Arizona Corporation Commission Workshop

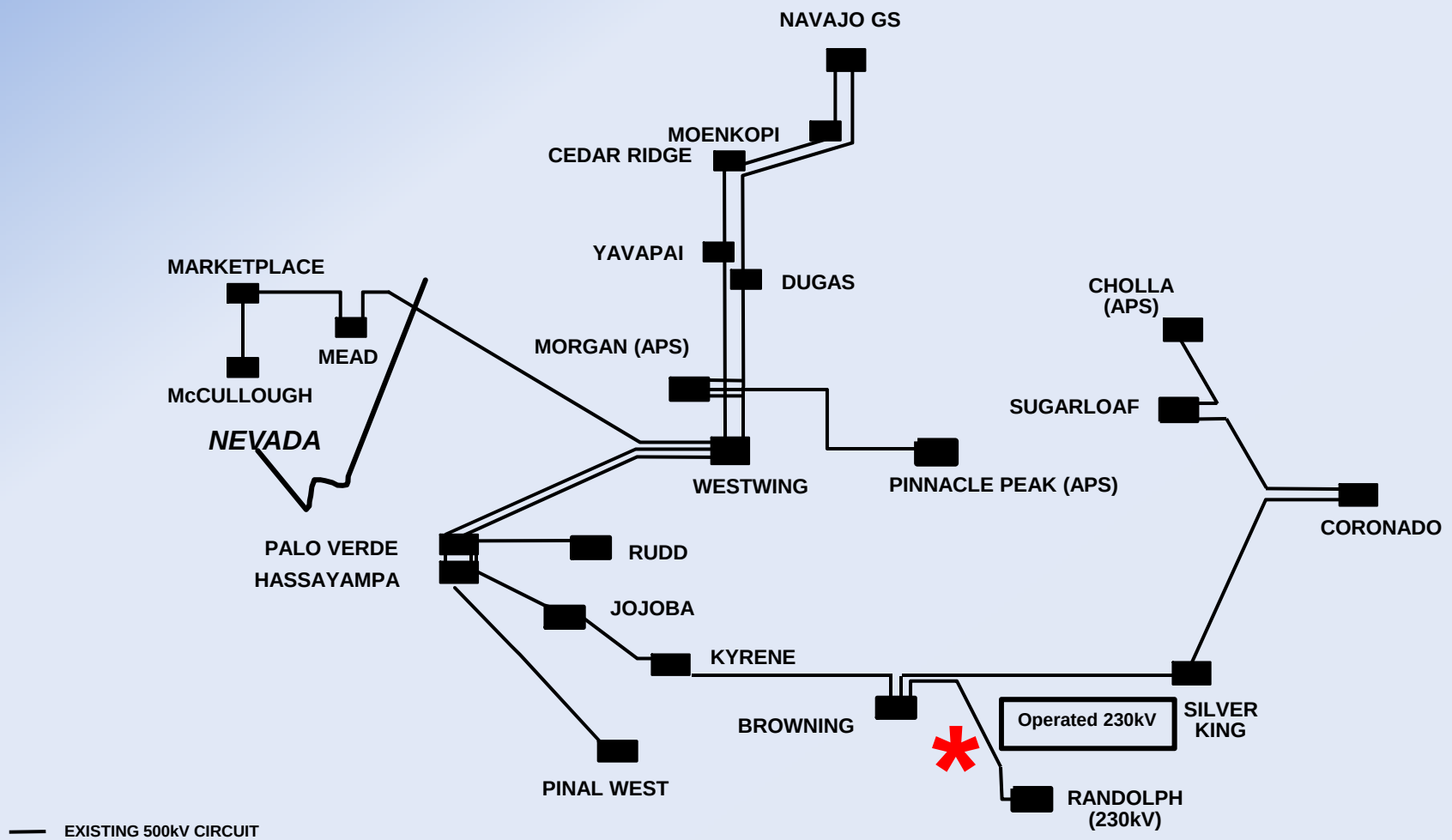
Eighth Biennial Transmission Assessment

SRP Ten Year Transmission Plan 2014-2023

Chuck Russell, SRP Transmission Planning

Arizona Corporation Commission, Phoenix, AZ
May 15, 2014

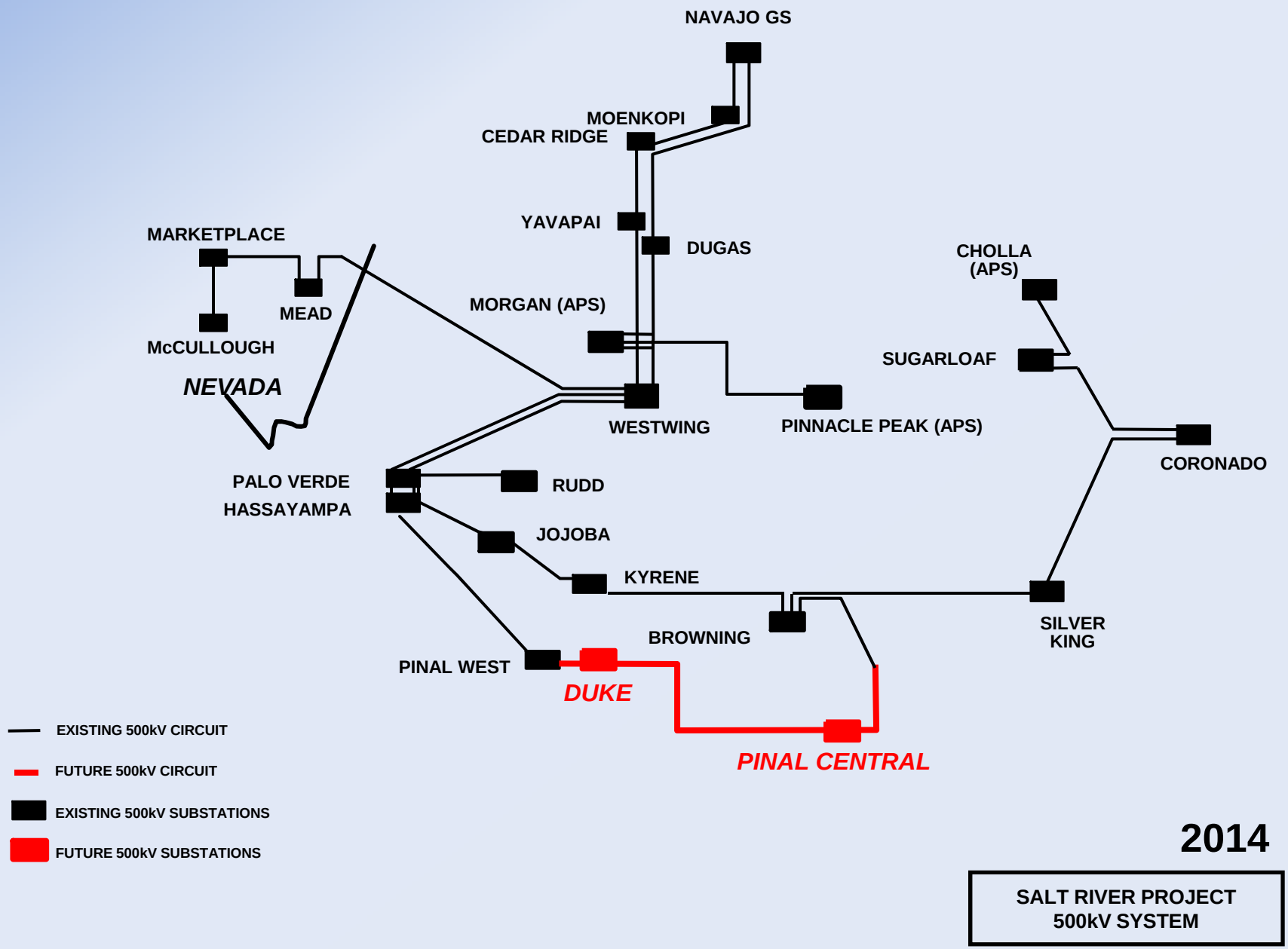
Delivering More Than Power.®



* **Note: This segment is constructed 500kV, operated 230kV**

Today

SALT RIVER PROJECT 500kV SYSTEM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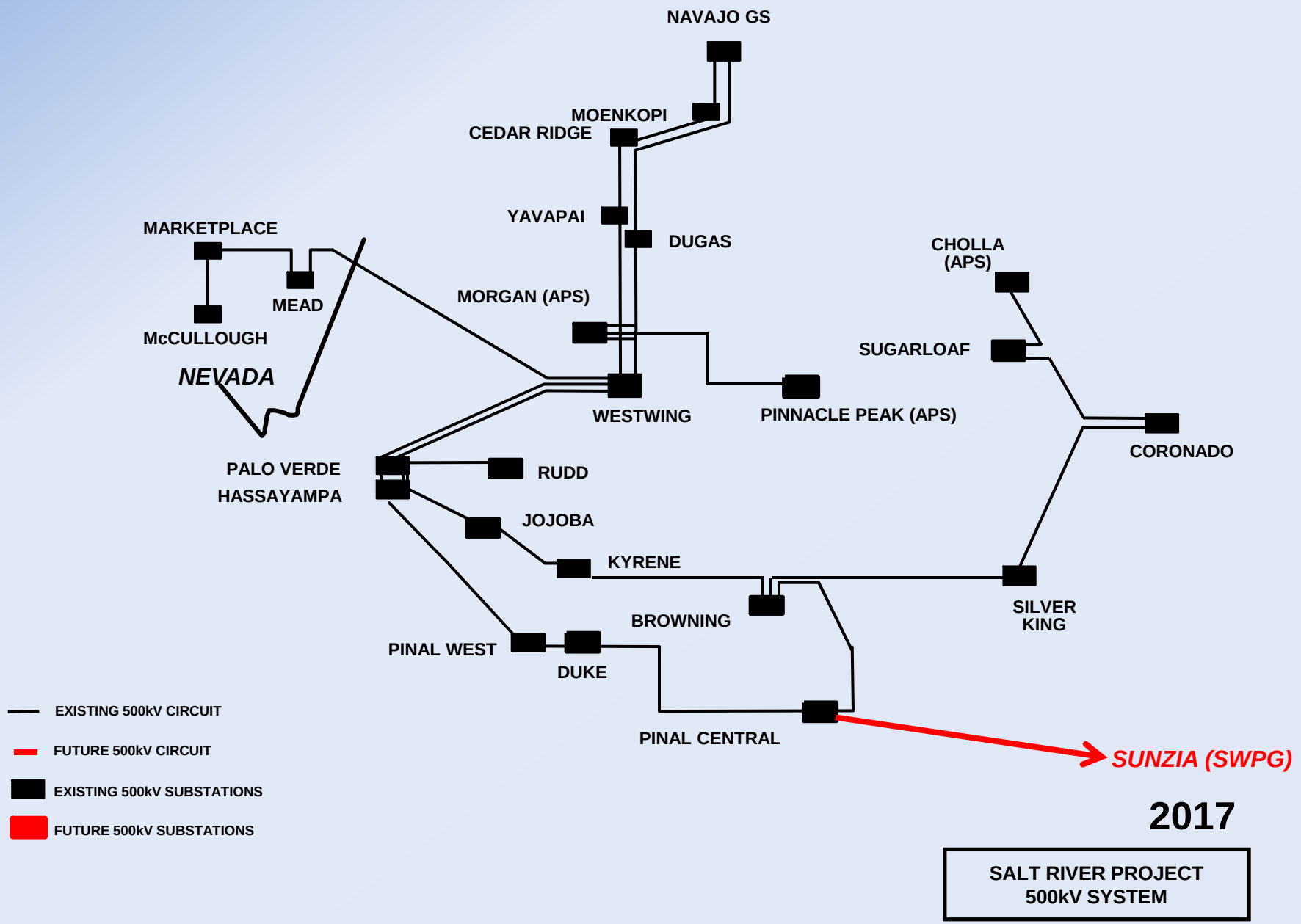
CEDAR RIDGE
YAVAPAI
DUGAS
MARKETPLACE
MEAD
McCULLOUGH
NEVADA
MORGAN (APS)
CHOLLA (APS)
SUGARLOAF
WESTWING
PINNACLE PEAK (APS)
CORONADO
PALO VERDE
HASSAYAMPA
RUDD
JOJOBA
KYRENE
BROWNING
SILVER KING
PINAL WEST
DUKE
PINAL CENTRAL
