Eagle Mountain Pumped Storage Project
Draft Environmental Impact Report
Volume III
Technical Memorandum, Appendix C

State Clearinghouse No. 2009011010
FERC Project No. 13123

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July 2010

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12.5 Seepage Analysis for Upper and Lower Reservoir

Eagle Mountain Pumped Storage Project – Seepage Analyses for Upper and Lower Reservoirs

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January 5, 2009, revised November 24, 2009

This memorandum summarizes preliminary estimates of seepage from the proposed Upper and Lower Reservoirs for the Eagle Mountain Pumped Storage Project. In addition, this TM provides opinions on the potential effectiveness of using the available fine mine tailings as a seepage control blanket to minimize seepage losses from the Upper and Lower Reservoirs. This treatment measure was proposed in the earlier project concepts developed in the 1990s. We also assessed the potential effectiveness of other seepage control measures at the two reservoirs.

Due to the current access constraints at the site, all geotechnical and geological information used for the seepage estimates was obtained from prior investigations and studies conducted by GeoSyntec Consultants, GSi/Water, and GeoPentech in support of studies for a proposed landfill. The results of those studies represent an initial step in characterizing potential seepage impacts associated with the Eagle Mountain Project. Seepage impacts are of particular concern to the Metropolitan Water District of Southern California (MWD), the State Water Quality Board, and others in the region.

Site Geology

Bedrock geologic units present at the site can be generally classified as either igneous or meta-sedimentary. The igneous units include several varieties of granitic rock including porphyritic quartz monzonite, diorite, monzonite porphyry, and granodiorite. The meta-sedimentary units include quartzites, meta-arkoses, and marbles formed by metamorphosis and/or hydrothermal-alteration or sandstones, conglomerates, arkoses, and carbonate rocks deposited in the Paleozoic or Precambrian age.

Surficial geology of the Eagle Mountain area generally consists of unconsolidated alluvial deposits. The alluvial deposits include sands, silts, gravels, and debris-flow deposits. The most significant alluvial deposits are found on the eastern edge of the site area, where they form a laterally extensive alluvial fan that extends and thickens to the east into the Chuckwalla Valley. Some of these deposits are exposed in the east wall of the east pit and underlie the eastern portion of the Lower Reservoir.

The alluvial deposits within the Chuckwalla Valley extend to significant depths below the ground surface and generally consist of sands, silty sands, sands and gravel, cobbles and boulders. Within the sandy alluvial deposits in the Chuckwalla Valley a predominately clay layer was logged in borings at depths varying from about 600 to 900 feet, and is generally about 100 to 300 feet in thickness.

The entire Central Pit (Upper Reservoir) is incised into bedrock. Alluvial deposits in the area of the Upper Reservoir are smaller in extent and are generally confined to laterally discontinuous, generally thin deposits along the bottoms of the canyons.

Rock containing little to no mineral value (waste rock and tailings) generated by the former Kaiser operations were deposited in numerous areas near the site. These mining by-products include several distinctly different materials, including both bedrock and alluvial overburden, and tailings produced as a result of the mining and separation of iron ore-bearing rock from host rock. The tailings include both fine and coarse varieties.

The hydraulically-placed fine tailings exist in settling ponds to the southeast of the proposed Upper Reservoir. Total volume of these materials is estimated to potentially be over 19 million cubic yards. Laboratory testing indicated that the fine tailings vary in composition, ranging from silty sand and sandy silt to clayey silt to silty clay. In general, soils with higher sand content are located near the slurry discharge point while finer grained soils are present in the distal portions of each pond.

Coarse tailings were placed at several locations around the site, although the largest deposit lies in a stockpile located immediately south of the proposed Lower Reservoir. The total volume of coarse tailings in this stockpile is estimated to be about 50 million cubic yards. The majority of the coarse tailings were classified as clean gravels or sandy gravels containing significant percentages of cobbles and boulders and few fines.

The chemical composition of these materials will be fully investigated during Phase 1 Pre-design investigations. Those studies are described in Section 12.1 of this document.

Upper Reservoir

The Upper Reservoir will occupy the former Central Pit of the Kaiser Mine. The reservoir is elongated generally east-west, with a maximum dimension of about 5,300 feet. North-south dimensions vary between 1,500 and 2,000 feet near the maximum planned reservoir surface (El. 2485). The existing low point in the Upper Reservoir is located in the eastern half of the pit and extends down to El. 2230. Due to topographic conditions, there will be two dams required to create the upper reservoir. The current concept is to construct these dams using roller-compacted concrete (RCC) with aggregate materials being derived from the abundant coarse mine tailings at the site or from other on-site aggregate sources with suitable characteristics for RCC.

Available geologic mapping shows the north side of the pit to be underlain by granitic rock units, while the central and southern portions of the pit are underlain by metasedimentary units and iron ore. Areas of the proposed Upper Reservoir are also covered with coarse tailings. Two borings completed in the bottom of the Upper Reservoir site (MW-10 and CH-10) provide insights on the hydrogeologic character of the rock materials. Rock core was obtained from boring CH-10. The boring was drilled to a total depth of 1,389 feet. Water was first observed at a depth of 1,309 feet. Rock lithology in the upper 350 feet of the boring was found to be moderately fractured, interbedded igneous and metasedimentary rock. Monitoring well MW-10, a 13.5-inch diameter borehole, was drilled to a total depth of 1,480 feet below ground surface. Water was first encountered at a depth of 506 feet; however, the static water level subsequently dropped and later stabilized at a depth of 1,040 feet. Borehole locations and logs are provided in the Appendix of this report.

Lower Reservoir

The Lower Reservoir will be located in the former East Pit of the Kaiser Mine. No dams are required to provide the needed storage at the Lower Reservoir. The pit has a maximum dimension of about 5,400 feet in an east-west direction, and a maximum dimension of about 2,000 feet in a north-south direction when measured at the normal maximum reservoir water surface at El. 1092. The pit narrows to the west to a minimum width of about 300 feet. The pit includes two low points or bowls, one in the east, and one in the western half of the pit. These low points are separated by a bedrock saddle, which is mantled with tailings deposits on the west side. The low point within the east bowl is at El. 776, while the lowest point within the west bowl is at El. 715. The intervening saddle is at about El. 880.

The proposed Lower Reservoir can be divided into two zones on the basis of geology. The eastern one-quarter of the site is excavated in Quaternary alluvial sediments, including fan deposits and debris flow deposits. In the eastern wall of the pit, a vertical section of about 300 feet of alluvial deposits is exposed. The western three-quarters of the site are underlain by granitic rocks and undifferentiated metasedimentary rocks and rocks of the upper quartzite unit. The granitic rocks are located along the northern face of the pit, while the metasedimentary rocks are found along the south pit face and the lower portions of the north face. Quartzite is located in the central portion of the pit and underlies the unconsolidated deposits.

A total of eight borings were used to characterize the geology in the area that would be occupied by the Lower Reservoir and surrounding areas; these include: MW-13, CH-5A, P-1, MW-1, MW-2, P-11, P-12, and C-10. Borings MW-13, CH-5A were completed along the western and northwestern corner of the Lower Reservoir site. These two borings show slightly fractured, interbedded igneous and metasedimentary rock extending to depths below El. 500. The static water level was subsequently measured in boring MW-13 at about 285 feet below the ground surface. The boring for P-1 is located on the bedrock saddle which divides the East Pit into two sections. This boring was drilled to a depth of 270 feet, and also shows interbedded igneous and metasedimentary rock for the entire depth. A static water level was subsequently measured at 177 feet below the ground surface in P-1.

Boreholes MW-1, MW-2, P-11, P-12, and C-10 were located east of the pit, and were projected onto the geologic section prepared for our analysis. The logs of these boreholes were reviewed to estimate the extent of alluvial deposits found on the eastern edge of the site. Generally, the alluvial deposits form a laterally extensive alluvial fan that extends and thickens to the east into the Chuckwalla Valley. These five borings encountered predominately fine to coarse sand, with gravel and cobbles in several locations. The borings also indicate a relatively thin, predominately clay layer interbedded within the primarily sandy alluvial deposits. The clay layer ranges in elevations from about 600 to 900 feet, and is generally about 100 to 300 feet thick. The groundwater in the bedrock and alluvium generally drops from west to east and from north to south. The groundwater was estimated to be approximately 240 feet below the ground surface at the point where boring P-12 is projected onto the geologic section. Borehole locations and logs are provided in the Appendix.

Seepage Analyses

The expected quantity of seepage through the Upper and Lower Reservoirs was evaluated by performing seepage analyses. The seepage analyses were performed using the two-dimensional, finite element program GeoStudio 2007, specifically the SEEP/W module.

The majority of the seepage from the proposed reservoirs is anticipated to travel from west to east towards the Chuckwalla Valley, similar to the existing ground water conditions at the site. Based on these ground water levels and the geologic conditions, the hydraulic gradient produced by the proposed reservoirs will be greater in the west-east direction than the hydraulic gradient in the north-south direction; therefore, all seepage flow rates and annual seepage volumes were estimated using west-east profiles. However, there is potential for seepage from the proposed reservoirs to travel from north to south. For this reason, north-south seepage profiles were also developed for both reservoirs only for estimating the ground water levels at specific down-gradient facilities of concern. We performed the analyses for the reservoirs using cross sections prepared for the locations shown in plan view on Figure 1. The representative cross sections used for the Upper Reservoir and Lower Reservoir seepage analyses are shown on Figures 2 through 5.

Hydraulic Conductivity

The estimates of hydraulic conductivity for the various geologic materials present at the site were developed based on the available results of field permeability tests, laboratory permeability tests, correlations with published values based on material descriptions and gradations, and empirical correlations between grain size and permeability. The hydraulic conductivity values used in the seepage analyses are presented in Table 1.

Table 1. Summary of Material Hydraulic Conductivities

Material	Hydraulic Conductivity (centimeters/sec)	Hydraulic Conductivity (feet/sec)	Conductivity Ratio
Rock – Upper Reservoir (moderately fractured)	1.00E-04	3.28E-06	1.00
Rock – Lower Reservoir (slightly fractured)	1.00E-05	3.28E-07	1.00
Sand	5.00E-03	1.64E-04	0.25
Clay (sandy)	1.00E-05	3.28E-07	1.00
Liner - (fine tailings)	2.16E-06	7.09E-08	1.00

The value for hydraulic conductivity of the rock in the Lower Reservoir was based on packer pressure testing conducted in 5 boreholes (borings 2, 3, 5A, 11 and 12). None of these boreholes were located within the Lower Reservoir, but are considered to be representative of the rock unit surrounding and within the reservoir. The calculated hydraulic conductivities ranged from 1 x 10-6 cm/s (centimeters/second) to 1 x 10-4 cm/s, with a geometric mean of 1 x 10-5 cm/s. The geometric mean was selected to represent the rock at the Lower Reservoir. Based on boreholes CH-10 (located in Upper Reservoir) and CH-5A (located on rim of Lower Reservoir), the rock at higher elevations is considered to be more fractured, which typically increases the hydraulic conductivity. Because the rock at the Upper Reservoir is considered to be more fractured than the rock in the Lower Reservoir, the hydraulic conductivity was increased by an order of magnitude to account for increased fracturing.

The alluvial deposits will have the highest conductivity and are represented by the sand category in Table 1. The hydraulic conductivity used for the sand category was based on the average of 17 empirical correlations between grain size and permeability. The range of hydraulic conductivities for the sand category was between 1 X 10-2 cm/s to 1 X 10-5 cm/sec, with an average of 5.0 X 10-3 cm/s.

The hydraulic conductivity used for the clay layer was based on an average of two laboratory permeability tests, which gave a value of 1.0 X 10-5 cm/s. Estimates of hydraulic conductivities for the fine tailings liner were based on an average of field and laboratory permeability tests. The results of field permeability tests on the fine tailings ranged from 9.2 X 10-9 to 4.3 X 10-7cm/s; laboratory permeability test yielded results between 5.8 X 10-9 to 8.2 X 10-6 cm/s. The average hydraulic conductivity from these field and laboratory tests was 2.16 X 10-6 cm/s. This averaged hydraulic conductivity value was adjusted proportionally to evaluate varying thicknesses of the liner. Calculations for the hydraulic conductivity used for the various materials are presented in the Appendix.

West-East Profile Analysis Results

Seepage flow rates and gradients were estimated for both the Upper and Lower Reservoirs of the Eagle Mountain Pumped Storage Project at both the minimum and maximum water surface elevations. Seepage flow rates were also estimated using liner thicknesses of 3, 5, and 8 feet for both reservoirs, at minimum and maximum water storage elevations. The seepage blankets would only be placed on the reservoir floors and on zones of the reservoir basin slopes where ground slopes are flat enough to support stable fill placement under rapid draw-down reservoir conditions. For the initial analyses, only seepage blankets were considered. Other treatment measures to reduce reservoir seepage are described later in this memorandum.

The seepage flow rates were determined based on a unit width of the geologic section. To estimate the total seepage rate for the entire reservoir, the unit width seepage rate was multiplied by the average top width for that water surface elevation. The minimum and maximum average top widths for the two reservoirs are shown in Table 2.

Table 2. Reservoir Water Surface Elevation Average Top Widths

Reservoir	Minimum Water Surface Elevation Average Top Width (feet)	Maximum Water Surface Elevation Average Top Width (feet)	Average Top Width Used for Average Annual Seepage Calculations (feet)
Central Pit Upper Reservoir	595	1485	1040
East Pit Lower Reservoir	680	1100	890

The estimated unit width seepage quantities and average annual seepage volumes for the Upper Reservoir are presented in Table 3. Seepage quantities and volumes for the Upper Reservoir with various liner options are also shown in Table 3. The resultant groundwater levels from seepage of the Upper Reservoir at maximum water surface elevation are shown on Figure 6.

Table 3. Upper Reservoir Seepage Analysis Results – Seepage Blanket Only

	Parameter	Max.	Min.	Average
NO LINER	Unit Width Seepage Rate (cfs)	0.00195	0.00124	0.00160
	Annual Seepage (ac-ft/yr)	2097	535	**1202**

3' THICK LINER	Unit Width Seepage Rate (cfs)	0.00178	0.00106	0.00142
	Annual Seepage (ac-ft/yr)	1913	456	**1068**
5' THICK LINER	Unit Width Seepage Rate (cfs)	0.00174	0.00091	0.00133
	Annual Seepage (ac-ft/yr)	1874	394	**1000**
8' THICK LINER	Unit Width Seepage Rate (cfs)	0.00170	0.00070	0.00120
	Annual Seepage (ac-ft/yr)	1823	303	**903**

cfs – cubic feet per second ac-ft/yr – acre-feet per year
Max. – Maximum Min. – Minimum

The estimated unit width seepage quantities and average annual seepage volumes for the Lower Reservoir are presented in Table 4. Seepage quantities and volumes for the Lower Reservoir with various liner options are also shown in Table 4. The resultant groundwater levels from seepage of the Lower Reservoir at maximum water surface elevation are shown on Figure 7. The remaining computer outputs of the analyses are included in the Appendix.

Table 4. Lower Reservoir Seepage Analysis Results – Seepage Blanket Only

	Parameter	Max.	Min.	Average
NO LINER	Unit Width Seepage Rate (cfs)	0.00356	0.00181	0.00269
	Annual Seepage (ac-ft/yr)	2836	891	**1731**
3' THICK LINER	Unit Width Seepage Rate (cfs)	0.00348	0.00177	0.00262
	Annual Seepage (ac-ft/yr)	2768	871	**1690**
5' THICK LINER	Unit Width Seepage Rate (cfs)	0.00347	0.00175	0.00261
	Annual Seepage (ac-ft/yr)	2765	863	**1683**
8' THICK LINER	Unit Width Seepage Rate (cfs)	0.00347	0.00175	0.00261
	Annual Seepage (ac-ft/yr)	2764	860	**1681**

cfs – cubic feet per second ac-ft/yr – acre-feet per year
Max. – Maximum Min. – Minimum

Based on the seepage analyses of the Eagle Mountain Pumped Storage Project and assuming no reservoir seepage treatments, the estimated annual average seepage volume from the Upper Reservoir is approximately 1,200 acre-feet, and the estimated annual average seepage volume from the Lower Reservoir is approximately 1,700 acre-feet. The estimated annual seepage volume for the Lower Reservoir is about 500 acre-feet more than the Upper Reservoir because the eastern wall of the Lower Reservoir primarily consists of alluvial sediments and debris flow deposits, which have significantly higher hydraulic conductivities.

Based on the seepage analysis, the fine tailings blanket liner options for the Upper Reservoir reduce the average annual seepage volume. The estimated reduction in average annual seepage volume for the Upper Reservoir ranged from about 11 to 25 percent, depending on the liner thickness. The maximum reduction for the Upper Reservoir was approximately 300 acre-feet annually, with an eight-foot thick liner in place.

The fine tailings blanket liner in the Lower Reservoir was estimated to be relatively ineffective. This is because the upper half of the walls in the pit, which consist of the alluvium deposit, are

too steep to support the fine tailings liner. And, since the majority of seepage from the Lower Reservoir will be through this alluvium deposit, the analyses indicated little change due to the various liner options. The estimated reduction in average annual seepage volume for the Lower Reservoir was about 2.5 percent, regardless of the liner thickness. The maximum reduction for the Lower Reservoir was approximately 50 acre-feet annually, with an eight-foot thick liner constructed where possible. Based on this analysis, additional seepage reduction measures beyond a fine tailings blanket liner will be required for the Lower Reservoir.

North-South Profile Analysis Results

Seepage and ground water elevations along a north-south profile toward the CRA were estimated for both the Upper and Lower Reservoirs of the Eagle Mountain Pumped Storage Project at both the minimum and maximum water surface elevations. The seepage analysis from the proposed Upper Reservoir at maximum water surface elevation is shown on Figure 8. Generally, the maximum water surface elevation in the Upper Reservoir is projected to cause the ground water levels near the location of the CRA to rise approximately 45 feet above the estimated existing ground water levels. Results of the seepage analysis from the proposed Lower Reservoir at maximum water surface elevation are shown on Figure 9. Generally, the maximum water surface elevation in the Lower Reservoir is projected to cause the ground water levels near the location of the CRA to rise approximately 150 feet above the estimated existing ground water levels. The remaining computer outputs of the analyses are included in the Appendix.

Potential Impacts from Reservoir Seepage

Concerns have been raised about the potential impacts of seepage from the reservoirs on the concrete lining of the Colorado River Aqueduct (CRA), which is owned and operated by MWD. The potential impacts to the CRA from reservoir seepage were analyzed using both west-east and north-south profiles for each of the project reservoirs. The impacts of seepage were expected to be the most noticeable in the west-east profiles due to the close proximity of the Lower Reservoir to the CRA; however, the impacts along the north-south profiles were also investigated to fully assess the seepage concerns.

Based on the west-east seepage analysis for the Lower Reservoir, assuming no seepage treatments and continuous seepage at the maximum reservoir water surface elevation, the estimated groundwater elevation near the location of the CRA is estimated to stabilize at approximately El. 915, as shown on Figure 7. The current static groundwater elevation at this location is about at El. 675, which is about 240 feet lower than the modeled ground water surface elevation with fully-developed reservoir seepage. The ground surface elevation near the CRA is approximately El. 1000, which is about 85 feet higher than the groundwater elevation predicted under worse-case conditions for seepage from the Lower Reservoir. Because the estimated ground water elevation is predicted to be well below the ground surface, no uplift forces are predicted on the concrete lining of the CRA.
Based on the north-south seepage analysis of seepage from the Upper and Lower Reservoirs, the Lower Reservoir produced the greatest increases from the estimated ground water elevations; therefore, the Lower Reservoir seepage results were used to analyze the impacts to the CRA facilities. The CRA facilities that could potentially be impacted by reservoir seepage along the north-south profiles include the CRA Pump Station and CRA channel near the pump station, as shown on Figure 1. Based on the north-south seepage analysis from the Lower Reservoir, and assuming no seepage treatments and continuous seepage at the maximum reservoir water surface elevation, the estimated ground water elevation near the location of the CRA is estimated to reach approximately El. 745 feet, as

shown on Figure 9. The current static ground water elevation at this location is assumed to be about at El. 580 feet. However, this elevation may be conservatively high, because ground water wells and elevation data are not available at this location, but data was extrapolated to develop a conservative estimate. Therefore, the existing ground water elevation is estimated to be about 165 feet lower than the modeled ground water surface elevation with fully developed reservoir seepage. The ground surface elevation near the CRA is approximately El. 985 feet, which is estimated to be about 240 feet higher than the ground water elevation predicted under worse-case conditions for seepage from the Lower Reservoir. Because the estimated ground water elevation is predicted to be well below the ground surface, no uplift forces are predicted on the concrete lining of the CRA or at the pump station.

In addition, we estimate that the steady-state groundwater profile for the Lower Reservoir shown on Figure 7 will take at least 15 years to fully develop from the estimated seepage volume, assuming a two year filling period and the reservoir remains at the maximum water surface elevation after filling. We also estimate that the steady-state groundwater profiles for the Upper Reservoir shown on Figures 6 and 8 will take at least 50 years to fully develop, assuming a two year filling period and the reservoir remains at the maximum water surface elevation after filling. Furthermore, it is estimated to take at least 30 years for groundwater levels near the Upper Reservoir to reach and daylight at the nearest surface drainage channel. If the groundwater levels do daylight in the adjacent surface drainage channels, any seepage will be collected and conveyed to the Lower Reservoir. However, the reservoirs can never be completely full at the same time, and reservoir levels will cycle up and down in response to energy demands and hydroelectric operations. Realistically, we expect that the estimated steady-state groundwater levels from seepage from the Eagle Mountain Project may not fully develop during the estimated project service life of 50 years.

Hydrocompaction has also been identified as a potential impact that could be associated with seepage from reservoirs of the Eagle Mountain Project. The potential for hydrocompaction in soils is related to the grain size of the sediments and how they were deposited. Fan deposits, such as those present near the project site, when deposited by flash-flood type of events, are highly susceptible to compaction when wetted either from above or below. Under worse-case conditions, our analyses indicate that groundwater levels will be about 80 feet below ground surface and will not reach the near-surface zones where hydrocompaction would be the most problematic.

Studies conducted for MWD in the Chuckwalla Aquifer (Upper Chuckwalla Groundwater Basin StorageGeoPentech 2003) addressed hydrocompaction. The studies suggested that to depths of 100 feet, hydrocompaction could range from 0.56 to 1.8 percent, depending on soil composition. As such, surface subsidence may total from 0.5 to 1.8 feet. Therefore, additional reduction of seepage is needed and seepage recovery wells are needed to reduce hydrocompaction to negligible levels.

Other Seepage Treatment and Monitoring Measures

The Project plans to limit seepage from the project reservoirs to the maximum extent possible. This includes the Upper Reservoir, Lower Reservoir, and the brine disposal ponds that will be part of the water quality management system for the project, which is described in the draft License Application. A more-detailed hydrogeologic analysis will be prepared during final design of the project. We will also undertake detailed geologic mapping of the reservoirs during project design. Upon completion of the hydrogeologic analysis and detailed geologic

mapping, engineering design solutions will be provided to reduce seepage from the project reservoirs in order to reduce the potential for hydrocompaction and impacts to groundwater levels and water quality.

Seepage control from the project reservoirs will be accomplished using systematic procedures and steps that have been applied successfully at similar projects. These procedures will include the following:

- After access to the site is obtained, a team of geologists and geotechnical engineers will conduct a detailed reconnaissance of the reservoir basins and pond areas to identify zones where leakage and seepage would be expected to occur. These areas will include faults, fissures and cracks in the bedrock, and zones that have direct connection to the alluvial deposits of the Chuckwalla Valley. During the reconnaissance, the team will evaluate the effectiveness of various methods for seepage and leakage control to mitigate the effects of these particular features.

- Seepage and leakage control methods will be further investigated utilizing data from the geologic reconnaissance and hydrogeologic modeling studies. Potential methods for seepage and leakage control will include curtain grouting of the foundation beneath the dam footprint and around the reservoir rim, as needed; backfill concrete placement and/or slush grouting of the faults, fissures and cracks recognized in the field reconnaissance; placement of low permeability materials, as technically feasible, over zones too large to be grouted and over areas of alluvium within the Lower Reservoir; seepage and leakage collection systems positioned based on the results of the hydrogeologic analyses; and clay or membrane lining of the brine ponds associated with the project's water quality management system. The collection systems would recycle water into the project reservoirs or the RO (reverse osmosis) system.

- Design and construction of the seepage and leakage control measures, which will be aided by the results of the groundwater modeling.

- Design and construction of a comprehensive monitoring program, consisting of observation wells and piezometers that will be used to assess the effectiveness of the seepage and leakage control measures.

- Based on monitoring results, additional actions may be taken to further control leakage and seepage from the reservoirs and ponds. Such measures may include curtain grouting and the expansion of seepage and leakage collection systems.

We modified the seepage model described above to reflect implementation of the above noted measures, in addition to the use of seepage blankets on the bottom and flatter-sloped areas of the two reservoirs. We assumed that the following measures would provide the indicated levels of seepage reduction:

- Grouting measures in fractured bedrock zones are expected to reduce the effective seepage area by 30% in the Upper Reservoir and 20 % in the Lower Reservoir. Grouting in the Lower Reservoir was not assumed to be possible or effective in the exposed alluvium on the eastern end of the reservoir. The

percentage reduction due to grouting of fractured bedrock zones was estimated based on rock quality index (RQI) test results from the earlier subsurface exploration programs. The RQI for the top 100 feet of the boreholes was averaged for each reservoir. The percentage reduction was estimated assuming 100-RQI_{avg} divided by two.

- The exposed alluvium in the eastern portion of the Lower Reservoir extends over a total perimeter distance of approximately 5,000 feet with the maximum depth of approximately 315 feet below the normal water surface elevation. The average slope of the pit walls in this zone is about 3 to 1 (horizontal: vertical), although the upper half of the pit has steep slopes near 1.5 to 1 in inclination. A possible treatment option, which will be investigated during final design for feasibility and effectiveness, would be to blanket the entire zone with a stepped RCC or soil cement overlay. This would reduce the effective seepage area by at least 80%. However, this approach could be very expensive. Therefore, other treatment options will be explored during final design.

Results of these analyses are presented below:

Table 5. Upper Reservoir Seepage Analysis Results – Grouting and Seepage Blanket

	Parameter	Max.	Min.	Average
3' THICK LINER	Unit Width Seepage Rate (cfs)	0.00126	0.00078	0.00102
	Annual Seepage (ac-ft/yr)	1351	338	**768**
5' THICK LINER	Unit Width Seepage Rate (cfs)	0.00124	0.00072	0.00098
	Annual Seepage (ac-ft/yr)	1332	310	**738**
8' THICK LINER	Unit Width Seepage Rate (cfs)	0.00122	0.00061	0.00092
	Annual Seepage (ac-ft/yr)	1308	265	**689**

cfs – cubic feet per second ac-ft/yr – acre-feet per year
Max. – Maximum Min. – Minimum

Table 6. Lower Reservoir Seepage Analysis Results – Grouting, Seepage Blanket and RCC or Soil Cement Treatment over the Alluvium

	Parameter	Max.	Min.	Average
3' THICK LINER	Unit Width Seepage Rate (cfs)	0.00206	0.00135	0.00171
	Annual Seepage (ac-ft/yr)	1641	665	**1099**
5' THICK LINER	Unit Width Seepage Rate (cfs)	0.00170	0.00106	0.00138
	Annual Seepage (ac-ft/yr)	1358	521	**890**
8' THICK LINER	Unit Width Seepage Rate (cfs)	0.00131	0.00090	0.00111
	Annual Seepage (ac-ft/yr)	1045	443	**713**

cfs – cubic feet per second ac-ft/yr – acre-feet per year

Max. – Maximum Min. – Minimum

Based on the seepage analysis of the Upper Reservoir, the grouting of rock fractures could potentially reduce seepage from the reservoir an additional 200 to 300 acre-feet depending on the fine tailings blanket liner thickness. The estimated total reduction in average annual seepage volume from the Upper Reservoir, using both grouting and blanket liner, ranged from about 36 to 41 percent, depending on the liner thickness. The maximum reduction for the Upper Reservoir was approximately 500 acre-feet annually, with an eight-foot thick liner plus grouting in place. The estimated groundwater levels resulting from seepage from the Upper Reservoir utilizing the additional seepage control measures are shown on Figure 10 at maximum reservoir water surface elevation.

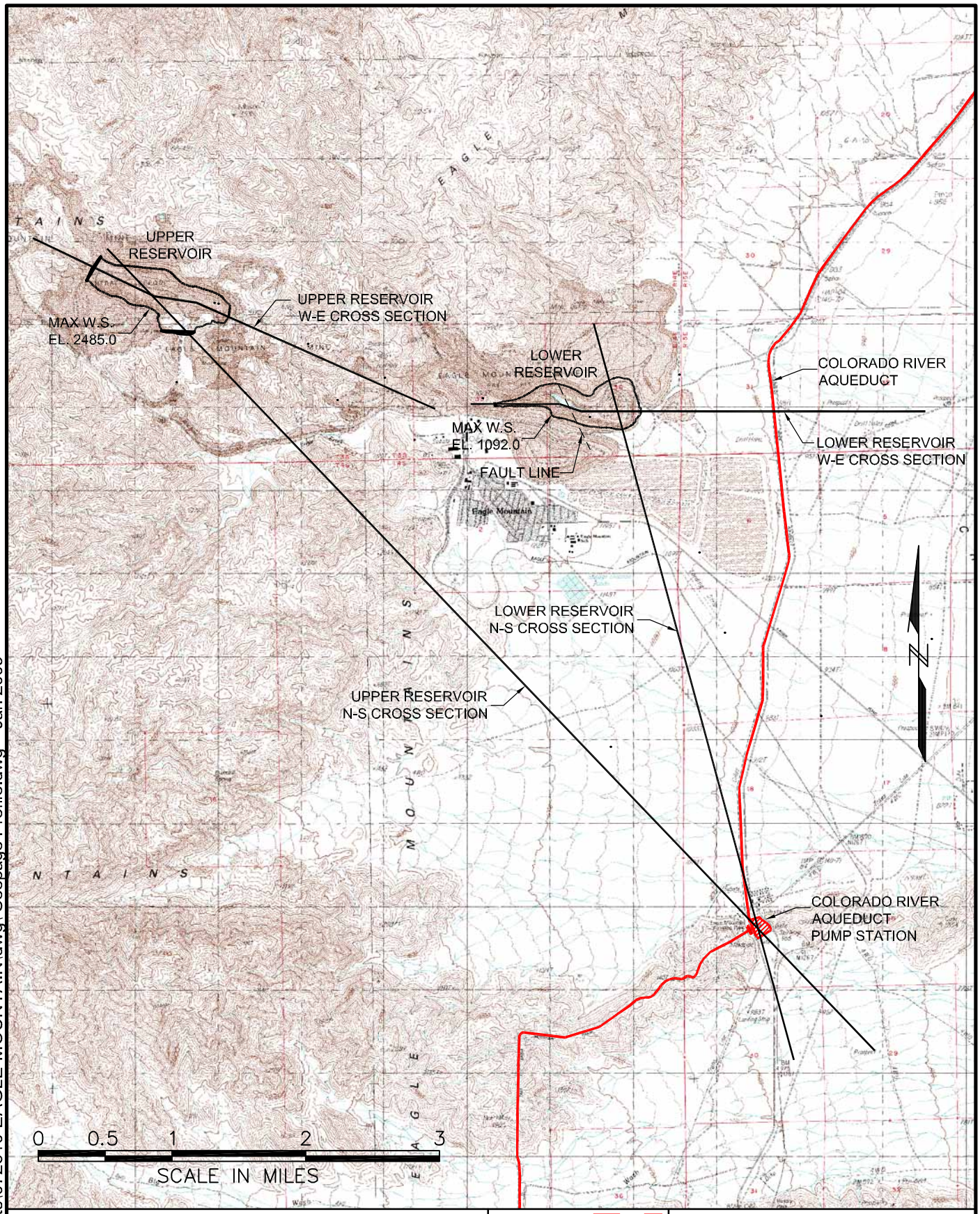
Based on the seepage analysis of the Lower Reservoir, the grouting of rock fractures and RCC or soil cement treatment on the alluvium could potentially reduce seepage from the reservoir an additional 600 to1,000 acre-feet depending on the fine tailings blanket liner thickness. The estimated total reduction in average annual seepage volume from the Lower Reservoir using a blanket liner, grouting rock fractures and treatment of alluvium, ranged from about 37 to 59 percent, depending on the liner thickness. The maximum reduction for the Lower Reservoir was approximately 1,000 acre-feet annually. The estimated groundwater levels resulting from seepage from the Lower Reservoir utilizing the additional seepage control measures are shown on Figure 11 at maximum reservoir water surface elevation.

We anticipate that any water that may escape the engineered seepage and leakage solutions will be captured by groundwater wells that will be operated to mitigate above-normal hydrostatic pressures on the CRA. The groundwater level control wells will be operated to maintain the groundwater levels within $\pm$5 feet of the historic levels in areas where hydrocompaction could potentially occur and adversely impact the CRA or other infrastructure. The combined pumping from the wells will be about 100 gpm from each of the proposed extraction wells for a total of 900 gpm. These wells will return the intercepted water to the Lower Reservoir. The wells, if found to be needed, will be located based on the results of detailed hydrogeologic modeling studies. Groundwater level and quality monitoring will be performed at monitoring wells and the project's extraction and water supply wells. Groundwater level and water quality sampling will be performed at:

- One up-gradient and 3 to 5 down-gradient wells around each reservoir and the brine disposal pond to detect seepage.
- Nine monitoring wells in the valley sediments to assess changes related to seepage or from project pumping.
- Two residential/municipal wells nearest the project to ensure safe drinking water.
- Extraction wells
- Groundwater levels will initially be monitored on a monthly basis, which may later be extended to quarterly or annual monitoring. Water quality sampling and testing will be performed initially on a quarterly basis.

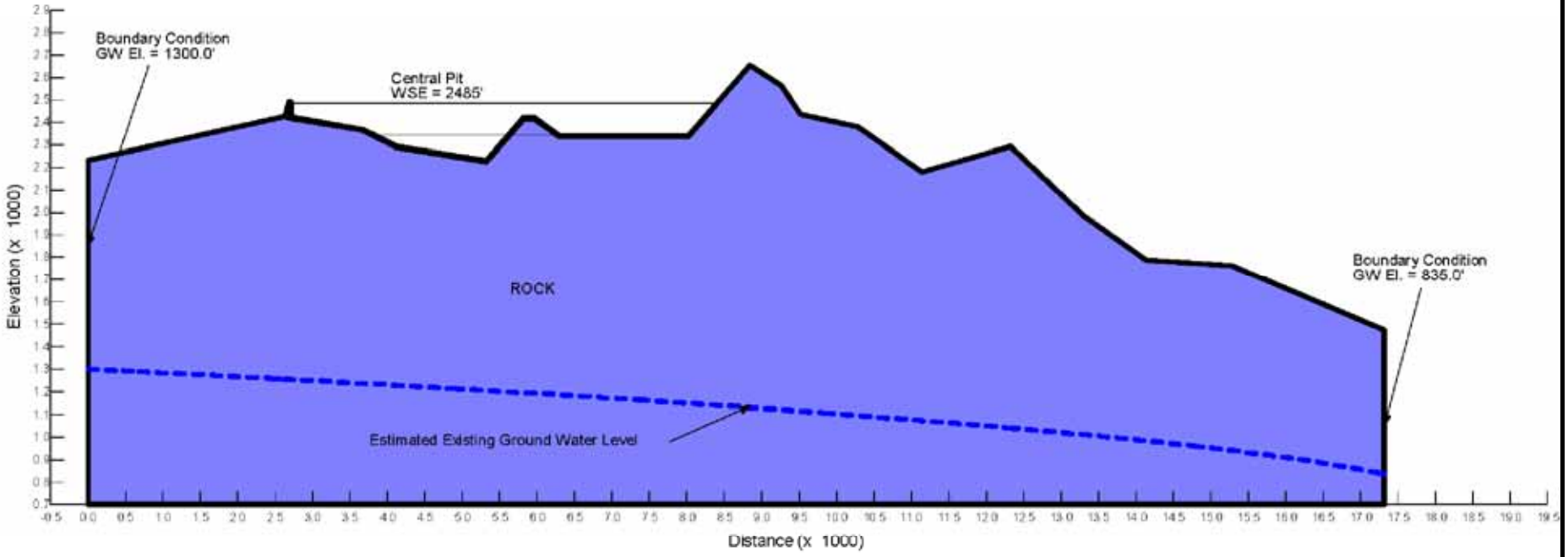
Based on implementation of the above-noted measures, we believe that our engineering design would mitigate any potential impacts to the CRA. The proposed measures to minimize and collect seepage will help insure that seepage emanating from the reservoirs is returned to the reservoirs prior to reaching the CRA.

Source: GeoPentech, 2003. Upper Chuckwalla Groundwater Basin Storage, Draft Report. Produced for Metropolitan Water District.



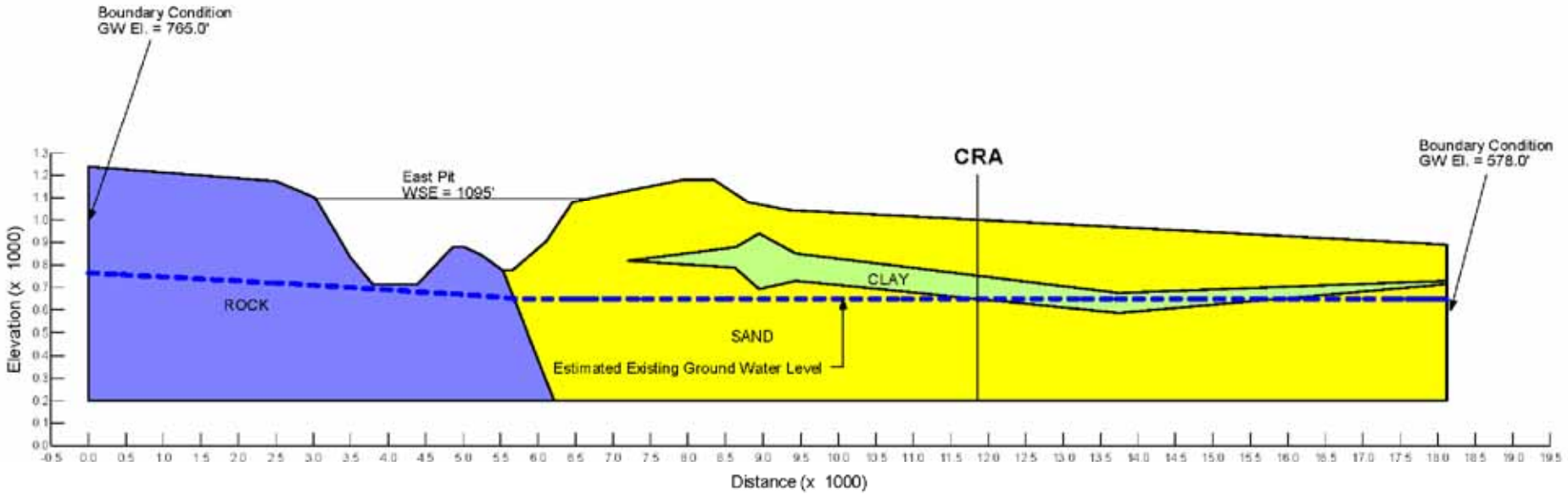
P:\Land Projects\072610 EAGLE MOUNTAIN\dwg\ Seepage Profile.dwg Jan 2009

Eagle Mountain Pumped Storage Project Eagle Mountain, California	GEI Consultants	PLAN VIEW OF RESERVOIR GEOLOGIC CROSS SECTIONS
Eagle Crest Energy	Project 080472	December 2008 Figure 1



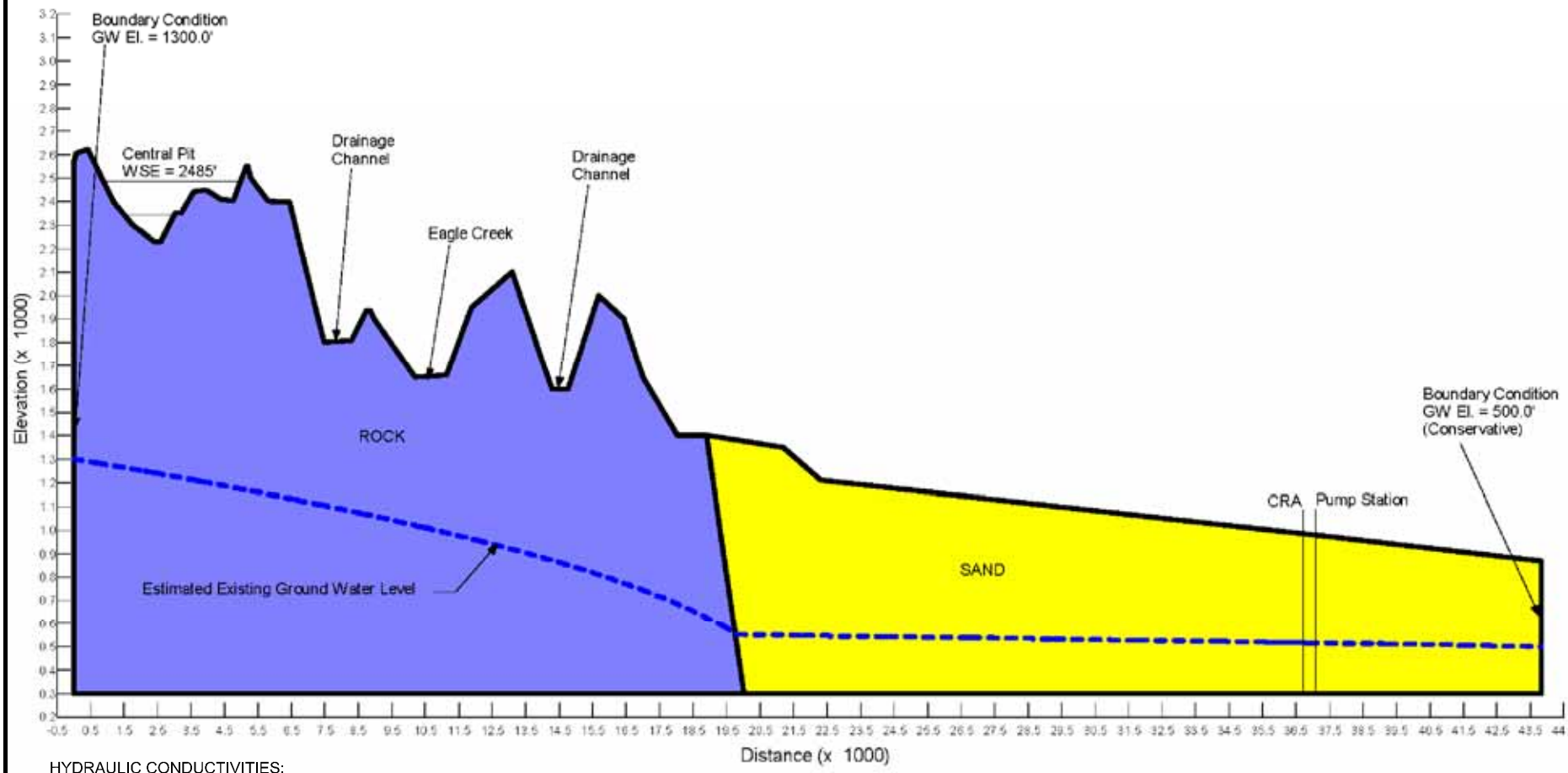
HYDRAULIC CONDUCTIVITIES:
ROCK = 1.0e-04 cm/s
LINER = 2.2e-06 cm/s

Eagle Mountain Pumped Storage Project Eagle Mountain, California	GEI Consultants	UPPER RESERVOIR WEST-EAST GEOLOGIC CROSS SECTION
Eagle Crest Energy	Project 080472	December 2008 Figure 2



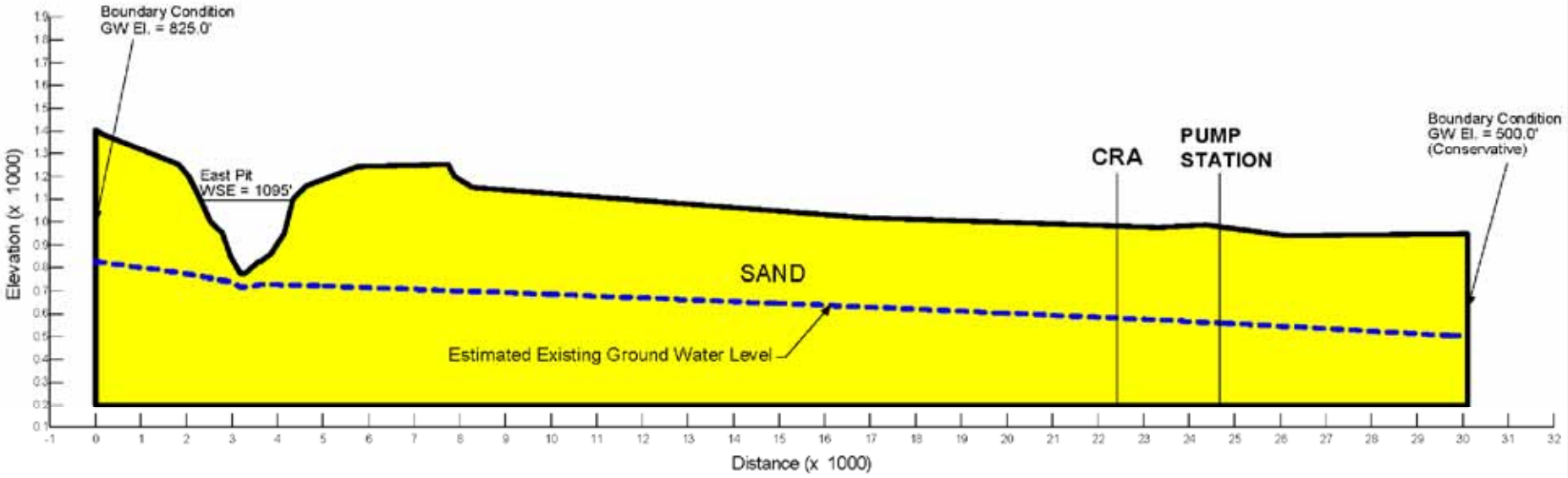
HYDRAULIC CONDUCTIVITIES:
ROCK = 1.0e-05 cm/s
SAND = 5.0e-03 cm/s
CLAY = 1.0e-05 cm/s
LINER = 2.2e-06 cm/s

Eagle Mountain Pumped Storage Project Eagle Mountain, California	GEI Consultants	LOWER RESERVOIR WEST-EAST GEOLOGIC CROSS SECTION
Eagle Crest Energy	Project 080472	December 2008 Figure 3



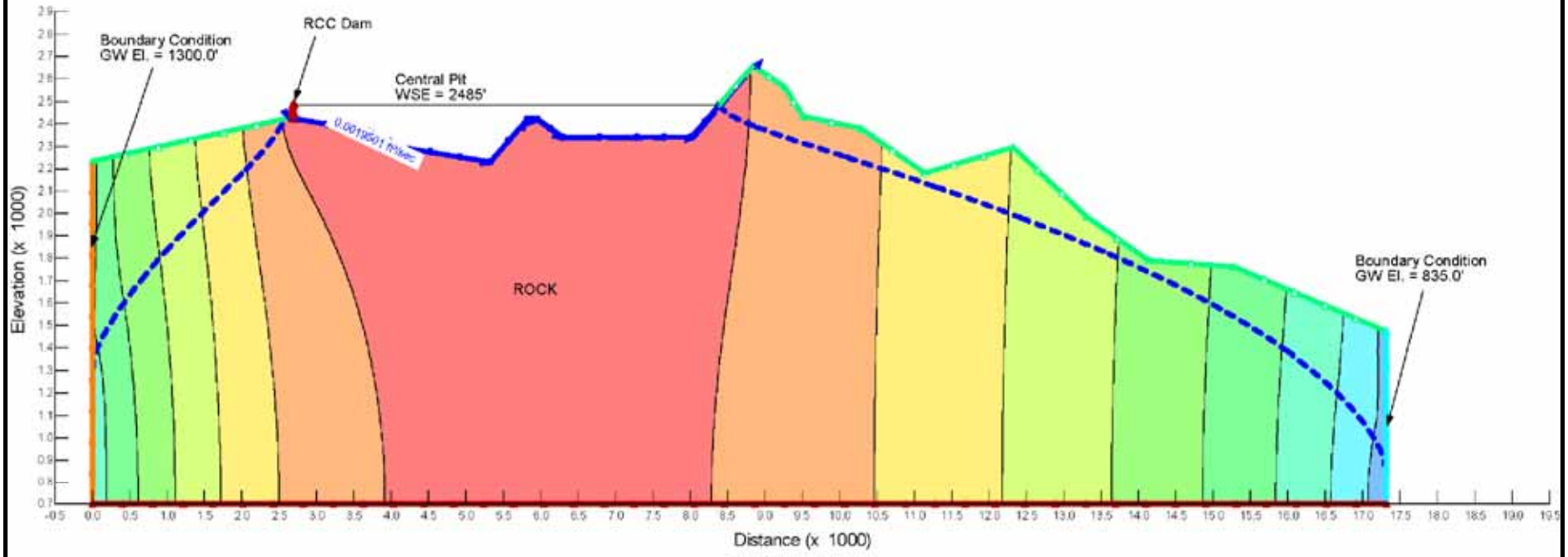
HYDRAULIC CONDUCTIVITIES:
ROCK = 1.0e-05 cm/s
SAND = 5.0e-03 cm/s

Eagle Mountain Pumped Storage Project Eagle Mountain, California	GEI Consultants	UPPER RESERVOIR NORTH-SOUTH GEOLOGIC CROSS SECTION
Eagle Crest Energy	Project 080472	December 2008 Figure 4

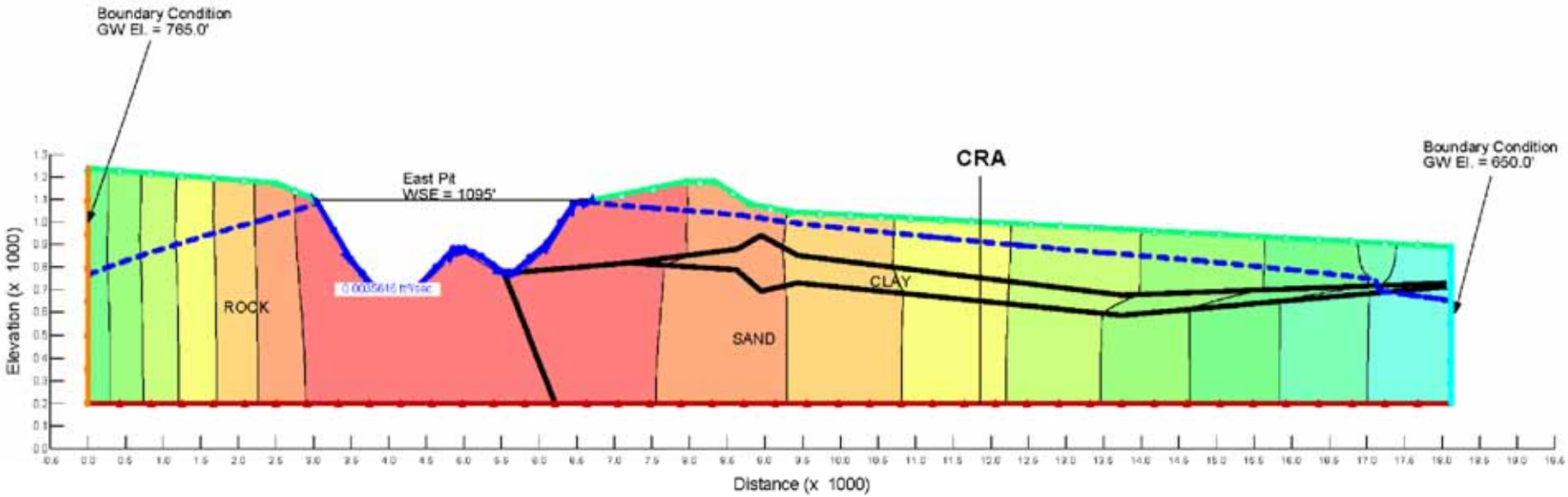


HYDRAULIC CONDUCTIVITIES:
SAND = 5.0e-03 cm/s

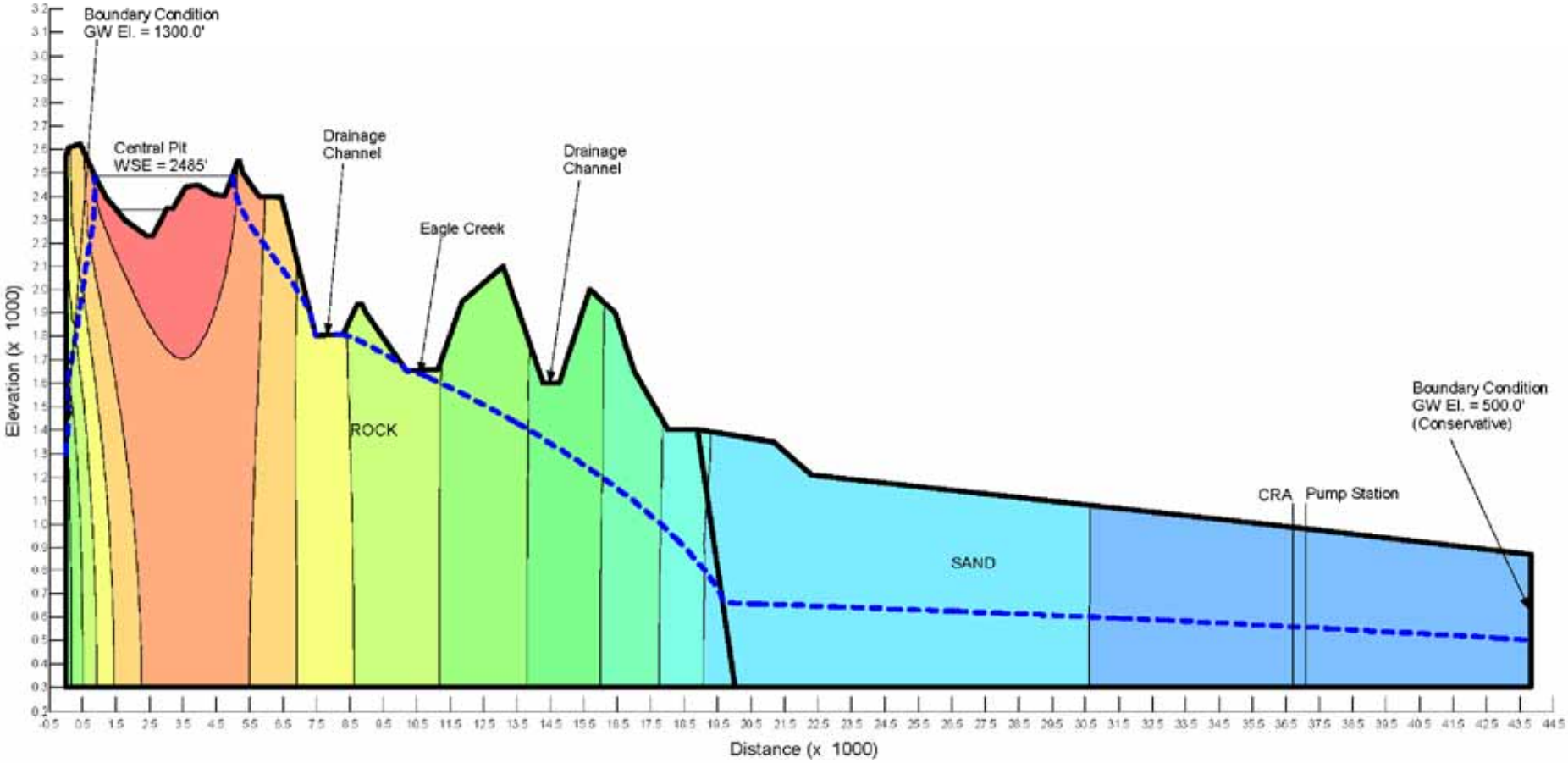
Eagle Mountain Pumped Storage Project Eagle Mountain, California	GEI Consultants	LOWER RESERVOIR NORTH-SOUTH GEOLOGIC CROSS SECTION
Eagle Crest Energy	Project 080472	December 2008 Figure 5



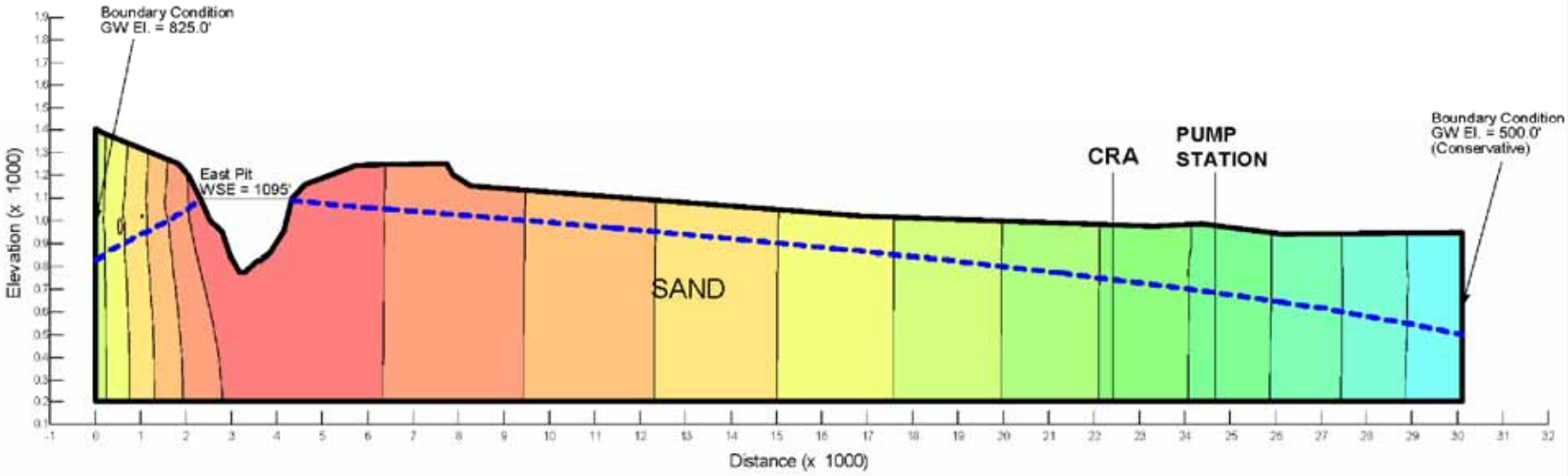
Eagle Mountain Pumped Storage Project Eagle Mountain, California		GEI Consultants	UPPER RESERVOIR MAXIMUM WATER SURFACE WEST-EAST SEEPAGE RESULTS
Eagle Crest Energy		Project 080472	December 2008 Figure 6



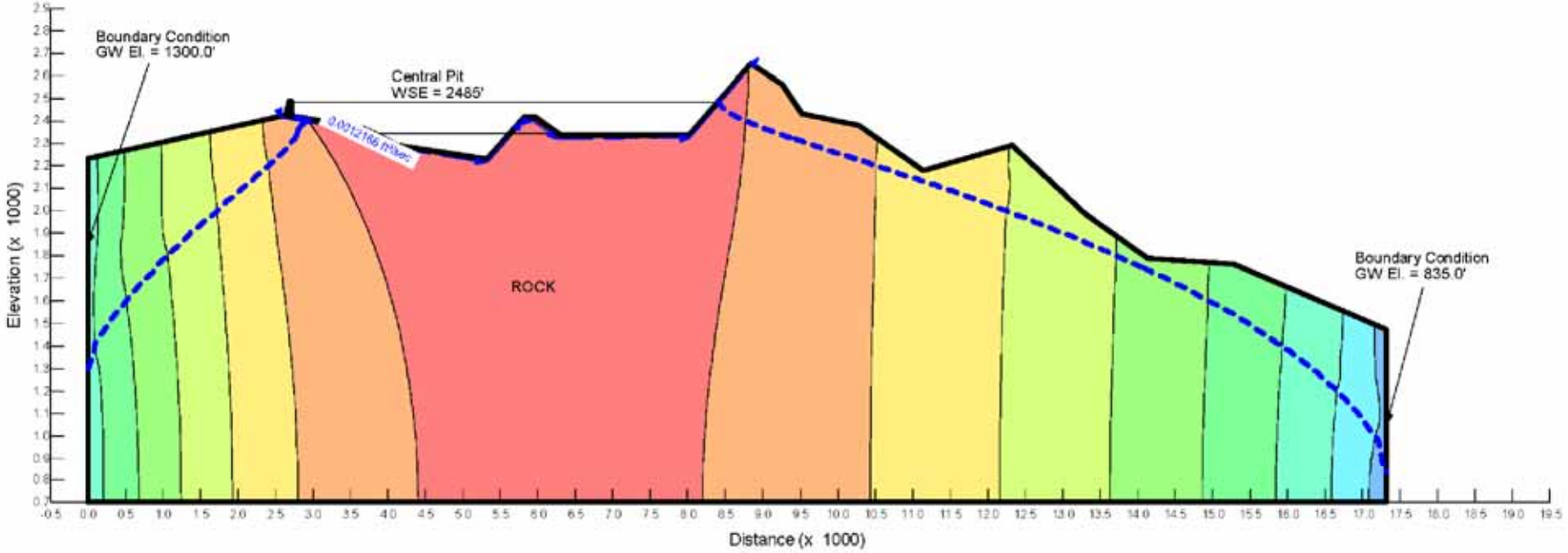
Eagle Mountain Pumped Storage Project Eagle Mountain, California	GEI Consultants	LOWER RESERVOIR MAXIMUM WATER SURFACE WEST-EAST SEEPAGE RESULTS
Eagle Crest Energy	Project 080472	December 2008 Figure 7



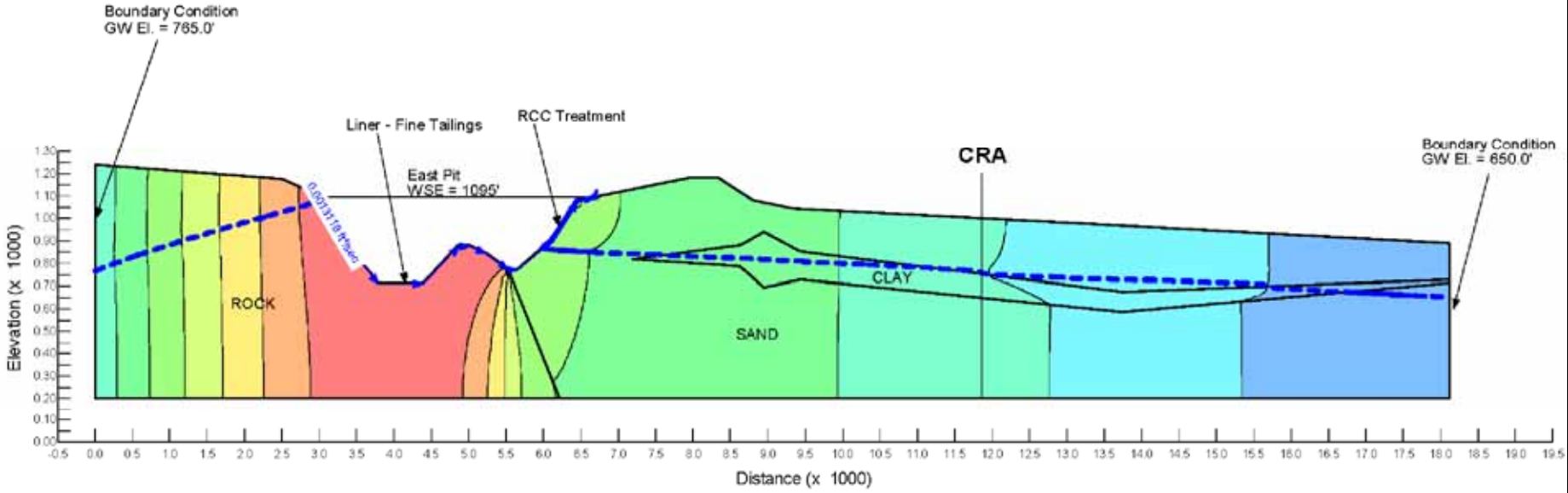
Eagle Mountain Pumped Storage Project Eagle Mountain, California	GEI Consultants	UPPER RESERVOIR MAXIMUM WATER SURFACE NORTH-SOUTH SEEPAGE RESULTS
Eagle Crest Energy	Project 080472	December 2008 Figure 8



Eagle Mountain Pumped Storage Project Eagle Mountain, California	GEI Consultants	LOWER RESERVOIR MAXIMUM WATER SURFACE NORTH-SOUTH SEEPAGE RESULTS
Eagle Crest Energy	Project 080472	August 2008 Figure 9



Eagle Mountain Pumped Storage Project Eagle Mountain, California	GEI Consultants	UPPER RESERVOIR MAXIMUM SEEPAGE TREATMENT RESULTS (MAX. WATER LEVEL)
Eagle Crest Energy	Project 080472	December 2008 Figure 10



Eagle Mountain Pumped Storage Project Eagle Mountain, California	GEI Consultants	LOWER RESERVOIR MAXIMUM SEEPAGE TREATMENT RESULTS (MAX. WATER LEVEL)
Eagle Crest Energy	Project 080472	December 2008 Figure 11

APPENDIX

GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
9/4/2008
NDM

EAGLE MOUNTAIN - CENTRAL PIT SEEPAGE RESULTS

SEEPAGE BLANKET ONLY

Reservoir Paramters

Max WSE	2485	ft
Min WSE	2343	ft
Max Reservoir WSE Area	48	acres
Min Reservoir WSE Area	191	acres
Max WSE Average Top Width	1485	ft
Min WSE Average Top Width	595	ft
Average Top Width	1040	ft

	Parameter	Max	Min	Average
NO LINER	Unit Width Seepage Rate (cfs)	0.00195	0.00124	0.00160
	Annual Seepage (ac-ft/yr)	2097	535	**1202**
3' THICK LINER	Unit Width Seepage Rate (cfs)	0.00178	0.00106	0.00142
	Annual Seepage (ac-ft/yr)	1913	456	**1068**
5' THICK LINER	Unit Width Seepage Rate (cfs)	0.00174	0.00091	0.00133
	Annual Seepage (ac-ft/yr)	1874	394	**1000**
8' THICK LINER	Unit Width Seepage Rate (cfs)	0.00170	0.00070	0.00120
	Annual Seepage (ac-ft/yr)	1823	303	**903**

GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
9/4/2008
NDM

EAGLE MOUNTAIN - CENTRAL PIT SEEPAGE RESULTS

GROUTING AND SEEPAGE BLANKET

Reservoir Paramters

Max WSE	2485	ft
Min WSE	2343	ft
Max Reservoir WSE Area	48	acres
Min Reservoir WSE Area	191	acres
Max WSE Average Top Width	1485	ft
Min WSE Average Top Width	595	ft
Average Top Width	1040	ft

	Parameter	Max	Min	Average
NO LINER	Unit Width Seepage Rate (cfs)	0.00195	0.00124	0.00160
	Annual Seepage (ac-ft/yr)	2097	535	**1202**
3' THICK LINER	Unit Width Seepage Rate (cfs)	0.00126	0.00078	0.00102
	Annual Seepage (ac-ft/yr)	1351	338	**768**
5' THICK LINER	Unit Width Seepage Rate (cfs)	0.00124	0.00072	0.00098
	Annual Seepage (ac-ft/yr)	1332	310	**738**
8' THICK LINER	Unit Width Seepage Rate (cfs)	0.00122	0.00061	0.00092
	Annual Seepage (ac-ft/yr)	1308	265	**689**

GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
9/4/2008
NDM

EAGLE MOUNTAIN - EAST PIT SEEPAGE RESULTS

SEEPAGE BLANKET ONLY

Reservoir Paramters

Max WSE	1095	ft
Min WSE	925	ft
Max Reservoir WSE Area	163	acres
Min Reservoir WSE Area	63	acres
Max WSE Average Top Width	1100	ft
Min WSE Average Top Width	680	ft
Average Top Width	890	ft

	Parameter	Max	Min	Average
NO LINER	Unit Width Seepage Rate (cfs)	0.00356	0.00181	0.00269
	Annual Seepage (ac-ft/yr)	2836	891	**1731**
3' THICK LINER	Unit Width Seepage Rate (cfs)	0.00348	0.00177	0.00262
	Annual Seepage (ac-ft/yr)	2768	871	**1690**
5' THICK LINER	Unit Width Seepage Rate (cfs)	0.00347	0.00175	0.00261
	Annual Seepage (ac-ft/yr)	2765	863	**1683**
8' THICK LINER	Unit Width Seepage Rate (cfs)	0.00347	0.00175	0.00261
	Annual Seepage (ac-ft/yr)	2764	860	**1681**

GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
9/4/2008
NDM

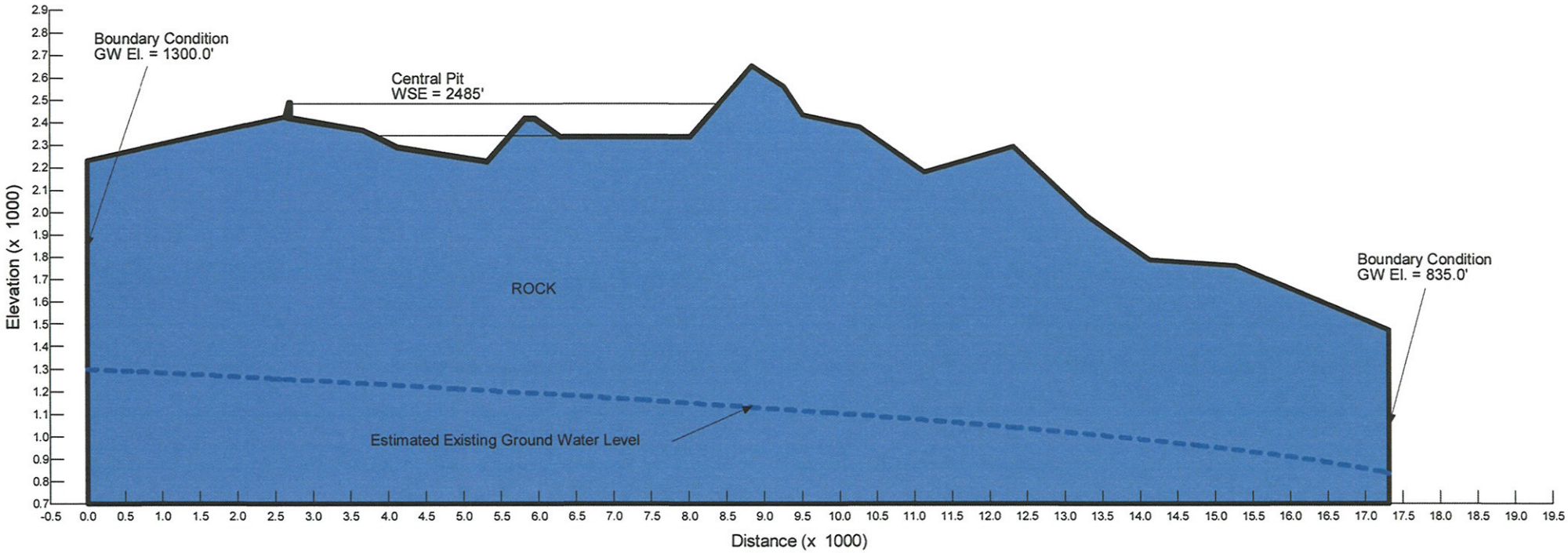
EAGLE MOUNTAIN - EAST PIT SEEPAGE RESULTS

GROUTING, SEEPAGE BLANKET, AND RCC TREATMENT

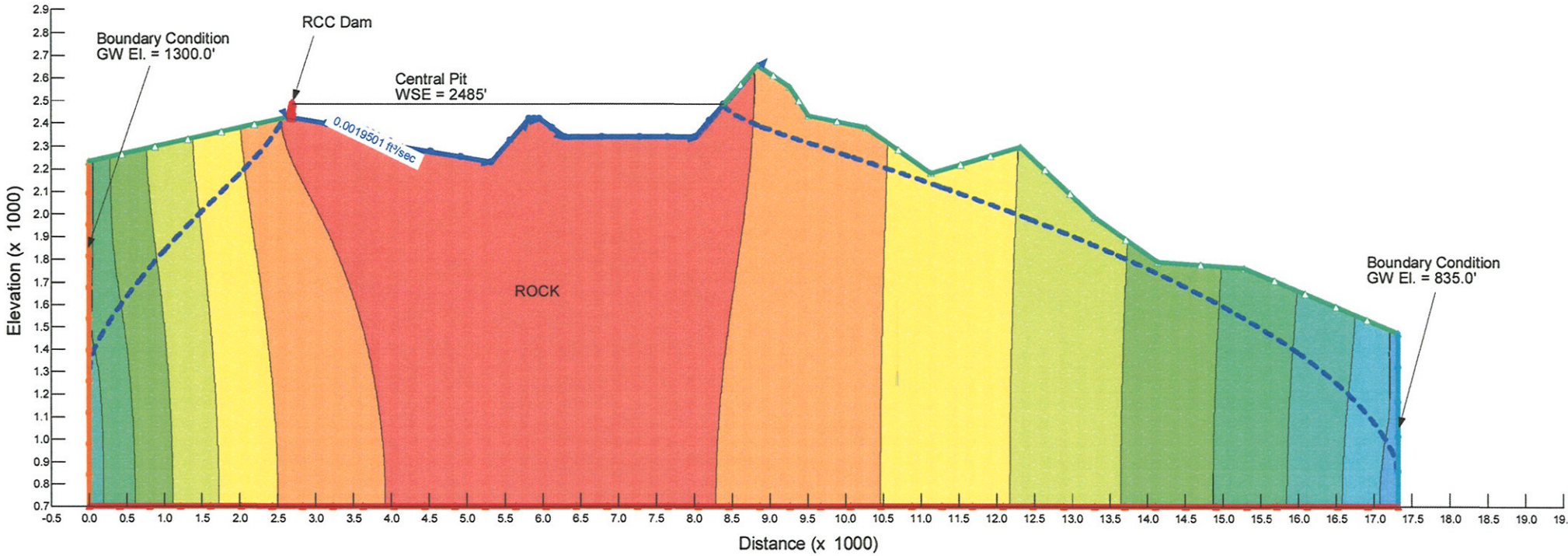
Reservoir Paramters

Max WSE	1095	ft
Min WSE	925	ft
Max Reservoir WSE Area	163	acres
Min Reservoir WSE Area	63	acres
Max WSE Average Top Width	1100	ft
Min WSE Average Top Width	680	ft
Average Top Width	890	ft

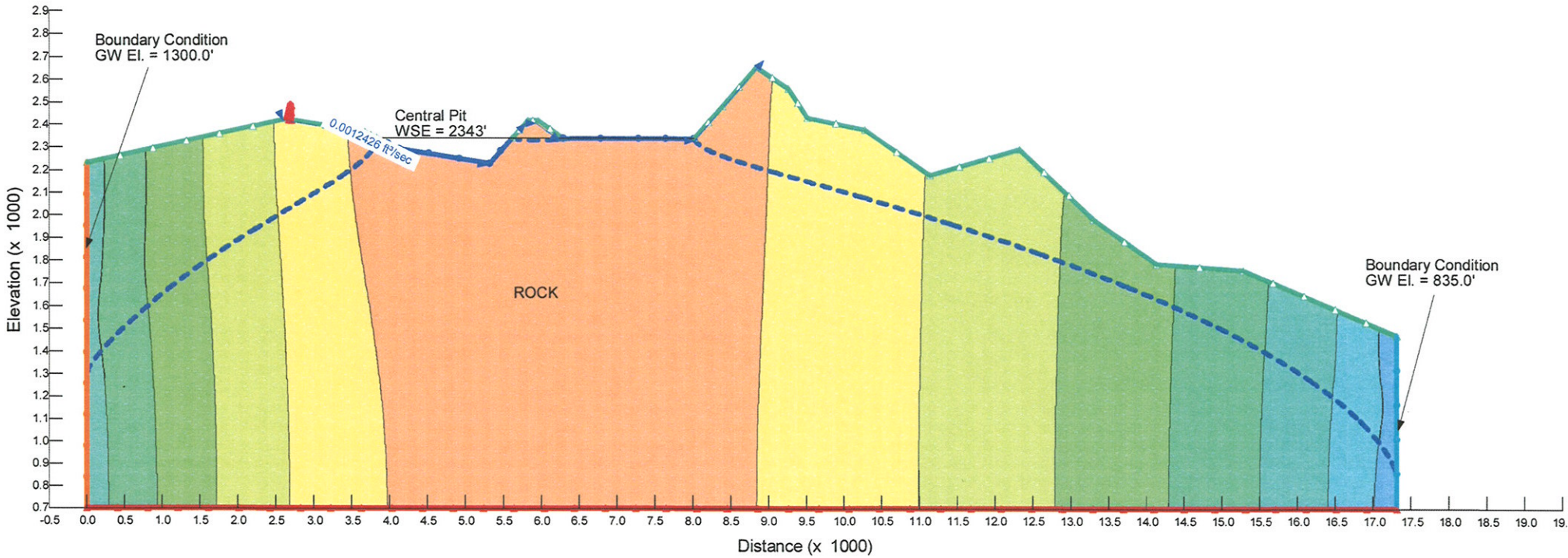
	Parameter	Max	Min	Average
NO LINER	Unit Width Seepage Rate (cfs)	0.00356	0.00181	0.00269
	Annual Seepage (ac-ft/yr)	2836	891	**1731**
3' THICK LINER	Unit Width Seepage Rate (cfs)	0.00206	0.00135	0.00171
	Annual Seepage (ac-ft/yr)	1641	665	**1099**
5' THICK LINER	Unit Width Seepage Rate (cfs)	0.00170	0.00106	0.00138
	Annual Seepage (ac-ft/yr)	1358	521	**890**
8' THICK LINER	Unit Width Seepage Rate (cfs)	0.00131	0.00090	0.00111
	Annual Seepage (ac-ft/yr)	1045	443	**713**



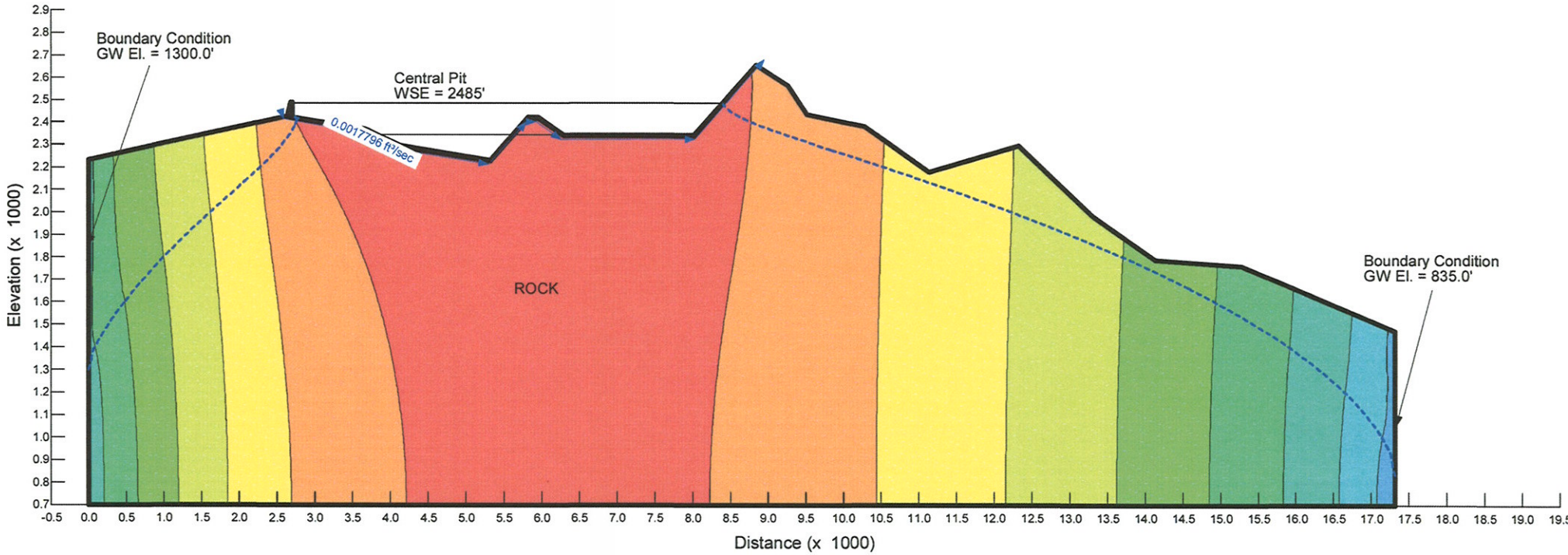
EXISTING CONDITIONS


Boundary Condition
GW El. = 1300.0'
RCC Dam
Central Pit
WSE = 2485'
0.0019501 ft³/sec
ROCK
Boundary Condition
GW El. = 835.0'
Elevation (x 1000)
Distance (x 1000)

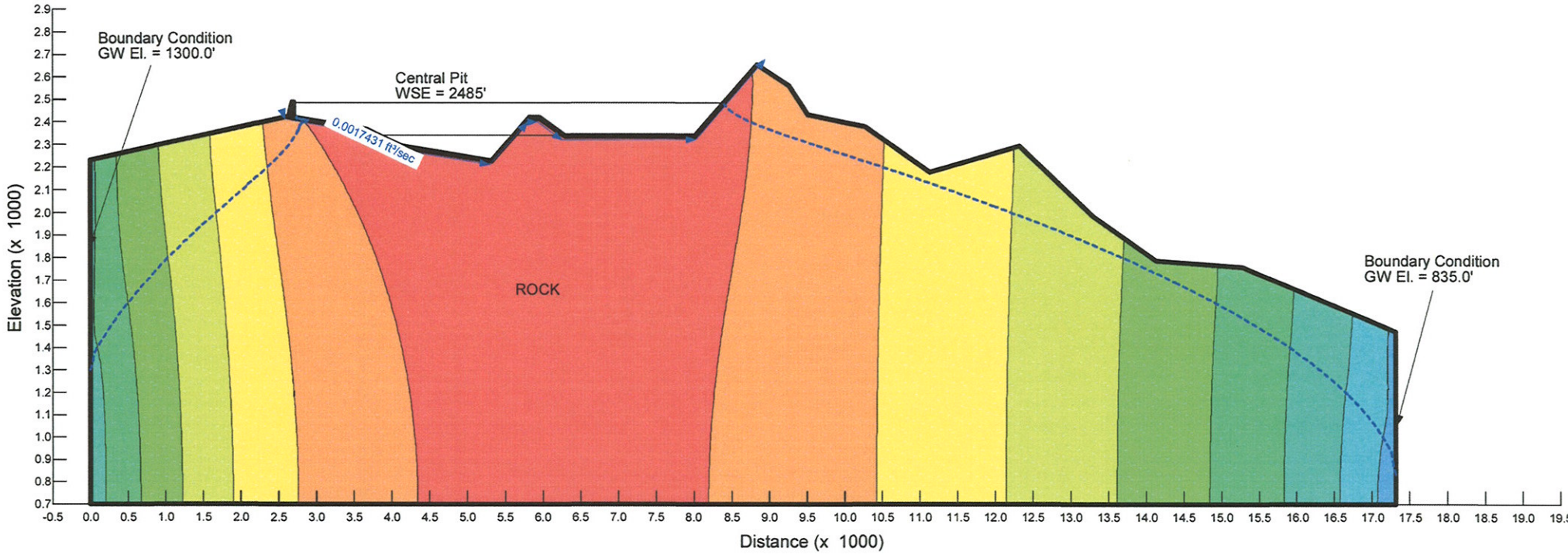
NO LINER


Boundary Condition
GW El. = 1300.0'
Central Pit
WSE = 2343'
0.0012426 ft³/sec
ROCK
Boundary Condition
GW El. = 835.0'
Elevation (x 1000)
Distance (x 1000)

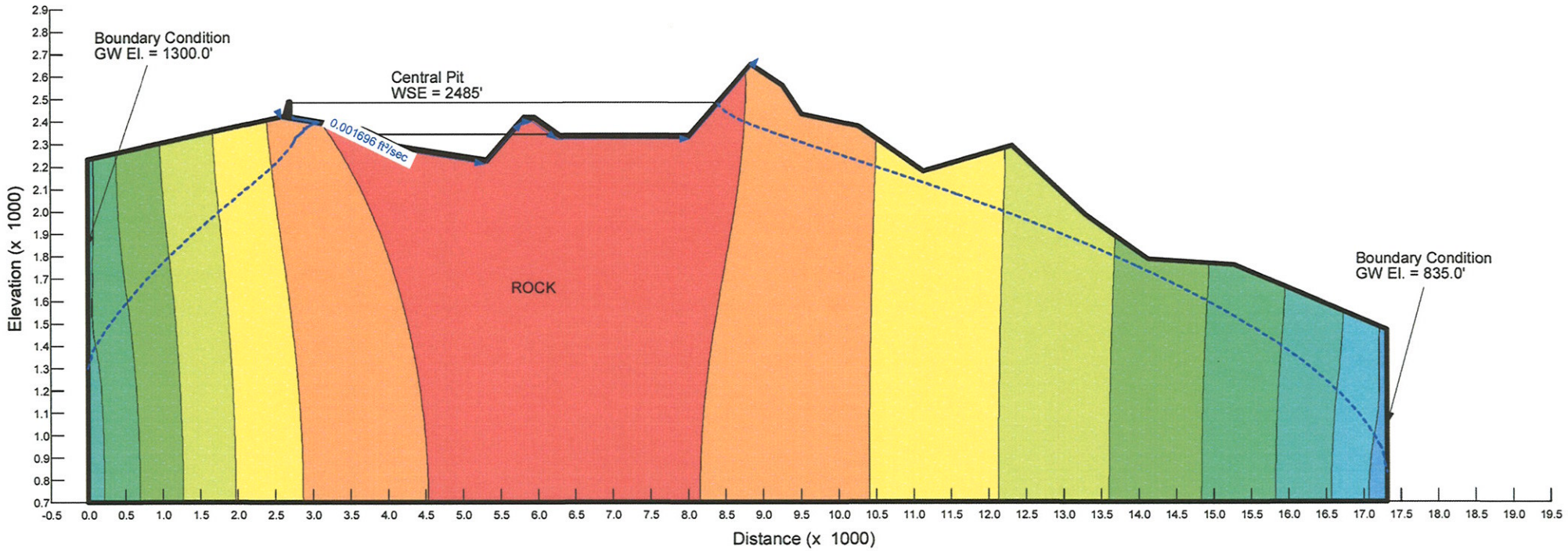
NO LINER


Boundary Condition
GW El. = 1300.0'
Central Pit
WSE = 2485'
0.0017796 ft³/sec
ROCK
Boundary Condition
GW El. = 835.0'
Elevation (x 1000)
Distance (x 1000)

