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2009 Ten Year Snapshot Study

A report to address Arizona Corporation Commission Biennial Transmission Assessment (BTA) requirements

Rev #4

Salt River Project



Central Arizona Transmission System – Extra High Voltage (CATS-EHV) Subcommittee

Chairman: LeeAnn Torkelson

Executive Summary

The Ten Year Snapshot Study is an assessment of the ten year high voltage and extra high voltage transmission plans developed by transmission owners in Arizona. The developed plans used a coordinated base case, which models the expected transmission system in 2019. The 2018 Western Electricity Coordinating Council (WECC) base case was used as the seed base case. Forecasted loads, resources, underlying transmission system, as well as planned facilities for all transmission owners in the 2019 timeframe were added to the seed case to develop the 2019 Central Arizona Transmission System (CATS) case used in this study.

Though the Ten Year Snapshot Study Area has historically focused on the central Arizona region (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 year's study has expanded to include reviewing impacts statewide. A state-wide view will assist in coordinating this and other study efforts (and results) among the various planning groups in Arizona.

The assessment of the ten year plan consisted of conducting N-0 and N-1 power flow analyses on the coordinated 2019 detail CATS base case to verify that there were no thermal overloads or voltage problems for the 2019 time frame with all participants' 2019 planned facilities. Project Outage (N-1-1) power flow analyses were conducted to show the impact on the surrounding transmission system by removing an individual participant's Project from the ten year plan.

The base case showed prior to any outages (N-0 conditions) there are a few busses outside of voltage criteria, but no overloaded elements. Single contingency (N-1) analysis showed overloads on transmission elements that can be addressed by upgrading the facilities, implementing switching solutions, or by implementing existing generation tripping solutions. Voltage deviations were noted for contingencies in the base case. The voltage deviations were a result of the simulated outage causing a radial condition, needed voltage support, and/or were indicative of a modeling error that will need further investigation. These thermal violations and voltage deviation issues have been seen by the utilities in internal studies and have solutions either identified or being investigated.

The Project Outage (N-1-1) portion of the study, taking out facilities associated with a Ten Year Planned Project and running contingencies, showed that delay of a single Project would generally not cause significant impact to the remaining transmission system. Fifteen Project Outages were studied, nine APS Projects, four SRP Projects, one TEP Project, and delay of the Palo Verde-Devers #2 500kV line. Delay of the following projects beyond the ten year window had the greatest impact (5% or greater loading as compared to the base case for the same contingency) to the transmission system:

Case # - Description

- APS #3 - Raceway-Avery-Pinnacle Peak 230kV line
- APS #5 - Raceway-Pinnacle Peak 500kV line
- TEP #1 - Pinal Central – Tortolita 500 kV line

The results of this study indicate the planned 2019 Arizona transmission system is robust as shown by limited voltage and thermal violations in the base case. Additionally, the Project Outage scenarios indicate that a delay of any one Project does not have a significant negative impact on the remaining transmission system.

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Introduction

The Ten Year Snapshot Study was performed to coincide with CATS-EHV biennial filings with the Arizona Corporate Commission (ACC). The Ten Year Snapshot Study is a collaborative effort to assess the CATS-EHV ten-year transmission plan for Arizona.

The objective of the study is to analyze how the participants' ten year plans perform as whole in a regional environment and the effect of omitting an individual planned transmission project from the plan.

The transmission system performance is assessed by studying N-0, N-1 and Project Outage (N-1-1) conditions on a transmission system topography, load level, and generation dispatch forecasted in a tenth year. The study consisted of a screening of voltage and thermal violations for N-0, N-1, and the Project Outage scenarios. The system performance is assessed by reviewing thermal and voltage violations under all lines in service and outage conditions. The violations are identified if thermal or voltage excursions exceed criteria determined by the North American Electric Reliability Council (NERC) transmission planning (TPL) standards.

This report is one of a series of reports required to be filed with the ACC on a biennial basis as result of Orders issued by the Arizona Corporation Commission from previous Biennial Transmission Assessments. Other reports, including the Corridor Outage Studies and Extreme Contingencies Studies, are not included with this report but will be submitted separately under separate cover.

Study Methodology

Case building

The study began with development of a power flow case that reflected a 2019 timeframe and included participant's Ten Year Plan (TYP) projects. Annually, entities planning to build transmission or generation above 100kV or 100MW must file a TYP with the Arizona Corporation Commission (ACC).

This year's planning case, reflective of a 2019 transmission and generation topology, was a 2018 case modified by Arizona Public Service (APS), Salt River Project (SRP), Electrical District #3 (ED3), Tucson Electric Power (TEP), Southwest Transmission Cooperative (SWTC), and Western Area Power Administration (WAPA).

After a round-robin approach to updating the case, the study work began with reviewing the system under "all lines in service" or "ALIS" conditions. Overloads or voltage violations were corrected to alleviate any ALIS issues. This analysis is also known as "N-O" analysis which indicates the number of lines out of service is "0", zero.

Case Highlights for Arizona

Generation

The generation capacity modeled for Arizona was 37,851MW with 33,967MW online.

Planned Generation

The following announced generation was modeled in the case:

Fuel Type	Project Name	Modeled	MW Dispatched
Coal	Desert Rock	Yes	1400
Natural Gas	Bowie	Yes	0
Natural Gas	TransCanada Coolidge	Yes	561
Natural Gas	Pinal Central	Yes	900
Natural Gas	San Luis Rio Colorado	Yes	300
Natural Gas	Abel	Yes	600
Solar	Solana-Gila Bend area	Yes	280

Table 1 - Announced Generation in 2019 case

Load

The state of Arizona was modeled with 25,340 MW of load in this 2019 study. The originating case, a 2018 coordinated case, had 26,029MW of load. The modest load reduction of 689MW, about 3%, is in part due to estimates of load reductions expected in the ten year time frame in response to the recession. The load reduction doesn't appear very large, and is in part due to the fact that the full depth of the recession wasn't yet accounted for in load forecasts at the time case building for this study began. Further, it has been utility experience that even in a recession, while near term load forecasts can be dramatically affected; longer term forecasts tend to rebound close to pre-recession forecasts.

State Status

The 2019 case shows Arizona generating nearly 7600MW more than required to serve Arizona loads. Arizona continues to export generation, primarily to California.

N-1 and Project Outage (N-1-1) Contingency Analysis

Once a base case was finalized contingency analysis was performed. Contingency analysis (also known as N-1 analysis) simulates taking an element out of service (maintenance, fire, storm damage, etc.) and assessing the impact to the remainder of the system due to the loss of that facility. The utilities reviewed the resultant violations and provided mitigation.

The last step of the study was the Project Outage analysis (also known as N-1-1) which resulted in fifteen additional cases. Each Project Outage case removed a Project (transmission facility/ies) and single contingencies were applied. The following Project Outages (separated into two tables) were considered for this analysis:

APS Project Outage cases included:

Case Code	Planned Project modeled as initially out of service for N-1-1 analysis	In service Date
	<ul style="list-style-type: none"> Bullet items are facilities identified for removal for the project 	
APS01	Palo Verde-Sun Valley (formerly TS5) 500 and 230 kV system <ul style="list-style-type: none"> Delany-Sun Valley 500 kV line Sun Valley 500/230kV transformer Sun Valley 500/230 kV transformer Sun Valley-Trilby Wash 230kV line Trilby Wash 230/69 kV transformer 	2014
APS02	Palo Verde-Sun Valley –Raceway 500 and 230 kV systems <ul style="list-style-type: none"> All of APS01 plus Sun Valley – Raceway 500 kV line 	2014
APS03	Raceway-Avery-Pinnacle Peak 230kV line <ul style="list-style-type: none"> Raceway-Avery 230kV line Avery-TS6 230kV line TS6-Pinnacle Peak 230kV line Both TS6 230/69 kV transformers 	2010 or 2012
APS04	Palm Valley-TS2-Trilby Wash (TS1) 230kV line <ul style="list-style-type: none"> Palm Valley-TS2 230kV line TS2-Trilby Wash 230kV line 	2015
APS05	Raceway-Pinnacle Peak 500kV line <ul style="list-style-type: none"> Raceway-Pinnacle Peak (APS) 500kV line All 3 Pinnacle Peak 500/230kV transformers 	2010
APS06	Raceway 500kV to 230kV transformer <ul style="list-style-type: none"> Raceway 500/230kV transformer 	2016
APS07	Sun Valley (TS5) –Raceway (TS9) 500kV line <ul style="list-style-type: none"> Sun Valley – Raceway 500kV line 	2016
APS08	Hassayampa-North Gila 500kV ckt 2 <ul style="list-style-type: none"> Hassayampa-North Gila 500kV line (ckt 2) 	2014
APS09	Pinal Central – Sundance 230kV line <ul style="list-style-type: none"> Pinal Central-Sundance 230kV line 	2013

Table 2 - APS Project Outage Cases

Project Outage cases for SRP , TEP and other Projects are shown below:

Case Code	Planned Project modeled as initially out of service for N-1-1 analysis <ul style="list-style-type: none"> • Bullet items are facilities identified for removal for the project 	In service Date
SRP01	Desert Basin-Pinal Central 230kV line <ul style="list-style-type: none"> • Pinal Central -Desert Basin 230kV line 	2013
SRP02	PC Gen 500/230 kV transformer and all generation <ul style="list-style-type: none"> • PC Gen 500/230kV transformer • All PC gen 	2018
SRP03	Pinal West – Pinal Central 500kV line <ul style="list-style-type: none"> • Pinal West – Santa Rosa • Santa Rosa – Pinal Central • Santa Rosa 500/230kV transformers 	2013
SRP04	RS24 All 230 kV lines and 230/69kV transformers at RS24 <ul style="list-style-type: none"> • RS24-Abel (1 and 2) • RS24 230/69 • RS24-Schrader • RS24-Santan 	2012
TEP01	Pinal Central-Tortolita 500kV line <ul style="list-style-type: none"> • Pinal Central-Tortolita 500kV line 	2013
PVD2	Palo Verde Devers #2 500kV line <ul style="list-style-type: none"> • Harquahala-Devers 500kV line 	TBD

Table 3 – SRP, TEP, and other Project Outage Cases

Monitoring Criteria

This analysis monitors thermal loading of transmission facilities and voltage deviation at substations caused by system disturbances (contingencies). The criteria in Table 4 - Monitoring criteria highlights the criteria used to identify violations for this study. Exceeding the criteria below can cause damage to the electric system. Elements that exceed the criteria indicate where problems in the system may exist and that need further review to appropriately address the thermal or voltage deviation issue. The voltage and thermal criteria are WECC criteria, which have the following limits:

Outage Type		Thermal Criteria	Voltage Criteria
N-0	No Outage, All lines in service	No element exceeding 100% of its normal rating	Less than .95 or Greater than 1.05 ¹
N-1	Single Element Outage	No element exceeding 100% of its emergency rating	No voltage deviation greater than 5%
Project Outage (N-1-1)	Project Outage (with system adjustments) followed by another contingency	Reducing loadings to 100% (or less) of normal rating following the removal of a project and 100% or less of the emergency rating for the subsequent outage	No voltage deviation greater than 5%

Table 4 - Monitoring criteria

All thermal overloading results were screened to show only elements above 115kV. Voltage results were also screened for bus voltages 115kV and higher. Voltage deviation calculated as the difference in voltage between post and pre outage voltage on buses. If the voltage deviation exceeds 5%, the bus is listed as exceeding criteria.

The Project Outage (N-1-1) thermal overload results were benchmarked against the N-1 results to distinguish loadings that were only associated with the N-1-1 and were not pre-existing in the N-1 base case. Highlighting was applied to the results where flow increased 5% or more in the Project Outage scenario on the same element for the same contingency as compared to the base case.

The N-1-1 voltage deviation results were also benchmarked against N-1 results. Highlighting was applied on the same busses where voltage deviations were greater than three percent more as compared to the base case for the same bus and contingency.

Monitored Elements

All transmission facilities in Arizona with voltage greater than 115kV were monitored for thermal and voltage criteria.

System Disturbances (Contingencies)

The contingencies studied included all Arizona transmission facilities (lines, transformers, and capacitors) with voltages equal to or greater than 115kV. Study Results

¹ Arizona utilities typically screen for voltage below 0.95 per unit and above 1.05 per unit on all systems less than 500kV. The 500kV system is typically operated at 525kV which results in a per unit voltage acceptable at 1.10 per unit.

Base case results

The base case results include voltage and thermal results with all lines in service (no contingencies) as well as voltage and thermal results under simulated contingency conditions.

The Base case showed no thermal violations (flow on elements exceeding an element's normal rating). Voltage violations in the base case were typically high voltage violations due to modeling issues on the system north of Phoenix. The high voltages can be addressed by adjusting transformer taps or removing capacitors. Two low voltage busses were noted, but are south of the CATS EHV study area. The suggestion to improve voltage at the two busses south of the CATS EHV study area was to turn on generation at Valencia.

<i>Voltage Violations (per unit voltage)</i>				
Name	kV	CONTINGENCY DESCRIPTION	Base Voltage	SOLUTIONS
VALNCIA	138	Base system (n-0)	0.94	Turn on generation at Valencia
SONOITA	138	Base system (n-0)	0.95	Turn on generation at Valencia
PRESCOTT	115	Base system (n-0)	1.06	Turn off capacitors at BAGCAP for n-0
CHOLLA	345	Base system (n-0)	1.06	Adjust taps on the two 500/345kV transformers
NAVAJO	500	Base system (n-0)	1.11	Adjust three generator step-up transformer taps
BAGDAD	115	Base system (n-0)	1.13	Turn off capacitors at BAGCAP for n-0
BAGCAP	115	Base system (n-0)	1.13	Turn off capacitors at BAGCAP for n-0

Table 5 - Base Case voltage violations

Under contingency conditions, the following busses showed voltage deviations in excess of 5% (.05) for the simulated outages. The voltage deviations shown in Table 6 – Base Case Voltage Violations indicate solutions for these violations.

<i>Delta Voltage Violations (voltage drop, per unit)</i>						
Name	kV	CONTINGENCY DESCRIPTION		Voltage Deviation	SOLUTIONS	
BAGDAD	115	Line YAVAPAI 230 to WILOWLKE	230 Ckt 1	-0.15	Fix modeling errors on radial Bagdad system	
BAGCAP	115	Line YAVAPAI 230 to WILOWLKE	230 Ckt 1	-0.15	Fix modeling errors on radial Bagdad system	
VLIFARMS	115	Line COOLIDGE 115 to VLIFARMS	115 Ckt 1	-0.14	Switch in capacitors at Merrill 69kV	
BAGCAP	115	Line PRESCOTT 115 to BAGCAP	115 Ckt 1	-0.13	Radial Bagdad system should be dropped	
BAGCAP	115	Tran PRESCOTT 2300 to PRESCOTT	115 Ckt 1	-0.13	Fix modeling errors on radial Bagdad system	
BAGDAD	115	Line PRESCOTT 115 to BAGCAP	115 Ckt 1	-0.13	Radial Bagdad system should be dropped	
BAGDAD	115	Line BAGCAP 115 to BAGDAD	115 Ckt 1	-0.13	Radial Bagdad system should be dropped	
BAGDAD	115	Tran PRESCOTT 2300 to PRESCOTT	115 Ckt 1	-0.13	Fix modeling errors on radial Bagdad system	
GILABEND	230	Line GILARIVR 230 to GILABEND	230 Ckt 1	-0.11	Switch In existing capacitor at Gila Bend 69kV	
PRESCOTT	115	Line YAVAPAI 230 to WILOWLKE	230 Ckt 1	-0.10	Fix modeling errors on radial Bagdad system	
WILOWLKE	230	Line YAVAPAI 230 to WILOWLKE	230 Ckt 1	-0.09	Fix modeling errors on radial Bagdad system; Switch in multiple capacitors on local 69kV system	
WILOWLKW	230	Line YAVAPAI 230 to WILOWLKE	230 Ckt 1	-0.09	Fix modeling errors on radial Bagdad system; Switch in multiple capacitors on local 69kV system	
PRESCOTT	230	Line YAVAPAI 230 to WILOWLKE	230 Ckt 1	-0.09	Fix modeling errors on radial Bagdad system	
BUCKEYE	230	Line BUCKEYE 230 to LIBERTY	230 Ckt 1	-0.09	Close backup tap at Buckeye	
PRSCOTWA	230	Line YAVAPAI 230 to WILOWLKE	230 Ckt 1	-0.09	Fix modeling errors on radial Bagdad system	
RED TAIL	230	Line APACHE 230 to RED TAIL	230 Ckt 1	-0.09	Add 50MVAR shunt at Hackberry	
HACKBERY	230	Line HACKBERY 230 to MORENCI	230 Ckt 1	-0.08	Add 50MVAR shunt at Hackberry	
DOSCONDO	230	Line HACKBERY 230 to MORENCI	230 Ckt 1	-0.07	Add 50MVAR shunt at Hackberry	
DOSCONDO	230	Line APACHE 230 to RED TAIL	230 Ckt 1	-0.06	Add 50MVAR shunt at Hackberry	
HACKBERY	230	Line APACHE 230 to RED TAIL	230 Ckt 1	-0.06	Add 50MVAR shunt at Hackberry	
PRESCOTT	115	Tran PRESCOTT 230 to PRESCOTT	115 Ckt 1	-0.06	Fix modeling errors on radial Bagdad system	
VERDE N	230	Line YAVAPAI 230 to VERDE N	230 Ckt 1	-0.06	Switch in capacitors at Verde 69kV	
VERDE S	230	Line YAVAPAI 230 to VERDE N	230 Ckt 1	-0.06	Switch in capacitors at Verde 69kV	

Table 6 – Base Case Voltage Violations

Thermal overloads due to contingencies are shown in Table 7 - Base Case Thermal Violations along with the solution to the overload. For the facilities in the Southeast Arizona Transmission System (SATS) study area, it is reasonable to allow the SATS membership to identify and address these overloads in their forum.

<i>Thermal Violations (overloads, per unit)</i>											
Fname	FkV	Tname	TkV	ckt	CONTINGENCY DESCRIPTION	RTG #	MVA RTG	Overload	Solutions		
PINPK	230	PINPKSRP	230	2	Line PINPK 230 to PINPKSRP 230 Ckt 1	2	658	1.36	Upgrade conductor		
PINPK	230	PINPKSRP	230	1	Line PINPK 230 to PINPKSRP 230 Ckt 2	2	658	1.36	Upgrade conductor		
YAVAPAI	500	YAVAPAI	230	2	Tran YAVAPAI 500 to YAVAPAI 230 Ckt 1	2	336	1.35	Replace transformers		
YAVAPAI	500	YAVAPAI	230	1	Tran YAVAPAI 500 to YAVAPAI 230 Ckt 2	2	336	1.35	Replace transformers		
TWNTYSEC	138	E. LOOP	138	1	Line LOSREALS 138 to VAIL 138 Ckt 1	2	225	1.15	Up-rate to min 540MVA by 2010		
N. LOOP	138	RILLITO	138	1	Line N. LOOP 138 to NARANJA 138 Ckt 1	2	382	1.15	Up-rate to min. 553MVA by 2016		
N. LOOP	138	RILLITO	138	1	Line RANVISTO 138 to NARANJA 138 Ckt 1	2	382	1.10	Up-rate to min. 553MVA by 2016		
TORTOLIT	138	N. LOOP	138	3	Line TORTOLIT 138 to N. LOOP 138 Ckt 1A	2	406	1.08	Planned reconfiguration		
TORTOLIT	138	N. LOOP	138	3	Line TORTOLIT 138 to N. LOOP 138 Ckt 2A	2	406	1.08	Planned reconfiguration		
BRANDOW	230	WARD	230	1	Line BRANDOW 230 to WARD 230 Ckt 2	2	438	1.02	Upgrade conductor		
BRANDOW	230	WARD	230	2	Line BRANDOW 230 to WARD 230 Ckt 1	2	438	1.02	Upgrade conductor		
TWNTYSEC	138	E. LOOP	138	1	Line VAIL 138 to CIENEGA 138 Ckt 1	2	225	1.02	Up-rate to min 540MVA by 2010		
TWNTYSEC	138	E. LOOP	138	1	Line PANTANO 138 to LOSREALS 138 Ckt 1	2	225	1.01	Up-rate to min 540MVA by 2010		
DMP	138	N. LOOP	138	1	Line N. LOOP 138 to WESTINA 138 Ckt 1	2	311	1.01	Up-rate to min 382MVA by 2015		

Table 7 - Base Case Thermal Violations

Project Outage (N-1-1) followed by single contingency

The tables below highlight the impact due to the delay of a project beyond 2019 on the remaining transmission system. The Project Outage analysis is a screening tool to assist in identifying criticality of projects to the interconnected system if not in service at the end of the ten year timeframe.