EXISTING 500kV CIRCUIT
FUTURE 500kV CIRCUIT
EXISTING 500kV SUBSTATIONS
FUTURE 500kV SUBSTATIONS
2014
SALT RIVER PROJECT
500kV SYSTEM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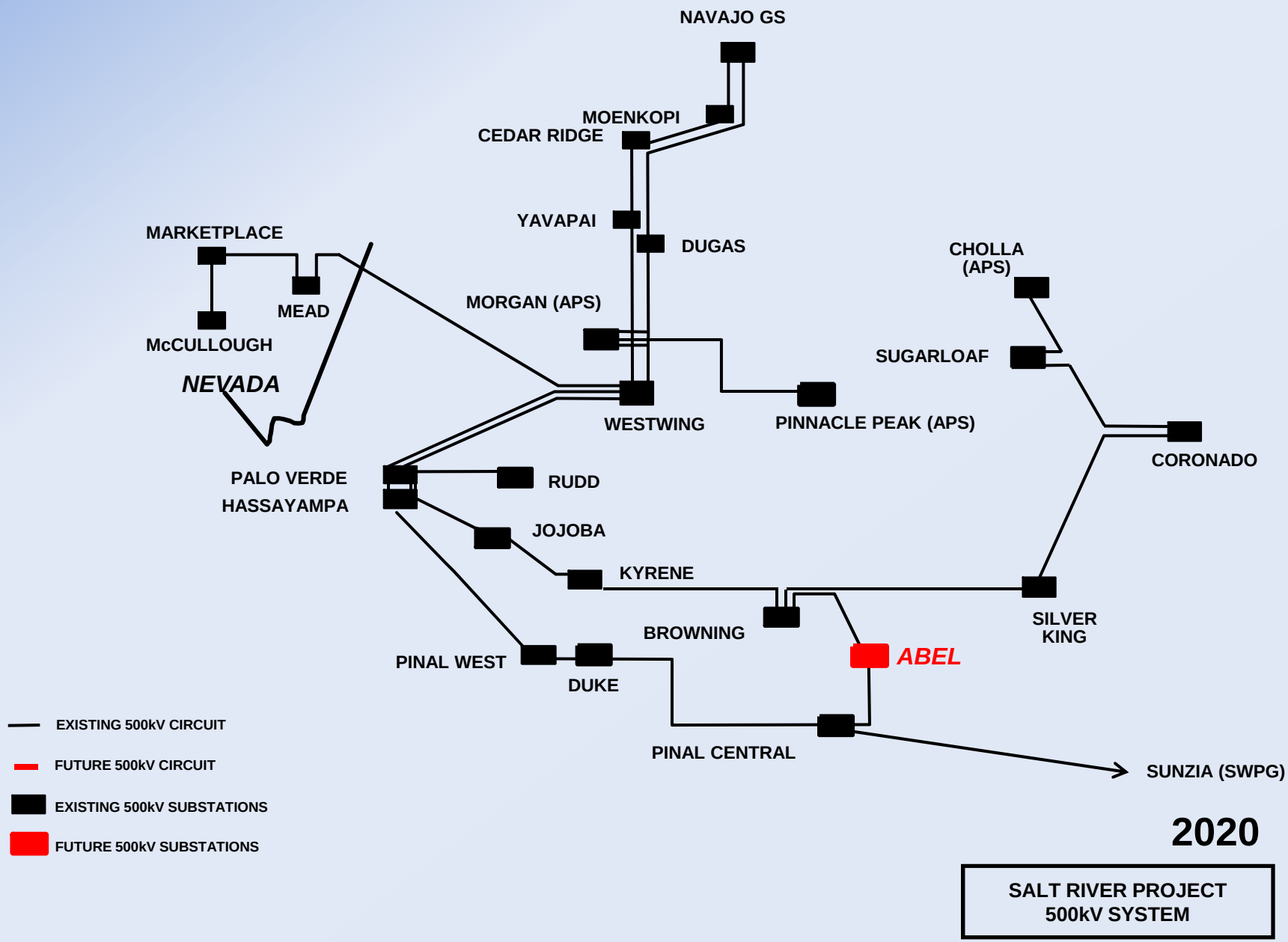
SILVER KING
BROWNING
PINAL WEST
DUKE
PINAL CENTRAL
SUNZIA (SWPG)
EXISTING 500kV CIRCUIT
FUTURE 500kV CIRCUIT
EXISTING 500kV SUBSTATIONS
FUTURE 500kV SUBSTATIONS
2017
SALT RIVER PROJECT
500kV SYSTEM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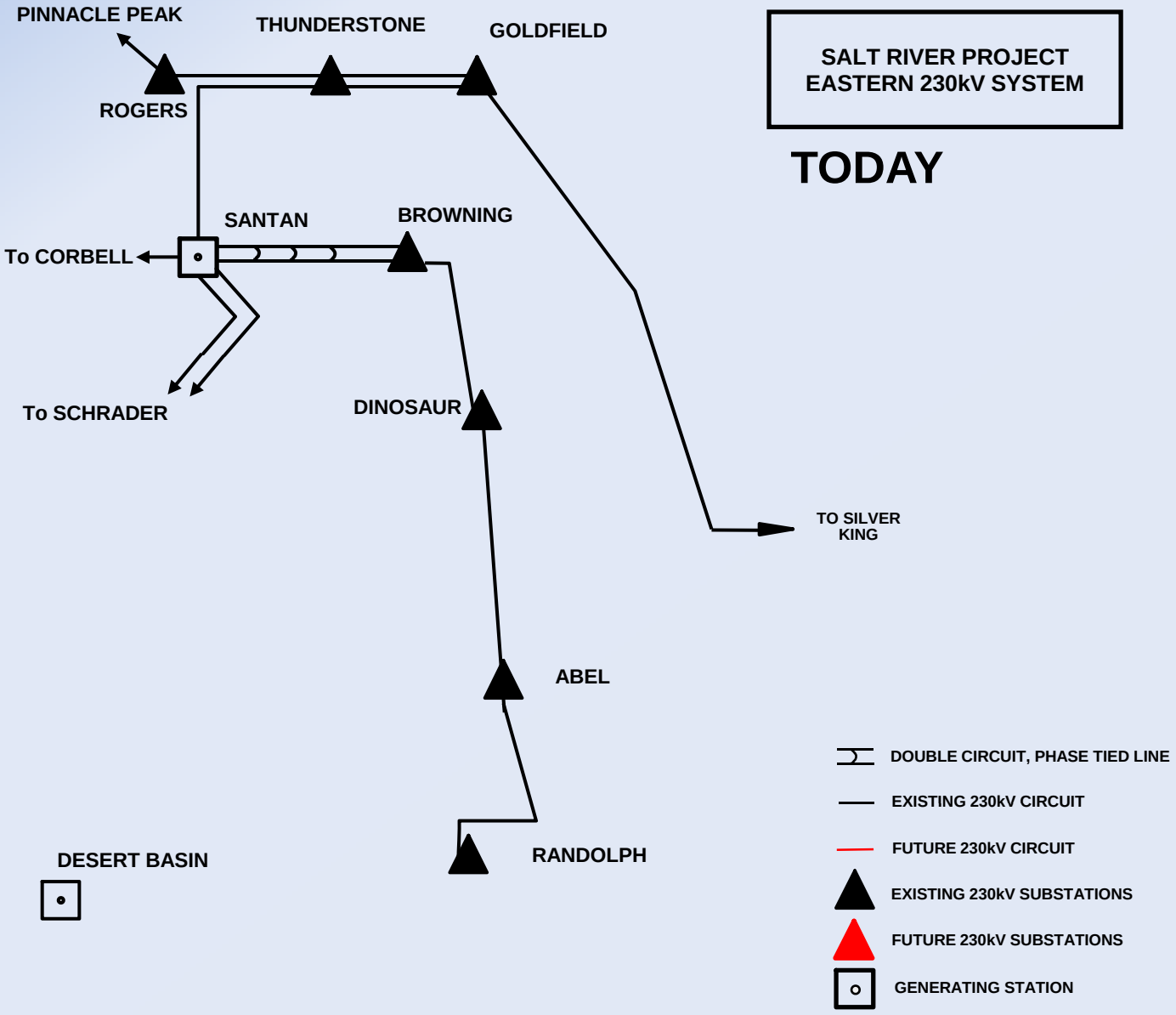
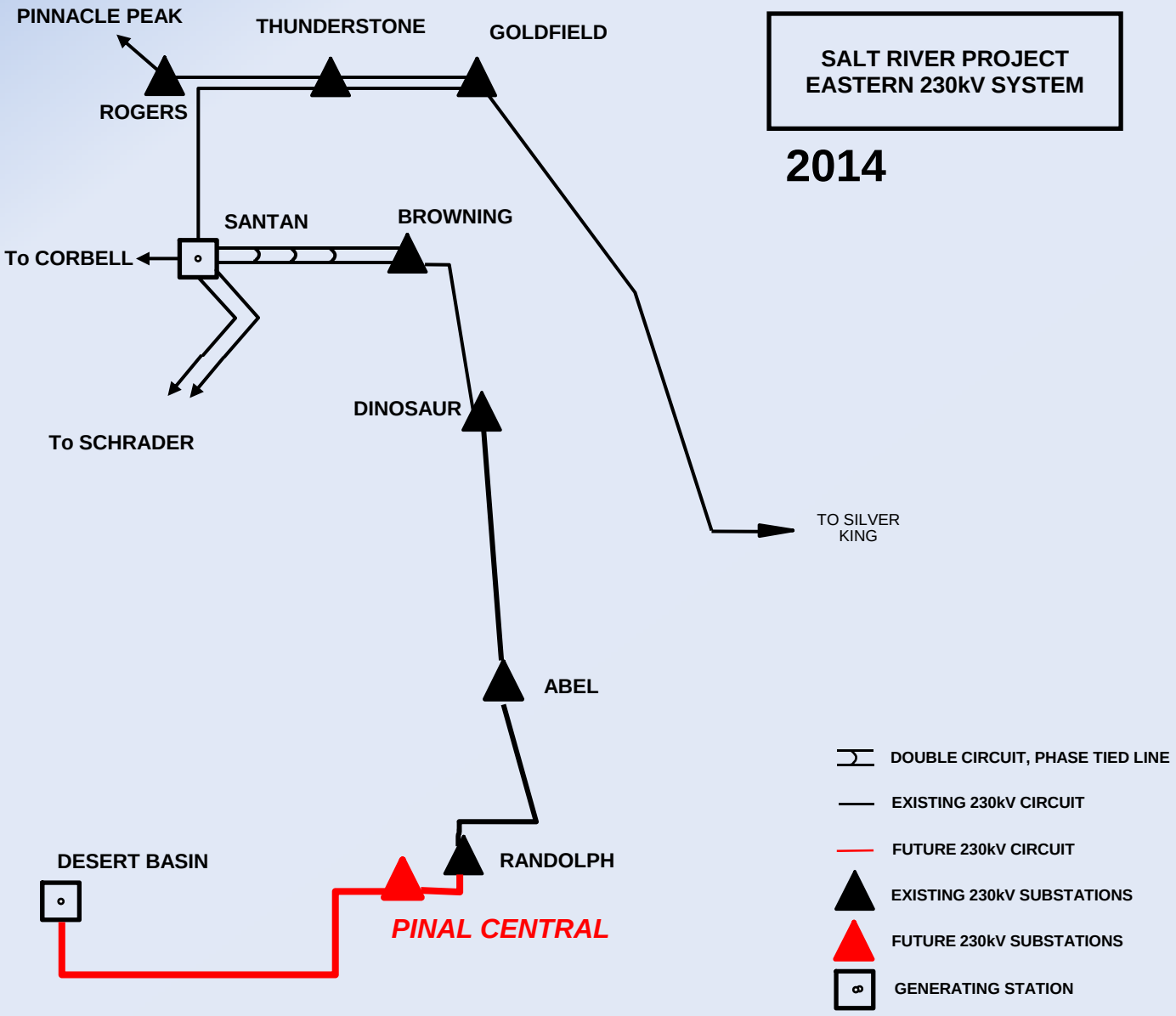
BROWNING
ABEL
PINAL WEST
DUKE
PINAL CENTRAL
SUNZIA (SWPG)
EXISTING 500kV CIRCUIT
FUTURE 500kV CIRCUIT
EXISTING 500kV SUBSTATIONS
FUTURE 500kV SUBSTATIONS
2020
SALT RIVER PROJECT
500kV SYSTEM


