Nuclear Operating Company
South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

November 1, 2010
U7-C-STP-NRC-100244

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

South Texas Project
Units 3 and 4
Docket Nos. 52-012 and 52-013
Response to Request for Additional Information

Reference: Letter, Scott Head to Document Control Desk, "Response to Request for Additional Information," dated August 30, 2010, U7-C-STP-NRC-100195 (ML102450252)

Attached are STP Nuclear Operating Company revised and supplemental responses to RAI questions related to Combined License Application Part 2, Tier 2, Section 2.4S.12, "Groundwater." Responses to these RAI questions were previously submitted in the referenced letter. Attachments 1 and 2 provide the responses to the RAI questions listed below:

02.04.12-44, Revision 1 02.04.12-45, Supplement 1, Revision 1

When a change to the COLA is required, it will be incorporated into the next routine revision of the COLA following NRC acceptance of the RAI response.

There are no commitments in this letter.

If you have any questions, please contact me at (361) 972-7136, or Bill Mookhoek at (361) 972-7274.

D091
NRO

STI 32774213

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 11/1/10

Scott Head
Manager, Regulatory Affairs
South Texas Project Units 3 & 4

rhb

Attachments: 02.04.12-44, Revision 1
02.04.12-45, Supplement 1, Revision 1

cc: w/o attachments and enclosure except*
(paper copy)

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RAI 02.04.12-44, Revision 1

QUESTION:

To meet the requirements of 52.79(a) and assist staff in its analysis, additional information concerning the groundwater modeling and the influence of the flooded cells is required. Describe the potential influence of flooded cells in model results. The manually calibrated model (run 201) presents relatively large areas in the western and southern side of the model exhibit flooding (hydraulic head above the specified land surface). Where flooding of cells is indicated, are the model results reasonable given the hydrologic system?

REVISED RESPONSE:

Response is revised to clarify the source of the topography used in the groundwater model for those areas outside of the STP site boundary. This revised response replaces the original response.

The manually calibrated model (Run 201) does exhibit relatively large areas where the simulated heads are above the model topography along the western and southern portions of the model (Figure 1). Although there is some swamp land in the south portion of the model, the presence of the majority of "flooded cells" is not believed to be representative of the given hydrologic system based on the Blessing SE, TX (Reference 1) and Palacios NE, TX (Reference 2) Quadrangle 7.5 minute series topographic maps. Given the information provided by these two maps, the topographic representation used in Run 201 outside of the STP site boundary was re-evaluated, resulting in refinement to the topography used in the groundwater model. Further re-evaluation of the western general head boundary (GHB) was conducted through a series of sensitivity analyses that resulted in eliminating the majority of the remaining flooded cells in the western part of the model domain.

In Run 201, the topography incorporated into the groundwater model for areas within the STP site boundary but outside the Main Cooling Reservoir (MCR) is based on aerial survey data. The topography for the areas outside the STP site boundary is based on U.S. Geological Survey National Elevation Dataset (NED) data; and the topography for the area inside the MCR is based on digitized elevation contours from pre-site construction. Considering the flooded cells occur outside of the STP site boundaries, only the topographic representation obtained from the NED was further evaluated.

The NED data used to represent the topography outside of the STP boundary in Run 201 had a resolution of 1 arc second (approximately thirty meter resolution) (Reference 3). The NED currently has a resolution of 1/9 arc second (approximately three meter resolution) topography data for the Matagorda County area (Reference 4). This updated NED data has a greater resolution than the NED data used to represent the topography outside of the STP boundary in Run 201. The 1/9 arc second NED data, which was not available when the Run 201 groundwater model was developed, was used to refine the topographic representation of the areas outside of the STP site boundaries in the groundwater model.

The examination and refinement of the model topography were performed as part of a sensitivity analysis, which is summarized in the response to RAI 02.04.12-40. The results of the sensitivity analyses performed and the evaluation of the updated model topography to evaluate the flooded cells in model Run 201 are discussed below.

The differences in surface elevation between the new topography (201NewTopo) and the old topography of Run 201 are displayed in Figure 2. Surface elevations between the two models are similar where the elevation differences are shown in white. However, areas across the model domain exist where the surface elevations are different in the two models as shown by the color gradations. These areas are attributed to the difference in the NED topography datasets. In addition, Figure 2 shows elevation differences within the boundary of the MCR and to the north of STP Units 1 & 2 and STP Units 3 & 4. During the sensitivity analysis, it was discovered that the splitting of the Strata A/B model layer in Run 201 unintentionally shifted the model topography surface at these areas. This shift in the topography was corrected for all sensitivity evaluations.

Topographic elevations range from one to six feet higher across the north, west, and south sides of the model domain outside of the STP property boundary in the "new" topography. An area of relative decrease in topographic elevation is evident in the northeast corner of Figure 2. This relative decrease occurs because a cut-off oxbow is represented in the "new" topography that was not captured by the original topographic data used in the Run 201 model. Table 1 presents the change in flooding observed in the groundwater model as a result of changing topography. This refinement alone eliminated roughly two-thirds of the area of flooded cells outside of the MCR as presented in Table 1. The updated topography, which was found to have no significant impact on the model calibration, was incorporated into the model as 201NewTopo and was used in place of Run 201 for subsequent sensitivity analysis runs.