Similar to the Base case results, tables below show voltage and thermal violations. The shaded cells indicate where thermal violations were 5% greater than the Base case results or 3% greater than the Base case results for voltage deviations.

The Projects showing the greatest impact to voltage violations are

- APS01 Palo Verde-Sun Valley (formerly TS5) 500 and 230 kV system
- APS04 Palm Valley-TS2-Trilby Wash (TS1) 230kV line
- APS07 Sun Valley (TS5) –Raceway (TS9) 500kV line

While these Project Outage cases indicate a lower voltage due to an outage, further investigation reveals these outages result in a radial connection. The voltage deviation shown occurred at the bus at the end of the radial connection and the bus has no load. The violations do not create cascading problems in the remaining system.

Delta Voltage Violations (voltage drop, per unit) – APS Cases

Name	kV	CONTINGENCY DESCRIPTION	APS01	APS02	APS03	APS04	APS05	APS06	APS07	APS08	APS09
TRLBY	230	Line TRLBY 230 to SNVLY 230 Ckt 1	0.00	0.00	-0.04	-0.08	-0.04	-0.04	-0.04	-0.04	-0.04
SNVLY	500	Line DELANY 500 to SNVLY 500 Ckt 1	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.07	-0.01	-0.01
SNVLY	500	Line SNVLY 500 to RACEWAY 500 Ckt 1	-0.08	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01

Table 8 – Voltage Violations - APS Project Outage cases

The following tables (Tables 9 and 10) show thermal overloads due to the Project Outage analyses. Highlighting on these tables indicate where overloads exceed base case loading by 5%. These thermal overload results indicate a delay in the following Projects could increase loading on the remaining system under contingency conditions:

- APS #3 - Raceway-Avery-Pinnacle Peak 230kV line
- APS #5 - Raceway-Pinnacle Peak 500kV line
- TEP #1 - Pinal Central – Tortolita 500 kV line

Thermal Violations (overloads, per unit) – APS Cases

Fname	FkV	Tname	TkV	ckt	CONTINGENCY DESCRIPTION	RTG	MVA	APS01	APS02	APS03	APS04	APS05	APS06	APS07	APS08	APS09
						#	RTG									
PINPK	230	PINPKSRP	230	2	Line PINPK 230 to PINPKSRP 230 Ckt 1	2	658	1.36	1.36	1.41	1.36	1.58	1.30	1.35	1.35	1.35
YAVAPAI	500	YAVAPAI	230	1	Tran YAVAPAI 500 to YAVAPAI 230 Ckt 2	2	336	1.36	1.36	1.36	1.35	1.44	1.35	1.34	1.34	1.35
RACEWAY ^{2,3}	500	RACEWAY	230	1	Tran WESTWING 500 to WESTWNGE 230 Ckt 1	2	598	0.98	0.98	0.92	0.99	1.34	DNE	0.94	0.98	0.99
YAVAPAI	230	WILOWLKE	230	1	Line PRSCOTWA 230 to RNDVLYTP 230 Ckt 1	2	355	0.99	0.99	0.99	0.98	1.05	0.98	0.98	0.97	0.98
YAVAPAI	230	WILOWLKE	230	1	Line RNDVLYTP 230 to PEACOCK 230 Ckt 1	2	355	0.99	0.99	0.99	0.98	1.05	0.98	0.98	0.97	0.98
RACEWYWA ³	230	WESTWNGE	230	1	Tran WESTWING 500 to WESTWNGE 230 Ckt 1	2	403	0.88	0.88	1.00	0.86	1.04	0.20	0.83	0.86	0.86

Table 9 - Thermal Overloads APS Project Outage Cases

Thermal Violations (overloads, per unit) – SRP and TEP Cases

Fname	FkV	Tname	TkV	ckt	CONTINGENCY DESCRIPTION	Rtg	MVA	PVDV2	SRP01	SRP02	SRP03	SRP04	TEP01
						#	RTG						
TWNTYSEC ⁴	138	E. LOOP	138	1	Line LOSREALS 138 to VAIL 138 Ckt 1	2	225	1.15	1.15	1.18	1.17	1.15	1.25
TWNTYSEC ⁴	138	E. LOOP	138	1	Line VAIL 138 to CIENEGA 138 Ckt 1	2	225	1.01	1.02	1.04	1.03	1.02	1.09
TWNTYSEC ⁴	138	E. LOOP	138	1	Line PANTANO 138 to LOSREALS 138 Ckt 1	2	225	1.02	1.01	1.04	1.03	1.01	1.11
TWNTYSEC ⁴	138	E. LOOP	138	1	Line DMP 138 to NE.LOOP 138 Ckt 1	2	225	0.97	0.97	0.99	0.99	0.97	1.03
TWNTYSEC ⁴	138	E. LOOP	138	1	Line E. LOOP 138 to PANTANO 138 Ckt 1	2	225	0.95	0.95	0.98	0.97	0.95	1.04

Table 10 - Thermal Overloads - SRP and TEP Project Outage cases

² Rating is incorrect. Rating should be 702MVA (not 598MVA). The higher rating would reduce, but not eliminate the overload noted.

³ APS closes the 230kV West Wing bus tie to mitigate overloads on Raceway transformers and Raceway-Westwing 230kV line.

⁴ Planned uprate (to 540 MVA normal/606 MVA emergency) of the Twenty Second-East Loop line in 2010 mitigate these overloads.

Study Findings

The Ten Year Snapshot study (aka the BTA study) investigating the coordinated impact of utilities ten year plans on the Arizona extra high voltage (EHV) system found that:

- The 2019 system is robust
- Planned projects support the loads estimated for the 2019 timeframe

The Project Outage analysis (an N-1-1 analysis) indicated that the delay of any one project beyond the 2019 timeframe results in consistent thermal and voltage violations of the base case, with the exception of:

Case # - Description

APS #3 - Raceway-Avery-Pinnacle Peak 230kV line

APS #5 - Raceway-Pinnacle Peak 500kV line

TEP #1 - Pinal Central – Tortolita 500 kV line

A delay of any one of the three Planned Projects listed above resulted in thermal loadings 5% or more than the base case (for contingencies). Because the contingencies related to these thermal violations were already causing thermal violations in the base case (without removal of the planned project), these findings are not surprising. Solutions that correct the base case loadings will be solutions for the Project Outage scenarios. As a screening analysis the Project Outage portion of the Ten Year Snapshot study indicates that the EHV system can support changes in the timing of some of the transmission and generation projects without significant adverse effects on the remaining system.

The results of this study could be interpreted that the delay of one project doesn't have a negative impact on the remaining system and therefore that particular project isn't needed. This interpretation of the data presented would be false. Utilities plan their transmission systems for reliability, redundancy, transmission scheduling capability, and economic considerations. This ten year snapshot is intended to view the combined impact of a state-wide collaboration of projects that perhaps individual utilities might not see when planning for the near term (5-6 years). Because all utilities' planned projects are modeled in this longer term view, and with the interconnected nature of the transmission system, removal of a single project results in redistribution of power on the remaining projects and system. This redistribution reduces the impact of the delay of an individual project and does not point to a conclusion supporting a lack of need for that individual project.

The results of the Ten Year Snapshot study indicates the planned 2019 Arizona transmission system is robust as shown by limited voltage and thermal violations in the base case. Additionally, the Project Outage scenarios indicate that a delay of any one Project does not have a significant impact on the remaining transmission system.

Appendices

Appendix A: Contingency List

Contingency Selection Criteria: From area 14 to 14; 100 kV to 999 kV
Contingency Selection Criteria: From area 14 to 14; 100 kV to 999 kV

line 1	"Line SAN_JUAN	345.0 to MCKINLEY	345.0 Ckt 1"
line 10292	16102 "1 "	1 0	
0			
line 2	"Line SAN_JUAN	345.0 to MCKINLEY	345.0 Ckt 2"
line 10292	16102 "2 "	1 0	
0			
line 3	"Line HIDALGO	345.0 to GREENLEE	345.0 Ckt 1"
line 11080	16101 "1 "	1 0	
0			
line 4	"Line CHOLLA	500.0 to SAGUARO	500.0 Ckt 1"
line 14000	14004 "1 "	1 0	
0			
line 5	"Line FOURCORN	500.0 to MOENKOPI	500.0 Ckt 1"
line 14001	14002 "1 "	1 0	
0			
line 6	"Line FOURCORN	500.0 to FCW	500.0 Ckt 1"
line 14001	14030 "1 "	1 0	
0			
line 7	"Line MOENKOPI	500.0 to YAVAPAI	500.0 Ckt 1"
line 14002	14006 "1 "	1 0	
0			
line 8	"Line MOENKOPI	500.0 to RME	500.0 Ckt 1"
line 14002	14032 "1 "	1 0	
0			
line 9	"Line MOENKOPI	500.0 to ELDORDO	500.0 Ckt 1"
line 14002	24042 "1 "	1 0	
0			
line 10	"Line MOENKOPI	500.0 to MARKETPL	500.0 Ckt 1"
line 14002	26044 "1 "	1 0	
0			
line 11	"Line NAVAJO	500.0 to MOENKOPI	500.0 Ckt 1"
line 14003	14002 "1 "	1 0	
0			
line 12	"Line NAVAJO	500.0 to RME	500.0 Ckt 1"
line 14003	14032 "1 "	1 0	
0			
line 13	"Line NAVAJO	500.0 to CRYSTAL	500.0 Ckt 1"
line 14003	26123 "1 "	1 0	
0			
line 14	"Line SAGUARO	500.0 to TORTOLIT	500.0 Ckt 1"
line 14004	16000 "1 "	1 0	
0			
line 15	"Line SAGUARO	500.0 to TORTOLIT	500.0 Ckt 2"
line 14004	16000 "2 "	1 0	
0			
line 16	"Line SAGUARO	500.0 to TORTLIT2	500.0 Ckt 1"
line 14004	16001 "1 "	1 0	
0			
line 17	"Line YAVAPAI	500.0 to WESTWING	500.0 Ckt 1"
line 14006	14005 "1 "	1 0	
0			
line 18	"Line SNVLY	500.0 to RACEWAY	500.0 Ckt 1"
line 14010	14011 "1 "	1 0	
0			
line 19	"Line RACEWAY	500.0 to WESTWING	500.0 Ckt 1"
line 14011	14005 "1 "	1 0	
0			
line 20	"Line RACEWAY	500.0 to PNPKAPS	500.0 Ckt 1"
line 14011	14016 "1 "	1 0	
0			
line 21	"Line SGRLF	500.0 to CHOLLA	500.0 Ckt 1"
line 14017	14000 "1 "	1 0	
0			
line 22	"Line DRPP	500.0 to FCW	500.0 Ckt 1"
line 14031	14030 "1 "	1 0	

0			
line_23	"Line DRPP	500.0 to FCW	500.0 Ckt 2"
line 14031	14030 "2 "	1 0	
0			
line 24	"Line RME	500.0 to FCW	500.0 Ckt 1"
line 14032	14030 "1 "	1 0	
0			
line 25	"Line CHOLLA	345.0 to PNPKAPS	345.0 Ckt 1"
line 14100	14102 "1 "	1 0	
0			
line 26	"Line CHOLLA	345.0 to PRECHCYN	345.0 Ckt 1"
line 14100	14103 "1 "	1 0	
0			
line 27	"Line FOURCORN	345.0 to SAN_JUAN	345.0 Ckt 1"
line 14101	10292 "1 "	1 0	
0			
line 28	"Line FOURCORN	345.0 to WESTMESA	345.0 Ckt 1"
line 14101	10369 "1 "	1 0	
0			
line 29	"Line FOURCORN	345.0 to RIOPUERC	345.0 Ckt 1"
line 14101	10390 "1 "	1 0	
0			
line 30	"Line FOURCORN	345.0 to CHOLLA	345.0 Ckt 1"
line 14101	14100 "1 "	1 0	
0			
line 31	"Line FOURCORN	345.0 to CHOLLA	345.0 Ckt 2"
line 14101	14100 "2 "	1 0	
0			
line 32	"Line BUCKEYE	230.0 to LIBERTY	230.0 Ckt 1"
line 14201	19052 "1 "	1 0	
0			
line 33	"Line CACTUS	230.0 to OCOTILLO	230.0 Ckt 1"
line 14202	14219 "1 "	1 0	
0			
line 34	"Line CHOLLA	230.0 to LEUPP	230.0 Ckt 1"
line 14204	14215 "1 "	1 0	
0			
line 35	"Line VERDE S	230.0 to COCONINO	230.0 Ckt 1"
line 14247	14205 "1 "	1 0	
0			
line 36	"Line CTRYCLUB	230.0 to LINCSTRRT	230.0 Ckt 1"
line 14206	14216 "1 "	1 0	
0			
line 37	"Line CTRYCLUB	230.0 to GRNDRML	230.0 Ckt 1"
line 14206	14270 "1 "	1 0	
0			
line 38	"Line DEERVALY	230.0 to WESTWNGE	230.0 Ckt 1"
line 14207	14259 "1 "	1 0	
0			
line 39	"Line DEERVALY	230.0 to ALEXANDR	230.0 Ckt 1"
line 14207	15202 "1 "	1 0	
0			
line 40	"Line DEERVALY	230.0 to PINPKSRP	230.0 Ckt 1"
line 14207	15211 "1 "	1 0	
0			
line 41	"Line EAGLEYE	230.0 to LIBERTY	230.0 Ckt 1"
line 14209	19052 "1 "	1 0	
0			
line 42	"Line EL SOL	230.0 to AGUAFRIA	230.0 Ckt 1"
line 14210	15201 "1 "	1 0	
0			
line 43	"Line FOURCORN	230.0 to PILLAR	230.0 Ckt 1"
line 14211	10248 "1 "	1 0	
0			
line 44	"Line GLENDALE	230.0 to GRNDRML	230.0 Ckt 1"
line 14212	14270 "1 "	1 0	
0			

line 45	"Line LEUPP	230.0 to COCONINO	230.0 Ckt 1"
0 line 14215	14205 "1 " 1 0		
line 46	"Line LINCSTRT	230.0 to OCOTILLO	230.0 Ckt 1"
0 line 14216	14219 "1 " 1 0		
line 47	"Line LINCSTRT	230.0 to WPHXAPSN	230.0 Ckt 1"
0 line 14216	14239 "1 " 1 0		
line 48	"Line LONEPEAK	230.0 to SUNYSLOP	230.0 Ckt 1"
0 line 14217	14227 "1 " 1 0		
line 49	"Line MEADOWBK	230.0 to CTRYCLUB	230.0 Ckt 1"
0 line 14218	14206 "1 " 1 0		
line 50	"Line MEADOWBK	230.0 to SUNYSLOP	230.0 Ckt 1"
0 line 14218	14227 "1 " 1 0		
line 51	"Line REACH	230.0 to LONEPEAK	230.0 Ckt 1"
0 line 14220	14217 "1 " 1 0		
line 52	"Line PNPKAPS	230.0 to PINPK	230.0 Ckt 1"
0 line 14221	19062 "1 " 1 0		
line 53	"Line JOJOBA	230.0 to GILARIVR	230.0 Ckt 1"
0 line 14224	14238 "1 " 1 0		
line 54	"Line SAGUARO	230.0 to TATMOMLI	230.0 Ckt 1"
0 line 14225	14229 "1 " 1 0		
line 55	"Line SNTAROSA	230.0 to TATMOMLI	230.0 Ckt 1"
0 line 14226	14229 "1 " 1 0		
line 56	"Line SURPRISE	230.0 to EL SOL	230.0 Ckt 1"
0 line 14228	14210 "1 " 1 0		
line 57	"Line SURPRISE	230.0 to WESTWNGW	230.0 Ckt 1"
0 line 14228	14231 "1 " 1 0		
line 58	"Line VERDE S	230.0 to VERDE N	230.0 Ckt 1"
0 line 14247	14230 "1 " 1 0		
line 59	"Line WESTWNGW	230.0 to EL SOL	230.0 Ckt 1"
0 line 14231	14210 "1 " 1 0		
line 60	"Line WESTWNGW	230.0 to WESTWNGE	230.0 Ckt 1"
0 line 14231	14259 "1 " 1 0		
line 61	"Line WESTWNGW	230.0 to PINPK	230.0 Ckt 1"
0 line 14231	19062 "1 " 1 0		
line 62	"Line WHTNKAPS	230.0 to EL SOL	230.0 Ckt 1"
0 line 14232	14210 "1 " 1 0		
line 63	"Line WHTNKAPS	230.0 to RUDD	230.0 Ckt 1"
0 line 14232	15230 "1 " 1 0		
line 64	"Line WPHXAPSS	230.0 to WPHXAPSN	230.0 Ckt 1"
0 line 14233	14239 "1 " 1 0		
line 65	"Line WPHXAPSS	230.0 to RUDD	230.0 Ckt 1"
0 line 14233	15230 "1 " 1 0		
line 66	"Line YAVAPAI	230.0 to VERDE N	230.0 Ckt 1"
0 line 14234	14230 "1 " 1 0		
line 67	"Line YAVAPAI	230.0 to WILOWLKE	230.0 Ckt 1"

line 14234	14249 "1 " 1 0		
0 line 68	"Line KYR-NEW	230.0 to OCOTILLO	230.0 Ckt 1"
0 line 14236	14219 "1 " 1 0		
line 69	"Line KYR-NEW	230.0 to KNOX	230.0 Ckt 1"
0 line 14236	15219 "1 " 1 0		
line 70	"Line GILARIVR	230.0 to GILABEND	230.0 Ckt 1"
0 line 14238	14235 "1 " 1 0		
line 71	"Line WPHXAPSN	230.0 to WHTNKAPS	230.0 Ckt 1"
0 line 14239	14232 "1 " 1 0		
line 72	"Line FORTROCK	230.0 to ROUNDVLY	230.0 Ckt 1"
0 line 14240	14223 "1 " 1 0		
line 73	"Line FORTROCK	230.0 to JUNIPRMT	230.0 Ckt 1"
0 line 14240	14264 "1 " 1 0		
line 74	"Line ALEXNDR	230.0 to ALEXANDR	230.0 Ckt 1"
0 line 14241	15202 "1 " 1 0		
line 75	"Line GLENDALW	230.0 to GLENDALE	230.0 Ckt 1"
0 line 14248	14212 "1 " 1 0		
line 76	"Line GLENDALW	230.0 to AGUAFRIA	230.0 Ckt 1"
0 line 14248	15201 "1 " 1 0		
line 77	"Line WILOWLKW	230.0 to PRESCOTT	230.0 Ckt 1"
0 line 14250	14222 "1 " 1 0		
line 78	"Line WILOWLKW	230.0 to WILOWLKE	230.0 Ckt 1"
0 line 14250	14249 "1 " 1 0		
line 79	"Line AVERY	230.0 to RACEWAY	230.0 Ckt 1"
0 line 14253	14246 "1 " 1 0		
line 80	"Line AVERY	230.0 to TS6	230.0 Ckt 1"
0 line 14253	14257 "1 " 1 0		
line 81	"Line TRLBY	230.0 to TS2	230.0 Ckt 1"
0 line 14254	14255 "1 " 1 0		
line 82	"Line TRLBY	230.0 to SNVLY	230.0 Ckt 1"
0 line 14254	14265 "1 " 1 0		
line 83	"Line TS2	230.0 to PLMVLY	230.0 Ckt 1"
0 line 14255	14252 "1 " 1 0		
line 84	"Line TS6	230.0 to PNPKAPS	230.0 Ckt 1"
0 line 14257	14221 "1 " 1 0		
line 85	"Line TS4	230.0 to JOJOBA	230.0 Ckt 1"
0 line 14258	14224 "1 " 1 0		
line 86	"Line TS4	230.0 to PLMVLY	230.0 Ckt 1"
0 line 14258	14252 "1 " 1 0		
line 87	"Line JUNIPRMT	230.0 to SELIGMAN	230.0 Ckt 1"
0 line 14264	14244 "1 " 1 0		
line 88	"Line ADAMS	115.0 to ADAMS TP	115.0 Ckt 1"
0 line 14350	19060 "1 " 1 0		
line 89	"Line SAG.EAST	115.0 to SAG.WEST	115.0 Ckt 1"
0 line 14356	14357 "1 " 1 0		

