Exelon. Generation

NP-11-0021
June 2, 2011

10 CFR 52, Subpart A

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Exelon Nuclear Texas Holdings, LLC
Victoria County Station Early Site Permit Application
Response to Request for Additional Information Letter No. 08
NRC Docket No. 52-042

Attached are responses to NRC staff questions included in Request for Additional Information (RAI) Letter No. 08, dated April 19, 2011, related to Early Site Permit Application (ESPA), Part 2, Sections 02.03.02, 02.04.03, 02.04.12, and 02.04.13. NRC RAI Letter No. 08 contained fourteen (14) Questions. This submittal comprises a partial response to RAI Letter No. 08, and includes responses to the following two (2) Questions:

02.04.12-5
02.04.12-6

When a change to the ESPA is indicated by a Question response, the change will be incorporated into the next routine revision of the ESPA, planned for no later than March 31, 2012.

Of the remaining twelve (12) RAIs associated with RAI Letter No. 08, responses to nine (9) Questions were submitted to the NRC in Exelon Letter NP-11-0017, dated May 18, 2011. The response to RAI Question 02.04.12-8 will be provided by July 18, 2011. The response to RAI Questions 02.04.12-2 and 02.04.13-1 will be provided by August 17, 2011. These response times are consistent with the response times described in NRC RAI Letter No. 08, dated April 19, 2011.

Regulatory commitments established in this submittal are identified in Attachment 3.

If any additional information is needed, please contact David J. Distel at (610) 765-5517.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 2nd day of June, 2011.

Respectfully,

Marilyn C. Kray

Marilyn C. Kray
Vice President, Nuclear Project Development

Attachments:
1. Question 02.04.12-5
2. Question 02.04.12-6
3. Summary of Regulatory Commitments

cc: USNRC, Director, Office of New Reactors/NRLPO (w/Attachments)
USNRC, Project Manager, VCS, Division of New Reactor Licensing (w/Attachments)
USNRC Region IV, Regional Administrator (w/Attachments)

RAI 02.04.12-5:

Question:

In accordance with the requirements of 10 CFR 100.20(c) "Factors to be considered when evaluating sites" relating to hydrology and, 10 CFR 52.79(a) "Contents of applications; technical information in final safety analysis report" relating to hydrologic characteristics of the proposed site, and as recommended by Standard Review Plan 2.4.12 "Groundwater" acceptance criteria, the NRC Staff requests that the Applicant provide: (1) A detailed description of how various site specific hydro-lithologic units were defined, particularly the distinction between the upper shallow and lower shallow aquifer units subdividing the Chicot aquifer; and (2) A discussion of the importance or influence of holes in confining units beneath the footprint of the site and cooling basin on vertical groundwater gradients and movement during post-construction.

Response:

The response to RAI 02.04.12-5 provides a description of the subsurface investigation completed at the VCS site, the results of which provide the basis for defining the hydro-lithologic units. The discussion includes justification for subdividing the Chicot aquifer at the VCS site into a series of inter-layered aquifer and confining units, based on several lines of evidence. The locations of windows in the confining units separating the subdivided aquifer units are identified and their significance in relation to post-construction groundwater flow is discussed.

The response to RAI 2.4.12-5 provides two hydrogeologic cross-sections: BB-BB' and HH-HH' (SSAR Figures 2.4.12-31 and 2.4.12-32, respectively). These hydrogeologic cross-sections demonstrate that the various sand units at the site form discrete aquifer zones with contrasting potentiometric levels and provide justification for subdivision of the Chicot aquifer at the VCS site. The response to RAI 2.4.12-6 provides two additional hydrogeologic cross-sections: E-E' and G-G' (SSAR Figures 2.4.12-26b and 2.4.12-26c, respectively).

Cross-sections BB-BB' and G-G' both show the stratigraphy at soil boring B-2319 (where the cross sections cross each other) but with slightly different interpretations because of differing perspective due to different orientations of the cross-sections. The stratigraphic interpretation in BB-BB' is incorporated in the layering of the VCS numerical model because it provides better characterization of layering within the Deep aquifer, based on soil boring information. No significant differences in the stratigraphic interpretations appear on the other cross sections, where they cross each other.

SSAR Subsection 2.4.12.3.1.2 is revised as follows in response to RAI 02.04.12-5. Note that this subsection was formerly numbered 2.4.12.3.1.1, but was renumbered by the response to RAI 02.04.12-1, which inserted a new Subsection 2.4.12.3.1.1. The response to RAI 02.04.12-5 adds two new subsections to SSAR Subsection 2.4.12.3.1.2: Subsection 2.4.12.3.1.2.1 responds to part 1 of the request for additional information, and Subsection 2.4.12.3.1.2.2 responds to part 2 of the request.

Associated ESPA Revisions:

2.4.12.3.1.2~~1~~ Groundwater Model Development

Hydrogeologic information for the VCS site was obtained primarily from the site subsurface investigation program and regional publications and databases to develop a stratigraphic model of the Chicot Aquifer within the area of the VCS site. Regional groundwater data and VCS site groundwater level measurements ~~for~~ were used as calibration targets for the groundwater model.

The Chicot Aquifer is subdivided into three saturated sandy zones: the Upper Shallow aquifer, the Lower Shallow aquifer, and the Deep aquifer. Additionally, a sand layer designated Sand 1 exists above the saturated zone beneath the cooling basin. These sand units are separated by less permeable layers of clayey materials. ~~Site borehole log data and borehole geophysical logs were combined with off-site TWDB driller's logs to develop a stratigraphic model of the area. The stratigraphic interpretations were used to create kriged surfaces for each model layer. Where a layer was missing, a thickness of 1 foot was assigned to the layer, and the properties of the underlying layer were used.~~

Eleven layers were chosen to represent the components of the Chicot Aquifer.~~:~~ These layers correspond to geotechnical layers and hydrogeologic units identified by the subsurface investigation as follows: Sand 1~~,~~ (unsaturated) corresponds to model layer 2; Sand 2 (the Upper Shallow~~,~~ aquifer) corresponds to model layer 4; and Sand 4 (the Lower Shallow~~,~~ aquifer) corresponds to model layer 6. Sand 5, Clay 5-bottom and Sand 6 (collectively the Deep aquifer~~s~~) correspond~~s~~ to ~~(~~model layers ~~2, 4, 6,~~ 8, 9 and 10. ~~[layers 8 and 10 represent the Deep aquifer]) and~~ Model layers 1, 3, 5, and 7 correspond to the ~~and the~~ inter-fingering clay layers between these aquifer units. ~~(model layers 1, 3, 5, 7, 9, and 11) based on the borehole data~~. The bottom model layer (layer 11) is comprised of Clay 7, Sand 8, Clay 9 and Sand 10. The geotechnical layers are further described in SSAR Subsection 2.5.4.

2.4.12.3.1.2.1 Description of Hydro-lithologic Units

The various hydro-lithologic units included in the VCS conceptual model were defined based on the results of a detailed subsurface investigation at the VCS site. The initial subsurface investigation included obtaining samples and data from over 150 soil borings, 27 pairs of observation wells and 2 well clusters each containing a test well and 4 nearby observation wells. The investigation was conducted within and around the power block area and in the area of the cooling basin. Sixty-five cone penetration tests (CPTs), geophysical logging, and laboratory testing were also performed for the subsurface investigation. A supplemental investigation included drilling an additional 94 borings and performing 12 additional CPTs as well as geophysical logging and laboratory testing. Soil samples were collected from the soil borings using standard penetration test (SPT) procedures and were visually examined and logged in the field by a geologist or geotechnical engineer. The number of hammer blows required to advance the soil sampler for each SPT was recorded. Soil index tests to determine grain-size distribution were completed on a total of 706 soil samples. The data produced by these investigative activities is provided in Part 5 of the ESP application.

The soil sample descriptions, sampler blow counts, soil index test results, cone penetrometer measurements, borehole geophysical logs, observations of soil cuttings, rate of loss of drilling fluid to the formation, rig behavior, and rate of advancement as drilling proceeded were all used to determine the depths in each boring at which changes in soil type occurred. Based on these depths and the surveyed elevations of ground surface at each soil boring and cone penetrometer sounding, a series of geotechnical cross-sections was constructed to provide an interpretation of the stratigraphy underlying the site. These cross-sections are provided in Subsection 2.5.4.

In addition, driller's logs obtained from the Texas Water Development Board of 72 water wells in the vicinity of the VCS site were used to assist in interpretation of the stratigraphy near the site. The elevations of the bottom of each soil layer noted in these well logs were correlated with those from onsite soil borings and cone penetrometer soundings to extend several cross-sections offsite and construct additional regional cross-sections that extend across the domain of the VCS numerical model. The locations of these cross-sections are shown on Figure 2.4.12-26a.

The cross-sections provide a conceptual model of the stratigraphy beneath the VCS site and its vicinity. This stratigraphic conceptual model provides the basis for interpolating elevations of the bottom of each soil stratum. The interpolated strata elevations were used to prepare contour maps representing the bottom of each layer in the numerical model. Where strata are absent, the bottom elevation of the corresponding model layer was arbitrarily set to 1 foot below the bottom elevation of the overlying layer. The hydraulic properties of this layer were set to the properties of the underlying layer. Contour maps were prepared by kriging the elevation data and contouring them using contouring and 3D surface-mapping software. Contouring accuracy was verified by manually contouring the data and comparing the results to the maps generated by the contouring and 3D surface-mapping software.

Based on the analyses described above, the stratigraphy of the site and its vicinity is interpreted to be comprised of a sequence of discontinuous and interbedded strata consisting primarily of sand and clay. In many cases, the vertical transition from one stratum to the next is gradational and open to interpretation, as is the continuity of strata from one soil boring to the next. As discussed in Subsection 2.5.1.1.1.3, the depositional environment within which the local soils accumulated is interpreted to be that of coalescing fluvial deltas containing a complex overlapping series of braided stream, levee, lagoon, and overbank flood deposits. Sediments deposited in this environment would typically vary in grain size, sorting, and hydraulic properties both horizontally and vertically. These variations would occur because of changes over time in the locations of stream meanders and distributaries related to the changing position of the Gulf of Mexico shoreline and the energy available for transporting sediments related to changes in stream flow.

