ORIGINAL

Southwest Transmission Partners

January 27, 2017

Arizona Corporation Commission
Docket Control, Room 108
1200 West Washington Street
Phoenix, Arizona 85007

Docket No. E-00000D-17-0001

Re: North Gila – Imperial Valley #2 Transmission Project - Ten Year Plan Filing

To Whom It May Concern:

Southwest Transmission Partners, LLC is planning to build a 500 kV transmission line referred to as the North Gila – Imperial Valley #2 ("NG-IV#2") Transmission Project. Per A.R.S. 40-360.02, the attached outlines the Ten-Year Plan for the proposed NG-IV#2 Project which is briefly summarized below.

The 500kV NG-IV#2 transmission line will run from the existing North Gila 500kV substation northeast of Yuma in Yuma County, Arizona into California where it will interconnect to the existing Imperial Valley 500kV substation southwest of El Centro in Imperial County. Approximately 7 miles of the 90-mile project would be located in Arizona (as currently proposed and within an existing BLM designated corridor). The portion of the line in Arizona would parallel existing / approved lines. The BLM will be the lead federal agency for the federal permitting and is expected to be initiated in 2017. We would expect to before the Arizona Corporation Commission sometime in 2019.

The NG-IV#2 Project has been actively involved with the Southwest Area Transmission ("SWAT"), WestConnect and California Independent System Operator ("CAISO") transmission planning forums. The NG-IV#2 Project provides for an incremental reliability benefit for the Arizona and southern California transmission systems, and allows for incremental transmission capacity for the load serving entities across the desert southwest.

The attached Report (North Gila – Imperial Valley #2 WECC Comprehensive Progress Report) is being submitted to demonstrate power flow and transient stability analysis including the NG-IV#2 transmission line.

Respectfully submitted,

Mark L. Etherton, P.E. – Managing Partner
SOUTHWEST TRANSMISSION PARTNERS, LLC

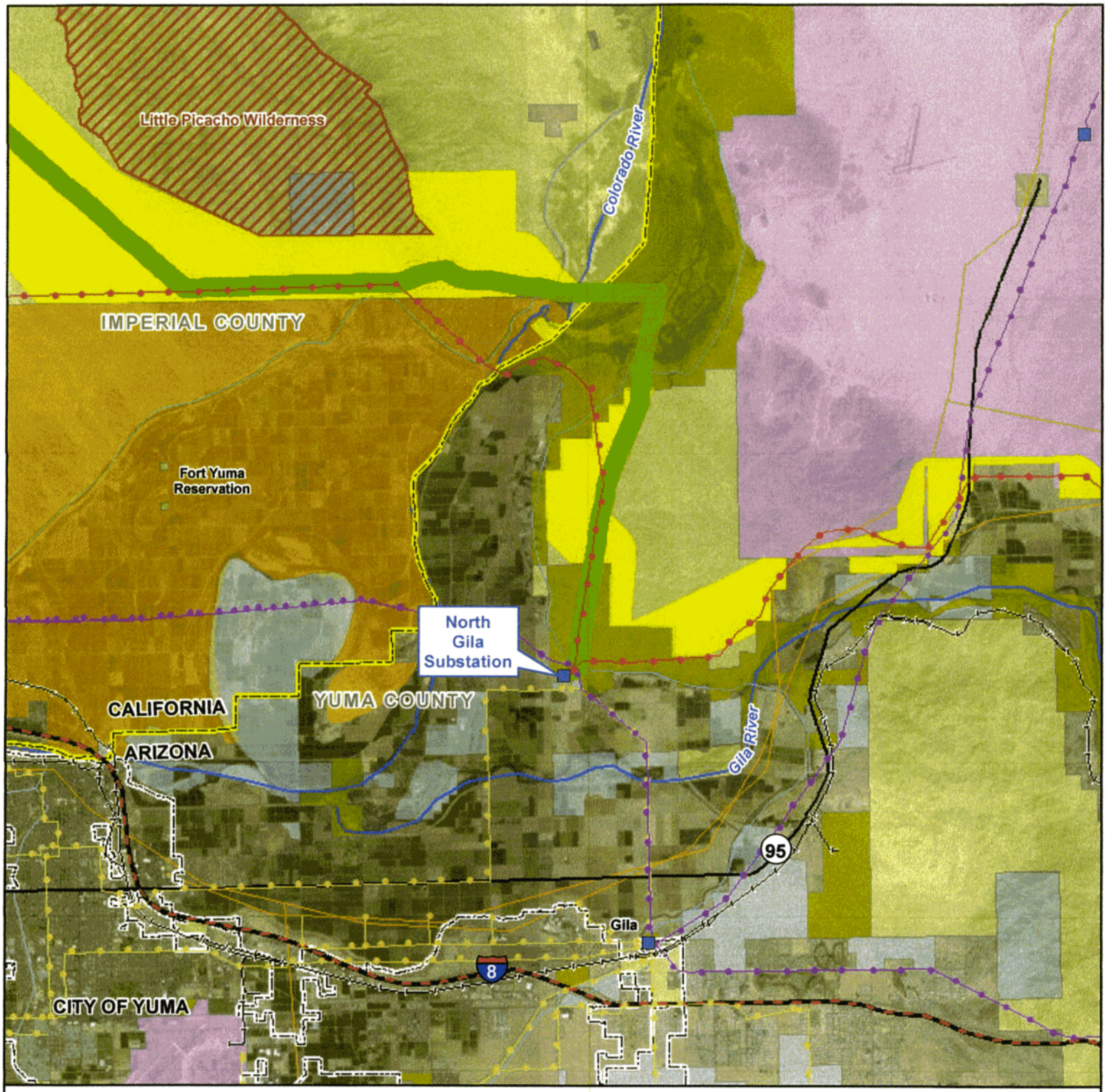
SOUTHWEST TRANSMISSION PARTNERS, LLC

Ten Year Plan

For Proposed Transmission Facilities

(In-service estimated December 2021)

LINE DESCRIPTION North Gila – Imperial Valley #2 Transmission Project	
Voltage	500 kV, single or double circuit (may also include 230kV)
Capacity	Minimum of 1250MW (500kV single circuit)
Point of Origin	Existing North Gila Substation in Yuma County, Arizona
Termination Point	Existing Imperial Valley Substation in Imperial County, California
Length	Approximately 90 Miles total, Approximately 7 Miles in Arizona
General Route	Map attached for the Arizona Portion (as currently proposed)
Purpose	Increase Transmission Capacity between Arizona and southern California, incremental reliability improvement for the loss of the existing transmission facilities in the area, provide for an additional transmission path for renewable energy deliveries across the desert southwest.
In-Service Date	Projected to be December 2021
Certificate Necessary?	Yes (for portion of line in AZ)
Power Flow Study	See attached (NG-IV #2 WECC Comprehensive Progress Report)



Legend

- Substation
- Existing 500 kV Transmission Line
- Existing 161 kV Transmission Line
- Existing 69 kV Transmission Line
- Major River
- Stream and/or Canal
- Interstate
- Major Road
- Railroad
- State Boundary
- County Boundary
- Proposed NG-IV#2 Transmission Line
- BLM Designated Utility Corridor
- Municipal Boundary
- Federal Wilderness Area
- Major Water Body

Jurisdictional Land Ownership

- Bureau of Land Management Land
- Department of Defense Land
- Bureau of Reclamation Land
- State Land
- Indian Land

0 1 2 3 4

Miles

NG-IV#2

OVERVIEW MAP

Map Extent: Imperial County, California and Yuma County, Arizona

Date: 01.26.17		Author: sjw

R:\Projects\Maps\NG-IV#2 Trans AZ Zoom 012617.mxd

TRANSCO.ENERGY

North Gila – Imperial Valley #2 Transmission Project

WECC Path 46 Rating Increase

Comprehensive Progress Report

Prepared for

SOUTHWEST TRANSMISSION PARTNERS, LLC

02/12/2016

Prepared by:
John Kyei, P.E
John.Kyei@transco.energy
916-837-5965

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EXECUTIVE SUMMARY

Southwest Transmission Partners, LLC (Project Sponsor) is proposing to construct a 90-mile, 500 kV single circuit or 500/230kV double circuit transmission line project from the existing North Gila switching station in Arizona to the existing Imperial Valley substation in California with a new proposed intermediate connection at Imperial Irrigation District's (IID) Highline substation. The analysis included in this report has been prepared to include only a 500kV single circuit as the initial buildout of the project. Additional sensitivities during the Phase 2 analysis may be examined as the project development progresses to co-locate planned 230kV facilities in the region.

