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AZ CORP COMMISSION
DOCUMENT CONTROL

January 29, 2003

Arizona Corporation Commission
DOCKETED
JAN 29 2003
DOCKETED BY

Mr. Ernest Johnson
Director, Utilities Division
Arizona Corporation Commission
1200 W. Washington Street
Phoenix, AZ 85007

Re: Ten-Year Plan, Docket No. E-00000D-03-0047

Dear Mr. Johnson:

Enclosed are thirteen (13) copies of The Salt River Project's 2003-2012 Ten-Year Plan filed pursuant to A.R.S. Section §40-360-02.

Please contact Mr. Robert Kondziolka, Manager, Transmission Planning Department at (602) 236-0971 if you have any questions concerning this plan.

Sincerely,

Kelly J. Barr

KJB/bjh

Enclosures (13)

SALT RIVER PROJECT

10 YEAR PLAN
2003 — 2012

Delivering more than power.™

02-07131 12/02

SALT RIVER PROJECT

TEN-YEAR PLAN

2003 - 2012

Prepared for the

Arizona Corporation Commission

January 2003

SALT RIVER PROJECT

OVERALL TRANSMISSION REVIEW
2003 - 2012

This report updates and replaces the ten-year transmission plan of the Salt River Project Agricultural Improvement and Power District (SRP), submitted January 2002 pursuant to A.R.S. Section 40-360.02. The following general review is intended to complement and clarify the individual tabular pages included herein.

CENTRAL ARIZONA TRANSMISSION SYSTEM (CATS) STUDY

Phase I of the CATS Study served as a screening process that evaluated a large group of transmission alternatives in Central Arizona. This work was used to narrow down the transmission options that merited further evaluation in the second phase of the Study. The results of the CATS phase I study were used to develop a long-range EHV transmission system for Central Arizona.

Phase II of the CATS Study (Attachment A) took a high-level long-range look at the performance of the CATS EHV transmission system. In addition, the study evaluated several transmission alternatives to refine the base EHV system. A report of the Phase II work can be found in Appendix 1.

It is important to note that, because of the nature of the CATS Phase II and Phase I studies, only a comparative analysis of the transmission alternatives were performed. Consequently the study did not represent a specific time frame.

The CATS Phase III study will be a collaborative regional study for Central Arizona for the 2012 time frame.

Since last year's submission, Salt River Project, in conjunction with APS, Santa Cruz Electric and Water Districts, and Tucson Electric Power, began the siting process for the Palo Verde – Southeast Valley Station 500kV line and attendant intermediate stations consistent with the CATS Long Term Plan. This project will provide the necessary transmission facilities to move power from the Palo Verde hub to the customers in the Pinal County area, reinforce the transmission system, facilitate the delivery of future generation in central Arizona to local customers, and provide the additional needs for the anticipated growth in those areas.

SRP is leading an environmental effort to site the facilities associated with this project. Current projections are to submit applications for Certificates of Environmental Compatibility in early to mid 2003.

Subsequent to the completion of Phase I of the CATS study, several of the participating utilities and other market participants embarked upon studies to define the underlying systems necessary to efficiently and effectively integrate their existing systems into the CATS plan. The Arizona Power Authority is coordinating this study work. This work will be reported upon in the next CATS report.

500kV TRANSMISSION

The SRP 500kV-transmission system is shown on Attachment B. It includes the transmission lines from the Palo Verde Nuclear Generating Station and the Coronado Generating Station.

In December of 2001, the Arizona Power Plant and Transmission Line Siting Committee awarded Arizona Public Service (APS) and SRP a Certificate of Environmental Compatibility (CEC) for the Southwest Valley 500kV Transmission Line Project. In February of 2002, the Arizona Corporation Commission approved the award of the CEC. APS and SRP commenced construction of various

components of the project immediately after the Commission's order so that the project can be in service by summer of 2003.

230kV TRANSMISSION

SRP's Valley 230kV transmission network is used to transmit power from the bulk power stations on the periphery of the Phoenix metropolitan area to the various load centers in SRP's Valley service territory (Attachment C). Additional transmission capacity will be required during the next ten years to meet load growth and for system reliability.

With the addition of Rudd Substation in 2003, SRP's western and central service territory is nearing "maturation". The eastern area of the SRP service territory, encompassing parts of Maricopa and Pinal Counties, will require additional transmission line construction and receiving station development to accommodate the projected customer load growth. The project description sheets and the map (Attachment C) describe and depict the additions anticipated to serve the future needs of the area.

The system additions with firm in service dates are the interconnection of the SRP White Tanks – Orme 230kV line into the Rudd 500/230kV Station (part of the Southwest Valley Project).

SRP continues to note transmission projects that take advantage of existing transmission corridors and open circuit positions on existing transmission structures. These are included as informational items that may become firm plans, as system studies look farther into the future. In this category SRP is reporting a Westwing to Pinnacle Peak 230kV line, a Pinnacle Peak to Brandow 230kV line with a possible loop into Rogers or Thunderstone, and a Rogers to Corbell 230kV line. These lines have been identified in past submissions of the plan as "place holders" since they will be included in any future analyses to find solutions to system problems. They are again included in this plan for

informational purposes. When system conditions are such that these facilities are needed, more definitive descriptions and schedules will be devised for the projects.

SRP has identified the need for the future RS17 230/69kV receiving station in the Gilbert/Queen Creek area to support the customer load growth forecasted for the area. The need date has moved beyond SRP's six year planning window, so it is being shown as a "to be determined" in service date. The station site was established during a previous environmental study for the RS16 (Schrader) transmission line siting process (Case No. 86). Initial service to RS17 will utilize existing transmission lines constructed in 1998 for the Schrader project.

During the RS18 (Browning Station) work SRP identified another future 230/69kV receiving station. RS19 will be needed to serve load in the eastern Queen Creek and southern Apache Junction areas. SRP envisions service to this station to come from transmission lines associated with the Southeast Valley Station development and will note so in the application for the Certificate of Environmental Compatibility for that project.

SRP has identified the need for a 230/69kV receiving station in the Fountain Hills area. The projected load in the area will create the need for additions to the underlying 69kV system to its limits by approximately 2012. This new station will provide a source for the growth in the area besides the existing 69kV system. The transmission lines that will feed this station are unknown at present. Initial planning work will begin during this year.

EASTERN MINING AREA TRANSMISSION

Additional transmission facilities will eventually be required in SRP's Eastern Mining Area (Attachment D). As mining loads increase between Superior and Hayden, a 230kV line from Silver King to New Hayden will be required. Depending on where new load is added, this 230kV line may

have an intermediate termination at Knoll Station. The line may be constructed in phases, with the Silver King to Knoll line being constructed first, followed by Knoll to New Hayden when required. The existing 115kV line from Kearny to Hayden will be looped into the New Hayden Station. The in-service dates for these lines are contingent upon customer need.

Attached as Appendix 2 to this report is a summary of SRP's six year planning work of this past year to support the need for the work reflected in this report.

Any future facilities which might have appeared in previous Ten-Year Plans, but which are not shown in this plan, are either completed, no longer scheduled in the period covered, or are no longer required to be part of the Ten-Year Plan.

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
2003

LINE DESIGNATION:		Palo Verde - Rudd 500kV Project (Formerly Southwest Valley Project)
SIZE:		
(a)	Voltage	500kV
(b)	Capacity	1200 MVA
(c)	Point of Origin	Palo Verde Generating Station Switchyard SEC 34, T1N, R6W
(d)	Point of Termination	Rudd (formerly Estrella) Station site at Broadway and 119th Avenue SEC 24, T1N, R1W
(e)	Length	36 miles

ROUTING: Generally north and east from the Palo Verde Switchyard along the Palo Verde – Westwing 500kV alignment to a point just north of I-10. From that point generally easterly along the north side of I-10 to approximately Miller Road. From that point the line generally follows WAPA 230kV lines to the Rudd Receiving Station (formerly known as Estrella) at Broadway and 119th Avenue.

PURPOSE: To provide adequate transmission capacity to serve load growth for the SRP distribution service territory and to provide another bulk power source into the southwestern part of the Phoenix metropolitan area.

DATE:

a) Construction Commenced:	February 2002
b) Estimated In-Service Date:	June 2003

NOTES:
A Certificate of Environmental Compatibility was awarded to APS and SRP for the construction of this project in February 2002. (Case # 115)

January 2003

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
2006

LINE DESIGNATION:		Hassayampa – Pinal West 500kV Line
SIZE:		
(a)	Voltage	500kV
(b)	Capacity	1200MVA
(c)	Point of Origin	Hassayampa Switchyard SEC 15, T1S, R6W
(d)	Intermediate Point	Jojoba Switchyard SEC 25, T2S, R4W
(e)	Point of Termination	Pinal West Station TBD
(f)	Length	Approximately 55 Miles

ROUTING: Dependent upon final approval by Arizona Corporation Commission.

PURPOSE: The Central Arizona Transmission System Study identified a number of system additions necessary to accommodate load growth and access to energy sources in the central Arizona area. This transmission line is one of the first segments of a series of transmission lines to serve the central Arizona region. This segment will initially provide an interconnection for an Independent Power Producer to market power to the Tucson area.

DATE:

(a) Right of Way/Property Acquisition:	Mid 2003
(b) Construction to Start:	Fall 2003
(c) Estimated In Service Date:	Summer 2006*

NOTES:
SRP does not hold a Certificate of Environmental Compatibility for this project, but will be seeking a Certificate upon completion of an environmental and public process to site the line.

*The in service date is dependent upon the development of agreements between TECo/Panda and TEP, and may be advanced to summer of 2005.

January 2003

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
2006

LINE DESIGNATION:		Pinal West – Southeast Valley Station 500kV Line
SIZE:		
(a)	Voltage	500kV
(b)	Capacity	1200MVA
(c)	Point of Origin	Pinal West Station To Be Determined
(d)	Point of Termination	Southeast Valley Station TBD (T3S, R9E)
(e)	Length	Approximately 55 to 70 miles, depending on final route

ROUTING: Dependent upon final approval by Arizona Corporation Commission.

PURPOSE: The Central Arizona Transmission System Study identified a number of system additions necessary to accommodate load growth and access to energy sources in the central Arizona area. This transmission line is one of the first segments of a series of transmission lines to serve the central Arizona region. This segment will initially provide an interconnection with the Palo Verde market area to market power to the Phoenix, central Arizona, and Tucson areas, and to accommodate the growth in development and number of customers in Pinal County.

DATE:

a) Right of Way/Property Acquisition:	Fall 2003
b) Construction to Start:	Spring 2005
c) Estimated In Service Date:	Summer 2006*

NOTES:
SRP does not hold a Certificate of Environmental Compatibility for this project, but will be seeking a Certificate upon completion of an environmental and public process to site the line.

* SRP is investigating moving this segment to the 2007 time frame.

January 2003

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
2006

LINE DESIGNATION:		Silver King – Southeast Valley Station 500kV Line & Southeast Valley Station – Browning 500kV Line
SIZE:		
(a)	Voltage	500kV
(b)	Capacity	1200MVA
(c)	Point of Origin	A point on the Silver King – Browning Line TBD (T2S, R9E)
(d)	Point of Termination	Southeast Valley Station TBD (T3S, R9E)
(e)	Length	Approximately 10 Miles

ROUTING: Dependent upon final approval by Arizona Corporation Commission.

PURPOSE: The Central Arizona Transmission System Study identified a number of system additions necessary to accommodate load growth and access to energy sources in the central Arizona area. This transmission line is one of the first segments of a series of transmission lines to serve the central Arizona region. This project loops the Silver King – Browning 500kV line into the Southeast Valley Station to provide for a redundant delivery path for the energy being delivered from Palo Verde, and to provide for the operational flexibility necessary to ensure deliveries to customers within the greater Phoenix Metropolitan and Pinal County.

DATE:

d) Right of Way/Property Acquisition:	Fall 2003
e) Construction to Start:	Spring 2005
f) Estimated In Service Date:	Summer 2006*

NOTES:
SRP does not hold a Certificate of Environmental Compatibility for this project, but will be seeking a Certificate upon completion of an environmental and public process to site the line.

* SRP is investigating moving this segment to the 2007 timeframe.

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
2008

LINE DESIGNATION:		Browning – Southeast Valley Station 230kV Line #1 and #2
SIZE:		
(a)	Voltage	230kV
(b)	Capacity	875MVA each
(c)	Point of Origin	Browning Station SEC 12, T1S, R7E
(d)	Intermediate Point	Future RS19 Station TBD (T2S, R8E)
(e)	Point of Termination	Southeast Valley Station TBD (T3S, R9E)
(f)	Length	Approximately 25 miles

ROUTING: Generally south and east of the Browning station to the Southeast Valley Station. Routing will be determined through an environmental and public process.

PURPOSE: Provides the backup or contingency to the 500kV facilities at Southeast Valley Station and to provide service to new receiving stations in SRP's distribution service territory.

DATE:

a) Right of Way/Property Acquisition:	Fall 2004
b) Construction to Start:	Spring 2007
c) Estimated In Service Date:	Summer 2008

NOTES:
SRP does not hold a Certificate of Environmental Compatibility for this 230kV transmission line project, but will be seeking a Certificate upon completion of an environmental and public planning process to site the lines.

January 2003

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
2012

LINE DESIGNATION:		Fountain Hills Station
SIZE:		
(a)	Voltage	115kV, 230kV, or 345kV
(b)	Capacity	560 MVA
(c)	Point of Origin	To Be Determined
(d)	Point of Termination	Fountain Hills Station Northeast Scottsdale/Fountain Hills area
(e)	Length	To Be Determined

ROUTING: SRP will embark upon a facilities siting/environmental assessment/public process to determine the location of the station and the transmission lines supplying the station. Contingent upon final plan of service for the station and the transmission lines supplying the station.

PURPOSE: Provide a source for the development occurring in and around the Fountain Hills area, as well as relieve the stress on the lower voltage system currently supplying the Fountain Hills/Rio Verde area.

DATE:

a) Right of Way Acquisition	2005
b) Construction to Start:	2010
c) Estimated In-service Date:	2012

NOTES:
SRP does not hold a Certificate of Environmental Compatibility for this project, but will be seeking a Certificate upon completion of an environmental and public process to site the line.

January 2003

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
TBD

LINE DESIGNATION:		Palo Verde – Saguaro Line
SIZE:		
(a)	Voltage	500kV
(b)	Capacity	1200MVA
(c)	Point of Origin	Palo Verde Generating Station Switchyard/Hassayampa Switchyard SEC 15, T1S, R6W
(d)	Intermediate Point	Site in the Mobile area TBD (T4S, R1E)
(e)	Point of Termination	Saguaro Station SEC 14, T10S, R10E
(f)	Length	Approximately 125 miles

ROUTING: Generally south and east from the Palo Verde area to a point near Gillespie Dam, then generally easterly until the point at which the Palo Verde – Kyrene 500kV line diverges to the north and east. The corridor then is generally south and east again adjacent to a gas line corridor until meeting up with the Tucson Electric Power Company's Westwing – South 345kV line. The corridor follows the 345kV line until a point due west of the Saguaro Generating Station. The corridor then follows a lower voltage line into the 500kV yard just south and east of the generating station.

PURPOSE: Provide for the delivery of power and energy from the Palo Verde area into the central and southern portions of Arizona.

DATE:

a) Right of Way/Property Acquisition:	To Be Determined
b) Construction to Start:	To Be Determined
c) Estimated In Service Date:	To Be Determined

NOTES:
A Certificate of Environmental Compatibility was applied for and granted in 1974 for this line (Case No. 24).

SRP is including this description sheet as a CATS participant.

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
TBD

LINE DESIGNATION:		Rogers – Browning 230kV line
SIZE:		
(a)	Voltage	230kV
(b)	Capacity	875MVA
(c)	Point of Origin	Rogers Station SEC 13, T1N, R5E
(d)	Point of Termination	Browning Station SEC 12, T1S, R7E
(e)	Length	Approximately 9 miles

ROUTING: To be determined through environmental and public processes, but generally east and south from Rogers, using existing right of way where possible.

PURPOSE: Provide adequate transmission facilities to deliver reliable power and energy to SRP's customers in the eastern valley area.

DATE:

a) Right of Way/Property Acquisition:	To Be Determined
b) Construction to Start:	To Be Determined
c) Estimated In Service Date:	To Be Determined

NOTES:
Previously described in the Rogers – Coolidge 230kV line description in the 2001 Plan.

This information is included in this Ten-Year Plan because the in-service date could advance into the 10-year reporting period.

January 2003

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
TBD

LINE DESIGNATION:		Silver King to Browning
SIZE:		
(a)	Voltage	230kV
(b)	Capacity	875 MVA
(c)	Point of Origin	Silver King Station Parts of SEC 15 & 16, T1S, R13E
(d)	Point of Termination	Browning 500/230kV Station SEC 12, T1S, R7E
(e)	Length	38 miles*

ROUTING: From Silver King in a westerly direction to Browning

PURPOSE: To deliver Coronado or other power in eastern Arizona into SRP's distribution service territory

DATE:

a) Construction to Start:	To Be Determined
b) Estimated In-Service Date:	To Be Determined

NOTES:
A Certificate of Environmental Compatibility exists for the segment of this line from the Browning station to a point on the Silver King – Kyrene 500kV line corridor in Apache Junction (T1S, R8E, Section 11 & 12) (Case #20).

This information is included in this Ten-Year Plan because the in-service date could advance into the 10-year reporting period.

* SRP proposes stringing 17 miles of conductor on existing lattice towers on Forest Service lands on structures built by Federal permit predating the AZ CEC process. The remaining 21 miles of the line will be new construction.

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
TBD

Line Designation:		Silver King-Browning 230kV/Superior Tie
SIZE:		
(a)	Voltage	230kV
(b)	Capacity	875 MVA
(c)	Point of Origin	Point on the Silver King to Browning 230kV transmission line SEC 34, T1S, R12E
(d)	Point of Termination	Superior Station SEC 34, T1S, R12E
(e)	Length	Approximately 1/2 mile

ROUTING: Southeast from the proposed Silver King to Browning Line to the existing Superior Station.

PURPOSE: To provide adequate transmission capacity to meet future load growth and/or to improve electric system reliability in SRP's eastern distribution service area.

DATE:

a) Construction to Start:	To Be Determined
b) Estimated In-Service Date:	To Be Determined

NOTES:
SRP does not hold a Certificate of Environmental Compatibility for this project, but will be seeking a Certificate subsequent to an environmental and public process to site the line.

This information is included in this Ten-Year Plan because the in-service date could advance into the 10-year reporting period.

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
TBD

Line Designation:		RS19 to RS23
SIZE:		
(a)	Voltage	230kV
(b)	Capacity	875MVA
(c)	Point of Origin	Future RS19, Queen Creek area TBD (T2S, R8E)
(d)	Point of Termination	Future RS23, Florence Junction area TBD (T1 or 2S, R10E)
(e)	Length	To Be Determined

ROUTING: Easterly from the future RS19 Station (Queen Creek area) to the future RS23 (Florence Junction area).

PURPOSE: To meet expected load growth in the eastern distribution area.

DATE:

a) Construction to Start:	To Be Determined
b) Estimated In-Service Date:	To Be Determined

NOTES:
SRP does not hold a Certificate of Environmental Compatibility for this project, but will be seeking a Certificate subsequent to an environmental and public process to site the line.

This information is included in this Ten-Year Plan because the in-service date could advance into the 10-year reporting period.

January 2003

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
TBD

Line Designation:		Westwing to Pinnacle Peak
SIZE:		
(a)	Voltage	230kV
(b)	Capacity	875 MVA
(c)	Point of Origin	Westwing Station SEC 12, T4N, R1W
(d)	Point of Termination	Pinnacle Peak Station SEC 10, T4N, R4E
(e)	Length	Approximately 22 miles

ROUTING: Along existing Westwing to Pinnacle Peak right-of-way

PURPOSE: To provide additional transfer capability from the northwest Phoenix area to the northeast Phoenix area.

DATE:

a) Construction to Start:	To Be Determined
b) Estimated In-Service Date:	To Be Determined

NOTES:
Existing corridor predates the Certificate of Environmental Compatibility process.

This information is included in this Ten-Year Plan because the in-service date could advance into the 10-year reporting period.

January 2003

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
TBD

Line Designation:		Pinnacle Peak to Brandow (with Future tie into Rogers or Thunderstone)
SIZE:		
(a)	Voltage	230kV
(b)	Capacity	875 MVA
(c)	Point of Origin	Pinnacle Peak Station SEC 10, T4N, R4E
(d)	Point of Termination	Brandow Station SEC 11, T1N, R4E
(e)	Length	To Be Determined

ROUTING: Use of available circuit position on existing SRP Pinnacle Peak – Papago Buttes 230kV structures from Pinnacle Peak to Brandow; easterly from a point on that line to a termination at either Rogers or Thunderstone.

PURPOSE: Provide adequate transmission capacity to accommodate SRP customer load.

DATE:

a) Construction to Start:	To Be Determined
b) Estimated In-Service Date:	To Be Determined

NOTES:
A Certificate of Environmental Compatibility was awarded for this circuit as a part of Case #69, Pinnacle Peak – Brandow/Papago Buttes 230kV line, dated 1/85.

This information is included in this Ten-Year Plan because the in-service date could advance into the 10-year reporting period.

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
TBD

Line Designation:		Rogers to Corbell
SIZE:		
(a)	Voltage	230kV
(b)	Capacity	875 MVA
(c)	Point of Origin	Rogers Station SEC 13, T1N, R5E
(d)	Point of Termination	Corbell Station SEC 10, T1S, R5E
(e)	Length	Approximately 12 miles

ROUTING: Use of available circuit position on existing 230kV structures in the area.

PURPOSE: Provide adequate transmission capacity to accommodate future load growth.

DATE:

a) Construction to Start:	To Be Determined
b) Estimated In-Service Date:	To Be Determined

NOTES:
SRP will be using existing structures for its entirety.

This information is included in this Ten-Year Plan because the in-service date could advance into the 10-year reporting period

January 2003

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
TBD

LINE DESIGNATION:		Silver King to Knoll to New Hayden
SIZE:		
(a)	Voltage	230kV
(b)	Capacity	875 MVA
(c)	Point of Origin	Silver King Station Parts of SEC 15 & 16, T1S, R13E
(d)	Intermediate Termination	Knoll Station SEC 23, T3S, R13E
(e)	Point of Termination	New Hayden Station SEC 7, T5S, R15E
(f)	Length	Approximately 35 miles

ROUTING: South from Silver King, looped into Knoll, continuing to the Hayden area.

PURPOSE: To increase the transmission capacity to serve a new mining load.

DATE:

a) Construction to Start:	To Be Determined
b) Estimated In-service Date:	Contingent upon customer need

NOTES:
SRP does not hold a Certificate of Environmental Compatibility for this project, but will be seeking a Certificate upon completion of an environmental and public process to site the line.

This information is included in this Ten-Year Plan because the in-service date could advance into the 10-year reporting period.

SALT RIVER PROJECT
TEN-YEAR PLAN
TRANSMISSION FACILITIES
TBD

LINE DESIGNATION:		Point on the Kearny-Hayden 115kV line to New Hayden; double circuit loop
SIZE:		
(a)	Voltage	115kV
(b)	Capacity	190 MVA
(c)	Point of Origin	Point on Kearny to Hayden 115kV Line, SEC 7, T5S, R15E
(d)	Point of Termination	New Hayden Station SEC 7, T5S, R15E
(e)	Length	Approximately 0.75 miles

ROUTING: Southwest from the existing Kearny-Hayden 115kV line to the New Hayden Transmission Station.

PURPOSE: To increase the transmission capacity to serve a new mining load.

DATE:

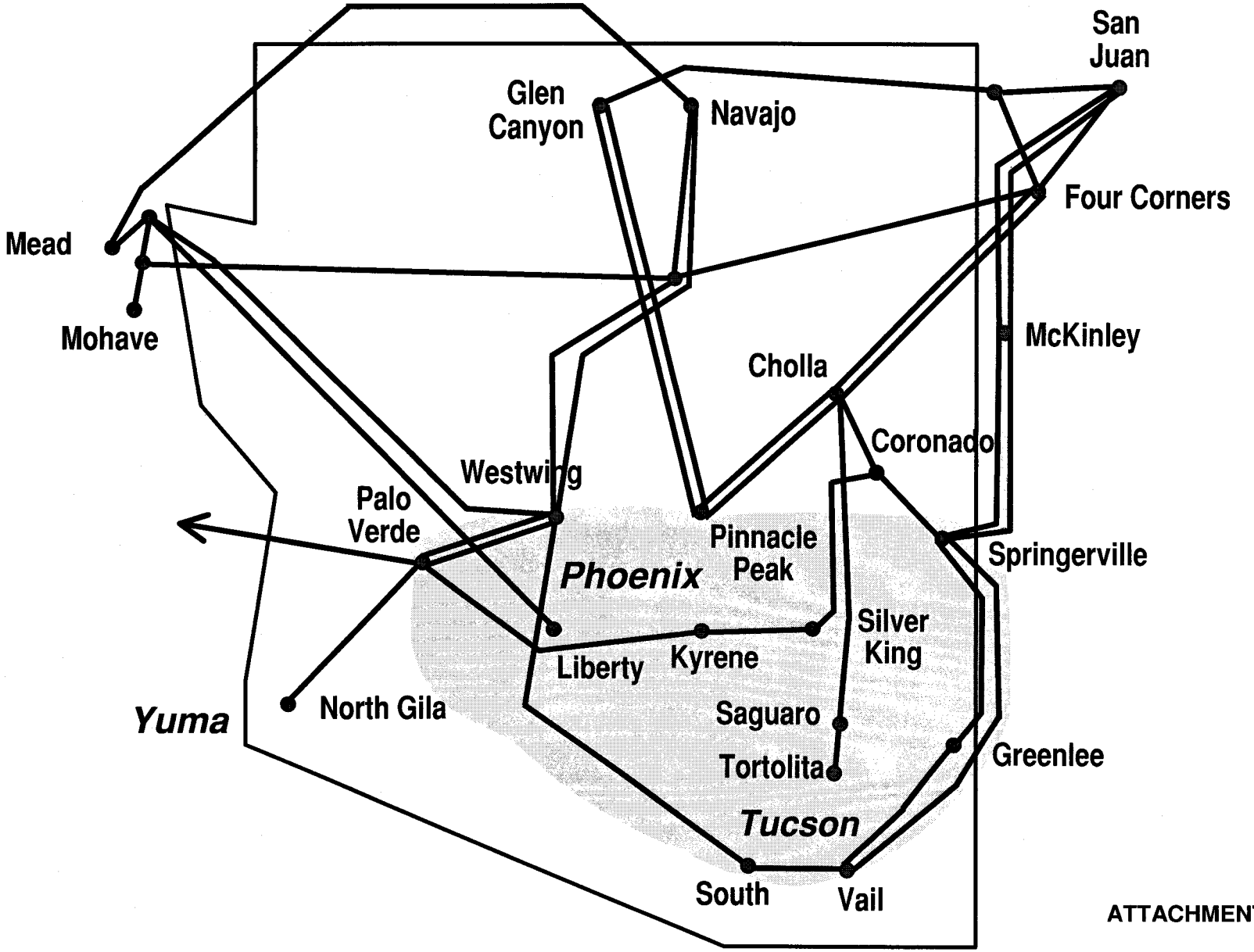
a) Construction to Start:	To Be Determined
b) Estimated In-service Date:	Contingent upon customer need

NOTES:
SRP does not hold a Certificate of Environmental Compatibility for this project, but will be seeking a Certificate upon completion of an environmental and public process to site the line.

This information is included in this Ten-Year Plan because the in-service date could advance into the 10-year reporting period.