PINNACLE PEAK
THUNDERSTONE
GOLDFIELD
ROGERS
SALT RIVER PROJECT
EASTERN 230kV SYSTEM
TODAY
SANTAN
BROWNING
To CORBELL
To SCHRADER
DINOSAUR
TO SILVER
KING
ABEL
RANDOLPH
DESERT BASIN
DOUBLE CIRCUIT, PHASE TIED LINE
EXISTING 230kV CIRCUIT
FUTURE 230kV CIRCUIT
EXISTING 230kV SUBSTATIONS
FUTURE 230kV SUBSTATIONS
GENERATING STATION


PINNACLE PEAK
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GOLDFIELD
ROGERS
SALT RIVER PROJECT
EASTERN 230kV SYSTEM
2014
SANTAN
BROWNING
To CORBELL
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To SCHRADER
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RANDOLPH
PINAL CENTRAL
DOUBLE CIRCUIT, PHASE TIED LINE
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FUTURE 230kV CIRCUIT
EXISTING 230kV SUBSTATIONS
FUTURE 230kV SUBSTATIONS
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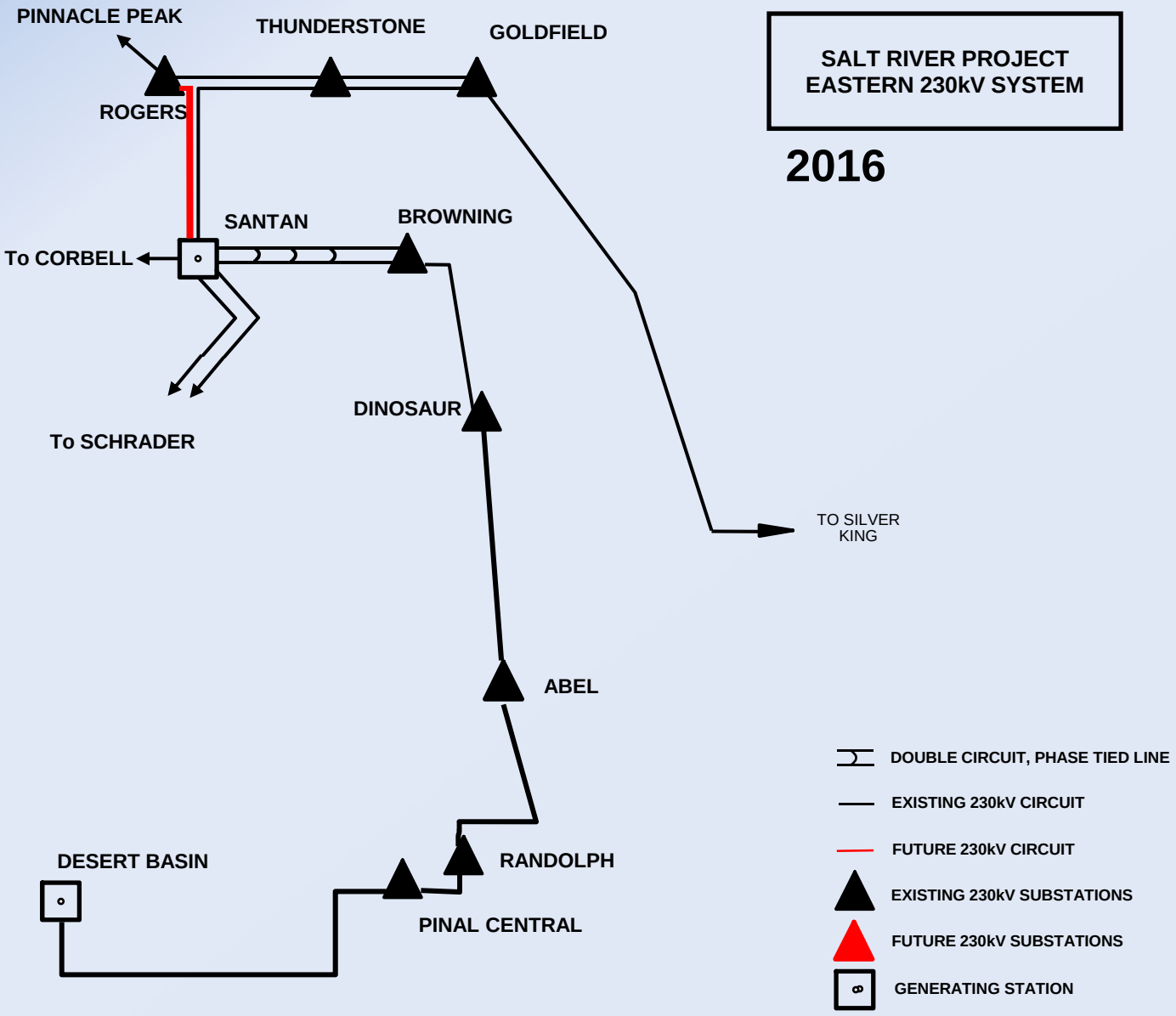
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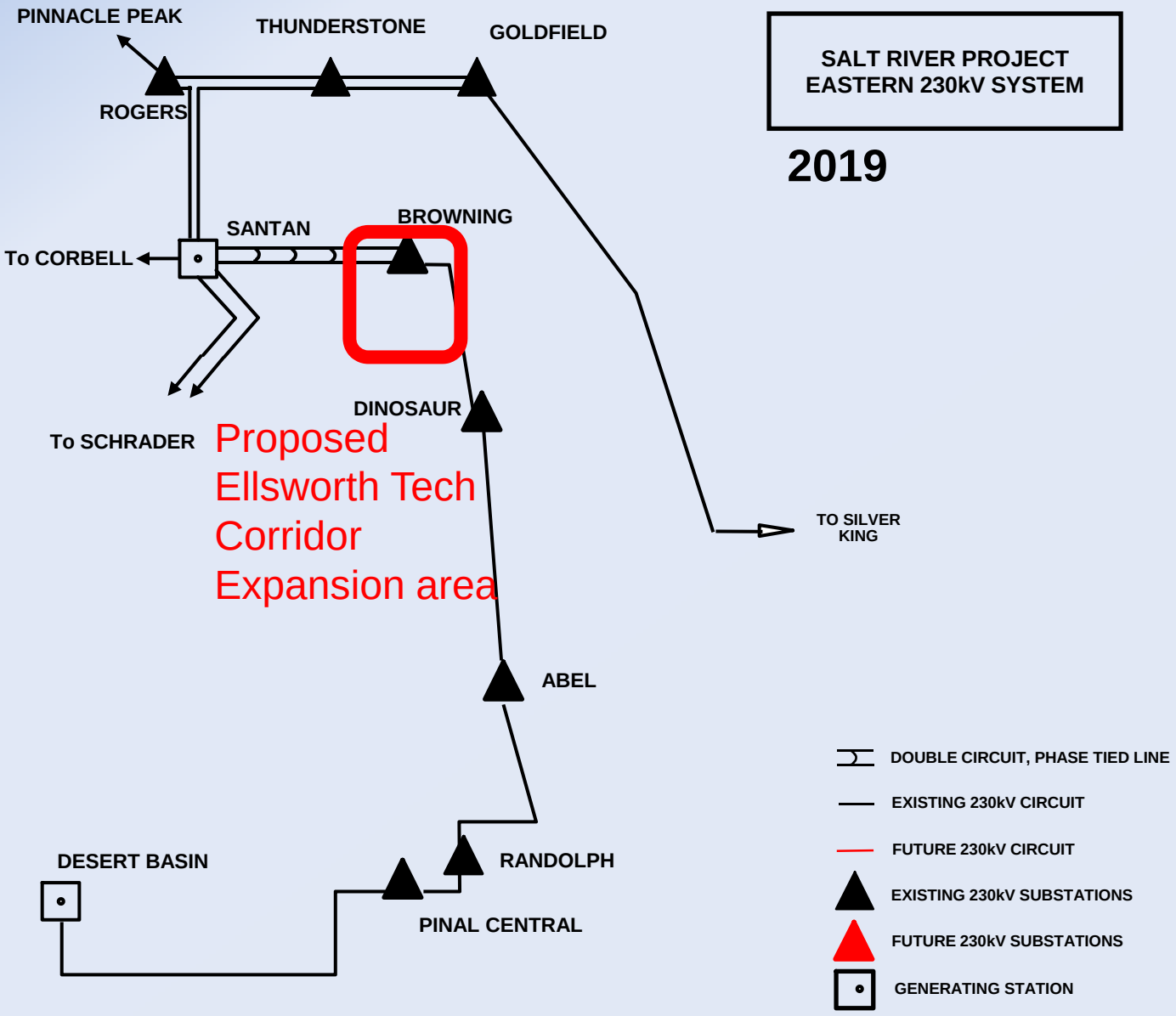
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GOLDFIELD
SALT RIVER PROJECT
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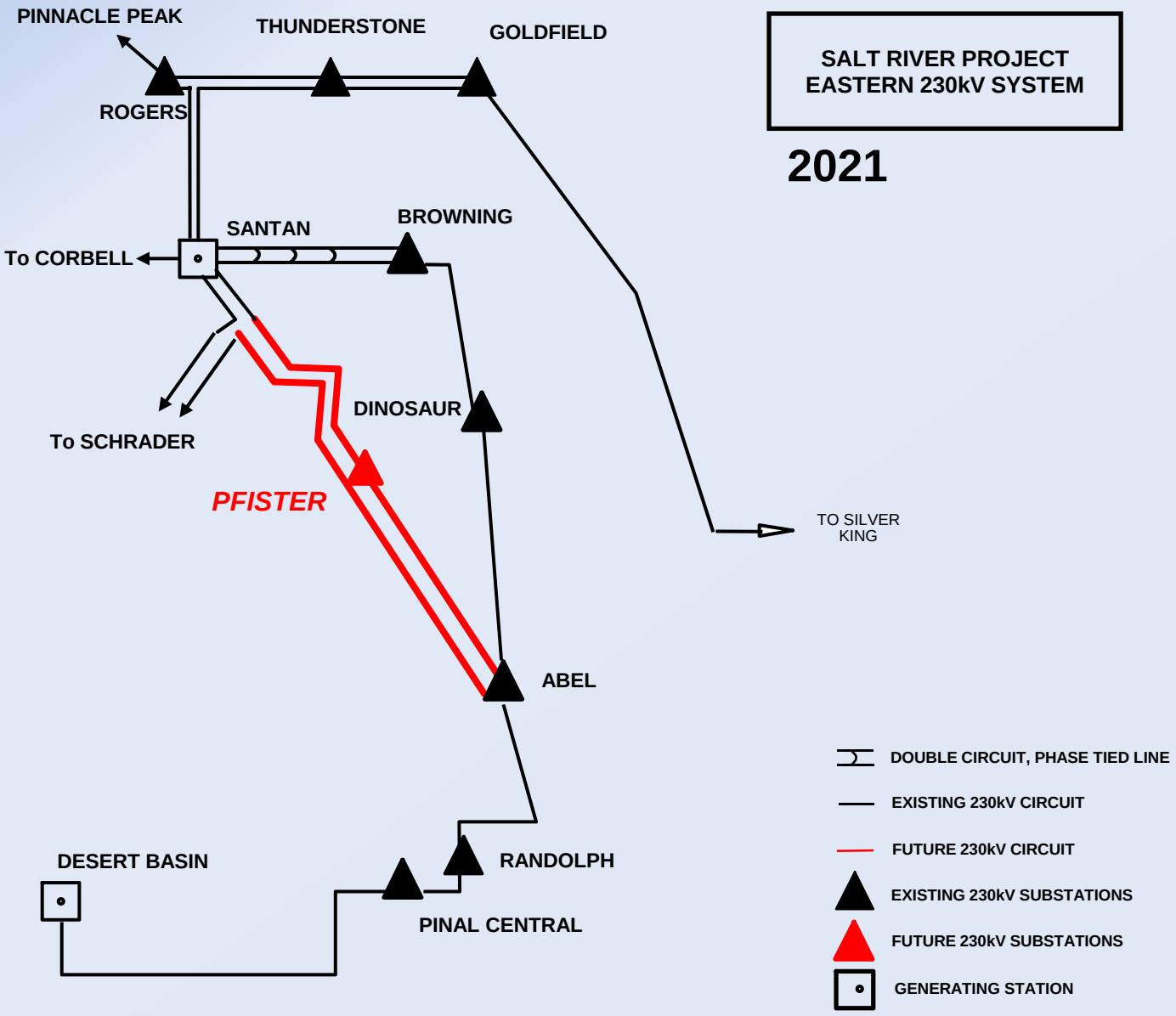
2019
ROGERS
SANTAN
BROWNING
To CORBELL
DINOSAUR
To SCHRADER
Proposed
Ellsworth Tech
Corridor
Expansion area
TO SILVER
KING
ABEL
DESERT BASIN
RANDOLPH
PINAL CENTRAL
DOUBLE CIRCUIT, PHASE TIED LINE
EXISTING 230kV CIRCUIT
FUTURE 230kV CIRCUIT
EXISTING 230kV SUBSTATIONS
FUTURE 230kV SUBSTATIONS
GENERATING STATION