The proposed North Gila – Imperial Valley #2 Project (NGIV2 Project or Project) would become additional component of the Western Electricity Coordinating Council's (WECC) West of Colorado River Transmission Path (WOR or Path 46), and it is expected to provide significant increase in transmission capacity between Arizona and southern California. The addition of the NGIV2 is also expected to remove the transmission bottleneck that would occur following the 2015 addition of the Hassayampa -North Gila #2 project. Additional benefits that may be derived from the NGIV2 include:

- Enabling California to have additional access to import and/or export from transmission-limited generation resource zones in the southwest
- Providing an increase in diversity of the regional energy resource zones
- Providing an increase in reliability and import capability to Southern California Import Transmission system
- Enabling efficient use of existing transmission corridors

The planned in-service date for the North Gila -Imperial Valley #2 Project is December 2021.

On April 7, 2011 the Project Sponsor initiated the WECC Project Coordination Review process for the NGIV2 Project and solicited interest to WECC members for the formation of a Project Coordination Review Group (PCRG). The NGIV2 PCRG has since been formed, and its inaugural meeting held in Phoenix, Arizona on June 24, 2011.

On August 21, 2011 a PCRG report for the NGIV2 was presented to the Planning Coordinating Committee (PCC) of the WECC for review and comment in conformity with the WECC Project Coordination Review Guidelines. Subsequently, the PCC accepted the NGIV2 PCRG report as complete on September 2, 2011.

To comply with WECC procedure for Project rating, a path rating study was needed to determine the potential rating increase on the WECC Path 46 following the addition of the proposed NGIV2. The Project Sponsor therefore contracted with TransCo.Energy, LLC (TRANSCO) to complete the work necessary to prepare a WECC Comprehensive Progress Report (CPR) for increasing the rating on WECC Path 46.

The Project's plan of service includes:

- New 500 kV substation (Highline 500 kV substation) to be located adjacent to IID's existing 230 kV Highline substation.
- New 1120 MVA, 500/230 kV transformer at Highline
- New 55-mile 2x 2156 ACSR 500 kV line from North Gila 500 kV switching station to Highline with 70% series compensation.
- New 35-mile 2x 2156 ACSR 500 kV line from Highline to Imperial Valley 500 kV substation.

TRANSCO conducted the study using the WECC approved 2018-19 heavy autumn power flow model previously used for the Hassayampa – North Gila #2 Project's path rating study. Analysis performed as part of the study included power flow, transient stability and post-transient stability.

The studies described in this CPR showed that the proposed North Gila – Imperial Valley #2 Project can achieve a total transfer capability of at least **1,330 MW** following the full implementation of the Project's plan of service while meeting NERC reliability standards and WECC system performance criteria. The study results also demonstrated that the proposed Project is feasible of increasing the non-simultaneous rating of WECC **Path 46** from 11,200 MW to **12,450 MW** while complying with NERC reliability standards and WECC system performance criteria.

The study identified the outage of the Lugo – El Dorado 500 kV line or Hassayampa – N. Gila 500 kV line or Hassayampa – Hoodoo Wash 500 kV line as critical following the implementation of the Project and subsequent increase of Path 46 rating to 12,450 MW. The limitations to each outage are respectively the thermal rating of the Lugo – Victorville 500 kV line, the thermal rating of the series capacitor on the N. Gila – Hoodoo Wash 500 kV line, and the thermal rating of the series capacitor on the Hassayampa – N. Gila 500 kV line.

Further, the study results showed that the proposed Project would not cause significant inadvertent flow on the existing WECC transmission system.

The study demonstrated that the established simultaneous interaction between Path 46 and Path 61 would persists following the addition of the Project and associated rating increase on Path 46. Thus the existing nomogram for operating the two paths would be reviewed and updated during the Phase 2 of Path rating process. Also, known simultaneous interactions between Path 46 and other paths such as Southern California Import Transmission (SCIT) Nomogram and Southern Nevada Transmission Interface (SNTI) would be reevaluated during Phase 2 of the Path rating process.

It is expected that this CPR will form the basis for the proposed Project to enter Phase 2 of the WECC three phase rating process. The WECC NGIV2 Project Review Group will be re-assembled to address comments received during the 60-day comment period and to conduct additional analysis that may be necessary to obtain a new WECC Accepted rating of **12,450 MW** for Path 46.

INTRODUCTION

Southwest Transmission Partners, LLC (Project Sponsor) is proposing to construct a 90-mile, 500 kV single circuit or 500/230kV double circuit transmission line project from the existing North Gila switching station in Arizona to the existing Imperial Valley substation in California with a new proposed intermediate connection at Imperial Irrigation District's (IID) Highline substation. The analysis included in this report has been prepared to include only a 500kV single circuit as the initial buildout of the project. Additional sensitivities during the Phase 2 analysis may be examined as the project development progresses to co-locate planned 230kV facilities in the region.

The proposed North Gila – Imperial Valley #2 Project (NGIV2 Project or Project) would become additional component of the Western Electricity Coordinating Council's (WECC) West of Colorado River Transmission Path (WOR or Path 46), and it is expected to provide significant increase in transmission capacity between Arizona and southern California. The addition of the NGIV2 is also expected to remove the transmission bottleneck that would occur following the 2015 addition of the Hassayampa -North Gila #2 project. Additional benefits that may be derived from the NGIV2 include:

- Enabling California to have additional access to import and/or export from transmission-limited generation resource zones in the southwest
- Allowing for an increase in diversity of the regional energy resource zones
- Allowing for an increase in reliability and import capability to Southern California Import Transmission system
- Enabling efficient use of existing transmission corridors

The proposed Project is expected to have a total transfer capability of at least **1,330 MW** and would increase the non-simultaneous rating of **Path 46 by 1,250 MW**. The planned in-service date for the North Gila -Imperial Valley #2 Project will be December 2021.

Project Background

On April 7, 2011 the Project Sponsor initiated the WECC Project Coordination Review process for the NGIV2 and solicited interest to WECC members for the formation of a Project Coordination Review Group (PCRG). The NGIV2 PCRG has since been formed, and its inaugural meeting held in Phoenix, Arizona on June 24, 2011.

On August 21, 2011 a PCRG report for the NGIV2 Project was presented to the Planning Coordinating Committee (PCC) of the WECC for review and comment in conformity with the WECC Project Coordination Review Guidelines. Subsequently the PCC accepted the NGIV2 PCRG report as complete on September 2, 2011.