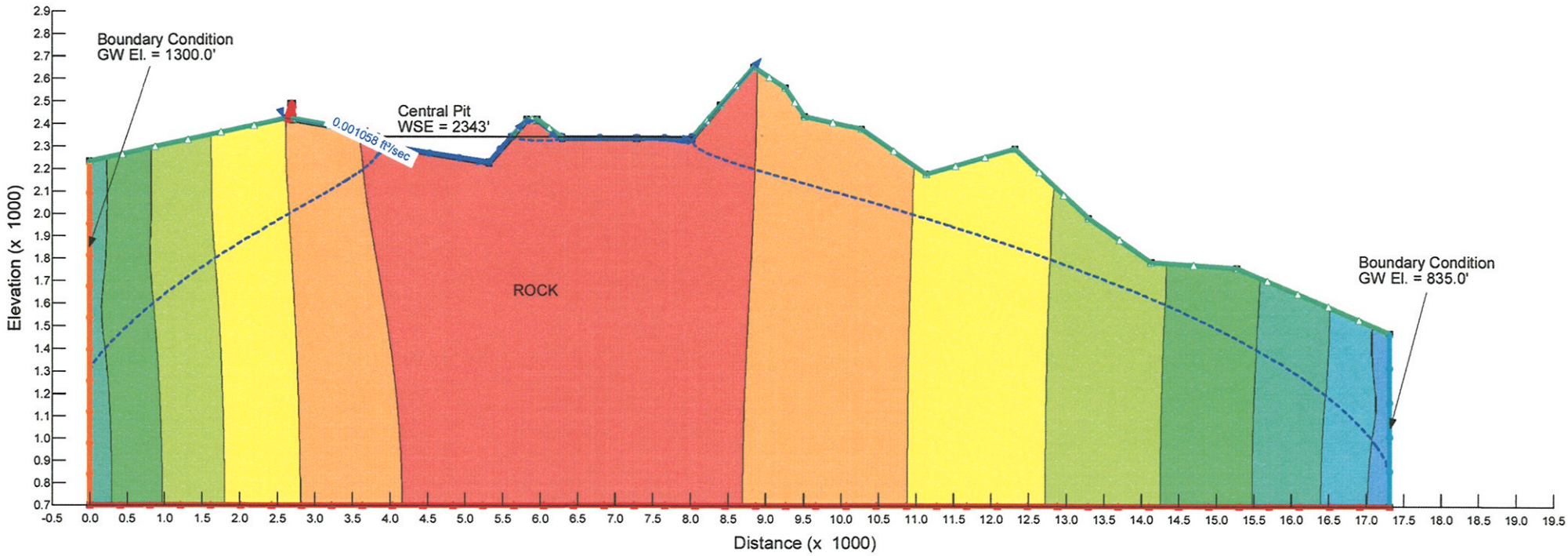
3' LINER


Boundary Condition
GW El. = 1300.0'
Central Pit
WSE = 2485'
0.0017431 ft³/sec
ROCK
Boundary Condition
GW El. = 835.0'
Elevation (x 1000)
Distance (x 1000)

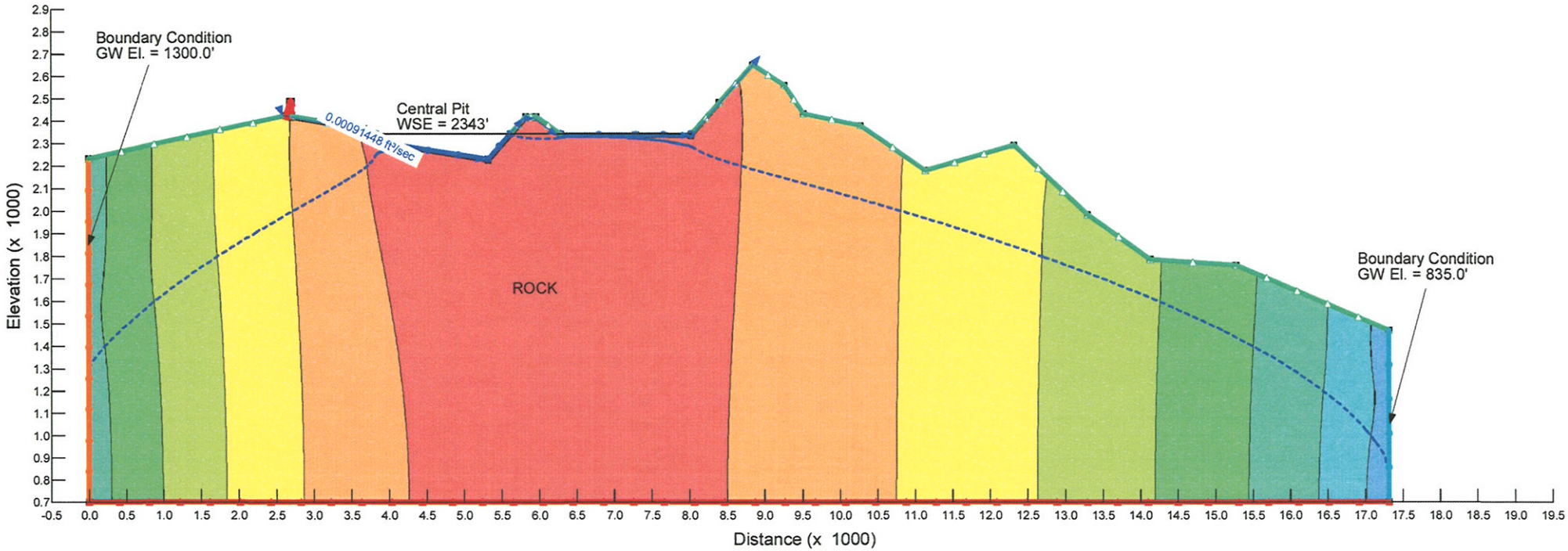
5' LINER


Boundary Condition
GW El. = 1300.0'
Central Pit
WSE = 2485'
0.001696 ft³/sec
ROCK
Boundary Condition
GW El. = 835.0'
Elevation (x 1000)
Distance (x 1000)

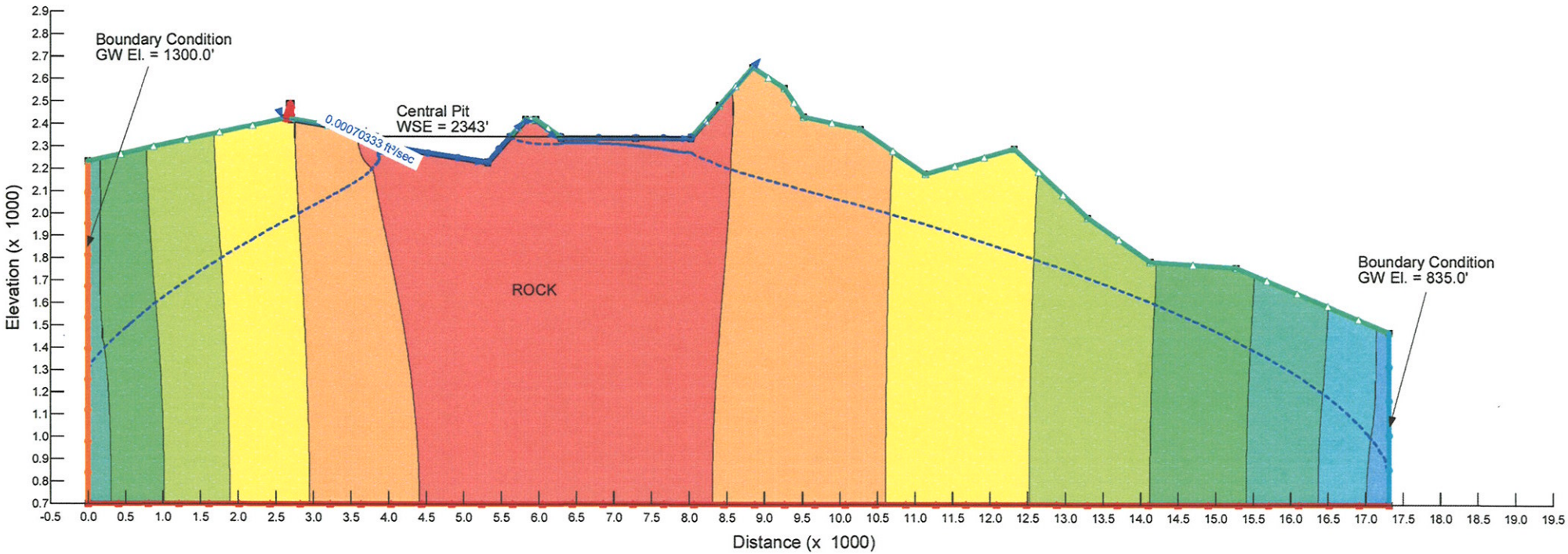
8' LINER


Boundary Condition
GW El. = 1300.0'
Central Pit
WSE = 2343'
0.001058 ft/sec
ROCK
Boundary Condition
GW El. = 835.0'
Elevation (x 1000)
Distance (x 1000)

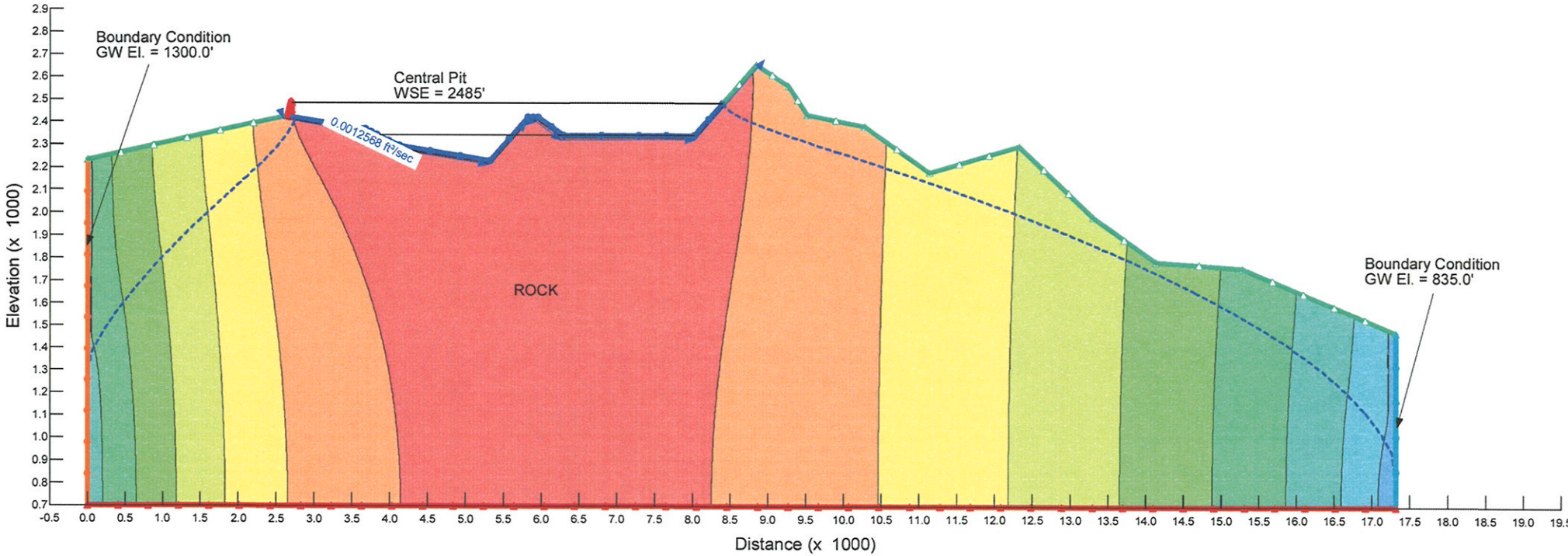
3' LINER


Boundary Condition
GW El. = 1300.0'
Central Pit
WSE = 2343'
0.00091448 ft³/sec
ROCK
Boundary Condition
GW El. = 835.0'
Elevation (x 1000)
Distance (x 1000)

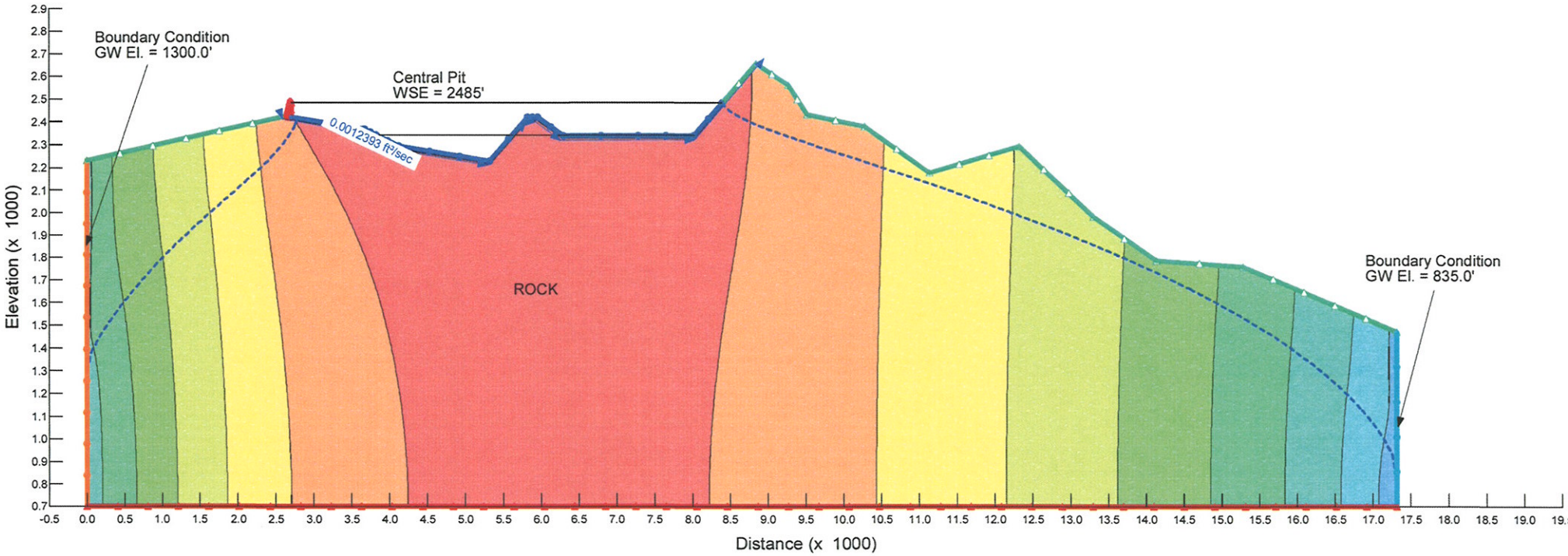
5' LINER


Boundary Condition
GW El. = 1300.0'
Central Pit
WSE = 2343'
0.00070333 ft/sec
ROCK
Boundary Condition
GW El. = 835.0'
Elevation (x 1000)
Distance (x 1000)

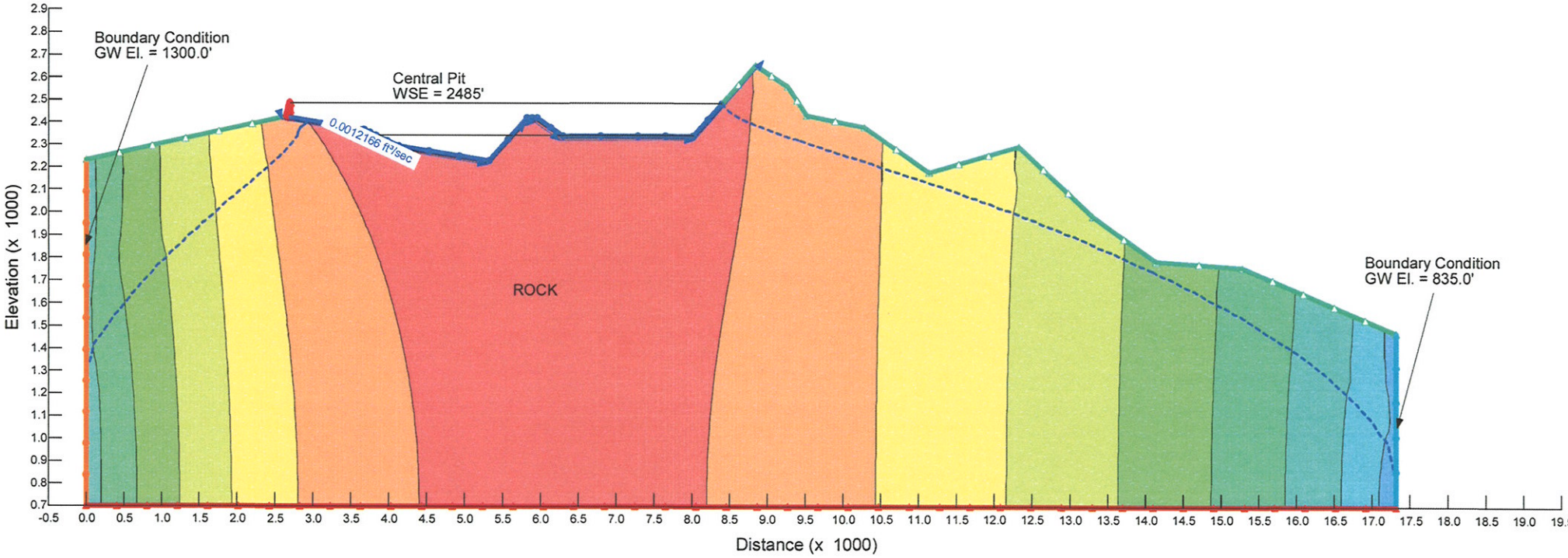
8' LINER



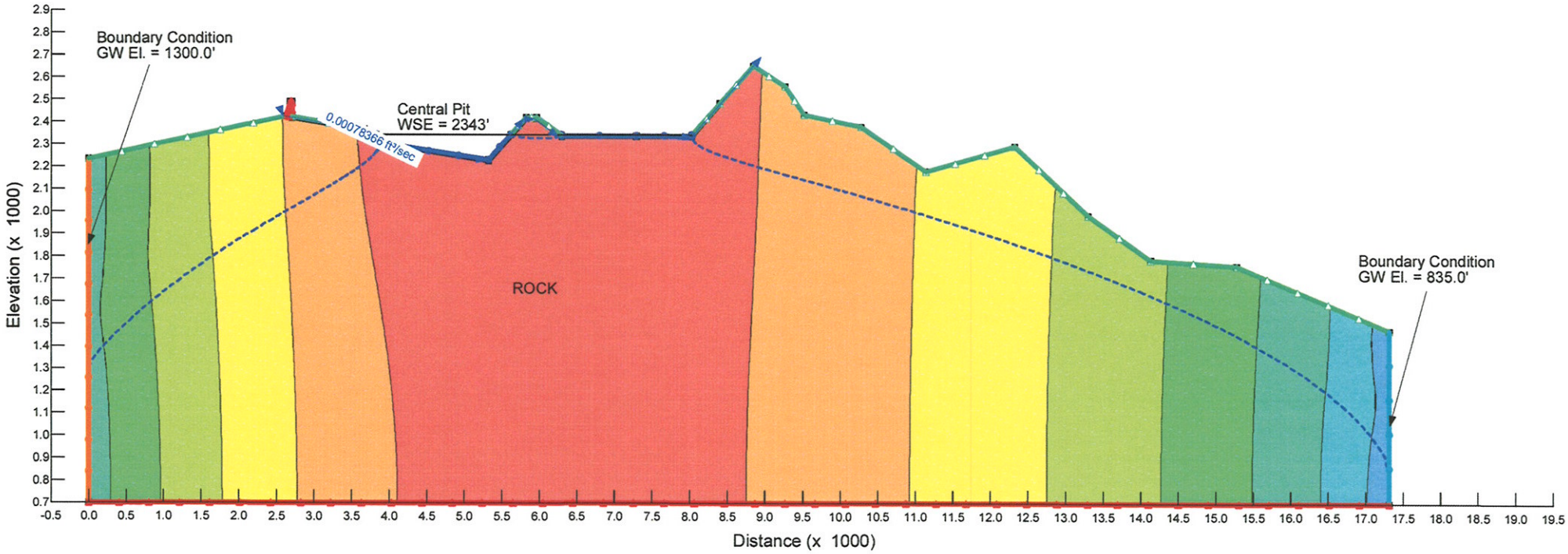
3' LINER W/ GROUTING



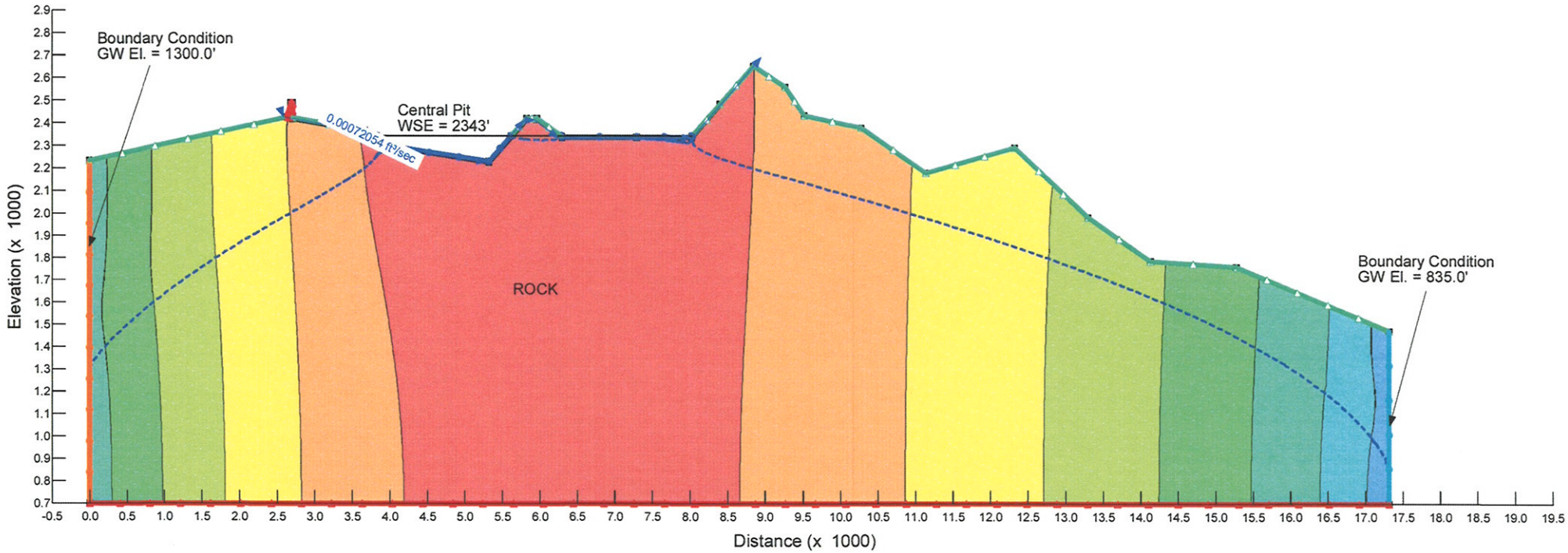
5' LINER W/ GROUTING



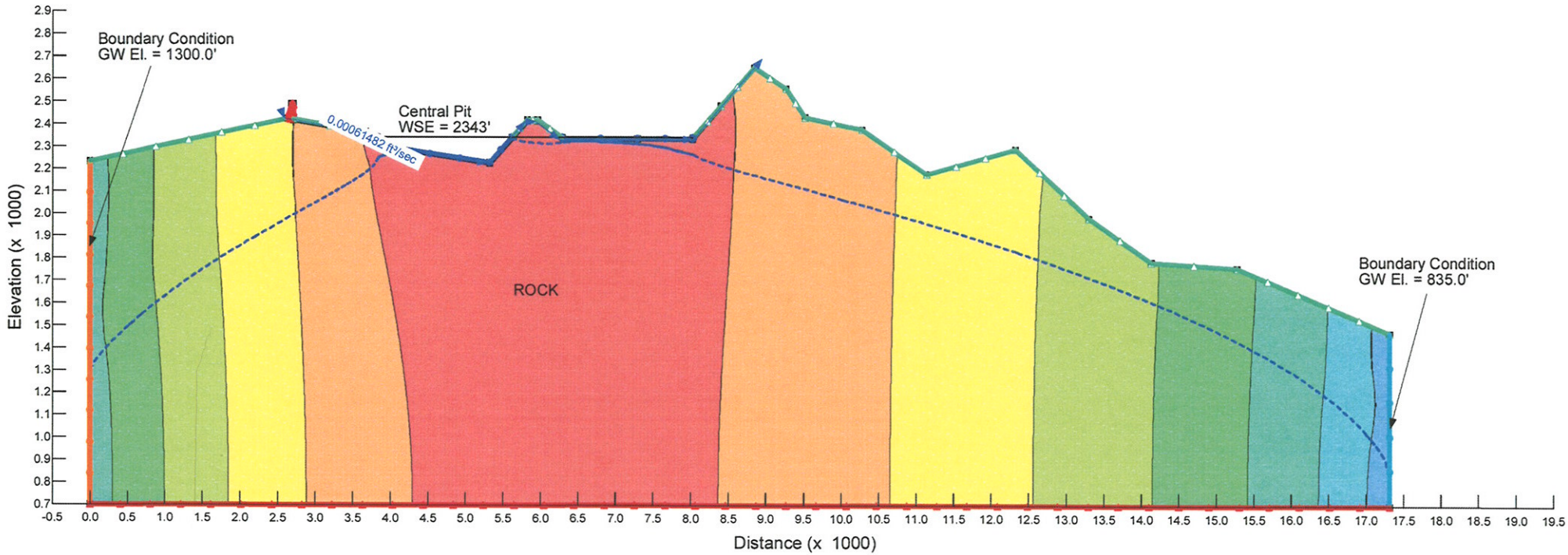
8' LINER W/ GROUTING



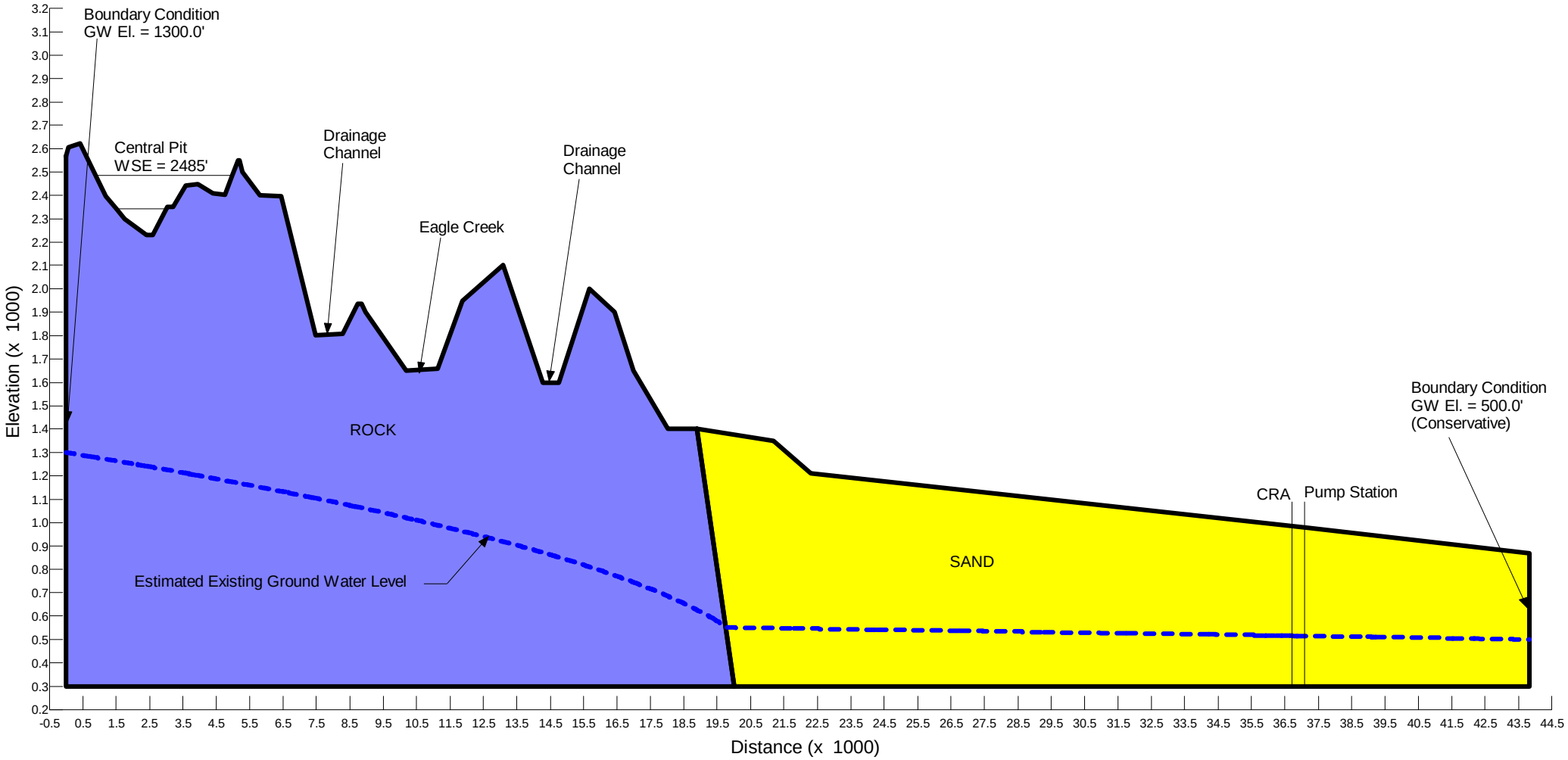
3' LINER W/ GROUTING

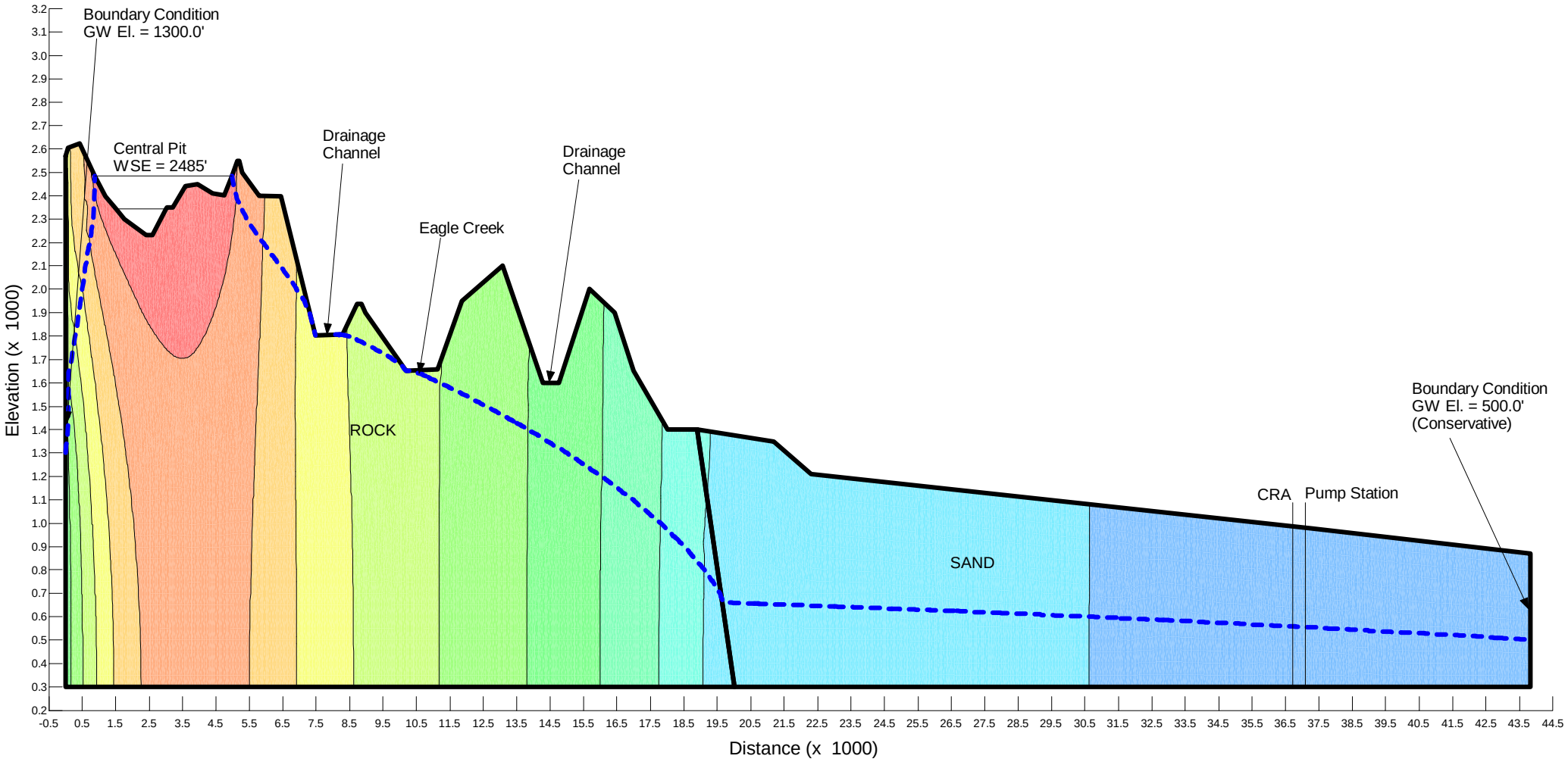


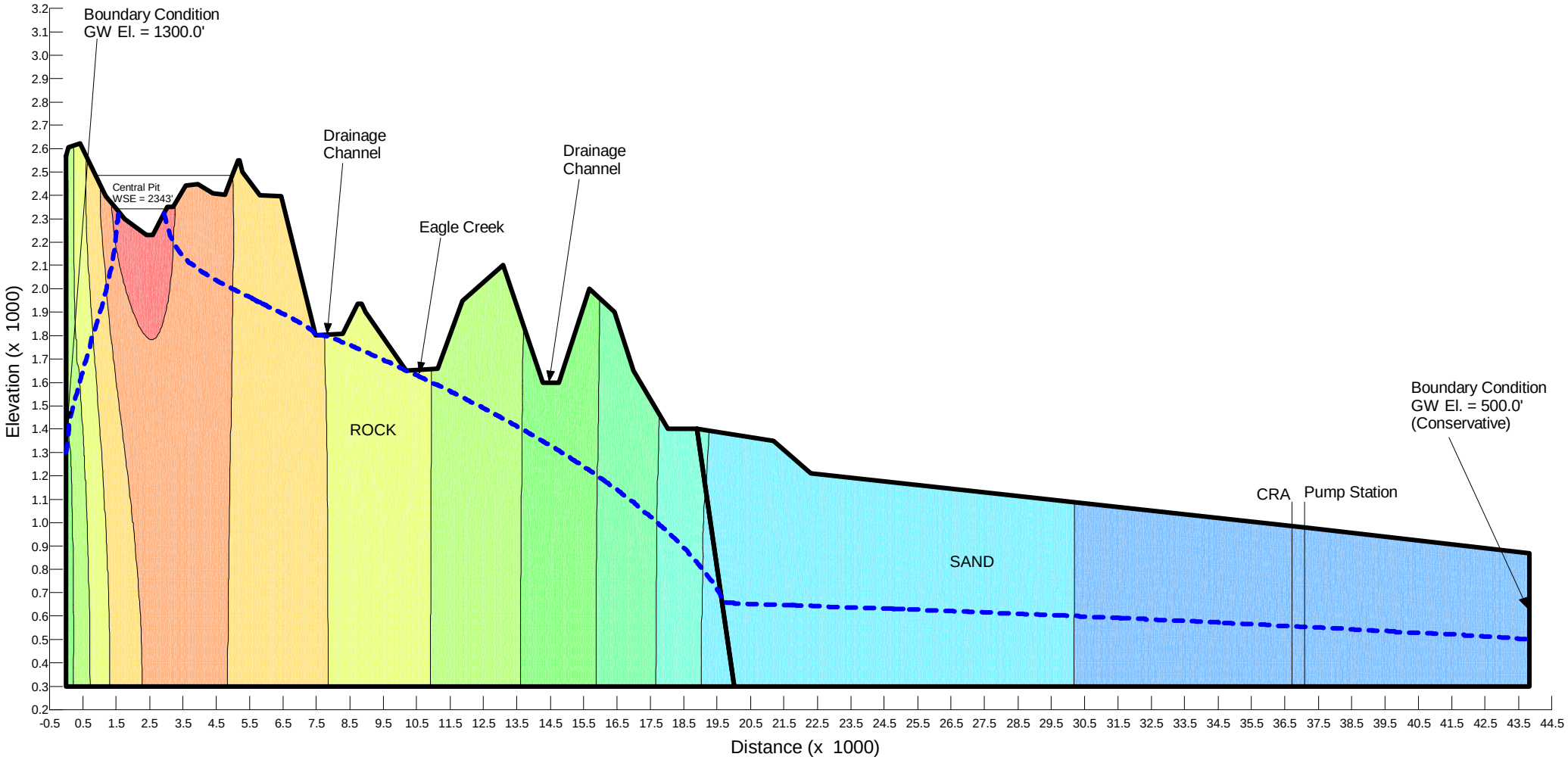
5' LINER W/ GROUTING

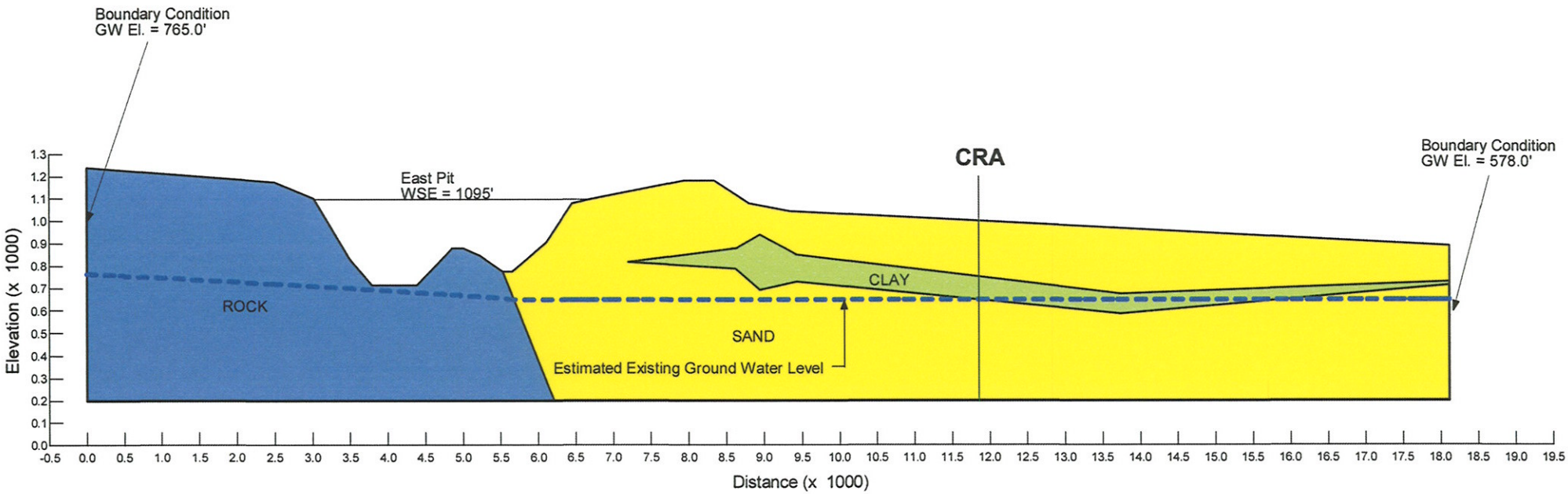


8' LINER W/ GROUTING

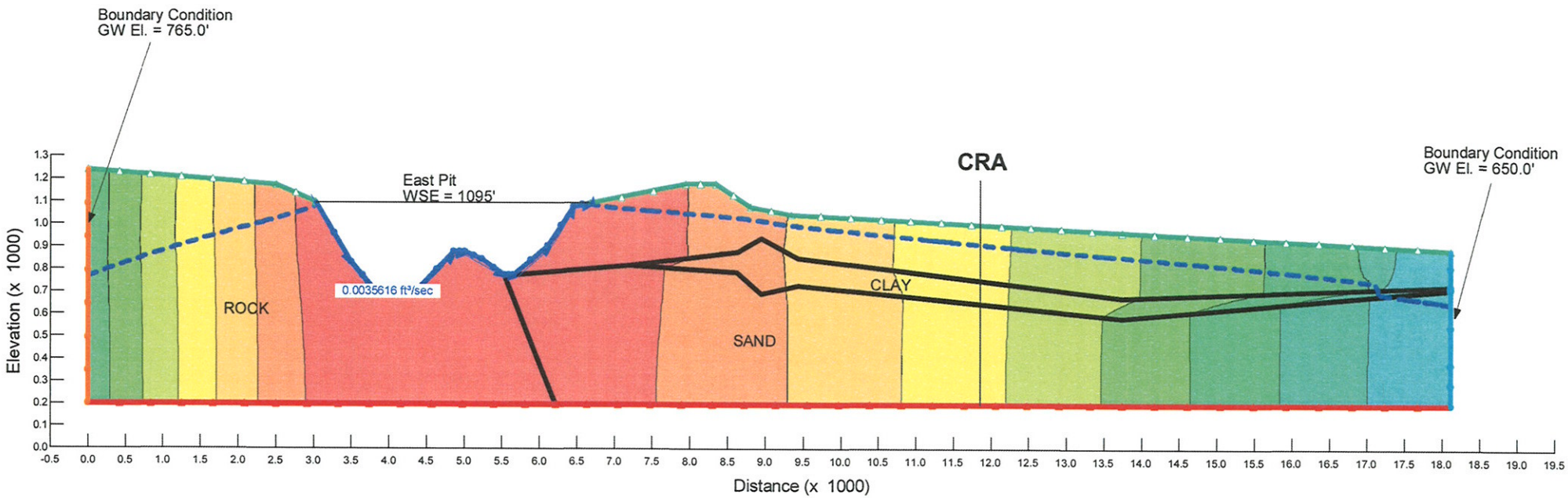

Boundary Condition
GW El. = 1300.0'
Central Pit
WSE = 2485'
Drainage
Channel
Eagle Creek
Drainage
Channel
ROCK
Estimated Existing Ground Water Level
SAND
CRA
Pump Station
Boundary Condition
GW El. = 500.0'
(Conservative)
Elevation (x 1000)
Distance (x 1000)


Boundary Condition
GW El. = 1300.0'
Central Pit
WSE = 2485'
Drainage
Channel
Eagle Creek
Drainage
Channel
ROCK
SAND
CRA
Pump Station
Boundary Condition
GW El. = 500.0'
(Conservative)
Elevation (x 1000)
Distance (x 1000)

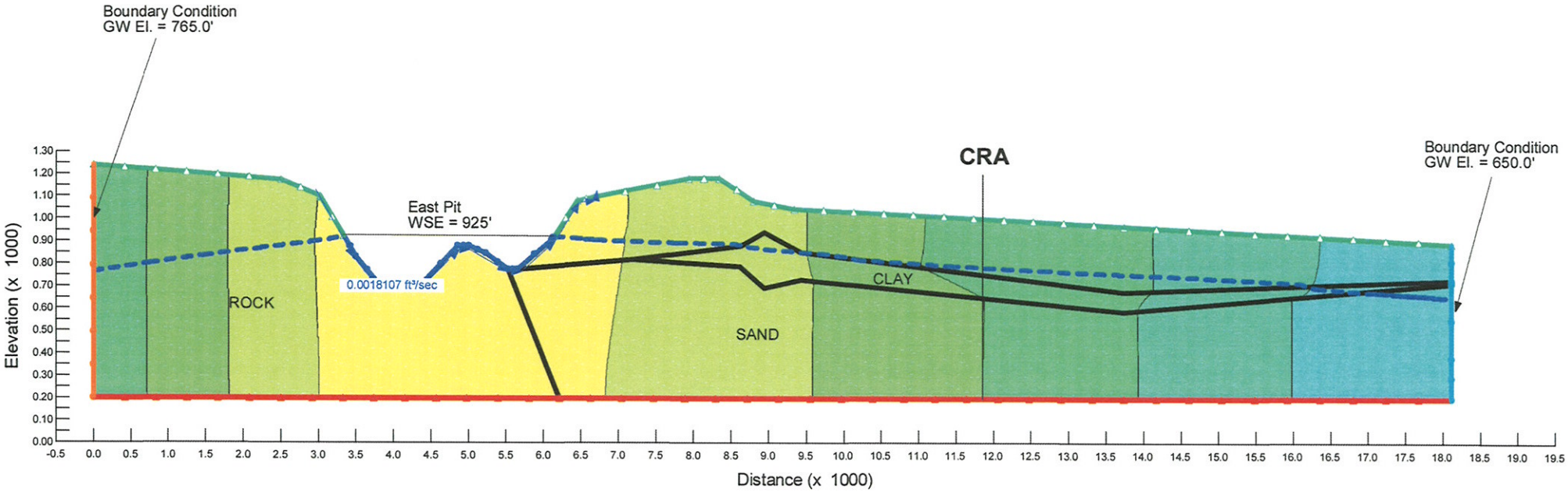

Boundary Condition
GW El. = 1300.0'
Central Pit
WSE = 2343'
Drainage
Channel
Eagle Creek
Drainage
Channel
ROCK
SAND
CRA
Pump Station
Boundary Condition
GW El. = 500.0'
(Conservative)
Elevation (x 1000)
Distance (x 1000)



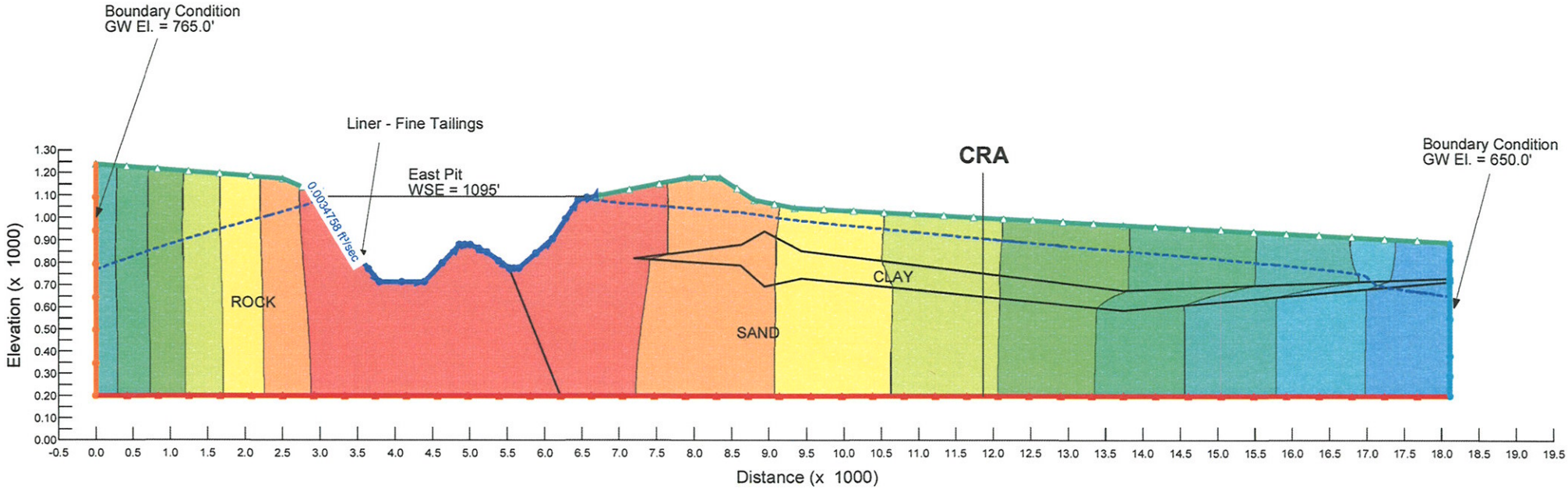
EXISTING CONDITIONS


Boundary Condition
GW El. = 765.0'
East Pit
WSE = 1095'
0.0035616 ft³/sec
CRA
Boundary Condition
GW El. = 650.0'
ROCK
SAND
CLAY
Elevation (x 1000)
Distance (x 1000)

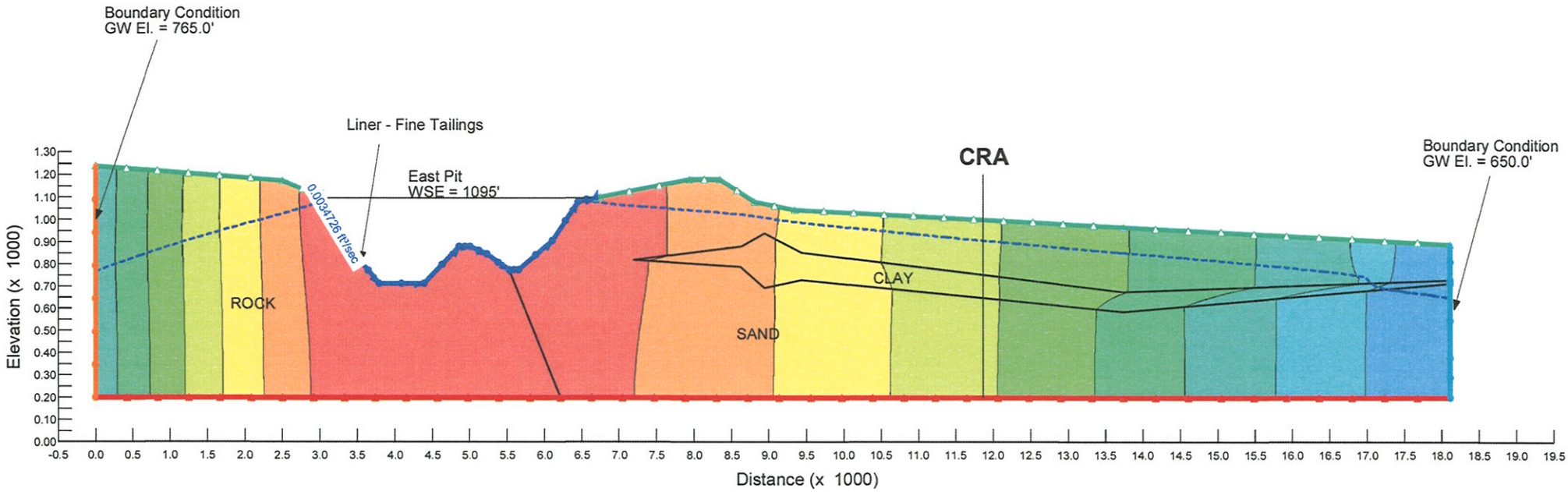
NO LINER


Boundary Condition
GW El. = 765.0'
CRA
Boundary Condition
GW El. = 650.0'
East Pit
WSE = 925'
0.0018107 ft³/sec
ROCK
SAND
CLAY
Elevation (x 1000)
Distance (x 1000)

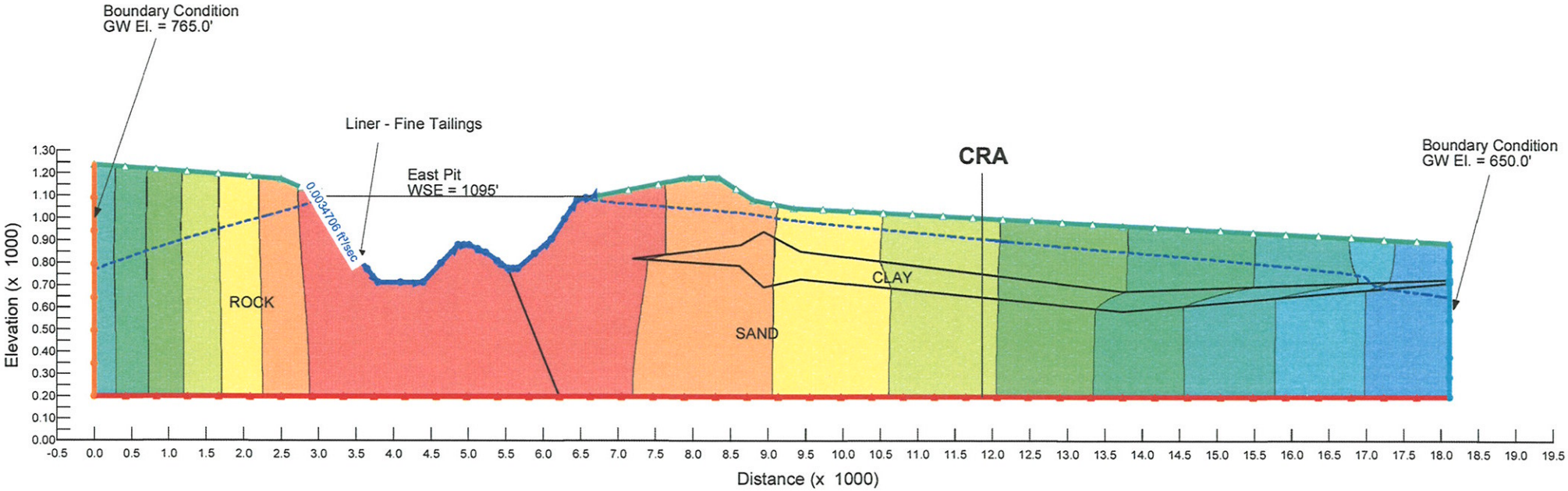
NO LINER


Boundary Condition
GW El. = 765.0'
Liner - Fine Tailings
East Pit
WSE = 1095'
0.00347758 ft/sec
CRA
Boundary Condition
GW El. = 650.0'
ROCK
SAND
CLAY
Elevation (x 1000)
Distance (x 1000)

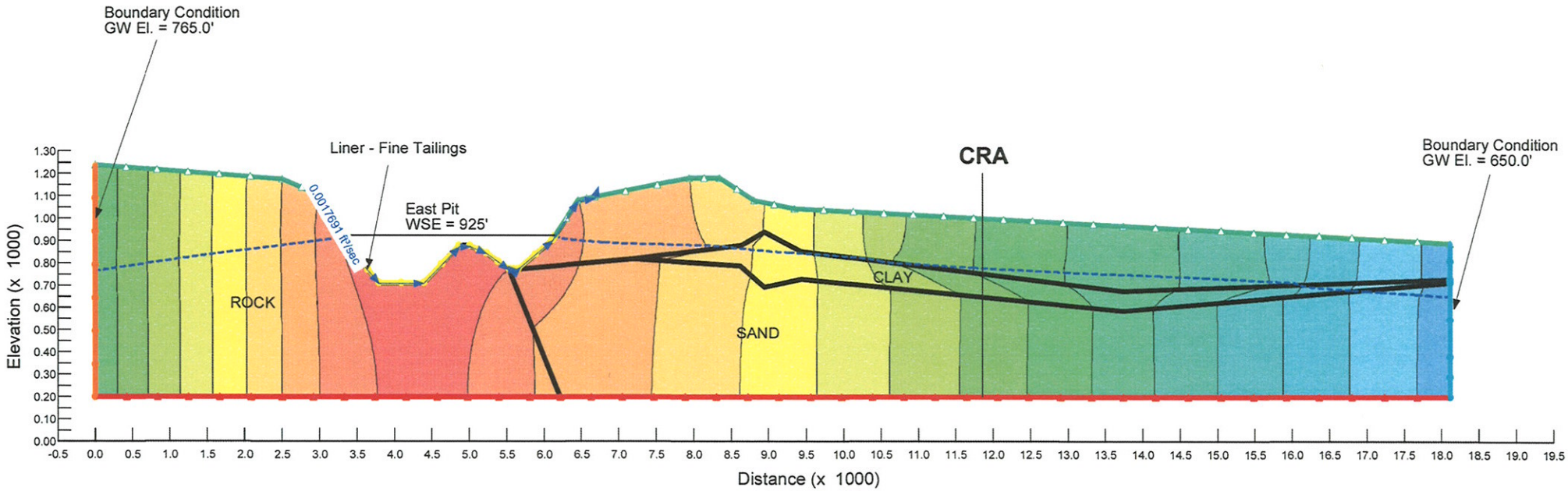
3' LINER


Boundary Condition
GW El. = 765.0'
Liner - Fine Tailings
East Pit
WSE = 1095'
0.0034726 ft/sec
CRA
Boundary Condition
GW El. = 650.0'
ROCK
SAND
CLAY
Elevation (x 1000)
Distance (x 1000)

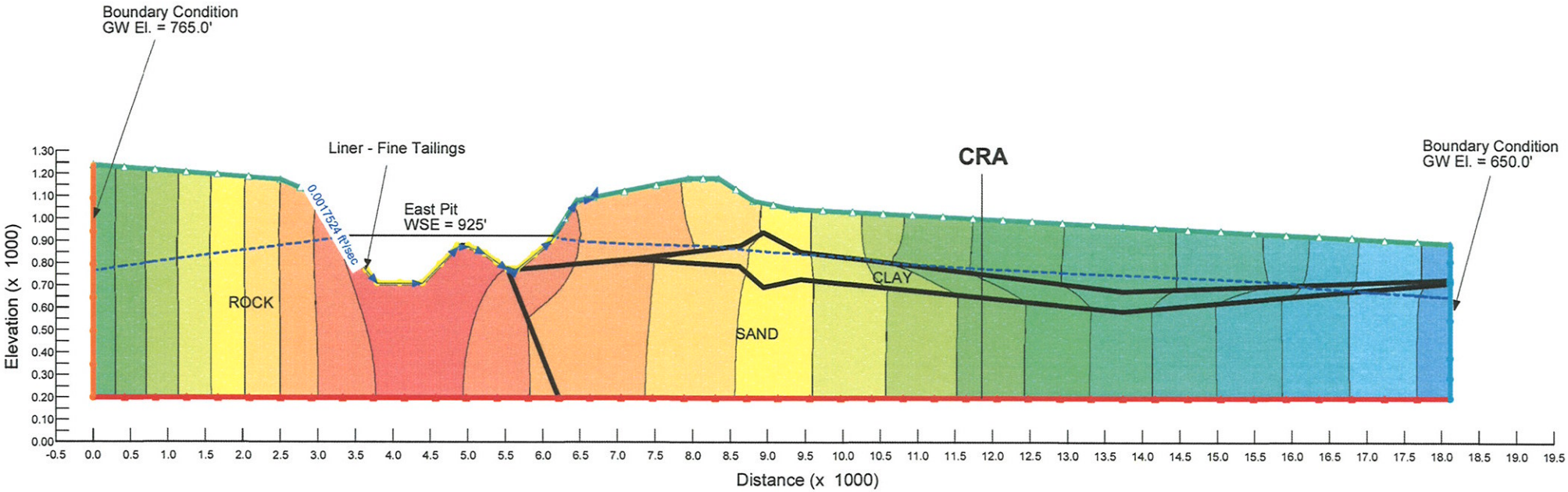
5' LINER


Boundary Condition
GW El. = 765.0'
Liner - Fine Tailings
East Pit
WSE = 1095'
0.0034706 ft/sec
CRA
Boundary Condition
GW El. = 650.0'
ROCK
SAND
CLAY
Elevation (x 1000)
Distance (x 1000)

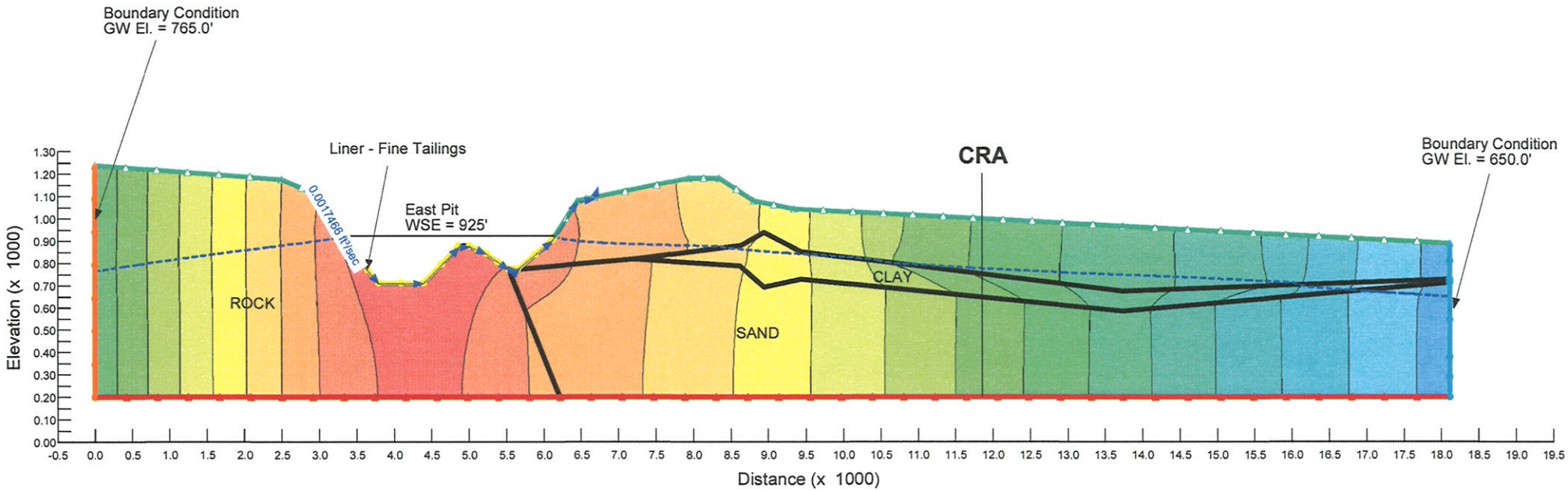
8' LINER


Boundary Condition
GW El. = 765.0'
Liner - Fine Tailings
East Pit
WSE = 925'
0.0017691 ft³/sec
CRA
Boundary Condition
GW El. = 650.0'
ROCK
SAND
CLAY
Elevation (x 1000)
Distance (x 1000)

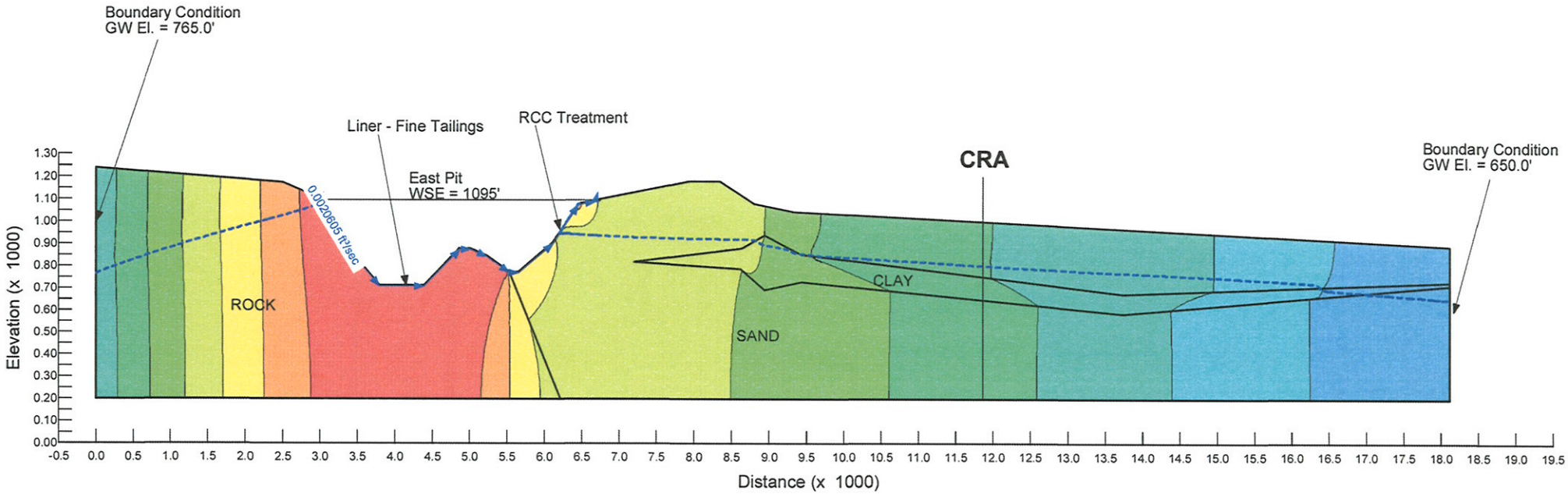
3' LINER


Boundary Condition
GW El. = 765.0'
Liner - Fine Tailings
East Pit
WSE = 925'
0.0017524 ft³/sec
ROCK
SAND
CLAY
CRA
Boundary Condition
GW El. = 650.0'
Elevation (x 1000)
Distance (x 1000)

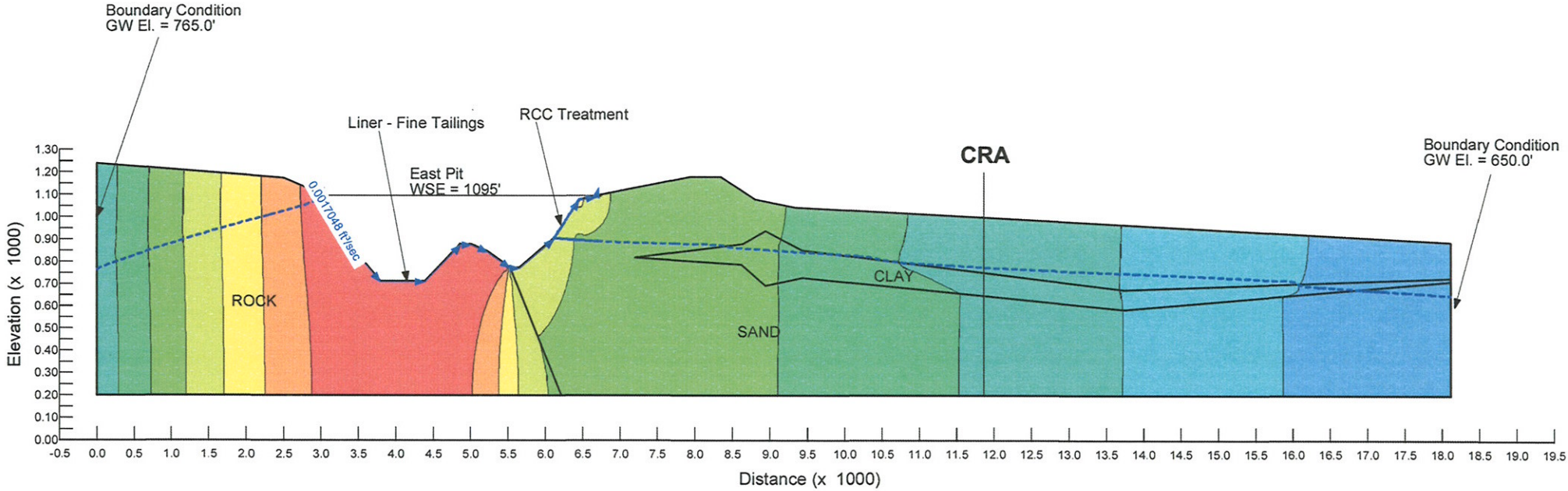
5' LINER


Boundary Condition
GW El. = 765.0'
Liner - Fine Tailings
East Pit
WSE = 925'
0.0017466 ft³/sec
CRA
Boundary Condition
GW El. = 650.0'
ROCK
SAND
CLAY
Elevation (x 1000)
Distance (x 1000)

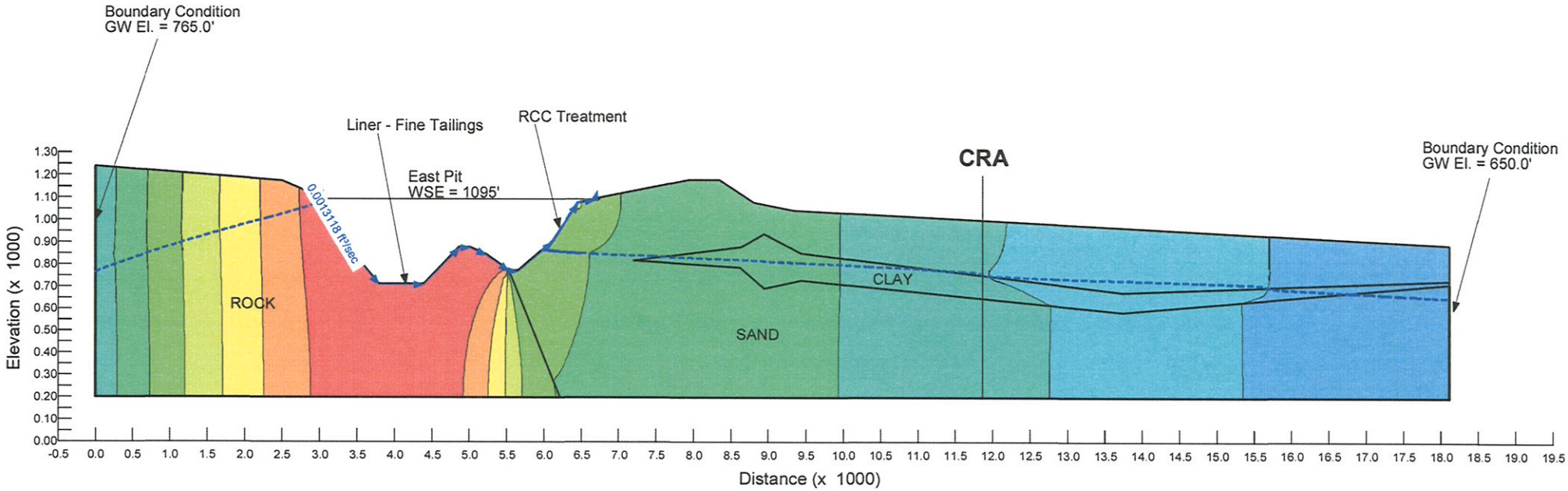
8' LINER



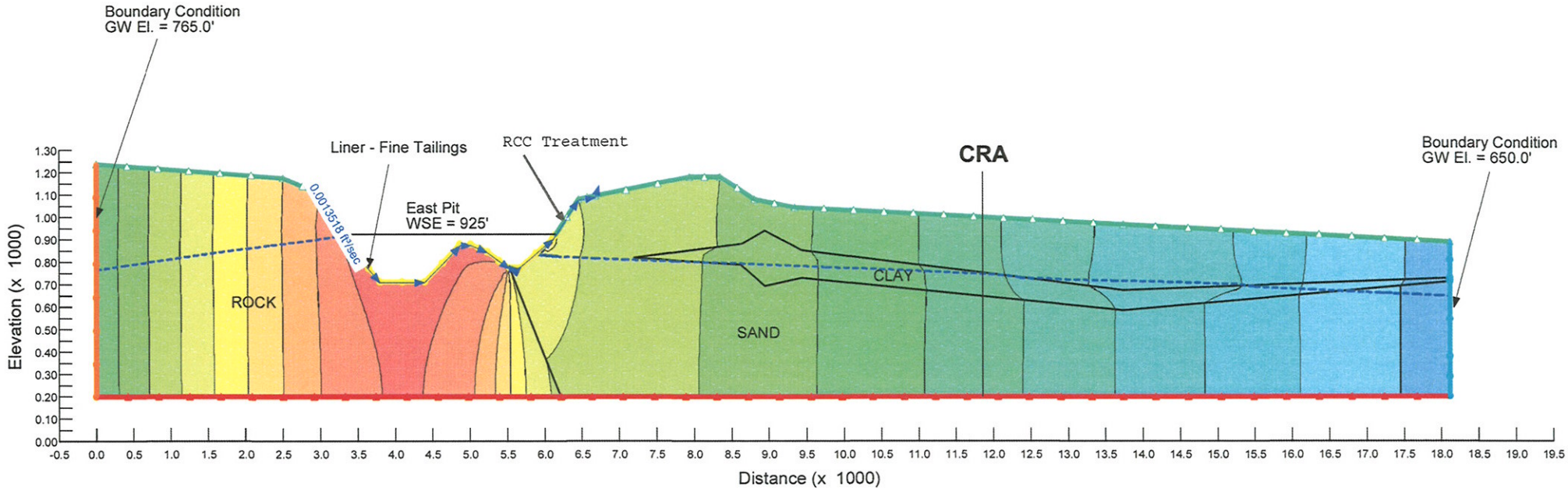
3' LINER W/ GROUTING AND RCC TREATMENT



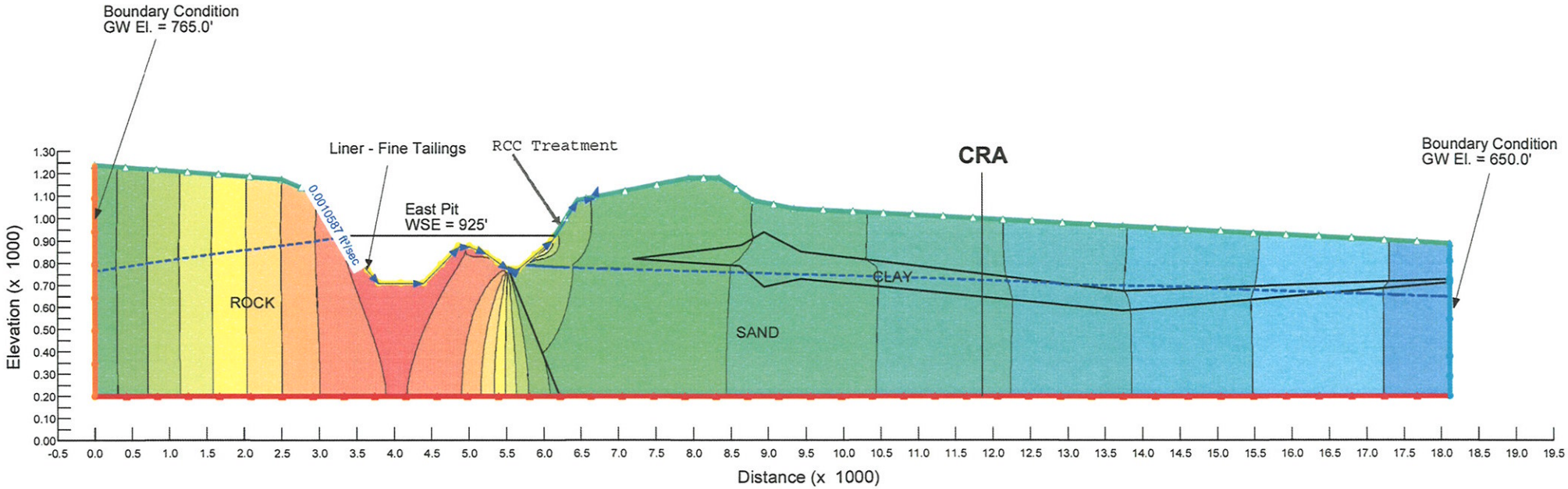
5' LINER W/ GROUTING AND RCC TREATMENT



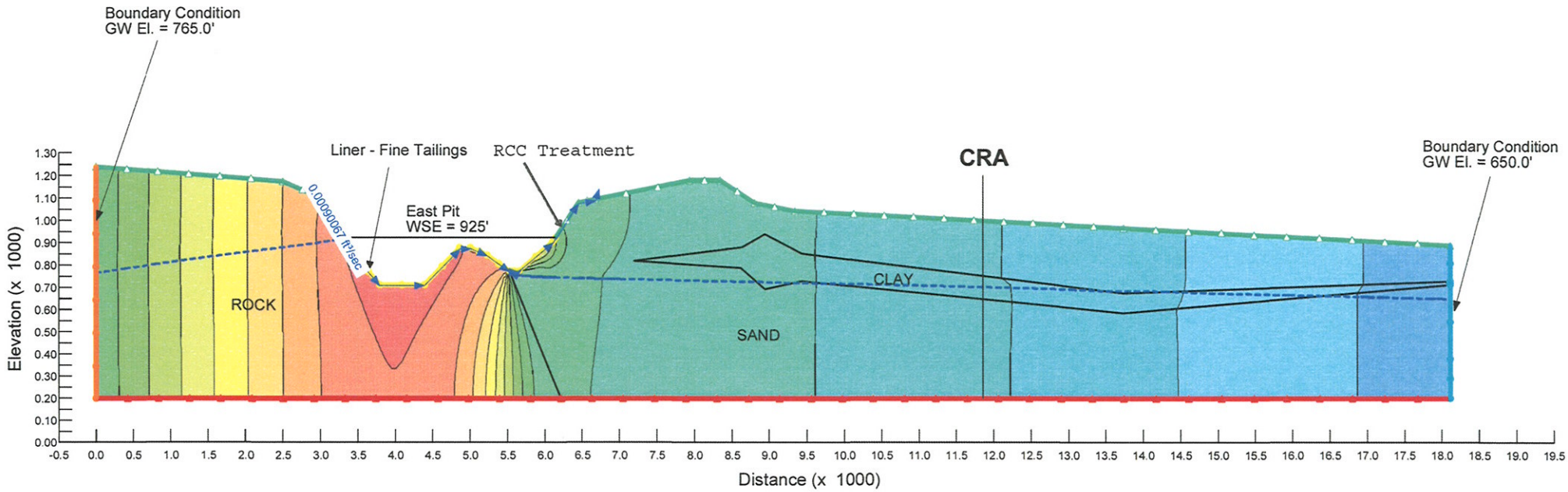
8' LINER W/ GROUTING AND RCC TREATMENT



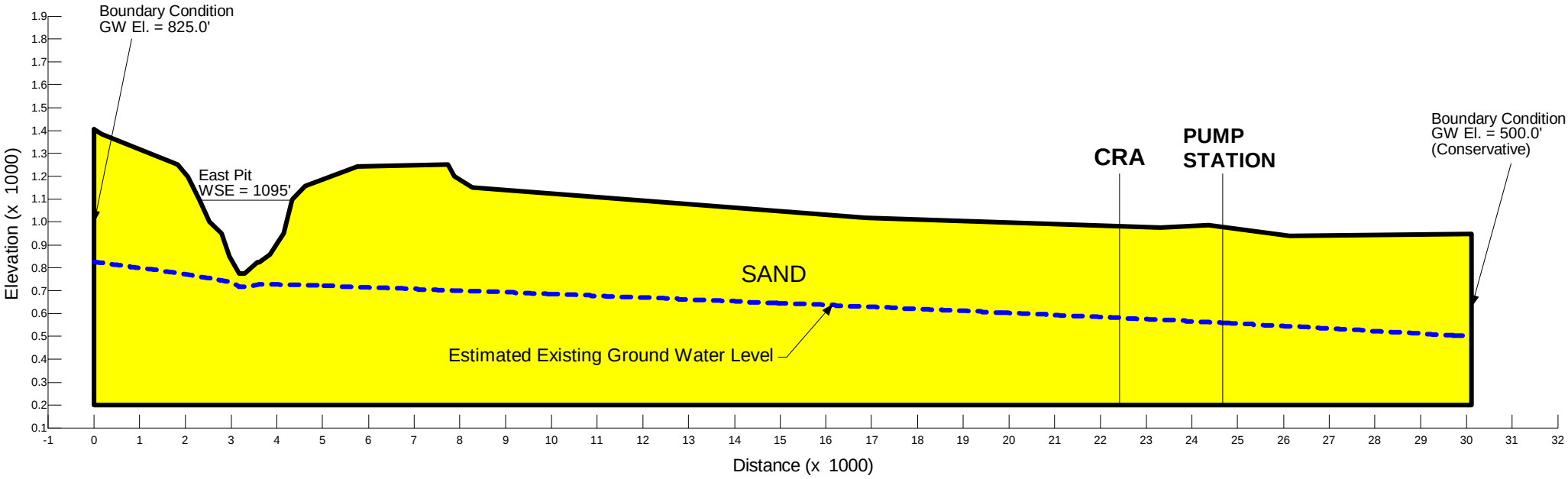
3' LINER W/ GROUTING AND RCC TREATMENT

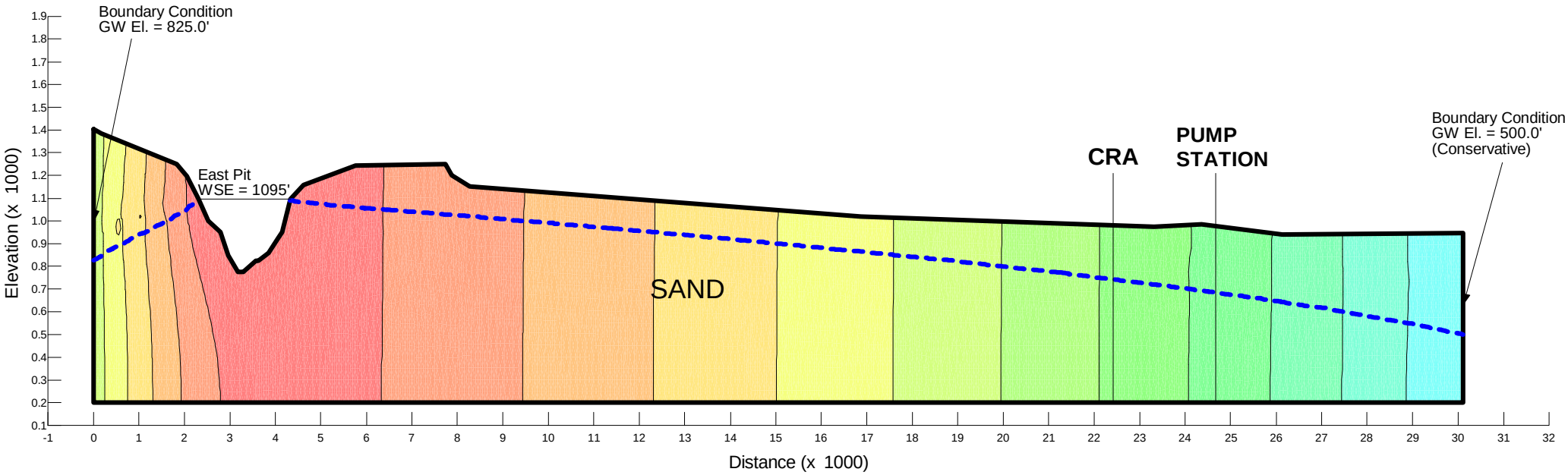


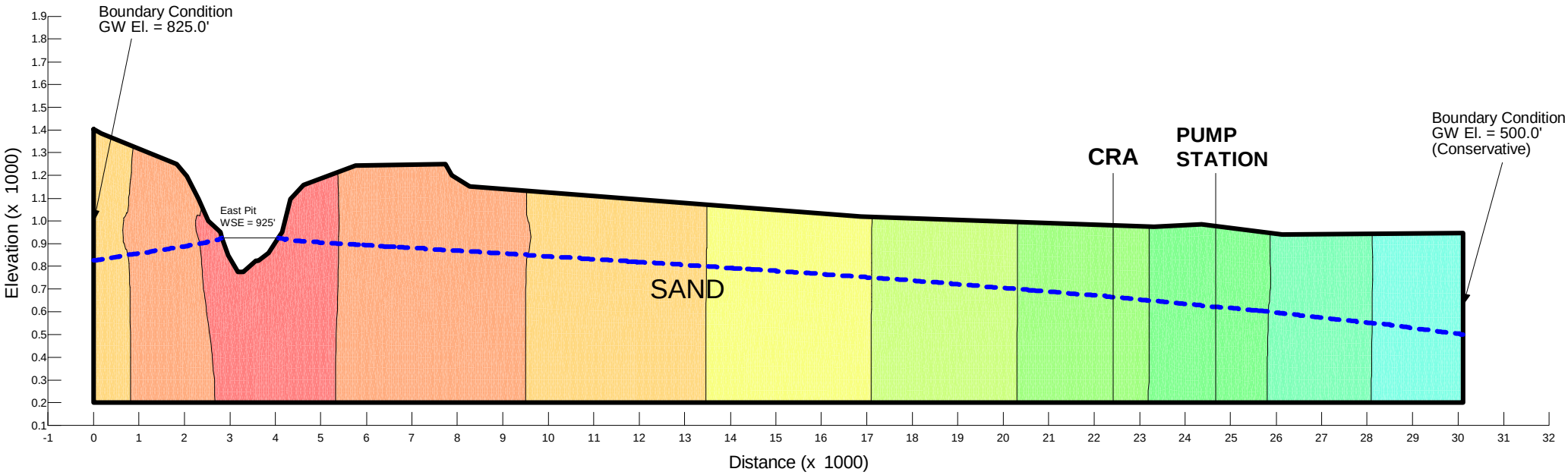
5' LINER W/ GROUTING AND RCC TREATMENT



8' LINER W/ GROUTING AND RCC TREATMENT


Boundary Condition
GW El. = 825.0'
East Pit
WSE = 1095'
CRA
PUMP
STATION
Boundary Condition
GW El. = 500.0'
(Conservative)
SAND
Estimated Existing Ground Water Level
Elevation (x 1000)
Distance (x 1000)
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32


Boundary Condition
GW El. = 825.0'
East Pit
WSE = 1095'
SAND
CRA
PUMP
STATION
Boundary Condition
GW El. = 500.0'
(Conservative)
Elevation (x 1000)
Distance (x 1000)


Boundary Condition
GW El. = 825.0'
East Pit
WSE = 925'
SAND
CRA
PUMP
STATION
Boundary Condition
GW El. = 500.0'
(Conservative)
Elevation (x 1000)
Distance (x 1000)
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
7/24/2008
NDM

Summary of SEEP/W Material Properties

Material	Hydraulic Conductivity (cm/sec)	Hydraulic Conductivity (ft/sec)	Conductivity Ratio
Rock – Upper Reservoir (Moderately Fractured)	1.00E-04	3.28E-06	1
Rock – Lower Reservoir (Slightly Fractured)	1.00E-05	3.28E-07	1
Sand	5.00E-03	1.64E-04	0.25
Clay (sandy)	1.00E-05	3.28E-07	1.00
Liner - (fine tailings)	2.16E-06	7.09E-08	1.00
RCC Treatment	1.00E-08	3.28E-10	1.00

GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
7/24/2008
NDM

Chuckwalla Report, Hydraulic Conductivities Summary

Boring	Description	USCS	Depth	Hydraulic Conductivity (cm/sec)
C-1	Sand	SP	201	1.00E-05
C-1	Clayey Sand	SC	201	2.10E-05
C-1	Silty Sand	SM	322	3.00E-06
C-5	Fat Clay	CH	142	9.20E-10
C-5	Clayey Sand	SC-SM	62	2.70E-07
C-5	Silty Sand	SM	62	3.00E-07
C-9	Silty sand	SM	145	3.50E-05
TP#2	Silty Sand	SM	14	1.20E-04
TP#3	Silty Sand	SM	5	3.90E-04

	Average
SM	**9.14E-05**
SC	**1.06E-05**

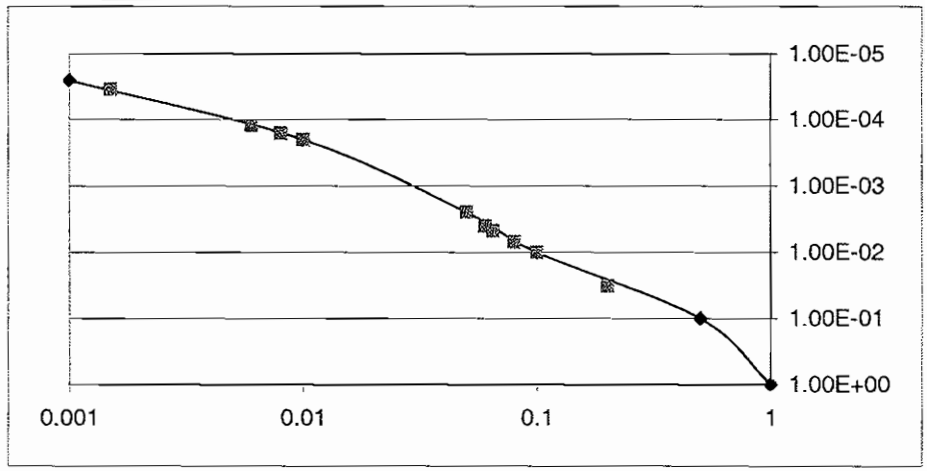
GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
7/24/2008
NDM

Emperical

Boring	Description	USCS	Depth	D5 (mm)	Hydraulic Conductivity (cm/sec)
C-1	Sand w/ Silt	SP-SM	17	0.08	7.00E-03
C-1	Sand w/ Silt	SP-SM	58	0.06	4.00E-03
C-1	Silty Sand	SM	101	0.0015	3.47E-05
C-1	Sand w/ Silt	SP-SM	110	0.0015	3.47E-05
C-1	Sand w/ Silt	SP-SM	123	0.008	1.61E-04
C-1	Sand w/ Silt	SP-SM	423	0.06	4.00E-03
C-5	Sand w/ Grave	SW	59	0.2	3.25E-02
C-5	Gravel w/ S&S	GP-GM	81	0.05	2.50E-03
C-5	Sand w/ Silt	SP-SM	101	0.1	1.00E-02
C-5	Gravel w/ S&S	GP-GM	121	0.065	4.75E-03
C-5	Sand w/ Silt	SP-SM	280	0.006	1.22E-04
C-9	Sand w/ Silt	SW-SM	17	0.05	2.50E-03
C-10	Sand w/ Silt	SP-SM	8	0.01	2.00E-04
C-10	Sand w/ Silt	SP-SM	16	0.06	4.00E-03
C-10	Sand	SP	78	0.08	7.00E-03
C-10	Sand w/ Silt	SP	130	0.05	2.50E-03
C-1	Sand	SP	201	--	1.00E-05
				Average	**4.78E-03**

Lookup Table

D5 (mm)	Hydraulic Conductivity (cm/sec)	Increment
0.001	2.50E-05	0.019444444
0.01	2.00E-04	0.057500000
0.05	2.50E-03	0.150000000
0.1	1.00E-02	0.225000000
0.5	1.00E-01	1.800000000
1	1.00E+00	1.000000000



GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
7/24/2008
NDM

Liner - Fine Tailings

Hydraulic Conductivities - cm/sec

Test Type	Min	Max	Average	
Field	9.20E-09	4.30E-07	2.20E-07	
Lab	5.80E-09	8.20E-06	4.10E-06	
Average =	**7.50E-09**	**4.32E-06**	**2.16E-06**	cm/sec
	2.46E-10	1.42E-07	7.09E-08	ft/sec

