Pico Power Project

Appendix 8.6-B
Air Navigation Hazard Analysis

October 2002

APPENDIX 8.6-B
AIR NAVIGATION HAZARD ANALYSIS METHODOLOGY

Silicon Valley Power has filed form 7460-1 *Notice of Proposed Construction or Alteration* with the Federal Aviation Administration (FAA). The FAA's regulations in 14 CFR Part 77 *Objects Affecting Navigable Airspace* require that entities planning the construction of tall structures near airports submit this form for FAA air navigation hazard review and analysis. The regulations describe imaginary geometric surfaces named the primary, approach, transitional, conical and horizontal surfaces. These surfaces have different characteristics, depending on runway type and size. The intent of the FAA regulations is to review tall structures near airports that could cause a hazard to air navigation.

Since the Pico Power Project (PPP) is within 0.5 miles of the San Jose International Airport (SJC) and plans to install two 95-foot-high structures, the Heat Recovery Steam Generator (HRSG) stacks, it is subject to the FAA air navigation hazard review. Silicon Valley Power (SVP) submitted form 7460-1 on July 3, 2002, for FAA review. The FAA analysis is not yet completed, but is expected shortly.

This Appendix describes the methods and techniques that SVP used to determine that the PPP will not cause a hazard to air navigation at SJC. This analysis involved two fundamental steps: 1) determine the applicable imaginary surface, and 2) calculate the height of the applicable SJC surface in relation to the PPP HRSG stack nearest the airport, the eastern stack.

The nearest SJC runway of concern to the PPP analysis is Runway 12R. Runway 12R is a precision instrument runway greater than 3,200 feet in length. For this category of runway, the primary surface is defined as an imaginary flat surface at ground level that is 1000 feet wide, centered on the runway centerline (500 feet each side of the centerline). The primary surface extends 200 feet beyond the runway end.

The approach surface, transitional surface, and horizontal surface are calculated in relation to the primary surface and in relation to the elevation of the end of the runway nearest the project site. In this case, the runway elevation at the end of Runway 12R is approximately 35 feet above sea level, roughly the same elevation as the PPP site. (The ground surface elevation at the PPP is approximately 32 feet above sea level, but construction may involve building up the site to a finished grade of 35 feet).

The approach surface extends from the end of the primary surface upwards at a slope of 50:1 and outwards to a width of 16,000 feet 40,000 feet from the end of the primary surface (50:1 for the first 10,000 feet, 40:1 thereafter). Based on maps provided by SJC, the approach surface extends over a portion of the PPP project parcel, but does not extend over the HRSG stacks.

The PPP HRSG stacks lie under the SJC transitional surface. This is an imaginary surface extending outwards from the runway, parallel to its centerline, from the edge of the primary surface (see above) at a slope of 7:1 to a final elevation of 150 feet above the elevation of the runway, where it meets the horizontal surface. To determine the height of the HRSG stacks in relation to the height of the transitional surface over the stacks, therefore, it is necessary to: 1) find the perpendicular distance from the eastern HRSG stack to the runway centerline (extended beyond the airport), 2) subtract 500 feet (half the width of the primary surface, at the outer edge of which the transitional surface begins, and 3) divide the result by 7 (since, at a 7:1 slope, the height will be the distance divided by 7).

This analysis was conducted using two different methods, which produced very similar results. The first of these was to locate the airport runway and eastern HRSG stack on a US Geological Survey orthogonally rectified digital aerial photograph, then to use geographic information system (GIS) and computer-aided design (CAD) software to measure the relevant distances and calculate the height of the airport imaginary surfaces relative to the PPP HRSG stacks. The second method was to obtain professionally surveyed benchmark locations on the PPP site and SJC runway 12R centerline and then, applying principles of trigonometry to calculate the relevant distances and elevations.

Method 1: GIS and CAD

The GIS and CAD methods involved the following steps:

1) Using corner benchmark points established in latitude/longitude by a professional surveyor, locate the stack in a scaled, engineering drawing of the project site.
2) Locate this point in a Geographic Information System (GIS) using an orthogonally rectified USGS 7.5-minute photographic quadrangle.
3) Using the GIS, extend the runway centerline to a point opposite the power plant site.
4) Using a Computer-aided design (CAD) program, draw a line between the power plant stack and the 12R/30L runway centerline and use the CAD program to measure the perpendicular distance between the power plant stack and centerline.
5) Subtract 500 feet, half the width of the primary surface (1000 feet) to establish the beginning point of the transitional surface.
6) Divide the remainder by 7, to account for the 7:1 slope of the transitional surface.

