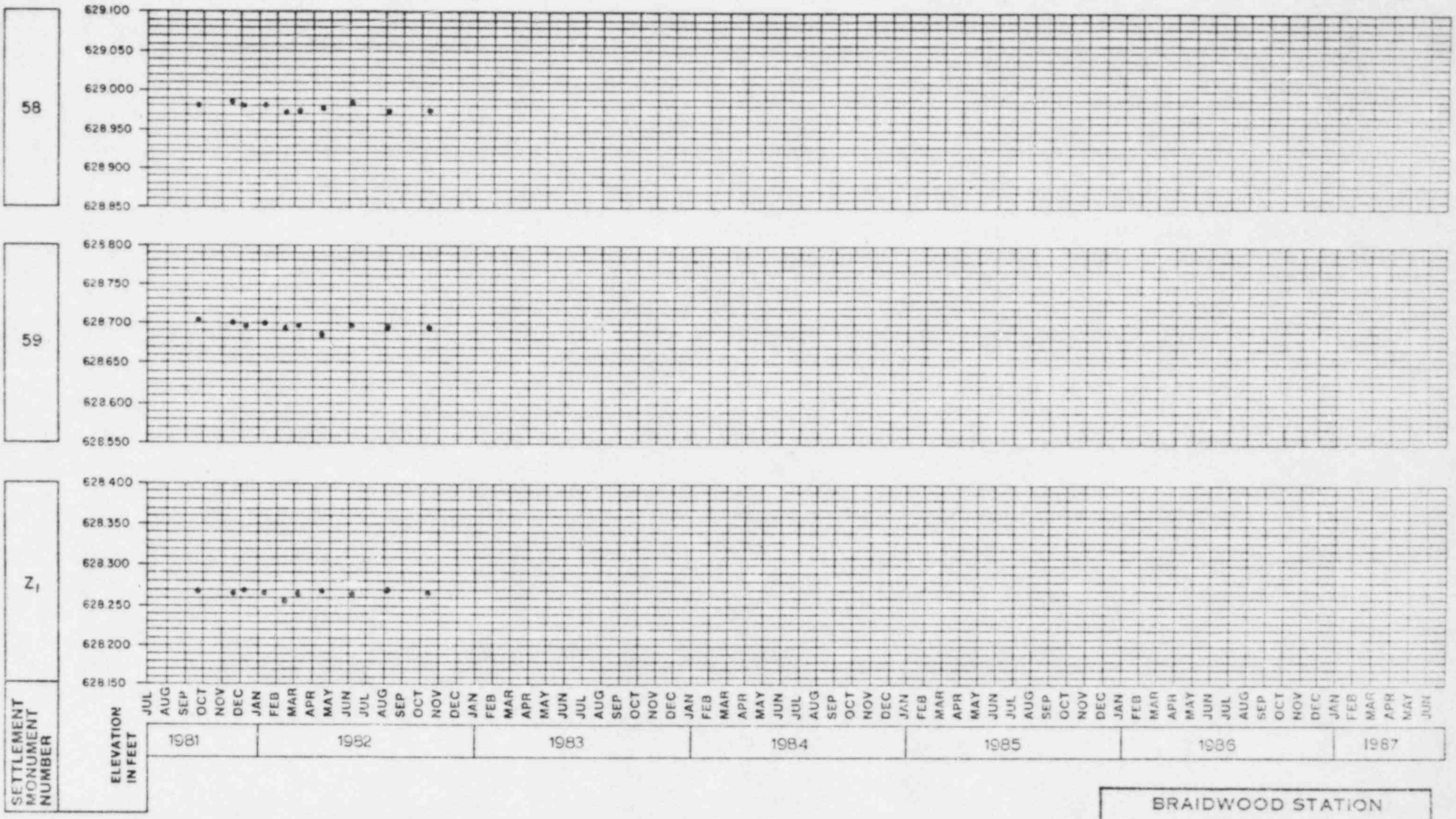


BRAIDWOOD STATION

FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-30

SETTLEMENT PLOTS FOR MONUMENTS 55, 56, 57



BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE Q362.1-31

SETTLEMENT PLOTS FOR MONUMENTS 58, 59, Z_1

QUESTION 362.10

"There appears to be a contradication in the Braidwood Station Final Safety Analysis Report between Table 3.7-3 (Supporting Media for Seismic Category 1 structures), Figure 2.5-25 (Geologic Section H-H'), Figure 2.5-26 (Geologic Sections F-F' and G-G') and Table 2.5-29 (Foundation Data) as to which structures are founded on rock and which structures are founded on soil. Provide the correct foundation media information for all Category 1 structures."

RESPONSE

Tables 2.5-29 and 3.7-3 have been corrected to provide the correct foundation media information for all Category I structures. The revised tables will be included in the next amendment. The foundation backfill plan and the foundation backfill sections, presented in Figures 2.5-75 and 2.5-76, respectively, show the exact foundation bearing materials.

QUESTION Q371.9

"1. You state there is little water use of the main streams in the site drainage area. Are there any potable water users that would be down gradient from a site (plant) radioactive spill source?

