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MUNGER CHADWICK, P.L.C.

ADMITTED TO PRACTICE IN:
ARIZONA, COLORADO, MONTANA,
NEVADA, TEXAS, WYOMING,
DISTRICT OF COLOMBIA

April 4, 2007

Ernest Johnson, Director
Utilities Division
Arizona Corporation Commission
1200 West Washington
Phoenix, Arizona 85007

Re: Bowie Power Station, L.L.C.

Dear Mr. Johnson,

Pursuant to A.R.S. §40-360.02 (B) and (C), enclosed for filing on behalf of Bowie Power Station, L.L.C. are four (4) copies of its "Plan" for a proposed 600 MW Integrated Gasification Combined Cycle ("IGCC") power plant to be sited and constructed in Cochise County, Arizona.

In the event you desire additional copies, please do not hesitate to let me know.

Sincerely,

Lawrence V. Robertson, Jr.

Lawrence V. Robertson, Jr.

cc: Laurie A. Woodall, w-enclosure
Janice M. Alward, w-enclosure

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BEFORE THE ARIZONA CORPORATION COMMISSION

MIKE GLEASON
Chairman
WILLIAM A. MUNDELL
Commissioner
JEFF HATCH-MILLER
Commissioner
KRISTIN K. MAYES
Commissioner
GARY PIERCE
Commissioner

IN THE MATTER OF THE CONTEMPLATED APPLICATION OF BOWIE POWER STATION, L.L.C., IN CONFORMANCE WITH THE REQUIREMENTS OF ARIZONA REVISED STATUTES 40-360.02, FOR A CERTIFICATE OF ENVIRONMENTAL COMPATABILITY AUTHORIZING CONSTRUCTION OF A 600 MEGAWATT INTEGRATED GASIFICATION COMBINED-CYCLE POWER PLANT, IN COCHISE COUNTY, ARIZONA. THE PROPOSED POWER STATION SITE IS LOCATED IN SECTIONS 28 AND 29, TOWNSHIP 12 SOUTH, RANGE 28 EAST, TOWNSHIP 11 SOUTH, RANGE 28 EAST, TOWNSHIP 11 SOUTH, RANGE 27 EAST, AND TOWNSHIP 11 SOUTH, RANGE 26 EAST, GILA AND SALT RIVER BASE AND MERIDIAN	)	FILING OF "PLAN" PURSUANT TO A.R.S. § 40-360.02 (B) AND (C)

I.

INTRODUCTION

Pursuant to A.R.S. § 40-360.02 (B) and (C), Bowie Power Station, L.L.C. ("Bowie") hereby files its "Plan," for a proposed 600 MW Integrated Gasification Combined Cycle ("IGCC") power plant to be sited and constructed in Cochise County, Arizona. Bowie currently

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contemplates that it will be filing an Application for a Certificate of Environmental Compatibility ("CEC") for the proposed IGCC facility pursuant to A.R.S. § 40-360.02 approximately ninety (90) days after the filing of this Plan.

II.

CONTENT AND ORGANIZATION OF THE "PLAN"

Pursuant to the directions set forth in A.R.S. §40-360.02(C), Bowie submits the following information:

A.R.S. §40-360.02(C)(1).

The proposed IGCC power plant will be nominally rated at 600 MW. The size and route of the transmission lines and switchyard associated with the aforesaid power plant will be the same as those previously authorized in Decision No. 64626 (Docket No. L-00000BB-01-0118), unless hereafter modified by an order of the Commission.

A.R.S. §40-360.02(C)(2).

The purpose of the proposed IGCC facility is to generate electricity for sale into the competitive wholesale market in Arizona and New Mexico.

A.R.S. §40-360.02(C)(3).

The currently estimated date by which the proposed IGCC facility will be in operation is 2013.

A.R.S. §40-360.02(C)(4).

The currently anticipated average and maximum power output of the proposed IGCC facility, as measured in megawatts, are 540-550 MW and 600 MW, respectively.

A.R.S. §40-360.02(C)(5).

The expected capacity factor for the proposed IGCC facility is on the order of 80% to 85%.

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A.R.S. §40-360.02(C)(6).

It is currently contemplated that the proposed IGCC facility will be designed and constructed to accommodate the use of coal from several different sources of supply, including San Juan (New Mexico), Powder River Basin (Wyoming), and Colorado. In addition, the facility will have the capability to use petroleum coke as a supplemental fuel.

A.R.S. §40-360.02(C)(7).

In connection with the requested information relating to analyses of the effect on the current Arizona electric transmission system of the proposed IGCC facility, attached as Appendix "A" is a copy of a feasibility study prepared by K. R. Saline and Associates, dated June 23, 2006, which included participation by both Tucson Electric Power Company and Southwest Transmission Cooperative, Inc.

III.

CONTACT INFORMATION

Questions relating to any of the above or attached information should be directed to:

David Getts, General Manager
Southwestern Power Group II, LLC
3610 North 44th Street, Suite 250
Phoenix, Arizona 85018
Phone: (602) 808-2004

Dated this 4th day of April 2007.

Respectfully Submitted,

Lawrence V. Robertson, Jr.
Attorney for Bowie Power Station, L.L.C.

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APPENDIX "A"

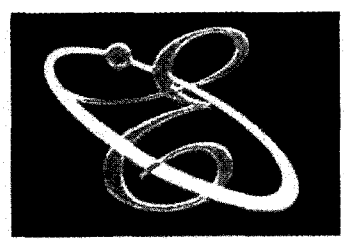
Bowie Power Station, L.L.C.
Filing of "Plan" Pursuant to
A.R.S. §40-360.02 (B) and (C)

Bowie Interconnection Feasibility Study

A 600MW generating facility
Connected to the Tucson Electric Power Company
Transmission System in 2012

~ Final ~
June 23, 2006

An Analysis for:
SouthWestern Power Group II, LLC



K. R. Saline & Associates, PLC
160 N. Pasadena, Suite 101
Mesa, AZ 85201-6764
Phone: 480-610-8741
Fax: 480-610-8796
www.krsaline.com

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1 EXECUTIVE SUMMARY

SouthWestern Power Group II, LLC (SWPG), requested an interconnection feasibility study for the Bowie generating facility in southeastern Arizona. The generating facility is a 600MW Integrated Gasification Combined Cycle, (IGCC) coal facility proposed to supplant the certificated 1000MW natural gas facility. The study reviewed two primary connection alternatives to the Tucson Electric Power Company's (TEP) transmission system. The two primary interconnection alternatives were a double circuit 345kV radial from the proposed Willow 345kV substation that intersects the existing Winchester-Greenlee 345kV line (Option 1) and a 500kV line radial from the Winchester 500kV substation (Option 2).

Four sensitivities were studied for the Winchester 500kV interconnection option (Option 2) to review the impact of regional transmission plans:

- Sensitivity 1 - Winchester–Vail and Vail–South 345kV lines
- Sensitivity 2 - Winchester–Vail and Vail–South 345kV lines with the Winchester – Tortolita 500kV line
- Sensitivity 3 - Winchester–Vail and Vail–South 345kV lines with the Winchester- Pinal South 500kV line
- Sensitivity 4 - Winchester-Vail and Vail-South 345kV lines with Winchester-Tortolita and Winchester-Bowie-Luna 500kV lines combined with 600MW of New Mexico wind generation

The purpose of the study was to identify which primary option would cause the least impact to the transmission system and which would provide the greatest compatibility with long-range transmission plans for the region. In particular, the Sensitivity cases were included to determine how connecting the facility to Winchester might integrate with regional transmission plans in the region and open up the potential for reaching other markets. For the fourth sensitivity case, with the additional 600MW of wind power connected to the Bowie facility, the purpose was to determine the capability of the 500kV option along with other anticipated system improvements of supporting up to 1200MW of added generation. Additional study work will be necessary to comply with an interconnection request.

This analysis reviewed the power flow impact to the Arizona transmission system, primarily the local systems of TEP and Southwest Transmission Cooperative (SWTC). Power flow analysis (thermal overloads and voltage criteria) and injection analysis were used to identify the impact to the system.

The power flow and injection analysis showed that the addition of the 600MW Bowie facility under heavy summer operating conditions in the 2012 timeframe to either the Willow 345kV substation or the Winchester 500kV substation was feasible. The 600MW addition had little impact to voltage and flow violations especially with the addition of planned transmission upgrades (modeled in the sensitivities). The voltage and loading violations for southeastern Arizona facilities noted in this analysis are larger than anticipated, specifically with regards to Southwest Transmission Cooperative (SWTC), due to the addition of an increased load forecast from its Member Owners. Both SWTC and Tucson Electric Power Company (TEP) are developing plans to mitigate the violations in their own Ten Year Plans. The Bowie project should only be responsible for any incremental impact to voltage and thermal violations that it causes or the incremental cost to accelerate a planned transmission project to mitigate voltage and thermal violations.

Both primary interconnection alternatives; Option 1 - the double circuit Willow 345kV and Option 2 - the single circuit Winchester 500kV result in heavier loading on lines south of the interconnection point. In particular, the all lines in service case showed an overload of the Winchester-Vail 345kV line. From a power flow and injection analysis perspective, neither the Willow nor Winchester option is significantly different. What is not captured in the power flow analysis is the value of the potential for reaching additional markets at Winchester versus Willow.

In this analysis, Sensitivities 1-3 incorporated TEP's Winchester-Vail and Vail-South 345kV 2nd circuit and found the addition of these planned elements eliminates many of the overloads identified in the Pre Project (Base), Options 1, and Option 2 cases.

The Sensitivity cases also indicate the planned regional transmission elements will significantly reduce overloading and losses; however, voltage deviation violations remain (with or without the project). The SWTC transmission system experienced the greatest number and largest voltage deviations, due largely to the addition of new load forecasts from its Member Owners, as noted above. SWTC is currently studying the effects of these load forecasts to determine the steps to be taken to mitigate the voltage deviations noted in this analysis. According to filed Ten Year Plans, TEP has plans to upgrade the 138kV transmission system and are reviewing in-service dates for the planned Extra High Voltage (EHV)

additions to their system. Both the planned 138kV additions and planned EHV additions should mitigate the thermal and voltage violations noted in this analysis.

This feasibility analysis found any of the options and sensitivities studied were viable from a power flow and injection analysis perspective, but there were system benefits for the additional transmission added with the sensitivities, in particular the 2nd Winchester-Vail-South 345kV line.

2 INTRODUCTION

SouthWestern Power Group II, LLC (SWPG), requested an interconnection feasibility study for the Bowie generating facility in southeastern Arizona. The generating facility is a 600MW Internal Gasification Combined Cycle, (IGCC) coal facility proposed to supplant the certificated 1000MW natural gas facility. The feasibility studied two primary connection alternatives to the Tucson Electric Power Company's (TEP) transmission system. The two primary interconnection alternatives were a double circuit 345kV radial from the proposed Willow 345kV substation that intersects the existing Winchester-Greenlee 345kV line (Option 1) and a 500kV line radial from the Winchester 500kV substation (Option 2).

Four sensitivities were studied for the Winchester 500kV interconnection option (Option 2) to review the impact of regional transmission plans:

- Sensitivity 1 - Winchester–Vail and Vail–South 345kV lines
- Sensitivity 2 - Winchester–Vail and Vail–South 345kV lines with the Winchester – Tortolita 500kV line
- Sensitivity 3 - Winchester–Vail and Vail–South 345kV lines with the Winchester- Pinal South 500kV line
- Sensitivity 4 - Winchester-Vail and Vail-South 345kV lines with Winchester-Tortolita and Winchester-Bowie-Luna 500kV lines combined with 600MW of New Mexico wind generation

The purpose of the study was to identify which primary option would cause the least impact to the transmission system and provides the greatest compatibility with long-range transmission plans for the region. In particular, the Sensitivity cases were included to determine how connecting the facility to Winchester might integrate with regional transmission plans in the region and open up the potential for reaching other markets. For the fourth sensitivity case, with the additional 600MW of wind power connected to the Bowie facility, the purpose was to determine the capability of the 500kV option along with other anticipated system improvements of supporting up to 1200MW of added generation.

Power flow analysis (thermal overloads and voltage criteria) and injection analysis were used to identify the impact to the system.

3 STUDY ASSUMPTIONS

The study assumptions section details the power flow case development and significant study assumptions. The power flow and stability analysis was performed with General Electric's Positive Sequence Load Flow (PSLF), version 13.1.

3.1 Cases Studied

The following cases were studied to investigate the transmission impacts, under a heavy summer operating condition, of connecting the Bowie project in approximately a 2014-2015 timeframe. The starting case was provided by TEP and was reviewed and modified by TEP (transmission changes and loads reflecting a 2012 timeframe), Salt River Project (addition of Springerville 4 and other transmission changes), and Southwest Transmission Cooperative.

PSLF Case Name	Description
BFS_base_rev4.0.sav	Base Case
BFS_option1_rev4.sav	Option 1 – Bowie connected to the Willow 345kV substation via two 345kV lines
BFS_option2_rev4.sav	Option 2 – Bowie connected to the Winchester 500kV substation via a bundled 500kV line
S1- BFS_option2_rev4.sav	Sensitivity 1 – Bowie connected to Winchester and Winchester-Vail-South 345kV line (2nd ckt) added
S2- BFS_option2_rev4.sav	Sensitivity 2 – Bowie connected to Winchester and Winchester-Vail-South345kV and Winchester-Tortolita 500kV lines added
S3- BFS_option2_rev4.sav	Sensitivity 3 - Bowie connected to Winchester and Winchester-Vail-South345kV and Winchester-Pinal South 500kV lines added
S4- BFS_option2_rev4.sav	Sensitivity 4 - Bowie connected to Winchester and Winchester-Vail-South 345kV and Winchester-Tortolita 500kV lines and a 500kV connection to Luna 500kV station added with an additional 600MW of wind resources connected in New Mexico and scheduled to California.

3.2 Generation Assumptions

For power flow analyses, generation and load plus losses must remain in balance. This requires that adding generation such as Bowie must be "offset" by reducing generation elsewhere. When energized, the Bowie facility was offset by reducing generation located at the Palo Verde hub in all cases. In the fourth sensitivity case, an additional 600MW of

wind generation was dispatched and offset by reducing generation with generation in Southern California Edison's control area.

3.3 The Bowie Project

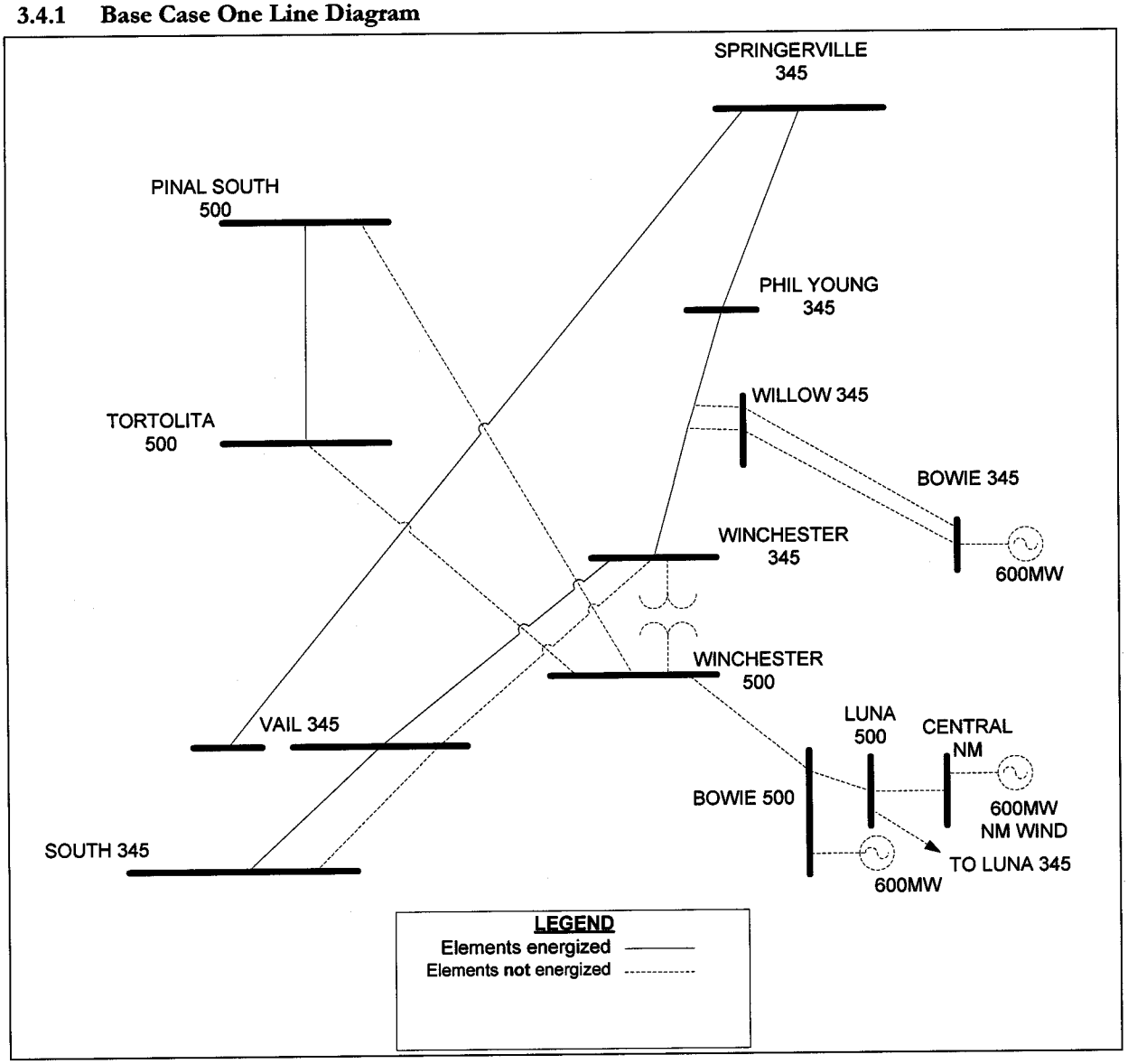
Bowie was modeled as three two hundred megawatt (MW) units either connected to a Bowie 345kV station (for Option 1) or to a Bowie 500kV station (for Option 2).