PINNACLE PEAK
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2021
ROGERS
SANTAN
BROWNING
To CORBELL
DINOSAUR
To SCHRADER
PFISTER
TO SILVER
KING
ABEL
DESERT BASIN
RANDOLPH
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DOUBLE CIRCUIT, PHASE TIED LINE
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FUTURE 230kV CIRCUIT
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FUTURE 230kV SUBSTATIONS
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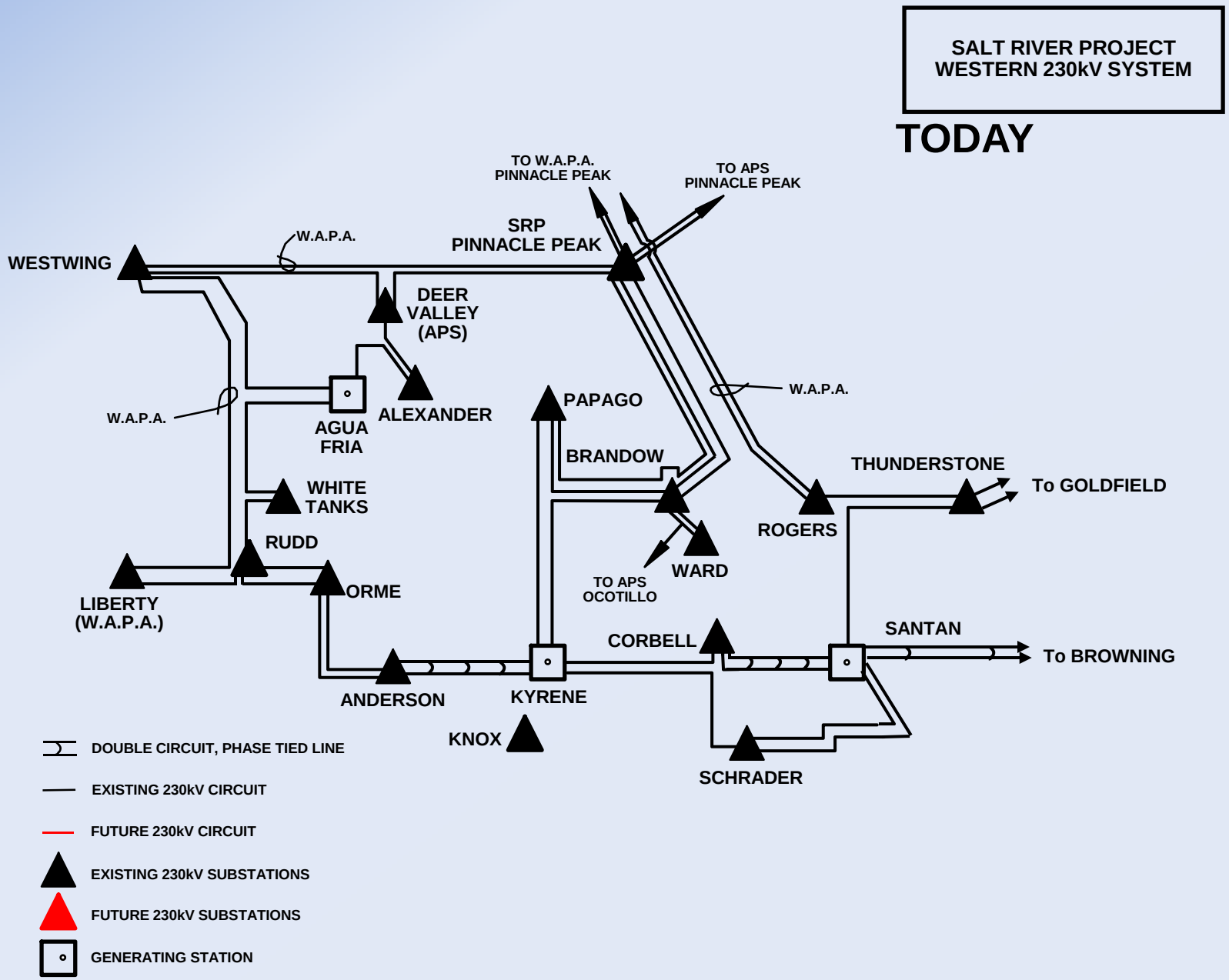
SALT RIVER PROJECT
WESTERN 230kV SYSTEM
TODAY
TO W.A.P.A.
PINNACLE PEAK
TO APS
PINNACLE PEAK
SRP
PINNACLE PEAK
W.A.P.A.
WESTWING
DEER
VALLEY
(APS)
W.A.P.A.
AGUA
FRIA
ALEXANDER
PAPAGO
W.A.P.A.
BRANDOW
THUNDERSTONE
To GOLDFIELD
WHITE
TANKS
ROGERS
RUDD
WARD
TO APS
OCOTILLO
LIBERTY
(W.A.P.A.)
ORME
CORBELL
SANTAN
To BROWNING
ANDERSON
KYRENE
KNOX
SCHRADER
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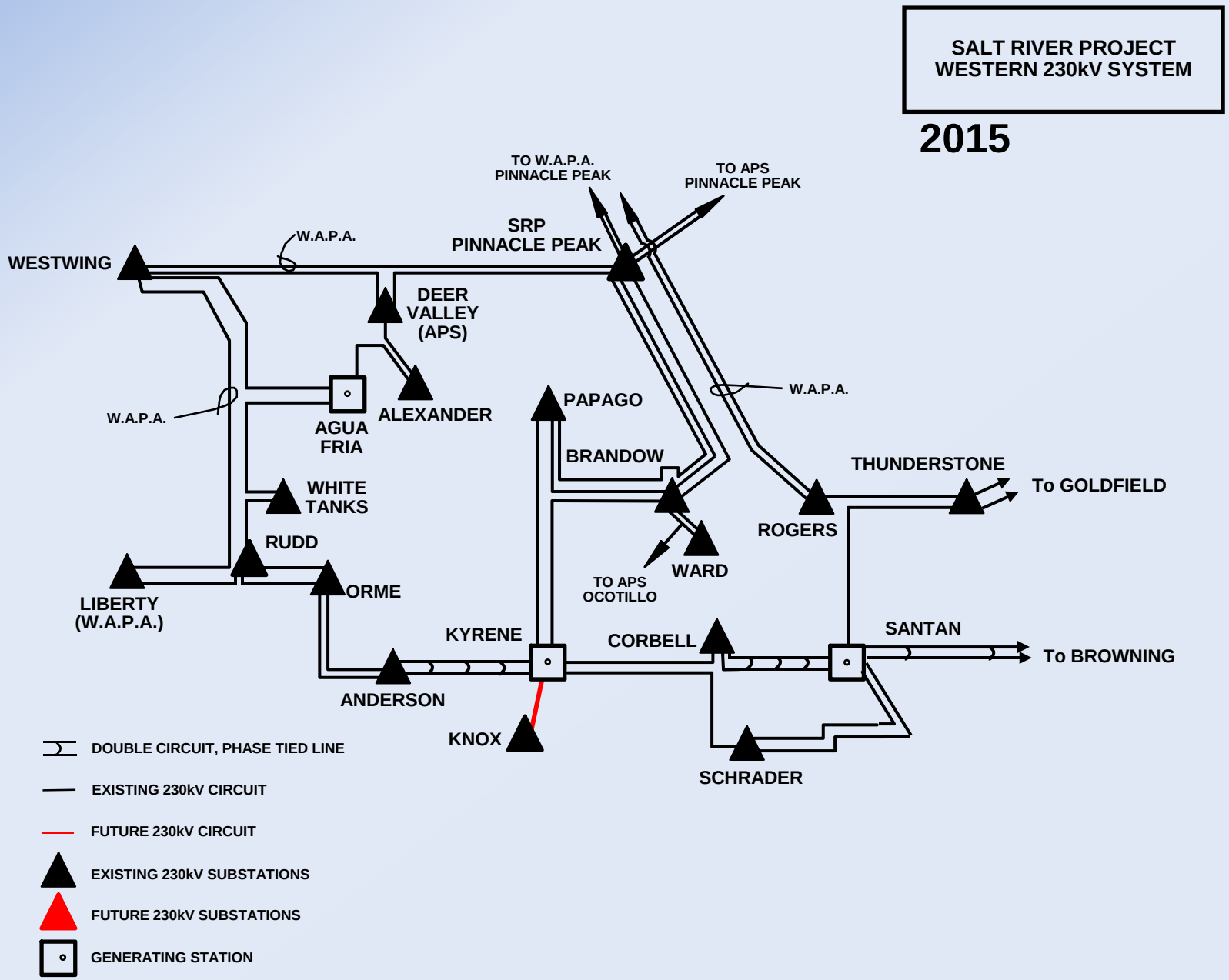
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2015
TO W.A.P.A.
PINNACLE PEAK
TO APS
PINNACLE PEAK