To comply with WECC procedure for Project rating, a path rating study was needed to determine the potential rating increase on the WECC Path 46 following the addition of the proposed NGIV2. The Project Sponsor has therefore contracted with TransCo.Energy, LLC (TRANSCO) to complete the work necessary to prepare a WECC Comprehensive Progress Report (CPR) for increasing the

WECC Path 46 from 11,200 MW to 12,450 MW. The CPR will form the basis for the proposed Project to enter Phase 2 of the WECC three phase rating process. After this report is completed, if there are sufficient interests, a WECC Project Review Group will be formed to address comments received and to conduct additional analysis that may be necessary to obtain a new WECC Accepted rating of 12,450 MW for Path 46.

Study Objectives and Scope

The main objective of this study is to complete the work necessary to prepare a comprehensive progress report that will enable the proposed NGIV2 and the associated WECC Path 46 rating increase to complete Phase 1 and enter Phase 2 of the WECC 3 phase rating process. This effort is expected to demonstrate that the proposed Project will provide an incremental transfer capability of 1,250 MW on WECC Path 46 and to establish a new Path 46 accepted rating of 12,450 MW while complying with North America Reliability Council's (NERC) reliability standards and WECC criteria.

Recent Path 46 upgrade study showed that there are simultaneous relationships between Path 46 and each of the following known paths within the WECC transmission system:

- Lugo – Victorville 500 kV line – Path 61
- Southern Nevada Transmission Interface (SNTI) –Path 81
- Southern California Import Transmission (SCIT) Nomogram

In accordance with WECC Project Coordination, Path Rating and Progress Report Processes, the simultaneous relationships between Path 46 at the proposed rating of 12,450 MW and Path 61 is reevaluated and addressed in this study. However, since SCIT nomogram varies seasonally, the impact of the Path 46 rating increase on the SCIT nomogram will be deferred and evaluated during the Phase 2 of the Path Rating process. Similarly, the reevaluation of the known simultaneous interaction between Path 61 and Path 81 is deferred to Phase 2 of the Path Rating process.

This CPR details the impact, if any, of the impact of the NGIV2 and the associated Path 46 rating increase on the WECC transmission system.

Project Description and Plan of Service

The NGIV2 Project will comprise of a 90-mile 500 kV single circuit from North Gila 500 kV switching station to Imperial Valley 500 kV substation with a 500/230 kV intermediate transformation at IID's existing Highline 230 kV substation at Holtville, California. The NGIV2 Project will initially parallel the existing North Gila – Imperial Valley 500 kV line before turning north to loop in and out of a proposed 500 kV substation to be constructed immediately adjacent to Highline 230 kV substation. The minimum separation between the proposed line and the existing North Gila to Imperial Valley 500 kV line is expected to be at least 250 feet. The North Gila to Highline segment of the NGIV2, which measures about 55-miles, will have a 70% series compensation in order to balance the flows on the two circuits. The series compensation will be located at the proposed Highline 500 kV substation. The Highline to Imperial Valley segment of the NGIV2 measures about 35-miles.

The NGIV2's plan of service is detailed below:

- New 500 kV substation (Highline 500 kV substation) to be located adjacent to IID's existing 230 kV Highline substation
- New 1120 MVA, 500/230 kV transformer at Highline
- New 55-mile 2x 2156 ACSR 500 kV line from North Gila 500 kV switching station to Highline with 70% series compensation
- New 35-mile 2x 2156 ACSR 500 kV line from Highline to Imperial Valley 500 kV substation

A conceptual one-line diagram for the NGIV2 is depicted in Figure 1.

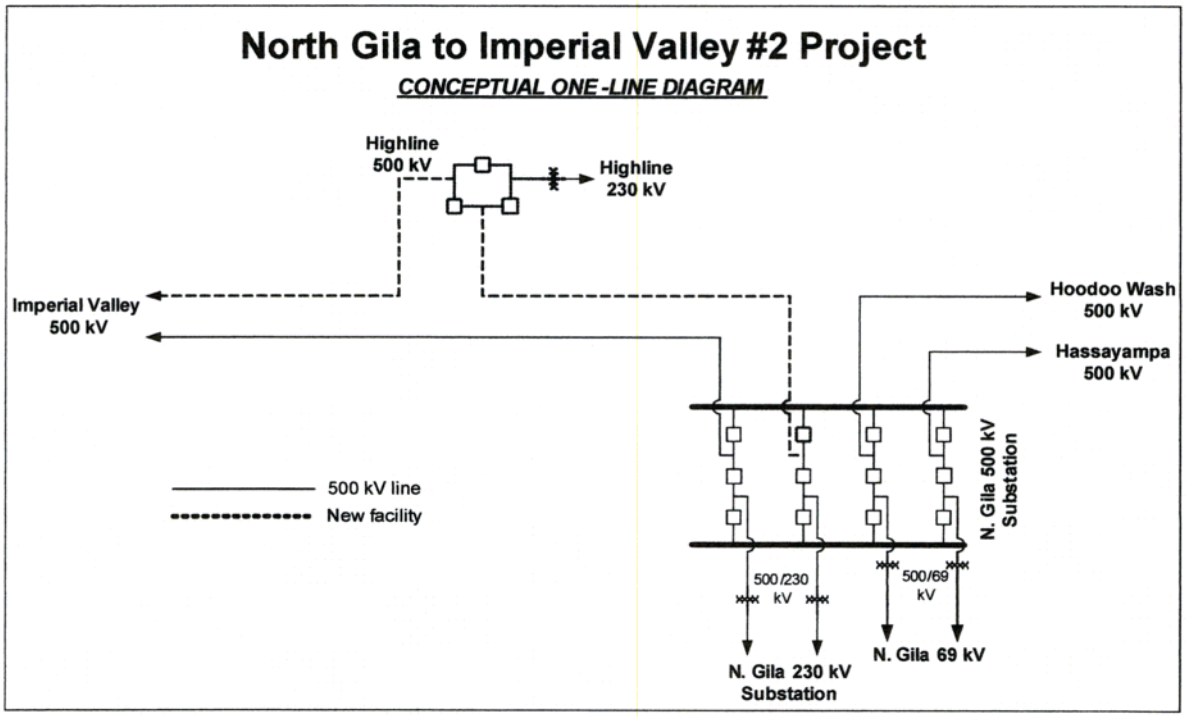


Figure 1: NGIV2 Conceptual One-Line Diagram

West of Colorado River Path

The WOR Path, depicted in Figure 2, comprises of the major transmission lines west of the Colorado River that connects southern Nevada and Arizona to southern California. This path is also referred to as WECC Path 46 and presently consists of the following 14 transmission lines:

- Adelanto – Marketplace 500 kV line (metered at Marketplace 500 kV)
- McCullough – Victorville #1 & #2 500 kV lines (metered at McCullough 500 kV)
- Mead – Victorville 287 kV line (metered at Mead 287 kV)
- El Dorado – Lugo 500 kV line (metered at El Dorado 500 kV)

- El Dorado – Cima – Pisgah #1 &2 230 kV lines (metered at El Dorado 230 kV)
- Lugo – Mohave 500 kV line (metered at Mohave 500 kV)
- Julian Hinds – Mirage 230 kV line (metered at Mirage 230 kV)
- Colorado River – Palo Verde 500 kV line (metered at Colorado River 500 kV)
- Mirage – Ramon 230 kV line (metered at Mirage 230 kV)
- Coachella – Devers 230 kV line (metered at Devers 230 kV)
- El Centro – Imperial Valley 230 kV line (metered at Imperial Valley 230 kV)
- Imperial Valley – N. Gila 500 kV line (metered at N. Gila 500 kV)

The East – to West non-simultaneous accepted rating of the WOR was recently increased from 10,623 MW to 11,200 MW. The WOR non-simultaneous rating of 11, 200 MW is limited by the contingency thermal rating of the Julian Hinds – Mirage 230 kV line following the outage of the Palo Verde – Colorado River 500 kV line and subsequent implementation of the existing Blythe RAS.