The hydro-lithologic units simulated by the VCS numerical model were defined based on the following investigations and findings. Pairs of observation wells were drilled at 27 locations across the VCS site. The wells in each pair were completed with 10-foot long screens, each in different sand strata. Hydrogeologic cross-sections BB-BB' and HH-HH' (Figures 2.4.12-31 and 2.4.12-32, respectively) show the approximate elevations of well screens within the various sand strata at a total of six observation well pairs. These cross-sections also show the potentiometric head measured in each observation well on February 18, 2008, and the inferred direction of the vertical groundwater gradient, based on differing heads in the sand strata within which each well screen is completed.

Figure 2.4.12-17 contains several hydrographs, each showing a time series of the potentiometric heads in an observation well pair, including those well pairs shown on cross-sections BB-BB' and HH-HH'. The hydrographs demonstrate a generally consistent vertical potentiometric gradient between the upper and lower screen zones in each well pair. The difference in potentiometric head between the sand strata in Figures 2.4.12-31 and 2.4.12-32 in which the well screens are completed provides evidence that the sands are to some extent hydraulically isolated from each other by the intervening strata comprised predominantly of silt and clay. These finer-grained strata are interpreted to be confining layers acting as aquitards, while the sand strata are interpreted to be aquifers.

This finding forms the basis for subdividing the Chicot Aquifer at the VCS site into the Upper Shallow, Lower Shallow, and Deep aquifer zones. These aquifer zones are represented in the VCS numerical model by Sand 2 (layer 4), Sand 4 (layer 6), and Sands 5 and 6 (layers 8 and 10), respectively. Estimates of the hydraulic properties of the aquitards and aquifers are discussed in Subsection 2.4.12.2.4.

Figure 2.4.12-15 provides a series of potentiometric surface maps for the Upper Shallow, Lower Shallow, and Deep aquifer zones at quarterly intervals over the 18-month period from February 2008 to August 2009. Comparison of the maps showing potentiometric surfaces of the three aquifer zones on the same date reveals significant differences in the horizontal hydraulic gradients, particularly with respect to the Upper Shallow and Lower Shallow aquifer zones. Further, as indicated by the hydrographs in Figure 2.4.12-17, the potentiometric surface maps show that on the same date and at the same location on the VCS site, the elevation of the head in each aquifer differs significantly, especially between the Upper Shallow and Lower Shallow aquifer zones. These differences provide additional evidence that the sand strata interpreted on the hydrogeologic cross-sections in Figures 2.4.12-31 and 2.4.12-32 behave as discrete aquifer zones that can appropriately be divided into the Upper Shallow, Lower Shallow, and Deep aquifers.

The following additional lines of evidence support subdivision of the Chicot Aquifer at the VCS site:

- The results of slug tests and pumping tests (Tables 2.4.12-8 and 2.4.12-9, respectively) show that the hydraulic conductivities of the Upper Shallow, Lower Shallow, and Deep aquifer zones differ significantly.
- During the 24-hour pumping test completed in the Deep aquifer, groundwater levels were monitored in a nearby observation well completed in the Lower Shallow aquifer. The results of that testing, provided in part 5 of the ESP application, indicate that there was no water-level response in the Lower Shallow aquifer, and therefore, the Lower Shallow and Deep aquifers are hydraulically isolated in the area of the test.
- Other investigators, including Haug et al. (Reference 2.4.12-28), have also subdivided the upper Chicot Aquifer in their numerical groundwater model of an area of Port Arthur, Texas.

2.4.12.3.1.2.2 Discussion of the Influence of Windows in Confining Units

The confining units of most interest throughout the VCS site are Clay 1-top (layer 1 in the VCS numerical model), Clay 1-bottom (layer 3), Clay 3 (layer 5), and Clay 5-top (layer 7). A geotechnical description of these clay layers is presented in Subsection 2.5.4. The incorporation of site stratigraphy into the numerical groundwater model is further discussed in Appendix 2.4.12-C. Table 2.4.12-18 summarizes the locations on the VCS site where one or more of the confining units are absent.

Clay 1-top was identified at all sample locations within the power block area, based on a summary of the bottom elevations of each stratum identified in the 73 soil borings and 28 cone penetrometer soundings completed in the power block area. The apparently continuous coverage of Clay 1-top throughout the power block area suggests relatively uniform hydraulic properties of the shallow soils in the area of the power block.

The summary of strata bottom elevations in the power block area indicates that Clay 1-bottom is absent at three locations in the eastern part of the power block, potentially providing a window that places Sand 1 (layer 2) in contact with Sand 2 (layer 4). The power block area will be excavated to allow construction of foundations. The depth of the foundation excavation will be determined based on the reactor design chosen for the site.

In the groundwater numerical model, the deepest foundation in the eastern part of the power block is set at elevation –35 feet, which is approximately the bottom elevation of Sand 4 (layer 6) in this area (Figures 2.5.4-9 and 2.5.4-10). Therefore, the foundation excavation will completely remove Clay 1-top, Sand 1, Clay 1-bottom, Sand 2, Clay 3, and Sand 4 (and the three windows between Sand 1 and Sand 2) in the modeled eastern part of the power block area. Although SSAR Subsection 2.4.12.3.2.2, states that excavation for the building foundations in the power block area could extend to elevation –15 feet, the groundwater numerical model represents a more conservative scenario with respect to groundwater travel time because it would result in placement of relatively high permeability structural fill across the entire thickness of Sand 4 and a correspondingly shorter travel time for a hypothetical release of radionuclides flowing through Sand 4 to their down-gradient discharge point.

The foundations will be surrounded with structural fill with hydraulic conductivity greater than that of the native soils. Therefore, the fill will provide a hydraulic connection between Sand 1, Sand 2, and Sand 4 in the power block area. The effect of this hydraulic connection has been evaluated with the VCS numerical groundwater flow model by a particle-tracking analysis (Subsection 2.4.12.3.2). This analysis simulates the flow paths and travel times for transport of liquid effluents postulated to be released from the basement of radwaste buildings in the power block. The particle tracking analysis (Subsection 2.4.12.3.2.3) indicates that the postulated release will travel vertically downward within the structural fill until encountering Clay 5-top (layer 7) and then travel laterally to the east-southeast within the overlying Sand 4 where it eventually discharges into Linn Lake, the Guadalupe River, or the Victoria Barge Canal (Figure 2.4.12-C-35). The travel time to reach the closest VCS site boundary in this direction is discussed in Appendix 2.4.12-C.

Figure 2.4.12-33 shows 16 sample locations where Clay 1-top (layer 1) is absent, based on a summary of the bottom elevations of each stratum identified in the 53 soil borings and 27 cone penetrometer soundings completed in the cooling basin area. Eleven of the locations where Clay 1-top is absent are east of the cooling basin. In this area, ground surface elevations are generally lower than those within the footprint of the basin (Tables 2.5.4-37 and 2.5.4-41). Unnamed streams draining eastward into the Guadalupe River Valley have eroded the shallow soils and completely removed Clay 1-top in some areas east of the cooling basin. In these areas, the underlying Sand 1 is exposed at the ground surface. Near the escarpment at the west side of the river valley the channels of the unnamed streams are incised into Sand 1. The incised channels were denoted as drains in the VCS numerical model to remove excess groundwater that may seep into the channels under high water table conditions. Pre- and post-construction model runs (Appendix 2.4.12-C) indicate that the combined discharge from the seeps will increase from 0 (pre-construction) to 310 gallons per minute when the cooling basin is filled (Appendix 2.4.12-C, Table 2.4.12-C-8).

Of the 16 locations where Clay 1-top is absent, five locations are within the footprint of the cooling basin. These five locations are widely distributed over the central portion of the approximately 4,900-acre cooling basin, and the absence of this unit is inferred based on widely spaced discrete sample locations. It can be noted that permeameter testing completed in the vicinity of those five locations where Clay 1-top was absent in samples collected from soil borings indicates that the permeability of the shallow soil is generally less than that assumed for Clay 1-top (layer 1) in the VCS numerical groundwater model (Table 2.4.12-14). This finding suggests that in its current pre-construction condition, the permeability of the shallow soil within the footprint of the cooling basin is not greater than that of Clay 1-top.

While excavation of the surficial soils to construct the cooling basin and embankment dam will partially or completely remove Clay 1-top in some areas, silt and clay are expected to accumulate on the floor of the basin when it is filled, due to re-distribution of fine-grained sediments by currents and wave action and importation of fine-grained sediments in makeup water from the Guadalupe River. These sediments will form a layer of relatively low permeability that will limit post-construction seepage through the bottom of the cooling basin and into Sand 1. A sensitivity analysis of the cooling basin seepage rate in the VCS numerical groundwater model demonstrated that a 10-fold increase in the hydraulic conductivity of Clay 1-top results in only a 2-percent increase in the seepage rate (Table 2.4.12-C-9).

Figure 2.4.12-34 shows Clay 1-bottom (layer 3) to be absent at three locations in the vicinity of the cooling basin, providing a window that places Sand 1 (layer 2) in contact with Sand 2 (layer 4). Each of these three locations is outside of the basin footprint; two (B-2346 and B-2348) are near the southwest corner of Linn Lake, and the third (C-2328) is near the southwest corner of the basin. Sand 1 is unsaturated at each of these locations under pre-construction conditions but will become saturated when the cooling basin is filled because of seepage through the bottom of the basin into Sand 1 (Figure 2.4.12-C-28).

With the cooling basin full, the modeled hydraulic head of 90.5 feet in the basin will induce a downward vertical gradient through Clay 1-top into Sand 1 and through Clay 1-bottom into Sand 2 and result in saturation of Sand 1, including the area near the basin embankment dam (Appendix 2.4.12-C, Figure 2.4.12-C-28). The VCS numerical model predicts that post-construction groundwater discharge to Linn Lake (east of the cooling basin) will approximately double relative to pre-construction flow (Appendix 2.4.12-C, Figure 2.4.12-C-22).

