

STATUS REPORT ON THE
INVESTIGATION OF THE DEWATERING SYSTEM
SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 & 3
MARCH 1979

I. INTRODUCTION

This report documents the status of the investigation and actions being performed on the dewatering system at the San Onofre Units 2 and 3 construction site and provides a summary of work accomplished from November 1978 through February 15, 1979.

II. STATUS OF DEWATERING WELL INVESTIGATION

The status of each well is summarized in Figure 1 (recent work shaded in yellow). Wells 1, 2, 3A and 9 were demobilized by filling with concrete after verifying that no cavities were present. Demobilization work at Wells 6 and 8 has been completed and documented. Investigative work was done on Wells 3, 4, 5, 7 and 10 (shaded in yellow) from November through February. Seismic cross hole surveys were run at Wells 4 and 10 and supplementary cross hole seismic work was performed at Well 3. Following completion of the cross hole seismic surveys, Wells 3, 4, 5 and 10 were demobilized by filling the well casing with gravel and capping the top of the casing with a concrete plug. All field effort was complete by the middle of February. In addition, the three-dimensional stick model for Dewatering Well 6 was completed and work was started on the Well 7 model.

Wells 11 and 12 are outside of the site area. Therefore, no work was planned for these wells. The paragraphs that follow include: summaries of work completed for Wells 3, 4, 7 and 10; discussion of the settlement observation monitoring program; and a progress report on construction of the models.

Well 3

Cross hole measurements have been completed between eight sets of drill holes using a downhole hammer. Frequency analyses were done on four sets of measurements. Data are presently being interpreted for submittal in a final report.

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Well 4

To provide additional coverage for the cross hole seismic survey, four additional angle holes (4B-5 through 4B-8) were drilled under the electrical tunnel as shown on Figure 2. Holes 4B-5 and 4B-6 were completed to 200 feet. Holes 4B-7 and 4B-8 were completed to 122 feet and 90 feet, respectively. The materials encountered were consistent with those found in the initial four holes drilled at this location, that is, up to 22 feet of backfill sand (to elevation +4.5), 12 feet of tremie concrete backfill (to elevation -12.5), and in-place San Mateo Formation. A 2-foot thick zone of disturbed material formed by localized erosion during construction of an electrical tunnel was encountered in Hole 4B-6 immediately below the tremie concrete backfill. This zone is similar to that encountered in Hole 4B-1 and reported in the status report dated November 20, 1978.

Further interpretations of the cross hole seismic data are in progress and will be submitted in a final report.

Well 6

Preparation of the Deep Exploration Drilling Program and the Exploration/Grouting Program reports has been completed. The reports were forwarded to the NRC under separate cover on February 16, 1979. No additional discussion of Well 6 is included in this report.

Well 7

The Exploration/Grouting Program at Dewatering Well 7 was essentially completed by the end of December. The final two holes were grouted on January 3, 1979. During November and December, 77 Stage 1 holes (4887 linear feet) and 24 Stage 2 holes (1809 linear feet) were drilled. All but nine of these holes were completed to their design depth, which varied from 50 to 120 feet. The nine incomplete holes were abandoned when they encountered buried utilities or previously drilled holes. The deepest disturbed material defined by the Exploration/Grouting Program is at a depth of 125 feet. A total of 139 Stage 1 and 2 holes, comprising 10825.5 linear feet, were drilled in the program.

A total of 128 holes were grouted in the Exploration/Grouting Program, with a total of 1292.7 bags of cement injected.

Preliminary analysis of the logs of the angle holes drilled beneath the Radwaste Building and construction of structure contours indicated that limited zones of disturbed material extended beneath the Radwaste Building. To further define the geometry of the disturbed material zone beneath the structure, three vertical holes (RW-1 through RW-3) were placed through the floor slab at the locations shown on Figure 3. These borings encountered in-place San Mateo Formation throughout their depths. These data further limit the geometry of the disturbed material zone to a limited area having maximum thickness of about 2 feet which would have no effect on the integrity of the structure.