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0
line_90 "Line SAG.EAST 115.0 to NAVISKA 115.0 Ckt 1"
line 14356 17665 "1 " 1 0
0
line_91 "Line SAG.EAST 115.0 to ORACLE 115.0 Ckt 1"
line 14356 19057 "1 " 1 0
0
line_92 "Line SAG.WEST 115.0 to SNMANUEL 115.0 Ckt 1"
line 14357 14358 "1 " 1 0
0
line_93 "Line SAG.WEST 115.0 to ED-5 115.0 Ckt 1"
line 14357 19067 "1 " 1 0
0
line_94 "Line SNMANUEL 115.0 to HAYDENAZ 115.0 Ckt 1"
line 14358 15108 "1 " 1 0
0
line_95 "Line VLYFARMS 115.0 to ORACLE 115.0 Ckt 1"
line 14359 19057 "1 " 1 0
0
line_96 "Line BOOTHILL 115.0 to ADAMS 115.0 Ckt 1"
line 14362 14350 "1 " 1 0
0
line_97 "Line BOOTHILL 115.0 to MURAL 115.0 Ckt 1"
line 14362 14353 "1 " 1 0
0
line_98 "Line CORONADO 500.0 to SGRLF 500.0 Ckt 1"
line 15001 14017 "1 " 1 0
0
line_99 "Line CORONADO 500.0 to SILVERKG 500.0 Ckt 1"
line 15001 15041 "1 " 1 0
0
line_100 "Line PALOVRDE 500.0 to WESTWING 500.0 Ckt 1"
line 15021 14005 "1 " 1 0
0
line_101 "Line PALOVRDE 500.0 to WESTWING 500.0 Ckt 2"
line 15021 14005 "2 " 1 0
0
line_102 "Line PALOVRDE 500.0 to RUDD 500.0 Ckt 1"
line 15021 15061 "1 " 1 0
0
line_103 "Line PALOVRDE 500.0 to DEVERS 500.0 Ckt 1"
line 15021 24801 "1 " 1 0
0
line_104 "Line PERK PS2 500.0 to PERKINPS 500.0 Ckt 1"
line 15032 15033 "1 " 1 0
0
line_105 "Line PERKINPS 500.0 to WESTWING 500.0 Ckt 1"
line 15033 14005 "1 " 1 0
0
line_106 "Line SILVERKG 500.0 to BROWNING 500.0 Ckt 1"
line 15041 15051 "1 " 1 0
0
line_107 "Line BROWNING 500.0 to KYRENE 500.0 Ckt 1"
line 15051 15011 "1 " 1 0
0
line_108 "Line ABEL 500.0 to BROWNING 500.0 Ckt 1"
line 15070 15051 "1 " 1 0
0
line_109 "Line PC GEN 500.0 to ABEL 500.0 Ckt 1"
line 15095 15070 "1 " 1 0
0
line_110 "Line PINAL C 500.0 to TORTOLIT 500.0 Ckt 1"
line 15080 16000 "1 " 1 0
0
line_111 "Line JOJOBA 500.0 to GILARIVR 500.0 Ckt 1"
line 15089 14007 "1 " 1 0
0

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line_112 "Line JOJOBA 500.0 to GILARIVR 500.0 Ckt 2"
line 15089 14007 "2 " 1 0
0
line_113 "Line JOJOBA 500.0 to KYRENE 500.0 Ckt 1"
line 15089 15011 "1 " 1 0
0
line_114 "Line HASSYAMP 500.0 to REDHAWK 500.0 Ckt 1"
line 15090 14009 "1 " 1 0
0
line_115 "Line HASSYAMP 500.0 to PALOVRDE 500.0 Ckt 1"
line 15090 15021 "1 " 1 0
0
line_116 "Line HASSYAMP 500.0 to PALOVRDE 500.0 Ckt 2"
line 15090 15021 "2 " 1 0
0
line_117 "Line HASSYAMP 500.0 to PALOVRDE 500.0 Ckt 3"
line 15090 15021 "3 " 1 0
0
line_118 "Line HASSYAMP 500.0 to PINAL_W 500.0 Ckt 1"
line 15090 15088 "1 " 1 0
0
line_119 "Line HASSYAMP 500.0 to JOJOBA 500.0 Ckt 1"
line 15090 15089 "1 " 1 0
0
line_120 "Line HASSYAMP 500.0 to ARLINTON 500.0 Ckt 1"
line 15090 15092 "1 " 1 0
0
line_121 "Line HASSYAMP 500.0 to MESQUITE 500.0 Ckt 1"
line 15090 15094 "1 " 1 0
0
line_122 "Line HASSYAMP 500.0 to N.GILA 500.0 Ckt 1"
line 15090 22536 "1 " 1 0
0
line_123 "Line HARQUAHA 500.0 to DEVERS 500.0 Ckt 1"
line 15093 24801 "1 " 1 0
0
line_124 "Line BONNEYTP 115.0 to BONNEYBK 115.0 Ckt 1"
line 15103 14352 "1 " 1 0
0
line_125 "Line BONNEYTP 115.0 to COOLIDGE 115.0 Ckt 1"
line 15103 19044 "1 " 1 0
0
line_126 "Line ELLISON 115.0 to 843E2.7N 115.0 Ckt 1"
line 15105 15133 "1 " 1 0
0
line_127 "Line FRAZIER 115.0 to MOONSHIN 115.0 Ckt 1"
line 15106 15115 "1 " 1 0
0
line_128 "Line FRAZIER 115.0 to ROOSEVLT 115.0 Ckt 1"
line 15106 15134 "1 " 1 0
0
line_129 "Line GOLDFELD 115.0 to HORSMESA 115.0 Ckt 1"
line 15107 15109 "1 " 1 0
0
line_130 "Line HAYDENAZ 115.0 to ASARCOTP 115.0 Ckt 1"
line 15108 15102 "1 " 1 0
0
line_131 "Line HAYDENAZ 115.0 to KEARNYTP 115.0 Ckt 1"
line 15108 15112 "1 " 1 0
0
line_132 "Line HORSMESA 115.0 to FRAZIER 115.0 Ckt 1"
line 15109 15106 "1 " 1 0
0
line_133 "Line HORSMESA 115.0 to MRMNPLAT 115.0 Ckt 1"
line 15109 15117 "1 " 1 0
0
line_134 "Line KEARNYTP 115.0 to KEARNY 115.0 Ckt 1"

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line	15112	15111	"1 "	1 0			
0							
line 135		"Line KEARNYTP		115.0 to MORRISAZ	115.0 Ckt 1"		
line	15112	15116	"1 "	1 0			
0							
line 136		"Line KNOLL		115.0 to MORRISAZ	115.0 Ckt 1"		
line	15113	15116	"1 "	1 0			
0							
line 137		"Line MIAMI		115.0 to PINTOVLY	115.0 Ckt 1"		
line	15114	15121	"1 "	1 0			
0							
line 138		"Line MOONSHIN		115.0 to PINAL	115.0 Ckt 1"		
line	15115	15119	"1 "	1 0			
0							
line 138a		"Line MOONSHIN		115.0 to PINAL	115.0 Ckt 1 & load trip"		
line	15115	15119	"1 "	1 0			
load	"ELLISON	115.00"	"SR"	1 11.3 4.81			
0							
line 139		"Line MOONSHIN		115.0 to 842E2.7N	115.0 Ckt 1"		
line	15115	15132	"1 "	1 0			
0							
line 140		"Line OAKFLAT		115.0 to SILVERT1	115.0 Ckt 1"		
line	15118	15126	"1 "	1 0			
0							
line 141		"Line PINAL		115.0 to SILVERT1	115.0 Ckt 1"		
line	15119	15126	"1 "	1 0			
0							
line 142		"Line RAY		115.0 to KNOLL	115.0 Ckt 1"		
line	15122	15113	"1 "	1 0			
0							
line 143		"Line RAY		115.0 to SUPERIOR	115.0 Ckt 1"		
line	15122	15129	"1 "	1 0			
0							
line 144		"Line REFINERY		115.0 to 842E2.7N	115.0 Ckt 1"		
line	15123	15132	"1 "	1 0			
0							
line 145		"Line SILVERK1		115.0 to SILVERT1	115.0 Ckt 1"		
line	15124	15126	"1 "	1 0			
0							
line 146		"Line SILVERK2		115.0 to PINTOVLY	115.0 Ckt 1"		
line	15125	15121	"1 "	1 0			
0							
line 147		"Line SILVERK2		115.0 to SUPERIOR	115.0 Ckt 1"		
line	15125	15129	"1 "	1 0			
0							
line 148		"Line SPURLOCK		115.0 to SUPERIOR	115.0 Ckt 1"		
line	15127	15129	"1 "	1 0			
0							
line 149		"Line 842E2.7N		115.0 to 843E2.7N	115.0 Ckt 1"		
line	15132	15133	"1 "	1 0			
0							
line 150		"Line SNYDHLAZ		115.0 to SNYDHILL	115.0 Ckt 1"		
line	15181	19214	"1 "	1 0			
0							
line 151		"Line AGUAFRIA		230.0 to WESTWNGW	230.0 Ckt 1"		
line	15201	14231	"1 "	1 0			
0							
line 152		"Line AGUAFRIA		230.0 to ALEXANDR	230.0 Ckt 1"		
line	15201	15202	"1 "	1 0			
0							
line 153		"Line AGUAFRIA		230.0 to WHITETNK	230.0 Ckt 1"		
line	15201	15218	"1 "	1 0			
0							
line 154		"Line ANDERSON		230.0 to ORME	230.0 Ckt 1"		
line	15203	15208	"1 "	1 0			
0							
line 155		"Line BRANDOW		230.0 to KYRENE	230.0 Ckt 1"		

line	15204	15207	"1 "	1 0			
0							
line 156		"Line BRANDOW		230.0 to PAPAGOBT	230.0 Ckt 1"		
line	15204	15209	"1 "	1 0			
0							
line 157		"Line BRANDOW		230.0 to WARD	230.0 Ckt 1"		
line	15204	15217	"1 "	1 0			
0							
line 158		"Line BRANDOW		230.0 to WARD	230.0 Ckt 2"		
line	15204	15217	"2 "	1 0			
0							
line 159		"Line CORBELL		230.0 to KYRENE	230.0 Ckt 1"		
line	15205	15207	"1 "	1 0			
0							
line 160		"Line KYRENE		230.0 to KYR-NEW	230.0 Ckt 1"		
line	15207	14236	"1 "	1 0			
0							
line 161		"Line KYRENE		230.0 to SCHRADER	230.0 Ckt 1"		
line	15207	15214	"1 "	1 0			
0							
line 162		"Line ORME		230.0 to ANDERSON	230.0 Ckt 2"		
line	15208	15203	"2 "	1 0			
0							
line 163		"Line ORME		230.0 to RUDD	230.0 Ckt 1"		
line	15208	15230	"1 "	1 0			
0							
line 164		"Line ORME		230.0 to RUDD	230.0 Ckt 2"		
line	15208	15230	"2 "	1 0			
0							
line 165		"Line PAPAGOBT		230.0 to PINPKSRP	230.0 Ckt 1"		
line	15209	15211	"1 "	1 0			
0							
line 166		"Line BRANDOW		230.0 to PINPKSRP	230.0 Ckt 1"		
line	15204	15211	"1 "	1 0			
0							
line 167		"Line PINPKSRP		230.0 to BRANDOW	230.0 Ckt 2"		
line	15211	15204	"2 "	1 0			
0							
line 168		"Line ROGERS		230.0 to THUNDRST	230.0 Ckt 1"		
line	15212	15216	"1 "	1 0			
0							
line 169		"Line ROGERS		230.0 to ROGSWAPA	230.0 Ckt 1"		
line	15212	19502	"1 "	1 0			
0							
line 170		"Line ROGERS		230.0 to ROGSWAPA	230.0 Ckt 2"		
line	15212	19502	"2 "	1 0			
0							
line 171		"Line SANTAN		230.0 to CORBELL	230.0 Ckt 1"		
line	15213	15205	"1 "	1 0			
0							
line 172		"Line SANTAN		230.0 to THUNDRST	230.0 Ckt 1"		
line	15213	15216	"1 "	1 0			
0							
line 173		"Line SCHRADER		230.0 to SANTAN	230.0 Ckt 1"		
line	15214	15213	"1 "	1 0			
0							
line 174		"Line SILVERKG		230.0 to GOLDFELD	230.0 Ckt 1"		
line	15215	15206	"1 "	1 0			
0							
line 175		"Line THUNDRST		230.0 to GOLDFELD	230.0 Ckt 1"		
line	15216	15206	"1 "	1 0			
0							
line 176		"Line THUNDRST		230.0 to GOLDFELD	230.0 Ckt 2"		
line	15216	15206	"2 "	1 0			
0							
line 177		"Line KNOX		230.0 to SNTAROSA	230.0 Ckt 1"		
line	15219	14226	"1 "	1 0			

0
line_178 "Line RS17 230.0 to SCHRADER 230.0 Ckt 1"
line 15221 15214 "1 " 1 0
0
line_179 "Line RS17 230.0 to SCHRADER 230.0 Ckt 2"
line 15221 15214 "2 " 1 0
0
line_180 "Line BROWNING 230.0 to SANTAN 230.0 Ckt 1"
line 15222 15213 "1 " 1 0
0
line_181 "Line DINOSAUR 230.0 to BROWNING 230.0 Ckt 1"
line 15223 15222 "1 " 1 0
0
line_182 "Line ABEL 230.0 to DINOSAUR 230.0 Ckt 1"
line 15224 15223 "1 " 1 0
0
line_183 "Line RUDD 230.0 to PLMVLY 230.0 Ckt 1"
line 15230 14252 "1 " 1 0
0
line_184 "Line RUDD 230.0 to WHITETNK 230.0 Ckt 1"
line 15230 15218 "1 " 1 0
0
line_185 "Line RUDD 230.0 to LIBERTY 230.0 Ckt 1"
line 15230 19052 "1 " 1 0
0
line_186 "Line GREENLEE 345.0 to WINCHSTR 345.0 Ckt 1"
line 16101 16109 "1 " 1 0
0
line_187 "Line GREENLEE 345.0 to WILLOW 345.0 Ckt 1"
line 16101 16112 "1 " 1 0
0
line_188 "Line GREENLEE 345.0 to COPPERVR 345.0 Ckt 1"
line 16101 16900 "1 " 1 0
0
line_189 "Line MCKINLEY 345.0 to SPRINGR 345.0 Ckt 1"
line 16102 16104 "1 " 1 0
0
line_190 "Line MCKINLEY 345.0 to SPRINGR 345.0 Ckt 2"
line 16102 16104 "2 " 1 0
0
line_191 "Line SOUTH 345.0 to GATEWAY 345.0 Ckt 1"
line 16103 16108 "1 " 1 0
0
line_192 "Line SOUTH 345.0 to GATEWAY 345.0 Ckt 2"
line 16103 16108 "2 " 1 0
0
line_193 "Line SPRINGR 345.0 to LUNA 345.0 Ckt 1"
line 16104 11093 "1 " 1 0
0
line_194 "Line SPRINGR 345.0 to CORONADO 345.0 Ckt 1"
line 16104 16100 "1 " 1 0
0
line_195 "Line SPRINGR 345.0 to GREENLEE 345.0 Ckt 1"
line 16104 16101 "1 " 1 0
0
line_196 "Line SPRINGR 345.0 to VAIL2 345.0 Ckt 1"
line 16104 16106 "1 " 1 0
0
line_197 "Line VAIL 345.0 to SOUTH 345.0 Ckt 1"
line 16105 16103 "1 " 1 0
0
line_198 "Line WESTWING 345.0 to PINALWES 345.0 Ckt 1"
line 16107 16114 "1 " 1 0
0
line_199 "Line WINCHSTR 345.0 to VAIL 345.0 Ckt 1"
line 16109 16105 "1 " 1 0
0

line_200 "Line WINCHSTR 345.0 to WILLOW 345.0 Ckt 1"
line 16109 16112 "1 " 1 0
0
line_201 "Line WILLOW 345.0 to BOWIE 345.0 Ckt 1"
line 16112 16111 "1 " 1 0
0
line_202 "Line WILLOW 345.0 to BOWIE 345.0 Ckt 2"
line 16112 16111 "2 " 1 0
0
line_203 "Line PINALWES 345.0 to SOUTH 345.0 Ckt 1"
line 16114 16103 "1 " 1 0
0
line_204 "Line DMP 138.0 to N. LOOP 138.0 Ckt 1"
line 16200 16207 "1 " 1 0
0
line_205 "Line DMP 138.0 to NE.LOOP 138.0 Ckt 1"
line 16200 16208 "1 " 1 0
0
line_206 "Line DMP 138.0 to SN.CRUZ 138.0 Ckt 1"
line 16200 16214 "1 " 1 0
0
line_207 "Line DMP 138.0 to TUCSON 138.0 Ckt 1"
line 16200 16218 "1 " 1 0
0
line_208 "Line DREXEL 138.0 to IRVNGTN 138.0 Ckt 1"
line 16201 16204 "1 " 1 0
0
line_209 "Line DREXEL 138.0 to MIDVALE 138.0 Ckt 1"
line 16201 16206 "1 " 1 0
0
line_210 "Line E. LOOP 138.0 to NE.LOOP 138.0 Ckt 1"
line 16202 16208 "1 " 1 0
0
line_211 "Line E. LOOP 138.0 to ROBERTS 138.0 Ckt 1"
line 16202 16211 "1 " 1 0
0
line_212 "Line E. LOOP 138.0 to PANTANO 138.0 Ckt 1"
line 16202 16224 "1 " 1 0
0
line_213 "Line E. LOOP 138.0 to HARRISON 138.0 Ckt 1"
line 16202 16247 "1 " 1 0
0
line_214 "Line IRVNGTN 138.0 to SOUTH 138.0 Ckt 1"
line 16204 16216 "1 " 1 0
0
line_215 "Line IRVNGTN 138.0 to TUCSON 138.0 Ckt 1"
line 16204 16218 "1 " 1 0
0
line_216 "Line IRVNGTN 138.0 to VAIL 138.0 Ckt 2"
line 16204 16220 "2 " 1 0
0
line_217 "Line IRVNGTN 138.0 to TECHPARK 138.0 Ckt 1"
line 16204 16233 "1 " 1 0
0
line_218 "Line IRVNGTN 138.0 to KINO 138.0 Ckt 1"
line 16204 16246 "1 " 1 0
0
line_219 "Line N. LOOP 138.0 to RILLITO 138.0 Ckt 1"
line 16207 16210 "1 " 1 0
0
line_220 "Line N. LOOP 138.0 to WESTINA 138.0 Ckt 1"
line 16207 16221 "1 " 1 0
0
line_221 "Line N. LOOP 138.0 to MARANA 138.0 Ckt 1"
line 16207 16244 "1 " 1 0
0
line_222 "Line NE.LOOP 138.0 to RILLITO 138.0 Ckt 1"

