

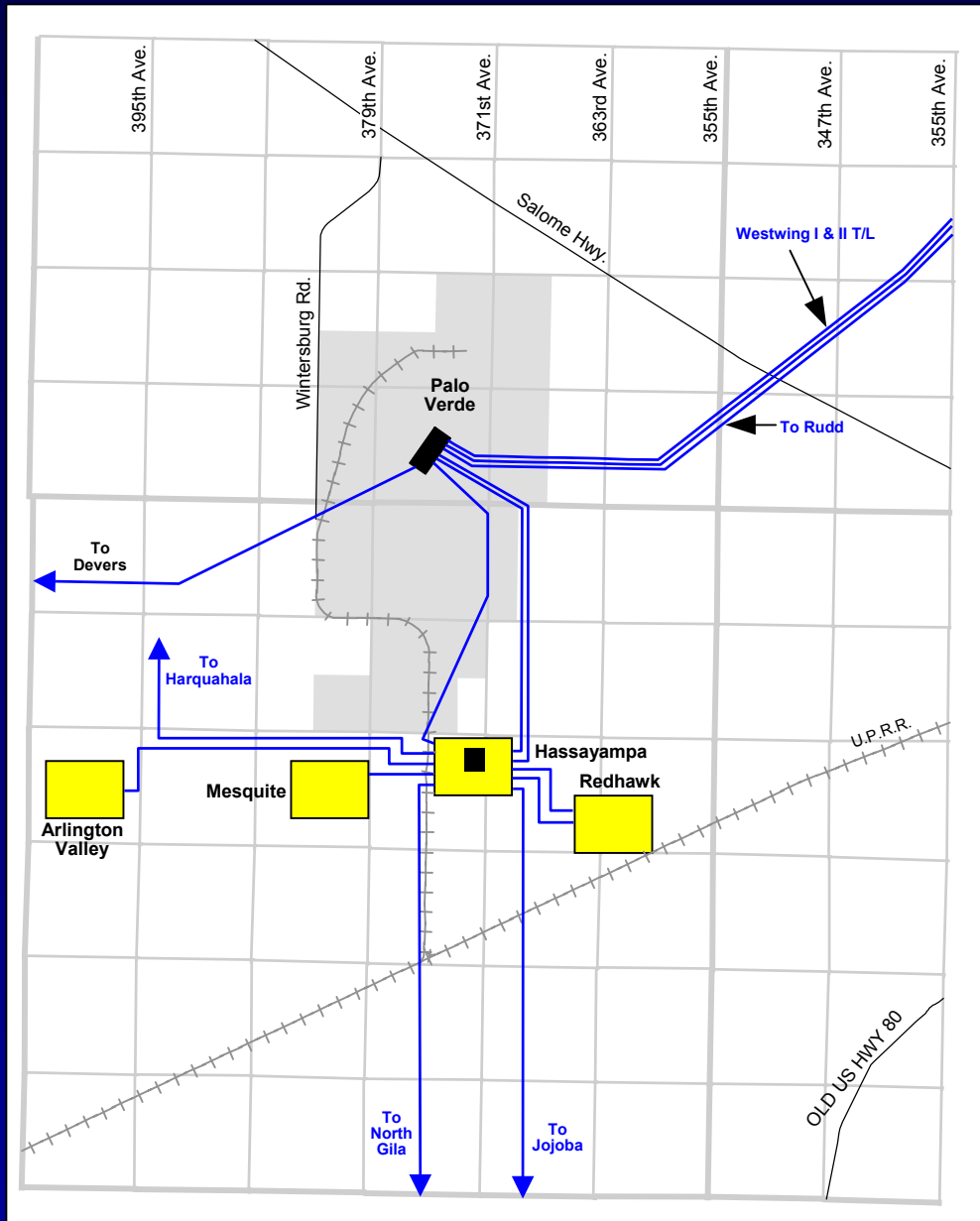
Southwest Transmission Expansion Planning

May 2003

Palo Verde Hub Risk Assessment Study

**Salt River Project
Arizona Public Service
Arizona Corporation Commission**

Palo Verde Hub Configuration



Southwest Valley Project

Arizona Corporation Commission Case No. 115 Certificate of Environmental Compatibility*

Condition No. 23 – Applicants agree to facilitate an industry review and work to achieve consensus with Staff on the reliability and system security measures appropriate for a large commercial hub such as the Palo Verde Hub. Such measures shall be recommended to WECC for consideration and adoption. If and when consensus is achieved between Applicants and Staff, Applicants shall work with Staff to initiate action to implement such measures on a statewide basis independent of WECC action.

Condition and study work does not include nor address contractual, regulatory, commercial, business or operational issues.

***Docket Nos. L-00000D-01-0115 and L-00000B-01-0115, Decision No. 64473**

NERC Planning Standards

Category D Criteria

D – Extreme event resulting in two or more (multiple) elements removed or cascading out of service	3 Phase Fault, with Delayed Clearing (stuck breaker or protection system failure): <ol style="list-style-type: none"> 1. Generator 2. Transmission Circuit 3. Transformer 4. Bus Section 	Evaluate for risks and consequences <ul style="list-style-type: none"> ● May involve substantial loss of customer demand and generation in a widespread area or areas. ● Portions or all of the interconnected systems may or may not achieve a new, stable operating point. ● Evaluation of these events may require joint studies with neighboring system.
	3 Phase Fault, with Normal Clearing: <ol style="list-style-type: none"> 5. Breaker (failure or internal fault) 	
	Other: <ol style="list-style-type: none"> 6. Loss of towerline with three or more circuits 7. All transmission lines on a common right-of-way 8. Loss of substation (one voltage level plus transformers) 9. Loss of a switching station (one voltage level plus transformers) 10. Loss of all generating units at a station 11. Loss of a large load or major load center 12. Failure of a fully redundant special protection system (or remedial action scheme) to operate when required. 13. Operation, partial operation, or misoperation of a fully redundant special protection system (or remedial action scheme) in response to an event or abnormal system condition for which it was not intended to operate. 14. Impact of severe power swings or oscillations from disturbances in another Regional Council. 	

Potential Causes of Extreme Events

- **Intentional Acts**
- **Weather Related**
- **Nature Initiated**
- **Equipment or Human**

Scenarios Studied & Results

- Palo Verde Switchyard
- Hassayampa Switchyard
- Palo Verde Hub Ties
- Common Gas Pipeline
- Railroad Event

Conclusions

- **Ability to Withstand Extreme Events Limited**
- **Load Shedding and Performance**
- **Hassayampa Switchyard Adds Diversity**
- **Performance with Ties**
- **Spinning Reserve & Radial Feed Concerns**
- **New Terminations : Performance and Diversity**

General Recommendations

- **Future generation or transmission projects should give consideration to risk mitigation for extreme events.**
- **For overall diversity, performance and risk mitigation consideration should be given to terminating future lines at generating stations interconnected at the hub rather than at the Palo Verde or Hassayampa Switchyards.**
- **Future generators desiring to interconnect at the Palo Verde hub should also be interconnected to at least one other location in the transmission network.**
- **A Remedial Action Scheme should be evaluated for the existing Palo Verde transmission system to mitigate risk for extreme events**