SRP
PINNACLE PEAK
W.A.P.A.
WESTWING
DEER
VALLEY
(APS)
W.A.P.A.
AGUA
FRIA
ALEXANDER
PAPAGO
W.A.P.A.
BRANDOW
THUNDERSTONE
To GOLDFIELD
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TANKS
ROGERS
RUDD
WARD
TO APS
OCOTILLO
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(W.A.P.A.)
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KYRENE
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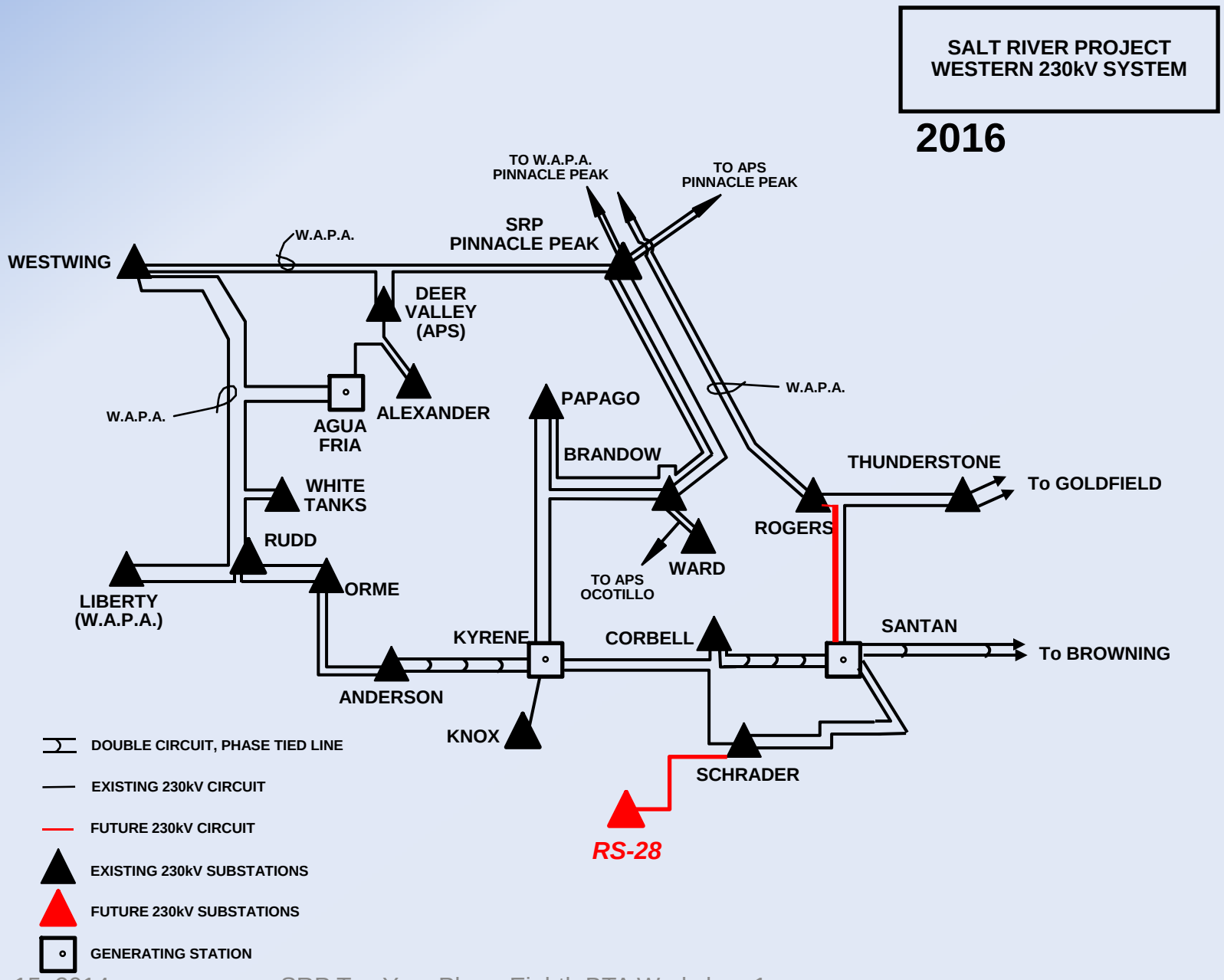
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2016
TO W.A.P.A.
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TO APS
PINNACLE PEAK
SRP
PINNACLE PEAK
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THUNDERSTONE
To GOLDFIELD
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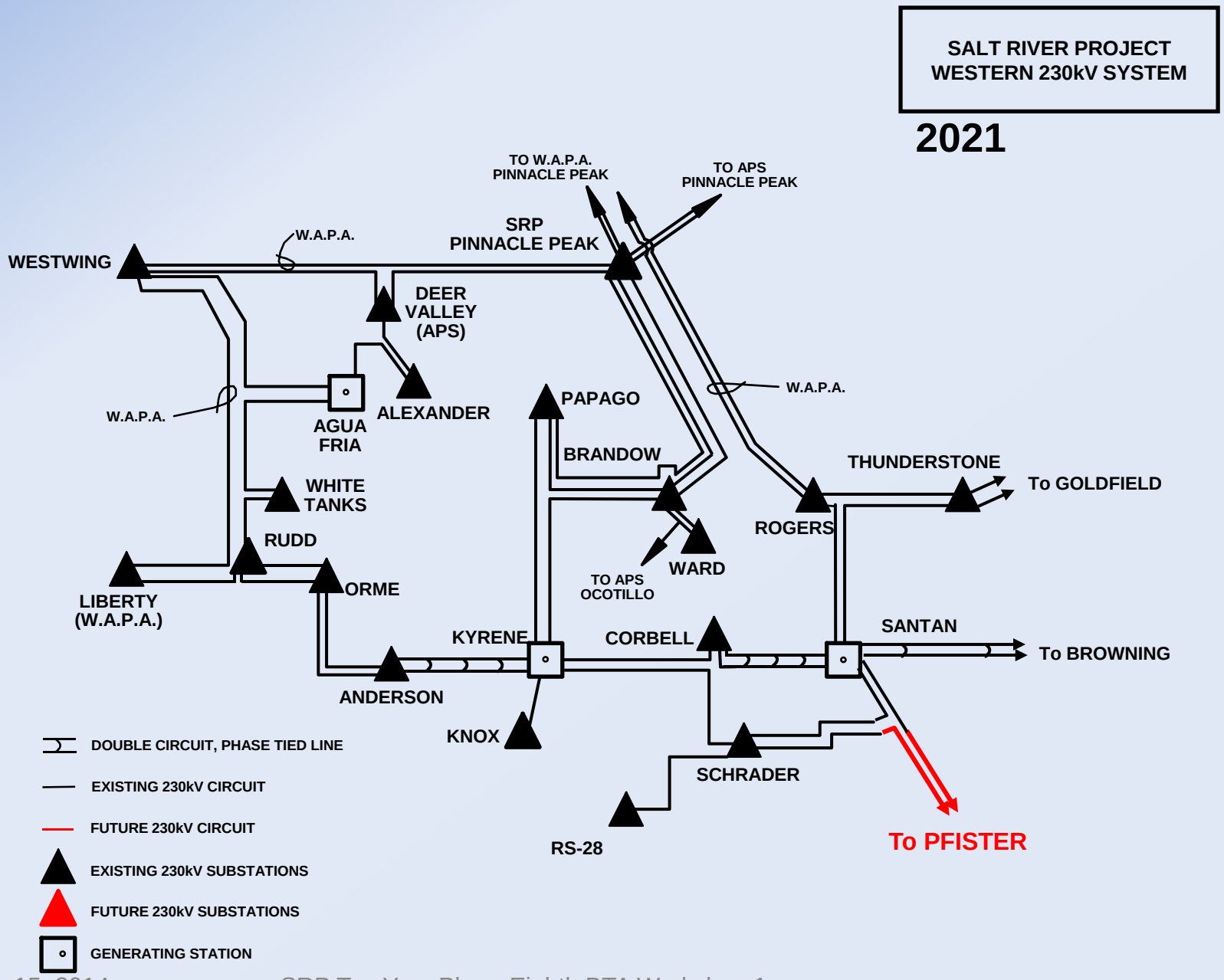
TANKS
ROGERS
RUDD
WARD
TO APS
OCOTILLO
LIBERTY
(W.A.P.A.)
ORME
KYRENE
CORBELL
SANTAN
To BROWNING
ANDERSON
KNOX
SCHRADER
RS-28
DOUBLE CIRCUIT, PHASE TIED LINE
EXISTING 230kV CIRCUIT
FUTURE 230kV CIRCUIT
EXISTING 230kV SUBSTATIONS
FUTURE 230kV SUBSTATIONS
GENERATING STATION