Following the successful implementation of the NGIV2 Project's plan of service, the WOR East – West non-simultaneous rating is expected to increase from 11,200 MW to 12,450 MW. The transmission line segment from Highline 500 kV to Imperial Valley 500 kV (metered at Highline 500 kV) of the NGIV2 will be included in the definition of the upgraded WOR.

Figure 2 provides a geographical (not to scale) and electrical overview of the EHV transmission system in the southwestern US and the configuration of the WECC Path 46 after the implementation of the proposed NGIV2 Project.

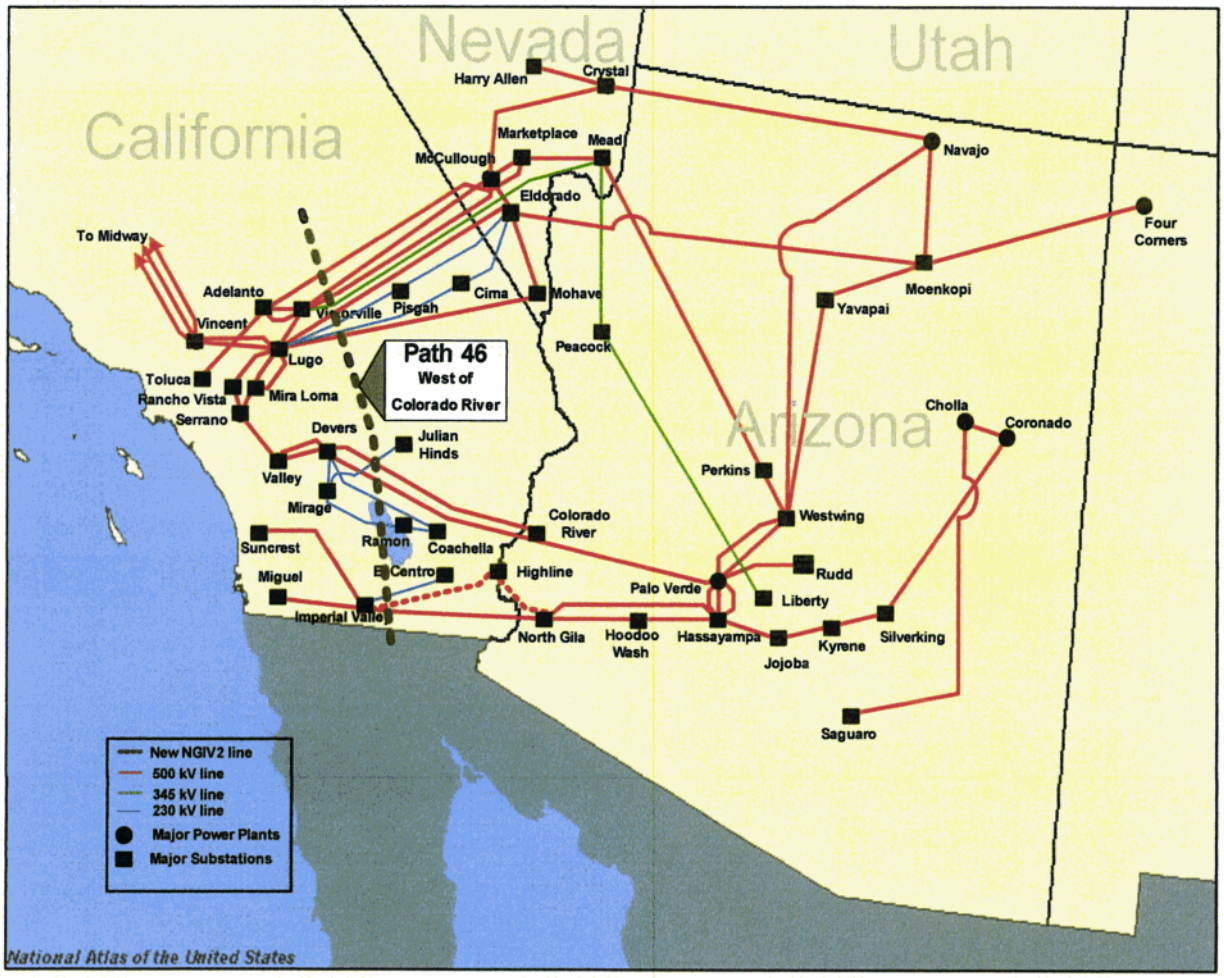


Figure 2: The West of River Path and Vicinity Transmission System

STUDY DESCRIPTION AND METHODOLOGY

This analysis was conducted using the WECC approved 2018-19 heavy autumn power flow model previously used for Hassayampa – North Gila #2 Project's path rating study as the starting base case. The starting base case had the following new 230 kV circuits replacing Imperial Valley – El Centro 230 kV in the definition of the WOR path:

- Imperial Valley – Fern 230 kV line (metered at Imperial Valley 230 kV)
- Imperial Valley – Dixieland 230 kV line (metered at Imperial Valley 230 kV)
- Imperial Valley – Lambert 230 kV line (metered at Imperial Valley 230 kV)

The starting base case was updated to also include the Harry Allen – El Dorado 500 kV line.

A Path 46 upgrade study base case (post-NGIV2 base case) was developed from the updated starting base case by modeling the proposed NGIV2 project's plan of service. Power transfers were made from Arizona to southern California to increase the flow on the proposed NGIV2 and Path

46 till a critical facility limit is reached. The post-NGIV2 base case showed that the NGIV2 would provide an incremental transfer capability of **1,250 MW** on Path 46.

Table 1 details key transmission paths loading assumptions for the post-NGIV2 base case developed for the study.

TABLE 1: KEY TRANSMISSION PATH LOADING ASSUMPTIONS

TRANSMISSION PATH	RATING	POST-NGIV2 FLOW
West of Colorado River –Path 46	11,200 MW	12,450 MW
East of Colorado River –Path 49	10,200 MW	10,125 MW
Lugo – Victorville –Path 61	2,400 MW	1,881 MW
Intermountain Power Project DC Line –Path 27	2,400 MW	1,504 MW
Southern Nevada Transmission Interface –Path 81	4,533 MW	383 MW
IID – SCE –Path 42	600 MW	555 MW
Pacific DC Intertie –Path 65	3,100 MW	1,500 MW
California – Oregon Intertie –Path 66	4,800 MW	1,613 MW
Northern – Southern California –Path 26	4,000 MW	383 MW
Midway – Los Banos –Path 15	3,265 MW	1,562 MW
Southern California Import Transmission –SCIT	N/A	16,792 MW

Apart from the stated modeling assumptions, the transmission and load assumptions in the starting base case were not altered in developing post- NGIV2 base case. Power flow, post-transient stability and transient stability analyses were performed to ensure that the system performance criteria prescribed in the NERC reliability standards and WECC criteria were met. Specific studies conducted and their evaluation criteria are outlined below:

Power Flow Analysis

Power flow analysis was performed on the post-NGIV2 base cases. The study simulated the impact of the proposed NGIV2 project and the associated Path 46 rating increase on the existing transmission system during normal operating conditions (Category P0), single event (Category P1-P2) as well as multiple (Category P3-P7) events. The outages simulated included:

- Selected Category P1-P2 (230-500 kV) transmission circuit and transformer outages within Arizona, Nevada and California transmission systems.
- Selected critical P3-P7 events (230 kV and above) transmission and transformer outages within Arizona, Nevada and California transmission systems.

The power flow analysis contingency list can be found in Attachment A.