BOREHOLE NO.	LOCATION NORTHING STATION	LOCATION EASTING OFFSET	GROUND ELEV. FT	DEPTH DRILLED FT	BOTTOM ELEV FT	DEPTH TO BEDROCK FT	CASING BOTTOM DEPTH	CASING BOTTOM ELEV.	DEPTH OF SCREENED INTERVAL FROM	DEPTH OF SCREENED INTERVAL TO	HOLE SIZE IN	DRILLING DATES BEGIN	DRILLING DATES END	HEIGHT OF CASING FT	DEPTH TO 1ST WATER FT	ELEV. OF 1ST WATER FT	5/6/92 SWL ELEV. FT	5/20/92 SWL ELEV. FT	6/3/92 SWL ELEV. FT	6/17/92 SWL ELEV. FT	7/1/92 SWL ELEV. FT	7/15/92 SWL ELEV. FT.	7/29/92 SWL ELEV. FT.	8/13/92 SWL ELEV. FT	8/28/92 SWL ELEV. FT.	BOREHOLE NO.	REMARKS
MAIN WELLS																										MAIN WELLS	
MW-1	6159859.37	2240189.01	1045.03	400	645.03	N/A	365	660.03	325	385	10	4/27/09	3/26/90	2.29	338.24	706.79	706.15	706.37	706.57	705.78	705.95	706.63	706.44	705.15	705.15	MW-1	MUD ROTARY SEE NOTE (1)
MW-2	6158081.48	2210848.20	1083.01	455	628.01	N/A	455	628.01	394	455	10	3/25/90	4/4/90	2.03	364.91	688.11	686.01	685.84	685.84	685.25	685.28	685.16	684.25	683.84	683.93	MW-2	AIR ROTARY (2)
MW-3	6158977.39	2232484.23	1048.84	380	668.84	11	350	698.84	289	350	8	4/4/90	4/10/90	1.25	283.43	765.41	758.06	757.84	754.01	756.06	753.72	756.25	755.34	756.01	753.18	MW-3	REVERSE CIRC. HAMMER (3)
MW-4	6158642.25	2237376.45	795.73	140	655.73	01	140	655.73	80	140	10	3/20/91	3/25/91	4.17	80.44	715.29	713.90	713.86	713.69	713.19	712.69	713.57	713.61	712.61	712.73	MW-4	REVERSE CIRC. HAMMER (3)
MW-5	6158340.71	2238163.12	911.86	245	666.86	235	240	671.86	180	240	10	3/24/91	3/27/91	2.00	206.74	705.12	699.78	699.75	698.36	699.32	698.71	699.34	699.07	697.86	698.73	MW-5	REVERSE CIRC. HAMMER (3)
MW-6	6156966.05	2232548.17	1347.89	640	707.89	460	620	727.89	560	620	10	3/21/91	4/9/91	2.75	566.58	781.31	772.14	772.22	772.15	771.77	768.54		769.39	768.56	771.89	MW-6	REVERSE CIRC. HAMMER (5)
MW-7	6158416.69	2228597.46	1605.82	765	820.82	01					10.625	9/11/91	9/14/91	2.33	690	915.82		916.45	914.46	915.9	915.82	915.74	916.73	915.40	916.8	MW-7	AIR HAMMER (2)
MW-8(OLD)	6159359.88	2222019.00	1768.54	984	804.54	1	N/A	N/A	N/A	N/A	6.25	9/20/91	9/30/91	N/A	910	858.54										MW-8(OLD)	AIR HAMMER (2) (4) (15)
MW-8(NEW)	6159359.88	2222019.00	1768.54	871	897.54	11	840	928.54	791.5	843.5	13.5	3/31/92	4/21/92	4.46	868	900.54		916.53	837.56	915.6	906.84	906.08	906.75	905.92	907.84	MW-8(NEW)	AIR HAMMER (5)
MW-9	6159812.02	2222286.54	2296.92	1,544	752.92	1	N/A	N/A	N/A	N/A	6.5	10/12/91	10/31/91	N/A												MW-9	AIR HAMMER (2) (4)
MW-10	6228525.58	2221819.48	2311.35	1213.7	1097.65	71	1179	1132.35	1069	1179	13.5	2/16/92	3/9/92	3.22	506	1805.35	1464.85	1446.44	1439.86	1427.27	1415.27	1271.06	1285.23	1285.32	1292.82	MW-10	MUD ROTARY (5)
MW-11	6177755.19	2221447.83	1781.25	1136	655.25	29	1115	668.25	662.7	916.7	13.5	3/1/92	3/25/92	0.92	925	856.25		1067		944.17		943.17	916.92	918.25	942.96	MW-11	MUD ROTARY AND AIR HAMMER (5) (12)
MW-12	624274.96	2219934.93	1206.77	550	656.77	37	430	776.77	365	430	13.5	3/22/92	3/25/92	0.17	490	716.77	683.65	662.72	658.11	657.91	655.44	654.56	652.62	646.44	646.4	MW-12	AIR HAMMER (5)
MW-13	6190092.2	2222153.31	1051.48	420	631.48	31	364.7	686.78	260	364.7	13.75	4/13/92	4/26/92	4.58	310.0	741.48	776.23	774.11	757.73	762.77	762.61	761.69	756.64	760.54	758.4	MW-13	AIR HAMMER (5)
CORE HOLES																										CORE HOLES	
CH-2	621283.17	2225143.1	2268.21	1179	1089.21	191	1179	1108.06	N/A	N/A	3.8	2/21/92	5/13/92	2.92	1120	1168.21				1120.33	1116.82	1115.87	1121.44		1117.79	CH-2	CORED (5) (14)
CH-3	619921.91	2228530.79	1758.67	661	1077.67	10	N/A	N/A	N/A	N/A	3.8	5/8/92	5/21/92	N/A	A	N/A										CH-3	CORED (4) (5) (15)
CH-3A	619921.91	2228530.79	1758.67	904.5	854.17	101	900	858.67	N/A	N/A	3.00-3.8	3/21/92	4/10/92	1.08	659	899.67	976.75		903.36	907.33	906.87	907.59	912.63	906.92	906.09	CH-3A	CORED TRICONE 0-122' (14)
CH-4	623160.42	2229815.46	1905.88	930	975.96	191	930	975.88	N/A	N/A	3.00-3.8	3/12/92	3/29/92	1.42	875	1030.98	1505.73	1501.73	1505.29	1496.05	1490.65	1491.85	1487.14	1487.9	1485.36	CH-4	CORED (3) (7) (14)
CH-5A	619921.91	2234444.36	1657.20	900	757.2	131	900	757.2	N/A	N/A	3.00-3.8	4/8/92	4/28/92	1.59	791	866.2										CH-5A	CORED (5) (14)
CH-10	622566.74	2221536.07	2307.75	1389	918.76	71	1389	918.76	N/A	N/A	3.8	2/13/92	3/5/92	0.25	1309	998.76				1250.58		1315.51				CH-10	CORED (5) (14)
CH-11	617737.38	2221490.64	1781.59	1100	681.59	191	1100	681.59	N/A	N/A	3.8	4/14/92	4/29/92	N/A	910	871.59										CH-11	CORED (5) (14) (15)
CH-12	624300.32	2224697.22	1207.88	545	662.69	37	525	682.69	N/A	N/A	3.8	5/12/92	5/17/92	N/A	475	732.59										CH-12	CORED (5) (14)
FIELDM																										FIELDM	
P-1	618311.22	2226815.26	876.70	270	606.7	15	257	619.7	207	257	5.625	3/20/92	3/23/92	2.75	200	676.7	699.37	700.27	700.49	699.45	698.24	698.79	698.41	697.37	697.66	P-1	AIR HAMMER (6)
P-2	619059.91	2228647.01	1744.15	900	784.16	291	955	789.16	905	955	6.5-6.25	3/25/92	3/26/92	2.00	855	889.16	917.49	917.49	917.52	917.7	918.91	920.25	922.13	916.33	920.01	P-2	AIR HAMMER (6)
P-3	615955.93	2224836.70	1241.77	675	566.77	181	663	578.77	613	663	6	3/27/92	4/22/92	1.83	560	681.77	736.49	736.31	735.4	735.19	735.27	734.97	733.52	733.02	733.31	P-3	AIR HAMMER & SAN-CASE (6)
P-4	615377.15	2230780.68	1364.50	625	739.5	34	625	739.5	575	625	5.5	4/9/92	4/28/92	1.58	554	810.5					913.25	919.25	833.24	918.83	918.87	P-4	AIR HAMMER & SAN-CASE (6)
P-5	6144253.58	2226849.39	1387.00	625	762	37	675	712	575	625	5.5	4/11/92	4/28/92	2.00	525	862						918.08	841.75	915.75	917.75	P-5	AIR HAMMER & SAN-CASE (6)
P-6	618199.92	2222275.89	1052.51	425	627.51	01	409	643.51	309	409	5.5	4/22/92	4/26/92	2.83	285	767.51	791.06	790.88	786.02	782.38	779.51	775.76	772.42	769.01	766.74	P-6	AIR HAMMER (6)
P-7	619091.96	2222330.67	1050.96	425	625.96	01	423	627.5	373	423	5.5	4/24/92	4/26/92	2.42	275	775.96	756.29	765.29	755.79	752.75	754.34	753.67	759.29	754.38	751.84	P-7	AIR HAMMER (6)
P-8	619059.92	2222337.93	1056.60	400	656.6	01	373	677.5	323	373	5.5	4/25/92	4/26/92	2.29	155	856.6	779.02	780.71	774.68	767.1	765.14	764.35	763.53	753.14	762.6	P-8	AIR HAMMER (6)
P-9			1000'	525	506'	260	520	510	470	520	5.625	4/29/92	5/9/92	0.75	475	555'		600.*	599.58'	600.25	600.25	600.46	598.5	601.75	599.58	P-9	AIR HAMMER & SAN-CASE (6)
P-10			1120'	675	445'	180	675	445	625	675	5.625	5/7/92	5/11/92	2.33	570	550'		591*	591.21'	591.41	591.15	591.68	590.25	592.41	590.67	P-10	AIR HAMMER & SAN-CASE (6)
P-11			900'	485	843'	N/A	470	372	350	470	5.5	5/12/92	5/18/92	3.38	425	506'		576*	577.31'	577.05	577.67	578.57	577.8	580.34	578	P-11	AIR HAMMER & SAN-CASE (6)
P-12			842'	500	342'	N/A	500	342	450	500	5.625	5/20/92	6/3/92	2.69	420	422'				509.25	502.75	503.86	502.06	503.61	500.61	P-12	AIR HAMMER & SAN-CASE (6)
P-13			1329'	725	635'	0	725	635	675	725	5.5	6/7/92	6/8/92	2.41	650	678'				800.25	800.71	801	800.06	802.41**	801.66	P-13	AIR HAMMER (5)

NOTES:

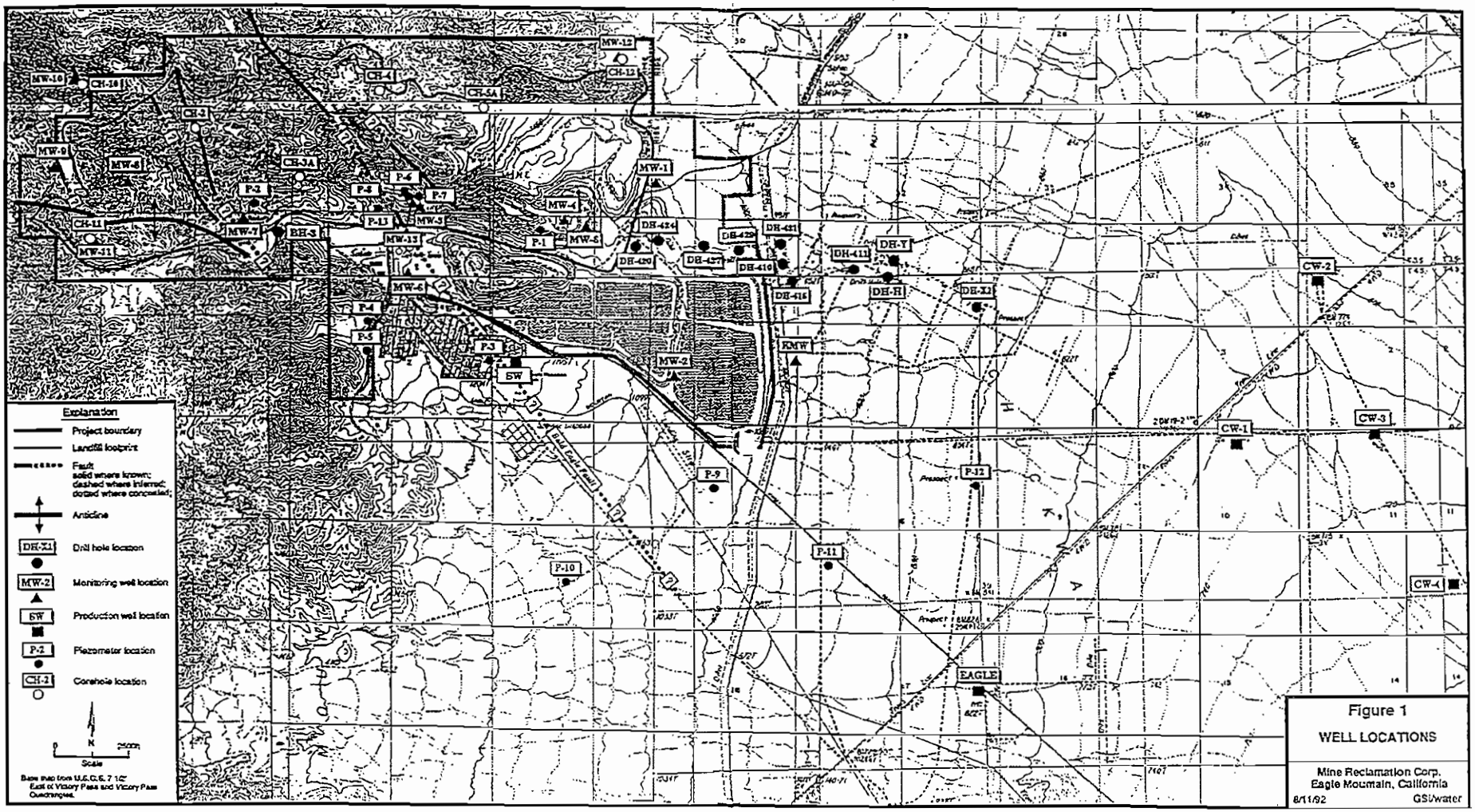
* APPROXIMATE ELEVATIONS - NOT YET SURVEYED
(1) PIONEER DRILLING
(2) BEYLIK DRILLING
(3) LAYNE ENVIRONMENTAL DRILLING
(4) NOT CONSTRUCTED
(5) TONTO DRILLING
(6) PARKS DRILLING
(7) WELL WAS ARTESIAN WHEN DRILD
(11) VIDEO LOG
(12) E-LOG, GAMMA LOG, CALIPER LOG, SONIC LOG
(13) E-LOG, GAMMA LOG
(14) PHOTOS TAKEN OF CORE
(15) HOLE ABANDONED
** READING ACCURATE TO WITHIN ONE FOOT

BOREHOLE DATA SUMMARY SHEET
UPDATED 8/27/92
Eagle Mountain Landfill, Riverside County, California
MINE RECLAMATION CORPORATION
GSWater

BOREHOLE NO.	LOCATION		GROUND ELEV.	DEPTH DRILLED	BOTTOM ELEV	DEPTH TO BEDROCK	CASING BOTTOM		DEPTH OF SCREENED INTERVAL		HOLE SIZE	DRILLING DATES		HEIGHT OF CASING	DEPTH TO 1ST WATER	ELEV. OF 1ST WATER	5/6/92 SWL ELEV.	5/20/92 SWL ELEV.	6/3/92 SWL ELEV.	6/17/92 SWL ELEV.	7/1/92 SWL ELEV.	7/15/92 SWL ELEV.	7/29/92 SWL ELEV.	8/13/92 SWL ELEV.	9/25/92 SWL ELEV.	BOREHOLE NO.	REMARKS
	NORTHING STATION	EASTING OFFSET	FT	FT	FT	FT	DEPTH	ELEV.	FROM	TO	IN	BEGIN	END	FT	FT	FT	FT	FT	FT	FT	FT	FT.	FT.	FT.	FT.		
DESERT BOR																										DESERT BOR	
DH-420	617787.38	2240015.1	1062.73											21						859.9	860.11	858.44	858.44	858.44	860.38	DH-420	
DH-421	617550.42	2244332.57	973.52	1075	-99.48	570						11/27/54	12/5/55	1.58			685.18	685.03	685.33	686.1	686.02	686.33	685.9	687.51	685.97	DH-421	
DH-411	617104.28	2246748.33	928.48											0.88			673.19	673.03	673.17	672.8	672.73	672.67	672.83	670.74	671.82	DH-411	
DH-H	616745.80	2247830.25	910.48	1530	-619.52	961						11/27/54	12/2/55	1.28			654.73	654.58	654.84	654.71	656.29	655.6	654.68	655.31	653.85	DH-H	
DH-X1	616114.99	2250438.42	871.29	1280	-398.71	1270						10/55	12/4/55	1.58			645.43	645.49	645.54	645	647.54	646.43	645.29	643.85	644.21	DH-X1	
DH-Y	615546.81	2247822.56	915.08	1548.6	-633.42	1155						2/55	12/10/55	0.87			665.75	675.56	675.83	675.5	675.33	675.65	674.56	676.75	674.5	DH-Y	
DH-410	617075.65	2244534.30	972.41											0.83			670.12	669.62	669.92	669.55	671.29	669.58	669.04	670.54	668.46	DH-410	
DH-415	616569.21	2244530.52	978.71											0.25			682.56	682.71	683.17	682.88	683.04	682.73	682.58	684.5	682.88	DH-415	
DH-424	617792.85	2240812.57	1064.42											0.17			698.67	698.76	699.85	698.51	698.42	698 **	697.13	697.25	698.13	DH-424	
MISC. WELLS																										MISC. WELLS	
SCHOOL			1240'	748.5	490.5'	211.5	740	500'						1.75				722 '	719'	718.75'	718.08'	718.46'	716.62'	716.25	718.33	SCHOOL	ROTARY
OWell			742'	1328	-586'																					OWell	MUD ROTARY
OW#2			782'	887	-94'		535	258'	331	527				1.00						469.5'	470.42'	468'	469.34'	471.92	468.83	OW#2	MUD ROTARY
OW#3			737'	899	38'		570	167'	273	562				.5									474.67'	476.17	475.04	OW#3	MUD ROTARY
OW#4			699'	860	-39'		500	199'	170	410																OW#4	MUD ROTARY
KAISER MW	614592.28	2244687.13	978.48											2.25			668.41	669.16	668.41	665.03	668.95	668.86	668.05	667.74	667.59	KAISER MW	

NOTES: * APPROXIMATE ELEVATIONS
** READING ACCURATE TO WITHIN ONE FOOT

BOREHOLE DATA SUMMARY SHEET
UPDATED 8/27/92
Eagle Mountain Landfill, Riverside County, California
MINE RECLAMATION CORPORATION
GS/wrzer


Explanation
Project boundary
Landfill footprint
Fault
solid where known;
dashed where inferred;
dotted where concealed;
Anticline
DH-X1 Drill hole location
MW-2 Monitoring well location
SW Production well location
P-2 Piezometer location
CH-2 Corehole location
N
0
2500ft
Scale
Base map from U.S.G.S. 7 1/2' East of Victory Pass and Victory Pass Quadrangles.
Figure 1
WELL LOCATIONS
Mine Reclamation Corp.
Eagle Mountain, California
8/11/92
GSI/water

BORING LOG

SCS ENGINEERS

PROJECT: EAGLE MOUNTAIN
LOCATION:
JOB NUMBER: 0187073.03
GEOLOGIST / ENGINEER: B. GARBACCIO / K. LISTER
DRILLER: PIONEER
DRILL RIG: FAILING F 8
DRILLING METHOD: MUD ROTARY

HOLE / WELL #: M.W.-1
DIAMETER: 10"
TOTAL DEPTH: 400'
DATE STARTED: APRIL 27, 1989
DATE COMPLETED: MAY 16, 1989
SAMPLING DEVICE: ——
PAGE: 1 OF 7

DEPTH (FEET)	SAMPLE	COMPLETION DETAIL	SAMPLE #	BLOW COUNTS / FOOT	USCS SYMBOL	DESCRIPTION
0		10" DIAMETER LOCKING MONUMENT COVER				DIRECT AIR ROTARY USED TO SET STEEL CASING
1						
2						
3						
4						LIGHT TAN SILTY FINE TO VERY COARSE SAND WITH 25% GRAVEL TO 2" (BOULDERS > 1 FOOT OBSERVED IN BOREHOLE) GRAVEL IS MOSTLY GRANITE WITH EPIDOTE, VEIN QUARTZ AND MINOR MAGNETITE - HEMATITE ORE
5		5" DIAMETER SCHEDULE 80 PVC				
6						
7		10" DIAMETER STEEL CASING				
8						
9						
10						
11						
12						MUD ROTARY MUD REMOVES FINES
13						
14						
15		CONCRETE - BENTONITE GROUT				
16						
17						
18						
19						
20						

BORING LOG

PROJECT: EAGLE MOUNTAIN
JOB NUMBER: 0187073.03

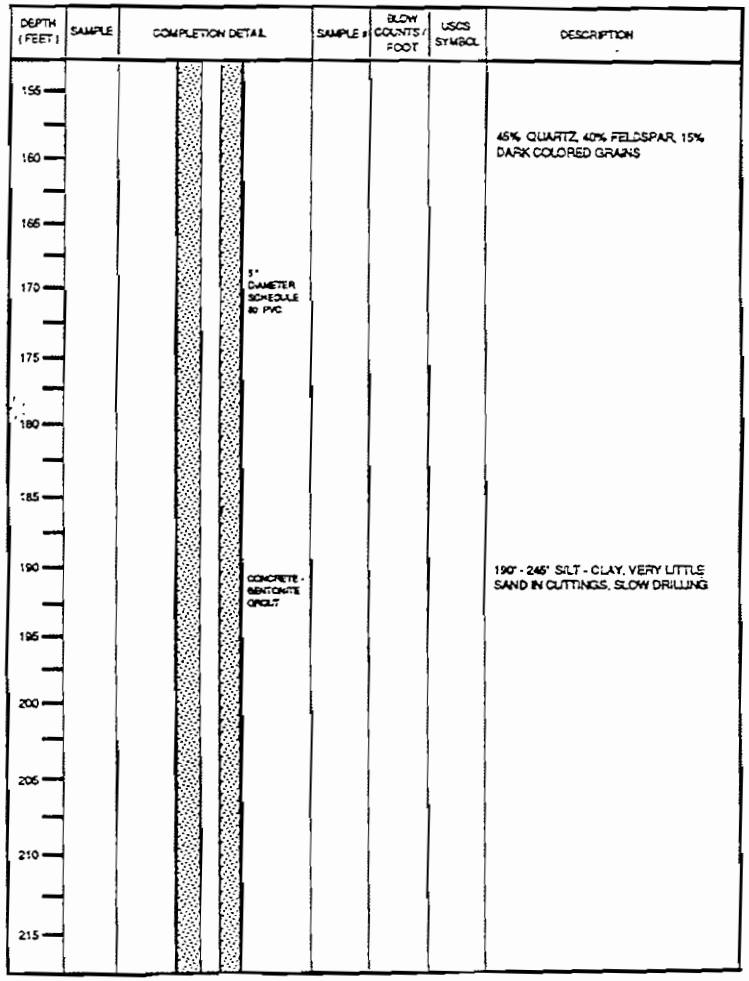
HOLE / WELL #: M.W.-1
PAGE: 3 OF 7

DEPTH (FEET)	SAMPLE	COMPLETION DETAIL	SAMPLE #	BLOW COUNTS / FOOT	USCS SYMBOL	DESCRIPTION
90						
95						SAME AS ABOVE 40% QUARTZ, 40% FELDSPAR, 20% DARK COLORED GRAINS
100						
105		5" DIAMETER SCHEDULE 80 PVC				
110						CUTTINGS ARE COARSE SAND SIZED 50% QUARTZ, 40% FELDSPAR, 10% DARK COLORED GRAINS
115						
120		CONCRETE - BENTONITE GROUT				45% QUARTZ, 40% FELDSPAR, 15% DARK COLORED GRAINS
125						
130						
135						
140						
145						50% QUARTZ, 35% FELDSPAR, 15% DARK COLORED GRAINS
150						

BORING LOG

PROJECT : EAGLE MOUNTAIN
JOB NUMBER: 0187073.03

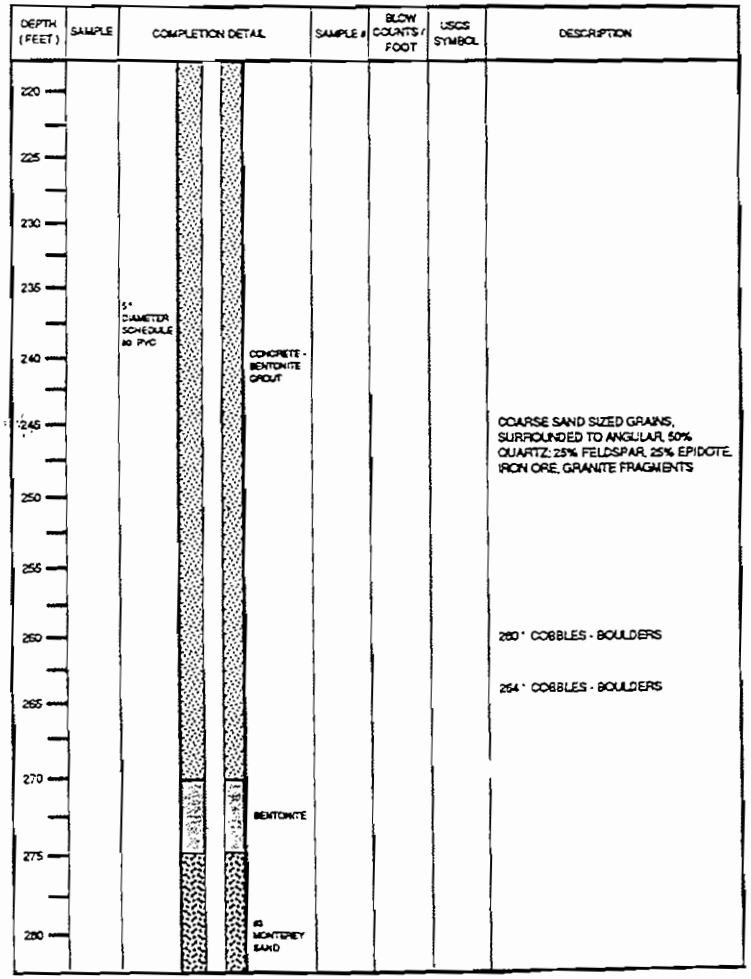
HOLE / WELL # : MW-1
PAGE : 4 OF 7



BORING LOG

PROJECT : EAGLE MOUNTAIN
JOB NUMBER: 0187073.03

HOLE / WELL # : MW-1
PAGE : 5 OF 7



BORING LOG

PROJECT: EAGLE MOUNTAIN
JOB NUMBER: 0187073.03

HOLE / WELL #: MW-1
PAGE: 6 OF 7

DEPTH (FEET)	SAMPLE	COMPLETION DETAIL	SAMPLE #	BLOW COUNTS / FOOT	USCS SYMBOL	DESCRIPTION
285		#3 MONTEREY SAND BRIDGES IN HOLE				284' - 290' COBBLES - BOULDERS
290						
295		6" DIAMETER SCHEDULE 80 PVC				
300		HOLE CAVES				COARSE SAND SIZED CUTTINGS, 30% MAFIC ROCK FRAGMENTS, 30% QUARTZ, 30% FELDSPAR, 10% EPIDOTE
305						
310						
315						318' COBBLES - BOULDERS
320		NATIVE SOIL				
325						328' - 330' COBBLES - BOULDERS
330						
335		80' .020" SLOT PVC				
340						
345						

BORING LOG

PROJECT: EAGLE MOUNTAIN
JOB NUMBER: 0187073.03

HOLE / WELL #: MW-1
PAGE: 7 OF 7

DEPTH (FEET)	SAMPLE	COMPLETION DETAIL	SAMPLE #	BLOW COUNTS / FOOT	USCS SYMBOL	DESCRIPTION
350		HOLE CAVES				WATER AT 350'? MUD THINS OUT
355						
360		NATIVE SOIL				
365						
370		.020" SLOT PVC				374' - 377' SILT - CLAY VERY LITTLE SAND IN CUTTINGS, SLOW DRILLING
375						
380						380' COBBLES - BOULDERS
385		PVC END CAP				COARSE SAND SIZED CUTTINGS, 40% QUARTZ, 30% FELDSPAR, 30% IRON ORE, EPIDOTE, MAFIC ROCK FRAGMENTS
390		HOLE CAVES TO 398'				
395						398' - 400' ANGULAR CHIPS OF IRON ORE TO 0.2"
400						TD = 400'

BORING LOG

SCS ENGINEERS

PROJECT: EAGLE MOUNTAIN
HOLE / WELL # : BH 4 / MW 2
LOCATION :
DIAMETER : 10 "
JOB NUMBER : 0187073.09
TOTAL DEPTH : 455 '
GEOLOGIST / ENGINEER B. GARBACCIO
DATE STARTED : MARCH 28, 1990
DRILLER BEYUK
DATE COMPLETED : APRIL 4, 1990
DRILL RIG : PORTADRILL
SAMPLING DEVICE CYCLONE
DRILLING METHOD : AIR ROTARY / MUD ROTARY
PAGE : 1 OF 9

DEPTH (FEET)	SAMPLE	COMPLETION DETAIL	SAMPLE #	BLOW COUNTS / FOOT	USCS SYMBOL	DESCRIPTION
0		LOCKING MONUMENT COVER				START WITH AUGER TO SET SURFACE CASING
1		15' 10" DIAMETER STEEL SURFACE CASING			SC - GC	0 - 15 ' - TAN - LIGHT BROWN CLAYEY SAND WITH GRAVEL, COBBLES AND BOULDERS (TO 6 " OBSERVED); SUBANGULAR TO SUBROUNDED; GRANITE, QUARTZITE, IRON ORE; DRY
2						
3						
4						
5						
6						
7						
8		CONCRETE GROUT TO SURFACE				
9						15 ' - 60 ' - DRILLED WITH 8 " DOWNHOLE HAMMER
10						
11						
12		4" DIAMETER CARBON STEEL CASING WITH WELDED COUPLINGS				CUTTINGS SEGREGATE IN CYCLONE
13						
14						
15					SP	SAND WITH GRAVEL TO 1 " OBSERVED, GRANITE WITH GREENSCHIST ALTERATION, CALC SILICATE ROCK, QUARTZITE, IRON ORE; NO CEMENT, SMALLER FRACTION IS MORE ANGULAR (FRAGMENTS OF LARGER ROCKS)
16						
17						
18						
19						
20						20 ' - SLIGHT CAVING

BORING

PROJECT : EAGLE MOUNTAIN
HOLE / WELL # : BH 4 / MW 2
JOB NUMBER: 0187073.09
PAGE . 2 OF 9

DEPTH (FEET)	SAMPLE	COMPLETION DETAIL	SAMPLE #	BLOW COUNTS / FOOT	USCS SYMBOL	DESCRIPTION
30						
40					SP	40 ' - FINES ARE LOST FROM CYCLONE COARSE SAND AND GRAVEL TO 2 " OBSERVED, ANGULAR TO SUBROUNDED, GRANITE, IRON ORE, QUARTZITE; NO CEMENT OR CLAY OBSERVED
						40 ' - 45 ' - BEGIN TO GET INTO CEMENTED ZONE, SEVERAL OF THE 0.1 - 0.2 " GRAVEL GRAINS HAVE TAN CLAY COATINGS
50		4" DIAMETER CARBON STEEL CASING WITH WELDED COUPLINGS; CONCRETE GROUT TO SURFACE				
60					SP - GW	60 ' - SWITCH TO 5 " TRICONE BIT
						SAND AND GRAVEL TO 1 " OBSERVED, ANGULAR TO SUBROUNDED, WHOLE CLASTS AND PIECES OF LARGER ROCKS, NO CLAY OR CEMENT; GRANITE, QUARTZITE, IRON ORE, PALE GREEN MARBLE, EPIDOTE; DRY
70						
						75 ' - TRACE CEMENT ON 0.1 - 0.2 " GRAVEL
80						80 ' - 85 ' - SMALL PIECES OF GRAVEL ARE PARTLY COATED WITH CLAY CEMENT, LARGE QUANTITY OF FINE BROWN CLAY IN DUST FROM CYCLONE, COHESIVE WHEN WET; DRY

BORING

PROJECT : EAGLE MOUNTAIN
JOB NUMBER: 0187073.09

HOLE / WELL # : BH 4 / MW 2
PAGE : 3 OF 9

DEPTH (FEET)	SAMPLE	COMPLETION DETAIL	SAMPLE #	BLOW COUNTS / FOOT	USCS SYMBOL	DESCRIPTION
90						95 ' - GRAVEL HAS CLAY COATINGS, VERY LITTLE CLAY IN FINES
100					SP	100 ' + - COARSE SAND WITH <10% GRAVEL; FINES ARE NOT COHESIVE WHEN WET; GRAVEL HAS SAND GRAINS CEMENTED TO IT, DRY
110		4" DIAMETER CARBON STEEL CASING WITH WELDED COUPLINGS; CONCRETE GROUT TO SURFACE			SP	105 ' - 110 ' + - SAND WITH 10 - 20% GRAVEL TO 1 ", VERY LITTLE FINES; GRAVEL HAS CLAY - CEMENT COATINGS, MOSTLY SUBROUNDED; GRANITE, FINE GRAINED CALC SILICATE ROCK, EPIDOTE, WHITE QUARTZITE, RED BROWN VESICULAR VOLCANIC OR DIKE ROCK
120					SP	125 ' - SAME AS ABOVE
130					SP	135 ' - VERY LITTLE FINES, GRAVEL IS MOSTLY ANGULAR QUARTZITE FROM LARGER ROCKS; SUBROUNDED GRANITE AND FINE GRAINED CALC SILICATE ROCK HAS CLAY - CEMENT COATINGS
140					SC	145 ' - 150 ' + - CLAY RICH ZONE WITH COARSE SAND AND GRAVEL TO 0.5 "; CLAY IS LIGHT TAN (REDDISH BROWN WHEN WET), GRAVEL IS ANGULAR TO SUBROUNDED; GRANITE, QUARTZITE, BLACK FINE GRAINED MAFIC DIKE ROCK, IRON ORE; SOME PIECES HAVE CLAY COATINGS; DRY

BORING

PROJECT . EAGLE MOUNTAIN
JOB NUMBER: 0187073.09

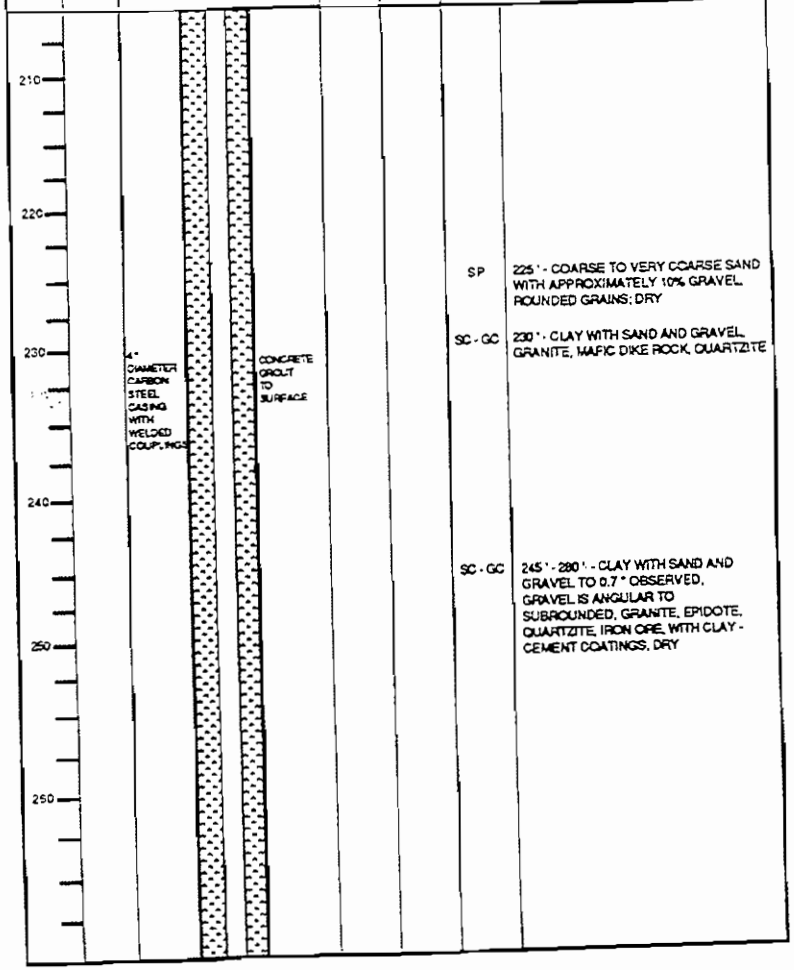
HOLE / WELL # : BH 4 / MW 2
PAGE : 4 OF 9

DEPTH (FEET)	SAMPLE	COMPLETION DETAIL	SAMPLE #	BLOW COUNTS / FOOT	USCS SYMBOL	DESCRIPTION
150						
160					SC	165 ' + - CLAY RICH ZONE WITH SAND + 20% GRAVEL TO 0.5 " (MOSTLY < 0.3 ") OBSERVED, SUBANGULAR TO SUBROUNDED, CLAY COATINGS ON SOME PIECES; META- ARKOSE, GRANITE, QUARTZITE, IRON ORE; DRY
170		4" DIAMETER CARBON STEEL CASING WITH WELDED COUPLINGS; CONCRETE GROUT TO SURFACE				
180					SC - GC	180 ' - 185 ' + - CLAY RICH ZONE WITH COARSE TO VERY COARSE SAND AND GRAVEL; GRAVEL IS ANGULAR TO SUBROUNDED, GRANITE, QUARTZITE, IRON ORE; DRY
190					CL	190 ' - CLAY RICH ZONE WITH < 20% SAND AND GRAVEL, CLAY IS LIGHT TAN (MEDIUM PINK - BROWN WHEN WET), GRAVEL INCLUDES GRANITE, IRON ORE (MAGNETITE), DIORITE, QUARTZ, EPIDOTE
200					SP - GW	195 ' - COARSE SAND AND GRAVEL TO 0.5 ", MOSTLY ANGULAR CHIPS OF GRANITE AND IRON ORE (MAGNETITE)
					SC	205 ' - CLAY WITH SAND AND GRAVEL TO 0.5 " OBSERVED, ANGULAR TO SUBROUNDED, GRANITE, IRON ORE, QUARTZITE, EPIDOTE; DRY

BORING

PROJECT : EAGLE MOUNTAIN
JOB NUMBER: 0187073.09

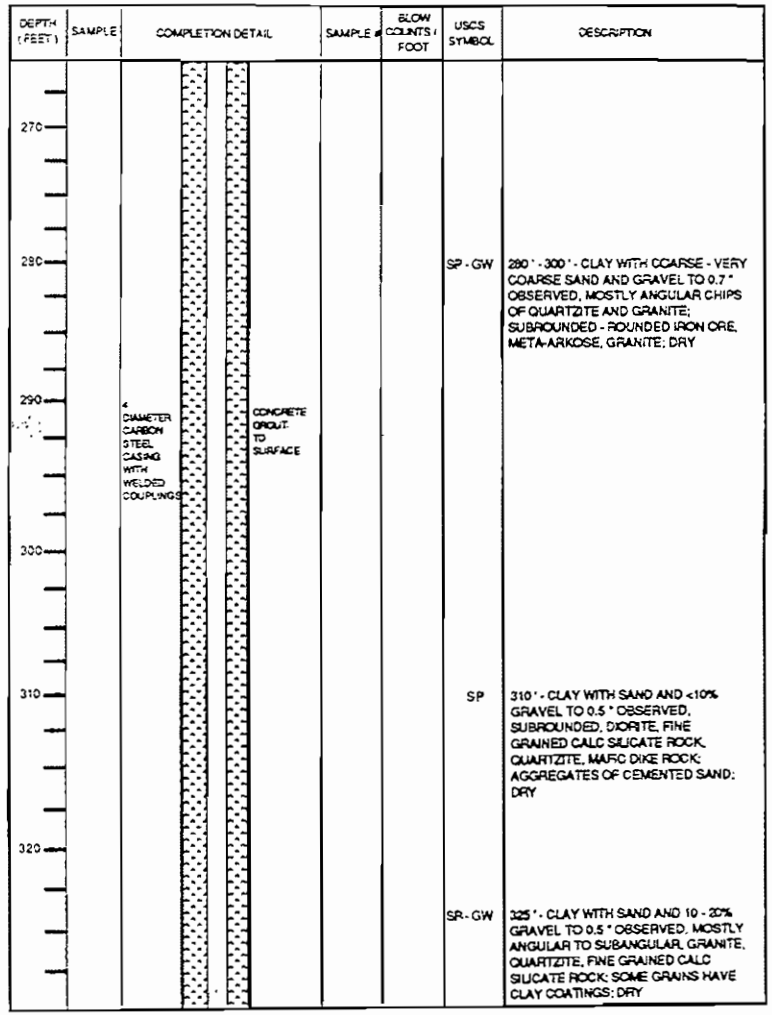
HOLE / WELL # : BH 4 / MW 2
PAGE : 5 OF 9



BORING

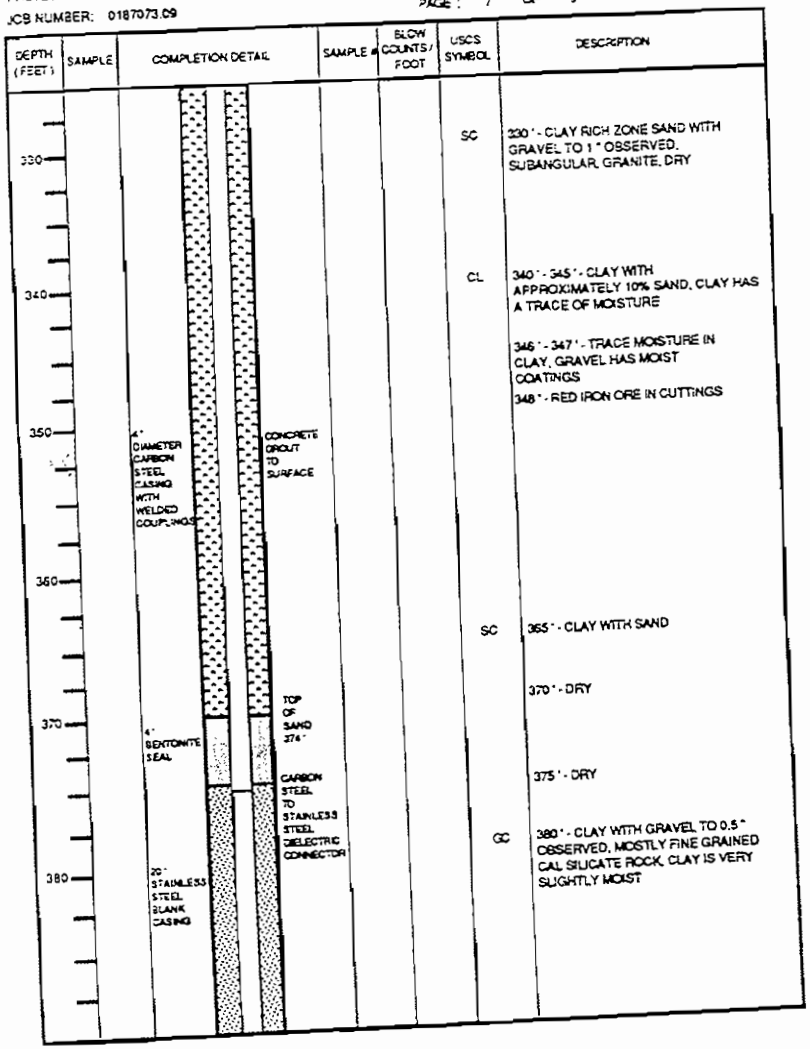
PROJECT EAGLE MOUNTAIN
JOB NUMBER: 0187073.09

HOLE / WELL # : BH 4 / MW 2
PAGE : 6 OF 9



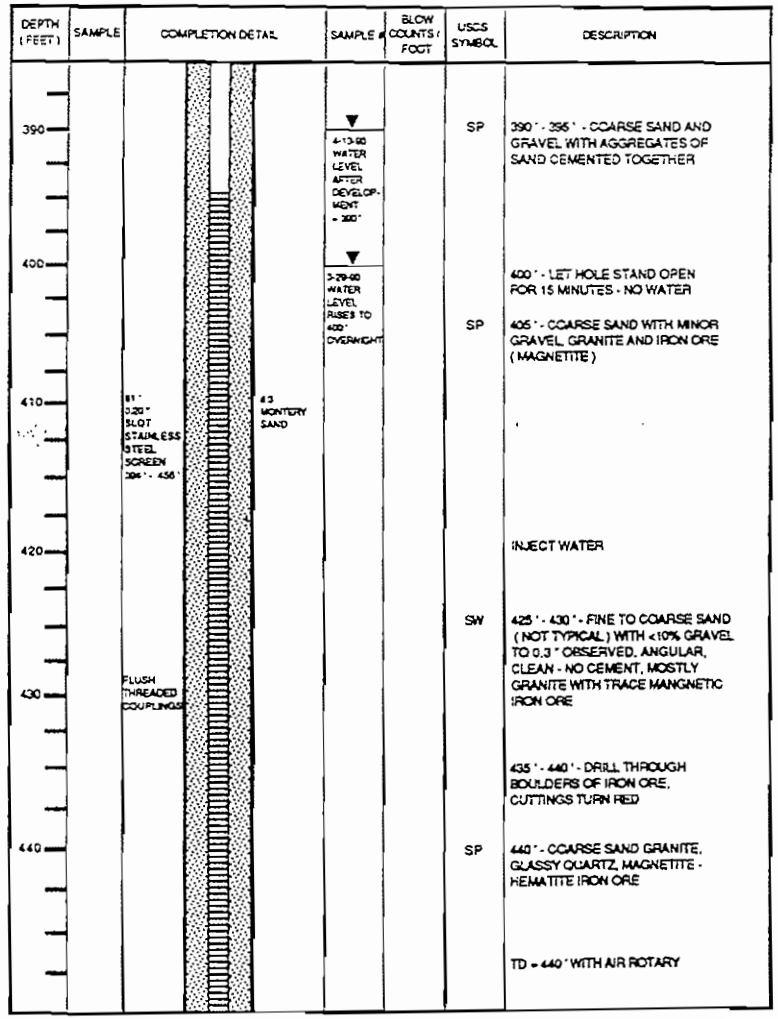
BORING

PROJECT: EAGLE MOUNTAIN
JOB NUMBER: 0187073.09
HOLE / WELL #: SH 4 / MW 2
PAGE: 7 OF 9



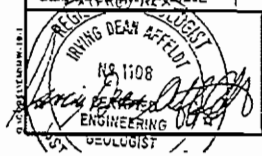
BORING

PROJECT: EAGLE MOUNTAIN
JOB NUMBER: 0187073.09
HOLE / WELL #: SH 4 / MW 2
PAGE: 8 OF 9



Site / Location	Spud date	Borehole Dia	Ground Elevation	Borehole No.
CENTRAL PIT	02/16/92	14"	3331.35'	MW - 10
Coordinates / Stationing	Completion Date	Logged By B. WILCOXON,		Bottom of Borehole (bgs)
	03/09/92	R. REYNOLDS, B. MARSH		1449'
Drill Make and Model	Drilling Method	Drill Fluid	Top of Bedrock (bgs)	First Encountered Water (bgs)
INGERSOL-RAND T 4 W	HAMMER / ROTARY	AIR / MUD	7'	1301
Drilling Contractor	Surf Csg OD/ID/Depth	Total Core Recovery %	Total Number of Core Sizes	Static Water Level
TONTO DRILLING SERVICES	16" / 15 1/2" /40'	N/A	N/A	

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Blows / ROD %	Advance / Recovery	Drill Rate (Min / 5 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
Foreman: Wayne Beaupre Drill Crew A (Morning) Driller: Frank Hight Helpers: Jim Wier Jason Verdi Drill Crew B (Afternoon) Driller: Mitch Bronson Helpers: Rick Gostevich Walt McKinney No samples taken for the first 310 feet.	18" in cone					310		No samples taken before 310'.
310' depth at 5:00 p.m., added 20' rod, and resumed drilling at 5:05 p.m. on 02/10/92.			310' 20' in 55 min			320		310.0 - 320.0' IRON ORE: Dark gray, magnetite-rich; compact, hard, extremely strong; containing minor quartzite, calc-silicates
330' depth at 6:00 p.m., added 20' rod, and resumed drilling at 6:15 p.m. on 02/18/92.			330' 20' in 1 hr 30 min			330		320.0 - 350.0' QUARTZITE: Yellow/brown, fine grained; very hard, very strong; minor calc-silicates and disseminated magnetite/hematite/pyrite grains.
	14" Air Hammer					340		350.0 - 380.0' IRON ORE: Dark gray, brown, magnetite-rich; hard, strong; minor green/brown calc-silicates, actinolite; trace yellow/brown quartzite.
350' depth at 7:45 p.m., added 20' rod, and resumed drilling at 8:00 p.m. on 02/18/92.			350' 20' in 2 hrs			350		
370' depth at 10:00 p.m., added 20' rod, and resumed drilling at 10:15 p.m. on 02/19/92.			370'			360 370		



DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/1
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

The PRA Group, Inc
CONSULTING ENGINEERS

BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO. 1 OF 2

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Blows / ROD %	Advance / Recovery	Drill Rate (Min / 5 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	14" Air Hammer		20' in 2 hrs 30 min			370		350.0 - 380.0' IRON ORE: Dark gray, brown, magnetite-rich; hard, extremely strong; minor green / brown calc-silicates, actinolite, trace yellow / brown quartzite.
						380		380.0 - 400.0' QUARTZ MONZONITE: Light yellow to reddish brown, fine grained; hard, very strong; minor green calc-silicates (diopside / actinolite).
390' depth at 12:45 a.m., added 20' rod, and resumed drilling at 12:52 a.m. on 02/15/92.			390' 20' in 1 hr 15 min			390		
						400		400.0 - 420.0' IRON ORE: Dark gray to brown magnetite-hematite; hard, extremely strong; minor green calc-silicates (diopside / actinolite).
410' depth at 2:07 a.m., added 20' rod, and resumed drilling at 2:19 a.m. on 02/18/92.			410' 20' in 3 hrs 32 min			410		
						420		420.0 - 440.0' SKARN: Dark gray calc-silicates(diopside / actinolite); hard, moderately strong; trace dark gray iron ore.
430' depth at 5:51 a.m., added 20' rod, and resumed drilling at 6:01 a.m. on 02/19/92.			430' 20' in 29 min			430		
						440		440.0 - 450.0' QUARTZ MONZONITE: Reddish brown, fine grained; very hard, very strong; minor dark green calc-silicates (diopside / actinolite).
450' depth at 6:20 a.m., added 20' rod, and resumed drilling at 6:42 a.m. on 02/19/92.			450'			450		450.0 - 460.0' MAFIC DIKE:

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/2
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO. 2 OF 2

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Bores / RQD %	Advance / Recovery	Drill Rate (Min / 6 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	14" Air Hammer		20' in 3 hr 5 mins			450		450.0 - 460.0' MAFIC DIKE: Gray green, propylitic alteration of feldspar, trace quartz.
						460		460.0 - 470.0' SKARN: Dark green calc-silicates (diopside / actinolite), with 50% magnetite-hematite ore
470' depth at 9:47 a.m., added 20' rod, and resumed drilling at 9:58 a.m. on 02/18/92.			470' 20' in 2 hrs 17 min			470		470.0 - 540.0' IRON ORE Dark gray magnetite-hematite, with silver / bronze colored mica (sericite ?) throughout hard, strong
						480		480.0 - 490.0' Minor dark green calc-silicates
490' depth at 12:15 p.m., added 20' rod, and resumed drilling at 2:10 p.m. on 02/19/92.			490' 20' in 5 hrs			490		490.0 - 500.0' Increase in dark green calc-silicates. Decrease in light green calc-silicates.
Deviation Survey = 1/2°.						500		500.0 - 540.0' Minor dark green calc-silicates
510' depth at 7:10 p.m., added 20' rod, and resumed drilling at 9:30 p.m. on 02/19/92.			510' 20' in 2 hrs			510		
530' depth at 11:30 p.m., added 20' rod, and resumed drilling at 11:55 p.m. on 02/19/92.			530'			520		
						530		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
№ 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/3
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

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REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Bores / RQD %	Advance / Recovery	Drill Rate (Min / 6 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	14" Air Hammer		20' in 1 hr 25 min			530		470.0 - 590.0' IRON ORE Dark gray magnetite-hematite, with silver / bronze colored mica throughout hard, strong.
						540		
550' depth at 1:20 a.m., added 20' rod, and resumed drilling at 2:36 a.m. on 02/20/92.			550' 20' in 4 hrs 48 min			550		
						560		
570' depth at 6:12 a.m., added 20' rod, and resumed drilling at 6:20 a.m. on 02/20/92.			570' 20' in 2.0 hrs 7 min			570		
						580		
590' depth at 2:27 a.m., added 20' rod, and resumed drilling at 2:45 a.m. on 02/21/92.			590' 20' in 5 hrs 15 min			590		590.0 - 600.0' SKARN: Dark green calc-silicates (diopside actinolite). Hard, extremely strong; minor magnetite.
Deviation Survey = 1°.						600		600.0 - 620.0' QUARTZITE: Yellow / brown, fine grained; very hard, very strong; minor banding of calc-silicates.
610' depth at 8:00 a.m., added 20' rod, and resumed drilling at 8:20 a.m. on 02/21/92.			610'			610		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
№ 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/4
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

4 OF 15

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Blows / ROD %	Advance / Recovery	Drill Rate (Min / 5 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	14" Air Hammer					610		600.0 - 620.0' QUARTZITE: Yellow / brown, fine grained; very hard, very strong; minor banding of calc-silicates.
						620		620.0 - 630.0' ANDESITE: Dark gray, porphyritic; hard, very strong; minor quartz monzonite.
			630'			630		630.0 - 640.0' QUARTZ MONZONITE: Light yellow to reddish brown, fine grained; hard, very strong; minor epidote, trace calcite
						640		640.0 - 650.0' QUARTZITE: Dark green / gray, fine grained; very hard very strong; minor epidote, tremolite, trace limonite.
650' depth at 9:50 p.m., added 20' rod, and resumed drilling at 11:01 p.m. on 02/22/92.			650' 20' in 12 hrs 14 min			650		650.0 - 670.0' ANDESITE: Dark gray, porphyritic; hard, very strong; minor quartz monzonite.
Break in hydraulic hose, rig shut down. Resumed drilling at 6:16 p.m. on 02/22/92.						660		
670' depth at 11:00 p.m., added 20' rod, and resumed drilling at 11:15 p.m. on 02/22/92.			670' 20' in 15 hrs 45 min			670		670.0 - 690.0' QUARTZITE: Light gray to dark gray green; very hard, very strong; minor limonite.
690' depth at 3:00 p.m., added 20' rod, and resumed drilling at 3:30 p.m. on 02/23/92.			690'			680		
						690		690.0 - 730.0' ANDESITE:

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/5
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

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REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Blows / ROD %	Advance / Recovery	Drill Rate (Min / 5 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	13 3/4" Tri Cone		20' in 45 hrs			690		650.0 - 730.0' ANDESITE: Medium-dark gray, fine grained; hard, very strong; minor iron ore and quartz monzonite, trace epidote and limonite stain.
						700		
710' depth at 12:30 p.m., added 20' rod, and resumed drilling at 7:45 a.m. on 02/25/92.			710' 20' in 3 hrs 45 min			710		
	13 1/2" Tri Cone					720		
730' depth at 11:00 a.m., added 20' rod, and resumed drilling at 11:15 a.m. on 02/25/92.			730' 20' in 5 hrs 25 min			730		730.0 - 750.0' IRON ORE: Dark gray magnetite-hematite; hard, strong; minor epidote.
	12 3/4" Tri Cone					740		
750' depth at 4:35 p.m., added 20' rod, and resumed drilling at 4:50 p.m. on 02/25/92.			750' 20' in 2 hrs 25 min			750		750.0 - 760.0' ANDESITE: Medium-dark gray, fine grained; hard, very strong; minor iron ore and quartz monzonite, trace epidote and limonite stain.
						760		760.0 - 770.0' QUARTZITE: tan gray to gray green, fine grained; very hard, very strong; minor limonite staining.
770' depth at 7:15 p.m., added 20' rod, and resumed drilling at 7:30 p.m. on 02/25/92.			770'			770		770.0 - 780.0' ANDESITE:

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/6
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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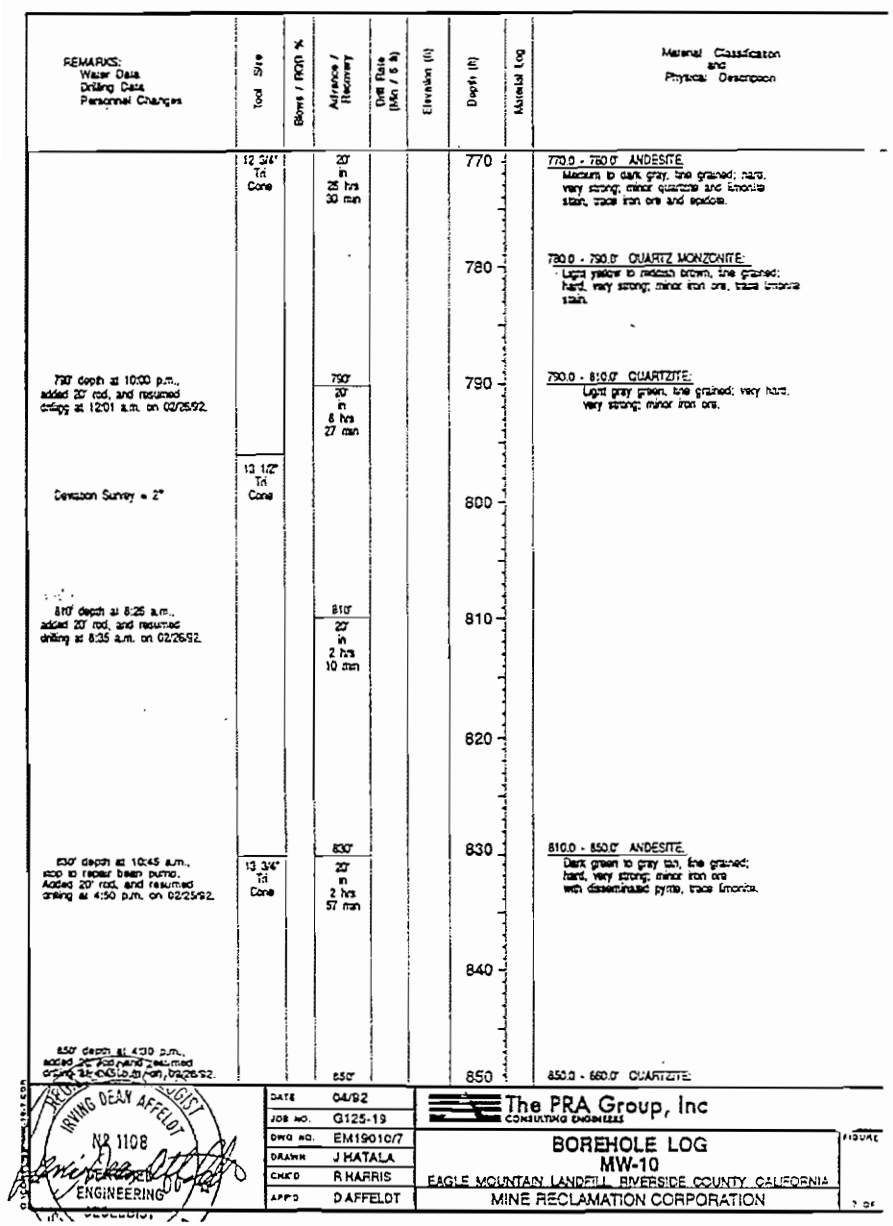
BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE A-

6 OF

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST



REGISTERED GEOLOGIST IRVING DEAN AFFELDT No 1108 ENGINEERING GEOLOGIST

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/7
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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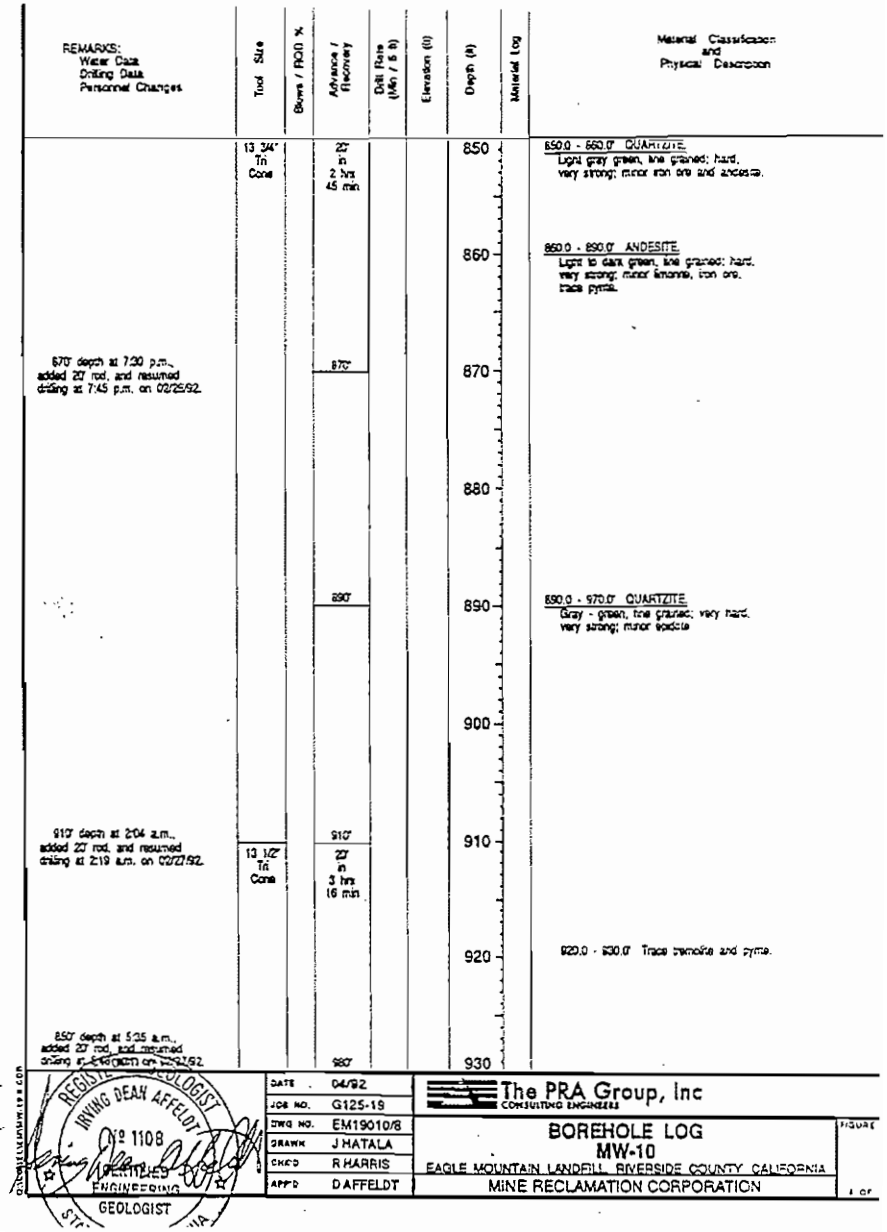
BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL RIVERSIDE COUNTY CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE

2 OF



REGISTERED GEOLOGIST IRVING DEAN AFFELDT No 1108 ENGINEERING GEOLOGIST

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/8
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL RIVERSIDE COUNTY CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE

1 OF

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Blows / ROD %	Advance / Recovery	Drill Rate (Min / 5 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	13 1/2" Tri Cone					930		890.0 - 970.0' QUARTZITE Gray - green, fine grained; very hard, very strong; minor exotics.
	13 3/4" Tri Cone					940		
						950		
						960		
						970		970.0 - 990.0' ANDESITE: Dark green, fine grained; hard, very strong; minor quartzite, trace limonite.
						980		
						990		990.0 - 1010.0' QUARTZITE Light green to gray, fine grained; very hard, very strong.
Deviation Survey = 1.5°						1000		1000.0 - 1010.0' Minor gray to light green andesite.
1010' depth at 3:17 a.m., added 20' [illegible] drilling at [illegible]			1010'			1010		1010.0 - 1070.0' ANDESITE:

REGISTERED GEOLOGIST IRVING DEAN AFFELDT No 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/9
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO

9 OF 12

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Blows / ROD %	Advance / Recovery	Drill Rate (Min / 5 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	13 3/4" Tri Cone					1010		1010.0 - 1070.0' ANDESITE: Dark green to gray, fine grained; hard, very strong; trace limonite. 1010.0 - 1070.0' Slightly porphyritic trace magnetite.
Lost circulation						1020		
1030' depth at 6:25 a.m., 03/01/92						1030		
						1040		
						1050		1050.0 - 1060.0' Epidote, actinolite
						1060		1060.0 - 1070.0' Trace clear quartz.
						1070		1070.0 - 1090.0' IRON ORE: Dark gray magnesite-hematite; hard, strong; abundant pyrite, minor tremolite.
						1080		1080.0 - 1090.0' Trace andesite.
			1090'			1090		1090.0 - 1195.0' ANDESITE:

REGISTERED GEOLOGIST IRVING DEAN AFFELDT No 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/10
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE

10 OF

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Blows / ROD %	Advance / Recovery	Drill Rate (Min / 5 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	13 3/4" Tri Cone					1090		1090.0 - 1195.0' ANDESITE Dark green to black, fine grained; hard, very strong; minor magnetite and pyrite, trace quartz, epidote, tremolite, biotite.
						1100		
	13 1/2" Tri Cone					1110		
						1120		
						1130		
						1140		1140.0 - 1150.0' Medium gray-green; minor quartzite and epidote.
						1150		1150.0 - 1195.0' Dark gray - green.
						1160		1160.0 - 1195.0' Trace magnetite.
			1090'			1170		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
ENGINEERING GEOLOGIST

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/11
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Blows / ROD %	Advance / Recovery	Drill Rate (Min / 5 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	13 1/2" Tri Cone					1170		1090.0 - 1195.0' ANDESITE Dark green to black, fine grained; hard, very strong; minor magnetite and pyrite, trace quartz, epidote, tremolite, biotite.
						1180		
						1190		
								1195.0 - 1235.0' QUARTZITE Light green - gray, very fine grained; very hard, very strong; minor chlorite, trace biotite.
1207 depth at 6:40 p.m., on 03/02/92						1200		
						1210		1210.0 - 1235.0' Minor dark green to black andesite, trace limonite stain.
1227 depth at 12:01 a.m., on 03/03/92						1220		1220.0 - 1235.0' Trace magnetite.
						1230		
								1235.0 - 1480.0' ANDESITE Dark green to black, fine grained, hard, very strong, minor magnetite and epidote, trace limonite stain.
1247 depth at 5:27 a.m., on 03/03/92						1240		
						1250		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
ENGINEERING GEOLOGIST

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/12
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Blows / ROD %	Advance / Recovery	Drill Rate (Min / 5 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	13 1/2" Tri Cone					1250		1235.0 - 1460.0' ANDESITE Dark green to black, fine grained; hard, very strong; minor magnetite and epidote, trace limonite. 1250.0 - 1260.0' Minor quartz, trace crystal calcite
1257' depth at 8:00 a.m., on 03/03/92.						1260		1260.0 - 1270.0' Abundant pink calcite, minor pink vein quartz.
						1270		1270.0 - 1280.0' Abundant pale green quartzite, minor amphibole, calcite.
1287' depth at 4:00 p.m., on 03/03/92.						1280		
						1290		1290.0 - 1300.0' 15% magnetite, trace pyrite.
1307' depth at 5:54 a.m., on 03/04/92.						1300		
						1310		
						1320		
						1330		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No 1108
CERTIFIED ENGINEERING GEOLOGIST
GEOLOGIST

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/13
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

13 OF 15

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	Blows / ROD %	Advance / Recovery	Drill Rate (Min / 5 ft)	Elevation (ft)	Depth (ft)	Material Log	Material Classification and Physical Description
	13 1/2" Tri Cone					1330		1235.0 - 1460.0' ANDESITE Dark green to black, fine grained; hard, very strong; minor magnetite and epidote, trace limonite stain.
						1340		1340.0 - 1350.0' Trace pyrite, actinolite.
						1350		
						1360		
						1370		1370.0 - 1390.0' Abundant limonite, trace calcite.
						1380		
						1390		1390.0 - 1400.0' Abundant amphibole.
						1400		1400.0 - 1410.0' Trace pyrite, rare calc-silicates.
						1410		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	04/92
JOB NO.	G125-19
DWG NO.	EM19010/14
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE
14 OF

Project Site / Drill Site	Spud Date	Borehole Dia	Ground Elevation	Borehole No
WEST END OF EAST PIT	04/13/92	13 3/4"	1251.42'	MW-13
Coordinates / Subzone	**Completion Date**	**Logged By**		**Bottom of Borehole (bgs)**
	04/17/92	C. L. TRANTHAM		420'
Drill Rig Make and Model	**Drilling Method**	**Drilling Fluid**	**Top of Bedrock (bgs)**	**First Encountered Water (bgs)**
INGERSOLL RAND T4	Air Hammer	Air	3.0'	315'
Drilling Contractor	**Surf Csg OD/ID/Depth**	**Total Core Recovery %**	**Total Number of Core Boxes**	**Static Water Level (bgs)**
TONTO DRILLING SERVICES, INC	16"OD / 15 1/2"ID / 19'	N/A	N/A	

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
Night Shift Crew: Driller: Mitch Bronson Helpers: Jason Verde Shawn Banal Day Shift Crew: Driller: Rick Gostovich Helpers: Chris Fox Dave Cozo	16" Tri Cone						0		0 - 3.0' ARTIFICIAL FILL: Gray, dense dry, angular, mainly 3/4 - 1/4" crushed road surface material.
19.0' Bottom of conductor casing.	19.0' 13 3/4" Air Hammer						10		3.0 - 142.0' QUARTZITE: Gray, fine-grained, scattered veins and veinlets of quartz, tremolite, serpentine, magnetite and white diopside (?). Scattered thin fracture fillings of white and clear gypsum. Locally lineation present with black FeMg minerals. Barely weathered, very hard, very strong.
							20		
							30		
							40		
							50		
							60		
Casing reset to 70'. Resume drilling on approx. 04/15/92.							70		

DATE	05/92
JOB NO.	G125-19
DWG NO.	EM19013/1
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-13
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE 7
1 of 6

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	13 3/4" Air Hammer						70		3.0 - 142.0' QUARTZITE: Gray, fine-grained, scattered veins and veinlets of quartz, tremolite, serpentine, magnetite and white diopside (?). Scattered thin fracture fillings of white and clear gypsum. Locally lineation present with black FeMg minerals. Barely weathered, very hard, very strong.
							80		
90.0 - 110' Cuttings to 3/4".							90		85.0 - 100.0' Darker gray.
							100		
120.0 - 142' Cuttings to 3/4".							110		
							120		
							130		135.0 - 142.0' Light gray.
142.0 - 155' Cuttings mainly fine sand sizes.							140		142.0 - 155.0' HEMATITE AND QUARTZITE: Red and gray, fine-grained with magnesite, tremolite and mica grains; barely weathered, very hard, very strong.
							150		

DATE	05/92
JOB NO.	G125-19
DWG NO.	EM19013/2
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-13
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

2 of 6

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
155-210' Cuttings are mainly fine and medium-grained sand sizes.	13 3/4" Air Hammer						150		142.0 - 155.0' HEMATITE QUARTZITE. Red and gray, fine-grained.
									155.0 - 210.0' QUARTZITE. Gray, fine-grained, scattered seams/layers and veinlets of magnetite, hematite, mica, actinolite, tremolite, white quartz, talc. Barely weathered, very hard, very strong
							160		
							170		
							180		180.0 - 190.0' Increased percent of magnetite in cuttings.
							190		190.0 - 210.0' Approximately 40% of cuttings are magnetite; trace mica and serpentine. Increased percent of magnetite with depth.
210-225' Cuttings are mostly fine and medium-grained sand sizes.							200		
							210		210.0 - 2750.0' MAGNETITE, HEMATITE QUARTZITE INTERMIXED: Dark gray, fine-grained, metallic black magnetite, reddish hematite and gray quartzite. Minor veinlets and fracture fillings of milky quartz, mica, actinolite, and serpentine. Barely weathered, moderately hard, very strong, brittle. Scattered iron stained fractures.
							220		
225-227' Cuttings are fine through coarse sand sizes.							230		

REGISTERED GEOLOGIST
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No. 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	06/92
JOB NO.	G125-19
DWG NO.	EM19013/3
DRAWN	J. HATALA
CHK'D	R. HARRIS
APP'D	D. AFFELDT

The PRA Group, Inc
CONSULTING ENGINEERS

BOREHOLE LOG
MW-13
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

3 of 6

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
230' Cuttings predominantly fine and medium sand sizes.	13 3/4" Air Hammer						230		210.0 - 2750.0' MAGNETITE, HEMATITE, QUARTZITE INTERMIXED: Dark gray, fine-grained, brittle. 230.0 - 275.0' Mossy magnetite.
									230.0 - 250.0' Pyrite fragments in cuttings.
							240		
							250		250.0 - 260.0' Decrease in percent magnetite and increase in percent hematite.
							260		
							270		
									275.0 - 420.0' QUARTZITE: Gray, fine-grained, scattered veinlets of magnetite. Some fracture filling with gypsum. Few brecciated pieces with quartz, feldspar and mica. Locally banding and foliation in the quartzite. Barely weathered, very hard, very strong. chlorite, epidote, calcite fill
							280		
							290		
310.0' Depth at end of night shift on 04/15/92. Encountered local water at 310'. Sample and rig down on 04/17/92.							300		
							310		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	06/92
JOB NO.	G125-19
DWG NO.	EM19013/4
DRAWN	J. HATALA
CHK'D	R. HARRIS
APP'D	D. AFFELDT

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BOREHOLE LOG
MW-13
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

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REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
310' Depth at 7:00 a.m. on 04/17/92. 315' Begin injecting some water. 320 - 330' Driller reports very tight (as when clay squeezes in hole). 330' Depth at 10:00 a.m. on 04/17/92. 350' Depth at 10:50 a.m. on 04/17/92. 350 - 360' Driller reports very tight. 370' End day shift on 04/17/92, and begin night shift on 04/17/92.	12 1/4" Tri Cone						310 320 330 340 350 360 370 380 390		275.0 - 420.0' QUARTZITE: Gray, fine-grained, scattered veinlets of magnetite. Some fracture filling with gypsum. Few brecciated pieces with quartz, feldspar and mica. Locally banding and lineation in the quartzite. Barely weathered, very hard, very strong. chlorite, epidote, calcite fill. 320.0 - 330.0' Some brecciation, minor serpentine and magnetite. 330.0 - 340.0' Banding more noticable. 340.0 - 350.0' Increase in percent pink feldspar. Scattered oxidized fractures, some filled with clay, some banding and lineation. 350.0 - 356.0' Brecciated (?), healed, with clay and gouge (?). 356.0 - 375.0' Reddish brown color of cuttings due to scattered magnetite veins. Scattered mica, actinolite-tremolite veinlets. Scattered iron-stained fractures. 375.0 - 420.0' Light greenish gray, brecciated with scattered minor veinlets of hematite/magnetite/serpentine; and veins of actinolite/tremolite in a clayey gouge. Scattered iron-stained fractures.

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	06/92
JOB NO.	G125-19
DWG NO.	EM19013/5
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-13
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO
5 of 6

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
420.0' Completed drilling on night shift on 04/17/92.	12 1/4" Tri Cone						390 400 410 420 430 440 450 460 470		275.0 - 420.0' QUARTZITE: Gray, fine-grained, scattered veinlets of magnetite. Some fracture filling with gypsum. Few brecciated pieces with quartz, feldspar and mica. Locally banding and lineation in the quartzite. Barely weathered, very hard, very strong. Chlorite, epidote, calcite fill. 375.0 - 420.0' Light greenish gray. Bottom of Borehole Total Depth: 420.0 feet Elevation: 531.48 feet

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	06/92
JOB NO.	G125-19
DWG NO.	EM19013/6
DRAWN	J HATALA
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
MW-13
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

6 of 6

APPENDIX A

LITHOLOGIC DESCRIPTION

Eagle Mountain Piezometer No. 1

0 - 15ft	ARTIFICIAL FILL
15 - 25ft	QUARTZITE
25 - 45ft	QUARTZITE AND QUARTZ MONZONITE
45 - 65ft	QUARTZITE
65 - 80ft	QUARTZ MONZONITE
80 - 196ft	QUARTZITE
196 - 200ft	QUARTZ MONZONITE WITH SOME QUARTZITE
200 - 205ft	QUARTZITE WITH SOME QUARTZ MONZONITE
205 - 270ft	QUARTZ MONZONITE

APPENDIX A

LITHOLOGIC DESCRIPTION

Eagle Mountain Piezometer No. 11

0- 10ft POORLY GRADED SAND (SP) : Trace coarse, angular to subrounded gravel; 10% fine, angular to subrounded gravel; 25% coarse, angular to subrounded sand; 60% medium, angular to subrounded sand; 5% fine, subangular to subrounded sand; brown, dry, maximum size = 25mm

10 - 20ft POORLY GRADED SAND WITH GRAVEL (SP) : 20% coarse, angular to subangular gravel; 15% fine, angular to subangular gravel; 30% coarse, angular to subrounded sand; 35% medium, angular to subrounded sand; trace fine sand; brown, dry, maximum size = 30mm

20 - 75ft POORLY GRADED SAND WITH GRAVEL (SP) : 5% coarse, angular to subangular gravel; 10% fine, angular to subangular gravel; 40% coarse, angular to subangular sand; 45% medium, angular to subangular sand; trace fine, subangular to subrounded sand; brown, dry, maximum size = 35mm

75 - 135ft POORLY GRADED GRAVEL WITH SAND (GP) : 25% coarse, angular to subrounded gravel; 35% fine, angular to subrounded gravel; 20% coarse, angular to subrounded sand; 20% medium, angular to subrounded sand; trace fine sand; brown, dry, maximum size = 43mm

135 - 205ft POORLY GRADED SAND WITH GRAVEL (SP) : 10% coarse, angular to subrounded gravel; 15% fine, angular to subrounded gravel; 30% coarse, angular to subrounded sand; 40% medium, angular to subrounded sand; 5% fine, subangular to subrounded sand; brown, moist (due to injection of water during drilling), maximum size = 37mm

205 - 210ft POORLY GRADED GRAVEL (GP) : 80% coarse, subangular to subrounded gravel; 20% fine, subangular to subrounded gravel; trace coarse, subangular to subrounded sand; trace medium, subangular to subrounded sand; trace fine, subangular to subrounded sand; trace fines; no dilatancy, medium toughness, medium plasticity, medium dry strength; brown, moist (due to injection of water during drilling), maximum size = 40mm

210- 255ft POORLY GRADED SAND (SP) : Trace coarse, subangular to subrounded gravel; trace fine, subangular to subrounded gravel; 15% coarse, subangular to subrounded sand; 85% medium, subangular to subrounded sand; trace fine, subangular to subrounded sand; brown, dry, maximum size = 39mm

255- 270ft SANDY LEAN CLAY (CL) : Trace fine, angular to subrounded gravel; trace coarse, angular to subrounded sand; 10% medium, angular to subrounded sand; 20% fine, subangular to subrounded sand; 70% fines; no dilatancy, medium toughness, medium plasticity, medium dry strength; brown, moist (due to injection of water during drilling)

270- 310ft CLAYEY SAND (SC) : Trace fine, angular to subrounded gravel; 5% coarse, angular to subrounded sand; 30% medium, angular to subrounded sand; 35% fine, subangular to subrounded sand; 30% fines; no dilatancy, medium toughness, medium plasticity, medium dry strength; brown, moist (due to injection of water during drilling)

310- 345ft SANDY LEAN CLAY (CL) : Trace fine, angular to subrounded gravel; trace coarse, angular to subrounded sand; 10% medium, subangular to subrounded sand; 30% fine, subangular to subrounded sand; 60% fines; no dilatancy, medium toughness, medium plasticity, medium dry strength; brown, moist (due to injection of water during drilling)

345- 365ft CLAYEY SAND (SC) : Trace fine, angular to subangular gravel; 10% coarse, angular to subangular sand; 40% medium, angular to subrounded sand; 30% fine, subangular to subrounded sand; 20% fines no dilatancy, medium toughness, medium plasticity, medium dry strength; brown, moist (due to injection of water during drilling)

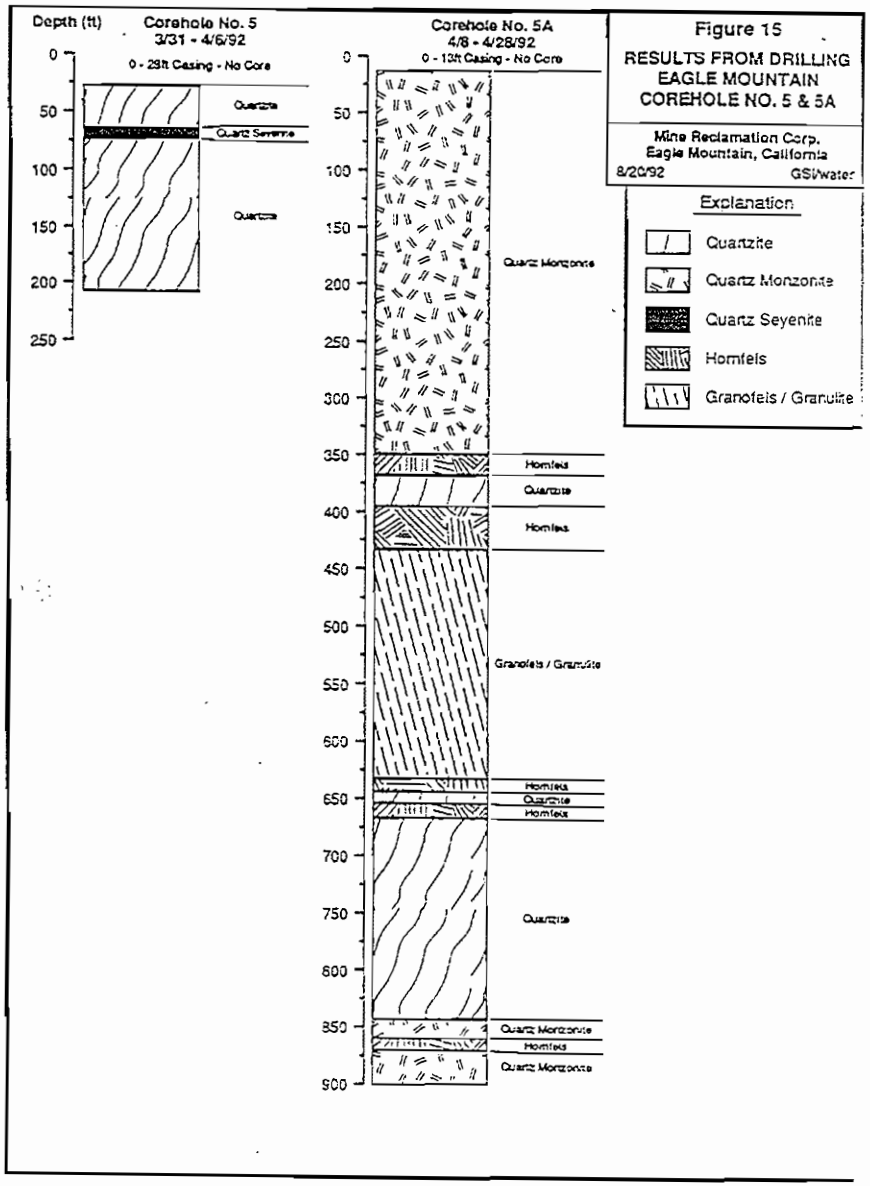
365- 485ft POORLY GRADED SAND (SP) : 5% fine, angular to subrounded gravel; 40% coarse, angular to subrounded sand; 55% medium, angular to subrounded sand; trace fine, subangular to subrounded sand; trace fines; brown, dry

APPENDIX A

LITHOLOGIC DESCRIPTION

Eagle Mountain Piezometer No. 12

0- 10ft	POORLY GRADED SAND (SP) : 10% coarse, angular to subrounded gravel; 10% fine, angular to subrounded gravel; 45% coarse, angular to subrounded sand; 35% medium, angular to subrounded sand; trace fine sand; brown, dry, maximum size = 38mm
10 - 15ft	POORLY GRADED GRAVEL WITH SAND (GP) : 25% coarse, angular to subrounded gravel; 35% fine, angular to subrounded gravel; 25% coarse, angular to subrounded sand; 15% medium, angular to subrounded sand; trace fine sand; brown, dry, maximum size = 40mm
15 - 30ft	POORLY GRADED SAND WITH GRAVEL (SP) : 5% coarse, angular to subrounded gravel; 20% fine, angular to subrounded gravel; 40% coarse, angular to subrounded sand; 35% medium, angular to subrounded sand; trace fine sand; brown, dry, maximum size = 22mm
30 - 60ft	POORLY GRADED GRAVEL WITH SAND (GP) : 30% coarse, angular to subrounded gravel; 35% fine, angular to subrounded gravel; 25% coarse, subangular to subrounded sand; 10% medium, subangular to subrounded sand; trace fine sand; brown, dry, maximum size = 31mm
60 - 115ft	POORLY GRADED SAND WITH GRAVEL (SP) : 10% coarse, angular to subangular gravel; 20% fine, angular to subrounded gravel; 40% coarse, angular to subrounded sand; 30% medium, subangular to subrounded sand; trace fine sand; brown, dry, maximum size = 30mm
115 - 130ft	ELASTIC SILT (ML) : 10% fine, subangular to subrounded sand; 90% fines; slow dilatancy, medium toughness, low plasticity, low dry strength; brown, dry
130- 155ft	POORLY GRADED SAND (SP) : Trace coarse, subangular to subrounded gravel; 10% fine, angular to subrounded gravel; 35% coarse, angular to subrounded sand; 50% medium, subangular to subrounded sand; 5% fine, subangular to subrounded sand; brown, dry, maximum size = 32mm
155- 370ft	POORLY GRADED SAND (SP) : Trace fine, subangular to subrounded gravel; trace coarse, subangular to subrounded sand; 60% medium, subangular to subrounded sand; 40% fine, subangular to subrounded sand; brown, dry
370- 500ft	POORLY GRADED SAND (SP) : Trace fine, subangular to subrounded gravel; 20% coarse, subangular to subrounded sand; 70% medium, subangular to subrounded sand; 10% fine, subangular to rounded sand; trace to 5% fines; slow dilatancy, medium toughness, medium plasticity, low dry strength; brown, dry



Project Site / Drill Site: NORTH OF EAST PIT	Spud Date: 4/02/92	Borehole Dia: 3.85"	Ground Elevation: 1557.2'	Borehole No.: CH-5	
Coordinates / Stationing	Completion Date: 4/05/92	Logged By: R. REYNOLDS, J. SUTHARD		Bottom of Borehole (bgs): 206'	
Drill Rig Make and Model: BOYLES 56	Drilling Method: CORE	Drilling Fluid: MUD	Top of Bedrock (bgs): 28'	First Encountered Water (bgs): /	
Drilling Contractor: TONTO DRILLING SERVICES, INC.	Surf Csg OD/ID/Depth: 4 1/2" / 4" / 28'	Total Core Recovery %:	Total Number of Core Boxes: 20	Static Water Level (bgs): /	

REMARKS. Water Data, Drilling Data, Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	5 5/8" TRI CONE								0' - 28.0' CASING - NO CORE
						28.0'			
30' depth at 10:10 am, 4/02/92	HQ	0	6	100	BOX 1				28.0' - 65.0' QUARTZITE. Variegated light to dark green-gray, fine-grained. Gneiss-rich banding 10-40 degrees to axis. Slightly to moderately fractured. Fractures smooth, slightly open.
		0	6	100					
Geologist: R. Reynolds	3.85" HOLE	31	3	100		36.5'			
	2.405" CORE	74	1	100					
40' depth at 2:00 pm, 4/02/92		62	1	100	BOX 2	46.5'			
50' depth at 3:45 pm, 4/02/92		57	1	100	BOX 3	55.0'			
		57	2	100					
60' depth at 7:00 pm, 4/02/92		73	<1	100	BOX 4	64.5'			
		47	2	100					
70' depth at 9:45 AM 4/03/92		72	<1	100	BOX 5				65.0' - 74.0' QUARTZ SEYENITE. Pink-gray, coarse-grained. Mostly K-feldspar, with minor interstitial quartz and pyroxene. Fractures hardly, slightly open, MnOx coating. Rock is massive, hard, strong.