Preparation of the Deep Exploration Drilling Program and the Exploration/Grouting Program reports is in progress. Completion of these reports is scheduled for April 1979.

Well 10

The four vertical exploration holes proposed in the October status report were drilled to 200 feet, and 4-inch diameter PVC was grouted in-place for the cross hole seismic survey. Materials encountered during drilling included backfill sand from ground surface to as deep as 10 feet below ground surface, with in-place San Mateo Formation comprising the remainder of the hole. The location of the holes and measured drift is shown on Figure 4.

Preliminary evaluations of the cross hole seismic survey data from Well 10 suggested the presence of two possible small cavity regions, one at 40 to 50 feet and another at about 120 feet.

To further investigate the presence or absence of cavities in these regions, three additional borings (10B-5 through 10B-7) were drilled as shown on Figure 4. Borings 10B-5 and 10B-6 were drilled to 130 feet and 125 feet, respectively, and 10B-7 was drilled to 70 feet. In the interval of suspected small cavities, the Standard Penetration Test interval was reduced from 10 feet to 2.5 feet to insure adequate coverage. Throughout the program at Well 10, there was no indication from the drilling that cavities exist at this well. The results of this drilling, combined with the fact that Well 10 is not located near Seismic Category I structures, suggests that no additional exploration is necessary.

Further interpretations of the cross hole seismic data are in progress and these will be submitted in a final report.

III. RELATED ACTIVITIES

Settlement Observation Program

A settlement observation monitoring program is being used to monitor the possible settlement of structures or components which are founded above or around those dewatering wells being investigated and demobilized. The settlement monitoring system involves 43 observation points, 31 of which have been installed to date. Most of the observation monuments not yet installed will be located on the Unit 3 electrical tunnel and tank building when the structures are completed. For reference, Figure 5 is included to show the physical location of the various settlement observation monuments in current use.

A review of the settlement observation data indicates that no significant movement has occurred.

Three-Dimensional Stick Models

The three-dimensional stick model for Well 6 has been completed. Photographs of the model are included as Appendix D to the Exploration/Grouting Program report for Well 6. Construction of the Well 7 model is in progress. The depiction of the Deep Drilling Program for Well 7 has been completed and addition of the information from the Exploration/Grouting Program is in progress.

IV. SUMMARY

Field work concerning the investigation/demobilization of Wells 3, 4, 5, 7 and 10 has been completed. The analysis of data from the cross hole seismic surveys and Exploration/Grouting Program is continuing and reports on these activities are in preparation. Completion of the report on the Deep Drilling Program and Exploration/Grouting Program at Well 7 is expected in April. The report on the cross hole seismic surveys at Wells 3, 4, 5 and 10 is an-

anticipated at about the same time.

The Deep Exploration Drilling Program and Exploration/Grouting Program at Wells 6, 7 and 8 have not encountered any cavities below a depth of about 140 feet. Drilling of deep exploration holes and supplementary holes in the cross hole seismic survey programs at Wells 4 and 10 have not encountered any cavities or abnormal conditions.

Additional cross hole seismic surveys were performed at Well 4 and a cross hole seismic survey was performed at Well 10. No cavities were indicated by the survey at Well 4 and drilling in the area of the anomaly at Well 10 did not encounter any cavities.

Figure 6 summarizes the projected schedule for completion of the reports on the investigation/demobilization work.