Clay 3 (layer 5) is absent at eight locations east of the cooling basin as shown in Figure 2.4.12-35, creating areas where Sand 2 (the Upper Shallow aquifer) is in contact with Sand 4 (the Lower Shallow aquifer). The Upper and Lower Shallow aquifers merge into one relatively continuous sand unit in these areas. The eight locations where Clay 3 is absent are located at the western edge of the Guadalupe River Valley. This valley is the principal drainage feature toward which shallow groundwater flows in the region of the VCS site (Figure 2.4.12-14). On this basis, it is reasonable to infer that an upward vertical gradient and groundwater flow from Sand 4 to Sand 2 exists within the valley. It is likely that this condition will not be affected significantly by construction of VCS.

Clay 5-top (layer 7) is shown in Figure 2.4.12-36 to be absent at four locations in the area of the cooling basin. The location at the northeast corner of the basin (B-09) is within the down-gradient flow path of a postulated release of radioactive effluent from the basement of a radwaste building in the power block area (Appendix 2.4.12-C, Figure 2.4.12-C-34). A particle-tracking analysis of that release determined that the effluent would flow vertically downward within the structural fill surrounding the building foundation until encountering Clay 5-top (Figure 2.4.12-C-35). The effluent would then flow laterally down-gradient toward the east-southeast within the overlying Sand 4. The absence of Clay 5-top at B-09 places Sand 4 in contact with Sand 5 at this location and may allow the released effluent to disperse into Sand 5. This condition is depicted on the cross-section in Appendix 2.4.12-C, Figure 2.4.12-C-41.

Groundwater in both Sand 4 and Sand 5 eventually discharges within the Guadalupe River valley to Linn Lake, the Guadalupe River, and the Victoria Barge Canal. The data in Table 2.4.12-7 show that the vertical groundwater gradient at observation well pair OW-2348U/L near Linn Lake is slightly upward, indicating a discharging condition from the Deep aquifer (Sand 5) to the Lower Shallow aquifer (Sand 4). Conversely, at well pair OW-2319U/L near the western side of the cooling basin, the data in Table 2.4.12-7 show the vertical groundwater gradient to be slightly downward from Sand 4 to Sand 5, indicating a recharge condition. Neither of these relationships is likely to be affected significantly by construction of VCS.

The explicit method of ~~representing a confining layer~~ using a model layer to represent a confining layer was selected for the VCS numerical model. ~~to represent the confining layers at the VCS site.~~ A single value of hydraulic conductivity was selected to represent ~~for~~ each sand geotechnical unit~~s~~. Some of the hydraulic conductivity values were adjusted to match the observed heads as part of model calibration ~~to match the observed heads~~. Other properties used to support model development include recharge rate, evapotranspiration, and effective porosity.

Model development included a pre-construction site elevation at the power block area ~~at an approximate elevation~~ of approximately 80 feet. The finished plant grade in the power block area is assumed to be elevation 95 feet. To the east of the power block, a steep decrease in surface elevation marks the edge of the Guadalupe River Valley. The surface elevation on the Guadalupe River floodplain is approximately 15 feet. Local wells are assumed to have average pumping rates of less than 10 gpm~~,~~ and are considered to have minimal impact on groundwater levels outside of the immediate area of the well.

The VCS cooling basin bottom is approximated at ~~an~~ elevation ~~of~~ 69 feet. The water level for the cooling basin is assumed to be at elevation 90.5 feet. The cooling basin dikes were not considered in the seepage analysis due to their small size in relation to the cooling basin area. The hydraulic conductivity of the fill material used in plant construction is assumed to be that of a clean sand and gravel.

The primary zones of ~~concern~~ interest for VCS cooling basin seepage and excavation dewatering are Sand 1 and the Upper Shallow aquifer because these are the uppermost layers through which much of the groundwater flow will occur. Sand 1 is unsaturated in the pre-construction groundwater flow system.

(End of Subsection 2.4.12.3.1.2).

Revisions to the corresponding section of the environmental report (Section 2.3.1.2.3.1.2) that are consistent with the SSAR revisions will be made in the next revision of the ESPA. Note that this subsection was formerly numbered 2.3.1.2.3.1.1, but was renumbered by the response to RAI 02.04.12-1, which inserted a new Subsection 2.3.1.2.3.1.1.

The following Table 2.4.12-18, Figure 2.4.12-26a and Figures 2.4.12-31 through 2.4.12-36 are added to SSAR Section 2.4.12.

Table 2.4.12-18 Summary of Locations Where Confining Layers are Absent

Confining Layer: Clay 1-Top
B-01
B-03
B-2306
B-2315
B-2322
B-2324
B-2332
B-2334
B-2336
C-2305
C-2307
C-2308
C-2309
C-2311
C-2311A
C-2317

Confining Layer: Clay 1-Bottom	
B-2250	B-2346
B-2251	B-2348
B-2256	C-2328
Confining Layer: Clay 3	
B-2315	
B-2322	
B-2346	
B-2353	
B-2357	
C-2308	
C-2311	
C-2311A	
Confining Layer: Clay 5-Top	
B-09	
B-2319	
B-2348	
B-2352	

