RESOLUTION OF HIGH GROUND WATER LEVELS AT GRAND GULF NUCLEAR STATION

Prepared for

Entergy Operations NPE

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Gaithersburg, Maryland

RESOLUTION OF HIGH GROUND WATER LEVELS AT GRAND GULF NUCLEAR STATION

I. INTRODUCTION

This report provides a discussion of the high ground water level issue at Grand Gulf Nuclear Station (GGNS) and presents information for Staff closeout of the following licensing related commitments and open items.

- Determine the cause of exceedance of the Design Ground Water Level (DGWL) (MAEC-85/0284).

- Develop a post-construction ground water level contour map in accordance with the commitment in Section 2.4.13 of the UFSAR.

- Determine the maximum expected post-construction ground water level within the power block area as required by the NRC letter of August 19, 1985 to Mississippi Power & Light Company (MAEC-85/0284).

- Identify actions required to resolve the high ground water level issue as stated in Entergy Operation's letter of December 21, 1990 to the NRC (GNRO-90/00006).

- Provide a response to the request for additional information attached to the NRC's letter of August 6, 1991 to Entergy Operations, Inc. (GNRI-91/00164).

II. BACKGROUND

GGNS has a ground water monitoring and construction dewatering system which was used during construction and continues to be used for monitoring the ground water level at various locations adjacent to the power block and in surrounding areas of the site. The dewatering system is also used to remove ground water

from the backfill around the power block structures. As reported in Section 2.4.13.5 of the UFSAR, the DGWL for the site is El. 109 ft. above mean sea level. The DGWL was determined early in the licensing and design stages of the plant based on limited ground water level and precipitation data available at that time and preliminary information on the final site configuration.

In 1983, following completion of the Unit 1 structures and backfilling between the tieback wall and the buildings, ground water levels exceeding the DGWL were recorded southeast of the power block in dewatering well DW-8 (Figure 1). The exceedance was reported to the NRC in early March 1984 (AECM-84/0020, dated March 9, 1984). Prior exceedances of the DGWL, at MW-4 in September 1978 and January 1979, are documented in the UFSAR (Section 2.5.4.6). They were related to a crack in the concrete surface seal and recharge to the sand backfill around the well from ponded surface water at the well. Since 1983 the DGWL has been exceeded on several occasions in the power block area, mainly at DW-8. In order to determine the causes of the high ground water level events and to assess the safety significance of the events, Entergy Operations, Inc. has completed several studies which have assessed the causes of the high ground water level and identified actions required to resolve the high ground water level issue.

Licensing issues relative to the site and final site configuration have been in an "open" status pending the completion of Unit 2. With the completion of grading in the Unit 2 area in early 1989, sufficient time has now elapsed for development of the data base necessary to determine a resolution to the existing ground water related issues.

III. SITE CONDITIONS

Sections 2.4 and 2.5 of the UFSAR provide a detailed description of the hydrogeology and geology of the site area, respectively. In addition, the design basis for subsurface hydrostatic loading is presented. As presented in the UFSAR,

the power block structures are founded on the Catahoula Formation which is comprised of dense claystone. The material overlying the Catahoula Formation consists of Terrace deposits, loess and alluvium. Regionally, ground water flows westward through the Terrace deposits, alluvial deposits of the Mississippi River floodplain and, to a lesser extent, relatively thin, fine sand lenses in the Catahoula Formation.

During site grading, loess and Terrace deposits were removed from the site area and excavation for the power block structures initiated from a flat surface, at about El. 132 ft., consisting of Terrace deposits (power block and north yard areas) and compacted fill (cooling tower, switchyard and south yard areas). Excavation for the power block structures and standby service water (SSW) basins from plant grade to the nominal foundation grade of El. 87 ft. was performed inside a tieback wall. A projection of this wall is shown on Figure 1. As the structures were completed, the area between the tieback wall and the building walls was backfilled with a clean granular backfill and capped with a 2-ft. thick clay surface seal from the building walls to at least 8 ft. beyond the vertical projection of the tieback wall. During construction, precipitation falling on the excavated area and ground water seepage from the Terrace deposits was initially controlled by a ditch and sump system. However, as construction proceeded, pumping from sumps became impractical due to construction interference. A construction dewatering system was installed in 1979 and 1980 (DW-1 through DW-8 on Figure 1) in order to continue the removal of seepage from the Terrace deposits into the excavation.

Backfill placement around the Unit 1 structures was completed in 1982. Placement of the Unit 2 backfill remained at about El. 110 ft. until late 1988. Backfilling and installation of the clay surface seal was completed in early 1989 and final site grading in the Unit 2 area was performed to stabilize the site in a post-construction condition.

North and south of the plant area, the regional ground water level generally occurs at an elevation of about 75 ft. However, ground water levels in the power block area have historically been at elevations higher than the surrounding regional levels with an average elevation of about 100 ft. This ground water level reflects a mounded condition that coincides with a rise in the top of the underlying Catahoula Formation, above elevation 70 ft., to form what has previously been termed a ridge-like feature beneath the power block area (UFSAR Section 2.4.13.1).

IV. GROUND WATER LEVEL MONITORING

At the start of subsurface exploration for GGNS in early 1972, the installation of observation wells and piezometers were an integral part of the effort to characterize the site. Wells were installed in the alluvium of the Mississippi River floodplain, the Terrace deposits, and the water bearing lenses of the Catahoula Formation. A tabulation of the wells is presented on Tables 2.4-24 and 2.4-25 of the UFSAR. The wells were monitored periodically from installation until March 1974 when most of the wells were destroyed during the clearing and grubbing operations in the site area. Several others were subsequently destroyed during site grading. After May 1974 the number of regional wells monitored has been relatively consistent at about 12 (UFSAR Table 2.4-29). These wells were monitored twice a month until October 1991 when the monitoring schedule was changed to semi-annually. The regional well locations in the power block area are shown on Figure 1 and the locations of the remaining regional wells are shown on Figure 2.4-27 in the UFSAR. In addition to the regional monitoring wells, other wells have been installed in the site area to monitor construction and post construction ground water levels as follows:

1974

Construction observation wells (COW-1 through COW-11 on Figure 2.4-35a in the UFSAR) were installed to monitor ground water levels adjacent to the

tieback wall. These wells were subsequently destroyed as construction progressed.