REGISTERED GEOLOGIST IRVING DEAN AFFELDT No. 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

DATE	7/92
JOB NO.	G125-19
DWG NO.	EM 19004-1
DRAWN	R. HARRIS
CHKD	D. MERIT
APPD	D. AFFELDT

The PRA Group, Inc
CONSULTING ENGINEERS

BOREHOLE LOG
CH-5
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
70' depth at 9:15 pm, 4/02/92	HQ 3.85" HOLE 2.405" CORE	20	4	100	5 73.0'		70		55.0' - 74.0' QUARTZ SYENITE: Pink-gray, coarse-grained, Mostly K-feldspar, with minor interstitial quartz and pyroxene. Fractures blocky, slightly open, MnOx coating. Rock is massive, hard, strong.
		32	3	100	BOX 6				
80' depth at 10:05 pm, 4/02/92		27	6	100	82.0' BOX 7		80		74.0' - 208.0' QUARTZITE Light to dark green, fine-grained, weak bedding banding. Hard, strong, slightly to moderately fractured. Fractures mostly 40-50 and 70-90 degrees to axis, smooth, minor calcite fill
Geologist: J. Suthard		45	2	100	90.3'				
90' depth at 3:13 am, 4/03/92		48	2	100	BOX 8		90		
		25	4	100	100.0'				
100' depth at 6:12 am, 4/03/92		45	1	100	BOX 9		100		100' - 107' dikelets of syenite to 1" common
Geologist: R. Reynolds Drilling down for repair		60	1	100	108.5'				
		25	2	100	BOX 10				
110' depth at 9:30 pm, 4/03/92		42	2	100	118.0'		110		115' - 127' minor syenite dikelets
		48	2	100	BOX 11				
120' depth at 10:25 pm, 4/03/92		52	2	100	127.0'		120		
		30	4	100	BOX 12				
130' depth at 2:00 am, 4/04/92		0	>5	20	139.0'		130		130'- 135' fault zone, brecciated
Problems retrieving core barrel all night		23	6	100	BOX 13				
Geologist: R. Reynolds									
140' depth at 2:00 pm, 4/04/92		98	<1	100	148.0'		140		
		67	1	100	BOX 14				
150' depth at 3:45 pm, 4/04/92							150		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
№ 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	7/92
JOB NO.	G125-19
DWG NO.	EM 19004-2
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

The PRA Group, Inc
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BOREHOLE LOG
CH-5
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

2 of 3

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
150' depth at 3:45 pm, 4/04/92	HQ 3.85" HOLE 2.405" CORE	40	5	100	BOX 14		150		74.0' - 208.0' QUARTZITE Light to dark green, fine-grained, weak biotite banding. Hard, strong, slightly to moderately fractured. Fractures mostly 40-50 and 70-90 degrees to axis smooth, minor calcite fill
		32	2	100	157.0'				
160' depth at 5:15 pm, 4/04/92		37	2	100	BOX 15		160		150.0' - 160.0' minor syenite dikelets
		68	1	100	166.5'				
170' depth at 11:00 pm, 4/04/92		64	<1	100	BOX 16		170		
		20	4	100	175.0'				
Geologist: J. Suthard									
180' depth at 12:55 am, 4/05/92		76	<1	100	BOX 17		180		
		82	<1	100	185.0'				
190' depth at 9:25 am, 4/05/92		92	1	100	BOX 18		190		
		60	3	100	193.5'				
		44	3	95	BOX 19				197.0' - 208.0' hydrothermal alteration bleaching
200' depth at 12:30 pm, 4/05/92 Deviation survey = <2 degrees		16	>5	100	202.0'		200		
Geologist: R. Reynolds		7	5	95	BOX 20				TOTAL DEPTH 208.0 FEET
208' stopped drilling due to severe vibration and loss of circulation, 1:40 pm, 4/04/92							210		
							220		
							230		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
№ 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	7/92
JOB NO.	G125-19
DWG NO.	EM 19004-3
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

The PRA Group, Inc
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BOREHOLE LOG
CH-5
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

3 of 3

Project Site / Drill Site: NORTH OF EAST PIT	Spud Date: 04/03/92	Borehole Dia: 3.85"	Ground Elevation: 1657.20'	Borehole No: CH-5A
Coordinates / Stationing:	Completion Date: 04/23/92	Logged By: R. REYNOLDS, J. SUTHARD		Bottom of Borehole (bgs): 903'
Drill Rig Make and Model: BOYLES 56	Drilling Method: CORE	Drilling Fluid: MUD	Top of Bedrock (bgs): 14'	First Encountered: 935'
Drilling Contractor: TONTO DRILLING SERVICES, INC.	Surf Csg OD/ID/Depth: 4 1/2" / 4" / 13'	Total Core Recovery %:	Total Number of Core Boxes: 93	Static Water Level (bgs):

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	5 5/8" Tri Cone								0' - 13.0' CASING NO CORE
20' depth at 2:20 a.m. on 04/08/92.	HQ 3.85" Hole 2.406" Core	75	<1	100	BOX 1		10		13.0' - 349.5' QUARTZ MONZONITE. Porphyritic, pink gray, medium to coarse grained. K-feldspar phenocrysts to 3 cm, abundant biotite. Mostly hard, strong; slightly to highly fractured. fractures variable.
		38	3	100					
		77	1	100	BOX 2		20		15.0' - 26.5' fractures 10 and 20 degrees to axis, slightly open, minor calcite fill.
30.0' depth at 3:11 a.m. on 04/08/92.		23	3	92					26.5' - 60.5' fractures 30, 60, and 90 degrees to axis, slightly open, very minor calcite
		80	1	100	BOX 3		30		
40.0' depth at 4:17 a.m. on 04/08/92.		72	1	100					
		70	1	100	BOX 4		40		
50.0' depth at 5:24 a.m. on 04/08/92.		68	3	88					
		12	4	100	BOX 5		50		
60.0' depth at 6:44 a.m. on 04/08/92.		55	<1	100					60.5' - 73.2' fractures horizontal, clay coating
		0	>5	48	BOX 6		60		
70.0' depth at 10:02 a.m. on 04/08/92.		0	>5	28			70		

DATE	06/92
JOB NO.	G125-19
DWG NO.	EM19005/1
DRAWN	N. TOOR
CHKD	R. HARRIS
APPD	D. AFFELDT

The PRA Group, Inc
CONSULTING ENGINEERS

BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

REGISTERED GEOLOGIST IRVING DEAN AFFELDT No 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.85" Hole 2.406" Core	10	>5	42	BOX 6		70		13.0' - 349.5' QUARTZ MONZONITE. Porphyritic, pink gray, medium to coarse grained. K-feldspar phenocrysts to 3 cm, abundant biotite. Mostly hard, strong; slightly to highly fractured. fractures variable.
		82	<1	100	76.5'				73.2' - 140.0' few fractures, 60 - 70 degrees to axis, weak chlorite coating.
60.0' depth at 11:35 a.m. on 04/09/92.		72	5	100	BOX 7		80		
		92	<1	80	85.0'				
90.0' depth at 1:25 p.m. on 04/09/92.		88	<1	100	BOX 8		90		
		74	<1	80	95.5'				
100.0' depth at 5:15 p.m. on 04/09/92.		71	1	100	BOX 9		100		
		100	0	97	105.0'				
110.0' depth at 6:45 p.m. on 04/09/92.		72	1	100	BOX 10		110		
		65	<1	100	115.0'				
120.0' depth at 8:40 p.m. on 04/09/92.		87	<1	100	BOX 11		120		
		68	1	100	124.0'				
130.0' depth at 10:30 p.m. on 04/09/92.		80	<1	100	BOX 12		130		
		87	<1	100	132.5'				
140.0' depth at 12:25 a.m. on 04/10/92.		85	<1	100	BOX 13		140		140.0' - 155.0' slightly fractured, 10, 60, and 80 degrees to axis, calcite coatings.
		57	2	100	141.0'				
150.0' depth at 04/10/92.		52	2	100	BOX 14		150		
					150.0'				

DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/2
DRAWN	N. TOOR
CHKD	R. HARRIS
APPD	D. AFFELDT

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BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

REGISTERED GEOLOGIST IRVING DEAN AFFELDT No 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

REMARKS Water Data Drilling Data Piezometer Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.85" Hole 2.405" Core	85	1	100	BOX 15		150		13.0' - 349.5' QUARTZ MONZONITE Porphyritic, pink gray, medium to coarse grained, K-feldspar phenocrysts to 3 cm, abundant biotite. Mostly hard, strong; slightly to highly fractured, fractures variable.
160.0' depth at 3:00 p.m., on 04/10/92.		0	—	0					
		20	4	55	154.5'				160.0' - 170.0' highly fractured, MnOx-stained sandy fracture filling, fractures 10 degrees to axis.
		73	<1	100	BOX 16		160		
170.0' depth at 4:50 p.m., on 04/10/92.		27	1	90	174.0'				170.0' - 194.5' moderately to highly fractured, fractures 70 - 90 degrees to axis, calcite fill.
		33	2	75	BOX 17		170		
180.0' depth at 8:30 p.m., on 04/10/92.		83	5	75					
		35	3	100	185.0'				
		31	3	85	BOX 18		180		
190.0' depth at 9:40 p.m., on 04/10/92.		9	3	75	195.5'				194.5' - 234.5' fractures 10-45, 60, and 80 degrees to axis, minor calcite, rare gypsum fill
		47	2	90	BOX 19		190		
200.0' depth at 1:00 a.m., on 04/11/92.		28	5	92	204.5'				
		22	4	95	BOX 20		200		
210.0' depth at 4:10 a.m., on 04/11/92.		27	>5	92	212.5'				
		0	4	68	BOX 21		210		
220.0' depth at 6:50 a.m., on 04/11/92.		22	4	100	223.0'				
		20	5	100	BOX 22		220		
230.0' depth at 04/11/92.							230		

DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/3
DRAWN	N TOOR
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

3 of 12

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

REMARKS Water Data Drilling Data Piezometer Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.85" Hole 2.405" Core	41	3	100	231.5' BOX 23		230		13.0' - 349.5' QUARTZ MONZONITE Porphyritic, pink gray, medium to coarse grained, K-feldspar phenocrysts to 3 cm, abundant biotite. Mostly hard, strong; slightly to highly fractured, fractures variable.
		10	4	100					
240.0' depth at 12:30 p.m., on 04/11/92.		0	4	100	240.0' BOX 24		240		234.5' - 243.0' fractures 10 - 40 degrees to axis; clay, calcite coating; weak slickensides at 238'.
		0	10	60					243.0' - 250.0' fractures 40 and 70-90 degrees to axis, slightly open, no fill
250.0' depth at 1:50 p.m., on 04/11/92.		0	10	50	251.0'		250		
		30	2	100	BOX 25				
		0	-	0					
		57	3	100	259.5'				
260.0' depth at 11:40 p.m., on 04/11/92.		0	>5	100	BOX 26		260		250.0' - 300.5' fractures 10-30 and 70-90 degrees to axis, irregular, clay and calcite fill
		17	3	100					
270.0' depth at 4:00 a.m., on 04/12/92.		9	3	48			270		
		11	>5	62	274.5' BOX 27				
		0	>5	80					
280.0' depth at 8:20 a.m., on 04/12/92.		11	3	100	283.2'		280		
		56	2	100	BOX 28				
290.0' depth at 10:20 a.m., on 04/12/92.		30	3	100	293.0'		290		
		37	3	100	BOX 29				
300.0' depth at 1:25 p.m., on 04/12/92.		38	2	100	301.5'		300		300.5' - 309.5' fractures 10-20 and 40-70 degrees to axis, calcite fill
		38	2	100	BOX 30				
310.0' depth at 04/12/92.		52	1	100			310		

DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/4
DRAWN	N TOOR
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.
4 of 12

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

REMARKS Water Data Drilling Data Pressures/ Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
					310.5'		310		10.0' - 349.5' QUARTZ MONZONITE Porphyritic, pink gray, medium to coarse grained K-feldspar phenocrysts to 3 cm, abundant biotite. Mostly hard, strong; slightly to highly fractured, orientation variable.
	HQ 3.85" Hole 2.405" Core	43	2	100	BOX 30				
		30	2	100	319.5'				
- 320.0' depth at 5:50 p.m., on 04/12/92.		48	2	100	BOX 32		320		309.5' - 324.5' fractures 40 and 70 degrees to axis, semi-smooth to hacky, slighty open.
		21	2	75	329.0'				
330.0' depth at 9:50 p.m., on 04/12/92.		8	>5	75	BOX 33		330		324.5' - 368.0' fractures 10, 40, and 70 degrees to axis, smooth to hacky, minor calcite fill.
		0	>5	80					
		22	4	80	339.5'				
340.0' depth at 12:20 a.m., on 04/13/92.		70	2	100	BOX 34		340		
		52	2	100	349.5'				
350.0' depth at 4:00 a.m., on 04/13/92.		23	4	100	BOX 35		350		349.5' - 368.0' HORNFELS Medium gray, fine grained, equigranular, Alternating bands of biotite-amphibole-magnetite and quartz-feldspar. Hard, strong.
		13	>10	95	357.5'				
360.0' depth at 2:00 p.m., on 04/13/92.		0	>10	75	BOX 36		360		
		0	>10	80	368.0'				
370.0' depth at 3:30 a.m., on 04/14/92.		53	<1	100	BOX 37		370		368.0' - 395.0' QUARTZITE White to medium gray, zones and dots of K-feldspar and epidote-diopside. Fractures 15-40 and 60-90 degrees to axis, calcite fill. Very hard, strong.
		95	<1	100	377.5'				
380.0' depth at 6:10 a.m., on 04/14/92.		61	<1	100	BOX 38		380		
		68	<1	100	386.5'				
390.0' depth at 9:20 a.m., on 04/14/92.					BOX 39		390		

REGISTERED GEOLOGIST IRVING DEAN AFFELDT No. 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/5
DRAWN	N. TOOR
CHK'D	R. HARRIS
APP'D	D. AFFELDT

The PRA Group, Inc
CONSULTING ENGINEERS

BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

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REMARKS Water Data Drilling Data Pressures/ Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
					395.0'		390		368.0' - 395.0' QUARTZITE White to medium gray, zones and dots of K-feldspar and epidote-diopside. Fractures 15-40 and 60-90 degrees to axis, calcite fill. Very hard, strong.
	HQ 3.85" Hole 2.405" Core	27	3	100	29				
		0	2	100	395.0'				
400.0' depth at 12:01 p.m., on 04/14/92.		37	2	100	BOX 40		400		395.0' - 434.0' HORNFELS Gray to green gray, fine grained, bands of biotite and feldspar. Fractures variable orientation, semi-smooth, slighty open, minor calcite fill
		13	>10	80	404.5'				
		30	2	100	BOX 41				
410.0' depth at 12:10 a.m., on 04/15/92.		28	5	100	413.0'		410		
		33	4	100	BOX 42				
		62	2	96	421.0'				
420.0' depth at 4:20 a.m., on 04/15/92.		50	3	92	BOX 43		420		
		0	>5	75	431.0'				
430.0' depth at 7:52 a.m., on 04/15/92.		0	5	100	BOX 44		430		434.0' - 632.5' GRANOFELS / GRANULITE Medium gray, medium to coarse grained, equigranular. Appears to be a plastic mixture of quartz monzonite and recrystalized metasediments. Hard, medium strong. Common quartz-feldspar stringers to 6"
		23	75	100	439.5'				
440.0' depth at 1:10 p.m., on 04/15/92.		36	3	100	BOX 45		440		434.0' - 470.0' fractures variable, slighty open semi-smooth, minor calcite fill.
		0	>10	100	447.5'				
450.0' depth at 4:40 p.m., on 04/15/92.		37	>10	100	BOX 46		450		
		50	1	100	457.0'				
		8	2	65	BOX 47				
460.0' depth at 1:22 a.m., on 04/16/92.		0	>5	75	466.0'		460		
		37	3	90	BOX 48				
470.0' depth at 04/16/92		21	3	85			470		

REGISTERED GEOLOGIST IRVING DEAN AFFELDT No. 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/6
DRAWN	N. TOOR
CHK'D	R. HARRIS
APP'D	D. AFFELDT

The PRA Group, Inc
CONSULTING ENGINEERS

BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

5 of 12

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.85" Hole 2.406" Core	21	3	100	BOX 48		470		434.0' - 632.5' GRANOFELS / GRANULITE Medium gray, medium to coarse grained, equigranular. Appears to be a plastic mixture of quartz monzonite and recrystallized metasediments. Hard, medium strong. Common quartz-feldspar dikelets to 6".
		28	>10	100	475.5'				
		50	<1	100	BOX 49				470' - 530' fractures variable orientation, semi-smooth to hacky, slightly open, minor calcite fill.
480.0' depth at 12:50 p.m., on 04/16/92.		100	0	100			480		
		0	4	100	484.5'				
Broken clutch housing on drill rig		22	>10	50	BOX 50				
		25	3	100					
490.0' depth at 12:00 a.m., on 04/17/92.					493.5'		490		
		8	3	100	BOX 51				
500.0' depth at 3:50 a.m., on 04/17/92.		32	3	100	502.5'		500		
		0	3	100	BOX 52				
		35	2	100	511.0'				
510.0' depth at 9:40 a.m., on 04/17/92.							510		
		18	6	100	BOX 53				
		39	1	100	519.5'				
520.0' depth at 6:30 p.m., on 04/17/92.		57	<1	100	BOX 54		520		
		8	>10	60	529.0'				
530.0' depth at 10:00 p.m., on 04/17/92.		0	>10	80	BOX 55		530		530.0' - 560.0' fracture pattern random, fractures slightly open, semi-smooth, with minor clay, FeOx, and calcite fill.
		0	>5	35					
					539.5'				
540.0' depth at 12:55 a.m., on 04/13/92.		22	>5	70	BOX		540		
		0	>5	40					
		0	4	90	56				
550.0' depth at 9:10 p.m., on 04/15/92.		17	>5	100	549.0'		550		

DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/7
DRAWN	N TOOR
CHKD	R HARRIS
APPD	D AFFELDT

The PRA Group, Inc
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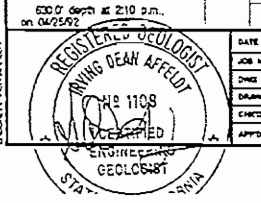
BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.85" Hole 2.406" Core	12	>5	90	BOX 56		550		434.0' - 632.5' GRANOFELS / GRANULITE Medium gray, medium to coarse grained, equigranular. Appears to be a plastic mixture of quartz monzonite and recrystallized metasediments. Hard, medium strong. Common quartz-feldspar dikelets to 6".
		0	>5	100	557.0'				
		0	>5	100	BOX 58				530.0' - 560.0' fracture pattern random, fractures slightly open, semi-smooth, with minor clay, FeOx, and calcite fill.
560.0' depth at 9:45 a.m., on 04/18/92.		100	4	100			560		
		26	2	100	565.5'				
		15	2	54	BOX 59				
570.0' depth at 9:30 p.m., on 04/18/92.							570		
		6	4	100	575.5'				
Rig down for clutch adjustment		7	4	83	BOX 60				
580.0' depth at 1:22 p.m., on 04/19/92.		7	>5	78			580		560.0' - 605.0' fractures 10, 40, and 70 degrees to axis, calcite fill to 1/8"
					585.0'				
Rig down for clutch repair		17	>5	62	BOX 61				
590.0' depth at 4:45 a.m., on 04/22/92.		0	>5	45			590		
		0	>5	100	597.5'				
600.0' depth at 9:30 a.m., on 04/22/92.		0	>10	100	BOX 62		600		
605' drilling stopped to run packer tests on HQ hole; reduced to NQ hole, resumed 5:47 a.m., 4/25/92	HQ	0	>10	100	605.0'				605.0' - 636.5' fractures 10-20 and 40-70 degrees to axis, semi-smooth to hacky, slightly open, clay and calcite fill.
	NQ 2.98" Hole 1.775" Core	0	—	37	BOX 63				
610.0' depth at 11:30 a.m., on 04/25/92.		0	5	100			610		
		0	6	100					
		11	6	95	616.5'				
		23	8	100	BOX 64				
620.0' depth at 12:55 p.m., on 04/25/92.							620		
		13	4	100	625.5'				
630.0' depth at 2:10 p.m., on 04/25/92.		7	6	100	BOX 65		630		



DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/8
DRAWN	N TOOR
CHKD	R HARRIS
APPD	D AFFELDT

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BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
750.0' depth at 2:10 p.m. on 04/27/92.	NQ 2.98" Hole 1.775" Core	0	6	85	BOX 81		790		667.0' - 843.2' QUARTZITE Medium to dark gray, fine to medium grained, weakly bedded. Common quartz monzonite dikelets. Mostly hard, strong, highly fractured. Fractures variable orientation, slightly open, weak clay and calcite coating
		0	10	55					
800.0' depth at 8:00 p.m. on 04/27/92.		10	>10	100	BOX 82		500		
		7	>10	60	803.5'				
		0	>10	80	BOX 83				
810.0' depth at 12:56 a.m. on 04/25/92.		14	5	90			810		
		27	3	100	812.5'				
		30	>5	92	BOX 84				
820.0' depth at 2:29 a.m. on 04/28/92.		0	>5	50			820		
		0	5	96	824.5'				
		43	10	100	BOX 85				827.0' - 938.0' abundant quartz monzonite, strongly stained by clay, with slickensides 10 degrees to azm
830.0' depth at 5:09 a.m. on 04/28/92.		10	>10	100	833.0'		830		
		11	>10	75	BOX 86				
840.0' depth at 8:35 a.m. on 04/28/92.		13	4	100	843.0'		840		
		28	4	100	BOX 87				843.0' - 864.0' QUARTZ MONZONITE Strongly clay-stained and bleached, abundant biotite (>20%). Moderately hard, moderately strong, highly fractured. Clay and calcite fracture filling.
850.0' depth at 9:25 a.m. on 04/28/92.		31	1	100	852.0'		850		
		48	5	100	BOX 88				
860.0' depth at 11:20 a.m. on 04/28/92.		7	>10	100	861.5'		860		
		13	>10	100	BOX 89				864.0' - 870.0' HORNFELS Medium to dark gray, fine grained, equigranular. Biotite 30-40%, weakly foliated. Fractures 10-70 degrees to azm, irregular, weak clay fill, weak FeOx stain
870.0' depth at 12:55 p.m. on 04/28/92.		52	2	95	871.5'		870		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/11
DRAWN	K. HOCHSTATTER
CHK'D	R. HARRIS
APP'D	D. AFFELDT

The PRA Group, Inc
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BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
870.0' depth at 12:55 p.m. on 04/28/92.	NQ 2.98" Hole 1.775" Core	42	2	100	BOX 89		870		870.0' - 900.0' QUARTZ MONZONITE Intensely clay-stained, weakly to strongly bleached. Abundant hornfels xenoliths. Moderately hard, moderately strong, highly fractured to brecciated. Fractures variable, clay and calcite fill.
880.0' depth at 2:30 p.m. on 04/28/92.		32	6	100	90 880.0'		880		880.0' - 883.0' fault breccia: quartzite and quartz monzonite clasts in matrix of calcite-cemented clay
		7	>10	100	BOX 91				885.0' - 890.0' fault breccia, strong calcite cement
		58	4	100	888.5'				
890.0' depth at 4:05 p.m. on 04/28/92.		22	>10	100	BOX 92		890		
		0	>10	100	897.0' BOX 93				895.0' - 900.0' fault breccia, clay-rich matrix
900.0' total depth at 5:50 p.m. on 04/28/92.					900.0'		900		TOTAL DEPTH 900'

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/12
DRAWN	K. HOCHSTATTER
CHK'D	R. HARRIS
APP'D	D. AFFELDT

The PRA Group, Inc
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BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
630.0' depth at 2:10 p.m. on 04/25/92.	HQ 2.56" Hole 1.775" Core	7	6	100	BOX 65 630.0'		630		434.0' - 632.5' GRANOFELS / GRANULITE: Medium gray, medium to coarse grained, equigranular. Appears to be a plastic mixture of quartz monzonite and recrystallized metasediments. Hard, medium strong.
		0	6	100	BOX 66				632.5' - 644.0' HORNFELS: Light to medium gray, fine grained, equigranular. Biotite 20%, weakly foliated, dikelets of quartz-feldspar. Hard, strong, highly fractured. Fractures 20, 40, and 70 degrees to axis, slightly open, minor calcite.
640.0' depth at 3:30 p.m. on 04/25/92.		0	6	100	642.0'		640		
		0	6	100	BOX 67				644.0' - 653.5' QUARTZITE: Pinkish gray, fine to medium gray, weakly foliated. Abundant feldspar, minor biotite. Hard, strong, highly fractured. Fractures 40 and 70 degrees to axis, slightly open, weak clay and minor calcite fill.
650.0' depth at 4:57 p.m. on 04/25/92.		13	6	80	651.0'		650		
		33	4	100	BOX 68				653.5' - 667.0' HORNFELS: Pinkish gray, fine grained, foliated. Strongly intermixed with pink quartz monzonite. Hard, strong, highly fractured. Fractures 20 and 50-70 degrees to axis, slightly open, blackly, weak clay and calcite coating.
		0	6	100	660.0'				
660.0' depth at 6:20 p.m. on 04/25/92.		15	>5	100	BOX 69		660		
		0	>10	80	669.5'				
670.0' depth at 8:55 p.m. on 04/25/92.		25	>10	100	BOX 70		670		667.0' - 843.2' QUARTZITE: Medium to dark gray, fine to medium grained, weakly bedded. Common quartz monzonite dikelets. Mostly hard, strong, highly fractured. Fractures variable orientation, slightly open, weak clay and calcite coating
		0	>10	80					
		13	6	100	678.0'				
680.0' depth at 11:30 p.m. on 04/25/92.		0	>10	100			680		
		0	5	60	BOX 71				
		0	—	10					
690.0' depth at 6:30 a.m. on 04/26/92.		40	1	67			690		
		0	>5	100	692.0'				
		13	4	100	BOX 72				
700.0' depth at 12:01 p.m. on 04/25/92.		28	4	100	700.5'		700		
		25	>5	100	BOX 73				
710.0' depth at 3:15 p.m. on 4/25/92		24	>2	95					
		13	5	100	710.0'		710		

DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/9
DRAWN	K HOCHSTATTER
CHK'D	R HARRIS
APP'D	D AFFELDT

The PRA Group, Inc
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BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL RIVERSIDE COUNTY CALIFORNIA
MINE RECLAMATION CORPORATION

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REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures / foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
710.0' depth at 3:15 p.m. on 04/25/92.	HQ 2.56" Hole 1.775" Core	13	5	100	BOX		710		667.0' - 843.2' QUARTZITE: Medium to dark gray, fine to medium grained, weakly bedded. Common quartz monzonite dikelets. Mostly hard, strong, highly fractured. Fractures variable orientation, slightly open, weak clay and calcite coating
		0	>10	100					
		57		>3					
720.0' depth at 5:05 p.m. on 04/25/92.		0	1	85	74		720		718.0' - 719.0' fault gouge, light gray clay with fragments of quartzite.
		13	>10	65	726.0'				
		0	>10	50	BOX 75				
730.0' depth at 10:30 p.m. on 04/25/92.		17	>5	100	735.5'		730		
		0	5	80	BOX 76				
740.0' depth at 1:05 a.m. on 04/27/92.		28	5	84			740		
		27	5	92	745.5'				
		0	6	66	BOX 77				
750.0' depth at 3:00 a.m. on 04/27/92.		13	6	80	756.0'		750		
		23	5	94	BOX 78				
760.0' depth at 5:40 a.m. on 04/27/92.		8	5	90	765.0'		760		766.0' - 772.0' quartz monzonite sill
		33	3	100	BOX 79				
770.0' depth at 7:30 a.m. on 04/27/92.		15	4	90	774.5'		770		
		0	>10	100	BOX 80				
780.0' depth at 12:05 p.m. on 04/27/92.		0	>10	100	783.5'		780		
		0	>10	30	BOX 81				
790.0' depth at 04/27/92		0	>10	95	790.0'		790		

DATE	07/92
JOB NO.	G125-19
DWG NO.	EM19005/10
DRAWN	K HOCHSTATTER
CHK'D	R HARRIS
APP'D	D AFFELDT

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BOREHOLE LOG
CH-5A
EAGLE MOUNTAIN LANDFILL RIVERSIDE COUNTY CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

10 of 12

Project Site / Drill Site: CENTRAL PIT	Spud Date: 02/13/92	Borehole Dia: 3.85 INCHES	Ground Elevation: 2307.76 FEET	Borehole No: CH-10	
Coordinates / Stationing	Completion Date: 02/25/92	Logged By: R. HARRIS, R. USREY, J. SUTHARD, D. VOLTURNO	Bottom of Borehole (bgs): 1388 feet		
Drill Rig Make and Model: BOYLES 56-6	Drilling Method: CORE	Drilling Fluid: MUD	Top of Bedrock (bgs): SURFACE	First Encountered Water (bgs): 1309 feet	
Drilling Contractor: TONTO DRILLING SERVICES, INC.	Surf Csg OD/ID/Depth: 6" / 5.5" / 17'	Total Core Recovery %: >95%	Total Number of Core Boxes: 161	Static Water Level (bgs):	

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
FOREMAN: WAYNE BEAUPRE DRILL CREW A: (7am-7pm) Driller: Shawn Ivanal Helpers: Eric Owens, John Cross DRILL CREW B: (7pm-7am) Driller: Jeff Riley Helpers: Bill Kerton, Brent Williams Geologist: D. Volturno Casing set at 7.0 feet. Began coring at 4:30 pm on 02/13/92 Geologist: R Harris Stopped drilling at 17' - problems retrieving core. Replaced casing to 17' 23.5' depth at 11:40 pm, 2/13/92 Driller noted that hole made minor amount of water	5.25" TRI CONE	\	\	\					0.0 - 7.0' SET CASING No sample taken
	HQ 3.850" HOLE	\	>10	43	BOX 1		10		7.0' - 15.4' QUARTZITE Light gray, fine-grained, barely weathered
	2.406" CORE	\	>10	90	15.0'				15.4' - 59.0' IRON ORE Dark brown, highly fractured very hard. Minor mica.
		\	\	\	BOX 2		20		23.5' Ore with irregular inclusions of light colored mineral (not calcite)
		90	\	98	27.5'				
		90	\	100	BOX 3		30		
		47	\	74	34.0' BOX 4		40		
		82	>10	80	44.5'				
		39	4	65	BOX 5		50		
		0	5	80					
		0	>10	\					
		19	>10	65	56.0'				
		16	>10	75	BOX 6		60		59.0' - 66.3' IRON ORE BRECCIA Light rust colored fragments (30%) in ore matrix (70%). Fragments up to 2" Fractures dipping 30-60 degrees
		13	4	84	65.0'				66.3' - 67.8' DIORITE DIKE Medium green, medium coarse-grained, with orthoclase phenocrysts. Fractures with slickensides Contact highly altered to chlorite
		46	3	86	BOX 7				
		43	3	96	74.0'		70		

REGISTERED GEOLOGIST IRVING DEAN AFFELDT No 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

DATE	3/92
JOB NO.	G125-19
DWG NO.	EM 19006-1
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

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BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

REMARKS: Water Data, Drilling Data, Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.850" HOLE	40	3	86	BOX 7		70		69.5' - 79.5' ORE BRECCIA Light rust colored fragments in ore, with weathered chunks of limonite-stained diorite 76.0' to 76.5' highly fractured, with clay gouge
	2.406" CORE	47	2	84	74.0' BOX 8				79.5' - 92.5' DIORITE Gray, fine-grained matrix. Hard, strong, healed fractures
Geologist: D. Volturno		85	<1	100	83.0'		80		
		82	2	100	BOX 9				fetsic zone with healed fractures
		17	3	100	92.5'		90		92.5' - 119.5' PORPHYRY DIKE Green, aphanitic. Fine-grained plagioclase phenocrysts. 2 - 5%, altering to chlorite. Limonite stain in fractures. Hard. Most fractures dipping 30 - 50 degrees.
		50	4	100	BOX 10				
		0	>10	100	102.0'		100		
		25	5	100	BOX 11				
		50	3	100	110.5'		110		highly altered zone - dark green epidote and chlorite
		47	4	100	BOX 12				brecciated, traces of calcite in veins
		13	6	100	120.5'		120		119.5' - 129.2' ORE BRECCIA Tan to light green angular fragments. 40-50% fragments 1-6mm in black ore matrix Fractures dip 20-60 degrees. Very hard, very strong. Apertures tight, some limonite staining
125' depth at 4:55 pm, 2/14/92		46	3	100	BOX 13				
		69	3	100	129.2'				
130' depth at 5:55 pm, 2/14/92		54	4	100	BOX 14		130		129.2' - 133.0' SKARN ZONE Increasing green alteration. Fractures with soft to medium hard fill.
		25	4	100	137.8'				133.0' - 138.5' DIORITE PORPHYRY DIKE Gray, with feldspar phenocryst (60%). Fractures dip steeply. Healed fractures with ore filling
140' depth at 6:43 pm, 2/14/92		37	5	100	BOX 15		140		138.5' - 140.2' SKARN ZONE Green alteration, soft to medium hard 140.2' - 155.0' ORE BRECCIA Tan to light grey angular fragments 40-50% fragments 1-6mm in black ore matrix Magnetite/ hematite matrix, with swirled green alteration bands. Fractures tight, dipping 20-60 degrees Slightly hard, moderately strong
		48	3	95	145.8' BOX 16		150		

REGISTERED GEOLOGIST IRVING DEAN AFFELDT No 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

DATE	3/92
JOB NO.	G125-19
DWG NO.	EM 19006-2
DRAWN	R HARRIS
CHK'D	D MERIT
APP'D	D AFFELDT

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BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ	32	5	100	BOX 16 154.2'		150		140.2' - 155.0' IRON ORE BRECCIA: Tan to light green, angular fragments. 40-50 % fragments 1- 6 cm in black ore matrix. Fragments dip 20 -60 degrees. Slightly hard, mod strong.
155' depth at 10:00 pm, 2/14/92	3.850" HOLE								
	2.406" CORE	16	8	100	BOX 17 167.7'				155.0' - 157.0' IRON ORE: Rust black. Highly fractured, nearly vertical clay limonite stained SZ, not well-healed.
		42	6	100			160		157.0' - 164.5' QUARTZITE Light green, very fine-grained. Steeply dipping banding. Highly fractured.
		12	≤6	100	BOX 18 171.0'				164.5' - 173.0' SCHISTOSE META-ARKOSE Light green with bands of black, pink, green. Bands dip 60 degrees. Fractures mostly parallel bands. Moderately hard, moderately strong
Geologist: J. Suhard 170' depth at 11:30 pm, 2/14/92		83	1	90	BOX 19 180.0'		170		173.0' - 176.0' IRON ORE Rusty black, highly fractured. Magnetite rich
		77	2	100					176.0' - 178.0' ORE BRECCIA: Fragments of meta-arkose in magnetite ore
180' depth at 1:00 am, 2/15/92		85	2	100	BOX 20 189.2'		180		178.0' - 185.5' IRON ORE Magnetite-rich. Light to dark green alteration zones, steeply dipping veins of calcite, abundant calcite.
		63	2	100					185.5' - 187.0' QUARTZITE Greenish white, very fine-grained Very hard, very strong.
190' depth at 2:07 am, 2/15/92		96	<1	100	BOX 21 197.5'		190		187.0' - 229.8' IRON ORE: Magnetite-rich, mussy with white calc-silicates or quartzite to 190.8'.
		65	1	100					
200' depth at 4:16 am, 2/15/92		82	1	100	BOX 22 208.0'		200		190.8' - 214.5' ore with veins of white calc-silicate, 20-30 degrees from vertical. Magnetite with pyrite, serpentine, minor chlorite. Moderately hard, moderately strong. Very fractured, brecciated, numerous healed fractures.
		66	1	100					
210' depth at 5:18 am, 2/15/92		58	3	100	BOX 23 214.5'		210		
		71	1	100	BOX 24 222.8'				
220' depth at 6:27 am, 2/15/92		83	<1	100			220		
		37	5	100	BOX 25		230		229.8' - 237.0' QUARTZITE:

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
№ 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	3/92
JOB NO.	G125-19
DWG NO.	EM 19006-3
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

The PRA Group, Inc
CONSULTING ENGINEERS

BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.
3 of 12

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
Geologist: D. Vahrmo 230' depth at 8:00 am, 2/15/92. Problems with mud cake. Geologist: R. Harris.	HQ	0	6	100	25 237.0'		230		229' - 237.0' QUARTZITE Light gray, fine-grained. Very hard, very strong, fresh. Highly fractured, fractures dipping 30 - 90 degrees, light, with hematite-limonite stain.
	3.850" HOLE								
	2.406" CORE	16	2	100	BOX 26				237.0' - 245.5' QUARTZ MONZONITE DIKE Light pink-brown, fine-grained. Moderately hard moderately strong
		0	8	100					
247' depth at 8:00 pm 2/15/92		0	8	100	241.3'		240		
		0	>10	56	BOX 27 250.0'				245.5' - 275.6' IRON ORE Magnetite rich, rusty black, slightly vuggy Moderately hard, slightly weathered. Scattered zones and veins of skarn minerals
250' depth at 8:00 pm, 2/15/92		28	1	80			250		
		14	2	92	BOX 28 259.0'				247.2' - 247.5' Green alteration zone (skarn, calc-silicate minerals)
		65	1	88					258.0 - 275.6 Skarn: dark green to yellow -green, some steeply dipping banding
260' depth at 9:30 pm, 2/15/92		28	3	100	BOX 29 267.0'		260		nearly vertical veins of calcite
Geologist: J. Suhard		22	3	92	BOX 30 275.6'				266.0' - 267.0' magnetite vein, slightly vuggy
		32	2	58			270		
		24	3	58	BOX 31 283.3'				275.6' - 294.0' QUARTZ MONZONITE DIKE Fine-grained, pink-brown. Highly fractured fractures slightly open, with limonite-hematite stain. Very hard, very strong, fresh
		0	5	81			280		282.0' increasing alteration, veins of ore
		33	2	82	BOX 32 293.5'				
		42	2	100					291.0' - 294.0' Gouge light to dark green crumbly
		46	2	98	BOX 33 303.2'		290		294.0' - 319.7' IRON ORE Black, fresh, hard, very strong. Abundant fresh pyrite. Minor fractures. Hard veins to 1/2" of tremolite and calcite.
300' depth at 5:47 am, 2/16/92 Deviation survey = 0.75 degrees Geologist: D. Vahrmo		100	<1	100			300		
		92	<1	100	BOX 34 312.8'				
		100	<1	100			310		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
№ 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	3/92
JOB NO.	G125-19
DWG NO.	EM 19006-4
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

The PRA Group, Inc
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BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

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REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.85" HOLE 2.406" CORE	100	<1	100	BOX 35		310		294.0' - 319.7' IRON ORE Black, fresh, hard, very strong. Abundant pyrite Minor fracturing, hard veins of calcite and hematite to > 1/2".
		93	<1	100	318.7'				
		33	4	100	BOX 36		320		319.7' - 341.0' QUARTZ MONZONITE Pink-brown, fine grained, highly fractured. Fractures variable dip, mostly steep, minor limonite stain. Veins and fractures chloritized. Very hard, very strong
		0	1	100	326.0'				
		0	6	100	BOX 37				
Geologist R. Harris		0	7	100	324.1'		330		
		67	3	100	BOX 38				
		33	2	100	343.5'				
		0	6	100	BOX 39				
		23	3	100	351.4'				341.0' - 389.5' SCHISTOSE META-ARKOSE Banded pink-brown, dark green, light green, yellow-green Moderately fractured, veins healed; fractures tend to follow bedding. Slightly weathered, decreasing with depth.
		44	2	100	BOX 40		340		
		0	4	100	360.5'				
		33	5	100	BOX 41		350		
		50	3	100	367.5'				
		33	8	100	BOX 42		360		
		25	10	100	375.0'				365.5' Increasing chlorite-epidote alteration, increasing fracture density, fractures open, 30-40 degrees to axis
Geologist J. Suhard Electrical generator failure, 9:03 pm, 2/16/92. Resumed drilling 11:40 pm, 2/16/92		\	\	\	BOX 43		370		
		18	4	100	382.2'				
		8	5	100	BOX 44		380		382' - 385' highly fractured, highly altered, limonite stain in fractures
Geologist D. Yokumo		11	4	100	389.5'				
		0	8	100	BOX 45				
397' depth at 4:12 p.m. on 2/16/92		0	9	100			390		389.5' - 395.0' QUARTZITE

DATE	3/92
JOB NO.	G125-19
DWG NO.	EM 19006-5
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

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BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE 4
5 of 15

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.85" HOLE 2.406" CORE	49	5	100	390.4' BOX 45		390		389' - 395.0' QUARTZITE Rust yellow to red hematite stain, moderately weathered moderately hard, moderately fractured, fractures variable orientation. Zones of pyroxene-chlorite-epidote alteration
		47	4	100	400.0'				395.0' - 402.5' SKARN: Fine grained, mottled with K-feldspar-epidote-biotite- quartz-pyroxene. Hard, strong
400' depth at 1:00 pm on 2/17/92 Deviation survey = 0.75 degrees		53	1	100	BOX 46		400		402.5' - 428.0' IRON ORE: Abundant fresh pyrite zones up to 2" Moderately fractured; fractures tight, dipping up to 60 degrees. Hard, strong, slightly weathered limonite stained.
		60	1	100	414.5'				
410' depth at 1:00 pm on 2/17/92		80	1	100	BOX 47		410		412.5' - 415.7' moderately weathered zone, abundant limonite stain. Vugs of remnant pyrite filled with quartz.
		93	<1	100	417.5'				
420' depth at 1:48 pm on 2/17/92		80	<1	100	BOX 48		420		423.7' - 425.0' slightly fractured with limonite-hematite stain. Slightly weathered
		87	<1	100	425.5'				
430' depth at 2:41 pm on 2/17/92		47	1	100	BOX 49		430		428.0' - 436.2' QUARTZ MONZONITE Pink-brown, coarse-grained. Abundant K-feldspar alteration and pyrite in healed fractures. Fractures, minor limonite stain, shallow dip.
		63	3	100	434.7'				
		58	2	100	BOX 50		440		436.2' - 452.0' IRON ORE Abundant pyrite. Very hard, very strong, fresh. Numerous vertical fractures with pyrite filling
440' depth at 3:55 pm on 2/17/92 Geologist R. Harris		43	4	100	443.2' BOX 51				
		60	4	100	452.0' BOX 52		450		452.0' - 457.6' ANDESITE DIKE: Greenish gray, fine-grained. Moderately altered, hard strong to 456.4, becoming brecciated softer more altered.
450' depth at 5:00 pm on 2/17/92		38	4	100	460.5'				457.6' - 610.0' QUARTZITE Light gray, fine-grained. Very hard, very strong Many re-healed fractures with limonite up to 5 mm dipping 0 - 10 degrees. Fractures tight, with pyrite, dipping 30 - 45 degrees. Irregular veins to 10 mm
460' depth at 5:55 pm on 2/17/92		32	4	100	BOX 53		460		
		100	0	100	466.5'				
470' depth at 7:30 a.m. on 2/18/92		63	1	100	BOX 54		470		

DATE	3/92
JOB NO.	G125-19
DWG NO.	EM 19006-6
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

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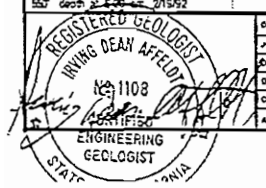
BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

5 of 15

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

REMARKS Water Data - Drilling Data - Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.850" HOLE 2.406" CORE	63	1	100	BOX 53		470		457.6' - 610.0' QUARTZITE Light gray, fine-grained. Very hard, very strong. Many re-healed fractures, with limonite, up to 5 mm, dipping 0 - 10 degrees. Fractures with pyrite, tight, dip 20 -45 degrees. Irregular quartz veins to 10 mm.
		13	4	80	54				
					477.0'				
480' depth at 4:13 am, 2/18/92		75	2	100	BOX 55		480		
		44	3	100					
		13	4	100	484.5'				483.0' - 484.5' gray sericized, with green epidote or diopside, and pyrite. Limonite-filled fractures.
RQD and fractures per foot averaged for box 56 (7 core runs).		(60)	(1)	100	BOX 56				
490' depth at 9:10 am, 2/18/92					497.5'		490		
RQD and fractures per foot averaged for box 57 (6 core runs).		(69)	(1)	100	BOX 57				
500' depth at 1:42 pm, 2/18/92					508.0'				
Deviation survey = 1.5 degrees		83	<1	100	BOX 58		500		500.0' - 547.0' light green, with zones of banding dipping about 60 degrees. Fractures nearly vertical. Slightly less hard and strong.
		100	<1	100					banding steepens with depth
		100	0	100	508.5'				
510' depth at 4:40 pm, 2/18/92		100	0	100	BOX 59		510		
		100	0	100					
		81	1	100					
		42	4	100	517.8'				
520' depth at 7:35 pm, 2/18/92		37	4	100	BOX 60		520		
		60	3	100					
		42	1	100	527.0'				
530' depth at 12:00 am, 2/19/92		94	1	100	BOX 61		530		
		70	0	100	536.0'				
		88	<1	100	BOX 62				
540' depth at 2:36 am, 2/19/92		83	1	100	545.0'		540		
		100	<1	100	BOX 63				547.0' - 550.0' Gray, banding nearly absent. Very hard, very strong. Dark green alteration zones.
557' depth at 6:06 am, 2/19/92		88	<1	100			550		



DATE	3/92
JOB NO.	G125-19
DWG NO.	EM 19006-7
DRAWN	R. HARRIS
CHK'D	D. MERT
APP'D	D AFFELDT

The PRA Group, Inc
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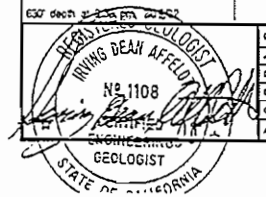
BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO.

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
Geologist D. Yokumo	HQ 3.850" HOLE 2.406" CORE	69	1	100	BOX 63		550		457.6' - 610.0' QUARTZITE Light gray, fine-grained. Very hard, very strong. Many re-healed fractures with limonite stain, up to 5 mm, dipping 0 - 10 degrees. Tight fractures with pyrite, dip 20 - 45 degrees. Irregular quartz veins to 10 mm.
		67	1	100	564.0'				
		58	2	100	BOX 64				
560' depth at 9:30 am, 2/19/92					572.0'		560		
		53	2	100	BOX 65				
570' depth at 10:55 am, 2/19/92					571.8'		570		
		58	2	100	BOX 66				575.0' - 578.5' abundant tight healed fractures with calcite. Orientation varies
		40	3	100					578.7' ore vein, one inch, 90 degrees to core axis.
580' depth at 2:15 pm, 2/19/92		40	4	100	BOX 67		580		
		80	<1	100	589.0'				
590' depth at 3:25 pm, 2/19/92		49	3	98	BOX 68		590		589.6' - 610.0' sericized quartz monzonite dikes, 2- 8 inches, 30 -45 degrees to axis. Green alteration in quartzite
Geologist J. Suhard		52	3	100	597.7'				
598' depth at 4:00 pm, 2/19/92 Deviation survey = 0.75 degrees		63	2	100	BOX 69		600		
		52	2	100	606.5'				
610' depth at 6:10 pm, 2/19/92		67	3	100	BOX 70		610		610.0' - 666.0' ANDESITE DIKE Dark gray with sericite-chlorite-pyroxene-pyrite alteration. Aphanitic groundmass with feldspar phenocrysts to 1/4". Moderately fractured, hard, strong, slightly weathered. Fractures tight, with quartz, epidote, minor calcite, serpentine, limonite
		37	1	100	615.0'				
620' depth at 6:06 pm, 2/19/92		38	1	100	BOX 71		620		
					624.0'				
630' depth at 2:34 pm, 2/20/92		56	2	100	BOX 72		630		



DATE	4/92
JOB NO.	G125-19
DWG NO.	EM 19006-8
DRAWN	R HARRIS
CHK'D	D. MERT
APP'D	D AFFELDT

The PRA Group, Inc
CONSULTING ENGINEERS

BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.650" HOLE 2.405" CORE	50	1	100	BOX 72 (453.0')		630		510.0' - 656.0' ANDESITE DIKE Light gray, fine-grained. Very hard, very strong. Many re-healed fractures with limonite stain, up to 5 mm, dipping 0 - 10 degrees. Tight fractures with pyrite, dipping 20 - 45 degrees. Irregular quartz veins to 10 cm.
		50	2	100	BOX				
640' depth at 10:45 pm, 2/19/92		67	2	100	73 (641.5')		640		634.0' - 645.0' minor limonite stain, calcite in veins. Slightly weathered.
Geologist: R. Usrey		33	2	100	BOX				
		52	2	100					
		67	2	100					
		55	2	100	74 (645.5')				
650' depth at 2:09 am, 2/20/92		74	1	100	BOX		650		
		0	3	100	75 (658.0')				655.0' - 662.8' highly fractured. Apertures slightly open, limonite stain, calcite, dipping 0 - 35 degrees
		0	5	100					
660' depth at 4:55 am, 2/20/92		15	3	100	BOX		660		662.8' - 666.0' shear zone with rocks, serpentine, talc fill in fractures.
		22	4	100	76 (667.0')				666.0' - 691.4' SKARN Dark green alteration in andesite (?), with iron ore and calcite veins. Moderately hard, moderately strong, moderately weathered
670' depth at 5:40 am, 2/20/92		18	2	100	BOX		670		
		30	2	100	77 (674.0') BOX				
680' depth at 7:15 am, 2/20/92		8	4	100	78 (683.5')		680		
		13	3	100	BOX				
Geologist: D. Yokuma									
690' depth at 9:00 am, 2/20/92		33	5	100	79 (691.5')		690		691.4' - 805.0' QUARTZITE Dark gray, very fine-grained. Hard, strong, fresh to slightly weathered. Moderately fractured, apertures slightly open, dipping mostly 0 - 30 degrees, minor limonite stain, minor calcite.
		27	2	100	BOX				
		0	>10	20					
700' depth at 9:20 am, 2/20/92 Deviation survey = 1 degree		0	4	100	80 (703.5')		700		
		17	6	100	BOX				
		67	1	100					
710' depth at 2:10 am, 2/20/92		22	4	100	81		710		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	4/92
JOB NO.	G125-18
DWG NO.	EM 19006-9
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

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BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO. 9 of 18

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
710' depth at 2:10 am, 2/20/92	HQ 3.650" HOLE 2.405" CORE	25	4	100	81 (712.0')		710		691.4' - 805.0' QUARTZITE Dark gray, very fine grained. Hard, strong, fresh to slightly weathered. Moderately fractured, apertures slightly open dipping mostly 0 - 30 degrees, minor limonite stain, minor calcite.
		20	4	100	BOX				
720' depth at 3:45 pm, 2/20/92		67	2	100	82 (720.2')		720		
Geologist: J. Suthard					BOX				
		75	2	100	83 (729.0')				
730' depth at 4:45 pm, 2/20/92		69	2	100	BOX		730		
		73	1	100	84 (738.0')				
740' depth at 5:47 pm, 2/20/92		32	2	100	BOX		740		
		52	1	100	85 (746.5')				
750' depth at 6:50 pm, 2/20/92		60	2	100	BOX		750		
		58	2	100	86 (754.5') BOX				
760' depth at 8:25 pm, 2/20/92		31	1	100	87 (762.5')		760		759.0' - 779.0' fault zone: brecciated, minor bleaching, minor gouge, moderately altered
		0	>10	100	BOX				
		0	>10	100					
770' depth at 9:45 pm, 2/20/92		0	>10	100	88 (772.5')		770		
Geologist: R. Usrey		25	>10	100	BOX				
780' depth at 11:25 pm, 2/20/92		23	4	100	89 (781.5')		780		
		17	3	100	BOX				
790' depth at 12:15 am, 2/21/92		28	2	100	90 (790.5')		790		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

DATE	4/92
JOB NO.	G125-18
DWG NO.	EM 19006-10
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

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BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

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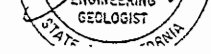
REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ	28	2	100	BOX		790		821.4' - 826.0' QUARTZITE Dark gray, very fine-grained. Hard, strong, fresh to slightly weathered. Moderately fractured, apertures slightly open, dipping mostly 0 - 30 degrees, minor limonite stain, minor calcite.
	3.850" HOLE	89	<1	100	91				
	2.406" CORE	60	1	100	726.0'				
800' depth at 4:01 am, 2/21/92 Deviation survey = 1 degree		47	1	100	BOX		800		
					92				
		43	2	100	807.0'				806.0' - 892.0' META-ARKOSE Light gray, generally quartz-rich, minor dolomitic zones. Moderately hard to hard, moderately strong to strong, moderately weathered. Moderately fractured with dark green alteration along fractures. Apertures tight, veins 20 - 30 degrees.
810' depth at 5:14 am, 2/21/92					BOX				
		48	1	100	93		810		
					815.0'				
		60	1	100	BOX				
820' depth at 6:28 am, 2/21/92					94		820		
		18	2	100	824.0'				
		33	2	100	BOX				
830' depth at 7:38 am, 2/21/92					95		830		
		50	2	100	832.0'				
Geologist D. Voturno					BOX				
		50	2	100	96				839.0' - 846.5' brecciated zones, highly altered. Healed fractures with massive pink-brown quartz veins, minor calcite veins.
840' depth at 8:28 am, 2/21/92					842.0'		840		
		60	1	100	BOX				
					97				
850' depth at 9:45 am, 2/21/92					850.0'		850		
		27	3	100	BOX				
		40	2	100	98				
					858.7'				
860' depth at 10:58 am, 2/21/92		40	2	100	BOX		860		
					99				863.6' - 869.0' brecciated zone with gouge slickensides, hematite stain
		27	>10	100	868.0' BOX				
870' depth at 11:40 am, 2/21/92							870		



DATE	4/92
JOB NO.	G125-19
DWG NO.	EM 19006-11
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

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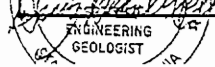
BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO. 11 of 18

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
870' depth at 11:40 am, 2/21/92	HQ	53	<1	100	BOX		870		806.0' - 892.0' META-ARKOSE Light gray, generally quartz-rich, minor dolomitic zones. Hard, strong, moderately weathered. Moderately fractured, with dark green alteration along fractures. Apertures tight, veins 20-30 degrees.
	3.85" HOLE			100	100				
	2.406" CORE	57	2	100	876.5'				
		11	3	100	BOX				
880' depth at 1:48 pm, 2/21/92 Geologist J. Schard		72	1	100	101		880		
					885.0'				
		35	1	100	BOX				
890' depth at 6:27 pm, 2/21/92		27	3	100	102		890		892.0' - 904.5' QUARTZ MONZONITE Light gray, coarse grained, K-feldspar phenocrysts. Epidote in fractures, chalcocite epidote 1-2 %
					893.0'				
		68	1	100	BOX				892' - 897' green andesite dike
					103				
900' depth at 10:00 pm, 2/21/92 Deviation survey = 1.0 degree		19	2	100	902.5'		900		
Geologist R. Usrey		100	<1	100	BOX				904.4' - 921.0' SKARN Dark green, fine grained, vertical flow texture. Pyroxene-rich, with epidote in veins. Hard, strong, slightly weathered. Moderately fractured with limonite, hematite stain, fractures dip 0-45 degrees.
		23	2	100	104				
910' depth at 3:10 am, 2/22/92					910.0'		910		
		70	1	100	BOX				
					105				
		57	2	100	918.7'				
920' depth at 4:15 am, 2/22/92					BOX		920		921.0' - 924.0' QUARTZ MONZONITE Green-gray, medium grained. Epidote-filled veins 1-3 mm, pyroxene-rich zones. Hard, strong, slightly fractured.
		42	1	100	106				
					927.0'				924.0' - 950.0' QUARTZITE Light gray, fine grained, shattered appearance, with dark green alteration along shatter lines. Veins of pink-brown massive quartz to 1 cm. Very hard, very strong, unweathered, slightly fractured, with minor calcite fill.
930' depth at 5:40 am, 2/22/92		85	1	100	BOX		930		
					107				
		83	1	100	935.5'				
		100	<1	100	BOX				937 - 946' scattered ore veins to 2 cm.
940' depth at 7:50 am, 2/22/92 Geologist D. Voturno		60	1	100	108		940		
					944.0'				
		27	3	100	BOX				
950' depth at 9:22 am, 2/22/92					109		950		



DATE	4/92
JOB NO.	G125-19
DWG NO.	EM 19006-12
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

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BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

12 of 1

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.65" HOLE 2.405" CORE	33	3	100	109 953.0'		950		951.0' - 952.8' IRON ORE Black, magnetite-rich, abundant massive pyrite-tremolite-sericite, minor limonite stain. Calcite abundant in fractures to 1 mm.
		60	1	100	BOX 110				952.8' - 955.0' QUARTZ MONZONITE Greenish, highly altered. Calcite abundant in horizontal fractures. Moderately to very fractured, hard, strong, slightly weathered.
960' depth at 10:25 am, 2/22/92		56	2	100	961.0'		960		
		87	<1	100	BOX 111				955.0' - 970.5' IRON ORE / SKARN Dark green to black, highly altered. Abundant magnetite, pyrite, pink massive quartz zones. Slightly fractured with calcite veins to 1 mm. Mostly hard to very hard, strong to very strong unweathered.
970' depth at 11:45 am, 2/22/92		47	1	100	970.0'		970		
		67	<1	100	BOX 112				970.5' - 977.1' ANDESITE DIKE Dark gray, slightly porphyritic, aphanitic groundmass. Slightly to moderately fractured, epidote and calcite lining. Apertures slightly open, minor limonite stain. Hard, strong, unweathered.
		17	2	100	978.2'				
980' depth at 1:55 pm, 2/22/92 Geologist: J. Suhard		0	>10	100	BOX 113		980		977.1' - 981.1' IRON ORE Red, brown, black; hematite, minor magnetite. Highly weathered, soft, crumbly, vuggy.
		5	5	100					
		67	1	100					
		0	3	85	987.0'				981.1' - 1027.5' SKARN Green chlorite, epidote, tremolite, with ore veins (magnetite + pyrite) to 2 inches. Scattered quartzite zones. Moderately fractured, with calcite fill, limonite stain. Hard, strong, slightly weathered.
990' depth at 4:00 pm, 2/22/92		52	2	100	BOX 114		990		
		22	4	100	995.5'				
		50	3	100	BOX 115				
1000' depth at 5:32 pm, 2/22/92 Deviation survey = 1 degree		75	3	100	1003.0'		1000		
		42	2	100	BOX 116				
1010' depth at 9:35 pm, 2/22/92		73	1	100	1011.0'		1010		
		40	2	100	BOX 117				
1020' depth at 10:35 pm, 2/22/92 Geologist: R. Laney		85	<1	100	1019.0'		1020		
		87	<1	100	BOX 118				1027.5' - 1054.9' IRON ORE Black, magnetite-rich. Moderately fractured, apertures slightly open, dip steep to vertical, with limonite stain. Hard, strong, very slightly weathered.
1030' depth at 5:00 pm, 2/22/92		62	1	100	1026.5' BOX 119		1030		

DATE	4/92
JOB NO.	G125-19
DWG NO.	EM 19006-13
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

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BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE 4
10 of 1

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.65" HOLE 2.405" CORE	62	1	100	BOX 119		1030		1027.5' - 1054.9' IRON ORE Black, magnetite-rich. Moderately fractured, apertures slightly open, dip steep to vertical, with limonite stain. Hard, strong, very slightly weathered.
		17	2	100	1026.9'				
1040' depth at 1:15 am, 2/23/92		60	2	100	BOX 120		1040		
		57	1	100	1046.0'				
1050' depth at 2:25 am, 2/23/92		25	1	100	BOX 121		1050		
		25	2	100	1054.0'				1045.9' - 1067.4' SKARN Mixed skarn mineralization: iron ore zone. Moderately weathered.
1060' depth at 4:00 am, 2/23/92		27	3	100	BOX 122		1060		
Geologist: D. Yohumo		28	2	100	1063.0'				
		0	>10	100	BOX 123				1067.4' - 1081.3' ANDESITE DIKE Green-gray, highly altered, abundant limonite stain. Mostly highly fractured to shattered. Slightly hard, slightly strong, highly weathered.
1070' depth at 5:50 am, 2/23/92		0	>10	100	1070.0'		1070		
		17	>10	100	BOX 124				
		29	3	100	1076.5'				
1080' depth at 8:47 am, 2/23/92		17	5	100	BOX 125		1080		1081.3' - 1109.0' QUARTZITE Pinkish tan, green, gray. Pervasive chlorite-epidote alteration. Calcite in veins 1-5 mm, minor limonite stain. Hard to very hard, very strong, slightly to moderately fractured, apertures slightly open.
		53	2	100					
		67	1	100	1084.5'				
1090' depth at 2:37 pm, 2/23/92		67	1	100	BOX 126		1090		
		67	1	100	1096.5'				
1100' depth at 3:30 pm, 2/23/92 Geologist: J. Suhard Deviation survey = 1.5 degrees		58	2	100	BOX 127		1100		
		72	2	100	1106.0'				
1110' depth at 4:40 pm, 2/23/92		78	1	100	BOX 128		1110		1109.0' - 1112.0' ANDESITE DIKE

DATE	4/92
JOB NO.	G125-19
DWG NO.	EM 19006-14
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

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BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No. 1108
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	ROD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
	HQ 3.85" HOLE	77	<1	100	BOX 128		1110		1109.9' - 1112.0' ANDESITE DIKE Green, highly altered, highly deformed. Moderately to slightly hard, moderately to slightly strong.
	2.405" CORE	0	5	66	BOX 129				1112.0' - 1116.5' FAULT GOUGE Green to yellow, minor limonite stain; slickensides.
1120' depth at 9:15 pm, 2/23/92		32	3	100	BOX 130		1120		1116.5' - 1164.8' QUARTZITE Green/gray/tan. Slightly weathered, moderately fractured, fractures slightly healed, mostly 5-20 degrees from axis, with calcite fill, limonite stain.
1130' depth at 10:00 pm, 2/23/92		43	3	100	BOX 131		1130		
Geologist: R. Usrey		47	2	100					
1140' depth at 12:25 am, 2/24/92		65	1	100	BOX 132		1140		
		52	3	100					
1150' depth at 2:25 am, 2/24/92		72	2	100	BOX 133		1150		
Geologist: D. Voltumo		57	2	100	BOX 134				
1160' depth at 4:55 am, 2/24/92		62	2	100			1160		
		70	2	100	BOX 135				1164.8' - 1178.9' QUARTZ MONZONITE Gray to pinkish green; inclusions of green altered quartzite. Hard to very hard, strong, slightly weathered. Moderate chlorite-epidote-pyrite alteration. Calcite veins, hairline to 1 cm.
		67	1	100					
1170' depth at 8:01 am, 2/24/92		52	1	100	BOX 136		1170		
		33	2	100					
1180' depth at 9:40 am, 2/24/92		53	2	100	BOX 137		1180		1178.9 - 1195.0' QUARTZITE Medium pink-gray. Highly fractured, healed with dark green chlorite-epidote-pyrite, hairline to 3 cm, 10-30 degrees from axis. Very hard, very strong, slightly weathered.
1190' depth at 11:12 am, 2/24/92		93	<1	100			1190		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No 1108
ENGINEERING GEOLOGIST

DATE	4/92
JOB NO.	G125-19
DWG NO.	EM 19006-15
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

The PRA Group, Inc
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EDITED BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO. 5
15 of 18

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	ROD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
1190' depth at 11:12 am, 2/24/92	HQ 3.85" HOLE	60	1	100	BOX 138		1190		1178.9' - 1195.0' QUARTZITE Medium pink-gray. Highly fractured, mostly healed with dark green chlorite-epidote-pyrite, hairline to 3 cm, 10-30 degrees from axis. Very hard, very strong, slightly weathered.
	2.405" CORE	13	>10	100	1194.5				1195.0' - 1198.5' SKARN: Very dark green to black, highly altered; ore veins with pyrite. Moderately hard, moderately strong, moderately weathered, highly fractured, apertures moderately open.
1200' depth at 12:30 pm, 2/24/92 Deviation survey = <1.5 degrees		28	3	100	BOX 139		1200		1198.5' - 1203.5' ANDESITE: Dark gray, porphyritic. Moderately to highly fractured. Minor epidote-calcite fill.
Geologist: J. Sunard		0	2	100	1206.0				1203.5' - 1223.5' DIORITE Medium gray to green, fine to medium grained. Green alteration (pyroxene-amphibole-feldspar-epidote-pyrite). Moderately fractured, tight to moderately open, veins of epidote-calcite, limonite stain. Hard, strong.
1210' depth at 4:40 pm, 2/24/92		61	1	100	BOX 140		1210		
		52	2	100	1212.7				
		0	3	100	BOX 141				
1220' depth at 6:30 pm, 2/24/92		50	5	100	1222.5		1220		
		16	4	65					
		18	3	68	BOX 142				1220.5' - 1236.0' ANDESITE Dark gray, aphanitic, slightly porphyritic. Moderately to highly fractured, apertures tight to slightly open with epidote-pyrite fill, limonite stain. Hard, strong, slightly weathered.
1230' depth at 9:55 pm, 2/24/92		11	4	92	1231.0		1230		
		52	2	100	BOX 143				1236.0' - 1238.5' QUARTZ MONZONITE Pink to brown, medium grained. Fractures mostly healed hairline to 3 mm, 10-30 degrees from axis, with calcite fill, limonite stain. Very hard, very strong, slightly weathered.
Geologist: R. Usrey		36	2	100	1239.5				
1240' depth at 3:40 am, 2/25/92		42	2	100	BOX 144		1240		1238.5' - 1252.0' QUARTZITE Gray, tan, pink mottled zones. Older fractures healed, with black to green alteration zones. Younger fractures healed, with abundant calcite, apertures slightly to moderately open, mostly near-vertical. Hard, strong.
Geologist: D. Voltumo		0	4	100	1247.0				
		33	3	100					
1250' depth at 9:50 am, 2/25/92		44	2	100	BOX 145		1250		
		14	>10	100	1255.0				
		13	2	100	BOX 146				
1260' depth at 12:05 pm, 2/25/92		53	1	100	1262.5		1260		1252.0' - 1276.5' QUARTZ MONZONITE Gray-brown, coarse-grained. Hard, strong. Moderately fractured, with calcite fill, slightly open. Scattered swirled masses of quartzite.
		47	1	100	BOX 147				
1270' depth at 2:30 pm, 2/25/92		47	2	100			1270		

REGISTERED GEOLOGIST
IRVING DEAN AFFELDT
No 1108
ENGINEERING GEOLOGIST

DATE	3/92
JOB NO.	G125-19
DWG NO.	EM 19006-16
DRAWN	R. HARRIS
CHK'D	C. MERIT
APP'D	D. AFFELDT

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BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

15 of 1

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
1270' depth at 2:00 pm, 2/25/92	HQ 3.55" hole 2.405" core	47	2	100	BOX 147		1270		1262.0' - 1276.5' QUARTZ MONZONITE Gray-brown, coarse-grained. Hard, strong. Moderately fractured, with calcite fill, apertures slightly open. Scattered swirled masses of quartzite
		83	2	100					
		74	1	100	148				1276.5' - 1285.6' LIMESTONE Gray-green, with abundant calcite veins and hairline fractures with black (ore?) fill. Hard, strong, moderately fractured, apertures slightly open. Increasing silicification with depth.
1280' depth at 4:06 pm, 2/25/92 Geologist: J. Suchard		50	3	60	BOX		1280		
		83	<1	100					
		40	2	100					
		50	2	100	149				1285.6' - 1289.0' QUARTZ MONZONITE Brown and gray, mixed with minor green-altered quartzite. Hard, strong, slightly weathered, moderately fractured, with epidote-calcite fill, limonite stain
1290' depth at 11:57 pm, 2/26/92 Geologist: R. Usrey		22	3	100	BOX		1290		
		57	3	100	150				1289.0' - 1296.9' QUARTZITE Dark gray, with 3-5 mm ore veins. Hard, strong. Moderately fractured apertures slightly open, with calcite-chlorite-epidote fill
		57	2	100	BOX				1296.9' - 1330.0' SKARN Gray, black, green, orange, with mixed zones of quartzite and ore. Up to 25% ore, with abundant pyrite. Hard, strong, slightly weathered. Moderately fractured, apertures moderately open, calcite in veins
Geologist: D. Vallumo 1300' depth at 11:52 am, 2/26/92 Deviation survey = 1.5 degrees		58	1	100	151		1300		
		44	2	100	BOX				1298' - 1327' dissolution of calcite veins
		13	3	100	152				
1310' depth at 3:10 pm, 2/26/92 Geologist: J. Suchard		25	3	100	BOX		1310		
1320' depth at 5:15 pm, 2/26/92		63	<1	100	153		1320		
Broken drive chain - rig down until 12:42 am, 2/28/92		100	0	100	BOX				
		56	<1	100					
		100	<1	100	154				
Geologist: R. Usrey 1330' depth at 1:27 am, 2/27/92		100	<1	100			1330		1330' - 1389' QUARTZITE Light green to medium dark gray, fine-grained to vitreous. Very hard, very strong, unweathered. Moderately fractured; fractures healed to slightly open. Calcite-epidote veins, hairline to 5 mm, 0-90 degrees to axis
		35	2	100	BOX				
		0	>10	100	155				
1340' depth at 4:00 am, 2/28/92		0	>10	60	BOX		1340		
		47	5	100	156				
Geologist: D. Vallumo 1350' depth at 11:05 am, 2/28/92		17	5	100			1350		

REGISTERED GEOLOGIST IRVING DEAN AFFELDT No 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

DATE	4/92
JOB NO.	G125-19
DWG NO.	EM 19006-17
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

The PRA Group, Inc
CONSULTING ENGINEERS

BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

FIGURE NO. 17 of 18

REMARKS Water Data Drilling Data Personnel Changes	Tool Size	RQD (%)	Fractures per foot	Percent Core Recovery	Box Number	Elevation (ft)	Depth (ft)	Lithologic Log	Material Classification and Physical Description
1350' depth at 10:05 am, 2/28/92	HQ	11	>10	100	BOX 157		1350		1330.0' - 1389.0' QUARTZITE Light green to medium dark gray, fine-grained to vitreous. Very hard, very strong, unweathered. Moderately fractured; fractures healed to slightly open. Calcite-epidote veins, hairline to 5 mm, 0-90 degrees from axis.
	3.560" HOLE 2.405" CORE	19	5	100		1356.2'			
		29	5	100	BOX				
1360' depth at 12:00 pm, 2/28/92		33	1	100	158	1353.0'	1360		
		13	5	100	BOX				
1370' depth at 2:17 pm, 2/28/92		17	3	100	159	1372.0'	1370		
		79	1	100	BOX				
Geologist: J. Suchard 1380' depth at 5:10 pm, 2/28/92		81	<1	100	160	1380.5'	1380		
		72	<1	100	BOX				
		87	<1	100	161	1389.0'			TOTAL DEPTH 1389 FEET
Total depth 1389' at 7:30 pm, 2/28/92							1390		
							1400		
							1410		
							1420		
							1430		

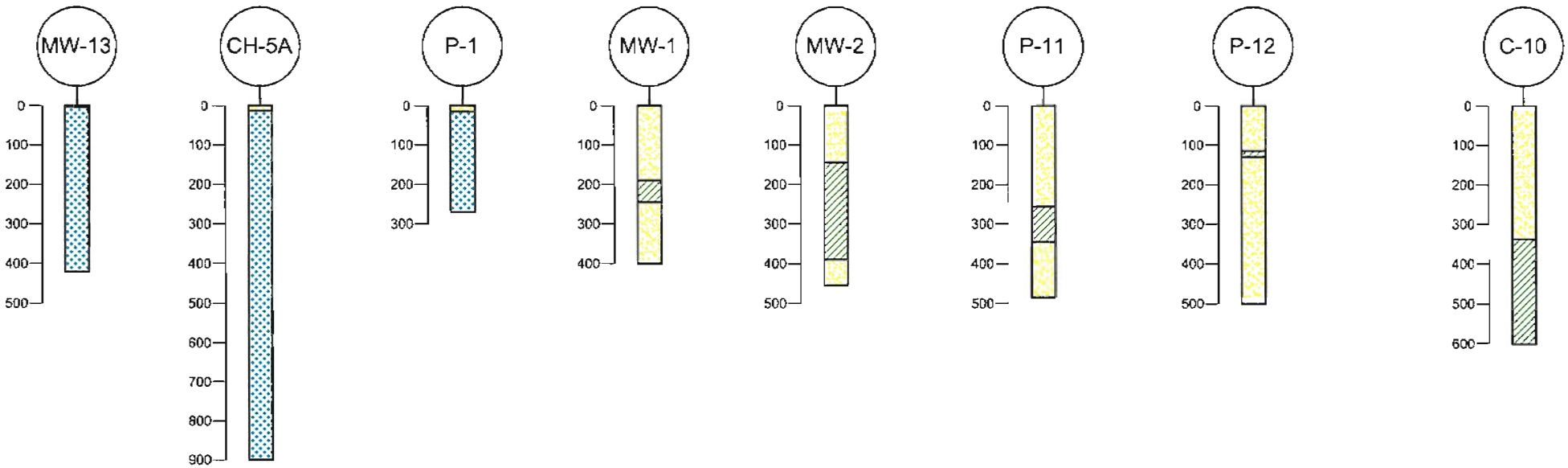
REGISTERED GEOLOGIST IRVING DEAN AFFELDT No 1108 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

DATE	4/92
JOB NO.	G125-19
DWG NO.	EM 19006-18
DRAWN	R. HARRIS
CHK'D	D. MERIT
APP'D	D. AFFELDT

The PRA Group, Inc
CONSULTING ENGINEERS

BOREHOLE LOG
CH-10
EAGLE MOUNTAIN LANDFILL, RIVERSIDE COUNTY, CALIFORNIA
MINE RECLAMATION CORPORATION

18 of


MW-13
0
100
200
300
400
500
CH-5A
0
100
200
300
400
500
600
700
800
900
P-1
0
100
200
300
MW-1
0
100
200
300
400
MW-2
0
100
200
300
400
500
P-11
0
100
200
300
400
500
P-12
0
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500
C-10
0
100
200
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400
500
600

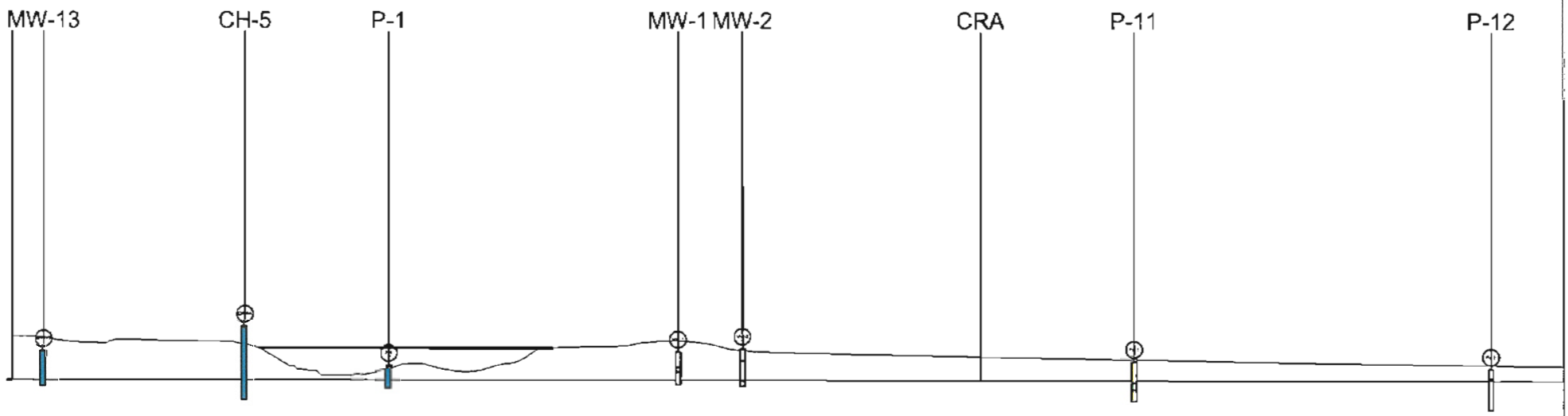

MW-13
CH-5
P-1
MW-1
MW-2
CRA
P-11
P-12

Table E.1 Summary of Soil Laboratory Testing

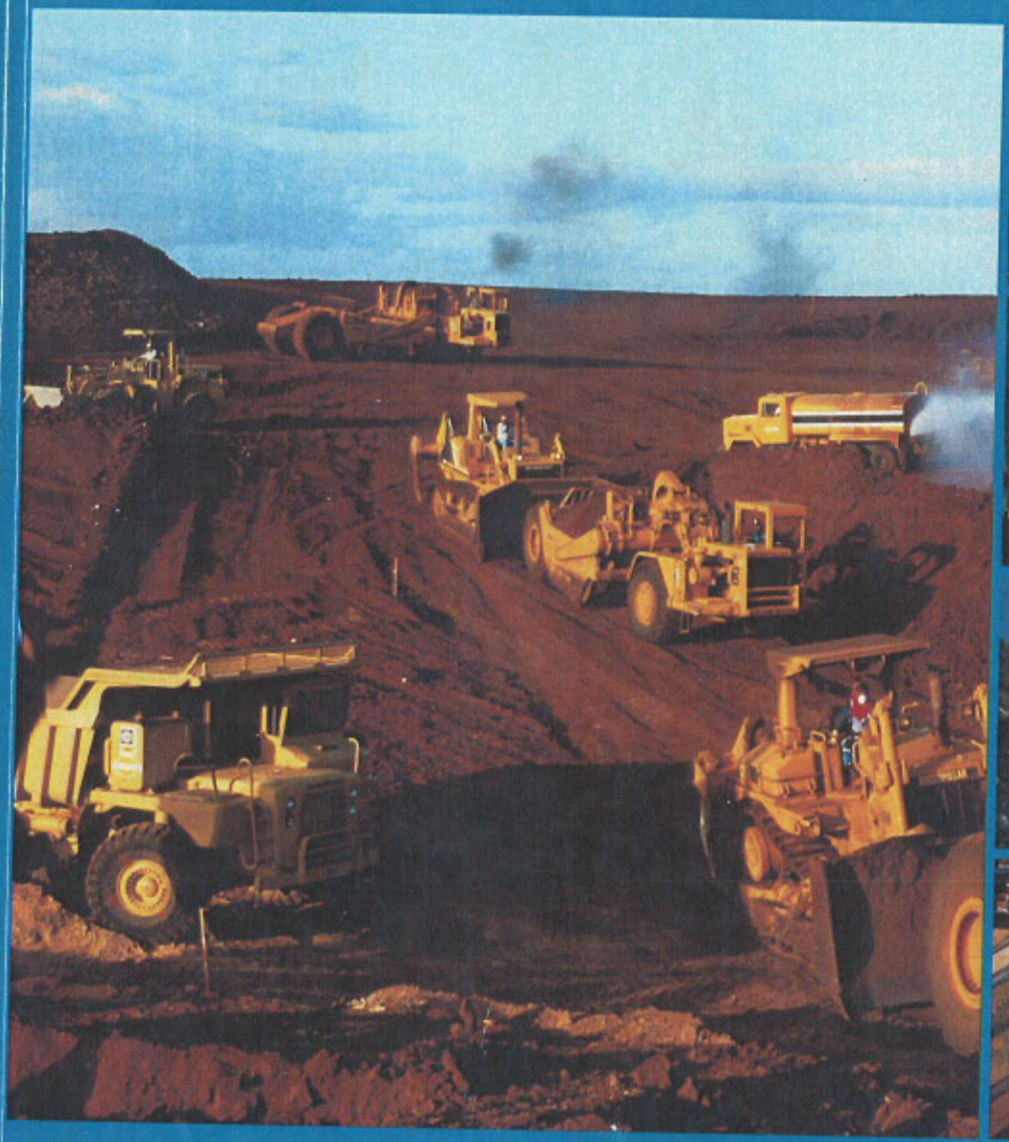
Sample Information			In-situ Water Content, %	In-situ Dry Unit Weight, pcf	Atterberg Limits		Sieve/Hydrometer			USCS Group Symbol	Hydraulic Conductivity
Boring	Sample No	Depth (ft)			LL	PI	#4 (%)	#200 (%)	(< 5μm) (%)		(cm/s)
C-1	3	17	1.7	112.4		-	91	8.3	-	SP-SM	
	7	58	1.1	111.5		-	97.3	9.3	-	SP-SM	
	12	101	2.8	111.6	NP	NP	98.3	14.6	8	SM	
	13	110	-	-	-	-	99.8	11.7	6	SP-SM	
	14	120-125*	-	-	-	-	83.6	8.7	3	(SP-SM)g	
	15	141	-	-	-	-	99.4	25.4	19	SM-SC	
	16	160	-	-	-	-	92.5	16.5	10	SM-SC	
	17	177	-	-	-	-	65.4	13.1	-	(SM)g	
	18	199	-	-	-	-	99.7	27.9	16	SC	
	19	201	5.3	109.9	31	9	94.1	18.8	11	SC	
	21	210-220*	-	-	NP	NP	-	-	-		
	24	240-250*	-	-	-	-	97.9	23.3	13	SM-SC	
	26	262	7.7	104.8	24	4	-	-	-	SC-SM	
	27	263-272*	-	-	-	-	96.7	19	8	SM	
	28	265-275*	-	-	-	-	77.9	14.9	7	(SM)g	
	29	280-295*	-	-	-	-	98.3	16.4	-	SM	
	32	322	5.6	126.1	-	-	99.7	26.1	13	SM	
	36-2	380	-	-	21	3	-	-	-	SM	
	37	400-420*	-	-	40	26	-	-	-	CL	
	38	420-426*	-	-	-	-	99.9	8.1	-		
	42-2	460	15.3	113.8	23	5	-	-	-	SC-SM	
	42-3	460	-	-	22	6	-	-	-	SC-SM	
C-5	1	n/a	-	-	-	-	97.6	19	15	SC-SM	
	2	n/a	-	-	-	-	93.4	14.4	11		
	4-2	20	2.6	124.2	-	-	74.6	13.3	7	(SM)g	
	8	n/a	-	-	-	-	99.7	16	13	SM	
	9	59	-	-	-	-	58.6	2.8	-	(SW)g	
	10-3	62	2.9	112.4	-	-	98.9	22	16	SC-SM	2.70E-07
	11	n/a	-	-	-	-	83.6	14.5	9	(SM)g	
	12-3	81	2	113.7	-	-	45	9.8	-	(GP-GM)s	
	13	101	-	-	-	-	98.3	4.6	-	SP-SM	
	14	121	-	-	-	-	52.7	6.7	-	(GP-GM)s	
	16	142	23.5	93.2	58	35	100	91.2	70	CH	9.20E-10
	19	n/a	-	-	-	-	100	96.2	53	MH/CL	
	23	206	15.3	109.8	36	10	100	75.6	47	(ML)s	
	25	241	-	-	-	-	99.7	42.3	18	SM	
	28	276	-	-	-	-	100	33.4	-	SM	
	29	280	-	-	-	-	100	8.2	7.4	SP-SM	
	30	300	-	-	-	-	100	41.5	18	SM-SC	
	MC-1	344**	31.4	92	100	58		98.7	-	CH	
C-9	3	17	9.4	102.4			90.4	9.2	-	SW-SM	
	6	35-45*	-	-	-	-	98.6	16.6	-	SM	
	11	59-77*	-	-	49	32	-	-	-	CL	
	13	82	23.6	90.5	41	24	100	68.6	30	s(CL)	
	15	87-94*	-	-	-	-	86.8	12.7	6	SM	
	17	95-105*	-	-	-	-	87.1	10.2	4	SP-SM	
	MC-1	145	5.9	107.9			94.6	23	-	SM	3.50E-05
C-10	1	0-15.5*	-	-	-	-	93.5	7.9	5	SP-SM	
	2	16	3.9	115.6			93.2	7.8	-	SP-SM	
	3	17-30	-	-	-	-	97.5	10.8	7	SP-SM	
	4	30-63*	-	-	-	-	97.1	5.8	-	SP-SM	
	5	63-93*	-	-	-	-	91.2	3.7	3	SP	
	9	95	-	-	-	-	98.4	12.4	8	SP-SM	
	10	100	2.1	115.8			91.3	9.5	-	SP-SM	
	12	104-121*	-	-	-	-	98	16.2	11	SM	
	13	122-139*	-	-	-	-	78.4	9	5	(SP-SM)g	
	14	175-191*	-	-	-	-	99.6	8.4	7	SP-SM	
	17	191-198*	-	-	-	-	73.4	8	6	(SP-SM)g	
	18	198	2.8	100.5			66.9	5.6	-	(SP-SM)g	
	20	207-240*	-	-	-	-	94.5	15.7	8	SM	
	21	240-260*	-	-	-	-	93.7	12.1	6	SP-SM	
	22	260-280*	-	-	-	-	99	10.5	-	SP-SM	
	29	359	0.4	110.3	47	24	100	63.6	53	(CL)s	
	34	428-442*	-	-	61	31	100	91.3	50	CH	
	35	442-453*	-	-	59	32	100	48.3	35	CH	
	37	469-470*	-	-	59	37	99.6	86.7	70	CH	
	39	500-520	-	-	51	29	98.2	80.4	59	(CH)s	

*grab sample

**Shelby Tube sample

Principles of Geotechnical Engineering

Fifth Edition



Braja M. Das

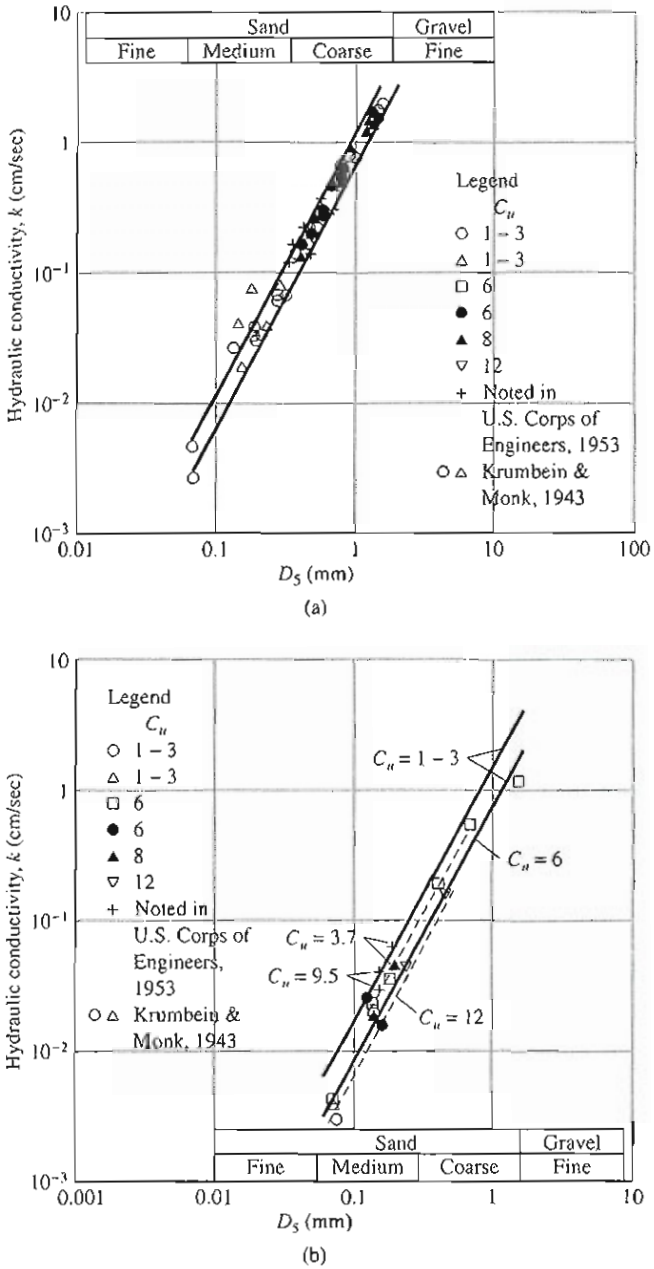


Figure 6.8
Results of permeability tests on which Eq. (6.27) is based: (a) results for $C_u = 1$–3; (b) results for $C_u > 3$ (after Kenney, Lau, and Ofoegbu, 1984)

where D_5 = diameter (mm) through which 5% of soil passes. Figures 6.8a and 6.8b show the results on which Eq. (6.27) is based.