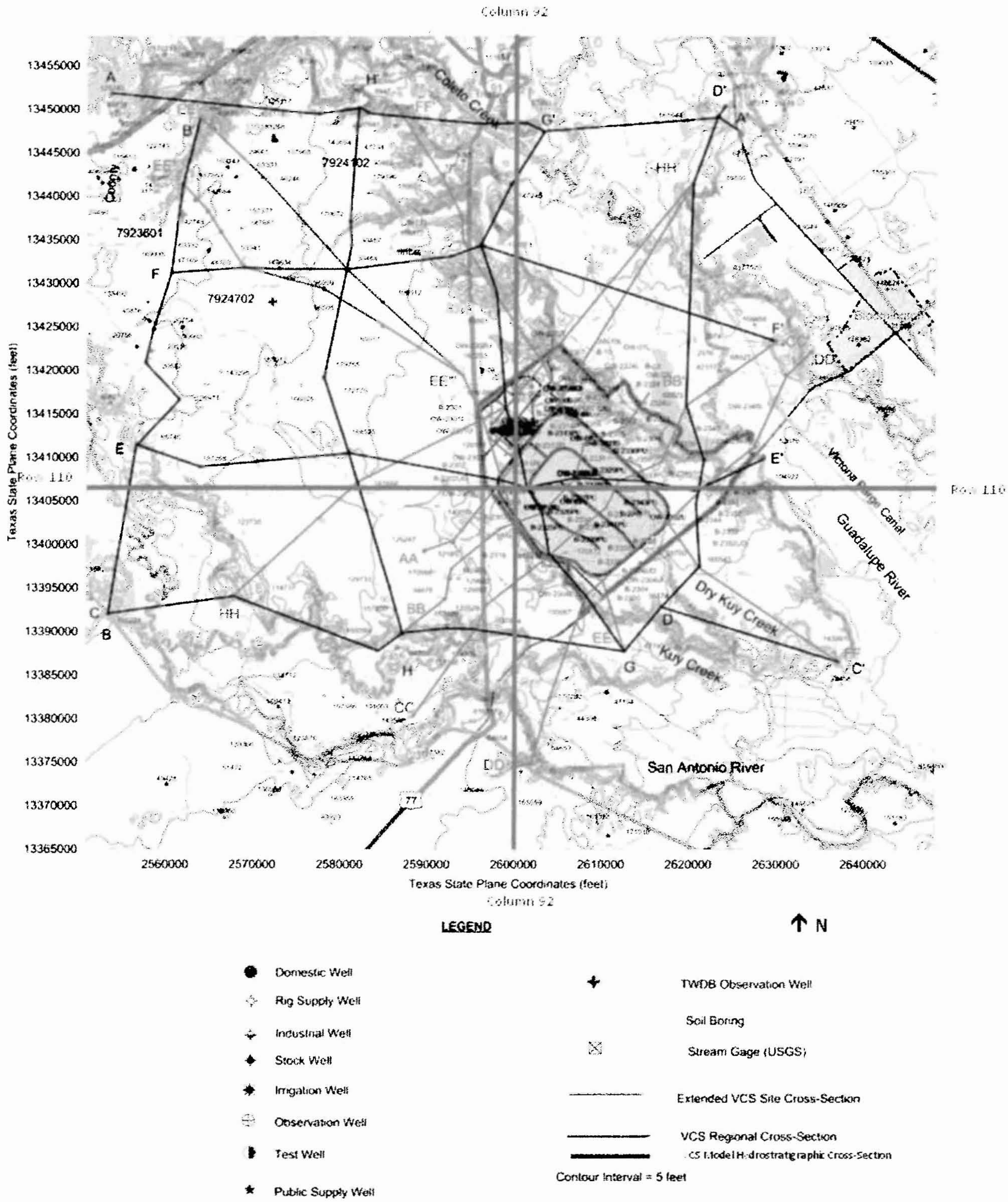

Figure 2.4.12-26a Plan View Showing Locations of Orthogonal Cross-Sections

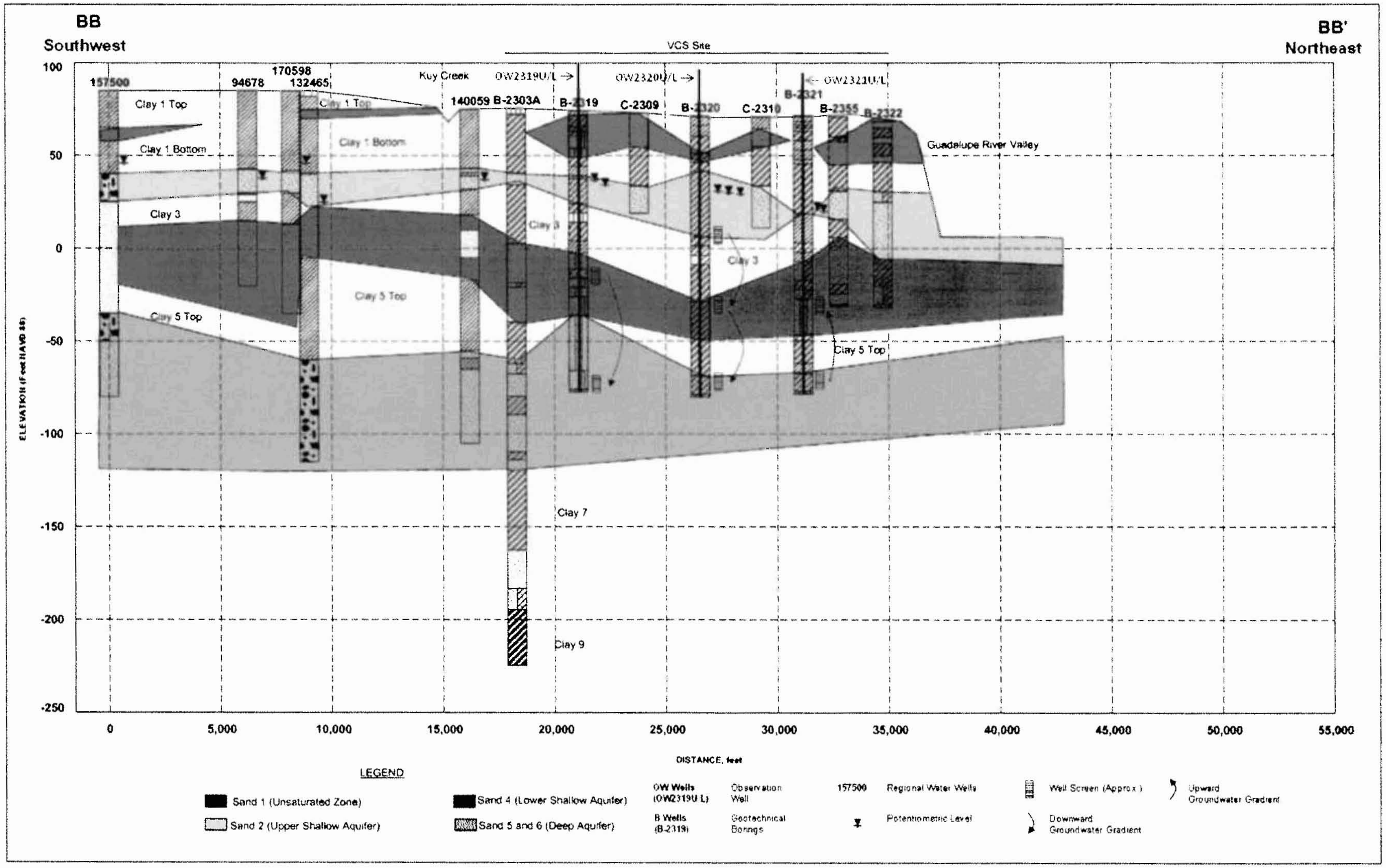

Figure 2.4.12-31 Hydrogeologic Cross-Section BB-BB'

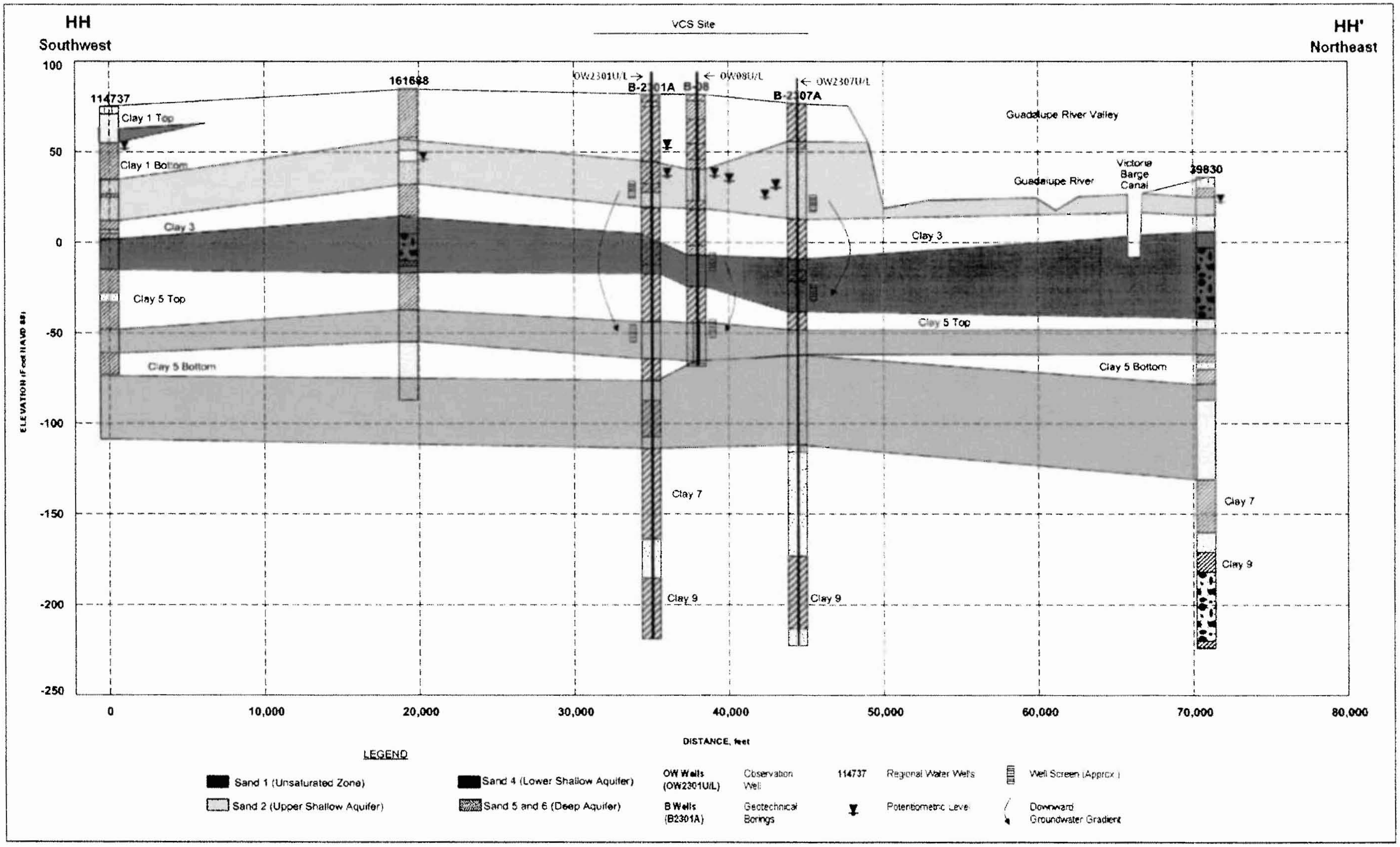

Figure 2.4.12-32 Hydrogeologic Cross-Section HH-HH'