"2. You also state that the Wilmington water supply is from the Ironton-Galesville aquifer and that it is not subject to local infiltration. We assume this alludes to the potential for contamination from the plant. However, you don't provide the bases or rationale for this statement either here or in Section 2.4.13. Please provide additional explanation and clarification in either Section 2.4.1 or 2.4.13."

RESPONSE

Item 1: There are no known potable water users from the surface water down gradient from a radioactive spill source.

The groundwater users around the site area are listed in Tables 2.4-22 and 2.4-23.

The consequences of any radioactive spill at the site on the surface water and groundwater users are described in Subsections 2.4.12 and 2.4.13.3, respectively.

Item 2: A description of the site and regional groundwater conditions is presented in Subsection 2.4.13.1.2. Table 2.4-20 presents the stratigraphic units and their hydrologic characteristics. The Cambrian-Ordovician Aquifer is recharged in northern Illinois and southern Wisconsin. Infiltration to the Cambrian-Ordovician Aquifer in the site area is limited by the relatively impermeable Pennsylvanian-age shales of the Carbondale and Spoon Formations and by the Ordovician-age shales of the Maquokata Shale Group. The presence of these two shale aquitards restricts the infiltration of any potential contaminants to the overlying Pleistoceneage units and no potential contaminants would reach the Cambrian-Ordovician Aquifer.

QUESTON 371.10

"The discussion of Kankakee River floods and table 2.4-1 do not include the most recent five years of record. Revise the table and discussion accordingly."

RESPONSE

Table 2.4-1 and Subsections 2.4.2.1 and 2.4.7 have been revised and will be included in the next amendment.

QUESTION 371.19

"The pond survey program should be incorporated into your formal inspection program as per Regulatory Guide 1.127."

RESPONSE

The essential service water cooling pond survey is a hydrographic survey incorporating precision water depth measurements. These measurements are performed with a survey fathometer which produces a continuous chart recording of water depth. Slope definition as well as pond bottom survey is obtained at approximately 100-foot-wide tracklines. The initial pond survey was performed on October 21, 1981. Subsequent surveys will be performed once every 18 months; however, this survey interval may be increased in the future. The survey program has been incorporated into the station formal inspection and monitoring program per Regulatory Guide 1.127.

adjusted to the Wilmington site by multiplying the Custer Park discharge by the ratio of the square roots of the drainage areas.

The maximum known discharge near Wilmington, 75,900 cfs, occurred July 13, 1957. Its corresponding gauge height was 11.40 feet above datum. The maximum stage during the period of record was 13.88 feet, caused by ice jams. Ice jam floods in 1883 and 1887 reached a stage of 16.73 feet, for which the discharge is not known. All maximum stages greater than those due to floods were caused by ice jams. Of the 36 years for which maximum water surface elevations are known, 18 maximums were caused by ice jams as high as almost 7 feet above the year's highest flood stage (see Subsection 2.4.7).

2.4.2.2 Flood Design Considerations

The plant main floor is located at elevation 601.0 feet, which is above all flood levels from nearby rivers, streams, and reservoirs. The cooling pond dike system is higher than the calculated flood elevation with coincident wind wave action. The probable maximum precipitation (PMP) water surface elevation of the pond is below safety-related facilities. Floods occurring on the Kankakee River could affect only the river screen house, which is a non-safety-related structure supplying makeup water to the cooling pond. Other streams in the area pose no flood threat to safety-related items. The site drainage system has been designed to pass rainfall without flooding.

There are no dams upstream on nearby rivers whose failure could cause flooding at the site. The general terrain of the area is flat, with no location at which landslides could cause flood waves at the site.

The controlling event for flooding at the site is the probable maximum flood for the cooling pond (see Subsection 2.4.8.2). This event has been analyzed by applying the local probable maximum precipitation (PMP) to the pond watershed following an antecedent storm equivalent to one-half the PMP (see Subsection 2.4.8.2.4).

2.4.2.3 Effects of Local Intense Precipitation

Site grading and drainage are designed to assure that the local PMP will have no effect on safety-related facilities. Some accumulation of water is expected during this extreme event, but the estimated water surface elevation will at all times remain below the grade floor elevation of 601.0 feet.

PMP is taken from Hydrometeorological Report No. 33 (Reference 2) and is estimated to amount to 31.9 inches over a 48-hour period. This is the summer PMP, which is greater than the largest winter PMP coincident with the water equivalent of the 100-year snow pack. The PMP time distribution in 6-hour and 1-hour periods is

The maximum water level in the pond during its PMF would be 598.17 feet; the grade of safety-related facilities is 600.0 feet. Thus, failure of the pond dikes would not affect safety-related facilities.

2.4.5 Probable Maximum Surge and Seiche Flooding

Surge and seiche flooding are not possible because there is no large body of water near the site.

2.4.6 Probable Maximum Tsunami Flooding

Tsunami flooding is not possible because the site is not near a coastal area.