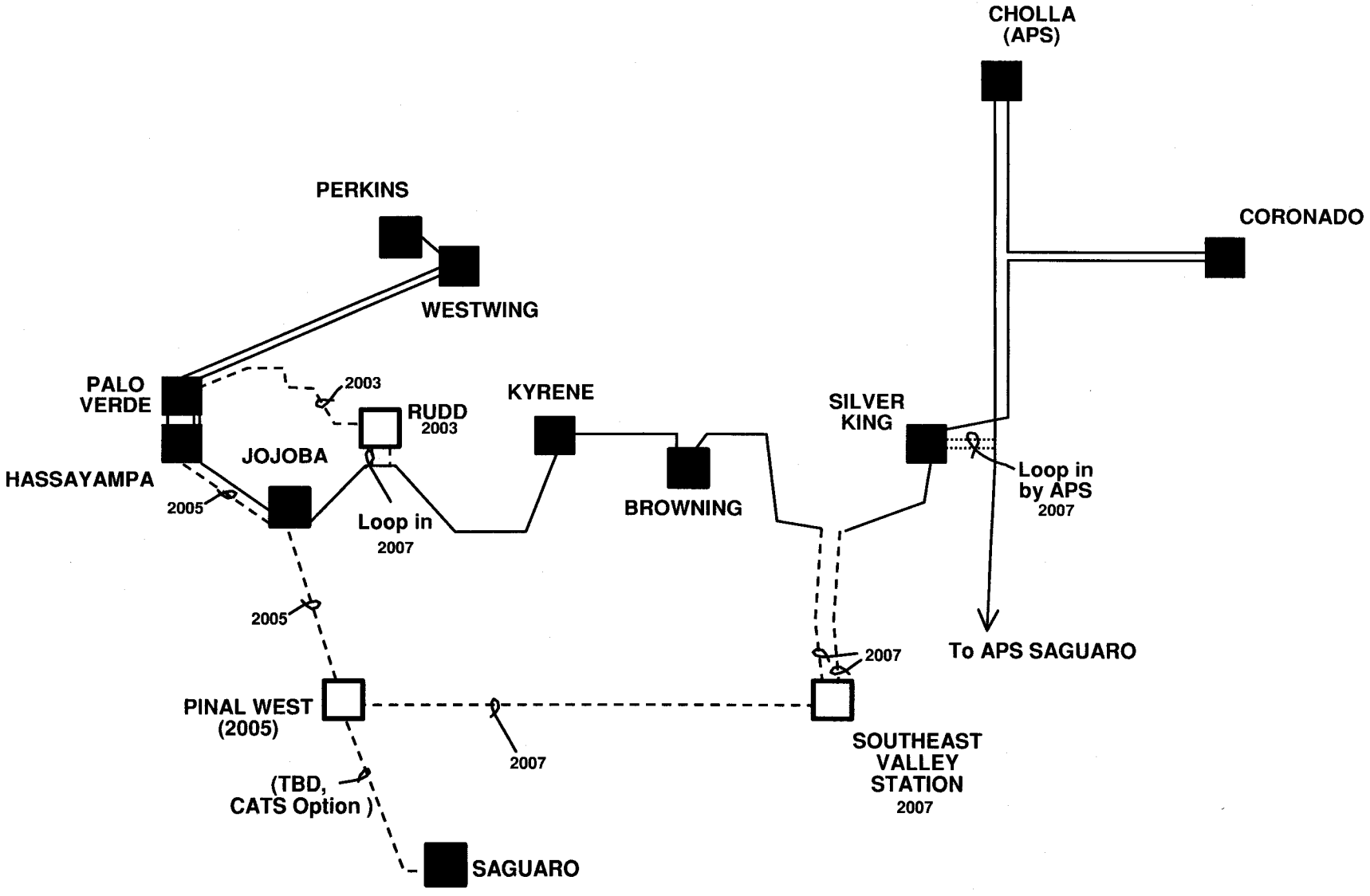
TABLE OF APPENDICES

Central Arizona Transmission System (CATS) Study



ATTACHMENT A

1/28/03 000705-1



FUTURE 500kV SUBSTATION

EXISTING 500kV SUBSTATION

EXISTING LINES

FUTURE LINES

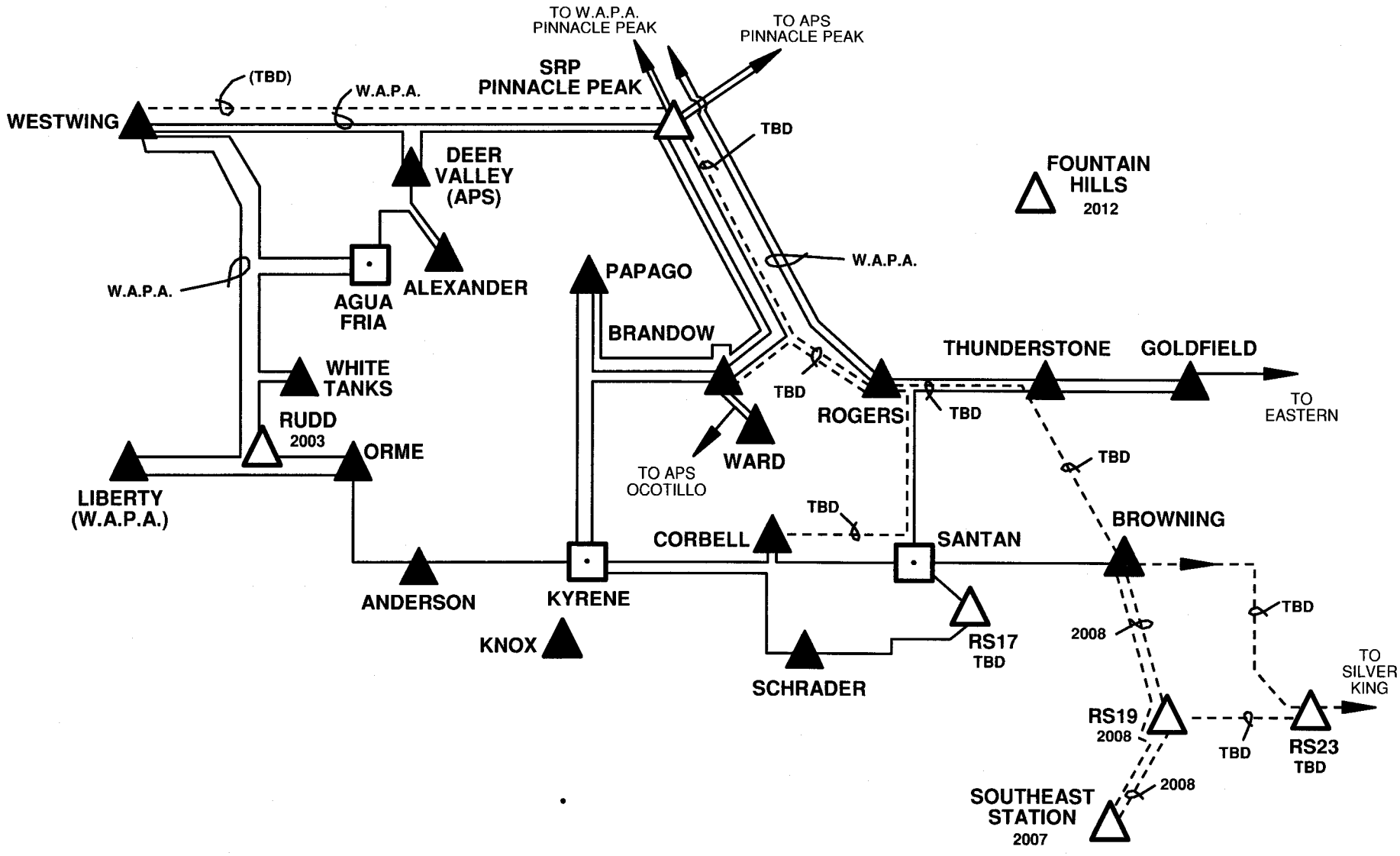
FUTURE APS LINES

JANUARY 1, 2003

SALT RIVER PROJECT
500kV SYSTEM

ATTACHMENT B

1/28/03 000705-2



FUTURE 230kV SUBSTATIONS

EXISTING 230kV SUBSTATIONS

GENERATING STATION

EXISTING 230kV CIRCUIT

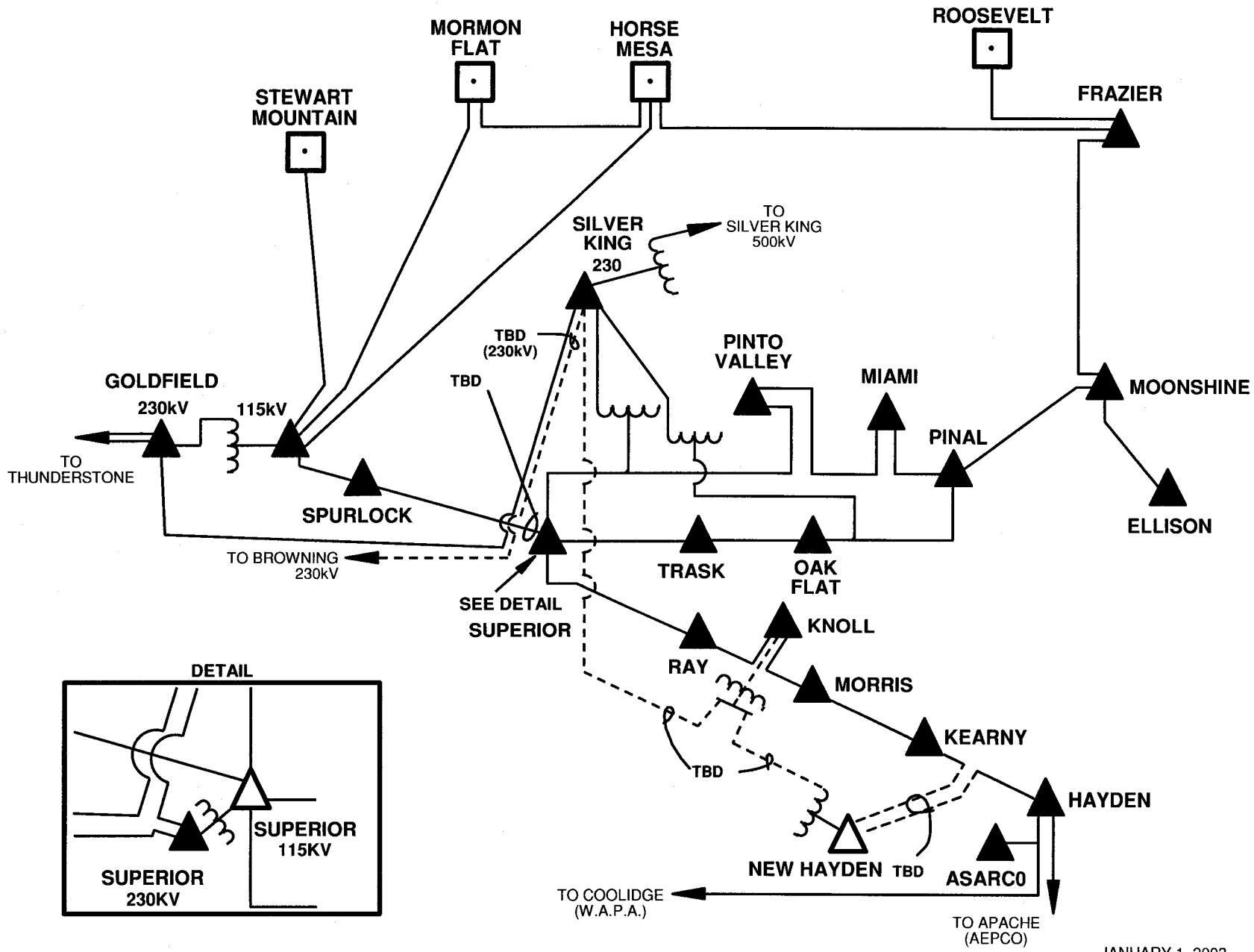
FUTURE 230kV CIRCUIT

JANUARY 1, 2003

SALT RIVER PROJECT
230kV SYSTEM

ATTACHMENT C

1/28/03 000705-3



JANUARY 1, 2003

SALT RIVER PROJECT
EASTERN MINING AREA SYSTEM

ATTACHMENT D

1/28/03 000705-4

SALT RIVER PROJECT

10 YEAR PLAN
2003 — 2012

APPENDIX 1

Report on the Phase II Study of the Central Arizona Transmission System (CATS)

Volume One

Prepared for the CATS Steering Committee

By Arizona Public Service, Salt River Project, Tucson Electric Power, Public Service Company of New Mexico

September 24, 2002

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Report on the Phase II Study Of the Central Arizona Transmission System (CATS)

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Central Arizona Transmission System (CATS) Phase II

Introduction

The CATS Study is a regional transmission collaborative effort with the purpose of developing a high-level transmission plan for Central Arizona. The objective of the CATS Study is to maximize regional benefits and make more efficient use of the existing transmission system.

One of the early objectives of the CATS Study was to develop transmission alternatives that would meet the needs of the study participants. Due to the regional planning nature of the study, it was recognized early in Phase I that several transmission alternatives would be required to address the needs of all the participants.

CATS Phase I served as a screening process that evaluated a large group of transmission alternatives. This work was used to narrow down the transmission options that merited further study in the second phase of the study. This narrowed down list of transmission alternatives served as the CATS Phase II EHV base system.

The CATS Phase II study is a high-level long-range transmission planning study that compared the performance of various transmission alternatives to the performance of the CATS Phase II EHV base system.

It is important to note, because of the nature of the study, only a comparative analysis of the transmission alternatives were performed. Consequently the study does not represent a specific time frame.

This report contains a summary of the CATS Study work to-date, including an overview of the Phase I work, CATS Phase II study results, and CATS Phase II conclusions.

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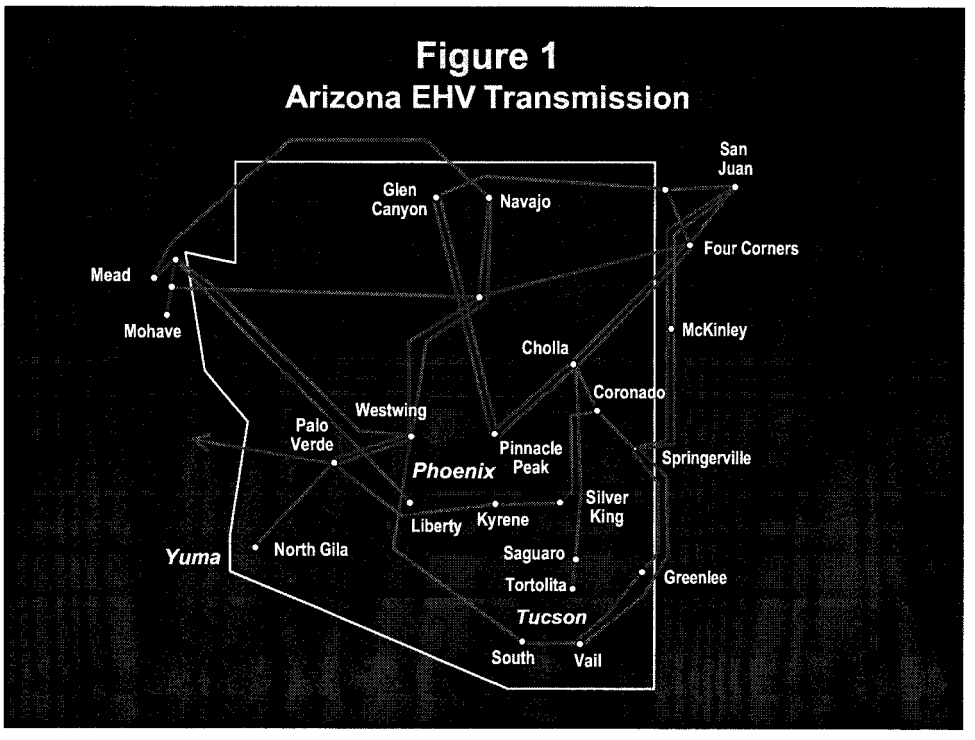
Central Arizona Transmission System (CATS) Phase II

A. Report Summary

I. Introduction

Historically, Arizona's EHV transmission system has been developed to interconnect large generating resources to major load centers primarily located in the Phoenix and Tucson metropolitan areas. Consequently a major portion of the EHV transmission development within Arizona occurred in the northern, eastern and western parts of the state. While the resultant transmission development interconnected large generation facilities with their consumers located in the Phoenix and Tucson areas, they also provided stronger ties to neighboring states such as California, New Mexico, Colorado, and Utah. In the early stages of developing the transmission system for the Palo Verde generation facility, consideration was given to building a 500kV line from Palo Verde to the Tucson area. However, the final Palo Verde transmission system design moved towards strengthening EHV transmission interconnection in the Phoenix area, resulting in the construction of the second Palo Verde-Westwing 500kV line. This left development of additional EHV transmission ties between the Phoenix and Tucson areas for future consideration. A map of Arizona's EHV Transmission is shown on Figure 1.



Over the last ten years Arizona has experienced significant increases in business and residential growth in the Phoenix and Tucson areas. As Arizona's electric utility industry continues a breakneck pace to keep up the increasing growth and demand, resource developers vie for opportunities to site and build new generation to access market opportunities in the Arizona and California areas.

Under these newer growth scenarios, Arizona's EHV system capability continues to experience higher flows and denser utilization. As projected growth continues to challenge the ability of the Phoenix and Tucson transmission system's ability to deliver needed energy to their respective areas, new generation proposals are also placing significant burden on the existing transmission system. Both the new and future resources additions are seeking to tap all existing transmission capability to achieve access to as many markets as possible.

Arizona is an attractive state to site new generation for developers. Due to the attractiveness of the Palo Verde switchyard as a market hub, existing gas pipeline location, and the existing Phoenix and Tucson growth markets, much of the proposed generation, in excess of 10,000 MW, is being sited in the CATS study area, within the central Arizona region between Palo Verde, Phoenix, and Tucson.

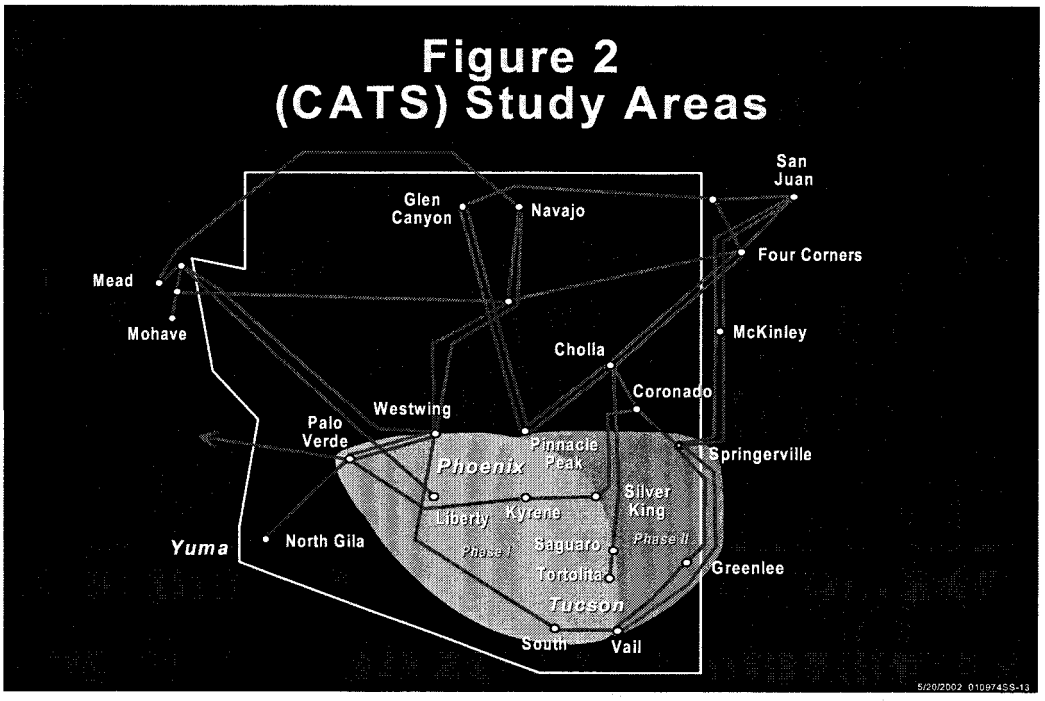
Unfortunately, EHV transmission is limited in this area and local utilities are struggling to keep pace with their near term transmission infrastructure

requirements to accommodate the expected growth in customer load while posturing themselves to tap the pool of proposed resource additions that are being proposed. Others are looking at opportunities to use proposed CATS transmission alternatives to facilitate siting of their generation in a manner that would stimulate economical and reliable transmission service from their facility to existing and future energy markets. Early discussion of these transmission needs occurred between Salt River Project (SRP), Arizona Public Service (APS), and Tucson Electric Power (TEP). In principle, the utilities agreed that a regional transmission planning effort was needed to assess EHV transmission needs and opportunities in the central Arizona area and would help facilitate the development of their transmission system in a prudent manner.

From this discussion, the Central Arizona Transmission System (CATS) study effort evolved. The initial participants included all of Arizona's transmission utilities including Arizona Public Service, Salt River Project, Tucson Electric Company, Southwest Transmission Cooperative (SWTC) formerly Arizona Electric Power Cooperative, Citizens Communications Company, Western Area Power Administration, and the Arizona Corporation Commission Staff.

It was recognized early in the study effort that all stakeholders in the process needed to be involved in the study effort. An invitation letter was sent to SWRTA (Southwest Regional Transmission Association) members and other interested parties. Consequently those involved with the CATS effort included many more participants. A current list of CATS Study participants is listed in the Appendix portion of this report.

Today the central Arizona region for the CATS study encompasses an area bounded by the Phoenix Metropolitan area to the north, the Tucson Metropolitan area to the south, the Palo Verde Generating Station to the west and the Arizona/New Mexico border to the east. This area includes Coolidge, Casa Grande, Eloy, Marana, Florence, Maricopa as well as the major metropolitan areas of Phoenix and Tucson. A map of the study area is shown in the highlighted areas on Figure 2.



The study participants held it's initial meeting in March 2000 to evaluate the conceptual aspects of a proposed regional study for the central Arizona area. A kick-off meeting was held in June 2000 to formalize the study, develop study objectives and criteria, create organizational structure, and allocate resources to meet the scope of work and schedule. The CATS Phase I Study was completed and report published in July 2001.

II. CATS Conceptual Plan

The CATS Phase I Study analyzed individual transmission alternatives proposed by the CATS participants. Each alternative was compared to a benchmarked case to determine its performance. The alternatives, which performed the best, were carried forward into the CATS Phase II Study for further analysis.

CATS Phase I showed that single alternatives could provide benefits to individual participants. However, more regional benefits can be achieved by combining alternatives. CATS Phase II analyzed the combining of several Phase I alternatives, and integrating other proposed transmission

projects in Arizona that were not studied in CATS Phase I.

The first CATS Phase II meeting was held in August 2001. This meeting was held to define the scope of the CATS Phase II Study. Round table discussions were held to determined which Phase I Transmission lines and Alternatives would be carried over to CATS Phase II for further consideration and Analysis. The following is a list of Transmission lines and Transmission Alternatives that were identified for further evaluation at the August 2001 CATS Meeting.

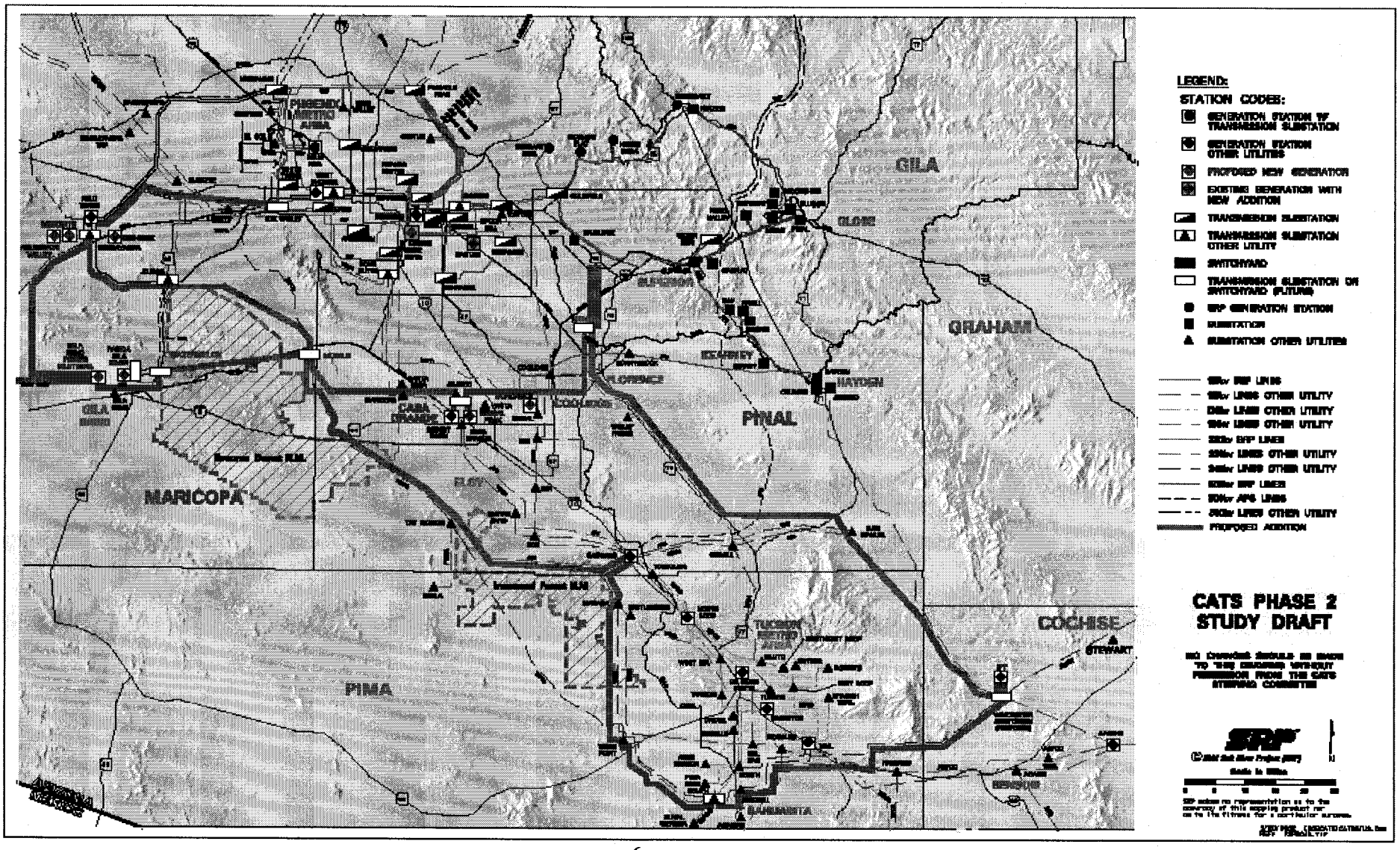
- Palo Verde To Jojoba 500kV Line
- Palo Verde To Gila Bend 500kV Line
- Gila Bend To Watermelon 500kV Line
- Watermelon To Mobile 500kV Line
- Jojoba To Mobile 500kV Line
- Mobile To Southeast Station 500kV Line
- Mobile To Saguaro 500kV Line
- Southeast Station Loop into Silver King/Browning 500kV Line
- Southeast Station To Winchester 500kV Line
- Saguaro To South 345KV Line
- Winchester To South 345kV Line

The scope also included the alternative of replacing one of the 500kV lines between Jojoba and Mobile as well as between Mobile and Saguaro with a 2-345kV system.

The loop-in of the Cholla to Saguaro 500kV line into Silver King with two additional alternatives to this loop-in was also studied.

In Figure 3 is a conceptual map of the CATS Phase II EHV transmission system (shown in green). This is the Base system that was studied in CATS Phase II. This map represents the vision or high level EHV transmission plan for Central Arizona. It should be viewed as work-in-progress. It is not intended to show specific line routes. These need to be developed through the appropriate environmental process, by those who fund and construct specific facilities.

CATS CONCEPTUAL PLAN
CATS PHASE II BASE SYSTEM
Figure 3



III. CATS Phase II Objectives

The objectives of the CATS Phase II study, which have been expanded from Phase I, are listed below:

- Improve the use of the existing transmission system for future load growth in Phoenix and southern Arizona.
- Increase the power transfer import level into the Phoenix area.
- Increase the power transfer import level into the Tucson area.
- Increase the power transfer capability between the Phoenix and Tucson areas.
- Encourage future generation additions south of Phoenix and north of Tucson.
- Provide additional transmission capacity to and from the Palo Verde hub.
- Assess the impact of the Transmission Alternatives identified in Phase I and develop a Transmission configuration and/or Transmission Alternatives, which can be carried on to Phase III for further consideration and analysis.

IV. CATS Phase II Conclusions

Based on the results of the CATS Phase II study, the following was concluded.

1) Both of the Palo Verde to Mobile options: Two 500kV Lines from Jojoba to Mobile or one 500kV line from Jojoba and one 500kV line from Watermelon had similar performance.

2) Looping the Cholla to Saguaro 500kV line into Silver King was a better alternative than looping this line into South East Valley. There was little or no benefit looping the Cholla to Saguaro 500kV line into both Southeast Valley and Silver King.

3) An EHV transmission line from the Phoenix metro area to Saguaro 500kV substation (second EHV line to Saguaro) strengthens this station, making it a strong source for southern Arizona.

4) There are several good options to strengthen the ties to Saguaro.

   These options are:

   a) A 500kV line from Mobile to Saguaro.

   b) Two 345kV lines from Mobile to Saguaro.

   c) A 500 kV line from Southeast Station to an intermediate switching station (initially named Carpas substation). From Carpas, a 500 kV line connecting to Winchester and another 500 kV line connecting to Saguaro. This can be enhanced with the loop-in of the Cholla to Saguaro 500kV line into Silver King

   Each of the above options would require additional facilities to reinforce the remaining Southern Arizona system.

5) The development of Winchester substation and a 500kV line connection from the north reinforces the existing eastern EHV feed into Tucson and Southern Arizona from the east.

6) The transfer capability from the Palo Verde Hub and from Central Arizona to the combined Tucson/Mexico area increased with the alternative of 1-500kV line and 2-345kV lines over the CATS base system (2-500kV lines).

7) Additional studies are needed to determine how these alternatives can be staged and integrated.

B. CATS Phase II Study Results.

I. Introduction

The CATS study effort is a collaborative regional study with the purpose of developing a high-level transmission plan for Central Arizona that maximizes regional benefits, and makes efficient use of the existing transmission. Phase I of the study was a screening effort that evaluated a group of transmission alternatives under a broad range of generation patterns. This work was used to narrow down the transmission options that merit further study in the second phase of study (CATS Phase II).

The first CATS Phase II meeting was held in August 2001. This meeting was held to define the scope of the CATS Phase II Study. Round table discussion were held to determined which Phase I Transmission lines and Alternatives would be carried over to CATS Phase II for further consideration and Analysis. The following is a list of Transmission lines and Transmission Alternatives that were identified for further evaluation at the August 2001 CATS Meeting.