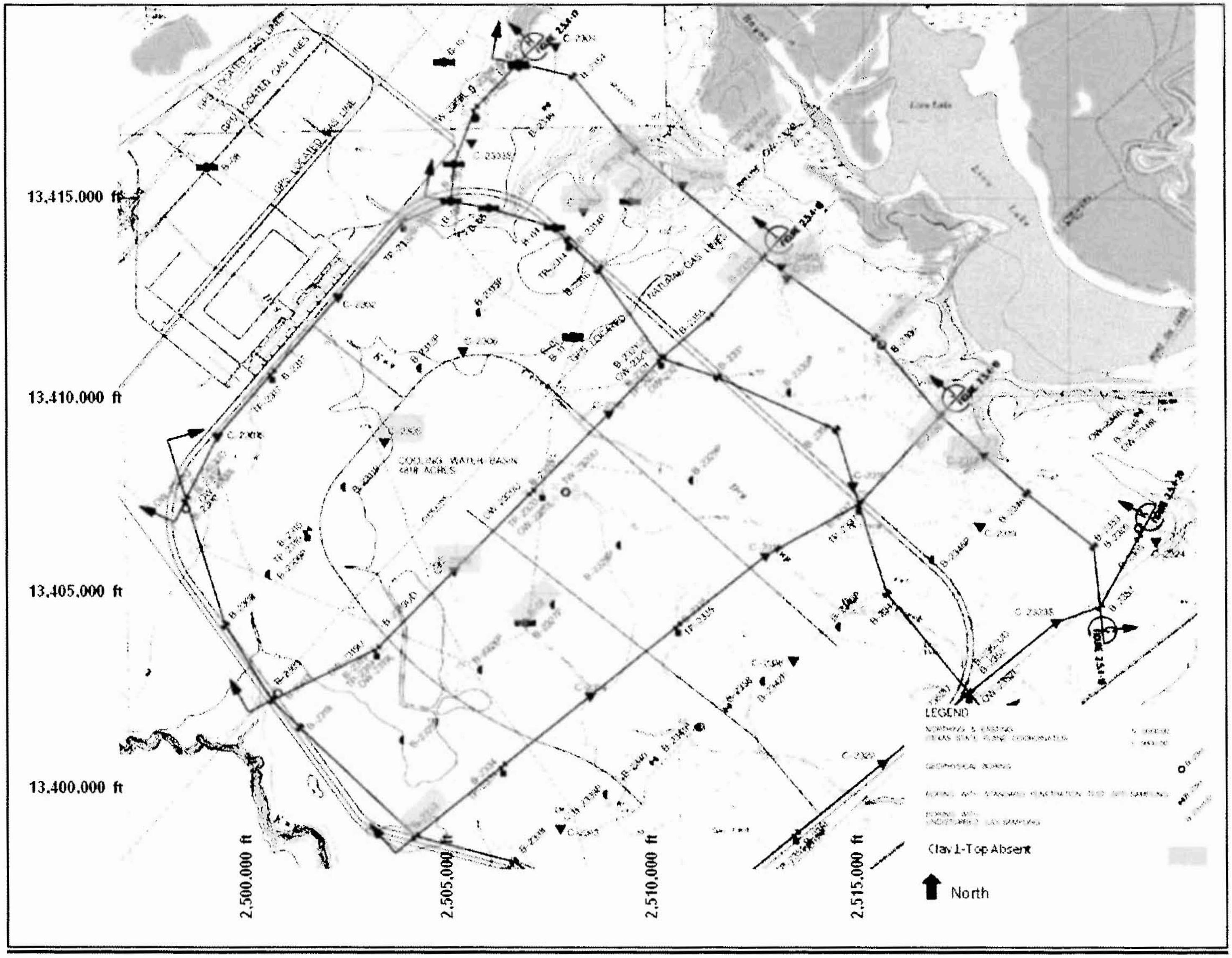

Figure 2.4.12-33 Locations Where Clay 1-Top is Absent

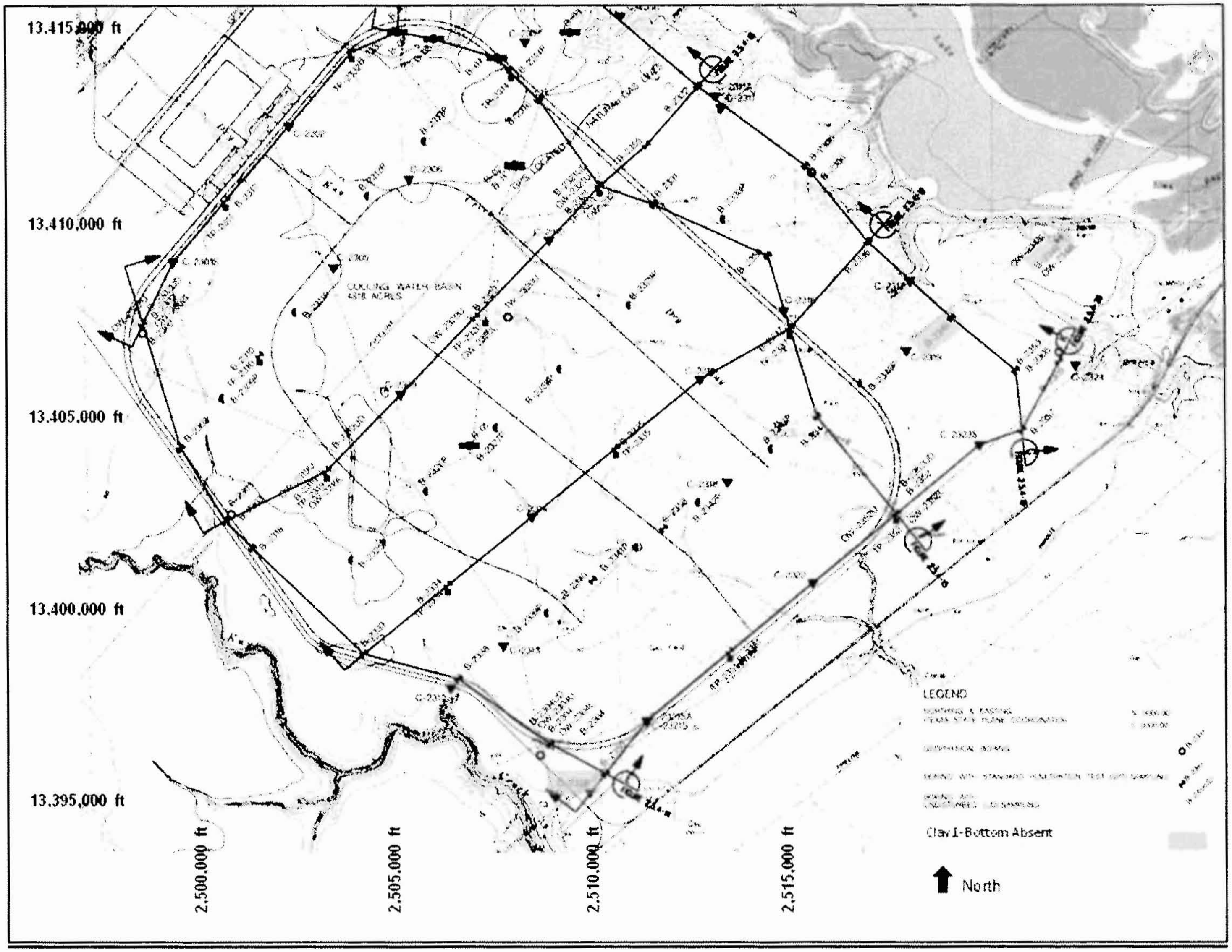

Figure 2.4.12-34 Locations Where Clay 1-Bottom is Absent

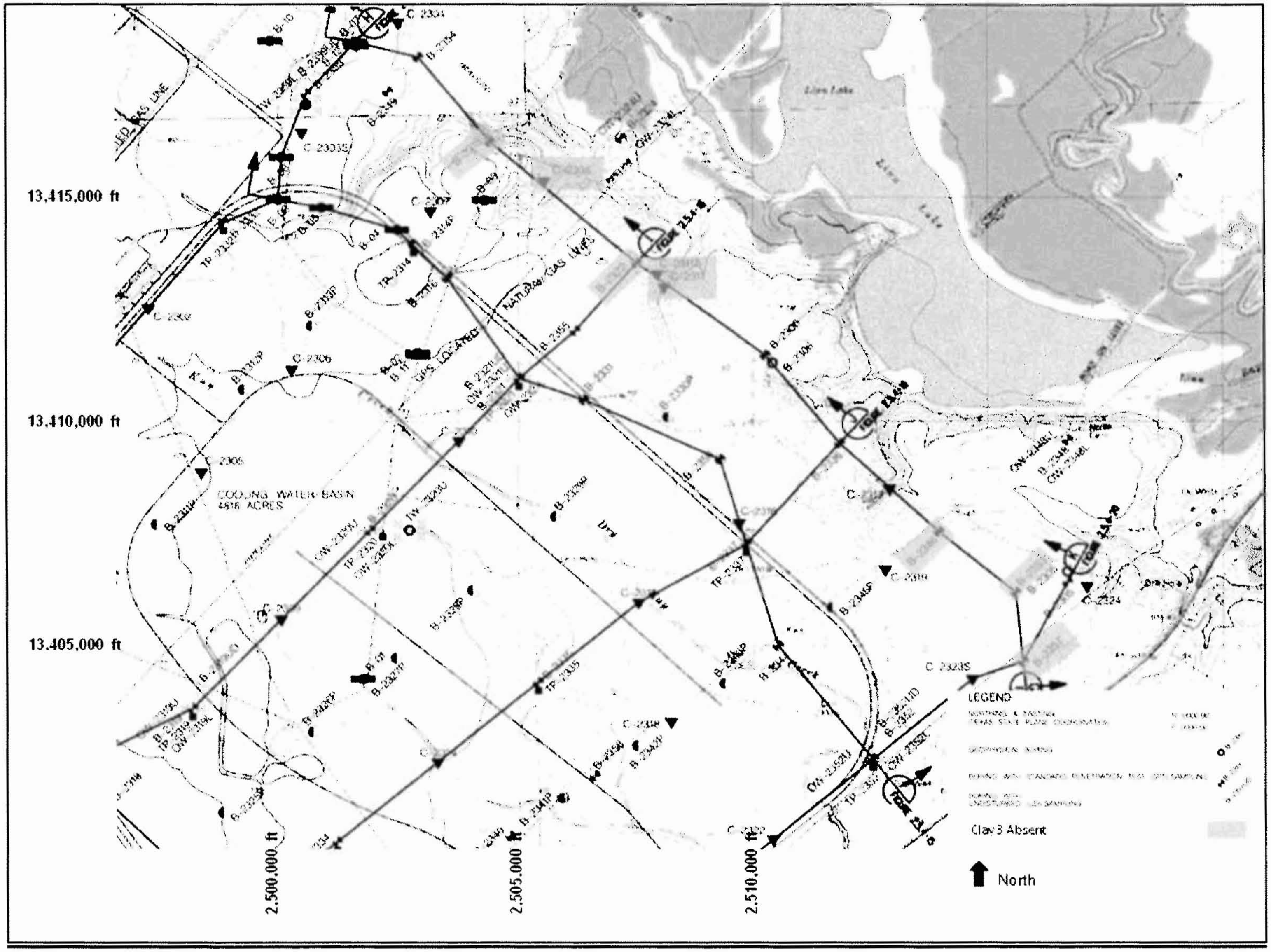

Figure 2.4.12-35 Locations Where Clay 3 is Absent

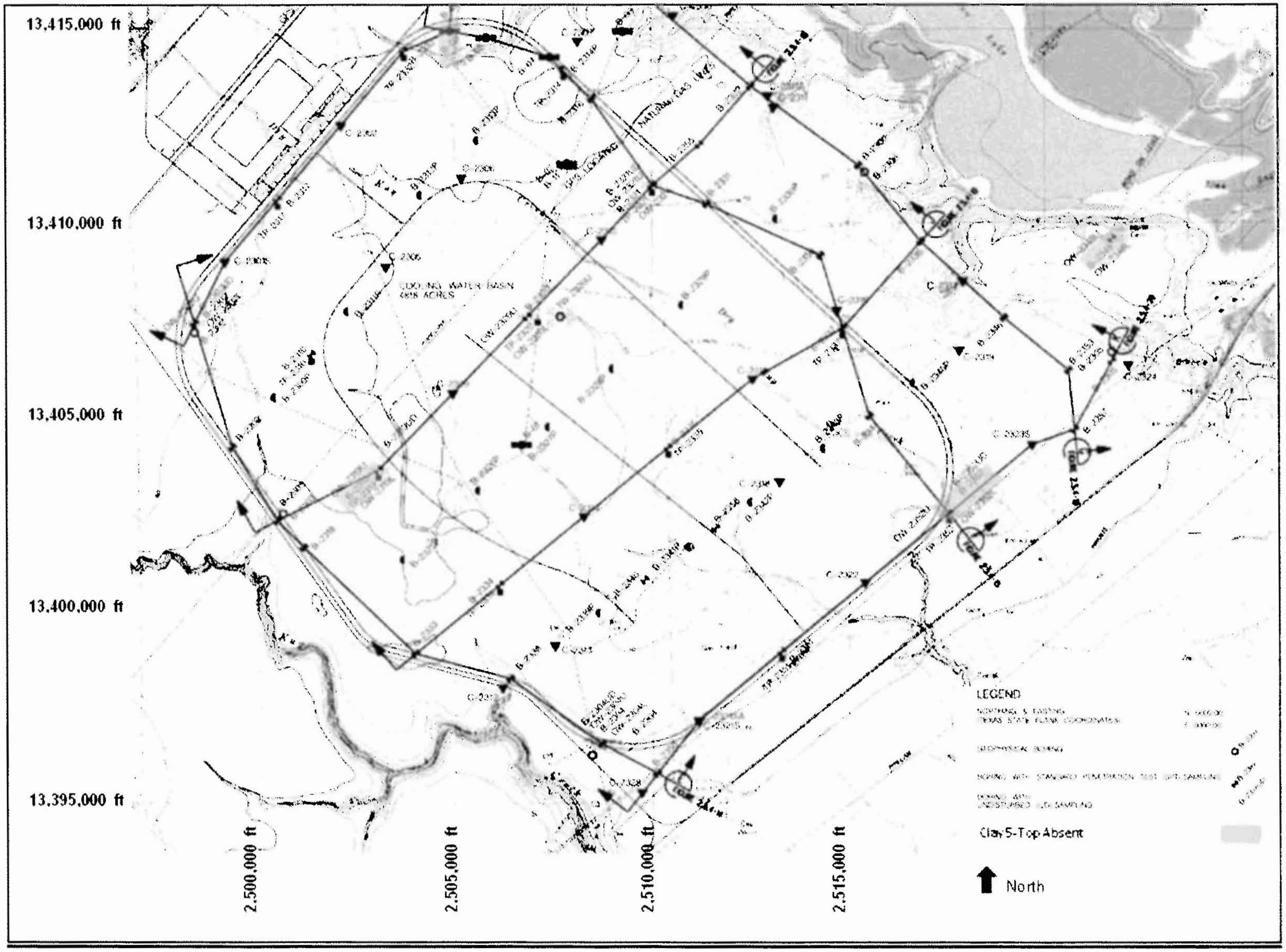

Figure 2.4.12-36 Locations Where Clay 5-Top is Absent

RAI 02.04.12-6:

Question:

In accordance with the requirements of 10 CFR 100.20(c) "Factors to be considered when evaluating sites" relating to hydrology and, 10 CFR 52.79(a) "Contents of applications; technical information in final safety analysis report" relating to hydrologic characteristics of the proposed site, and as recommended by Standard Review Plans 2.4.12 "Groundwater" acceptance criteria, the NRC Staff requests that the Applicant provide: (1) Two orthogonal cross-sections across the site with the hydro-lithologic units labeled consistent with site nomenclature and include the vertical direction of ground water flow and the potentiometric surfaces for the hydrologic layers; and (2) Two orthogonal cross sections (replacing or adding to FSAR, Rev0, Figure 2.4.12-26), of the model grid that approximate the location of the two hydro-stratigraphic cross-sections in (1) above.

Response:

The response to RAI 2.4.12-6 includes the following:

(1) Two orthogonal hydro-stratigraphic cross-sections with the hydro-lithologic units labeled consistent with site nomenclature (Figures 2.4.12-26b and 2.4.12-26c). These hydro-stratigraphic cross-sections include the potentiometric levels in the hydro-lithologic units and the vertical direction of groundwater flow.
(2) Two orthogonal cross-sections of the model grid that approximate the locations of the two hydro-stratigraphic cross-sections in (1) above (Figures 2.4.12-26d and 2.4.12-26e).

The locations of the cross sections are shown in Figure 2.4.12-26a.

Subsection 2.4.12.3.1.3 of the SSAR is revised as follows in response to RAI 2.4.12-6. Note that this subsection was formerly numbered 2.4.12.3.1.2, but its number was revised by the response to RAI 2.4.12-1, which inserted a new Subsection 2.4.12.3.1.1. Figure 2.4.12-26 is deleted, and Figures 2.4.12-26a, 2.4.12-26b, 2.4.12-26c, 2.4.12-26d, and 2.4.12-26e are added to the SSAR.

Associated ESPA Revisions:

Subsection 2.4.12.3.1.3 of the SSAR is revised as follows:

2.4.12.3.1.~~2~~3 Numerical Model

The model area was established to take advantage of natural boundary conditions in the site area. The Guadalupe and San Antonio Rivers, the Victoria Barge Canal, and Coleto Creek form physical boundaries along the north, east, west, and south perimeters of the model domain. Groundwater flow directions are interpreted as generally west to east across the VCS site, based on the regional potentiometric surface in the Chicot Aquifer. Pre-construction groundwater discharge is interpreted to occur on the west side of the Guadalupe River valley into Linn Lake and a series of sloughs that ~~run~~ flow eastward along the west side of the valley.

The model grid consists of 189 columns, 193 rows, and 11 layers. Grid spacing ranges from 500 feet at the edges to 250 feet in the power block area. Figure 2.4.12-25 is a plan view of the model domain showing the grid and calibration wells. ~~Figure 2.4.12-26 shows a west to east cross-section through the model, passing through the proposed power block area.~~

As stated in Subsection 2.4.12.3.1.2.1, hydrogeologic cross-sections and structure contour maps were developed from the subsurface data obtained from the VCS site subsurface investigation and from regional driller's log databases. These cross-sections and contour maps were used as the basis for the hydrogeologic layers developed for the numerical groundwater model. The locations of the cross-sections are shown in Figure 2.4.12-26a. Figures 2.4.12-26b and 2.4.12-26c present orthogonal hydrogeologic cross-sections E-E' and G-G'.