2.4.7 Ice Effects

Ice flooding, which is common on the Kankakee River, could affect only the river screen house. In 17 of the most recent 34 years of record at the Wilmington gauging station, the highest yearly water levels were caused by ice jams. At such times, ice forms all along the Kankakee River in Illinois. Major ice jams (such as those which occurred in 1866, 1883, and 1887) caused stages much higher than have been observed for flood discharge alone but would be lower than the PMF level. According to the Woermann profile of 1927, the 1866 ice jam caused a stage of 553.0 near Horse Creek. The 1883 ice jam destroyed the railroad bridge at Custer Park and displaced the approach embankments several feet downstream; it then completely destroyed the upper dam at Wilmington. Just before failure of the dam, the jam was reported to be 20 feet higher than the crest elevation of 545.0 (the present crest is at 530.5) (Reference 9). The maximum elevation upstream from Custer Park was 554.5, which occurred on February 15, 1959, due to an ice jam. Ice flooding is therefore expected to raise the water surface near the intake to a maximum elevation of 555.

Ice and ice flooding on the tributaries outside the cooling pond will not affect the plant facilities. The major tributary closest to the plant is the East Fork Mazon River, which lies about 1 mile southwest of the proposed site at its closest point. Because of this distance from the proposed site and the wide floodplain of the river, there will be no adverse effects on safety-related facilities due to ice in the river and subsequent flooding.

2.4.8 Cooling Water Canals and Reservoirs

2.4.8.1 Pipelines

Makeup from the Kankakee River is pumped by a 48-inch underground pipeline uphill to the cooling pond. The maximum gross withdrawal rate is 112 cfs for two units. Blowdown is discharged

TABLE 2.4-1

FLOODS ON THE KANKAKEE RIVER NEAR WILMINGTON

WATER YEAR	PEAK FLOOD DISCHARGE (cfs)	PEAK FLOOD STAGE (ft)	MAXIMUM GAUGE HEIGHT, (ft)
1981	41,000	6.45	Same
1980	24,800	5.88	Same
1979	48,000	--	12.07
1978	30,500	6.68	9.40
1977	16,200	4.54	Same
1976	32,600	6.95	Same
1975	27,100	6.24	Same
1974	49,100	8.49	12.78
1973	33,200	7.03	Same
1972	15,800	4.47	Same
1971	12,600	4.07	Same
1970	54,500	9.40	Same
1969	29,700	6.59	Same
1968	35,100	7.26	13.88
1967	19,400	5.18	10.08
1966	23,400	5.75	6.99
1965	19,500	5.20	Same
1964	10,800	3.70	Same
1963	22,000	--	9.72
1962	23,800	5.70	6.68
1961	17,000	4.86	Same
1960	19,500	5.25	9.13
1959	30,000	--	9.52
1958	30,600	6.72	9.92
1957	75,900	11.40	Same
1956	16,200	4.70	Same
1955	14,400	4.38	7.13
1954	15,000	4.53	Same
1953	19,500	5.17	Same
1952	29,000	6.46	9.43
1951	30,000	--	10.83
1950	37,800	7.61	11.39
1949	16,700	4.8	11.57
1948	23,000	5.67	6.00
1947	21,600	5.40	Same
1946	19,500	5.2	--
1945	21,600	5.4	--
1944	33,800	7.1	--
1943	48,000	8.87	10.06
1942	46,600	8.7	--
1941	8,290	3.30	--
1940	11,100	3.95	--
1939	24,600	6.0	--

TABLE 2.4-1 (Cont'd)

WATER YEAR	PEAK FLOOD DISCHARGE (cfs)	PEAK FLOOD STAGE (ft)	MAXIMUM GAUGE HEIGHT, (ft)
1938	19,600	5.3	--
1937	15,100	4.65	--
1936	17,500	5.0	--
1935	17,500	5.0	--
1934	7,000	--	--
1933	35,300	--	--
1932	10,600	--	--
1931	6,510	--	--
1930	17,200	--	--
1929	24,800	--	--
1928	24,000	--	--
1927	29,100	--	--
1926	20,900	--	--
1925	14,100	--	--
1924	18,900	--	--
1923	16,400	--	--
1922	34,300	--	--
1921	7,270	--	--
1920	26,200	--	--
1919	22,800	--	--
1918	26,600	--	--
1917	15,600	--	--
1916	14,500	--	--
1915	22,400	--	--
		--	--
1887	--	--	16.73
1883	--	--	16.73

within approximately 1 mile surrounding the plant site and cooling pond areas are shown on Figures 2.5-36 and 2.5-36A.

In the plant site area, borings were spaced on 100-foot centers in the area of Seismic Category I structures (Figures 2.5-16 and 2.5-33). The Colchester (No. 2 Coal) member was encountered in all the borings drilled, indicating that underground mining activity does not exist at the plant site. Also, coal development drill holes on approximately 330-foot centers (Reference 59) indicate that no underground coal mining underlies any portion of the NE1/4 and the SE1/4 of Section 19, T.32N., R.9E. Since the longwall mining system which was used in the district did not involve the use of isolated tunnels and drifts and allowed for complete extraction of the coal, the results of the development drill holes can be considered as a reliable indication that no mining has been pursued in the previously described parcels of Section 19. In the NW1/4 of this same Section 19, although land records indicate that in 1867 the Kankakee Coal Company held an interest in the E1/2 of the NW1/4, examination of the surface reveals that no mine shafts or dumps exist in this parcel, and that consequently no evidence exists that coal was ever mined in this quarter-section. The detailed topographic map presented in Figure 2.5-39 supports this conclusion.