- Palo Verde To Jojoba 500kV Line
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- Southeast Station Loop into Silver King/Browning 500kV Line
- Southeast Station To Winchester 500kV Line
- Saguaro To South 345kV Line
- Winchester To South 345kV Line

The scope also included the alternative of replacing one of the 500kV lines between Jojoba and mobile as well as between Mobile and Saguaro with a 2-345kV system.

The loop-in of the Cholla to Saguaro 500kV line into Silver King with two additional alternatives to this loop-in was also studied.

A conceptual map of the CATS Phase II base system is shown in figure 3 of the Executive Summary. This CATS conceptual EHV transmission plan is the base system for the CATS Phase II Study. All transmission alternatives were compared to this base.

This report summarizes the study work done by Arizona Public Service, Salt River Project, Tucson Electric Company and Public Service Company of New Mexico.

II. Report Organization.

The organization of this part of the report is as follows:

- Introduction and Summary of Results
- Study Scope
- Study Assumptions
- Study Alternatives
- Methodology
- Individual Study Reports
- Tables
- Appendices
- One-lines
- Attachments

The conclusions are summarized in the Report Summary section of this report.

III. CATS Phase II Study Scope

The CATS Phase II Study is a high-level long-range transmission study, which compared the performance of various transmission alternatives to the performance of the CATS Phase II EHV base system for several generation dispatch scenarios.

The CATS Phase II base System was bench marked for a given dispatch scenario by increasing load and generation until an EHV facility limit was reached. The performance of a transmission alternative was measured by comparing the change in load serving capability for a given dispatched between the bench marked CATS Phase II base system and the benched marked CATS Phase II base system with the alternative Transmission.

It is important to note, because of the nature of the study, only a comparative analysis of the transmission alternatives were performed. Consequently the study does not represent a specific time frame. Studies can be done for a specific time period in the next study phase.

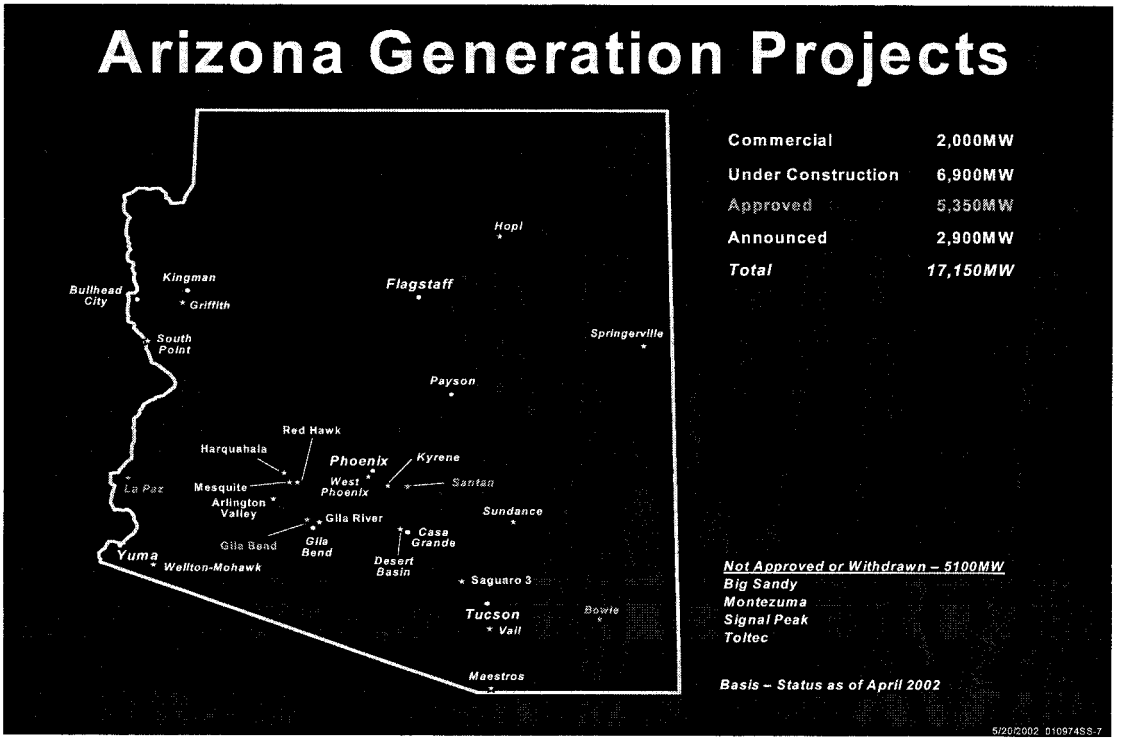
The scope of the study work for Phase II was limited to power flow analysis of all the transmission alternatives and generation dispatch scenarios for N-1 disturbances.

IV. Study Assumptions

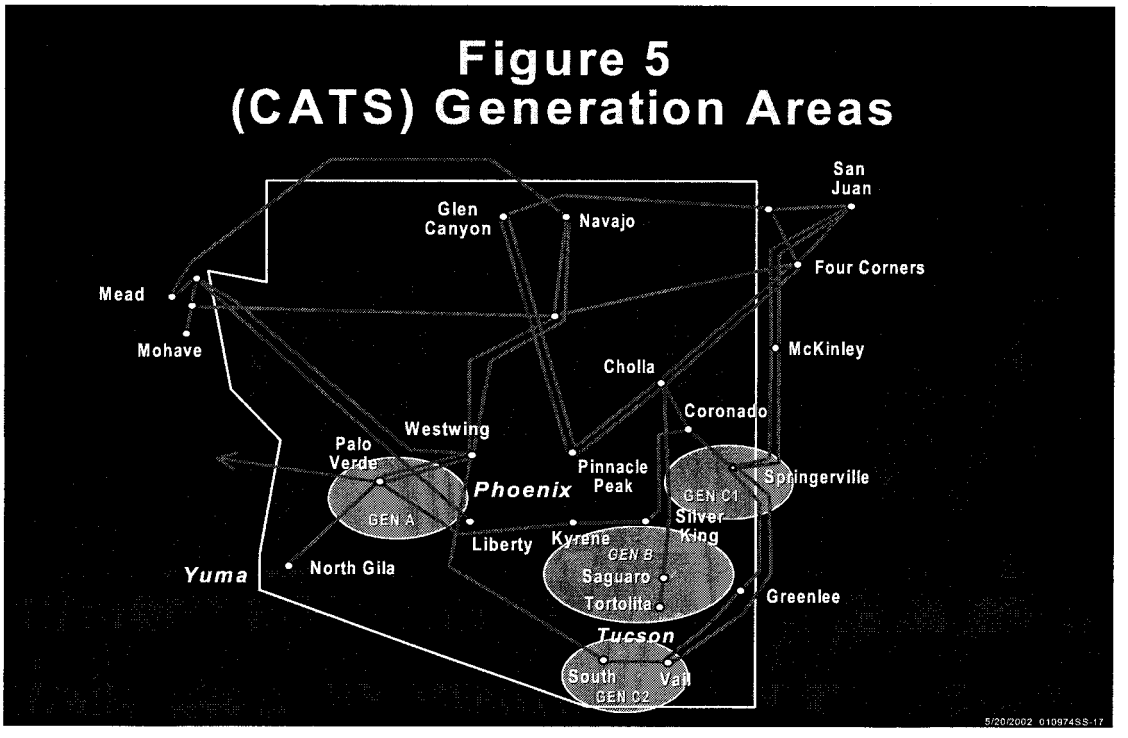
Generation

One of the early objectives of CATS was to develop transmission alternatives that would meet the needs of the study participants. Due to the regional planning nature of the study, it was recognized early in the Phase I study that several transmission alternatives would be required to address the needs of all the participants. In addition, the development of new generation resources on the CATS study area also suggested that different dispatch scenarios would also be required to fully assess the system performance of the transmission alternatives. In figure 4 is a map showing Arizona Generation Projects as of April 2002. A list of Arizona Generation modeled in the study case is included in the Attachment section of this report, within the Study Plan.

FIGURE 4



Generation sited in the Palo Verde area would most likely impact the Phoenix area system more than the Tucson area system. Conversely, generation sited in the Saguaro area would most likely impact the Tucson area system more than the Phoenix area system. For this reason, the assessment of the transmission alternatives was split based on four different generation areas. These areas as shown on Figure 5 were defined in the Phase I study and retained in the Phase II study.



Study Area

The Central Arizona Study Area encompasses an area bounded by the Phoenix Metropolitan area to the north, the Tucson Metropolitan area to the south, the Palo Verde Generation Station to the west and the Arizona/New Mexico border to the east. This area includes Coolidge, Casa Grande, Eloy, Marana, Florence, Maricopa as well as the major metropolitan areas of Phoenix and Tucson. A map of the study area is shown in the highlighted areas on Figure 2 in the Report Summary section of this report.

Load

The load was initially established in the CATS base case as 90% of forecasted 2005 summer peak. There were four major load centers identified for this study. These load centers consisted of the Phoenix area load, Central Arizona area load, Tucson area load, and Southern Arizona area load. The Phoenix area load consisted of (55%) SRP Valley Load and (45%) APS Valley Load while the Southern Arizona area load consisted of (80%) TEP Load and (20%) SWTC Load. The Central Arizona load consisted of the load area between South Phoenix and North Tucson.

Base Case

The WECC 2002 Light Summer base case was selected for development for this study. The load was grown and the facilities were added to represent the Central Arizona area for the 2005 summer peak. Load was grown initially at 90% of 2005 summer peak.

V. Transmission Alternatives

Based on input received from the CATS study members, several alternative transmission paths were determined to be of significant interest to the study members. These paths are listed below.

- Palo Verde to Saguaro 500kV or 345kV Lines (3 different variations).
- Palo Verde to Southwest Phoenix Valley 500kV Line (2 different variations)
- 500kV Line to the Southeast Phoenix Valley (2 variations)
- Loop-In of the Cholla to Saguaro 500kV Line into Silver King (3 different variations)
- Saguaro to Tucson Area at 500kV and or 345kV (4 different variations)

As can be seen from the above list, numerous transmission variations were developed and considered for study. As a result of discussion and evaluation and the CATS Phase I study, the CATS study group reduced the number of study alternatives to the ten listed below. General one-lines of the study alternatives are included the Appendix section of this report.

SRP Alternatives

Alternative 1: (SRP_ALT_1)
Loop-in the Cholla to Saguaro 500kV Line into Silver King.

Alternative 2: (SRP_ALT_2)
Loop-in the Cholla to Saguaro 500kV Line into Southeast Station.

Alternative 3: (SRP_ALT_3)
Loop-in the Cholla to Saguaro 500kV line into both, Silver King and Southeast Station.

APS Alternatives

Alternative 4: (APS_ALT_1)
Two 500kV lines from Jojoba to Mobile.

WAPA Alternatives

Alternative 5: (WAPA_ALT_1)
Southwest Station to Mobile 500kV Line
Liberty to Signal Peak 500kV Line
Signal Peak to Coolidge 500kV Line
Southwest Valley to Coolidge 500kV Line
Two Coolidge to Browning 500kV Lines
Two Browning to Rogers 500kV Lines
Coolidge to Winchester 500kV Line
Coolidge to Oracle 500klV Line

Alternative 6: (WAPA_ALT_2)
Palo Verde to Freedom 500kV Line
Freedom to Southwest Valley 500kV Line
Freedom to Westwing 500kV Line
Southwest Valley to Mobile 500kV Line
Southwest Valley to Coolidge 500kV Line
Liberty to Signal Peak 500kV Line
Signal Peak to Coolidge 500kV Line
Two Coolidge to Browning 500kV Lines
Two Browning to Rogers 500kV Lines
Coolidge to Winchester 500kV Line
Coolidge to Oracle 500klV Line
Two Rogers to Pinnacle Peak 500kV Lines
Two Westwing to Pinnacle Peak 500kV Lines

PNM Alternatives

Alternative 7: (PNM_ALT_1)
Two Jojoba to Mobile 345kV Lines
Two Mobile to Saguaro 345kV Lines
Two Saguaro to South 345kV Lines

TEP/SWTC Alternatives

Alternative 8: (TEP_ALT_1)
Saguaro – Winchester 500 kV line in place of the Southeast Station – Winchester 500 kV line.

Alternative 9: (TEP_ALT_2)
Removal of the Mobile – Saguaro 500 kV line.

Alternative 10: (TEP_ALT_3)
Removal of Saguaro – South 345 kV line.

Alternative 11: (TEP_ALT_4)
Removal of Saguaro – South 345 kV and Vail – South #2 345 kV lines.

Alternative 12: (TEP_ALT_5)
Combination of Alternatives 1 and 3.

Alternative 13: (TEP_ALT_6)
Combination of Alternatives 1 and 4.

Alternative 14: (TEP_ALT_7)
Southeast Station – Winchester replaced with Southeast Station – Carpas, Carpas – Winchester, Carpas – Saguaro "Y" connection.

Alternative 15: (TEP_ALT_9)
Alternative 7 plus the tie-in of the Cholla – Saguaro 500 kV line at Silver King substation.

It should also be noted, like in the CATS Phase I Study, the scope of the CATS Phase II study was focused on the high voltage transmission system. No attempt was made to address local area transmission problems or issues.

VI. Methodology

The intent of the (CATS) study was to provide a framework for the participating entities to plan and coordinate transmission lines and bulk power stations located within the study area boundaries. Phase I of the study was a screening effort that evaluated a group of transmission alternatives under a broad range of generation patterns to determine how

the resultant system performance could meet the objectives of the study. The strengths and weaknesses of the transmission alternatives were observed and evaluated. This work was used to narrow down the transmission options that merit further study in the second phase of the study effort.

Power flow studies were performed to assess the relative performance of each of the proposed transmission alternative for each of the generation dispatch patterns studied. The assessment was performed by raising generation in the generation area being studied and increasing load in the load area being studied until a facility limit is reached. For example: to assess the capability of the CATS Phase II base system to deliver generation from the Palo Verde area to the Phoenix Metro area. The CATS Phase II base system was bench marked by increasing the load in the Phoenix Metro area and increasing the generation in the Palo Verde area until an EHV facility-loading limit was reached. The performance of each alternative was determined by comparing the relative change in load serving capability between the bench marked case with and without the transmission alternative.

It should be noted that there was no specific time period assessed to this study. Load and generation were raised until an EHV facilities limit was reached.

There were four major load centers identified for this study. These load centers consisted of the Phoenix area load, Central Arizona area load, Tucson area load, and Southern Arizona area load. The Phoenix area load consisted of (55%) SRP Valley Load and (45%) APS Valley Load while the Southern Arizona area load consisted of (80%) TEP Load and (20%) SWTC Load. The Central Arizona load consisted of the load area between South Phoenix and North Tucson.

Power flow studies were performed using the General Electric Positive Sequence Load Flow (GE PSLF) program. The Western Electric Coordinating Council (WECC) 2002 LS1 case was selected for use in this study. All CATS base cases were developed from this case. Study participants added all planned facilities from 2002 to 2005 for Arizona to the CATS base cases. Load was modeled at 90% of the forecasted 2005 summer peak load. All Transmission Alternatives were identified and modeled by study participants in the CATS base case with an out-of-service status.

Study performance standards were based on WECC Reliability Criteria for Transmission System Planning and individual utility ratings for facilities. All study simulations were evaluated with all facilities in service (N-0) and under single contingency conditions (N-1).

VII. Summary of Technical Results

Arizona Public Service

Arizona Public Service reviewed the effects of delivering new generation from the Palo Verde area into the Phoenix-Metro area. The review studied two ways to bring new generation west of Phoenix to Mobile, either from Jojoba or Watermelon. This review included studying the effects of two transmission alternatives; Alternative 1 consisting of a 500 kV line between Watermelon and Mobile, and Alternative 2 consisting of a second line between Jojoba and Mobile. The base case included one 500 kV line between Jojoba and Mobile.

A line from Watermelon has advantages in that two distinct paths would exist into Mobile, increasing reliability, and bring the additional generation from the Gila Bend area into the integrated transmission system. Recent national monument designation of land between Watermelon and Mobile challenges the viability of the Watermelon line. A second line from Jojoba, (Alternative 2), has an advantage in that it would be easier to permit parallel lines.

Load

The load in the Phoenix-Metro area was split in a 45%/55% ratio between APS and SRP, SRP having the greater load. APS maintained the load ratio throughout the study. APS grew the load evenly throughout the affected zones by increasing the resistive component only. In addition, generation in the subject area was reduced to arrive at the final results.

Voltage Devices

To maintain system voltages and preclude convergence problems, static var devices (SVD) were added to the Phoenix-Metro 230 kV system. The SVDs automatically adjusted VAR support to maintain the scheduled bus voltages in base case and contingency analysis. SVD's were added at the following 230 kV buses: Cactus, Country Club, Deer Valley, Glendale, Lincoln Street, Lonepeak, Meadowbrook, Ocotillo, Reach, and Sunnyslope.

Benchmark

The benchmark was established on the base case by increasing the Phoenix-Metro load and PV generation until an N-1 condition resulted in an overload. In the base case and each alternative, the Jojoba - Kyrene 500 kV transmission line was the limiting element. Overload of the line in the base case for N-1 occurred at approximately 4150 MW load increase in the Phoenix-Metro area. The Palo Verde – Rudd 500 kV line outage resulted in the highest overload of the Jojoba-Kyrene line.

A second benchmark included cut in of the Cholla – Saguaro 500 kV line at Silver King. This improved the base case transfer capability into the Phoenix-Metro area by 500 MW, to 4650 MW. The Jojoba – Kyrene line remained the limiting element for the Palo Verde - Rudd outage

Both alternatives studied by APS produced similar results, an additional 200 MW of transfer capability. At 4350 MW of load increase, the Jojoba - Kyrene line overloaded to 100.6% for Alternative 1 and 101% for Alternative 2, N-1 condition being removal of the Palo Verde – Rudd line.

Transfer capability into the Phoenix-Metro area increased with the cut in of the Cholla – Saguaro 500 kV line at Silver King. Both alternatives equally improved by 500 MW to 4850 MW of load increase in the Phoenix- Metro area. For N-1, the Jojoba - Kyrene line overloaded to 100.6% for Alternative 1 and 101% for Alternative 2.

Conclusions

Alternatives 1 and 2 provide similar results, an additional 200 MW of transfer capability into the Phoenix Metro area. Cut in of the Cholla – Saguaro 500 kV line at Silver King actually improves both the base case and the alternatives by 500 MW. Either alternative together with the Silver King cut in will provide an additional 700 MW of transfer capability.

Salt River Project

The Salt River Project (SRP) studied the Transmission Alternatives associated with delivering new Palo Verde Generation into the Phoenix area.

Load

There were four major load centers studied. These load centers consisted of the following areas:

- Phoenix area load.
- Tucson area load.
- Central Arizona load.
- Southern Arizona area.

SRP was assigned to study the load in the Phoenix area. The Phoenix area load was defined as being 45% APS Valley Load and 55% SRP Valley Load. The load in Phoenix was adjusted base on this APS/SRP 45%/55% break down.

SRP Valley load is modeled on the 69kV bus on the 69kV side of the 230/69kV transformers. In order to avoid losses across the transformer and to avoid losses due to overloading the 230/69kV transformers, all additional loads were added to the 230kV bus.

The system voltages could not be maintained during the load-growing process with existing voltage control facilities. This resulted in bus voltages below the scheduled voltage and in some cases the power flow would not converge. To mitigate the problem, several fictitious static var compensator devices (SVD) were added to the SRP/APS system. The SVDs were added to the Kyrene 230kV, Rudd 230kV, Pinnacle Peak 230kV, Agua Fria 230kV and the Santan 230kV buses. These SVDs were sized to provide sufficient vars to support the scheduled bus voltages in the base case for pre contingency conditions. The SVDs fixed and held constant for post-contingency runs.

Benchmark

In order to measure what was gained by adding a transmission alternative to the base case, a benchmark was established. This benchmark was defined as being the amount of load and generation, which can be added to the base case system, without overloading the Central Arizona 500kV system, for a (N-1) condition.

The load in the Phoenix area and the (Group A) generation were simultaneously raised until an (N -1) overload condition was reached. The load was increased by approximately (6000MW). An outage of the Palo Verde to Rudd 500kV Line caused the Kyrene to Jojoba 500kV Line to load to approximately (107%) of its emergency rating. Extrapolating this value back to (100%) yield approximately a (5500MW) load increase.

The next critical outage was the outage of the Cholla to Pinnacle Peak 345kV line, which overloaded the Cholla to Preacher Canyon 345kV line to 101% of its emergency rating.

Transmission Alternatives

There were various transmission options reviewed by the CATS study participants. SRP studied the following three transmission alternatives.

SRP Alternative 1: Loop-In of the Cholla to Saguaro 500kV Line into Silver King

SRP Alternative 2: Loop-in of the Cholla to Saguaro 500kV Line into the Southeast Station.

SRP Alternative 3: Loop-in of the Cholla to Saguaro 500kV Line into Silver King and Loop-in of the Cholla to Saguaro 500kV Line into the Southeast Station.

Each one of these three transmission alternatives was studied to determine how much more load and generation could be grown above the benchmark case.

Study Results

Alternative 1

The immediate result of applying Alternative 1, showed a decrease in the percent loading of the Kyrene to Jojoba 500kV Line from 107% to 100% for a Palo Verde to Rudd 500kV Line outage and it also showed a decrease in the percent loading of the Cholla to Preacher Canyon 345kV line from 101% to 94%. The addition of the Cholla to Saguaro 500kV line

looped into Silver King, reduced the flows on the Kyrene to Jojoba 500kV Line and the Palo Verde to Rudd 500kV Line. The Loop-in of the Cholla to Saguaro 500kV Line into Silver King increased the flows from Silver King to Browning 500kV Line and from Browning to Kyrene 500kV Line.

With the added transmission of Alternative 1, the load and generation could be increased from approximately (5500MW) to approximately (6000MW). The increase in load from the (5500MW) benchmark case to the (6000MW) level with Alternative 1 was an increase of (500MW).

Alternative 2

The immediate result of applying Alternative 2 showed a decrease in the percent loading of the Kyrene to Jojoba 500kV Line from 107% to 98% for a Palo Verde to Rudd 500kV Line outage. The additions of the Loop-in of the Cholla to Saguaro 500kV Line into Southeast Station decreased the flows on the Kyrene Jojoba 500kv Line and the Palo Verde to Rudd 500kV Line. The flows on the Silver King to Browning 500kV Line and on the Browning to Kyrene 500kV Line increased.

This alternative showed little change in the Cholla to Pinnacle Peak 345kV line outage.

With the added transmission of Alternative 2 the load and generation was increased to approximately (6000MW) before the first (n-1) overload occurred. The increase in load from the (6000MW) benchmark case to the (5500MW) level with Alternative 2 was an increase of (500MW), approximately the same results of Alternative 1.

Alternative 3

The immediate result of applying Alternative 3, showed a decrease in the percent loading of the Kyrene to Jojoba 500kV Line from 107% to 96% for a Palo Verde to Rudd 500kV Line outage and it also showed a decrease in the percent loading of the Cholla to Preacher Canyon 345kV line from 101% to 86%. The addition of the Cholla to Saguaro 500kV line looped into Silver King and looped into Southeast Station, reduced the flows on the Kyrene to Jojoba 500kV Line and the Palo Verde to Rudd 500kV Line. The Loop-in of the Cholla to Saguaro 500kV Line into Silver King increased the flows from Silver King to Browning 500kV Line and from Browning to Kyrene 500kV Line.

With the added transmission of Alternative 3, the load and generation could be increased from approximately (5500MW) to approximately (6000MW). The increase in load from the (5500MW) benchmark case to

the (6000MW) level with Alternative 3 was an increase of (500MW).

Sensitivities

In comparing the results of the three Alternatives, all three alternatives reduced the loading on the Kyrene to Jojoba 500kV line approximately the same amount. The major difference between Alternative 1, 2 and 3 was their impact on the Cholla to Pinnacle Peak 500kV line. Alternative 1 and 3 were very similar, where Alternative 2 had very little impact on this line outage.

Three sensitivities were run to determine how Alternative 1, 2 and 3 would perform if various sections of the proposed CAT's base system were not included. The following defines the three sensitivities that were studied.

1. Sensitivity 1

   Sensitivity 1 studied the alternatives with the following changes to the base system.

   a.) Without the Southeast Station to Winchester 500kv Line
   b.) With a new line 500kV Line from Saguaro to Winchester

   Sensitivity 1 impacted the base system benchmark by 3%. The two critical lines outages increased in severity by 3%. After applying the Alternative 1 to this Sensitivity approximately the same results were obtained. After applying the Alternative 2 and Alternative 3 there was no significant change in the prior pre-sensitivity cases. Therefore this sensitivity showed no significant change for all three Alternatives.

2. Sensitivity 2

   a.) Without the Southeast Station to Winchester 500kV line.
   b.) Without the Saguaro to South 500kV line.
   c.) With a new 500kv line from Saguaro to Winchester.

   Sensitivity 2 impacted the base system benchmark by 4%. The two critical lines outages increased in severity by 4%. After applying the Alternative 1 to this Sensitivity approximately the same results were obtained. After applying the Alternative 2 and Alternative 3 there was no significant change in the prior pre-sensitivity cases. Therefore this sensitivity showed no significant change for all three Alternatives.

3. Sensitivity 3

   a.) Without the Southeast Station to Winchester 500kV line.
   b.) Without the Saguaro to South 500kV line.
   c.) Without the Mobile to Saguaro 500kV line.
   d.) With a new 500kv line from Saguaro to Winchester.

   Sensitivity 3 impacted the base system benchmark by 9% for the outage of the Palo Verde to Rudd 500kV Line. The Kyrene to Jojoba 500kV line increased in severity by 9%. The Cholla to Preacher Canyon 345kV line had very little impact. After applying the Alternative 1 to this Sensitivity approximately the same results were obtained. After applying the Alternative 2 and Alternative 3 there was no significant change in the prior pre-sensitivity cases. Therefore this sensitivity only showed a 9% change in severity for the Palo Verde to Rudd 500kV line for the base System and very little change for the Cholla to Pinnacle Peak 345kV line outage. All three Alternatives showed the same relative performance as the pre-sensitivity cases.

4. Sensitivity 4

   Scheduled 1000MW of Group B Generation and 5000MW of Group A Generation into the Phoenix Area. Sensitivity 4 reduced the severity of the Palo Verde to Rudd 500kV line by 4% and increased the severity of the Cholla to Pinnacle Peak 345kV line by 5%. All three Alternatives showed the same relative performance as the pre-sensitivity cases.

5. Sensitivity 5

   Scheduled 1000MW of Group C Generation and 5000MW of Group A Generation into the Phoenix Area. Sensitivity 5 reduced the severity of the Palo Verde to Rudd 500kV line by 10% and increased the severity of the Cholla to Pinnacle Peak 345kV line by 8%. All three Alternatives showed the same relative performance as the pre-sensitivity cases.

Salt River Project 230kV Study

Salt River Project (SRP) studied the power flow impact of Central Arizona Transmission System SRP Alternative 1 (loop-In of the Cholla to Saguaro 500kV Line into Silver King) on the valley 230kV system using a 2008 SRP planning base case. It was assumed that the Cholla/Saguaro loop-in into Silver King is due to the addition of Springerville new generation. The 430MW of new Springerville generation was scheduled as follows: 229MW to northwest area, 30MW to San Diego, 60MW to LADWP and 110MW to SCE. Hassayampa/Jojoba/South East Valley 500kV line, and loop-in of Silver King/Browning 500kV line into South East Valley were already in our 2008 planning base case, thus, the study case had this phase of the line in-service.

The study base case had generation levels of 2250MW, 646MW, 510MW, and 200MW for Hassayampa, Signal Peak, Desert Basin, and Sun Dance, respectively. Though Signal Peak had been cancelled after the study was begun, it is still useful as a generation sensitivity.

Benchmark

As mentioned above, the SRP 2008 planning base case already had the addition of Hassayampa/Jojoba/South East Valley 500kV line, and loop-in of Silver King/Browning 500kV line into South East Valley. The need for this phase of the CATS project in the planning case was due to voltage concerns during a critical 500kV line outage.

Study Results

1. Option 3A

The study outage results were compared to planning outage results to determine the impact of the Silver King loop-in. Many overloads exist in the 2008 timeframe and the Silver King loop-in reduces loading but does not resolve overloads. Some of these loading problems exist today. The increased flow into the SRP 115kV system aggravates loading of the Goldfield 230/115kV transformers.

2. Generation Sensitivity

The robustness of Option 3A was explored with generation levels of 500MW and 1000MW added at Hassayampa or South East Valley station.

Outages were run and significant results are in the table below.

Interpolating outage results between zero generation, 500MW, and 1000MW of new generation at South East Valley indicates that the system can handle 200MW, 750MW, 290MW, and 750MW of generation before Oakflat/Superior, DBG/Santa Rosa, Knox transformer, and Pnpkaps/Cactus will overload, respectively.

Interpolating outage results for the generation at Hassayampa indicates that the system can handle 750MW, 667MW, and 786MW before Oakflat/Superior, Knox transformer, and Pnpkaps/Cactus will overload, respectively.