Cross-section E-E' is oriented approximately east-west and passes through the central part of the cooling basin. Cross-section G-G' is oriented approximately north-south and passes through the power block area and the western portion of the cooling basin. These cross-sections show the hydro-lithologic units labeled consistent with site nomenclature and the conceptual model of the stratigraphy beneath the VCS area. The hydro-lithologic units were interpreted from logs of geotechnical borings drilled on the VCS site, drillers' logs of water wells drilled in the region of the site, and results of other onsite investigative activities.

Cross-sections E-E' and G-G' both show the stratigraphy at soil boring B-2310 but with slightly different interpretations because of differing perspective due to different orientations of the cross-sections. The stratigraphic interpretation in E-E' is incorporated in the layering of the VCS numerical model because it provides better characterization of layering within the Deep aquifer, based on soil boring information.

Tables 2.4.12-1 and 2.4.12-6 from the SSAR show construction details and monthly groundwater levels for the observation wells, respectively. Potentiometric levels measured on February 18, 2008, in each of the observation wells in the cross-sections and the direction of the vertical groundwater gradient are also shown. The potentiometric levels shown in the regional water wells were measured as each was drilled during the period between 2003 and 2009.

Figures 2.4.12-26d and 2.4.12-26e are orthogonal cross-sections showing the modeled hydrostratigraphy along row 110 and column 92, respectively, of the VCS numerical groundwater model grid. As shown in Figure 2.4.12-26a, the locations of the cross-sections in Figures 2.4.12-26d and 2.4.12-26e approximate the locations of the two hydrostratigraphic cross-sections in Figures 2.4.12-26b and 2.4.12-26c. Comparison of the figures confirms that the hydro-lithologic units of the conceptual model closely match those of the groundwater numerical model. The numerical model cross-sections do not precisely mirror the conceptual model cross-sections because the sets of east-west sections and north-south sections are not constructed on the same vertical plane.

A layer type is defined for each layer in the model. The layer type represents the hydrogeologic conditions anticipated for each layer. For the VCS model, two layer types are used: ~~T~~type 0 ~~(C~~confined (where the transmissivity and storage coefficient are constant throughout the simulation) and ~~T~~type 3 ~~(C~~confined/~~U~~unconfined~~,~~ (with variable storage coefficient and transmissivity). Layer type 3 was assigned to all layers in the pre-construction model to represent the variable conditions in these layers. Layer type 0 was applied to model layers 4 through 11 in the post-construction model simulations representing the relatively constant confined conditions present in these layers. The MODFLOW default method for assigning inter-block transmissivity using the harmonic mean is used for all layers.

The solver used in the model is the algebraic multigrid (SAMG) solver. The configuration of the model requires the use of the re-wetting function to saturate unsaturated cells in the model.

(End of Subsection 2.4.12.3.1.3)

Revisions to the corresponding section of the environmental report (Subsection 2.3.1.2.3.1.3) that are consistent with the SSAR revisions will be made in the next revision of the ESPA. Note that this subsection was formerly numbered 2.3.1.2.3.1.2, but was renumbered by the response to RAI 02.04.12-1, which inserted a new Subsection 2.3.1.2.3.1.2.

The following figures are being added to SSAR Subsection 2.4.12 and will be added to ER Subsection 2.3.1.2.3.1.3.