Applicable NERC reliability standard and the WECC System Performance Criteria were used to assess the adequacy of the study results. The power flow analysis evaluation criteria that were used are summarized below:

- Pre-contingency bus voltage must be between 0.95 per unit and 1.05 per unit, unless specific minimum and maximum operating voltage requirements exists.
- Pre-disturbance loading to remain within continuous ratings of all equipment and line conductors.
- Post-disturbance loading to remain within emergency ratings of all equipment and line conductors.
- Post-disturbance bus voltages to remain within applicable criteria:
  - Between 0.9 per unit and 1.10 per unit for Category P1-P7 events, unless lower standards have previously been adopted.
- Post-disturbance bus voltage deviation to remain within applicable criteria:
  - Within 5% for Category P1-P2 events, unless lower standards have previously been adopted
  - Within 10% for Category P3-P7 events, unless lower standards have previously been adopted.
- Load shedding was not allowed for Category P1-P2 events unless previously defined.

Transient Stability Analysis

Transient stability studies were conducted on the post-NGIV2 study base case. Transient stability runs were simulated for 15 seconds, excluding a 1 second pre-outage run, to ensure the system is stable and positively damped. All simulated faults were three-phase with a 4-cycle breaker clearing time. System damping was assessed visually with the aid of stability plots.

Selected critical disturbances were simulated. Provided below are the disturbances simulated:

- P1: Palo Verde- Colorado River 500 kV line (Palo Verde 500 kV bus faulted)
- P1: Hassayampa – N. Gila 500 kV line (Hassayampa 500 kV bus faulted)
- P1: Hassayampa – Hoodoo Wash 500 kV line (Hassayampa 500 kV bus faulted)
- P1: Palo Verde – Westwing #1 500 kV line (Palo Verde 500 kV bus faulted)
- P1: Palo Verde – Rudd 500 kV line (Palo Verde 500 kV bus faulted)
- P1: Imperial Valley – N. Gila 500 kV line (Imperial Valley 500 kV bus faulted)
- P1: Imperial Valley – ECO 500 kV line (Imperial Valley 500 kV bus faulted)
- P1: Imperial Valley – Ocotillo500 kV line (Imperial Valley 500 kV bus faulted)
- P1: Highline – N. Gila 500 kV line (Highline 500 kV bus faulted)
- P1: Imperial Valley – Highline 500 kV line (Imperial Valley 500 kV bus faulted)
- P1: Miguel – ECO 500 kV line (ECO 500 kV bus faulted)
- P1: Perkins – Mead 500 kV line (Mead 500 kV bus faulted)
- P1: Mead – Marketplace 500 kV line (Mead 500 kV bus faulted)
- P1: Harry Allen – Mead 500 kV line (Harry Allen 500 kV bus faulted)
- P1: Navajo – Crystal 500 kV line (Navajo 500 kV bus faulted)
- P1: Moenkopi – El Dorado 500 kV line (El Dorado 500 kV bus faulted)

- P1: Adelanto – Marketplace 500 kV line (Adelanto 500 kV bus faulted)
- P1: El Dorado – Lugo 500 kV line (El Dorado 500 kV bus faulted)
- P1: Mohave – Lugo 500 kV line (Lugo 500 kV bus faulted)
- P1: Lugo – Victorville 500 kV line (Victorville 500 kV bus faulted)
- P1: Coachella – Mirage 230 kV line (Coachella 230 kV bus faulted)
- P1: Ramon – Mirage 500 kV line (Mirage 230 kV bus faulted)
- P1: Devers – Mirage #1 230 kV line (Devers 230 kV bus faulted)
- P1: Devers - Valley #1 500 kV line (Devers 500 kV bus faulted)
- P6: Lugo – El Dorado & Lugo – Mohave 500 kV lines (Lugo 500 kV bus faulted)
- P6: Lugo – El Dorado & El Dorado – Mohave 500 kV lines (El Dorado 345 kV bus faulted)
- P6: Imperial Valley – N. Gila & Imperial Valley – Highline 500 kV lines (Imperial Valley 500 kV bus faulted)
- P6: Harry Allen – Mead & Mead – El Dorado 500 kV lines (Mead 500 kV bus faulted)
- P6: Coachella – Mirage & Mirage – Ramon 230 kV lines (Mirage 230 kV bus faulted)
- P7: Imperial Valley – ECO & Imperial Valley – Ocotillo 500 lines (Imperial Valley 500 kV bus faulted)
- P7: Imperial Valley – N. Gila & Highline – N. Gila 500 kV lines (N. Gila 500 kV bus faulted)
- P7: Palo Verde G-2 (Palo Verde 500 kV bus faulted)
- P7: IPP DC line
- P7: Palo Verde – Westwing #1 & 2 500 kV lines (Palo Verde 500 kV bus faulted)
- P7: Hassayampa – N. Gila & Hassayampa – Hoodoo Wash 500 kV lines (Hassayampa 500 kV bus faulted)

The following WECC transient voltage dip and transient frequency criteria were used to evaluate the study results. A summary of the transient stability analysis evaluation criteria is provided in Table 2 and depicted graphically in Figure 2.

- WECC transient voltage dip criteria: The transient voltage dip must not exceed 25% at load buses or 30% at non-load buses for Category P1-P2 events. For Category P3-P7 events, the transient voltage dip must not exceed 30% at any bus. The maximum duration of the voltage dip of 20% at load buses must not exceed 20 cycles for Category P1-P2 events or 40 cycles for Category P3-P7 events.
- WECC transient frequency criteria: The minimum transient frequency for Category P1-P2 events is 59.6 Hz; if below 59.6 Hz, the duration must not exceed 6 cycles at load bus. For Category P3-P7 events, the minimum transient frequency is 59.0 Hz; if below 59.0 Hz, the duration should not exceed 6 cycles at load bus.

TABLE 2: STABILITY ANALYSIS EVALUATION CRITERIA

NERC AND WECC CATEGORIES	OUTAGE FREQUENCY ASSOCIATED WITH THE PERFORMANCE CATEGORY (OUTAGE/YEAR)	TRANSIENT VOLTAGE DIP STANDARD	MINIMUM TRANSIENT FREQUENCY STANDARD
P0 System normal	Not Applicable	Nothing in addition to NERC	
P1-P2 One element out-of-service	□ 0.33	Not to exceed 25% at load buses or 30 % at non-load buses. Not to exceed 20% for more than 20 cycles at load buses.	Not below 59.6Hz for 6 cycles or more at a load bus.
P3-P7 Two or more elements out-of-service	0.033 – 0.33	Not to exceed 30% at any bus. Not to exceed 20% for more than 40 cycles at load buses.	Not below 59.0Hz for 6 cycles or more at a load bus.