1976

Seven monitoring wells (MW-1 through MW-7 on Figure 1) were installed in the backfill between the plant structures and the tieback wall.

1979 - 1980

Eight dewatering wells (DW-1 through DW-8 on Figure 1) were installed in the backfill in the power block area. These wells have also been used to monitor ground water levels.

1986

Five monitoring wells (MW-8 through MW-12 on Figure 1) were installed to monitor water levels in the circulating water pipe trench (CWPT) backfill and in the Terrace deposits east of the power block. In addition, a supplemental dewatering well (DW-8A) was installed in the Terrace deposits in the vicinity of DW-8.

1990

Fifteen monitoring wells (MW-13 through MW-26 on Figure 1) were installed in the Terrace deposits in the vicinity of the cooling tower and in the north site area to better define ground water flow patterns across the site and recharge sources. These wells were installed in accordance with the recommendations from the studies prepared for the GGNS Ground Water Monitoring Status Report (GNRO-90/00006) in 1990.

Water levels have been obtained periodically since 1972 according to varying schedules from daily to monthly depending on the purpose of the measurements. (Exceptions: April 1982 to September 1982 and November 1982 to January 1983

when only Unit 1 wells were monitored.) The data has been used for various analyses and studies since the early site suitability studies initiated in late 1971.

The monitoring wells in the power block area are currently measured and any ground water level equal to or greater than El. 109.0 ft. is reported to the Staff in accordance with the August 19, 1985 letter (MAEC-85/0284). The results of ground water monitoring in DW-1 through DW-8 and MW-1 through MW-7 are also submitted in the Annual Environmental Operating Report.

V. DESIGN GROUND WATER LEVEL EXCEEDANCE

In 1985, the Staff issued a Safety Evaluation Report (SER) (MAEC-85/0284, dated August 19, 1985) which presented the results of the Staff's review of several high ground water level events. These events involved ground water levels in excess of the design basis, El. 109 ft., at dewatering well DW-8, located south of the Radwaste Building in the CWPT. The SER concluded "... the integrity of safety related facilities was not compromised by the reported exceedance of the design basis ground water level".

The SER indicated that the cause of the exceedance was partially due to the incomplete clay surface seal and backfilling of the excavation in the Unit 2 area. It recommended that the construction dewatering wells be retained until Unit 2 construction was completed, at which time, it was believed there would be sufficient ground water level data to demonstrate that water levels in the vicinity of the safety related structures would remain below the design basis level without the use of the construction dewatering wells. As indicated in Entergy's December 21, 1990 submittal to the NRC, completion of backfilling and installation of the clay surface seal did not occur until 1989. Exceedances of the DGWL have continued to occur in the vicinity of DW-8 since the completion of site grading and installation of the clay seal.

In conjunction with studies to determine the cause of ground water levels higher than the DGWL, assessments of the structural implications have been undertaken to evaluate the effect of raising the DGWL to 114.5 ft.

VI. GROUND WATER STUDIES

Studies of the hydrogeology in the GGNS site area have been completed. These studies have resulted in a better understanding of the influence of the Catahoula Formation, hydraulic conductivities of the site geologic and backfill materials, ground water recharge, precipitation, and dewatering well production on the site ground water levels.

VI.1 GROUND WATER LEVEL STUDY - 1983

In response to a high ground water level which occurred from January through July of 1983 (AECM-84/0020, dated March 9, 1984), GGNS conducted a Ground Water Level Study in December 1983. The results of the study were submitted to the NRC in February 1985 (AECM-85/0035, dated February 14, 1985). The exceedances were attributed to:

- Excessive precipitation at the site
- Lack of completion of the Unit 2 structures
- Lack of completion of the clay surface seal
- Incomplete grading of the general yard area
- Increased infiltration south of the power block due to natural causes

In addition a study was completed to determine if the integrity of safety related structures was compromised by the high ground water levels in 1983. This study of the structural analysis for stability and hydrostatic loading concluded that adequate factors of safety exist for water levels up to El. 114.5 ft. in the vicinity of both the Control Building and SSW basins, and El. 117.0 ft. for the other safety related power block structures. The adequacy of the structural backfill at El. 117 ft. was also verified against liquefaction. The Staff agreed, in 1985, that the ground water level of El. 110.2 ft. in 1983 did not compromise the integrity of safety related structures (MAEC-85/0284, dated August 19, 1985).

Recommendations implemented from this Ground Water Level Study were:

- Reestablish temporary power to the Unit 1 construction dewatering wells and operate them when ground water levels approach El. 109 ft. This activity was implemented in late 1983.

- Install five additional monitoring wells (MW-8 through MW-12) south and east of DW-8, as well as a supplementary dewatering well (DW-8A). This activity was implemented in 1986. The monitoring wells were intended to permit development of a better characterization of the direction of ground water flow in the CWPT backfill and the Terrace deposits to the east.

VI.2 GROUND WATER LEVEL STUDY - 1990

With the completion of backfilling and installation of the clay surface seal adjacent to the Unit 2 structures in early 1989 and completion of site grading in the north yard area, the site was considered to be in a post-construction condition. An investigation was initiated into the source(s) of ground water flow into the backfill adjacent to the power block structures to resolve the DGWL issue as requested by the Staff in 1985. The tasks and studies initiated in 1989-90 included:

- A review of the ground water level data and precipitation records from 1984 to 1990

- Installation of flowmeters on the dewatering wells and daily monitoring of well production

- Analysis of water samples from 14 wells and 3 surface water locations to determine the presence and relative concentrations of elements which may be indicative of a source other than precipitation

- Hydraulic conductivity testing in the power block area wells and selected regional wells to determine permeability variations in the backfill and Terrace deposits

- Performance of a leak detection survey of major and minor piping systems in the CWPT and in the vicinity of the SSW basins

- A review of site grading to determine areas of the site that may be contributing to infiltration

- Monitoring of ground water levels in the power block area with the liquid level controls in the dewatering wells reset to initiate pumping at an elevation slightly below the DGWL

- A study of the hydrogeologic and geologic parameters in the site area which may be affecting ground water movement

The results of the studies and tasks performed indicated that the sources of ground water within the power block area are leakage from the cooling tower and infiltration from precipitation. A rise in elevation of the Catahoula Formation on

which the power block structures are founded causes ground water to mound within the Terrace deposits and backfill. This rise of the Catahoula has a northwest-southeast trend and reaches a maximum elevation of about 100 ft. just south of the Unit 1 Auxiliary Building (Figure 2.5-31 in the UFSAR).