After updating the off-site topography using the updated NED data, some areas along the western model boundary remained flooded. This suggested that the general head boundaries (GHBs) along the western edge of the model domain likely contributed to the remainder of the flooded cells. Consequently, the GHBs were the focus for further evaluation in a series of additional sensitivity analyses performed.

Two different sets of GHB representations were used in the sensitivity analyses to determine which boundary configuration minimizes the remaining flooded cells while maintaining or improving the model calibration statistics (see responses to RAI 02.04.12-40, RAI 02.04.12-45, Supplement 1, and RAI 02.04.12-47 for further discussion). The first set uses the original GHBs as described in the Groundwater Model Report (Reference 5). The second set of GHBs was produced by altering the distance and elevation of the specified heads used in the GHBs. The two sets of GHB values were combined during intermediate runs because the original GHB values represent influences from local sources of recharge and discharge, whereas the values used by the alternative GHB scenario represent influences from the regional flow regime. From these two sets of GHB conditions, seven model runs were executed for this sensitivity analysis. The updated off-site topography and GHB values have been incorporated into an updated groundwater model, referred to as Run 301, as discussed in the responses to RAI 02.04.12-40, RAI 02.04.12-45, Supplement 1, and RAI 02.04.12-47.

Based on the progressive alterations made to the GHB values along the western edge of the model during the sensitivity analyses, the flooding issues identified in this portion of the groundwater model were eliminated as shown in Figure 3. The few areas of flooding that remained are located in areas defined by the Blessing SE, TX and Palacios, TX topographic maps (References 1 and 2) as either marsh or swamp or submerged marsh or swamp, and are believed to be reasonable given the hydrologic system within the vicinity of the STP site. The modified GHB values along the western boundary slightly improved the calibration statistics compared to those from Run 201 while having limited impact on the overall model water balance. Therefore, based on the results of the GHB sensitivity analysis, the flooded cells had no significant influence on the groundwater modeling results and simulations presented for STP Units 3 & 4 in Run 201.

No COLA revision is required as a result of this RAI response.

References:

1) U.S. Geological Survey (USGS), 1995. Blessing SE Quadrangle, Texas-Matagorda Co., 7.5 Minute Series (Topographic).

2) U.S. Geological Survey (USGS), 1995. Palacios NE Quadrangle, Texas-Matagorda Co., 7.5 Minute Series (Topographic).

3) U.S. Geological Survey (USGS), 2007. USA 30-m National Elevation Dataset (NED) in ESRI RASTER GRID Format, Purchased on a Portable Hard-Drive from Digital Data Services, Inc., on May 22, 2007.

4) U.S. Geological Survey (USGS), 2009. "Jackson, Matagorda and Victoria Counties, Texas, 2007, 1/9 Arc Second National Elevation Dataset".

5) STPNOC Letter No. U7-C-STP-NRC-090206, "Supplemental Response to Requests for Additional Information," dated November 30, 2009, Attachment 2, "Groundwater Model Development and Analysis for STP Units 3&4."

Table 1. Comparison of flooded areas between runs 201 and 201NewTopo

Description	201	201NewTopo
Area of Dry Cells (sq. ft.)	230,228,000	228,249,750
% of model area covered by dry cells	11.9	11.8
Area of flooded cells (sq. ft.)	597,070,700	410,754,250
% area covered by flooded cells	30.8	21.2
Area flooded outside of MCR (sq.ft.)	285,413,450	99,097,000
% of area outside of MCR covered by flooded cells	17.6	6.1

Notes:

The area of the dry cells are primarily along the MCR Embankment and the northeastern portion of the model domain (further explained in the response to RAI 02.04.12-43).

The area of flooding outside of the MCR includes the river cells.