3.4 Pre Project Power Flow Model

The following additions were incorporated into the Pre-Project Power flow model:

- TEP voltage, load adjustments, and transmission plans for 2012
- SWTC transmission additions
- SRP's Springerville 4 project

3.4.1 Base Case One Line Diagram

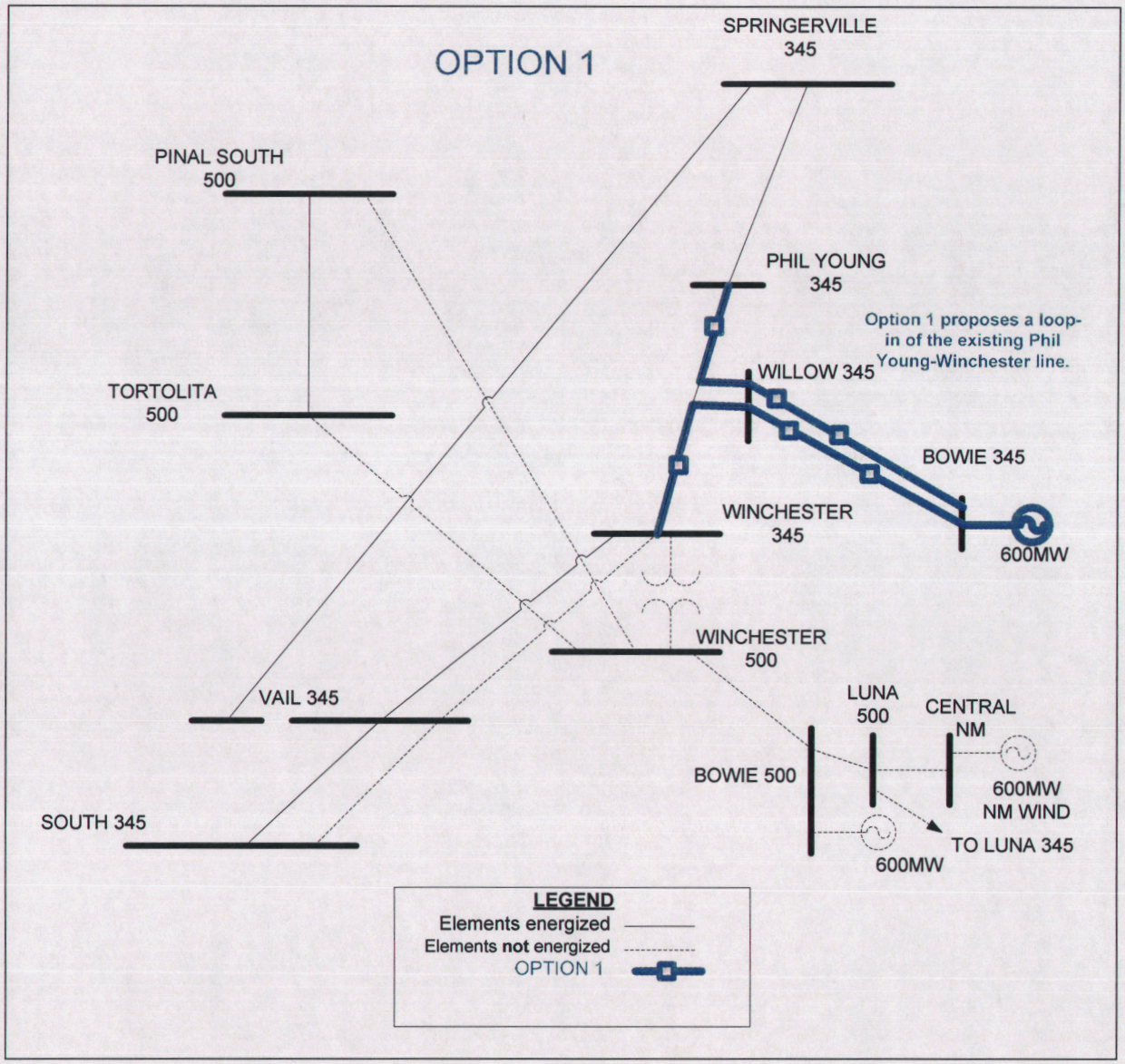


3.5 Option 1 & 2 Post Project Power Flow Model

The post project power flow cases energized the project elements modeled (as off) in the pre-project power flow model.

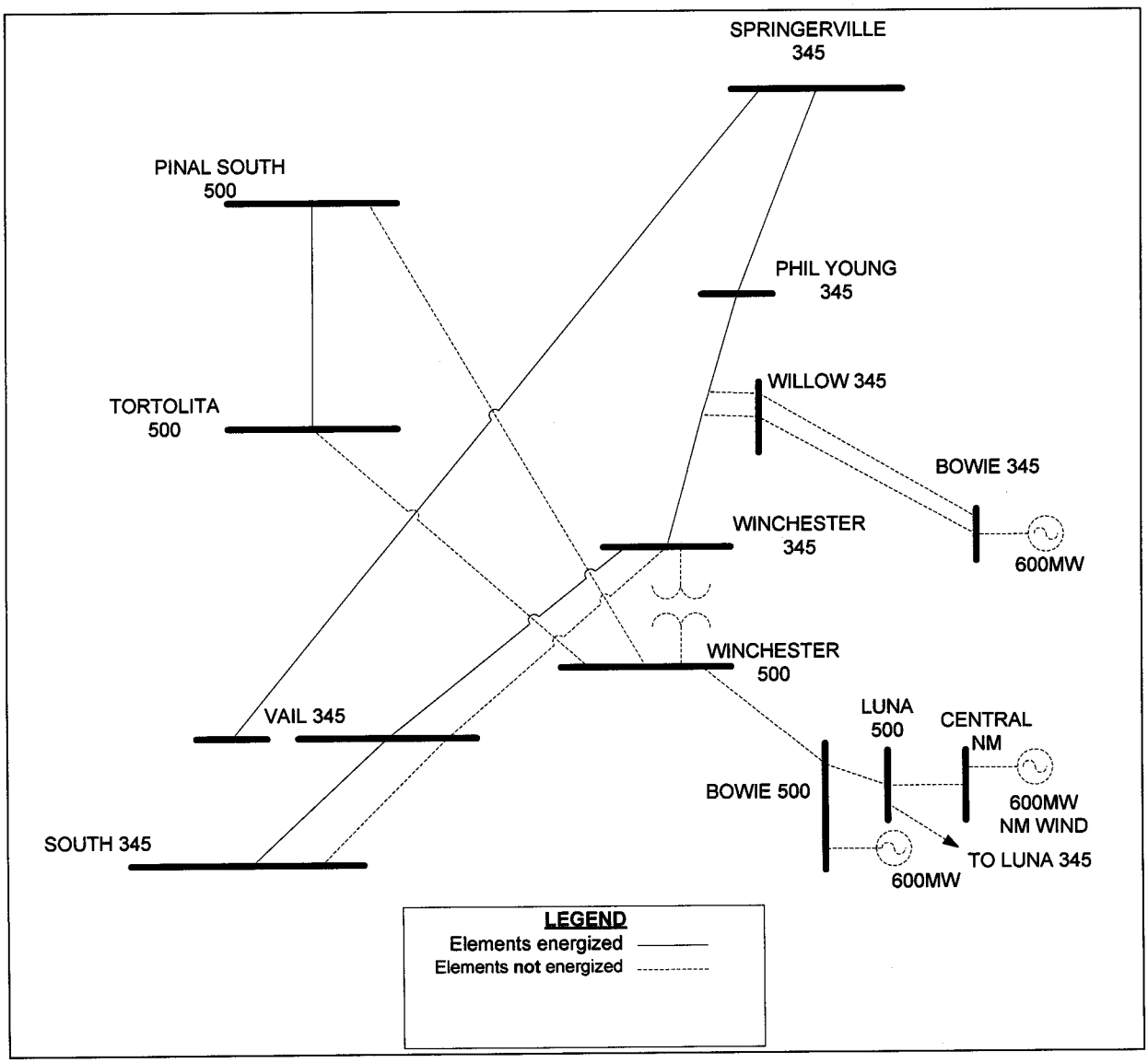
3.5.1 Option 1 - Double circuit 345kV to Willow and Option 1 One-Line Diagram

Option 1 evaluated the Bowie project connected to a new Willow 345kV substation which would be located between Winchester and Phil Young 345kV substations. The project would interconnect via a double circuit 345kV line from the facility to the Willow 345kV substation.



3.5.2 Option 2 – Single circuit bundled 500kV to Winchester and Option 1 One-Line Diagram

Option 2 evaluated the Bowie project connected to the existing Winchester 345kV substation. The project would interconnect via a single circuit bundled 500kV line from the facility to a new 500kV bus and 500/345kV transformer at the Winchester substation.



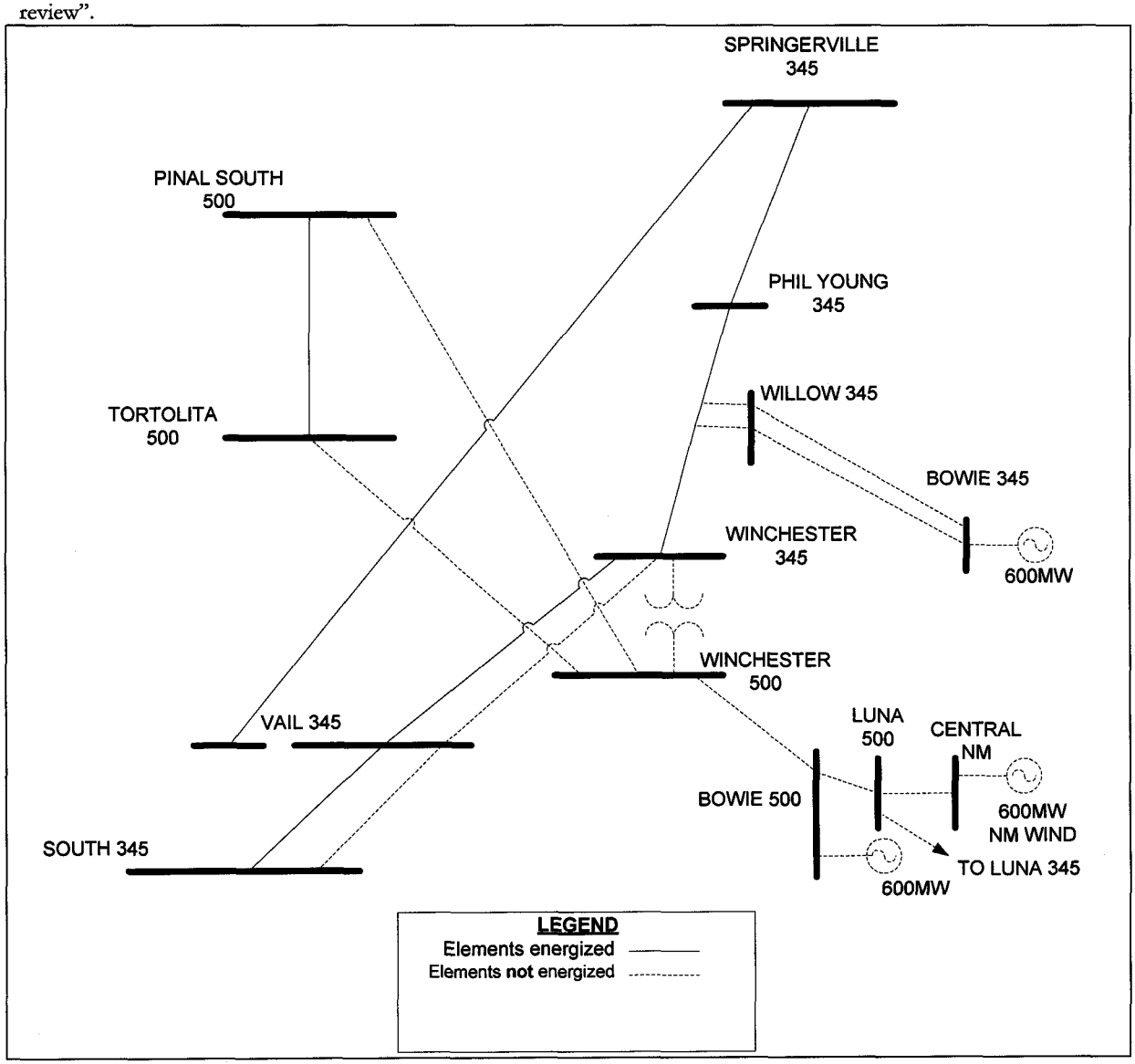
3.6 Sensitivity Cases Power Flow Model

Four Sensitivity cases were developed for this analysis to study the impact of regional transmission plans combined with the Bowie Winchester 500kV interconnection (Option 2). The Sensitivity cases included:

- Sensitivity 1 - Winchester–Vail and Vail–South 345kV lines
- Sensitivity 2 - Winchester–Vail and Vail–South 345kV lines with the Winchester – Tortolita 500kV line
- Sensitivity 3 - Winchester–Vail and Vail–South 345kV lines with the Winchester- Pinal South 500kV line
- Sensitivity 4 - Winchester-Vail and Vail-South 345kV lines with Winchester-Tortolita and Winchester-Bowie-Luna 500kV lines combined with 600MW of New Mexico wind generation

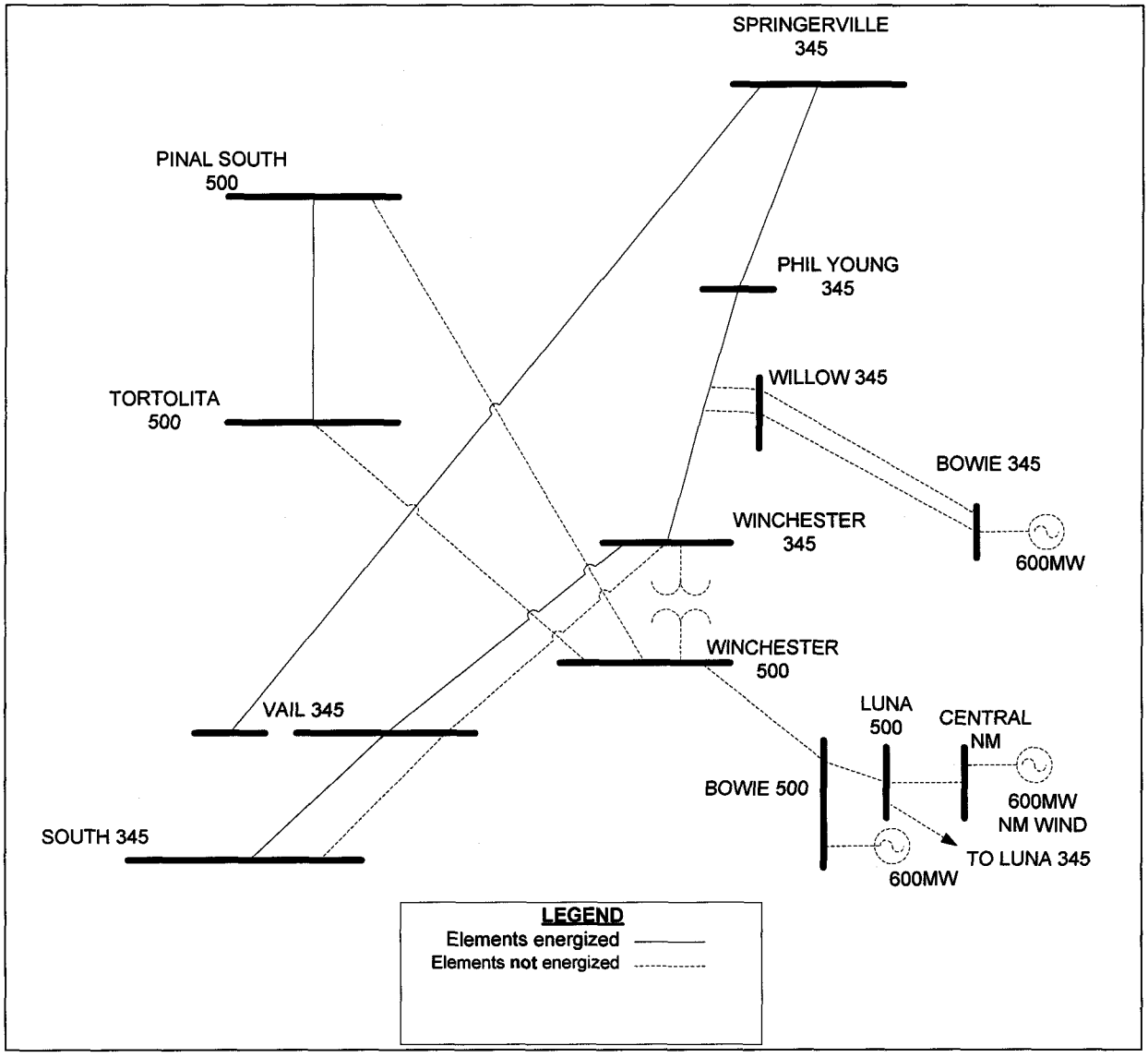
3.6.1 Sensitivity 1 Transmission Description & One Line Diagram

Sensitivity 1 evaluated the Winchester 500kV connection for the Bowie facility and energized the Winchester-Vail and Vail-South 345kV 2nd circuit planned by TEP and published in their 2006 Ten Year Plan filed at the Arizona Corporation Commission. While the facilities were included with the Ten Year Plan, the in service date is "under review".