Regional ground water levels north and south of the site occur at an elevation of about 75 ft. In the site area, water levels generally occur at elevations of 100 ft. or higher. The highest levels have shifted from the power block area southward to the cooling tower area since plant construction was initiated.

The repositioning of the liquid level controls in September 1990 resulted in a significant decline in overall dewatering well production. Pumping only occurred in the areas of the power block when required to maintain ground water levels below the DGWL. Pumping was reduced almost exclusively to DW-8 after the adjustment of the liquid level controls (pumping occurred at DW-6 and DW-7 due partly to the entry of surface runoff into or around the well casing).

Recommendations implemented from this ground water level study were:

- Installation of 15 monitoring wells to assist in the definition of leakage from the cooling tower and ground water flow paths throughout the site area

- Continue the frequency of monitoring (daily) established during the October-November 1990 plant outage (RFO-4) through December 1990

- Continue monitoring during 1991 (dewatering well production and water levels) to observe water level changes during a full one-year cycle

The results of the 1990 Ground Water Level Study were summarized in the status report provided to the NRC in December 1990 (GNR0-90/00006) with a

commitment to issue a final report on the high ground water level issue by April 30, 1992.

VI.3 GROUND WATER LEVEL STUDY - 1991

The ground water level study initiated in 1991 was intended to expand on the previous studies and provide an action plan for resolution of the high ground water level issue. In addition to a review of the previous studies, the data from these studies was combined with the data generated by the following tasks:

- Incorporate precipitation records and historical data from the site and regional wells into the data base containing more recent data and review for significant trends

- Further develop the influence of the rise in the Catahoula Formation on ground water flow and determine the distribution of zones of higher hydraulic conductivity within the Terrace deposits

- Perform hydraulic conductivity testing in 15 monitoring wells installed in 1990 to provide additional information on ground water flow through the Terrace deposits

- Analyze precipitation, dewatering well production, and ground water levels from 1990-91 obtained under controlled pumping conditions to provide input to the development of the average post-construction ground water level contour map of the site

- Establish a relationship between ground water level change and precipitation for use in estimating the maximum ground water level at the site

- Define ground water flow paths and sources of recharge for the present site configuration based on data from 1990-91

- Review the feasibility of raising the DGWL to El. 114.5 ft., including an evaluation of the seismic parameters and implications of raising the DGWL on the systems and components of the plant

The results of these studies confirmed that cooling tower leakage and infiltration of precipitation are the two sources of ground water recharge into the Terrace deposits and backfill in the power block area and the CWPT. The results were used to develop the post-construction ground water level map and determine the maximum ground water level expected to occur at the site without the influence of leakage from the cooling tower. In addition, the data was used as input to development of a resolution to the high ground water level issue.

VII. RESOLUTION OF GROUND WATER LEVEL ISSUE

VII.1 POST-CONSTRUCTION GROUND WATER LEVEL CONTOUR MAP

A post-construction ground water level contour map (Figure 2) has been developed that reflects estimated average ground water levels which are considered likely to occur at GGNS during the life of the plant. The map is based on ground water levels that have occurred since the achievement of final site configuration, the absence of cooling tower leakage, and no further pumping from the dewatering wells.

The map was constructed utilizing ground water level measurements taken on November 8, 1990. It was determined that these measurements reflect average ground water level conditions for the following reasons:

1. The ground water levels reflect a repaired cooling tower condition. On November 8, the cooling tower basin had been drained since October 2. Ground water levels in wells near the cooling tower fell by as much as 7 ft. (at MW-12) during this period. The cooling tower basin was refilled on November 9 and 10.

2. Prior to the plant outage, ground water levels in the monitoring wells were near their post-construction average level, based on a visual inspection of hydrographs containing data from January 1989 to October 1991. No significant change in the water levels was observed in wells located away from the influence of the cooling tower between the start of the outage and November 8.

3. The ground water levels are representative of conditions when the dewatering wells are not pumping. The dewatering wells pumped only minor amounts of water in the three months prior to November 8 and did not pump at all during the outage.

The contour map shows that average water levels are between El. 105 and 110 ft. immediately south of the power block and between El. 100 and 105 ft. in the northern portion of the plant area. Water levels are higher east of the cooling tower due to the low permeability of the geologic materials in that area.

VII.2 STRUCTURAL EVALUATION OF CHANGE TO THE DESIGN GROUND WATER LEVEL

In order to study the impact of observed exceedance of the DGWL on safe plant operation, study calculations were performed in 1983 for the Unit 1 structures. These calculations indicated that adequate factors of safety for hydrostatic loading are present for a ground water level at El. 114.5 ft. for the Control Building and SSW basins and El. 117 ft. for the remaining safety related structures. Adequate resistance against sliding, overturning, and buoyancy was also concluded in the calculation. A study calculation of the Unit 2 structures in 1990 concluded adequate resistance as well. Recently, a detailed engineering assessment of the past studies and the related plant calculations has corroborated the earlier results.

An evaluation of the effect of raising the DGWL on the equipment and components inside the safety related structures was undertaken as part of a 1991 study. This evaluation considered:

- the dynamic soil characteristics and how they are affected by a raised DGWL, and

- the analysis methodology and how it is affected by the dynamic soil properties.

The evaluation found that, for all Category I structures founded on the Catahoula Formation, there would be a negligible effect on the stiffness/density of the formation materials as a result of raising the DGWL and, therefore, no change in the dynamic soil properties.

For the dynamic properties of soils beneath the Diesel Generator Building, founded on structural backfill, the elastic modulus and Poisson's ratio will be affected to a

limited extent and the effective unit weight will be approximately halved in the interval between the current DGWL (El. 109 ft.) and a DGWL up to at least El. 117 ft. The effect of these changes in the soil properties on the analysis methodology is negligible.