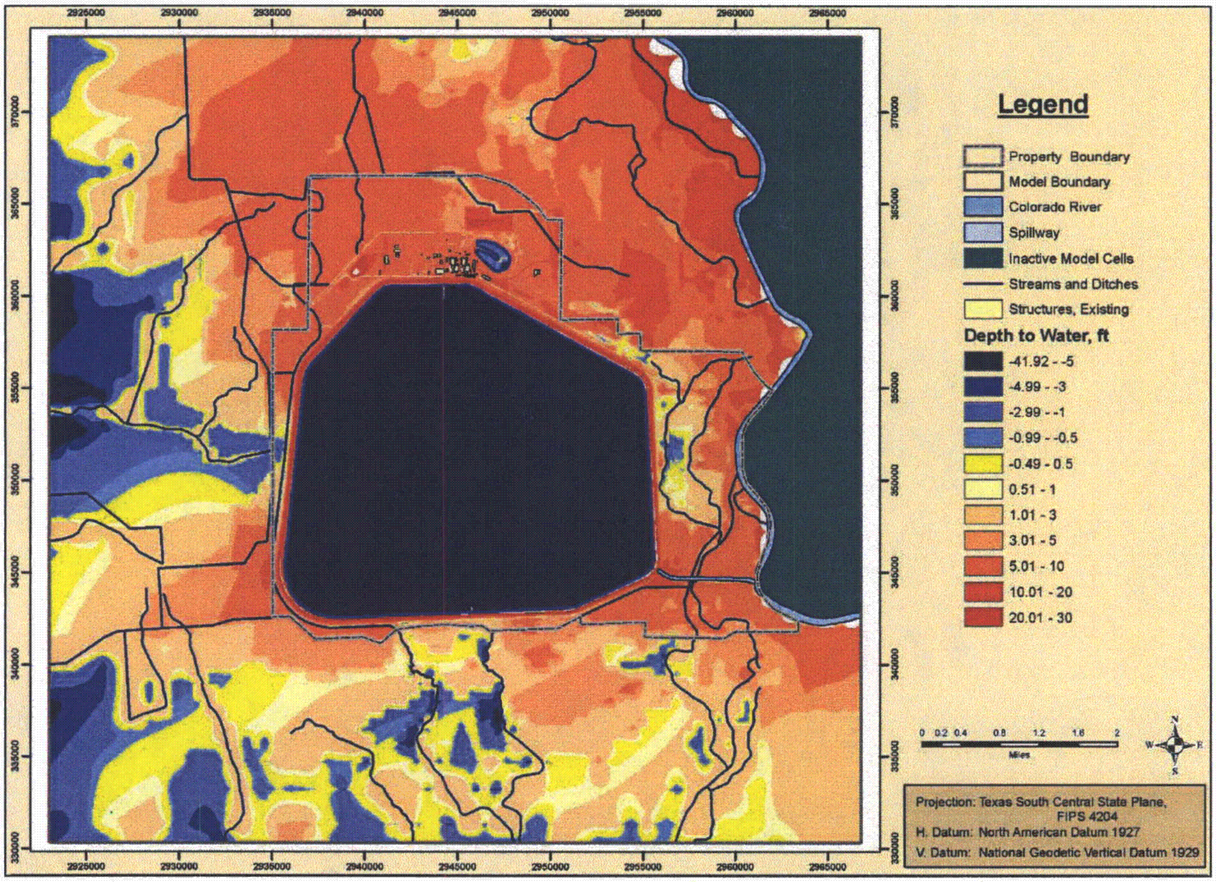


Figure 1: Run 201 areas of "flooded cells" shown by areas of negative depth to water.

(Negative depth to water shown in blue to yellow color range.)

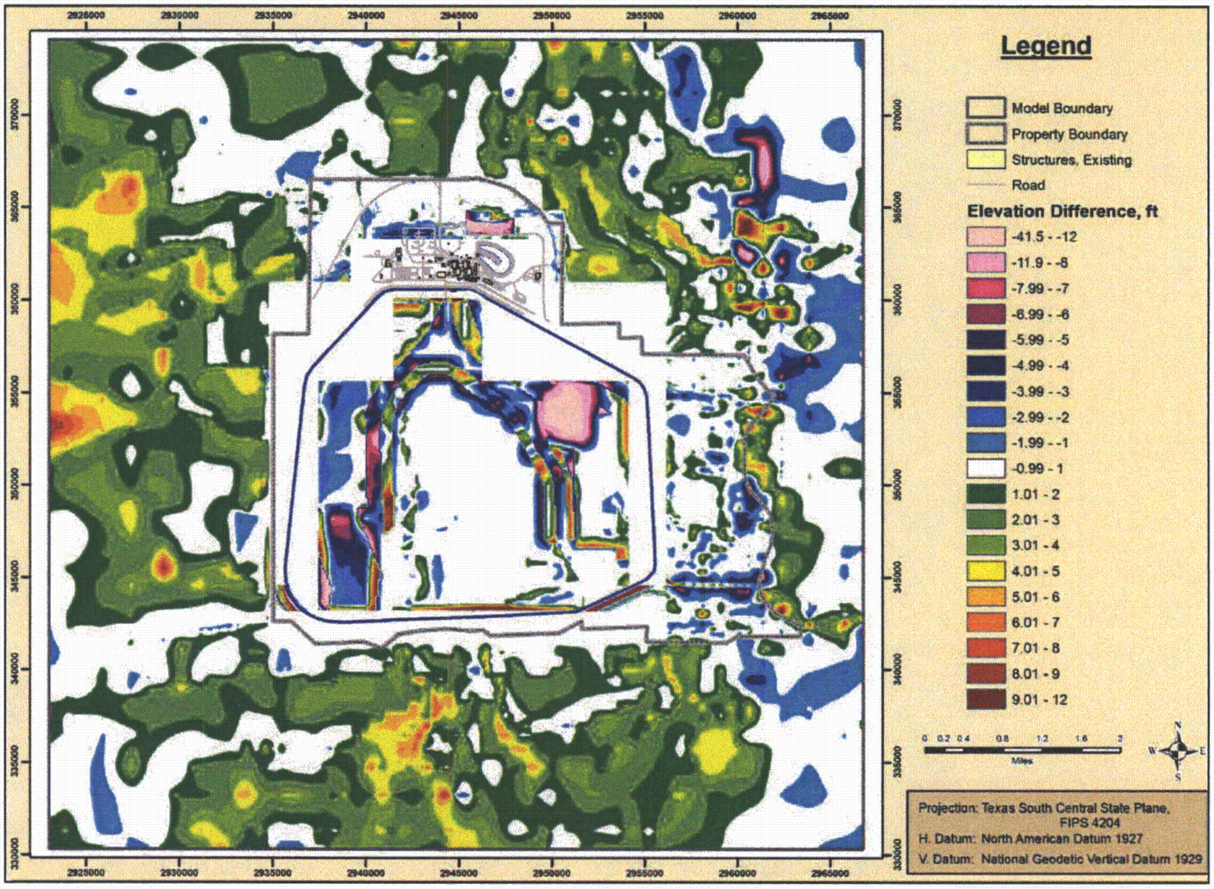


Figure 2. Difference in surface elevation between *run* 201 and 201NewTopo.