On the basis of laboratory experiments, the U.S. Department of Navy (1971) provided an empirical correlation between k (ft/min) and D_{10} (mm) for granular soils with the uniformity coefficient varying between 2 and 12 and $D_{10}/D_5 < 1.4$. This correlation is shown in Figure 6.9.

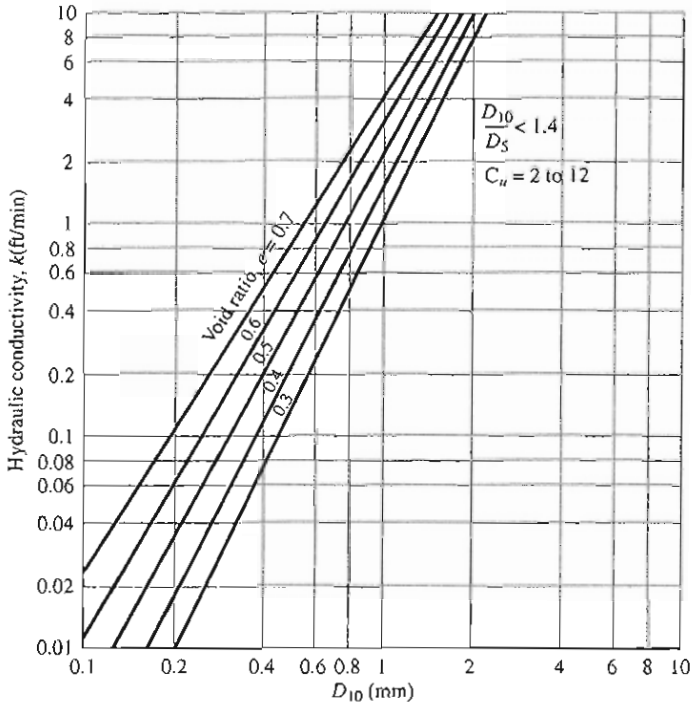


Figure 6.9 Permeability of granular soils (after U.S. Department of Navy, 1971)

According to their experimental observations, Samarasinghe, Huang, and Drnevich (1982) suggested that the hydraulic conductivity of normally consolidated clays (see Chapter 10 for definition) can be given by

$$k = C_3 \left(\frac{e^n}{1 + e} \right) \tag{6.28}$$

where C_3 and n are constants to be determined experimentally. This equation can be rewritten as

$$\log[k(1 + e)] = \log C_3 + n \log e \tag{6.29}$$

Hence, for any given clayey soil, if the variation of k with the void ratio is known, a log-log graph can be plotted with $k(1 + e)$ against e to determine the values of C_3 and n.

Some other empirical relationships for estimating the hydraulic conductivity in sand and clayey soils are given in Table 6.3. One should keep in mind, however, that any empirical relationship of this type is for estimation only, because the magnitude of k is a highly variable parameter and depends on several factors.

Tavenas et al. (1983) also gave a correlation between the void ratio and the hydraulic conductivity of clayey soil. This correlation is shown in Figure 6.10. An important point to note, however, is that in Figure 6.10, *PI*, the plasticity index, and *CF*, the clay-size fraction in the soil, are in *fraction* (decimal) form.

Table 6.3 Empirical Relationships for Estimating Hydraulic Conductivity

Type of Soil	Source	Relationship[a]	Comments
Sand	Amer and Awad (1974)	$k = C_2 D_{10}^{2.32} C_u^{0.6} \frac{e^3}{1+e}$	
	Shahabi, Das, Tarquin (1984)	$k = 1.2 C_2^{0.735} D_{10}^{0.89} \frac{e^3}{1+e}$	Medium to fine sand
Clay	Mesri and Olson (1971)	$\log k = A' \log e + B'$	
	Taylor (1948)	$\log k = \log k_0 - \frac{e_0 - e}{C_k}$ $C_k \approx 0.5 e_0$	For $e < 2.5$,

[a] D_{10} = effective size
C_u = uniformity coefficient
C_2 = a constant
k_0 = *in situ* hydraulic conductivity at void ratio e_0
k = hydraulic conductivity at void ratio e
C_k = permeability change index

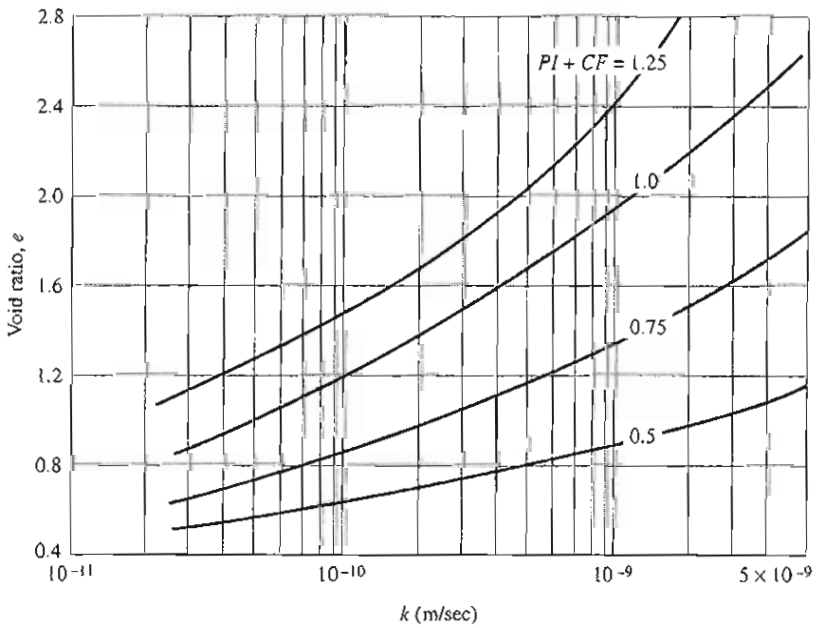


Figure 6.10 Variation of void ratio with hydraulic conductivity of clayey soils (based on Tavenas et al., 1983)

...ic Conductivity

eral empirical equations for estimating hydraulic conductivity have been pro-ed in the past. Some of these are briefly discussed in this section.

For fairly uniform sand (that is, sand with a small uniformity coefficient), Hazen 30) proposed an empirical relationship for hydraulic conductivity in the form

$$k\ (\text{cm/sec}) = cD_{10}^2 \tag{6.23}$$

re c = a constant that varies from 1.0 to 1.5
D_{10} = the effective size, in mm

ation (6.23) is based primarily on Hazen's observations of loose, clean, filter s. A small quantity of silts and clays, when present in a sandy soil, may change ydraulic conductivity substantially.

Casagrande proposed a simple relationship for hydraulic conductivity for fine-edium clean sand in the form

$$k = 1.4e^2k_{0.85} \tag{6.24}$$

e k = hydraulic conductivity at a void ratio e
$_{0.85}$ = the corresponding value at a void ratio of 0.85

Another form of equation that gives fairly good results in estimating the hy-ic conductivity of sandy soils is based on the Kozeny-Carman equation. The ation of this equation is not presented here. Interested readers are referred to dvanced soil mechanics book (for example, Das, 1997). An application of the ny-Carman equation yields

$$k \propto \frac{e^3}{1+e} \tag{6.25}$$

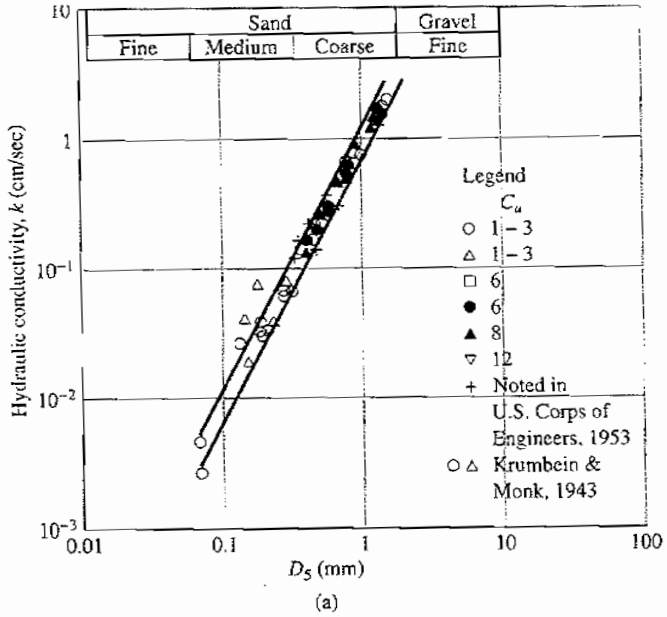
k = hydraulic conductivity at a void ratio of e. This equation can be re-n as

$$k = C_1\frac{e^3}{1+e} \tag{6.26}$$

C_1 = a constant.

Mention was made at the end of Section 6.1 that turbulent flow conditions may n very coarse sands and gravels, and that Darcy's law may not be valid for these als. However, under a low hydraulic gradient, laminar flow conditions usually Kenney, Lau, and Ofoegbu (1984) conducted laboratory tests on granular soils h the particle sizes in various specimens ranged from 0.074 to 25.4 mm. The nity coefficients, C_u, of these specimens ranged from 1.04 to 12. All perme-tests were conducted at a relative density of 80% or more. These tests showed laminar flow conditions,

$$\overline{K}\ (\text{mm}^2) = (0.05 \text{ to } 1)D_5^2 \tag{6.27}$$



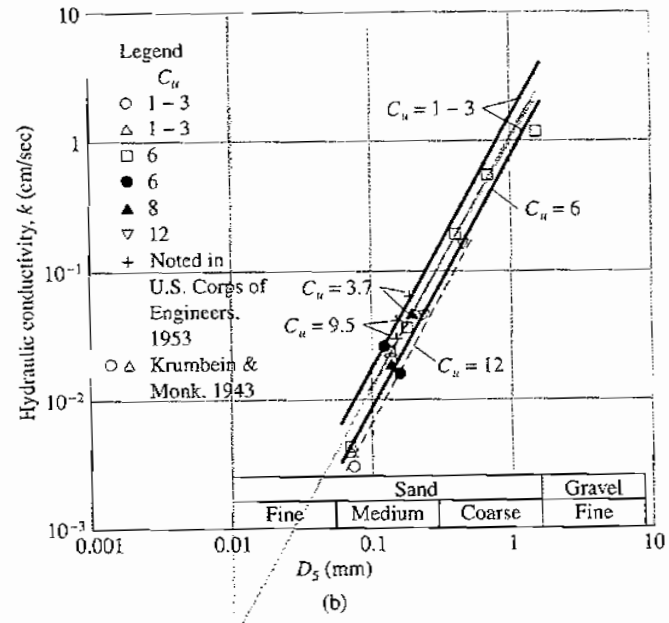
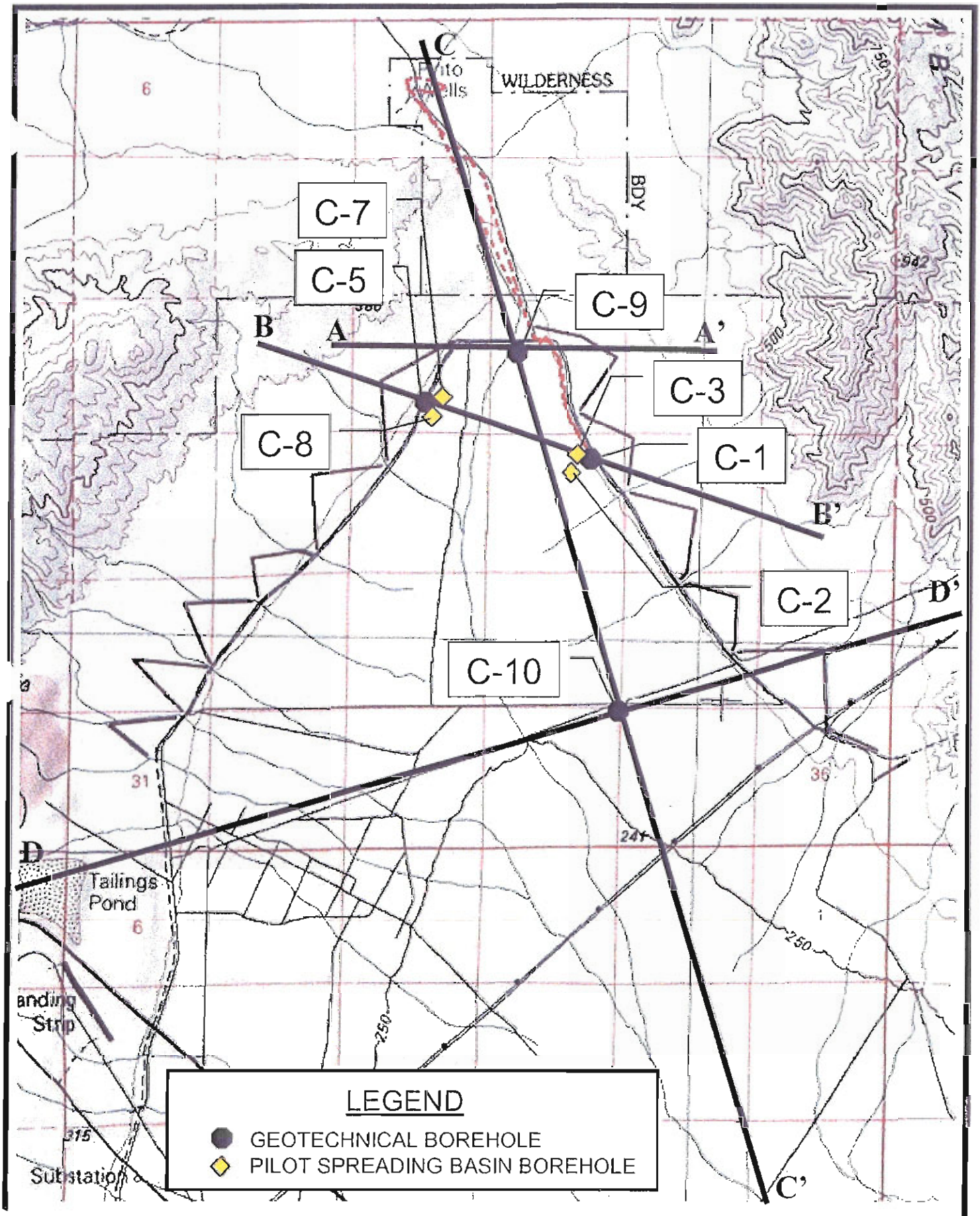


Figure 6.8
Results of permeability tests on wh
Eq. (6.27) is based: (a) results for C
(b) results for $C_u > 3$ (after Kenne
Ofoegbu, 1984)

where D_5 = diameter (mm) through which 5% of soil passes. Figures 6.
show the results on which Eq. (6.27) is based.

On the basis of laboratory experiments, the U.S. Department of N
provided an empirical correlation between k (ft/min) and D_{10} (mm) for gr
with the uniformity coefficient varying between 2 and 12 and $D_{10}/D_5 < 1$
relation is shown in Figure 6.9.



DRAFT

FIGURE D-1
LOCATION OF BOREHOLES

DRAFT

D
WEST

D'
EAST

EAGLE MOUNTAIN
MINE

MW - 1

CRA

CRA

C-10

Qc

Qal

Qc

gr
(granitics)

Sheephole Fault

gr
(granitics)

ELEVATION (ft, MSL)

1,750
1,500
1,250
1,000
750
500
250
0
-250
-500
-750
-1,000
-1,250
-1,500
-1,750

LEGEND

Geotechnical Boring

- Predominantly Sand and Silty Sand Deposits
- Sand with Gravel, Cobbles and Boulders
- Predominantly Clay Deposits
- Granitics
- Volcanics
- Water Level Observed during drilling
- Static Water Level Observed in Piezometers

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GeoPentech

Groundwater Storage & Dry Year Supply
Project Upper Chuckwalla Valley

Section D-D'

Proj. No. 00019A

Figure D-5

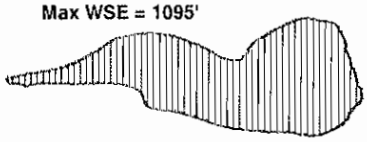
GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
7/24/2008
NDM

East Pit - Top Widths

WSE = 1095'	WSE = 925'
495.9	783.9
912.7	876.3
1451.8	1047.3
1749.8	1169.1
1888.0	1178.1
1953.6	1170.2
2000.5	1132.3
2044.8	1083.4
2057.2	987.3
2032.3	900.1
1974.3	729.1
1911.7	615.9
1859.0	519.3
1805.4	505.7
1739.0	511.0
1667.5	507.9
1598.0	508.9
1502.0	547.0
1315.9	546.7
1224.5	570.9
1196.6	736.9
1190.8	818.8
1204.2	825.3
1224.6	841.5
1255.2	854.9
1272.6	865.4
1279.3	880.4
1294.3	897.9
1301.0	748.4
1311.1	637.2
1317.2	561.9
1327.2	498.3
1333.1	455.9
1322.0	423.9
1274.3	378.7
1031.9	321.9
938.4	239.2
880.3	174.3
824.7	116.8
784.7	40.4
730.0	
654.1	
581.7	
523.8	
466.2	
411.5	
362.8	
319.5	
281.6	
255.0	
226.4	
209.2	
196.4	
197.7	
189.9	
136.2	
113.4	
Average = 1098	680

SKETCH:

Max WSE = 1095'



Min WSE = 925'

Note: Top widths were obtained every 100 feet across surface area from east to west

GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
7/24/2008
NDM

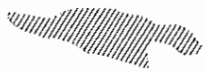
Central Pit - Top Widths

WSE = 2485'	WSE = 2343'
316.4	696.2
600.1	554.7
788.4	168.7
870.1	145.5
906.4	171.2
932.8	124.6
1148.6	246.7
1254.2	333.6
1413.9	405.9
1481.7	441.9
1655.1	428.0
1797.9	426.3
1828.9	428.8
1856.7	896.3
1878.9	886.6
1902.9	933.4
1929.9	958.3
1956.5	968.5
1982.8	960.8
2008.0	952.7
2028.8	950.2
2016.7	954.5
2029.5	979.8
2054.9	989.2
1978.9	953.0
1903.9	904.3
1804.2	851.3
1742.6	800.1
1560.2	757.7
1569.5	721.9
1566.4	691.5
1578.7	662.5
1601.6	603.7
1622.1	512.0
1643.8	421.2
1657.1	373.3
1667.2	342.7
1675.0	318.7
1673.4	297.8
1673.6	265.7
1668.7	180.0
1653.3	215.9
1623.8	
1579.6	
1520.1	
1469.0	
1430.9	
1401.0	
1381.9	
1369.0	
1369.5	
1368.8	
1340.2	
1302.2	
1263.0	
1224.3	
1188.2	
1165.4	
1147.6	
1109.0	
1096.8	
1070.9	
1038.5	
1033.5	
1057.1	
Average = **1484**	**592**

SKETCH:

Max WSE = 2485'

Min WSE = 2343'



Note: Top widths were obtained every 100 feet across surface area from east to west

GEI Consultants, Inc.
080470 Eagle Mountain Pumped Storage Project
Reservoir Seepage Analysis (SEEP/W)
9/4/2008
NDM

Borehole
CH-5A
Average RQD
for Top 100' = **58.0**

Depth	RQD Values
15	75
20	38
25	77
30	23
35	80
40	72
45	73
50	68
55	12
60	95
65	0
70	0
74	10
79	82
83	72
88	92
93	88
98	74
100	71

Borehole
CH-10
Average RQD
for Top 100' = **39.8**

Depth	RQD Values
28	40
32	90
38	47
43	82
47	39
48	0
50	0
55	19
59	19
64	13
69	46
74	40
79	47
84	85
89	82
93	17
98	50
100	0

Appendix C – Technical Memoranda

12.6 Seepage Recovery Assessment

Eagle Mountain Pumped Storage Project – Seepage Recovery Assessment

Prepared by: Richard Shatz [C.E.G. 1514], David Fairman, Donghai Wang, GEI Consultants

May 13, 2009, Revised November 24,2009

Introduction

Eagle Crest Energy Company (ECEC) is in the licensing stages of a two reservoir hydroelectric project known as the Eagle Mountain Pumped Storage Project (Project). The Colorado River Aqueduct (CRA) passes within about one mile east of the Lower Reservoir, and is located between the reservoir and the proposed location of the groundwater supply wells, near Desert Center, that will be used to draw water for the initial fill and annual makeup water for the reservoirs. The potential effects of Project operations on groundwater elevations beneath the CRA are of particular interest, since significant changes in the subsurface saturated conditions could result in land subsidence and impact the integrity and function of the CRA.

Two particular groundwater-related issues associated with the Project are: 1) the potential effects of groundwater extraction in the Desert Center area as water supply for the initial filling and replacement of annual losses from evaporation and seepage; and 2) the potential effects of seepage from the reservoirs. The first issue is addressed in a separate memorandum titled *Groundwater Supply Pumping Effects*, dated April 20, 2009. This memorandum describes the approach and results to address the second issue, the potential impacts of seepage from the reservoirs on groundwater levels.

Approach

This technical memorandum provides an assessment of the groundwater impacts due to seepage, and seepage recovery schemes to address the Lower and Upper reservoirs separately. Different approaches are required to address the Lower and Upper reservoirs since subsurface conditions are dramatically different. The Lower Reservoir is partially situated on unconsolidated alluvium and is evaluated using a groundwater flow model to develop a seepage recovery system design. The Upper Reservoir sits atop fractured bedrock, and a seepage recovery system is defined by performing a review of known faults that intersect the reservoir footprint.

For the Lower Reservoir, the model set-up, analysis results, and proposed seepage recovery design are discussed. For the Upper Reservoir, this memo includes a description of the geology beneath the reservoir and the proposed seepage recovery system. A groundwater model was not developed for the Upper Reservoir as application of the model would require data that does not currently exist.

Lower Reservoir Seepage Assessment

Portions of the Lower Reservoir overlie saturated alluvium, while the remainder sits atop fractured bedrock. A groundwater model was developed to assess the effects of seepage from the reservoir on local groundwater conditions for the portion overlying saturated alluvium. Because of the close proximity of the bedrock to the saturated alluvium it was assumed that the faults and fractures would be hydraulically connected to the alluvium.

Upon review of the geologic conditions at the Project site, it was decided that a numerical model built in MODFLOW would be the most cost-effective and beneficial approach to evaluating groundwater conditions in the vicinity of the CRA. The model was developed using MODFLOW-2000 (version 1.18.00, released on 8/23/2007).

Modeling Goals and Objectives
Upon filling of the Lower Reservoir, some seepage from the reservoir is expected. That seepage needs to be controlled to prevent adverse changes in water elevations beneath the CRA that could cause subsidence and hydrocompaction.

The model objectives are to:

- Create a model that can accurately simulate current groundwater conditions in the vicinity of the Lower Reservoir and the CRA based on the available data.
- Evaluate the impacts of seepage from the Lower Reservoir into the saturated alluvium.
- Simulate the effects of seepage recovery wells to capture the seepage lost from the Lower Reservoir.
- Prepare a plan for the seepage recovery array to adequately capture Lower Reservoir seepage, but not significantly raise or depress the groundwater elevations beneath the CRA.

This analysis defines an optimum number and spacing of the recovery wells, and presents hydrographs at hypothetical observation wells located adjacent to the CRA to document the effects of seepage/pumping on the CRA. The potential impacts of seepage from the Lower Reservoir and extraction from the seepage recovery wells were determined by comparing the baseline model results with those of the different scenarios.

Final design of the monitoring and recovery well system will be based upon a refined modeling effort during final engineering design based upon measured aquifer hydraulic characteristics. The model developed for this evaluation can be re-applied to support the final design phase.

Hydrogeology
Figure 1 shows the general project area. The regional hydrogeology and the basis for model development are based on:

- Descriptions of geologic conditions in the Lower Reservoir (CH2MHill, 1996).
- Water elevations obtained from monitoring wells constructed for the Eagle Mountain Landfill and Recycling Center Project.
- Subsurface logs from coring performed for the Eagle Mountain Mine.
- Well drillers' logs from Eagle Mountain Mine water supply wells.
- Cross-sections developed by ECEC, shown on Figures 2 and 3.
- Cross-sections developed by GeoPentech for a groundwater banking project in the area, shown on Figures 4 and 5.
- Geophysical survey (gravity survey) from GeoPentech shown on Figure 6.

The regional hydrogeology is characterized by fractured bedrock at the surface, with recent and older alluvium overlapping onto the sloping surface of the bedrock. The alluvium is part of the Chuckwalla Groundwater Basin. The alluvium in the upper portions of the Chuckwalla Groundwater Basin can be grouped into three units with similar sediments and hydraulic parameters. Figures 2 through 5 show the geologic layering of the alluvial sediments in the vicinity of the Lower Reservoir.

The first alluvial layer is about 300 feet thick and consists of sand and gravel with a few discontinuous layers of silt and clay. Approximately 150 feet of the alluvium is saturated. Exposures of the alluvium in the eastern face of the Lower Reservoir were described as a coarse fanglomerate (CH2MHill, 1996). Underlying the first layer are lake deposits consisting primarily of clay. The lakebed thickness varies and may be thinner near the margins of the basin and thicker towards the central portions of the basin based on geophysical surveys (gravity). However, no wells have fully penetrated the lakebeds to determine their actual thickness. One well (CW-1) penetrated over 900 feet of clayey lakebed deposits before being terminated. The lakebed deposits are potentially underlain by coarser sediments, based on geophysical surveys, but there are no wells to confirm the presence of this layer (GeoPentech, 2003). The sediments are likely to have a lower permeability than the first alluvial layer because of compaction and development of clay due to weathering.

The alluvial sediments were deposited on an irregular bedrock surface. Geophysical surveys suggest the bedrock surface is a large bowl opposite the reservoirs (GeoPentech, 2003). The southern edge of the bowl aligns with a narrow bedrock ridge that juts easterly into the basin. The upper coarse-grained sediments were deposited above the bowl rim, whereas the lakebed sediments are below the rim. This configuration would create confining conditions in the underlying coarse sediment and prevent outflow from these sediments. The northern edge of the bowl connects to the Pinto Groundwater Basin where inflow into the Chuckwalla Groundwater Basin occurs. A basalt flow and several faults are present, as shown on Figure 4, but their effects on groundwater levels are not defined.

The bedrock beneath the Lower Reservoir is broken by the inactive East Pit Fault. The East Pit Fault appears to offset the bedrock by about 300 feet, which creates a near vertical bedrock contact on the western side of the valley starting near the reservoirs and extending to the south. Figure 2 shows the difference in the bedrock surface. West of the fault the alluvium is thin and unsaturated. Portions of the CRA, south of hypothetical monitoring well OW03 (Figure 1), rests on this unsaturated alluvium. The East Pit fault consists of about a 30-foot zone of broken rock and is in hydraulic continuity with the alluvial deposits.

Groundwater level measurements near the reservoirs are available for a two-year period between 1992 and 1994, after the time when significant pumping for the Eagle Mountain Mine and jojoba agricultural activities occurred in the 1960's through the1980s. The measurements occurred during a period when there were no quantifiable or significant stresses applied to the aquifer that could be used for calibration. There was some pumping in the Desert Center area for domestic uses and limited agricultural uses during this period.

Groundwater occurs in the sediments above the lakebeds at a depth of about 25 feet below the lowest point in theEast Pit, in the west bowl. The west bowl of the East Pit is the western portion of the East Pit, and is outside and to the west of, the portion of the East Pit proposed to be used for the project's lower reservoir. The groundwater surface generally is deeper, progressing easterly into the valley. The nature of the sediments infer – and groundwater levels show – that the aquifer is unconfined.

Only one groundwater level measurement is available for the lakebed deposits at groundwater monitoring well (C-10) located near the eastern edge of the model area. It showed the groundwater level was about 60 feet below the top of the clay surface and over 200 feet below the water surface in the overlying sediments as shown on Figure 4. There is great uncertainty regarding this single data point due to this significant difference.

No groundwater levels are available for the coarse-grained sediments underlying the lakebeds. If present, this aquifer would be confined.

The groundwater flow direction in the alluvium is relatively uniform while flow in the bedrock is variable. Figure 1 shows the groundwater flow directions. The flow direction in the saturated alluvium above the lakebeds is generally to the southeast (CH2MHill, 1996). Groundwater flow in the bedrock is towards the Eagle Creek Canyon, from both the northwest and southwest.

Hydraulic characteristics of the sediments overlying the lakebeds were estimated during the investigation for the landfill. The hydraulic conductivities were estimated to be between 0.02 and 7.1 feet per day as shown in Table 1. Descriptions of the fanglomerate from monitoring well construction describe the sediments as ranging from boulders to coarse sand, and therefore the estimated K appear to be too low. Typical K values for well-sorted sand and gravel are from 3 to 180 feet/day (Fetter, 1988). Because the fanglomerate are part of older continental deposits and could be weathered and compacted, a conservative K of 25 feet per day and an S of 0.05 were used in the model.

Conceptual Model

The model area was defined to include both the Upper and Lower Reservoirs, but is centered on the Lower Reservoir and the closest portion of the CRA as shown in Figure 1. The area modeled is the alluvial aquifers, which will extend from the alluvium–bedrock contact at the Lower Reservoir to about 2 miles east of the CRA. As described above, the model is only set up to simulate groundwater conditions for the portion of the model area overlying saturated alluvium, with the portion of the model overlying bedrock, including the Upper Reservoir, designated as *inactive*. The following assumptions were made in development of the model:

1. A 3-layer model simulates the geologic conditions present in the vicinity of the reservoir. Layer 1 represents the saturated alluvium above the lakebeds, Layer 2 represents the lakebeds, and Layer 3 represents the underlying coarse-grained sediments.

2. The model is run under steady-state conditions because of the short period of available groundwater level measurements, and those data obtained during a period when there was little to no stress on the aquifer to calibrate the model.

3. The model boundaries are generally oriented to be parallel and perpendicular with the regional groundwater flow direction in the alluvial basin.

4. Layer 3, the confined aquifer, has no outflow, either naturally or by pumping wells. The aquifer is full and water is neither flowing into nor out of the aquifer. Therefore, assigning very small hydraulic conductivities is appropriate to both Layers 2 and 3, essentially making the model a 1-layer model at this time. The deeper layers are built into the model for use during final engineering design.

5. The upgradient and downgradient boundaries are specified to keep the system in balance under current conditions so the seepage from the Lower Reservoir can be added after the model performance is verified.

6. Seepage from the reservoir instantaneously percolates through the unsaturated sediments and reaches the groundwater surface.

7. There are no other sources or outflows of water such as wells, streams, evaporation, or precipitation.

Model Development

The groundwater flow model was developed as follows.

Model Grid

The model cells are square, with a two-step nodal spacing. The node spacing in the central portion of the model area, which is in the vicinity of the Lower Reservoir and the closest stretch of CRA, is 200 feet by 200 feet. The node spacing expands to 400 feet by 400 feet for the extremities of the model area. Figure 7 shows the model grid.

Layers

The model was constructed with three layers to simulate the hydrogeologic conditions in the Upper Chuckwalla Groundwater Basin. Layer 1 is the saturated sands and gravels above the lakebeds. Layer 2 is the lakebed deposits. Layer 3 is the coarse sediments that may underlie the lakebeds.

The top of Layer 1 is the groundwater surface and was determined from the general gradient in the area and extrapolated as a uniform planar surface to best fit actual groundwater elevations, particularly in those areas close to the reservoir and aqueduct as shown on Figure 8. Given the limited measurements available, Layer 1 has been assigned a uniform thickness of 150 feet over the entire modeled area. This assumed thickness resulted in a reasonable fit to the few clay surface elevations shown on Figure 9. Layer 1 slopes to the southeast with edges partially controlled by the bedrock contact and partially by no flow and constant head boundaries as discussed in the Boundary Conditions section of this memo.

The lakebed deposits extent is poorly defined and may have a variable thickness as shown on Figures 4 and 5. Because of the limited data points available an average and uniform thickness of 400 feet was used to create Layer 2. Definition of Layer 3 is also limited, so an average and uniform thickness of 850 feet was used. Both Layer 2 and Layer 3 surfaces

were assumed to be parallel to the top of Layer 1. Both layers were created to extend throughout the modeled area.

Seepage Infiltration

The average seepage from the Lower Reservoir assuming a 0.5 foot thick seepage blanket is constructed would have seepage losses of about 890 acre-feet per year (AFY), or about 550 gpm (GEI, *Seepage Analyses for Upper and Lower Reservoirs*, dated January 5, 2009). The maximum seepage would be about 1,600 AFY if only limited seepage control improvements were made. For the current analysis, the average seepage was distributed evenly over the eastern portion of the reservoir overlying alluvium, even though it is possible that some of the seepage could migrate through the bedrock via the crushed zone of the East Pit Fault. Based on this interpretation of the subsurface conditions, it appears the fault intersects the alluvium near the Lower Reservoir. To simplify the modeling approach and provide a reasonable worst-case scenario, all seepage is assumed to be entering the system through the alluvial sediments.

Aquifer Parameters

Layer 1 was assigned a hydraulic conductivity (K) of 25 feet per day (ft/day) and a storativity (S) of 0.05. Layers 2 and 3 were assigned a K = 3 x 10^{-6} ft/day (1 x 10^{-9} centimeters per second) and S = 0.0001, which creates an essentially impermeable lower boundary for Layer 1. The aquifer characteristics of these deeper layers may be adjusted based upon measurements made to support final engineering design.

Initial and Boundary Conditions

The model is oriented such that the east and west boundaries are parallel to the direction of groundwater flow and therefore are no-flow boundaries. The upgradient and downgradient boundaries are general head boundaries assuming a total volumetric flow of 6,625 AFY (estimated outflow through the southern edge of the modeled area) through the system (790,120 ft^3/day), and an aquifer thickness of 150 feet. The flow was distributed across an up gradient length of 20,600 feet and across a down gradient length of 14,600 feet. The down gradient length is shorter due to the model area coinciding with a bedrock ridge that juts easterly into the valley.

The initial heads for Layer 1 were based on groundwater levels measured in monitoring wells constructed for the landfill. A uniform planar surface was developed that provided a best fit near the Lower Reservoir. Because Layers 2 and 3 have no hydraulic head measurements the heads were assumed to be at the top of Layer 2.

Modeling Runs

The overall approach to simulating the groundwater conditions in the vicinity of the Lower Reservoir and CRA was performed using the model runs outlined below. All runs are steady-state simulations.

Run 1 – Simulate current groundwater conditions and compare results of model analysis with current groundwater elevations interpolated by observation wells to evaluate the model performance.

Run 2 – Add seepage from the Lower Reservoir to Run 1 and observe changes in water elevations around the reservoir and at simulated observation wells along the CRA.

Run 3 – Add seepage recovery wells to Run 2 and observe changes in water elevations around the reservoir and at simulated observation wells along the CRA.

Transient simulations were performed for both Runs 2 and 3 to develop hydrographs showing the projected changes in groundwater levels beneath the CRA and when steady state conditions are reached. This allows the timing of groundwater changes in response to seepage, and seepage mitigation, to be evaluated. Water balance results for each modeling run are also provided.

Run 1 - Model Performance

The model performance was evaluated by observing the model's ability to replicate the current groundwater conditions using the given aquifer parameters, boundary conditions, and initial conditions. General agreement was observed between the initial groundwater gradient and the steady-state elevations simulated by the model after Run 1. As shown on Figure 10, the up gradient and down gradient elevations were accurately estimated and the model reasonably matched the uniform initial gradient.

It was expected that the uniform gradient projected over the entire alluvial portion of the model would not be as accurately replicated near the encroaching bedrock contact along the southwestern portion of the model since the extrapolated gradient does not take into account the no-flow boundary effects. It would appear that the model better approximated the groundwater elevations in this area. Overall, the model appears to reasonably replicate the current groundwater conditions in the alluvial area.

Run 2 – Seepage

Run 2 was performed following verification of the model's ability to replicate the current groundwater conditions. The purpose of Run 2 was to assess the impacts of seeping 890 AFY from the Lower Reservoir on groundwater elevations and did not include seepage recovery wells. The estimated seepage is based on the analysis found in the Technical Memorandum on Seepage (Section 12.5). Run 2 is based on an assumed placement of a 5-feet thick liner consisting of grouting, seepage blanket, and RCC or soil cement treatment over alluvium.

As shown in Figure 11, Run 2 showed that a groundwater mound is created in the vicinity of the Lower Reservoir and a rise in groundwater elevations occur across the model. Groundwater levels rose about 8 feet beneath the reservoir, far less than the 25 feet of unsaturated alluvium. A series of hypothetical observation wells were placed along the CRA as monitoring points to evaluate groundwater elevation changes. As shown on Figures 12 through 14, groundwater elevations at the closest observation well, OW05, rose 1.88 feet in response to seepage from the Lower Reservoir. Down gradient observation well OW03.2 rose about 2.65 feet.

A transient analysis was performed to evaluate the change of groundwater elevations over time. Figure 12 showed that groundwater elevations at OW05 rose 1.64 feet (87 percent of elevation change at steady state) after three years in response to seepage from the Lower Reservoir, and reached 1.87 feet (99 percent) after 10 years.

Run 3 – Seepage Recovery and Alternatives Evaluation

Run 3 consisted of multiple runs varying the number, pumping rates, and preliminary locations of the seepage recovery wells. In all runs the seepage from the reservoirs was captured, using 5 to 7 wells, but the drawdown beneath the CRA varied from about 1 to 4 feet. Consideration was given to placement of the wells away from the reservoir to effectively capture the seepage. Model Run 2 showed that a saturated mound would not rise high enough to connect to the reservoir bottom. Therefore, the seepage will migrate mostly vertically through unsaturated alluvium before reaching the water surface. To allow the

seeped water to reach the groundwater surface the recovery wells' array design consisted of six wells distributed about 1500 to 2000 feet from the eastern and southern edges of the Lower Reservoir at a spacing of about 1000 feet, each pumping 92 gpm. The locations of the wells are shown on Figure 15. Figure 16 shows the results of Run 3. Groundwater elevations in the vicinity of the CRA were maintained between 0 and 3 feet below the initial groundwater conditions. Pumping the seepage recovery wells would result in less than 6 feet of drawdown in these wells.

A transient analysis was performed to evaluate the change of groundwater elevations over time. Figures 12 through 14 show that the seepage recovery wells reduced the water elevations at OW05 to 1.86 feet (89 percent of elevation change at steady state) below the initial groundwater elevations after three years, and reached 2.08 feet (greater than 99 percent) after 10 years. The other observation wells reached steady state conditions in a similar time frame.

Water Balances

Figure 17 shows the mass balance for all three runs. The inflow and outflow values are within a fraction of a percent of each other, indicating that model parameters are being accounted for and the model is valid.

Upper Reservoir Seepage Assessment

The Upper Reservoir is entirely underlain by bedrock. The bedrock is fractured and seepage from the Upper Reservoir will likely be through these fractures. These groundwater conditions do not readily lend themselves to modeling. Therefore, a geologic assessment of the major faulting pattern was prepared to develop a preliminary seepage recovery well network to capture all of the seepage from the Upper Reservoir.

Hydrogeology

Bedrock geologic units present at the site can be generally classified as igneous or meta-sedimentary (including the iron ore) with little to no primary permeability. The meta-sediments have been folded into an anticline with the Upper Reservoir on the north limb. Subsequent to the folding and fracturing volcanic dikes intruded the rock in a northeast–southwest trend.

Fracturing and faulting of the rock created secondary permeability that can convey water from the reservoir. Geologic mapping of the Upper Reservoir was performed prior to the excavation of the pit by the Eagle Mountain Mine and shows the location of the major faults. Figure 18 shows the location of these major faults (digitized from Proctor, 1992). For purposes of this analysis, it was assumed that the fractures would be connected to these major faults. The faults near and beneath the Upper Reservoir (Fault "A") have a similar northwest-southeast trend to the East Pit Fault, which crosses through the Lower Reservoir. Although no dips are provided for faults in the Upper Reservoir it is believed they would be similar to the East Pit Fault, which is nearly vertical (dips about 80 degrees to the east).

Two borings were completed in the Upper Reservoir site vicinity (MW-10 and CH-10). Rock core obtained from boring CH-10 provides insights on the hydrogeologic character of the bedrock. The boring was drilled to a total depth of 1,389 feet. Water was first observed at a depth of 1,309 feet. Rock in the upper 350 feet of the boring was found to be moderately fractured, interbedded igneous and meta-sedimentary rock. Monitoring well MW-10 was drilled to a total depth of 1,214 feet. Water was first encountered at a depth of 506 feet. The water surface subsequently dropped and later stabilized at a depth of 1,018 feet. The

observations suggest that water may be present in joints and fractures at various depths and that lower fractures are either dry or at lower heads.

The groundwater flow direction in the bedrock is regionally towards the southeast, in the direction of Eagle Creek Canyon as shown on Figure 1 (CH2MHill, 1996). It is possible there are either faults or fractures in the rock that are concealed beneath the thin alluvium in the canyon. Faults and fractures typically create weak zones where erosion can create canyons. The orientation of the canyon would suggest a fault or fracture could convey water to the east into the saturated alluvium where it could be captured by the Lower Reservoir seepage recovery wells.

The depth to groundwater in the bedrock beneath portions of the CRA is about 450 feet below ground surface, as shown on Figure 2. Groundwater levels in the bedrock would have to rise by about 180 feet before saturating the alluvium overlying bedrock.

Hydraulic Characteristics
Hydraulic characteristics of the bedrock joint and fractures were estimated during the investigation for the landfill. The hydraulic conductivities were estimated to be between 0.02 and 5.1 feet per day as shown in Table 1.

Few wells in the area obtain water from the fractured bedrock. The former Eagle Mountain school well (School Well) was drilled to a depth of about 750 feet before encountering adequate flow to support a small well. The well could be pumped at a rate of about 75 gpm.

Seepage
The Upper Reservoir may seep an average of 738 acre-feet of water annually or about 460 gallons per minute (GEI, *Seepage Analyses for Upper and Lower Reservoirs*, dated January 5, 2009). Raising and lowering of water levels in the reservoir during normal operations would allow some of the seepage, especially in the sidewalls, to drain back into the reservoir during low water level periods.

Seepage Recovery Wells
A preliminary seepage recovery network was designed assuming that the average well would be capable of pumping only 70 gallons per minute, similar to the School Well. About seven seepage recovery wells may be needed. Five of the seven seepage recovery wells were positioned around the Upper Reservoir outside of the landfill perimeter at currently known locations of faults that extend beneath the reservoir. Figure 18 shows the location of the proposed seepage recovery well system.

In addition to the seepage recovery well system near the Upper Reservoir, additional seepage recovery wells will be constructed along the axis of the Eagle Creek Canyon at the intersections of the faults that cross beneath the Upper Reservoir. These wells in conjunction with the wells near the Upper Reservoir will be used to maintain the water levels below the elevation of the liner for the proposed landfill operations in this area and to prevent a rise in groundwater levels in the bedrock beneath the CRA.

Conclusions

The results of the MODFLOW model for the Lower Reservoir indicate that groundwater levels in the vicinity of the CRA would increase by up to three feet by seepage from the Lower Reservoir if not controlled through seepage recovery wells. A preliminary seepage recovery well array design consists of six wells, each pumping 92 gpm, and resulted in capture of all of the seepage, with groundwater elevations only being reduced beneath the CRA by about

three feet. The absolute elevations are reflected in Figure 13 with the elevation increasing from about 629 feet msl to about 632 feet msl without the network and decreasing from about 629 to 626 with the network. Although the seeped water could be allowed to flow unimpeded to offset drawdown related to water supply pumping, this does not allow for unanticipated conditions. Therefore, seepage recovery wells will be installed and equipped. Once the reservoirs are at full capacity and the actual operating conditions are observed, groundwater management alternatives will be employed to minimize groundwater level changes beneath the CRA.

The maximum seepage from the Lower Reservoir with limited seepage control improvements is estimated to be about 1,600 AFY, about double the average seepage that was analyzed in this assessment. Therefore, worst case projections would suggest the seepage, if not controlled by pumping, would raise groundwater levels by about 6 feet beneath the CRA. The seepage could be controlled by pumping wells.

Seepage from the Upper Reservoir will be along joints, fractures, and faults that cross beneath the reservoir. About seven seepage control wells will be needed to control the seepage losses, assuming they will each pump about 70 gpm. Since the faults are near-vertical angle drilling may be an effective method. Additional seepage recovery wells will be constructed along the axis of the Eagle Creek Canyon to provide secondary control to prevent groundwater levels from rising beneath this area of the proposed landfill.

Mitigation Measures

Mitigation SR-1:

Aquifer tests will be performed during final engineering design to confirm the seepage recovery well pumping rates and aquifer characteristics. The tests will be performed by constructing one of the seepage recovery wells and pumping the well while observing the drawdown in at least two seepage recovery or monitoring wells. If available, additional observation wells will be monitored. Upon completion of this testing the model will be re-run and the optimal locations of the remainder of the seepage recovery wells will be determined to effectively capture water from the Lower Reservoir and maintain groundwater level rises and drawdown at less than significant levels beneath the CRA.

Mitigation SR-2:

A testing program will also be employed for seepage recovery wells for the Upper Reservoir. However, the purpose of these tests is to assess the interconnectedness of the joints and fractures and the pumping extraction rate. Drawdown observations will be made in nearby observation wells to support final engineering design.

Mitigation SR-3:

A groundwater level monitoring network will be developed to confirm that seepage recovery well pumping is effective at managing groundwater levels beneath the CRA and in the Eagle Creek Canyon portion of the proposed landfill. The monitoring network will consist of both existing and new monitoring wells to assess changes in groundwater levels beneath the landfill and the CRA. In addition to the proposed monitoring wells, groundwater levels, water quality, and production will be recorded at the Project seepage recovery wells.

Mitigation SR-4:

Seepage from the upper reservoir will be maintained below the bottom elevation of the landfill liner. Seepage from the Lower Reservoir will be maintained to prevent significant rise in water levels beneath the CRA.

Alternative Mitigation Measure:

As shown in the analyses for the Project water supply well pumping assessment, the cumulative change in groundwater levels beneath the CRA (near OW03) over the 50-year life of the Project are projected to be drawn down by about 14 feet as a result of pumping for the proposed projects – pumped-storage project, landfill project, and solar projects – and other existing uses in the basin (GEI, 2009). The Project water supply pumping will result in about 6 feet of drawdown. Project pumping drawdown could be mitigated by managing seepage from the reservoirs, which, if left unimpeded, could raise groundwater levels by up to 3 feet. Implementation of this option would require confirmation of groundwater level rises and water quality of the resulting seepage.

Mitigation SR-5:

Groundwater monitoring will be performed on a quarterly basis for the first four years of Project pumping and thereafter may be extended to bi-annually or annually depending on the findings. Annual reports will be prepared and distributed to interested parties.

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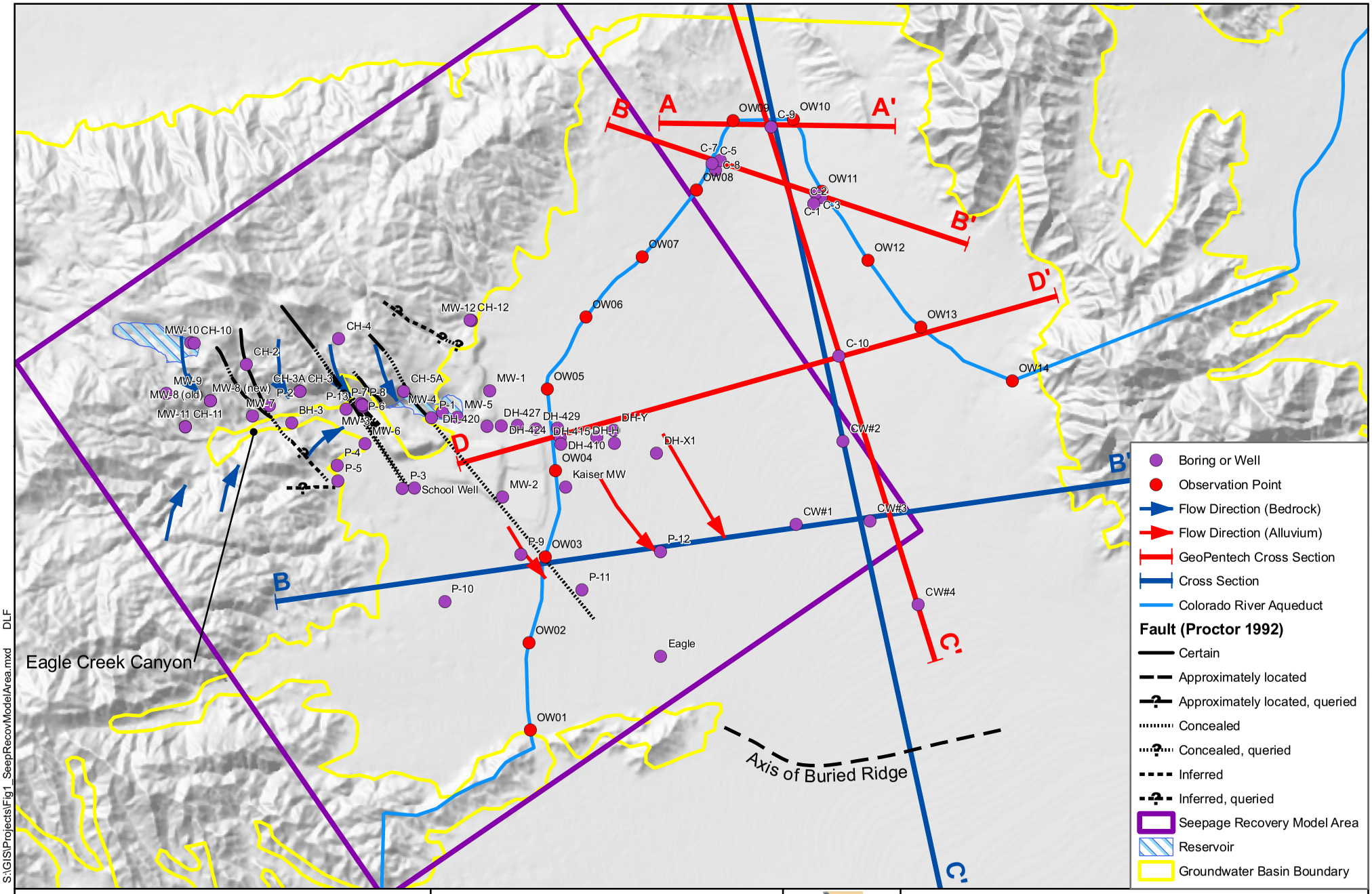
Proctor, Richard J., July 31, 1992. Largest Faults and General Geologic Units at Eagle Mtn. Landfill Site, Plate 1.

Figures



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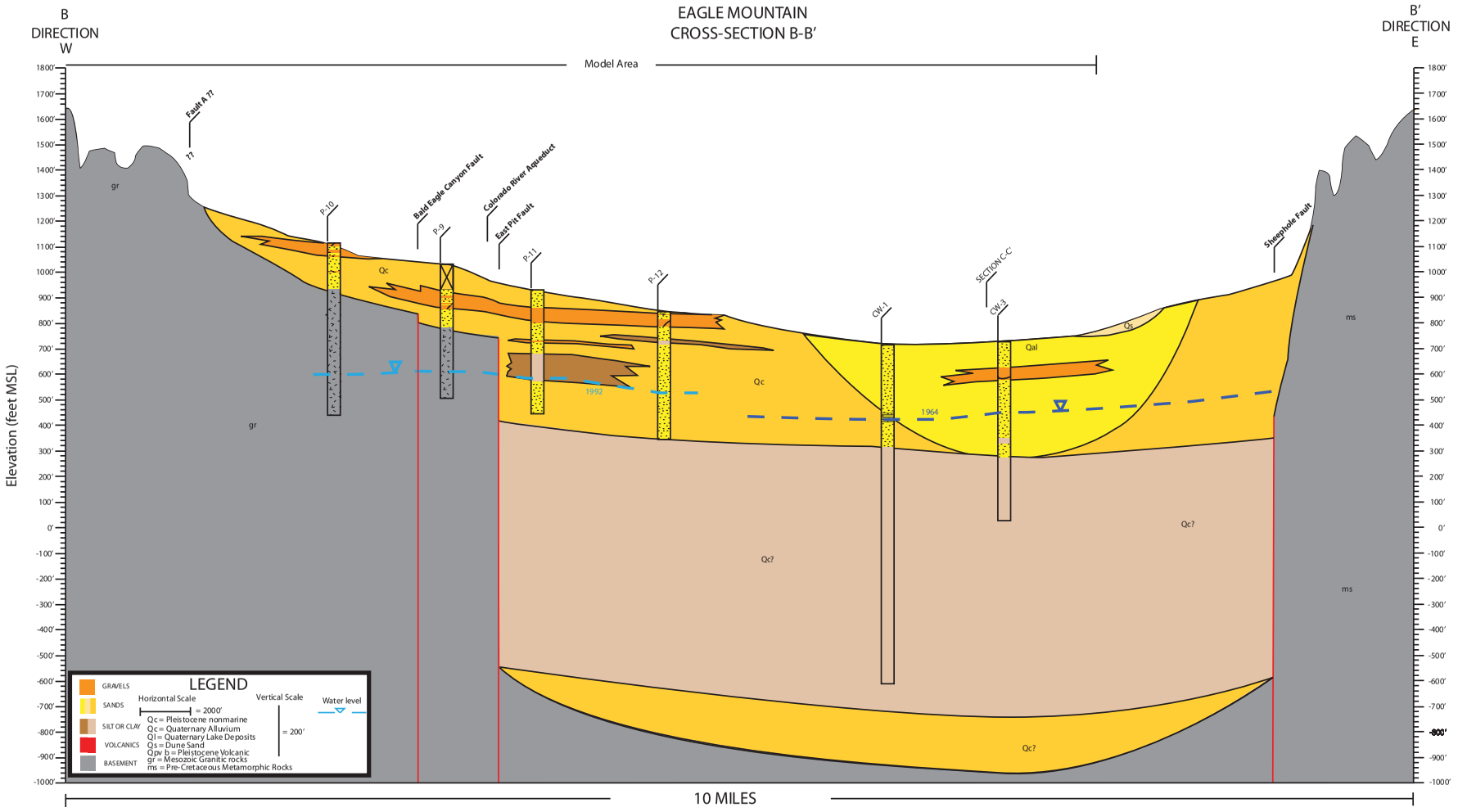
31-Mar-2009

Pumped Storage Project
Eagle Mountain, California

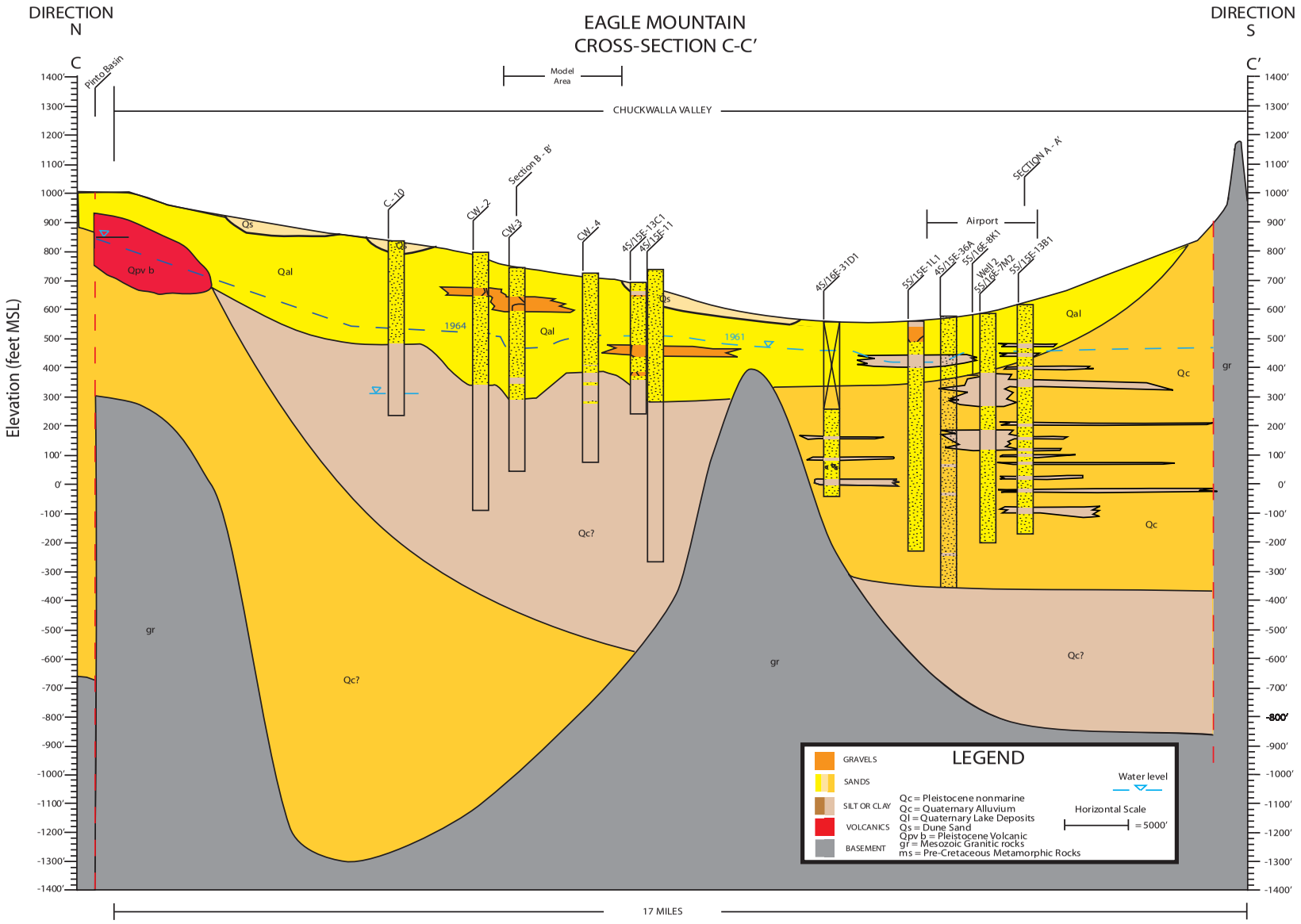
Eagle Crest Energy Company

SEEPAGE RECOVERY MODEL AREA

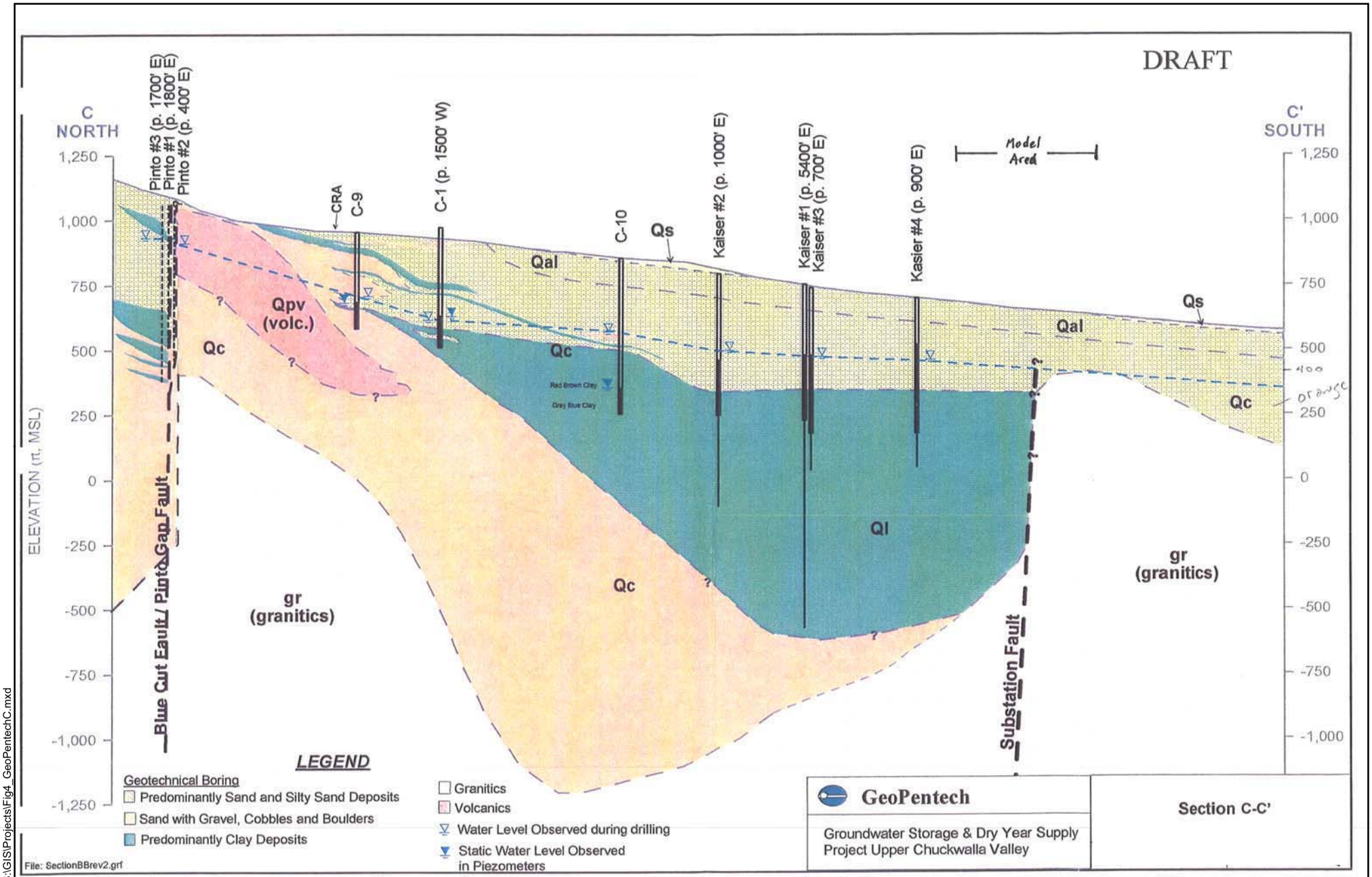
MARCH 2009 FIGURE 1



EAGLE MOUNTAIN PUMPED STORAGE EAGLE MOUNTAIN, CA	Eagle Crest Energy Company	CROSS-SECTION B-B'
EAGLE CREST ENERGY COMPANY		MARCH 2009 FIGURE 2



EAGLE MOUNTAIN PUMPED STORAGE EAGLE MOUNTAIN, CALIFORNIA		CROSS-SECTION C - C'
EAGLE CREST ENERGY COMPANY		MARCH 2009 FIGURE 3



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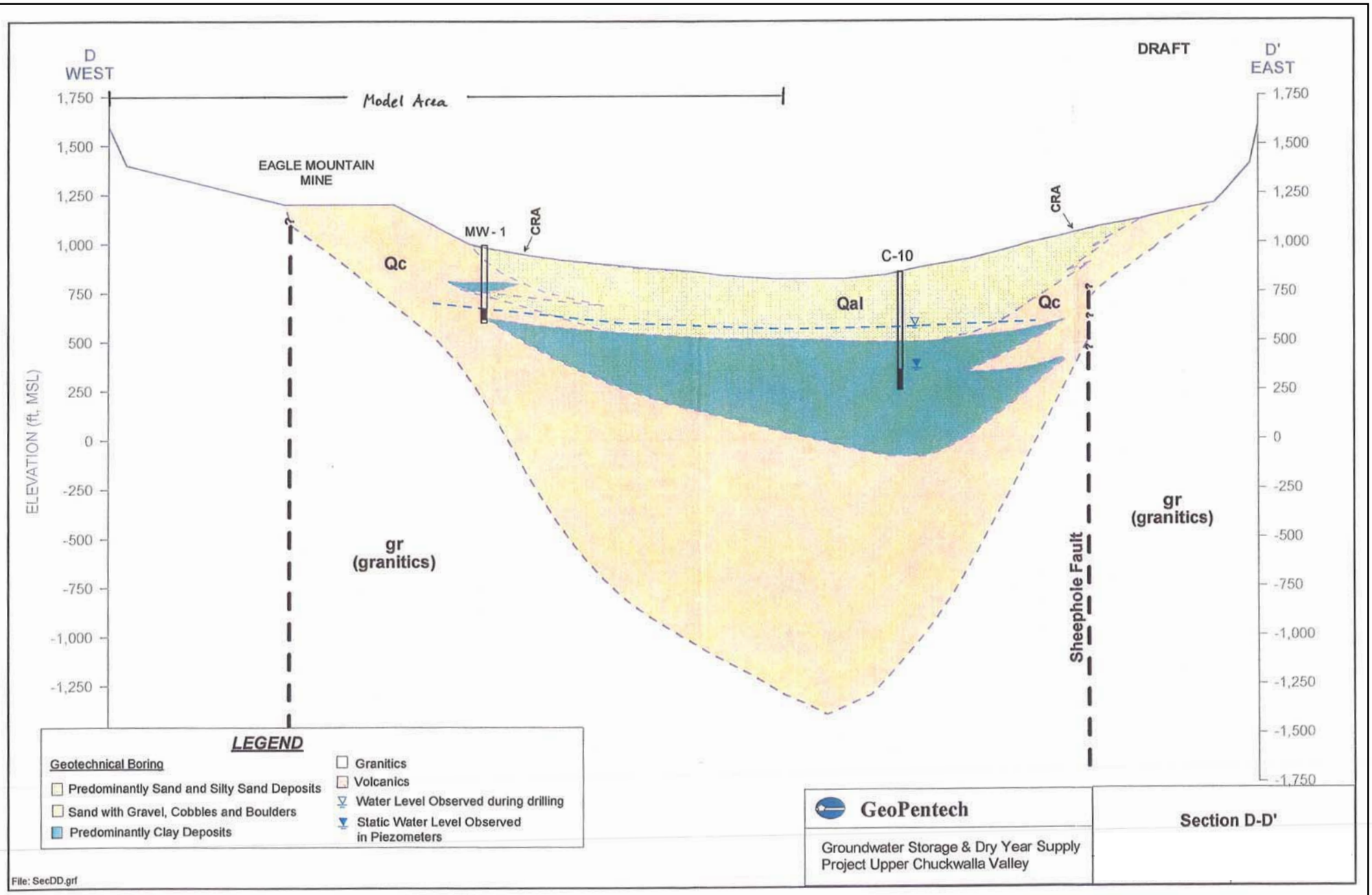
31-Mar-2009

	Pumped Storage Project Eagle Mountain, California		GEOPENTECH CROSS SECTION C-C'
	Eagle Crest Energy Company		MARCH 2009 FIGURE 4



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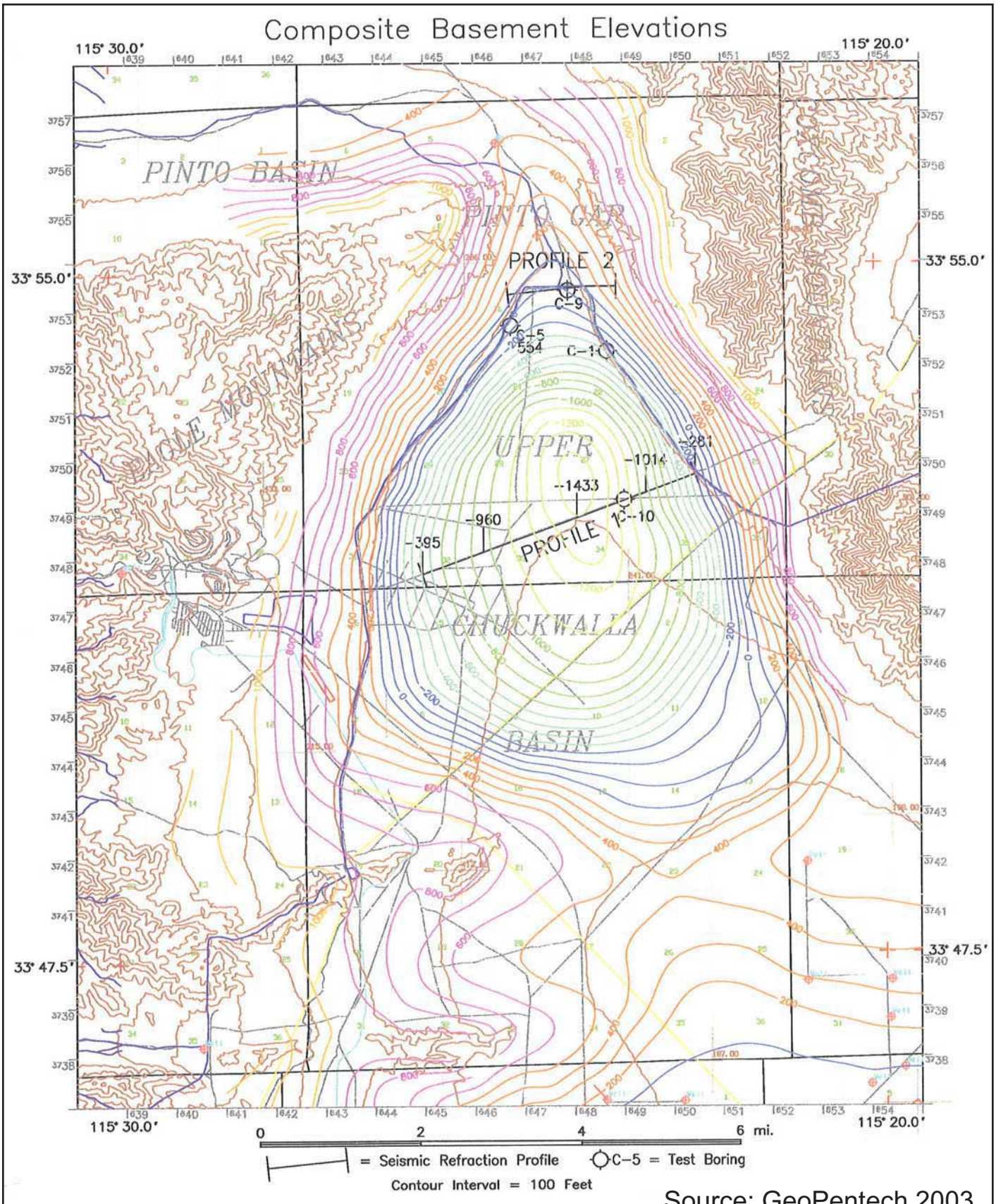
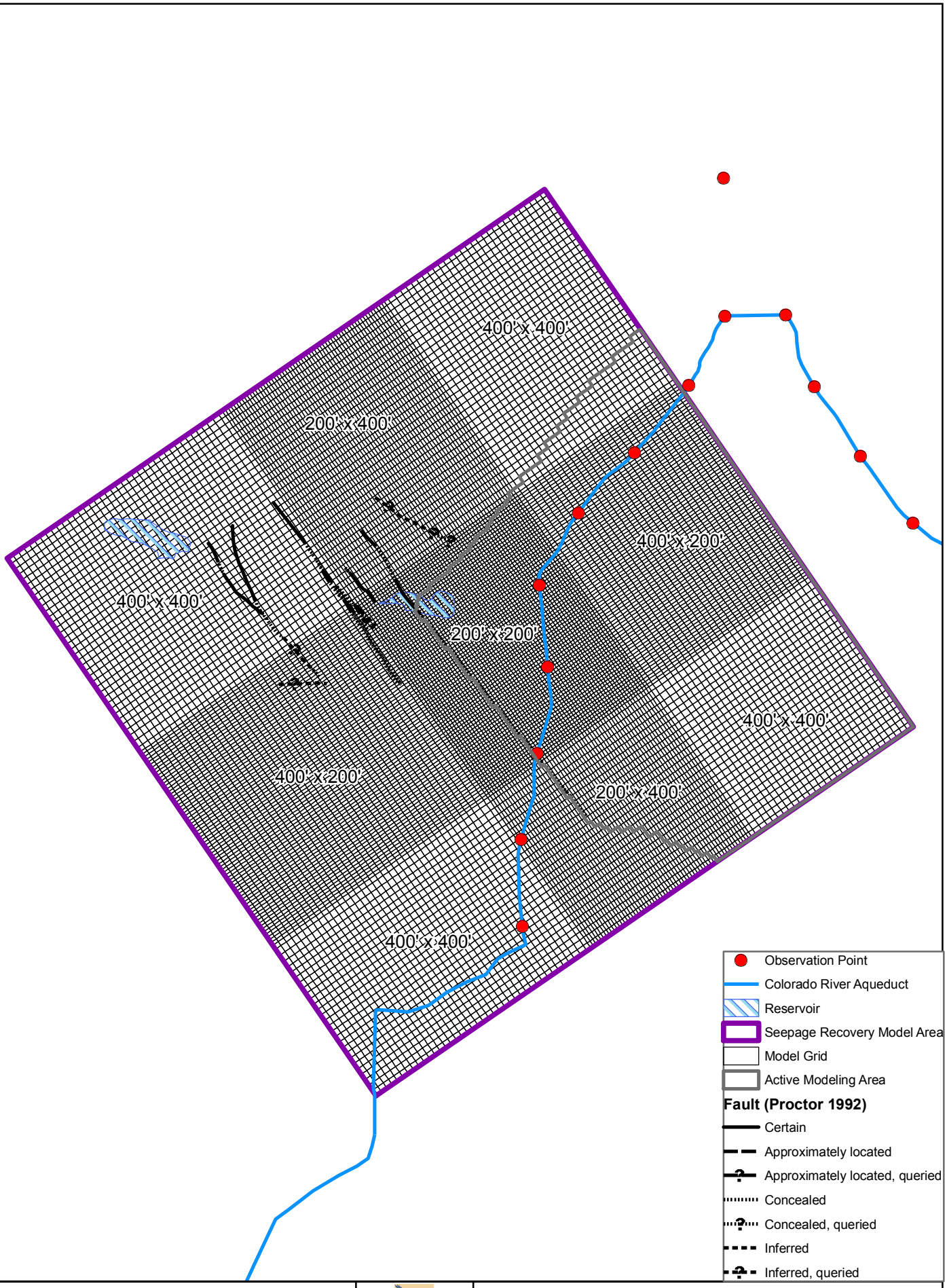
31-Mar-2009

	Pumped Storage Project Eagle Mountain, California		GEOPENTECH CROSS SECTION D-D'
	Eagle Crest Energy Company		MARCH 2009 FIGURE 5



Source: GeoPentech 2003.

Pumped Storage Project Eagle Mountain, California		BEDROCK ELEVATION MAP BASED ON BOUGOUR ANOMALIES
Eagle Crest Energy Company	Eagle Crest Energy Company	MARCH 2009 FIGURE 6



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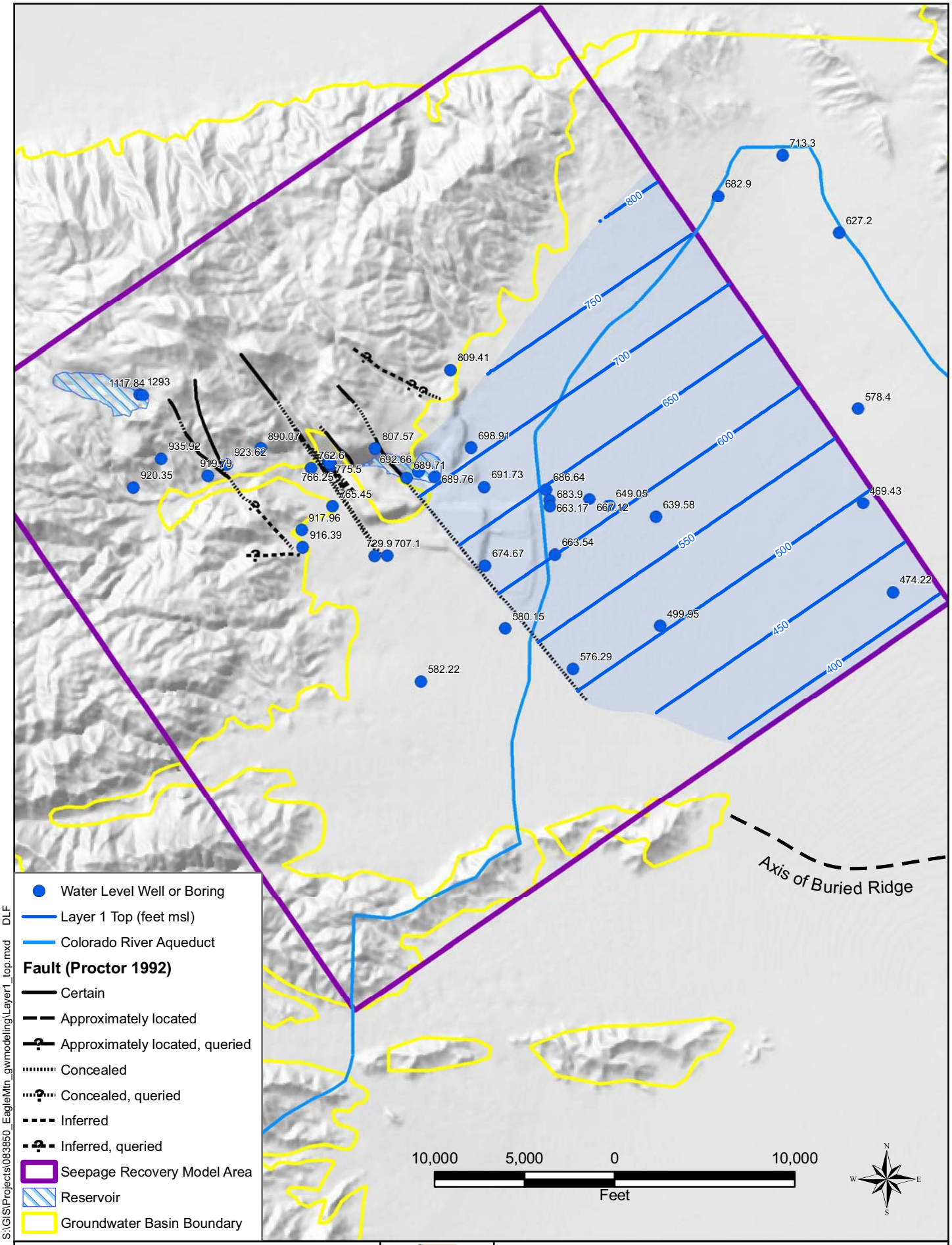
Pumped Storage Project Eagle Mountain, California		MODEL GRID
Eagle Crest Energy Company	Eagle Crest Energy Company	MARCH 2009 FIGURE 7



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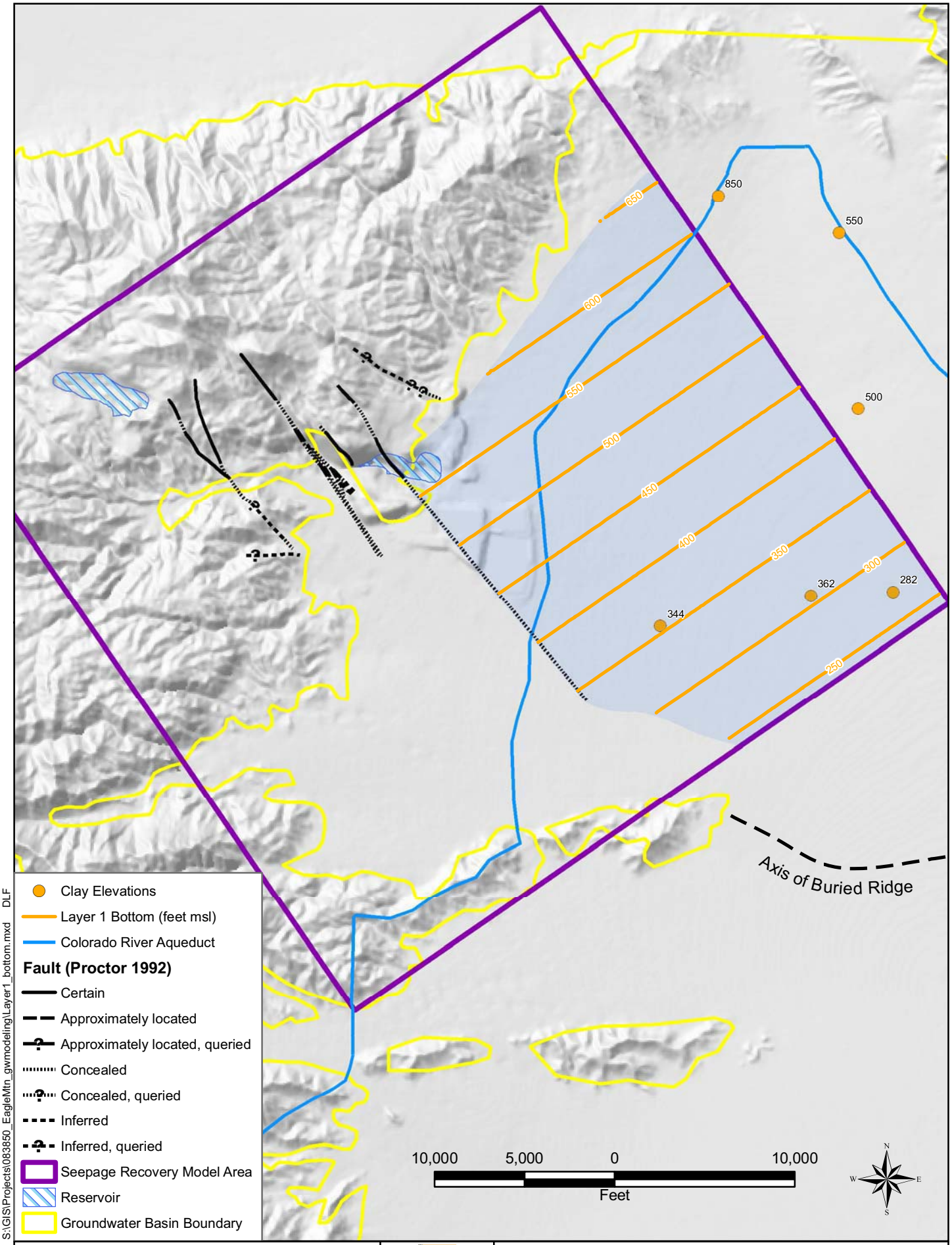
30-Mar-2009

Pumped Storage Project Eagle Mountain, California		TOP OF LAYER 1
Eagle Crest Energy Company		MARCH 2009 FIGURE 8



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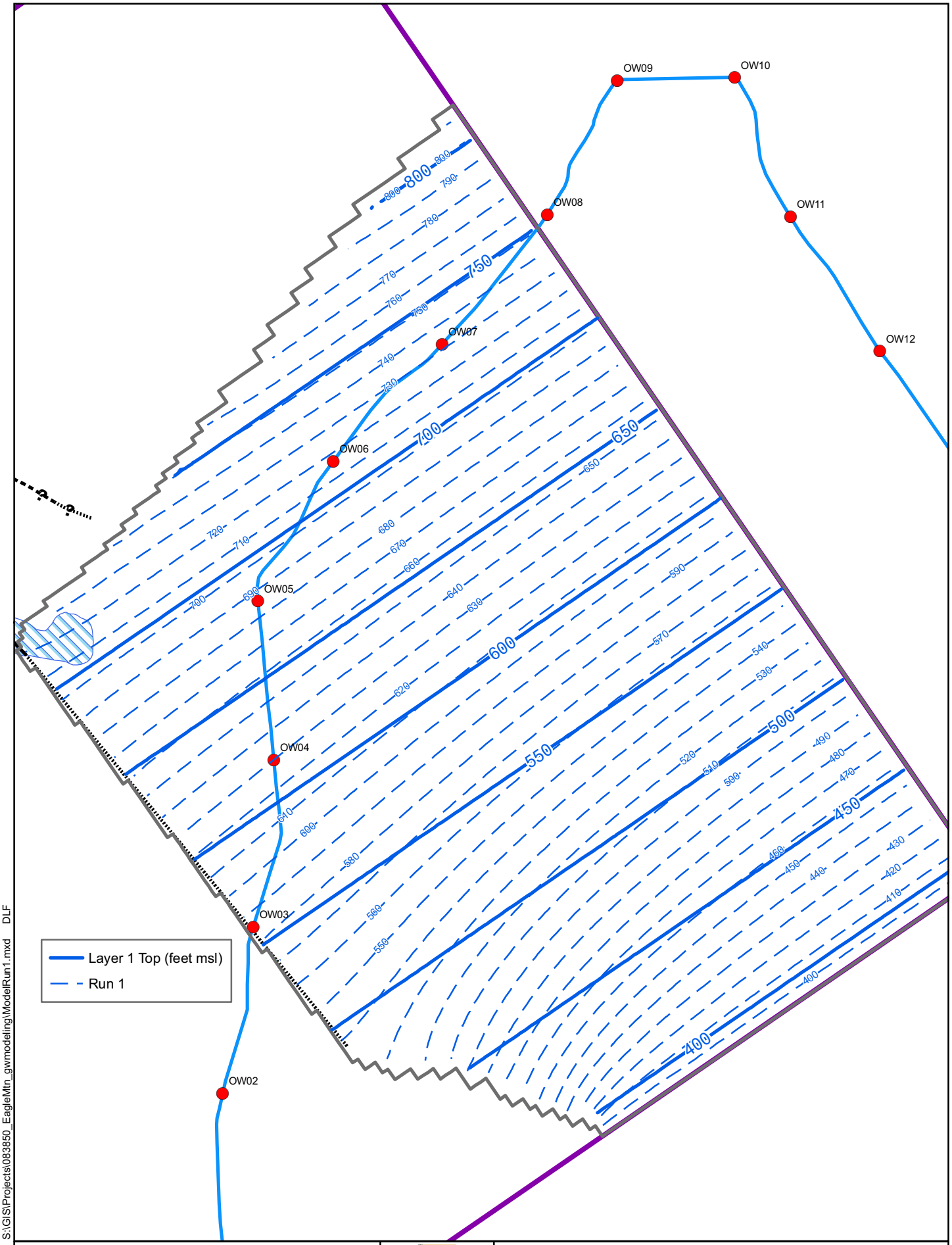
30-Mar-2009