The results were as follows:

1) The east power plant stack is located at Universal Transverse Mercator (UTM) coordinates 592,983.3E/4,136,986.8N (North American Datum [NAD] 27). Note that NAD 27 coordinates were used because US Geological Survey maps more often use the NAD 27 datum.
2) The runway 12R/30L centerline is 1212 feet northeast of the proposed Pico Power Project's eastern stack (perpendicular distance).
3) The western edge of the primary surface would be 712 feet northeast of the Pico stack (1212-500) (except that the primary surface is engulfed by the approach surface in this location).
4) The height of the transitional surface at the location of the Pico Project eastern stack is approximately 102 feet above ground. The ground elevation at the Pico site and at the end of runway are roughly equal, at 35 feet.
5) Since the Pico stacks are 95 feet tall, the stacks would not penetrate the transitional surface.

Method 2: Survey Coordinates and Trigonometry

This method is more accurate than the GIS and CAD method because it does not rely on map measurements. It involved using surveyed points to arithmetically and trigonometrically calculate the distance between the eastern stack and runway centerline. as follows:

Data provided by the San Jose Airport courtesy of Mr. Carey Greene and his staff gives precisely surveyed geographic coordinates for the Runway 12R centerline at the centerlines of various taxiways that intercept the runways. The grid coordinates of the eastern HRSG stack were determined by scaling on a large-format engineering drawing from a professionally surveyed corner monument at the PPP site. Table 1 lists the key data points (State Plane Coordinates, NAD 83, Zone 0403, in feet):

Table 1. Key geographic coordinates and distances used in the analysis.

Geographic point or distance	Northing (ft)	Easting (ft)
Runway coordinates and distances:		
Runway 12R, Taxiway H	1,958,457.66	6,145,482.54
Runway 12R, Taxiway G	1,957,740.55	6,146,090.93
Distances between Taxiway G and H	717.12	608.39
Pico project coordinates and distances:		
Pico Project, SW corner	1,962,887.98	6,139.912.43
Distance from SW monument to East Stack	24.5	190.95
PPP East Stack coordinates	1,962,912.90	6,140,103.18
Distance from Taxiway H to East Stack	4,455.24	5,379.36

The first step in the analysis is to plot the three key points (2 points on the centerline and the PPP east HRSG stack) in coordinate space and to determine their relationships in that space in terms of right triangles. Figure 1 is a diagram showing the triangles and distances.

The trigonometric analysis uses the following steps:

A. Create a right triangle (Triangle I or Triangle ABC) with three sides:
   1) A line (AB) extending due north from Taxiway G
   2) A line (AC) connecting Taxiways H and G on the runway 12R centerline as a hypotenuse,
   3) A line (BC) due east from H to connect with north-south line AB.

B. Subtract the Taxiway H Northing from the Taxiway G northing to obtain the length of AB (717.12 feet) and subtract the Taxiway G Easting from the Taxiway H Easting to obtain the length of BC (608.39 feet).

C. Compute angle BCA as:

   $\tan BCA = AB/BC$ or $\tan^{-1} = 717.12/608.39 = 49.69°$

D. The opposite angle of this right triangle is 90°- 49.69°, or 40.31°.

E. Form a right triangle (Triangle II, or Triangle CDE) with the same angles as Triangle I. The sides are:
   1) A line (CD) extended due north from point C (Taxiway H).
   2) The runway centerline extended northwest from Taxiway H (CE).
   3) A line extended due east from the Pico eastern stack between the runway centerline and the line north from Taxiway H (ED).

F. Compute side CD of this triangle by subtracting the Taxiway H Northing from the Pico stack Northing (4455.24 feet).

G. Compute side DE of this triangle as:

   $\tan DCE$ = opposite side (DE)/adjacent side (CD) or $DE = \tan(40.31°)*4455.3 = 3779.78$.

H. Form a third right triangle (Triangle III or Triangle EFG. The sides are:
   1) A line formed as the shortest (perpendicular) distance between the Pico Stack and the runway centerline (GF).

2) A line (EG) from the centerline due west to the Pico stack.

3) The runway centerline between the east-west line from the Pico stack and line 1 (EF)

I. Compute the hypotenuse of Triangle EFG (GE) by subtracting the length of line DE (step G above, 3779.78) from the Easting difference between the Pico Stack and Taxiway H (5379.36 feet), which is 1599.58 feet.

J. Compute the distance between the Pico stack and the runway centerline (GF) as:

Sin angle GEF = side GF/hypotenuse(EG) or sin 49.69° = GF/1599.58 = 1219.75 feet

K. Subtract 500 feet from this perpendicular distance to obtain the shortest distance to the edge of the transitional surface adjacent to the Pico project (719.75 feet).