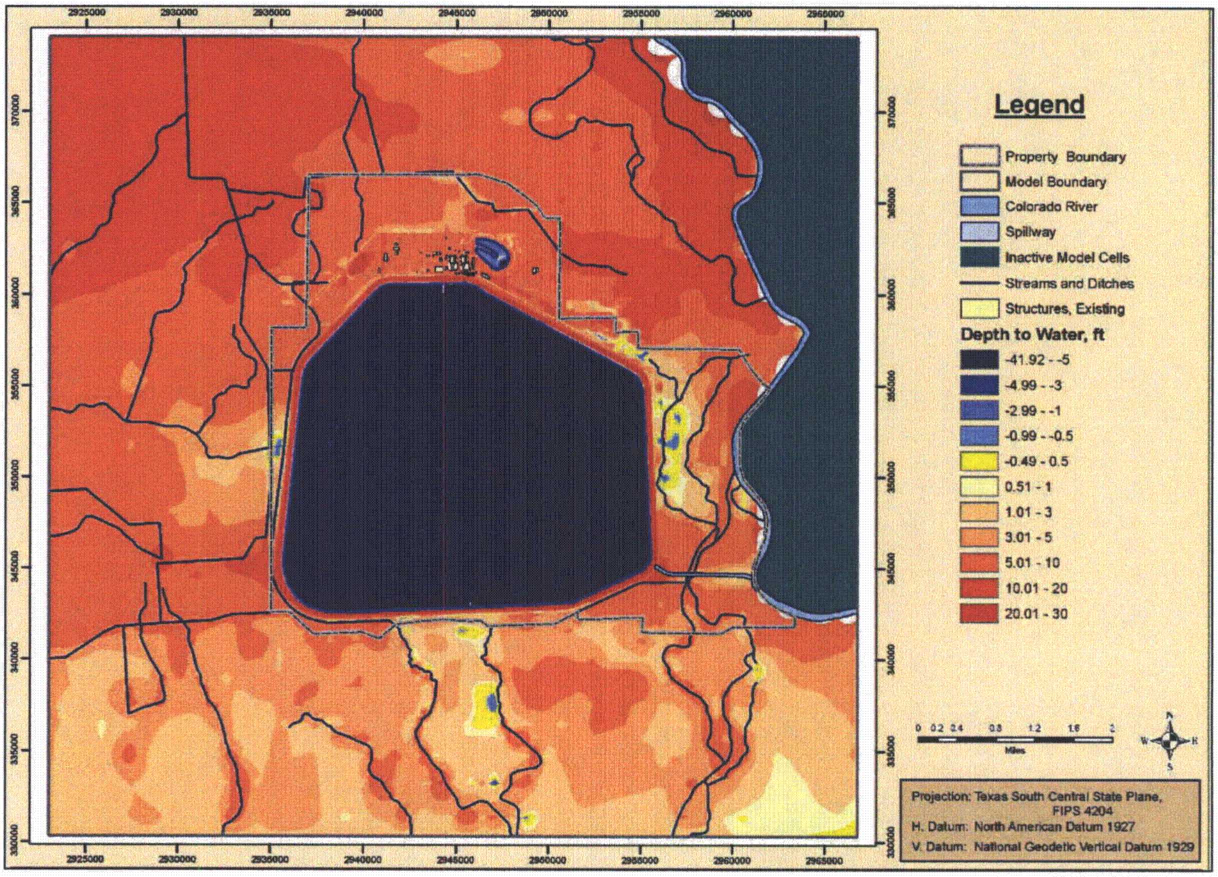


Figure 3. Depth to groundwater following refinements to model topography and general head boundary conditions.

Note: The few areas of flooding shown in Figure 3 are located in areas generally defined by the Blessing SE, TX and Palacios, TX topographic maps as either marsh or swamp or submerged marsh or swamp (References 1 and 2).

RAI 02.04.12-45, Supplement 1, Revision 1:

QUESTION:

To meet the requirements of 52.79(a) and assist staff in its analysis, additional information concerning the groundwater modeling is required. Staff requests additional information for the groundwater model results and the bands of piezometric contours. The manually calibrated model (run 201) exhibits several rectangular bands of piezometric contours at locations on the south and west sides of the model domain in Layers 1&2. Describe whether these model results are reasonable, or whether they indicate model configuration issues with the drain boundary conditions (e.g., surface elevation, drain boundary conditions)?

REVISED RESPONSE TO SUPPLEMENT 1:

This response is revised to clarify the source of the topography used in the groundwater model for those areas within and outside of the STP site boundary. This revised response replaces the original response.

This response supplements the initial response to RAI 02.04.12-45 (STPNOC Letter U7-C-STP-NRC-100107, dated May 17, 2010) to provide a further evaluation concerning the "several rectangular bands of piezometric contours" at locations on the south and west sides of the model domain in layer 1 and layer 2.

The initial response indicated that the "rectangular bands of piezometric contours" are produced by:

- Hydraulic head differentials between the assigned values of head in the drain boundary cells that simulate canals and ditches in model layers 1 and 2 and the computed head outside of the drain boundary cells;
- Relatively low horizontal hydraulic conductivity of model layers 1 and 2 that create steep hydraulic gradients; and
- Rectangular-shape grid cells.

The findings of this additional evaluation indicate that flooded cells found along the south and west sides of the model domain also contribute to the formation of the "rectangular bands of piezometric contours".