Pumped Storage Project
Eagle Mountain, California

Eagle Crest Energy Company

BOTTOM OF LAYER 1

MARCH 2009 FIGURE 9



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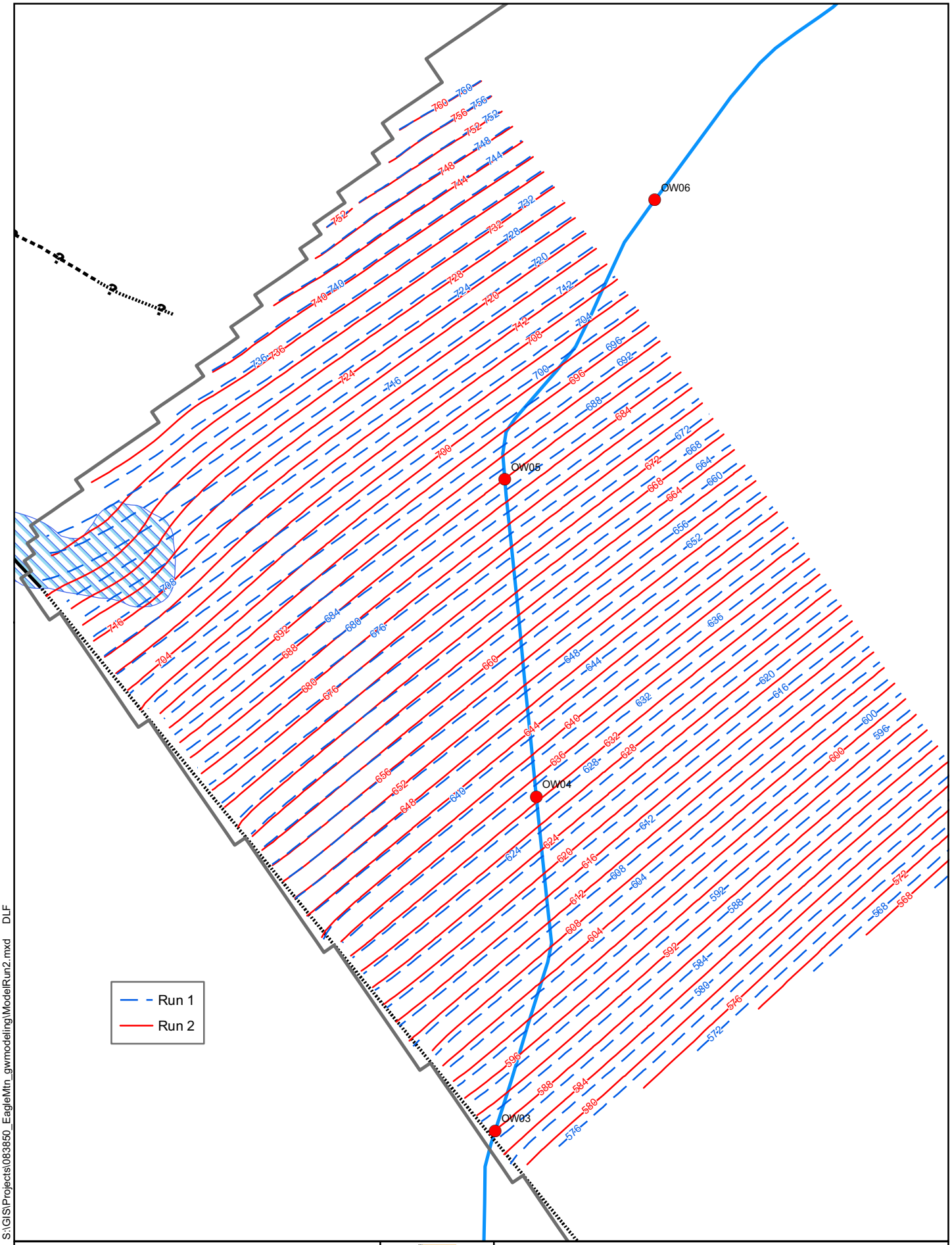
30-Mar-2009

Pumped Storage Project Eagle Mountain, California		LAYER 1 INPUT AND MODEL RESULTS RUN 1
Eagle Crest Energy Company	Eagle Crest Energy Company	MARCH 2009 FIGURE10



Pumped Storage Project
Eagle Mountain, California

Eagle Crest Energy Company

MODEL RESULTS RUNS 1 AND 2

MARCH 2009

FIGURE11

30-Mar-2009 S:\GIS\Projects\083850_EagleMtn_gwmodeling\ModelRun2.mxd DLF

FIGURE 12
GROUNDWATER LEVEL CHANGE OVER TIME AT OW03.2

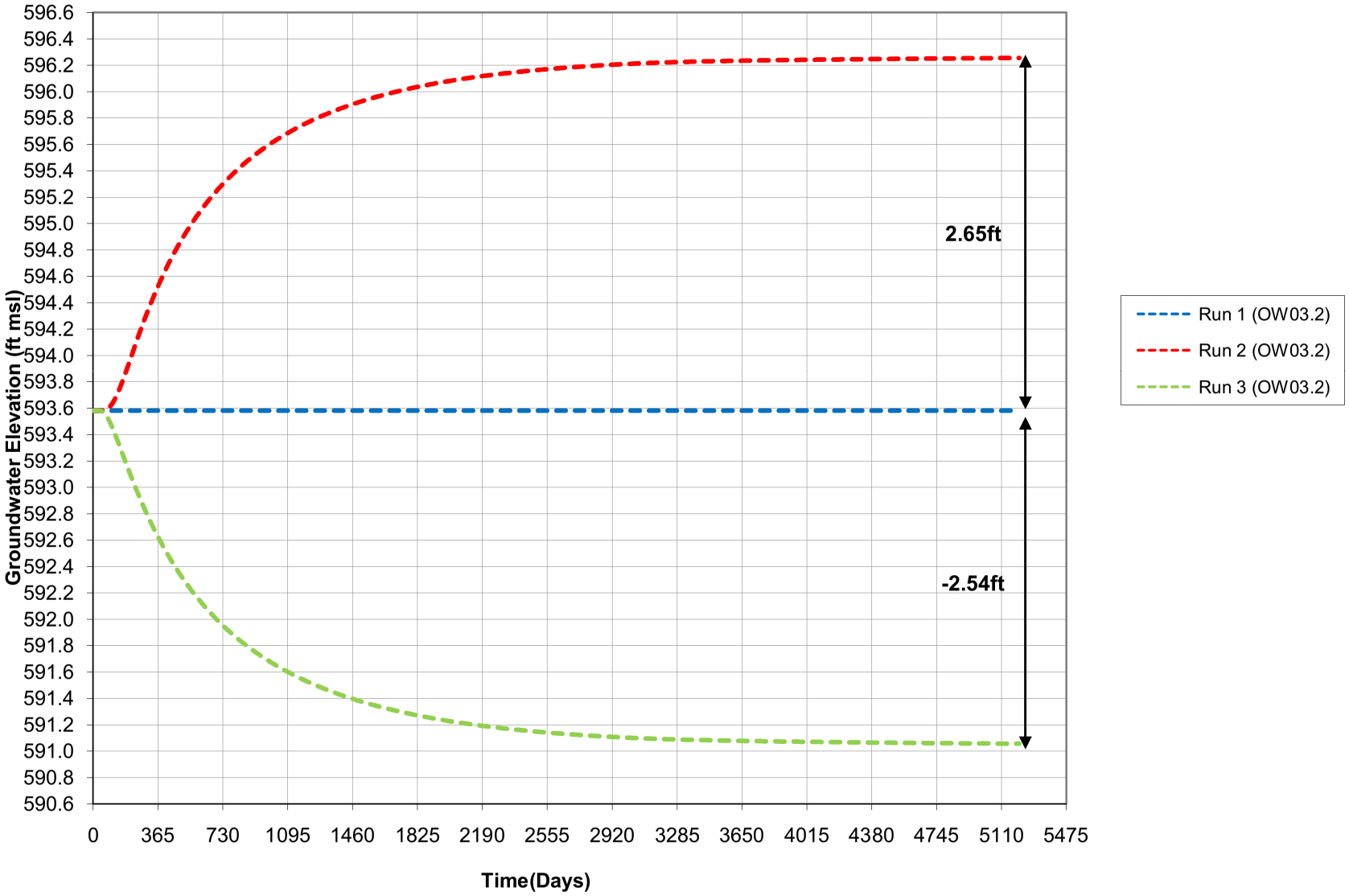


FIGURE 13
GROUNDWATER LEVEL CHANGE OVER TIME AT OW04

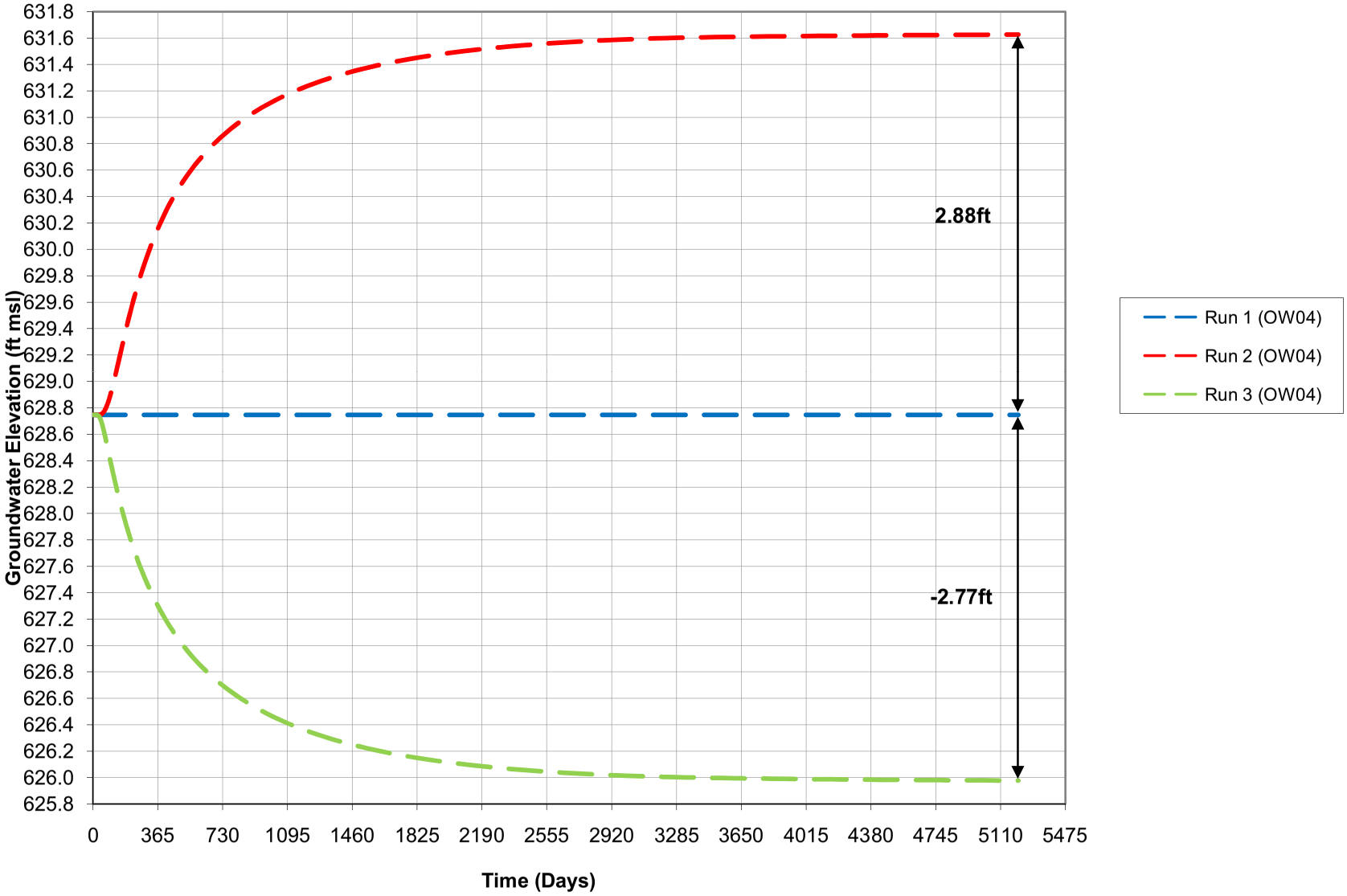
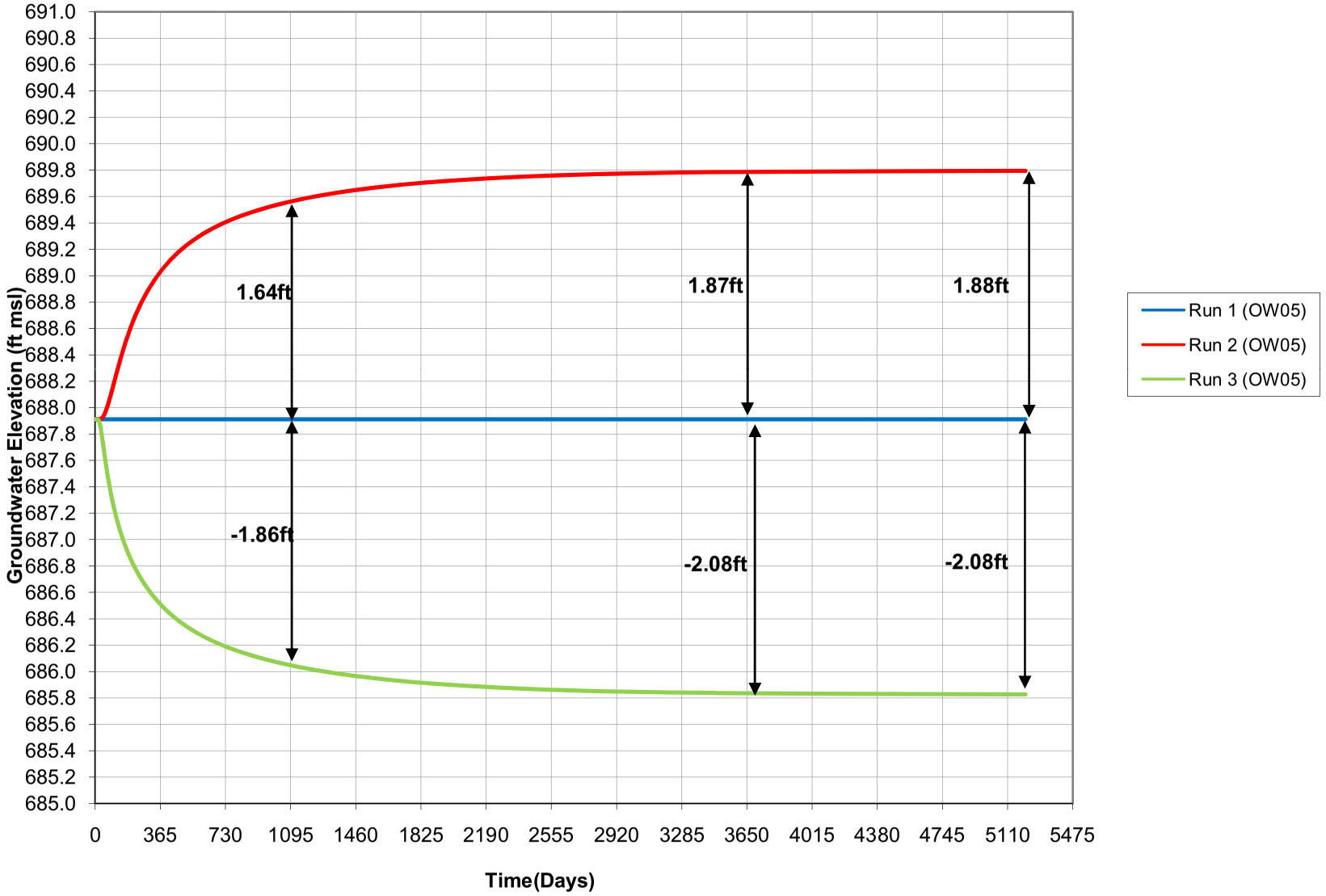
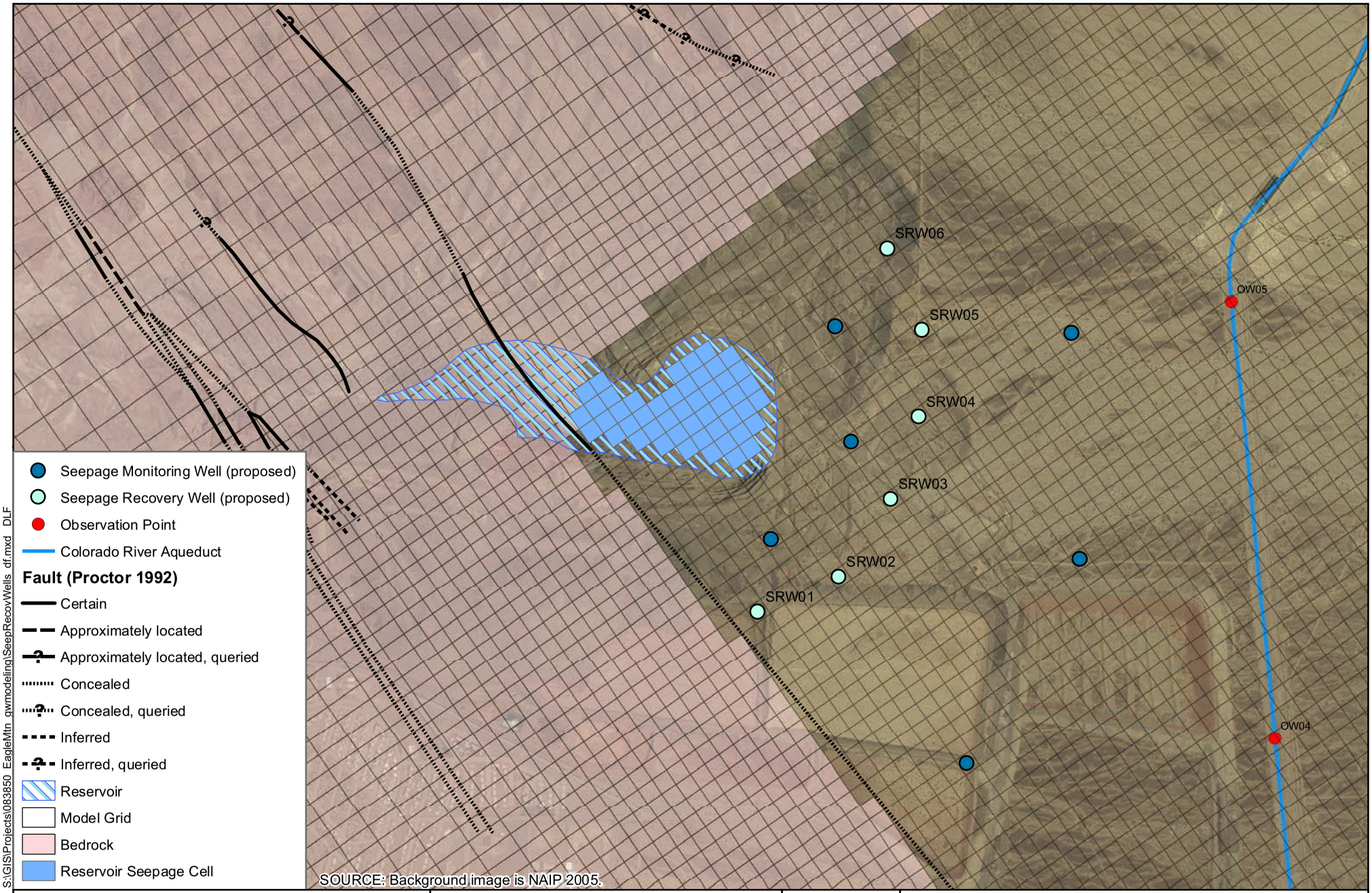


FIGURE 14
GROUNDWATER LEVEL CHANGE OVER TIME AT OW05





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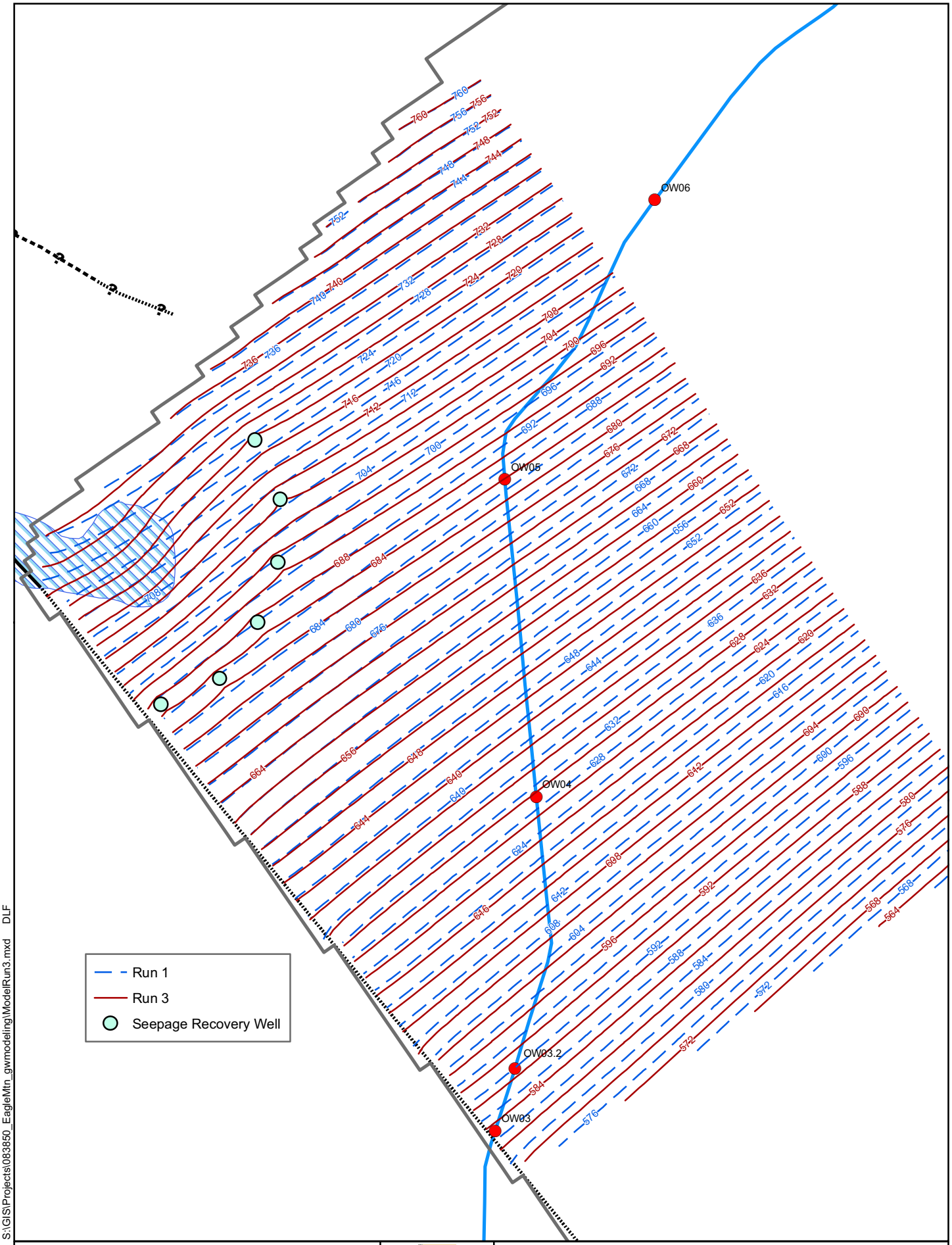
27-Mar-2009

Pumped Storage Project
Eagle Mountain, California

Eagle Crest Energy Company

LOCATION OF SEEPAGE RECOVERY WELLS

MARCH 2009 FIGURE 15



Pumped Storage Project
Eagle Mountain, California

Eagle Crest Energy Company

MODEL RESULTS RUNS 1 AND 3

MARCH 2009

FIGURE16

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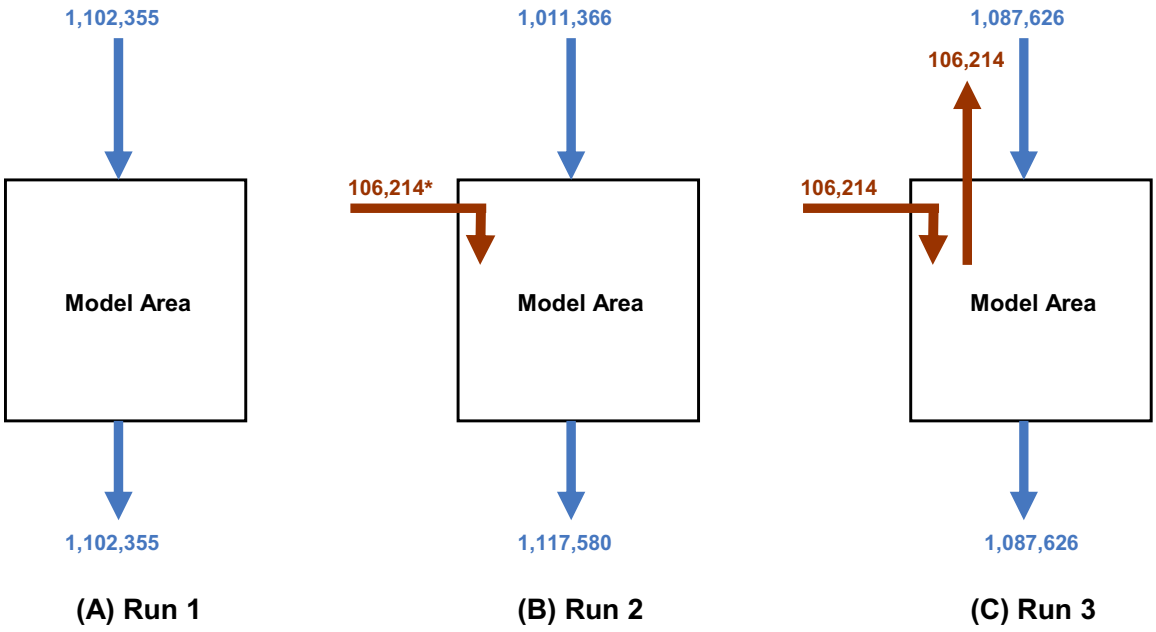
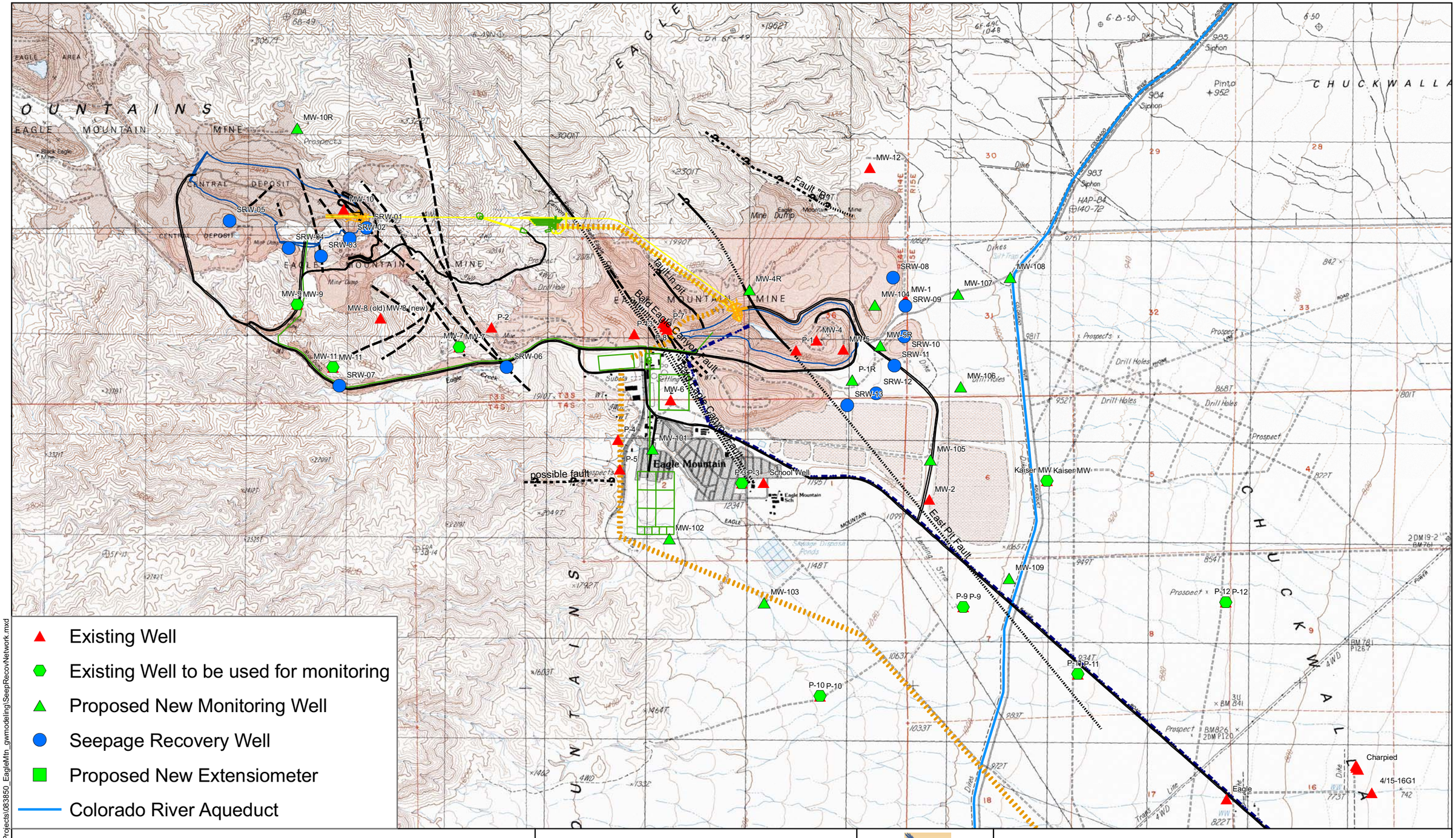
Figure 17 Mass Balance for Three Model Runs





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09-Apr-2009

Pumped Storage Project
Eagle Mountain, California

Eagle Crest Energy Company

MITIGATION AND MONITORING NETWORK

APRIL 2009

FIGURE 18

Tables

Table 1
Aquifer Characteristics Near Project Site

Well No./Name	Aquifer Material	Screen Interval (feet bgs)	Flow Rate (gpm)	Drawdown (feet)	Saturated Aquifer Thickness (feet)	Hydraulic Conductivity (ft/day)	Transmissivity (gpd/ft)
MW-1	Alluvium	325 - 385			51	7.1	2,700
MW-2	Alluvium	394-455	33	37	65	0.02	10
MW-2					65	0.37	180
MW-3	Bedrock	289 - 350	3.3	33			200
MW-4	Bedrock	60 - 140	3.5	47	40	0.02	6
MW-4					40	0.50	150
MW-5	Alluvium	180 - 240	20	25	30	2.0	450
MW-5					30	2.2	500
MW-5					30	7.1	1,600
MW-6	Bedrock	560 - 620	5	12	65	0.1	50
					65	1.4	680
					65	1.8	870
School Well	Bedrock	475-740	75	11	265	0.5	1,000
					265	5.1	10,105

Source: CH2MHill, 1996

TABLE 2

Proposed Mitigation Well Network and Maximum Allowable Changes From Seepage Recovery Pumping[1]

Existing Monitoring Wells or Piezometer

Well No./Name	Aquifer Material	Monitoring Purpose	Total Borehole Depth (feet)	Borehole Diameter (inches)	Casing Diameter (inches)	Screen Interval (feet bgs)		Maximum Allowable Drawdown (feet)	Maximum Allowable Water Elevation (feet msl)
						Top	Bottom		
P-2	Bedrock	Water Level Beneath Landfill	960	6.5	2	905	955		1,620
P-3	Bedrock	Brine Pond Downgradient	675	6.0	Unknown	613	663		
P-4	Bedrock	Brine Pond Upgradient	625	5.5	Unknown	575	625		
P-5	Bedrock	Brine Pond Upgradient	625	5.5	Unknown	575	625		
P-9	Bedrock	Lower Reservoir Seepage	525	5.6	Unknown	470	520		
P-10	Bedrock	Upper Reservoir Seepage	675	5.6	Unknown	625	675		
P-11	Alluvium	Lower Reservoir Seepage	485	5.5	Unknown	350	470	2	
MW-7	Bedrock	Water Level Beneath Landfill	785	10.6	4	666	726		1,560
MW-8	Bedrock	Water Level Beneath Landfill	871	13.5	Unknown	792	844		1,880
MW-9	Bedrock	Water Level Beneath Landfill	1,544	6.5	Unknown	Unknown	Unknown		2,350
MW-11	Bedrock	Water Level Beneath Landfill	1,130	13.5	Unknown	663	917		1,940
Kaiser MW	Alluvium	CRA	Unknown	Unknown	Unknown	Unknown	Unknown	3	
Existing Monitoring Wells to be Replaced									
P-1R	Alluvium	Lower Reservoir Pumping Contol	550	10	4	490	540	6	
MW-4R	Bedrock	Background Lower Reservoir	774	10	4	704	764		
MW-5R	Alluvium	Lower Reservoir Pumping Contol	418	10	4	348	408	6	
MW-10R	Bedrock	Background Upper Reservoir	1,672	10	4	1,558	1,662		1,464
New Monitoring Wells to be Constructed									
MW-101A	Alluvium	Brine Pond Downgradient	110	10	4	60	100	dry	
MW-101B	Bedrock	Brine Pond Downgradient	599	10	4	549	589		
MW-102A	Alluvium	Brine Pond Downgradient	110	10	4	60	100	dry	
MW-102B	Bedrock	Brine Pond Downgradient	658	10	4	608	648		
MW-103A	Alluvium	Brine Pond Downgradient	200	10	4	150	190	dry	
MW-103B	Bedrock	Brine Pond Downgradient	658	10	4	608	648		
MW-104	Alluvium	Lower Reservoir Pumping Contol	575	10	4	525	565	6	
MW-105	Alluvium	Lower Reservoir Seepage	552	10	4	502	542	4	
MW-106	Alluvium	Lower Reservoir Seepage	383	10	4	333	373	4	
MW-107	Alluvium	Lower Reservoir Seepage	353	10	4	303	343	4	
MW-108	Alluvium	CRA	318	10	4	268	308	2	
MW-109	Alluvium	CRA	497	10	4	447	487	3	

Seepage Recovery Wells to be Constructed

Well No./Name	Aquifer Material	Purpose	Total Borehole Depth (feet)	Borehole Diameter (inches)	Casing Diameter (inches)	Screen Interval (feet bgs)		Maximum Allowable Drawdown (feet)	Maximum Allowable Water Elevation (feet msl)
						Top	Bottom		
SRW-01	Bedrock	Upper Reservoir Seepage Recovery	1,477	10	6	1,353	1,467		2,540
SRW-02	Bedrock	Upper Reservoir Seepage Recovery	1,421	10	6	1,297	1,411		586
SRW-03	Bedrock	Upper Reservoir Seepage Recovery	1,359	10	6	1,235	1,349		586
SRW-04	Bedrock	Upper Reservoir Seepage Recovery	1,297	10	6	1,173	1,287		586
SRW-05	Bedrock	Upper Reservoir Seepage Recovery	1,522	10	6	1,398	1,512		586
SRW-06	Bedrock	Upper Reservoir Seepage Recovery	696	10	6	614	686		940
SRW-07	Bedrock	Upper Reservoir Seepage Recovery	1,043	10	6	969	1,033		2,060
SRW-08	Alluvium	Lower Reservoir Seepage Recovery	650	18	12	493	640	7	
SRW-09	Alluvium	Lower Reservoir Seepage Recovery	495	18	12	328	485	7	
SRW-10	Alluvium	Lower Reservoir Seepage Recovery	645	18	12	463	635	7	1,560
SRW-11	Alluvium	Lower Reservoir Seepage Recovery	575	18	12	385	565	7	
SRW-12	Alluvium	Lower Reservoir Seepage Recovery	640	18	12	453	630	7	
SRW-13	Alluvium	Lower Reservoir Seepage Recovery	695	18	12	513	685	7	

Footnote: [1] Drawdown projections soley due to Seepage Recovery Pumping

12.7 Schedule, Manpower, and Equipment Utilization During Construction of the Eagle Mountain Pumped Storage Project

Eagle Mountain Pumped Storage Project – Schedule, Manpower and Equipment Utilization During Construction

Prepared by: Richard Westmore, P.E., GEI Consultants, Inc.

April 9, 2009

Preparation of an environmental evaluation of the Eagle Mountain Pumped Storage Project under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) includes an assessment of construction-related impacts associated with the project. These impacts typically include: air quality (fugitive dust and carbon emissions from construction equipment operation); noise generated during construction; night-time light "pollution"; water quality concerns (erosion and sedimentation entering surface water bodies, as well as hazardous spills that might affect surface and ground water supplies); and socio-economic impacts on the region. Assessment of these construction-related impacts requires an evaluation of the probable construction schedule and the estimated quantities of work (excavation, fill placement, concrete production and placement, tunneling by boring machine and conventional methods, etc.) to identify the types and numbers of equipment pieces that are likely to be used over time, as well as the required labor force.

At this early stage in project design and given the complexity of the Eagle Mountain Project, it is difficult to develop an overall schedule of equipment and man-power that will closely follow what actually will occur during construction. However, the estimates provided in Attachment 1 represent a reasonable estimate of the type, schedule and monthly use of construction equipment, as well as the monthly man-power utilization during construction of the project. These estimates are based on an overall construction period of about 4 years and engineering judgment and experience relative to construction methods and procedures.

The estimated construction schedule is provided on Figure 1. Key features of the estimated schedule are summarized below:

First Year of Construction

General:

- Mobilize and construct temporary office, storage, maintenance and staging facilities.
- Construct and improve permanent and construction access roads.

Water Conduits:

- Proceed and erect Tunnel Boring Machine and start excavation of tailrace tunnel.

Power Plant:

- Construct access tunnel portal and start excavation of access tunnel.

Upper Reservoir:

- Excavation of approach channel to inlet/outlet works.

Production Wells:

- Begin Construction

Lower Reservoir:

- Start moving unstable tailings pile.
- Start to line lower reservoir.

Monitoring Wells:

- Begin Construction

Switchyard:

- Start switchyard construction.

Transmission Line:

- Start construction of transmission line foundations.

Second Year of Construction

Upper Reservoir:

- Complete excavation of approach tunnel.
- Complete construction of the south and west dams.
- Start Construction of inlet/outlet structures.
- Start lining of Reservoir.

Production Wells:

- Complete Construction

Lower Reservoir:

- Complete moving unstable tailings pile.
- Seepage control liner blanketing.
- Construct inlet/outlet works.

- Install water pipeline from wells, pumping plant, and reverse osmosis system.
- Begin to fill lower reservoir.

Monitoring Wells:
- Complete Construction

Water Conduits:
- Complete tailrace tunnel, manifold and draft tube tunnels.
- Move and erect Tunnel Boring Machine and excavate upper pressure tunnel.
- Excavate lower pressure tunnel, manifold and penstock tunnels.
- Start to excavate pressure shaft.
- Start Installation of steel tunnel linings.

Power Plant:
- Complete majority of underground power plant access.
- Finish excavation of access tunnel.
- Excavate powerhouse cavern.
- Excavate transformer gallery caverns.
- Embed spiral cases and draft tube liners.
- Start to install pump/turbines and generators.
- Start first stage and second stage concrete.
- Start to install electrical and mechanical equipment.

Transmission Line:
- Build foundations and towers.
- String high voltage transmission wires.

Switchyard:
- Complete switchyard and install equipment.

Third Year of Construction

Upper Reservoir:
- Seepage Control by blanketing with fines and grouting.
- Complete inlet/outlet works.

Lower Reservoir:
- Continue filling lower reservoir.

Water Conduits:
- Finish excavation of pressure shaft.
- Construct downstream surge chambers.
- Concrete line penstock and draft tube manifolds.
- Install steel linings in penstocks and concrete linings in draft tube tunnels.

Power Plant:
- Complete excavation of transformer gallery caverns.
- Construct cable tunnel and shaft.
- Complete first stage concrete.
- Start and complete superstructure concrete.
- Continue installation of pump/turbines.

- Continue installation of motor/generators.
- Continue installation of other mechanical and electrical equipment.
- Install water delivery pipeline, pump, and reverse osmosis system.
- Installation of mechanical and electrical equipment.

Fourth Year of Construction

Power Plant:

- Finish installation of pump/turbines.
- Finish installation of motor/generators.
- Continue and Finish installation of other mechanical and electrical equipment.
- Start architectural construction.
- Start startup and testing of units.
- Commission unit 1.
- Commission units 2, 3 and 4 at three month intervals ending the beginning of April.
- Complete architectural work.

Transmission Line:

- Test and energize high voltage transmission line.

Commercial Operation:

- June 2016.

Attachment 1 is organized as follows:

- Bar chart showing the major features of the project construction and the estimated duration in months for construction.

- The schedule bar chart with an overlay graph showing the total number of persons working on the project per month. The peak work force is estimated to be 209 laborers. The total work force is estimated to be 4,674 person months over the duration of construction.

- The schedule bar chart with an overlay graph showing the total number of on-site equipment items, daily concrete trucks (on-site), and daily heavy trucks (on-site) required for the project per month. The peak monthly on-site equipment items are estimated to be 150 items. The peak daily concrete trucks (on-site) are estimated to be 210 trucks. This estimate assumes the trucks are traveling to and from an on-site batch plant. The peak daily heavy trucks (on-site) are estimated to be 258 trucks. This estimate assumes the trucks are hauling materials to and from locations on-site.

- The schedule bar chart with an overlay graph showing the total number of off-site trucks working on the project per month. The peak monthly off-site truck volume is estimated to be 75 trucks. The total off-site truck volume is estimated to be 925 trucks for the duration of construction. This estimate assumes the off-site trucks are importing the necessary construction materials to the site such as steel linings, steel reinforcement, electrical components, etc.

- The schedule bar chart with an overlay graph showing the total labor cost for staff working on the project per month. The peak monthly labor cost is estimated to be $2.51 million.

- The schedule bar chart with an overlay graph showing the cumulative total labor cost for staff working on the project. The cumulative labor cost for the project is estimated to be $58 million.

- A summary table showing the average crew size for each major feature of the project construction, the associated average duration in months, and the total number of person months for each item and for the complete project.

- A summary table showing the type and total number of equipment required for each major feature of the project construction.

- A summary table showing estimates of construction crew member's basic hourly wages and hourly wages including the contractor's overhead and profit.

- A summary table showing a typical pumped-storage project operations crew, and their associated annual salaries. Also shown is a table presenting the annual operations and maintenance costs expected to occur over the project duration.

- A table showing the typical equipment and task production rates used in calculations for the duration and quantity of equipment required for each major feature of the project construction.

- A list of major construction activities and items required for the pumped-storage project.

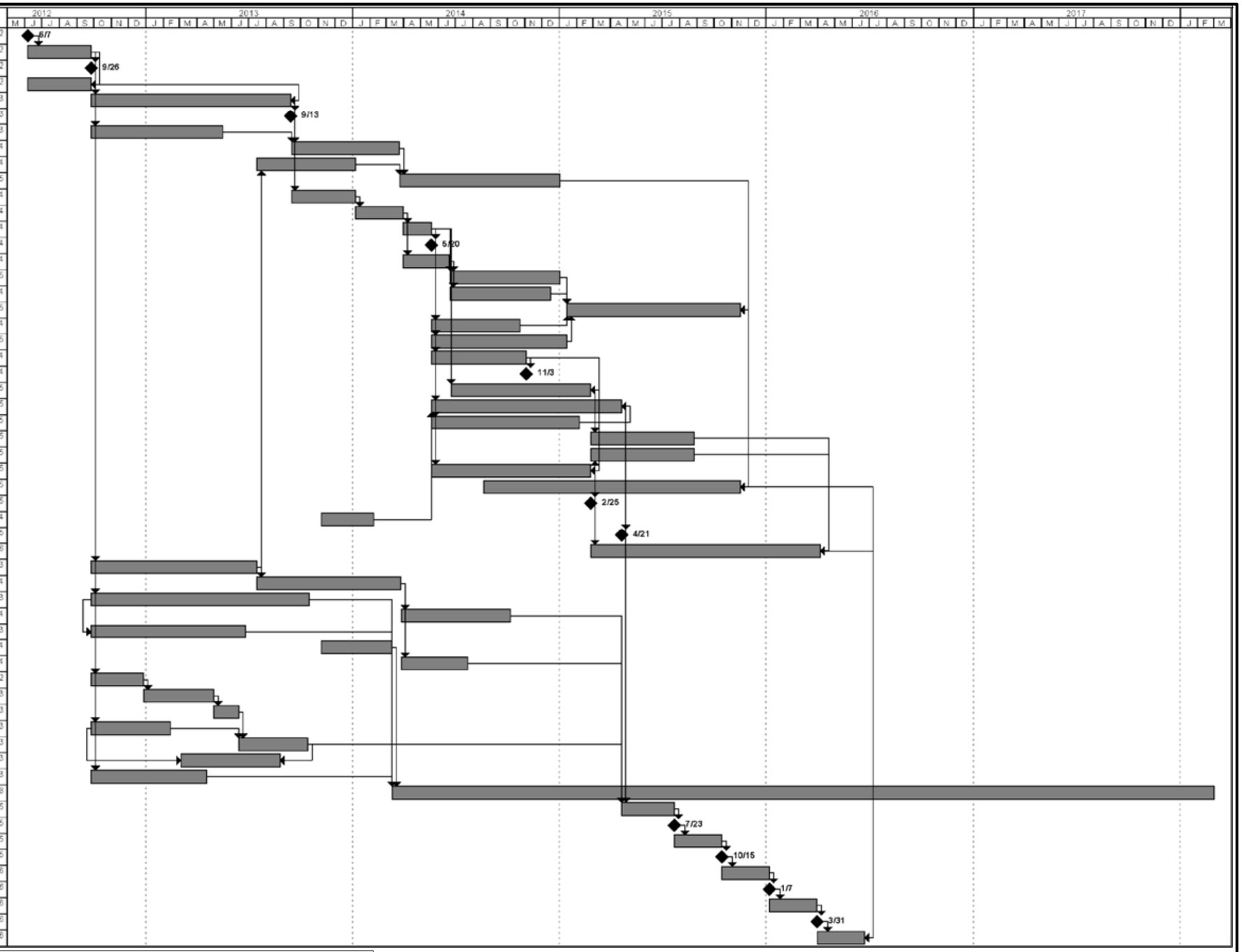
- Equipment and crew size calculation spreadsheets for each major feature of the project construction. Only project features with construction durations are presented.

- Tunnel excavation advancement rate calculation spreadsheet. The spreadsheet includes advancement rates for Tunnel Boring Machine (TBM) and Drill and Blast (D&B) excavation methods.

- Project features and cost estimate spreadsheet. Includes quantities and unit prices for major project features.

- Project reservoir filling calculations and associated charts.

ID	Task Name	Duration	Start	Finish
1	Notice to Proceed	0 days	Thu 6/7/12	Thu 6/7/12
2	Civil Contractor Mobilization	16 wks	Thu 6/7/12	Wed 9/26/12
3	Civil Contractor Mobilized	0 days	Wed 9/26/12	Wed 9/26/12
4	Construct Access Roads	16 wks	Thu 6/7/12	Wed 9/26/12
5	Excavate Power House Access Tunnel	50.4 wks	Thu 9/27/12	Fri 9/13/13
6	Complete Access Tunnel Excavation	0 days	Fri 9/13/13	Fri 9/13/13
7	Excavate Tailrace Tunnel	33.2 wks	Thu 9/27/12	Thu 5/16/13
8	Excavate Lower Pressure Tunnel	27.3 wks	Mon 9/16/13	Tue 3/25/14
9	Excavate Upper Pressure Tunnel	24.7 wks	Wed 7/17/13	Mon 1/6/14
10	Excavate Pressure Shaft	40.6 wks	Tue 3/25/14	Fri 1/2/15
11	Excavate Top Heading	16.1 wks	Mon 9/16/13	Mon 1/6/14
12	Roof Anchorage and Lining	12.1 wks	Mon 1/6/14	Mon 3/31/14
13	Excavate Remainder of Cavern	7.1 wks	Tue 4/1/14	Tue 5/20/14
14	Complete Power House Excavation	0 days	Tue 5/20/14	Tue 5/20/14
15	Excavate Transformer Gallery	11.8 wks	Tue 4/1/14	Fri 6/20/14
16	Excavate Tailrace Surge Chamber	27.8 wks	Mon 6/23/14	Thu 1/1/15
17	Excavate Cable Tunnel Shaft	25.4 wks	Mon 6/23/14	Tue 12/16/14
18	Line and Pave Cable Tunnel	43.6 wks	Thu 1/15/15	Mon 11/16/15
19	Line Penstocks and Draft Tube Manifolds	22.5 wks	Tue 5/20/14	Thu 10/23/14
20	Install Steel Tunnel Linings	34.3 wks	Tue 5/20/14	Wed 1/14/15
21	First Stage Concrete	23.9 wks	Tue 5/20/14	Mon 11/3/14
22	Complete Power House 1st Stage Concrete	0 days	Mon 11/3/14	Mon 11/3/14
23	Install Spiral Cases and Draft Tube Liners	35.3 wks	Tue 6/24/14	Wed 2/25/15
24	Install Pump-Turbines and Generators	48 wks	Tue 5/20/14	Tue 4/21/15
25	Embed Spiral Cases and Draft Liners	37.5 wks	Tue 5/20/14	Thu 2/5/15
26	Install Mechanical Equipment	26 wks	Thu 2/26/15	Wed 8/26/15
27	Install Electrical Equipment	26 wks	Thu 2/26/15	Wed 8/26/15
28	Complete Concrete Work (2nd StelConc)	40.3 wks	Tue 5/20/14	Wed 2/25/15
29	Structural and Architectural Construction	64.5 wks	Thu 8/21/14	Mon 11/16/15
30	Complete Draft Tube, Spiral Case and Powerhous	0 days	Wed 2/25/15	Wed 2/25/15
31	Electrical and Mechanical Mobilization	13.4 wks	Thu 11/7/13	Fri 2/7/14
32	Complete Installation of Pump-Turbines, Generato	0 days	Tue 4/21/15	Tue 4/21/15
33	Complete Electrical Construction	57.9 wks	Thu 2/26/15	Wed 4/6/16
34	Excavate Approach Channel - Upper Reservoir	41.8 wks	Thu 9/27/12	Tue 7/16/13
35	Construct Upper Reservoir Dam	36.4 wks	Wed 7/17/13	Thu 3/27/14
36	Move Unstable Soil - Lower Reservoir	55.1 wks	Thu 9/27/12	Thu 10/17/13
37	Line Upper Reservoir	27.4 wks	Fri 3/28/14	Mon 10/6/14
38	Line Lower Reservoir	38.9 wks	Thu 9/27/12	Wed 6/26/13
39	Construct I/O Structure - Lower Reservoir	17.8 wks	Thu 11/7/13	Tue 3/11/14
40	Construct I/O Structure - Upper Reservoir	16.8 wks	Fri 3/28/14	Wed 7/23/14
41	Switchyard Excavation	13.3 wks	Thu 9/27/12	Fri 12/28/12
42	Switchyard Foundations	17.6 wks	Fri 12/28/12	Wed 5/1/13
43	Switchyard Structures	6.4 wks	Wed 5/1/13	Fri 6/14/13
44	Transmission Line Foundations	20 wks	Thu 9/27/12	Wed 2/13/13
45	Transmission Line Stringing	17.2 wks	Fri 6/14/13	Mon 10/14/13
46	Transmission Line Structures	25 wks	Mon 3/4/13	Mon 8/26/13
47	Install Water Supply Pipeline and RO System	29.2 wks	Thu 9/27/12	Thu 4/18/13
48	Reservoir Filling	207.6 wks	Wed 3/12/14	Fri 3/2/18
49	Unit 1 Startup	13.4 wks	Tue 4/21/15	Thu 7/23/15
50	U-1 Start-up	0 days	Thu 7/23/15	Thu 7/23/15
51	Unit 2 Startup	12 wks	Thu 7/23/15	Thu 10/15/15
52	U-2 Start-up	0 days	Thu 10/15/15	Thu 10/15/15
53	Unit 3 Startup	12 wks	Thu 10/15/15	Thu 1/7/16
54	U-3 Start-up	0 days	Thu 1/7/16	Thu 1/7/16
55	Unit 4 Startup	12 wks	Thu 1/7/16	Thu 3/31/16
56	U-4 Start-up	0 days	Thu 3/31/16	Thu 3/31/16
57	Finish Project	12 wks	Thu 3/31/16	Thu 6/23/16



Task — Progress — Summary — External Tasks — Deadline

Split — Milestone — Project Summary — External Milestone

Eagle Crest Energy Company

Eagle Mountain Pumped Storage Project
Eagle Mountain, California

Project 080472

ESTIMATED PROJECT CONSTRUCTION SCHEDULE

Eagle Crest Energy

GEI Consultants

February 2009 Figure 1

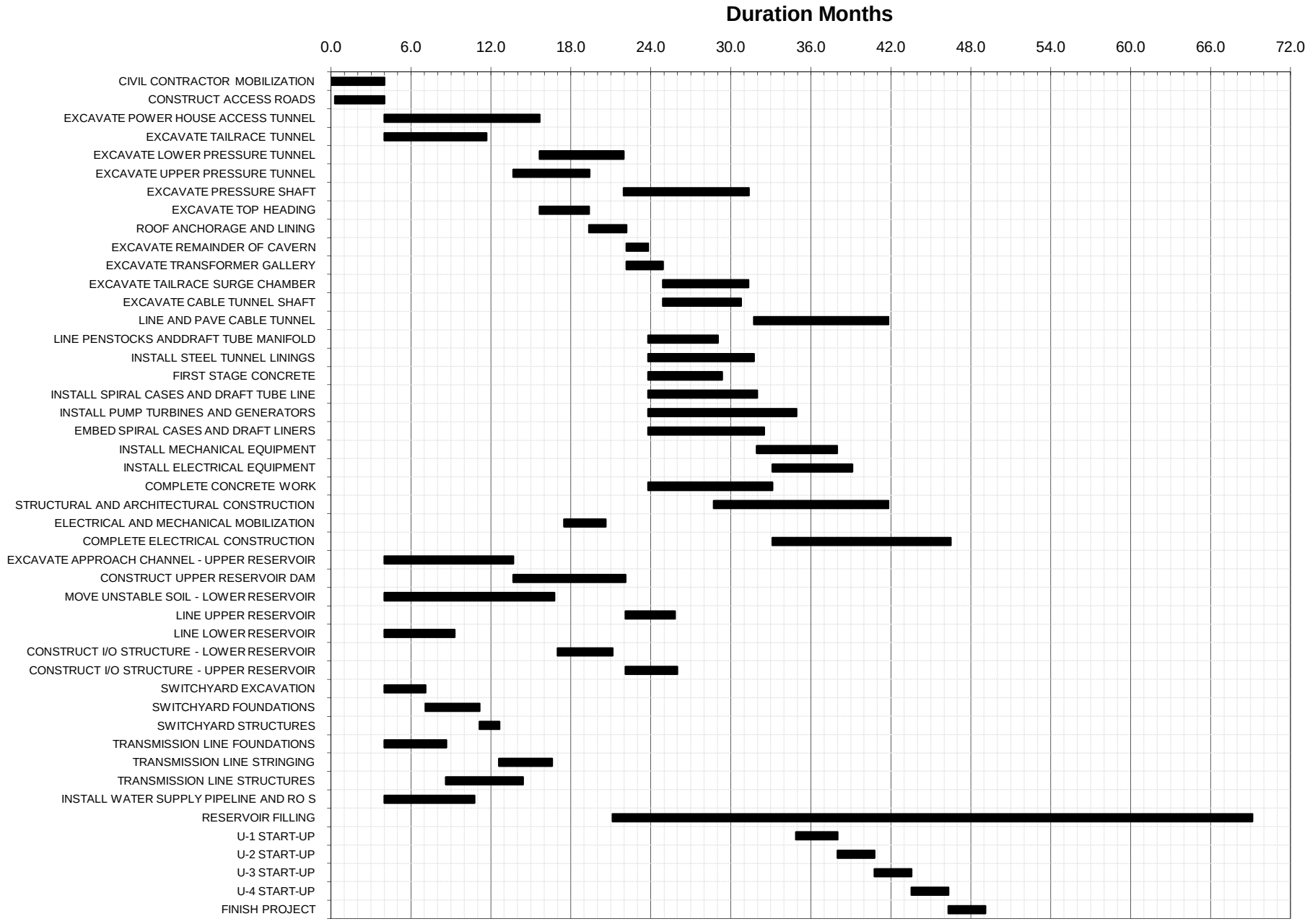
I:\NMiller\PROJECTS\080470 Eagle Mountain\Equipment\ Schedule.dwg Apr 2009

ATTACHMENT 1

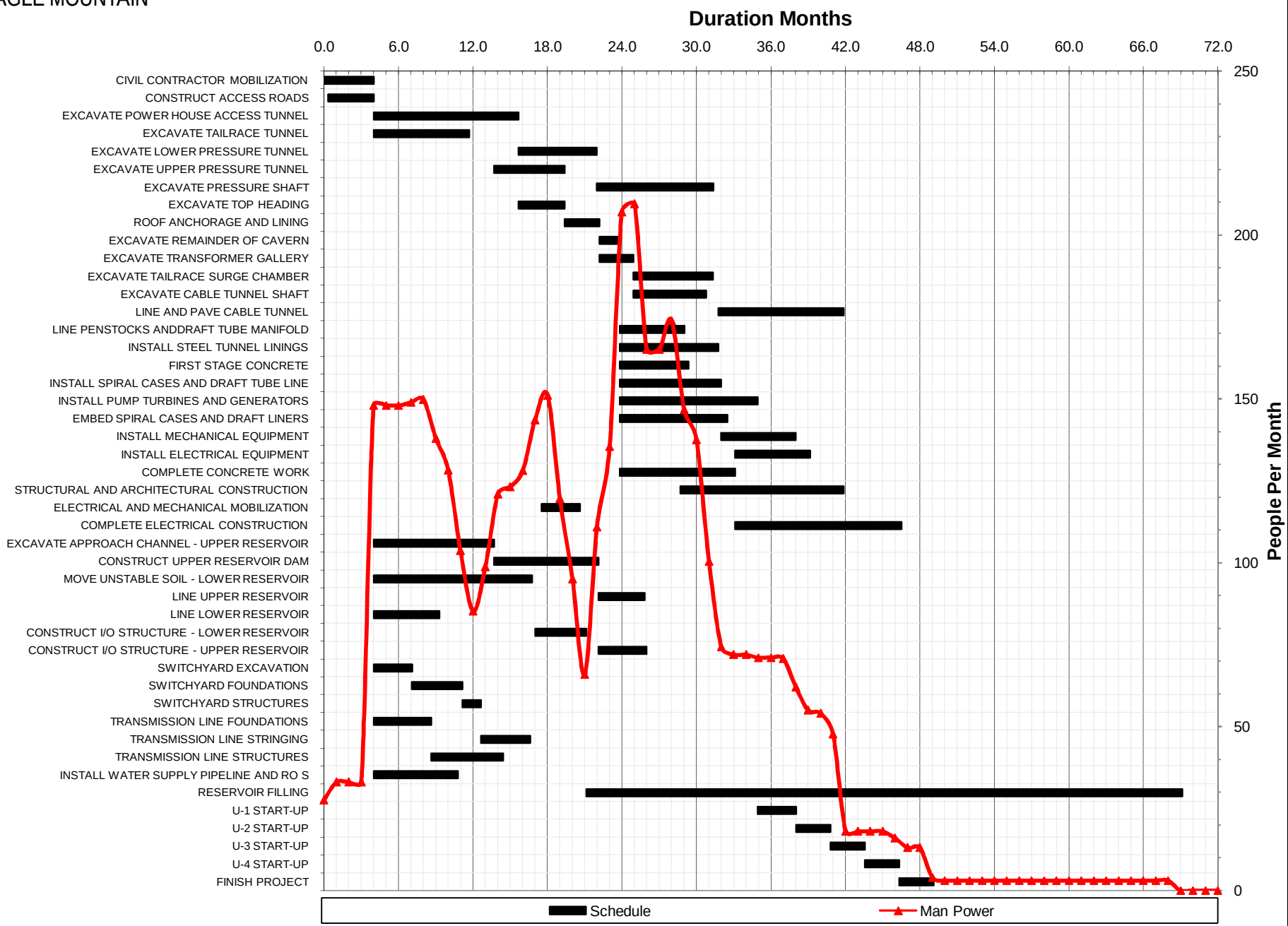
EAGLE MOUNTAIN
PUMPED STORAGE PROJECT

SCHEDULE, EQUIPMENT, AND MAN POWER ESTIMATES

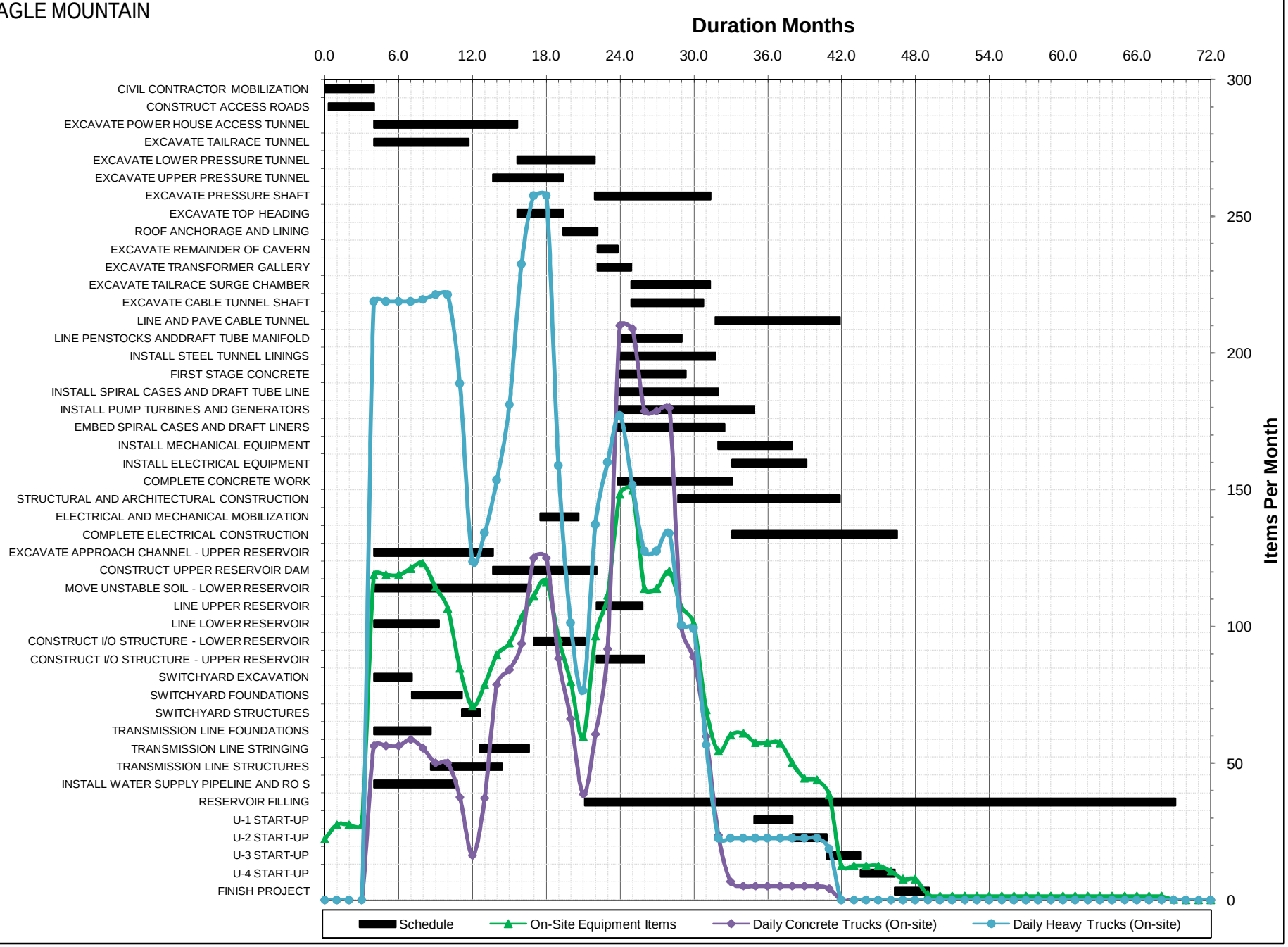
ESTIMATED CONSTRUCTION SCHEDULE
EAGLE MOUNTAIN



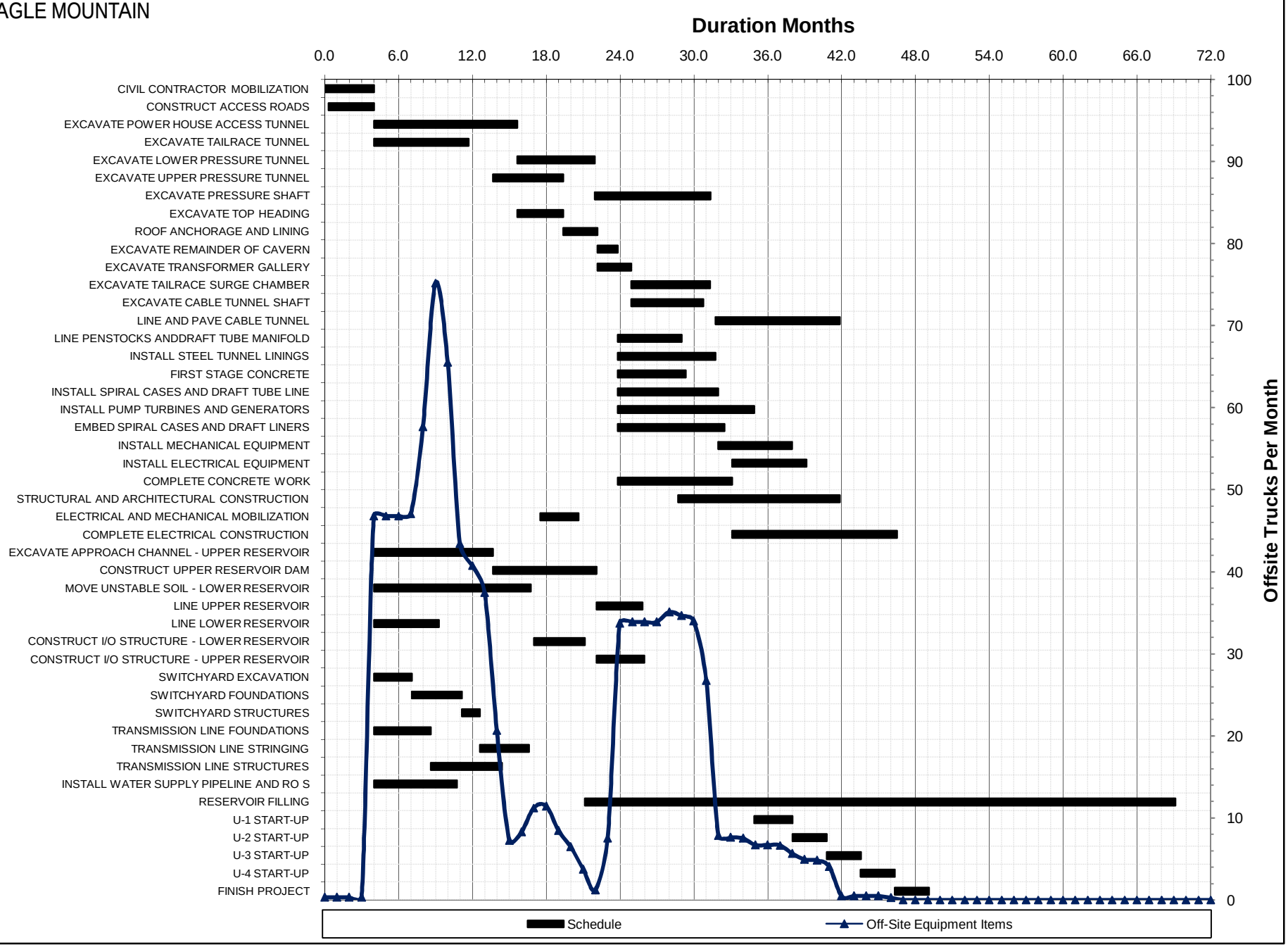
ESTIMATED CONSTRUCTION SCHEDULE & MAN POWER
EAGLE MOUNTAIN



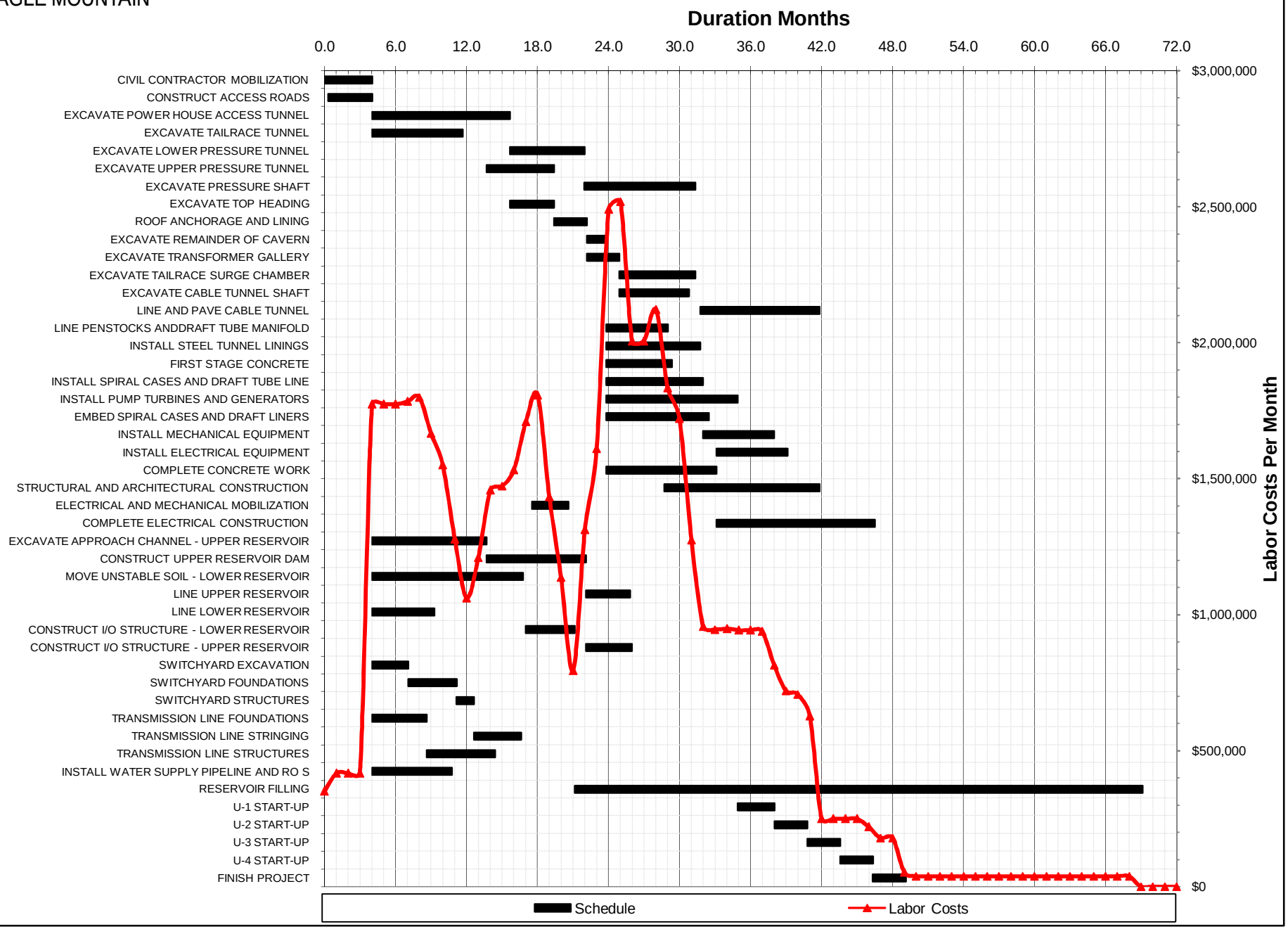
ESTIMATED CONSTRUCTION SCHEDULE & EQUIPMENT
EAGLE MOUNTAIN



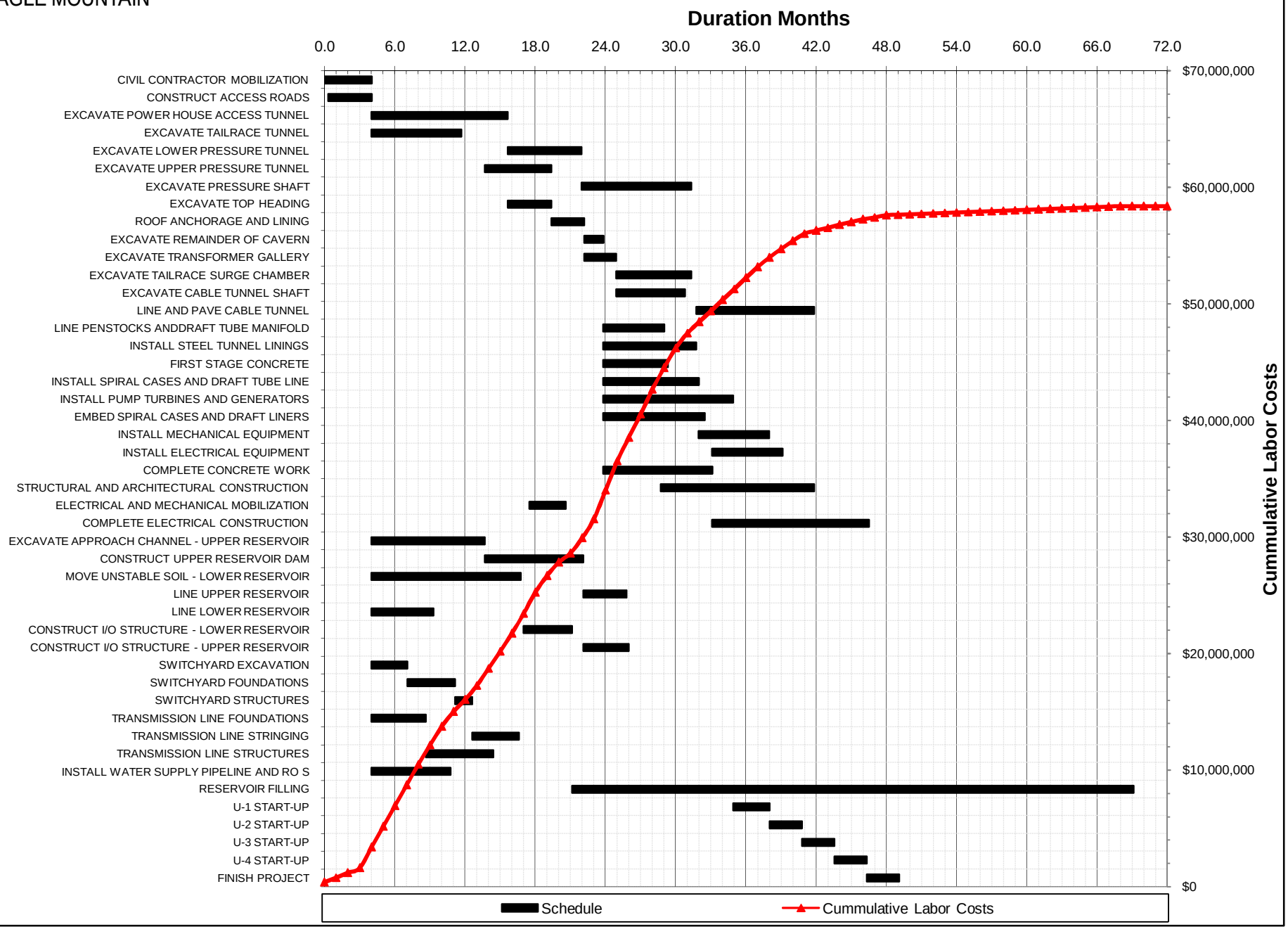
ESTIMATED CONSTRUCTION SCHEDULE & OFFSITE TRUCKS PER MONTH
EAGLE MOUNTAIN



ESTIMATED CONSTRUCTION SCHEDULE & MONTHLY LABOR COSTS
EAGLE MOUNTAIN



ESTIMATED CONSTRUCTION SCHEDULE & CUMMULATIVE LABOR COSTS
EAGLE MOUNTAIN



ESTIMATED CONSTRUCTION WORK FORCE
EAGLE MOUNTAIN PUMPED-STORAGE PROJECT

CONSTRUCTION SEGMENT	AVERAGE CREW SIZE (1)	AVERAGE DURATION (MONTHS) (2)	SHIFTS (3)		PERSON MONTHS (4)
			NUMBER	LENGTH (HRS)	
CIVIL CONTRACTOR MOBILIZATION	15	4	1	8	60
CONSTRUCT ACCESS ROADS	18	4	1	8	67
EXCAVATE POWER HOUSE ACCESS TUNNEL	23	12	1	8	268
EXCAVATE TAILRACE TUNNEL	26	8	1	8	199
EXCAVATE LOWER PRESSURE TUNNEL	16	6	1	8	101
EXCAVATE UPPER PRESSURE TUNNEL	29	6	1	8	166
EXCAVATE PRESSURE SHAFT	20	9	1	8	188
EXCAVATE TOP HEADING	27	4	1	8	100
ROOF ANCHORAGE AND LINING	6	3	1	8	17
EXCAVATE REMAINDER OF CAVERN	27	2	1	8	44
EXCAVATE TRANSFORMER GALLERY	18	3	1	8	49
EXCAVATE TAILRACE SURGE CHAMBER	16	6	1	8	103
EXCAVATE CABLE TUNNEL SHAFT	11	6	1	8	65
LINE AND PAVE CABLE TUNNEL	6	10	1	8	61
LINE PENSTOCKS ANDDRAFT TUBE MANIFOLD	36	5	1	8	187
INSTALL STEEL TUNNEL LININGS	22	8	1	8	175
FIRST STAGE CONCRETE	19	6	1	8	105
INSTALL SPIRAL CASES AND DRAFT TUBE LINE	8	8	1	8	65
INSTALL PUMP TURBINES AND GENERATORS	8	11	1	8	89
EMBED SPIRAL CASES AND DRAFT LINERS	7	9	1	8	61
INSTALL MECHANICAL EQUIPMENT	9	6	1	8	54
INSTALL ELECTRICAL EQUIPMENT	8	6	1	8	48
COMPLETE CONCRETE WORK	15	9	1	8	140
STRUCTURAL AND ARCHITECTURAL CONSTRUCTION	30	13	1	8	394
ELECTRICAL AND MECHANICAL MOBILIZATION	15	3	1	8	46
COMPLETE ELECTRICAL CONSTRUCTION	8	13	1	8	107
EXCAVATE APPROACH CHANNEL - UPPER RESERVOIR	23	10	1	8	222
CONSTRUCT UPPER RESERVOIR DAM	38	8	1	8	320
MOVE UNSTABLE SOIL - LOWER RESERVOIR	19	13	1	8	242
LINE UPPER RESERVOIR	23	4	1	8	85
LINE LOWER RESERVOIR	18	5	1	8	95
CONSTRUCT I/O STRUCTURE - LOWER RESERVOIR	26	4	1	8	107
CONSTRUCT I/O STRUCTURE - UPPER RESERVOIR	27	4	1	8	105
SWITCHYARD EXCAVATION	10	3	1	8	31
SWITCHYARD FOUNDATIONS	11	4	1	8	45
SWITCHYARD STRUCTURES	9	1	1	8	13
TRANSMISSION LINE FOUNDATIONS	10	5	1	8	46
TRANSMISSION LINE STRINGING	7	4	1	8	28
TRANSMISSION LINE STRUCTURES	12	6	1	8	69
INSTALL WATER SUPPLY PIPELINE AND RO S	19	7	1	8	128
RESERVOIR FILLING	3	24	1	8	72
U-1 START-UP	7	3	1	8	22
U-2 START-UP	7	3	1	8	19
U-3 START-UP	7	3	1	8	19
U-4 START-UP	7	3	1	8	19
FINISH PROJECT	10	3	1	8	28
				TOTAL	4674

(1) Average number of people on site during a construction activity, rounded to the nearest person.
(2) Estimated time to complete a construction activity if completed independent of other construction activities and without consideration of other construction and schedule constraints, rounded to the nearest month.
(3) Number and length of daily shifts.
(4) Rounded to nearest person month. One person month is equal to 173 hours. Calculated prior to rounding crew sizes and durations.

ESTIMATED CONSTRUCTION EQUIPMENT
EAGLE MOUNTAIN

TYPE OF EQUIPMENT	CIVIL CONTRACTOR MOBILIZATION	ACCESS ROADS	POWER HOUSE ACCESS TUNNEL	EXCAVATE TAILRACE TUNNEL	EXCAVATE LOWER PRESSURE TUNNEL	EXCAVATE UPPER PRESSURE TUNNEL	EXCAVATE PRESSURE SHAFT	EXCAVATE TOP HEADING	ROOF ANCHORAGE AND LINING	EXCAVATE REMAINDER OF CABIN
DURATION [5]	**4**	**4**	**12**	**8**	**6**	**6**	**9**	**4**	**3**	**2**
On-site										
Air Compressor	0.0	1.3	0.0	0.0	0.0	0.0	1.3	3.8	1.3	1.3
Backhoe / Front End Loader, Wheeled	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backhoe, Tracked	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compactor, Sheepsfoot, Self-Propelled	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compactor, Vibratory, Self-Propelled	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Pump	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane - 40 Ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane - 70 Ton	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
Dozer, D5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dozer, D6	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dozer, D8	0.0	1.3	0.0	0.0	0.0	0.0	1.3	2.5	0.0	2.5
Drill, Tracked	0.0	1.3	2.5	1.3	1.3	0.0	1.3	3.8	1.3	3.8
Dump Truck, End Dump, 15 Ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump Truck, Off-Highway, 34 Ton	0.0	3.8	5.0	6.3	2.5	6.3	2.5	5.0	0.0	5.0
Excavator, 325	0.0	1.3	1.3	1.3	1.3	0.0	1.3	2.5	0.0	2.5
Forklift, Rough Terrain	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Front End Loader, Wheeled	0.0	1.3	2.5	2.5	2.5	1.3	2.5	5.0	0.0	5.0
Fuel Truck / Support Truck	1.3	1.3	0.0	0.0	0.0	1.3	1.3	1.3	1.3	1.3
Generator - Diesel	1.3	1.3	1.3	1.3	1.3	1.3	1.3	2.5	1.3	2.5
Grout Pump	0.0	0.0	1.3	1.3	1.3	0.0	1.3	0.0	1.3	0.0
Motor Grader	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pump truck - Concrete	0.0	0.0	1.3	2.5	2.5	0.0	2.5	0.0	0.0	0.0
Truck, Flatbed	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
Tunnel Rig	0.0	0.0	1.3	1.3	1.3	1.3	0.0	0.0	0.0	0.0
Water Pump, Diesel	1.3	0.0	1.3	1.3	1.3	1.3	1.3	0.0	0.0	0.0
Water Truck	0.0	1.3	0.0	0.0	0.0	0.0	0.0	1.3	0.0	1.3
Welder and Generator Set	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	**10.0**	**17.5**	**17.5**	**18.8**	**15.0**	**12.5**	**18.8**	**27.5**	**7.5**	**25.0**
Daily Vehicles [3]										
Daily Concrete Mixer Truck - 8 CY	0.0	0.0	16.3	31.3	31.3	62.5	31.3	0.0	3.8	0.0
Daily Semi Trailer Truck	0.0	0.0	71.3	97.5	76.3	81.3	30.0	75.0	0.0	50.0
Off-Site Vehicles										
Total Offsite Flatbed/Semi Trucks	1.3	0.0	11.3	6.3	16.3	32.5	8.8	0.0	2.5	0.0

(1) Rounded to nearest unit of equipment.
(2) Sum of estimated pieces of equipment times duration of construction activity. Calculated prior to rounding duration and equipment quantities. One equipment month is equal to 173 hours of operation.

(3) Number of daily vehicles on site.
(4) Pieces of equipment not equal to a whole number represent equipment not being utilized for entire duration of the activity.

(5) Rounded to the nearest month.

ESTIMATED CONSTRUCTION EQUIPMENT
EAGLE MOUNTAIN

TYPE OF EQUIPMENT / DURATION [5]	EXCAVATE TRANSFORMER GALLERY	EXCAVATE TAILRACE SURGE CHANBER	EXCAVATE CABLE TUNNEL SHAFT	LINE AND PAVE CABLE TUNNEL	LINE PENSTKS DRAFT TUBE MAN.	INSTALL STEEL TUNNEL LINES	FIRST STAGE CONCRETE	INSTALL CASES DRAFT TUBE LINE.	INSTALL PUMP TURBIN. AND GEN.	EMBED CASES AND DRAFT LINERS
	3	6	6	10	5	8	6	8	11	9
On-site										
Air Compressor	1.3	1.3	1.3	1.3	2.5	1.3	0.0	0.0	1.3	0.0
Backhoe / Front End Loader, Wheeled	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backhoe, Tracked	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compactor, Sheepsfoot, Self-Propelled	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compactor, Vibratory, Self-Propelled	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Pump	0.0	0.0	0.0	1.3	0.0	0.0	0.0	1.3	0.0	0.0
Crane - 40 Ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
Crane - 70 Ton	0.0	0.0	0.0	1.3	0.0	0.0	1.3	0.0	1.3	0.0
Dozer, D5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dozer, D6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dozer, D8	1.3	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Drill, Tracked	2.5	1.3	1.3	1.3	0.0	1.3	0.0	0.0	0.0	0.0
Dump Truck, End Dump, 15 Ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dump Truck, Off-Highway, 34 Ton	3.8	1.3	1.3	0.0	3.8	2.5	0.0	0.0	0.0	0.0
Excavator, 325	1.3	1.3	1.3	0.0	1.3	1.3	0.0	0.0	0.0	0.0
Forklift, Rough Terrain	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0
Front End Loader, Wheeled	2.5	2.5	2.5	0.0	3.8	2.5	0.0	0.0	0.0	0.0
Fuel Truck / Support Truck	1.3	1.3	1.3	1.3	1.3	1.3	1.3	0.0	1.3	1.3
Generator - Diesel	1.3	1.3	1.3	1.3	2.5	1.3	1.3	1.3	1.3	0.0
Grout Pump	0.0	0.0	0.0	1.3	0.0	0.0	1.3	0.0	0.0	0.0
Motor Grader	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pump truck - Concrete	0.0	1.3	0.0	0.0	5.0	2.5	2.5	0.0	0.0	1.3
Truck, Flatbed	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Tunnel Rig	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Pump, Diesel	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Truck	1.3	1.3	0.0	0.0	1.3	1.3	1.3	0.0	0.0	1.3
Welder and Generator Set	0.0	0.0	0.0	0.0	0.0	1.3	0.0	1.3	1.3	0.0
TOTAL	**16.3**	**12.5**	**11.3**	**10.0**	**22.5**	**17.5**	**8.8**	**5.0**	**6.3**	**3.8**
Daily Vehicles [3]										
Daily Concrete Mixer Truck - 8 CY	0.0	0.0	0.0	1.3	62.5	31.3	31.3	1.3	0.0	5.0
Daily Semi Trailer Truck	50.0	18.8	3.8	0.0	50.0	25.0	0.0	0.0	0.0	0.0
Off-Site Vehicles										
Total Offsite Flatbed/Semi Trucks	0.0	1.3	0.0	2.5	11.3	192.5	10.0	13.8	10.0	3.8

(1) Rounded to nearest unit of equipment.
(2) Sum of estimated pieces of equipment times duration of construction activity. Calculated prior to rounding duration and equipment quantities. One equipment month is equal to 173 hours of operation.

(3) Number of daily vehicles on site.
(4) Pieces of equipment not equal to a whole number represent equipment not being utilized for entire duration of the activity.

(5) Rounded to the nearest month.

ESTIMATED CONSTRUCTION EQUIPMENT
EAGLE MOUNTAIN

TYPE OF EQUIPMENT	ESTIMATED AVERAGE PIECES OF EQUIPMENT FOR CONSTRUCTION ACTIVITIES[1]									
	INSTALL MECH. EQUIPMENT	INSTALL ELECT. EQUIPMENT	COMPLETE CONCRETE WK.	STRUCTURAL AND ARCHIT. CONST.	ELECTRICAL AND MECH. MOBE.	COMPLETE ELEC. CONSTRUCTION	EXCAVATE APPR. CHANNEL - UPPER	CONSTRUCT UPPER DAM	MOVE UNSTABLE SOIL - LOWER	LINE UPPER RESERVOIR
DURATION [5]	**6**	**6**	**9**	**13**	**3**	**13**	**10**	**8**	**13**	**4**
On-site										
Air Compressor	1.3	1.3	0.0	1.3	0.0	1.3	1.3	2.5	0.0	0.0
Backhoe / Front End Loader, Wheeled	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Backhoe, Tracked	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compactor, Sheepsfoot, Self-Propelled	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compactor, Vibratory, Self-Propelled	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	1.3
Concrete Pump	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane - 40 Ton	0.0	0.0	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Crane - 70 Ton	1.3	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Dozer, D5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0
Dozer, D6	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Dozer, D8	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	2.5	1.3
Drill, Tracked	0.0	0.0	0.0	1.3	0.0	0.0	2.5	0.0	0.0	0.0
Dump Truck, End Dump, 15 Ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0
Dump Truck, Off-Highway, 34 Ton	0.0	0.0	0.0	1.3	0.0	0.0	7.5	5.0	6.3	12.5
Excavator, 325	0.0	0.0	0.0	1.3	0.0	0.0	1.3	0.0	1.3	2.5
Forklift, Rough Terrain	0.0	1.3	0.0	2.5	1.3	1.3	0.0	0.0	0.0	0.0
Front End Loader, Wheeled	0.0	0.0	0.0	2.5	0.0	0.0	2.5	2.5	0.0	2.5
Fuel Truck / Support Truck	1.3	1.3	1.3	2.5	1.3	1.3	1.3	2.5	1.3	1.3
Generator - Diesel	1.3	1.3	1.3	2.5	1.3	2.5	0.0	0.0	0.0	0.0
Grout Pump	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Motor Grader	0.0	0.0	0.0	0.0	1.3	0.0	0.0	2.5	1.3	0.0
Pump truck - Concrete	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Truck, Flatbed	0.0	0.0	0.0	0.0	1.3	2.5	0.0	0.0	0.0	0.0
Tunnel Rig	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Pump, Diesel	0.0	0.0	0.0	1.3	1.3	0.0	0.0	0.0	0.0	0.0
Water Truck	0.0	0.0	1.3	0.0	0.0	0.0	1.3	2.5	1.3	1.3
Welder and Generator Set	2.5	1.3	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	**7.5**	**6.3**	**6.3**	**21.3**	**10.0**	**8.8**	**20.0**	**33.8**	**13.8**	**22.5**
Daily Vehicles[3]										
Daily Concrete Mixer Truck - 8 CY	0.0	0.0	16.3	3.8	0.0	0.0	0.0	0.0	0.0	0.0
Daily Semi Trailer Truck	0.0	0.0	0.0	22.5	0.0	0.0	50.0	0.0	0.0	0.0
Off-Site Vehicles										
Total Offsite Flatbed/Semi Trucks	6.3	5.0	12.5	53.8	1.3	6.3	0.0	0.0	0.0	0.0

(1) Rounded to nearest unit of equipment.
(2) Sum of estimated pieces of equipment times duration of construction activity. Calculated prior to rounding duration and equipment quantities. One equipment month is equal to 173 hours of operation.