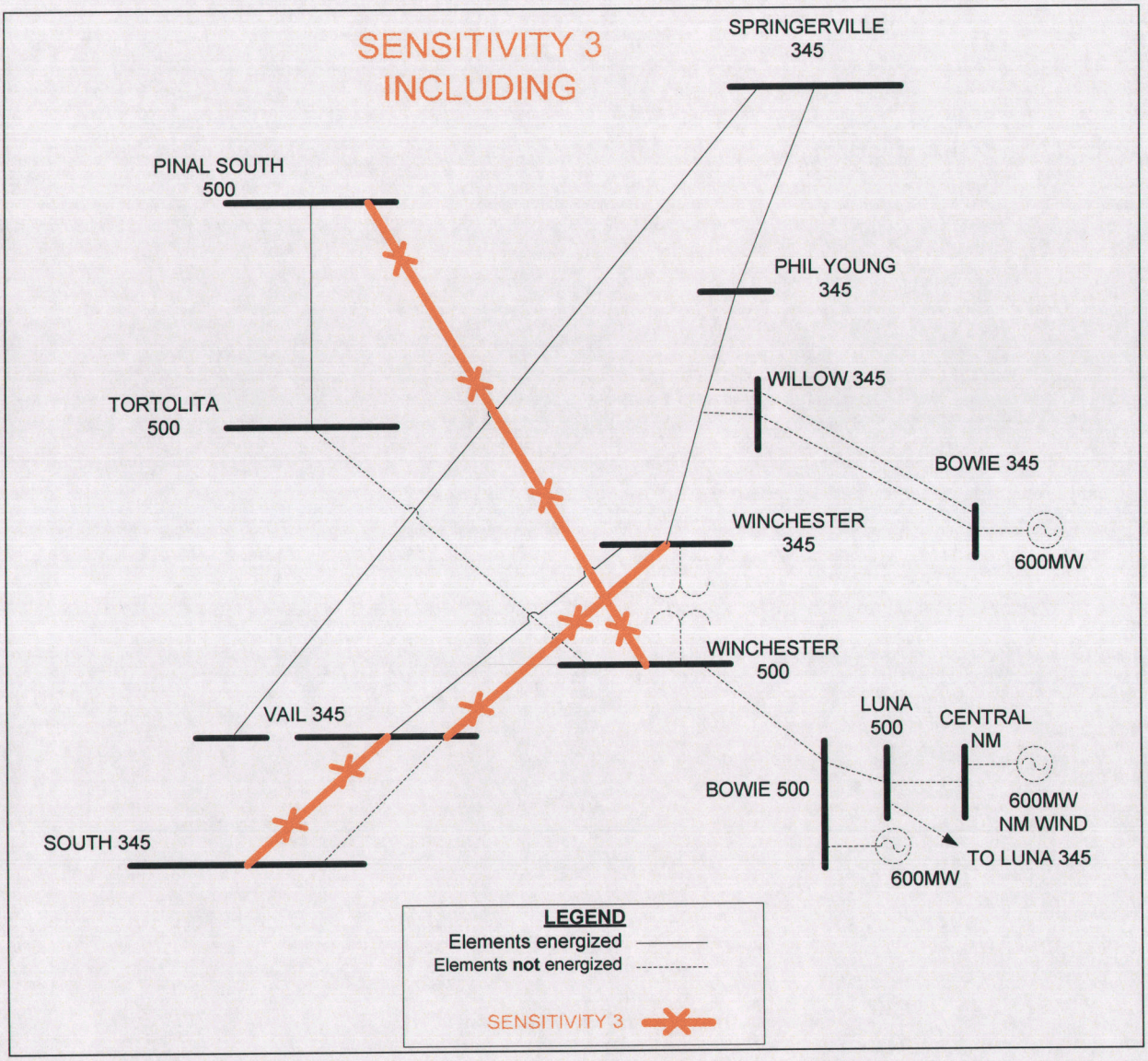
3.6.2 Sensitivity 2 Transmission Description & One Line Diagram

Sensitivity 2 evaluated the Winchester 500kV connection for the Bowie facility (Option 2) and energized the Winchester-Vail and Vail-South 345kV 2nd circuit. The new element for Sensitivity 2 was the Winchester-Tortolita 500kV line. While the facilities were included with TEP's Ten Year Plan, the in service date is "under review".



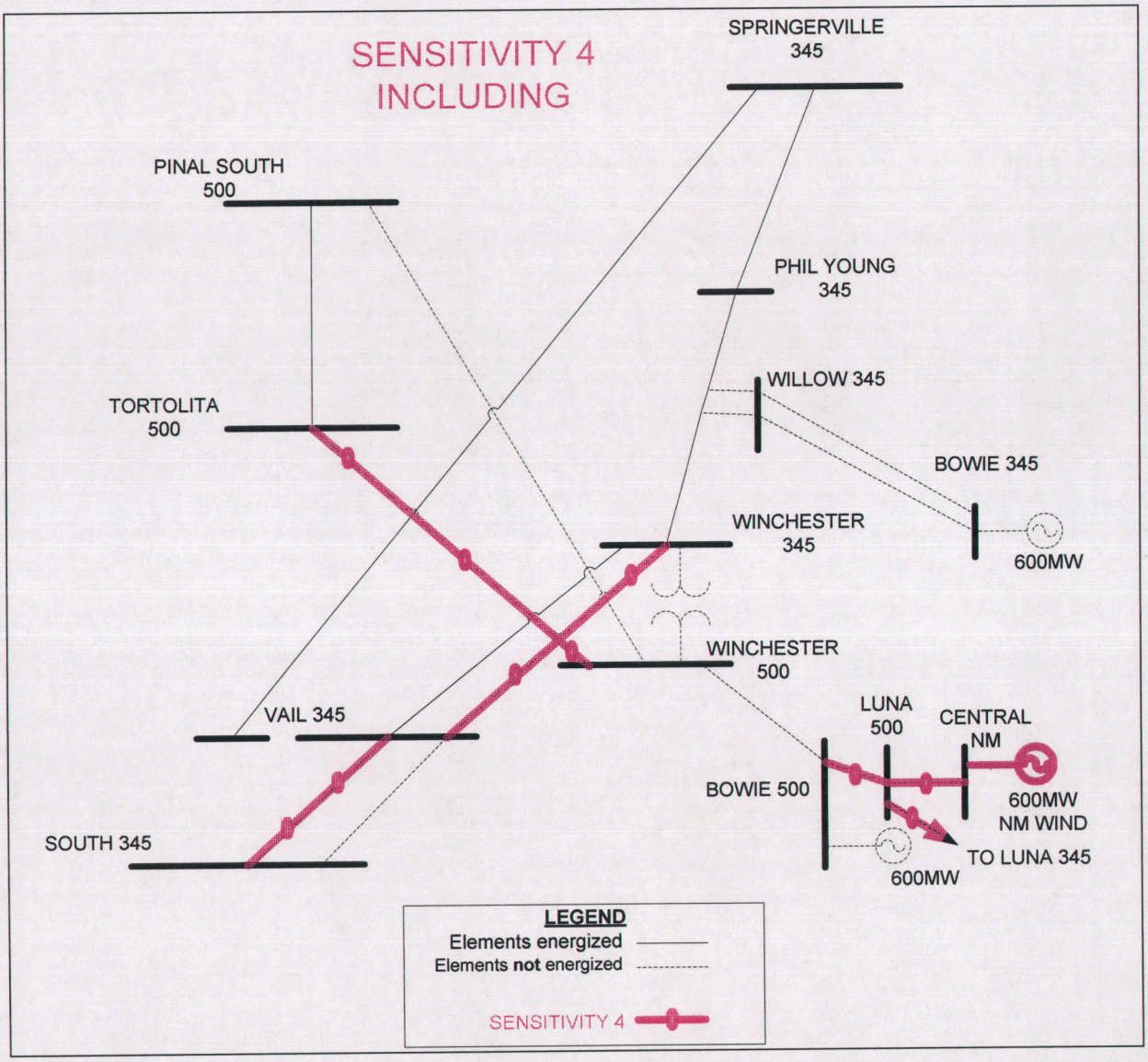
3.6.3 Sensitivity 3 Transmission Description & One Line Diagram

Sensitivity 3 evaluated the Winchester 500kV connection for the Bowie facility (Option 2) and energized the Winchester-Vail and Vail-South 345kV 2nd circuit. The new element for Sensitivity 3 was the Winchester-Pinal South 500kV line. TEP is studying Winchester-Pinal South as a competing project (beyond the 2015 timeframe) to the Tortolita-Winchester 500kV project and was not included with TEP's Ten Year Plan.



3.6.4 Sensitivity 4 Transmission Description & One Line Diagram

Sensitivity 4 evaluated the Winchester 500kV connection for the Bowie facility (Option 2), the Winchester-Vail and Vail-South 345kV 2nd circuit and the Winchester-Tortolita 500kV line. The new elements energized for Sensitivity 4 were the Bowie-Luna 500kV line, 500/345kV transformer at Luna, and an additional 600MW of New Mexico Wind generation connected to the Luna 500kV substation via a 500kV radial line.



3.7 Study Evaluation Criteria

This analysis evaluated the system for thermal and voltage limitations. The system was evaluated both with all lines in service and under emergency, or unplanned outage, conditions that the system might sustain, such as the outage of a line or transformer. Western Electricity Coordinating Council (WECC) Reliability Criteria, and the North American Electric Reliability Council (NERC) Planning Standards, were used to evaluate the system as noted below. While the NERC/WECC criteria are applicable, the interconnecting transmission system owner/operator has stricter voltage or thermal criteria based on operating or reliability needs. These locally-applied criteria were also observed.

3.7.1 Power Flow Criteria

The following power flow related criteria were used:

- Pre-disturbance (normal conditions) average 138kV transmission bus voltage must be between 1.021-1.023 per unit on the 138kV system. (TEP requirement that is not included in the WECC criteria)
- Post disturbance (outage conditions) average 138kV transmission bus voltage average must be between 0.98 and 1.05 per unit. (TEP requirement that is not included in the WECC criteria)
- Allowable voltage deviation of five (5) percent for N-1 Contingencies (deviation from pre-disturbance voltage).
- Allowable voltage deviation of ten (10) percent for N-2 contingencies (deviation from pre disturbance voltage).
- Post transient average bus voltage must be at least 0.98 per unit (TEP requirement that is not included in the WECC criteria)
- Pre disturbance loading must be less than the continuous ratings of all equipment and line conductors as provided in the PSLF database.
- Post disturbance loading must be less than the emergency ratings of all equipment and line conductors as provided in the PSLF database. The emergency ratings are determined by the owner/operator of each equipment item.

All tables and results for loading criteria were based on the normal rating (Rating 1) for continuous conditions and the emergency rating (Rating 2) for outage conditions. Continuous and Emergency ratings were identified in the cases.

3.8 Regional Transmission

3.8.1 The "Two County Rule"

The Two County Rule requires that the flow on and into Tucson's system must meet both of the following criteria:

- All flows through the 345/138kV tie transformers must be inbound to the TEP system
- The sum of the transformer flows at Vail and South must meet or exceed the amount of power being generated at Springerville unit #2. The metering points are the 345 kV bus for the Vail T1 and South T2 and T3 transformers and the 138 kV bus for the Vail T2 transformer.

This analysis did not show any violation of the Two-County Rule for either Option or any of the Sensitivities.

3.8.2 Planned Transmission Projects

In January 2006 TEP filed its annual Ten Year Plan with the Arizona Corporation Commission indicating plans to build a Winchester- Pinal South 500kV line in two segments looped into a Tortolita 500kV substation. Both segments, Pinal South-Tortolita 500kV line and the Tortolita-Winchester 500kV line have in-service dates "under review".

4 STUDY METHODOLOGY

This section summarizes the methods used to derive the power flow and injection results.

4.1 Power Flow Methodology

Power flow analysis reviews the transmission system for a single point in time where all fast-acting devices (typically load tap changing transformers, SVD's, and phase shifting transformers) have had time to adjust to an outage. All power flow analysis was conducted with version 13.1 of General Electric's Positive Sequence Load Flow (PSLF) software. Power flow results (voltage, voltage deviation, and loading) were reported.

Power flow analysis was used to evaluate the voltage and thermal response of the Arizona transmission system under single contingencies using emergency ratings. Thermal overloads 80% or higher of the emergency MVA rating (as shown in the power flow case) were reported for pre contingency and single contingencies and 100% for multiple contingencies.

Transmission voltage conditions were monitored for voltage below 0.95 or above 1.05 pre contingency and below 0.90 and above 1.05 post contingency. Voltage deviations between pre and post contingency conditions were monitored for voltage deviations greater than 5% for single contingencies and 10% for multiple contingencies.

4.2 Injection Analysis Purpose and Methodology

The Injection Analysis is an evaluation of flow impacts caused by injecting additional power at a particular location on the transmission system. A standard load flow solution has serious limitations for this type of analysis in that it requires generation and load (plus losses) to remain in balance. Therefore, in order to evaluate additional generation at a given location (the source), there must be a corresponding change at another location (the sink). The sink can be represented as either increased load or decreased generation. In either case, both the source and the sink will have an effect on the transmission grid. The actual impacts of the generation source can be difficult to extract from the combined effects of a source-to-sink evaluation. Moreover, a source-to-sink evaluation can have distorted results, if unrealistic assumptions are made regarding the sink.

Unlike a standard power flow analysis, the Injection Analysis does not require generation and load to remain in balance but, instead, uses what are commonly know as generator shift factors to evaluate the impacts caused by a generation source, independent of the sink. The generator shift factors used in this analysis were developed by pre-solving a separate AC load flow case for each bus in the entire WECC transmission network. Other uses for generator shift factors include the control of generation dispatch for managing transmission congestion and the calculations employed in a security constrained economic dispatch (SCED) program.

There are several important considerations when using generator shift factors:

- Calculations that employ generator shift factors assume a linear system, which is not the case for an AC network. While the inaccuracies are generally very minimal for the intended purpose, it is advisable that standard power flow analyses be performed to confirm the results.
- Although the Injection Analysis evaluates the impacts attributable only to the generation source, there is still a corresponding sink that must be considered under certain circumstances. This is especially true if the sink is in near proximity to the source, in which case it will have an approximately equal but opposite effect on the transmission grid.

5 POWER FLOW FINDINGS

This section provides the results obtained by applying the previous assumptions and methodology. It illustrates findings associated with the power flow analysis. The Base Case was used as a baseline to measure the impact of the project and regional transmission plans. Contingencies were applied to Option and Sensitivity cases. The addition of the project showed voltage and overload issues for both single and multiple contingencies; however the addition of the facility did not greatly impact the voltage or thermal violations and should not be attributable to the project. The voltage issues shown below are known issues to both TEP and SWTC and each entity is developing plans to mitigate the issues with line upgrades and/or capacitor banks. It should be noted that the addition of the 2nd Winchester-Vail and Vail-South 345kV circuits eliminates many of the thermal overloads even with the addition of the project (Sensitivity 1 overloading results).

5.1 Voltage Violations

5.1.1 Single Contingencies (Category B outages) voltage violations

The table is limited to those voltage deviations greater than 5% while the "-" indicates less than 5% voltage deviation. Complete results are contained in the appendix.

The single contingency voltage violation table below shows consistent voltage deviations among all cases or improvement with the addition of the proposed transmission system additions (modeled in the Sensitivities).

Bus & kV	BASE	OPT1	OPT2	SENS 1	SENS2	SENS3	SENS4	Outage description
SAN RAF 230	-16%	-16%	-17%	-15%	-14%	-14%	-15%	line APACHE to BUTERFLD 230 ck 1
BUTERFLD 230	-15%	-15%	-16%	-14%	-13%	-13%	-15%	line APACHE to BUTERFLD 230 ck 1
G.SLOAN 230	-13%	-13%	-14%	-12%	-12%	-11%	-13%	line APACHE to BUTERFLD 230 ck 1
KARTCHNR 115	-13%	-12%	-13%	-11%	-11%	-10%	-12%	line APACHE to BUTERFLD 230 ck 1
PANTANO 230	-11%	-11%	-12%	-10%	-10%	-9%	-11%	line APACHE to BUTERFLD 230 ck 1
GATEWAY 138	-8%	-8%	-9%	-8%	-8%	-8%	-8%	sgl_61 GATEWAY -GATEWAY 138 ckt 1
VALENCIA 138	-8%	-8%	-8%	-8%	-8%	-8%	-8%	sgl_61 GATEWAY -GATEWAY 138 ckt 1
SONOITA 138	-8%	-8%	-8%	-7%	-7%	-7%	-8%	sgl_61 GATEWAY -GATEWAY 138 ckt 1
CANEZ 138	-8%	-8%	-8%	-7%	-7%	-7%	-7%	sgl_61 GATEWAY -GATEWAY 138 ckt 1
SAHUARIT 230	-7%	-7%	-7%	-6%	-6%	-6%	-7%	line APACHE to BUTERFLD 230 ck 1
KARTCHNR 115	-6%	-13%	-15%	-	-	-	-	line WINCHSTR to VAIL 345 ck 1
BICKNELL 230	-5%	-5%	-5%	-	-	-	-5%	line APACHE to BUTERFLD 230 ck 1
PANTANO 230	-5%	-9%	-11%	-	-	-	-	line WINCHSTR to VAIL 345 ck 1
SAHUARIT 230	-5%	-9%	-10%	-	-	-	-	line WINCHSTR to VAIL 345 ck 1
BICKNELL 230	-	-8%	-8%	-	-	-	-	line WINCHSTR to VAIL 345 ck 1
G.SLOAN 230	-	-8%	-10%	-	-	-	-	line WINCHSTR to VAIL 345 ck 1
SAN RAF 230	-	-6%	-8%	-	-	-	-	line WINCHSTR to VAIL 345 ck 1
HIDALGO 345	-	-	-	-	-	-	-5%	line WINCHSTR to BOWIE 500 ck 1
PYOUNG 345	-	-	-	-	-	-	-6%	line WINCHSTR to BOWIE 500 ck 1
COPPERVR 345	-	-	-	-	-	-	-6%	line WINCHSTR to BOWIE 500 ck 1

5.1.2 Multiple Contingencies (Category C outages) voltage violations

The N-2 outage list was provided by TEP and included N-2 (Category C) and extreme multiple contingency outages (Category D). Additional actions can be taken for Category D outages which were not simulated. The table is limited to those voltage deviations greater than 10% while the "-" indicates less than 10% voltage deviation. Complete results are contained in the appendix.