The closest underground mine that exerts any influence upon the plant site is the Chicago, Wilmington and Vermillion Coal Company's "M" shaft in the SW1/4 of Section 19, T.32N., R.9E. (Figures 2.5-36 and 2.5-36a). This mine produced 277,845 tons of coal from the No. 2 seam between 1889 and 1891. Approximately 3 feet of coal was mined at a depth of 95 feet, or at about elevation 500. The calculated area of the underground mine workings computed from these production data is approximately 72 acres. This area is considerably less than the mine outline indicated in the mined-out coal area maps from the Illinois State Geological Survey, shown on Figures 2.5-36 and 2.5-36a. This undocumented outline is disproved by the development drilling; the alternative outline is the preferred interpretation.

In the E1/2 of the NW1/4 of Section 20, T.32N., R.9E., the Joliet Wilmington Coal Company mined a total of 150,363 tons from its No. 2 mine during the period 1905 to 1909. Drilling data have revealed the presence of a mined-out area of 31 acres. The published production data agree with tonnage computed from this area within 1%. These workings do not endanger the site.

In Section 17, T.32N., R.9E., records suggest that the Braidwood Coal Company may have mined coal underground at some time about 1879. An examination of Will County land records indicates that this company's involvement was limited to the NE1/4 of the SW1/4 of that section; it is therefore doubtful that any underground workings extend beyond this parcel. A strip mine was operated in the E1/2 of the NW1/4 of this same section about 1940, but the old workings as shown in the aerial photographs are not extensive

2.5.4.5.2 Main Plant

2.5.4.5.2.1 Excavation

Excavation for the main plant was carried to final grades within the soil and upper rock by using heavy construction equipment. Blasting was required for excavations in the competent rock. The depth of the excavation varied throughout the main plant site. The excavation extended to a minimum depth required to remove all eolian and lacustrine sand deposits. This depth was approximately 20 feet below final grade. The maximum depth of excavation was 84 feet under portions of the auxiliary building. The locations and limits of excavations for the main plant including Seismic Category I structures are shown in plan (Figure 2.5-72) and section (Figure 2.5-73). The excavated sand was stockpiled east of the main plant. The excavated topsoil, till, and rock were disposed of at designated locations on site.

The final subgrade surfaces of all major structures were protected against frost, ponding of water, and construction activity until the protective mud mat was poured.

Excavation dewatering was accomplished by constructing a slurry trench around the excavation limits. The location of the slurry trench is shown in Figure 2.5-74.

2.5.4.5.2.2 Backfill

The backfill material used consisted of sand previously excavated from the main plant site, the circulating water pipeline corridors, and from approved borrow areas east of the main plant. In addition, lean concrete was used in lieu of sand backfill adjacent to the containment building walls beneath the fuel handling building. The locations and limits of backfill are shown in plan (Figure 2.5-75) and section (Figure 2.5-76). The sand backfill within the zone of significant influence of loadings produced by the main plant structures was placed in horizontal lifts and compacted by use of vibrating rollers to a minimum of 85% relative density as determined by ASTM D2049-69. The backfill was placed according to Sargent & Lundy specifications and was monitored by a soil engineer. The sand backfill within the remaining areas was placed in horizontal lifts and compacted by use of vibrating rollers to a minimum of 80% relative density as determined by ASTM D2049-69.

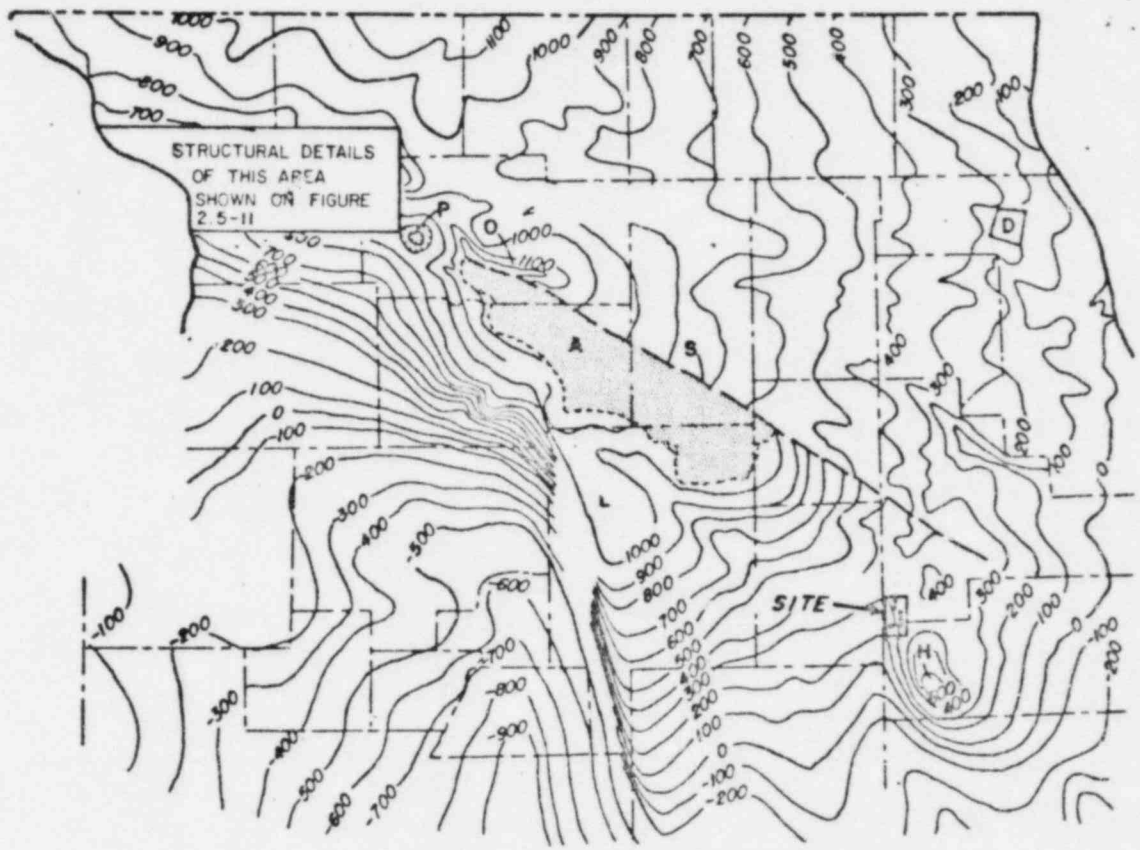
The static and dynamic properties of the sand backfill are discussed in Subsections 2.5.4.2 and 2.5.4.7.