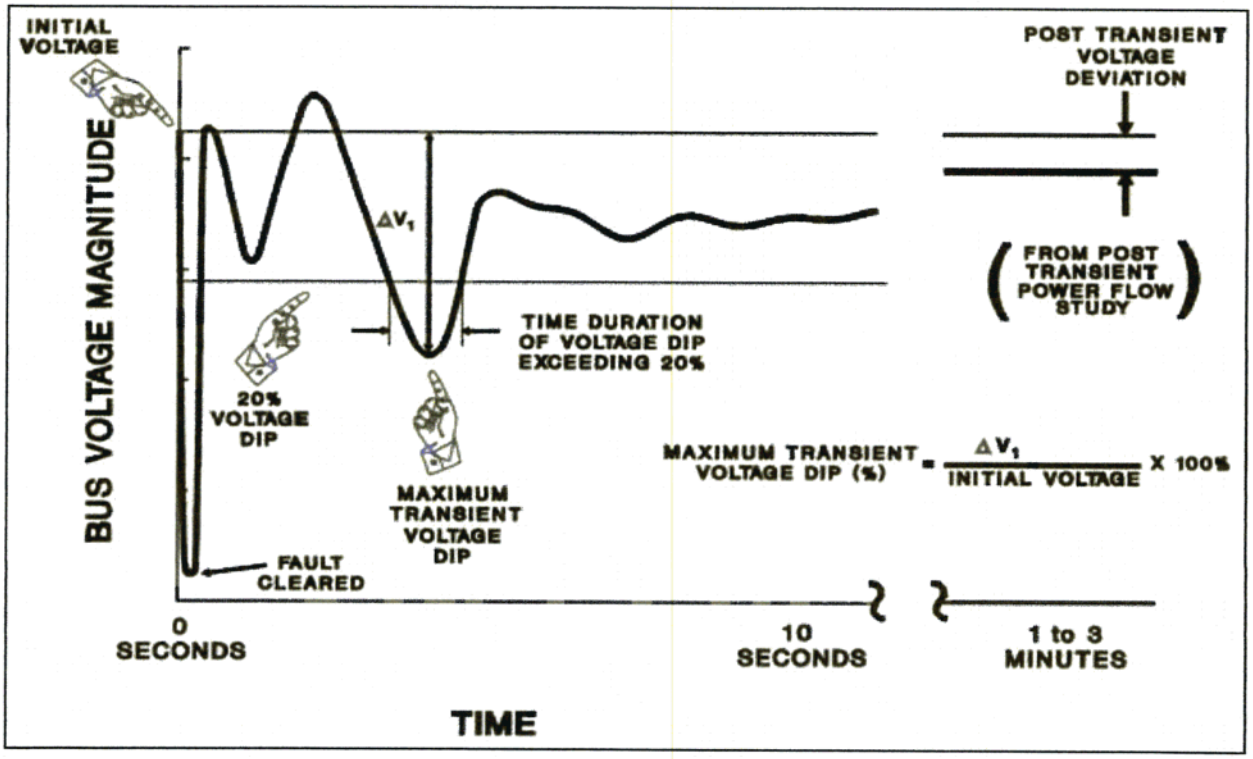


Figure 2: Graphical Representation of Stability Analysis Evaluation Criteria

Post-Transient Stability Analysis

Post-transient stability analysis was performed on the proposed Path 46 rating increase. This included modeling flow on the Path 46 with at least a 5% higher than the proposed rating of 12,450 MW for single outage events and 2.5% higher for multiple outage events. In this analysis, the increased flow on Path 46 was achieved by modeling additional transfers from Arizona to southern California.

The outage list for the post-transient stability analysis is follows:

- P1: Palo Verde- Colorado River 500 kV line
- P1: Hassayampa – N. Gila 500 kV line
- P1: Hassayampa – Hoodoo Wash 500 kV line
- P1: Palo Verde – Westwing #1 500 kV line
- P1: Palo Verde – Rudd 500 kV line
- P1: Imperial Valley – N. Gila 500 kV line
- P1: Imperial Valley – ECO 500 kV line
- P1: Imperial Valley – Ocotillo500 kV line
- P1: Highline – N. Gila 500 kV line
- P1: Imperial Valley – Highline 500 kV line
- P1: Miguel – ECO 500 kV line
- P1: Perkins – Mead 500 kV line
- P1: Mead – Marketplace 500 kV line
- P1: Harry Allen – Mead 500 kV line
- P1: Navajo – Crystal 500 kV line
- P1: Moenkopi – El Dorado 500 kV line
- P1: Adelanto – Marketplace 500 kV line
- P1: El Dorado – Lugo 500 kV line
- P1: Mohave – Lugo 500 kV line
- P1: Lugo – Victorville 500 kV line
- P1: Coachella – Mirage 230 kV line
- P1: Ramon – Mirage 500 kV line
- P1: Devers – Mirage #1 230 kV line
- P1: Devers - Valley #1 500 kV line
- P6: Lugo – El Dorado & Lugo – Mohave 500 kV lines
- P6: Lugo – El Dorado & El Dorado – Mohave 500 kV lines
- P6: P6: Imperial Valley – N. Gila & Imperial Valley – Highline 500 kV lines
- P6: Devers – Valley #1 &2 500 kV lines
- P6: Harry Allen – Mead & Mead – El Dorado 500 kV lines (Mead 500 kV bus faulted)

To meet the reliability criteria, the system must also have a positive reactive margin under the stated conditions.

SIMULTANEOUS INTERACTIONS

Per WECC Project Coordination, Path Rating and Progress Report Processes, the CPR for the proposed Project shall include the evaluation of known simultaneous relationships. Recent Path 46 upgrade study showed that there are simultaneous relationships between Path 46 and each of the following known paths within the WECC transmission system:

- Lugo – Victorville 500 kV line – Path 61

- Southern Nevada Transmission Interface (SNTI) –Path 81
- Southern California Import Transmission (SCIT) Nomogram

While the simultaneous relationship between Path 46 rating increase and Path 61 is reevaluated as part of this study, reevaluations of known interactions between Path 46 and other paths mentioned above (SCIT and SNTI) are deferred to Phase 2 of the Path rating process because of complexity of the interactions.

Path 46 versus Path 61

The WECC Path 61 comprised of the 500 kV transmission line that links Victorville and Lugo substations. This path has an accepted rating of 2,400 MW, limited by the loss of either the Mohave – Lugo 500 kV line or the El Dorado – Lugo 500 kV line.

In this simultaneous reevaluation, a post-NGIV2 base case that models the Path 61 at its acceptable rating of 2,400 MW and Path 46 at its proposed rating of 12,450 MW is developed. Power flow and transient stability analyses were performed to show if the simultaneous relationship still exists. A nomogram for operating the two paths will be proposed at Phase 2 of the Path Rating process if the reevaluation showed the established interaction between Path 46 and Path 61 persists following the addition of NGIV2 and the associated rating increase on Path 46.

Path 46 Non-Simultaneous Rating

Provided in Table 3 is a summary of the power flows on each segment of Path 46 in the post-NGIV2 base case with all transmission lines in service. Power flow maps with all transmission lines in service for the post- NGIV2 base case is provided in Appendix A; Figure A-1.

TABLE 3: SUMMARY OF PATH 46 BASE CASE TRANSMISSION LINE FLOWS

TRANSMISSION LINE SEGMENT/ PATH	FACILITY RATING	POST-NGIV2 BASE CASE FLOW
El Dorado – Lugo 500 kV	2,078 MVA	1,428 MW
El Dorado – Cima 230 kV	289 MVA	180 MW
El Dorado – Pisgah 230 kV	289 MVA	177 MW
Mohave – Lugo 500 kV	2,078 MVA	957 MW
Marketplace – Adelanto 500 kV	1,636 MVA	1,328 MW
Mead – Victorville 287 kV	446 MVA	203 Mw
McCullough – Victorville #1 500 kV	1,455 MVA	1,281 MW
McCullough – Victorville #2 500 kV	1,455 MVA	1,270 MW
Mirage – Julian Hinds 230 kV	357 MVA	-311 MW
Colorado River – Palo Verde 500 kV	2,338 MVA	-2,181 MW
North Gila – Imperial Valley 500 kV	1,905 MVA	1,454 MW
Imperial Valley – Fern 230 kV	1,195 MVA	-58
Imperial Valley – Dixieland 230 kV	1,195 MVA	-2
Imperial Valley – Liebert 230 kV	1,195 MVA	-58
Mirage - Coachella 230 kV	1,195 MVA	-290 MW
Mirage – Ramon 230 kV	1,195 MVA	-265 MW
Highline – Imperial Valley 500 kV	2,598 MVA	1009 MW
Path 46	**N/A**	**12,450 MW**

STUDY RESULTS

This section details the key study findings from the power flow, post-transient stability and transient stability analyses. NERC Reliability Standard and WECC System Performance Criteria were used to assess the adequacy of the study results.