SALT RIVER PROJECT
WESTERN 230kV SYSTEM
2021
TO W.A.P.A.
PINNACLE PEAK
TO APS
PINNACLE PEAK
SRP
PINNACLE PEAK
W.A.P.A.
WESTWING
DEER
VALLEY
(APS)
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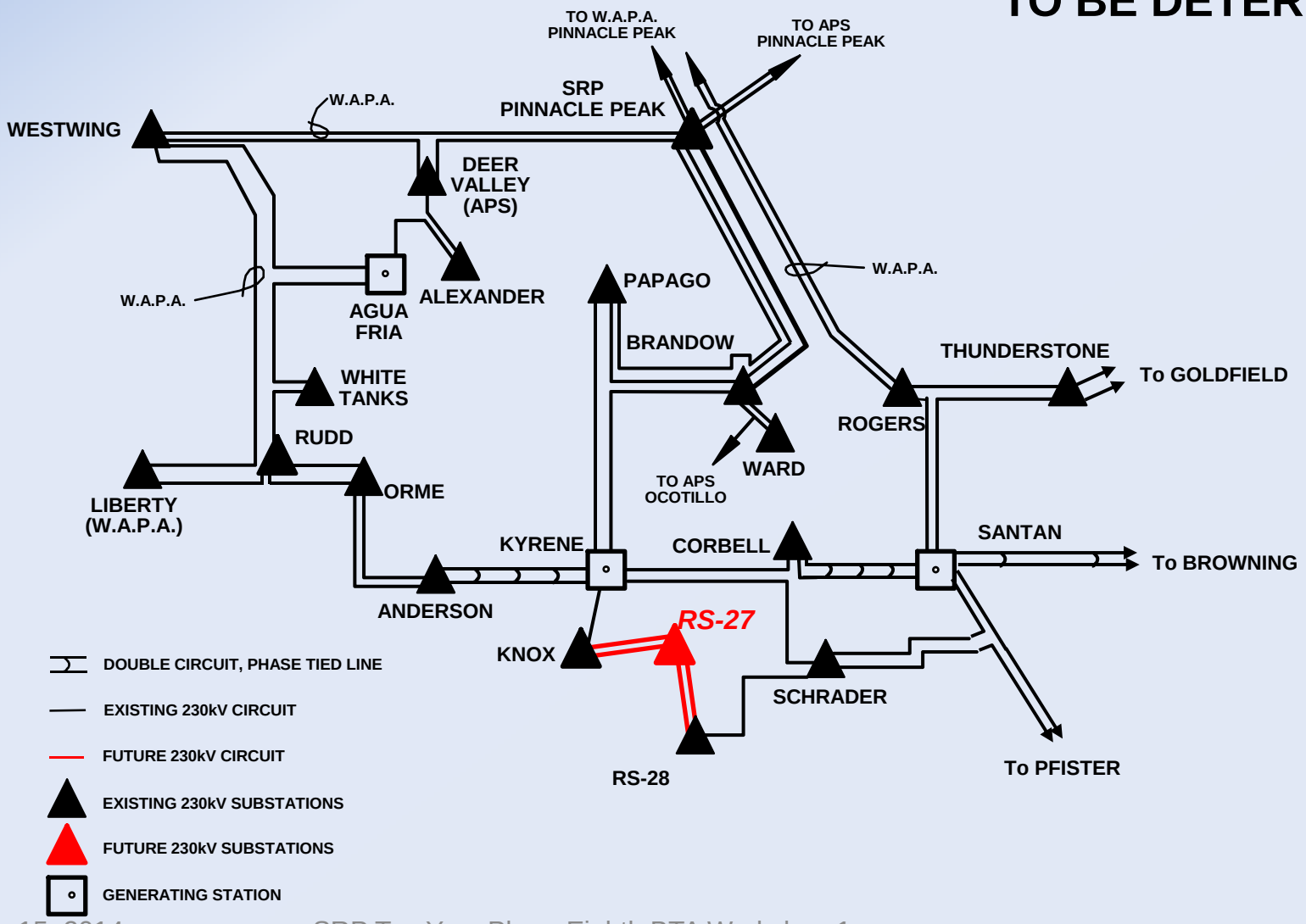
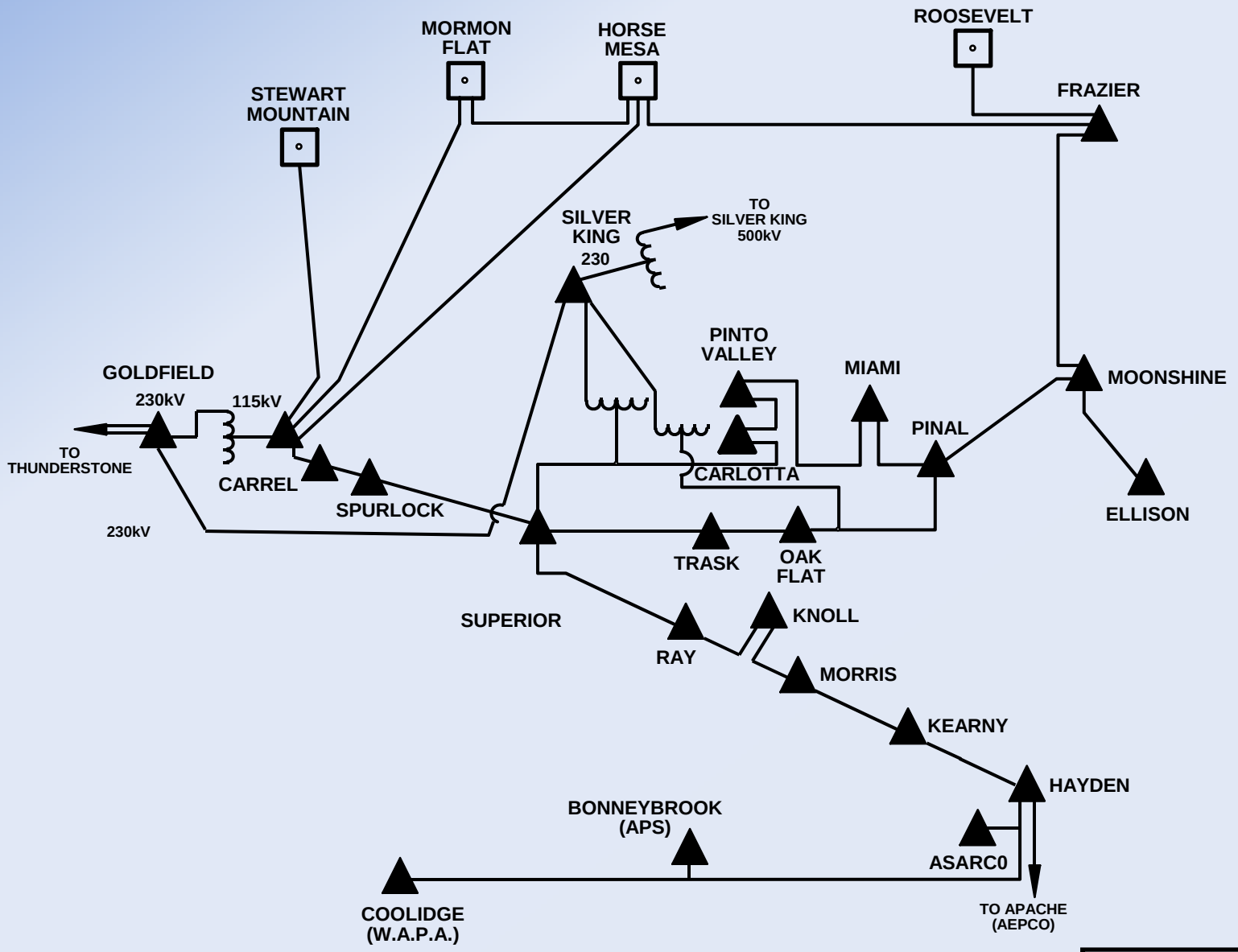
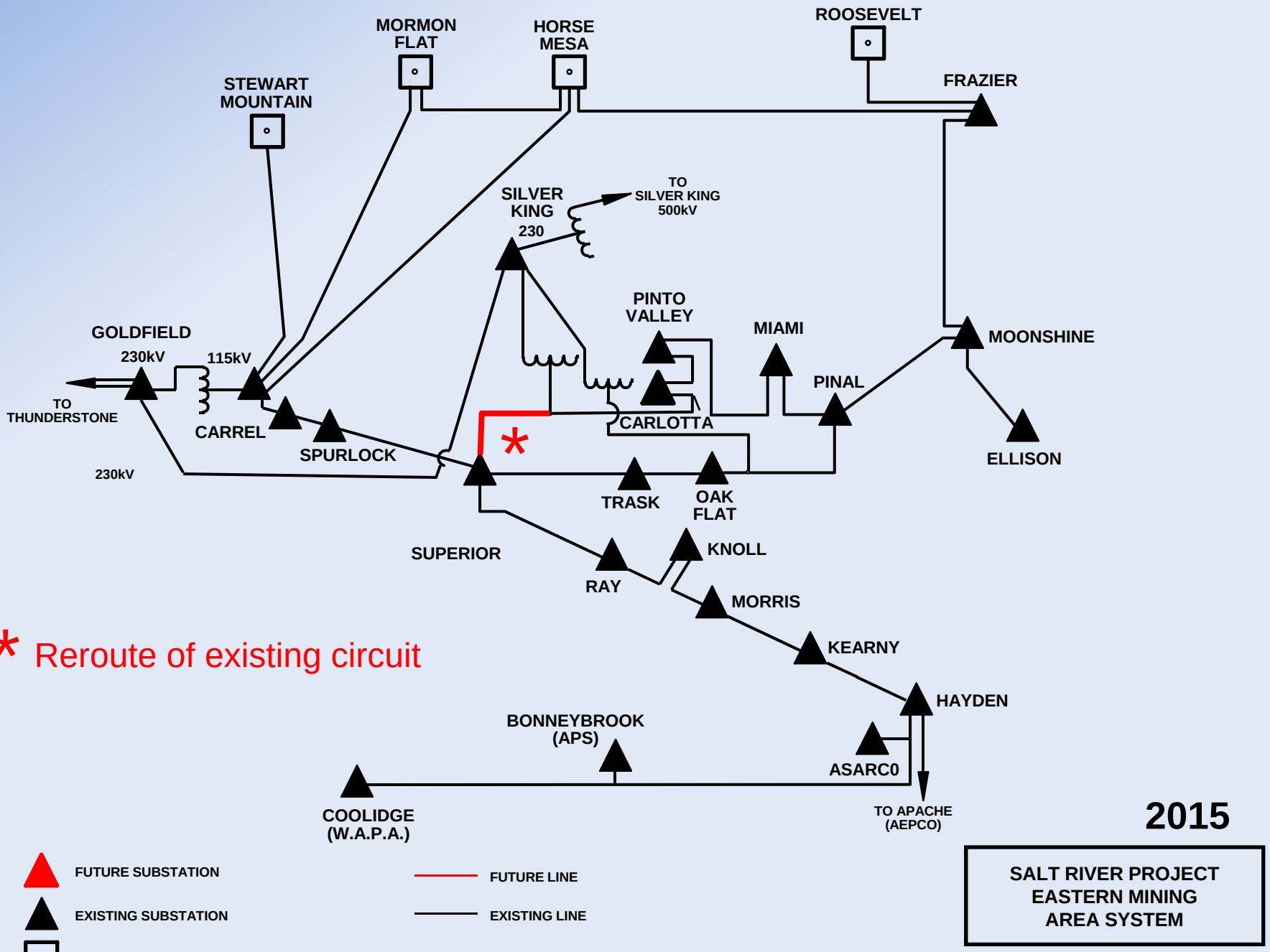
FUTURE 230kV SUBSTATIONS
GENERATING STATION