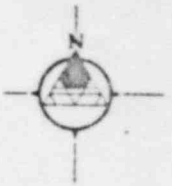
The envelope of the 58 grain size curves for the backfill material within the zone of significant influence of loadings produced by the main plant structures is shown on Figure 2.5-261. Laboratory relative density tests were performed on representative samples of the sand backfill material that was placed within the zone of significant influence of the

TABLE 2.5-29

FOUNDATION DATA

STRUCTURE	SEISMIC CATEGORY I	APPROXIMATE PLAN DIMENSIONS	FOUNDATION ELEVATION	APPROXIMATE STATIC BEARING PRESSURE	BEARING STRATA	MAXIMUM ESTIMATED TOTAL SETTLEMENT
Reactor containment (Core)	Yes	160 ft. diam.	565 ft. (538 ft.)	6-10 kaf	Siltstone (sandstone)	0.5 inch (0.25 inch)
Auxiliary building	Yes	80 X 410 ft.	527 to 541 ft.	5-10 kaf	Siltstone	0.25 inch
Fuel handling building	Yes	90 X 90 ft. and 90 X 120 ft.	579 ft. and 595 ft.	4-5 kaf	Glacial till and recompacted sand	0.75 inch
Lake screen house	Yes	70 X 90 ft.	565 ft.	3 kaf	Glacial till	0.5 inch
Turbine building	No	130 X 760 ft.	564 ft.	4 kaf	Sandstone	0.5 inch
Turbine generator pedestal	No	60 X 120 ft.	564 ft.	6 kaf	Sandstone	0.5 inch
Radwaste building	No	130 X 200 ft.	568 ft.	2 kaf	Recompacted sand	0.5 inch
Service building	No	100 X 140 ft.	598 ft.	2 kaf	Recompacted sand	0.5 inch
Heater bay	No	50 X 440 ft.	598 ft.	4 kaf	Recompacted sand	1.0 inch





SCALE IN MILES

10 0 10 20

NOTE:

1. ELEVATIONS ARE BASED ON U.S.G.S. DATUM.
2. SEE FIGURE 2.5-30 FOR ENLARGED VIEW OF STRUCTURAL CONTOURS AND BORINGS IN SITE AREA.

REFERENCE:

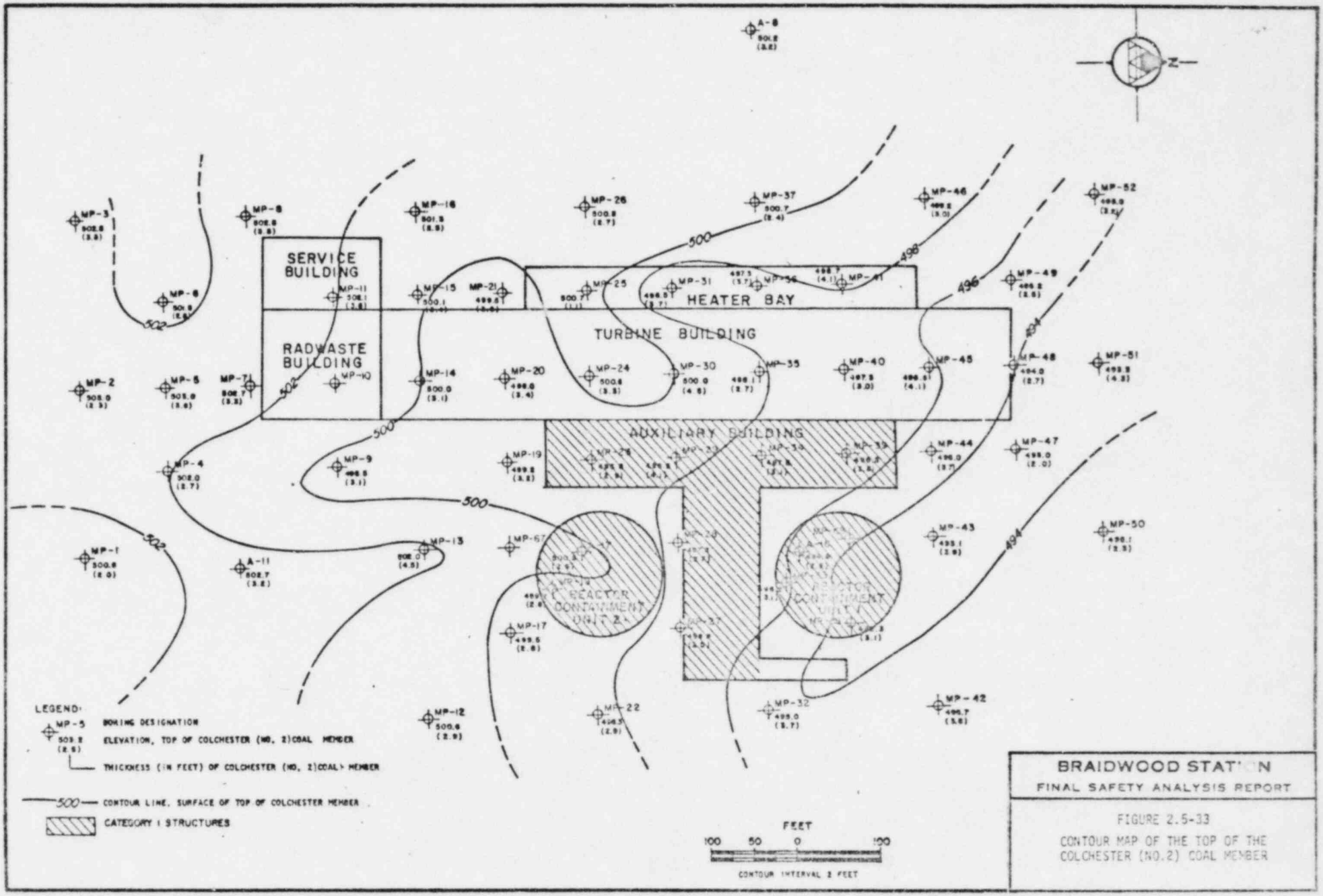
TEMPLETON, J.S., AND H.B. WILLIAM, 1952, CENTRAL ILLINOIS-GUIDEBOOK FOR THE 16TH ANNUAL FIELD CONFERENCE OF THE TRI-STATE GEOLOGICAL SOCIETY, ILLINOIS GEOLOGICAL SURVEY, GUIDEBOOK SERIES 3, 47 p.