(3) Number of daily vehicles on site.
(4) Pieces of equipment not equal to a whole number represent equipment not being utilized for entire duration of the activity.

(5) Rounded to the nearest month.

ESTIMATED CONSTRUCTION EQUIPMENT
EAGLE MOUNTAIN

TYPE OF EQUIPMENT	LINE LOWER RESERVOIR	CONSTRUCT I/O STRUC. - LOWER	CONSTRUCT I/O STRUC. - UPPER	SWITCHYARD EXCAVATION	SWITCHYARD FOUNDATIONS	SWITCHYARD STRUCTURES	TRANS. LINE FOUNDATIONS	TRANS. LINE STRINGING	TRANS. LINE STRUCTURES	INSTALL H20 SUPPLY AND RO S	RESERVOIR FILLING
DURATION [5]	5	4	4	3	4	1	5	4	6	7	24
On-site											
Air Compressor	0.0	1.3	1.3	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0
Backhoe / Front End Loader, Wheeled	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backhoe, Tracked	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compactor, Sheepsfoot, Self-Propelled	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	1.3	0.0
Compactor, Vibratory, Self-Propelled	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Concrete Pump	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Crane - 40 Ton	0.0	0.0	0.0	0.0	0.0	0.0	1.3	2.5	2.5	0.0	0.0
Crane - 70 Ton	0.0	1.3	1.3	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Dozer, D5	0.0	0.0	0.0	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Dozer, D6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dozer, D8	1.3	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
Drill, Tracked	0.0	1.3	1.3	0.0	1.3	0.0	1.3	0.0	0.0	0.0	0.0
Dump Truck, End Dump, 15 Ton	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0
Dump Truck, Off-Highway, 34 Ton	6.3	5.0	6.3	6.3	6.3	0.0	0.0	0.0	0.0	0.0	0.0
Excavator, 325	2.5	1.3	1.3	1.3	0.0	0.0	0.0	0.0	0.0	1.3	0.0
Forklift, Rough Terrain	0.0	0.0	0.0	0.0	0.0	1.3	0.0	1.3	1.3	0.0	0.0
Front End Loader, Wheeled	2.5	1.3	1.3	1.3	0.0	0.0	1.3	0.0	0.0	1.3	0.0
Fuel Truck / Support Truck	1.3	1.3	1.3	1.3	1.3	2.5	1.3	2.5	2.5	1.3	1.3
Generator - Diesel	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0
Grout Pump	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Motor Grader	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Pump truck - Concrete	0.0	2.5	2.5	0.0	1.3	0.0	1.3	0.0	0.0	0.0	0.0
Truck, Flatbed	0.0	0.0	0.0	0.0	0.0	1.3	0.0	1.3	1.3	0.0	0.0
Tunnel Rig	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Pump, Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Truck	1.3	1.3	1.3	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0
Welder and Generator Set	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	2.5	1.3	0.0
TOTAL	**16.3**	**17.5**	**18.8**	**12.5**	**15.0**	**8.8**	**6.3**	**7.5**	**11.3**	**13.8**	**1.3**
Daily Vehicles[3]											
Daily Concrete Mixer Truck - 8 CY	0.0	31.3	31.3	0.0	2.5	0.0	8.8	0.0	0.0	0.0	0.0
Daily Semi Trailer Truck	0.0	25.0	25.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
Off-Site Vehicles											
Total Offsite Flatbed/Semi Trucks	0.0	11.3	0.0	0.0	1.3	12.5	30.0	0.0	200.0	260.0	0.0

(1) Rounded to nearest unit of equipment.
(2) Sum of estimated pieces of equipment times duration of construction activity. Calculated prior to rounding duration and equipment quantities. One equipment month is equal to 173 hours of operation.

(3) Number of daily vehicles on site.
(4) Pieces of equipment not equal to a whole number represent equipment not being utilized for entire duration of the activity.

(5) Rounded to the nearest month.

ESTIMATED CONSTRUCTION EQUIPMENT
EAGLE MOUNTAIN

TYPE OF EQUIPMENT	U-1 START-UP	U-2 START-UP	U-3 START-UP	U-4 START-UP	FINISH PROJECT		ESTIMATED EQUIPMENT MONTHS[2]
DURATION [5]	3	3	3	3	3		
On-site							
Air Compressor	1.3	1.3	1.3	1.3	1.3		220
Backhoe / Front End Loader, Wheeled	0.0	0.0	0.0	0.0	0.0		9
Backhoe, Tracked	0.0	0.0	0.0	0.0	0.0		5
Compactor, Sheepsfoot, Self-Propelled	0.0	0.0	0.0	0.0	0.0		13
Compactor, Vibratory, Self-Propelled	0.0	0.0	0.0	0.0	0.0		53
Concrete Pump	0.0	0.0	0.0	0.0	0.0		23
Crane - 40 Ton	0.0	0.0	0.0	0.0	0.0		57
Crane - 70 Ton	0.0	0.0	0.0	0.0	0.0		81
Dozer, D5	0.0	0.0	0.0	0.0	0.0		42
Dozer, D6	0.0	0.0	0.0	0.0	0.0		9
Dozer, D8	0.0	0.0	0.0	0.0	0.0		125
Drill, Tracked	0.0	0.0	0.0	0.0	0.0		188
Dump Truck, End Dump, 15 Ton	0.0	0.0	0.0	0.0	0.0		95
Dump Truck, Off-Highway, 34 Ton	0.0	0.0	0.0	0.0	0.0		629
Excavator, 325	0.0	0.0	0.0	0.0	0.0		190
Forklift, Rough Terrain	0.0	0.0	0.0	0.0	0.0		90
Front End Loader, Wheeled	0.0	0.0	0.0	0.0	0.0		328
Fuel Truck / Support Truck	0.0	0.0	0.0	0.0	3.8		340
Generator - Diesel	1.3	1.3	1.3	1.3	1.3		264
Grout Pump	0.0	0.0	0.0	0.0	0.0		83
Motor Grader	0.0	0.0	0.0	0.0	0.0		50
Pump truck - Concrete	0.0	0.0	0.0	0.0	0.0		179
Truck, Flatbed	0.0	0.0	0.0	0.0	0.0		72
Tunnel Rig	0.0	0.0	0.0	0.0	0.0		39
Water Pump, Diesel	0.0	0.0	0.0	0.0	0.0		83
Water Truck	0.0	0.0	0.0	0.0	0.0		127
Welder and Generator Set	0.0	0.0	0.0	0.0	0.0		98
TOTAL	**2.5**	**2.5**	**2.5**	**2.5**	**6.3**	**TOTAL**	**3492**
Daily Vehicles[3]							
Daily Concrete Mixer Truck - 8 CY	0.0	0.0	0.0	0.0	0.0		-
Daily Semi Trailer Truck	0.0	0.0	0.0	0.0	0.0		-
Off-Site Vehicles							
Total Offsite Flatbed/Semi Trucks	0.0	0.0	0.0	0.0	0.0		924

(1) Rounded to nearest unit of equipment.
(2) Sum of estimated pieces of equipment times duration of construction activity. Calculated prior to rounding duration and equipment quantities. One equipment month is equal to 173 hours of operation.

(3) Number of daily vehicles on site.
(4) Pieces of equipment not equal to a whole number represent equipment not being utilized for entire duration of the activity.

(5) Rounded to the nearest month.

Labor Costs

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	3/19/2009	By	NDM
		Checked		By	
		Approved		By	

LABOR COSTS

Crew	Hourly Wages ($/hr)	Hourly Wages (including O &P) ($/hr)	Source
Blaster	$33.60	$52.10	R.S. Means 2009, Crew B-47, Blast Foreman
Carpenters	$39.95	$61.95	R.S. Means 2009, Carpenters
Cement Finisher	$38.30	$56.05	R.S. Means 2009, Cement Finishers
Driller	$31.60	$49.00	R.S. Means 2009, Crew B-47, Driller
Electricians	$47.00	$69.95	R.S. Means 2009, Electricians
Equipment Operators	$41.35	$62.15	R.S. Means 2009, Equipment Operator (Medium)
Grade Setter	$41.35	$62.15	R.S. Means 2009, Equipment Operator (Medium)
Foreman	$42.85	$66.35	R.S. Means 2009, Foreman Average (Outside)
Labor Foreman	$33.60	$52.10	R.S. Means 2009, Labor Foreman (Outside)
Laborers	$31.60	$49.00	R.S. Means 2009, Common Building Laborers
Mechanics	$42.70	$64.20	R.S. Means 2009, Equipment Operator, Master Mechanics
Painter	$35.20	$52.75	R.S. Means 2009, Painters, Ordinary
Pile Driver	$38.50	$62.50	R.S. Means 2009, Pile Drivers
Pipe Foreman	$49.35	$74.05	R.S. Means 2009, Pipe Fitter
Pipe Layer	$40.85	$63.25	R.S. Means 2009, Skilled Worker
Plumber	$48.75	$73.15	R.S. Means 2009, Plumber
Rigger	$40.85	$63.25	R.S. Means 2009, Skilled Worker
Survey/Rodmen	$39.75	$60.80	R.S. Means 2009, Average of: Instrument Man, Rodmen/Chainmen
Steel Worker	$44.70	$79.65	R.S. Means 2009, Structural Steel Workers
Steel Worker Foreman	$46.70	$83.20	R.S. Means 2009, Structural Steel Foremen
Truck Drivers	$31.95	$49.15	R.S. Means 2009, Truck Drivers (Heavy)
Welder	$44.70	$79.65	R.S. Means 2009, Welders

Operations Labor Costs

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Operations	Date	1/21/2009	By	NDM
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		Approved		By	

OPERATIONS

Crew	Shift Quantity	Number of Daily Shifts	Total Operations Crew	Annual Salaries[1] ($/year)	Annual Labor Costs ($)
Mechanical Engineer	2	2	4	$63,000	$252,000
Electrical Engineer	2	2	4	$63,000	$252,000
Project Engineer	1	2	2	$62,000	$124,000
Project Manager	1	2	2	$75,000	$150,000
Construction Manager	1	2	2	$70,000	$140,000
Manager	1	2	2	$54,000	$108,000
Power Plant Operator	2	2	4	$58,000	$232,000
Plant Engineer	1	2	2	$63,000	$126,000
Mechanical Maintenance Technician	1	2	2	$37,000	$74,000
Scheduler	1	2	2	$57,000	$114,000
Field Service Engineer	1	2	2	$53,000	$106,000
Administration Staff	1	2	2	$57,000	$114,000
TOTAL =	**15**		**30**		**$1,792,000**

1) Source: http://www.simplyhired.com/a/salary/search/q-Hydro+Power (3/19/2009)

OPERATIONS AND MAINTENANCE COSTS

The operation and maintenance costs are those associated with Project operation and upkeep. They include the cost of the direct salaries and administrative support of plant administration, operating and maintenance personnel, and of maintenance equipment and materials and repairs and spare parts.

Eagle Mountain Pumped Storage Estimated Annual Project Costs

Operating Costs Elements	Amount ($/year)
Property Tax	$8,390,000
Land Leases	$2,000,000
Makeup Water and Pumping	$2,400,000
Water Treatment	$720,000
Property Insurance	$4,200,000
Salaries	$1,800,000
Home Office Administration	$900,000
Supplies and Parts	$2,500,000
FERC Fees	$1,500,000
Total Annual Operating Cost	**$24,410,000**

Note:
Table from Draft License Application - Exhibit D

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
		Checked		By	
		Approved		By	

EAGLE MOUNTAIN PUMPED-STORAGE PROJECT --- TYPICAL EQUIPMENT AND TASK PRODUCTION RATES

TASK/EQUIPMENT	TYPICAL PRODUCTION RATES (SINGLE CREW ONLY)	
Tunnel Boring Machine	45 - 120	ft/day
Drill and Blast Excavation	200 - 400	cy/day
Benching Excavation	500	cy/day
Trench Excavation	200	lcy/hr
Prelining Shotcrete	200 - 300	sy/day
Concrete	100 - 200	cy/day
Grouting	450	cf/day
Roof & Wall Support	2000 - 2500	sf/day
Rock Anchors	400	lf/day
Misc. Steel	20	tons/day
Steel Liner	50	lf/day
Elevator Shaft	50	lf/day
Excavator	200 - 300	cy/hr
Compactor (large)	850	cy/hr
Compactor (small)	120	cy/hr
Grading	1200	cy/day
Gravel Placement	1500	cy/day
RCC Dams	1500	cy/day
Trashrack Installation	200	sf/day
Peir Foundations	4 - 10	peirs/day
Fencing Installation	300	lf/day
Transmission Line Stringing	8000	ft/day
Pipeline Installation	1000	ft/day

GEI Consultants, Inc.
080473 Eagle Mountain Pumped Storage Project
Construction Schedule Item List
1/20/2009
NDM

1 **NOTICE TO PROCEED**
2 **CIVIL CONTRACTOR MOBILIZATION**
3 **CIVIL CONTRACTOR MOBILIZED**
4 **CONSTRUCT ACCESS ROADS**
5 **EXCAVATE POWER HOUSE ACCESS TUNNEL**
6 **COMPLETE ACCESS TUNNEL EXCAVATION**
7 **EXCAVATE TAILRACE TUNNEL**
8 **EXCAVATE LOWER PRESSURE TUNNEL**
9 **EXCAVATE UPPER PRESSURE TUNNEL**
10 **EXCAVATE PRESSURE SHAFT**
11 **EXCAVATE TOP HEADING**
12 **ROOF ANCHORAGE AND LINING**
13 **EXCAVATE REMAINDER OF CAVERN**
14 **COMPLETE POWER HOUSE EXCAVATION**
15 **EXCAVATE TRANSFORMER GALLERY**
16 **EXCAVATE TAILRACE SURGE CHAMBER**
17 **EXCAVATE CABLE TUNNEL SHAFT**
18 **LINE AND PAVE CABLE TUNNEL**
19 **LINE PENSTOCKS ANDDRAFT TUBE MANIFOLD**
20 **INSTALL STEEL TUNNEL LININGS**
21 **FIRST STAGE CONCRETE**
22 **COMPLETE POWER HOUSE 1ST STAGE CONCRETE**
23 **INSTALL SPIRAL CASES AND DRAFT TUBE LINE**
24 **INSTALL PUMP TURBINES AND GENERATORS**
25 **EMBED SPIRAL CASES AND DRAFT LINERS**
26 **INSTALL MECHANICAL EQUIPMENT**
27 **INSTALL ELECTRICAL EQUIPMENT**
28 **COMPLETE CONCRETE WORK**
29 **STRUCTURAL AND ARCHITECTURAL CONSTRUCTION**
30 **COMPLETE DRAFT TUBE, SPIRAL CASE AND POWERHOUSE, 2ND STAGE CONCRETE**
31 **ELECTRICAL AND MECHANICAL MOBILIZATION**
32 **COMPLETE INSTALLATION OF PUMP-TURBINES, GENERATOR**
33 **COMPLETE ELECTRICAL CONSTRUCTION**
34 **EXCAVATE APPROACH CHANNEL - UPPER RESERVOIR**
35 **CONSTRUCT UPPER RESERVOIR DAM**
36 **MOVE UNSTABLE SOIL - LOWER RESERVOIR**
37 **LINE UPPER RESERVOIR**
38 **LINE LOWER RESERVOIR**
39 **CONSTRUCT I/O STRUCTURE - LOWER RESERVOIR**
40 **CONSTRUCT I/O STRUCTURE - UPPER RESERVOIR**
41 **SWITCHYARD EXCAVATION**
42 **SWITCHYARD FOUNDATIONS**
43 **SWITCHYARD STRUCTURES**
44 **TRANSMISSION LINE FOUNDATIONS**
45 **TRANSMISSION LINE STRINGING**
46 **TRANSMISSION LINE STRUCTURES**
47 **INSTALL WATER SUPPLY PIPELINE AND RO S**
48 **RESERVOIR FILLING**
49 **UNIT-1 START-UP**
50 **U-1 START-UP**
51 **UNIT-2 START-UP**
52 **U-2 START-UP**
53 **UNIT-3 START-UP**
54 **U-3 START-UP**
55 **UNIT-4 START-UP**
56 **U-4 START-UP**
57 **FINISH PROJECT**

2 Civil Contractor Mobe

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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		Approved		By	

EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	1
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	1
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	1
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump	
Hydroseed Sprayer, Truck Mounted	
Motor Grader	1
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	1
Tunnel Rig	
Water Pump, Diesel	1
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	1
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	2
Cement Finisher	
Driller	
Electricians	2
Equipment Operators	5
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	1
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	1
Welder	

Total Crew Size	15
Monthly Labor Cost	$195,100

Duration: **4.0** Months **16.0** Weeks

NOTES:

Mobilization to include installing field offices, preparing staging area, minor road grading, temporary utility connections, security fencing, bringing equipment to site, prepartion of equipment, and lighting

4 Accesss Roads

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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		Approved		By	

EQUIPMENT	Quantity	
On Site		
Air Compressor	1	
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked	1	
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled	1	
Compactor, Vibratory, Self-Propelled		
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton		
Dozer, D5		
Dozer, D6		
Dozer, D8	1	
Dozer, D10		
Drill, Tracked	1	
Dump Truck, End Dump, 15 Ton		
Dump Truck, Off-Highway, 34 Ton	3	hauling onsite
Dump Truck, Semi-Trailer		
Excavator, 325	1	
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled	1	
Fuel Truck / Support Truck	1	
Generator - Diesel	1	
Grout Pump/Plant		
Hydroseed Sprayer, Truck Mounted		
Grader, H14	1	
Pile Driver		
Pump Truck - Concrete		
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed		
Tunnel Rig (TBM) **(3)**		
Water Pump, Diesel		
Water Truck	1	Dust Control
Welder and Generator Set		
Total Offsite Flatbed/Semi Trucks		
Daily Concrete Mixer Truck - 8 CY		
Daily Semi Trailer Truck		

Crew	Quantity
Blaster	2
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	6
Grade Setter	1
Foreman	1
Labor Foreman	
Laborers	
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	5
Welder	

Total Crew Size	18
Monthly Labor Cost	$221,300

Duration: **3.7** Months **16.0** Weeks

1.0 - CONSTRUCTION AND ACCESS ROADS SCHEDULE				
Existing Unpaved Mining Roads				
1.1 Construction Road to Saddle Dams			13,800	LF
1.2 Road from South Dam to Intake Platform			1,800	LF
Total Existing			15,600	LF
Width			30	FT
Depth			2	FT
Volume			34,667	CY
Production Rate	900	FT/DAY	2000	CY/DAY
			10	HR/DAY
			216.25	HRS/MONTH
Initial Duration			0.8	MONTHS
Contingency			15	%
Final Duration			0.9	MONTHS
Final Duration			4.0	WEEKS
New Dirt Roads				
1.3 Road from intake platform down to Channel			2,000	LF
1.4 Road from South Dam to Power Tunnel Portal Const.			10,100	LF
1.5 Extension to Cable, Elevator Shafts & Surge Tank			4,400	LF
1.5 Access road to Lower Inlet Platform			4,000	LF
1.6 Inlet Platform Down to Channel			3,000	LF
Total Existing			23,500	LF
Width			30	FT
Depth			2	FT
Volume			52,222	CY
Production Rate	450	FT/DAY	1000	CY/DAY
			10	HR/DAY
			216.25	HRS/MONTH
Initial Duration			2.4	MONTHS
Contingency			15	%
Final Duration			2.8	MONTHS
Final Duration			12.0	WEEKS

Assumptions:

New road construction will require rock blasting and excavtion.
Hauling of material (onsite)
Survey control
Dust control
Grading
Compacting

Access Roads:

Equipment: Air Compressor, Backhoe, Sheepsfoot Compactor, Dozer, Tracked Drill, Dump Trucks, Excavator, FE Loader, Support Truck, Generator, Grader, Water Truck.
Crew: 1 Driller, 2 Blasters, 6 Equip Opr., 2 survey, 3 DT Driver, 1 Foreman, 1 Grade Setter, 2 Survey.
Schedule: Additive activities, Existing + New.

5 Power House Access Tunnel

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EQUIPMENT	Quantity	
On Site		
Air Compressor		
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked		
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled		
Compactor, Vibratory, Self-Propelled		
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton		
Dozer, D5		
Dozer, D6		
Dozer, D8		
Dozer, D10		
Drill, Tracked	2	
Dump Truck, End Dump, 15 Ton		
Dump Truck, Off-Highway, 34 Ton	4	Haul Cuttings
Dump Truck, Semi-Trailer		
Excavator, 325	1	
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled	2	Load cuttings
Fuel Truck / Support Truck		
Generator - Diesel	1	
Grout Pump/Plant	1	
Hydroseed Sprayer, Truck Mounted		
Grader, H14		
Pile Driver		
Pump Truck - Concrete	1	
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed		
Tunnel Rig (TBM)	1	
Water Pump, Diesel	1	
Water Truck		
Welder and Generator Set		
Total Offsite Flatbed/Semi Trucks	9	
Daily Concrete Mixer Truck - 8 CY	13	
Daily Semi Trailer Truck	57	

Crew	Quantity
Blaster	2
Carpenters	
Cement Finisher	
Driller	2
Electricians	
Equipment Operators	5
Grade Setter	
Foreman	2
Labor Foreman	
Laborers	4
Mechanics	1
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	5
Welder	

Total Crew Size	23
Monthly Labor Cost	$275,600

Duration: **11.6** Months **50.4** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

2.0 - CONSTRUCTION TUNNELS SCHEDULE				
2.1 To Machine Hall Roof			2,900	CY
2.2 To Transformer Hall Roof			1,700	CY
2.3 To Power Shaft Construction			8,500	CY
2.4 To Tailrace Surge Tank Construction Access			1,900	CY
Total Volume			15,000	CY
D&B Production Rate	38	FT/DAY	250	CY/DAY
Initial Duration			2.8	MONTHS
Contingency			25	%
Final Duration			3.5	MONTHS
Final Duration			15.0	WEEKS
EQUIPMENT/TRUCKING				
DUMP TRUCKS			30	CY/TRUCK
			500	# OF TRUCKS FOR TASK
			9	LOADS/DAY
			1.0	CYCLE TIME (HRS)
			1	REQUIRED # OF TRUCKS
SEMIS			20	CY/TRUCK
			750	# OF TRUCKS FOR TASK
			13	TRUCKS/DAY

3.0 - ACCESS TUNNEL SCHEDULE				
3.1 Main Access Tunnel (6628') to Power House				
3.1.1 Excavation (TBM)			192,500	CY
Duration (from Tunnel Exc. Spreadsheet)			27.1	WEEKS
Average Production Rate			1,136	CY/DAY
Contingency			25	%
Final Duration			7.8	MONTHS
Final Duration			33.9	WEEKS
3.1.2 Prelining Shotcrete(w/wire-mesh)			20,600	SY
Production Rate			200	SY/DAY
Duration			4.8	MONTHS
Contingency			25	%
Final Duration			6.0	MONTHS
Final Duration			25.8	WEEKS
Lag			2.0	WEEKS
Maximum Duration			27.8	WEEKS
3.1.3 Invert concrete			6,900	CY
Production Rate			100	CY/DAY
Duration			3.2	MONTHS
Contingency			25	%
Final Duration			4.0	MONTHS
Final Duration			17.3	WEEKS
Lag			2.0	WEEKS
Maximum Duration			19.3	WEEKS
3.1.4 Rock anchors (15' long)			5,000	EA
Total Bolt Length			75,000	FT
Production Rate		(2 crews)	800	FT/DAY
Duration			4.3	MONTHS
Contingency			25	%
Final Duration			5.4	MONTHS
Final Duration			23.4	WEEKS
Lag			2.0	WEEKS
Maximum Duration			25.4	WEEKS
3.2 Drainage Gallery Access Tunnel (L=80')				
3.2.1 Excavation			800	CY
D&B Production Rate	38	FT/DAY	250	CY/DAY
Initial Duration			0.1	MONTHS
Contingency			25	%
Final Duration			0.2	MONTHS
Final Duration			0.8	WEEKS
3.2.2 Invert Concrete			10	CY
Production Rate			100	CY/DAY
Duration			0.005	MONTHS
Contingency			25	%
Final Duration			0.006	MONTHS
Final Duration			0.025	WEEKS
Lag			0.5	WEEKS
Maximum Duration			0.5	WEEKS
3.2.3 Prelining			200	SY
Production Rate			200	SY/DAY
Duration			0.0	MONTHS
Contingency			25	%
Final Duration			0.1	MONTHS
Final Duration			0.3	WEEKS
Lag			0.5	WEEKS
Maximum Duration			0.8	WEEKS

5 Power House Access Tunnel

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3.3 Tailrace Rock Trap Access Tunnel (L = 100')		100	LF
D&B Production Rate		37	FT/DAY
Initial Duration		0.1	MONTHS
Contingency		25	%
Final Duration		0.2	MONTHS
Final Duration		0.7	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		193954	TOTAL VOLUME, CY
		30	CY/TRUCK
		6,417	# OF TRUCKS FOR TASK
		38	LOADS/DAY
		1.0	CYCLE TIME (HRS)
		4	REQUIRED # OF TRUCKS
OFFSITE TRUCKS		168	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		9	# OF TRUCKS
CONCRETE TRUCKS		8643	TOTAL VOLUME, CY
		8	CY/TRUCK
		1,080	# OF TRUCKS FOR TASK
		13	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		1	# OF TRUCKS
SEMIS		20	CY/TRUCK
		9,698	# OF TRUCKS FOR TASK
		57	TRUCKS/DAY

Assumptions:
Const. Tunnel Diameter = 15', = 177sf
D&B advancement rate = 37 ft/day, = 250cy/day
Excavation Then Haul Offsite
Survey Control
Shotcrete/Prelining = 3" thick

Construction Tunnels:
Process: Drill, Blast, Excavate, Load, Haul, Dump, Load, Haul offsite.
Equipment: Track Drill, Excavator, FE Loader, Dump Trucks, FE Loader, Semis.
Crew: 1 Driller, 2 Blasters, 4 Equip Opr., 2 survey, 1 DT Driver

Access Tunnels:
Process: TBM bore, Excavate, Load, Haul, Dump, Load, Haul offsite; Rock Anchors; Shotcrete; Invert Concrete.
Equipment: TBM, Excavator, FE Loader, Dump Trucks, FE Loader, 2 Track Drill, Semis; Grout Pump; Concrete

7 Excavate Tailrace Tunnel

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Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity	
On Site		
Air Compressor		
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked		
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled		
Compactor, Vibratory, Self-Propelled		
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton		
Dozer, D5		
Dozer, D6		
Dozer, D8		
Dozer, D10		
Drill, Tracked	1	
Dump Truck, End Dump, 15 Ton		
Dump Truck, Off-Highway, 34 Ton	5	Haul Cuttings
Dump Truck, Semi-Trailer		
Excavator, 325	1	
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled	2	Load cuttings
Fuel Truck / Support Truck		
Generator - Diesel	1	
Grout Pump/Plant	1	
Hydroseed Sprayer, Truck Mounted		
Grader, H14		
Pile Driver		
Pump Truck - Concrete	2	
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed		
Tunnel Rig (TBM)	1	
Water Pump, Diesel	1	
Water Truck		
Welder and Generator Set		
Total Flatbed/Semi Trucks	5	
Daily Concrete Mixer Truck - 8 CY	25	
Daily Semi Trailer Truck	78	

Crew	Quantity
Blaster	2
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	3
Grade Setter	
Foreman	1
Labor Foreman	1
Laborers	8
Mechanics	1
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	7
Welder	

Total Crew Size	26
Monthly Labor Cost	$298,700

Duration: **7.7** Months **33.2** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

12.0 - TAILRACE TUNNEL SCHEDULE				
12.1 Tailrace Tunnel Excavation (TBM)			223,100	CY
Duration (from Tunnel Exc. Spreadsheet)			23.1	WEEKS
Average Production Rate			1,544	CY/DAY
Contingency			25	%
Final Duration			6.7	MONTHS
Final Duration			28.9	WEEKS
12.2 Prelining Shotcrete & Support			78,700	SY
Production Rate		(3-4 crews)	800	SY/DAY
Duration			4.5	MONTHS
Contingency			25	%
Final Duration			5.7	MONTHS
Final Duration			24.6	WEEKS
Lag			2.0	WEEKS
Maximum Duration			26.6	WEEKS
12.3 Plug Concrete Construction			3,400	CY
Production Rate			200	CY/DAY
Duration			0.8	MONTHS
Contingency			25	%
Final Duration			1.0	MONTHS
Final Duration			4.3	WEEKS
12.4 Plug Grout Injection			4,273	SY
Production Rate		(1.5 crews)	300	SY/DAY
Duration			0.7	MONTHS
Contingency			25	%
Final Duration			0.8	MONTHS
Final Duration			3.6	WEEKS
Lag			0.5	WEEKS
Maximum Duration			4.1	WEEKS
12.5 Tailrace Rock Trap Construction			1,133	CY
D&B Production Rate			250	CY/DAY
Duration			0.21	MONTHS
Contingency			25	%
Final Duration			0.26	MONTHS
Final Duration			1.1	WEEKS
12.6 Excavate Tailrace Surge Tank (shown on different schedule task)				
EQUIPMENT/TRUCKING				
DUMP TRUCKS			224,233	TOTAL VOLUME, CY
			30	CY/TRUCK
			7,474	# OF TRUCKS FOR TASK
			46	LOADS/DAY
			1.0	CYCLE TIME (HRS)
			5	REQUIRED # OF TRUCKS
OFFSITE TRUCKS			80	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;			20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete			5	# OF TRUCKS
CONCRETE TRUCKS			9958	TOTAL VOLUME, CY
			8	CY/TRUCK
			1,245	# OF TRUCKS FOR TASK
			25	TRUCKS/DAY
CONCRETE PUMP TRUCKS		(15 TRUCKS)-->	120	CY/DAY
			2	# OF TRUCKS
SEMIS			20	CY/TRUCK
			11,212	# OF TRUCKS FOR TASK
			78	TRUCKS/DAY

Assumptions:
Excavation Then Haul Offsite
Survey Control
Shotcrete/Prelining = 3" thick
Tailrace Tunnel:
Process: TBM bore, Excavate, Load, Haul, Dump, Load, Haul offsite; Shotcrete; Plug Concrete.
Equipment: TBM, Excavator, FE Loader, Dump Trucks, FE Loader, Semis; Grout Pump; Concrete Pump Truck.
Crew: 1 TBM Operator, 2 TBM Laborers, 3 Equip Opr., 2 survey, 5 DT Drivers;
(Activities do not overlap, therefore use maximum of activities to find equimpent and crew estimates)
Tailrace Rock Trap:
Process: Drill, Blast, Excavate, Load, Haul, Dump, Load, Haul offsite.
Equipment: Track Drill, Excavator, FE Loader, Dump Trucks, FE Loader, Semis.
Crew: 1 Driller, 2 Blasters, 3 Equip Opr., 2 survey, 1 DT Driver
Schedule: Excavation and Plug construction = duration, other activies + lag are less, Rock trap constructed concurrently.

8 Excavate Lower Pres. Tunnel

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity	
On Site		
Air Compressor		
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked		
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled		
Compactor, Vibratory, Self-Propelled		
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton		
Dozer, D5		
Dozer, D6		
Dozer, D8		
Dozer, D10		
Drill, Tracked	1	
Dump Truck, End Dump, 15 Ton		
Dump Truck, Off-Highway, 34 Ton	2	haul cuttings
Dump Truck, Semi-Trailer		
Excavator, 325	1	
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled	2	Load cuttings
Fuel Truck / Support Truck		
Generator - Diesel	1	
Grout Pump/Plant	1	
Hydroseed Sprayer, Truck Mounted		
Grader, H14		
Pile Driver		
Pump Truck - Concrete	2	
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed		
Tunnel Rig (TBM)	1	
Water Pump, Diesel	1	
Water Truck		
Welder and Generator Set		
Total Offsite Flatbed/Semi Trucks	13	
Daily Concrete Mixer Truck - 8 CY	25	
Daily Semi Trailer Truck	61	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	3
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	4
Mechanics	1
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	4
Welder	

Total Crew Size	16
Monthly Labor Cost	$190,600

Duration: **6.3** Months **27.3** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

8.0 - LOWER PRESSURE TUNNEL SCHEDULE			
8.1 Lower Pressure Tunnel Excavation (TBM)		52,600	CY
Duration (from Tunnel Exc. Spreadsheet)		6.9	WEEKS
Average Production Rate		1,214	CY/DAY
Contingency		25	%
Final Duration		2.0	MONTHS
Final Duration		8.7	WEEKS
8.2 Prelining Shotcrete & Support (6")		13,900	SY
Production Rate	(2 crews)	500	SY/DAY
Duration		1.3	MONTHS
Contingency		25	%
Final Duration		1.6	MONTHS
Final Duration		7.0	WEEKS
Lag		2.0	WEEKS
Maximum Duration		9.0	WEEKS
8.3 Tunnel Lining		14,300	CY
Production Rate		200	CY/DAY
Duration		3.3	MONTHS
Contingency		25	%
Final Duration		4.1	MONTHS
Final Duration		17.9	WEEKS
Lag		2.0	WEEKS
Maximum Duration		19.9	WEEKS
8.4 Miscellaneous Concrete (bends, plug, etc.)		5,900	CY
Production Rate		200	CY/DAY
Duration		1.4	MONTHS
Contingency		25	%
Final Duration		1.7	MONTHS
Final Duration		7.4	WEEKS
8.5 Contact Grouting		10,700	CF
Production Rate		450	CF/DAY
Duration		1.10	MONTHS
Contingency		25	%
Final Duration		1.37	MONTHS
Final Duration		5.9	WEEKS
Lag		1.0	WEEKS
Maximum Duration		6.9	WEEKS
8.6 Curtain Grouting		5,800	CF
Production Rate		450	CF/DAY
Duration		0.60	MONTHS
Contingency		25	%
Final Duration		0.75	MONTHS
Final Duration		3.2	WEEKS
Lag		1.0	WEEKS
Maximum Duration		4.2	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		52,600	TOTAL VOLUME, CY
		30	CY/TRUCK
		1,753	# OF TRUCKS FOR TASK
		13	LOADS/DAY
		1.0	CYCLE TIME (HRS)
		2	REQUIRED # OF TRUCKS
OFFSITE TRUCKS		249	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		13	# OF TRUCKS
CONCRETE TRUCKS		23,128	TOTAL VOLUME, CY
		8	CY/TRUCK
		2,891	# OF TRUCKS FOR TASK
		25	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		2	# OF TRUCKS
SEMIS		20	CY/TRUCK
		2,630	# OF TRUCKS FOR TASK
		61	TRUCKS/DAY

Assumptions:

Excavation Then Haul Offsite
Survey Control
Shotcrete/Prelining = 3" thick

Lower Pressure Tunnel:

Process: TBM bore, Excavate, Load, Haul, Dump, Load, Haul offsite; Shotcrete; Concrete Lining, Grouting.
Equipment: TBM, Excavator, FE Loader, Dump Trucks, FE Loader, Semis; Concrete Pump Truck; Drill, Grout
Crew: 1 TBM Operator, 2 TBM Laborers, 3 Equip Opr., 2 survey, 2 DT Drivers;
Schedule: Tunnel lining + Misc. Concrete = duration, other activies + lag are less, other activies constructed concurrently.

9 Excavate Upper Pres. Tunnel

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Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity	
On Site		
Air Compressor		
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked		
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled		
Compactor, Vibratory, Self-Propelled		
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton		
Dozer, D5		
Dozer, D6		
Dozer, D8		
Dozer, D10		
Drill, Tracked		
Dump Truck, End Dump, 15 Ton		
Dump Truck, Off-Highway, 34 Ton	5	haul cuttings
Dump Truck, Semi-Trailer		
Excavator, 325		
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled	1	Load cuttings
Fuel Truck / Support Truck	1	
Generator - Diesel	1	
Grout Pump/Plant		
Hydroseed Sprayer, Truck Mounted		
Grader, H14		
Pile Driver		
Pump Truck - Concrete		
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed		
Tunnel Rig (TBM)	1	
Water Pump, Diesel	1	
Water Truck		
Welder and Generator Set		
Total Offsite Flatbed/Semi Trucks	26	
Daily Concrete Mixer Truck - 8 CY	50	
Daily Semi Trailer Truck	65	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	4
Grade Setter	
Foreman	1
Labor Foreman	1
Laborers	10
Mechanics	1
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	10
Welder	

Total Crew Size	29
Monthly Labor Cost	$332,200

Duration: **5.7** Months **24.7** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

5.0 - UPPER PRESSURE TUNNEL SCHEDULE			
5.1 Upper Pressure Tunnel Excavation (TBM)		133,300	CY
Duration (from Tunnel Exc. Spreadsheet)		16.6	WEEKS
Average Production Rate		1,284	CY/DAY
Contingency		25	%
Final Duration		4.8	MONTHS
Final Duration		20.8	WEEKS
5.2 Prelining Shotcrete & Support (6")		35,300	SY
Production Rate	(2 crews)	500	SY/DAY
Duration		3.3	MONTHS
Contingency		25	%
Final Duration		4.1	MONTHS
Final Duration		17.7	WEEKS
Lag		2.0	WEEKS
Maximum Duration		19.7	WEEKS
5.3 Tunnel Lining		36,300	CY
Production Rate	(2 crews)	400	CY/DAY
Duration		4.2	MONTHS
Contingency		25	%
Final Duration		5.2	MONTHS
Final Duration		22.7	WEEKS
Lag		2.0	WEEKS
Maximum Duration		24.7	WEEKS
5.4 Miscellaneous Concrete (bends, plug, etc.)		5,400	CY
Production Rate		200	CY/DAY
Duration		1.2	MONTHS
Contingency		25	%
Final Duration		1.6	MONTHS
Final Duration		6.8	WEEKS
5.5 Contact Grouting		27,200	CF
Production Rate		450	CF/DAY
Duration		2.80	MONTHS
Contingency		25	%
Final Duration		3.5	MONTHS
Final Duration		15.1	WEEKS
Lag		1.0	WEEKS
Maximum Duration		16.1	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		133,300	TOTAL VOLUME, CY
		30	CY/TRUCK
		4,443	# OF TRUCKS FOR TASK
		43	LOADS/DAY
		1.0	CYCLE TIME (HRS)
		5	REQUIRED # OF TRUCKS
OFFSITE TRUCKS		518	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		26	# OF TRUCKS
CONCRETE TRUCKS		45,649	TOTAL VOLUME, CY
		8	CY/TRUCK
		5,706	# OF TRUCKS FOR TASK
		50	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		4	# OF TRUCKS
SEMIS		20	CY/TRUCK
		6,665	# OF TRUCKS FOR TASK
		65	TRUCKS/DAY

Assumptions:

Excavation Then Haul Offsite
Survey Control
Shotcrete/Prelining = 3" thick

Lower Pressure Tunnel:

Process: TBM bore, Excavate, Load, Haul, Dump, Load, Haul offsite; Shotcrete; Concrete Lining, Grouting.
Equipment: TBM, Excavator, FE Loader, Dump Trucks, FE Loader, Semis; Concrete Pump Truck; Grout Pump,
Crew: 1 TBM Operator, 2 TBM Laborers, 3 Equip Opr., 2 survey, 5 DT Drivers;
Schedule: Maximum of All Activities = duration, other activies + lag are less, other activies constructed concurrently.

10 Excavate Pressure Shaft

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EQUIPMENT	Quantity	
On Site		
Air Compressor	1	
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked		
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled		
Compactor, Vibratory, Self-Propelled		
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton	1	shaft work
Dozer, D5		
Dozer, D6		
Dozer, D8	1	Benching
Dozer, D10		
Drill, Tracked	1	
Dump Truck, End Dump, 15 Ton		
Dump Truck, Off-Highway, 34 Ton	2	
Dump Truck, Semi-Trailer		
Excavator, 325	1	Larger Model
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled	2	
Fuel Truck / Support Truck	1	
Generator - Diesel	1	
Grout Pump/Plant	1	
Hydroseed Sprayer, Truck Mounted		
Grader, H14		
Pile Driver		
Pump Truck - Concrete	2	
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed		
Tunnel Rig (TBM)		
Water Pump, Diesel	1	
Water Truck		
Welder and Generator Set		
Total Offsite Flatbed/Semi Trucks (3)	8	
Daily Concrete Mixer Truck - 10 CY	25	
Daily Semi Trailer Truck	24	

Crew	Quantity
Blaster	2
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	4
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	4
Mechanics	1
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	5
Welder	

Total Crew Size	20
Monthly Labor Cost	$237,200

Duration: **9.4** Months **40.6** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

7.0 - POWER SHAFT SCHEDULE		
7.1 Power Shaft Excavation (D&B)	40,600	CY
Duration (from Tunnel Exc. Spreadsheet)	11.6	WEEKS
Average Production Rate	467	CY/DAY
Contingency	50	%
Final Duration	4.0	MONTHS
Final Duration	17.4	WEEKS
7.2 Shaft Prelining & Support	2,200	SF
Production Rate	100	SF/DAY
Duration	1.0	MONTHS
Contingency	25	%
Final Duration	1.3	MONTHS
Final Duration	5.5	WEEKS
Lag	2.0	WEEKS
Maximum Duration	7.5	WEEKS
7.3 Concrete Lining	11,100	CY
Production Rate	200	CY/DAY
Duration	2.6	MONTHS
Contingency	25	%
Final Duration	3.2	MONTHS
Final Duration	13.9	WEEKS
Lag	2.0	WEEKS
Maximum Duration	15.9	WEEKS
7.4 Contact Grouting	9,300	CF
Production Rate	450	CF/DAY
Duration	1.0	MONTHS
Contingency	25	%
Final Duration	1.2	MONTHS
Final Duration	5.2	WEEKS
Lag	2.0	WEEKS
Maximum Duration	7.2	WEEKS

EQUIPMENT/TRUCKING			
DUMP TRUCKS		40,600	TOTAL VOLUME, CY
		30	CY/TRUCK
		1,353	# OF TRUCKS FOR TASK
		16	LOADS/DAY
		1.0	CYCLE TIME (HRS)
		2	REQUIRED # OF TRUCKS
OFFSITE TRUCKS		133	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		7	# OF TRUCKS
CONCRETE TRUCKS		11,628	TOTAL VOLUME, CY
		8	CY/TRUCK
		1,453	# OF TRUCKS FOR TASK
		25	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		2	# OF TRUCKS
SEMIS		20	CY/TRUCK
		2,030	# OF TRUCKS FOR TASK
		24	TRUCKS/DAY

6.0 - SURGE TANK SCHEDULE		
6.1 Shaft Excavation (D&B)	8,900	CY
Production Rate	400	CY/DAY
Duration	1.0	MONTHS
Contingency	25	%
Final Duration	1.3	MONTHS
Final Duration	5.6	WEEKS
6.2 Benching Excavation	35,300	CY
Production Rate	500	CY/DAY
Duration	3.3	MONTHS
Contingency	25	%
Final Duration	4.1	MONTHS
Final Duration	17.7	WEEKS

10 Excavate Pressure Shaft

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6.3 Concrete Works	700	CY
Production Rate	100	CY/DAY
Duration	0.3	MONTHS
Contingency	25	%
Final Duration	0.4	MONTHS
Final Duration	1.8	WEEKS
Lag	2.0	WEEKS
Maximum Duration	3.8	WEEKS

EQUIPMENT/TRUCKING			
OFFSITE TRUCKS		8	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		1	# OF TRUCKS
CONCRETE TRUCKS		700	TOTAL VOLUME, CY
		8	CY/TRUCK
		88	# OF TRUCKS FOR TASK
		13	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		1	# OF TRUCKS
SEMIS		20	CY/TRUCK
		2,210	# OF TRUCKS FOR TASK
		20	TRUCKS/DAY

Assumptions:

Excavation Then Haul Offsite
Survey Control
Shotcrete/Prelining = 3" thick

Power Shaft:

Process: Drill, Blast, Excavate, Crane Hoist, Load, Haul, Dump, Load, Haul offsite.
Equipment: Track Drill, Excavator, Crane, FE Loader, Dump Trucks, FE Loader, Semis; Grout Pump, Concrete
Crew: 1 Driller, 2 Blasters, 4 Equip Opr., 2 survey, 2 DT Driver;

Surge Tank:

Process: D&B: Drill, Blast, Excavate, Crane Hoist, Load, Haul offsite.
Equipment: D&B: Track Drill, Excavator, Crane, FE Loader, Dump Trucks, FE Loader, Semis; Grout Pump,
Crew: 1 Driller, 2 Blasters, 4 Equip Opr., 2 survey;
Schedule: Shaft Exc. + Surge Exc. + Bench Exc. = duration, other activies + lag are less, other activies constructed concurrently.

11 Excavate Top Heading

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Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity	
On Site		
Air Compressor	3	
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked		
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled		
Compactor, Vibratory, Self-Propelled		
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton		
Dozer, D5		
Dozer, D6		
Dozer, D8	2	
Dozer, D10		
Drill, Tracked	3	
Dump Truck, End Dump, 15 Ton		
Dump Truck, Off-Highway, 34 Ton	4	
Dump Truck, Semi-Trailer		
Excavator, 325	2	Larger Model
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled	4	
Fuel Truck / Support Truck	1	
Generator - Diesel	2	
Grout Pump/Plant		
Hydroseed Sprayer, Truck Mounted		
Grader, H14		
Pile Driver		
Pump Truck - Concrete		
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed		
Tunnel Rig (TBM) **(3)**		
Water Pump, Diesel		
Water Truck	1	
Welder and Generator Set		
Total Offsite Flatbed/Semi Trucks		
Daily Concrete Mixer Truck - 8 CY		
Daily Semi Trailer Truck	60	

Crew	Quantity
Blaster	6
Carpenters	
Cement Finisher	
Driller	3
Electricians	
Equipment Operators	8
Grade Setter	
Foreman	2
Labor Foreman	
Laborers	1
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	5
Welder	

Total Crew Size	27
Monthly Labor Cost	$326,000

Duration: **3.7** Months **16.1** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

13.0 MACHINE HALL SCHEDULE			
13.1-C Hall Benching Excavation (El. 18, El. 85)		64,000	CY
Production Rate	(3 crews)	1,200	CY/DAY
Duration		2.5	MONTHS
Contingency		25	%
Final Duration		3.1	MONTHS
Final Duration		13.3	WEEKS
13.1-D Roof Excavation (El. 85, El. 100)		9,900	CY
Production Rate	(2-3 crews)	900	CY/DAY
Duration		0.5	MONTHS
Contingency		25	%
Final Duration		0.6	MONTHS
Final Duration		2.8	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		73,900	TOTAL VOLUME, CY
		30	CY/TRUCK
		2,463	# OF TRUCKS FOR TASK
		40	LOADS/DAY (MAX.)
		1.0	CYCLE TIME (HRS)
		4	REQUIRED # OF TRUCKS
SEMIS		20	CY/TRUCK
		3,695	# OF TRUCKS FOR TASK
		60	TRUCKS/DAY

Assumptions:

Excavation Then Haul Offsite

Survey Control

Excavate Top Heading

Process: Drill, Blast, Excavate, Load, Haul, Dump, Load, Haul offsite.

Equipment: Track Drills, 2 Excavators, 2 Dozers, 4 FE Loaders, Dump Trucks, Semis, Water Truck, Support Truck.

Crew: 3 Drillers, 6 Blasters, 8 Equip Opr., 2 survey, 4 DT Drivers, 2 Foreman, 1 Water Truck Driver, 1 Support Driver.

Schedule: Activities are additive.

12 Roof Anchorage and Lining

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Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity	
On Site		
Air Compressor	1	
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked		
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled		
Compactor, Vibratory, Self-Propelled		
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton		
Dozer, D5		
Dozer, D6		
Dozer, D8		
Dozer, D10		
Drill, Tracked	1	drill anchor holes
Dump Truck, End Dump, 15 Ton		
Dump Truck, Off-Highway, 34 Ton		
Dump Truck, Semi-Trailer		
Excavator, 325		
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled		
Fuel Truck / Support Truck	1	
Generator - Diesel	1	
Grout Pump/Plant	1	shotcrete
Hydroseed Sprayer, Truck Mounted		
Grader, H14		
Pile Driver		
Pump Truck - Concrete		
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed	1	
Tunnel Rig (TBM)		
Water Pump, Diesel		
Water Truck		
Welder and Generator Set		
Total Offsite Flatbed/Semi Trucks	2	
Daily Concrete Mixer Truck - 8 CY	3	
Daily Semi Trailer Truck		

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	1
Welder	

Total Crew Size	6
Monthly Labor Cost	$67,500

Duration: **2.8** Months **12.1** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

13.0 MACHINE HALL SCHEDULE				
13.2	Roof & Walls Support (3")		96,700	SF
	Production Rate	(1 crew)	2,200	SF/DAY
	Duration		2.0	MONTHS
	Contingency		25	%
	Final Duration		2.5	MONTHS
	Final Duration		11.0	WEEKS
NA	Rock Bolts			
	Assume Bolts Lengths are:		20.0	LF
	Assume 1 bolt per:		100.0	SF
	Total Length		19340.0	LF
	Production Rate		400	LF/DAY
	Duration		2.2	MONTHS
	Contingency		25	%
	Final Duration		2.8	MONTHS
	Final Duration		12.1	WEEKS
EQUIPMENT/TRUCKING				
OFFSITE TRUCKS			25	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;			20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete			2	# OF TRUCKS
CONCRETE TRUCKS			895	TOTAL VOLUME, CY
			8	CY/TRUCK
			112	# OF TRUCKS FOR TASK
			3	TRUCKS/DAY

Assumptions:
Roof and Walls Support is 3" thick shotcrete
Grout for rockbolts is included in shotcrete volume
Roof and Walls Support:
Process: Drill, Install Rock Bolts, Grout Bolts, Shotcrete Surface.
Equipment: Track Drill, Support Truck, Flatbed Truck for rock bolts.
Crew: 1 Driller, 3 Laborers, 1 Foreman, 1 Truck Driver.

Schedule: Activities are additive.

13 Excavate Remainder of Cavern

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Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	2
Dozer, D10	
Drill, Tracked	3
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	4
Dump Truck, Semi-Trailer	
Excavator, 325	2
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	4
Fuel Truck / Support Truck	1
Generator - Diesel	2
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	40

Crew	Quantity
Blaster	6
Carpenters	
Cement Finisher	
Driller	3
Electricians	
Equipment Operators	8
Grade Setter	
Foreman	1
Labor Foreman	1
Laborers	1
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	5
Welder	

Total Crew Size	27
Monthly Labor Cost	$322,900

Duration: **1.6** Months **7.1** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

13.0 MACHINE HALL SCHEDULE			
13.1-A Excavation Draft Tubes (El. -16,El. -36)		4,600	CY
Production Rate	(2 crews)	800	CY/DAY
Duration		0.3	MONTHS
Contingency		25	%
Final Duration		0.3	MONTHS
Final Duration		1.4	WEEKS
13.1-B Benching Excavation (El. -16, El. 18)		22,700	CY
Production Rate	(2-3 crews)	1,000	CY/DAY
Duration		1.0	MONTHS
Contingency		25	%
Final Duration		1.3	MONTHS
Final Duration		5.7	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		27,300	TOTAL VOLUME, CY
		30	CY/TRUCK
		910	# OF TRUCKS FOR TASK
		33	LOADS/DAY (MAX.)
		1.0	CYCLE TIME (HRS)
		4	REQUIRED # OF TRUCKS
SEMIS		20	CY/TRUCK
		1,365	# OF TRUCKS FOR TASK
		40	TRUCKS/DAY

Assumptions:

Excavation Then Haul Offsite

Survey Control

Excavate Remainder of Cavern

Process: Drill, Blast, Excavate, Load, Haul, Dump, Load, Haul offsite.

Equipment: Track Drills, 2 Excavators, 2 Dozers, 4 FE Loaders, Dump Trucks, Semis, Water Truck, Support Truck.

Crew: 3 Drillers, 6 Blasters, 8 Equip Opr., 2 survey, 4 DT Drivers, 2 Foreman, 1 Water Truck Driver, 1 Support Driver.

Schedule: Activities are additive.

15 Excavate Transformer Gallery

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Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	1
Dozer, D10	
Drill, Tracked	2
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	3
Dump Truck, Semi-Trailer	
Excavator, 325	1
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	2
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	40

Crew	Quantity
Blaster	2
Carpenters	
Cement Finisher	
Driller	2
Electricians	
Equipment Operators	5
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	1
Mechanics	1
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	4
Welder	

Total Crew Size	18
Monthly Labor Cost	$218,800

Duration: **2.7** **Months** **11.8** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

15.1 TRANSFORMER HALL EXCAVATION (D&B)			
SCHEDULE			
15.1-A Transformer Hall Excavation		30,900	CY
Production Rate	(2 crews)	800	CY/DAY
Duration		1.8	MONTHS
Contingency		25	%
Final Duration		2.2	MONTHS
Final Duration		9.7	WEEKS
15.1-B Nishe Excavation		2,700	CY
Production Rate	(1crew)	400	CY/DAY
Duration		0.3	MONTHS
Contingency		25	%
Final Duration		0.4	MONTHS
Final Duration		1.7	WEEKS
15.1-C Cable Gallery Excavation		700	CY
Production Rate	(1crew)	400	CY/DAY
Duration		0.1	MONTHS
Contingency		25	%
Final Duration		0.1	MONTHS
Final Duration		0.4	WEEKS
15.1-D A/C Gallery Excavation		100	CY
Production Rate	(1crew)	400	CY/DAY
Duration		0.0	MONTHS
Contingency		25	%
Final Duration		0.0	MONTHS
Final Duration		0.1	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		34,400	TOTAL VOLUME, CY
		30	CY/TRUCK
		1,147	# OF TRUCKS FOR TASK
		27	LOADS/DAY (MAX.)
		1.0	CYCLE TIME (HRS)
		3	REQUIRED # OF TRUCKS
SEMIS		20	CY/TRUCK
		1,720	# OF TRUCKS FOR TASK
		40	TRUCKS/DAY

Assumptions:

Excavation Then Haul Offsite

Survey Control

Excavate Transformer Gallery:

Process: Drill, Blast, Excavate, Load, Haul, Dump, Load, Haul offsite.

Equipment: Track Drills, 1 Excavators, 1 Dozer, 3 FE Loaders, Dump Trucks, Semis, Water Truck, Support Truck.

Crew: 2 Drillers, 4 Blasters, 5 Equip Opr., 2 survey, 3 DT Drivers, 1 Foreman, 1 Water Truck Driver, 1 Support Driver.

Schedule: Activities are additive.

16 Exc. Tailrace Surge Chamber

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	1
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	1
Dump Truck, Semi-Trailer	
Excavator, 325	1
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	2
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	1
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	1
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	15

Crew	Quantity
Blaster	2
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	3
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	4
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	3
Welder	

Total Crew Size	16
Monthly Labor Cost	$188,600

Duration: **6.4** **Months** **27.8** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

12.6 D/S Surge Tank Construction (D&B)			
SCHEDULE			
NA Surge Tank Excavation (D&B)		19,000	CY
Production Rate	(1 crew)	300	CY/DAY
Duration	(Reduced Production - Limited Access)	2.9	MONTHS
Contingency		25	%
Final Duration		3.7	MONTHS
Final Duration		15.8	WEEKS
NA Roof & Walls Support (3")		105,000	SF
Production Rate	(1 crew)	2,200	SF/DAY
Duration		2.2	MONTHS
Contingency		25	%
Final Duration		2.8	MONTHS
Final Duration		11.9	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		19,000	TOTAL VOLUME, CY
		30	CY/TRUCK
		633	# OF TRUCKS FOR TASK
		10	LOADS/DAY (MAX.)
		1.0	CYCLE TIME (HRS)
		1	REQUIRED # OF TRUCKS
OFFSITE TRUCKS		6	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		1	# OF TRUCKS
SEMIS		20	CY/TRUCK
		950	# OF TRUCKS FOR TASK
		15	TRUCKS/DAY

Assumptions:

Excavation Then Haul Offsite

Survey Control

Excavate Transformer Gallery:

Process: Drill, Blast, Excavate, Load, Haul, Dump, Load, Haul offsite.

Equipment: Track Drill, 1 Excavators, 2 FE Loaders, Dump Truck, Semis, Water Truck, Support Truck.

Crew: 1 Driller, 2 Blasters, 3 Equip Opr., 2 survey, 1 DT Driver, 1 Water Truck Driver, 1 Support Driver.

Shotcrete Crew: 1 Forman, 2 Laborers, 1 CPT Driver.

Schedule: Activities are additive.

17 Excavate Cable Tunnel Shaft

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		Approved		By	

EQUIPMENT	Quantity	
On Site		
Air Compressor	1	
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked		
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled		
Compactor, Vibratory, Self-Propelled		
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton		
Dozer, D5		
Dozer, D6		
Dozer, D8		
Dozer, D10		
Drill, Tracked	1	
Dump Truck, End Dump, 15 Ton		
Dump Truck, Off-Highway, 34 Ton	1	
Dump Truck, Semi-Trailer		
Excavator, 325	1	Larger Model
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled	2	
Fuel Truck / Support Truck	1	
Generator - Diesel	1	
Grout Pump/Plant		
Hydroseed Sprayer, Truck Mounted		
Grader, H14		
Pile Driver		
Pump Truck - Concrete		
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed		
Tunnel Rig (TBM)		
Water Pump, Diesel	1	
Water Truck		
Welder and Generator Set		
Total Offsite Flatbed/Semi Trucks		
Daily Concrete Mixer Truck - 8 CY		
Daily Semi Trailer Truck	3	

Crew	Quantity
Blaster	2
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	4
Grade Setter	
Foreman	
Labor Foreman	
Laborers	1
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	1
Welder	

Total Crew Size	11
Monthly Labor Cost	$134,600

Duration:	**5.9**	**Months**	**25.4**	**Weeks**

CONSTANTS:	10	HR/DAY	216.25	HRS/MONTH

15.1-E CABLE SHAFT EXCAVATION SCHEDULE				
NA Cable Shaft Excavation (D&B)			4,700	CY
	Production Rate	(1 crew)	50	CY/DAY
	Duration	(Low production - restricted work area)	4.3	MONTHS
	Contingency		35	%
Final Duration			5.9	MONTHS
Final Duration			25.4	WEEKS
EQUIPMENT/TRUCKING				
DUMP TRUCKS			4,700	TOTAL VOLUME, CY
			30	CY/TRUCK
			157	# OF TRUCKS FOR TASK
			2	LOADS/DAY (MAX.)
			1.0	CYCLE TIME (HRS)
			1	REQUIRED # OF TRUCKS
SEMIS			20	CY/TRUCK
			235	# OF TRUCKS FOR TASK
			3	TRUCKS/DAY

Assumptions:

Excavation Then Haul Offsite

Survey Control

Excavate Transformer Gallery:

Process: Drill, Blast, Excavate, Crane Hoist, Load, Haul, Dump, Load, Haul offsite.

Equipment: Track Drill, Excavator, Crane, FE Loader, Dump Truck, FE Loader, Semis, Support Truck.

Crew: 1 Driller, 2 Blasters, 4 Equip Opr., 2 survey, 1 DT Driver, 1 Support Driver.

18 Line and Pave Cable Tunnel

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
		Checked		By	
		Approved		By	

EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	1
Crane - 40 Ton	
Crane - 70 Ton	1
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	1
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump/Plant	1
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	1
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	2
Daily Concrete Mixer Truck - 8 CY	1
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	1
Welder	

Total Crew Size	6
Monthly Labor Cost	$67,500

Duration: **10.1** Months **43.6** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

15.0 TRANSFORMER HALL SCHEDULE			
15.2-E	Roof & Walls Support - Cable Shaft	56,900	SF
	Production Rate (1 crew)	500	SF/DAY
	Duration (Low production - restricted work area)	5.3	MONTHS
	Contingency	25	%
	Final Duration	6.6	MONTHS
	Final Duration	28.5	WEEKS
NA	Rock Bolts		
	Assume Bolts Lengths are:	5.5	LF
	Assume 1 bolt per:	45.0	SF
	Total Length	6954	LF
	Production Rate	200	LF/DAY
	Duration (Low production - restricted work area)	1.6	MONTHS
	Contingency	25	%
	Final Duration	2.0	MONTHS
	Final Duration	8.7	WEEKS
NA	Ladders, Platforms, Cable Installation		
	Total Length	1300	LF
	Production Rate	50	LF/DAY
	Duration	1.2	MONTHS
	Contingency	25	%
	Final Duration	1.5	MONTHS
	Final Duration	6.5	WEEKS

EQUIPMENT/TRUCKING		
OFFSITE TRUCKS	36	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;	20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete	2	# OF TRUCKS
CONCRETE TRUCKS	527	TOTAL VOLUME, CY
	8	CY/TRUCK
	66	# OF TRUCKS FOR TASK
	1	TRUCKS/DAY

Assumtions:

Roof and Walls Support is 3" thick shotcrete

Grout for rockbolts is included in shotcrete volume

Roof and Walls Support:

Process: Drill, Install Rock Bolts, Grout Bolts, Shotcrete Surface, Install Equipment.

Equipment: Track Drill, Hoist, Support Truck, Flatbed Truck for rock bolts, Pump.

Crew: 1 Driller, 3 Laborers, 1 Foreman, 1 Truck Driver.

Schedule: Activities are additive.

19 Penstock & Draft Tube Man.

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
		Checked		By	
		Approved		By	

EQUIPMENT	Quantity
On Site	
Air Compressor	2
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	1
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	3
Dump Truck, Semi-Trailer	
Excavator, 325	1
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	3
Fuel Truck / Support Truck	1
Generator - Diesel	2
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	4
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	9
Daily Concrete Mixer Truck - 8 CY	50
Daily Semi Trailer Truck	40

Crew	Quantity
Blaster	4
Carpenters	
Cement Finisher	
Driller	2
Electricians	
Equipment Operators	5
Grade Setter	
Foreman	3
Labor Foreman	3
Laborers	9
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	8
Welder	

Total Crew Size	36
Monthly Labor Cost	$417,400

Duration: 5.2 **Months** 22.5 **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

9.0 PENSTOCK MANIFOLD SCHEDULE				
9.1 Manifold Tunnel Excavation (D&B)			7,400	CY
	Production Rate	(2 crews)	800	CY/DAY
	Duration		0.4	MONTHS
	Contingency		25	%
Final Duration			0.5	MONTHS
Final Duration			2.3	WEEKS
9.2 Manifold Tunnel Prelining & Support (3", 75%)			2,400	SY
	Production Rate	(2 crews)	500	SY/DAY
	Duration		0.2	MONTHS
	Contingency		25	%
Final Duration			0.3	MONTHS
Final Duration			1.2	WEEKS
9.3 Concrete Lining			1,800	CY
	Production Rate	(2 crews)	400	CY/DAY
	Duration		0.2	MONTHS
	Contingency		25	%
Final Duration			0.3	MONTHS
Final Duration			1.1	WEEKS
9.4 Concrete Plug			10,700	CY
	Production Rate	(1crew)	200	CY/DAY
	Duration		2.5	MONTHS
	Contingency		25	%
Final Duration			3.1	MONTHS
Final Duration			13.4	WEEKS
EQUIPMENT/TRUCKING				
DUMP TRUCKS			7,400	TOTAL VOLUME, CY
			30	CY/TRUCK
			247	# OF TRUCKS FOR TASK
			27	LOADS/DAY (MAX.)
			1.0	CYCLE TIME (HRS)
			3	REQUIRED # OF TRUCKS
OFFSITE TRUCKS			151	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;			20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete			8	# OF TRUCKS
CONCRETE TRUCKS			12700	TOTAL VOLUME, CY
			8	CY/TRUCK
			1,588	# OF TRUCKS FOR TASK
			50	TRUCKS/DAY
CONCRETE PUMP TRUCKS		(15 TRUCKS)-->	120	CY/DAY
			4	# OF TRUCKS
SEMIS			20	CY/TRUCK
			370	# OF TRUCKS FOR TASK
			40	TRUCKS/DAY

11.0 DRAFT TUBE MANIFOLD SCHEDULE				
11.1 Manifold Tunnel Excavation (D&B)			7,400	CY
	Production Rate	(2 crews)	800	CY/DAY
	Duration		0.4	MONTHS
	Contingency		25	%
Final Duration			0.5	MONTHS
Final Duration			2.3	WEEKS
11.2 Manifold Tunnel Prelining & Support (3", 75%)			2,400	SY
	Production Rate	(2 crews)	500	SY/DAY
	Duration		0.2	MONTHS
	Contingency		25	%
Final Duration			0.3	MONTHS
Final Duration			1.2	WEEKS
11.3 Concrete Lining			1,600	CY
	Production Rate	(2 crews)	400	CY/DAY
	Duration		0.2	MONTHS
	Contingency		25	%
Final Duration			0.2	MONTHS
Final Duration			1.0	WEEKS
EQUIPMENT/TRUCKING				
DUMP TRUCKS			7,400	TOTAL VOLUME, CY
			30	CY/TRUCK
			247	# OF TRUCKS FOR TASK
			27	LOADS/DAY (MAX.)
			1.0	CYCLE TIME (HRS)
			3	REQUIRED # OF TRUCKS
OFFSITE TRUCKS			20	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;			20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete			1	# OF TRUCKS
CONCRETE TRUCKS			1800	TOTAL VOLUME, CY
			8	CY/TRUCK
			225	# OF TRUCKS FOR TASK
			50	TRUCKS/DAY
CONCRETE PUMP TRUCKS		(15 TRUCKS)-->	120	CY/DAY
			4	# OF TRUCKS
SEMIS			20	CY/TRUCK
			370	# OF TRUCKS FOR TASK
			40	TRUCKS/DAY

Assumptions:
Excavation Then Haul Offsite
Survey Control
(Activities do not overlap, therefore use maximum of activities to find equimpent and crew estimates)

20 Install Steel Tunnel Linings

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
		Checked		By	
		Approved		By	

EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	1
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	2
Dump Truck, Semi-Trailer	
Excavator, 325	1
Forklift, Rough Terrain	1
Front End Loader, Tracked	
Front End Loader, Wheeled	2
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	2
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	1
Total Offsite Flatbed/Semi Trucks	154
Daily Concrete Mixer Truck - 8 CY	25
Daily Semi Trailer Truck	20

Crew	Quantity
Blaster	2
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	3
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	4
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	2
Steel Worker Foreman	
Truck Drivers	5
Welder	2

Total Crew Size	22
Monthly Labor Cost	$278,800

Duration: **7.9** **Months** **34.3** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

10.0 PENSTOCKS SCHEDULE			
10.1 Penstock Tunnel Excavation - D&B		18,900	CY
Production Rate	(1 crew)	400	CY/DAY
Duration		2.2	MONTHS
Contingency		25	%
Final Duration		2.7	MONTHS
Final Duration		11.8	WEEKS
10.2 Penstock Tunnel Prelining & Support (3", 30%)		3,800	SY
Production Rate	(1 crew)	200	SY/DAY
Duration		0.9	MONTHS
Contingency		25	%
Final Duration		1.1	MONTHS
Final Duration		4.8	WEEKS
10.3 Steel Liner Installation		3,000	TONS
Assumed Unit Weight of Steel Liner		475	LBS/CF
Tunnel Diameter		15	FT
Thickness		1.625	INCHES
Unit Weight		1.5	TONS/FT
Length		2,000	FT
Production Rate		50	LF/DAY
Duration		1.8	MONTHS
Contingency		25	%
Final Duration		2.3	MONTHS
Final Duration		10.0	WEEKS
10.4 Concrete Filling Around Liner		5,200	CY
Production Rate	(2 crews)	400	CY/DAY
Duration		0.6	MONTHS
Contingency		25	%
Final Duration		0.8	MONTHS
Final Duration		3.3	WEEKS
10.5 Contact Grouting		2,000	LF
Diameter		15	FT
Contact Grouting Area Percent		25	%
Grout Volume		5,890	CF
Production Rate	(1 crew)	450	CF/DAY
Duration		0.6	MONTHS
Contingency		25	%
Final Duration		0.8	MONTHS
Final Duration		3.3	WEEKS
10.6 Curtain Grouting			
Assumed Grout Curtain Diameter		30	FT
Grout Curtain Thickness		1	FT
Penstock Diameter		15	FT
Number of Penstocks		4	
Volume of Grout		2,200	CF
Production Rate		450	CF/DAY
Duration		0.23	MONTHS
Contingency		25	%
Final Duration		0.28	MONTHS
Final Duration		1.2	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		18,900	TOTAL VOLUME, CY
		30	CY/TRUCK
		630	# OF TRUCKS FOR TASK
		13	LOADS/DAY (MAX.)
		1.0	CYCLE TIME (HRS)
		2	REQUIRED # OF TRUCKS
CONCRETE TRUCKS		5816	TOTAL VOLUME, CY
		8	CY/TRUCK
		727	# OF TRUCKS FOR TASK
		25	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		2	# OF TRUCKS
OFFSITE TRUCKS		3064	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		154	# OF TRUCKS
SEMIS		20	CY/TRUCK
		945	# OF TRUCKS FOR TASK
		20	TRUCKS/DAY

Assumptions:

Excavation Then Haul Offsite

Survey Control

Penstock & Draft Tube Manifolds:

Process: Drill, Blast, Excavate, Load, Haul, Dump, Load, Haul offsite; Shotcrete; Steel Lining, Concrete Lining, Contact Grouting, Curtain Grouting.

Equipment: Track Drill, 1 Excavator, 2 FE Loaders, Dump Trucks, Semis, Water Truck, Support Truck.

Crew: 1 Driller, 2 Blasters, 3 Equip Opr., 2 survey, 2 DT Drivers, 1 Foreman, 1 Water Truck Driver, 1 Support Driver.

Steel Lining Crew: 2 Welders, 2 Steel Workers, 1 Equip Opr.

Shotcrete/Concrete/Grouting Crew: 1 Foreman, 4 Laborers, 2 CPT Drivers.

Schedule: Activities are additive.

21 First Stage Concrete

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Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
		Checked		By	
		Approved		By	

EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	1
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump/Plant	1
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	2
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	8
Daily Concrete Mixer Truck - 8 CY	25
Daily Semi Trailer Truck	

Crew	Quantity	
Blaster		
Carpenters		
Cement Finisher	2	
Driller		
Electricians		
Equipment Operators	1	
Grade Setter		
Foreman	1	
Labor Foreman	1	
Laborers	9	form work
Mechanics		
Painter		
Pile Driver		
Pipe Foreman		
Pipe Layer		
Plumber		
Rigger		
Survey/Rodmen		
Steel Worker	2	rebar
Steel Worker Foreman		
Truck Drivers	3	
Welder		

Total Crew Size	19
Monthly Labor Cost	$225,300

Duration: **5.5** **Months** **23.9** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

FIRST STAGE CONCRETE - MULTIPLE ITEMS SCHEDULE				
13.3-B	Machine Hall (El.-16,El.-12)		2,700	CY
	Production Rate	(1 crew)	200	CY/DAY
	Duration		0.6	MONTHS
	Contingency		25	%
	Final Duration		0.8	MONTHS
	Final Duration		3.4	WEEKS
13.3-C	Machine Hall (El.-12,El.+9)		10,100	CY
	Production Rate	(1 crew)	200	CY/DAY
	Duration		2.3	MONTHS
	Contingency		25	%
	Final Duration		2.9	MONTHS
	Final Duration		12.6	WEEKS
15.2-A	Roof & Wall Support Transformer Hall		44,300	SF
	Production Rate	(1 crew)	2,200	SF/DAY
	Duration		0.9	MONTHS
	Contingency		25	%
	Final Duration		1.2	MONTHS
	Final Duration		5.0	WEEKS
15.2-B	Roof & Wall Support Nishe Excavation		2,500	SF
	Production Rate	(1 crew)	500	SF/DAY
	Duration	(Low production - restricted work area)	0.2	MONTHS
	Contingency		25	%
	Final Duration		0.3	MONTHS
	Final Duration		1.3	WEEKS
15.2-C	Roof & Wall Support Cable Gallery		3,200	SF
	Production Rate	(1 crew)	500	SF/DAY
	Duration	(Low production - restricted work area)	0.30	MONTHS
	Contingency		25	%
	Final Duration		0.37	MONTHS
	Final Duration		1.6	WEEKS
15.2-D	Roof & Wall Support A/C Gallery		100	SF
	Production Rate	(1 crew)	500	SF/DAY
	Duration	(Low production - restricted work area)	0.01	MONTHS
	Contingency		25	%
	Final Duration		0.01	MONTHS
	Final Duration		0.1	WEEKS
EQUIPMENT/TRUCKING				
OFFSITE TRUCKS			156	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;			20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete			8	# OF TRUCKS
CONCRETE TRUCKS			13,264	TOTAL VOLUME, CY
			8	CY/TRUCK
			1,658	# OF TRUCKS FOR TASK
			25	TRUCKS/DAY
CONCRETE PUMP TRUCKS		(15 TRUCKS)-->	120	CY/DAY
			2	# OF TRUCKS

Assumptions:

Process: Form, Pump, Finish.
Equipment: Concrete Trucks, Concrete Pump Trucks, 1 Water Truck, 1 Support Truck, Hoist Crane.
Crew: 1 Foreman, 1 Laborer Foreman, 8 Laborers, 2 Cement Finishers, 2 Steel Workers, 1 Water Truck Driver, 1 Support Driver, 2 CPT Drivers, 1 Crane Oper.
Schedule: Activities are additive.

23 Spiral Cases & Draft Tube

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
		Checked		By	
		Approved		By	

EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	1
Crane - 40 Ton	1
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	1
Total Offsite Flatbed/Semi Trucks	11
Daily Concrete Mixer Truck - 8 CY	1
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller (3)	
Electricians	
Equipment Operators	1
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	2
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	2
Steel Worker Foreman	
Truck Drivers	1
Welder	1

Total Crew Size	8
Monthly Labor Cost	$111,400

Duration: **8.2** **Months** **35.3** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

13.4 Spiral Cases & Draft Tube Liners			
SCHEDULE			
13.4-A Draft Tube Steel Liner		220	TONS
Assumed Unit Weight of Steel Liner		475	LBS/CF
Average Draft Tube Diameter		10	FT
Thickness		1.625	INCHES
Unit Weight		1.0	TONS/FT
Length		300	FT
Production Rate	(1 crew)	5	LF/DAY
Duration	(Very low production - very restricted work area)	2.8	MONTHS
Contingency		25	%
Final Duration		3.5	MONTHS
Final Duration		15.0	WEEKS
10.5 Contact Grouting		8,100	CF
Production Rate	(1 crew)	100	CF/DAY
Duration	(Very low production - very restricted work area)	3.7	MONTHS
Contingency		25	%
Final Duration		4.7	MONTHS
Final Duration		20.3	WEEKS
EQUIPMENT/TRUCKING			
CONCRETE TRUCKS		300	TOTAL VOLUME, CY
		8	CY/TRUCK
		38	# OF TRUCKS FOR TASK
		1	TRUCKS/DAY
OFFSITE TRUCKS		220	TOTAL WEIGHT, TONS
		20	TONS/TRUCK
		11	# OF TRUCKS

Assumptions:
Process: Steel Lining, Contact Grouting.
Equipment: Crane, Concrete Pump, Welder.
Steel Lining Crew: 1 Welders, 2 Steel Workers, 1 Equip Opr.
Grouting Crew: 1 Foreman, 2 Laborers, 1 CPT Drivers.
Schedule: Activities are additive.

24 Pump Turbines and Generators

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	1
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	1
Total Offsite Flatbed/Semi Trucks	8
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	2
Equipment Operators	1
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	
Welder	1

Total Crew Size	8
Monthly Labor Cost	$107,200

Duration: **11.1** **Months** **48.0** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

14.0 TURBINES & GENERATORS SCHEDULE		
14.1 & .2 Install Water to Wire Package	4	EA
Production Rate	50	DAYS/EA
Duration	9.2	MONTHS
Contingency	20	%
Final Duration	11.1	MONTHS
Final Duration	48.0	WEEKS
EQUIPMENT/TRUCKING		
OFF SITE FLATBED SEMIS	0.5	UNITS/TRUCK
	8	# OF TRUCKS FOR TASK
	1	TRUCKS/DAY

Assumptions:

Equipment: Crane, Welder, Air Compressor (tools), Support Truck, Generator, Semis.
Installation Crew: 1 Welder, 2 Electricians, 1 Equip Opr., 1 Foreman, 2 Laborers, 1 Support Truck Driver.

25 Embed Spiral Case&Draft Tube

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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	1
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	3
Daily Concrete Mixer Truck - 8 CY	4
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	1
Driller	
Electricians	
Equipment Operators	
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	2
Welder	

Total Crew Size	7
Monthly Labor Cost	$79,600

Duration: **8.7** **Months** **37.5** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

13.0 MACHINE HALL SCHEDULE			
13.3-A Concrete Draft Tubes (El. -41,El. -16)		4,500	CY
Production Rate	(1 crew)	30	CY/DAY
Duration	(Very low production - very restricted work area)	6.9	MONTHS
Contingency		25	%
Final Duration		8.7	MONTHS
Final Duration		37.5	WEEKS
EQUIPMENT/TRUCKING			
OFFSITE TRUCKS		54	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		3	# OF TRUCKS
CONCRETE TRUCKS		4,500	TOTAL VOLUME, CY
		8	CY/TRUCK
		563	# OF TRUCKS FOR TASK
		4	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		1	# OF TRUCKS

Assumptions:

Process: Form, Pump, Finish.
Equipment: Concrete Trucks, Concrete Pump Truck, 1 Water Truck, 1 Support Truck.
Crew: 1 Foreman, 2 Laborers, 1 Cement Finisher, 1 Water Truck Driver, 1 Support Driver, 1 CPT Driver.

26 Install Mech. Equip.

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	1
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	2
Total Offsite Flatbed/Semi Trucks	5
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	1
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	2
Steel Worker Foreman	
Truck Drivers	
Welder	2

Total Crew Size	9
Monthly Labor Cost	$128,600

Duration: **6.0** **Months** **26.0** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

INSTALL MECHANICAL EQUIPMENT SCHEDULE		
13.8 96" Dia. Spherical Valve	4	EA
Production Rate	20	DAYS/EA
Duration	3.7	MONTHS
Contingency	25	%
Final Duration	4.6	MONTHS
Final Duration	20.0	WEEKS
NA 350 Ton Bridge Crane	1.0	EA
Production Rate	24	DAYS/EA
Duration	1.1	MONTHS
Contingency	25	%
Final Duration	1.4	MONTHS
Final Duration	6.0	WEEKS
EQUIPMENT/TRUCKING		
OFFSITE FLATBED SEMIS	1.0	UNITS/TRUCK
	5	# OF TRUCKS FOR TASK
	1	TRUCKS/DAY

Assumptions:

Equipment: Crane, Welder, Air Compressor (tools), Support Truck, Generator, Semis.

Installation Crew: 2 Welders, 2 Steel Workers, 1 Equip Opr., 1 Foreman, 2 Laborers, 1 Support Truck Driver.
Schedule: Activities are additive.

27 Install Elec. Equip.

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	1
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	1
Total Offsite Flatbed/Semi Trucks	4
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	2
Equipment Operators	1
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	
Welder	1

Total Crew Size	8
Monthly Labor Cost	$107,200

Duration: **6.0** **Months** **26.0** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

INSTALL ELECTRICAL EQUIPMENT SCHEDULE			
NA	Install Electrical Equipment (1300 MW)	1,300	MW
	Production Rate	60	MW/WEEK
	Duration	5.0	MONTHS
	Contingency	20	%
	Final Duration	6.0	MONTHS
	Final Duration	26.0	WEEKS

Assumptions:

Equipment: Forklift, Welder, Air Compressor (tools), Support Truck, Generator.
Installation Crew: 1 Welder, 2 Electricians, 1 Equip Opr., 1 Foreman, 2 Laborers, 1 Support Truck Driver.

28 Complete Concrete Work

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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	1
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	1
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	10
Daily Concrete Mixer Truck - 8 CY	13
Daily Semi Trailer Truck	

Crew	Quantity	
Blaster		
Carpenters		
Cement Finisher	2	
Driller		
Electricians		
Equipment Operators	1	
Grade Setter		
Foreman	1	
Labor Foreman		
Laborers	5	
Mechanics		
Painter		
Pile Driver		
Pipe Foreman		
Pipe Layer		
Plumber		
Rigger		
Survey/Rodmen	2	
Steel Worker	2	rebar
Steel Worker Foreman		
Truck Drivers	2	
Welder		

Total Crew Size	15
Monthly Labor Cost	$187,200

Duration: **9.3** **Months** **40.3** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

COMPLETE CONCRETE WORK (2ND STAGE) - MULTIPLE ITEMS SCHEDULE				
13.3-D	Machine Hall (El.9,El.19)		1,100	CY
	Production Rate	(1 crew)	100	CY/DAY
	Duration	(Half Production - Detailed Finishing)	0.5	MONTHS
	Contingency		25	%
	Final Duration		0.6	MONTHS
	Final Duration		2.8	WEEKS
13.3-E	Machine Hall (El.19,El.21)		1,900	CY
	Production Rate	(1 crew)	100	CY/DAY
	Duration	(Half Production - Detailed Finishing)	0.9	MONTHS
	Contingency		25	%
	Final Duration		1.1	MONTHS
	Final Duration		4.8	WEEKS
13.3-F	Machine Hall Slab (El.38)		1,000	CY
	Production Rate	(1 crew)	100	CY/DAY
	Duration	(Half Production - Detailed Finishing)	0.5	MONTHS
	Contingency		25	%
	Final Duration		0.6	MONTHS
	Final Duration		2.5	WEEKS
13.3-G	Machine Hall Walls (El.9,El.18)		500	CY
	Production Rate	(1 crew)	100	CY/DAY
	Duration	(Half Production - Detailed Finishing)	0.2	MONTHS
	Contingency		25	%
	Final Duration		0.3	MONTHS
	Final Duration		1.3	WEEKS
13.3-H	Machine Hall Walls (El.18,El.85)		5,100	CY
	Production Rate	(1 crew)	100	CY/DAY
	Duration	(Half Production - Detailed Finishing)	2.4	MONTHS
	Contingency		25	%
	Final Duration		2.9	MONTHS
	Final Duration		12.8	WEEKS
13.3-I	Machine Hall Roof		2,600	CY
	Production Rate	(1 crew)	100	CY/DAY
	Duration	(Half Production - Detailed Finishing)	1.2	MONTHS
	Contingency		25	%
	Final Duration		1.5	MONTHS
	Final Duration		6.5	WEEKS
15.3	Transformer Hall Concrete Works		3,900	CY
	Production Rate	(1 crew)	100	CY/DAY
	Duration	(Half Production - Detailed Finishing)	1.8	MONTHS
	Contingency		25	%
	Final Duration		2.3	MONTHS
	Final Duration		9.8	WEEKS
EQUIPMENT/TRUCKING				
OFFSITE TRUCKS			193	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;			20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete			10	# OF TRUCKS
CONCRETE TRUCKS			16,100	TOTAL VOLUME, CY
			8	CY/TRUCK
			2,013	# OF TRUCKS FOR TASK
			13	TRUCKS/DAY
CONCRETE PUMP TRUCKS		(15 TRUCKS)-->	120	CY/DAY
			1	# OF TRUCKS

Assumptions:

Process: Form, Pump, Finish.

Equipment: Concrete Trucks, Concrete Pump Truck, 1 Water Truck, 1 Support Truck, Hoist Crane.

Crew: 1 Foreman, 4 Laborers, 2 Cement Finishers, 2 Steel Workers, 1 Water Truck Driver, 1 Support Driver, 1 CPT Driver, 1 Crane Oper., 2 Survey

Schedule: Activities are additive.

29 Struc. & Archit. Construct.

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	1
Crane - 70 Ton	1
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	1
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	1
Dump Truck, Semi-Trailer	
Excavator, 325	1
Forklift, Rough Terrain	2
Front End Loader, Tracked	
Front End Loader, Wheeled	2
Fuel Truck / Support Truck	2
Generator - Diesel	2
Grout Pump/Plant	1
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	1
Water Truck	
Welder and Generator Set	1
Total Offsite Flatbed/Semi Trucks	43
Daily Concrete Mixer Truck - 8 CY	3
Daily Semi Trailer Truck	18

Crew	Quantity
Blaster	2
Carpenters	4
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	4
Grade Setter	
Foreman	2
Labor Foreman	
Laborers	5
Mechanics	1
Painter	2
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	2
Rigger	
Survey/Rodmen	2
Steel Worker	2
Steel Worker Foreman	
Truck Drivers	2
Welder	1

Total Crew Size	30
Monthly Labor Cost	$390,100

Duration: **13.1** **Months** **64.5** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

STRUCTURAL & ARCHITECTURAL CONSTRUCTION SCHEDULE			
NA	Structural & Architectural Construction		
	Machine Hall Volume	144,000	CY
	Transformer Hall Volume	27,300	CY
	Total Struc. & Arch. Const. Volume	171,300	CY
	Production Rate	1,000	CY/DAY
	Duration	7.9	MONTHS
	Contingency	25	%
	Final Duration	9.9	MONTHS
	Final Duration	42.8	WEEKS
13.5	Elevator Shaft Construction	1,250	LF
	Production Rate	50	LF/DAY
	Duration	1.2	MONTHS
	Contingency	25	%
	Final Duration	1.4	MONTHS
	Final Duration	6.3	WEEKS
13.6	Miscellaneous Metal Works - Machine Hall		
	Assumed Steel Weight	250	TONS
	Production Rate	20	TONS/DAY
	Duration	0.6	MONTHS
	Contingency	25	%
	Final Duration	0.7	MONTHS
	Final Duration	3.1	WEEKS
NA	Drainage Gallery Excavation - D&B	6,200	CY
	D&B Production Rate	200	CY/DAY
	Duration	1.4	MONTHS
	Contingency	25	%
	Final Duration	1.8	MONTHS
	Final Duration	7.8	WEEKS
13.7	Drainage Gallery S&A Construction Volume	6,200	CY
	Production Rate	1,000	CY/DAY
	Duration	0.3	MONTHS
	Contingency	25	%
	Final Duration	0.4	MONTHS
	Final Duration	1.6	WEEKS
13.6	Miscellaneous Steel - Transformer Hall		
	Assumed Steel Weight	240	TONS
	Production Rate	20	TONS/DAY
	Duration	0.6	MONTHS
	Contingency	25	%
	Final Duration	0.7	MONTHS
	Final Duration	3.0	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		6,200	TOTAL VOLUME, CY
		30	CY/TRUCK
		207	# OF TRUCKS FOR TASK
		7	LOADS/DAY (MAX.)
		1.0	CYCLE TIME (HRS)
		1	REQUIRED # OF TRUCKS
CONCRETE TRUCKS (Elevator Construction)		463	TOTAL VOLUME, CY
		8	CY/TRUCK
		58	# OF TRUCKS FOR TASK
		3	TRUCKS/DAY
OFFSITE FLATBED SEMIS (MISC. METAL)		490	TOTAL WEIGHT, TONS
		20	TONS/TRUCK
		25	# OF TRUCKS FOR TASK
		7	TRUCKS/DAY
OFFSITE FLATBED SEMIS (STRUCT. & ARCH. WORK)		355	TOTAL WEIGHT, TONS
(assume 1 ton of materials per 500 CY of Volume)		20	TONS/TRUCK
		18	# OF TRUCKS FOR TASK
		1	TRUCKS/DAY
SEMIS - DUMP		20	CY/TRUCK
		310	# OF TRUCKS FOR TASK
		10	TRUCKS/DAY

Assumptions:

Structural & Architectural work consists of interior walls (i.e. wood, alum., drywall, offices, restrooms, etc.)
Excavation Then Haul Offsite
Survey Control

Structural, Architectural, & Misc. Metal Work:

Equipment: Crane Hoist, Air Compressor, Generator, Flatbed Semis, Fork Lifts, Support Truck.
Crew: 1 Equip. Oper., 2 Foremans, 4 Carpenters, 4 Laborers, 2 Painters, 2 Plumbers, 1 Welder, 2 Steel Workers.