GENERATION SENSITIVITYFOR OPTION 3A

		2008 BC	OPT 3A	OPT 3A SES 500MW	OPT 3A SES 1000MW	OPT 3A HAA 500MW	OPT 3A HAA 1000MW
LINE/XMFR	RATE (A or MVA)	PCT	PCT	PCT	PCT	PCT	PCT
Knox 230/69	338	<90	94	104	113	99	102
Oakflat/Superior 115	600	<90	97	102	106	99	101
DBG/Sntarosa 230	2259	<90	<90	91	109	<90	<90
Pnpkaps/Cactus 230	1122	92	90	97	103	96	103
Wphx/Lincstrt 230	1157	183	173	181	189	187	200
Bicknell 345/230	193	126	124	125	126	123	122
Lincstrt/Ctryclub 230	1599	101	97	103	110	104	112
Goldfeld 230/115xfmrs	202	95	103	106	109	105	107
Mrmnflat/46E-5N 115	798	102	105	107	110	106	108
Yavapai/Verde W 230	530	105	104	104	105	105	107

Conclusions

1. Looping-in the Cholla to Saguaro 500kV Line into Silver King reduces the loading on the critical Paths (Kyrene to Jojoba 500kV and Palo Verde to Rudd 500kV) into the Phoenix area. This alternative also reduces the flows on the Cholla to Pinnacle Peak and Cholla to Preacher Canyon 345kV lines into the Phoenix area.

2. Looping-in the Cholla to Saguaro 500kV Line into South East Valley station reduces the loading on the critical Paths (Kyrene to Jojoba 500kV and Palo Verde to Rudd 500kV) into the Phoenix area. It does not reduce the loading on the Cholla to Pinnacle Peak and Cholla to Preacher Canyon 345kV lines into the Phoenix area.

3. Looping in the Cholla to Saguaro 500kV Line into Silver King increased the flows on the Silver King to Browning 500kV Line and the Browning to Kyrene 500kV Line. This increase in flow overloads the underlying 230kV system for certain (N-1) outages. The 230kV Lines out of Silver King and the Kyrene 500/230kV transformers were loaded beyond their emergency limits, for certain (N-1) outages. The underlying system problems can be addressed by adding an additional 500kV transformer at Kyrene and upgrading or building new 230kV Lines out of Silver King and building out the Browning Station.

4. Alternative 3, which combines both Alternative 1 and 2, performs approximately the same as Alternative 1 with no significant differences.

5. All three of the Transmission Alternatives will require some kind of 230kV system upgrades.

6. Existing SRP 230kV system can accommodate South East Valley station with Silver King/Browning loop in and a loop in of the Cholla/Saguaro 500kV line into Silver King. However, with the additional power flowing through the 115kV system, a couple of 115kV lines may need upgrading and an additional Goldfield 230/115kV transformer is needed

7. 230kV system can accommodate higher level of generation at Hassayampa than at South East Valley station.

Tucson Electric Power

Study Methodology

The basic methodology involved increasing load in one area and a comparable amount of generation in another area to stress the interconnecting transmission system. This was done for several transmission alternatives. TEP used the following new generation sources for its portion of the analysis:

1) Palo Verde area
2) Toltec
3) Bowie
4) Springerville Expansion
5) Winchester

The loads in the following areas were increased to accommodate the corresponding increase in generation:

1) Metro Phoenix load
2) Tucson and SWTC (formerly AEPCO) load
3) 50% metro Phoenix load and 50% TEP/SWTC load

Appendix B illustrates how the source, load increases, and transmission alternatives were implemented.

Originally, the study methodology was to stress the defined base system as previously mentioned until an EHV N-1 thermal limit was reached. The transfer increase, as measured by the increase in load and generation, would be a benchmark value. Next, the same system with a transmission alternative would be similarly stressed until an EHV N-1 thermal limit was again reached. The delta value measured in the transfer increase would represent a measure of effectiveness for the particular alternative. By applying the same technique to the remaining alternatives, a hierarchy of relative merit for the transmission alternatives could be established. In theory, the best one or two alternatives would carry over to a potential Phase III for more detailed analysis.

TEP/SWTC had some difficulties with this approach, however. It turned out that the Phase I elements added to the system model during the base case development made reaching the initial N-1 thermal limit extremely difficult.

To overcome this difficulty, the TEP/SWTC alternatives primarily consisted of removing transmission segments from the base. These removals, in

general, resulted in relative overloads compared to the base configuration. However, by comparing the magnitude of these overloads for the various alternatives, a relative ranking system could still be implemented. This was the approach TEP/SWTC used in their portion of the analysis.

The TEP/SWTC alternatives consisted of the following modifications of the base case:

1) Saguaro – Winchester 500 kV line in place of the Southeast Station – Winchester 500 kV line.

2) Removal of the Mobile – Saguaro 500 kV line (removal of Mobile – Toltec with scenarios involving Toltec generation)

3) Removal of Saguaro – South 345 kV line

4) Removal of Saguaro – South 345 kV and Vail – South #2 345 kV lines

5) Combination of Alternatives 1 and 3

6) Combination of Alternatives 1 and 4

7) Consists of the following elements replacing Southeast Station – Winchester:
   a) A new switching substation, named Carpas, approximately northwest of Oracle Junction. The name Carpas was arbitrarily chosen because of a wash by that name in the vicinity.
   b) Southeast Station – Carpas 500 kV line
   c) Carpas – Winchester 500 kV line
   d) Carpas – Saguaro 500 kV line

   Alternative 7 effectively creates a "Y" connection between Southeast Station, Winchester, and Saguaro substations.

8) Alternative 7 plus Mobile – Saguaro was taken out of service

9) Alternative 7 plus the tie-in of the Cholla – Saguaro 500 kV line at Silver King substation.

Local area voltages were problematic during the analysis. In the process of raising load to stress the EHV transmission system, local losses (real and particularly reactive) grew to exorbitant levels. Fictitious static-var compensator devices were placed throughout the local TEP system and also in one location on the SWTC system to aid in power flow

convergence. Additionally, load power factors were raised to unity, and in some limited, extreme situations var limits were removed from generators. Obviously, these problems demonstrate the inadequacy of the lower-voltage, local sub-transmission system to support the higher load levels used in this analysis. This is to be somewhat expected, however, since the sub-transmission system was not designed to support load up to twice current levels. The sub-transmission situation will be addressed in separate analyses by TEP and SWTC.

Analysis

The analysis involved many different combinations and variations of multiple quantities. For example, there were variations in:

Generation
Load areas and magnitude of load
Transmission configurations (Alternatives)
Contingencies
Overloads
Outages causing overloads

Due to the multi-dimensional nature of the analysis data, it was decided the best approach was to form a table for each generation dispatch scenario. These tables, coupled with descriptive narrative, form the basis of the analysis section.

The tables for each generating dispatch scenario follow the same general format. All the pertinent branches overloaded above their emergency ratings for an N-1 contingency are listed on the left-hand side of the table. Across the top are the different transmission alternatives studied. The matrix values consist of the maximum overload of a particular branch given a particular transmission alternative. The contingency causing this overload is also given in the form of a contingency number. Beneath the matrix are keys relating the contingencies and transmission alternatives to their respective numbers.

Palo Verde area dispatch

Since APS and SRP are both examining Palo Verde area generation dispatch into the Phoenix area, TEP/SWTC did not investigate it. Similarly, TEP/SWTC did not investigate the scenario of Palo Verde area generation dispatched 50% to Phoenix and 50% to TEP/SWTC.

However, dispatch from Palo Verde area generation to the TEP/SWTC service area was investigated. As previously described in the Methodology section, the first step was to increase Palo Verde area generation and corresponding TEP/SWTC load until an N-1 emergency thermal limit was reached. Though difficult, a limit was reached for the base case. The transfer represents an additional 3000 MW, Palo Verde to TEP/SWTC dispatch, above the initial year 2005 dispatch. The limit is represented by the 105% Springerville – Vail line in table 1 under the base case column. There was a bit of overshoot above 100% due to the iterative nature of the process. The Springerville – Greenlee line came in slightly below at 102%. The Winchester 500 kV / 230 kV transformer overload, although higher, was discounted because the transformer rating is estimated; it does not physically exist yet and can be procured with a sufficiently high rating.

Alternative #1 (Saguaro – Winchester 500 kV line in place of the Southeast Station – Winchester 500 kV line) – The table indicates that the Springerville – Vail and Springerville – Greenlee overloads were worsened. This can be explained by the fact that Southeast Station – Winchester provides a tighter parallel path to the TEP Springerville – Vail transmission corridor than does Mobile – Saguaro – Winchester. The table also indicates a new overload of the Westwing 500 kV / 345 kV transformer. The offending outage is the Mobile – Saguaro line. Without Mobile – Saguaro, power must flow up along the South – Saguaro line to reach Saguaro. In turn, power can get to South via Westwing or Vail. Since a great deal of the dispatch is from the Palo Verde area, and the Southeast Station – Winchester line does not exist for this alternative, more is forced to come down the Westwing – South line.

Alternative #2 (Removal of the Mobile – Saguaro 500 kV line) – The table indicates that the Winchester 500 kV / 345 kV transformer has a substantial relative overload on it with the worst contingency being loss of the South – Westwing line. This is true because for alternative #2, Saguaro's EHV path directly from the Palo Verde area is removed. Saguaro is now being fed via the South – Saguaro and the Cholla – Saguaro line. Most of the Palo Verde area power feeding Saguaro is coming from the South via Westwing – South and Southeast Station – Winchester – Vail – South paths. With the subsequent loss of Westwing – South, much more power now flows through Winchester to feed Saguaro via Winchester – Vail – South.

The Springerville – Vail path is relatively more overloaded than in the base due to loss of the Greenlee – Vail line. Again, without Mobile – Saguaro, more power flows down the Springerville – Vail corridor to compensate. With the subsequent loss of the Greenlee – Vail line, more power flows down the Springerville – Vail line.

The Springerville – Greenlee and Westwing – South lines overload for the loss of the Southeast Station – Winchester line. Without Mobile – Saguaro, more power has to flow on the alternative lines to make its way into Tucson. Subsequently, losing the Southeast Station – Winchester line forces even more power down the remaining Springerville – Greenlee and Westwing – South lines. The Westwing – South line is particularly impacted since it is a more direct electrical route from Palo Verde.

Alternative #3 (Removal of Saguaro – South 345 kV line) – The table indicates several overloads, many of which are the same as Alternative #2, but with primarily lower magnitudes. Many of these differences can be attributed to the fact that the Mobile – Saguaro line is in service. The one exception is the Sonoita – Valencia line.

Sonoita – Valencia : With Saguaro – South initially out of service, the EHV paths to South substation are via the Vail – South line and Westwing – South line. Additionally, two EHV lines from South substation supply power to CFE with an additional tie to the Citizen's system at Nogales. After loss of the Westwing – South line, all power to CFE and Citizen's must ultimately come from Vail, and from the SWTC and WAPA underlying systems. This situation causes the Sonoita – Valencia piece of Citizen's transmission system near Nogales to overload slightly above its emergency rating.

Alternative #4 (Removal of Saguaro – South 345 kV and Vail – South #2 345 kV lines) – These results are similar to the results from Alternative #3. This makes sense since the only difference in the two alternatives is that the Vail – South #2 line is initially out of service. The big difference is the overload magnitude of the Sonoita – Valencia line due to loss of the remaining Vail – South line. With both Vail – South lines out, more power is diverted over the SWTC and WAPA underlying systems over Citizen's system to Nogales. This situation causes the Sonoita – Valencia piece of Citizen's transmission system near Nogales to overload above its emergency rating.

Alternative #5 (Combination of Alternatives 1 and 3) – This alternative is the same as Alternative #1 except for the absence of the Saguaro – South line. The worst overload is on the Winchester 345/500 kV transformer due to loss of the Westwing – South 500 kV line. This is due to the fact that this loss, coupled with the Saguaro – South line being initially out-of-service forces all EHV flow to South substation via Vail substation. That in turn caused more power to flow into Vail via Winchester and caused the relatively high overload on the transformer.

Alternative #6 (Combination of Alternatives 1 and 4) – This alternative is the same as Alternative #5 except that the Vail – South #2 is initially out-of-service. The biggest change is the overload in the Sonoita – Valencia line. The same situation as described in the Alternative #4 analysis is occurring.

Alternative #7 (Southeast Station – Winchester replaced with Southeast Station – Carpas, Carpas – Winchester, Carpas – Saguaro "Y" connection) – All of the overloads for this alternative are relatively low compared with many of the other alternatives, with the exception of the Winchester 500/345 kV transformer. Loss of the Saguaro – Carpas line causes what was flowing into Saguaro via Southeast Station – Carpas – Saguaro to take the alternate Southeast Station – Carpas – Winchester – Vail path. The extra flow through the Winchester 500/345 kV transformer causes the relative overload.

Alternative #9 (Alternative 7 plus the tie-in of the Cholla – Saguaro 500 kV line at Silver King substation) – This alternative is the same as Alternative #7 except that additionally the Cholla – Saguaro line is tied into the Silver King substation. As can be seen from the table, this alternative provides for the lowest relative overloads of all the alternatives. The improvement in the Winchester 500/345 kV transformer overload is obviously due to the Cholla – Saguaro line tie-in at Silver King. The tie-in provides a more direct path to Palo Verde generation via Kyrene – Silver King – Saguaro than the more distant Cholla substation. Consequently, loss of Saguaro – Carpas station, which effectively cuts off flow from Southeast Station to Saguaro, is not as detrimental.

Bowie area dispatch

As can be seen from the tables, there are few overloads due to Bowie area generation dispatch. The overloads on the Marana – Avra line and the Dos Condidos 230/69 kV transformers are localized issues that SWTC plans to study as part of a separate sub-transmissions analysis. Essentially, the tables indicate that any of transmission alternatives appear to be adequate for Bowie generation. It must be noted however, that the base transmission in the case exceeds what is in service today. Specifically, the Willow – Winchester and the Winchester – Vail #2 lines are new.

Simultaneous dispatch of Bowie, Winchester, and the Springerville Expansion generation to Tucson

As indicated in the table, there are a few overloads for this dispatch scenario. Most of these involve SWTC and again are localized issues that

SWTC plans to study as part of a separate su-transmission analysis. The most significant overloads are on the Winchester to Vail lines. Loss of one overloads the other. This is not surprising since most of the 1500 MW of additional generation coming from Bowie and Winchester must flow down these lines. Loss of one line forces all of this power to flow over the remaining line. The impact from Springerville is mitigated to some extent because of the Springerville – Vail express circuit. However, the fact that it is an express circuit effectively precludes it from helping deliver Bowie and Winchester generation to Tucson.

Simultaneous dispatch of Bowie, Winchester, and the Springerville Expansion generation to Phoenix

As the table indicates, there are essentially no overloads for any of the alternatives with this dispatch scenario. The exception is the Springerville – Coronado line and its terminating transformer at Coronado. A large percentage of the power from these generators is flowing to Springerville and down to the Phoenix area via the Coronado substation. A relatively smaller portion is flowing south through the Tucson system and back up to Phoenix via this indirect route. Loss of the Winchester – Southeast Station line or the Springerville – Vail express circuit restricts this alternative path forcing even more to flow through Coronado – hence the overloads.

Toltec generation to Phoenix

As indicated in the table, the only overloads for any of the alternatives for this dispatch scenario involve the 500/345 kV tie transformers at Toltec. Loss of Mobile – Toltec deprives the Toltec generators of the primary path to the Phoenix area. The next best alternative is for the power to go up the TEP 345 kV system to Phoenix. The 500/345 kV transformers overload in the process. The rating for these transformers is somewhat arbitrary estimates since they don't physically exist yet. Presumably, they could be acquired with a higher capability.

Toltec generation to Tucson

As can be seen from the table, there are a number of overloads occurring on the SWTC system. These have been addressed previously and again are localized issues that SWTC plans to study as part of a separate sub-transmission analysis. The remaining overloads involve the TEP 345 kV system between Toltec and South substations. Similarly to the problem

with dispatch to Phoenix, loss of the Toltec – Saguaro line eliminates the primary path of the Toltec generation into the Tucson area. The alternative path is via the Toltec – South line that subsequently overloads.

Conclusions

A second EHV transmission line from the Phoenix metro area to Saguaro 500 kV substation strengthens this station making it a strong source for southern Arizona. This would be particularly beneficial to the TEP system. There are two good options or family of alternatives to get to Saguaro, one from the northwest and one from the northeast. Both of these options connect to the Palo Verde to Southeast Station Project currently under development.

The options are:

1) A 500kV line from Mobile to Saguaro, potentially with the intermediate Toltec generating station.

   The Toltec generation project could support this option by building approximately 25 miles of the Mobile-Saguaro 500 kV line, as outlined in its plan of service. However, the Toltec project is questionable at this time due to denial of a Certificate of Environmental Compatibility by the Arizona Corporation Commission. APS also has interests in this option, but other priorities such as their announced EHV transmission alternatives north of Phoenix could delay or obviate any plans to reinforce Saguaro.

   Also for this option, additional transmission out of Saguaro into the Tucson metropolitan area is required. A 345 kV line from Saguaro to South was examined. It helps distribute power from Saguaro into the Tucson metropolitan area. Additionally, it provides backup to Saguaro (Tortolita) for a contingency involving other EHV transmission into Saguaro.

2) A 500 kV line from Southeast Station to an intermediate switching station (initially named Carpas substation). From Carpas, a 500 kV line connecting to Winchester and another 500 kV line connecting to Saguaro.

   SRP has expressed interest in a project from Southeast Station to Winchester -- a subset of this option – potentially with an additional tie to Saguaro substation. SRP is also interested in possible joint

development of the right-of-way for other uses that might include a natural gas line and access by future resource projects.

Additional EHV transmission reinforcement in the Tucson area will likely be required in conjunction with this alternative. This is anticipated to take the form of a second Winchester – Vail line and a second Vail – South line. Other resource additions directed into the Winchester station will also likely require these transmission additions. These include:

a) A generating station at Winchester
b) The Bowie power station. (In addition, it is anticipated that a second 345 kV line may be required from the proposed Willow station to Winchester in conjunction with the Bowie power station.)

Each of these options has different advantages and benefits depending on how the system (load and generation) develops and who the line participants will be. It is prudent in the planning phase to pursue both options until the decision on which one will be built first is made. While construction of both of these alternatives would make for a robust EHV system between Phoenix and Tucson, it is not considered likely that both will be constructed in the same time frame.

Public Service Company of New Mexico

Public Service Company of New Mexico (PNM) is developing plans for construction of a 1000 MW transmission system to delivery power from Palo Verde to Mexico south of the Tucson area. The proposed PNM plan includes construction of two 345 kV lines largely paralleling proposed additions being studied in the base CATS Phase II system. PNM has added analysis in this study that reviews integrating the planned Palo Verde to Mexico transmission facilities ("the PNM alternative") in place of building certain segments of the base CATS system.

Integrating the PNM alternative into the study database included adding the following elements:

Two 345 kV lines from Jojoba to Mobile
Two 345 kV lines from Mobile to Toltec
Two 345 kV lines from Toltec to Saguaro
Two 345 kV lines from Saguaro to South
500kV/345 kV transformers at Jojoba, Mobile, Toltec and Saguaro, nominally sized at 1200 MVA for study purposes

When the PNM alternative is modeled the following elements are removed:

Watermelon to Mobile 500 kV Line
Mobile to Toltec to Saguaro 500 kV Line
Saguaro/Tortolita to South 345 kV Line

Initiation of the PNM 345 kV alternative at Jojoba as opposed to Hassayampa, as currently being permitted, was modeled due to the base study assumption of the completion of two new 500 kV lines between Hassayampa and Jojoba. Actual final construction plans would depend upon the completion of these two new 500 kV lines prior to initiation of the PNM project as well as successful negotiation of rights on these lines. Replacement of one of the two new 500 kV Hassayampa to Jojoba lines with two new 345 kV lines would have negligible effect on the study results reported herein. Similarly, although PNM's proposed project would include the extension of the two new 345 kV lines from South substation to the Mexican border, two such lines were already modeled in the base CATS system and as such were not repeated when including the PNM proposal.

Study Criteria

The primary objective of system stressing in the study cases was to identify the amount of load and generation that could be increased before reaching an N-1 overload on any 345 kV or 500 kV transmission line. Overloads on transformers and underlying 230 kV and below systems are ignored. This criterion is utilized to identify which major EHV facilities offer the greatest potential for increasing transfer capability while assuming that underlying system problems will be addressed as needed to accommodate load growth and new generation.

Likewise, no attempt is made to identify the optimal voltage support requirements needed to accommodate generation and load growth. To obtain power flow solutions, fictitious SVD's are modeled at key buses in the Phoenix and Tucson load centers. Also, based on input from the CATS study participants, all cases are modeled without the Cholla-Saguaro 500 kV line series compensation in-service and without a second Springerville-Greenlee 345 kV line.

Load Stressing

The effect of the PNM alternative on service to two major load centers and to Mexico is studied:

- Phoenix
- Tucson
- Mexico

Service to the Phoenix load center is primarily studied for comparison of the alternatives against other benchmarks in this study and in determining if there are trade-offs between load served in Phoenix and the Tucson/Mexico area. In the Phoenix area, total load increases are split to be 45% APS load and 55% SRP load. In the Tucson area, load increases are split to be 80% TEP load and 20% SWTC load up to 2000 MW. After the first 2000 MW of increase the ratio is changed to 90% TEP and 10% SWTC. Mexico load is modeled at 1000 MW in all cases benchmarking transfer capability increases to the Tucson/Mexico area. The initial CATS base case includes 500 MW of Mexico load.

Generation Stressing

Because the PNM project is proposed for delivering generation from the Palo Verde hub to Mexico, generation stressing first emphasizes the use of new generation in Group A. Group B generation is utilized when sufficient resources can no longer be exported from Group A but additional load scaling can still be accommodated. Group C generation is not used in assessing the PNM alternative.

Stressing and Sensitivity Scenarios

Although PNM assesses only one alternative modification to the CATS base system, the alternative is compared against the base system under the following stressing scenarios:

Scenario 1: Group A generation to Phoenix
Scenario 2: Group A and B generation to Phoenix and Tucson/Mexico
Scenario 3: Group A generation to Tucson/Mexico

Reduced Initial Build Sensitivity

The PNM service plan for Mexico includes the ultimate construction of both 345 kV lines with a schedule that is generally prior to the potential completion of many of the CATS proposed line segments. As a result, a sensitivity analysis is performed on a reduce CATS base system by assuming that only one of the two 500 kV paths from Jojoba to the SES/Saguaro area and only one of the proposed CATS paths from SES/Saguaro to the southern Tucson area is completed. The sensitivity analysis compares the SES-Winchester 500 kV alternative to the PNM alternative for serving the combined Tucson area /Mexico load. The sensitivity is evaluated using both stressing scenario 2 and 3.

Study Results

Comparison of CATS base system configuration versus PNM Alternative configuration

Scenario 1 Stressing

This scenario was largely developed to compare against other benchmarks stressing the CATS system with Group A generation scheduled to Phoenix. The CATS base configuration was found to be limited to around 5500 MW of increased load in the Phoenix area when served with new generation in Group A. The total generation increase required to cover load and losses was 5700 MW. The base configuration is limited first by overloads of the Cholla-Pinnacle Peak 345 kV lines under outage of the other Cholla-Pinnacle Peak 345 kV line. Loadings on the Jojoba-Kyrene 500 kV line reached 98% for outages of the Palo Verde-Estrella 500 kV line. The Cholla-Pinnacle peak lines were also found to be loaded to 103 percent of rating under base conditions after stressing. Addition of the PNM alternative did not significantly change this stressing scenario. The results are summarized in PNM Table 1 and PNM Table 2 below.

PNM Table 1 - Stressing Information for Stressing Scenario 1

Stressing Scenario 1: Group A Generation to Phoenix Load Area						
	Generation Increase					
	Group A	Group B	Group C	**Total**		
CATS Base Configuration	5700	0	0	**5700**		
PNM_ALT_1 Configuration	5700	0	0	**5700**		
	Incremental Load			Import/Export Totals		
	Phoenix Load Increase	Tucson/ SWTC/ Mexico Load Increase	Total Load Increase	Phoenix Total Import	Tucson Area Total Import	Mexico Total Import
05 HS Pre-Stress Reference→				7905	2560	500
CATS Base Configuration	5500	0	5500	13541	2568	500
PNM_ALT_1 Configuration	5500	0	5500	13511	2569	500
Stressing increase with PNM_ALT_1 over Base Configuration	**0**	**0**	**0**	**-30**	**1**	**0**

PNM Table 2 - Limit Conditions for Scenario 1 Stressing

Stressing Scenario 1: Group A Generation to Phoenix Load Area				
		Loading (% of Rating)		
Branch	Contingency	Base Configuration	PNM_ALT_1 Configuration	Rating (Amps/MVA)
Cholla-Preacher 345kV	None	103.0%	102.4%	1004/600
Cholla-Pinnacle Pk 345 kV	None	98.7%	98.1%	1004/600
Cholla-Preacher 345 kV	Cholla-Pinnacle Pk 345 kV	102.6%	102.2%	1310/783
Cholla-Pinnacle Pk 345 kV	Cholla-Preacher 345 kV	100.3%	99.9%	1305/780
Jojoba-Kyrene 500 kV	Palo Verde-Estrella 500 kV	97.6%	97.6%	3000/2728

Scenario 2 Stressing

This scenario determines the amount of incremental load above the CATS 2005 HS base case that can be served in southern Arizona along with the increased load identified in scenario A in the Phoenix area. The results show total load increases to the Tucson area and south to be approximately 2650 MW with the base configuration and approximately 3150 with the PNM alternative configuration. The total load increase to Phoenix and Tucson for the base configuration was 8580 MW with 6300 MW of generation from Group A, 2280 MW of generation from Group B and approximately 300 MW of losses. Use of additional group A generation was limited by overloads of the Jojoba-Kyrene line under outages of the Palo Verde-Estrella 500 kV line. With the PNM alternative an additional 500 MW in the Tucson/Mexico area could be served.

Loadings on the Springerville-Greenlee 345 kV and Springerville-Vail 345 kV lines limited the Tucson/Mexico total load increase with the base CATS configuration and with the PNM alternative. The scenario 2 results are summarized in PNM Table 3 and PNM Table 4 below.

PNM Table 3 - Stressing Information for Scenario 2

Stressing Scenario 2: Group A and B Generation to Phoenix & Tucson/Mexico Load Area						
	Generation Increase					
	Group A	Group B	Group C	**Total**		
CATS Base Configuration	6300	2280	0	**8580**		
PNM_ALT_1 Configuration	6300	2960	0	**9260**		
	Incremental Load			Import/Export Totals		
	Phoenix Load Increase	Tucson/ SWTC/ Mexico Load Increase	Total Load Increase	Phoenix Total Import	Tucson Area Total Import	Mexico Total Import
05 HS Pre-Stress Reference→				7905	2560	500
CATS Base Configuration	5500	2650	8150	13881	4782	1000
PNM_ALT_1 Configuration	5500	3150	8650	13855	5357	1000
Stressing increase with PNM_ALT_1 over Base Configuration	**0**	**500**	**500**	**-26**	**575**	**0**

PNM Table 4 - Limit Conditions for Scenario 2 Stressing

Stressing Scenario 2: Group A and B Generation to Phoenix & Tucson/Mexico Load Area				
		Loading (% of Rating)		
Branch	Contingency	Base Configuration	PNM_ALT_1 Configuration	Rating (Amps/MVA)
Springervl-Greenlee 345 kV	None	106.2%	105.4%	1247/745
Springervl-Vail 345 kV	None	104.5%	105.6%	1115/666
Springervl-Greenlee 345 kV	Springervl-Vail2 345 Kv	100.3%	99.1%	1690/1010
Springervl-Vail 345 kV	Springer-Greenlee 345 kV	100.3%	100.3%	1439/860
Jojoba-Kyrene 500 kV	Palo Verde-Estrella 500 kV	100.5%	98.1%	3000/2728

Scenario 3 Stressing

The amount of non-simultaneous incremental load served in the Tucson area and south to Mexico from group A generation was determined to be 2350 MW for the base configuration. With the PNM alternative, the amount of load that could be served increased by 450 MW to 2800 MW. Both the base configuration and the PNM alternative configuration were limited by overloads on the Springerville-Greenlee 345 kV line and Springerville-Vail

345 kV line. The results are summarized in PNM Table 5 and PNM Table 6 below.

PNM Table 5 - Stressing Information for Scenario 3

Stressing Scenario 3: Group A Generation to Tucson/Mexico Load Area						
	Generation Increase					
	Group A	Group B	Group C	**Total**		
CATS Base Configuration	2510	0	0	**2510**		
PNM_ALT_1 Configuration	3025	0	0	**3025**		
	Incremental Load			Import/Export Totals		
	Phoenix Load Increase	Tucson/ SWTC/ Mexico Load Increase	Total Load Increase	Phoenix Total Import	Tucson Area Total Import	Mexico Total Import
05 HS Pre-Stress Reference→				7905	2560	500
CATS Base Configuration	0	2350	2350	8262	4453	1000
PNM_ALT_1 Configuration	0	2800	2800	8250	4960	1000
Stressing increase with PNM_ALT_1 over Base Configuration	**0**	**450**	**450**	**-12**	**507**	**0**

PNM Table 6 - Limit Conditions for Scenario 3 Stressing

Stressing Scenario 3: Group A Generation to Tucson/Mexico Load Area				
		Loading (% of Rating)		
Branch	Contingency	Base Configuration	PNM_ALT_1 Configuration	Rating (Amps/MVA)
Springervl-Greenlee 345 kV	None	104.9%	104.9%	1247/745
Springervl-Vail 345 kV	None	104.1%	105.3%	1115/666
Springervl-Greenlee 345 kV	Springervl-Vail2 345 kV	99.1%	98.5%	1690/1010
Springervl-Vail 345 kV	Springer-Greenlee 345 kV	99.6%	99.8%	1439/860

Reduced Initial Build Sensitivity Results

Study results were evaluated further under both stressing scenarios 2 and 3 assuming a reduced initial build to southern Arizona. The sensitivity compared the transfer capability differences between a reduced CATS base system where one 500 kV line from the Palo Verde area to Southeast of Phoenix is removed (Mobile-Toltec-Saguaro 500 kV line) and one line form Southeast of Phoenix to the southern Tucson area is removed (Saguaro to South 345 kV line). This results in a sensitivity analysis that compares the SES-Winchester 500 kV line to a system with the PNM 2-345 kV line project for serving incremental load in the Tucson area and to Mexico.