L. Dividing this distance by 7 gives the height of the transitional surface at 102.82 feet above the elevation of the runway end, which is 35 feet above sea level. Since this is roughly the same as the finished grade at the Pico eastern HRSG stack location, no elevation adjustment is needed and the allowable height at the location of the Pico HRSG stacks is 102.82 feet, higher than the Pico project stack height of 95 feet. The Pico project will not be a hazard to air navigation at SJC.

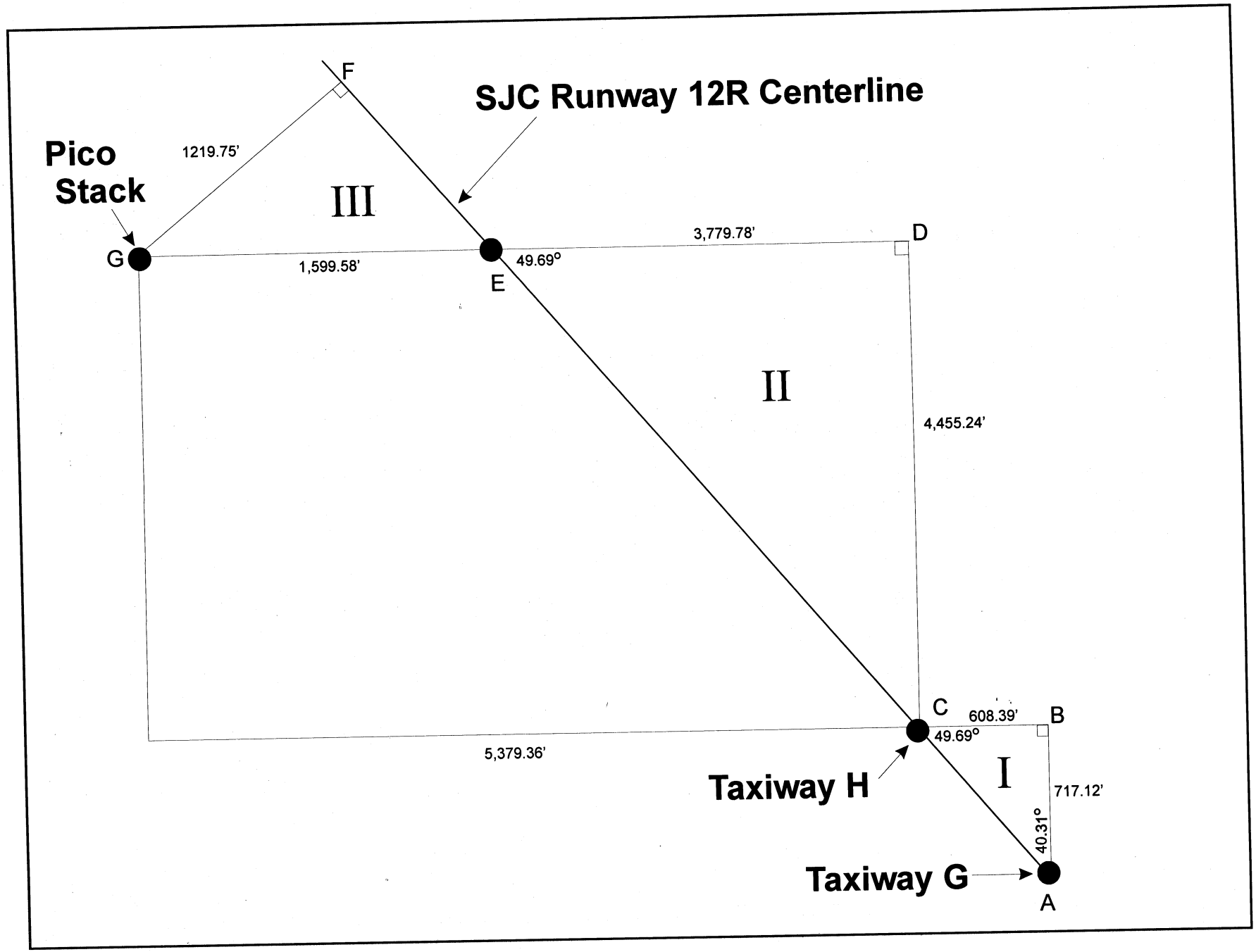
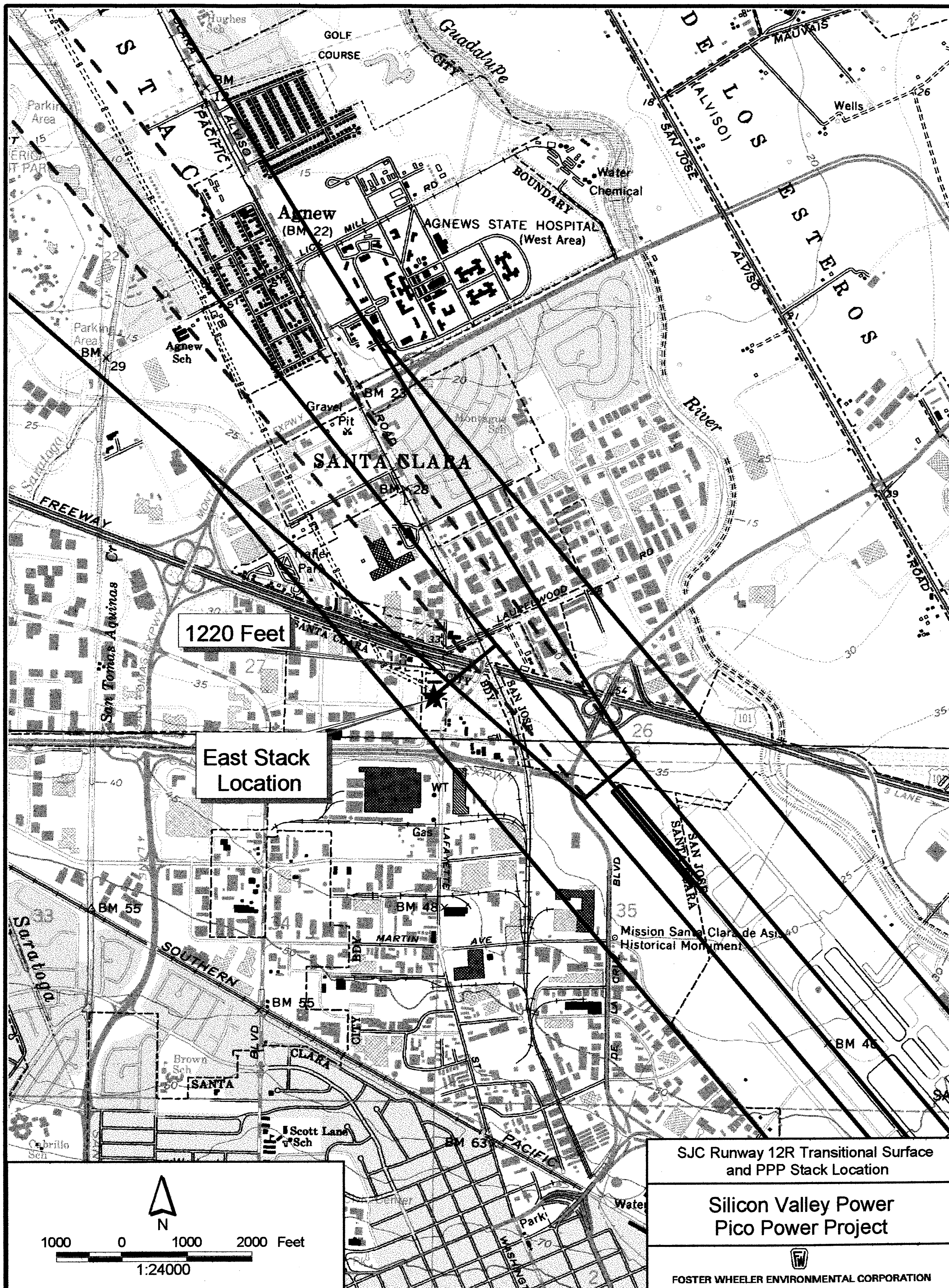