Power Flow Analysis Findings

Provided below are the key findings from the power flow analysis:

- Path 46 non-simultaneous rating can be increased from 11,200 MW to 12,450 MW following the implementation of the NGIV2's plan of service while satisfying NERC Reliability Standard and WECC System Performance Criteria. The Path 46 non-simultaneous rating of 12,450 MW is limited by contingency ratings on the following transmission lines:
    - Lugo – Victorville 500 kV line (Critical outage: Lugo – El Dorado 500 kV line)
    - Hassayampa – N. Gila 500 kV line (Critical outage: Hassayampa – Hoodoo Wash 500 kV line)
    - N. Gila – Hoodoo Wash 500 kV line (Critical outage: Hassayampa – N. Gila 500 kV line)
- Power flow solutions were achieved for all Category P1 outages simulated. Two (2) post-contingency transmission facility overloads were identified following selected Category P1 outages. The overloaded facilities are:
    - Mirage – J. Hinds 230 kV line
    - Eagle Mountain – J. Hinds 230 kV line

  However, both the identified transmission facility thermal overloads are mitigated by deploying the existing Blythe RAS which trips the Blythe Energy Project's Generation Combustion Turbine Unit 1 (CT1). A summary of the thermal overloads is provided in Appendix B, Table B-1.
- No bus voltage deviation violation was identified following all the Category P1 outages simulated.
- Power flow solutions were achieved for all Category P6-P7 outages simulated with exception of the simultaneous loss of the following circuits:
    - Hassayampa – N. Gila & Hassayampa – Hoodoo Wash 500 kV lines.
    - Imperial Valley – ECO & Imperial Valley – Ocotillo 500 kV lines
    - N. Gila – Highline & N. Gila – Imperial Valley 500 kV lines

  The simultaneous loss of the Category P7 outages above did not produce power flow solutions. Mitigation plans for resolving these outages will be developed during the Phase 2 of the Path Rating process.
- Thermal overloads following selected Category P6 outages were identified. These contingency overloads are summarized in Appendix B, Table B-1. Operational procedures for preventing the identified overloads will be developed during the Phase 2 of the Path Rating process.
- No bus voltage deviation violation was identified following the selected Category P6 outages simulated.

Post-Transient Stability Analysis Findings

Post-transient stability analysis was performed on the post-NGIV2 study base case. This analysis was done by increasing the flow on Path 46 by 5% of the proposed rating from 12,450 MW to 13,072 MW for Category P1 outages and by 2.5% for Category P6 outages. The increased flow was achieved by power transfers from Arizona to southern California.

Power flow solutions were achieved for all the outages simulated. Thus, per WECC voltage stability criteria, positive reactive margins were recorded for all outages simulated.

Transient Stability Analysis Findings

Transient stability analysis was performed on the post-NGIV2 base case. A set of bus voltage and frequency plots following each contingency can be found in Attachment B.

Key findings from the stability analysis using the post-NGIV2 study base case are:

- All outages with exception of the simultaneous outages of the Hassayampa – N. Gila 500 kV & Hassayampa – Hoodoo Wash 500 kV lines resulted in transient stability with positive damping.
- No violation of WECC transient voltage dip criteria was found.
- No violation of WECC transient frequency criteria was found.

Path 46 versus Path 61 – Simultaneous Analysis Findings

In this known simultaneous interaction reevaluation, the flow on Path 46 was modeled at the proposed rating of 12,450 MW while Path 61 flow was modeled at its accepted rating of 2,400 MW. A power flow map, with all transmission lines in service for this simultaneous study is provided in Appendix A, Figure A-2.

The results of the power flow analysis performed on this base case and summarized in Appendix B, Table B-2 showed that the established simultaneous interaction between Path 46 and Path 61 still persists following the addition of the NGIV2. The results of the power flow analysis showed that operating Path 46 at the proposed rating of 12,450 MW and Path 61 at its accepted rating of 2,400 MW will lead to thermal violations under both Category P1 and Category P6 outages. Thus, the existing nomogram for operating Path 46 and Path 61 would need to be reviewed and updated to reflect the Path 46 rating increase.

The results of the stability analysis showed that operating Path 46 at its proposed rating of 12,450 MW while Path 61 is at its accepted rating of 2,400 MW would not impact the stability of the existing transmission system. A set of bus voltage and frequency plots for substations within Arizona, Nevada and southern California for each contingency simulated can be found in Attachment C.

A nomogram for operating Path 46 and Path 61 following the addition of the NGIV2 would be proposed during Phase 2 study.

CONCLUSION

The study results showed that the proposed North Gila – Imperial Valley #2 Project can achieve a total transfer capability of at least **1,330 MW** following the full implementation of the Project's plan of service described in this CPR while also satisfying NERC reliability standards and WECC system performance criteria. The study results also demonstrated that the proposed Project is feasible of increasing the non-simultaneous rating of WECC Path 46 from 11,200 MW to **12,450 MW** while complying with NERC reliability standards and WECC system performance criteria.
The study identified the outage of the Lugo – El Dorado 500 kV line or Hassayampa – N. Gila 500 kV line or Hassayampa – Hoodoo Wash 500 kV line as critical following the implementation of the Project and associated increase of Path 46 rating to 12,450 MW. The limitation to each outage are respectively the thermal rating of the Lugo – Victorville 500 kV line, the thermal rating of the series capacitor on the N. Gila – Hoodoo Wash 500 kV line, and the thermal rating of the series capacitor on the Hassayampa – N. Gila 500 kV line.

Further, the study results showed that the proposed Project would not cause significant inadvertent flow on the existing WECC transmission system.

The study demonstrated that the established interaction between Path 46 and Path 61 would persists following the addition of the Project and associated Path 46 rating increase. The existing nomogram for operating the two paths would be reviewed and updated during the Phase 2 of Path rating process. Known simultaneous interactions between Path 46 and other paths such as SCIT and Path 81 will be evaluated during Phase 2 of the WECC Path Rating Process.