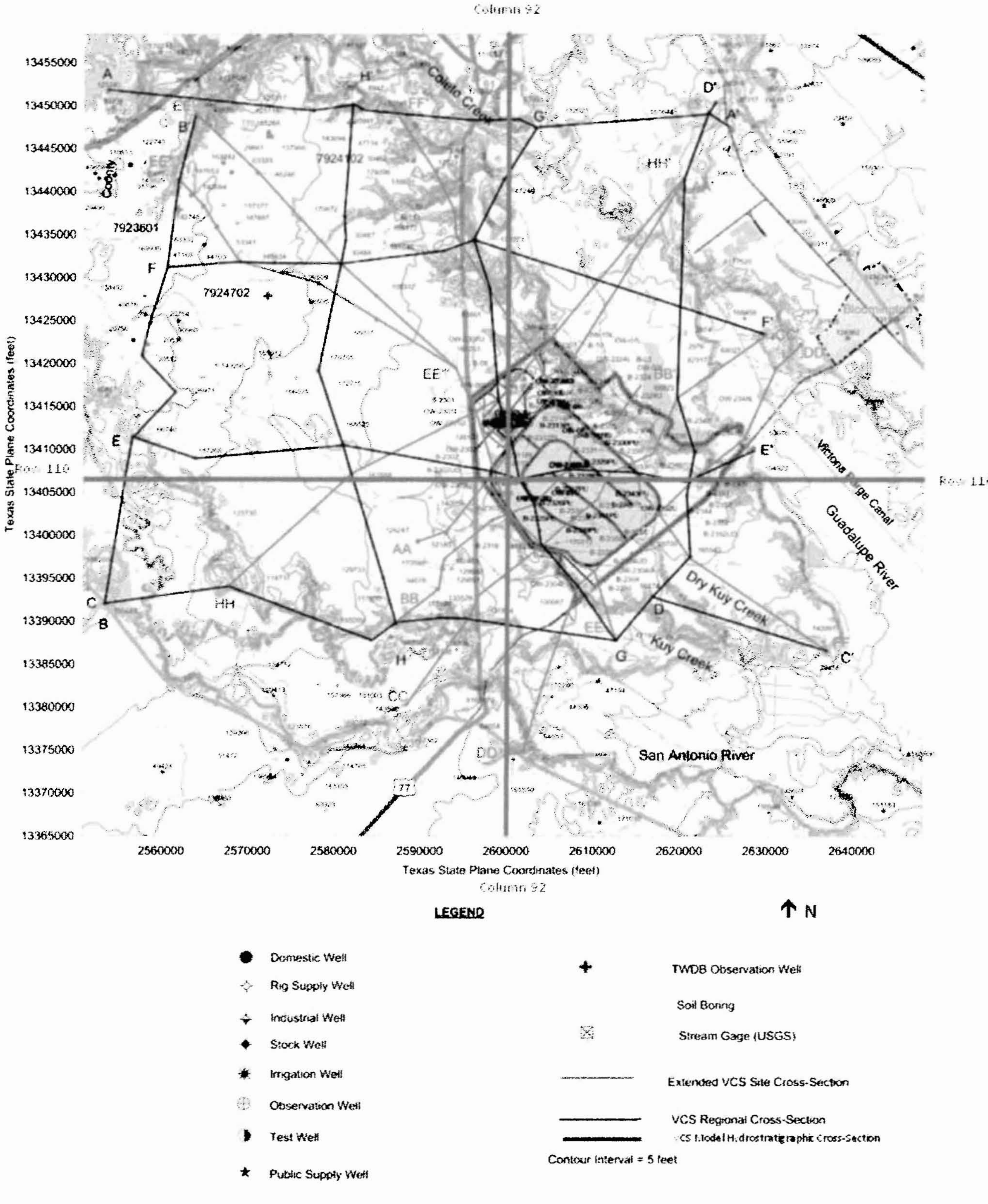

Figure 2.4.12-26a Plan View Showing Locations of Orthogonal Cross Sections

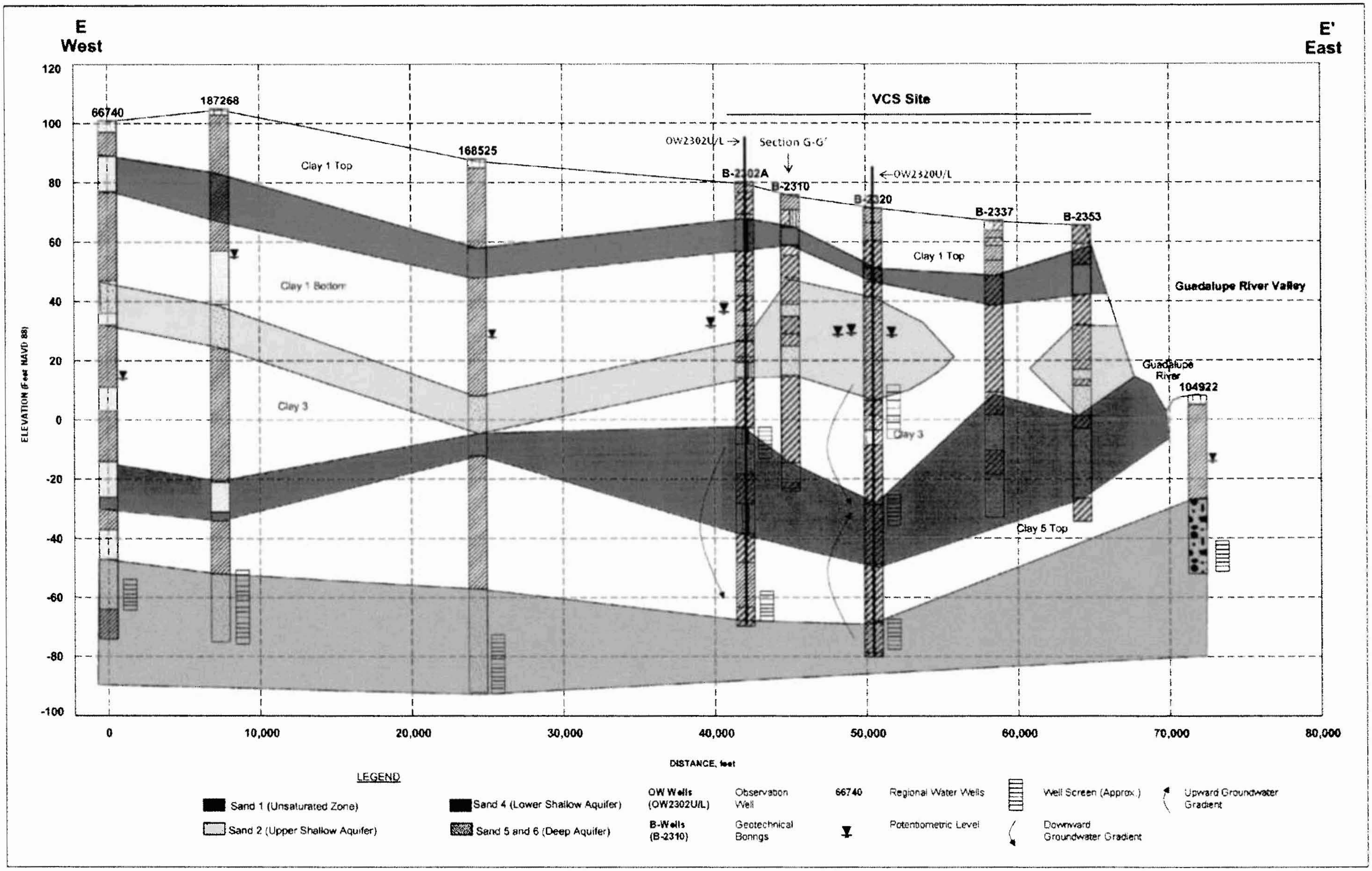

Figure 2.4.12-26b Hydrogeologic Cross-Section (E-E')

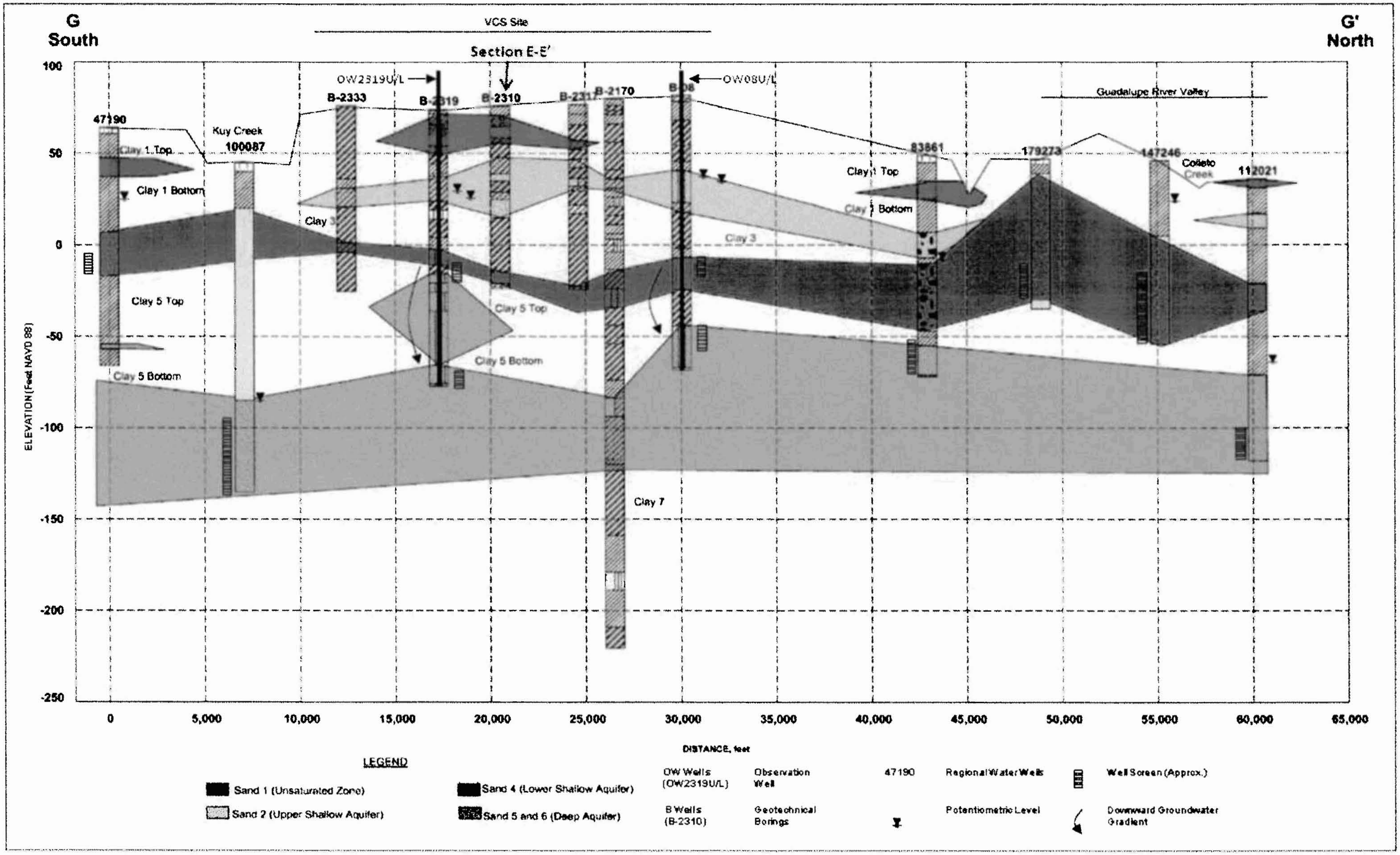

Figure 2.4.12-26c Hydrogeologic Cross-Section (G-G')