BRAIDWOOD STATION

FINAL SAFETY ANALYSIS REPORT

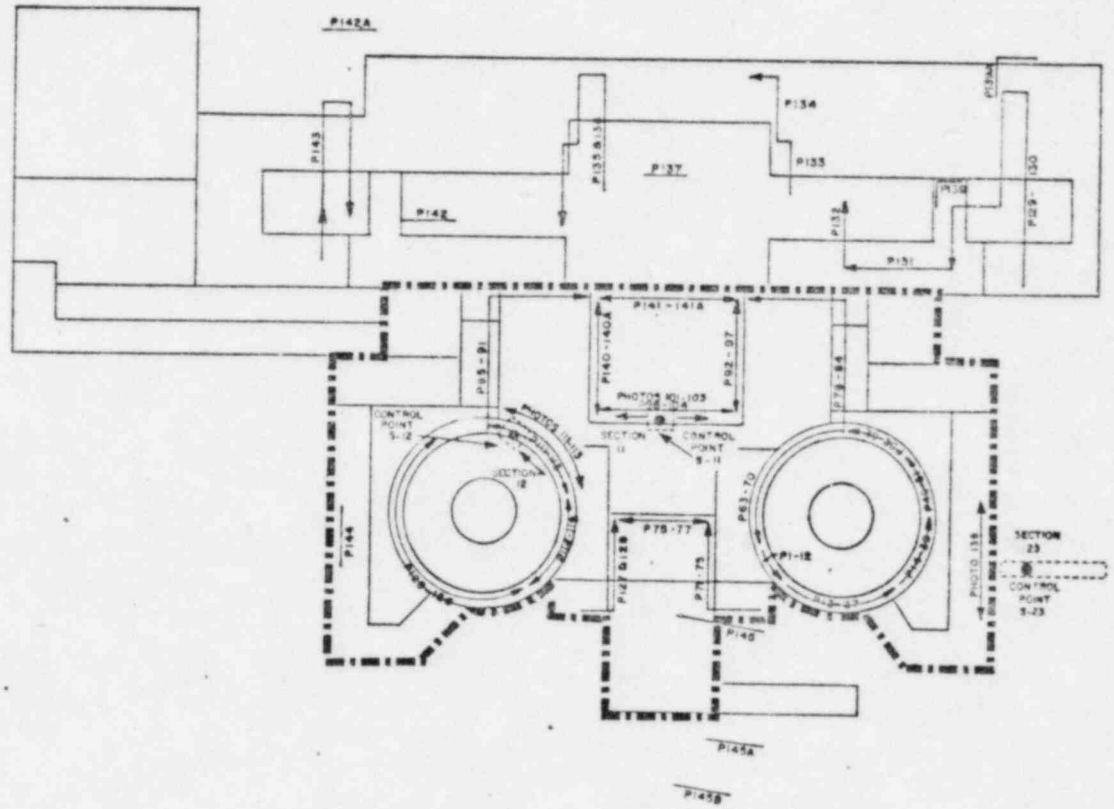
FIGURE 2.5-12

REGIONAL STRUCTURE CONTOURS ON TOP OF THE GALENA GROUP



BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE 2.5-33
CONTOUR MAP OF THE TOP OF THE COLCHESTER (NO.2) COAL MEMBER



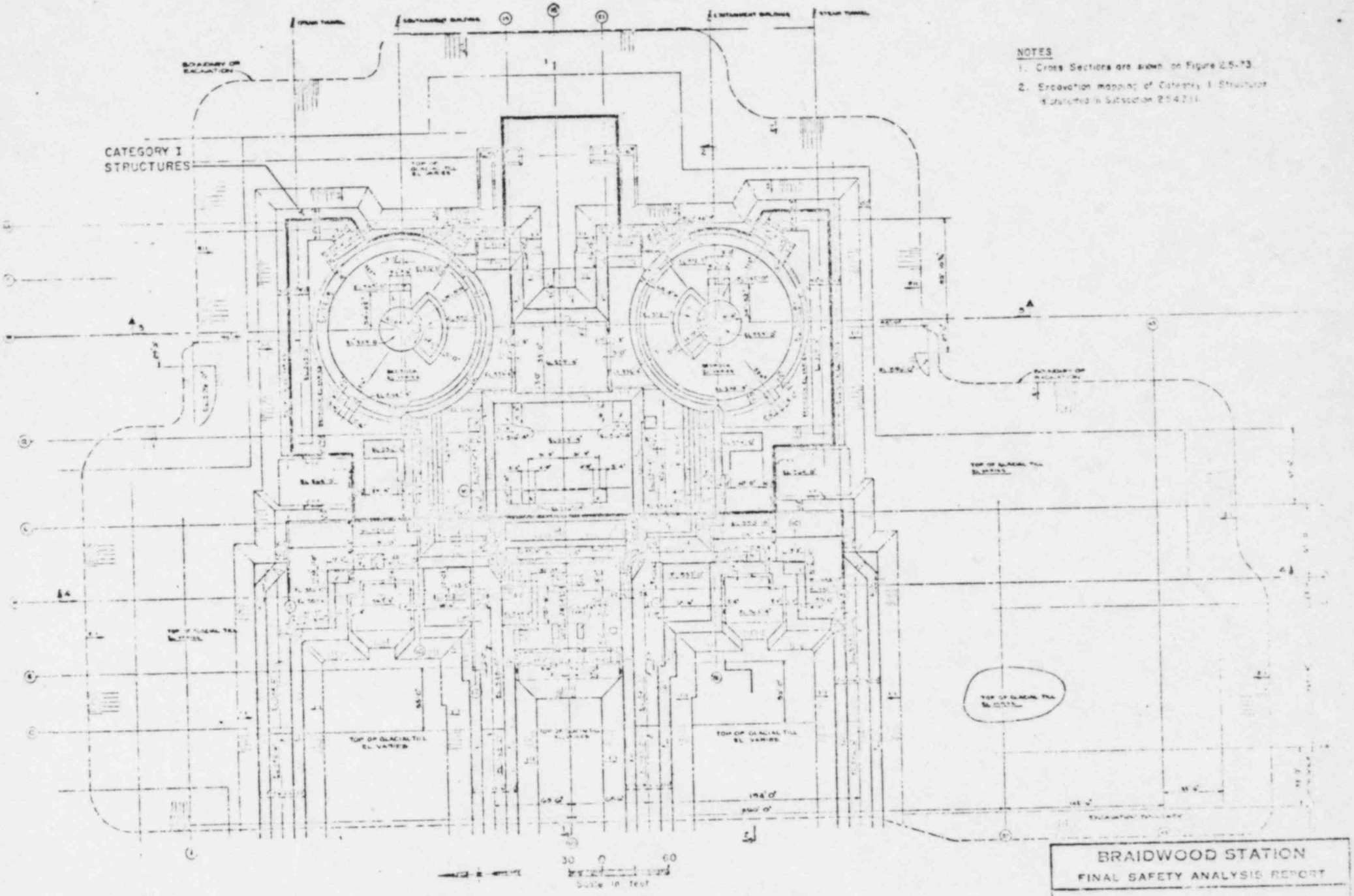
LEGEND:

- PHOTO COVERAGE
- P143 PHOTO NUMBER
- GEOLOGIC SECTION LOCATION
- CONTROL POINT LOCATION
- BOUNDARY OF CATEGORY I STRUCTURES.