The initial response stated that the drain boundaries that represent canals and ditches lower the simulated heads in adjacent cells in model layers 1 and 2 from 10 ft to about 3 ft and from 5 ft to about 0.3 ft along the south domain, and from 22.5 ft to about 13 ft along the west domain. Further analysis of these head differences reveals that flooded cells, which occur along the west and south sides of the model domain (Figure 1), also play a role in the formation of the rectangular bands of piezometric contours. Figures 2 and 3 show the potentiometric surface of layer 1 and layer 2, respectively. Figure 1 shows the location of flooded cells where depth to groundwater is negative (blue to yellow color spectrum). Comparison of Figure 1 and Figure 2 shows the proximity of the flooded cells to the rectangular bands of piezometric contours.

A model sensitivity analysis was performed to assist in responding to the Groundwater Model RAIs received in RAI Letter No. 333. The process for development of the sensitivity analysis that supports this response is summarized in the response to RAI 02.04.12-40.

Evaluation of the cause of the flooded cells reveals that a coarsely resolved model topography and the general head boundaries along the model limits of the base model (Run 201) contribute more significantly to the formation of the flooded cells. The USGS National Elevation Database (NED) data used to represent the topography outside of the STP boundary in Run 201 had a resolution of 1 arc second (approximately thirty meter resolution) (Reference 1). The topography has now been replaced by a higher resolution NED 1/9 arc second (approximately three meter resolution) digital file (Reference 2) to better represent the model topography outside of the STP site boundaries. The specified heads for the western general head boundaries in layer 3 (stratum C) were also reset to 6 ft MSL, which was lower than the prescribed head in the base model (Run 201), to eliminate or reduce the presence of flooded cells. This specified head value for the western-most general head boundary was obtained from the water surface elevation of the Tres Palacios River (a hydraulic boundary), located about 9,650 ft west of the model boundary. Drain cells representing the canals and ditches were also evaluated, but were found to play a less significant role in the formation and elimination of the flooded cells. These changes, along with others, were incorporated into a revision to the base model designated as Run 301. Run 301 was verified against the September 2008 data and also against February and March 2003 data. Calibration statistics and residuals for Run 301 were similar to that in Run 201.

After adjusting the above model input criteria, flooded cells were essentially eliminated. Figures 4 and 5 show the potentiometric surface of layer 1 and layer 2, respectively, as a result of the revision to the base model described above. Based on the evaluation of the flooded cells, the appearance of "rectangular bands" of piezometric contours is eliminated in certain areas and minimized in other areas. As a consequence of the readjustment of the model topography and refinement of the general head boundaries, the model generated heads are now slightly lower in some areas than the drain elevations. In addition, the large gradient, which was observed in Run 201, that caused the "rectangular bands" around the drain cells are now minimal. Thus, the resulting potentiometric surface contour lines shown in Figures 4 and 5 are more reasonable and appropriate for the conditions on which this model is based and do not indicate model configuration issues with the drain boundary conditions (e.g., surface elevation, drain boundary conditions). No further evaluations concerning the rectangular bands of piezometric contours are anticipated based on the findings from the flooded cell analysis.

No COLA revision is required as a result of this RAI response.

References:

1. U.S. Geological Survey (USGS), 2007. USA 30-m National Elevation Dataset (NED) in ESRI RASTER GRID Format, Purchased on a Portable Hard-Drive from Digital Data Services, Inc., on May 22, 2007.

2. U.S. Geological Survey (USGS), 2009. "Jackson, Matagorda and Victoria Counties, Texas, 2007, 1/9 Arc-Second National Elevation Dataset".