line	16208	16210	"1 "	1 0			
0							
line 223		"Line NE.LOOP	138.0 to NELP_SVC	138.0 Ckt 1"			
line	16208	16298	"1 "	1 0			
0							
line 224		"Line RANVISTO	138.0 to LACANADA	138.0 Ckt 1"			
line	16209	16205	"1 "	1 0			
0							
line 225		"Line RANVISTO	138.0 to SUN_CITY	138.0 Ckt 1"			
line	16209	16226	"1 "	1 0			
0							
line 226		"Line RANVISTO	138.0 to NARANJA	138.0 Ckt 1"			
line	16209	16245	"1 "	1 0			
0							
line 227		"Line RILLITO	138.0 to LACANADA	138.0 Ckt 1"			
line	16210	16205	"1 "	1 0			
0							
line 228		"Line ROBERTS	138.0 to HARRISON	138.0 Ckt 1"			
line	16211	16247	"1 "	1 0			
0							
line 229		"Line S.TRAIL	138.0 to ROBERTS	138.0 Ckt 1"			
line	16213	16211	"1 "	1 0			
0							
line 230		"Line SN.CRUIZ	138.0 to IRVNGTN	138.0 Ckt 1"			
line	16214	16204	"1 "	1 0			
0							
line 231		"Line SNYDER	138.0 to E. LOOP	138.0 Ckt 1"			
line	16215	16202	"1 "	1 0			
0							
line 232		"Line SNYDER	138.0 to NE.LOOP	138.0 Ckt 1"			
line	16215	16208	"1 "	1 0			
0							
line 233		"Line SNYDER	138.0 to CRYCROFT	138.0 Ckt 1"			
line	16215	16239	"1 "	1 0			
0							
line 234		"Line SOUTH	138.0 to MIDVALE	138.0 Ckt 1"			
line	16216	16206	"1 "	1 0			
0							
line 235		"Line SOUTH	138.0 to ASARCO	138.0 Ckt 1"			
line	16216	16225	"1 "	1 0			
0							
line 236		"Line SOUTH	138.0 to CYPRUS	138.0 Ckt 1"			
line	16216	16228	"1 "	1 0			
0							
line 237		"Line SOUTH	138.0 to GREENVLY	138.0 Ckt 1"			
line	16216	16232	"1 "	1 0			
0							
line 238		"Line SOUTH	138.0 to HARTT	138.0 Ckt 1"			
line	16216	16242	"1 "	1 0			
0							
line 239		"Line TORTOLIT	138.0 to N. LOOP	138.0 Ckt 1"			
line	16217	16207	"1 "	1 0			
0							
line 240		"Line TORTOLIT	138.0 to N. LOOP	138.0 Ckt 2"			
line	16217	16207	"2 "	1 0			
0							
line 241		"Line TORTOLIT	138.0 to RANVISTO	138.0 Ckt 1"			
line	16217	16209	"1 "	1 0			
0							
line 242		"Line TORTOLIT	138.0 to MARANA	138.0 Ckt 1"			
line	16217	16244	"1 "	1 0			
0							
line 243		"Line TUCSON	138.0 to WESTINA	138.0 Ckt 1"			
line	16218	16221	"1 "	1 0			
0							
line 244		"Line TUCSON	138.0 to DELCERRO	138.0 Ckt 1"			
line	16218	16229	"1 "	1 0			

0							
line_245		"Line TUCSON	138.0 to KINO	138.0 Ckt 1"			
line	16218	16246	"1 "	1 0			
0							
line 246		"Line TWNTYSEC	138.0 to E. LOOP	138.0 Ckt 1"			
line	16219	16202	"1 "	1 0			
0							
line 247		"Line TWNTYSEC	138.0 to IRVNGTN	138.0 Ckt 1"			
line	16219	16204	"1 "	1 0			
0							
line 248		"Line VAIL	138.0 to S.TRAIL	138.0 Ckt 1"			
line	16220	16213	"1 "	1 0			
0							
line 249		"Line VAIL	138.0 to FT.HUACH	138.0 Ckt 1"			
line	16220	16230	"1 "	1 0			
0							
line 250		"Line VAIL	138.0 to CIENEGA	138.0 Ckt 1"			
line	16220	16243	"1 "	1 0			
0							
line 251		"Line RBWILMOT	138.0 to VAIL	138.0 Ckt 1"			
line	16222	16220	"1 "	1 0			
0							
line 252		"Line LOSREALS	138.0 to VAIL	138.0 Ckt 1"			
line	16223	16220	"1 "	1 0			
0							
line 253		"Line PANTANO	138.0 to LOSREALS	138.0 Ckt 1"			
line	16224	16223	"1 "	1 0			
0							
line 254		"Line CANOARCH	138.0 to CYPRUS	138.0 Ckt 1"			
line	16227	16228	"1 "	1 0			
0							
line 255		"Line DELCERRO	138.0 to WESTINA	138.0 Ckt 1"			
line	16229	16221	"1 "	1 0			
0							
line 256		"Line GREENVLY	138.0 to CANOARCH	138.0 Ckt 1"			
line	16232	16227	"1 "	1 0			
0							
line 257		"Line TECHPARK	138.0 to VAIL	138.0 Ckt 1"			
line	16233	16220	"1 "	1 0			
0							
line 258		"Line CORONA	138.0 to IRVNGTN	138.0 Ckt 1"			
line	16238	16204	"1 "	1 0			
0							
line 259		"Line CORONA	138.0 to SOUTH	138.0 Ckt 1"			
line	16238	16216	"1 "	1 0			
0							
line 260		"Line CRYCROFT	138.0 to NE.LOOP	138.0 Ckt 1"			
line	16239	16208	"1 "	1 0			
0							
line 261		"Line HARTT	138.0 to GREENVLY	138.0 Ckt 1"			
line	16242	16232	"1 "	1 0			
0							
line 262		"Line CIENEGA	138.0 to S.TRAIL	138.0 Ckt 1"			
line	16243	16213	"1 "	1 0			
0							
line 263		"Line COPPERVR	230.0 to FRISCO	230.0 Ckt 1"			
line	16901	16902	"1 "	1 0			
0							
line 264		"Line PD-MORNC	230.0 to FRISCO	230.0 Ckt 1"			
line	16903	16902	"1 "	1 0			
0							
line 265		"Line APACHE	115.0 to SNMANUEL	115.0 Ckt 1"			
line	17001	14358	"1 "	1 0			
0							
line 266		"Line APACHE	230.0 to BUTERFLD	230.0 Ckt 1"			
line	17002	17007	"1 "	1 0			
0							

line 267	"Line APACHE	230.0 to RED TAIL	230.0 Ckt 1"
0 line 17002	17018 "1 " 1 0		
line 268	"Line APACHE	230.0 to WINCHSTR	230.0 Ckt 1"
0 line 17002	17105 "1 " 1 0		
line 269	"Line AVRA	115.0 to MARANA	115.0 Ckt 1"
0 line 17003	17012 "1 " 1 0		
line 270	"Line AVRA	115.0 to SNDARIO	115.0 Ckt 1"
0 line 17003	17089 "1 " 1 0		
line 271	"Line BICKNELL	345.0 to VAIL	345.0 Ckt 1"
0 line 17005	16105 "1 " 1 0		
line 272	"Line BUTERFLD	230.0 to SAN RAF	230.0 Ckt 1"
0 line 17007	17020 "1 " 1 0		
line 273	"Line DOSCONDO	230.0 to HACKBERY	230.0 Ckt 1"
0 line 17008	17044 "1 " 1 0		
line 274	"Line MORENCI	230.0 to PD-MORNC	230.0 Ckt 1"
0 line 17014	16903 "1 " 1 0		
line 275	"Line MORENCI	230.0 to GREEN-SW	230.0 Ckt 1"
0 line 17014	17009 "1 " 1 0		
line 276	"Line PANTANO	115.0 to KARTCHNR	115.0 Ckt 1"
0 line 17015	17039 "1 " 1 0		
line 277	"Line PANTANO	230.0 to NEWTUCSN	230.0 Ckt 1"
0 line 17016	17676 "1 " 1 0		
line 278	"Line RED TAIL	230.0 to DOSCONDO	230.0 Ckt 1"
0 line 17018	17008 "1 " 1 0		
line 279	"Line THREEPNT	115.0 to SNDARIO	115.0 Ckt 1"
0 line 17022	17089 "1 " 1 0		
line 280	"Line VALEN-SW	115.0 to BLACKMTN	115.0 Ckt 1"
0 line 17023	19201 "1 " 1 0		
line 281	"Line HACKBERY	230.0 to MORENCI	230.0 Ckt 1"
0 line 17044	17014 "1 " 1 0		
line 282	"Line SNDARIO	115.0 to BRAWLEY	115.0 Ckt 1"
0 line 17089	19203 "1 " 1 0		
line 283	"Line SNDARIO	115.0 to SANDARIO	115.0 Ckt 1"
0 line 17089	19212 "1 " 1 0		
line 284	"Line SAHUARIT	230.0 to BICKNELL	230.0 Ckt 1"
0 line 17102	17004 "1 " 1 0		
line 285	"Line S.BRKRCH	115.0 to SNMANUEL	115.0 Ckt 1"
0 line 17608	14358 "1 " 1 0		
line 286	"Line NAVISKA	115.0 to ADONIS	115.0 Ckt 1"
0 line 17665	17674 "1 " 1 0		
line 287	"Line SAN JOAQ	115.0 to SANXAVER	115.0 Ckt 1"
0 line 17668	19213 "1 " 1 0		
line 288	"Line NEWTUCSN	230.0 to SAHUARIT	230.0 Ckt 1"
0 line 17676	17102 "1 " 1 0		
line 289	"Line HENDRSON	230.0 to MEAD N	230.0 Ckt 1"

line 18006	19011 "1 " 1 0		
0 line 290	"Line BC TAP	230.0 to MEAD N	230.0 Ckt 1"
0 line 18055	19011 "1 " 1 0		
line 291	"Line H ALLEN	500.0 to MEAD	500.0 Ckt 1"
0 line 18450	19038 "1 " 1 0		
line 292	"Line EQUEST N	500.0 to MEAD	500.0 Ckt 1"
0 line 18455	19038 "1 " 1 0		
line 293	"Line MEAD N	230.0 to ARDEN	230.0 Ckt 1"
0 line 19011	18004 "1 " 1 0		
line 294	"Line MEAD N	230.0 to DECATUR	230.0 Ckt 1"
0 line 19011	18015 "1 " 1 0		
line 295	"Line MEAD N	230.0 to EASTSIDE	230.0 Ckt 1"
0 line 19011	18016 "1 " 1 0		
line 296	"Line MEAD N	230.0 to NEWPORT	230.0 Ckt 1"
0 line 19011	18021 "1 " 1 0		
line 297	"Line MEAD N	230.0 to EQUEST	230.0 Ckt 2"
0 line 19011	18600 "2 " 1 0		
line 298	"Line MEAD N	230.0 to MGM-CC	230.0 Ckt 1"
0 line 19011	18618 "1 " 1 0		
line 299	"Line MEAD N	230.0 to HVRA3A4	230.0 Ckt 1"
0 line 19011	19043 "1 " 1 0		
line 300	"Line MEAD S	230.0 to PAHRUMP	230.0 Ckt 1"
0 line 19012	18023 "1 " 1 0		
line 301	"Line MEAD S	230.0 to EQUEST	230.0 Ckt 1"
0 line 19012	18600 "1 " 1 0		
line 302	"Line MEAD S	230.0 to GREENWAY	230.0 Ckt 1"
0 line 19012	18674 "1 " 1 0		
line 303	"Line MEAD S	230.0 to DIAMOND	230.0 Ckt 1"
0 line 19012	18915 "1 " 1 0		
line 304	"Line MEAD S	230.0 to DIAMOND	230.0 Ckt 2"
0 line 19012	18915 "2 " 1 0		
line 305	"Line MEAD S	230.0 to MEAD N	230.0 Ckt 1"
0 line 19012	19011 "1 " 1 0		
line 306	"Line MEAD S	230.0 to ELDORDO	230.0 Ckt 1"
0 line 19012	24041 "1 " 1 0		
line 307	"Line MEAD S	230.0 to ELDORDO	230.0 Ckt 2"
0 line 19012	24041 "2 " 1 0		
line 308	"Line MEAD S	230.0 to MCCULLGH	230.0 Ckt 1"
0 line 19012	26046 "1 " 1 0		
line 309	"Line MEAD S	230.0 to MCCULLGH	230.0 Ckt 2"
0 line 19012	26046 "2 " 1 0		
line 310	"Line BLYTHE	161.0 to BUCKBLVD	161.0 Ckt 1"
0 line 19020	19101 "1 " 1 0		
line 311	"Line BLYTHE	161.0 to GLT TAP	161.0 Ckt 1"
0 line 19020	19105 "1 " 1 0		

0
line_312 "Line BLYTHE 161.0 to HEADGATE 161.0 Ckt 1"
line 19020 19206 "1 " 1 0
0
line_313 "Line BLYTHE 161.0 to NILAND 161.0 Ckt 1"
line 19020 21047 "1 " 1 0
0
line_314 "Line BLYTHE 161.0 to BLYTHESC 161.0 Ckt 1"
line 19020 24017 "1 " 1 0
0
line_315 "Line DAVIS 230.0 to RIVIERA 230.0 Ckt 1"
line 19022 17087 "1 " 1 0
0
line_316 "Line DAVIS 230.0 to MEAD N 230.0 Ckt 1"
line 19022 19011 "1 " 1 0
0
line_317 "Line DAVIS 230.0 to ZORB 230.0 Ckt 1"
line 19022 19224 "1 " 1 0
0
line_318 "Line DAVIS 230.0 to TOPOCK 230.0 Ckt 2"
line 19022 19320 "2 " 1 0
0
line_319 "Line DAVIS 230.0 to MCCULLGH 230.0 Ckt 1"
line 19022 26046 "1 " 1 0
0
line_320 "Line HOVRA5A6 230.0 to MEAD S 230.0 Ckt 1"
line 19029 19012 "1 " 1 0
0
line_321 "Line HOVRA7-9 230.0 to MEAD S 230.0 Ckt 1"
line 19030 19012 "1 " 1 0
0
line_322 "Line MEAD 500.0 to MARKETPL 500.0 Ckt 1"
line 19038 26044 "1 " 1 0
0
line_323 "Line PARKER 161.0 to BLYTHE 161.0 Ckt 1"
line 19041 19020 "1 " 1 0
0
line_324 "Line PARKER 161.0 to BOUSE 161.0 Ckt 1"
line 19041 19046 "1 " 1 0
0
line_325 "Line PARKER 161.0 to HEADGATE 161.0 Ckt 1"
line 19041 19206 "1 " 1 0
0
line_326 "Line PARKER 161.0 to PARKERAZ 161.0 Ckt 1"
line 19041 19602 "1 " 1 0
0
line_327 "Line PARKER 230.0 to EAGLEYE 230.0 Ckt 1"
line 19042 14209 "1 " 1 0
0
line_328 "Line PARKER 230.0 to BLK MESA 230.0 Ckt 1"
line 19042 19019 "1 " 1 0
0
line_329 "Line PARKER 230.0 to HAVASU 230.0 Ckt 1"
line 19042 19075 "1 " 1 0
0
line_330 "Line PARKER 230.0 to HARCUVAR 230.0 Ckt 1"
line 19042 19204 "1 " 1 0
0
line_331 "Line PARKER 230.0 to GENE 230.0 Ckt 1"
line 19042 25402 "1 " 1 0
0
line_332 "Line COOLIDGE 115.0 to VLYFARMS 115.0 Ckt 1"
line 19044 14359 "1 " 1 0
0
line_333 "Line COOLIDGE 115.0 to ED-2 115.0 Ckt 1"
line 19044 19065 "1 " 1 0
0

line_334 "Line COOLIDGE 115.0 to SIGNAL 115.0 Ckt 1"
line 19044 19066 "1 " 1 0
0
line_335 "Line COOLIDGE 115.0 to COOLDGAZ 115.0 Ckt 1"
line 19044 19600 "1 " 1 0
0
line_336 "Line COOLIDGE 230.0 to SUN ARIZ 230.0 Ckt 1"
line 19045 19410 "1 " 1 0
0
line_337 "Line COOLIDGE 230.0 to SUN ARIZ 230.0 Ckt 2"
line 19045 19410 "2 " 1 0
0
line_338 "Line BOUSE 161.0 to KOFA 161.0 Ckt 1"
line 19046 19100 "1 " 1 0
0
line_339 "Line BOUSE 161.0 to BOUSE AZ 161.0 Ckt 1"
line 19046 19601 "1 " 1 0
0
line_340 "Line DEL BAC 115.0 to NOGALES 115.0 Ckt 1"
line 19047 19221 "1 " 1 0
0
line_341 "Line GILA 161.0 to KNOB 161.0 Ckt 1"
line 19050 19051 "1 " 1 0
0
line_342 "Line GILA 161.0 to DOME TAP 161.0 Ckt 1"
line 19050 19070 "1 " 1 0
0
line_343 "Line KNOB 161.0 to PILOTKNB 161.0 Ckt 1"
line 19051 21059 "1 " 1 0
0
line_344 "Line LIBERTY 230.0 to WESTWNGW 230.0 Ckt 1"
line 19052 14231 "1 " 1 0
0
line_345 "Line LIBERTY 230.0 to TS4 230.0 Ckt 1"
line 19052 14258 "1 " 1 0
0
line_346 "Line LIBERTY 230.0 to LONE BUT 230.0 Ckt 1"
line 19052 19055 "1 " 1 0
0
line_347 "Line LIBERTY 230.0 to PHXWAPA 230.0 Ckt 1"
line 19052 19061 "1 " 1 0
0
line_348 "Line LIBERTY 345.0 to PEACOCK 345.0 Ckt 1"
line 19053 19315 "1 " 1 0
0
line_349 "Line LONE BUT 230.0 to TESTTRAK 230.0 Ckt 1"
line 19055 19068 "1 " 1 0
0
line_350 "Line LONE BUT 230.0 to SUN ARIZ 230.0 Ckt 1"
line 19055 19410 "1 " 1 0
0
line_351 "Line MCCONICO 230.0 to DAVIS 230.0 Ckt 1"
line 19056 19022 "1 " 1 0
0
line_352 "Line MCCONICO 230.0 to GRIFFITH 230.0 Ckt 1"
line 19056 19310 "1 " 1 0
0
line_353 "Line MCCONICO 230.0 to HARRIS 230.0 Ckt 1"
line 19056 19651 "1 " 1 0
0
line_354 "Line ORACLE 115.0 to S.BRKRCH 115.0 Ckt 1"
line 19057 17608 "1 " 1 0
0
line_355 "Line ORACLE 115.0 to ORACLEAZ 115.0 Ckt 1"
line 19057 19652 "1 " 1 0
0
line_356 "Line PHXWAPA 230.0 to LONE BUT 230.0 Ckt 1"