SALT RIVER PROJECT
WESTERN 230kV SYSTEM

TO BE DETERMINED




MORMON FLAT
HORSE MESA
ROOSEVELT
STEWART MOUNTAIN
FRAZIER
SILVER KING
230
TO SILVER KING 500kV
PINTO VALLEY
MIAMI
MOONSHINE
GOLDFIELD
230kV
115kV
TO THUNDERSTONE
CARREL
SPURLOCK
CARLOTTA
PINAL
ELLISON
230kV
TRASK
OAK FLAT
SUPERIOR
KNOLL
RAY
MORRIS
KEARNY
HAYDEN
BONNEYBROOK (APS)
ASARC0
COOLIDGE (W.A.P.A.)
TO APACHE (AEPCO)
TODAY
FUTURE SUBSTATION
EXISTING SUBSTATION
GENERATING STATION
FUTURE LINE
EXISTING LINE
SALT RIVER PROJECT
EASTERN MINING
AREA SYSTEM


MORMON FLAT
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STEWART MOUNTAIN
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TO SILVER KING 500kV
PINTO VALLEY
MIAMI
MOONSHINE
GOLDFIELD
230kV
115kV
TO THUNDERSTONE
CARREL
SPURLOCK
CARLOTTA
PINAL
ELLISON
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KNOLL
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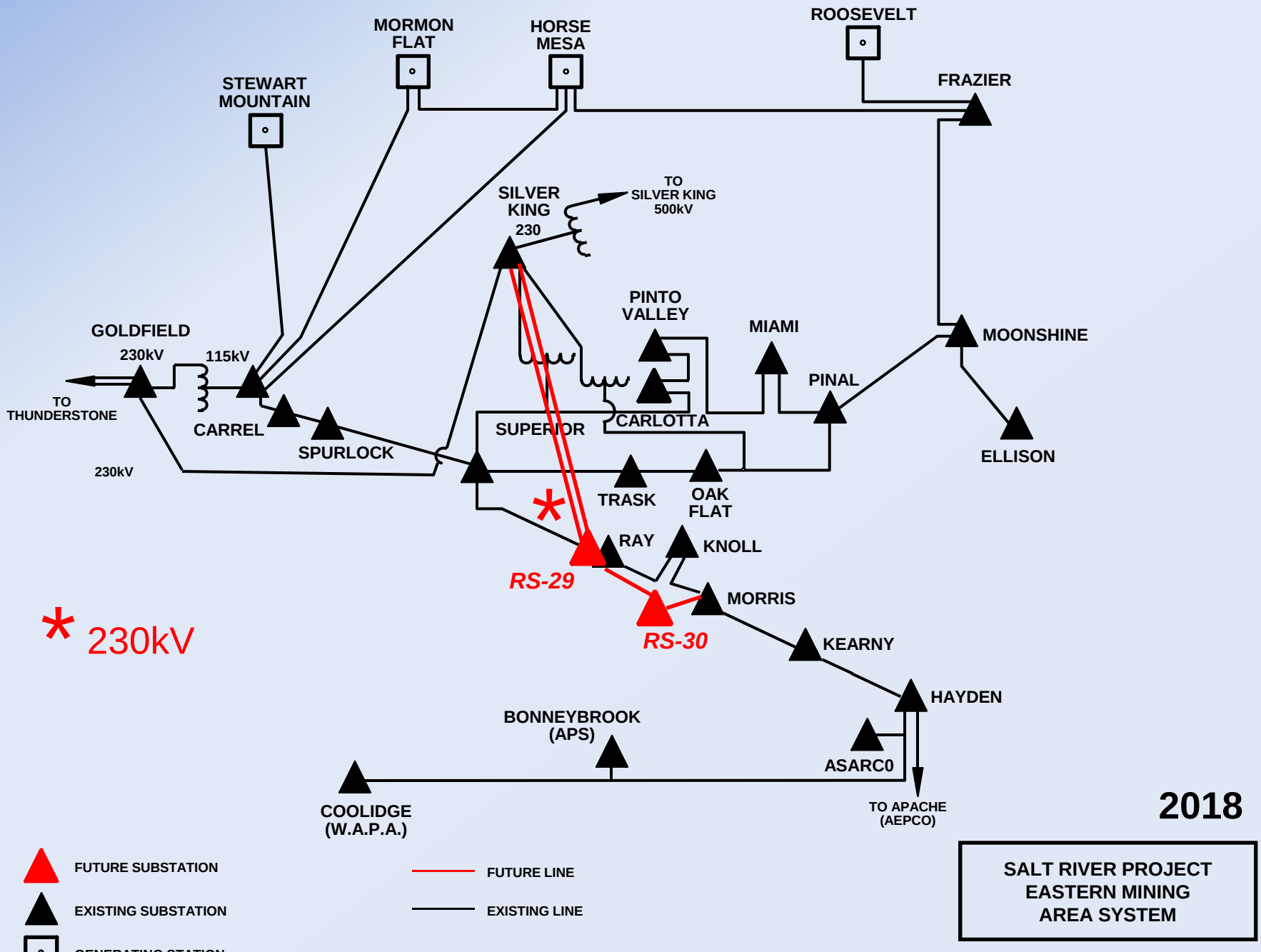
MORRIS
KEARNY
HAYDEN
BONNEYBROOK (APS)
ASARC0
COOLIDGE (W.A.P.A.)
TO APACHE (AEPCO)
* Reroute of existing circuit
FUTURE SUBSTATION
EXISTING SUBSTATION
GENERATING STATION
FUTURE LINE
EXISTING LINE
2015
SALT RIVER PROJECT
EASTERN MINING
AREA SYSTEM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TO SILVER KING 500kV
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230kV
115kV
TO THUNDERSTONE
CARREL
SPURLOCK
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SUPERIOR
CARLOTTA
PINAL
ELLISON
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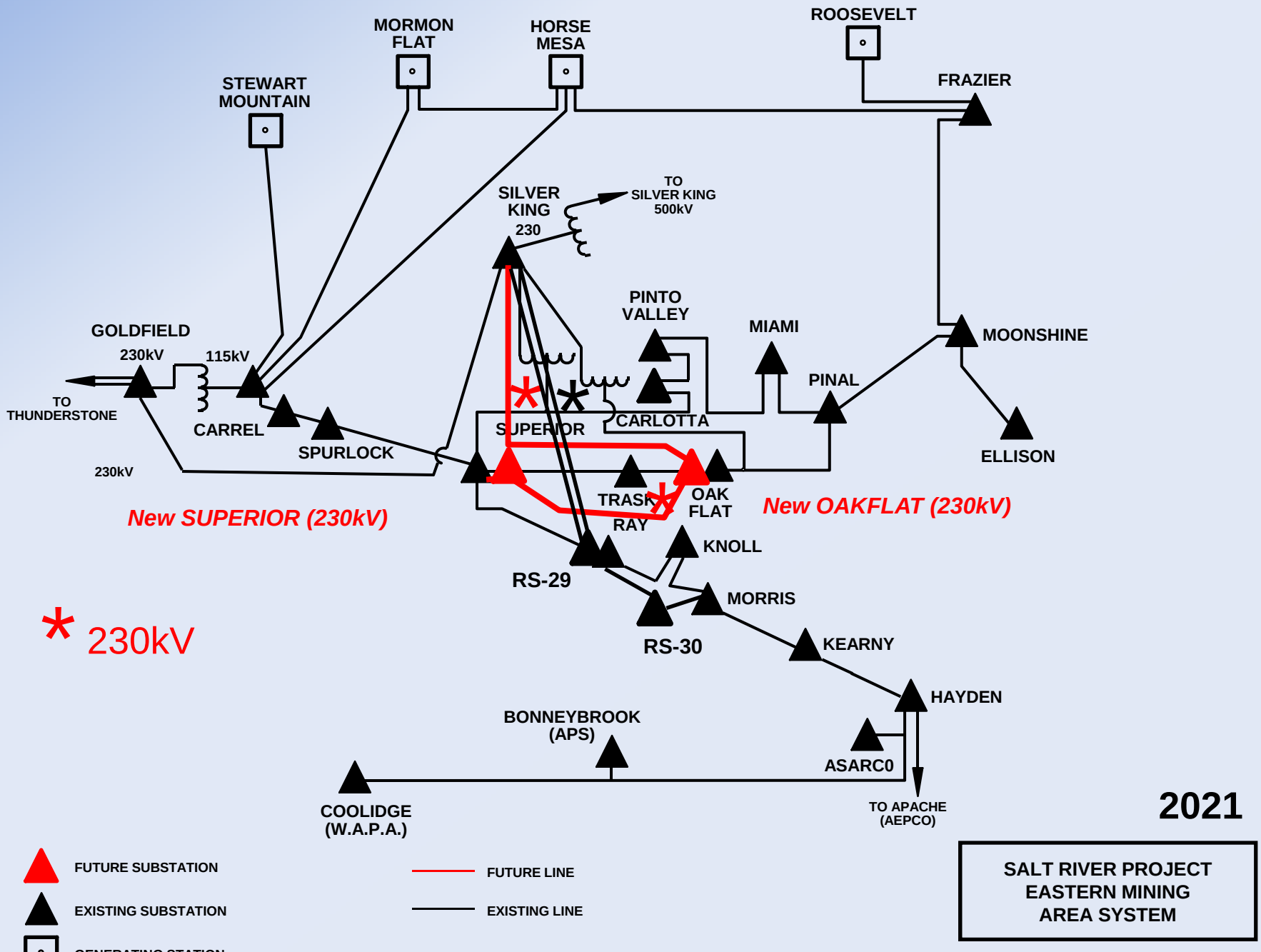
OAK FLAT
RAY
KNOLL
RS-29
RS-30
MORRIS
KEARNY
HAYDEN
BONNEYBROOK (APS)
ASARC0
COOLIDGE (W.A.P.A.)
TO APACHE (AEPCO)
* 230kV
2018
FUTURE SUBSTATION
EXISTING SUBSTATION
GENERATING STATION
FUTURE LINE
EXISTING LINE
SALT RIVER PROJECT
EASTERN MINING
AREA SYSTEM