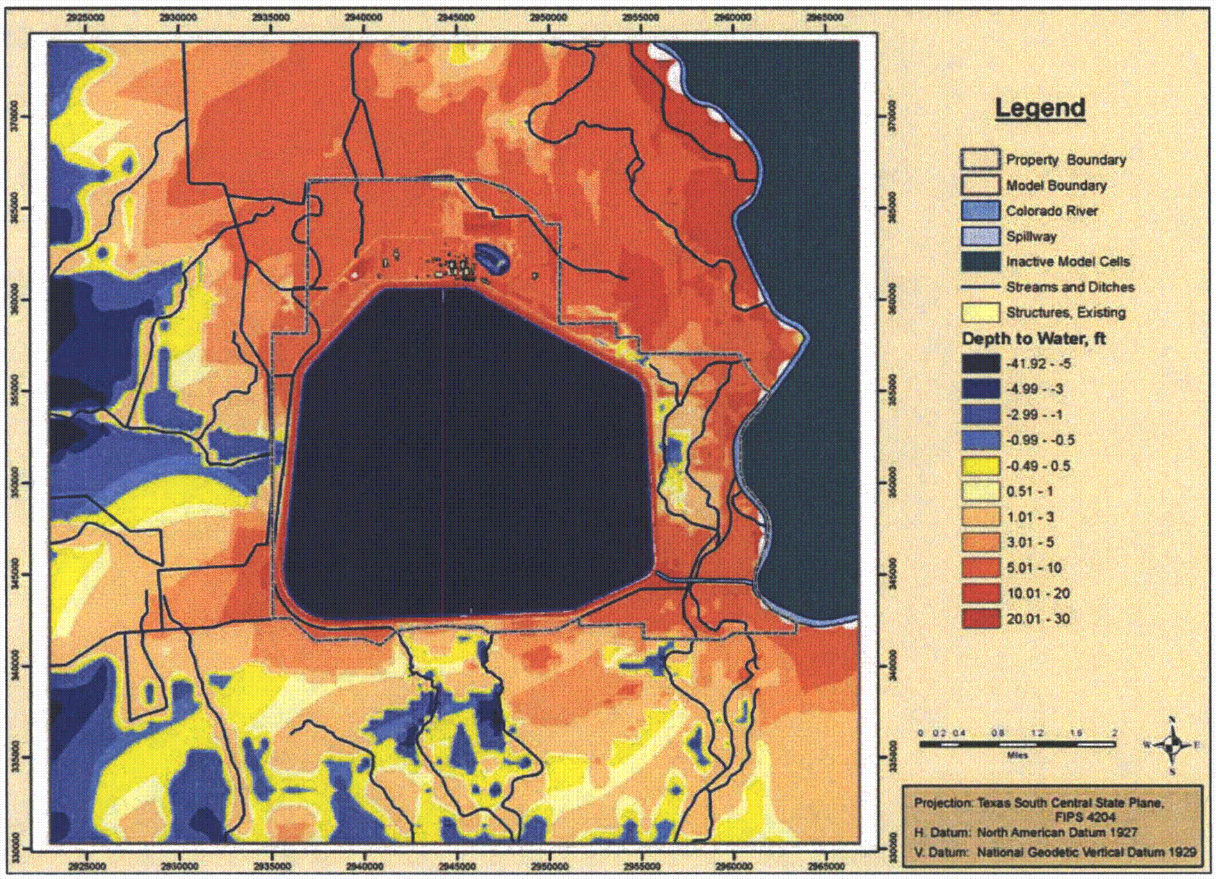
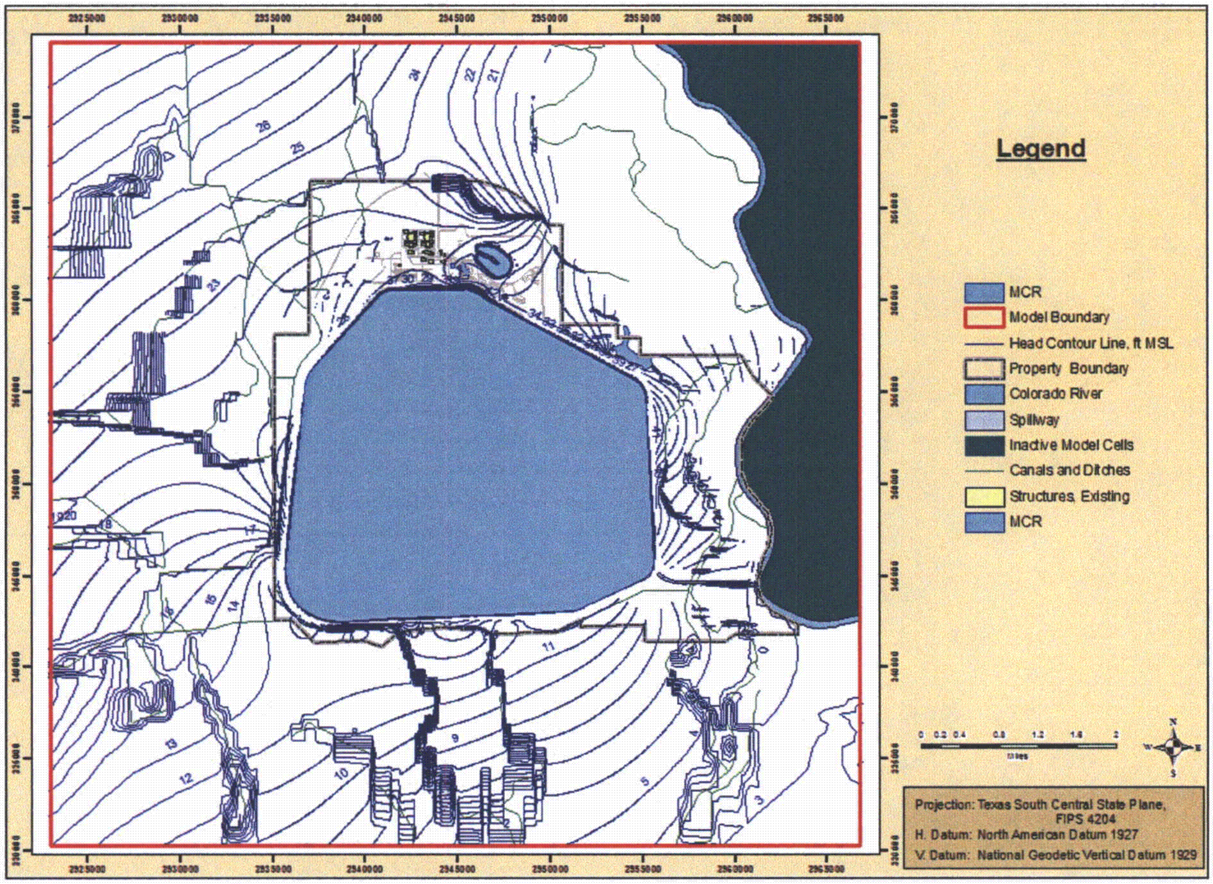


Figure 1. Location of flooded cells in Run 201.



Note: Areas where contour lines abruptly end denote dry cells.

Figure 2. Head contours in layer 1 (Stratum A/B) Run 201.