The analysis methodology is primarily affected by changes in the dynamic shear modulus and the shear wave velocity. These properties remained essentially unchanged, resulting in an unaffected seismic model. It was concluded that these slight variations in soil properties would have a minimal effect on response and would be more than adequately enveloped by the broadening of the design response spectra (+/- 15 percent). Therefore, additional evaluation of the equipment and components within the structures is not required.

It is concluded that the structures and components can withstand a change of DGWL to El. 114.5 ft. for the Control Building and SSW basins and El. 117 ft. for the remaining safety related structures.

VII.3 MAXIMUM POST-CONSTRUCTION GROUND WATER LEVEL

The maximum expected post-construction ground water level within the power block area has been determined to be El. 113 ft. This level was derived on the basis of recorded water levels within and adjacent to the power block and the magnitude of ground water level rises following extended periods of heavy precipitation. A review of recorded ground water level data shows that dewatering well DW-8 has historically measured the highest ground water levels in the power block area. The highest ground water level recorded at DW-8 during a six-month period of high precipitation between December 1982 and May 1983 was El. 110.2 ft. The total precipitation during this period was estimated to have a 35-year recurrence interval and resulted in a rise of approximately 3 ft. in the ground water level at DW-8.

The maximum expected post-construction ground water level of El. 113 ft. within the power block area is derived by conservatively adding the highest level of El. 110.2 ft. recorded during this period and the measured ground water level rise of approximately 3 ft. This maximum level is based on natural sources of recharge without any influence from plant sources.

VII.4 COOLING TOWER LEAKAGE

Indication that leakage from the cooling tower is a source of recharge to the backfill in the CWPT is based on a review of the hydrographs of monitoring wells MW-11 and MW-12 installed in the backfill. The hydrographs demonstrate that water levels are consistently higher in these two wells than in wells to the east installed in Terrace deposits. Fluctuations of up to 7 ft. have occurred in MW-12 and up to about 2 ft. in DW-8 (also installed in the backfill) during periods of plant outage. During the outages, the hydrographs show a steep decline in the early part of the outage and a sharp rise following the outage which correlates with the draining and filling of the cooling tower basin.

Leakage from the cooling tower was verified by visual inspection during RFO-4 (October-November 1990). The inspection indicated that significant leakage is occurring at a damaged expansion joint in the warm-water inlet tunnel under the cooling tower basin.

Entergy will reduce the quantity of water entering the power block area by repairing the cooling tower leak. The repair will be performed during the next plant outage (RFO-5) in April-May 1992 and will consist of repairing the expansion joint in the concrete inlet tunnel under the main portion of the cooling tower basin. During each subsequent refueling outage, a visual inspection of the cooling tower will be performed to verify no potential leakage paths exist.

VIII. CONCLUSIONS

As a result of the studies undertaken to resolve the high ground water level issue, the following is concluded:

- Recharge to the ground water at GGNS is solely from on-site sources. The major sources of recharge are infiltration from precipitation and leakage from the cooling tower.

- The present cooling tower leakage has a significant impact on the local ground water conditions southeast of the power block. The impact is dependent upon local hydrogeologic conditions, including hydraulic conductivity, elevation of the top of the Catahoula Formation, etc., and is estimated to result in an increase of approximately 2 ft. in the ground water level at DW-8.

- Periods of higher than average precipitation occurring over several months influence ground water levels at the site. Water levels typically rise when precipitation is high for several consecutive months and fall during similar periods of lower than average precipitation. The maximum ground water level measured during a period of long-term ground water level rise at GGNS was El. 110.2 ft. This level was measured in DW-8 on February 15, 1983 and coincided with the highest six-month on-site cumulative precipitation period, which is estimated to have a 35-year recurrence interval.

- Hydrogeologic conditions significantly affect the site ground water levels. Higher ground water levels south of the power block are largely influenced

by a local rise in the top of the Catahoula Formation. These conditions are also the result of the presence of low permeability materials within the Terrace deposits that impede the flow of ground water from the cooling tower area. In addition, final site configuration, grading, paving, etc., has changed since the DGWL of El. 109 ft. was established.

- The maximum ground water level expected to occur in the backfill adjacent to a safety related structure is estimated to be El. 113 ft. This level was estimated assuming recharge only from natural sources.

- Structural assessments of Unit 1 structures conclude that adequate factors of safety for hydrostatic loading, including stability, are present for the following ground water levels: El. 114.5 ft. for the Control Building and SSW basins and El. 117 ft. for the remaining safety related structures. Assessment of the Unit 2 structures also concluded adequate resistance.

- The basic seismic model for the Category I structures will be unaffected by a change in the DGWL to El. 114.5 ft. for the Control Building and SSW basins and El. 117 ft. for the remaining safety related structures. The seismic impact on components and systems are enveloped by the broadening of the seismic response spectra.

IX. RESOLUTION OF OPEN ISSUES

Following is a summary of the results of the studies conducted to resolve the high ground water level issue at GGNS:

- The cause of exceedance of the DGWL has been determined to be leakage from the cooling tower combined with naturally high ground water levels due to the rise in the top of the Catahoula Formation, preferential flow paths

resulting from plant backfilling operations (higher permeability materials), the presence of low permeability materials resulting in the impedance of ground water flow, and extended periods of higher than average precipitation.

- The average post-construction ground water level contour map is attached as Figure 2. The map will be incorporated into the UFSAR.

- Sufficient precipitation, ground water level, and hydrogeologic data exist to predict the maximum expected site ground water level based on current plant conditions excluding the effect of leakage from the cooling tower. The maximum expected post-construction ground water level in the power block area is estimated to be El. 113 ft.

- Entergy identified and is undertaking the following actions to resolve the high ground water level issue:
  - The DGWL will be raised from El. 109 ft. to El. 114.5 ft. A UFSAR change will be submitted to reflect this change. All studies and assessments will be incorporated into the plant calculations to support this change.
  - The cooling tower leakage will be repaired during the refueling outage scheduled for April-May 1992 (RFO-5).
  - Ground water levels will be monitored until sufficient data is available to confirm the cooling tower repair.