Well No.	Operational Status	Exploration Borings	Casing Removal and/or Borehole TV		Investigation/Demobilization Status					Cavity Detected	Overall Status to 15 February 1979
			Depth	Condition of Casing	Initial	Airlift Cleaning	Gravity Grout	Pressure Grout	Caliper		
1	Offline, Demobilized Avg. Maint.	—	200' removed, TV to 196'	Heavily Encrusted	No	Yes	Yes	No	Mech.	None	Annulus cleaned; casing pulled in good structural conditions with no holes; caliper indicated no borehole enlargement indicative of erosion; well completely demobilized by gravity grouting.
2	Offline, Demobilized High Maint.	None	Casing 200' removed, TV to 188'	Heavily Encrusted	No	Yes	Yes	No	Mech.	None	Annulus cleaned; casing pulled in good structural condition with no holes; caliper indicated no borehole enlargement indicative of erosion; well completely demobilized by gravity grouting.
3	Offline, Very Low Maint.	31 borings to El. -30' (27 slope indicators)	Casing ° in place, TV to 196'	Heavily ° Encrusted	No	Yes	Yes	—	Initial Mech. 6 Sonar	Yes	The annulus was airlift cleaned to a depth of 55'. The annulus subsequently filled to 44' depth. Cavity encountered, and source and extent was investigated by drilling, slope indicators, gravity survey and crosshole seismic survey. Crosshole seismic work completed and interpretations are in progress. Well demobilized.**
3A	Offline, Test Well Demobilized	None	Casing in place, TV to 296'	Lightly Encrusted some Corrosion	No	No	Yes	No	No	None	Well operated a few days as test well; only 6' fill in bottom of well, TV showed minor encrustations and some lower corrosion, gravel pack visible where louvers were enlarged; well completely demobilized by gravity grouting the casing.
4	Offline, Very Low Maint.	8 deep borings to El. -175'	Casing ° in place, TV to 198'	Heavily ° Encrusted	Yes	Yes (inside casing)	Yes	—	—	—	Well initially demobilized by cutting off top, filling with sand, and welding steel cap on top. Inclination of well bore was measured. Crosshole seismic work completed and interpretations are in progress. Well demobilized.**
5	Offline, High Maint.	23 borings to El. -20 to -175'	Casing ° in place, TV to 141'	Heavily ° Encrusted below 50'	Yes	Yes	Yes	Yes, Cement to El. -23'	—	Yes	Cavity detected near working surface by borings; 30° casing placed around well casing to El. -35' and cavity pressure grouted. Casing cleaned to 141'. Inclination of well bore was measured. Crosshole seismic work completed and interpretations are in progress. Well demobilized.**
6	Offline, High Maint. Demobilized	35 borings to El. -20 to -170' (19 slope indicators) 21 deep borings to El. +29 to -170'	Casing 200' removed, TV to 200'	Bad Deterioration below 115'	Yes	Yes Casing backfilled w/sand	Yes	Yes, 74 borings complete	Mech. 6 Sonar	Yes	Cavity detected by borings, inside casing cleaned by airlift and photographed, annulus and cavity partially cleaned of gravel and loose sand by airlift, cavity measured by mechanical caliper and sonar. Below 163' casing is almost non-existent but gravel pack and asphalt coating in place. (NOTE: Bailing tried in early stages but caused too much disturbance in well and was discontinued). A 36° casing was redriven from 108 to 118'. The casing weld broke at about 62', with about a 2° horizontal offset. Seals for the offset have been placed and airlift cleaned to 128-1/2'. The casing filled to 124', airlifted to 126-1/2' for bottom camera inspection. Casing filled to 125'. Open cavity filled with gravity grout. Deep exploration drilling has been completed. The grout hole drilling and grouting has been completed.