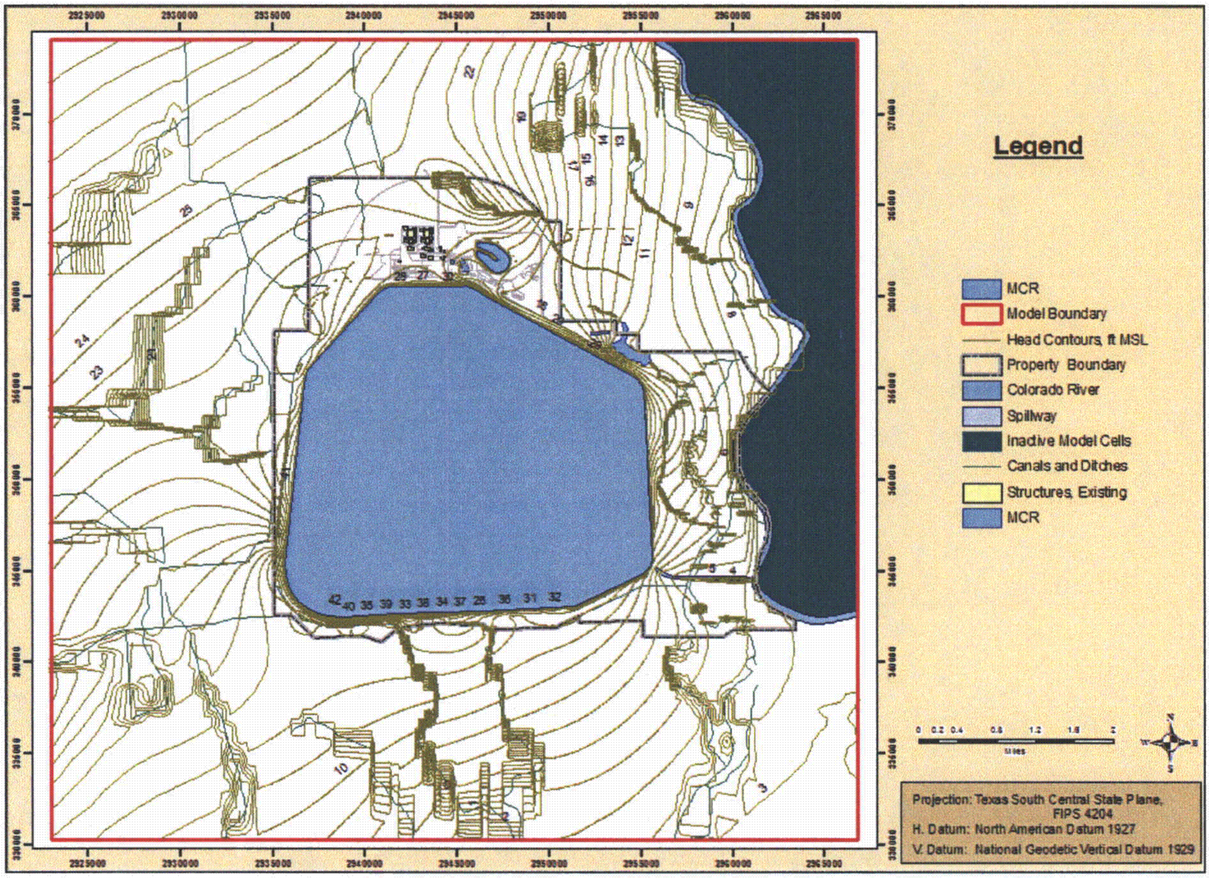
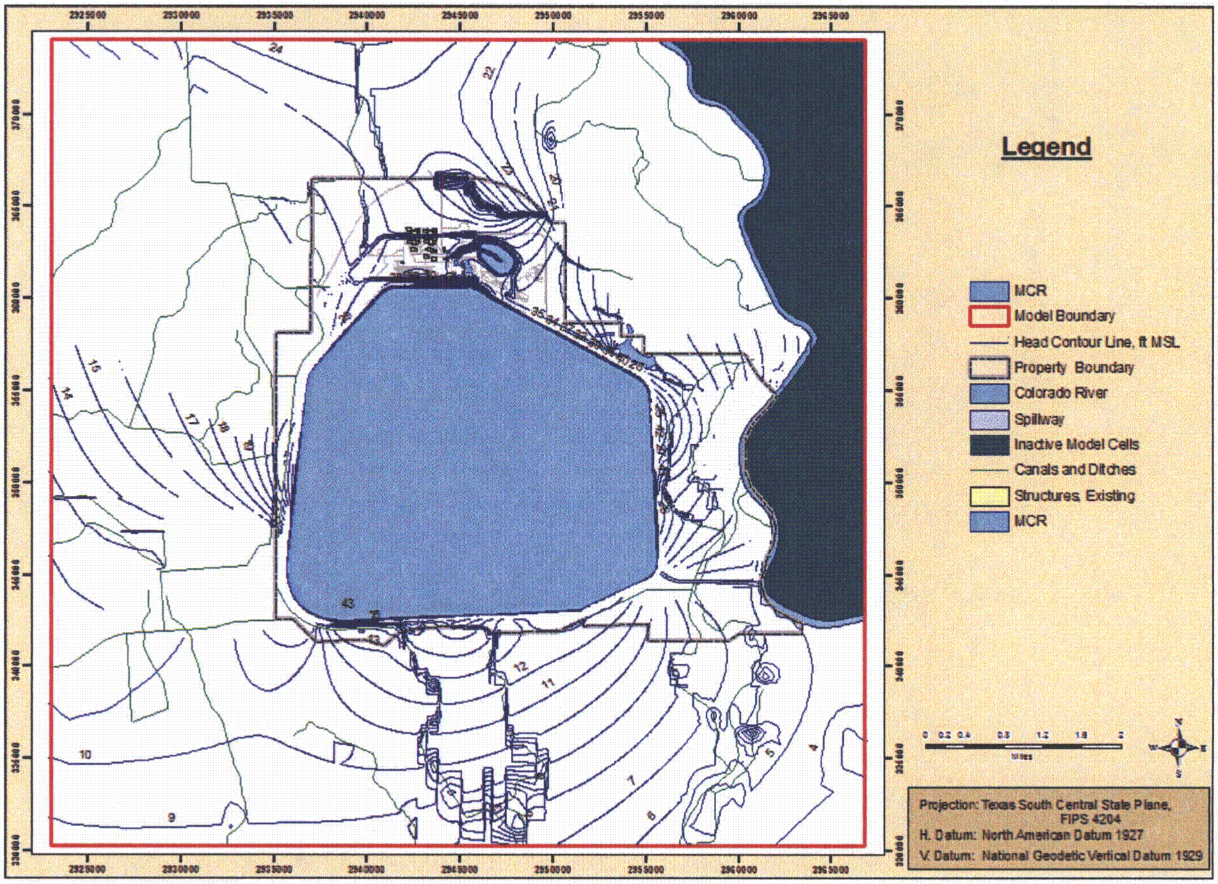