Similar to the single contingency voltage violation table, the multiple contingency voltage violation table below shows consistent voltage deviations among all cases or improvement with the addition of regional transmission system improvements that were modeled in the Sensitivities.

Bus & kV	BASE	OPT1	OPT2	SENS1	SENS2	SENS3	SENS4	Outage description
BICKNELL 230	-	-	-12%	-	-	-	-	DBL967 WINCHSTR -VAIL 345 and PINAL_W 500 - PINALWES 345
BUTERFLD 230	-	-	-10%	-	-	-	-	DBL672 SPRINGR -PYOUNG 345 and WINCHSTR - VAIL 345
COPPERVR 230	-	-	-	-	-	-	-11%	DBL641 SPRINGR -VAIL2 345 and WINCHSTR - BOWIE 500
FRISCO 230	-	-	-	-	-	-	-11%	DBL641 SPRINGR -VAIL2 345 and WINCHSTR - BOWIE 500
G.SLOAN 230	-	-	-12%	-	-	-	-	DBL967 WINCHSTR -VAIL 345 and PINAL_W 500 - PINALWES 345
GATEWAY 138	-13%	-11%	-12%	-11%	-11%	-11%	-11%	DBL1771 VAIL2 345 -VAIL 138 and GATEWAY 345 - GATEWAY 138
GATEWAY 345	-10%	-10%	-10%	-	-	-	-	DBL1112 SOUTH -GATEWAY 345 and SOUTH - GATEWAY 345
GREEN-SW 230	-	-	-	-	-	-	-10%	DBL1575 WINCHSTR -BOWIE 500 and VAIL2 345 - VAIL 138
GREEN-SW 345	-	-	-	-	-	-	-11%	DBL641 SPRINGR -VAIL2 345 and WINCHSTR - BOWIE 500
KARTCHNR 115	-	-15%	-20%	-	-	-	-	DBL672 SPRINGR -PYOUNG 345 and WINCHSTR - VAIL 345
MORENCI 230	-	-	-	-	-	-	-10%	DBL591 SPRINGR -CORONADO 345 and WINCHSTR - BOWIE 500
NE.LOOP 138	-	-	-	-	-11%	-10%	-	DBL649 SPRINGR -VAIL2 345 and VAIL345 - VAIL 138
PANTANO 230	-	-11%	-13%	-	-	-	-	DBL672 SPRINGR -PYOUNG 345 and WINCHSTR - VAIL 345
PYOUNG 345	-	-	-	-	-	-	-10%	DBL591 SPRINGR -CORONADO 345 and WINCHSTR - BOWIE 500
PYOUNG 345	-	-	-	-	-	-	-11%	DBL641 SPRINGR -VAIL2 345 and WINCHSTR - BOWIE 500
SAHUARIT 230	-	-10%	-13%	-	-	-	-	DBL967 WINCHSTR -VAIL 345 and PINAL_W 500 - PINALWES 345
SAN RAF 230	-	-	-11%	-	-	-	-	DBL672 SPRINGR -PYOUNG 345 and WINCHSTR - VAIL 345

5.2 Thermal Violations

5.2.1 No Outage (Category A – all lines in service)

The following table lists to those transmission elements with loading greater than 80% of the continuous rating while the "-" indicates less than 80% of the continuous rating. Yellow highlighting indicates loading greater than 120% of the continuous rating. Complete results are contained in the appendix.

The overload table below shows an overload attributed to the project in Options 1 and 2 which are mitigated with the planned transmission system additions modeled in the Sensitivity Cases.

Transmission Element	Rated MVA	Percent of Continuous rating							Outage description
		Base	Opt 1	Opt 2	S1	S2	S3	S4	
ARROYO 115/345 ck 1 tran	200	97%	98%	97%	97%	97%	97%	100%	Base system (n-0)
WINCHSTR-VAIL 345 ck 1 line	925	-	109%	120%	-	-	-	-	Base system (n-0)

5.2.2 Single Contingencies (Category B outages)

The following table lists to those transmission elements with loading greater than 80% of the emergency rating while the "-" indicates less than 80% of the emergency rating. Yellow highlighting indicates loading greater than 120% of the emergency rating. Complete results are contained in the appendix.

Similar to the "Percentage of Continuous rating" table above, the table below shows loading on elements following an outage. The table indicated overloads attributable to the project were generally mitigated or similar to the Base Case with the addition of the planned regional transmission facilities modeled in the Sensitivities.

Transmission Element	Emergc'y Rating MVA	Percent of Emergency rating							Outage description
		Base	Opt 1	Opt 2	S1	S2	S3	S4	
APACHE -BUTERFLD 230 ck 1 line	368	116%	146%	152%	-	-	-	-	line WINCHSTR to VAIL 345 ck 1
AVRA -MARANA 115 ck 1 line	79	114%	84%	80%	-	83%	81%	-	line SPRINGR to VAIL2 345 ck 1
BUTERFLD-G.SLOAN 230 ck 1 line	368	90%	118%	124%	-	-	-	-	line WINCHSTR to VAIL 345 ck 1
COPPERVR 345/230 ck 1 tran	224	118%	128%	113%	113%	114%	114%	118%	sgl_28 GREEN-SW -PYOUNG345 ckt 1
G.SLOAN -PANTANO 230 ck 1 line	368	80%	109%	114%	-	-	-	-	line WINCHSTR to VAIL 345 ck 1
GREEN-SW 345/230 ck 1 tran	193	135%	147%	129%	129%	131%	130%	136%	line PYOUNG to COPPERVR 345 ck 1
HIDALGO -PYOUNG 345 ck 1 line	789	-	-	-	-	-	-	107%	line WINCHSTR to BOWIE 500 ck 1
IRVNGTN -RBWILMOT 138 ck 1 line	287	81%	102%	106%	-	-	-	-	line VAIL to SOUTH 345 ck 1
IRVNGTN -SOUTH 138 ck 1 line	309	-	98%	105%	108%	95%	99%	105%	sgl_44 VAIL -VAIL138 ckt 1
IRVNGTN -TECHPARK 138 ck 1 line	287	-	100%	105%	-	-	-	-	line VAIL to SOUTH 345 ck 1
LUNA500 500/345 ck 1 tran	806	-	-	-	-	-	-	149%	line WINCHSTR to BOWIE 500 ck 1
RBWILMOT-VAIL 138 ck 1 line	287	86%	107%	111%	-	-	-	-	line VAIL to SOUTH 345 ck 1
TECHPARK-VAIL 138 ck 1 line	287	87%	108%	113%	-	-	-	-	line VAIL to SOUTH 345 ck 1
VAIL 345/138 ck 1 tran	806	85%	98%	100%	100%	97%	99%	103%	line SPRINGR to VAIL2 345 ck 1
WINCHSTR 500/345 ck 1 tran	806	-	-	-	-	-	-	109%	line WINCHSTR to TORTOLIT 500 ck 1
WINCHSTR-VAIL 345 ck 1 line	1110	81%	109%	118%	-	-	-	-	line SPRINGR to VAIL2 345 ck 1
WINCHSTR-VAIL 345 ck 1 line	1110	-	95%	104%	-	-	-	-	line G.SLOAN to PANTANO 230 ck 1

5.2.3 Multiple Contingencies (Category C outages)

The N-2 outage list was provided by TEP and included N-2 (Category C) and extreme multiple contingency outages (Category D). Additional actions can be taken for Category D outages which were not simulated. The table is limited to those overloads greater than 100% while the "-" indicates less than 100% loading. Complete results are contained in the appendix. Yellow highlighting indicates loading greater than 120% of the emergency rating.

The overload table below showed loading on elements, following a Category C or D outage, as higher than the pre-project case. It is unclear which of the outages simulate true Category C versus Category D outages. Category D outages allow for other actions to occur which may eliminate these overloads. Simulating TEP's load shed routine may eliminate many of the noted overloads.

Overloaded Element	Emergc'y Rating MVA	Percent of Emergency rating							Outage description
		Base	Opt 1	Opt 2	S1	S2	S3	S4	
WINCHSTR 500 - WINCHSTR 345 ckt 1	1110	-	-	107%	-	-	-	-	DBL10 CHOLLA -SAGUARO 500 and SPRINGR - CORONADO 345
WINCHSTR 345 - WILLOW 345 ckt 1	789	-	-	-	-	-	-	107%	DBL1005 WINCHSTR -VAIL 345 and WINCHSTR - BOWIE 500
WINCHSTR 345 - WINCHSTR 230 ckt 1	806	-	-	-	-	-	-	149%	DBL1005 WINCHSTR -VAIL 345 and WINCHSTR - BOWIE 500
WINCHSTR 345 - VAIL 345 ckt 1	1110	-	109%	117%	118%	112%	114%	131%	DBL1014 WINCHSTR -VAIL 345 and VAIL2 345 - VAIL 138
WINCHSTR 345 - VAIL 345 ckt 1	286	-	108%	113%	112%	100%	103%	113%	DBL1031 VAIL -SOUTH 345 and VAIL - SOUTH 345
WINCHSTR 345 - VAIL 345 ckt 1	67	165%	260%	285%	-	-	-	-	DBL1054 VAIL -SOUTH 345 and VAIL345 - VAIL 138
WINCHSTR 345 - VAIL 345 ckt 1	806	-	-	-	-	-	-	132%	DBL1368 HIDALGO-PYOUNG 345 and WINCHSTR - TORTOLIT 500
VAIL 345 - VAIL 138 ckt 1	193	108%	122%	109%	108%	108%	108%	114%	DBL1446 PYOUNG –COPPERVR 345 and WINCHSTR345 - WINCHSTR 230
TECHPARK 138 - VAIL 138 ckt 1	308	-	107%	114%	117%	100%	105%	110%	DBL1496 SNTAROSA-PINALSTH 500 and VAIL345 - VAIL 138
SONOITA 138 - VALENCIA 138 ckt 1	286	115%	125%	127%	127%	120%	123%	127%	DBL1702 SOUTH345 -SOUTH 138 ckt1 and ckt 2
MORENCI 230 - GREEN-SW 230 ckt 1	1210	-	102%	-	-	-	-	-	DBL566 SPRINGR -CORONADO 345 and SPRINGR - VAIL2 345
LUNA500 500 - LUNA 345 ckt 1	1110	-	-	107%	108%	-	-	110%	DBL574 SPRINGR -CORONADO 345 and WINCHSTR - VAIL 345
HIDALGO 345 - PYOUNG 345 ckt 1	1110	-	109%	118%	118%	112%	114%	131%	DBL624 SPRINGR -VAIL2 345 and WINCHSTR - VAIL 345
GREEN-SW 345 - GREEN-SW 230 ckt 1	368	-	116%	120%	-	-	-	-	DBL672 SPRINGR -PYOUNG 345 and WINCHSTR - VAIL 345
GREEN-SW 345 - GREEN-SW 230 ckt 1	482	-	102%	-	-	-	-	-	DBL780 WINCHSTR -WILLOW 345 and PYOUNG - COPPERVR 345
G.SLOAN 230 - PANTANO 230 ckt 1	224	174%	128%	155%	157%	159%	158%	158%	DBL912 PYOUNG -WINCHSTR 345 and GREEN-SW - PYOUNG 345
COPPERVR 345 - COPPERVR 230 ckt 1	193	201%	147%	179%	181%	183%	182%	182%	DBL915 PYOUNG -WINCHSTR 345 and PYOUNG - COPPERVR 345
APACHE 230 - BUTERFLD 230 ckt 1	368	116%	146%	152%	152%	115%	122%	126%	DBL946 WINCHSTR -VAIL 345 ckt 1 and ckt2
BUTERFLD 230 - G.SLOAN 230 ckt 1	368	-	118%	124%	124%	-	-	-	DBL946 WINCHSTR -VAIL 345 ckt 1 and ckt2
APACHE 230 - BUTERFLD 230 ckt 1	368	108%	144%	150%	-	-	-	-	DBL956 WINCHSTR -VAIL 345 and HIDALGO - PYOUNG 345

5.2.4 Unsolved Outages

The following table highlights those outages of elements that did not solve, or result in a mathematical solution for the outage, in this feasibility analysis. The "x" indicates that the outage did not solve for that particular case. A future study should review the single "line" outages and try to resolve the issue; if it is determined these external outages are significant. A future study should review the multiple contingencies "dbl" outages for true Category C, N-2 conditions (not extreme contingency, Category D outages) and work with TEP to implement additional Remedial Action Schemes, "RAS", as necessary to obtain a solution. No overloads or voltage deviations were obtained from those outages that did not result in a solved case. The RAS that added the Northeast Loop "b3" 138kV, Vail "b3" and "b4" 138kV shunts, and removed the Pinal West 345kV line reactor did not fix the divergence (unsolved case) issue. Simulating TEP's load shed routine may eliminate many of the noted unsolved outages.

Contingency_Description	Base	Option1	Option2	Sens1	Sens2	Sens3	Sens4
line CALIENTE to AMRAD 345 ck 1	x	x	x	x	x	x	x
line ANDERSON to KYR-NEW 230 ck 1	x	x	x	x	x	x	x
line LINCSTRT to OCOTILLO 230 ck 1	-	-	-	-	x	-	-
line YAVAPAI to VERDE N 230 ck 1	x	x	x	x	x	x	x
DBL1333 GREEN-SW -PYOUNG 345 and PYOUNG - COPPERVR 345	x	x	x	x	x	x	x
DBL16207 NL LONG BUS DIF- and DMP - N. LOOP 138	x	x	x	x	x	x	x
DBL1739 VAIL -VAIL 138 and VAIL2 - VAIL 138	x	x	x	x	x		x
DBL308 PINALSTH -TORTOLIT 500 and WINCHSTR - VAIL 345		x	x				
DBL573 SPRINGR -CORONADO 345 and WINCHSTR - VAIL 345			x				
DBL623 SPRINGR -VAIL2 345 and WINCHSTR - VAIL 345	x	x	x				
DBL630 SPRINGR -VAIL2 345 and PINALWES - SOUTH 345	x						
DBL649 SPRINGR -VAIL2 345 and VAIL - VAIL 138	x	x	x	x			x
DBL720 PYOUNG -WILLOW 345 and WINCHSTR - VAIL 345		x					
DBL794 WINCHSTR -WILLOW 345 and VAIL2 - VAIL 138		x					
DBL902 PYOUNG -WINCHSTR 345 and WINCHSTR - VAIL 345			x				
DBL952 WINCHSTR -VAIL 345 and PINALWES - SOUTH 345		x	x				
DBL954 WINCHSTR -VAIL 345 and BICKNELL - VAIL 345		x					
DBL972 WINCHSTR -VAIL 345 and VAIL2 - VAIL 138	x	x	x				
DBL978 WINCHSTR -VAIL 345 and WINCHSTR - WINCHSTR 230		x					

5.2.5 Loads and Resources

The table below shows the loads, losses, generation, and area interchange for the cases studied. The table shows the addition of the facility without other transmission system upgrades could result in a significant increase in Arizona losses (16-17MW for Options 1 and 2). With other transmission system upgrades (Sensitivity cases 1-3) the increase in losses was minimal, 5MW or less. Sensitivity 4 shows a 41MW increase in losses, but reflects 1200MW of generation and a 500kV line and should be noted for its impact to Arizona but not attributed solely to the Project.

Loads & Resources		Base & Primary Options			Sensitivities			
		Base	Option 1	Option 2	1	2	3	4
Loads & Losses (MW)	Arizona Load	21976	21976	21976	21976	21976	21976	21976
	Arizona Losses	681	696	698	686	684	684	725
Generation (MW)	Bowie	0	600	600	600	600	600	600
	NM wind	0	0	0	0	0	0	600
	Arizona	29753	29768	29770	29758	29757	29756	29798
	Springerville	1640	1640	1640	1640	1640	1640	1640
	Coronado	850	850	850	850	850	850	850
	Apache	559	559	559	559	559	559	559
Area Interchange (MW)	Arizona	7097	7097	7097	7097	7096	7096	7096
	Southern California Edison	-5362	-5362	-5362	-5362	-5363	-5363	-5962
	New Mexico	57	57	57	57	57	57	657

5.2.6 Significant Line Flow

The table below shows the impact on critical lines in the southeastern Arizona system under normal operating conditions. The negative sign indicates direction of flow as opposite of the line definition. For example, the -69MW value for the Springerville-McKinley 345kV line indicates the flow is actually from McKinley to Springerville.