0	line	19061	19055	"1 "	1 0				
0	line 357	19062	"Line PINPK	230.0 to	PINPKSRP	230.0	Ckt 1"		
0	line	19062	15211	"1 "	1 0				
0	line 358	19062	"Line PINPK	230.0 to	PINPKSRP	230.0	Ckt 2"		
0	line	19062	15211	"2 "	1 0				
0	line 359	19063	"Line WLTMOHK	161.0 to	GILA	161.0	Ckt 1"		
0	line	19063	19050	"1 "	1 0				
0	line 360	19063	"Line WLTMOHK	161.0 to	DOME TAP	161.0	Ckt 1"		
0	line	19063	19070	"1 "	1 0				
0	line 361	19064	"Line TUCSON	115.0 to	DEL BAC	115.0	Ckt 1"		
0	line	19064	19047	"1 "	1 0				
0	line 362	19064	"Line TUCSON	115.0 to	ORACLE	115.0	Ckt 1"		
0	line	19064	19057	"1 "	1 0				
0	line 363	19065	"Line ED-2	115.0 to	SIGNAL	115.0	Ckt 1"		
0	line	19065	19066	"1 "	1 0				
0	line 364	19065	"Line ED-2	115.0 to	ED-4	115.0	Ckt 1"		
0	line	19065	19071	"1 "	1 0				
0	line 365	19065	"Line ED-2	115.0 to	BRADY	115.0	Ckt 1"		
0	line	19065	19202	"1 "	1 0				
0	line 366	19067	"Line ED-5	115.0 to	ED-5 AZ	115.0	Ckt 1"		
0	line	19067	15171	"1 "	1 0				
0	line 367	19068	"Line TESTTRAK	230.0 to	CASAGRND	230.0	Ckt 1"		
0	line	19068	19218	"1 "	1 0				
0	line 368	19071	"Line ED-4	115.0 to	ED-4 AZ	115.0	Ckt 1"		
0	line	19071	15170	"1 "	1 0				
0	line 369	19071	"Line ED-4	115.0 to	ED-5	115.0	Ckt 1"		
0	line	19071	19067	"1 "	1 0				
0	line 370	19072	"Line HILLTOP	230.0 to	MCCONICO	230.0	Ckt 1"		
0	line	19072	19056	"1 "	1 0				
0	line 371	19074	"Line N.HAVASU	230.0 to	PARKER	230.0	Ckt 1"		
0	line	19074	19042	"1 "	1 0				
0	line 372	19074	"Line N.HAVASU	230.0 to	TOPOCK	230.0	Ckt 1"		
0	line	19074	19320	"1 "	1 0				
0	line 373	19079	"Line HOVRN7N8	230.0 to	MEAD S	230.0	Ckt 1"		
0	line	19079	19012	"1 "	1 0				
0	line 374	19080	"Line HOVRN5N6	230.0 to	MEAD S	230.0	Ckt 1"		
0	line	19080	19012	"1 "	1 0				
0	line 375	19081	"Line HOVRN3N4	230.0 to	MEAD S	230.0	Ckt 1"		
0	line	19081	19012	"1 "	1 0				
0	line 376	19082	"Line HOVRN1N2	230.0 to	MEAD S	230.0	Ckt 1"		
0	line	19082	19012	"1 "	1 0				
0	line 377	19083	"Line HOVRA1A2	230.0 to	MEAD S	230.0	Ckt 1"		
0	line	19083	19012	"1 "	1 0				
0	line 378	19100	"Line KOFA	161.0 to	DOME TAP	161.0	Ckt 1"		
0	line	19100	19070	"1 "	1 0				

0	line_379	19105	"Line GLT TAP	161.0 to	KNOB	161.0	Ckt 1"		
0	line	19105	19051	"1 "	1 0				
0	line 380	19106	"Line PRSCOTWA	230.0 to	PRESCOTT	230.0	Ckt 1"		
0	line	19106	14222	"1 "	1 0				
0	line_381	19106	"Line PRSCOTWA	230.0 to	RNDVLYTP	230.0	Ckt 1"		
0	line	19106	19501	"1 "	1 0				
0	line 382	19107	"Line GAVLINWA	230.0 to	GAVILNPK	230.0	Ckt 1"		
0	line	19107	14243	"1 "	1 0				
0	line_383	19107	"Line GAVLINWA	230.0 to	PINPK	230.0	Ckt 1"		
0	line	19107	19062	"1 "	1 0				
0	line 384	19107	"Line GAVLINWA	230.0 to	PRSCOTWA	230.0	Ckt 1"		
0	line	19107	19106	"1 "	1 0				
0	line_385	19201	"Line BLACKMTN	115.0 to	BLKMTNAZ	115.0	Ckt 1"		
0	line	19201	15182	"1 "	1 0				
0	line 386	19201	"Line BLACKMTN	115.0 to	DEL BAC	115.0	Ckt 1"		
0	line	19201	19047	"1 "	1 0				
0	line_387	19201	"Line BLACKMTN	115.0 to	SNYDHILL	115.0	Ckt 1"		
0	line	19201	19214	"1 "	1 0				
0	line 388	19202	"Line BRADY	115.0 to	BRADYAZ	115.0	Ckt 1"		
0	line	19202	15174	"1 "	1 0				
0	line_389	19202	"Line BRADY	115.0 to	PICACHOW	115.0	Ckt 1"		
0	line	19202	19209	"1 "	1 0				
0	line 390	19203	"Line BRAWLEY	115.0 to	BRAWLYAZ	115.0	Ckt 1"		
0	line	19203	15179	"1 "	1 0				
0	line_391	19203	"Line BRAWLEY	115.0 to	SAN JOAQ	115.0	Ckt 1"		
0	line	19203	17668	"1 "	1 0				
0	line 392	19204	"Line HARCUIVAR	230.0 to	HARCU AZ	230.0	Ckt 1"		
0	line	19204	15172	"1 "	1 0				
0	line_393	19204	"Line HARCUIVAR	230.0 to	HASSYTAP	230.0	Ckt 1"		
0	line	19204	19500	"1 "	1 0				
0	line 394	19209	"Line PICACHOW	115.0 to	PICACHAZ	115.0	Ckt 1"		
0	line	19209	15175	"1 "	1 0				
0	line_395	19209	"Line PICACHOW	115.0 to	RED ROCK	115.0	Ckt 1"		
0	line	19209	19211	"1 "	1 0				
0	line 396	19210	"Line RATTL5NK	115.0 to	TUCSON	115.0	Ckt 1"		
0	line	19210	19064	"1 "	1 0				
0	line_397	19210	"Line RATTL5NK	115.0 to	TWINPEAK	115.0	Ckt 1"		
0	line	19210	19216	"1 "	1 0				
0	line 398	19211	"Line RED ROCK	115.0 to	SAG.EAST	115.0	Ckt 1"		
0	line	19211	14356	"1 "	1 0				
0	line 399	19211	"Line RED ROCK	115.0 to	REDRCKAZ	115.0	Ckt 1"		
0	line	19211	15176	"1 "	1 0				
0	line 400	19212	"Line SANDARIO	115.0 to	SANDARAZ	115.0	Ckt 1"		
0	line	19212	15178	"1 "	1 0				

line 401	"Line SANXAVER	115.0 to SANXAVAZ	115.0 Ckt 1"
0 line 19213	15180 "1 " 1 0		
line 402	"Line SANXAVER	115.0 to SNYDHILL	115.0 Ckt 1"
0 line 19213	19214 "1 " 1 0		
line 403	"Line SPKHILTP	230.0 to COOLIDGE	230.0 Ckt 1"
0 line 19215	19045 "1 " 1 0		
line 404	"Line TWINPEAK	115.0 to TWINPKAZ	115.0 Ckt 1"
0 line 19216	15177 "1 " 1 0		
line 405	"Line ZORB	230.0 to TOPOCK	230.0 Ckt 1"
0 line 19224	19320 "1 " 1 0		
line 406	"Line GRIFFITH	230.0 to PEACOCK	230.0 Ckt 1"
0 line 19310	19314 "1 " 1 0		
line 407	"Line PEACOCK	230.0 to HILLTOP	230.0 Ckt 1"
0 line 19314	19072 "1 " 1 0		
line 408	"Line PEACOCK	345.0 to MEAD	345.0 Ckt 1"
0 line 19315	19037 "1 " 1 0		
line 409	"Line TOPOCK	230.0 to BLK MESA	230.0 Ckt 1"
0 line 19320	19019 "1 " 1 0		
line 410	"Line TOPOCK	230.0 to SOPOINT	230.0 Ckt 1"
0 line 19320	19316 "1 " 1 0		
line 411	"Line TOPOCK	230.0 to SOPOINT	230.0 Ckt 2"
0 line 19320	19316 "2 " 1 0		
line 412	"Line HASSYTAP	230.0 to HASSY AZ	230.0 Ckt 1"
0 line 19500	15173 "1 " 1 0		
line 413	"Line HASSYTAP	230.0 to LIBERTY	230.0 Ckt 1"
0 line 19500	19052 "1 " 1 0		
line 414	"Line RNDVLYTP	230.0 to ROUNDVLY	230.0 Ckt 1"
0 line 19501	14223 "1 " 1 0		
line 415	"Line RNDVLYTP	230.0 to PEACOCK	230.0 Ckt 1"
0 line 19501	19314 "1 " 1 0		
line 416	"Line ROGSWAPA	230.0 to PINPK	230.0 Ckt 1"
0 line 19502	19062 "1 " 1 0		
line 417	"Line ROGSWAPA	230.0 to PINPK	230.0 Ckt 2"
0 line 19502	19062 "2 " 1 0		
line 418	"Line ROGSWAPA	230.0 to SPKHILTP	230.0 Ckt 1"
0 line 19502	19215 "1 " 1 0		
line 419	"Line CAMINO	230.0 to MEAD S	230.0 Ckt E"
0 line 24019	19012 "E " 1 0		
line 420	"Line CAMINO	230.0 to MEAD S	230.0 Ckt W"
0 line 24019	19012 "W " 1 0		
line 421	"Line PINTO PS	345.0 to FOURCORN	345.0 Ckt 1"
0 line 66235	14101 "1 " 1 0		
line 422	"Line SIGURDPS	230.0 to GLENCANY	230.0 Ckt 1"
0 line 66355	79031 "1 " 1 0		
line 423	"Line FLAGSTAF	345.0 to GLENCANY	345.0 Ckt 1"

line 79024	79032 "1 " 1 0		
0 line 424	"Line FLAGSTAF	345.0 to GLENCANY	345.0 Ckt 2"
0 line 79024	79032 "2 " 1 0		
line 425	"Line FLAGSTAF	345.0 to PINPKBRB	345.0 Ckt 1"
0 line 79024	79053 "1 " 1 0		
line 426	"Line FLAGSTAF	345.0 to PINPKBRB	345.0 Ckt 2"
0 line 79024	79053 "2 " 1 0		
line 427	"Line GALLEGOS	115.0 to BERGIN	115.0 Ckt 1"
0 line 79027	79098 "1 " 1 0		
line 428	"Line GLEN PS	230.0 to NAVAJO	230.0 Ckt 1"
0 line 79028	79093 "1 " 1 0		
line 429	"Line KAYENTA	230.0 to SHIPROCK	230.0 Ckt 1"
0 line 79043	79063 "1 " 1 0		
line 430	"Line KAYENTA	230.0 to LNGHOUSE	230.0 Ckt 1"
0 line 79043	79096 "1 " 1 0		
line 431	"Line SHIPROCK	115.0 to FRUITAP	115.0 Ckt 1"
0 line 79062	79101 "1 " 1 0		
line 432	"Line SHIPROCK	115.0 to MESA FM	115.0 Ckt 1"
0 line 79062	79112 "1 " 1 0		
line 433	"Line SHIPROCK	345.0 to SAN_JUAN	345.0 Ckt 1"
0 line 79064	10292 "1 " 1 0		
line 434	"Line SHIPROCK	345.0 to FOURCORN	345.0 Ckt 1"
0 line 79064	14101 "1 " 1 0		
line 435	"Line NAVAJO	230.0 to LNGHOUSE	230.0 Ckt 1"
0 line 79093	79096 "1 " 1 0		
line 436	"Line ANIMAS	115.0 to MESA FM	115.0 Ckt 1"
0 line 79097	79112 "1 " 1 0		
line 437	"Line ANIMAS	115.0 to SULLIVAN	115.0 Ckt 1"
0 line 79097	79116 "1 " 1 0		
line 438	"Line BERGIN	115.0 to FOOTHILS	115.0 Ckt 1"
0 line 79098	79100 "1 " 1 0		
line 439	"Line BERGIN	115.0 to SAN JUAN	115.0 Ckt 1"
0 line 79098	79114 "1 " 1 0		
line 440	"Line FOOTHILS	115.0 to HOODMESA	115.0 Ckt 1"
0 line 79100	79106 "1 " 1 0		
line 441	"Line FRUITAP	115.0 to FRUITLND	115.0 Ckt 1"
0 line 79101	79102 "1 " 1 0		
line 442	"Line FRUITAP	115.0 to HOODMESA	115.0 Ckt 1"
0 line 79101	79106 "1 " 1 0		
line 443	"Line GLADETAP	115.0 to HOODMESA	115.0 Ckt 1"
0 line 79105	79106 "1 " 1 0		
line 444	"Line GLADETAP	115.0 to LAPLATA	115.0 Ckt 1"
0 line 79105	79109 "1 " 1 0		
line 445	"Line GLADETAP	115.0 to ELPASOTP	115.0 Ckt 1"
0 line 79105	79260 "1 " 1 0		

0					
line_446		"Line HOODMESA	115.0 to SULLIVAN	115.0 Ckt 1"	
line	79106	79116 "1 " 1 0			
0					
line_447		"Line NAVAJO	115.0 to SAN JUAN	115.0 Ckt 1"	
line	79113	79114 "1 " 1 0			
0					
line_448		"Line NAVAJO	500.0 to DUGAS	500.0 Ckt 1"	
line	14003	14018 "1 " 1 0			
0					
line_449		"Line DUGAS	500.0 to RACEWAY	500.0 Ckt 1"	
line	14018	14011 "1 " 1 0			
0					
line_450		"Line PRECHCYN	345.0 to MAZATZAL	345.0 Ckt 1"	
line	14103	14107 "1 " 1 0			
0					
line_451		"Line MAZATZAL	345.0 to PNPKAPS	345.0 Ckt 1"	
line	14107	14102 "1 " 1 0			
0					
line_452		"Line SAGUARO	230.0 to MILLIGAN	230.0 Ckt 1"	
line	14225	14271 "1 " 1 0			
0					
line_453		"Line RACEWAY	230.0 to RACEWYWA	230.0 Ckt 1"	
line	14246	19115 "1 " 1 0			
0					
line_454		"Line MILLIGAN	230.0 to CASGRAPS	230.0 Ckt 1"	
line	14271	14203 "1 " 1 0			
0					
line_455		"Line SAG.WEST	115.0 to ED-5B	115.0 Ckt 1"	
line	14357	19069 "1 " 1 0			
0					
line_456		"Line VAIL NOG	138.0 to VAIL	138.0 Ckt 1"	
line	16718	16220 "1 " 1 0			
0					
line_457		"Line VAIL NOG	138.0 to NOGALES	138.0 Ckt 1"	
line	16718	16719 "1 " 1 0			
0					
line_458		"Line NOGALES	138.0 to KANTOR	138.0 Ckt 1"	
line	16719	16720 "1 " 1 0			
0					
line_459		"Line KANTOR	138.0 to CANEZ	138.0 Ckt 1"	
line	16720	16721 "1 " 1 0			
0					
line_460		"Line CANEZ	138.0 to SONOITA	138.0 Ckt 1"	
line	16721	16722 "1 " 1 0			
0					
line_461		"Line SONOITA	138.0 to VALNCIA	138.0 Ckt 1"	
line	16722	16723 "1 " 1 0			
0					
line_462		"Line GATEWAY	138.0 to VALNCIA	138.0 Ckt 1"	
line	16724	16723 "1 " 1 0			
0					
line_463		"Line MEAD	500.0 to PERKINPS	500.0 Ckt 1"	
line	19038	15033 "1 " 1 0			
0					
line_464		"Line EMPIRE	115.0 to CASAGRND	115.0 Ckt 1"	
line	19048	19222 "1 " 1 0			
0					
line_465		"Line ED-5	115.0 to ED-5B	115.0 Ckt 1"	
line	19067	19069 "1 " 1 0			
0					
line_466		"Line ED-5B	115.0 to EMPIRE	115.0 Ckt 1"	
line	19069	19048 "1 " 1 0			
0					
line_467		"Line RACEWYWA	230.0 to WESTWNGE	230.0 Ckt 1"	
line	19115	14259 "1 " 1 0			
0					

line_468		"Line N.WADDEL	230.0 to RACEWYWA	230.0 Ckt 1"	
line	19208	19115 "1 " 1 0			
0					
line_469		"Line SUN ARIZ	230.0 to PINAL_C	230.0 Ckt 1"	
line	19410	15098 "1 " 1 0			
0					
line_470		"Line GOLDFELD	115.0 to 461E5.1N	115.0 Ckt 1"	
line	15107	15848 "1 " 1 0			
0					
line_471		"Line 461E5.1N	115.0 to MRMNPLAT	115.0 Ckt 1"	
line	15848	15117 "1 " 1 0			
0					
line_472		"Line 461E5.1N	115.0 to STEWMTN1	115.0 Ckt 1"	
line	15848	15128 "1 " 1 0			
0					
line_473		"Line MIAMI 4	115.0 to 843E2.7N	115.0 Ckt 1"	
line	15135	15133 "1 " 1 0			
0					
line_474		"Line ASARCOSR	115.0 to ASARCOTP	115.0 Ckt 1"	
line	15101	15102 "1 " 1 0			
0					
line_475		"Line ASARCOTP	115.0 to CRUSHER	115.0 Ckt 1"	
line	15102	15138 "1 " 1 0			
0					
line_476		"Line MIAMI 3	115.0 to MIAMI 4	115.0 Ckt 1"	
line	15008	15009 "1 " 1 0			
0					
line_477		"Line MIAMI 3	115.0 to PINAL	115.0 Ckt 1"	
line	15008	15119 "1 " 1 0			
0					
line_478		"Line HASSYAMP	500.0 to REDHAWK	500.0 Ckt 2"	
line	15090	14009 "2 " 1 0			
0					
line_479		"Line ABEL	230.0 to RANDOLPH	230.0 Ckt 1"	
line	15224	15240 "1 " 1 0			
0					
line_480		"Line PINAL_C	230.0 to RANDOLPH	230.0 Ckt 1"	
line	15098	15240 "1 " 1 0			
0					
line_481		"Line ANDERSON	230.0 to KYR-NEW	230.0 Ckt 1"	
line	15203	14236 "1 " 1 0			
0					
line_482		"Line PAPAGOBT	230.0 to KYR-NEW	230.0 Ckt 1"	
line	15209	14236 "1 " 1 0			
0					
line_483		"Line CARREL	115.0 to GOLDFELD	115.0 Ckt 1"	
line	15130	15107 "1 " 1 0			
0					
line_484		"Line SPURLOCK	115.0 to GOLDFELD	115.0 Ckt 1"	
line	15127	15107 "1 " 1 0			
0					
line_485		"Line SCHRADER	230.0 to RS-24	230.0 Ckt 1"	
line	15214	15225 "1 " 1 0			
0					
line_486		"Line ABEL	230.0 to RS-24	230.0 Ckt 1"	
line	15224	15225 "1 " 1 0			
0					
line_487		"Line ABEL	230.0 to RS-24	230.0 Ckt 2"	
line	15224	15225 "2 " 1 0			
0					
line_488		"Line SANTAN	230.0 to RS-24	230.0 Ckt 1"	
line	15213	15225 "1 " 1 0			
0					
line_489		"Line HASSYAMP	500.0 to N.GILA	500.0 Ckt 2"	
line	15090	22536 "2 " 1 0			
0					
line_490		"Line BONNEYTP	115.0 to CRUSHER	115.0 Ckt 1"	