7	Offline, Very High Maint.	54 borings to El. -18 to -170' (19 slope indicators) 26 deep borings to El. +20 to -170'	Casing 199' TV to 199', 139' 10" removed	Bad Deterioration 10" casing also bad	No	Yes	Partial Fill	Yes, 102 borings complete	Limited Sonar	Yes	New 10" casing placed early in operation inside original 14" casing because well filled with sand (removed by bailing). Cleaned inside 14" and 10" casing to bottom of hole. Attempted cleaning of annulus around 14" casing, but unable to advance because of volume of material. Pulled 139' of 10" casing. Attempted retrieval of remainder of 10" casing by tool. The tool became lodged in the 14" casing at 122'. Partial concrete and sand filling of the open cavity on east side and a portion of west side has been completed. Cavity detected by borings. The deep exploration drilling, grout hole drilling and grouting is completed.
8	Offline, Demobilized High Maint.	64 borings to El. -5 to -25' (12 slope indicators) 18 deep borings to El. -142 1/2 to -172 1/2'	142' Casing removed, TV from 142 to 185' through telescope casing	Minor Corrosion 100-120' highly corroded below 120'	Yes	Yes	Yes	Yes, 108 borings complete	Mech.	Yes above a depth of 115'	Casing and annulus was cleaned with airlift with casing impeding cleaning; casing removed and cavity calipered, boreholes drilled to define plan size and depth of cavity, central access casing set, grout pipes set through cavity and cavity filled with grout (gravity), subsidence occurred at west end due to local water rise during gravity grouting, area below pressure grouted, telescoping casing set and airlift operation resumed. Casing had to be telescoped to a 160' depth due to caving. Positive head airlifted to 192' and TV logged to 183'. The cavity was gravity grouted and excavation of the Unit 3 P&S Tunnel to El. +7' completed. The deep drilling exploration has been completed. The grout hole drilling and grouting has been completed. The well was demobilized August 1978.
9	Offline, Demobilized High Maint.	None	200' Casing removed, TV to 200' in casing	Heavily Encrusted with some corrosion below 90'	No	Yes	Yes	No	Mech.	No	Annulus around casing and 46' of fill in casing cleaned, casing removed in good structural condition with some minor corrosion below 90' (no holes larger than louvers), caliper indicated no borehole enlargement indicative of erosion, well completely demobilized by gravity grouting.
10	Operational Avg. to Low Maint.	7 deep borings to El. -170'	200' Casing ° TV to 189'	Heavily ° Encrusted	No	—	Yes	—	—	—	Crosshole seismic work completed and interpretations are in progress. Well demobilized.**
11	Operational Avg. Maint.	—	200' Casing TV to 200'	Very Heavily Encrusted	No	—	—	—	—	—	Outside Plant area, no investigation work planned.
12	Operational	—	—	—	No	—	—	—	—	—	Outside Plant area, no investigation work planned.