The line flow table shows the addition of the project reduced flow on lines north of the interconnection and increased flow south of the interconnection without causing the element to exceed the normal rating.

Element	Normal Rating (MVA)	Base & Primary Options Flow(MW)			Sensitivities Flow(MW)			
		Base	Option 1	Option 2	1	2	3	4
Springerville-McKinley 345kV ckt 1	925	-117	-69	-79	-82	-90	-89	-45
Springerville-McKinley 345kV ckt 2	925	-118	-70	-80	-83	-91	-90	-45
Springerville – Luna 345kV ckt 1	657	122	59	86	90	99	98	-19
Springerville-Vail 345kV	666	646	610	573	572	591	586	574
Springerville-PYoung 345kV	925	459	298	368	380	404	398	332
PYoung – Winchester 345kV	925	488	-	377	393	422	413	451
PYoung-Willow 345kV	896	-	243	-	-	-	-	-
PYoung-Greenlee 345kV	818	131	143	123	124	126	125	131
Willow-Winchester 345kV	896	-	840	-	-	-	-	-
Winchester 345/500kV transformer	672	-	-	-584	-584	-412	-468	-587
Winchester-Tortolita 500kV	1200	-	-	-	-	173	-	331
Winchester-Pinal South 500kV	1200	-	-	-	-	-	117	-
Winchester-Vail ckt 1 500kV	925	658	994	1093	561	495	517	593
Winchester-Vail ckt 2 500kV	925	-	-	-	556	490	511	587
Winchester-Bowie 500kV line	1200	-	-	-585	-585	-585	-585	-919

5.2.7 WECC Path Flow

The following Western Electricity Coordinating Council (WECC) paths were monitored for flow impact for the cases and Sensitivities. The table shows greatest impact (approximately 100-150MW) to Paths 22 and 47 for the addition of Bowie and planned regional transmission elements, but the addition does not cause any loading greater than the Path rating.

Path 22 – Southwest of Four Corners includes these lines:

- Four Corners – Moenkopi 500kV
- Four Corners – Cholla 345kV (ckts 1 and 2)

Path 47 – Southern New Mexico includes these lines:

- WestMesa- Arroyo 345kV
- Springerville – Luna 345kV
- PYoung – Hidalgo 345kV
- Belen_PG – Bernardo 115kV

Path 48 – Northern New Mexico included the following lines and transformers:

- Four Corners – Rio Puerco 345kV line
- San Juan – Rio Puerco 345kV line
- San Juan – Ojo East 345kV line
- Yah Ta Hey – McKinley 115/345kV transformer
- Bisti - Ambrosia 230kV line
- West Mesa – Arroyo 345kV line
- Belen_PG – Bernado 115kV line
- Gladstone 115/230kV transformer

Path	Normal Rating (MVA)	Base & Primary Options Path Flow (MW)			Sensitivities Path Flow (MW)			
		Base	Option 1	Option 2	1	2	3	4
Path 22 – SW of Four Corners	5700	1706	1777	1762	1767	1755	1760	1819
Path 47 – Southern NM	1048	-85	2	2	2	2	2	-235
Path 48 – Northern NM	1665	1525	1525	1525	1525	1525	1525	1524

6 INJECTION ANALYSIS

In each of the tables that follow, the branches most affected by an assumed 600 MW injection are listed in sorted order based on the magnitude of the effect, either positive or negative. Detailed information is provided as to branch ratings, shift factors, flow impact and net branch flow after the injection. When reviewing this information, please note that the shift factors, flow impact and net branch flow data are all direction sensitive. **A negative flow impact value, for instance, means that power is actually flowing from the "To-Bus" to the "From-Bus".**

After each table, a map of the Study Region displays the same information graphically. The following information is displayed in the maps:

- A grey-colored line indicates that the power injection has little effect on the transmission line.
- Red - indicates that the power injection increases loading on a transmission line to a level that is more than 60% of its normal thermal rating (Rating 1 in the power flow case).
- Orange - indicates that the power injection increases loading on a transmission line, but not to a level that exceeds 60% of its normal thermal rating.
- Green - indicates that the power injection decreases loading on a transmission line that was previously loaded to more than 60% of its normal thermal rating.
- Teal - indicates that the power injection decreases loading on a transmission line that was previously loaded to less than 60% of its normal thermal rating.
- The line width indicates the relative amount of injected power that wants to flow over the transmission line.

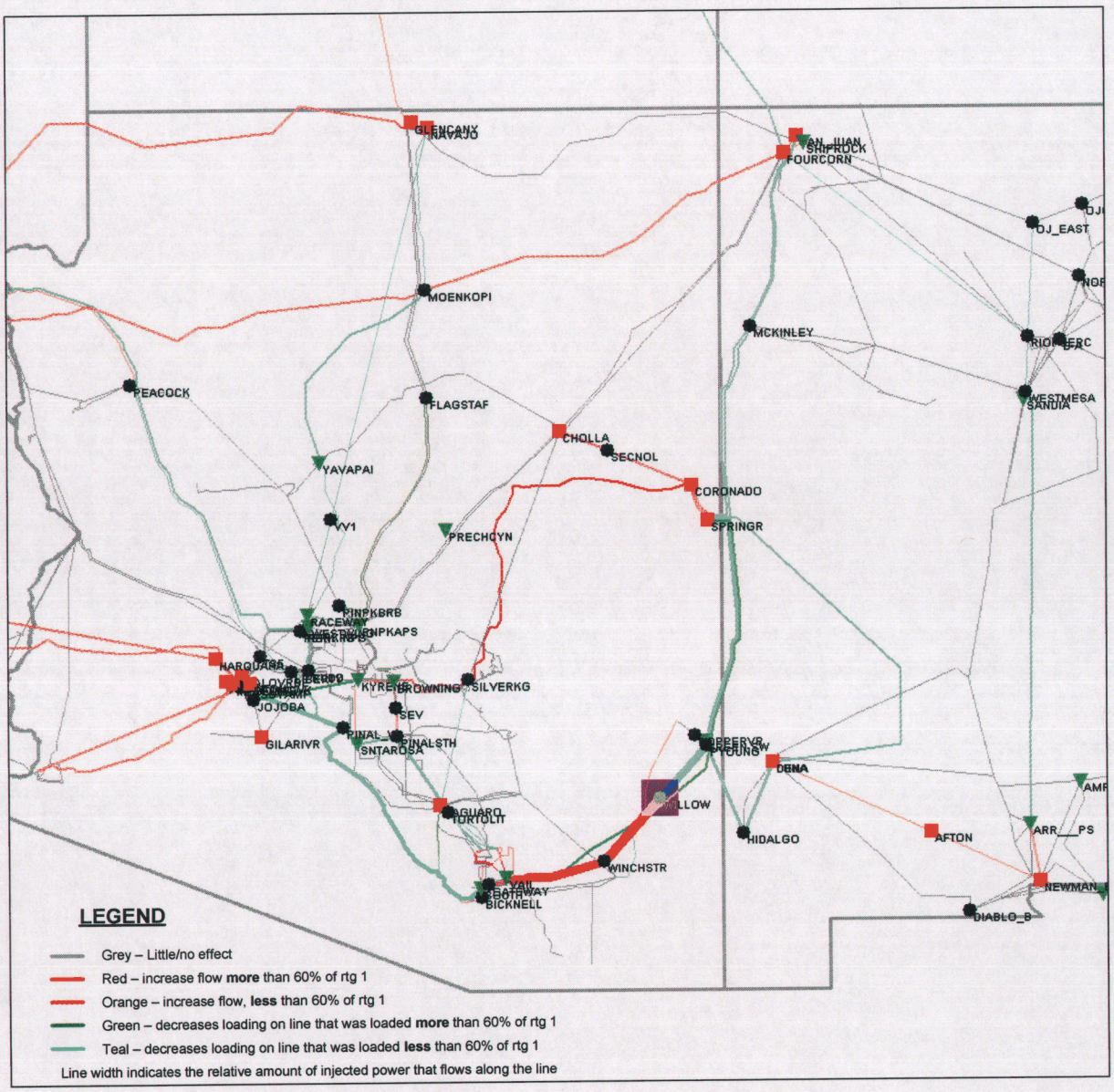
6.1 Option 1 – Connection to Willow 345kV

6.1.1 Flow Impact Table – Willow 345 kV

Bus: 16112 WILLOW Area: 14 kV: 345 PMax: 0.0 Gen: 0.0 Load: 0.0 Added Gen: 600.0

From-Bus				To-Bus					Ratings		Shift	Branch Flow		Flow
No.	Name	kV	Ar	No.	Name	kV	Ar	Ck	#1	#2	Factor	Pre Inj	Post Inj	Impact
16109	WINCHSTR	345	14	16112	WILLOW	345	14	1	896	1210	-55.74	-481.4	-815.8	-334.5
16105	VAIL	345	14	16109	WINCHSTR	345	14	1	925	1210	-52.57	-651.9	-967.4	-315.4
16101	PYOUNG	345	14	16112	WILLOW	345	14	1	896	1210	-43.71	490.8	228.6	-262.2
16103	SOUTH	345	14	16105	VAIL	345	14	1	925	1110	-29.57	-261.3	-438.7	-177.4
16101	PYOUNG	345	14	16104	SPRINGR	345	14	1	925	1110	24.74	-450.8	-302.4	148.4
16103	SOUTH	345	14	16114	PINALWES	345	14	1	925	1110	24.2	-251.9	-106.7	145.2
15090	HASSYAMP	500	14	79264	PINAL_W	500	14	1	2598	2598	-21.8	899.9	769.1	-130.8
16100	CORONADO	345	14	16104	SPRINGR	345	14	1	1195	1434	-21.45	-523.3	-652	-128.7
15011	KYRENE	500	14	15051	BROWNING	500	14	1	1732	1888	-16.56	-381.1	-480.4	-99.3
16000	TORTOLIT	500	14	90000	PINALSTH	500	14	1	1732	2217	15.74	-365.1	-270.6	94.4
11080	HIDALGO	345	10	16101	PYOUNG	345	14	1	717	789	-15.62	332.2	238.5	-93.7
16114	PINALWES	345	14	79264	PINAL_W	500	14	1	672	806	15.61	-182.7	-89	93.7
11080	HIDALGO	345	10	11093	LUNA	345	10	1	717	956	14.64	-190	-102.2	87.8
14008	JOJOBA	500	14	15011	KYRENE	500	14	1	1732	3066	-12.52	1684.1	1609	-75.1
14008	JOJOBA	500	14	15090	HASSYAMP	500	14	1	2598	3066	11.98	142	213.9	71.9
14017	SECNOL	500	14	15001	CORONADO	500	14	1	1732	2832	-11.64	-251.5	-321.4	-69.9
14000	CHOLLA	500	14	14017	SECNOL	500	14	1	1732	2832	-11.64	-251.3	-321.2	-69.8
15041	SILVERKG	500	14	15051	BROWNING	500	14	1	1732	2886	11.31	862.6	930.4	67.8
14002	MOENKOPI	500	14	24042	ELDORDO	500	24	1	1732	2382	11.19	716.9	784	67.1
14005	WESTWING	500	14	15033	PERKINPS	500	14	1	1732	2078	11.14	-153.9	-87.1	66.8
15034	PERKINS	500	14	19038	MEAD	500	14	1	1238	1362	11.13	-153.9	-87.1	66.8
16208	NE.LOOP	138	14	16210	RILLITO	138	14	1	478	478	10.95	-192.5	-126.8	65.7
15001	CORONADO	500	14	16100	CORONADO	345	14	2	672	806	-10.7	-261.4	-325.6	-64.2
15001	CORONADO	500	14	16100	CORONADO	345	14	1	672	806	-10.7	-261.4	-325.6	-64.2
15001	CORONADO	500	14	15041	SILVERKG	500	14	1	1732	1732	9.74	1011.9	1070.3	58.4
14003	NAVAJO	500	14	26123	CRYSTAL	500	26	1	3201	4082	9.53	828	885.2	57.2
15021	PALOVRDE	500	14	24801	DEVERS	500	24	1	3421	4616	9.3	1021.9	1077.7	55.8
19038	MEAD	500	14	26044	MARKETPL	500	26	1	3248	3897	9.24	318.8	374.2	55.4
16107	WESTWING	345	14	16114	PINALWES	345	14	1	925	1110	-9.16	72.5	17.5	-54.9
16102	MCKINLEY	345	14	16104	SPRINGR	345	14	2	925	1110	-9.07	118.9	64.5	-54.4
16102	MCKINLEY	345	14	16104	SPRINGR	345	14	1	925	1110	-8.96	117.5	63.7	-53.8
14001	FOURCORN	500	14	14002	MOENKOPI	500	14	1	1732	2182	8.86	869.3	922.5	53.2
10292	SAN_JUAN	345	10	16102	MCKINLEY	345	14	1	925	1110	-8.74	157.4	104.9	-52.4
10292	SAN_JUAN	345	10	16102	MCKINLEY	345	14	2	845	1016	-8.74	157.4	104.9	-52.4
10292	SAN_JUAN	345	10	79064	SHIPROCK	345	14	1	717	717	8.69	253.3	305.5	52.2
15992	SEV	500	14	90000	PINALSTH	500	14	1	2598	2598	-7.93	-249.7	-297.3	-47.6
14015	SNTAROSA	500	14	90000	PINALSTH	500	14	1	2598	2598	-7.82	616	569.1	-46.9
15093	HARQUAHA	500	14	24801	DEVERS	500	24	1	3421	4616	7.78	1138.9	1185.6	46.7
15090	HASSYAMP	500	14	15093	HARQUAHA	500	14	1	3000	3000	7.77	47	93.7	46.6
10369	WESTMESA	345	10	11014	ARR___PS	345	10	1	717	717	-7.42	187.4	142.9	-44.5
16202	E. LOOP	138	14	16208	NE.LOOP	138	14	1	287	287	7.23	72	115.4	43.4
11014	ARR___PS	345	10	11017	ARROYO	345	10	1	275	462	-7.22	184.1	140.8	-43.3

6.1.2 Flow Impact Map – Willow 345 kV



6.1.3 Willow 345kV Conclusion

The analysis of a 600MW injection at the Willow 345kV bus indicated significant potential of flow related issues on the Willow-Winchester 345 and Winchester-Vail 345kV lines. The analysis indicated a reduction of flow on elements connected to the west of South substation, south of the Springerville substation, and south of the Phil Young/Greenlee 345kV substations. The flow increased on the Vail-South 345kV line and on the Springerville-Coronado 345kV line.

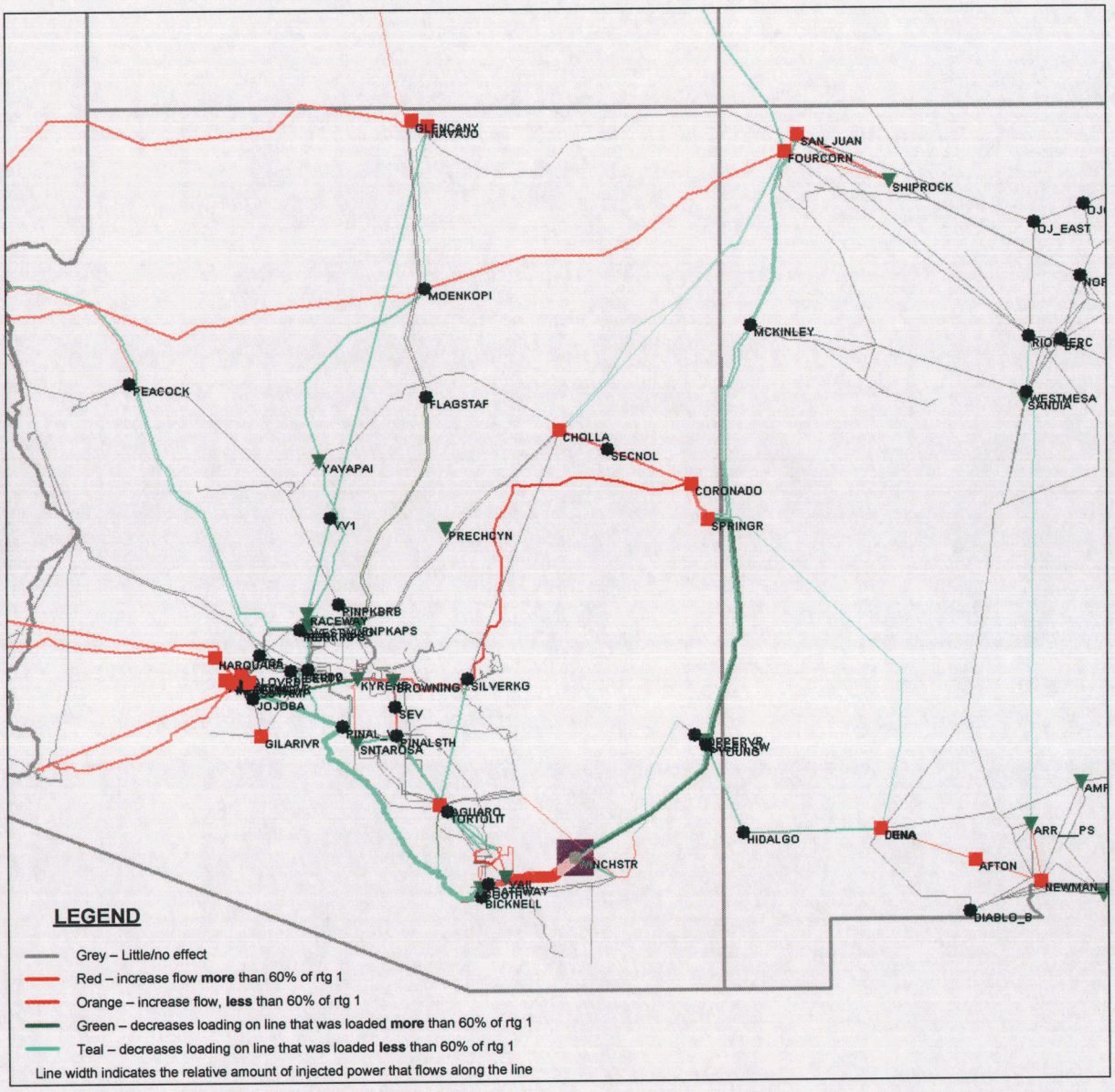
6.2 Option 2 – Connection to Winchester 500kV