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line 15103 15138 "1 " 1 0
0
line 491 "Line CARLOTA 115.0 to PINTOVLY 115.0 Ckt 1"
line 15104 15121 "1 " 1 0
0
line 492 "Line CARLOTA 115.0 to SILVERK2 115.0 Ckt 1"
line 15104 15125 "1 " 1 0
0
line 493 "Line CARREL 115.0 to SPURLOCK 115.0 Ckt 1"
line 15130 15127 "1 " 1 0
0
line 494 "Line MIAMI 3 115.0 to MIAMI 115.0 Ckt 1"
line 15008 15114 "1 " 1 0
0
line 495 "Line OAKFLAT 115.0 to TRASK 115.0 Ckt 1"
line 15118 15131 "1 " 1 0
0
line 496 "Line SUPERIOR 115.0 to TRASK 115.0 Ckt 1"
line 15129 15131 "1 " 1 0
0
line 497 "Line PINAL C 500.0 to PC GEN 500.0 Ckt 1"
line 15080 15095 "1 " 1 0
0
line 498 "Line SNVLY 230.0 to HASSY AZ 230.0 Ckt 1"
line 14265 15173 "1 " 1 0
0
line 499 "Line DELANY 500.0 to SNVLY 500.0 Ckt 1"
line 14012 14010 "1 " 1 0
0
line 500 "Line DELANY 500.0 to HARQUAHA 500.0 Ckt 1"
line 14012 15093 "1 " 1 0
0
line 501 "Line HASSYAMP 500.0 to DELANY 500.0 Ckt 1"
line 15090 14012 "1 " 1 0
0
line 502 "Line SNTAROSA 500.0 to PINAL_C 500.0 Ckt 1"
line 15087 15080 "1 " 1 0
0
line 503 "Line SNTAROSA 500.0 to PINAL_W 500.0 Ckt 1"
line 15087 15088 "1 " 1 0
0
line 504 "Line SNTAROSA 230.0 to TESTTRAK 230.0 Ckt 1"
line 14226 19068 "1 " 1 0
0
line 505 "Line ED5-230 230.0 to PINAL_C 230.0 Ckt 1"
line 88006 15098 "1 " 1 0
0
line 506 "Line ED5-230 230.0 to MARANATP 230.0 Ckt 1"
line 88006 88007 "1 " 1 0
0
line 507 "Line TESTTRAK 230.0 to ED5-230 230.0 Ckt 1"
line 19068 88006 "1 " 1 0
0
line 508 "Line BLYTHE 161.0 to BLYTHEAZ 161.0 Ckt 1"
line 19020 14302 "1 " 1 0
0
line 509 "Line BOUSE 161.0 to BLACK PK 161.0 Ckt 1"
line 19046 14301 "1 " 1 0
0
line 510 "Line PRESCOTT 115.0 to BAGCAP 115.0 Ckt 1"
line 14355 14361 "1 " 1 0
0
line 511 "Line BAGCAP 115.0 to BAGDAD 115.0 Ckt 1"
line 14361 14351 "1 " 1 0
0
line 512 "Line CASGRAPS 230.0 to DBG 230.0 Ckt 1"
line 14203 15235 "1 " 1 0

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0
line_513 "Line SNTAROSA 230.0 to DBG 230.0 Ckt 1"
line 14226 15235 "1 " 1 0
0
line 514 "Line DBG 230.0 to PINAL_C 230.0 Ckt 1"
line 15235 15098 "1 " 1 0
0
line_515 "Line TS12 230.0 to SAGUARO 230.0 Ckt 1"
line 14277 14225 "1 " 1 0
0
line 516 "Line MILLIGAN 230.0 to TS12 230.0 Ckt 1"
line 14271 14277 "1 " 1 0
0
line_517 "Line ED-4 115.0 to ELOY 115.0 Ckt 1"
line 19071 14360 "1 " 1 0
0
line 518 "Line GILA 230.0 to NGL-E 230.0 Ckt 1"
line 19124 19125 "1 " 1 0
0
line_519 "Line GILA 230.0 to NGL-W 230.0 Ckt 1"
line 19124 19126 "1 " 1 0
0
line 520 "Line GILA 230.0 to TS8 230.0 Ckt 1"
line 19124 14214 "1 " 1 0
0
line_521 "Line SLRC 230.0 to TS8 230.0 Ckt 1"
line 19120 14214 "1 " 1 0
0
line 522 "Line SLRC 230.0 to GILA 230.0 Ckt 1"
line 19120 19124 "1 " 1 0
0
line_523 "Line PNPKAPS 230.0 to PPAPS C 230.0 Ckt 1"
line 14221 14260 "1 " 1 0
0
line 524 "Line PPAPS C 230.0 to PPAPS E 230.0 Ckt 1"
line 14260 14261 "1 " 1 0
0
line_525 "Line SPURLOCK 115.0 to PIERCE 115.0 Ckt 1"
line 15127 15136 "1 " 1 0
0
line 526 "Line PIERCE 115.0 to SUPERIOR 115.0 Ckt 1"
line 15136 15129 "1 " 1 0
0
line_527 "Line GOLDFELD 230.0 to 40E15.5N 230.0 Ckt 1"
line 15206 15227 "1 " 1 0
0
line 528 "Line ADAMS TP 115.0 to NOGALES 115.0 Ckt 1"
line 19060 19221 "1 " 1 0
0
line_529 "Line SAG.EAST 115.0 to MARANATP 115.0 Ckt 1"
line 14356 17013 "1 " 1 0
0
line 530 "Line BICKNELL 115.0 to THREEPNT 115.0 Ckt 1"
line 17006 17022 "1 " 1 0
0
line_531 "Line BUTERFLD 230.0 to PANTANO 230.0 Ckt 1"
line 17007 17016 "1 " 1 0
0
line 532 "Line MARANATP 115.0 to MARANA 115.0 Ckt 1"
line 17013 17012 "1 " 1 0
0
line 533 "Line MARANATP 115.0 to RATTLSNK 115.0 Ckt 1"
line 17013 19210 "1 " 1 0
0
line 534 "Line THREEPNT 115.0 to VALEN-SW 115.0 Ckt 1"
line 17022 17023 "1 " 1 0
0

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line 535	"Line PICTROCK	115.0 to SANDARIO	115.0 Ckt 1"
0 line 17670	19212 "1 " 1 0		
line 536	"Line ADONIS	115.0 to RATTLSNK	115.0 Ckt 1"
0 line 17674	19210 "1 " 1 0		
line 537	"Line ADAMS TP	115.0 to APACHE	115.0 Ckt 1"
0 line 19060	17001 "1 " 1 0		
line 538	"Line ADAMS TP	115.0 to NOGALES	115.0 Ckt N"
0 line 19060	19221 "N " 1 0		
line 539	"Line TWINPEAK	115.0 to PICTROCK	115.0 Ckt 1"
0 line 19216	17670 "1 " 1 0		
line 540	"Line TORTOLIT	345.0 to NLOOP345	345.0 Ckt 1"
0 line 16115	16124 "1 " 1 0		
line 541	"Line DMP	138.0 to ANKLAM	138.0 Ckt 1"
0 line 16200	16253 "1 " 1 0		
line 542	"Line MIDVALE	138.0 to SPNCER	138.0 Ckt 1"
0 line 16206	16235 "1 " 1 0		
line 543	"Line MIDVALE	138.0 to RAYTHEON	138.0 Ckt 1"
0 line 16206	16257 "1 " 1 0		
line 544	"Line N. LOOP	138.0 to RANVISTO	138.0 Ckt 1"
0 line 16207	16209 "1 " 1 0		
line 545	"Line N. LOOP	138.0 to RANVISTO	138.0 Ckt 1A"
0 line 16207	16209 "1A" 1 0		
line 546	"Line N. LOOP	138.0 to NARANJA	138.0 Ckt 1"
0 line 16207	16245 "1 " 1 0		
line 547	"Line SN.CRUZ	138.0 to ANKLAM	138.0 Ckt 1"
0 line 16214	16253 "1 " 1 0		
line 548	"Line SOUTH	138.0 to SPNCER	138.0 Ckt 1"
0 line 16216	16235 "1 " 1 0		
line_549	"Line SOUTH	138.0 to MEDINA	138.0 Ckt 1"
0 line 16216	16255 "1 " 1 0		
line 550	"Line SOUTH	138.0 to RAYTHEON	138.0 Ckt 1"
0 line 16216	16257 "1 " 1 0		
line_551	"Line SOUTH	138.0 to ROSEMONT	138.0 Ckt 1"
0 line 16216	16920 "1 " 1 0		
line 552	"Line TORTOLIT	138.0 to N. LOOP	138.0 Ckt 1A"
0 line 16217	16207 "1A" 1 0		
line 553	"Line TORTOLIT	138.0 to N. LOOP	138.0 Ckt 2A"
0 line 16217	16207 "2A" 1 0		
line 554	"Line TORTOLIT	138.0 to N. LOOP	138.0 Ckt 3"
0 line 16217	16207 "3 " 1 0		
line_555	"Line TORTOLIT	138.0 to N. LOOP	138.0 Ckt 4"
0 line 16217	16207 "4 " 1 0		
line 556	"Line TORTOLIT	138.0 to RANVISTO	138.0 Ckt 1A"
0 line 16217	16209 "1A" 1 0		
line_557	"Line VAIL	138.0 to ROSEMONT	138.0 Ckt 1"

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line 16220	16920 "1 " 1 0		
0 line 558	"Line RBWILMOT	138.0 to IRVNGTN	138.0 Ckt 1"
0 line 16222	16204 "1 " 1 0		
line 559	"Line SPNCER	138.0 to MEDINA	138.0 Ckt 1"
0 line 16235	16255 "1 " 1 0		
line 560	"Line ORNGROVE	138.0 to LACANADA	138.0 Ckt 1"
0 line 16251	16205 "1 " 1 0		
line 561	"Line ORNGROVE	138.0 to RILLITO	138.0 Ckt 1"
0 line 16251	16210 "1 " 1 0		
line 562	"Line ORNGROVE	138.0 to EASTINA	138.0 Ckt 1"
0 line 16251	16254 "1 " 1 0		
line 563	"Line THRNDALE	138.0 to N. LOOP	138.0 Ckt 1"
0 line 16252	16207 "1 " 1 0		
line 564	"Line THRNDALE	138.0 to MARANA	138.0 Ckt 1"
0 line 16252	16244 "1 " 1 0		
line 565	"Line UA MED	138.0 to TUCSON	138.0 Ckt 1"
0 line 16256	16218 "1 " 1 0		
line 566	"Line UA MED	138.0 to KINO	138.0 Ckt 1"
0 line 16256	16246 "1 " 1 0		
line 567	"Line RAYTHEON	138.0 to MEDINA	138.0 Ckt 1"
0 line 16257	16255 "1 " 1 0		
line 568	"Line KANTOR	138.0 to TUBAC	138.0 Ckt 1"
0 line 16720	16725 "1 " 1 0		
line 569	"Line TUBAC	138.0 to CANEZ	138.0 Ckt 1"
0 line 16725	16721 "1 " 1 0		
line 570	"Line FRANCONI	230.0 to N.HAVASU	230.0 Ckt 1"
0 line 16805	19074 "1 " 1 0		
line 571	"Line FRANCONI	230.0 to GRIFFITH	230.0 Ckt 1"
0 line 16805	19310 "1 " 1 0		
line 572	"Line WHTHILLS	230.0 to MERC230	230.0 Ckt 1"
0 line 16843	16841 "1 " 1 0		
line 573	"Line MCCONICO	230.0 to MERC230	230.0 Ckt 1"
0 line 19056	16841 "1 " 1 0		
line 574	"Line BLACKMTN	115.0 to SPNCER	115.0 Ckt 1"
0 line 19201	16414 "1 " 1 0		
line 575	"Line BUCKEYE	230.0 to BUCKEYE2	230.0 Ckt 1"
0 line 14201	14213 "1 " 1 0		
line 576	"Line CACTUS	230.0 to PPAPS N	230.0 Ckt 1"
0 line 14202	14278 "1 " 1 0		
line 577	"Line EAGLEYE	230.0 to BUCKEYE2	230.0 Ckt 1"
0 line 14209	14213 "1 " 1 0		
line 578	"Line BUCKEYE2	230.0 to LIBERTY	230.0 Ckt 1"
0 line 14213	19052 "1 " 1 0		
line 579	"Line LONEPEAK	230.0 to PPAPS E	230.0 Ckt 1"
0 line 14217	14261 "1 " 1 0		

0									
line_580		"Line REACH	230.0 to PPAPS C	230.0 Ckt 1"					
line	14220	14260 "1 " 1 0							
0									
line_581		"Line PPAPS E	230.0 to PPAPS N	230.0 Ckt 1"					
line	14261	14278 "1 " 1 0							
0									
line_582		"Line PPAPS N	230.0 to OCOTILLO	230.0 Ckt 1"					
line	14278	14219 "1 " 1 0							
0									
line_583		"Line PPAPS N	230.0 to PINPKSRP	230.0 Ckt 1"					
line	14278	15211 "1 " 1 0							
0									
line_584		"Line PPAPS N	230.0 to PINPKSRP	230.0 Ckt 2"					
line	14278	15211 "2 " 1 0							
0									
line_585		"Line Q044	230.0 to GILARIVR	230.0 Ckt 1"					
line	86010	14238 "1 " 1 0							
0									
tran_586		"Tran GALLEGOS	230.00 to GALLEGOS	115.00 Ckt 1	0.0				
tran	10111	79027 "1 " 0	-1						
0									
tran_587		"Tran CHOLLA	500.00 to CHOLLA	345.00 Ckt 1	0.0				
tran	14000	14100 "1 " 0	-1						
0									
tran_588		"Tran CHOLLA	500.00 to CHOLLA	345.00 Ckt 2	0.0				
tran	14000	14100 "2 " 0	-1						
0									
tran_589		"Tran FOURCORN	500.00 to FOURCORN	345.00 Ckt 1	0.0				
tran	14001	14101 "1 " 0	-1						
0									
tran_590		"Tran SAGUARO	500.00 to SAG.EAST	115.00 Ckt 1	0.0				
tran	14004	14356 "1 " 0	-1						
0									
tran_591		"Tran SAGUARO	500.00 to SAG.WEST	115.00 Ckt 1	0.0				
tran	14004	14357 "1 " 0	-1						
0									
tran_592		"Tran WESTWING	500.00 to WESTWNGW	230.00 Ckt 2WESTWG 4	34.5				
tran	14005	14231 "2 " 0	14409						
0									
tran_593		"Tran WESTWING	500.00 to WESTWNGW	230.00 Ckt 3WESTWG10	34.5				
tran	14005	14231 "3 " 0	14410						
0									
tran_594		"Tran WESTWING	500.00 to WESTWNGE	230.00 Ckt 1WESTWG 1	34.5				
tran	14005	14259 "1 " 0	14408						
0									
tran_595		"Tran WESTWING	500.00 to WESTWING	345.00 Ckt 1	0.0				
tran	14005	16107 "1 " 0	-1						
0									
tran_596		"Tran YAVAPAI	500.00 to YAVAPAI	230.00 Ckt 1	0.0				
tran	14006	14234 "1 " 0	-1						
0									
tran_597		"Tran YAVAPAI	500.00 to YAVAPAI	230.00 Ckt 2	0.0				
tran	14006	14234 "2 " 0	-1						
0									
tran_598		"Tran GILARIVR	500.00 to GILARIVR	230.00 Ckt 1	0.0				
tran	14007	14238 "1 " 0	-1						
0									
tran_599		"Tran SNVLY	500.00 to SNVLY	230.00 Ckt 1SNVLYT1T	12.4				
tran	14010	14265 "1 " 0	85988						
0									
tran_600		"Tran SNVLY	500.00 to SNVLY	230.00 Ckt 2SNVLYT2T	12.4				
tran	14010	14265 "2 " 0	85989						
0									
tran_601		"Tran RACEWAY	500.00 to RACEWAY	230.00 Ckt 1RACEWY1T	12.4				
tran	14011	14246 "1 " 0	85990						
0									

tran_602		"Tran RACEWAY	500.00 to RACEWAY	230.00 Ckt 2RACEWY2T	12.4				
tran	14011	14246 "2 " 0	85991						
0									
tran_603		"Tran PNPKAPS	500.00 to PNPKAPS	230.00 Ckt 1	0.0				
tran	14016	14221 "1 " 0	-1						
0									
tran_604		"Tran CHOLLA	345.00 to CHOLLA	230.00 Ckt 1	0.0				
tran	14100	14204 "1 " 0	-1						
0									
tran_605		"Tran CHOLLA	345.00 to CHOLLA	230.00 Ckt 2	0.0				
tran	14100	14204 "2 " 0	-1						
0									
tran_606		"Tran FOURCORN	345.00 to FOURCORN	230.00 Ckt 1	0.0				
tran	14101	14211 "1 " 0	-1						
0									
tran_607		"Tran FOURCORN	345.00 to FOURCORN	230.00 Ckt 2	0.0				
tran	14101	14211 "2 " 0	-1						
0									
tran_608		"Tran PRESCOTT	230.00 to PRESCOTT	115.00 Ckt 1	0.0				
tran	14222	14355 "1 " 0	-1						
tran	14222	14355 "2 " 0	-1						
0									
tran_610		"Tran SAGUARO	230.00 to SAG.EAST	115.00 Ckt 1	0.0				
tran	14225	14356 "1 " 0	-1						
0									
tran_611		"Tran SAGUARO	230.00 to SAG.WEST	115.00 Ckt 1SAG 1T	12.5				
tran	14225	14357 "1 " 0	85921						
0									
tran_612		"Tran CORONADO	500.00 to CORONADO	345.00 Ckt 1	0.0				
tran	15001	16100 "1 " 0	-1						
0									
tran_613		"Tran CORONADO	500.00 to CORONADO	345.00 Ckt 2	0.0				
tran	15001	16100 "2 " 0	-1						
0									
tran_614		"Tran KYRENE	500.00 to KYRENE	230.00 Ckt 6KYRENE6	34.5				
tran	15011	15207 "6 " 0	15013						
0									
tran_615		"Tran KYRENE	500.00 to KYRENE	230.00 Ckt 7KYRENE7	34.5				
tran	15011	15207 "7 " 0	15015						
0									
tran_616		"Tran KYRENE	500.00 to KYR-NEW	230.00 Ckt 8KYRENE8	34.5				
tran	15011	14236 "8 " 0	15017						
0									
tran_617		"Tran PERKINS	500.00 to PERK PS1	500.00 Ckt 1	0.0				
tran	15034	15031 "1 " 0	-1						
0									
tran_618		"Tran PERKINS	500.00 to PERK PS2	500.00 Ckt 1	0.0				
tran	15034	15032 "1 " 0	-1						
0									
tran_619		"Tran SILVERKG	500.00 to SILVERKG	230.00 Ckt 1SILVERKG	34.5				
tran	15041	15215 "1 " 0	15043						
0									
tran_620		"Tran BROWNING	500.00 to BROWNING	230.00 Ckt 1BROWIN1	12.4				
tran	15051	15222 "1 " 0	15053						
0									
tran_621		"Tran BROWNING	500.00 to BROWNING	230.00 Ckt 2BROWIN2	12.4				
tran	15051	15222 "2 " 0	15055						
0									
tran_622		"Tran RUDD	500.00 to RUDD	230.00 Ckt 1RUDD 1	12.4				
tran	15061	15230 "1 " 0	15063						
0									
tran_623		"Tran RUDD	500.00 to RUDD	230.00 Ckt 2RUDD 2	12.4				
tran	15061	15230 "2 " 0	15064						
0									
tran_624		"Tran RUDD	500.00 to RUDD	230.00 Ckt 3RUDD 3	12.4				
tran	15061	15230 "3 " 0	15066						
0									