- The response to the Staff's request for additional information (GNRI-91/00164, dated August 6, 1991) is attached to this report as Appendix I.

Based on the above, we believe that outstanding GGNS ground water issues have been addressed.

APPENDIX I

RESPONSE TO NRC LETTER GNRI-91/00164, AUGUST 6, 1991

By letter dated August 6, 1991 the Staff requested additional information in reply to the Entergy submittal GNRO-90/0006 dated December 21, 1991. Three requests pertaining to ground water conditions at GGNS were made in this letter. These requests are as follows:

1. An analysis of the ground water events which occurred since the 1983 event, with special regard to seismic structural design and geotechnical problems. Describe corrective actions to prevent such events.

Response:

Study calculations performed in 1983 for safety related structures in Unit 1 at GGNS indicated adequate factors of safety for a hydrostatic loading at El. 114.5 ft. for the Control Building and SSW basins and El. 117 ft. for the remaining safety related structures. A study calculation of the Unit 2 structures performed in 1990 concluded adequate resistance as well. Adequate factors of safety against liquefaction within the Category I backfill exist for water levels up to El. 124 ft. In addition, a detailed engineering assessment of the study calculations and the related plant calculations has corroborated these results. This assessment included the evaluation of the effect of raising the DGWL on the equipment and components inside the safety related structures. It was concluded that the DGWL change would be enveloped by the broadening of the design response spectra (+/- 15%) and that additional evaluation of the equipment and components within the structures is not required. Therefore, by raising the DGWL to El. 114.5 ft., no additional corrective action will be required.

2. A description and discussion of the dewatering pumps and instrumentation to keep the ground water level below the design basis level.

Response:

No dewatering wells will be required to maintain ground water levels below El. 114.5 ft. adjacent to safety related structures.

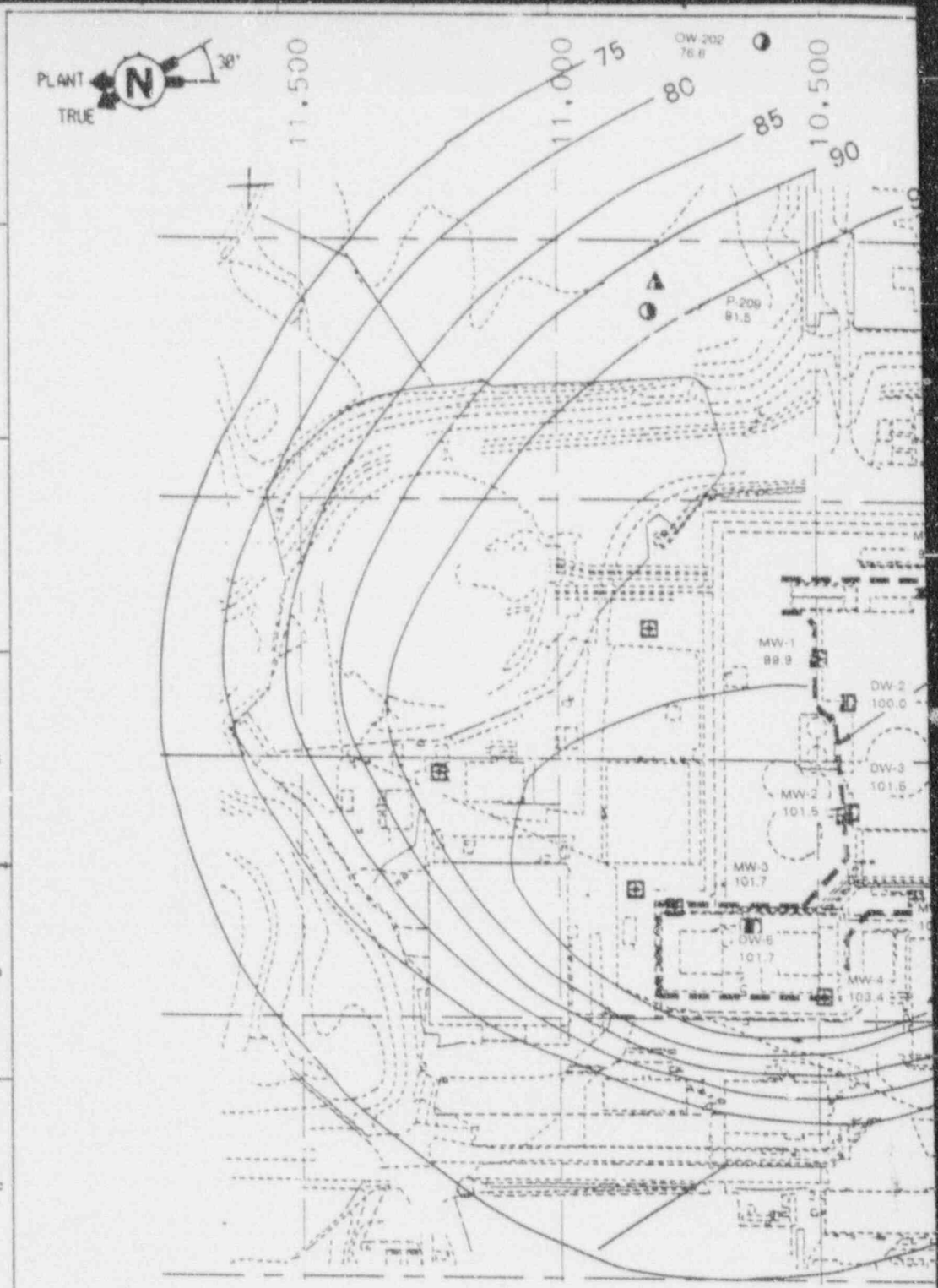
3. A description of a procedure that would provide for maintaining the ground water level at or below the design basis for Unit 1. The procedure should be detailed enough to clearly define the steps and actions the licensee will take [illegible] commitment to notify the NRC through the provisions of 10 [illegible]

Response:

Following completion of repair to the cooling tower during the April through May, 1992 refueling outage, the maximum groundwater level expected to occur in the power block is Elev. 113.0 ft. Engineering studies and assessments of Unit 1 structures have concluded that an adequate margin of safety is present to raise the design basis ground water level to Elev. 114.5 ft. for the Control Building and SSW Basins and Elev. 117 ft. for the remaining safety related structures. The UFSAR will be updated to reflect the new DGWL. When in effect, GGNS will no longer require ground water monitoring to ensure levels are maintained below the design basis ground water elevation for Unit 1 structures assuming recharge only from natural sources.