Scenario 2 Stressing

With the SES-Winchester 500 kV line, total generation from Group A is restricted to approximately 5200 MW and total load increase to Phoenix is limited to approximately 4800 MW. The Jojoba-Kyrene 500 kV line is the limiting element under N-1 conditions. Scheduling additional generation to Phoenix from either Group A or Group B further overloads the Jojoba-Kyrene line. The total load increase to Tucson and south to Mexico is 1800 MW. Transfers of Group A and Group B generation to Tucson were limited by overloads of the Springerville-Greenlee 345 kV line and Springerville-Vail 345 kV line.

With the PNM alternative configuration added in place of the SES-Winchester 500 kV line, load increases up to 2650 MW to the combined Tucson/Mexico area could be accommodated. Simultaneously, total load in the Phoenix area could be increased back to 5500 MW (the limit found in scenarios 1 and 2 above) which is the limit found with two 500 kV paths from the Palo Verde area to South and East of Phoenix. The PNM alternative configuration provided a total load increase of 1550 MW (700 MW to Phoenix area and 850 MW to the Tucson/Mexico area) over the reduced SES-Winchester alternative configuration. The results of this sensitivity case are summarized in PNM Table 7 and PNM Table 8 below.

PNM Table 7 - Stressing Information for Reduced Build Sensitivity and Scenario 2 Stressing

Stressing Scenario 2: Group A and B Generation to Phoenix & Tucson/Mexico Load Area						
	Generation Increase					
	Group A	Group B	Group C	**Total**		
CATS Base_S1 Configuration	5200	1750	0	**6950**		
PNM_ALT_1_S1 Configuration	6300	2300	0	**8300**		
	Incremental Load			Import/Export Totals		
	Phoenix Load Increase	Tucson/ SWTC/ Mexico Load Increase	Total Load Increase	Phoenix Total Import	Tucson Area Total Import	Mexico Total Import
05 HS Pre-Stress Reference→				7905	2560	500
CATS Base_S1 Configuration	4800	1800	6600	13223	3875	1000
PNM_ALT_1_S1 Configuration	5500	2650	8150	13832	4765	1000
Stressing increase with PNM_ALT_1 over Base Configuration	**700**	**850**	**1550**	**609**	**890**	**0**

PNM Table 8 - Limiting Conditions for Reduced Build Sensitivity and Scenario 3 Stressing

Stressing Scenario 2: Group A and B Generation to Phoenix & Tucson/Mexico Load Area				
		Loading (% of Rating)		
Branch	Contingency	Base Configuration	PNM_ALT_1 Configuration	Rating (Amps/MVA)
Springervl-Greenlee 345 kV	None	103.1%	106.1%	1247/745
Springervl-Vail 345 kV	None	103.4%	100.8%	1115/666
Springervl-Greenlee 345 kV	Springervl-Vail2 345 kV	99.0%	100.2%	1690/1010
Springervl-Vail 345 kV	Springer-Greenlee 345 kV	100.0%	98.7%	1439/860
Jojoba-Kyrene 500 kV	Palo Verde-Estrella 500 kV	100.3%	96.3%	3000/2728

Scenario 3 Stressing

The amount of non-simultaneous incremental load served in the Tucson area and south to Mexico from group A generation under a reduced initial build scenario was determined to be 1750 MW for the SES-Winchester alternative configuration. With the PNM alternative, the amount of load that could be served increased by 600 MW to 2350 MW. Both the SES-Winchester alternative configuration and the PNM alternative configuration were limited by overloads on the Springerville-Greenlee 345 kV line and Springerville-Vail 345 kV line. The results are summarized in PNM Table 9 and PNM Table 10 below.

PNM Table 9 - Stressing Information for Reduced Build Sensitivity and Scenario 3 Stressing

Stressing Scenario 3: Group A Generation to Tucson/Mexico Load Area						
	Generation Increase					
	Group A	Group B	Group C	**Total**		
CATS Base Configuration	1890	0	0	**1890**		
PNM_ALT_1 Configuration	2500	0	0	**2500**		
	Incremental Load			Import/Export Totals		
	Phoenix Load Increase	Tucson/ SWTC/ Mexico Load Increase	Total Load Increase	Phoenix Total Import	Tucson Area Total Import	Mexico Total Import
05 HS Pre-Stress Reference→				7905	2560	500
CATS Base Configuration	0	1750	1750	8319	3828	1000
PNM_ALT_1 Configuration	0	2350	2350	8231	4442	1000
Stressing increase with PNM_ALT_1 over Base Configuration	**0**	**600**	**600**	**-88**	**614**	**0**

PNM Table 10 - Limiting Conditions for Reduced Build Sensitivity and Scenario 3 Stressing

Stressing Scenario 3: Group A Generation to Tucson/Mexico Load Area				
		Loading (% of Rating)		
Branch	Contingency	Base Configuration	PNM_ALT_1 Configuration	Rating (Amps/MVA)
Springervl-Greenlee 345 kV	None	104.0%	107.2%	1247/745
Springervl-Vail 345 kV	None	105.0%	101.9%	1115/666
Springervl-Greenlee 345 kV	Springervl-Vail2 345 kV	100%	101.0%	1690/1010
Springervl-Vail 345 kV	Springer-Greenlee 345 kV	101.3%	99.6%	1439/860

Conclusions

The study analysis shows that for a full CATS system recommended development, replacing one of the proposed 500 kV circuits from the Palo Verde Area to Saguaro and the proposed Saguaro/Tortolita to South 345 kV line with the PNM alternative would increase transfer capability from the Group A and Group B generation to the combined Tucson area/Mexico load by 450 to 500 MW, an increase of approximately 20 percent over the base configuration.

The sensitivity cases looking at a reduced initial CATS base system development show a similar but more dramatic increase in transfer capability of the PNM alternative over the SES-Winchester alternative. These results affect both the Phoenix and Tucson/Mexico load areas with a potential 14% (700 MW) increase in transfer capability to the Phoenix area and between a 48% and 65% (600 to 850 MW) increase to the Tucson/Mexico load area.

Follow-up Recommendations

CATS Phase III

More clearly define the objectives to be met by the CATS project components. Develop final CATS configuration recommendations along with identifying the desired timing, if possible, of each individual recommended section.

For the PNM alternative specifically, define desired system interconnection configuration and timing and assess whether there is any impact of replacing one of the Palo Verde/Hassayampa to Jojoba 500 kV lines with the two 345 kV circuits comprising PNM's planned Palo Verde to Mexico system.

Western Area Power Administration

The Western Area Power Administration (WAPA) studied transmission alternatives 5 & 6, listed on page 16. The summary of WAPA's technical results is being drafted. There was insufficient time to complete the documentation and review of their work before the Phase II report was published. After WAPA's work is reviewed by the Technical Work Group and approved by the Steering Committee, it will be published as an addendum to the Phase II Report.

Tables

Table 1

Dispatch Palo Verde Area Generation to Tucson

TEP Load 4266 MW; SWTC Load 952 MW; Citizen's Load 72 MW

From bus			To bus				Maximum Contingency Load (p.u. of Emergency Rating) & Contingency Numbers																	
Number	Name	kV	Number	Name	kV	Ck	Base	Cont	Alt1	Cont	Alt2	Cont	Alt3	Cont	Alt4	Cont	Alt5	Cont	Alt6	Cont	Alt 7	Cont	Alt 9	Cont
17005	BICKNELL	345	17004	BICKNELL	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.00	250	1.00	250
16109	WINCHSTR	345	16002	WINCHSTR	500	1	1.10	368	1.00	277	1.46	542	1.29	542	1.28	542	1.36	542	1.34	542	1.20	402	1.09	402
16104	SPRINGR	345	16106	VAIL2	345	1	1.05	283	1.10	283	1.17	283	1.14	283	1.14	283	1.18	283	1.18	283	1.13	283	1.10	283
16109	WINCHSTR	345	16105	VAIL	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17007	BUTERFLE	230	17002	APACHE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16702	SONOITA	115	16703	VALENCIA	115	1	---	---	---	---	---	---	1.05	542	1.40	286	1.03	288	1.39	286	---	---	---	---
16105	VAIL	345	16103	SOUTH	345	1	---	---	---	---	---	---	---	---	1.02	542	---	---	1.05	542	---	---	---	---
16104	SPRINGR	345	16101	GREENLEE	345	1	1.02	285	1.08	285	1.03	141	1.11	285	1.10	285	1.14	285	1.14	285	1.10	284	1.07	284
14004	WESTWING	500	16107	WESTWING	345	1	---	---	1.1	368	1.14	141	1.00	141	1.08	286	1.00	1	1.14	368	1.11	401	---	---
14000	CHOLLA	500	15041	SILVERKG	500	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.00	126

Alt 1 Base with Saguaro-Winchester in place of SES-Winchester

Alt 2 Base w/o Mobile-Saguaro (w/o Mobile-Toltec when Toltec in-servi

Alt 3 Base w/o Saguaro-South

Alt 4 Base w/o Saguaro-South, w/o Vail-South #2

Alt 5 Base w/o Saguaro-South & Saguaro-Winchester in place of SES-Winchester

Alt 6 Base w/o Saguaro-South, w/o Vail-South #2, & Saguaro-Winchester in place of SES-Winchester

Alt 7 Base w/o Mobile-Saguaro; SES-Carpas, Carpas-Winchester, Carpas-Saguaro

Alt 9 Base w/o Mobile-Saguaro; SES-Carpas, Carpas-Winchester, Carpas-Saguaro, Cholla-Saguaro/Silver King Tie-in

Contingency Lists Subset

From bus			To bus				
Number	Name	kV	Number	Name	kV	Ck	Num
14004	SAGUARO	500	16002	WINCHSTR	500	1	1
16002	WINCHSTR	500	15070	STHESTS	500	1	141
16111	TORTOLI	345	16103	SOUTH	345	1	277
16104	SPRINGR	345	16101	GREENLEE	345	1	283
16104	SPRINGR	345	16106	VAIL2	345	1	285
16105	VAIL	345	16103	SOUTH	345	1	286
16107	WESTWING	345	16103	SOUTH	345	1	288
16800	TOLTEC	500	14004	SAGUARO	345	1	368
16107	WESTWING	345	14005	WESTWING	500	1	542
15001	CORONADO	500	15041	SILVERKG	500	1	126
17002	APACHE	230	17007	BUTERFLE	230	1	250
16104	SPRINGR	345	16101	GREENLEE	345	1	283
16104	SPRINGR	345	16106	VAIL2	345	1	284
16004	CARPAS	500	16002	WINCHSTR	500	1	401
14004	SAGUARO	500	16004	CARPAS	500	1	402

Table 2

From bus			To bus				Maximum Contingency Load (p.u. of Emergency Rating) & Contingency Number											
Number	Name	kV	Number	Name	kV	Ck	Base	Cont	Alt1	Cont	Alt2	Cont	Alt3	Cont	Alt4	Cont	Alt5	Cont	Alt6	Cont
17012	MARANA	115	17003	AVRA	115	1	1.16	525	1.16	---	1.17	---	1.17	---	1.17	---	1.16	---	1.16	---
17003	AVRA	115	17022	THREEPNT	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17012	MARANA	115	17013	MARANATP	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17008	DOSCONDO	230	17035	DOSCONDO	69	2	1.31	532	1.31	---	1.31	---	1.31	---	1.31	---	1.31	---	1.31	---
17008	DOSCONDO	230	17035	DOSCONDO	69	1	1.31	533	1.31	---	1.31	---	1.31	---	1.31	---	1.31	---	1.31	---
17010	GREEN-AE	345	17009	GREEN-AE	230	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17010	GREEN-AE	345	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17005	BICKNELL	345	17004	BICKNELL	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17000	APACHE	69	17001	APACHE	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16002	WINCHSTR	500	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17017	GREEN-PD	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16104	SPRINGR	345	16106	VAIL2	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17007	BUTERFLD	230	17002	APACHE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16702	SONOITA	115	16703	VALENCIA	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Alt 1	Base with Saguaro-Winchester in place of SES-Winchester
Alt 2	Base w/o Mobile-Saguaro (w/o Mobile-Toltec when Toltec in-service
Alt 3	Base w/o Saguaro-South
Alt 4	Base w/o Saguaro-South, w/o Vail-South #2
Alt 5	Base w/o Saguaro-South & Saguaro-Winchester in place of SES-Winchester
Alt 6	Base w/o Saguaro-South, w/o Vail-South #2, & Saguaro-Winchester in place of SES-Winchester

Contingency Lists Subset

From bus			To bus				
Number	Name	kV	Number	Name	kV	Ck	Num
17004	BICKNELL	230	17006	BICKNELL	115	1	525
17035	DOSCONDO	69	17008	DOSCONDO	230	1	532
17035	DOSCONDO	69	17008	DOSCONDO	230	2	533

Table 3

Dispatch Bowie Generation to Phoenix

TEP Load 1748 MW; SWTC Load 493 MW; Citizen's Load 50 MW

From bus			To bus				Maximum Contingency Load (p.u. of Emergency Rating) & Contingency Number													
Number	Name	kV	Number	Name	kV	Ck	Base	Cont	Alt1	Cont	Alt2	Cont	Alt3	Cont	Alt4	Cont	Alt5	Cont	Alt6	Cont
17012	MARANA	115	17003	AVRA	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17003	AVRA	115	17022	THREEPNT	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17012	MARANA	115	17013	MARANATP	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17008	DOSCONDO	230	17035	DOSCONDO	69	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17008	DOSCONDO	230	17035	DOSCONDO	69	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17010	GREEN-AE	345	17009	GREEN-AE	230	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17010	GREEN-AE	345	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17005	BICKNELL	345	17004	BICKNELL	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17000	APACHE	69	17001	APACHE	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16002	WINCHSTR	500	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17017	GREEN-PD	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16104	SPRINGR	345	16106	VAIL2	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17007	BUTERFLD	230	17002	APACHE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16702	SONOITA	115	16703	VALENCIA	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Alt 1 Base with Saguaro-Winchester in place of SES-Winchester

Alt 2 Base w/o Mobile-Saguaro (w/o Mobile-Toltec when Toltec in-service

Alt 3 Base w/o Saguaro-South

Alt 4 Base w/o Saguaro-South, w/o Vail-South #2

Alt 5 Base w/o Saguaro-South & Saguaro-Winchester in place of SES-Winchester

Alt 6 Base w/o Saguaro-South, w/o Vail-South #2, & Saguaro-Winchester in place of SES-Winchester

Table 4

Dispatch Springerville Expansion, Bowie, and Winchester Generation to Tucson

TEP Load 3609 MW; SWTC Load 860 MW; Citizen's Load 72 MW

From bus			To bus				Maximum Contingency Load (p.u. of Emergency Rating) & Contingency Number											
Number	Name	kV	Number	Name	kV	Ck	Base	Cont	Alt1	Cont	Alt2	Cont	Alt3	Cont	Alt4	Cont	Alt5	Cont	Alt6	Cont
17012	MARANA	115	17003	AVRA	115	1	1.17	525	1.17	525	1.19	525	1.18	525	1.18	525	1.17	525	1.17	525
17003	AVRA	115	17022	THREEPNT	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17012	MARANA	115	17013	MARANATP	115	1	---	---	---	---	1.00	525	---	---	---	---	---	---	---	---
17008	DOSCONDO	230	17035	DOSCONDO	69	2	1.31	532	1.31	532	1.31	532	1.31	532	1.31	532	1.31	532	1.31	532
17008	DOSCONDO	230	17035	DOSCONDO	69	1	1.31	533	1.31	533	1.31	533	1.31	533	1.31	533	1.31	533	1.31	533
17010	GREEN-AE	345	17009	GREEN-AE	230	2	1.10	400	1.11	400	1.11	400	1.11	400	1.11	400	1.11	400	1.11	400
17010	GREEN-AE	345	17009	GREEN-AE	230	1	1.04	400	1.04	400	1.05	400	1.04	400	1.04	400	1.05	400	1.05	400
17005	BICKNELL	345	17004	BICKNELL	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17000	APACHE	69	17001	APACHE	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16002	WINCHSTR	500	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17017	GREEN-PD	230	1	---	---	---	---	1.00	262	---	---	---	---	1.00	262	---	---
17014	MORENCI	230	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16104	SPRINGR	345	16106	VAIL2	345	1	---	---	---	---	1.02	50	---	---	---	---	1.02	283	1.01	283
16109	WINCHSTR	345	16105	VAIL	345	1	1.08	3	---	---	1.17	3	1.14	3	1.13	3	1.05	3	1.04	3
16109	WINCHSTR	345	16105	VAIL	345	2	1.08	2	---	---	1.17	2	1.14	2	1.13	2	1.05	2	1.04	2
17007	BUTERFLD	230	17002	APACHE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16702	SONOITA	115	16703	VALENCIA	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Alt 1 Base with Saguaro-Winchester in place of SES-Winchester

Alt 2 Base w/o Mobile-Saguaro (w/o Mobile-Toltec when Toltec in-service

Alt 3 Base w/o Saguaro-South

Alt 4 Base w/o Saguaro-South, w/o Vail-South #2

Alt 5 Base w/o Saguaro-South & Saguaro-Winchester in place of SES-Winchester

Alt 6 Base w/o Saguaro-South, w/o Vail-South #2, & Saguaro-Winchester in place of SES-Winchester

Contingency Lists Subset

From bus			To bus				
Number	Name	kV	Number	Name	kV	Ck	Num
16109	WINCHSTR	345	16105	VAIL	345	1	2
16109	WINCHSTR	345	16105	VAIL	345	2	3
14000	CHOLLA	500	14004	SAGUARO	500	1	50
17104	MORENCI	230	17009	GREEN-AE	230	1	262
16104	SPRINGR	345	16101	GREENLEE	345	1	283
17014	MORENCI	230	17107	GREEN-PD	230	1	400
17004	BICKNELL	230	17006	BICKNELL	115	1	525
17035	DOSCONDO	69	17008	DOSCONDO	230	1	532
17035	DOSCONDO	69	17008	DOSCONDO	230	2	533

Table 5

Dispatch Springerville Expansion, Bowie, and Winchester Generation to Phoenix

TEP Load 1748 MW; SWTC Load 493 MW; Citizen's Load 50 MW

From bus			To bus				Maximum Contingency Load (p.u. of Emergency Rating) & Contingency Number											
Number	Name	kV	Number	Name	kV	Ck	Base	Cont	Alt1	Cont	Alt2	Cont	Alt3	Cont	Alt4	Cont	Alt5	Cont	Alt6	Cont
17012	MARANA	115	17003	AVRA	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17003	AVRA	115	17022	THREEPNT	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17012	MARANA	115	17013	MARANATP	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17008	DOSCONDO	230	17035	DOSCONDO	69	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17008	DOSCONDO	230	17035	DOSCONDO	69	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17010	GREEN-AE	345	17009	GREEN-AE	230	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17010	GREEN-AE	345	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17005	BICKNELL	345	17004	BICKNELL	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17000	APACHE	69	17001	APACHE	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16002	WINCHSTR	500	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17017	GREEN-PD	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16104	SPRINGR	345	16106	VAIL2	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17007	BUTERFLD	230	17002	APACHE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16702	SONOITA	115	16703	VALENCIA	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16100	CORONADO	345	15001	CORONADO	500	1	1.15	551	1.18	285	1.15	285	1.15	141	1.16	141	1.18	551	1.18	551
16100	CORONADO	345	16104	SPRINGR	345	1	1.00	285	1.03	285	1.01	285	1.01	141	1.02	141	1.03	285	1.03	285

Alt 1 Base with Saguaro-Winchester in place of SES-Winchester

Alt 2 Base w/o Mobile-Saguaro (w/o Mobile-Toltec when Toltec in-service

Alt 3 Base w/o Saguaro-South

Alt 4 Base w/o Saguaro-South, w/o Vail-South #2

Alt 5 Base w/o Saguaro-South & Saguaro-Winchester in place of SES-Winchester

Alt 6 Base w/o Saguaro-South, w/o Vail-South #2, & Saguaro-Winchester in place of SES-Winchester

Contingency Lists Subset

From bus			To bus				
Number	Name	kV	Number	Name	kV	Ck	Num
16002	WINCHSTR	500	15070	STHESTST	500	1	141
16104	SPRINGR	345	16106	VAIL2	345	1	285
16106	VAIL2	345	16220	VAIL2	138	1	551

Table 6

Dispatch Springerville Expansion, Bowie, and Winchester Generation to Phoenix & Tucson

TEP Load 1748 MW; SWTC Load 493 MW; Citizen's Load 50 MW

From bus			To bus				Maximum Contingency Load (p.u. of Emergency Rating) & Contingency Number													
Number	Name	kV	Number	Name	kV	Ck	Base	Cont	Alt1	Cont	Alt2	Cont	Alt3	Cont	Alt4	Cont	Alt5	Cont	Alt6	Cont
17012	MARANA	115	17003	AVRA	115	1	1.17	525	1.16	525	1.17	525	1.17	525	1.17	525	1.17	525	1.17	525
17003	AVRA	115	17022	THREEPNT	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17012	MARANA	115	17013	MARANATP	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17008	DOSCONDO	230	17035	DOSCONDO	69	2	1.31	532	1.31	532	1.31	532	1.31	532	1.31	532	1.31	532	1.31	532
17008	DOSCONDO	230	17035	DOSCONDO	69	1	1.31	533	1.31	533	1.31	533	1.31	533	1.31	533	1.31	533	1.31	533
17010	GREEN-AE	345	17009	GREEN-AE	230	2	1.02	400	1.02	400	1.03	400	1.03	400	1.02	400	1.02	400	1.02	400
17010	GREEN-AE	345	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17005	BICKNELL	345	17004	BICKNELL	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17000	APACHE	69	17001	APACHE	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16002	WINCHSTR	500	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17017	GREEN-PD	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16104	SPRINGR	345	16106	VAIL2	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17007	BUTERFLD	230	17002	APACHE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16702	SONOITA	115	16703	VALENCIA	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16100	CORONADO	345	15001	CORONADO	500	1	1.02	551	1.01	285	1.01	551	1.00	285	1.01	551	---	---	1.00	551
16100	CORONADO	345	16104	SPRINGR	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Alt 1 Base with Saguaro-Winchester in place of SES-Winchester

Alt 2 Base w/o Mobile-Saguaro (w/o Mobile-Toltec when Toltec in-service

Alt 3 Base w/o Saguaro-South

Alt 4 Base w/o Saguaro-South, w/o Vail-South #2

Alt 5 Base w/o Saguaro-South & Saguaro-Winchester in place of SES-Winchester

Alt 6 Base w/o Saguaro-South, w/o Vail-South #2, & Saguaro-Winchester in place of SES-Winchester

Contingency Lists Subset

From bus			To bus				
Number	Name	kV	Number	Name	kV	Ck	Num
16104	SPRINGR	345	16106	VAIL2	345	1	285
17014	MORENCI	230	17107	GREEN-PD	230	1	400
17004	BICKNELL	230	17006	BICKNELL	115	1	525
17035	DOSCONDO	69	17008	DOSCONDO	230	1	532
17035	DOSCONDO	69	17008	DOSCONDO	230	2	533
16106	VAIL2	345	16220	VAIL2	138	1	551

Table 7

Dispatch Toltec Generation to Phoenix

TEP Load 1748 MW; SWTC Load 493 MW; Citizen's Load 50 MW

From bus			To bus				Maximum Contingency Load (p.u. of Emergency Rating) & Contingency Number													
Number	Name	kV	Number	Name	kV	Ck	Base	Cont	Alt1	Cont	Alt2	Cont	Alt3	Cont	Alt4	Cont	Alt5	Cont	Alt6	Cont
17012	MARANA	115	17003	AVRA	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17003	AVRA	115	17022	THREEPNT	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17012	MARANA	115	17013	MARANATP	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17008	DOSCONDO	230	17035	DOSCONDO	69	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17008	DOSCONDO	230	17035	DOSCONDO	69	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17010	GREEN-AE	345	17009	GREEN-AE	230	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17010	GREEN-AE	345	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17005	BICKNELL	345	17004	BICKNELL	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17000	APACHE	69	17001	APACHE	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16002	WINCHSTR	500	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17017	GREEN-PD	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16104	SPRINGR	345	16106	VAIL2	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17007	BUTERFLD	230	17002	APACHE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16702	SONOITA	115	16703	VALENCIA	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16100	CORONADO	345	15001	CORONADO	500	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16100	CORONADO	345	16104	SPRINGR	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16800	TOLTEC	500	16801	TOLTEC	345	1	---	---	---	---	1.12	367	---	---	---	---	---	---	---	---
16800	TOLTEC	500	16801	TOLTEC	345	2	---	---	---	---	1.12	367	---	---	---	---	---	---	---	---

Alt 1 Base with Saguaro-Winchester in place of SES-Winchester

Alt 2 Base w/o Mobile-Saguaro (w/o Mobile-Toltec when Toltec in-service

Alt 3 Base w/o Saguaro-South

Alt 4 Base w/o Saguaro-South, w/o Vail-South #2

Alt 5 Base w/o Saguaro-South & Saguaro-Winchester in place of SES-Winchester

Alt 6 Base w/o Saguaro-South, w/o Vail-South #2, & Saguaro-Winchester in place of SES-Winchester

Contingency Lists Subset

From bus			To bus				
Number	Name	kV	Number	Name	kV	Ck	Num
16800	TOLTEC	500	14004	SAGUARO	500	1	367

Table 8

Dispatch Toltec Generation to Tucson

TEP Load 3214 MW; SWTC Load 805 MW; Citizen's Load 72 MW

From bus			To bus				Maximum Contingency Load (p.u. of Emergency Rating) & Contingency Number													
Number	Name	kV	Number	Name	kV	Ck	Base	Cont	Alt1	Cont	Alt2	Cont	Alt3	Cont	Alt4	Cont	Alt5	Cont	Alt6	Cont
17012	MARANA	115	17003	AVRA	115	1	1.40	524	1.39	524	1.40	524	1.41	524	1.41	524	1.40	524	1.40	524
17003	AVRA	115	17022	THREEPNT	115	1	1.09	524	1.08	524	1.10	524	1.10	524	1.10	524	1.09	524	1.09	524
17012	MARANA	115	17013	MARANATP	115	1	1.16	524	1.15	524	1.16	524	1.17	524	1.17	524	1.16	524	1.16	524
17008	DOSCONDO	230	17035	DOSCONDO	69	2	1.46	531	1.46	531	1.46	531	1.46	531	1.46	531	1.46	531	1.46	531
17008	DOSCONDO	230	17035	DOSCONDO	69	1	1.46	532	1.46	532	1.46	532	1.46	532	1.46	532	1.46	532	1.46	532
17010	GREEN-AE	345	17009	GREEN-AE	230	2	1.08	399	1.08	399	1.08	399	1.09	399	1.09	399	1.08	399	1.08	399
17010	GREEN-AE	345	17009	GREEN-AE	230	1	1.02	399	1.02	399	1.02	399	1.03	399	1.03	399	1.02	399	1.02	399
17005	BICKNELL	345	17004	BICKNELL	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17000	APACHE	69	17001	APACHE	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16002	WINCHSTR	500	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17017	GREEN-PD	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17014	MORENCI	230	17009	GREEN-AE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16104	SPRINGR	345	16106	VAIL2	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16109	WINCHSTR	345	16105	VAIL	345	2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
17007	BUTERFLD	230	17002	APACHE	230	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16702	SONOITA	115	16703	VALENCIA	115	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16100	CORONADO	345	15001	CORONADO	500	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16100	CORONADO	345	16104	SPRINGR	345	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---
16800	TOLTEC	500	16801	TOLTEC	345	1	---	---	---	---	1.13	367	---	---	---	---	---	---	---	---
16800	TOLTEC	500	16801	TOLTEC	345	2	---	---	---	---	1.13	367	---	---	---	---	---	---	---	---
16801	TOLTEC	345	16103	SOUTH	345	1	---	---	---	---	1.13	367	---	---	---	---	---	---	---	---

Alt 1 Base with Saguaro-Winchester in place of SES-Winchester

Alt 2 Base w/o Mobile-Saguaro (w/o Mobile-Toltec when Toltec in-service

Alt 3 Base w/o Saguaro-South

Alt 4 Base w/o Saguaro-South, w/o Vail-South #2

Alt 5 Base w/o Saguaro-South & Saguaro-Winchester in place of SES-Winchester

Alt 6 Base w/o Saguaro-South, w/o Vail-South #2, & Saguaro-Winchester in place of SES-Winchester

Contingency Lists Subset

From bus			To bus				
Number	Name	kV	Number	Name	kV	Ck	Num
16800	TOLTEC	500	14004	SAGUARO	500	1	367
17014	MORENCI	230	17107	GREEN-PD	230	1	399
17004	BICKNELL	230	17006	BICKNELL	115	1	524
17035	DOSCONDO	69	17008	DOSCONDO	230	1	531
17035	DOSCONDO	69	17008	DOSCONDO	230	2	532