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tran 625	"Tran RUDD	500.00 to RUDD	230.00 Ckt 4	0.0	
0	tran 15061	15230 "4 " 0	-1		
tran 626	"Tran RUDD	500.00 to RUDD	230.00 Ckt 5RUDD5	12.4	
0	tran 15061	15230 "5 " 0	15060		
tran 627	"Tran ABEL	500.00 to ABEL	230.00 Ckt 1ABEL 1	12.4	
0	tran 15070	15224 "1 " 0	15071		
tran 628	"Tran ABEL	500.00 to ABEL	230.00 Ckt 2ABEL 2	12.4	
0	tran 15070	15224 "2 " 0	15073		
tran 629	"Tran PINAL W	500.00 to PINALWES	345.00 Ckt 1	0.0	
0	tran 15088	16114 "1 " 0	-1		
tran 630	"Tran MESQUITE	500.00 to MESQUITE	230.00 Ckt 1	0.0	
0	tran 15094	15163 "1 " 0	-1		
tran 631	"Tran GOLDFELD	230.00 to GOLDFELD	115.00 Ckt 1	0.0	
0	tran 15206	15107 "1 " 0	-1		
tran 632	"Tran GOLDFELD	230.00 to GOLDFELD	115.00 Ckt 2	0.0	
0	tran 15206	15107 "2 " 0	-1		
tran 633	"Tran SILVERKG	230.00 to SILVERK1	115.00 Ckt 1	0.0	
0	tran 15215	15124 "1 " 0	-1		
tran 634	"Tran SILVERKG	230.00 to SILVERK2	115.00 Ckt 1	0.0	
0	tran 15215	15125 "1 " 0	-1		
tran 635	"Tran MCKINLEY	345.00 to YAHTAHEY	115.00 Ckt 1	0.0	
0	tran 16102	10382 "1 " 0	-1		
tran 636	"Tran SOUTH	345.00 to SOUTH	138.00 Ckt 1SOUTH2	13.8	
0	tran 16103	16216 "1 " 0	16627		
tran 637	"Tran SOUTH	345.00 to SOUTH	138.00 Ckt 2SOUTH2	13.8	
0	tran 16103	16216 "2 " 0	16627		
tran 638	"Tran VAIL2	345.00 to VAIL	138.00 Ckt 1	0.0	
0	tran 16106	16220 "1 " 0	-1		
tran 639	"Tran WINCHSTR	345.00 to WINCHSTR	230.00 Ckt 1	0.0	
0	tran 16109	17105 "1 " 0	-1		
tran 640	"Tran TORTOLIT	138.00 to SAG.EAST	115.00 Ckt 1	0.0	
0	tran 16217	14356 "1 " 0	-1		
tran 641	"Tran TORTOLIT	138.00 to SAG.WEST	115.00 Ckt 1	0.0	
0	tran 16217	14357 "1 " 0	-1		
tran 642	"Tran TORTOLIT	138.00 to TORTOLIT	500.00 Ckt 1	0.0	
0	tran 16217	16000 "1 " 0	-1		
tran 643	"Tran TORTOLIT	138.00 to TORTOLIT	500.00 Ckt 2	0.0	
0	tran 16217	16000 "2 " 0	-1		
tran 644	"Tran TORTOLIT	138.00 to TORTLIT2	500.00 Ckt 1	0.0	
0	tran 16217	16001 "1 " 0	-1		
tran 645	"Tran IRVMID3	138.00 to IRVNGTN	138.00 Ckt 1	0.0	
0	tran 16333	16204 "1 " 0	-1		
tran 646	"Tran IRVMID4	138.00 to IRVNGTN	138.00 Ckt 1	0.0	
0	tran 16334	16204 "1 " 0	-1		
tran 647	"Tran COPPERVR	345.00 to COPPERVR	230.00 Ckt 1	0.0	

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tran 16900	16901 "1 " 0	-1			
0	tran 17002	"Tran APACHE	230.00 to APACHE	115.00 Ckt 1	0.0
0	tran 17002	17001 "1 " 0	-1		
tran 649	"Tran APACHE	230.00 to APACHE	115.00 Ckt 2	0.0	
0	tran 17002	17001 "2 " 0	-1		
tran 650	"Tran BICKNELL	230.00 to BICKNELL	115.00 Ckt 1	0.0	
0	tran 17004	17006 "1 " 0	-1		
tran 651	"Tran BICKNELL	230.00 to BICKNELL	115.00 Ckt 2	0.0	
0	tran 17004	17006 "2 " 0	-1		
tran 652	"Tran BICKNELL	345.00 to BICKNELL	230.00 Ckt 1	0.0	
0	tran 17005	17004 "1 " 0	-1		
tran 653	"Tran GREEN-SW	345.00 to GREEN-SW	230.00 Ckt 1	0.0	
0	tran 17010	17009 "1 " 0	-1		
tran 654	"Tran PANTANO	230.00 to PANTANO	115.00 Ckt 1	0.0	
0	tran 17016	17015 "1 " 0	-1		
tran 655	"Tran MEAD S	230.00 to MEAD	287.00 Ckt 1	0.0	
0	tran 19012	26051 "1 " 0	-1		
tran 656	"Tran MEAD	345.00 to MEAD N	230.00 Ckt 1	0.0	
0	tran 19037	19011 "1 " 0	-1		
tran 657	"Tran MEAD	500.00 to MEAD N	230.00 Ckt 1	0.0	
0	tran 19038	19011 "1 " 0	-1		
tran 658	"Tran MEAD	500.00 to MEAD N	230.00 Ckt 2	0.0	
0	tran 19038	19011 "2 " 0	-1		
tran 659	"Tran PARKER	161.00 to PARKER	230.00 Ckt 1	0.0	
0	tran 19041	19042 "1 " 0	-1		
tran 660	"Tran PARKER	161.00 to PARKER	230.00 Ckt 2	0.0	
0	tran 19041	19042 "2 " 0	-1		
tran 661	"Tran COOLIDGE	230.00 to COOLIDGE	115.00 Ckt 1COL12-1	12.5	
0	tran 19045	19044 "1 " 0	19097		
tran 662	"Tran COOLIDGE	230.00 to COOLIDGE	115.00 Ckt 2COL12-2	12.5	
0	tran 19045	19044 "2 " 0	19098		
tran 663	"Tran LIBERTY	345.00 to LIBTYPHS	230.00 Ckt 1	0.0	
0	tran 19053	19054 "1 " 0	-1		
tran 664	"Tran LIBTYPHS	230.00 to LIBERTY	230.00 Ckt 1	0.0	
0	tran 19054	19052 "1 " 0	-1		
tran 665	"Tran CASAGRND	230.00 to CASAGRND	115.00 Ckt 1	0.0	
0	tran 19218	19222 "1 " 0	-1		
tran 666	"Tran PEACOCK	345.00 to PEACOCK	230.00 Ckt 1	0.0	
0	tran 19315	19314 "1 " 0	-1		
tran 667	"Tran GLEN PS	230.00 to GLENCANY	230.00 Ckt 1	0.0	
0	tran 79028	79031 "1 " 0	-1		
tran 668	"Tran GLENCANY	345.00 to GLENCANY	230.00 Ckt 1	0.0	
0	tran 79032	79031 "1 " 0	-1		
tran 669	"Tran GLENCANY	345.00 to GLENCANY	230.00 Ckt 2	0.0	
0	tran 79032	79031 "2 " 0	-1		

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0									
tran_670		"Tran PINPKBRB	345.00 to PINPK	230.00 Ckt 1	0.0				
tran	79053	19062 "1 " 0	-1						
0									
tran_671		"Tran PINPKBRB	345.00 to PINPK	230.00 Ckt 2	0.0				
tran	79053	19062 "2 " 0	-1						
0									
tran_672		"Tran PINPKBRB	345.00 to PINPK	230.00 Ckt 3	0.0				
tran	79053	19062 "3 " 0	-1						
0									
tran_673		"Tran SHIP PS	230.00 to SHIPROCK	230.00 Ckt 1	0.0				
tran	79061	79063 "1 " 0	-1						
0									
tran_674		"Tran SHIPROCK	230.00 to SHIPROCK	115.00 Ckt 1	0.0				
tran	79063	79062 "1 " 0	-1						
0									
tran_675		"Tran SHIPROCK	345.00 to SHIPROCK	230.00 Ckt 1	0.0				
tran	79064	79063 "1 " 0	-1						
0									
tran_676		"Tran VAIL	345.00 to VAIL_NOG	138.00 Ckt 1VAIL	13.8				
tran	16105	16718 "1 " 0	16630						
0									
tran_677		"Tran GATEWAY	138.00 to GATEWAY	345.00 Ckt 1	0.0				
tran	16724	16108 "1 " 0	-1						
0									
tran_678		"Tran PC GEN	500.00 to PINAL_CG	230.00 Ckt 1	0.0				
tran	15095	15191 "1 " 0	-1						
0									
tran_679		"Tran PINAL C	500.00 to PINAL_C	230.00 Ckt 1PINAL_C1	12.5				
tran	15080	15098 "1 " 0	15081						
0									
tran_680		"Tran PINAL C	500.00 to PINAL_C	230.00 Ckt 2PINAL_C2	12.5				
tran	15080	15098 "2 " 0	15083						
0									
tran_681		"Tran SNTAROSA	500.00 to SNTAROSA	230.00 Ckt 1SNTAROS1	12.5				
tran	15087	14226 "1 " 0	88001						
0									
tran_682		"Tran SNTAROSA	500.00 to SNTAROSA	230.00 Ckt 2SNTAROS2	12.5				
tran	15087	14226 "2 " 0	88003						
0									
tran_683		"Tran PINAL C	230.00 to ED-2	115.00 Ckt 1	0.0				
tran	15098	19065 "1 " 0	-1						
0									
tran_684		"Tran SNMANUEL	115.00 to SNMANUEL	100.00 Ckt 1	0.0				
tran	14358	14550 "1 " 0	-1						
0									
tran_685		"Tran NGL-E	230.00 to N.GILA	500.00 Ckt 1	0.0				
tran	19125	22536 "1 " 0	-1						
0									
tran_686		"Tran NGL-W	230.00 to N.GILA	500.00 Ckt 1	0.0				
tran	19126	22536 "1 " 0	-1						
0									
tran_687		"Tran GILA	161.00 to GILA	230.00 Ckt 1	0.0				
tran	19050	19124 "1 " 0	-1						
0									
tran_688		"Tran GREEN-SW	345.00 to GREEN-SW	230.00 Ckt 2	0.0				
tran	17010	17009 "2 " 0	-1						
0									
tran_689		"Tran TORTOLIT	500.00 to TORTOLIT	345.00 Ckt 1	0.0				
tran	16000	16115 "1 " 0	-1						
0									
tran_690		"Tran VAIL	345.00 to VAIL	138.00 Ckt 2VAIL	13.8				
tran	16105	16220 "2 " 0	16630						
0									
tran_691		"Tran VAIL2	345.00 to VAIL	138.00 Ckt 2	0.0				
tran	16106	16220 "2 " 0	-1						
0									

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tran_692		"Tran TORTOLIT	138.00 to TORTOLIT	500.00 Ckt 3	0.0				
tran	16217	16000 "3 " 0	-1						
0									
tran_693		"Tran TORTOLIT	138.00 to TORTOLIT	500.00 Ckt 4	0.0				
tran	16217	16000 "4 " 0	-1						
0									
tran_694		"Tran SPNCER	138.00 to SPNCER	115.00 Ckt 1SPNCER	13.8				
tran	16235	16414 "1 " 0	16669						
0									
tran_695		"Tran WHTHILLS	345.00 to WHTHILLS	230.00 Ckt 1	0.0				
tran	16842	16843 "1 " 0	-1						
0									
tran_696		"Tran COPPERVR	345.00 to COPPERVR	230.00 Ckt 2	0.0				
tran	16900	16901 "2 " 0	-1						
0									
tran_697		"Tran PNPKAPS	500.00 to PPAPS E	230.00 Ckt 2	0.0				
tran	14016	14261 "2 " 0	-1						
0									
tran_698		"Tran PNPKAPS	500.00 to PPAPS N	230.00 Ckt 3	0.0				
tran	14016	14278 "3 " 0	-1						
0									
tran_699		"Tran PNPKAPS	345.00 to PPAPS C	230.00 Ckt 1PNPK 7T	14.4				
tran	14102	14260 "1 " 0	85911						
0									
tran_700		"Tran PNPKAPS	345.00 to PPAPS E	230.00 Ckt 3PNPK T14	14.4				
tran	14102	14261 "3 " 0	14402						
0									
tran_701		"Tran PNPKAPS	345.00 to PPAPS N	230.00 Ckt 2PNPK T4	14.4				
tran	14102	14278 "2 " 0	14403						
0									
svd_800		"SVD THUNDERSTONE 69							
svd	"THUNDRST 69.0"	"v " 0							
0									
svd_801		"SVD SCHRADER 69							
svd	"SCHRADER 69.0"	"v " 0							
0									
svd_802		"SVD ORME 69							
svd	"ORME RS 69.0"	"v " 0							
0									
svd_803		"SVD CORBELL 69							
svd	"CORBELRS 69.0"	"v " 0							
0									
svd_804		"SVD ANDERSON 69							
svd	"ANDERSRS 69.0"	"v " 0							
0									
svd_805		"SVD ALEXANDR 69							
svd	"ALEXANDR 69.0"	"v " 0							
0									
svd_806		"SVD KNOLL 115							
svd	"KNOLL 115.0"	"v " 0							
0									
svd_807		"SVD KYRENE 230							
svd	"KYRENE 230.0"	"v " 0							
0									
svd_808		"SVD NELP_SVC 138							
svd	"NELP_SVC 138.0"	"SV" 0							
0									
end									
# End of Contingency List, 701 Contingencies Added to List									

Appendix B: Contingency Results

Central Arizona Transmission System - 2019 BTA Study Work

Voltage Violations (per unit voltage)

#	Name	KV	CONTINGENCY DESCRIPTION	BASE
16723	VALNCIA	138	Base system (n-0)	0.94
16722	SONOITA	138	Base system (n-0)	0.95
14215	LEUPP	230	Base system (n-0)	1.05
14204	CHOLLA	230	Base system (n-0)	1.05
14355	PRESCOTT	115	Base system (n-0)	1.06
14100	CHOLLA	345	Base system (n-0)	1.06
14032	RME	500	Base system (n-0)	1.10
14003	NAVAJO	500	Base system (n-0)	1.11
14351	BAGDAD	115	Base system (n-0)	1.13
14361	BAGCAP	115	Base system (n-0)	1.13

Central Arizona Transmission System - 2019 BTA Study Work

Thermal Violations (overloads, per unit)

Fname	FkV	Tname	Tkv	ckt	CONTINGENCY DESCRIPTION	RTG	MVA	RTG	BASE	APS01	APS02	APS03	APS04	APS05	APS06	APS07	APS08	APS09
PINPK	230	PINPKSRP	230	2	"line_357"Line PINPK 230 to PINPKSRP 230 Ckt 1	2	658	1.36	1.36	1.36	1.36	1.41	1.36	1.58	1.30	1.35	1.35	1.35
PINPK	230	PINPKSRP	230	1	"line_358"Line PINPK 230 to PINPKSRP 230 Ckt 2	2	658	1.36	1.36	1.36	1.36	1.41	1.36	1.58	1.30	1.35	1.35	1.35
YAVAPAI	500	YAVAPAI	230	2	"tran_596"Tran YAVAPAI 500 to YAVAPAI 230 Ckt 1	2	336	1.35	1.36	1.36	1.36	1.36	1.35	1.44	1.35	1.35	1.34	1.35
YAVAPAI	500	YAVAPAI	230	1	"tran_597"Tran YAVAPAI 500 to YAVAPAI 230 Ckt 2	2	336	1.35	1.36	1.36	1.36	1.36	1.35	1.44	1.35	1.34	1.34	1.35
TWNTYSEC	138	E. LOOP	138	1	"line_252"Line LOSREALS 138 to VAIL 138 Ckt 1	2	225	1.15	1.15	1.15	1.15	1.15	1.15	1.16	1.15	1.15	1.15	1.15
N. LOOP	138	RILLITO	138	1	"line_546"Line N. LOOP 138 to NARANJA 138 Ckt 1	2	382	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
N. LOOP	138	RILLITO	138	1	"line_226"Line RANVISTO 138 to NARANJA 138 Ckt 1	2	382	1.10	1.10	1.10	1.10	1.10	1.10	1.09	1.10	1.10	1.10	1.10
TORTOLIT	138	N. LOOP	138	3	"line_552"Line TORTOLIT 138 to N. LOOP 138 Ckt 1A	2	406	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
TORTOLIT	138	N. LOOP	138	3	"line_553"Line TORTOLIT 138 to N. LOOP 138 Ckt 2A	2	406	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
BRANDOW	230	WARD	230	1	"line_158"Line BRANDOW 230 to WARD 230 Ckt 2	2	438	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
BRANDOW	230	WARD	230	2	"line_157"Line BRANDOW 230 to WARD 230 Ckt 1	2	438	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
TWNTYSEC	138	E. LOOP	138	1	"line_250"Line VAIL 138 to CIENEGA 138 Ckt 1	2	225	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02
TWNTYSEC	138	E. LOOP	138	1	"line_253"Line PANTANO 138 to LOSREALS 138 Ckt 1	2	225	1.01	1.01	1.01	1.01	1.01	1.01	1.02	1.01	1.01	1.01	1.01
DMP	138	N. LOOP	138	1	"line_220"Line N. LOOP 138 to WESTINA 138 Ckt 1	2	311	1.01	1.01	1.01	1.01	1.01	1.01	1.00	1.01	1.01	1.01	1.01
FLAGSTAF	345	PINPKBRB	345	1	"line_426"Line FLAGSTAF 345 to PINPKBRB 345 Ckt 2	2	1219	0.99	0.99	0.99	0.99	0.99	0.99	1.03	0.99	0.99	0.98	0.99
FLAGSTAF	345	PINPKBRB	345	2	"line_425"Line FLAGSTAF 345 to PINPKBRB 345 Ckt 1	2	1219	0.99	0.99	0.99	0.99	0.99	0.99	1.03	0.99	0.99	0.98	0.99
RACEWAY	500	RACEWAY	230	1	"tran_594"Tran WESTWING 500 to WESTWNGE 230 Ckt 2	2	598	0.98	0.98	0.98	0.98	0.92	0.99	1.34	DNE	0.94	0.98	0.99
YAVAPAI	230	WILOWLKE	230	1	"line_381"Line PRSCOTWA 230 to RNDVLYTP 230 Ckt 1 2	2	355	0.98	0.99	0.99	0.99	0.99	0.98	1.05	0.98	0.98	0.97	0.98
YAVAPAI	230	WILOWLKE	230	1	"line_415"Line RNDVLYTP 230 to PEACOCK 230 Ckt 1	2	355	0.98	0.99	0.99	0.99	0.99	0.98	1.05	0.98	0.98	0.97	0.98
FOURCORN	500	FOURCORN	345	1	"line_24"Line RME 500 to FCW 500 Ckt 1	2	840	0.96	0.96	0.96	0.96	0.97	0.96	1.01	0.97	0.96	0.96	0.96
YAVAPAI	500	YAVAPAI	230	2	"line_17"Line YAVAPAI 500 to WESTWING 500 Ckt 1	2	336	0.96	0.96	0.96	0.97	0.96	0.96	1.01	0.96	0.96	0.95	0.96
YAVAPAI	500	YAVAPAI	230	1	"line_17"Line YAVAPAI 500 to WESTWING 500 Ckt 1	2	336	0.96	0.96	0.96	0.96	0.96	0.96	1.01	0.96	0.96	0.95	0.96
RACEWYWA	230	WESTWNGE	230	1	"tran_594"Tran WESTWING 500 to WESTWNGE 230 Ckt 2	2	403	0.86	0.88	0.88	0.88	1.00	0.86	1.04	0.20	0.83	0.86	0.86

colored cells indicate where flows increased by 5% or more, as compared to the base case flows