50 0 100 FEET

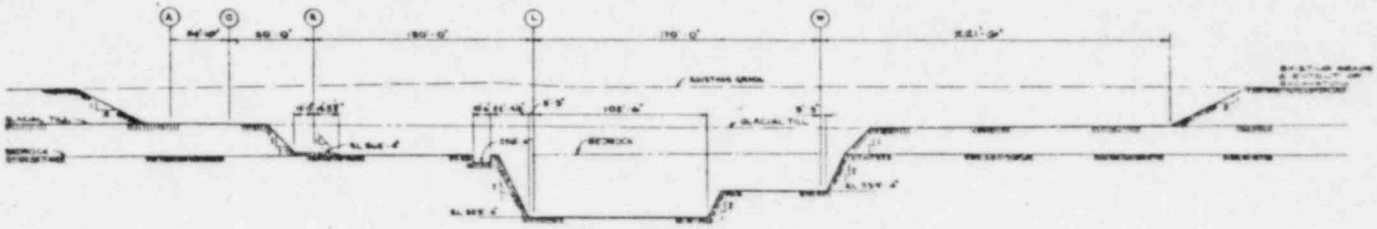
BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

FIGURE 2.5-55
EXCAVATION MAPPING PHOTOGRAPH
LOCATION MAP

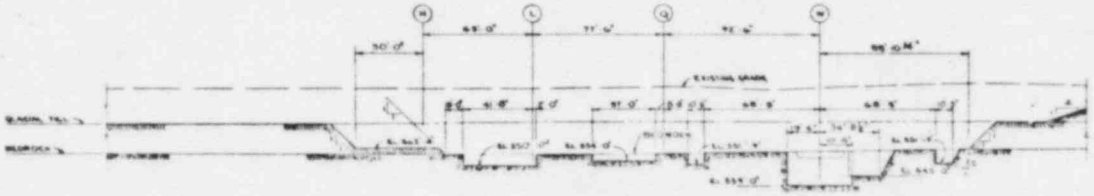


BRAIDWOOD STATION
FINAL SAFETY ANALYSIS REPORT

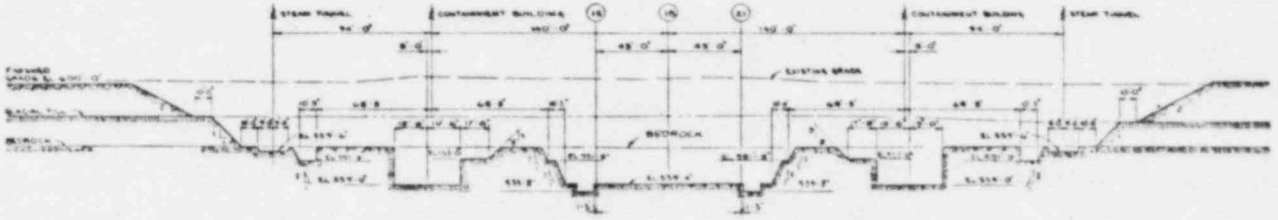
FIGURE 2.5-72
FOUNDATION EXCAVATION PLAN



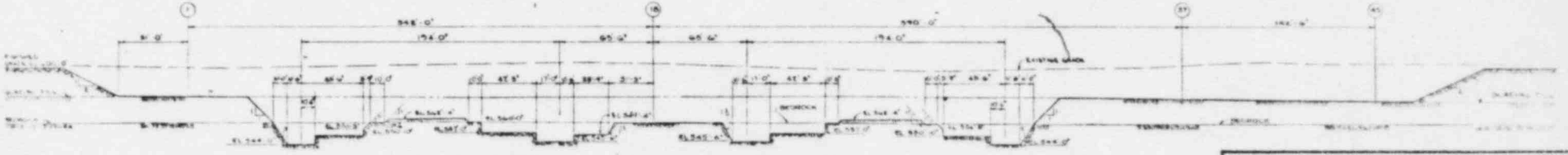
SECTION 1-1



SECTION 2-2



SECTION 3-3



SECTION 4-4

30 0 60

Scale in feet

NOTES

1. Location of sections are shown on Figure 2.5-72.
2. Excavation mapping for Category I Structure is presented in Subsection 2.5.4.5.1.

BRAIDWOOD STATION

FINAL SAFETY ANALYSIS REPORT

FIGURE 2.5-73

FOUNDATION EXCAVATION SECTIONS

QUESTION 372.23

"In Figure 2.1-5, the table indicates the minimum exclusion boundary distance is 1625 ft. (495 m) in the northwest. In Section 2.3.4.2 this same minimum distance is given as 485 m. Identify the correct value to be used for calculation of relative concentration."

RESPONSE

The value of 495 meters (1625 feet) is cited in Figure 2.1-5, Table 2.1-2 and in the text of Subsection 2.1.1.3. This is the distance between the vent stack (gaseous effluent release point) and the exclusion area boundary (EAB).

The value of 485 meters given in the text of Subsections 2.1.2.1 and 2.3.4.2, and used in Chapter 15.0 accident assessments (see Table 15.0-14), is the shortest distance between the surface of a containment building and the EAB. Releases for a design basis loss-of-coolant accident are assumed to occur via this minimum distance pathway rather than via the stack. This assumption is consistent with the guidance of Regulatory Guide 1.145, Section C.1.2.