Table 9

Stressing: Palo Verde Area Generation into Phoenix Metro					
APS Alternatives Comparison					
Alternative	**Limiting Element**	**%Loading**	**Outage**	**Stressing**	**PHX Import**
Base Case (1-JJ-Mobile)	Jojob-Kyrene 500KV Line	100.3	Palo Verde-Estrella	4150 MW	12297 MW
Alt. 2 (2-JJ-Mobile)	Jojob-Kyrene 500KV Line	101	Palo Verde-Estrella	4350 MW	12497 MW
Alt. 1 (JJ-Mob., Watrmlon-Mobile)	Jojob-Kyrene 500KV Line	100.6	Palo Verde-Estrella	4350 MW	12492 MW
Alternative w/ Silverking Cut-in	**Limiting Element**	**%Loading**	**Outage**	**Stressing**	**PHX Import**
Base Case (1-JJ-Mobile)	Jojob-Kyrene 500KV Line	100.9	Palo Verde-Estrella	4650 MW	12800 MW
Alt. 2 (2-JJ-Mobile)	Jojob-Kyrene 500KV Line	101	Palo Verde-Estrella	4850 MW	12998 MW
Alt. 1 (JJ-Mob., Watrmlon-Mobile)	Jojob-Kyrene 500KV Line	100.6	Palo Verde-Estrella	4850 MW	12994 MW
NOTE: JJ-KYX LINE RATED AT 2292 MVA					

Table 10

BASE CASE BENCH MARK

STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA SAGUARO 500KV LINE	1026	109	1117	CORONADO SILVERKING 500KV LINE	BASE CASE
SANTAN CORBELL 230KV LINE	1100	126	1389	CORBEL KYRENE 230KV LINE	BASE CASE
SANTAN CORBELL 230KV LINE	1100	101	1111	SANTAN THUNDRSTONE 230KV LINE	BASE CASE
SANTAN THUNDERSTONE 230KV LINE	1100	119	1311	SILVERKING 500/230KV BK # 1	BASE CASE
KYRENE 500/230 KV BK #6	1233	101	1245	KYRENE 500/230KV BK #7	+ 3000MW
RUDD 500/230KV BK # 3	600	103	620	RUDD 500/230KV BK #1	+ 3000MW
RUDD 500/230KV BK # 2	600	103	620	RUDD 500/230KV BK #1	+ 3000MW
JOJOBA KYRENE 500KV LINE	2647	107	2833	PALOVERDE RUDD 500KV LINE	+ 5000MW
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW

Table 11

SRP ALTERNATIVE #1

LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SILVER-KING 500KV STATION
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
	1310	94	1231		WITH ALT #1
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
	2647	112	2988		WITH ALT #1

Table 12

SRP ALTERNATIVE #2

LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SOUTH EAST 500KV STATION
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
	1310	100	1315		WITH ALT #2
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
	2647	110	2933		WITH ALT #2

Table 13

SRP ALTERNATIVE #3

LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SOUTH EAST STATION
LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SILVER-KING 500KV STATION
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
	1310	86.0	1131		WITH ALT #3
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
	2647	109	2874		WITH ALT #3

Table 14

BASE CASE BENCH MARK
Sensitivity 1

WITH WINCHESTER TO SAGAURO
WITHOUT SES TO WINCHESTER
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA SAGUARO 500KV LINE	1026	109	1117	CORONADO SILVERKING 500KV LINE	BASE CASE
SANTAN CORBELL 230KV LINE	1100	126	1389	CORBEL KYRENE 230KV LINE	BASE CASE
SANTAN CORBELL 230KV LINE	1100	101	1111	SANTAN THUNDRSTONE 230KV LINE	BASE CASE
SANTAN THUNDERSTONE 230KV LINE	1100	119	1311	SILVERKING 500/230KV BK # 1	BASE CASE
KYRENE 500/230 KV BK #6	1233	101	1245	KYRENE 500/230KV BK #7	+ 3000MW
RUDD 500/230KV BK # 3	600	103	620	RUDD 500/230KV BK #1	+ 3000MW
RUDD 500/230KV BK # 2	600	103	620	RUDD 500/230KV BK #1	+ 3000MW
JOJOBA KYRENE 500KV LINE	2647	107	2833	PALOVERDE RUDD 500KV LINE	+ 5000MW
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
		103	1351		SEN_1
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
		123	3250		SEN_1

Table 15

SRP ALTERNATIVE #1

Sensitivity 1

WITH WINCHESTER TO SAGAURO
WITHOUT SES TO WINCHESTER
LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SILVER-KING 500KV STATION
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
	1310	94	1231		WITH ALT #1
		95	1235		SEN_1 / ALT #1
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
	2647	112	2988		WITH ALT #1
		113	3000		SEN_1 / ALT #1

Table 16

SRP ALTERNATIVE #2

Sensitivity 1

WITH WINCHESTER TO SAGAURO
WITHOUT SES TO WINCHESTER
LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SOUTH EAST 500KV STATION
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
	1310	100	1315		WITH ALT #2
		100	1312		SEN_1 / ALT #2
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
	2647	110	2933		WITH ALT #2
		111	2934		SEN_1 / ALT #2

Table 17

SRP ALTERNATIVE #3
Sensitivity 1

WITH WINCHESTER TO SAGAURO
WITHOUT SES TO WINCHESTER
LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SOUTH EAST STATION
LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SILVER-KING 500KV STATION
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
	1310	86.0	1131		WITH ALT #3
		86.0	1130		SEN_1 / ALT #3
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
	2647	110	2933		WITH ALT #3
		108	2886		SEN_1 / ALT #3

Table 18

BASE CASE BENCH MARK
Sensitivity 2

WITH WINCHESTER TO SAGAURO
NO SES TO WINCHESTER
NO SAGAURO TO SOUTH
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA SAGUARO 500KV LINE	1026	109	1117	CORONADO SILVERKING 500KV LINE	BASE CASE
SANTAN CORBELL 230KV LINE	1100	126	1389	CORBEL KYRENE 230KV LINE	BASE CASE
SANTAN CORBELL 230KV LINE	1100	101	1111	SANTAN THUNDRSTONE 230KV LINE	BASE CASE
SANTAN THUNDERSTONE 230KV LINE	1100	119	1311	SILVERKING 500/230KV BK # 1	BASE CASE
KYRENE 500/230 KV BK #6	1233	101	1245	KYRENE 500/230KV BK #7	+ 3000MW
RUDD 500/230KV BK # 3	600	103	620	RUDD 500/230KV BK #1	+ 3000MW
RUDD 500/230KV BK # 2	600	103	620	RUDD 500/230KV BK #1	+ 3000MW
JOJOBA KYRENE 500KV LINE	2647	107	2833	PALOVERDE RUDD 500KV LINE	+ 5000MW
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
		103	1351		SEN_2
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
		124	3256		SEN_2

Table 19

SRP ALTERNATIVE #1
Sensitivity 2

WITH WINCHESTER TO SAGAURO
NO SES TO WINCHESTER
NO SAGAURO TO SOUTH
LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SILVER-KING 500KV STATION
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
	1310	94	1231		WITH ALT #1
		94	1234		SEN_2 / ALT #1
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
	2647	112	2988		WITH ALT #1
		113	2998		SEN_2 / ALT #1

Table 20

SRP ALTERNATIVE #2
Sensitivity 2

WITH WINCHESTER TO SAGAURO
NO SES TO WINCHESTER
NO SAGAURO TO SOUTH
LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SOUTH EAST 500KV STATION
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
	1310	100	1315		WITH ALT #2
		100	1309		SEN_2 / ALT #2
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
	2647	110	2933		WITH ALT #2
		111	2936		SEN_2 / ALT #2

Table 21

SRP ALTERNATIVE #3
Sensitivity 2

WITH WINCHESTER TO SAGAURO
NO SES TO WINCHESTER
NO SAGAURO TO SOUTH
LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SOUTH EAST STATION
LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SILVER-KING 500KV STATION
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
	1310	86.0	1131		WITH ALT #3
		86.0	1130		SEN_2 / ALT #3
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
	2647	110	2933		WITH ALT #3
		108	2888		SEN_2 / ALT #3

Table 22

BASE CASE BENCH MARK
Sensitivity 3

WITH WINCHESTER TO SAGAURO
NO SES TO WINCHESTER NO SAGAURO TO SOUTH
NO TOLTEC TO SAGURO NO TOLTEC TO MOBILE
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA SAGUARO 500KV LINE	1026	109	1117	CORONADO SILVERKING 500KV LINE	BASE CASE
SANTAN CORBELL 230KV LINE	1100	126	1389	CORBEL KYRENE 230KV LINE	BASE CASE
SANTAN CORBELL 230KV LINE	1100	101	1111	SANTAN THUNDRSTONE 230KV LINE	BASE CASE
SANTAN THUNDERSTONE 230KV LINE	1100	119	1311	SILVERKING 500/230KV BK # 1	BASE CASE
KYRENE 500/230 KV BK #6	1233	101	1245	KYRENE 500/230KV BK #7	+ 3000MW
RUDD 500/230KV BK # 3	600	103	620	RUDD 500/230KV BK #1	+ 3000MW
RUDD 500/230KV BK # 2	600	103	620	RUDD 500/230KV BK #1	+ 3000MW
JOJOBA KYRENE 500KV LINE	2647	107	2833	PALOVERDE RUDD 500KV LINE	+ 5000MW
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
		99	1297		SEN_3
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
		129	3421		SEN_3

Table 23

SRP ALTERNATIVE #1
Sensitivity 3

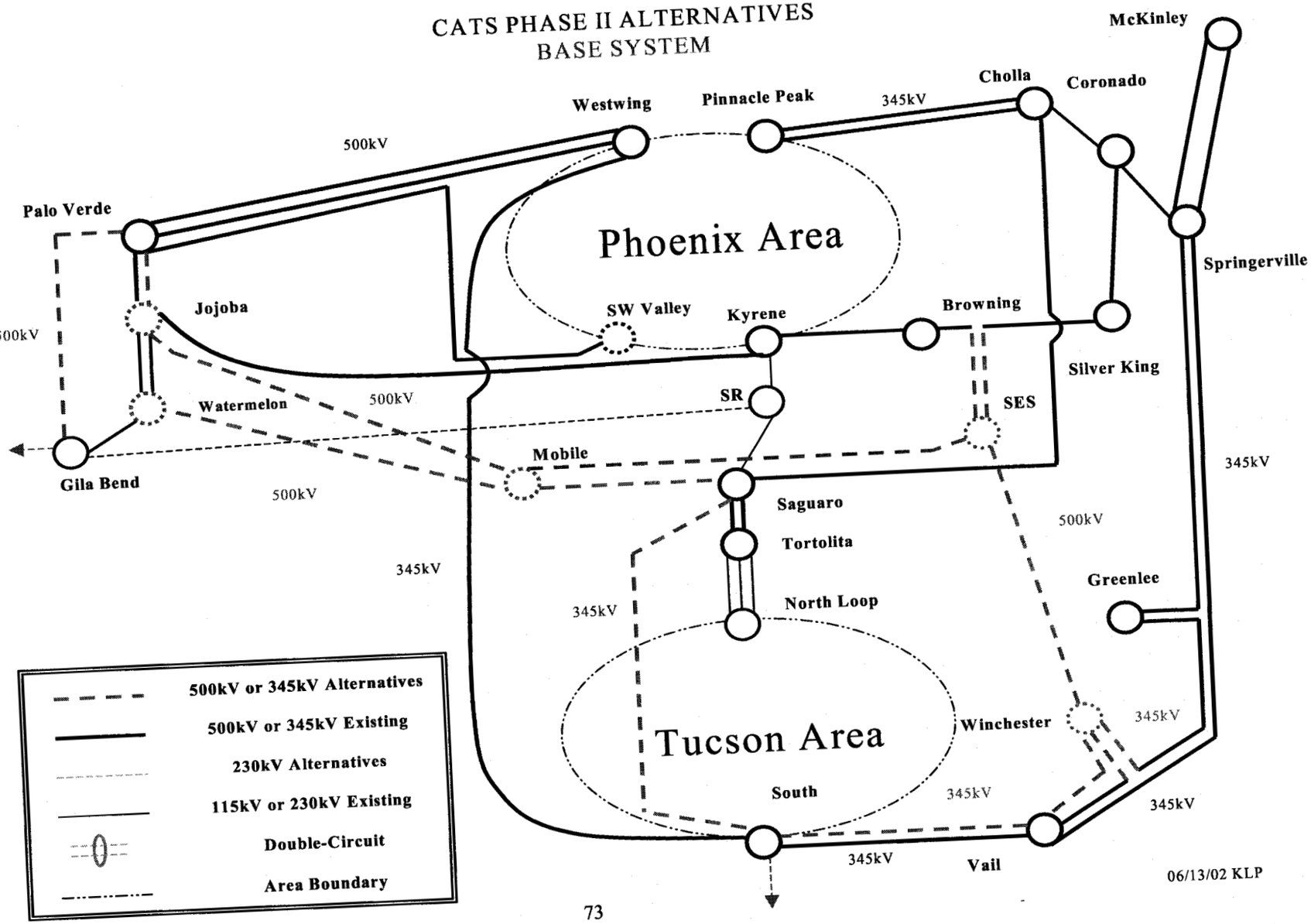
WITH WINCHESTER TO SAGAURO
NO SES TO WINCHESTER NO SAGAURO TO SOUTH
NO TOLTEC TO SAGURO NO TOLTEC TO MOBILE
LOOP-IN THE CHOLLA/SAGUARO 500KV LINE INTO THE SILVER-KING 500KV STATION
STRESSING: SCHEDULE PALO VERDE AREA GENERATION INTO THE PHOENIX AREA.

LINE / XFMR	RATING AMPS/MVA	PERCENT LOADING	AMP /MVA	OUTAGE	STRESSING
CHOLLA PRECHCYN 345KV LINE	1310	101	1332	CHOLLA PNPKAPS 345KV LINE	+ 6000MW
	1310	94	1231		WITH ALT #1
		99	1296		SEN_3 / ALT #1
JOJOBA KYRENE 500KV LINE	2647	120	3191	PALOVERDE RUDD 500KV LINE	+ 6000MW
	2647	112	2988		WITH ALT #1
		125	3315		SEN_3 / ALT #1