Central Arizona Transmission System - 2019 BTA Study Work

Thermal Violations (overloads, per unit)

F#	Fname	FkV	T#	Tname	TkV	ckt	CONTINGENCY DESCRIPTION	RTG#	RTG	BASE	PVDV2	SRP01	SRP02	SRP03	SRP04	TEP01
19062	PINPK	230	15211	PINPKSRP	230	2	"line_357"Line PINPK 230.0 to PINPKSRP 230.0 Ckt 1	2	658	1.36	1.33	1.35	1.38	1.37	1.36	1.37
19062	PINPK	230	15211	PINPKSRP	230	1	"line_358"Line PINPK 230.0 to PINPKSRP 230.0 Ckt 2	2	658	1.36	1.33	1.35	1.38	1.37	1.36	1.37
14006	YAVAPAI	500	14234	YAVAPAI	230	2	"tran_596"Tran YAVAPAI 500 to YAVAPAI 230 Ckt 1	2	336	1.35	1.33	1.35	1.37	1.36	1.35	1.36
14006	YAVAPAI	500	14234	YAVAPAI	230	1	"tran_597"Tran YAVAPAI 500 to YAVAPAI 230 Ckt 2	2	336	1.35	1.33	1.35	1.37	1.36	1.35	1.36
16219	TWNTYSEC	138	16202	E. LOOP	138	1	"line_252"Line LOSREALS 138.0 to VAIL 138.0 Ckt 1	2	225	1.15	1.15	1.15	1.18	1.17	1.15	1.25
16207	N. LOOP	138	16210	RILLITO	138	1	"line_546"Line N. LOOP 138.0 to NARANJA 138.0 Ckt 1	2	382	1.15	1.15	1.15	1.12	1.13	1.15	1.07
16207	N. LOOP	138	16210	RILLITO	138	1	"line_226"Line RANVISTO 138.0 to NARANJA 138.0 Ckt 1	2	382	1.10	1.10	1.10	1.07	1.08	1.10	1.02
16217	TORTOLIT	138	16207	N. LOOP	138	3	"line_552"Line TORTOLIT 138.0 to N. LOOP 138.0 Ckt 1A	2	406	1.08	1.09	1.08	1.05	1.06	1.09	1.01
16217	TORTOLIT	138	16207	N. LOOP	138	3	"line_553"Line TORTOLIT 138.0 to N. LOOP 138.0 Ckt 2A	2	406	1.08	1.09	1.08	1.05	1.06	1.09	1.01
79032	GLENCANY	345	79031	GLENCANY	230	1	"tran_669"Tran GLENCANY 345.00 to GLENCANY 230 Ckt 2	2	300	1.06	1.01	1.06	1.05	1.06	1.06	1.03
79032	GLENCANY	345	79031	GLENCANY	230	2	"tran_668"Tran GLENCANY 345.00 to GLENCANY 230Ckt 1	2	300	1.06	1.01	1.06	1.05	1.06	1.06	1.03
15204	BRANDOW	230	15217	WARD	230	1	"line_158"Line BRANDOW 230.0 to WARD 230.0 Ckt 2	2	438	1.02	1.02	1.02	1.02	1.02	1.02	1.02
15204	BRANDOW	230	15217	WARD	230	2	"line_157"Line BRANDOW 230.0 to WARD 230.0 Ckt 1	2	438	1.02	1.02	1.02	1.02	1.02	1.02	1.02
79024	FLAGSTAF	345	79032	GLENCANY	345	1	"line_424"Line FLAGSTAF 345.0 to GLENCANY 345.0 Ckt 2	2	1089	1.02	1.01	1.02	1.02	1.02	1.02	1.01
16219	TWNTYSEC	138	16202	E. LOOP	138	1	"line_250"Line VAIL 138.0 to CIENEGA 138.0 Ckt 1	2	225	1.02	1.02	1.02	1.04	1.03	1.02	1.09
79024	FLAGSTAF	345	79032	GLENCANY	345	2	"line_423"Line FLAGSTAF 345.0 to GLENCANY 345.0 Ckt 1	2	1089	1.02	1.00	1.02	1.01	1.02	1.02	1.01
16219	TWNTYSEC	138	16202	E. LOOP	138	1	"line_253"Line PANTANO 138.0 to LOSREALS 138.0 Ckt 1	2	225	1.01	1.01	1.01	1.04	1.03	1.01	1.11
16200	DMP	138	16207	N. LOOP	138	1	"line_220"Line N. LOOP 138.0 to WESTINA 138.0 Ckt 1	2	311	1.01	1.01	1.01	0.96	0.98	1.01	0.88
14011	RACEWAY	500	14246	RACEWAY	230	1	"tran_594"Tran WESTWING 50 to WESTWNGE 230 Ckt 1	2	598	0.98	0.99	0.98	1.01	1.01	0.99	0.99
16219	TWNTYSEC	138	16202	E. LOOP	138	1	"line_205"Line DMP 138.0 to NE.LOOP 138.0 Ckt 1	2	225	0.97	0.97	0.97	0.99	0.99	0.97	1.03
16219	TWNTYSEC	138	16202	E. LOOP	138	1	"line_212"Line E. LOOP 138.0 to PANTANO 138.0 Ckt 1	2	225	0.95	0.95	0.95	0.98	0.97	0.95	1.04

colored cells indicate where flows increased by 5% or more, as compared to the base case flows

Central Arizona Transmission System - 2019 BTA Study Work

Delta Voltage Violations (voltage drop, per unit)

#	Name	kV	CONTINGENCY DESCRIPTION	BASE	APS01	APS02	APS03	APS04	APS05	APS06	APS07	APS08	APS09
14351	BAGDAD	115	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.15	-0.16	-0.16	-0.16	-0.15	-0.16	-0.15	-0.15	-0.15	-0.15
14361	BAGCAP	115	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.15	-0.16	-0.16	-0.16	-0.15	-0.16	-0.15	-0.15	-0.15	-0.15
14359	VLYFARMS	115	"line_332"Line COOLIDGE 115 to VLYFARMS 115 Ckt 1	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14
14361	BAGCAP	115	"line_510"Line PRESCOTT 115 to BAGCAP 115 Ckt 1	-0.13	-0.12	-0.12	-0.12	-0.13	-0.12	-0.13	-0.13	-0.13	-0.13
14361	BAGCAP	115	"tran_608"Tran PRESCOTT 2300 to PRESCOTT 115 Ckt 1	-0.13	-0.12	-0.12	-0.12	-0.13	-0.12	-0.13	-0.13	-0.13	-0.13
14351	BAGDAD	115	"line_510"Line PRESCOTT 115 to BAGCAP 115 Ckt 1	-0.13	-0.12	-0.12	-0.12	-0.13	-0.12	-0.12	-0.13	-0.13	-0.13
14351	BAGDAD	115	"line_511"Line BAGCAP 115 to BAGDAD 115 Ckt 1	-0.13	-0.12	-0.12	-0.12	-0.13	-0.12	-0.12	-0.13	-0.13	-0.13
14351	BAGDAD	115	"tran_608"Tran PRESCOTT 2300 to PRESCOTT 115 Ckt 1	-0.13	-0.12	-0.12	-0.12	-0.13	-0.12	-0.12	-0.13	-0.13	-0.13
14235	GILABEND	230	"line_70"Line GILARIVR 230 to GILABEND 230 Ckt 1	-0.11	-0.12	-0.13	-0.11	-0.11	-0.12	-0.11	-0.11	-0.11	-0.11
14355	PRESCOTT	115	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.10	-0.11	-0.11	-0.11	-0.10	-0.11	-0.10	-0.10	-0.10	-0.10
14249	WILOWLKE	230	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	-0.09	-0.10	-0.10	-0.09	-0.10	-0.09	-0.09	-0.09	-0.09
14250	WILOWLKW	230	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	-0.09	-0.10	-0.09	-0.09	-0.10	-0.09	-0.09	-0.09	-0.09
14222	PRESCOTT	230	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.10	-0.09	-0.09	-0.09	-0.09
14201	BUCKEYE	230	"line_32"Line BUCKEYE 230 to LIBERTY 230 Ckt 1	-0.09	-0.10	-0.10	-0.09	-0.09	-0.10	-0.09	-0.09	-0.09	-0.09
19106	PRSCOTWA	230	"line_67"Line YAVAPAI 230 to WILOWLKE 230 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.10	-0.09	-0.09	-0.09	-0.09
17018	RED TAIL	230	"line_267"Line APACHE 230 to RED TAIL 230 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
17044	HACKBERY	230	"line_281"Line HACKBERY 230 to MORENCI 230 Ckt 1	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08
17008	DOSCONDO	230	"line_281"Line HACKBERY 230 to MORENCI 230 Ckt 1	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07
15032	PERK PS2	500	"line_104"Line PERK PS2 500 to PERKINPS 500 Ckt 1	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07
17008	DOSCONDO	230	"line_267"Line APACHE 230 to RED TAIL 230 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
17044	HACKBERY	230	"line_267"Line APACHE 230 to RED TAIL 230 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14355	PRESCOTT	115	"tran_608"Tran PRESCOTT 230 to PRESCOTT 115 Ckt 1	-0.06	-0.05	-0.05	-0.05	-0.06	-0.05	-0.06	-0.06	-0.06	-0.06
14230	VERDE N	230	"line_66"Line YAVAPAI 230 to VERDE N 230 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14247	VERDE S	230	"line_66"Line YAVAPAI 230 to VERDE N 230 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14243	GAVILNPK	230	"line_382"Line GAVILINWA 230 to GAVILNPK 230 Ckt 1	-0.06	-0.06	-0.06	-0.07	-0.05	-0.06	-0.06	-0.06	-0.06	-0.05
14353	MURAL	115	"line_537"Line ADAMS TP 115 to APACHE 115 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
14205	COCONINO	230	"line_66"Line YAVAPAI 230 to VERDE N 230 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
14254	TRLBY	230	"line_82"Line TRLBY 230 to SNVLY 230 Ckt 1	-0.04	0.00	0.00	-0.04	-0.08	-0.04	-0.04	-0.04	-0.04	-0.04
14010	SNVLY	500	"line_499"Line DELANY 500 to SNVLY 500 Ckt 1	-0.01	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.07	-0.01	-0.01
14010	SNVLY	500	"line_18"Line SNVLY 500 to RACEWAY 500 Ckt 1	-0.01	-0.08	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01
14018	DUGAS	500	"line_449"Line DUGAS 500 to RACEWAY 500 Ckt 1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
16720	KANTOR	138	"line_461"Line SONOITA 138 to VALNCIA 138 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
15008	MIAMI 3	115	"line_491"Line CARLOTA 115 to PINTOVLY 115 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
15009	MIAMI 4	115	"line_491"Line CARLOTA 115 to PINTOVLY 115 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
15114	MIAMI	115	"line_491"Line CARLOTA 115 to PINTOVLY 115 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	"line_457"Line VAIL_NOG 138 to NOGALES 138 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	"line_458"Line NOGALES 138 to KANTOR 138 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	"line_460"Line CANEZ 138 to SONOITA 138 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
16720	KANTOR	138	"line_459"Line KANTOR 138 to CANEZ 138 Ckt 1	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
15121	PINTOVLY	115	"line_492"Line CARLOTA 115 to SILVERK2 115 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
14361	BAGCAP	115	"line_511"Line BAGCAP 115 to BAGDAD 115 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16721	CANEZ	138	"line_461"Line SONOITA 138 to VALNCIA 138 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
15104	CARLOTA	115	"line_492"Line CARLOTA 115 to SILVERK2 115 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16721	CANEZ	138	"line_457"Line VAIL_NOG 138 to NOGALES 138 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16721	CANEZ	138	"line_458"Line NOGALES 138 to KANTOR 138 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16721	CANEZ	138	"line_459"Line KANTOR 138 to CANEZ 138 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16722	SONOITA	138	"line_461"Line SONOITA 138 to VALNCIA 138 Ckt 1	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
16722	SONOITA	138	"line_457"Line VAIL_NOG 138 to NOGALES 138 Ckt 1	0.07	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.07	0.07
16722	SONOITA	138	"line_458"Line NOGALES 138 to KANTOR 138 Ckt 1	0.07	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.07	0.07
16722	SONOITA	138	"line_459"Line KANTOR 138 to CANEZ 138 Ckt 1	0.07	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.07	0.07
16722	SONOITA	138	"line_460"Line CANEZ 138 to SONOITA 138 Ckt 1	0.07	0.08	0.08	0.08	0.07	0.08	0.08	0.07	0.07	0.07
16721	CANEZ	138	"line_460"Line CANEZ 138 to SONOITA 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
15121	PINTOVLY	115	"line_491"Line CARLOTA 115 to PINTOVLY 115 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16723	VALNCIA	138	"line_457"Line VAIL_NOG 138 to NOGALES 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16723	VALNCIA	138	"line_458"Line NOGALES 138 to KANTOR 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16723	VALNCIA	138	"line_459"Line KANTOR 138 to CANEZ 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16723	VALNCIA	138	"line_460"Line CANEZ 138 to SONOITA 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16723	VALNCIA	138	"line_461"Line SONOITA 138 to VALNCIA 138 Ckt 1	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
16106	VAIL2	345	"tran_638"Tran VAIL2 345 to VAIL 138 Ckt 1 0.00	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11

Colored cells indicate where voltage deviation increased by >3% as compared to voltage deviation in the base case.

Central Arizona Transmission System - 2019 BTA Study Work

Delta Voltage Violations (voltage drop, per unit)

#	Name	kV	CONTINGENCY DESCRIPTION	BASE	PVDV2	SRP01	SRP02	SRP03	SRP04	TEP01
14351	BAGDAD	115	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15
14361	BAGCAP	115	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15
14359	VLXFARMS	115	"line_332"Line COOLIDGE 115.0 to VLYFARMS 115.0 Ckt 1	-0.14	-0.14	-0.14	-0.14	-0.14	-0.14	-0.15
14361	BAGCAP	115	"line_510"Line PRESCOTT 115.0 to BAGCAP 115.0 Ckt 1	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13
14361	BAGCAP	115	"tran_608"Tran PRESCOTT 230 to PRESCOTT 115.00 Ckt 1	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13	-0.13
14351	BAGDAD	115	"line_510"Line PRESCOTT 115.0 to BAGCAP 115.0 Ckt 1	-0.13	-0.13	-0.13	-0.13	-0.12	-0.12	-0.13
14351	BAGDAD	115	"line_511"Line BAGCAP 115.0 to BAGDAD 115.0 Ckt 1	-0.13	-0.13	-0.13	-0.13	-0.12	-0.12	-0.13
14351	BAGDAD	115	"tran_608"Tran PRESCOTT 230 to PRESCOTT 115.00 Ckt 1	-0.13	-0.13	-0.13	-0.13	-0.12	-0.12	-0.13
15105	ELLISON	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
15133	843E2.7N	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
15135	MIAMI 4	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
15123	REFINERY	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
15132	842E2.7N	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
15115	MOONSHIN	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
14235	GILABEND	230	"line_70"Line GILARIVR 230.0 to GILABEND 230.0 Ckt 1	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11	-0.11
14355	PRESCOTT	115	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10	-0.10
14249	WILOWLKE	230	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
14250	WILOWLKW	230	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
14222	PRESCOTT	230	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
14201	BUCKEYE	230	"line_32"Line BUCKEYE 230.0 to LIBERTY 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
19106	PRSCOTWA	230	"line_67"Line YAVAPAI 230.0 to WILOWLKE 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
17018	RED TAIL	230	"line_267"Line APACHE 230.0 to RED TAIL 230.0 Ckt 1	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09	-0.09
17044	HACKBERY	230	"line_281"Line HACKBERY 230.0 to MORENCI 230.0 Ckt 1	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08
17008	DOSCONDO	230	"line_281"Line HACKBERY 230.0 to MORENCI 230.0 Ckt 1	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07
15032	PERK PS2	500	"line_104"Line PERK PS2 500.0 to PERKINPS 500.0 Ckt 1	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07
17008	DOSCONDO	230	"line_267"Line APACHE 230.0 to RED TAIL 230.0 Ckt 1	-0.06	-0.06	-0.06	-0.07	-0.06	-0.06	-0.07
17044	HACKBERY	230	"line_267"Line APACHE 230.0 to RED TAIL 230.0 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14355	PRESCOTT	115	"tran_608"Tran PRESCOTT 230 to PRESCOTT 115.00 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14230	VERDE N	230	"line_66"Line YAVAPAI 230.0 to VERDE N 230.0 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14247	VERDE S	230	"line_66"Line YAVAPAI 230.0 to VERDE N 230.0 Ckt 1	-0.06	-0.05	-0.06	-0.06	-0.06	-0.06	-0.06
14243	GAVILNPK	230	"line_382"Line GAVLINWA 230.0 to GAVILNPK 230.0 Ckt 1	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06	-0.06
14353	MURAL	115	"line_537"Line ADAMS TP 115.0 to APACHE 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.06
15106	FRAZIER	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
14362	BOOTHILL	115	"line_537"Line ADAMS TP 115.0 to APACHE 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.06
15134	ROOSEVLT	115	"line_138"Line MOONSHIN 115.0 to PINAL 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
14350	ADAMS	115	"line_537"Line ADAMS TP 115.0 to APACHE 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
19060	ADAMS TP	115	"line_537"Line ADAMS TP 115.0 to APACHE 115.0 Ckt 1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
17020	SAN RAF	230	"line_266"Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.05	-0.04	-0.05	-0.05	-0.05	-0.05	-0.05
17007	BUTERFLD	230	"line_266"Line APACHE 230.0 to BUTERFLD 230.0 Ckt 1	-0.04	-0.04	-0.04	-0.05	-0.04	-0.04	-0.05