6.2.1 Flow Impact Table – Winchester 500 kV

Bus: 16109 WINCHSTR Area: 14 kV: 345 PMax: 0.0 Gen: 0.0 Load: 0.0 Added Gen: 600.0

From-Bus				To-Bus					Ratings		Shift	Branch Flow		Flow
No.	Name	kV	Ar	No.	Name	kV	Ar	Ck	#1	#2	Factor	Pre Inj	Post Inj	Impact
16105	VAIL	345	14	16109	WINCHSTR	345	14	1	925	1210	-71.71	-650.2	-1080.5	-430.3
16103	SOUTH	345	14	16105	VAIL	345	14	1	925	1110	-37.91	-260.6	-488.1	-227.4
16103	SOUTH	345	14	16114	PINALWES	345	14	1	925	1110	30.56	-252.3	-69	183.3
15090	HASSYAMP	500	14	79264	PINAL_W	500	14	1	2598	2598	-24.75	900	751.5	-148.5
16101	PYOUNG	345	14	16109	WINCHSTR	345	14	1	925	1110	-20.23	488.4	367	-121.4
16114	PINALWES	345	14	79264	PINAL_W	500	14	1	672	806	20.03	-183	-62.9	120.2
16000	TORTOLIT	500	14	90000	PINALSTH	500	14	1	1732	2217	18.09	-365.1	-256.6	108.5
15011	KYRENE	500	14	15051	BROWNING	500	14	1	1732	1888	-17.05	-381.2	-483.5	-102.3
16100	CORONADO	345	14	16104	SPRINGR	345	14	1	1195	1434	-14.81	-524.3	-613.2	-88.9
16208	NE.LOOP	138	14	16210	RILLITO	138	14	1	478	478	14.02	-192.7	-108.6	84.1
16101	PYOUNG	345	14	16104	SPRINGR	345	14	1	925	1110	13.55	-449.4	-368.1	81.3
16104	SPRINGR	345	14	16106	VAIL2	345	14	1	733	992	-13.38	645.8	565.5	-80.3
14008	JOJOBA	500	14	15011	KYRENE	500	14	1	1732	3066	-12.55	1684	1608.7	-75.3
16106	VAIL2	345	14	16220	VAIL	138	14	1	672	806	-12.41	603.8	529.4	-74.5
14008	JOJOBA	500	14	15090	HASSYAMP	500	14	1	2598	3066	11.97	142.1	214	71.8
15034	PERKINS	500	14	19038	MEAD	500	14	1	1238	1362	11.95	-153.9	-82.2	71.7
14005	WESTWING	500	14	15033	PERKINPS	500	14	1	1732	2078	11.94	-153.9	-82.3	71.6
15992	SEV	500	14	90000	PINALSTH	500	14	1	2598	2598	-11.34	-249.4	-317.4	-68
16107	WESTWING	345	14	16114	PINALWES	345	14	1	925	1110	-11.24	72.6	5.2	-67.4
14002	MOENKOPI	500	14	24042	ELDORDO	500	24	1	1732	2382	10.82	716.9	781.8	64.9
15051	BROWNING	500	14	15992	SEV	500	14	1	2598	2598	-10.23	-90	-151.4	-61.4
19038	MEAD	500	14	26044	MARKETPL	500	26	1	3248	3897	9.93	318.8	378.4	59.6
15021	PALOVRDE	500	14	24801	DEVERS	500	24	1	3421	4616	9.79	1021.9	1080.6	58.8
11080	HIDALGO	345	10	16101	PYOUNG	345	14	1	717	789	-9.63	331.9	274.1	-57.8
14003	NAVAJO	500	14	26123	CRYSTAL	500	26	1	3201	4082	9.41	827.9	884.4	56.5
16202	E. LOOP	138	14	16208	NE.LOOP	138	14	1	287	287	9.24	71.8	127.2	55.4
14017	SECNOL	500	14	15001	CORONADO	500	14	1	1732	2832	-9.06	-252	-306.3	-54.4
14000	CHOLLA	500	14	14017	SECNOL	500	14	1	1732	2832	-9.03	-251.7	-305.9	-54.2
11080	HIDALGO	345	10	11093	LUNA	345	10	1	717	956	8.96	-189.7	-135.9	53.8
15041	SILVERKG	500	14	15051	BROWNING	500	14	1	1732	2886	8.71	863	915.3	52.3
16200	DMP	138	14	16207	N. LOOP	138	14	1	287	287	8.37	-96.6	-46.4	50.2
15093	HARQUAHA	500	14	24801	DEVERS	500	24	1	3421	4616	8.24	1138.9	1188.4	49.5
15090	HASSYAMP	500	14	15093	HARQUAHA	500	14	1	3000	3000	8.21	47	96.3	49.3
16204	IRVNGTN	138	14	16214	SN.CRUZ	138	14	1	287	287	7.95	155.6	203.3	47.7
14002	MOENKOPI	500	14	14006	YAVAPAI	500	14	1	2018	2018	-7.81	754.6	707.7	-46.9
16000	TORTOLIT	500	14	16217	TORTOLIT	138	14	1	672	806	-7.77	331.9	285.3	-46.6
16000	TORTOLIT	500	14	16217	TORTOLIT	138	14	2	672	806	-7.77	331.9	285.3	-46.6
16000	TORTOLIT	500	14	16217	TORTOLIT	138	14	3	672	806	-7.77	331.9	285.3	-46.6
16102	MCKINLEY	345	14	16104	SPRINGR	345	14	2	925	1110	-7.77	118.7	72.1	-46.6
16200	DMP	138	14	16214	SN.CRUZ	138	14	1	309	309	-7.74	-109.3	-155.8	-46.4
16102	MCKINLEY	345	14	16104	SPRINGR	345	14	1	925	1110	-7.68	117.3	71.2	-46.1
10292	SAN_JUAN	345	10	16102	MCKINLEY	345	14	1	925	1110	-7.45	157.1	112.5	-44.7

6.2.2 Flow Impact Map – Winchester 500 kV



6.2.3 Winchester 500kV Conclusion

The analysis of a 600MW injection at the Winchester 500kV bus indicated significant potential of flow related issues on the Winchester-Vail 345kV and Vail-South 345kV line. The analysis otherwise indicated a considerable reduction of flow on elements connected to the South (except the Vail-South 345kV line), Springerville (except Springerville-Coronado 345kV line), Phil Young, and Greenlee 345kV substations.

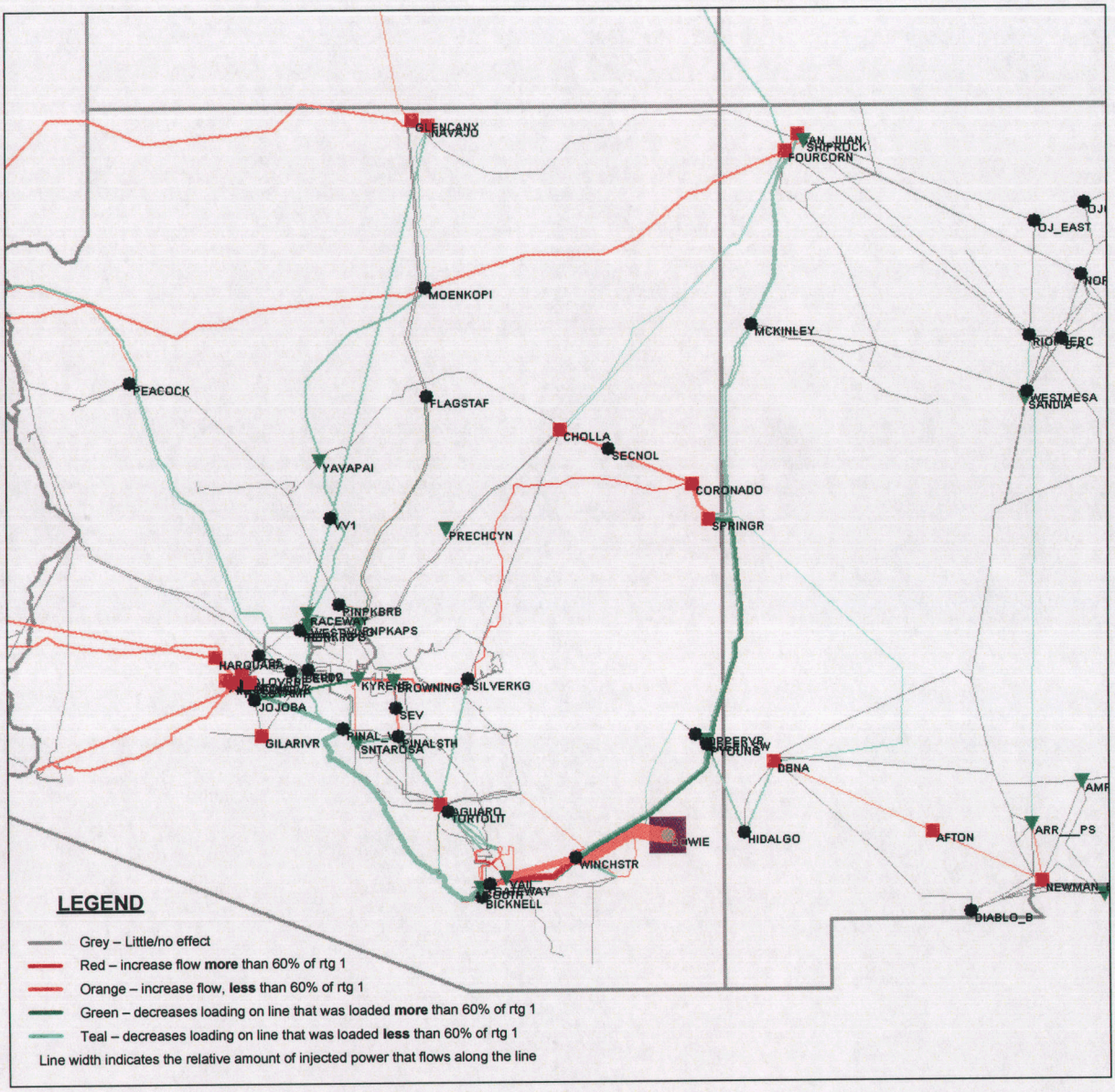
6.3 Sensitivity 1 – Winchester 500kV and Winchester-Vail-South 345kV

6.3.1 Flow Impact Table – Sensitivity 1

Bus: 16013 BOWIE Area: 14 kV: 500 PMax: 0.0 Gen: 0.0 Load: 0.0 Added Gen: 600.0

From-Bus				To-Bus					Ratings		Shift	Branch Flow		Flow
No.	Name	kV	Ar	No.	Name	kV	Ar	Ck	#1	#2	Factor	Pre Inj	Post Inj	Impact
16002	WINCHSTR	500	14	16109	WINCHSTR	345	14	1	672	806	99.96	0	599.8	599.8
16002	WINCHSTR	500	14	16013	BOWIE	500	14	1	1200	1320	-99.96	0	-599.8	-599.8
16105	VAIL	345	14	16109	WINCHSTR	345	14	1	925	1210	-37.05	-336.7	-559	-222.3
16105	VAIL	345	14	16109	WINCHSTR	345	14	2	925	1210	-36.82	-333.5	-554.4	-220.9
16103	SOUTH	345	14	16114	PINALWES	345	14	1	925	1110	32.09	-241.6	-49.1	192.5
15090	HASSYAMP	500	14	79264	PINAL_W	500	14	1	2598	2598	-25.3	896.1	744.3	-151.8
16114	PINALWES	345	14	79264	PINAL_W	500	14	1	672	806	21.1	-175.7	-49.1	126.6
16103	SOUTH	345	14	16105	VAIL	345	14	1	925	1110	-20.63	-142.6	-266.4	-123.8
16103	SOUTH	345	14	16105	VAIL	345	14	2	925	1110	-20.63	-142.6	-266.4	-123.8
16101	PYOUNG	345	14	16109	WINCHSTR	345	14	1	925	1110	-19.44	499.5	382.8	-116.6
16000	TORTOLIT	500	14	90000	PINALSTH	500	14	1	1732	2217	18.06	-363	-254.6	108.4
15011	KYRENE	500	14	15051	BROWNING	500	14	1	1732	1888	-17.17	-382.5	-485.6	-103
16100	CORONADO	345	14	16104	SPRINGR	345	14	1	1195	1434	-14.35	-517.6	-603.7	-86.1
16208	NE.LOOP	138	14	16210	RILLITO	138	14	1	478	478	14.21	-189	-103.8	85.3
16104	SPRINGR	345	14	16106	VAIL2	345	14	1	733	992	-13.46	645.6	564.9	-80.8
16101	PYOUNG	345	14	16104	SPRINGR	345	14	1	925	1110	13.02	-457.1	-379	78.1
14008	JOJOBA	500	14	15011	KYRENE	500	14	1	1732	3066	-12.56	1683.7	1608.4	-75.4
16106	VAIL2	345	14	16220	VAIL	138	14	1	672	806	-12.48	604	529.1	-74.9
15034	PERKINS	500	14	19038	MEAD	500	14	1	1238	1362	12.13	-152.4	-79.6	72.8
14005	WESTWING	500	14	15033	PERKINPS	500	14	1	1732	2078	12.13	-152.4	-79.6	72.8
14008	JOJOBA	500	14	15090	HASSYAMP	500	14	1	2598	3066	11.96	142.4	214.2	71.8
15992	SEV	500	14	90000	PINALSTH	500	14	1	2598	2598	-11.71	-253.8	-324.1	-70.2
16107	WESTWING	345	14	16114	PINALWES	345	14	1	925	1110	-11.69	69	-1.1	-70.2
14002	MOENKOPI	500	14	24042	ELDORDO	500	24	1	1732	2382	10.86	716.1	781.3	65.1
15051	BROWNING	500	14	15992	SEV	500	14	1	2598	2598	-10.56	-94.1	-157.5	-63.4
19038	MEAD	500	14	26044	MARKETPL	500	26	1	3248	3897	10.12	320.3	381	60.7
15021	PALOVRDE	500	14	24801	DEVERS	500	24	1	3421	4616	9.91	1022.7	1082.2	59.5
14003	NAVAJO	500	14	26123	CRYSTAL	500	26	1	3201	4082	9.47	826.7	883.5	56.8
16202	E. LOOP	138	14	16208	NE.LOOP	138	14	1	287	287	9.32	73.9	129.8	55.9
11080	HIDALGO	345	10	16101	PYOUNG	345	14	1	717	789	-9.32	335.9	280	-55.9
14017	SECNOL	500	14	15001	CORONADO	500	14	1	1732	2832	-8.88	-249.2	-302.4	-53.3
14000	CHOLLA	500	14	14017	SECNOL	500	14	1	1732	2832	-8.82	-248.9	-301.9	-52.9
11080	HIDALGO	345	10	11093	LUNA	345	10	1	717	956	8.68	-193.3	-141.2	52.1
16200	DMP	138	14	16207	N. LOOP	138	14	1	287	287	8.5	-94.2	-43.2	51
15041	SILVERKG	500	14	15051	BROWNING	500	14	1	1732	2886	8.47	860.5	911.3	50.8
15093	HARQUAHA	500	14	24801	DEVERS	500	24	1	3421	4616	8.35	1139.8	1189.8	50.1
15090	HASSYAMP	500	14	15093	HARQUAHA	500	14	1	3000	3000	8.32	47.9	97.8	49.9
16204	IRVNGTN	138	14	16214	SN.CRUZ	138	14	1	287	287	8.13	158.2	207	48.8
14002	MOENKOPI	500	14	14006	YAVAPAI	500	14	1	2018	2018	-7.98	752.5	704.6	-47.9
16200	DMP	138	14	16214	SN.CRUZ	138	14	1	309	309	-7.91	-111.9	-159.3	-47.5
16000	TORTOLIT	500	14	16217	TORTOLIT	138	14	1	672	806	-7.89	329.7	282.4	-47.3
16000	TORTOLIT	500	14	16217	TORTOLIT	138	14	2	672	806	-7.89	329.7	282.4	-47.3

6.3.2 Flow Impact Map – Sensitivity 1



6.3.3 Sensitivity 1 Conclusion

The analysis of a 600MW injection at the Winchester 500kV bus and adding the 2nd Winchester-Vail-South 345kV line resulted in increased flow, but generally under 60% of the line's capacity (indicated by the orange lines). The analysis otherwise indicated a considerable reduction of flow on elements connected to the South (except the Vail-South 345kV line), Springerville (except Springerville-Coronado 345kV line), Phil Young, and Greenlee 345kV substations. The additional transmission reduced loading on lines south of the Winchester substation as compared to Options 1 and 2.