Appendices

Appendix 1

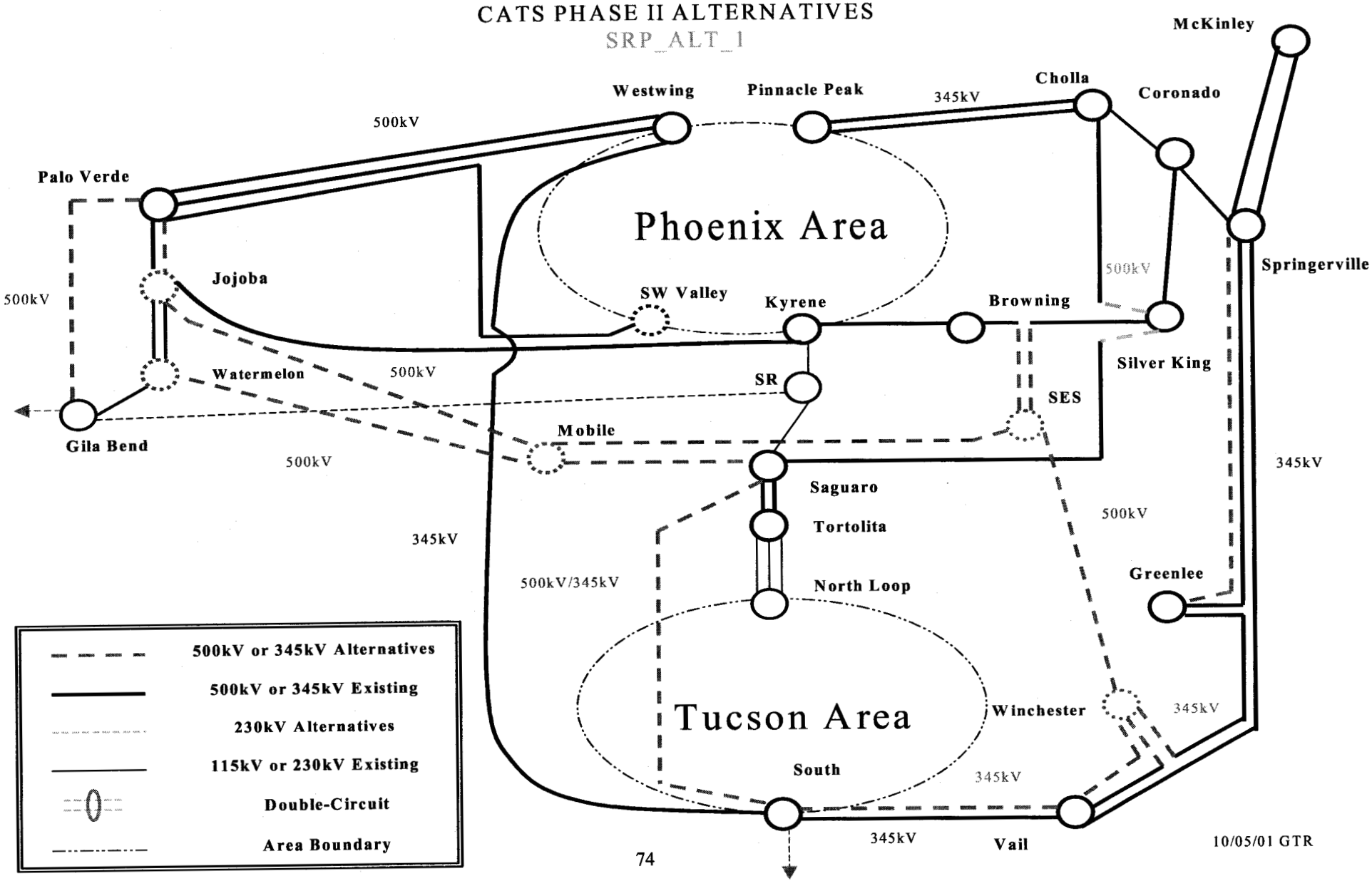
CATS PHASE II ALTERNATIVES
BASE SYSTEM



Appendix 2

CATS PHASE II ALTERNATIVES

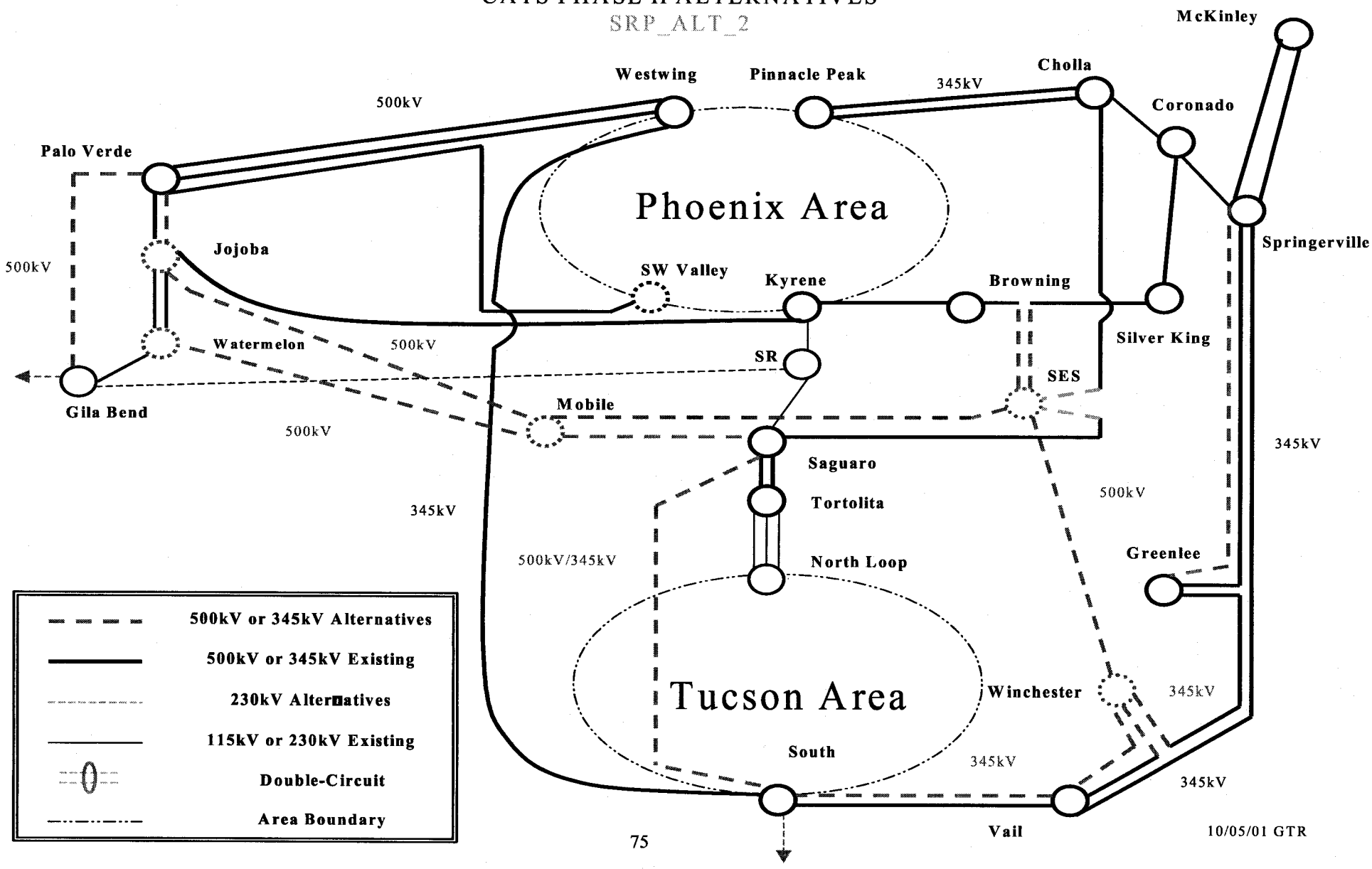
SRP_ALT_1



Appendix 3

CATS PHASE II ALTERNATIVES

SRP_ALT_2

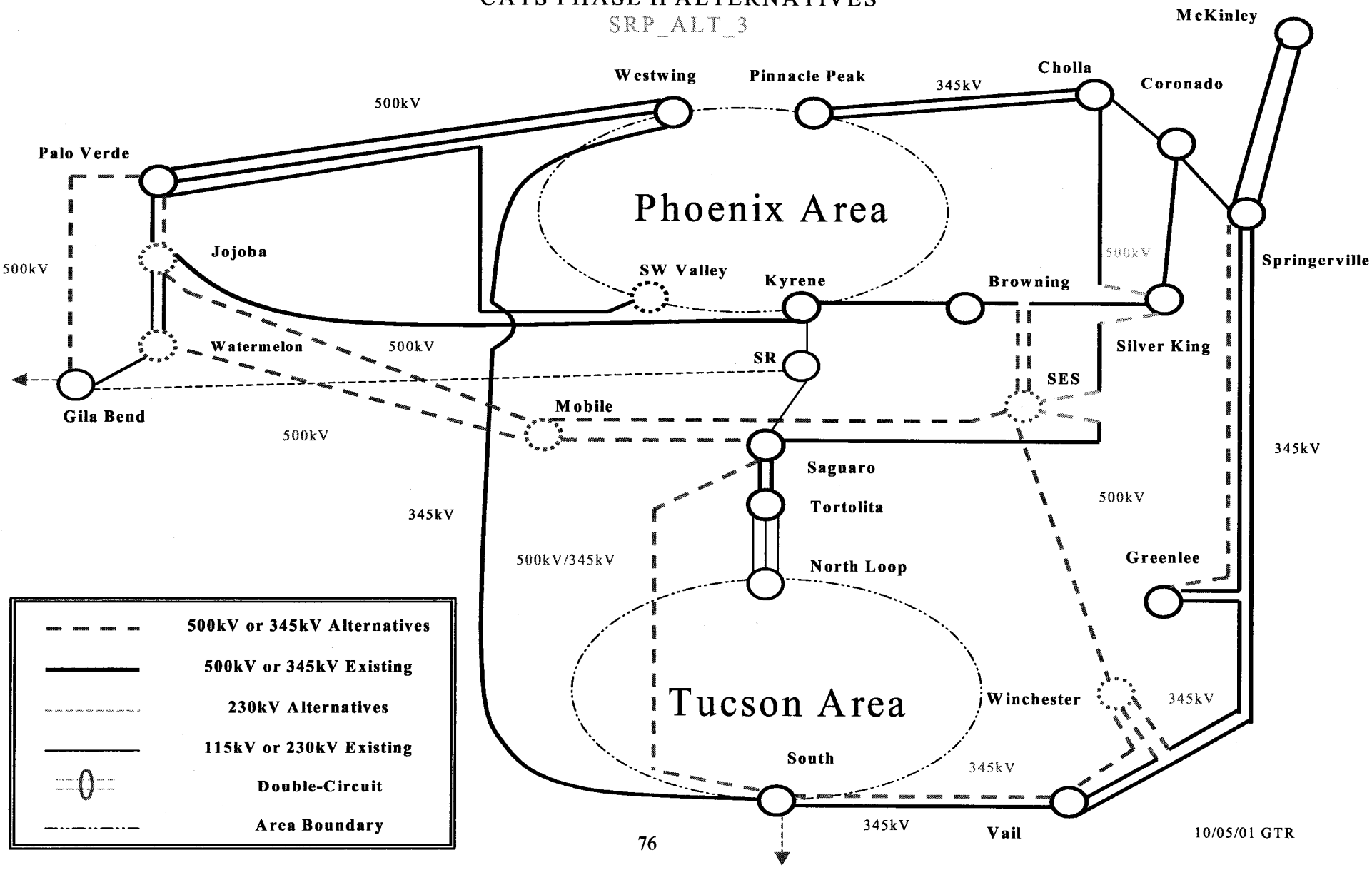


10/05/01 GTR

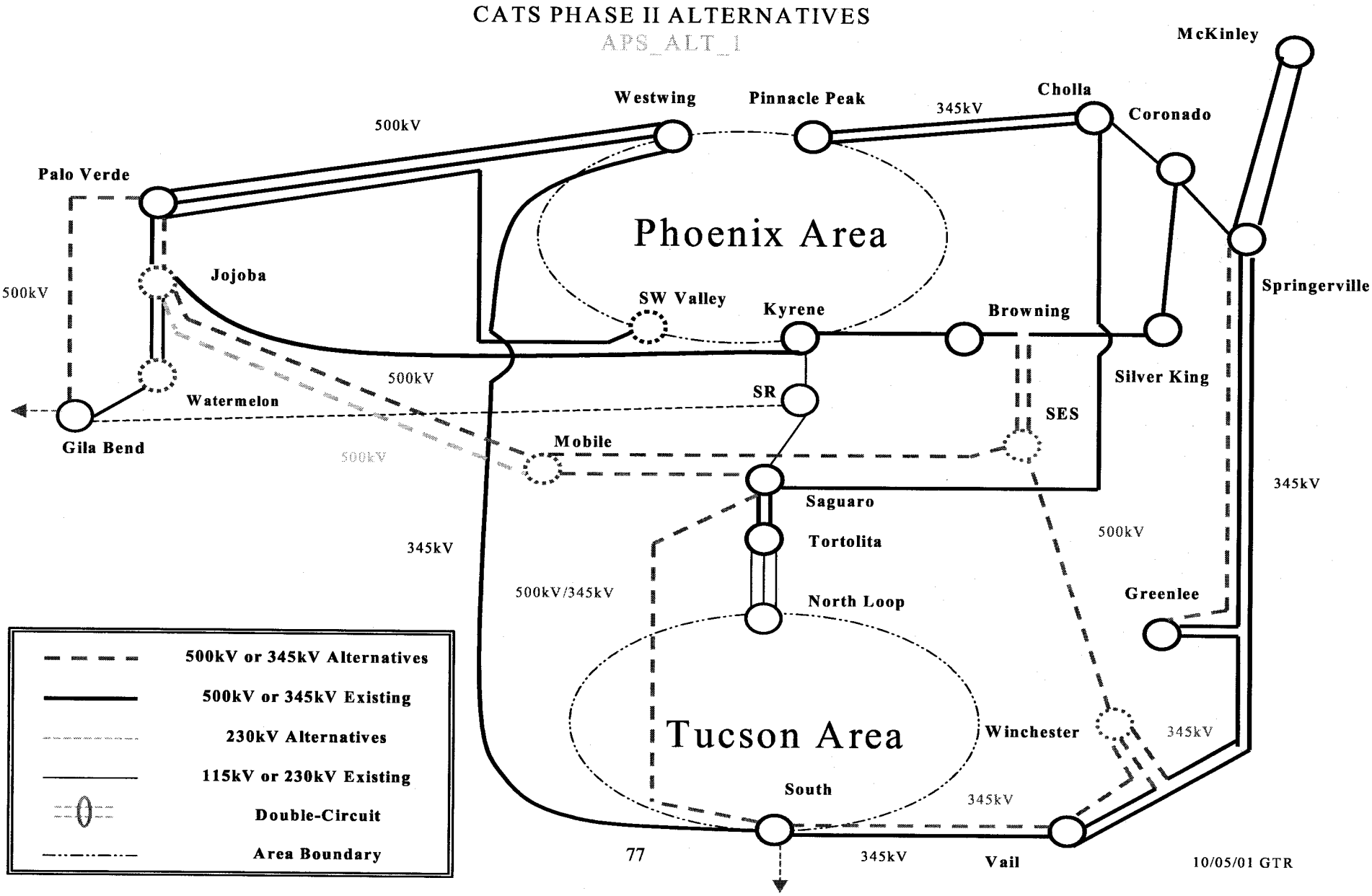
Appendix 4

CATS PHASE II ALTERNATIVES

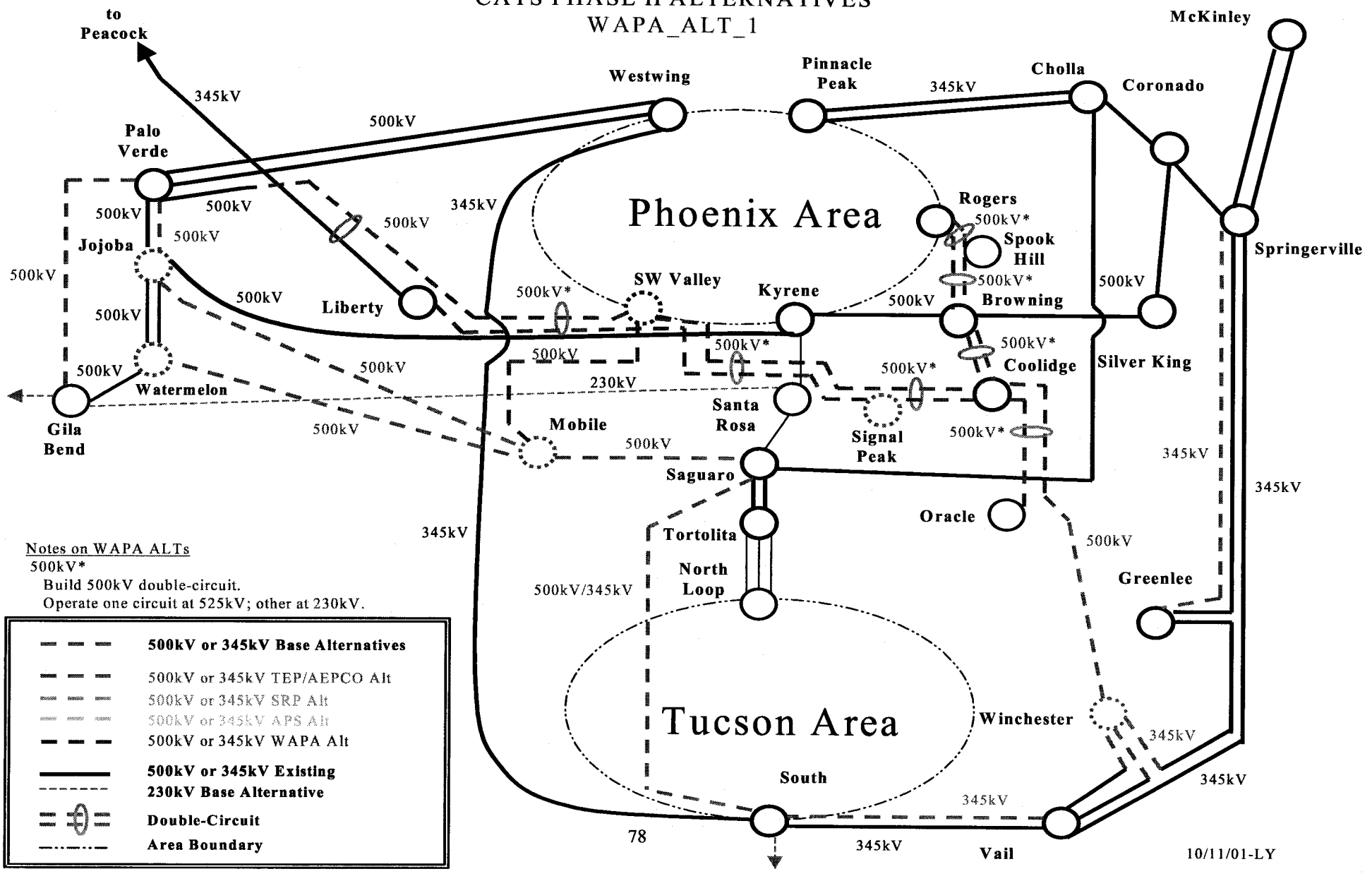
SRP_ALT_3



Appendix 5

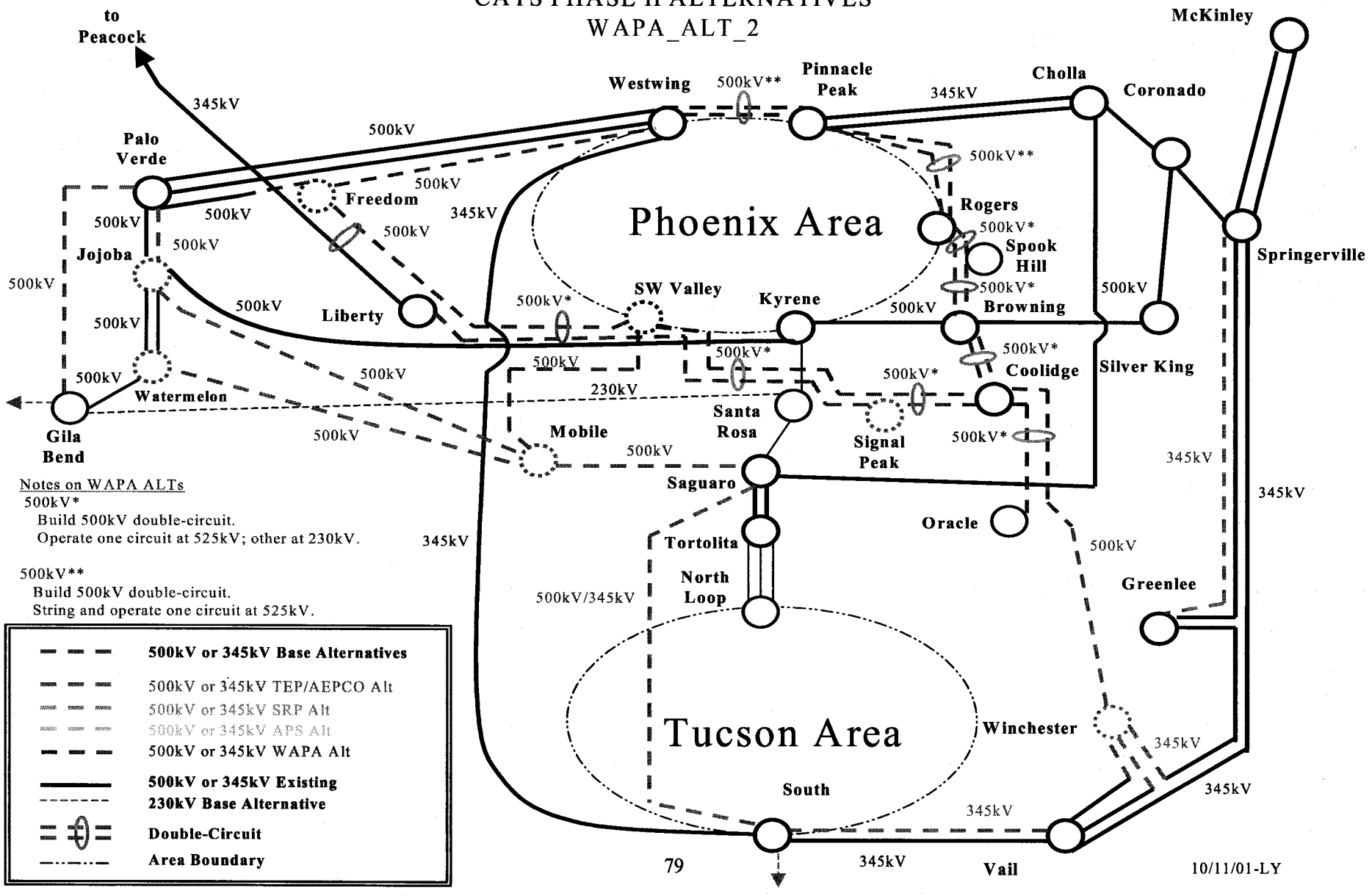

CATS PHASE II ALTERNATIVES
APS_ALT_1
McKinley
Westwing
Pinnacle Peak
345kV
Cholla
Coronado
500kV
Palo Verde
Phoenix Area
Springerville
Jojoba
500kV
SW Valley
Kyrene
Browning
Silver King
500kV
SR
SES
Watermelon
Gila Bend
Mobile
500kV
345kV
Saguaro
345kV
Tortolita
500kV
500kV/345kV
North Loop
Greenlee
Tucson Area
Winchester
345kV
South
345kV
345kV
Vail
500kV or 345kV Alternatives
500kV or 345kV Existing
230kV Alternatives
115kV or 230kV Existing
Double-Circuit
Area Boundary
10/05/01 GTR

Appendix 6

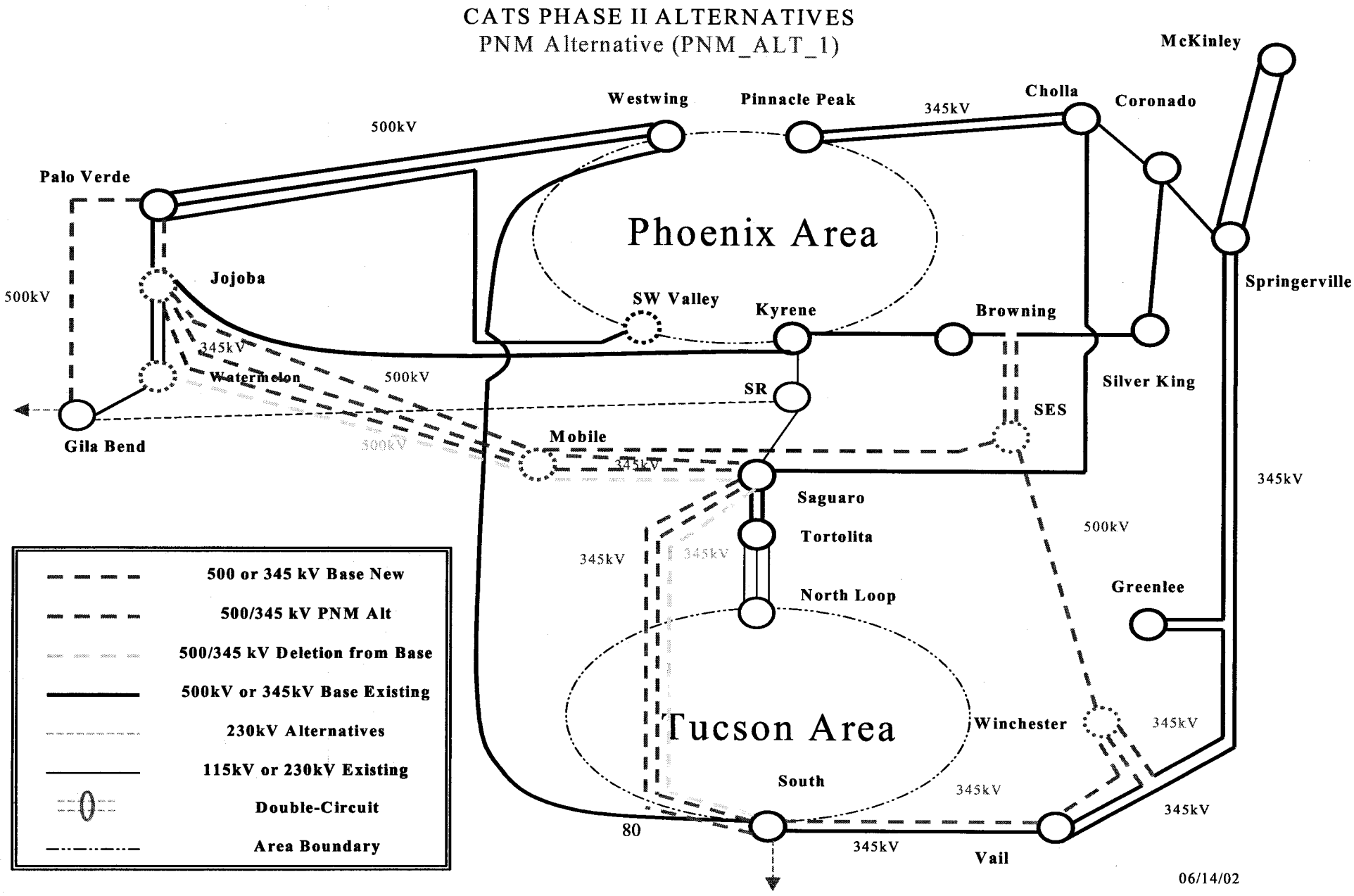

CATS PHASE II ALTERNATIVES
WAPA_ALT_1
to Peacock
345kV
500kV
Palo Verde
Westwing
Pinnacle Peak
345kV
Cholla
Coronado
McKinley
Springerville
Phoenix Area
Rogers
500kV*
Spook Hill
500kV*
Browning
500kV
Jojoba
500kV
Liberty
500kV
345kV
500kV*
SW Valley
Kyrene
500kV
500kV
500kV
500kV
500kV*
500kV*
Coolidge
Silver King
500kV
500kV
Watermelon
230kV
500kV*
500kV
Gila Bend
500kV
Mobile
Santa Rosa
Signal Peak
500kV*
345kV
345kV
500kV
Saguaro
Oracle
345kV
Tortolita
500kV
North Loop
500kV/345kV
Greenlee
Tucson Area
Winchester
345kV
345kV
South
345kV
345kV
78
Vail
10/11/01-LY
Notes on WAPA ALTs
500kV*
Build 500kV double-circuit.
Operate one circuit at 525kV; other at 230kV.
500kV or 345kV Base Alternatives
500kV or 345kV TEP/AEPCO Alt
500kV or 345kV SRP Alt
500kV or 345kV APS Alt
500kV or 345kV WAPA Alt
500kV or 345kV Existing
230kV Base Alternative
Double-Circuit
Area Boundary

Appendix 7

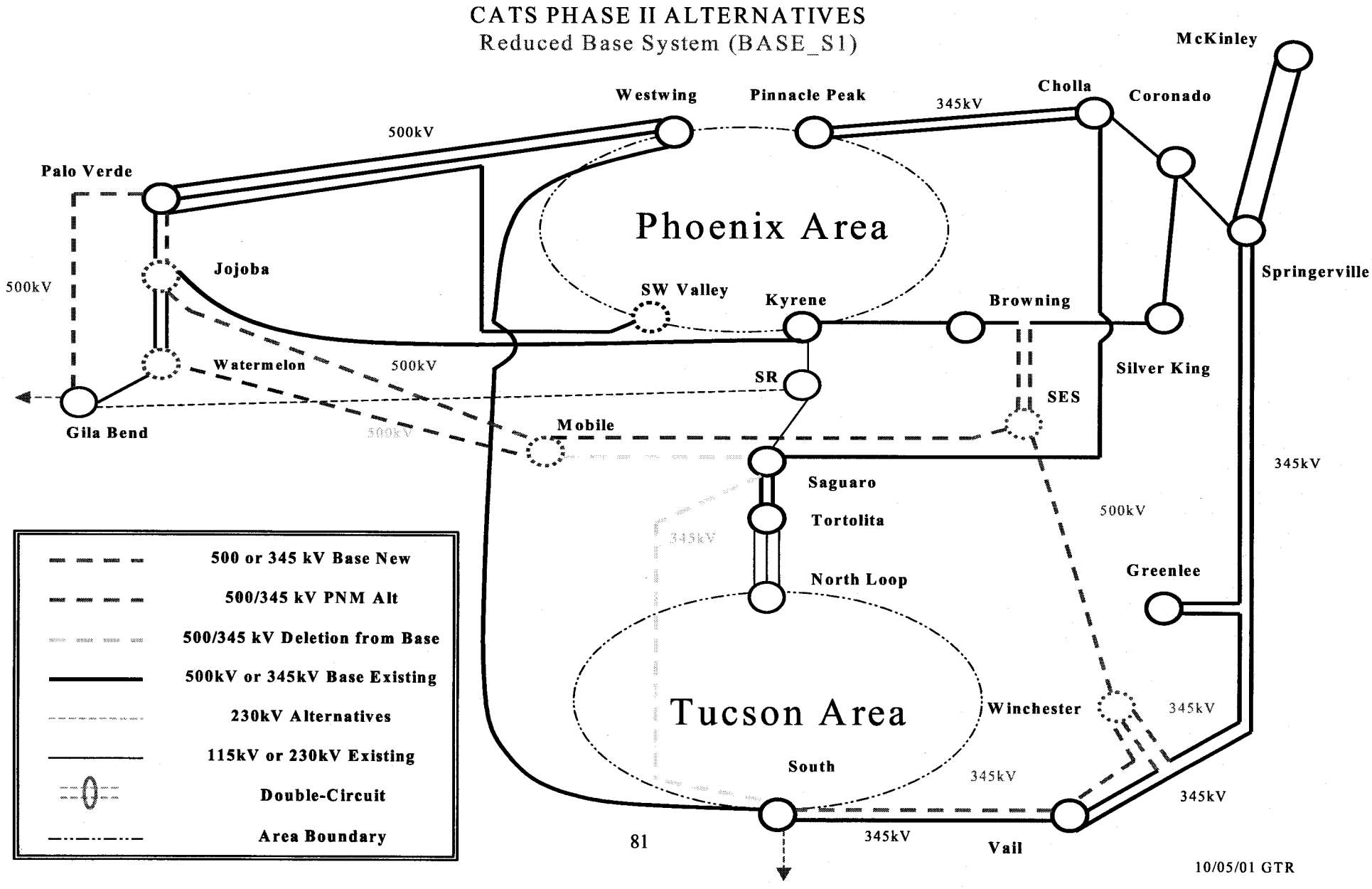
CATS PHASE II ALTERNATIVES
WAPA_ALT_2



Appendix 8

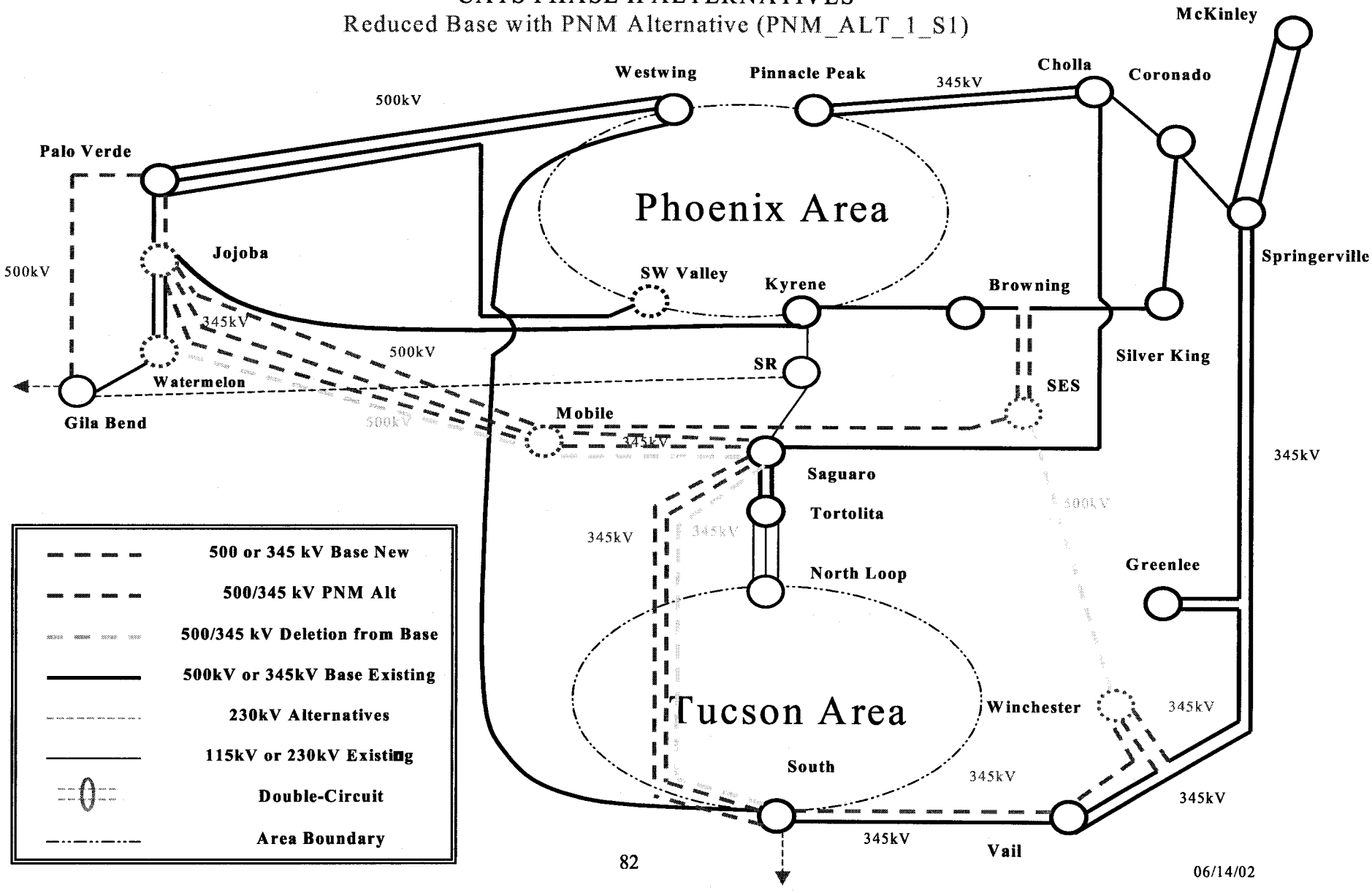

CATS PHASE II ALTERNATIVES
PNM Alternative (PNM_ALT_1)
McKinley
Westwing
Pinnacle Peak
Cholla
Coronado
500kV
345kV
Palo Verde
Phoenix Area
Springerville
Jojoba
500kV
SW Valley
Kyrene
Browning
345kV
Watermelon
500kV
Silver King
SR
SES
Gila Bend
Mobile
500kV
345kV
345kV
Saguaro
Tortolita
500kV
345kV
345kV
North Loop
Greenlee
Tucson Area
Winchester
345kV
South
345kV
345kV
80
345kV
Vail
06/14/02
500 or 345 kV Base New
500/345 kV PNM Alt
500/345 kV Deletion from Base
500kV or 345kV Base Existing
230kV Alternatives
115kV or 230kV Existing
Double-Circuit
Area Boundary

Appendix 9


CATS PHASE II ALTERNATIVES
Reduced Base System (BASE_S1)
McKinley
Westwing
Pinnacle Peak
345kV
Cholla
Coronado
500kV
Palo Verde
Phoenix Area
Springerville
Jojoba
500kV
SW Valley
Kyrene
Browning
Watermelon
500kV
SR
Silver King
SES
Gila Bend
500kV
Mobile
345kV
Saguaro
Tortolita
500kV
345kV
North Loop
Greenlee
Tucson Area
Winchester
345kV
South
345kV
345kV
345kV
Vail
500 or 345 kV Base New
500/345 kV PNM Alt
500/345 kV Deletion from Base
500kV or 345kV Base Existing
230kV Alternatives
115kV or 230kV Existing
Double-Circuit
Area Boundary
81
10/05/01 GTR

Appendix 10

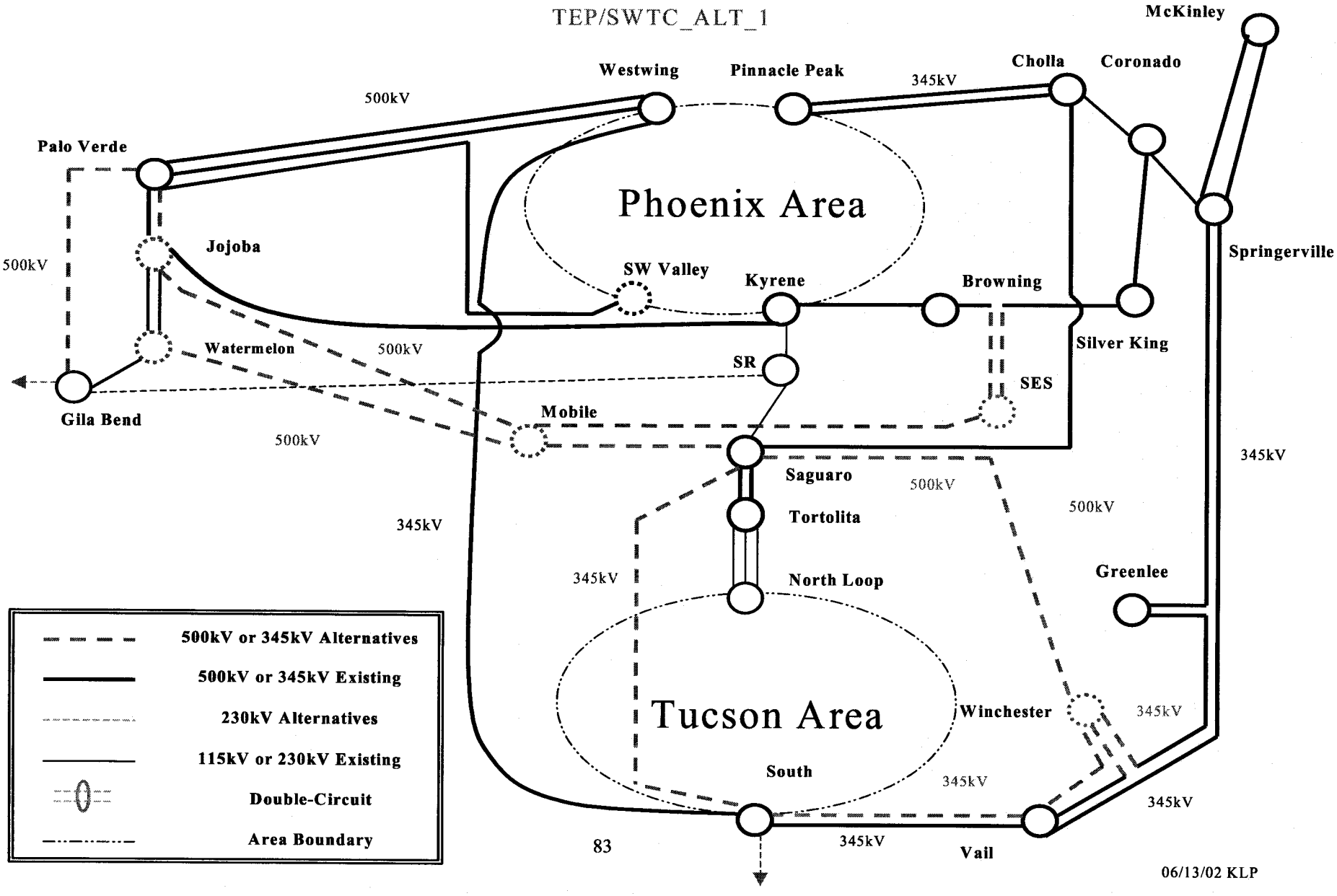
CATS PHASE II ALTERNATIVES
Reduced Base with PNM Alternative (PNM_ALT_1_S1)



06/14/02

Appendix 11

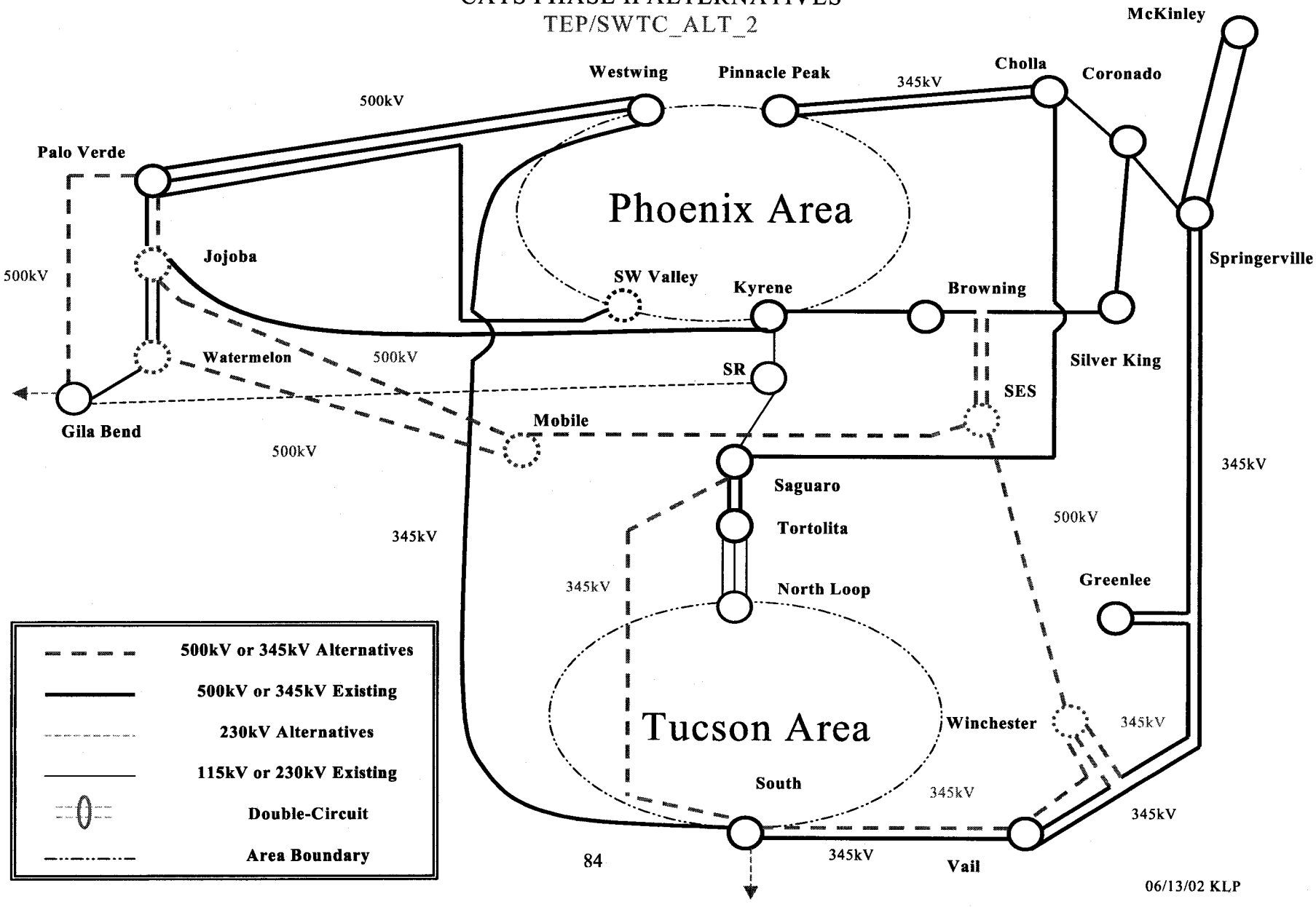
CATS PHASE II ALTERNATIVES
TEP/SWTC_ALT_1