On March 9, 1984, Entergy Operations, Inc. (formally Mississippi Power & Light Company) notified the Staff of an incident in which the ground water elevation was measured above 109 feet Mean Sea Level (MSL). However, the slight variation did not present a safety concern for the plant. In a letter dated August 19, 1985 (MAEC-85/0284), the Staff

concluded that based on the information provided by Entergy Operations, the integrity of safety-related structures was not compromised by the reported exceedance and that any future occurrences of ground water exceedances in the power block area should be reported. All subsequent ground water level elevations measured in excess of 109 feet MSL were reported to the staff.



LEGEND:

DW-4 101.6	Ground water dewatering well
MW-3 101.7	wells and estimated average p
OW-202 76.6	elevations based on measuren
115	Ground water elevation conto
	Tieback Wall Project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SCALE IN FEET
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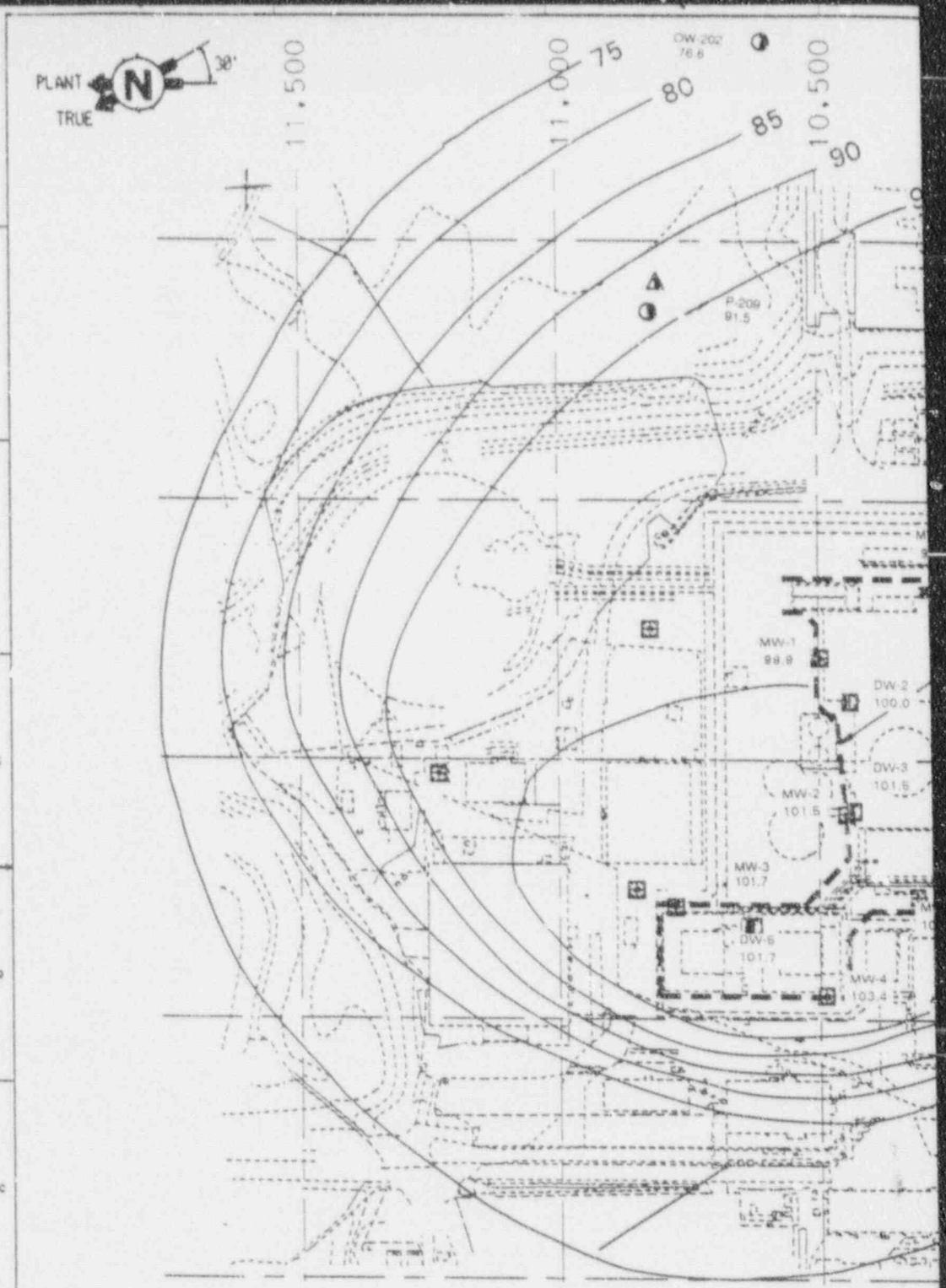

LEGEND:

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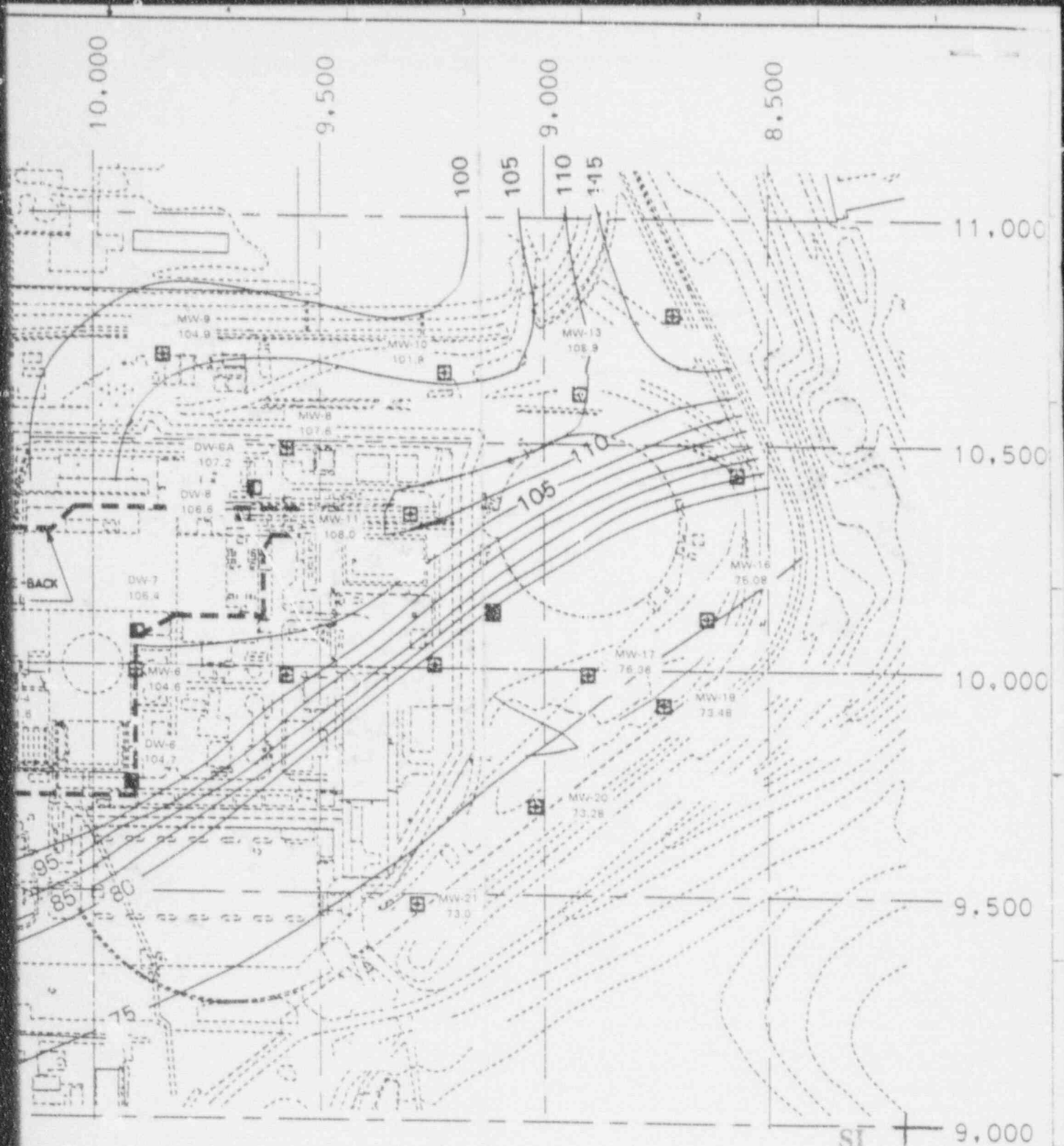
115	Ground water elevation conto
	Tieback Wall Project



nitoring wells, observation

onstruction ground water

taken on 11/09/90

ntour interval is 5 feet

0 100 200 300
SCALE IN FEET

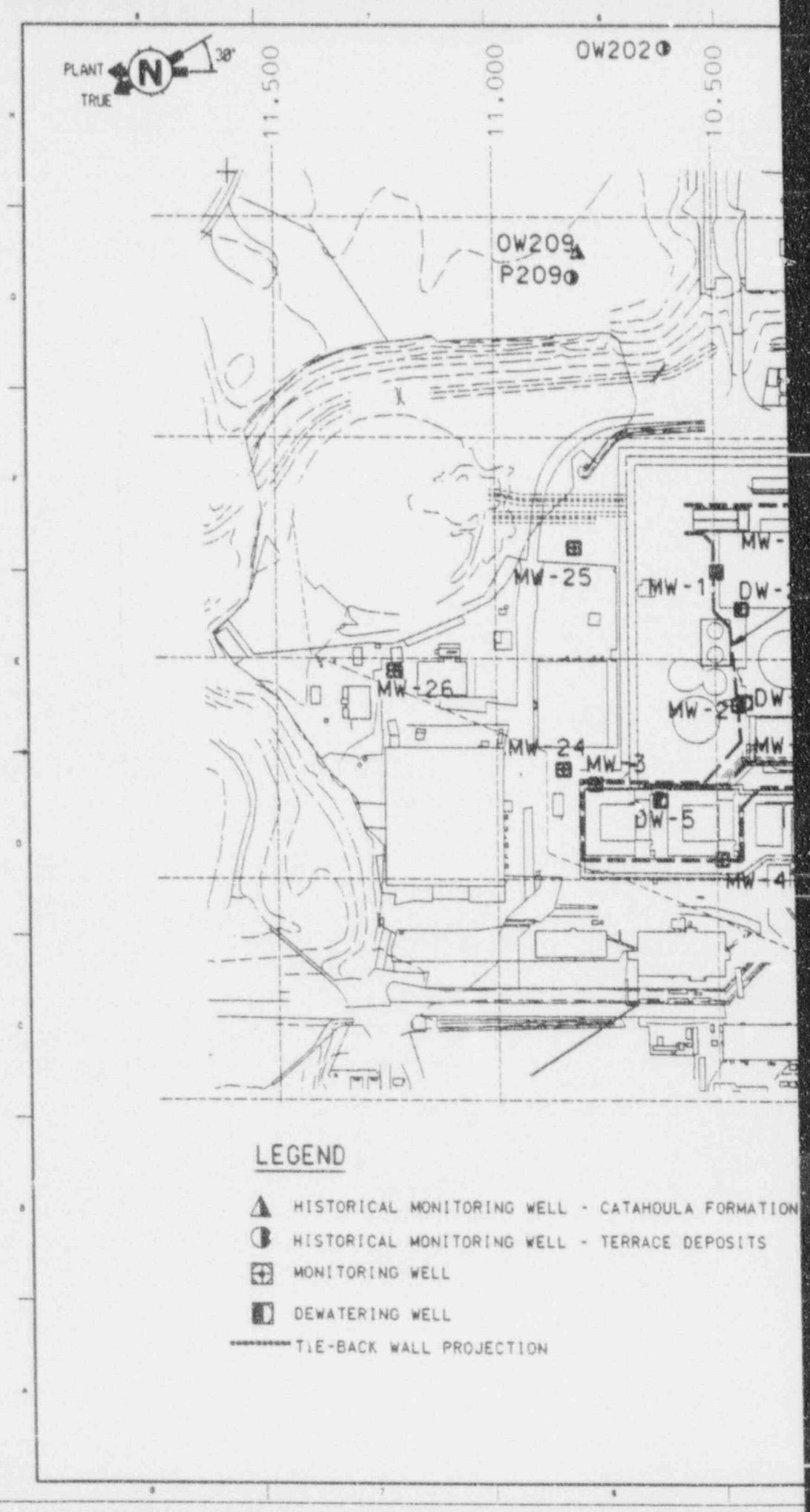
ENTERGY OPERATIONS, INC.
NUCLEAR PLANT ENGINEERING