Figure 1. Survey coordinate and trigonometric analysis of distance from Pico stack to Runway 12R centerline.



SJC Runway 12R Transitional Surface and PPP Stack Location

Silicon Valley Power
Pico Power Project

FOSTER WHEELER ENVIRONMENTAL CORPORATION

Federal Aviation Administration
Western Pacific Regional Office
PO Box 92007-AWP-520
Los Angeles, CA 90009-2007

AERONAUTICAL STUDY No.
2002-AWP-2865-OE
PRIOR STUDY No.

Issued Date: 8/28/2002

JOHN ROUKEMA
SILICON VALLEY POWER
1500 WARBURTON AVENUE
SANTA CLARA, CA 95050

**** THIS IS NOT A DETERMINATION ****

The Federal Aviation Administration has received your notice concerning:

Structure Type:	EXHAUST STACK
Location:	SANTA CLARA, CA
Latitude:	37-22-36.3 NAD83
Longitude:	121-57-3.1
Heights:	95 feet above ground level (AGL)
	130 feet above mean sea level (AMSL)

NOTE: If the coordinates of your notice were submitted in NAD 27 datum, they have been converted to NAD 83 datum as shown above. NAD 83 datum will be referenced on all future correspondence and will be used for the purpose of this study.

Your notice has been assigned Aeronautical Study Number 2002-AWP-2865-OE and we are in the process of conducting an aeronautical study to determine the affect on air navigation. A determination or response will be forthcoming.

Please inform involved consultants of this correspondence.

If you have any questions, please contact LADONNA JAMES at (310)725-6558. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2002-AWP-2865-OE.

(REC)

Please Type or Print on This Form — Form Approved OMB No. 2120-0001

U.S. Department of Transportation
Federal Aviation Administration

Failure To Provide All Requested Information May Delay Processing of Your Notice

Notice of Proposed Construction or Alteration

FOR FAA USE ONLY
Aeronautical Study Number
- - -

1. Sponsor *(person, company, etc. proposing this action)* :
Attn. of: John Roukema, Assistant Director of Electric Utility
Name: Silicon Valley Power
Address: 1500 Warburton Avenue
City: Santa Clara State: CA Zip: 95050
Telephone: 408-261-5480 Fax: 408-249-0217

2. Sponsor's Representative *(if other than #1)* :
Attn. of: Douglas Davy
Name: Foster Wheeler Environmental Corporation
Address: 3947 Lennane Drive, Suite 200
City: Sacramento State: CA Zip: 95834
Telephone: 916-928-4805 Fax: 916-928-0594

3. Notice of: ☒ New Construction ☐ Alteration ☐ Existing

4. Duration: ☒ Permanent ☐ Temporary (months, days)

5. Work Schedule: Beginning 6/2003 End 11/2004

6. Type: ☐ Antenna Tower ☐ Crane ☐ Building ☐ Power Line
☐ Landfill ☐ Water Tank ☒ Other Power plant exhaust stack

7. Marking/Painting and/or Lighting Preferred:
☐ Red Lights and Paint ☒ Dual - Red and Medium Intensity White
☐ White - Medium Intensity ☐ Dual - Red and High Intensity White
☐ White - High Intensity ☐ Other

8. FCC Antenna Structure Registration Number *(if applicable)*:
N/A

9. Latitude: See #21° ' . "

10. Longitude: See #21° ' . "
corrected by telephone 8/28/02

11. Datum: ☒ NAD 83 ~~☒ NAD 27~~ ☐ Other

12. Nearest: City: Santa Clara State: CA

13. Nearest Public-use (not private-use) or Military Airport or Heliport:
San Jose International Airport

14. Distance from #13. to Structure: 3200 feet

15. Direction from #13. to Structure: northwest

16. Site Elevation *(AMSL)*: 35 ft.

17. Total Structure Height *(AGL)*: 95 ft.

18. Overall height (#16. + #17.) *(AMSL)*: 130 ft.

19. Previous FAA Aeronautical Study Number (if applicable):
- OE

20. Description of Location: (Attach a USGS 7.5 minute Quadrangle Map with the precise site marked and any certified survey.)
850 Duane Avenue
Santa Clara, California 95054

See Attachment 1. Site location on USGS map.

21. Complete Description of Proposal:

Two power plant exhaust stacks (identical structure height) are proposed for construction at 850 Duane Ave.

Stack 1: Latitude: 37 deg. 22' 36.3"
Longitude: 121 deg. 57' 4.1 "

Stack 2: Latitude: 37 deg. 22' 36.3"
Longitude: 121 deg. 57' 3.1"

See Attachment 2. Site Plan

See Attachment 3. Elevation

Frequency/Power (kW)	

Notice is required by 14 Code of Federal Regulations, part 77 pursuant to 49 U.S.C., Section 44718. Persons who knowingly and willingly violate the notice requirements of part 77 are subject to a civil penalty of $1,000 per day until the notice is received, pursuant to 49 U.S.C., section 46301 (a).

I hereby certify that all of the above statements made by me are true, complete, and correct to the best of my knowledge. In addition, I agree to mark and/or light the structure in accordance with established marking and lighting standards as necessary.

Date	Typed or Printed name and Title of Person Filing Notice	Signature
07/02/02	Douglas Davy, Project Manager	