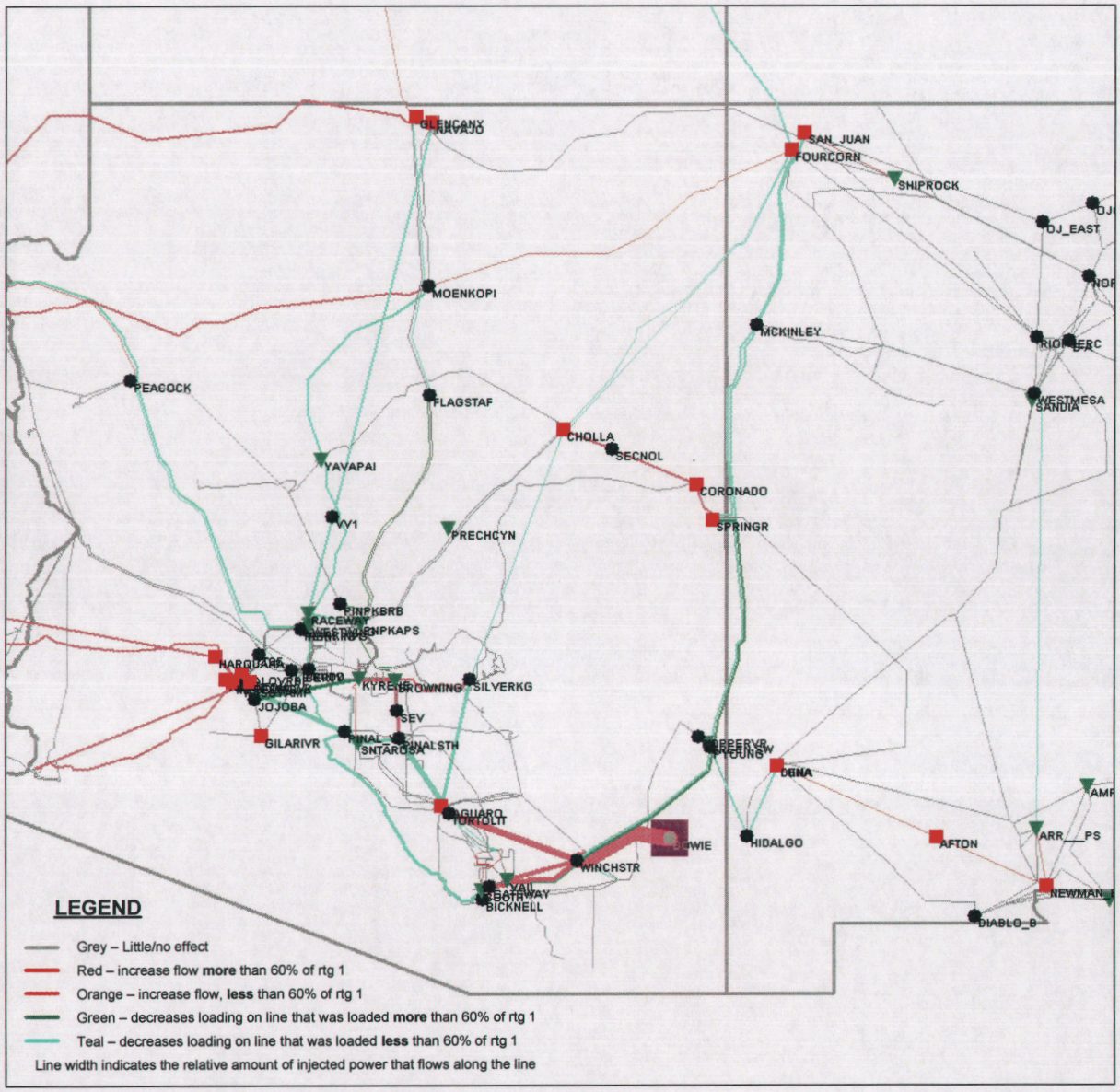
6.4 Sensitivity 2 – Winchester 500kV and Winchester-Vail-South 345kV & Winchester-Tortolita 500kV

6.4.1 Flow Impact Table – Sensitivity 2

Bus: 16013 BOWIE Area: 14 kV: 500 PMax: 0.0 Gen: 0.0 Load: 0.0 Added Gen: 600.0

From-Bus				To-Bus					Ratings		Shift	Branch Flow		Flow
No.	Name	kV	Ar	No.	Name	kV	Ar	Ck	#1	#2	Factor	Pre Inj	Post Inj	Impact
16002	WINCHSTR	500	14	16013	BOWIE	500	14	1	1200	1320	-99.96	0	-599.8	-599.8
16002	WINCHSTR	500	14	16109	WINCHSTR	345	14	1	672	806	60.88	64.3	429.6	365.3
16000	TORTOLIT	500	14	16002	WINCHSTR	500	14	1	1200	1200	-39.39	64.7	-171.6	-236.3
16000	TORTOLIT	500	14	90000	PINALSTH	500	14	1	1732	2217	33.25	-389.6	-190.1	199.5
15090	HASSYAMP	500	14	79264	PINAL_W	500	14	1	2598	2598	-25.73	898.1	743.7	-154.4
16105	VAIL	345	14	16109	WINCHSTR	345	14	1	925	1210	-21.99	-360.3	-492.3	-132
16105	VAIL	345	14	16109	WINCHSTR	345	14	2	925	1210	-21.89	-356.7	-488	-131.3
15011	KYRENE	500	14	15051	BROWNING	500	14	1	1732	1888	-20.68	-376.9	-501	-124.1
16103	SOUTH	345	14	16114	PINALWES	345	14	1	925	1110	19.95	-220.9	-101.2	119.7
14015	SNTAROSA	500	14	90000	PINALSTH	500	14	1	2598	2598	-16.66	636.7	536.8	-100
15992	SEV	500	14	90000	PINALSTH	500	14	1	2598	2598	-16.62	-245.8	-345.6	-99.7
15051	BROWNING	500	14	15992	SEV	500	14	1	2598	2598	-15.18	-86.5	-177.6	-91.1
14008	JOJOBA	500	14	15011	KYRENE	500	14	1	1732	3066	-14.63	1687.8	1600.1	-87.8
14015	SNTAROSA	500	14	79264	PINAL_W	500	14	1	2598	2598	14.29	-734.9	-649.1	85.8
14004	SAGUARO	500	14	15041	SILVERKG	500	14	1	2018	2018	14.21	-473	-387.7	85.3
14008	JOJOBA	500	14	15090	HASSYAMP	500	14	1	2598	3066	13.96	138.4	222.2	83.7
16101	PYOUNG	345	14	16109	WINCHSTR	345	14	1	925	1110	-12.8	486.7	409.9	-76.8
16103	SOUTH	345	14	16105	VAIL	345	14	1	925	1110	-12.53	-155.6	-230.7	-75.2
16103	SOUTH	345	14	16105	VAIL	345	14	2	925	1110	-12.53	-155.6	-230.7	-75.2
15034	PERKINS	500	14	19038	MEAD	500	14	1	1238	1362	12.29	-152.7	-79	73.7
14005	WESTWING	500	14	15033	PERKINPS	500	14	1	1732	2078	12.19	-152.7	-79.6	73.1
16114	PINALWES	345	14	79264	PINAL_W	500	14	1	672	806	11.28	-158.9	-91.2	67.7
14002	MOENKOPI	500	14	24042	ELDORDO	500	24	1	1732	2382	10.39	716.3	778.6	62.3
19038	MEAD	500	14	26044	MARKETPL	500	26	1	3248	3897	10.23	319.8	381.2	61.4
15021	PALOVRDE	500	14	24801	DEVERS	500	24	1	3421	4616	10.07	1022.2	1082.6	60.4
16104	SPRINGR	345	14	16106	VAIL2	345	14	1	733	992	-9.22	637.5	582.2	-55.3
14003	NAVAJO	500	14	26123	CRYSTAL	500	26	1	3201	4082	9.2	826.5	881.7	55.2
16107	WESTWING	345	14	16114	PINALWES	345	14	1	925	1110	-9.07	64.7	10.2	-54.4
16106	VAIL2	345	14	16220	VAIL	138	14	1	672	806	-8.81	597	544.1	-52.9
14004	SAGUARO	500	14	16000	TORTOLIT	500	14	1	1093	1311	-8.76	324	271.5	-52.5
14004	SAGUARO	500	14	16000	TORTOLIT	500	14	2	1093	1311	-8.76	324	271.5	-52.5
15093	HARQUAHA	500	14	24801	DEVERS	500	24	1	3421	4616	8.51	1139.3	1190.3	51.1
15090	HASSYAMP	500	14	15093	HARQUAHA	500	14	1	3000	3000	8.49	47.4	98.3	50.9
14002	MOENKOPI	500	14	14006	YAVAPAI	500	14	1	2018	2018	-8.44	753	702.4	-50.6
16101	PYOUNG	345	14	16104	SPRINGR	345	14	1	925	1110	8.33	-448	-398	50
15041	SILVERKG	500	14	15051	BROWNING	500	14	1	1732	2886	7.73	862.2	908.6	46.4
15090	HASSYAMP	500	14	22536	N.GILA	500	22	2	1905	2572	7.08	835.8	878.3	42.5
15090	HASSYAMP	500	14	22536	N.GILA	500	22	1	1905	2572	7.08	835.8	878.3	42.5
16208	NE.LOOP	138	14	16210	RILLITO	138	14	1	478	478	7.05	-179.7	-137.4	42.3
14003	NAVAJO	500	14	14018	VV1	500	14	1	2018	2390	-6.8	595	554.2	-40.8
14011	RACEWAY	500	14	14018	VV1	500	14	1	2017	2390	6.76	-587.6	-547	40.6

6.4.2 Flow Impact Map – Sensitivity 2



6.4.3 Sensitivity 2 Conclusion

The analysis of a 600MW injection at the Winchester 500kV bus and adding the 2nd Winchester-Vail-South 345kV line and the 500kV Winchester-Tortolita line increased line flow on elements south of Winchester, but the resultant flows were less than 60% of the element's rating (orange lines). This interconnection, like the previous interconnections, indicated a considerable reduction of flow on elements connected to the South (except the Vail-South 345kV line), Springerville (except Springerville-Coronado 345kV line), Phil Young, and Greenlee 345kV substations.

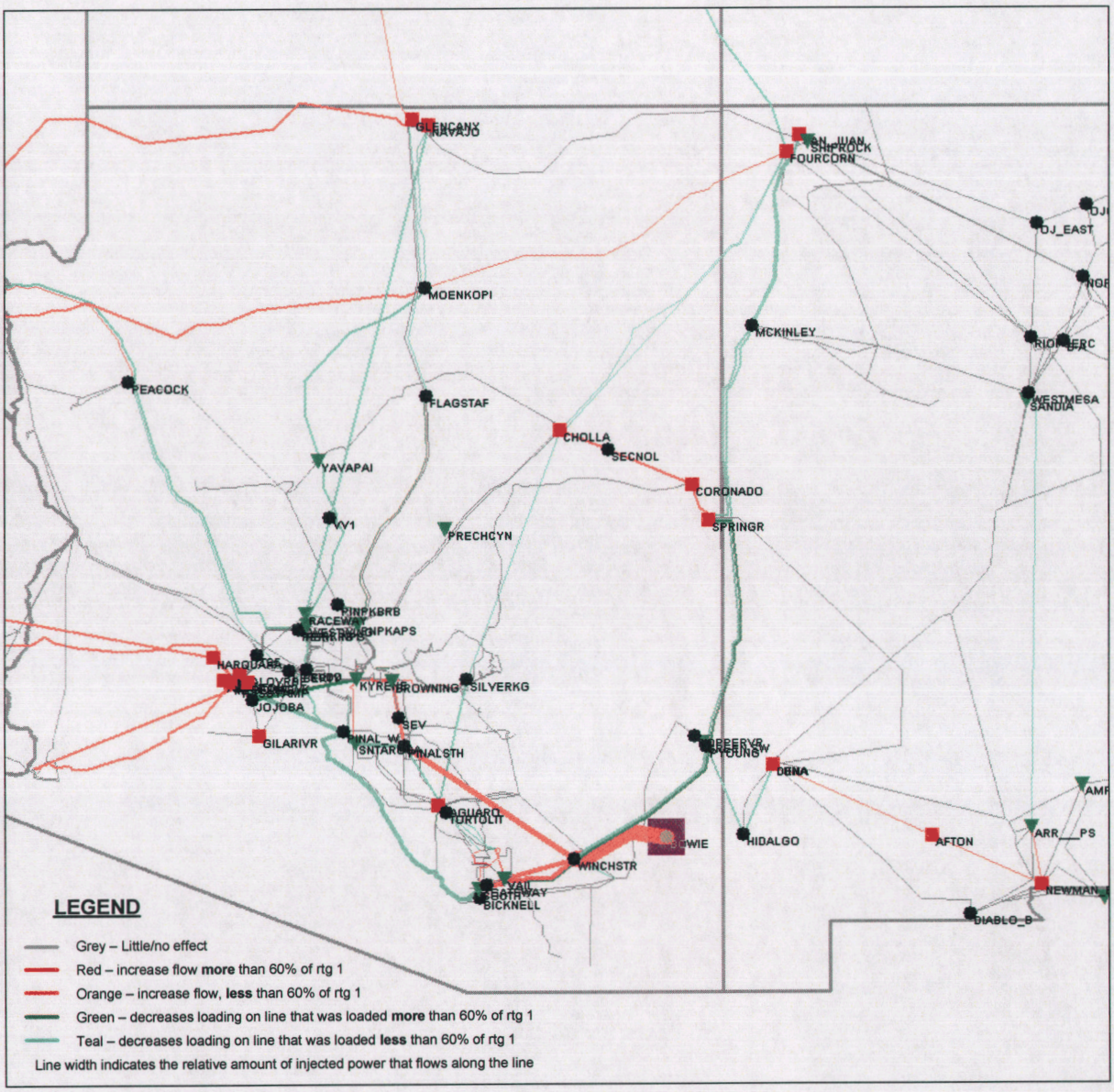
6.5 Sensitivity 3 – Winchester 500kV and Winchester-Vail-South 345kV & Winchester-Pinal South 500kV

6.5.1 Flow Impact Table – Sensitivity 3

Bus: 16013 BOWIE Area: 14 kV: 500 PMax: 0.0 Gen: 0.0 Load: 0.0 Added Gen: 600.0

From-Bus				To-Bus					Ratings		Shift	Branch Flow		Flow
No.	Name	kV	Ar	No.	Name	kV	Ar	Ck	#1	#2	Factor	Pre Inj	Post Inj	Impact
16002	WINCHSTR	500	14	16013	BOWIE	500	14	1	1200	1320	-99.96	0	-599.8	-599.8
16002	WINCHSTR	500	14	16109	WINCHSTR	345	14	1	672	806	69.75	67.5	486	418.5
16002	WINCHSTR	500	14	90000	PINALSTH	500	14	1	1200	1200	30.21	-67.5	113.8	181.3
15090	HASSYAMP	500	14	79264	PINAL_W	500	14	1	2598	2598	-26.75	901.2	740.7	-160.5
16105	VAIL	345	14	16109	WINCHSTR	345	14	1	925	1210	-25.34	-362.1	-514.2	-152
16105	VAIL	345	14	16109	WINCHSTR	345	14	2	925	1210	-25.21	-358.7	-509.9	-151.2
16103	SOUTH	345	14	16114	PINALWES	345	14	1	925	1110	21.97	-218.6	-86.8	131.8
15011	KYRENE	500	14	15051	BROWNING	500	14	1	1732	1888	-20.25	-376.5	-498	-121.5
15992	SEV	500	14	90000	PINALSTH	500	14	1	2598	2598	-19.75	-236.9	-355.3	-118.5
15051	BROWNING	500	14	15992	SEV	500	14	1	2598	2598	-18.09	-77.9	-186.5	-108.5
14015	SNTAROSA	500	14	90000	PINALSTH	500	14	1	2598	2598	-17.3	644.3	540.5	-103.8
16103	SOUTH	345	14	16105	VAIL	345	14	1	925	1110	-14.17	-157	-242	-85
16103	SOUTH	345	14	16105	VAIL	345	14	2	925	1110	-14.17	-157	-242	-85
16101	PYOUNG	345	14	16109	WINCHSTR	345	14	1	925	1110	-14.16	487.2	402.2	-85
14008	JOJOBA	500	14	15011	KYRENE	500	14	1	1732	3066	-14.09	1687.7	1603.1	-84.5
14015	SNTAROSA	500	14	79264	PINAL_W	500	14	1	2598	2598	13.9	-740.1	-656.7	83.4
14008	JOJOBA	500	14	15090	HASSYAMP	500	14	1	2598	3066	13.36	138.7	218.8	80.2
16114	PINALWES	345	14	79264	PINAL_W	500	14	1	672	806	12.7	-156.7	-80.5	76.2
14005	WESTWING	500	14	15033	PERKINPS	500	14	1	1732	2078	12.31	-152.8	-78.9	73.9
15034	PERKINS	500	14	19038	MEAD	500	14	1	1238	1362	12.31	-152.8	-78.9	73.9
14002	MOENKOPI	500	14	24042	ELDORDO	500	24	1	1732	2382	10.42	716.5	779	62.5
19038	MEAD	500	14	26044	MARKETPL	500	26	1	3248	3897	10.23	319.8	381.2	61.4
15021	PALOVRDE	500	14	24801	DEVERS	500	24	1	3421	4616	10.09	1022.1	1082.6	60.5
16104	SPRINGR	345	14	16106	VAIL2	345	14	1	733	992	-9.95	637.3	577.5	-59.7
16107	WESTWING	345	14	16114	PINALWES	345	14	1	925	1110	-9.71	64.5	6.3	-58.3
16106	VAIL2	345	14	16220	VAIL	138	14	1	672	806	-9.45	596.8	540.1	-56.7
16101	PYOUNG	345	14	16104	SPRINGR	345	14	1	925	1110	9.3	-448.4	-392.6	55.8
16208	NE.LOOP	138	14	16210	RILLITO	138	14	1	478	478	9.26	-179	-123.5	55.5
14003	NAVAJO	500	14	26123	CRYSTAL	500	26	1	3201	4082	9.21	826.5	881.8	55.3
15093	HARQUAHA	500	14	24801	DEVERS	500	24	1	3421	4616	8.53	1139.1	1190.3	51.2
15090	HASSYAMP	500	14	15093	HARQUAHA	500	14	1	3000	3000	8.52	47.3	98.4	51.1
14002	MOENKOPI	500	14	14006	YAVAPAI	500	14	1	2018	2018	-8.41	753.1	702.7	-50.4
16100	CORONADO	345	14	16104	SPRINGR	345	14	1	1195	1434	-8.32	-532	-582	-49.9
14004	SAGUARO	500	14	15041	SILVERKG	500	14	1	2018	2018	8.09	-462.3	-413.7	48.6
15090	HASSYAMP	500	14	22536	N.GILA	500	22	2	1905	2572	7.11	835.8	878.4	42.7
15090	HASSYAMP	500	14	22536	N.GILA	500	22	1	1905	2572	7.11	835.8	878.4	42.6
11080	HIDALGO	345	10	16101	PYOUNG	345	14	1	717	789	-7.01	330.5	288.5	-42.1
14005	WESTWING	500	14	14006	YAVAPAI	500	14	1	2018	2018	6.78	-354.9	-314.2	40.7
14003	NAVAJO	500	14	14018	VV1	500	14	1	2018	2390	-6.78	595.1	554.4	-40.7
14011	RACEWAY	500	14	14018	VV1	500	14	1	2017	2390	6.74	-587.7	-547.2	40.4
14017	SECNOL	500	14	15001	CORONADO	500	14	1	1732	2832	-6.55	-254.4	-293.7	-39.3