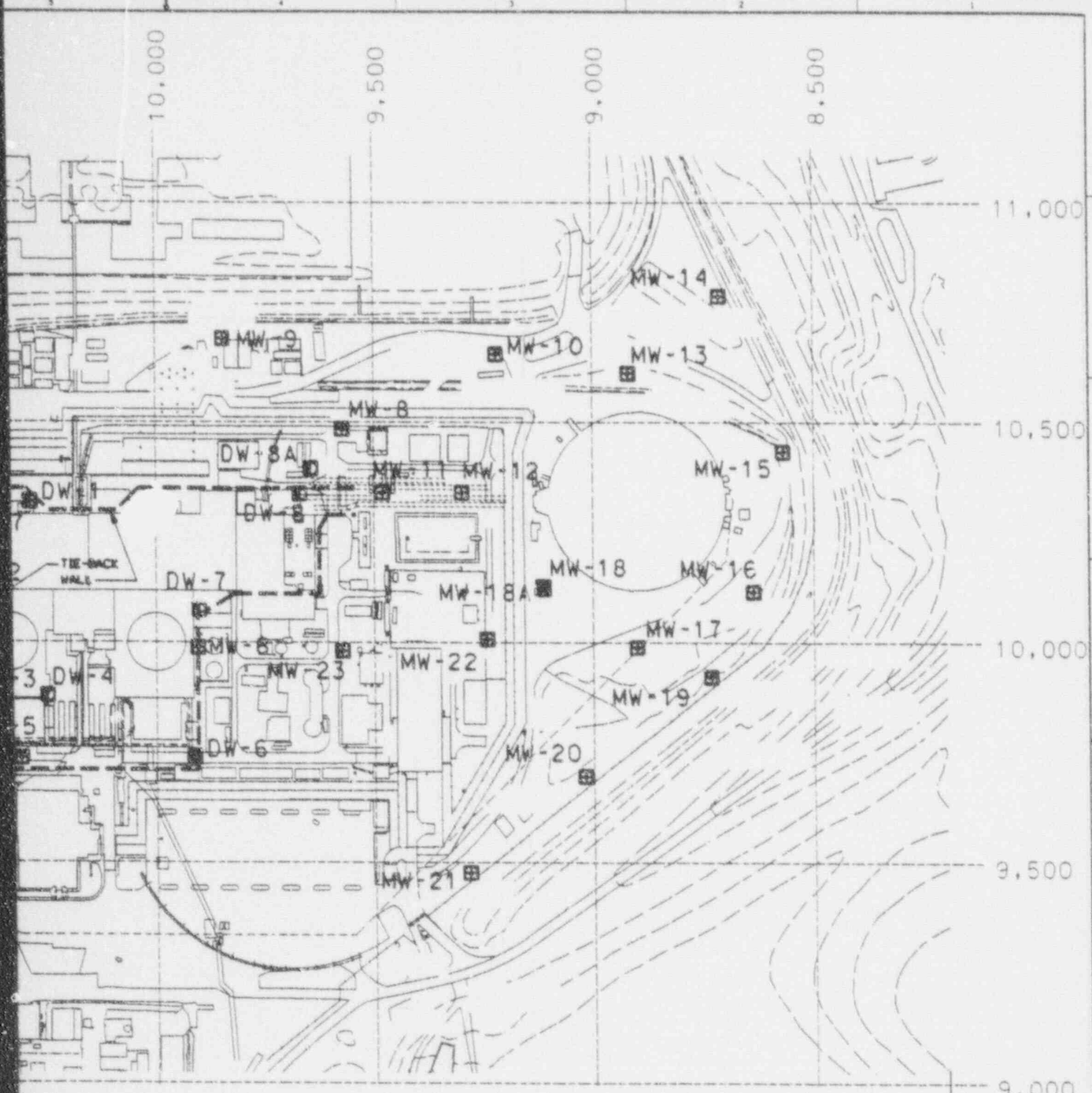
GRAND GULF GROUND WATER STUDY

AVERAGE
POST-CONSTRUCTION
GROUND WATER ELEVATIONS

FIGURE 2

9205050005-01


PLANT
TRUE
N
30°
11,500
11,000
10,500
OW202
OW209
P209
MW-25
MW-1
MW-26
MW-24
MW-3
DW-5
MW-4
LEGEND
HISTORICAL MONITORING WELL - CATAHOULA FORMATION
HISTORICAL MONITORING WELL - TERRACE DEPOSITS
MONITORING WELL
DEWATERING WELL
TIE-BACK WALL PROJECTION



1. REFERENCE DRAWINGS:
C-0013C (REV.15)-
SITE & YARD WORK CW PIPE, TRANS,
COND STM TANKS EXCAVATION, OBSERVATION &
DEWATERING WELL PLAN (TIE-BACK WALL PLAN)

0 100 200 300
SCALE IN FEET

ENTERGY OPERATIONS, INC.
NUCLEAR PLANT ENGINEERING

GRAND GULF GROUND WATER STUDY

PLANT SITE
WELL PLAN

SCALE: | FIGURE 1 | REV.

9205050005-02