° Brush-cleaned inside of casing and re-TV logged.

** Demobilized procedure presented in accompanying report.

FIG. 1 — STATUS SUMMARY OF INVESTIGATION/DEMobilIZATION OF WELLS AS OF 15 FEBRUARY 1979

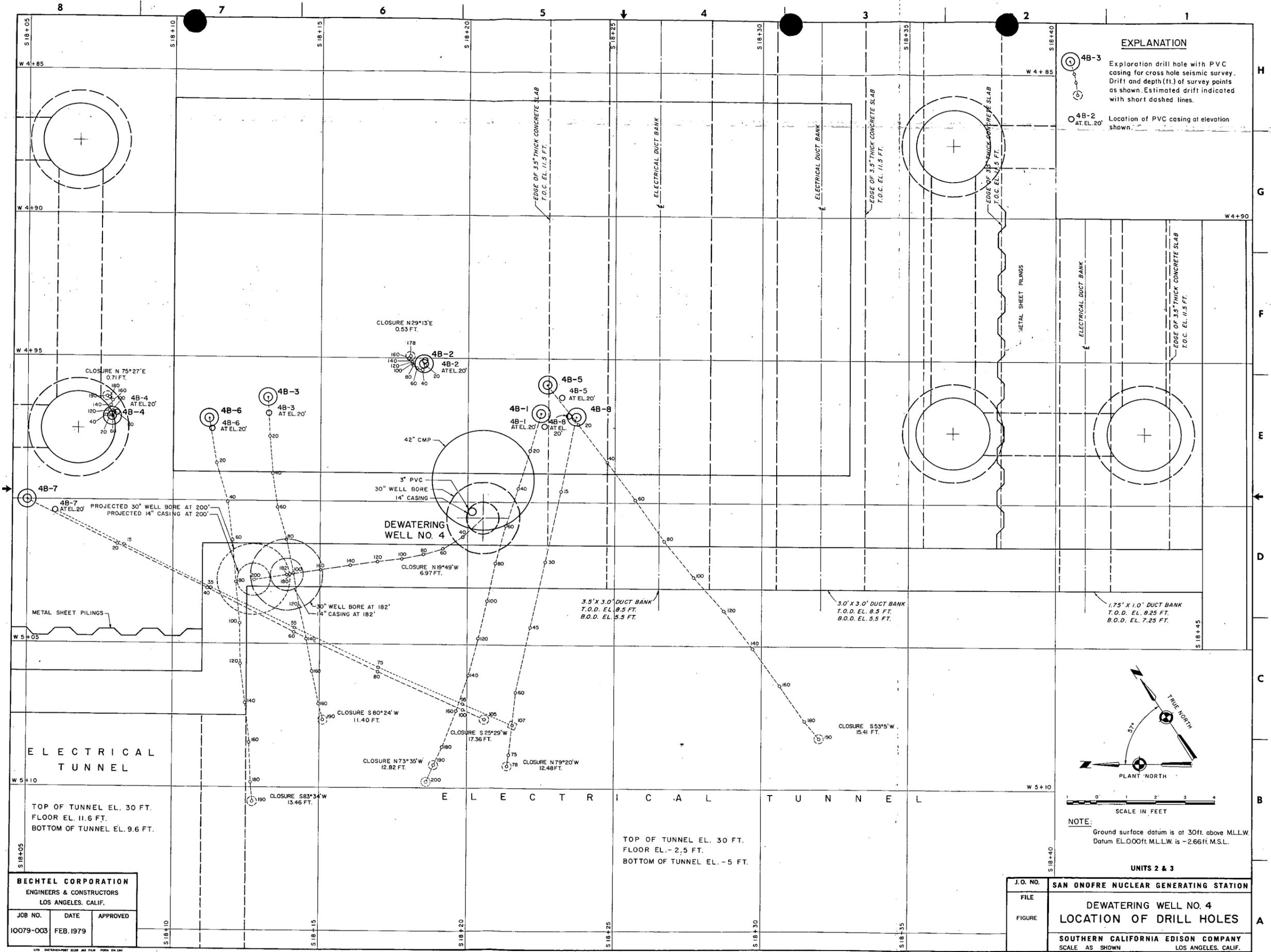
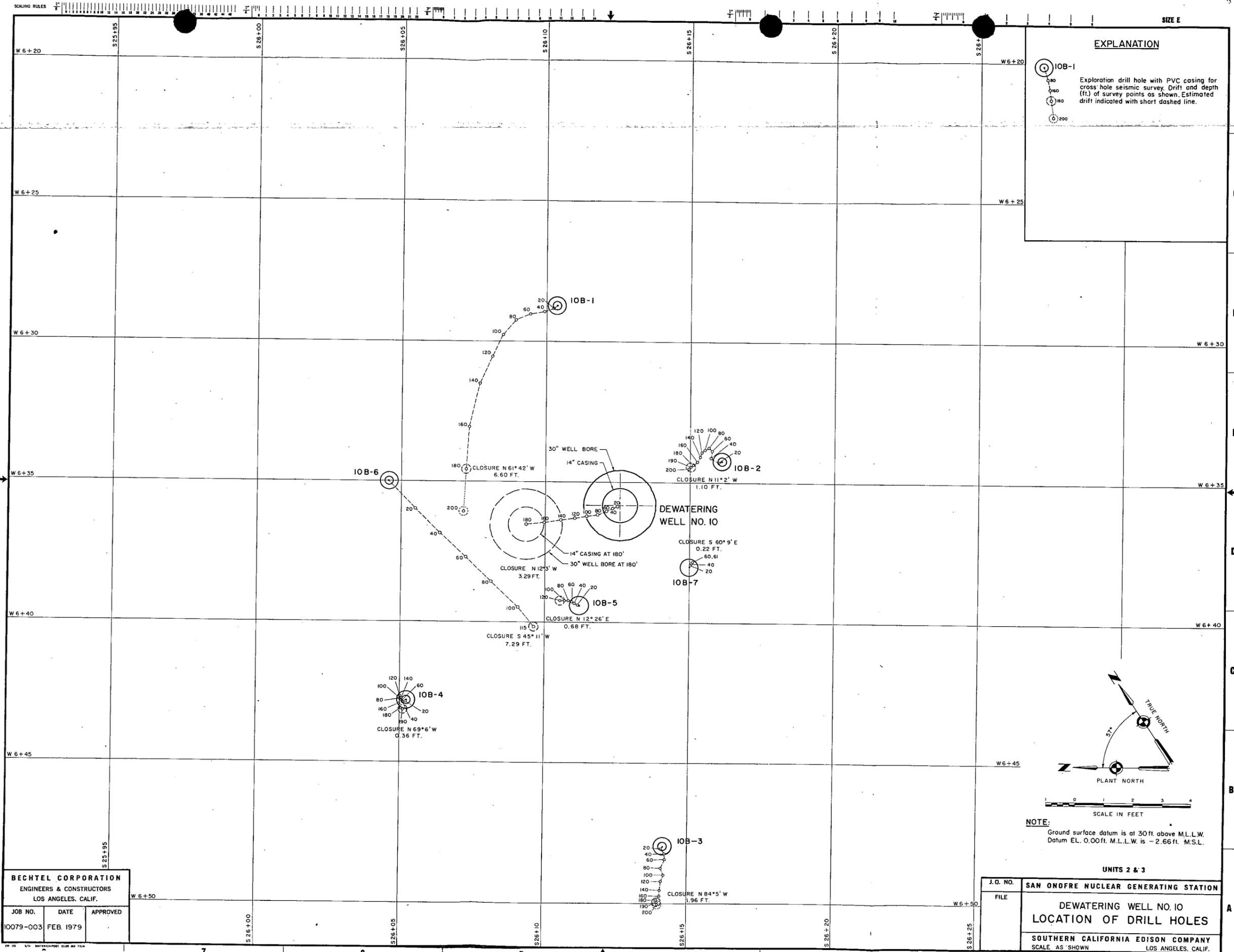


