APPENDIX G
PRELIMINARY DETENTION BASIN CALCULATIONS

Sargent & Lundy LLC	**Calcs for** Runoff Detention Pond			**Calc. No.** C-1	
				Rev. 0	**Date 3/08/07**
		Safety-Related		**Non-Safety-Related**	**Page 1 of 2**

Client Reliant Energy	
Project Etiwanda Power Plant	
Proj. No. 11962-003	**Equip. No.**

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Reviewed by Doug Dahlberg	**Date 03/14/07**
Approved by	**Date**

Purpose: To determine the **<u>PRELIMINARY</u>** rough size of the runoff detention basin for the Etiwanda Power Plant.

Sources of Data:

1. Detention Basin Design Criteria for San Bernardino County (no Date), Received 12/06/06 via facsimile.
2. Point Precipitation Frequency Estimates from NOAA Atlas 14. California 34.09 N 117.53 W, From "Precipitation-Frequency Atlas of the US" NOAA Atlas 14, Volume 1, Version 4, Extracted Wed Mar 7, 2007.
3. Institute of Transportation Studies, University of California, Street and Highway Drainage, Volume 2 Design Charts, 1978

Procedure:

1. Planimeter the GA to determine the area of the plant
2. Determine the pre-development runoff factor and the post-construction runoff factor.
3. Calculate the runoff before construction. Calculate the runoff after construction. The detention basin must be sized to hold the difference between the two runoffs. Determine the size of the detention basin based on the difference in the runoff before and after construction, the size of the pumps, and the size of the discharge pipe.
2. In an addendum to Reference 2, San Bernardino County states that the 25-year rainfall shall be used for the 100-year pre-development rainfall when calculating runoff for sizing the Detention Basin. From Reference 2, the 100-year, 24 hour rainfall = 7.47 inches. The 25-year, 24 hour rainfall = 5.78 inches.
4. Use Q = CIA where Q = Flow in Acre-Feet, C = Runoff factor, I = Rainfall rate in feet, A = Runoff Area in acres
5. The San Bernardino Procedure states that the basin cannot be deeper than 5-feet. The plant does not have enough area for this depth of basin. Public access is not allowed into the plant. Ladders will be provided on each end of the basin for an adult to exit the basin. Handrails will surround the basin. Allow the basin to be deeper than 5 feet.
6. Determine the 1000-year flow. Per Reference 1, the 1000-year peak is 1.35 times the 100-year peak. Determine the size of the overflow weir and pipe used for outflow of the basin due to the 1000-year runoff.
7. The basin must drain empty in 24-hours.

Assumptions:

1. Assume that the basin is a Local Detention Basin.
3. Assume that the average C factor of the drainage area for the pre-development runoff = 0.5
4. Assume that the average C factor of the post-construction drainage area = 0.85
5. Reference 1 states "When a basin is to be used to mitigate downstream impacts due to increased flows generated by a development, the basin capacity and outlet size shall be such that the post-development peak flow rate generated by the site shall be less than or equal to 90% of the pre-development peak flow rate for all frequency storms up to and including the 100-year".

6. Use 1/90% = 1.11 times the delta flow for the preliminary design. Per Procedure Note 2, use the 25-year rainfall for pre-development runoff

Calculation:

1. Planimeter the size of the plant. The size of the drainage area into the detention basin = 17.0 acres.
2. Pre-development flow Q = CIA = 0.5(5.78/12)17. Q = 4.09 Acre feet.
3. Post-Construction flow = 0.85(7.47/12)17. Q = 8.99 Acre Feet
4. Delta Runoff = 8.99-4.09 = 4.9 Acre-feet. 4.9 x 1.11 = 5.43 Ac Ft.
5. Size of the detention basin = 120 Ft wide x 10.0 feet deep x 200 feet long. 120 x 10.0 x 200/43560 = 5.5 acre feet 5.5 acre feet > 5.43 acre feet ok

6. Provide 1.0-feet of sediment capacity, 10.0-feet of basin depth, 1.8 feet of head to discharge the 1000-year runoff over the weir, and 1.0-feet of freeboard. Total depth = 1.0 + 10.0 + 2.8 = 13.8-feet.
7. Determine rough size of the weir for the 1000-year runoff. Take the peak 100-year runoff to be the 30-minute rainfall. I_{30} = 1.33 inches x 2 = 2.66 inches. $C_{100\ year}$ = 0.85 x 1.25 = 1.06 Use 1.0 Q = CIA = 1.0 x 2.66 x 17 = 45.2 cubic feet per second (cfs). Q_{1000} = 1.35 (45) = 61 cfs
8. From Reference 3 Chart 1041, Page II-59, determine the size of pipe to carry 61 cfs. Length of pipe = 70 feet. Use 80 feet. C(e) = 0.1. H = 2.3 feet, Diameter = 36".
9. Try a 15-feet wide broadcrested weir (Ignores corners). $Q = CLH^{3/2}$ C = 2.65, Q = 61 cfs, L = 15 feet, $H^{3/2}$ = 61/2.65 x 15 = 1.53, H = 1.35 feet. Try a 10 feet wide weir. $H^{3/2}$ = 61/2.65 x 10 = 2.3 feet, H = 1.75 1.75 < 1.8 feet ok
10. Size the pumps. Try 3 x 450 gpm pumps. Assume pumps come on in 6-inch increments. All three pumps will operate. One pump flows 450 gpm x 60 min/hr x 24 h/day = 648,000 gallons/day / 7.48 g/cubic feet x 43560 sq. feet per acre-feet = 2.00 acre-feet per day. Three pumps x 2.00 acre feet = 6.00 acre feet. Have to have the pumping capacity to empty 5.5 acre feet in 24-hours. 3 x 2.0 = 6 acre feet > 5.5 acre feet ok

Conclusions:

The size of the basin is 120 feet wide x 200 feet long by 1 + 10.0 + 2.8 = 13.8 feet deep. It has I-foot of sediment capacity, 1.8 feet of head above the weir for head required to flow over the weir due to the 1000-year rainfall, and 1 foot of freeboard above the maximum water level. The basin has 3-450 gpm pumps discharging to the aft basin. The emergency weir also discharges to the aft basin. A 36" RCP drains the aft basin to the Chadwick Channel. The weir for the 1000-year flow is 10-feet wide, with a crest elevation 2.8 feet below the top of the basin.