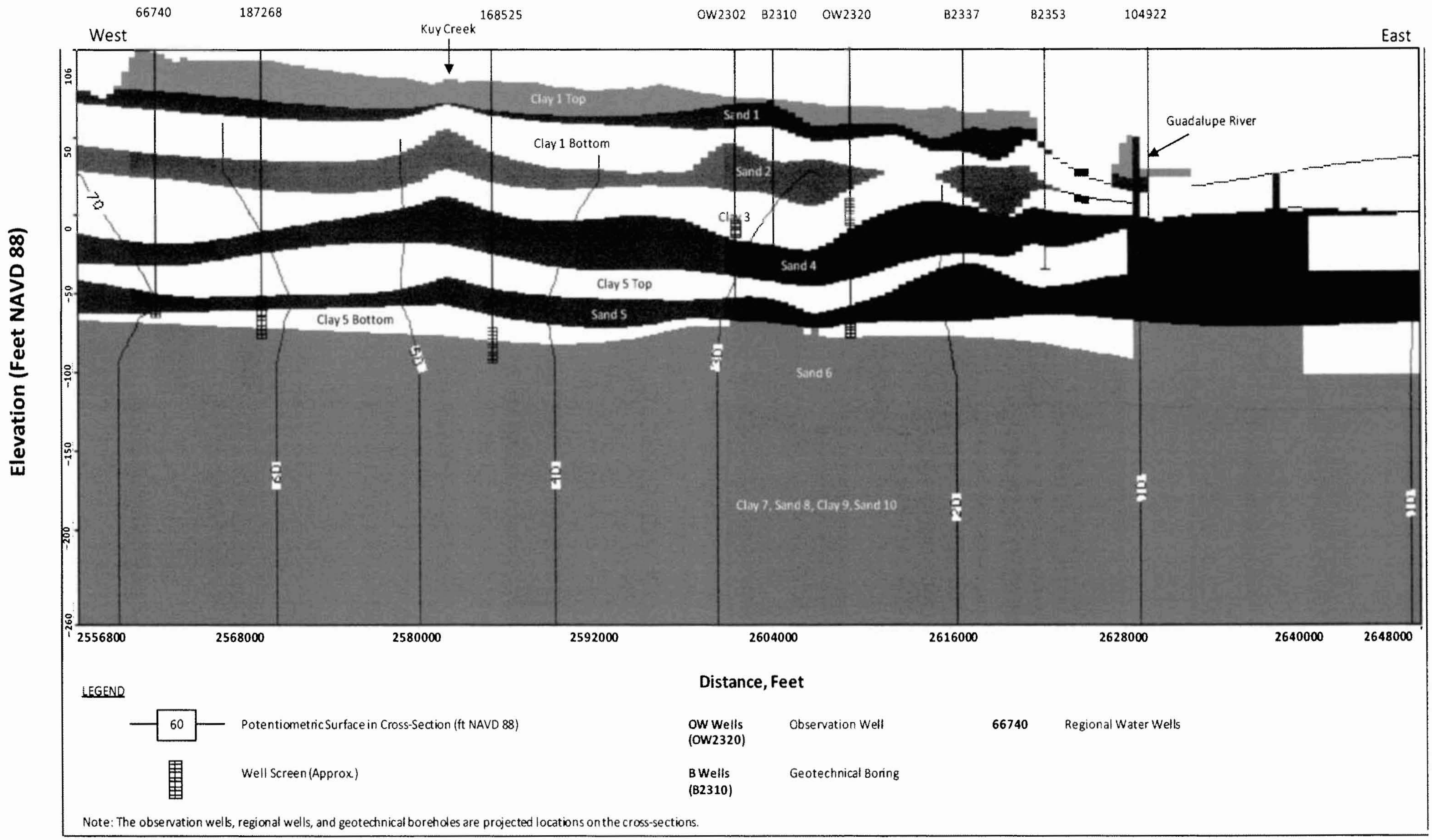

Figure 2.4.12-26d Cross-Section Along Row 110 of Groundwater Model Grid

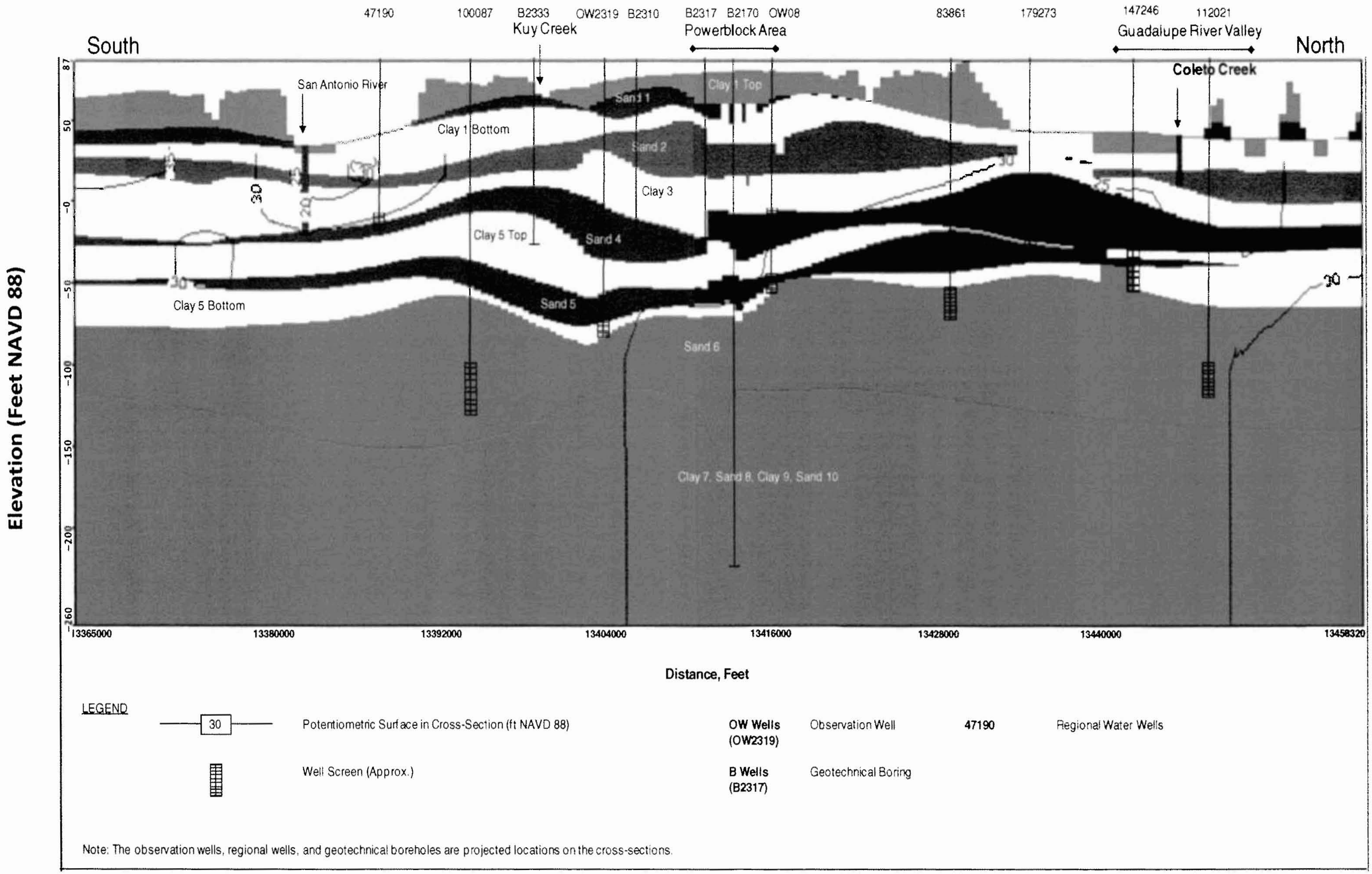

Figure 2.4.12-26e Cross-Section Along Column 92 of Groundwater Model Grid

ATTACHMENT 3

SUMMARY OF REGULATORY COMMITMENTS

(Exelon Letter to USNRC, NP-11-0021, dated June 2, 2011)

The following table identifies commitments made in this document. (Any other actions discussed in the submittal represent intended or planned actions. They are described to the NRC for the NRC's information and are not regulatory commitments.)

COMMITMENT	COMMITTED DATE	COMMITMENT TYPE	
		ONE-TIME ACTION (Yes/No)	Programmatic (Yes/No)
Exelon will revise the VCS ESPA SSAR Section 2.4.12 to incorporate the change shown in the enclosed response to the following NRC RAI: 02.04.12-5 (Attachment 1)	Revision 1 of the ESPA SSAR and ER planned for no later than March 31, 2012	Yes	No
Exelon will revise the VCS ESPA SSAR Section 2.4.12 to incorporate the change shown in the enclosed response to the following NRC RAI: 02.04.12-6 (Attachment 2)	Revision 1 of the ESPA SSAR and ER planned for no later than March 31, 2012	Yes	No