MORMON FLAT
HORSE MESA
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SILVER KING
230
TO SILVER KING 500kV
PINTO VALLEY
MIAMI
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GOLDFIELD
230kV
115kV
TO THUNDERSTONE
CARREL
SPURLOCK
SUPERIOR
CARLOTTA
PINAL
ELLISON
230kV
New SUPERIOR (230kV)
TRASK
RAY
OAK FLAT
New OAKFLAT (230kV)
KNOLL
RS-29
MORRIS
RS-30
KEARNY
HAYDEN
BONNEYBROOK (APS)
ASARC0
COOLIDGE (W.A.P.A.)
TO APACHE (AEPCO)
* 230kV
2021
FUTURE SUBSTATION
EXISTING SUBSTATION
GENERATING STATION
FUTURE LINE
EXISTING LINE
SALT RIVER PROJECT
EASTERN MINING
AREA SYSTEM

Summary Status

Project	I/S	Status
Pinal Central – Randolph 230kV	2014	Const
Pinal Central – Browning 500kV	2014	Const
Pinal West – Pinal Central 500kV,230kV	2014	Const
Duke 500kV Substation	2014	
Desert Basin – Pinal Central	2014	
Price Road Corridor	2015-TBD	Not Sited
Superior – Silver King Re-route	2015	Design
Rogers – Santan	2016	
Sunzia	2017	Not Sited (SRP a Participant in Project)
Eastern Mining Expansion	2018	Not Sited
Ellsworth Technology Corridor	2019	Sited
Abel 500kV Substation	2020	Design
Abel – Pfister – Ball	2021	Design/ROW
New Superior – New Oak Flat	2021	Not Sited
New Oak Flat – Silver King	2021	Sited

SRP Changes from 7th BTA to 8th BTA

Completed Projects

3rd Kyrene 500/230kV Transformer (2012)

3rd Schrader 230/69kV Transformer (2013)

Rogers – Thunderstone 230kV Re-Conductor (2013)

SRP Changes from 7th BTA to 8th BTA

500kV Projects

2013-2015 Palo Verde – Delaney – Sun Valley

SRP has withdrawn

2014 Pinal Central – Tortolita

SRP has withdrawn

2016 Sun Valley – Morgan

SRP has withdrawn

2016 SunZia

Now 2017

SRP Changes from 7th BTA to 8th BTA

230kV Projects

2016 East Valley Industrial Expansion

Now Price Road Corridor and 2015-TBD

2019-2021 *Abel* – Pfister – Ball

Now 2021

2019 New *Oak Flat to Silver King*

Now 2021

2019 New *Superior to New Oak Flat*

Now 2021

2019 Ellsworth Technology Corridor

New project

2021 New *Silver King to New Pinto Valley*

Withdrawn; Customer is no longer pursuing

SRP Changes from 7th BTA to 8th BTA

115kV Projects

2013 *Superior – Silver King* re-route

Now 2015

2015 Eastern Mining Expansion

Now 2018

SRP Changes from 7th BTA to 8th BTA

TBD Projects that have been removed:

- **Pinal Central – Abel – RS20 500kV**
- **Hassayampa – Pinal West 500kV #2**
- **Northeast Arizona to Phoenix 500kV**
- **Palo Verde – Saguaro 500kV**
- **Ball (RS17) 230kV Loop-in**
- **Silver King – Browning 230kV**
- **Superior 230kV Loop-in**
- **Thunderstone – Browning 230kV**
- **Pinnacle Peak – Brandow 230kV**
- **Browning – Corbell 230kV**
- **Silver King – Knoll – New Hayden 230kV**
- **New Hayden 115kV Station Loop-in**
- **RS25 Project**
- **RS26 Project**

Electric System Additions/Upgrades

Equipment	Year
Reactive Devices	
Pinal Central	**2014**
Silver King - Coronado	**2017**
Transformers	
Browning 230/69kV transformer	**2014**
Rudd 230/69kV transformer	**2019**

1. Describe all technical studies that were performed in support of your filed transmission plan

Ten Year Plan Technical Study

- System improvements and upgrades proposed within the ten year plan were included in each case
- Power flow performed for each of the ten years
- Power flow analysis showed no overloads for N-1 outages on SRP's system
- Stability Study analyzed transmission system for its ultimate ten year build-out in 2023
- Stability Study showed the transmission system remains stable following an outage

1. Technical studies performed (cont.)

SWAT-AZ 2013 Ten Year Snapshot Study

- Collaborative effort to assess Arizona transmission system based on participants' ten year plans
- Analyzed how participants' ten year plans perform as a whole and the effect of removing an individual project
- Includes N-0, N-1, and N-1-1 conditions on transmission system forecasted in the tenth year (2023)
- Study showed the planned transmission system in 2023 is robust and the delay of any one project beyond 2023 won't result in significant adverse effects on the remaining transmission system

1. Technical studies performed (cont.)

SWAT 2014 Extreme Contingency Study

- Done to determine the impact to load serving capability of Phoenix load area due to simultaneous outage of multiple transmission elements within a common corridor, or multiple transformers of the same voltage class within a substation
- Confidential Study showed that for all outages studied, all load can be served and local Phoenix reserve requirements met

2. List all reports that exist for the studies identified in item 1 and identify which reports were not included in your ten year plan filing.

Reports for each of the studies identified in item 1 were filed in the 8th BTA docket:

- SRP Technical Study included with SRP's 2014 Ten Year Plan
- SWAT-AZ 2013 Ten Year Snapshot Study submitted by SWAT
- SWAT 2014 Extreme Contingency Study submitted by SWAT under NDA

3. Identify all transmission projects in your transmission plan for which power flow and stability analyses have not been performed or for which reports have not been filed. Describe how and when do you intend to respond with the required studies and reports.

Power flow and stability analyses were performed for all of SRP's transmission projects included in its 2014 Ten Year Plan, except for the following three projects due to their uncertainty of timing and scope as the projects are solely dependent on load growth developing in the areas:

- Ellsworth Technology Corridor
- New Superior – New Oak Flat 230kV
- New Oak Flat – Silver King 230kV

These projects will be included in future studies/reports once more certainty of load is known.

4. Describe any stakeholder input and review that occurred regarding your transmission plan.

- Defined projects included in WECC base case submissions
- WECC base cases used as basis for WestConnect and SWAT base cases
- APS/SRP joint FERC Order 890 (OATT) stakeholder meetings - 6/20/2013 and 12/19/2013
- Regional planning meetings of SWAT, WestConnect, WECC, PCC, and TEPPC open to stakeholders

5. Please identify the subregional transmission planning forum(s) in which your transmission plan was addressed. Were your project(s) or planned facilities studied in that forum? Did your project(s) or plan undergo a peer review in that subregional forum and were they incorporated in the subregional plan?

- SWAT
- Projects were included in all base cases of the subregional plans; No deficiencies identified

6. Identify all projects in your filed transmission plans that were not addressed in a subregional transmission planning forum.

Due to the uncertainty of timing and scope, as these projects are solely dependent on load growth developing in the areas:

- Ellsworth Technology Corridor
- New Superior – New Oak Flat 230kV
- New Oak Flat – Silver King 230kV

7. Describe which transmission projects have been avoided or delayed by the effects of distributed generation and energy efficiency programs.

No transmission projects have been avoided or delayed by the effects of distributed generation and energy efficiency programs.

8. Describe the steps being taken to evaluate the transmission system adequacy impacts of the potential coal plant closures resulting from Environmental Protection Agency regulations.

- SWAT Coal Generation Reduction Assessment
  - SWAT task force formed on February 19, 2013
  - Current study effort to determine any reliability issues due to loss of inertia from coal plant output reductions/shutdowns
  - Additional study work planned to address path ratings impacts
  - Coordination with TEPPC, NREL (Western Wind and Solar Integration Study)
  - Outreach to WestConnect and CAISO

9. Describe how the Arizona-Southern California September 8, 2011 outage has affected transmission system adequacy planning within your company.

As a member of WECC, SRP is working diligently to improve upon system adequacy planning and is participating in WECC activities in response to the outage.

- Specific SRP enhancements include:
  - Integration and coordination of seasonal studies by sub-region (Southwest Area Study Group – SASG)
  - Inclusion of internal and external sub 100kV facilities in modeling
  - Inclusion of multiple base cases (studies expanded by virtue of seasonal studies)
  - Sharing of relay trip settings with WECC members
  - Expansion of cases on which planning studies are performed to cover critical system conditions across the planning horizon
  - Benchmarking models against actual data – dynamics simulation

10. Describe the steps being taken to evaluate the impacts on transmission system adequacy, including transmission system ancillary service requirements, of the increasing penetration of variable energy resources.

- Participation in forums discussing and analyzing the integration of renewable resources into power systems (WECC VGS (Variable Generation Subcommittee), WECC TEPPC, EPRI)
- Participation in the Southwest Variable Energy Resource Initiative (SVERI), formed in Fall 2012
  - Evaluating likely penetration, locations and operating characteristics of variable energy resources within the Southwest over the next 20 years
  - Exploring tools that may facilitate variable energy resource integration and provide benefits to customers
  - Partnered with University of Arizona to collect, display (via a dedicated website), and analyze generator output and load data from across the desert southwest

Questions ?