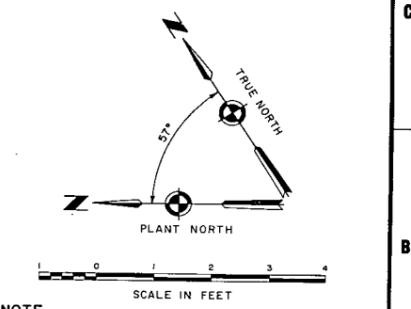
FIGURE 2



EXPLANATION

IOB-1
 180
 160
 140
 120
 100
 80
 60
 40
 20

Exploration drill hole with PVC casing for cross-hole seismic survey. Drift and depth (ft.) of survey points as shown. Estimated drift indicated with short dashed line.



NOTE:
 Ground surface datum is at 30 ft. above M.L.L.W.
 Datum EL. 0.00 ft. M.L.L.W. is -2.66 ft. M.S.L.

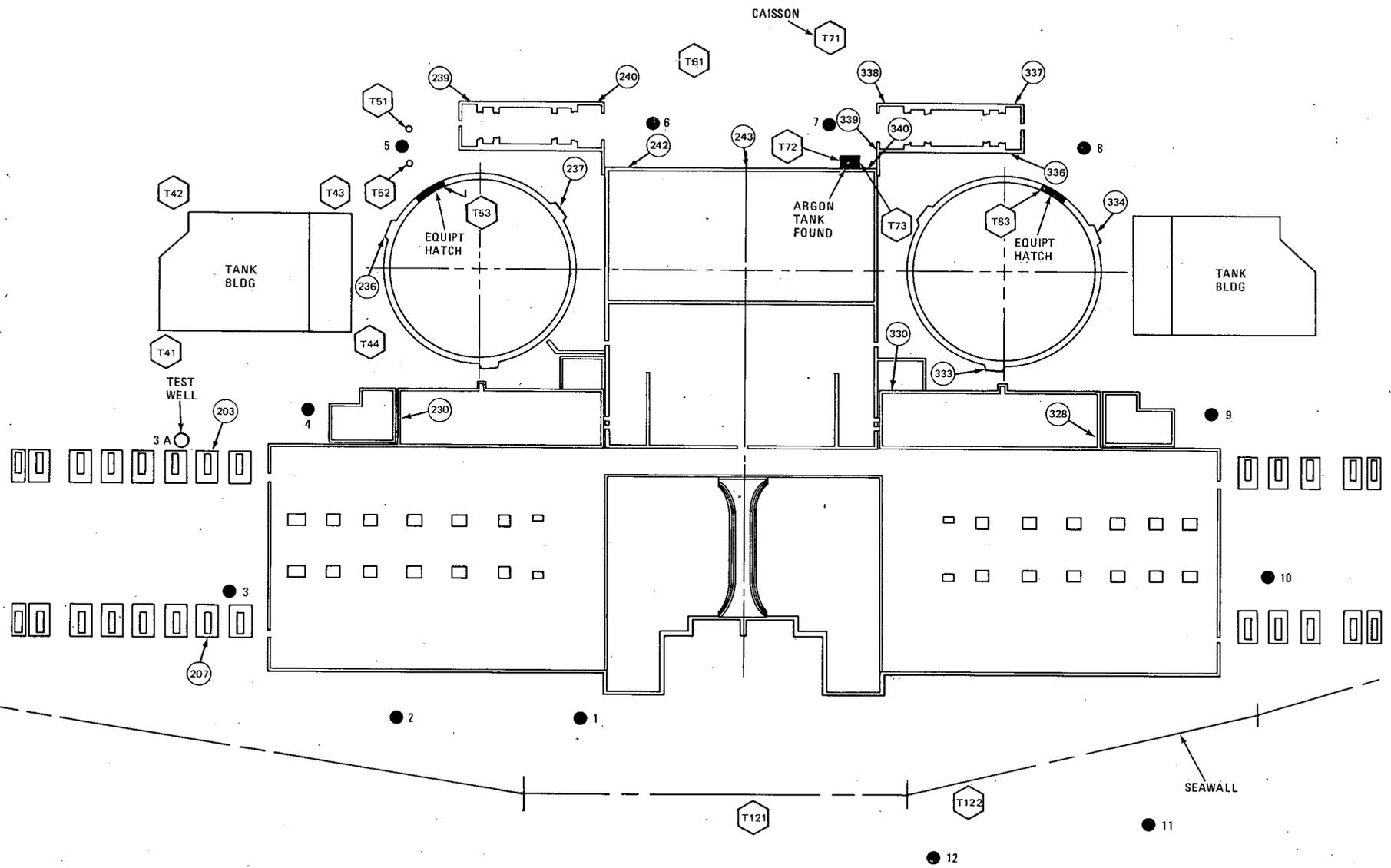
UNITS 2 & 3

J.O. NO.	SAN ONOFRE NUCLEAR GENERATING STATION	
FILE	DEWATERING WELL NO. 10 LOCATION OF DRILL HOLES	
SOUTHERN CALIFORNIA EDISON COMPANY SCALE AS SHOWN LOS ANGELES, CALIF.		