Elevator & Drainage Gallery Construction:

Process: Drill, Blast, Excavate, Crane Hoist, Load, Haul, Dump, Load, Haul offsite; Shotcrete.
Equipment: Track Drill, Excavator, Crane, FE Loader, Dump Truck, FE Loader, Semis; Grout Pump, Support Truck, Water Pump.
Crew: 1 Driller, 2 Blasters, 4 Equip Opr., 2 survey, 1 DT Driver; Shotecrete/Concrete: 2 Laborers, 1 Forman, 1 Support Driver.
Schedule: Activities are additive.

31 Elec. and Mech. Mobe

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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	1
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	1
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	1
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	1
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	1
Tunnel Rig (TBM)	
Water Pump, Diesel	1
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	1
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	2
Cement Finisher	
Driller	
Electricians	2
Equipment Operators	5
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	1
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	1
Welder	

Total Crew Size	15
Monthly Labor Cost	$195,100

Duration: **3.1** Months **13.4** Weeks

NOTES:

Mobilization to include installing field offices, preparing staging area, minor road grading, temporary utility connections, security fencing, bringing equipment to site, prepartion of equipment, and lighting

33 Complete Elec. Const.

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
		Checked		By	
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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	1
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	2
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	2
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	5
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	4
Equipment Operators	1
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	2
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	
Welder	

Total Crew Size	8
Monthly Labor Cost	$109,600

Duration: **13.4** **Months** **57.9** **Weeks**

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

COMPLETE ELECTRICAL CONSTRUCTION SCHEDULE			
NA	Complete Electrical Construction		
	Machine Hall Volume	144,000	CY
	Transformer Hall Volume	27,300	CY
	Total Electircal Const. Volume	171,300	CY
	Production Rate	800	CY/DAY
	Duration	9.9	MONTHS
	Contingency	25	%
	Final Duration	12.4	MONTHS
	Final Duration	53.5	WEEKS
13.5	Cable Shaft Electrical Construction	1,300	LF
	Production Rate	75	LF/DAY
	Duration	0.8	MONTHS
	Contingency	25	%
	Final Duration	1.0	MONTHS
	Final Duration	4.3	WEEKS

Assumptions:

Completing electrical work consists of wiring lighting, power outlets, controls systems, IT requirments, etc.
Equipment: Fork Lift, Air Compressor, Generator, Flatbed Trucks, Semis, Support Truck.
Crew: 1 Equip. Oper., 4 Electricians, 1 Foreman, 2 Laborers.

Schedule: Activities are additive.

34 Exc. Approach Channel Upper

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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		Approved		By	

EQUIPMENT	Quantity	
On Site		
Air Compressor	1	
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked		
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled		
Compactor, Vibratory, Self-Propelled		
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton		
Dozer, D5		
Dozer, D6		
Dozer, D8	2	
Dozer, D10		
Drill, Tracked	2	
Dump Truck, End Dump, 15 Ton		
Dump Truck, Off-Highway, 34 Ton	6	
Dump Truck, Semi-Trailer		
Excavator, 325	1	
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled	2	
Fuel Truck / Support Truck	1	
Generator - Diesel		
Grout Pump/Plant		
Hydroseed Sprayer, Truck Mounted		
Grader, H14		
Pile Driver		
Pump Truck - Concrete		
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed		
Tunnel Rig (TBM)		
Water Pump, Diesel		
Water Truck	1	dust control
Welder and Generator Set		
Total Offsite Flatbed/Semi Trucks		
Daily Concrete Mixer Truck - 8 CY		
Daily Semi Trailer Truck	40	

Crew	Quantity
Blaster	4
Carpenters	
Cement Finisher	
Driller	2
Electricians	
Equipment Operators	5
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	2
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	7
Welder	

Total Crew Size	23
Monthly Labor Cost	$270,000

Duration: **9.7** Months **41.8** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

UPPER RESERVOIR INTAKE APPROACH CHANNEL EXCAVATION SCHEDULE			
NA	Excavate Approach Channel	376,250	CY
	Excavator Hourly Production Rate	225	CY/HR
	Assume: cycle time = 40 sec, 3.0 cy bucket, 83% eff.		
	# of Excavators	1	
	Production Rate	2,250	CY/DAY
	Duration	7.7	MONTHS
	Contingency	25	%
	Final Duration	9.7	MONTHS
	Final Duration	41.8	WEEKS
NA	Approach Channel Rock Excavation (D&B) (20%)	75,250	CY
	Production Rate (2 crew)	800	CY/DAY
	Duration	4.3	MONTHS
	Contingency	25	%
	Final Duration	5.4	MONTHS
	Final Duration	23.5	WEEKS

EQUIPMENT/TRUCKING		
DUMP TRUCKS	376,250	TOTAL VOLUME, CY
	30	CY/TRUCK
	12,542	# OF TRUCKS FOR TASK
	75	LOADS/DAY (MAX.)
	0.75	CYCLE TIME (HRS)
	6	REQUIRED # OF TRUCKS
SEMIS	20	CY/TRUCK
	3,763	# OF TRUCKS FOR TASK
	40	TRUCKS/DAY

Assumptions:

Standard Excavation Haul & Dump Onsite

Rock Excavation Haul Offsite

Survey Control

Drilling and blast rock sections (~20%) while excavator works concurrently, therefore use maximum.

Upper Reservoir Approach Channel Excavation:

Process: Excavate, Load, Haul, Dump; Drill, Blast, Excavate, Load, Haul offsite.

Equipment: Track Drills, 1 Excavator, 2 Dozers, 2 FE Loaders, Dump Trucks, Semis, Water Truck, Support Truck.

Crew: 2 Drillers, 4 Blasters, 5 Equip Opr., 1 Laborer, 2 survey, 6 DT Drivers, 1 Foreman, 1 Water Truck Driver, 1 Support Driver.

Schedule: Activities are additive.

35 Construct Upper Res Dams

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity	
On Site		
Air Compressor	2	Tools
Backhoe / Front End Loader, Wheeled		
Backhoe, Tracked		
Chipper, Wood		
Compactor, Sheepsfoot, Self-Propelled		
Compactor, Vibratory, Self-Propelled	4	
Concrete Pump		
Crane - 40 Ton		
Crane - 70 Ton		
Dozer, D5	4	
Dozer, D6		
Dozer, D8		
Dozer, D10		
Drill, Tracked		
Dump Truck, End Dump, 15 Ton	5	
Dump Truck, Off-Highway, 34 Ton	4	
Dump Truck, Semi-Trailer		
Excavator, 325		
Forklift, Rough Terrain		
Front End Loader, Tracked		
Front End Loader, Wheeled	2	
Fuel Truck / Support Truck	2	
Generator - Diesel		
Grout Pump/Plant		
Hydroseed Sprayer, Truck Mounted		
Grader, H14	2	
Pile Driver		
Pump Truck - Concrete		
Powder Truck		
Scraper, Self-propelled, 21 CY		
Truck, Flatbed		
Tunnel Rig (TBM)		
Water Pump, Diesel		
Water Truck	2	
Welder and Generator Set		
Total Offsite Flatbed/Semi Trucks		
Daily Concrete Mixer Truck - 8 CY		
Daily Semi Trailer Truck		

Crew	Quantity	
Blaster		
Carpenters	4	form work
Cement Finisher		
Driller		
Electricians		
Equipment Operators	12	
Grade Setter		
Foreman	2	
Labor Foreman		
Laborers	6	
Mechanics	1	
Painter		
Pile Driver		
Pipe Foreman		
Pipe Layer		
Plumber		
Rigger		
Survey/Rodmen	2	
Steel Worker		
Steel Worker Foreman		
Truck Drivers	11	
Welder		

Total Crew Size	38
Monthly Labor Cost	$464,700

Duration: **8.4** Months **36.4** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

4.0 UPPER RESERVOIR SADDLE DAMS SCHEDULE		
4.1 South Saddle Dam	218,400	CY
Production Rate	1,500	CY/DAY
Duration	6.7	MONTHS
Contingency	25	%
Final Duration	8.4	MONTHS
Final Duration	36.4	WEEKS
4.2 West Saddle Dam	72,100	CY
Production Rate	1,500	CY/DAY
Duration	2.2	MONTHS
Contingency	25	%
Final Duration	2.8	MONTHS
Final Duration	12.0	WEEKS
EQUIPMENT/TRUCKING		
DUMP TRUCKS (for aggregate material, 90%)	261,450	TOTAL VOLUME, CY
(End Dump 15 Ton)	15	CY/TRUCK
	17,430	# OF TRUCKS FOR TASK
	100	LOADS/DAY (MAX.)
(From processed material stockpile onsite, to batch plant)	0.50	CYCLE TIME (HRS)
	5	REQUIRED # OF TRUCKS
CONCRETE TRUCKS (assume 10% of material)	29,050	TOTAL VOLUME, CY
	8	CY/TRUCK
	3,631	# OF TRUCKS FOR TASK
	38	TRUCKS/DAY
DUMP TRUCKS RCC MATERIAL	290,500	TOTAL VOLUME, CY
(End Dump 34 Ton)	30	CY/TRUCK
	9,683	# OF TRUCKS FOR TASK
	100	LOADS/DAY (MAX.)
(From batch plant to dam site)	0.33	CYCLE TIME (HRS)
	4	REQUIRED # OF TRUCKS

Assumptions:

South and West dams will be constructed concurrently, therefore, equipment and labor is additive for this task.
Survey Control

Upper Reservoir Dams:

Process: Haul Materials, Mix Batch, Haul to Dam Site, Place, Spread, Vibrotory Compaction.
Equipment: Dump Trucks (15,34 ton), 2 FE Loaders, 4 Dozers, 2 Graders, 4 Compactors, Water Trucks, Support Trucks.
Crew: 12 Equip Opr., 4 Laborers, 4 Carpenters, 2 survey, 9 DT Drivers, 2 Foreman, 2 Water Truck Driver, 2 Support Driver, 1 Mechanics.
Schedule: Activities are additive.

36 Move Unstable Soil LR

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	2
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	5
Dump Truck, Semi-Trailer	
Excavator, 325	1
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	1
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	6
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	4
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	6
Welder	

Total Crew Size	19
Monthly Labor Cost	$227,700

Duration: **12.7** Months **55.1** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

MOVE UNSTABLE SOIL - LOWER RESERVOIR		
SCHEDULE		
16.1 Platform Excavation	661,000	CY
Excavator Hourly Production Rate	300	CY/HR
Assume: cycle time = 30 sec, 3.0 cy bucket, 83% eff.		
# of Excavators	1	
Production Rate	3,000	CY/DAY
Duration	10.2	MONTHS
Contingency	25	%
Final Duration	12.7	MONTHS
Final Duration	55.1	WEEKS
EQUIPMENT/TRUCKING		
DUMP TRUCKS	330,500	TOTAL VOLUME, CY
(assume 50% moved by trucks, 50% moved by equipment)	30	CY/TRUCK
	11,017	# OF TRUCKS FOR TASK
	100	LOADS/DAY (MAX.)
	0.50	CYCLE TIME (HRS)
	5	REQUIRED # OF TRUCKS

Assumptions:

Standard Excavation Haul & Dump Onsite

Survey Control

50% of material moved by Dozers & Loaders, other 50% loaded onto dump trucks and hauled to onsite location.

Move Unstable Soil Lower Reservoir:

Process: Excavate, Load, Haul, Dump.

Equipment: 1 Excavator, 1 Grader, 2 Dozers, 2 FE Loaders, Dump Trucks, Water Truck, Support Truck.

Crew: 6 Equip Opr., 3 Laborers, 2 survey, 5 DT Drivers, 1 Foreman, 1 Water Truck Driver, 1 Support Driver.

37 Line Upper Res.

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	1
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	1
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	10
Dump Truck, Semi-Trailer	
Excavator, 325	2
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	2
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	6
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	11
Welder	

Total Crew Size	23
Monthly Labor Cost	$270,300

Duration: **3.7** Months **27.4** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

LINE UPPER RESERVOIR SCHEDULE			
NA	Upper Reservoir Lining (Bottom 3rd of reservoir)	385,587	SY
	Lining Depth	3	FT
	Total Lining Volume	385,587	CY
	Excavator Hourly Production Rate	300	CY/HR
	Assume: cycle time = 30 sec, 3.0 cy bucket, 83% eff.		
	# of Excavators	2	
	Production Rate	6,000	CY/DAY
	Duration	3.0	MONTHS
	Contingency	25	%
	Final Duration	3.7	MONTHS
	Final Duration	16.1	WEEKS
NA	Compaction of Upper Reservoir Lining	385,587	SY
	Compactor Hourly Production Rate	847	CY/HR
	Assume: Drum Width = 84", Lift = 12", Passes = 6, V = 4mph		
	# of Compactors	1	
	Production Rate	8,470	CY/DAY
	Duration	2.1	MONTHS
	Contingency	25	%
	Final Duration	2.6	MONTHS
	Final Duration	11.4	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		385,587	TOTAL VOLUME, CY
		30	CY/TRUCK
		12,853	# OF TRUCKS FOR TASK
		200	LOADS/DAY (MAX.)
		0.50	CYCLE TIME (HRS)
		10	REQUIRED # OF TRUCKS

Assumptions:

Standard Excavation Haul & Dump Onsite

Survey Control

Line Upper Reservoir:

Process: Excavate, Load, Haul, Dump, Compact.

Equipment: 2 Excavators, 1 Dozer, 1 Compactor, 2 FE Loaders, Dump Trucks, Water Truck, Support Truck.

Crew: 6 Equip Opr., 2 Laborers, 10 DT Drivers, 1 Foreman, 1 Water Truck Driver, 1 Support Driver, 2 survey.

Schedule: Activities are additive.

38 Line Lower Res.

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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		Approved		By	

EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	1
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	1
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	5
Dump Truck, Semi-Trailer	
Excavator, 325	2
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	2
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	6
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	6
Welder	

Total Crew Size	18
Monthly Labor Cost	$217,100

Duration: **5.3** Months **38.9** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

LINE LOWER RESERVOIR SCHEDULE		
NA Lower Reservoir Lining (Bottom half of reservoir)	546,920	SY
Lining Depth	3	FT
Total Lining Volume	546,920	CY
Excavator Hourly Production Rate	300	CY/HR
Assume: cycle time = 30 sec, 3.0 cy bucket, 83% eff.		
# of Excavators	2	
Production Rate	6,000	CY/DAY
Duration	4.2	MONTHS
Contingency	25	%
Final Duration	5.3	MONTHS
Final Duration	22.8	WEEKS
NA Compaction of Upper Reservoir Lining	546,920	SY
Compactor Hourly Production Rate	847	CY/HR
Assume: Drum Width = 84", Lift = 12", Passes = 6, V = 4mph		
# of Compactors	1	
Production Rate	8,470	CY/DAY
Duration	3.0	MONTHS
Contingency	25	%
Final Duration	3.7	MONTHS
Final Duration	16.1	WEEKS
EQUIPMENT/TRUCKING		
DUMP TRUCKS	546,920	TOTAL VOLUME, CY
	30	CY/TRUCK
	18,231	# OF TRUCKS FOR TASK
	200	LOADS/DAY (MAX.)
	0.25	CYCLE TIME (HRS)
	5	REQUIRED # OF TRUCKS

Assumptions:

Standard Excavation Haul & Dump Onsite

Survey Control

Line Lower Reservoir:

Process: Excavate, Load, Haul, Dump, Compact.

Equipment: 2 Excavators, 1 Dozer, 1 Compactor, 2 FE Loaders, Dump Trucks, Water Truck, Support Truck.

Crew: 6 Equip Opr., 2 Laborers, 5 DT Drivers, 1 Foreman, 1 Water Truck Driver, 1 Support Driver, 2 survey.

Schedule: Activities are additive.

39 Construct IO Struc. Lower

Client:	Eagle Crest Energy	Project	080473	Page	1
Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	1
Dozer, D5	
Dozer, D6	
Dozer, D8	1
Dozer, D10	
Drill, Tracked	1
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	4
Dump Truck, Semi-Trailer	
Excavator, 325	1
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	1
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	2
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	9
Daily Concrete Mixer Truck - 8 CY	25
Daily Semi Trailer Truck	20

Crew	Quantity
Blaster	2
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	4
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	9
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	7
Welder	

Total Crew Size	26
Monthly Labor Cost	$297,600

Duration: **4.1** Months **17.8** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

CONSTRUCT LOWER I/O STRUCTURE SCHEDULE			
16.3 Intake Structure Excavation		13,900	CY
Excavator Hourly Production Rate		225	CY/HR
Assume: cycle time = 40 sec, 3.0 cy bucket, 83% eff.			
# of Excavators		1	
Production Rate		2,250	CY/DAY
Duration		0.3	MONTHS
Contingency		25	%
Final Duration		0.4	MONTHS
Final Duration		1.5	WEEKS
NA Intake Structure Rock Excavation (D&B) (20%)		2,780	CY
Production Rate	(1 crew)	400	CY/DAY
Duration		0.3	MONTHS
Contingency		25	%
Final Duration		0.4	MONTHS
Final Duration		1.7	WEEKS
16.2 Access Tunnel Portal Concrete		180	CY
Production Rate	(1 crew)	200	CY/DAY
Duration		0.0	MONTHS
Contingency		25	%
Final Duration		0.1	MONTHS
Final Duration		0.2	WEEKS
16.4 Intake Structure Concrete		6,400	CY
Production Rate	(1 crew)	200	CY/DAY
Duration		1.5	MONTHS
Contingency		25	%
Final Duration		1.8	MONTHS
Final Duration		8.0	WEEKS
16.5 Trashracks, Misc. Metals		100	TONS
Assumed Unit Weight of Steel		475	LBS/CF
Area		5,040	SQ FT
Thickness		6	INCHES
Percent Openings		85	%
Unit Weight		35.6	LBS/SQ FT
Production Rate		200	SQ FT/DAY
Duration		1.2	MONTHS
Contingency		25	%
Final Duration		1.5	MONTHS
Final Duration		6.3	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		13,900	TOTAL VOLUME, CY
		30	CY/TRUCK
		463	# OF TRUCKS FOR TASK
		75	LOADS/DAY (MAX.)
		0.50	CYCLE TIME (HRS)
		4	REQUIRED # OF TRUCKS
OFFSITE TRUCKS		179	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		9	# OF TRUCKS
SEMIS		20	CY/TRUCK
		139	# OF TRUCKS FOR TASK
		20	TRUCKS/DAY
CONCRETE TRUCKS		6,580	TOTAL VOLUME, CY
		8	CY/TRUCK
		823	# OF TRUCKS FOR TASK
		25	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		2	# OF TRUCKS

Assumptions:

Standard Excavation Haul & Dump Onsite
Rock Excavation Haul Offsite
Survey Control

Lower Reservoir I/O Structure:

Process: Excavate, Load, Haul, Dump; Drill, Blast, Excavate, Load, Haul offsite.
Equipment: Track Drill, 1 Excavator, 1 Dozers, 1 FE Loader, Dump Trucks, Semis, CP Trucks, Water Truck, Support Truck, Crane.
Crew: 1 Driller, 2 Blasters, 4 Equip Opr., 8 Laborers, 2 survey, 4 DT Drivers, 1 Foreman, 1 Water Truck Driver, 2 CPT Drivers, 1 Support Driver.
Schedule: Activities are additive.

40 Construct IO Struc. Upper

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	1
Dozer, D5	
Dozer, D6	
Dozer, D8	1
Dozer, D10	
Drill, Tracked	1
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	5
Dump Truck, Semi-Trailer	
Excavator, 325	1
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	1
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	2
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	25
Daily Semi Trailer Truck	20

Crew	Quantity
Blaster	2
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	4
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	9
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	8
Welder	

Total Crew Size	27
Monthly Labor Cost	$308,300

Duration: **3.9** Months **16.8** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

CONSTRUCT UPPER I/O STRUCTURE SCHEDULE			
4.3.1 Intake Structure Excavation		12,000	CY
Excavator Hourly Production Rate		299	CY/HR
Assume: cycle time = 30 sec, 3.0 cy bucket, 83% eff.			
# of Excavators		1	
Production Rate		2,990	CY/DAY
Duration		0.2	MONTHS
Contingency		25	%
Final Duration		0.2	MONTHS
Final Duration		1.0	WEEKS
NA Intake Structure Rock Excavation (D&B) (20%)		2,400	CY
Production Rate	(1 crew)	400	CY/DAY
Duration		0.3	MONTHS
Contingency		25	%
Final Duration		0.3	MONTHS
Final Duration		1.5	WEEKS
4.3.2 Intake Structure Concrete		6,400	CY
Production Rate	(1 crew)	200	CY/DAY
Duration		1.5	MONTHS
Contingency		25	%
Final Duration		1.8	MONTHS
Final Duration		8.0	WEEKS
16.5 Trashracks, Misc. Metals		100	TONS
Assumed Unit Weight of Steel		475	LBS/CF
Area		5,040	SQ FT
Thickness		6	INCHES
Percent Openings		85	%
Unit Weight		35.6	LBS/SQ FT
Production Rate		200	SQ FT/DAY
Duration		1.2	MONTHS
Contingency		25	%
Final Duration		1.5	MONTHS
Final Duration		6.3	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		12,000	TOTAL VOLUME, CY
		30	CY/TRUCK
		400	# OF TRUCKS FOR TASK
		100	LOADS/DAY (MAX.)
		0.50	CYCLE TIME (HRS)
		5	REQUIRED # OF TRUCKS
OFFSITE TRUCKS		177	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		9	# OF TRUCKS
SEMIS		20	CY/TRUCK
		120	# OF TRUCKS FOR TASK
		20	TRUCKS/DAY
CONCRETE TRUCKS		6,400	TOTAL VOLUME, CY
		8	CY/TRUCK
		800	# OF TRUCKS FOR TASK
		25	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		2	# OF TRUCKS

Assumptions:

Standard Excavation Haul & Dump Onsite
Rock Excavation Haul Offsite
Survey Control

Upper Reservoir I/O Structure:

Process: Excavate, Load, Haul, Dump; Drill, Blast, Excavate, Load, Haul offsite.
Equipment: Track Drill, 1 Excavator, 1 Dozers, 1 FE Loader, Dump Trucks, Semis, CP Trucks, Water Truck, Support Truck, Crane.
Crew: 1 Driller, 2 Blasters, 4 Equip Opr., 8 Laborers, 2 survey, 5 DT Drivers, 1 Foreman, 1 Water Truck Driver, 2 CPT Drivers, 1 Support Driver.
Schedule: Activities are additive.

41 Switchyard Exc.

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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	1
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	5
Dump Truck, Semi-Trailer	
Excavator, 325	1
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	1
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	3
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	3
Welder	

Total Crew Size	10
Monthly Labor Cost	$118,500

Duration: **3.1** Months **13.3** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

SWITCHYARD EXCAVATION SCHEDULE			
NA	Switchyard Excavation	107,860	CY
	Excavation Depth	5	FT
	Excavator Hourly Production Rate	299	CY/HR
	Assume: cycle time = 30 sec, 3.0 cy bucket, 83% eff.		
	# of Excavators	1	
	Production Rate	2,988	CY/DAY
	Duration	1.7	MONTHS
	Contingency	25	%
	Final Duration	2.1	MONTHS
	Final Duration	9.0	WEEKS
NA	Transfer Station Grading	20,370	CY
	Production Rate	1,200	CY/DAY
	Duration	0.8	MONTHS
	Contingency	25	%
	Final Duration	1.0	MONTHS
	Final Duration	4.2	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS		107,860	TOTAL VOLUME, CY
(Assume haul and dump onsite)		30	CY/TRUCK
		3,595	# OF TRUCKS FOR TASK
		100	LOADS/DAY (MAX.)
		0.50	CYCLE TIME (HRS)
		5	REQUIRED # OF TRUCKS

Assumptions:

Standard Excavation Haul & Dump Onsite

Upper Reservoir I/O Structure:

Process: Excavate, Load, Haul, Dump, Grading.

Equipment: 1 Excavator, 1 Dozers, 1 FE Loader, Dump Trucks, Water Truck, Support Truck.

Crew: 3 Equip Opr., 2 Laborers, 5 DT Drivers, 1 Foreman, 1 Water Truck Driver, 1 Support Driver.

Schedule: Activities are additive.

42 Switchyard Foundations

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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	1
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	1
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	1
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	5
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	1
Pile Driver	
Pump Truck - Concrete	1
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	1
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	1
Daily Concrete Mixer Truck - 8 CY	2
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	3
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	3
Welder	

Total Crew Size	11
Monthly Labor Cost	$129,100

Duration: **4.1** Months **17.6** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

SWITCHYARD FOUNDATIONS SCHEDULE			
NA	Switchyard Foundations (assume peirs)		
	Foundations Area (assume 5% of area)	27,500	SQ FT
	Area per peir	50	SQ FT
	Peir Depth	30	FT
	Peir Diameter	1	FT
	Number of Peirs	552	#
	Production Rate	10	PEIRS/DAY
	Duration	2.6	MONTHS
	Contingency	25	%
	Final Duration	3.2	MONTHS
	Final Duration	13.8	WEEKS
NA	Gravel Base Placement	10,185	CY
	Production Rate	1,500	CY/DAY
	Duration	0.3	MONTHS
	Contingency	25	%
	Final Duration	0.4	MONTHS
	Final Duration	1.7	WEEKS
NA	Compaction of Gravel Base (assume 3' thick)	10,185	CY
	Compactor Hourly Production Rate	120	CY/HR
	Assume: Drum Width = 50", Lift = 4", Passes = 6, V = 4mph		
	# of Compactors	1	
	Production Rate	1,204	CY/DAY
	Duration	0.4	MONTHS
	Contingency	25	%
	Final Duration	0.5	MONTHS
	Final Duration	2.1	WEEKS
EQUIPMENT/TRUCKING			
DUMP TRUCKS (gravel base)		10,185	TOTAL VOLUME, CY
		30	CY/TRUCK
		340	# OF TRUCKS FOR TASK
		50	LOADS/DAY (MAX.)
		1.0	CYCLE TIME (HRS)
		5	REQUIRED # OF TRUCKS
OFFSITE TRUCKS		6	TOTAL WEIGHT, TONS
Assume 2lbs/ft of rebar/rockbolts; 12ft of rebar/c.y. of conc;		20	TONS/TRUCK
1lbs of reinforcment/s.y. of shotcrete		1	# OF TRUCKS
CONCRETE TRUCKS		482	TOTAL VOLUME, CY
		8	CY/TRUCK
		60	# OF TRUCKS FOR TASK
		2	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		1	# OF TRUCKS

Assumptions:

Process: Drill and Pour Peirs, Place Gravel Base, Compact Gravel Base.
Equipment: 1 Track Drill, 1 Dozer, 1 Grader, 1 Vibro. Compactor, Dump Trucks, Conc. Pump Truck, Water Truck, Support Truck.
Crew: 1 Driller, 3 Equip Opr., 2 Laborers, 5 DT Driver, 1 Foreman, 1 Water Truck Driver, 2 CPT Driver, 1 Support Driver.

Schedule: Activities are additive.

43 Switchyard Structures

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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	1
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	1
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	2
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	1
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	1
Total Offsite Flatbed/Semi Trucks	10
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	2
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	2
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	2
Steel Worker Foreman	
Truck Drivers	
Welder	2

Total Crew Size	9
Monthly Labor Cost	$131,500

Duration: **1.5** Months **6.4** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

SWITCHYARD STRUCTURES SCHEDULE			
NA	Switchyard Large Structures		
	Number of Structures	6	#
	Assumed Structure Height	100	FT
	Production Rate	50	FT/DAY
	Duration	0.6	MONTHS
	Contingency	25	%
	Final Duration	0.7	MONTHS
	Final Duration	3.0	WEEKS
NA	Switchyard Small Structures		
	Number of Structures	6	#
	Assumed Structure Height	30	FT
	Production Rate	50	FT/DAY
	Duration	0.2	MONTHS
	Contingency	25	%
	Final Duration	0.2	MONTHS
	Final Duration	0.9	WEEKS
15.5-C	Switchyard Fencing	3,200	LF
	Production Rate	300	LF/DAY
	Duration	0.5	MONTHS
	Contingency	15	%
	Final Duration	0.6	MONTHS
	Final Duration	2.5	WEEKS

Assumptions:

Equipment: 1 Crane, 1 Flatbed Truck, 2 Support Trucks, 1 Forklift, Generator, Welder.
Crew: 1 Crane Opr., 1 Equip. Opr., 2 Laborers, 2 Steel Workers, 1 Foreman, 2 Welders.
Schedule: Activities are additive.

44 Trans. Line Foundations

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Subject:	Eagle Mountain Construction Schedule and Equipment	Date	1/21/2009	By	NDM
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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	1
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	1
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	1
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	1
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	24
Daily Concrete Mixer Truck - 8 CY	7
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	1
Electricians	
Equipment Operators	3
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	2
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	2
Steel Worker Foreman	
Truck Drivers	1
Welder	

Total Crew Size	10
Monthly Labor Cost	$131,700

Duration: **4.6** Months **20.0** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

TRANSMISSION LINE FOUNDATIONS SCHEDULE			
NA	Transmission Line Foundations - Concrete		
	Line Length	10	MILES
	Assumed Structures/Mile	8	#/MILE
	Peirs Per Structure	4	#/STRUCTURE
	Total # of Peirs	320	#
	Estimated Length of Peirs	50	FT
	Peir Diameter	3	FT
	Total Volume	4,189	CY
	Production Rate	4	PEIRS/DAY
	Duration	3.7	MONTHS
	Contingency	25	%
	Final Duration	4.6	MONTHS
	Final Duration	20.0	WEEKS
NA	Transmission Line Foundations - Steel		
	Total # of Peirs	320	#
	Estimated Length of Peirs	50	FT
	Peir Diameter	3	FT
	# of Bars/Sq. ft	5	#/SQ FT
	Bar Size	6	#
	Bar Weight Per Foot	1.5	LBS/FT
	Shear Reinforcement Bar Size	4	#
	Shear Reinforcement Weight Per Foot	0.67	LBS/FT
	Total Weight	475	TONS

EQUIPMENT/TRUCKING			
CONCRETE TRUCKS		4,189	TOTAL VOLUME, CY
		8	CY/TRUCK
		524	# OF TRUCKS FOR TASK
		7	TRUCKS/DAY
CONCRETE PUMP TRUCKS	(15 TRUCKS)-->	120	CY/DAY
		1	# OF TRUCKS
OFFSITE FLATBED SEMIS (reinforcement)		20	TONS/TRUCK
		24	# OF TRUCKS FOR TASK
		1	TRUCKS/DAY

Assumptions:

Process: Drill Peirs, Place Steel, Pour Concrete, Finish Work.
Equipment: 1 Tracked Drill, 1 Front End Loader, 1 Crane, 1 Flatbed Truck, 1 Support Truck, 1 Conc. Pump Truck.
Crew: 3 Equip. Opr., 2 Laborers, 2 Steel Workers, 1 Foreman, 1 CPT Driver.

45 Trans. line stringing

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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	2
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	1
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	2
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	1
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	3
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	
Welder	

Total Crew Size	7
Monthly Labor Cost	$86,600

Duration: **4.0** Months **17.2** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

TRANSMISSION LINE STRINGING SCHEDULE			
NA	Transmission Line Stringing		
	Transmission Line Length	10	MILES
	# of Lines	8	#
	Sag Factor	1.30	
	Total Line Length	549,200	FT
	Production Rate	8,000	FT/DAY
	Duration	3.2	MONTHS
	Contingency	25	%
	Final Duration	4.0	MONTHS
	Final Duration	17.2	WEEKS

Assumptions:

Equipment: 2 Cranes, 1 Flatbed Truck, 2 Support Truck, 1 Forklift.
Crew: 3 Equip. Opr., 3 Laborers, 1 Foreman.

46 Trans. line structures

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	2
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	1
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	2
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	1
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	2
Total Offsite Flatbed/Semi Trucks	160
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	2

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	3
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	2
Steel Worker Foreman	1
Truck Drivers	
Welder	2

Total Crew Size	12
Monthly Labor Cost	$173,600

Duration: **5.8** Months **25.0** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

TRANSMISSION LINE STRUCTURES SCHEDULE		
NA Transmission Line Structures		
Line Length	10	MILES
Assumed Structures/Mile	8	#/MILE
Total # of Structures	80	#
Assumed Structure Weight	40	TONS
Total Steel Weight	3,200	TONS
Production Rate	0.8	STRUCTURES/DAY
Duration	4.6	MONTHS
Contingency	25	%
Final Duration	5.8	MONTHS
Final Duration	25.0	WEEKS
EQUIPMENT/TRUCKING		
OFFSITE FLATBED SEMIS	20	TONS/TRUCK
	160	# OF TRUCKS FOR TASK
	2	TRUCKS/DAY

Assumptions:

Process: Deliver Steel, Cut, Bolt, and Erect Steel Structure.
Equipment: 2 Cranes, 1 Flatbed Truck, 2 Support Truck, 1 Forklift, 1 Air compressor, 2 Generator/Welder Set.

Crew: 3 Equip. Opr., 3 Laborers, 2 Steel Workers, 2 Welders, 1 Steel Foreman, 1 Foreman.

47 Inst. H2O Supply Pipe & RO S

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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	1
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	1
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	5
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	1
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	1
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	1
Total Offsite Flatbed/Semi Trucks	208
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	4
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	3
Mechanics	
Painter	
Pile Driver	
Pipe Foreman	1
Pipe Layer	2
Plumber	
Rigger	
Survey/Rodmen	2
Steel Worker	
Steel Worker Foreman	
Truck Drivers	6
Welder	

Total Crew Size	19
Monthly Labor Cost	$233,600

Duration: **6.7** Months **29.2** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

INSTALL WATER SUPPLY LINE SCHEDULE			
NA	Pipeline Excavation		
	Excavation Length	75,000	FT
	Excavation Unit Volume	1.6	CY/FT
	(assume 30 Steel pipe, 10,000 gpm, 3' Backfill)		
	Excavation Total Volume	120,000	CY
	Excavator Hourly Production Rate	200	LCY/HR
	# of Excavators	1	
	Production Rate	2,000	CY/DAY
	Duration	2.8	MONTHS
	Contingency	25	%
	Final Duration	3.5	MONTHS
	Final Duration	15.0	WEEKS
NA	Pipeline Bedding Material (25% of Backfill)	25,500	CY
	Production Rate	1,000	CY/DAY
	Duration	1.2	MONTHS
	Contingency	25	%
	Final Duration	1.5	MONTHS
	Final Duration	6.4	WEEKS
	Lag from Excavation	2.0	WEEKS
	Maximum Duration	8.4	WEEKS
NA	Pipeline Installation	75,000	FT
	Production Rate	1,000	FT/DAY
	Duration	3.5	MONTHS
	Contingency	25	%
	Final Duration	4.3	MONTHS
	Final Duration	18.8	WEEKS
	Lag from Excavation	4.0	WEEKS
	Maximum Duration	22.8	WEEKS
NA	Compaction Pipeline (85% of Exc.)	102,000	CY
	Compactor Hourly Production Rate	120	CY/HR
	Assume: Drum Width = 50", Lift = 4", Passes = 6, V = 4mph		
	# of Compactors	1	
	Production Rate	1,204	CY/DAY
	Duration	3.9	MONTHS
	Contingency	25	%
	Final Duration	4.9	MONTHS
	Final Duration	21.2	WEEKS
	Lag from Installation	4.0	WEEKS
	Maximum Duration (incl. this lag + install lag)	29.2	WEEKS

EQUIPMENT/TRUCKING		
DUMP TRUCKS (bedding material onsite)	25,500	TOTAL VOLUME, CY
(Assume bedding material is 25% of backfill)	15	CY/TRUCK
	1,700	# OF TRUCKS FOR TASK
	80	LOADS/DAY (MAX.)
	0.50	CYCLE TIME (HRS)
	5	REQUIRED # OF TRUCKS
OFFSITE SEMIS (pipe material)	360	LF/TRUCK
(Assume 40' sticks, 9 per truck)	208	# OF TRUCKS FOR TASK
	3	TRUCKS/DAY

Assumptions:

Upper Reservoir I/O Structure:

Process: Excavate, Place Bedding, Install Pipe, Backfill, Compact.

Equipment: 1 Excavator, 1 Dozers, 1 FE Loader, 1 Sheepsfoot Compactor, Dump Trucks, Water Truck, Support Truck, Welder.

Crew: 4 Equip Opr., 2 Laborers, 5 DT Drivers, 1 Foreman, 1 Water Truck Driver, 1 Support Driver, 1 Pipe Forman, 2 Pipe Layers, 2 Survey.

Schedule: Activities are additive.

48 Reservoir Filling

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EQUIPMENT	Quantity
On Site	
Air Compressor	
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	1
Generator - Diesel	
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	
Equipment Operators	1
Grade Setter	
Foreman	
Labor Foreman	
Laborers	1
Mechanics	1
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	
Welder	

Total Crew Size	3
Monthly Labor Cost	$38,000

Duration: **48.0** Months **207.6** Weeks

CONSTANTS: 20 HR/DAY 216.25 HRS/MONTH

RESERVOIR FILLING SCHEDULE			
NA	Reservoir Filling		
	Reservoirs Active Storage	17,700	AC-FT
	Upper Reservoir Inactive Storage	2,300	AC-FT
	Lower Reservoir Inactive Storage	4,200	AC-FT
	Total Storage	24,200	AC-FT
	Annual Seepage	1,628	AC-FT
	Annual Evaporation	1,763	AC-FT
	Pumping Rate	6,000	GPM
	Final Duration **(From Reservoir Filling Calculations, attached)**	48.0	MONTHS
	Final Duration	207.6	WEEKS

Assumptions:
Equipment: Support Truck.
Crew: 1 Equip Opr., 1 Laborer, 1 Mechanic.

49 U 1 START

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	3
Equipment Operators	
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	
Mechanics	3
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	
Welder	

Total Crew Size	7
Monthly Labor Cost	$101,500

Duration: **3.1** Months **13.4** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

UNIT 1 START-UP

Assumptions:

Process: Start-up involves inspections and testing of all electrical and mechanical equipment prior to unit initiation.
Equipment: Air Compressor, Generator.
Crew: 3 Electricians, 3 Mechanics, 1 Foreman.

51 U 2 START

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	3
Equipment Operators	
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	
Mechanics	3
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	
Welder	

Total Crew Size	7
Monthly Labor Cost	$101,500

Duration: **2.8** Months **12.0** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

UNIT 2 START-UP

Assumptions:

Process: Start-up involves inspections and testing of all electrical and mechanical equipment prior to unit initiation.
Equipment: Air Compressor, Generator.
Crew: 3 Electricians, 3 Mechanics, 1 Foreman.

53 U 3 START

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	3
Equipment Operators	
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	
Mechanics	3
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	
Welder	

Total Crew Size	7
Monthly Labor Cost	$101,500

Duration: **2.8** Months **12.0** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

UNIT 3 START-UP

Assumptions:

Process: Start-up involves inspections and testing of all electrical and mechanical equipment prior to unit initiation.
Equipment: Air Compressor, Generator.
Crew: 3 Electricians, 3 Mechanics, 1 Foreman.

55 U 4 START

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	3
Equipment Operators	
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	
Mechanics	3
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	
Truck Drivers	
Welder	

Total Crew Size	7
Monthly Labor Cost	$101,500

Duration: **2.8** Months **12.0** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

UNIT 4 START-UP

Assumptions:

Process: Start-up involves inspections and testing of all electrical and mechanical equipment prior to unit initiation.
Equipment: Air Compressor, Generator.
Crew: 3 Electricians, 3 Mechanics, 1 Foreman.

57 FINSIH PROJECT

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EQUIPMENT	Quantity
On Site	
Air Compressor	1
Backhoe / Front End Loader, Wheeled	
Backhoe, Tracked	
Chipper, Wood	
Compactor, Sheepsfoot, Self-Propelled	
Compactor, Vibratory, Self-Propelled	
Concrete Pump	
Crane - 40 Ton	
Crane - 70 Ton	
Dozer, D5	
Dozer, D6	
Dozer, D8	
Dozer, D10	
Drill, Tracked	
Dump Truck, End Dump, 15 Ton	
Dump Truck, Off-Highway, 34 Ton	
Dump Truck, Semi-Trailer	
Excavator, 325	
Forklift, Rough Terrain	
Front End Loader, Tracked	
Front End Loader, Wheeled	
Fuel Truck / Support Truck	3
Generator - Diesel	1
Grout Pump/Plant	
Hydroseed Sprayer, Truck Mounted	
Grader, H14	
Pile Driver	
Pump Truck - Concrete	
Powder Truck	
Scraper, Self-propelled, 21 CY	
Truck, Flatbed	
Tunnel Rig (TBM)	
Water Pump, Diesel	
Water Truck	
Welder and Generator Set	
Total Offsite Flatbed/Semi Trucks	
Daily Concrete Mixer Truck - 8 CY	
Daily Semi Trailer Truck	

Crew	Quantity
Blaster	
Carpenters	
Cement Finisher	
Driller	
Electricians	3
Equipment Operators	
Grade Setter	
Foreman	1
Labor Foreman	
Laborers	2
Mechanics	3
Painter	
Pile Driver	
Pipe Foreman	
Pipe Layer	
Plumber	
Rigger	
Survey/Rodmen	
Steel Worker	
Steel Worker Foreman	1
Truck Drivers	
Welder	

Total Crew Size	10
Monthly Labor Cost	$140,700

Duration: **2.8** Months **12.0** Weeks

CONSTANTS: 10 HR/DAY 216.25 HRS/MONTH

FINISH PROJECT

Assumptions:

Finish Project involves final inspections and testing of all major electrical and mechanical equipment, final tunnel and I/O structures inspections, and all other ancillary structures and equipment inspections and testing.
Equipment: 3 Support Trucks, Air Compressor, Generator.
Crew: 3 Electricians, 3 Mechanics, 1 Steel Worker Foreman, 2 Laborers, 1 Foreman.

GEI Consultants, Inc.
080473 Eagle Mountain Pumped Storage Project
Construction Schedule & Excavation Advancement Rates
1/20/2009
NDM

TBM Advancement Rates - Lookup Table

Type A	120	ft/day
Type B	95	ft/day
Type C	45	ft/day

D&B Advancement Rates - Lookup Table

D&B Rate Reduction Factor (%) =		**25**
Type A	37	ft/day
Type B	32	ft/day
Type C	17	ft/day

Upper Pressure Tunnel

Begin Sta. (ft)	End Sta. (ft)	Length (ft)	Rock Type (A, B, C)	Geologic Rock Description	Excavation Method (TBM, D&B)	Advancement Rate (ft/day)	Duration (days)	Cummulative Duration (days)
0	500	500	B	Granite	TBM	95	5	5
500	1500	1000	C	Quartzite	TBM	45	22	27
1500	2500	1000	C	Schistose meta-arkose	TBM	45	22	50
2500	3000	500	C	Quartzite	TBM	45	11	61
3000	4000	1000	C	Schistose meta-arkose	TBM	45	22	83
	Total =	4000 ft				**Total =**	83	16.7 weeks
						Contingency (%) =	25	
						Estimated Total Construction Duration =	104	20.8 weeks

Original Construction Schedule Estimate

Duration =	22.2	weeks
Length =	4000	ft
Advancement Rate =	36	ft/day
Calc. Advancement Rate =	39	ft/day

Vertical Shaft

Begin Sta. (ft)	End Sta. (ft)	Length (ft)	Rock Type (A, B, C)	Geologic Rock Description	Excavation Method (TBM, D&B)	Advancement Rate (ft/day)	Duration (days)	Cummulative Duration (days)
0	300	300	B	Granite	D&B	32	9	9
300	600	300	B	Granite	D&B	32	9	19
600	900	300	B	Granite	D&B	32	9	28
900	1200	300	C	Schistose meta-arkose	D&B	17	18	46
1200	1398	198	C	Schistose meta-arkose	D&B	17	12	58
	Total =	1398 ft				**Total =**	58	11.6 weeks
						Contingency (%) =	50	
						Estimated Total Construction Duration =	87	17.4 weeks

Original Construction Schedule Estimate

Duration =	39.8	weeks
Length =	1398	ft
Advancement Rate =	7	ft/day
Calc. Advancement Rate =	16	ft/day

Lower Pressure Tunnel

Begin Sta. (ft)	End Sta. (ft)	Length (ft)	Rock Type (A, B, C)	Geologic Rock Description	Excavation Method (TBM, D&B)	Advancement Rate (ft/day)	Duration (days)	Cummulative Duration (days)
0	200	200	C	Granite	TBM	45	4	4
200	500	300	C	Quartz Monzonite	TBM	45	7	11
500	1000	500	C	Granite	TBM	45	11	22
1000	1200	200	C	Schistose meta-arkose	TBM	45	4	27
1200	1560	360	C	Schistose meta-arkose	TBM	45	8	35
	Total =	1560 ft				**Total =**	35	7 weeks
						Contingency (%) =	25	
						Estimated Total Construction Duration =	43	8.7 weeks

Original Construction Schedule Estimate

Duration =	32.6	weeks
Length =	1560	ft
Advancement Rate =	10	ft/day
Calc. Advancement Rate =	36	ft/day

GEI Consultants, Inc.
080473 Eagle Mountain Pumped Storage Project
Construction Schedule & Excavation Advancement Rates
1/20/2009
NDM

Penstocks & Draft Tubes

Begin Sta. (ft)	End Sta. (ft)	Length (ft)	Rock Type (A, B, C)	Geologic Rock Description	Excavation Method (TBM, D&B)	Advancement Rate (ft/day)	Duration (days)	Cummulative Duration (days)
0	350	350	C	Granite	D&B	17	21	21
350	850	500	C	Granite	D&B	17	30	51
850	1200	350	C	Granite	D&B	17	21	72
1200	1200	0	C	-	D&B	17	0	72
1200	1200	0	C	-	D&B	17	0	72
	Total =	1200 ft				**Total =**	72	14.4 weeks
						Contingency (%) =	50	
						Estimated Total Construction Duration =	108	21.6 weeks

Original Construction Schedule Estimate
Duration = 22.6 weeks
Length = 1200 ft
Advancement Rate = 11 ft/day

Calc. Advancement Rate = 11 ft/day

Tailrace Tunnel

Begin Sta. (ft)	End Sta. (ft)	Length (ft)	Rock Type (A, B, C)	Geologic Rock Description	Excavation Method (TBM, D&B)	Advancement Rate (ft/day)	Duration (days)	Cummulative Duration (days)
0	600	600	B	Granite	TBM	95	6	6
600	2500	1900	C	Quartz Monzonite	TBM	45	42	49
2500	4000	1500	B	Granite	TBM	95	16	64
4000	5000	1000	B	Schistose meta-arkose	TBM	95	11	75
5000	6835	1835	C	Schistose meta-arkose	TBM	45	41	116
	Total =	6835 ft				**Total =**	116	23.2 weeks
						Contingency (%) =	25	
						Estimated Total Construction Duration =	145	29 weeks

Original Construction Schedule Estimate
Duration = 31.2 weeks
Length = 6835 ft
Advancement Rate = 44 ft/day

Calc. Advancement Rate = 47 ft/day

Access Tunnel

Begin Sta. (ft)	End Sta. (ft)	Length (ft)	Rock Type (A, B, C)	Geologic Rock Description	Excavation Method (TBM, D&B)	Advancement Rate (ft/day)	Duration (days)	Cummulative Duration (days)
0	500	500	B	Granite	TBM	95	5	5
500	2000	1500	C	Quartz Monzonite	TBM	45	33	39
2000	4000	2000	C	Granite	TBM	45	44	83
4000	4500	500	B	Schistose meta-arkose	TBM	95	5	88
4500	6625	2125	C	Schistose meta-arkose	TBM	45	47	136
	Total =	6625 ft				**Total =**	136	27.2 weeks
						Contingency (%) =	25	
						Estimated Total Construction Duration =	169	33.9 weeks

Original Construction Schedule Estimate
Duration = 48.6 weeks
Length = 6625 ft
Advancement Rate = 27 ft/day

Calc. Advancement Rate = 39 ft/day

Cable Shaft

Begin Sta. (ft)	End Sta. (ft)	Length (ft)	Rock Type (A, B, C)	Geologic Rock Description	Excavation Method (TBM, D&B)	Advancement Rate (ft/day)	Duration (days)	Cummulative Duration (days)
0	500	500	B	Granite	D&B	32	16	16
500	1000	500	B	Quartz Monzonite	D&B	32	16	31
1000	1500	500	B	Granite	D&B	32	16	47
1500	2010	510	C	Schistose meta-arkose	D&B	17	30	77
2010	2010	0	C	-	D&B	17	0	77
	Total =	2010 ft				**Total =**	77	15.5 weeks
						Contingency (%) =	50	
						Estimated Total Construction Duration =	116	23.3 weeks

Original Construction Schedule Estimate
Duration = 26 weeks
Length = 2010 ft
Advancement Rate = 15 ft/day

Calc. Advancement Rate = 17 ft/day

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Tunnel Boring Maching Advancement Rates
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Average Advancment Rate	**120**	**ft/day**	**Equation**	
Std. Dev. (rounded) =	**50**	**ft/day**		
Type A (std. TBM Exc.) =	120	ft/day	Average Value	
Type B (CIP Liner Req'd) =	95	ft/day	Average Value - (1/2) Std. Dev.	
Type C (Diff. Exc w/ Conc. Liner) =	45	ft/day	Average Value - (1.5) Std. Dev.	

Assumptions:

Work days/week: 5

Work Hours/Day: 20

Diameter (ft)	Rock Type	Advancement Rate	Units	Advancement Rate (ft/day)	Source
16	A - Std. TBM Exc.	225	m/week	148	Hatch Mott MacDonald Tunnel Estimating Database spreadsheet,
16	B - CIP Liner	195	m/week	128	Appendix D of VLHC in Northern Illinios, Fermi National Accelerator Labs.
16	C - Difficult Exc. Conc Liner	102	m/week	67	
NA	NA	16	m/day	52	http://www-project.slac.stanford.edu/lc/local/documentation/pdf/TBM-
NA	Limestone	8.8	ft/hr	176	Peter J. Tarkoy, Predicting TBM Penetration Rates in Selected Rock
	Shale & Siltstone	9.5	ft/hr	190	Types, Figure 3, Plot of group averages, 1973.
	Sandstone	11.2	ft/hr	224	
	Orthoquartzite	5.2	ft/hr	104	
	Quartzite	3.6	ft/hr	72	
NA	Schist	3.5	ft/hr	70	
					Projects Involving Robbins Equipment reported by TunnelBuilder.com,
11.5	Sandstone	55.0	m/day	180	Bolivia, Misicuni
16.2	Hardrock	28.8	m/day	94	China, Shanxi
13.3	NA	39.1	m/day	128	Ecuador, Manabi
32.8	Hardrock	30.0	m/day	98	New Zealand, Manapouri
18.7	NA	38.0	m/day	125	Peru, Chinango
18.2	Limestone	57.2	m/day	188	United States, Illinios
10.4	Sandstone, shale	58.1	m/day	191	United States, Colorado, Plateau Creek
11	Sandstones	50	ft/day	50	Jacobs Associates. Beatriz Reservoir Intake Tunnel, Tunnel Feasibility
NA	Quartzite	20	m/day	66	EM 1110-2-2901, May 30, 1997, Low values used of Drilling Rate Index
NA	Basalt	30	m/day	98	range given in Table C-10.
NA	Gneiss	30	m/day	98	
NA	Mica Gneiss/Coarse Granite	30	m/day	98	
NA	Schist/Phyllite	35	m/day	115	
NA	Med/Fine Granite	30	m/day	98	
NA	Limestone	50	m/day	164	
NA	Shale	55	m/day	180	
NA	Sandstone	45	m/day	148	
NA	Siltstone	60	m/day	197	

PROJECT FEATURES
& COSTS

Item	Description	Unit	Quantity	Unit Cost	Cost	
1	**CONSTRUCTION AND ACCESS ROADS**					
	1.1 Construction Road to Saddle Dams*	LF	13,800	$95	1,306,900	
	1.2 Road from South Dam to Intake Platform*	LF	1,800	$95	170,500	
	1.3 Road from intake platform down to Channel	LF	2,000	$95	189,400	
	1.4 Road from South Dam to Power Tunnel Portal Const.	LF	10,100	$95	956,400	
	1.5 Extension to Cable, Elevator Shafts & Surge Tank	LF	4,400	$95	416,700	
	1.5 Access road to Lower Inlet Platform	LF	4,000	$95	378,800	
	1.6 Inlet Platform Down to Channel	LF	3,000	$95	284,100	
	* Existing unpaved mining road					**3,702,700**
2	**CONSTRUCTION TUNNELS**					
	2.1 To Machine Hall Roof	CY	2,900	$208	603,200	
	2.2 To Transformer Hall Roof	CY	1,700	$208	353,600	
	2.3 To Power Shaft Construction	CY	8,500	$208	1,768,000	
	2.4 To Tailrace Surge Tank Construction Access	CY	1,900	$208	395,200	
						3,120,000
3	**ACCESS TUNNELS**					
	3.1 Main Access Tunnel (6628')					
	3.1.1 Excavation	CY	192,500	$208	40,040,000	
	3.1.2 Prelining Shotcrete(w/wire-mesh)	SY	20,600	$109	2,245,400	
	3.1.3 Invert concrete	CY	6,900	$500	3,450,000	
	3.1.4 Rock anchors (15' long)	EA	5,000	$300	1,500,000	
	3.2 Drainage Gallery Access Tunnel (L=80')					
	3.2.1 Excavation	CY	800	$208	166,400	
	3.2.2 Invert Concrete	CY	10	$500	5,000	
	3.2.3 Prelining	SY	200	$72	14,400	
	3.3 Tailrace Rock Trap Access Tunnel (L = 100')	LF	100	$780	78,000	
						47,499,200
4	**UPPER RESERVOIR**					
	4.1 South Saddle Dam	CY	218,400	$100	21,840,000	
	4.2 West Saddle dam	CY	72,100	$100	7,210,000	
	4.3 Upper Reservoir Intake Structure					
	4.3.1 Excavation	CY	12,000	$25	300,000	
	4.3.2 Concrete	CY	6,400	$878	5,616,000	
	4.3.3 Trashracks, Gares, miscl. Metals	Tons	100	$10,000	1,000,000	
						35,966,000
5	**UPPER PRESSURE TUNNEL (3963')**					
	5.1 Tunnel Excavation - TBM	CY	133,300	$156	20,794,800	
	5.2 Tunnel Prelining & Support (3")	SY	35,300	$72	2,541,600	
	5.3 Tunnel Lining	CY	36,300	$1,080	39,204,000	
	5.4 Miscellaneous Concrete (bent, plug etc)	CY	5,400	$1,080	5,832,000	
	5.5 Contact Grouting	CF	27,200	$42	1,142,400	
						69,514,800
6	**SURGE TANK**					
	6.1 Shaft Excavation - D/B	CY	8,900	$208	1,851,200	
	6.2 Benching Excavation	CY	35,300	$150	5,295,000	
	6.3 Concrete Works	CY	700	$878	614,300	
						7,760,500
7	**POWER SHAFT (1348')**					
	7.1 Power Shaft Excavation (1208') - D/B	CY	40,600	$208	8,444,800	
	7.2 Shaft Prelining & support	SF	2,200	$72	158,400	
	7.3 Concrete Lining	CY	11,100	$1,080	11,988,000	
	7.4 Contact Grouting	CF	9,300	$42	390,600	
						20,981,800
8	**LOWER PRESSURE TUNNEL (1563')**					
	8.1 Tunnel Excavation - TBM	CY	52,600	$156	8,205,600	
	8.2 Tunnel Prelining & Support (6")	SY	13,900	$109	1,515,100	
	8.3 Tunnel Lining	CY	14,300	$1,080	15,444,000	
	8.4 Miscellaneous Concrete (bent, plug etc)	CY	5,900	$1,080	6,372,000	
	8.5 Contact Grouting	CF	10,700	$42	449,400	
	8.6 Curtain Grouting	CF	5,800	$42	243,600	
						32,229,700
9	**PENSTOCK MANIFOLD (350')**					
	9.1 Manifold Tunnel Excavation - D/B	CY	7,400	$208	1,539,200	
	9.2 Manifold Tunnel Prelining & Support (3", 75%)	SY	2,400	$72	172,800	
	9.3 Concrete Lining	CY	1,800	$1,080	1,944,000	
	9.4 Concrete Plug	CY	10,700	$1,080	11,556,000	
						15,212,000
10	**PENSTOCKS (500')**					
	10.1 Penstock Tunnel Excavation - D/B	CY	18,900	$208	3,931,200	
	10.2 Penstock Tunnel Prelining & Support (3", 30%)	SY	3,800	$72	273,600	
	10.3 Steel liner installation	Tons	3,000	$12,000	36,000,000	
	10.4 Concrete Filling around Liner	CY	5,200	$1,080	5,616,000	
	10.5 Contact Grouting	LF	2,000	$59	118,000	
	10.6 Curtain Grouting	LS	1	$92,000	92,000	
						46,030,800
11	**DRAFT TUBE MANIFOLD (350')**					
	11.1 Manifold Tunnel Excavation - D/B	CY	7,400	$208	1,539,200	
	11.2 Manifold Tunnel Prelining & Support (3", 75%)	SY	2,400	$72	172,800	
	11.3 Concrete Lining	CY	1,600	$1,080	1,728,000	
	11.4 Tube Fingers Excavation (Total L=620')	CY	6,500	$208	1,352,000	
	11.5 Tube Fingers Prelining	SY	4,100	$72	295,200	
	11.6 Tube Fingers Concrete	CY	1,200	$1,080	1,296,000	
						6,383,200
12	**TAILRACE TUNNEL (6635')**					
	12.1 Tailrace Tunnel Excavation - TBM	CY	223,100	$156	34,803,600	
	12.2 Tailrace Tunnel Prelining & Support (3", 100%)	SY	79,700	$109	8,578,300	
	12.3 Plug Concrete Construction	CY	3,400	$1,080	3,672,000	
	12.4 Plug -Radial Grout injection	LS	1	$92,000	92,000	
	12.5 Rock Trap Construction	LS	1	$950,000	950,000	
	12.6 D/S Surge Tank Construction	LS	1	$6,000,000	6,000,000	
						54,095,900

PROJECT FEATURES
& COSTS

Item	Description	Unit	Quantity	Unit Cost	Cost	
13	**MACHINE HALL**					
	13.1 Excavation Draft Tubes(El.-16,El.-36)	CY	4,600	$208	956,800	
	Benching excavation (El.-16,18)	CY	22,700	$156	3,541,200	
	Hall Benching excavation (El.18,El.85)	CY	64,000	$156	9,984,000	
	Roof excavation (El.85 , 100)	CY	9,900	$208	2,059,200	
	13.2 Roof &Walls Support (W/3" shotcrete)	SF	96,700	$42	4,082,700	
	13.3 Concrete					
	Draft Tubes El.-41, EL.-16	CY	4,500	$1,000	4,500,000	
	Machine Hall El.-16, El.-12	CY	2,700	$800	2,160,000	
	Machine Hall El.-12, El.+9	CY	10,100	$1,000	10,100,000	
	Machine Hall El.9, El. 19	CY	1,100	$1,000	1,100,000	
	Machine Hall El.19, El.21	CY	1,900	$800	1,520,000	
	Machine Hall slab El. 38	CY	1,000	$1,000	1,000,000	
	Machine Hall Walls El. 9, El.18	CY	500	$1,000	500,000	
	Machine Hall Walls El.18, El.85	CY	5,100	$1,000	5,100,000	
	Machine Hall Roof	CY	2,600	$1,000	2,600,000	
	13.4 Draft Tube Liner	Tons	220	$12,000	2,640,000	
	Draft Tube Contact Grouting	LS	1	$340,000	340,000	
	13.5 Elevator Shaft Construction	LS	1	$1,194,647	1,194,600	
	13.6 Miscellaneous Metal works	LS	1	$500,000	500,000	
	13.7 Drainage Gallery Construction	LS	1	$852,013	852,000	
	13.8 96" Dia. Spherical Valve	EA	4	$360,000	1,440,000	
						56,170,500
14	**TURBINES/GENERATORS**					
	14.1 Water to Wire Package	EA	4	$60,000,000	240,000,000	
	14.2 Installation	EA	4	$15,000,000	60,000,000	
						300,000,000
15	**TRANSFORMER HALL**					
	15.1 Excavation					
	Transformer Hall Excavation	CY	30,900	$156	4,820,400	
	Nishe Excavation	CY	2,700	$208	561,600	
	Cable Gallery Excavation	CY	700	$208	145,600	
	A/C Gallery Excavation	CY	100	$208	20,800	
	Cable Shaft Excavation	CY	4,700	$156	733,200	
	15.2 Roof & Wall Support					
	Transformer Hall	SF	44,300	$35	1,566,500	
	Nishe	SF	2,500	$12	30,400	
	Cable Gallery	SF	3,200	$12	38,900	
	A/C Gallery	SF	100	$12	1,200	
	Cable Shaft	SF	56,900	$12	691,200	
	15.3 Concrete works	CY	3,900	$1,000	3,900,000	
	15.4 Miscellaneous Steel	LS	1	$472,764	472,800	
	15.5 Transfer Station					
	Grading	CY	820	$10	8,200	
	Gravel Base	CY	410	$40	16,400	
	Fence	LS	1	$20,000	20,000	
	Towers	Tons	7	$15,000	105,000	
	Footings	LS	1	$18,000	18,000	
	O/H Transmission Lines, (Two pll. each 0.9 mile long)	Mile	1.8	$300,000	540,000	
						13,690,200
16	**LOWER RESERVOIR**	CY				
	16.1 Platform Excavation	CY	661,000	$25	16,525,000	
	16.2 Access tunnel portal concrete	CY	180	$500	90,000	
	16.3 Intake structure excavation	CY	13,900	$40	556,000	
	16.4 Intake structure concrete	CY	6,400	$800	5,120,000	
	16.5 Trashracks, Gares, misc. Metals	Tons	100	$10,000	1,000,000	
						23,291,000
17	**Unlisted Items (10% of all other items)**	LS	1	$73,564,800	73,564,800	**73,564,800**
				Total	809,213,100	
	Base Construction Subtotal (BCS)				**$809,213,100**	
	Mobilization @ 5% of BSC				$40,460,700	
	Construction Contingencies (15% of BCS+Mob.)				$127,451,100	
	Direct Construction Subtotal (DCS)				**$977,124,900**	
	Design Engineering (4% of DCS)				$39,085,000	
	Permitting (.5% of DCS)				$4,885,600	
	Legal and Administrative Costs (.3% of DCS)				$2,931,400	
	Construction Administration and Engineering (5% of DCS)				$48,856,200	
	Opinion of Probable Construction Costs (OPCC) 2008				**$1,072,880,000**	

GEI Consultants, Inc.
080473 Eagle Mountain Pumped Storage Project
Reservoir Filling Calculations
4/7/2009
NDM

RESERVOIR FILLING CALCULATIONS

Purpose: Estimate the time required to fill the Eagle Mountain Pumped Storage Project Reservoirs to full operating capacity.

Procedure: Calculate inflow, losses, and final reservoir levels based on a monthly time step.

Calculation Steps:

1. Determine volume of groundwater pumped from wells to Lower Reservoir (varies by month).
2. Determine Lower Reservoir storage and water surface elevation after inflow from groundwater wells.
3. Subtract seepage and evaporation losses from Lower Reservoir.
4. If Lower Reservoir level is above 25% active capacity, pump available water up to the Upper Reservoir.
5. Determine the Upper Reservoir storage and water surface elevation after inflow from Lower Reservoir.
6. Subtract seepage and evaporation losses from Upper Reservoir.
7. Repeat steps 1 through 6 until Upper Reservoir is at full capacity.

See attached calculation table and required inputs.

Attached Charts:

1. Eagle Mountain Pumped Storage Project Lower Reservoir Filling:
   This graph shows the Lower Reservoir storage and water surface elevation just before pumping to the Upper Reservoir and the storage and water surface elevation after pumping to the Upper Reservoir, for each monthly time step.

2. Eagle Mountain Pumped Storage Project Upper Reservoir Filling:
   This graph shows the Upper Reservoir storage and water surface elevation just before pumping from the Lower Reservoir and the storage and water surface elevation after pumping From the Lower Reservoir, for each monthly time step.

3. Eagle Mountain Pumped Storage Project Groundwater Supply and Lower Reservoir Pumping:
   This graph shows the volume of water pumped from the groundwater supply wells to Lower Reservoir, and the water pumped from the Lower Reservoir to the Upper Reservoir, for each monthly time step.

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080473 Eagle Mountain Pumped Storage Project
Reservoir Filling
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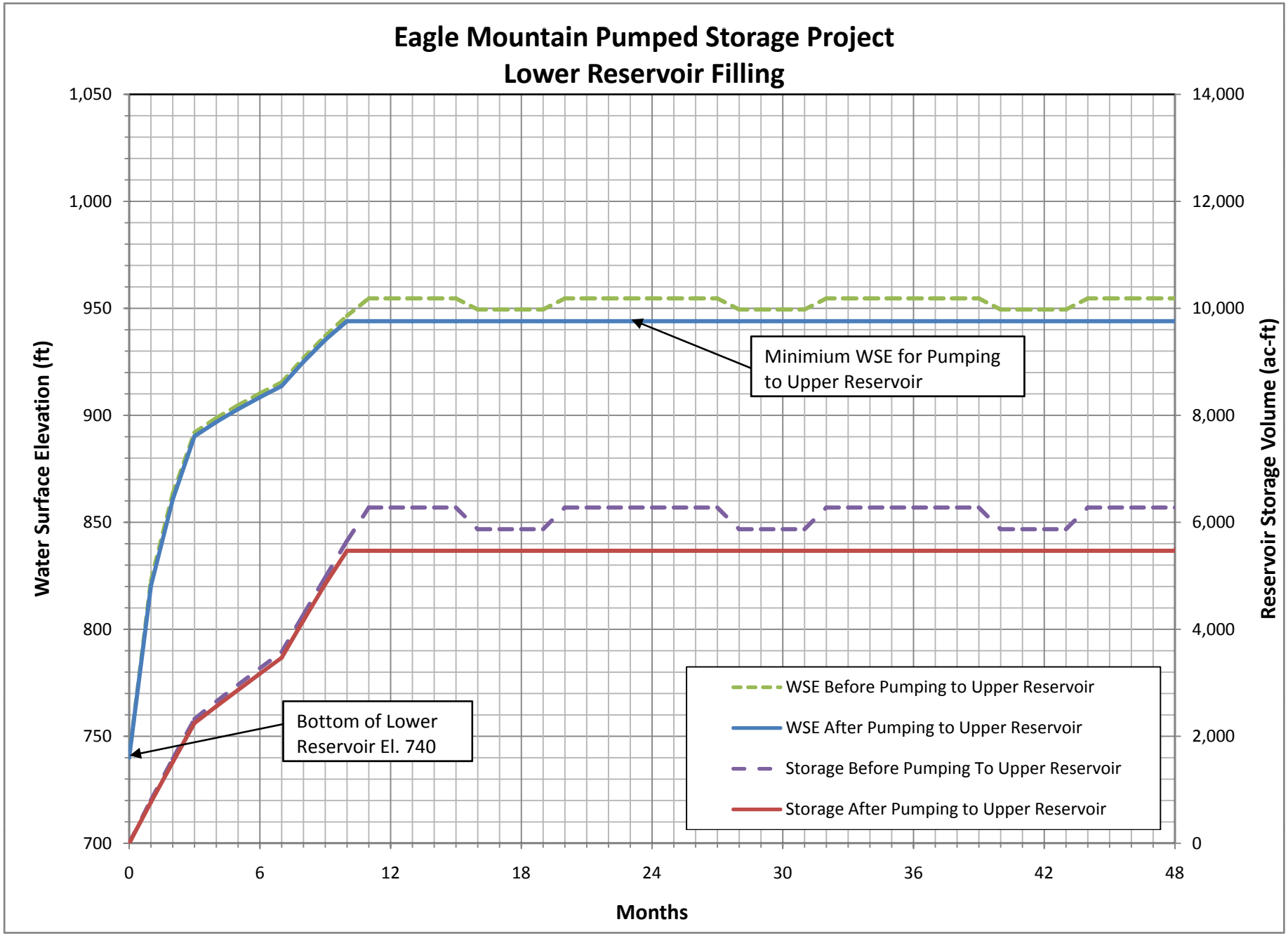
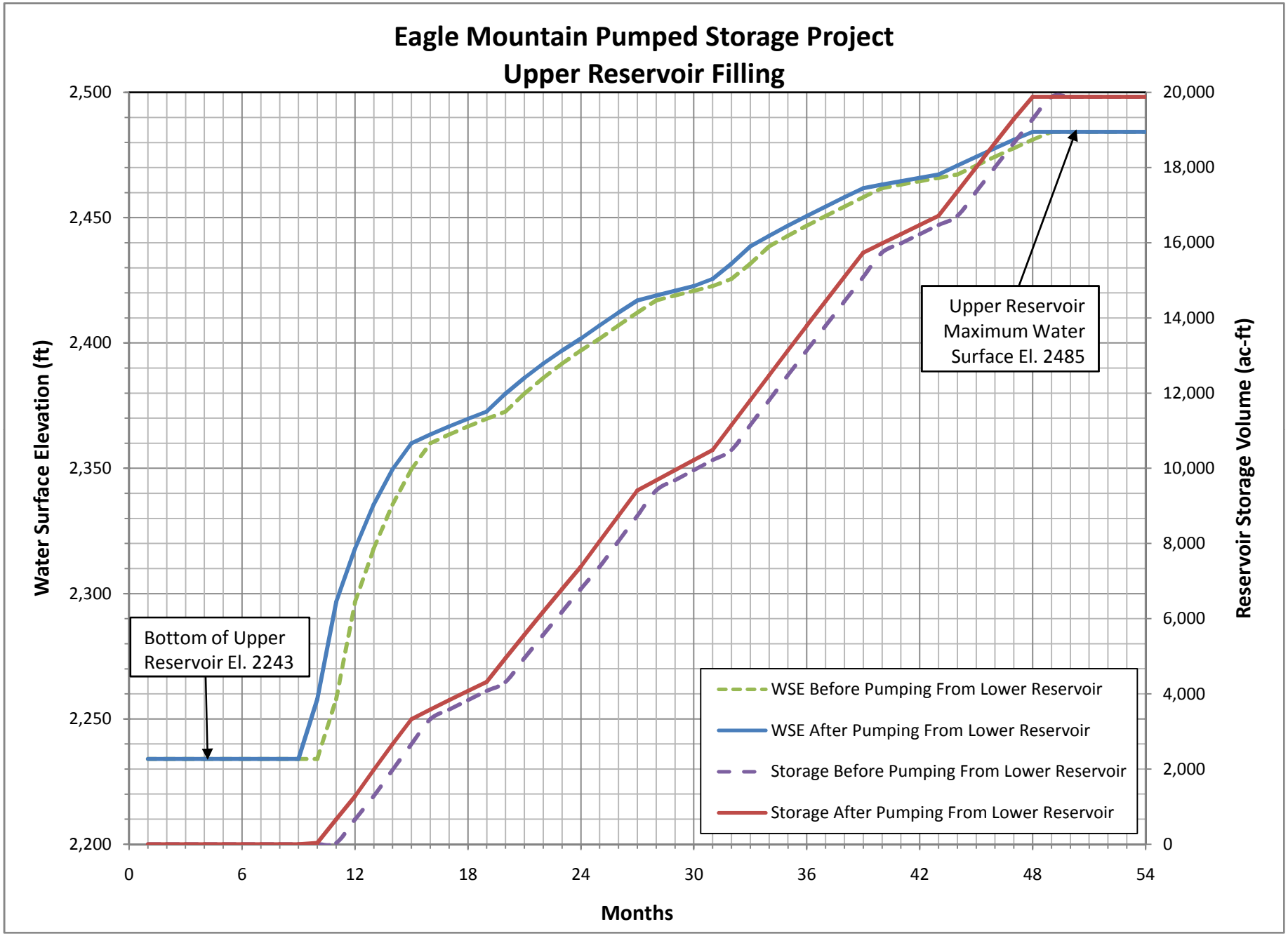
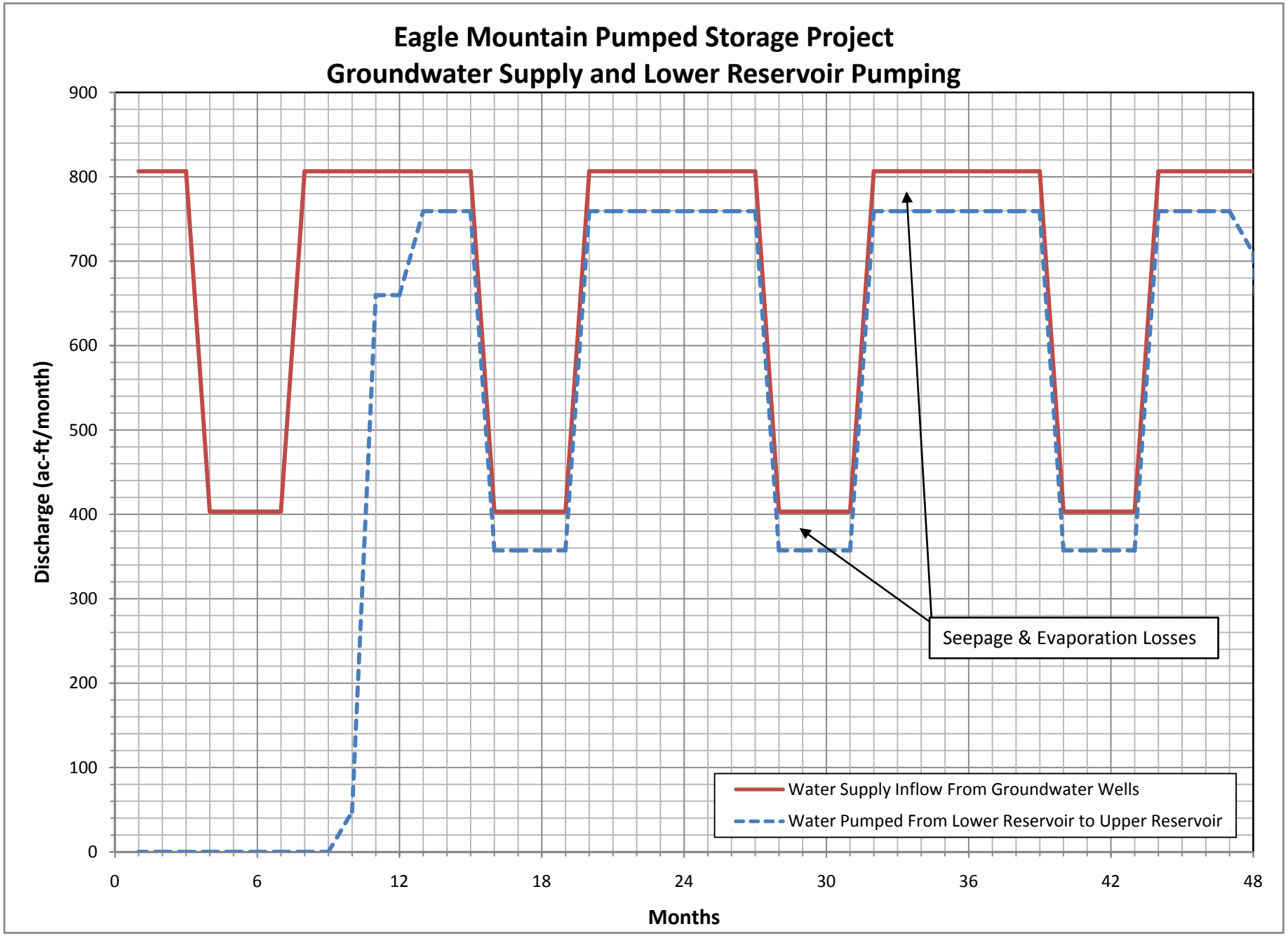
INPUT DATA		
First Filling Month	March	
Pumping Duration Oct-May, t1:	24	hrs
Pumping Duration Jun-Sept, t2:	12	hrs
Pumping Rate, Q:	6,000	gpm
Pumping Rate, Q:	13.37	cfs
Pumping Rate, Q1:	9679	AF/yr
Pumping Rate, Q2:	4839	AF/yr
Evaporation Rate:	7.5	ft/yr

SEEPAGE DATA		
LR Seepage at Max. El.:	2765	AF/yr
LR Seepage at Min. El.:	863	AF/yr
Begin LR Seepage Pumpback Month:	12	
UR Seepage at Max. El.:	1913	AF/yr
UR Seepage at Min. El.:	456	AF/yr
Begin UR Seepage Pumpback Month:	24	

			Lower Reservoir											Upper Reservoir										
Month Count	Month	Water Supply Pipeline Discharge (ac-ft)	Starting Elevation (ft)	Starting Storage (ac-ft)	After Filling Storage (ac-ft)	After Filling Elevation (ft)	Evaporation (ac-ft)	Seepage (ac-ft)	Intermediate Storage Volume (ac-ft)	Intermediate Water Surface Elevation (ft)	Percent of Total Capacity (%)	Final Storage Volume (ac-ft)	Final Water Surface Elevation (ft)	Available Pumping Volume to UR (ac-ft)	UR Starting Elevation (ft)	Starting Storage (ac-ft)	Ending Storage (ac-ft)	Volume Pumped (ac-ft)	Ending Elevation (ft)	Evaporation (ac-ft)	Seepage (ac-ft)	Final Storage Volume (ac-ft)	Final Water Surface Elevation (ft)	Percent of Total Capacity (%)
1	March	807	740.0	0	807	822.6	7	32	768	820.2	3.5%	768	820.2	0	2234	0	0.0	0.0	2234.0	0.0	0.0	0.0	2234.0	0.0%
2	April	807	820.2	768	1575	863.3	12	48	1515	860.6	6.9%	1515	860.6	0	2234	0	0.0	0.0	2234.0	0.0	0.0	0.0	2234.0	0.0%
3	May	807	860.6	1515	2322	892.0	15	59	2247	890.2	10.3%	2247	890.2	0	2234	0	0.0	0.0	2234.0	0.0	0.0	0.0	2234.0	0.0%
4	June	403	890.2	2247	2651	898.7	30	62	2559	896.9	11.7%	2559	896.9	0	2234	0	0.0	0.0	2234.0	0.0	0.0	0.0	2234.0	0.0%
5	July	403	896.9	2559	2963	904.7	32	64	2867	902.9	13.1%	2867	902.9	0	2234	0	0.0	0.0	2234.0	0.0	0.0	0.0	2234.0	0.0%
6	August	403	902.9	2867	3270	910.2	34	66	3170	908.4	14.5%	3170	908.4	0	2234	0	0.0	0.0	2234.0	0.0	0.0	0.0	2234.0	0.0%
7	September	403	908.4	3170	3573	915.4	36	68	3469	913.7	15.8%	3469	913.7	0	2234	0	0.0	0.0	2234.0	0.0	0.0	0.0	2234.0	0.0%
8	October	807	913.7	3469	4276	926.7	38	74	4164	925.0	19.0%	4164	925.0	0	2234	0	0.0	0.0	2234.0	0.0	0.0	0.0	2234.0	0.0%
9	November	807	925.0	4164	4971	937.0	42	83	4846	935.2	22.1%	4846	935.2	0	2234	0	0.0	0.0	2234.0	0.0	0.0	0.0	2234.0	0.0%
10	December	807	935.2	4846	5652	946.5	44	92	5516	944.6	25.2%	5469	944.0	47	2234	0	47.4	47.4	2259.0	0.6	8.7	38.1	2257.9	0.2%
11	January	807	944.0	5469	6275	954.7	47	100	6128	952.8	28.0%	5469	944.0	660	2258	38	697.8	659.8	2297.9	10.0	22.3	665.5	2296.6	3.3%
12	February	807	944.0	5469	6275	954.7	47	100	6128	952.8	28.0%	5469	944.0	660	2297	666	1325.3	659.8	2319.2	17.5	29.7	1278.0	2317.9	6.4%
13	March	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2318	1278	2037.4	759.3	2336.9	24.6	35.9	1976.9	2335.5	9.9%
14	April	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2336	1977	2736.2	759.3	2350.9	30.0	44.7	2661.6	2349.6	13.3%
15	May	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2350	2662	3420.9	759.3	2361.3	39.5	53.6	3327.8	2360.0	16.6%
16	June	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2360	3328	3685.0	357.2	2364.8	45.8	56.6	3582.6	2363.5	17.9%
17	July	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2363	3583	3939.8	357.2	2368.1	47.2	59.4	3833.2	2366.7	19.2%
18	August	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2367	3833	4190.4	357.2	2371.1	50.1	62.0	4078.3	2369.8	20.4%
19	September	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2370	4078	4435.5	357.2	2374.0	51.5	64.5	4319.5	2372.6	21.6%
20	October	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2373	4319	5078.8	759.3	2381.1	55.7	70.6	4952.6	2379.7	24.8%
21	November	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2380	4953	5711.9	759.3	2387.4	61.4	75.9	5574.5	2386.1	27.9%
22	December	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2386	5575	6333.8	759.3	2393.1	65.3	80.8	6187.7	2391.8	30.9%
23	January	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2392	6188	6947.0	759.3	2398.3	72.9	85.2	6788.8	2397.0	33.9%
24	February	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2397	6789	7548.2	759.3	2403.0	76.5	89.3	7382.3	2401.7	36.9%
25	March	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2402	7382	8141.6	759.3	2407.6	80.3	0.0	8061.3	2407.0	40.3%
26	April	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2407	8061	8820.6	759.3	2412.7	82.5	0.0	8738.1	2412.1	43.7%
27	May	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2412	8738	9497.4	759.3	2417.6	85.6	0.0	9411.8	2417.0	47.1%
28	June	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2417	9412	9769.1	357.2	2419.5	87.5	0.0	9681.5	2418.9	48.4%
29	July	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2419	9682	10038.8	357.2	2421.4	88.5	0.0	9950.3	2420.8	49.8%
30	August	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2421	9950	10307.5	357.2	2423.3	89.7	0.0	10217.8	2422.7	51.1%
31	September	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2423	10218	10575.1	357.2	2427.4	90.8	0.0	10484.3	2425.6	52.4%
32	October	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2426	10484	11243.6	759.3	2432.2	92.9	0.0	11150.7	2431.6	55.8%
33	November	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2432	11151	11910.0	759.3	2439.2	96.1	0.0	11814.0	2438.6	59.1%
34	December	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2439	11814	12573.3	759.3	2443.3	99.3	0.0	12474.0	2442.7	62.4%
35	January	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2443	12474	13233.3	759.3	2447.4	101.6	0.0	13131.7	2446.7	65.7%
36	February	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2447	13132	13891.0	759.3	2451.3	104.7	0.0	13786.4	2450.6	68.9%
37	March	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2451	13786	14545.7	759.3	2455.0	107.7	0.0	14438.0	2454.4	72.2%
38	April	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2454	14438	15197.3	759.3	2458.8	109.4	0.0	15087.9	2458.1	75.4%
39	May	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2458	15088	15847.2	759.3	2462.4	110.9	0.0	15736.4	2461.8	78.7%
40	June	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2462	15736	16093.6	357.2	2463.8	111.7	0.0	15981.9	2463.2	79.9%
41	July	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2463	15982	16339.2	357.2	2465.1	112.4	0.0	16226.8	2464.5	81.1%
42	August	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2465	16227	16584.0	357.2	2466.5	112.4	0.0	16471.7	2465.9	82.4%
43	September	403	944.0	5469	5872	949.4	46	0	5826	948.8	26.6%	5469	944.0	357	2466	16472	16828.9	357.2	2467.9	113.0	0.0	16715.9	2467.2	83.6%
44	October	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2467	16716	17475.2	759.3	2471.4	113.7	0.0	17361.5	2470.8	86.8%
45	November	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2471	17361	18120.8	759.3	2474.9	115.1	0.0	18005.7	2474.3	90.0%
46	December	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2474	18006	18765.0	759.3	2478.3	116.5	0.0	18648.6	2477.7	93.2%
47	January	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2478	18649	19407.9	759.3	2481.7	117.1	0.0	19290.8	2481.1	96.5%
48	February	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	5469	944.0	759	2481	19291	20000.0	709.2	2484.9	118.5	0.0	19881.5	2484.2	99.4%
49	March	807	944.0	5469	6275	954.7	47	0	6228	954.0	28.4%	6228	954.0	759	2484	19881	20000.0	118.5	2484.9	119.2	0.0	19880.8	2484.2	99.4%
50	April	807	954.0	6228	7035	964.1	50	0	6985	963.5	31.9%	6985	963.5	1516	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%
51	May	807	963.5	6985	7791	973.1	52	0	7739	972.5	35.3%	7739	972.5	2270	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%
52	June	403	972.5	7739	8142	977.1	54	0	8088	976.5	36.9%	8088	976.5	2620	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%
53	July	403	976.5	8088	8492	981.1	55	0	8437	980.4	38.5%	8437	980.4	2968	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%
54	August	403	980.4	8437	8840	984.9	56	0	8784	984.3	40.1%	8784	984.3	3315	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%
55	September	403	984.3	8784	9187	988.7	57	0	9130	988.0	41.7%	9130	988.0	3661	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%
56	October	807	988.0	9130	9936	996.5	59	0	9877	995.9	45.1%	9877	995.9	4409	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%
57	November	807	995.9	9877	10684	1004.1	61	0	10623	1003.5	48.5%	10623	1003.5	5154	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%
58	December	807	1003.5	10623	11429	1011.5	63	0	11366	1010.8	51.9%	11366	1010.8	5897	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%
59	January	807	1010.8	11366	12172	1018.6	65	0	12108	1018.0	55.3%	12108	1018.0	6639	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%
60	February	807	1018.0	12108	12914	1025.5	67	0	12847	1024.8	58.7%	12847	1024.8	7379	2484	19881	20000.0	119.2	2484.9	119.2	0.0	19880.8	2484.2	99.4%


Eagle Mountain Pumped Storage Project
Lower Reservoir Filling
Water Surface Elevation (ft)
Reservoir Storage Volume (ac-ft)
Months
1,050
1,000
950
900
850
800
750
700
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
6
12
18
24
30
36
42
48
Minimium WSE for Pumping to Upper Reservoir
Bottom of Lower Reservoir El. 740
WSE Before Pumping to Upper Reservoir
WSE After Pumping to Upper Reservoir
Storage Before Pumping To Upper Reservoir
Storage After Pumping to Upper Reservoir


Eagle Mountain Pumped Storage Project
Upper Reservoir Filling
Water Surface Elevation (ft)
Reservoir Storage Volume (ac-ft)
Months
2,500
2,450
2,400
2,350
2,300
2,250
2,200
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
6
12
18
24
30
36
42
48
54
Bottom of Upper Reservoir El. 2243
Upper Reservoir Maximum Water Surface El. 2485
WSE Before Pumping From Lower Reservoir
WSE After Pumping From Lower Reservoir
Storage Before Pumping From Lower Reservoir
Storage After Pumping From Lower Reservoir


Eagle Mountain Pumped Storage Project
Groundwater Supply and Lower Reservoir Pumping
Discharge (ac-ft/month)
900
800
700
600
500
400
300
200
100
0
0
6
12
18
24
30
36
42
48
Months
Seepage & Evaporation Losses
Water Supply Inflow From Groundwater Wells
Water Pumped From Lower Reservoir to Upper Reservoir