Figure 3. Head contours in layer 2 (Stratum A/B) Run 201.



Note: Areas where contour lines abruptly end denote dry cells.

Figure 4. Head contours in layer 1 (Stratum A/B) Run 301.

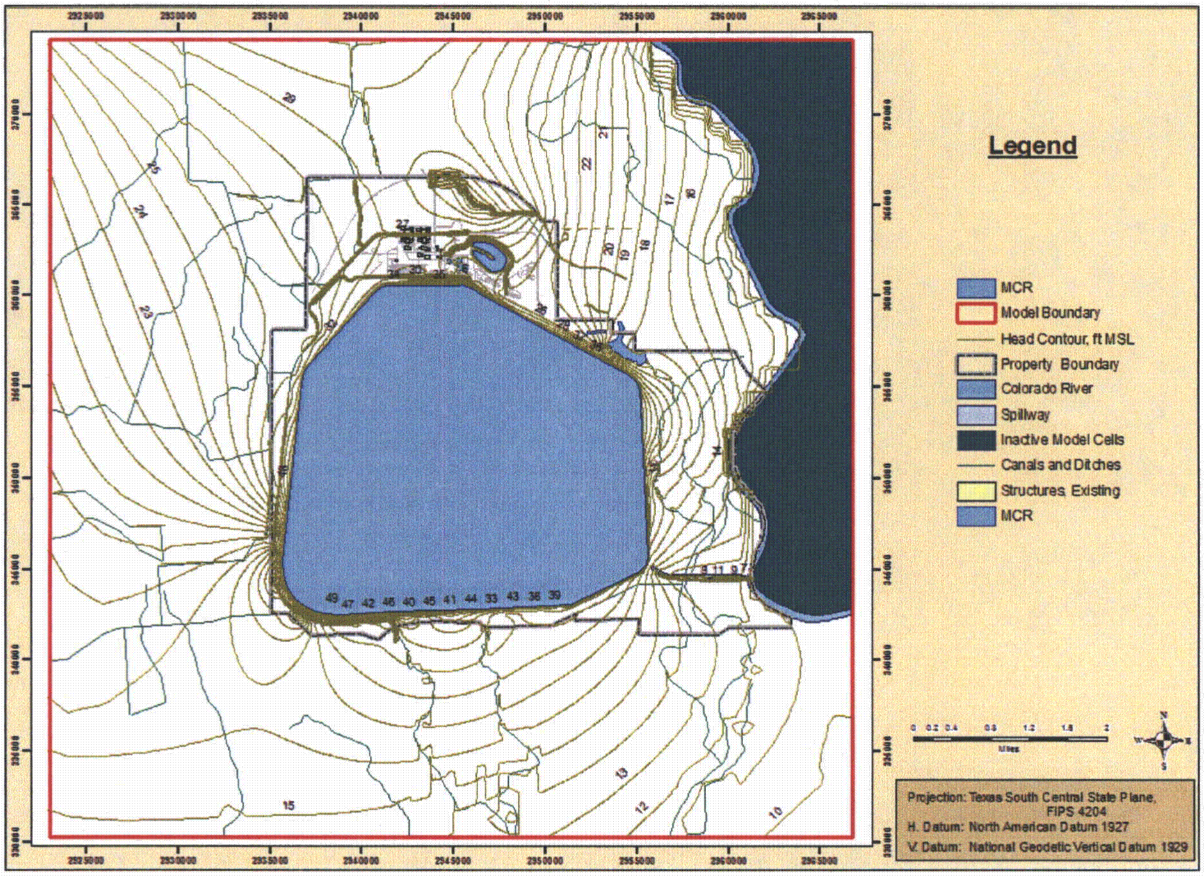


Figure 5. Head contours in layer 2 (Stratum A/B) Run 301.