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JOB NO.	DATE	APPROVED
10079-003	FEB. 1979	

FIGURE 4



DEWATERING SYSTEM SETTLEMENT
OBSERVATION PROGRAM

FIGURE 5

**PROJECTED SCHEDULE
SONGS 2 & 3 WELL INVESTIGATION/DEMobilIZATION PROGRAM**

REV. NO. 12
DATE ISSUED: MARCH 19, 1979

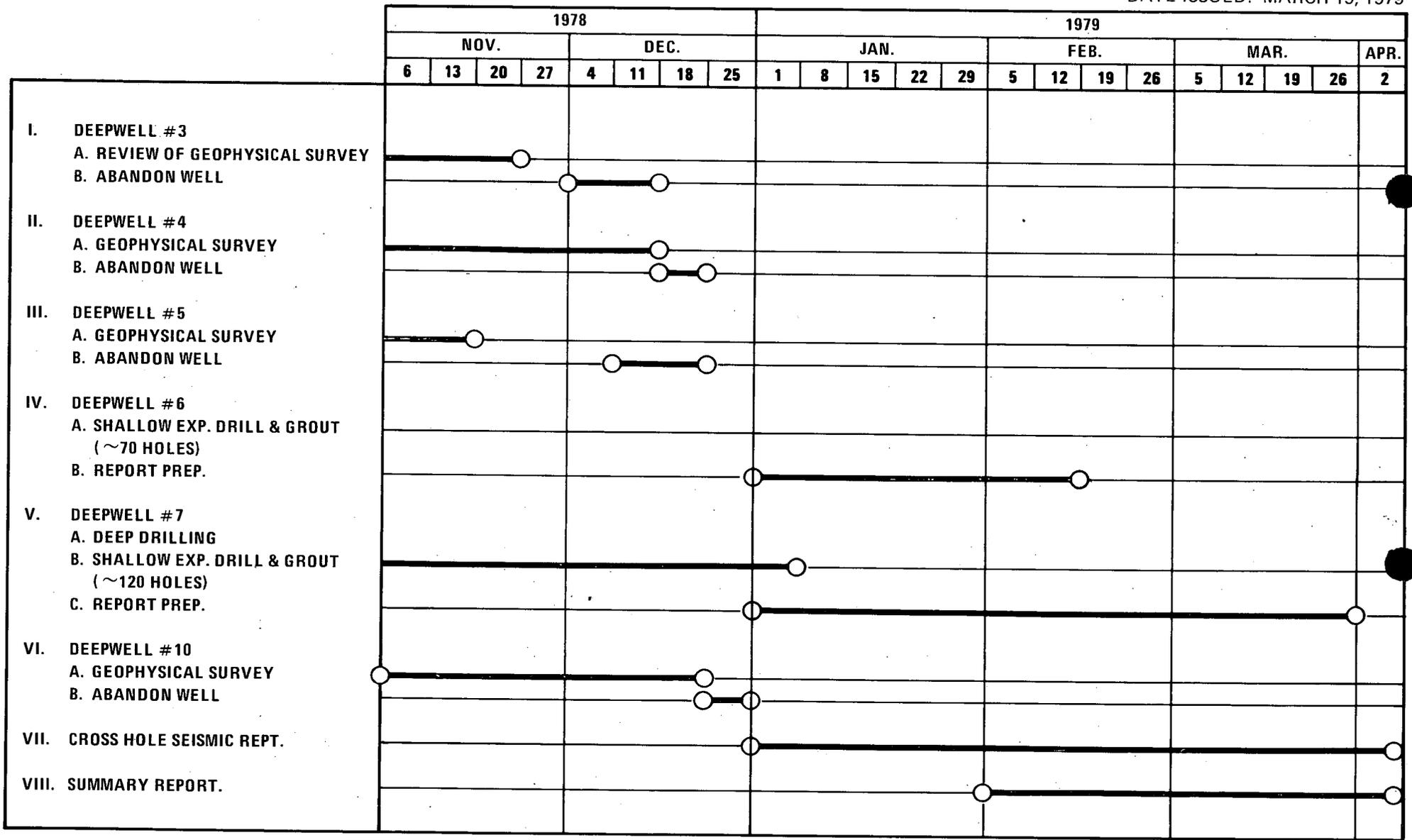


Figure 6