6.5.2 Flow Impact Map – Sensitivity 3



6.5.3 Sensitivity 3 Conclusion

The analysis of a 600MW injection at the Winchester 500kV bus and adding the 2nd Winchester-Vail-South 345kV line and the 500kV Winchester-Pinal South line increased line flow on elements south of Winchester, but the resultant flows were less than 60% of the element's rating (orange lines). This interconnection, like the previous interconnections, indicated a considerable reduction of flow on elements connected to the South (except the Vail-South 345kV line), Springerville (except Springerville-Coronado 345kV line), Phil Young, and Greenlee 345kV substations. There was no significant difference between Sensitivities 2 and 3, the flow tables corresponding to these Sensitivities show comparable flows.

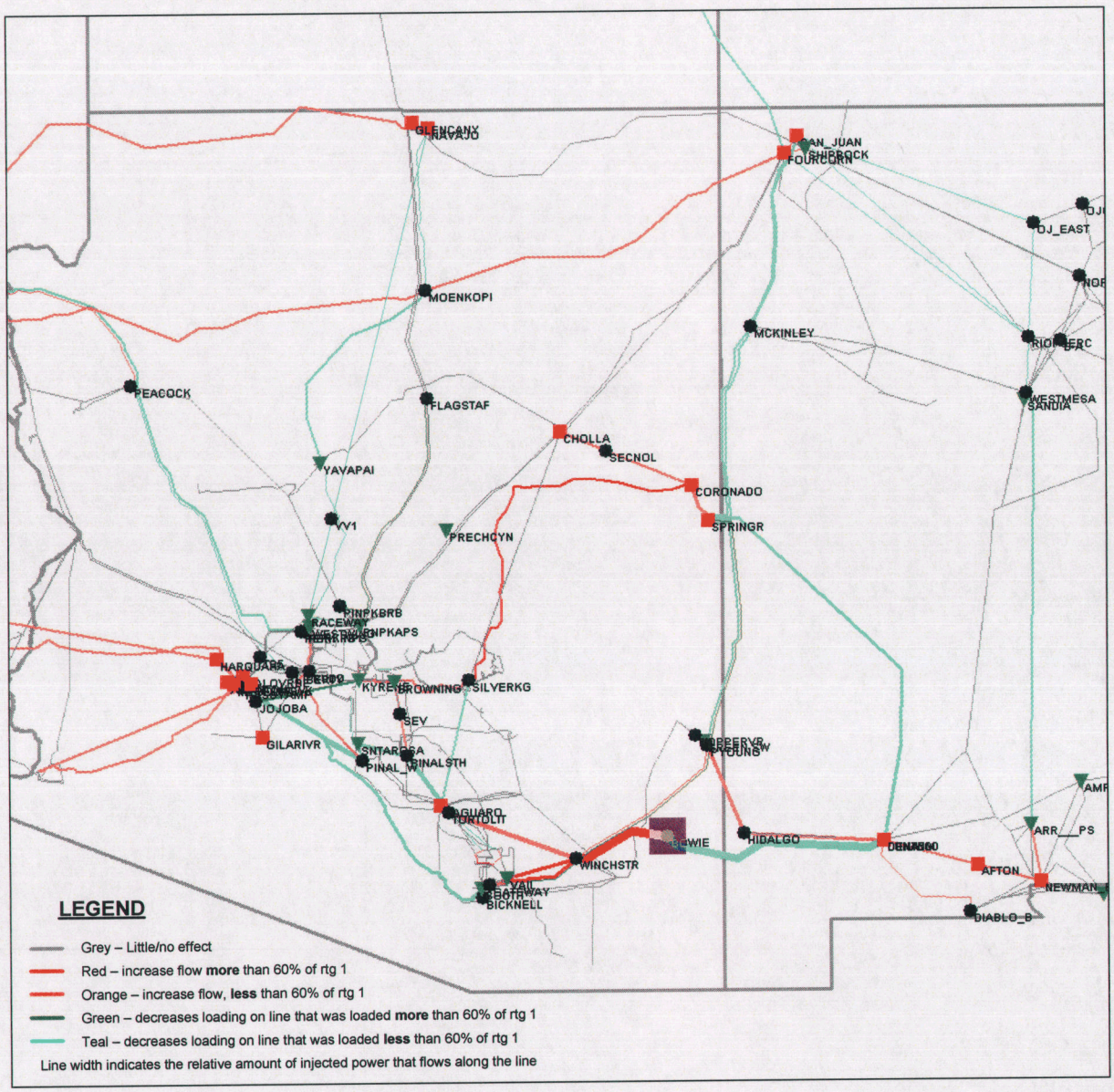
6.6 Sensitivity 4 – Winchester 500kV and Winchester-Vail-South 345kV & Winchester-Tortolita 500kV with New Mexico Wind (600MW) and Bowie-Luna 500kV line

6.6.1 Flow Impact Table – Sensitivity 4

Bus: 16013 BOWIE Area: 14 kV: 500 PMax: 0.0 Gen: 0.0 Load: 0.0 Added Gen: 600.0

From-Bus				To-Bus					Ratings		Shift	Branch Flow		Flow
No.	Name	kV	Ar	No.	Name	kV	Ar	Ck	#1	#2	Factor	Pre Inj	Post Inj	Impact
16002	WINCHSTR	500	14	16013	BOWIE	500	14	1	1200	1320	-53.87	-583.8	-907	-323.2
11093	LUNA	345	10	11220	LUNA500	500	14	1	672	806	-43.49	0.4	-260.5	-260.9
11220	LUNA500	500	14	16013	BOWIE	500	14	1	1200	1200	-43.47	599.2	338.4	-260.8
16002	WINCHSTR	500	14	16109	WINCHSTR	345	14	1	672	806	29.46	413.2	589.9	176.8
16000	TORTOLIT	500	14	16002	WINCHSTR	500	14	1	1200	1200	-23.87	-168.9	-312.1	-143.2
16000	TORTOLIT	500	14	90000	PINALSTH	500	14	1	1732	2217	23.19	-184.6	-45.5	139.1
15090	HASSYAMP	500	14	79264	PINAL_W	500	14	1	2598	2598	-20.71	727.9	603.6	-124.3
15011	KYRENE	500	14	15051	BROWNING	500	14	1	1732	1888	-17.23	-511.8	-615.2	-103.4
11093	LUNA	345	10	16104	SPRINGR	345	14	1	939	1313	16.18	-102	-4.9	97.1
16100	CORONADO	345	14	16104	SPRINGR	345	14	1	1195	1434	-15.75	-589.9	-684.4	-94.5
16103	SOUTH	345	14	16114	PINALWES	345	14	1	925	1110	15.27	-91.4	0.2	91.6
16105	VAIL	345	14	16109	WINCHSTR	345	14	1	925	1210	-14.92	-490.6	-580.1	-89.5
16105	VAIL	345	14	16109	WINCHSTR	345	14	2	925	1210	-14.81	-485.6	-574.4	-88.9
11080	HIDALGO	345	10	16101	PYOUNG	345	14	1	717	789	14.42	308.1	394.6	86.5
11080	HIDALGO	345	10	11093	LUNA	345	10	1	717	956	-13.97	-167.6	-251.5	-83.8
14015	SNTAROSA	500	14	90000	PINALSTH	500	14	1	2598	2598	-13.66	526.6	444.6	-82
14008	JOJOBA	500	14	15011	KYRENE	500	14	1	1732	3066	-13.01	1590.2	1512.1	-78
14008	JOJOBA	500	14	15090	HASSYAMP	500	14	1	2598	3066	12.4	232.3	306.7	74.4
14015	SNTAROSA	500	14	79264	PINAL_W	500	14	1	2598	2598	12.04	-637.3	-565.1	72.2
14002	MOENKOPI	500	14	24042	ELDORDO	500	24	1	1732	2382	10.75	817.3	881.8	64.5
14005	WESTWING	500	14	15033	PERKINPS	500	14	1	1732	2078	10.68	-49.4	14.7	64.1
10369	WESTMESA	345	10	11014	ARR___PS	345	10	1	717	717	-10.67	186.8	122.8	-64
15034	PERKINS	500	14	19038	MEAD	500	14	1	1238	1362	10.64	-49.4	14.4	63.8
15041	SILVERKG	500	14	15051	BROWNING	500	14	1	1732	2886	10.51	921.7	984.7	63
11014	ARR___PS	345	10	11017	ARROYO	345	10	1	275	462	-10.36	183.5	121.4	-62.1
16101	PYOUNG	345	14	16104	SPRINGR	345	14	1	925	1110	10.23	-395.1	-333.8	61.4
15992	SEV	500	14	90000	PINALSTH	500	14	1	2598	2598	-9.53	-341.2	-398.3	-57.2
16103	SOUTH	345	14	16105	VAIL	345	14	1	925	1110	-9.34	-232.5	-288.5	-56
16103	SOUTH	345	14	16105	VAIL	345	14	2	925	1110	-9.34	-232.5	-288.5	-56
14003	NAVAJO	500	14	26123	CRYSTAL	500	26	1	3201	4082	9.2	908.8	964	55.2
14017	SECNOL	500	14	15001	CORONADO	500	14	1	1732	2832	-9.17	-296.3	-351.3	-55
14000	CHOLLA	500	14	14017	SECNOL	500	14	1	1732	2832	-9.13	-296	-350.8	-54.8
11017	ARROYO	345	10	11111	NEWMAN	345	10	1	863	1172	-8.95	-3.3	-57	-53.7
19038	MEAD	500	14	26044	MARKETPL	500	26	1	3248	3897	8.85	424.7	477.8	53.1
14001	FOURCORN	500	14	14002	MOENKOPI	500	14	1	1732	2182	8.83	931.7	984.7	53
15051	BROWNING	500	14	15992	SEV	500	14	1	2598	2598	-8.63	-173.9	-225.6	-51.8
16114	PINALWES	345	14	79264	PINAL_W	500	14	1	672	806	8.6	-87.6	-36	51.6
15021	PALOVRDE	500	14	24801	DEVERS	500	24	1	3421	4616	8.5	1099.6	1150.6	51
10292	SAN_JUAN	345	10	79064	SHIPROCK	345	14	1	717	717	8.15	283.5	332.4	48.9
15001	CORONADO	500	14	16100	CORONADO	345	14	1	672	806	-7.86	-294.7	-341.8	-47.2
15001	CORONADO	500	14	16100	CORONADO	345	14	2	672	806	-7.86	-294.7	-341.8	-47.2

6.6.2 Flow Impact Map – Sensitivity 4



6.6.3 Sensitivity 4 Conclusion

The analysis of a 600MW injection at the Winchester 500kV bus and 600MW of wind generation in New Mexico combined with the 2nd Winchester-Vail-South 345kV line, 500kV Winchester-Tortolita line, and the Bowie-Luna 500kV line increased line flow on elements south of Bowie. In particular, the Winchester-Vail 345kV lines which appear red (60% or higher loading) could mean for loss of one circuit, the parallel circuit overloads. The generation in New Mexico relieves loading on lines in New Mexico, in particular out of Four Corners and Springerville. This option may indicate the need for additional transmission to support 1200MW connected to the Bowie substation.

7 CONCLUSIONS

The power flow and injection analysis showed that the addition of the 600MW Bowie facility under heavy summer operating conditions in the 2012 timeframe to either the Willow 345kV substation or the Winchester 500kV substation was feasible. The 600MW addition had little impact to voltage and flow violations especially with the planned and proposed regional transmission additions (modeled in the sensitivities). The voltage and loading violations for southeastern Arizona facilities noted in this analysis are larger than anticipated, specifically with regards to Southwest Transmission Cooperative (SWTC), due to the addition of an increased load forecast from its Member Owners. Both SWTC and Tucson Electric Power Company (TEP) are developing plans to mitigate the violations in their own Ten Year Plans. The Bowie project should only be responsible for any incremental impact to voltage and thermal violations or the incremental cost to accelerate a planned transmission project to mitigate voltage and thermal violations.

Both primary interconnection alternatives; Option 1 - the double circuit Willow 345kV and Option 2 - the single circuit Winchester 500kV result in heavier loading on lines south of the interconnection point, in particular all lines in service case showing an overload of the Winchester-Vail 345kV line. The Base Case (pre-project) overloads indicated a need to upgrade the transmission system south of the proposed Bowie interconnection points. Tucson Electric Power Company filed a Ten Year Plan with the Arizona Corporation Commission in January 2006 which included plans to upgrade the transmission system south of Winchester, including a Winchester-Vail and a Vail-South 345kV 2nd circuit. Both elements do not have a defined in-service date but are in the process of being studied by TEP.

In this analysis, Sensitivities 1-3 incorporated TEP's Winchester-Vail and Vail-South 345kV 2nd circuit and found the addition of these planned elements eliminates many of the overloads seen in the Pre Project (Base), Options 1, and Option 2 cases. From a power flow and injection analysis perspective neither the Willow nor Winchester option is significantly different. What was not captured in the power flow analysis was the potential value of the additional markets at Winchester versus Willow.

The Sensitivity Cases also indicate the additional transmission elements will significantly reduce overloading and losses, however voltage deviation violations remain (with or without the project). The SWTC transmission system experienced the greatest number and largest voltage deviations, due largely to the addition of new load forecasts from its Member Owners as noted above. SWTC is currently studying the effects of these load forecasts to determine the steps to be taken to mitigate the voltage deviations noted in this analysis. TEP has plans to upgrade the 138kV transmission system. These projects are expected to alleviate overloads and voltage issues noted in this analysis but a detailed analysis of TEP's system will be required for verification. The timing of these upgrades has not been determined at this time.

Sensitivity 1, simulating the addition of the Winchester-Vail and Vail South 345kV second circuit resulted in significant loading reductions and would appear to be a beneficial system enhancement for the transmission system with or without the project. The lines in Sensitivity 1 were included with Sensitivities 2-4.

Sensitivity 2 modeled a 72-mile Winchester-Tortolita 500kV line (TEP had already turned on Tortolita-Pinal South 500kV line in the model) and Sensitivity 3 which modeled an express Winchester-Pinal South 116-mile 500kV line. Again, both options would electrically work and there was no significant difference between the two sensitivities. TEP indicated they may accelerate the Winchester-Tortolita segment if the Bowie project was built. If the Bowie project shows a need for the Tortolita-Winchester line, Bowie would be responsible for the acceleration of the project. If only the 2nd Winchester-Vail and Vail-South lines are needed, TEP will evaluate the benefit of the Tortolita-Winchester line for TEP's needs and it will compete for construction with other planned TEP projects.

Sensitivity 4, adding another 600MW of generation, simulating wind resources in Central New Mexico appeared feasible, but would require additional system upgrades primarily for contingency conditions. One interesting upgrade noted in this analysis would be a larger or additional Luna 500/345kV transformer in the event the line from the Bowie Facility to Winchester was lost and all the Bowie generation would be re-directed to the remaining circuit, Bowie-Luna 500kV. With this condition, the single Luna 500/345kV transformer overloaded 149% of its 806MVA rating, indicating sufficient transformer capacity must be planned for Luna if this interconnection is made.

This feasibility analysis found any of the Options and Sensitivities studied were viable from a power flow and injection analysis perspective, but there were system benefits for the additional transmission added with the sensitivities, in particular the 2nd Winchester-Vail-South 345kV line.