06/13/02 KLP

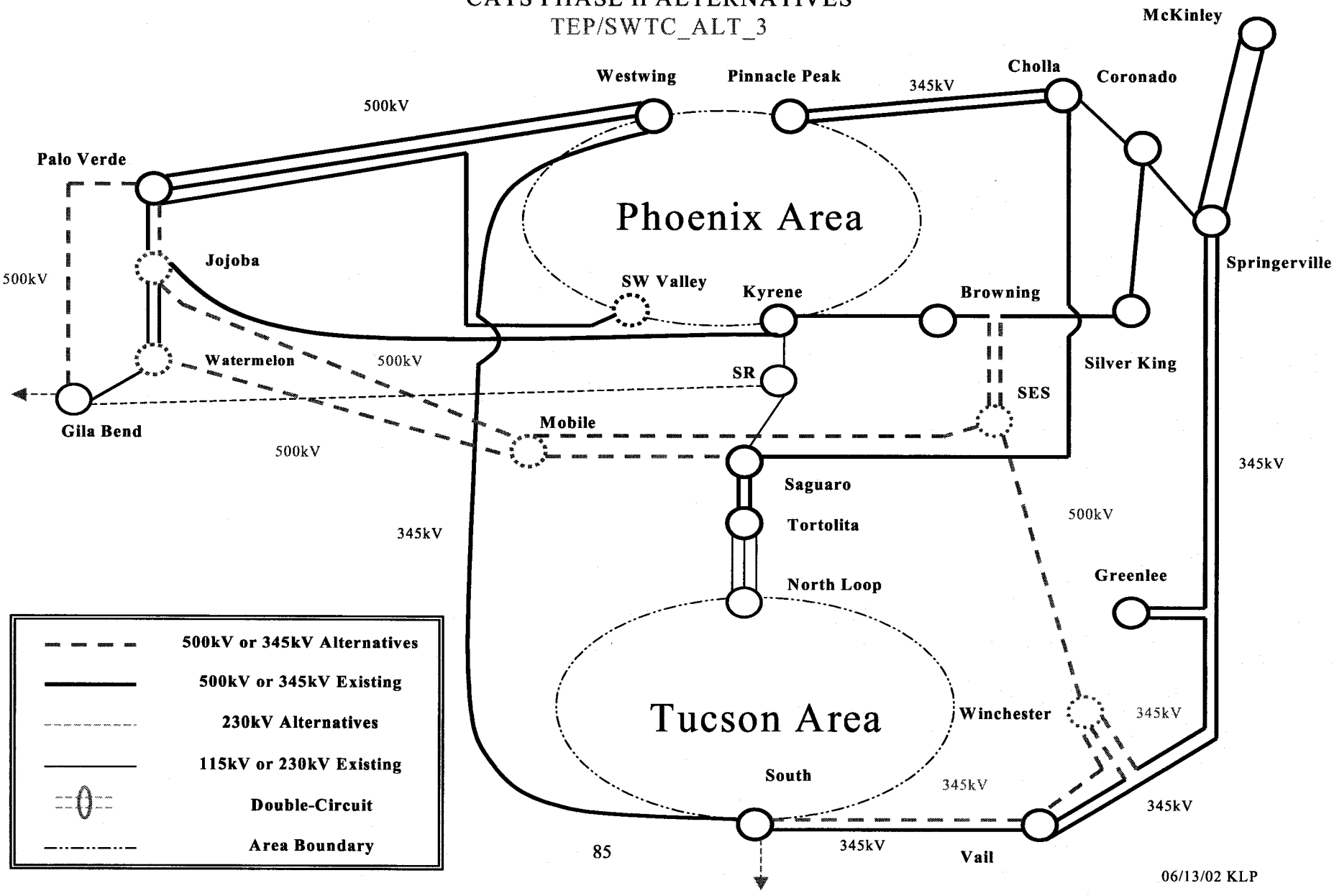
Appendix 12

CATS PHASE II ALTERNATIVES
TEP/SWTC_ALT_2



Appendix 13

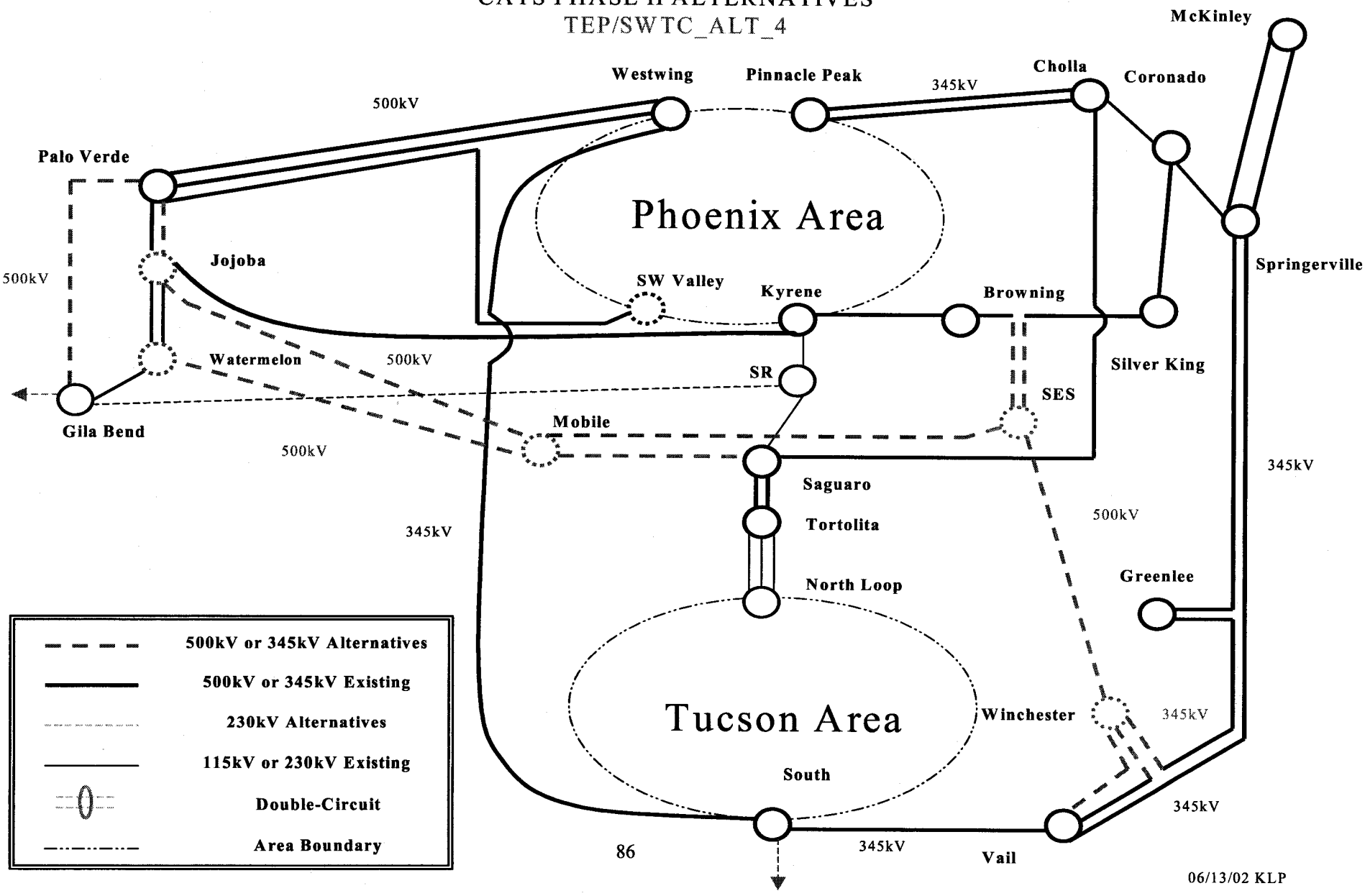
CATS PHASE II ALTERNATIVES
TEP/SWTC_ALT_3



06/13/02 KLP

Appendix 14

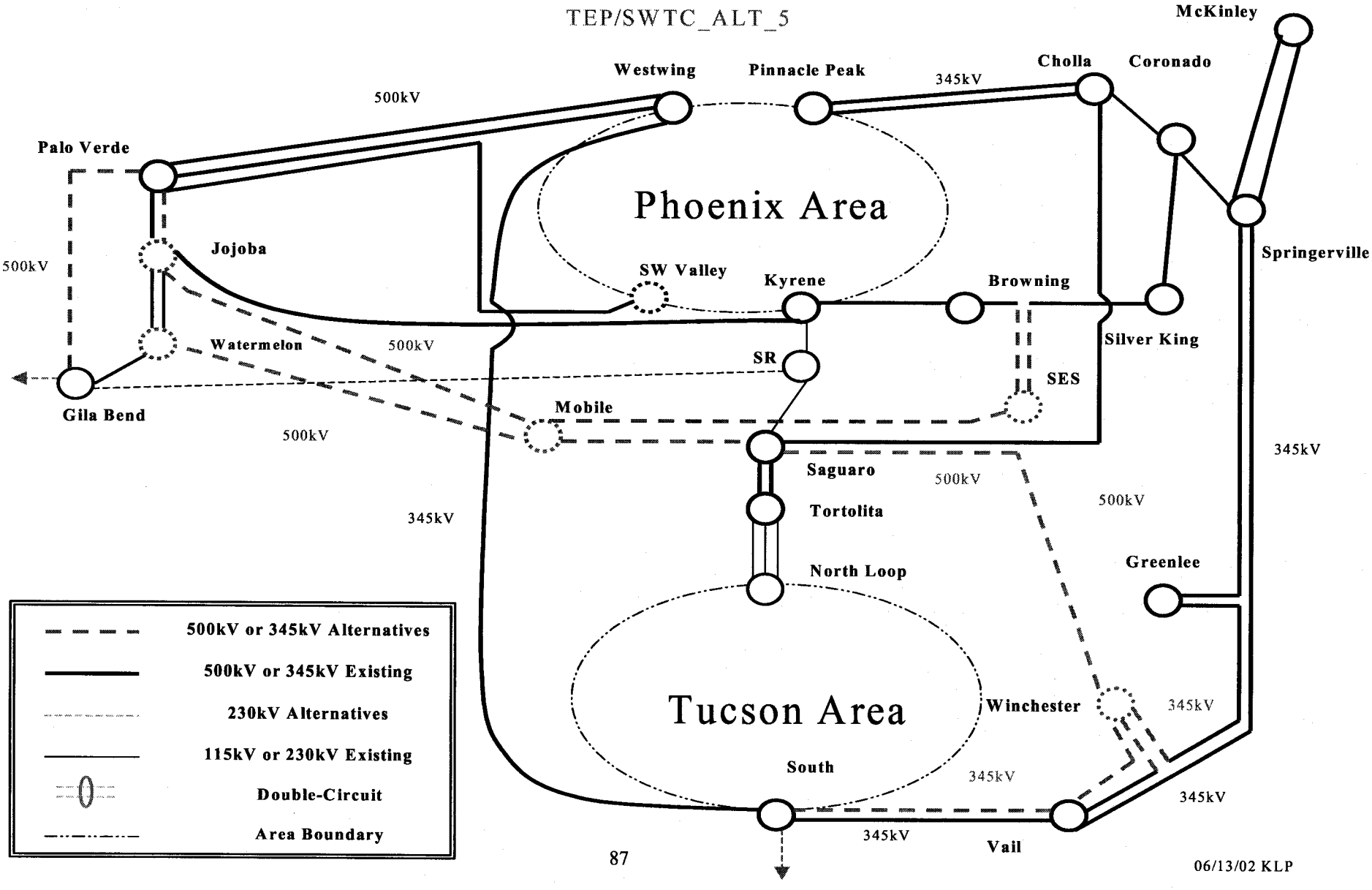
CATS PHASE II ALTERNATIVES
TEP/SWTC_ALT_4



06/13/02 KLP

Appendix 15

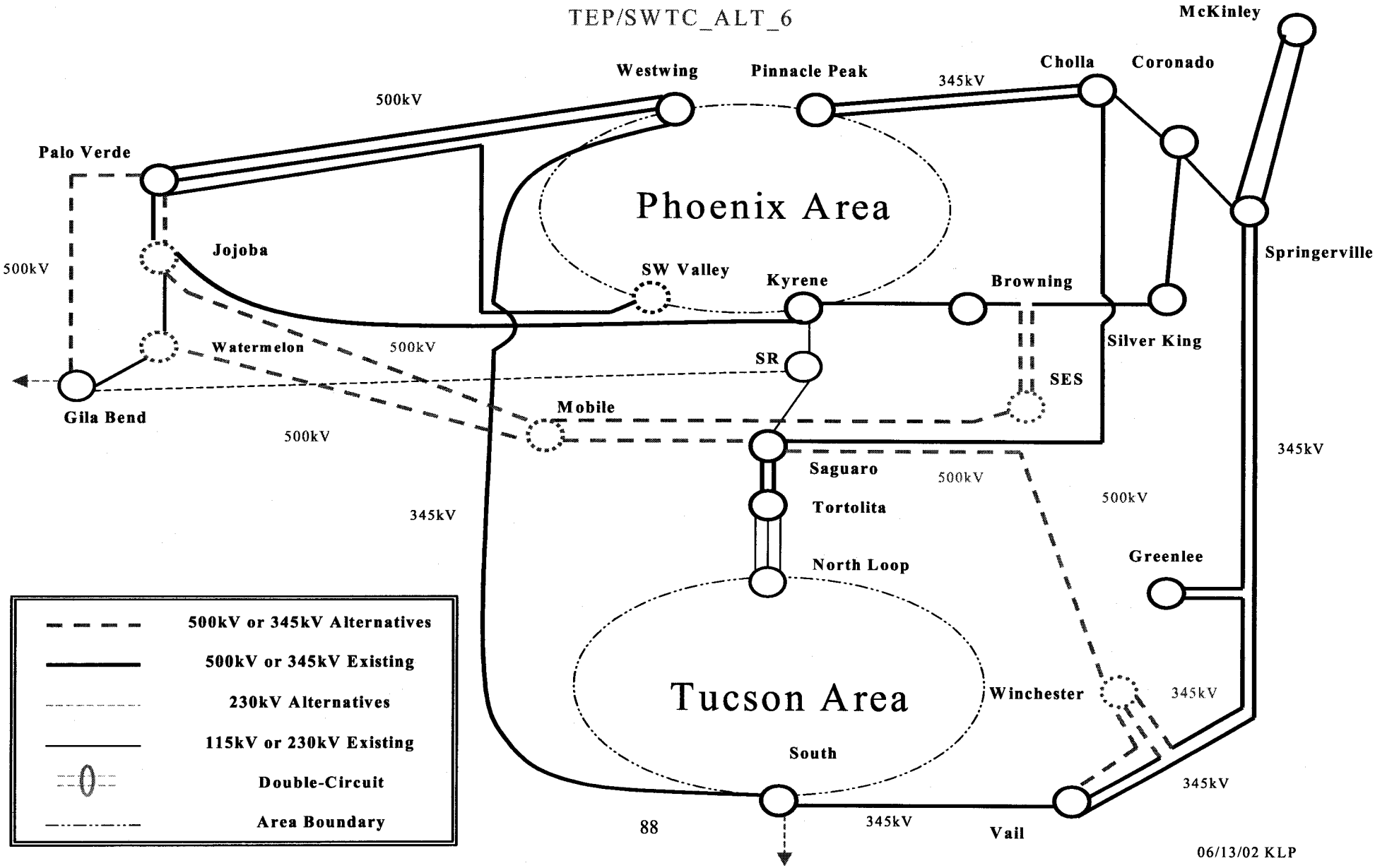
CATS PHASE II ALTERNATIVES
TEP/SWTC_ALT_5



06/13/02 KLP

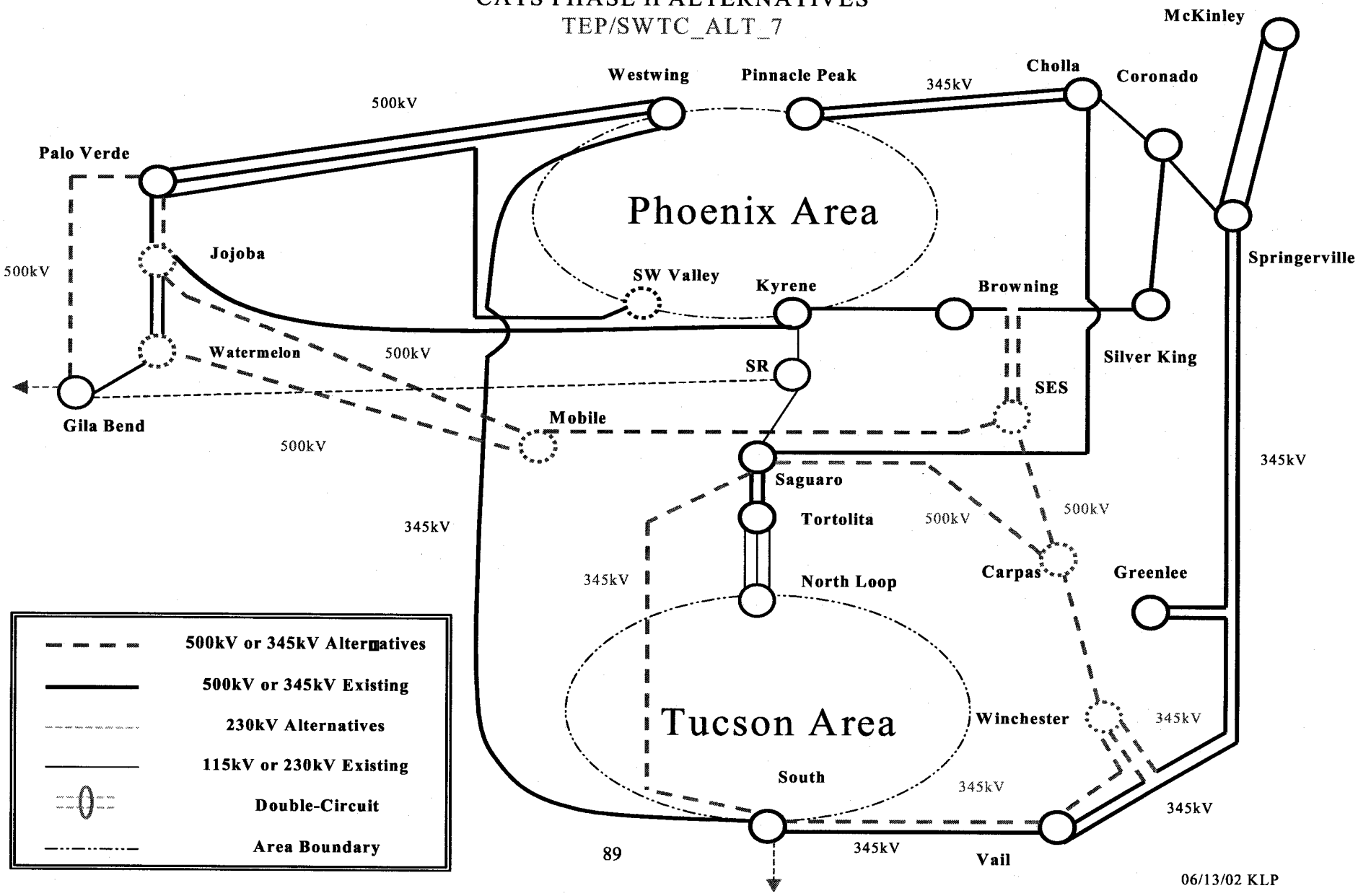
Appendix 16

CATS PHASE II ALTERNATIVES
TEP/SWTC_ALT_6



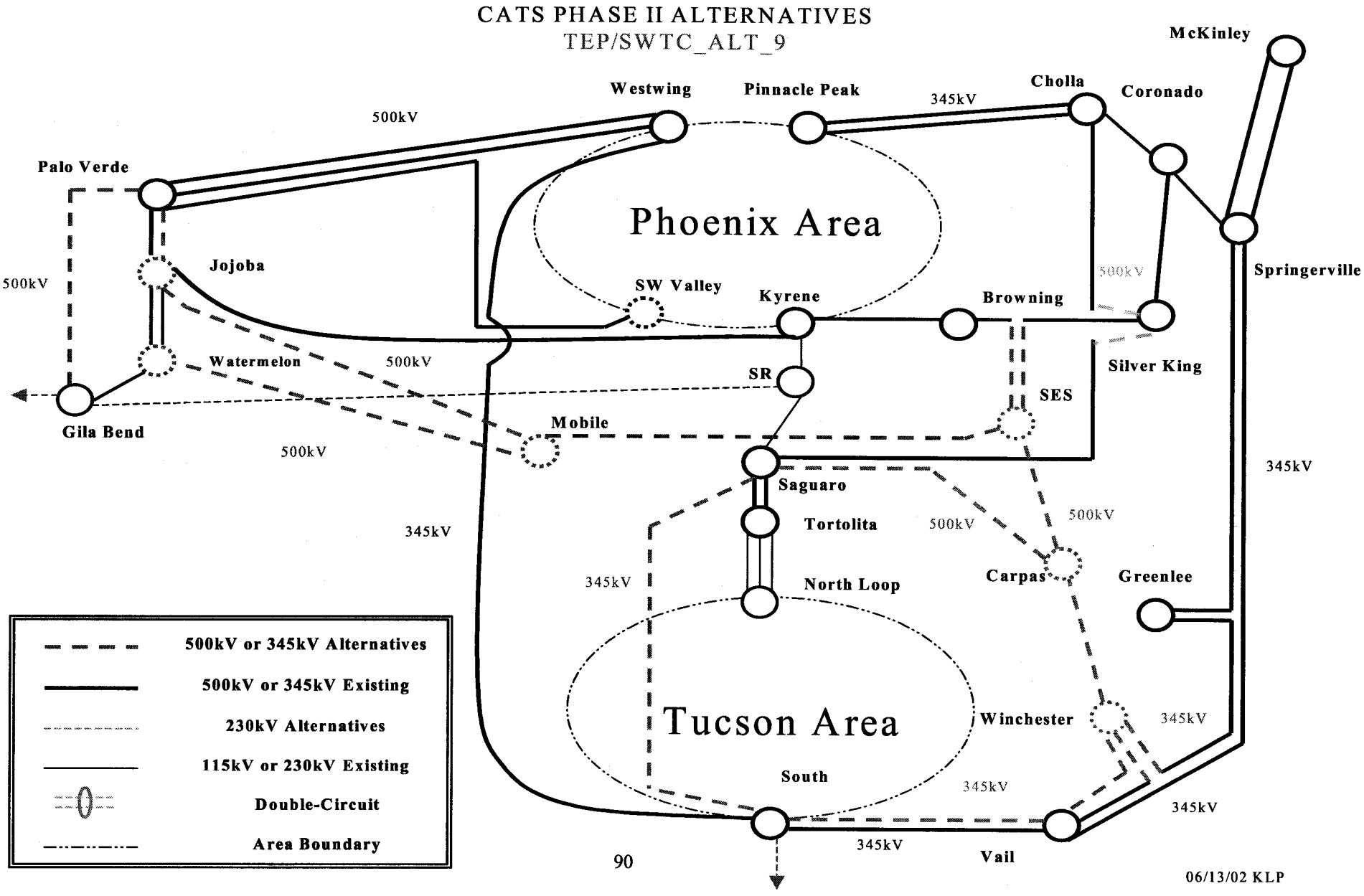
Appendix 17

CATS PHASE II ALTERNATIVES
TEP/SWTC_ALT_7



06/13/02 KLP

Appendix 18



06/13/02 KLP

Appendix 19

CATS STUDY
LIST OF
PARTICIPANTS

- Arizona Corporation Commission
- Arizona Public Service Company
- Tucson Electric Power
- Salt River Project
- Southwest Transmission Cooperative
- Western Area Power Authority
- Public Service Company of New Mexico
- Citizens Utilities
- Williams Energy Mkfg & Trading
- Industrial Power Tech.
- Arizona Power Authority
- Power Up Corp.
- Desert Energy
- Central Arizona Project
- NRG Energy
- Southwestern Power Group
- Reliant Energy
- PPL Sundance Energy
- Allegheny Energy Supply
- Pinnacle West Energy
- Mountain County Co Generation
- Trans - Elect
- Panda Energy
- TECo Energy
- Power Development Enterprises
- Duke Energy & Trading
- ED #3 & MSIDD
- Pacific Gas and Electric Company

SALT RIVER PROJECT

10 YEAR PLAN
2003 — 2012

APPENDIX 2

Summary of Need for the Fountain Hills Station

Delivering more than power.™

CENTENNIAL 1903-2003

02-07131 12/02

2003 CAPITAL PROJECT DESCRIPTION

Budget Year 2007/2008

EHV Diagrams 115,230 & 500
Area Switching Diagrams fountain2.pdf
Rec. Station Diagrams
Dist. Station Diagrams fountain3-69.pdf

Date: January 7, 2003 ***Location:*** Fountain #3 (33.75E13N)

Job Title: Fountain #3 69kV Station.

Project Summary: Build a new 4 Bay 69kV Station at the Fountain #3 Site (33.75E 13N). Terminate the Wheeler 69kV line, the Fountain 69kV line, the Evergreen/Speedway 69kV line, and the Thunderstone/Verde 69kV line into the new station.

Description of Work:

FOUNTAIN #3 STATION WORK

- Install 4 Bays.
- Install 4-69kV line drops.
- Install 10-69kV 2000A switches.
- Install 4-69kV 2000A 40kA i.c. Breaker
- Terminate the Fountain 69kV line in Bay 1
- Terminate the Evergreen/Speedway in 69kV line in Bay 2
- Terminate the Wheeler 69kV line in Bay 3
- Terminate the Thunderstone/Verde 69kV line in Bay 4

FOUNTAIN #3 STATION SUBTOTAL $2,270,000

69kV LINE WORK

- Construct Double Circuit 69kV line (approx. 0.75 miles) of 1-954ACSS per phase from the Wheeler/Speedway Tap to the Fountain #3 Station and from the Fountain/Verde Tap to the Fountain #3 Station (approx. 2.0 miles).

69kV LINE SUBTOTAL $730,000

ESTIMATED TOTAL $3,000,000

Note: The Line terminations and Station layout will be determined based on line routings. Design the Fountain #3 station to accommodate the future addition of 69/12kV transformers, 12kV switchgear and feeders.

In-Service Date: April 30, 2008

_____ _____
Manager ***Date***

Load Growth Project, TSP Contact: Gary Romero (69kV)

2003 CAPITAL PROJECT DESCRIPTION

Budget Year 2007/2008

Date: January 7, 2003 ***Location:*** Fountain #3 (33.75E13N)

Job Title: Fountain #3 69kV Station.

Project Summary: Build a new 4 Bay 69kV Station at the Fountain #3 Site (33.75E 13N). Terminate the Wheeler 69kV line, the Fountain 69kV line, the Evergreen/Speedway 69kV line, and the Thunderstone/Verde 69kV line into the new station.

Justification:

During summer peak loading with all projects in, the voltage in the Fountain area falls below the minimum acceptable level at several 69kV stations for an Evergreen/Pima outage. This project will delay the need date for the Fountain Receiving Station. It will also delay the need to upgrade some 69kV line sections in the area. The table below lists voltages at the Evergreen substation with and without the new Fountain #3 Station. Evergreen is the worst-case scenario. There are several other buses in the Fountain Area with low voltage problems.

EVERGREEN BUS VOLTAGE
(V MIN = 0.926)
The worst case is an Evergreen/Pima 69KV Line Outage with additional load at or near Evergreen.

	Without Fountain East			With Fountain #3 Switchyard		
	W/+20MW NEAR EVERGREEN	W/+10MW NEAR EVERGREEN	NO ADDITIONAL LOAD	W/+20MW NEAR EVERGREEN	W/+10MW NEAR EVERGREEN	NO ADDITIONAL LOAD
2006	0.875	0.935	0.990	0.986	1.010	1.030
2007	0.813	0.893	0.953	0.999	0.986	1.009
2008	0.738	0.858	0.918	0.958	0.987	0.983

2002 Project Summary: This project was not identified in the 2002 Electric System Plan.