APPENDIX A: POWER FLOW MAP

Figure A-1: Power Flow Map – Post-NGIV2 Base Case

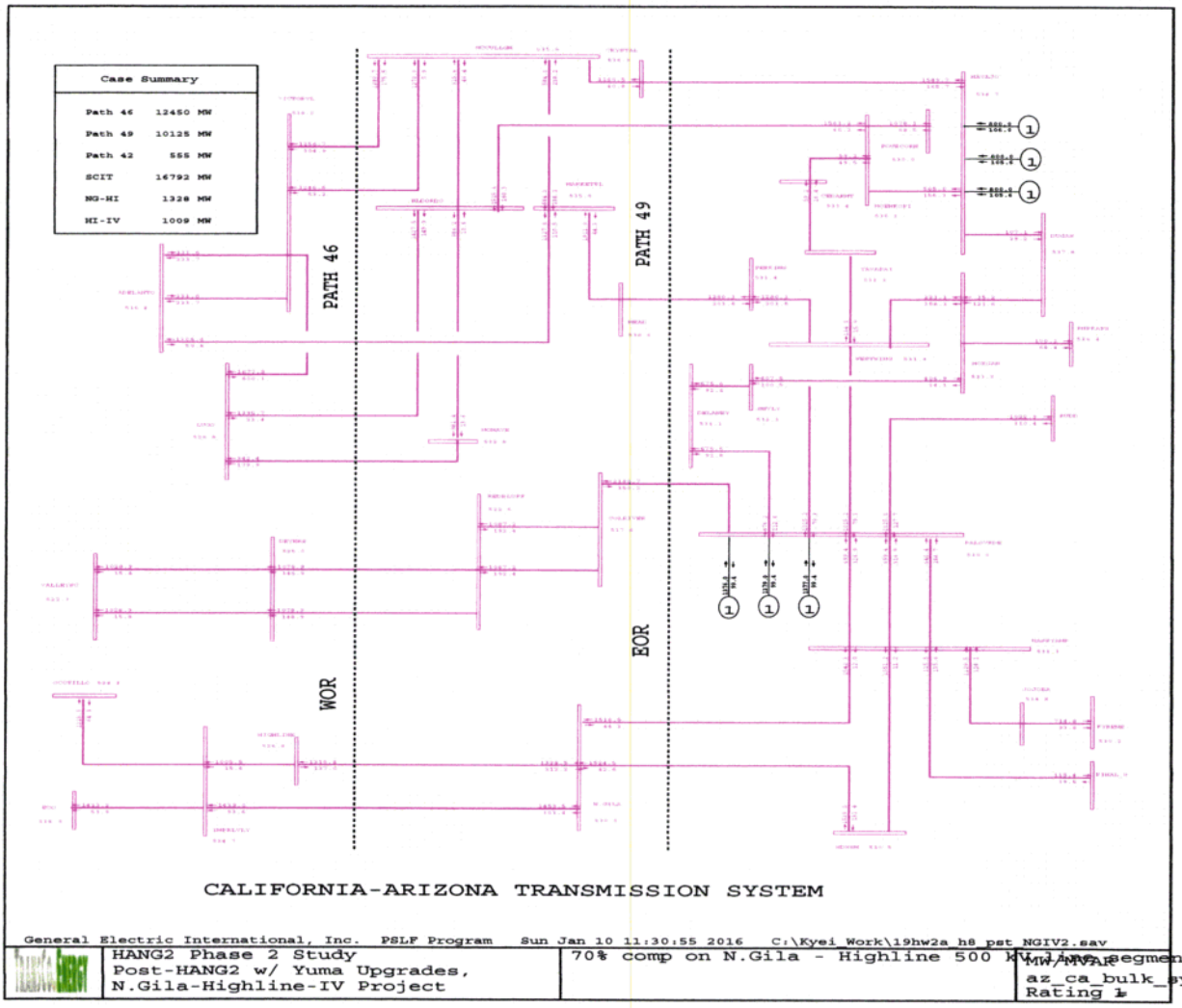
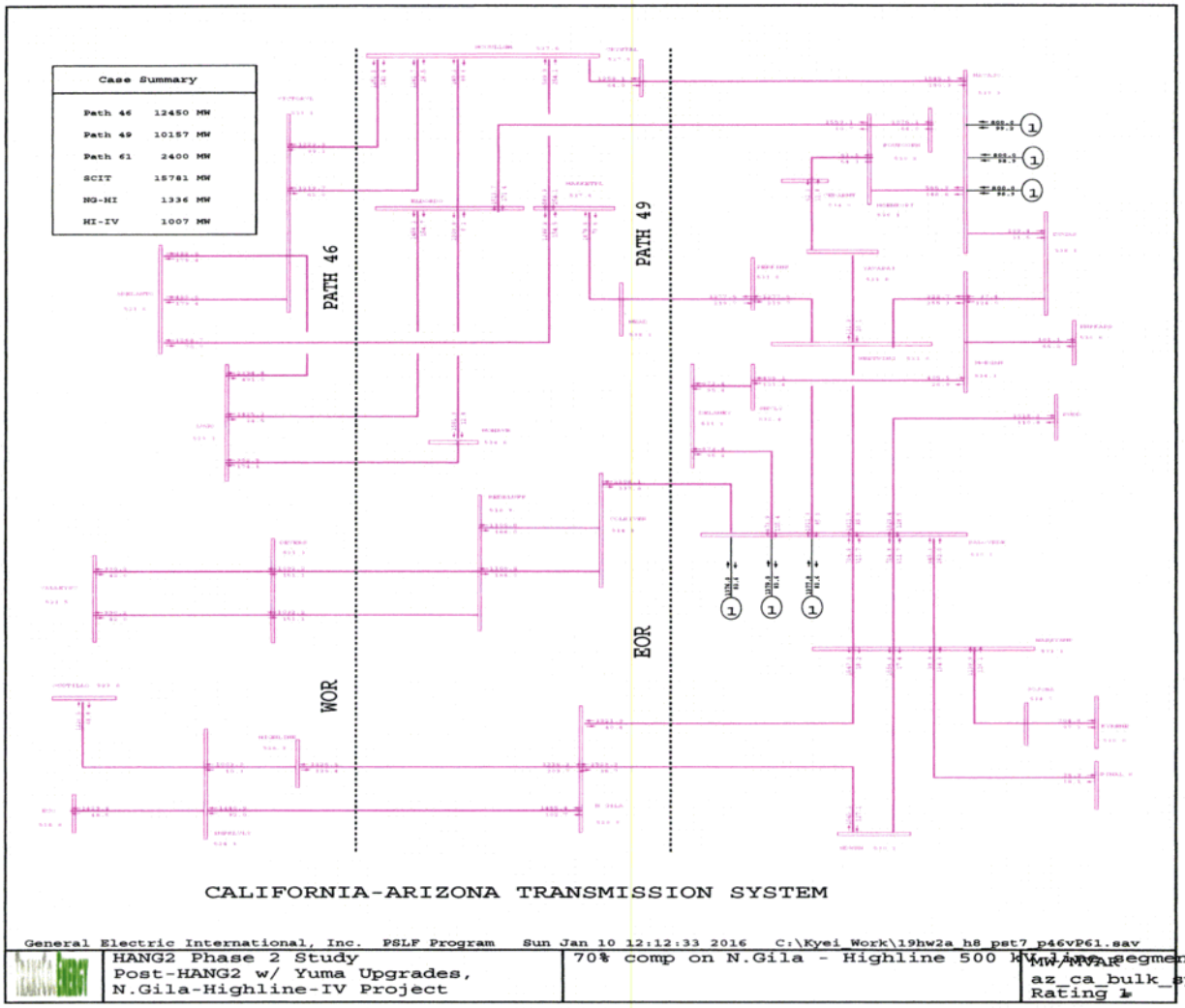


Figure A-2: Power Flow Map – Path 46 vs. Path 61



APPENDIX B: SUMMARY OF POWER FLOW RESULTS

Table B-1: Path 46 - Non-Simultaneous Rating

Outage Element (s)	Overloaded Facility	Applicable Rating	Post-NGIV2 Loading (%)	Notes
Category P0—Normal Overloads				
ALL LINES IN SERVICE	NONE	N/A	N/A	None
Category P1 —Single Element Outage Overloads				
ELDORDO – LUGO 500 KV LINE	LUGO – VICTORVILLE 500 KV LINE	3000 A	99.9	Limiting Elements and associated critical outages to Path 46 rating increase.
HASSYAMPA – HOODOO WASH 500 KV LINE	HASSYAMPA – N. GILA 500 KV LINE	2970 A	99.9	
HASSYAMPA – N. GILA 500 KV LINE	N. GILA – HOODOO WASH 500 KV LINE	2970 A	99.9	
PALO VERDE – COLORADO RIVER 500 KV LINE	MIRAGE – J. HINDS 230 KV LINE	896 A	122.0	Deploying Blythe CT1 RAS mitigates the identified overloads.
MIRAGE – J. HINDS 230 KV LINE	EAGLEMTN – J. HINDS 230 KV LINE	901 A	117.0	
EAGLEMTN – J. HINDS 230 KV LINE	MIRAGE – J. HINDS 230 KV LINE	291 A	114.2	
Category P6 — Multiple Elements Outage Overloads				
IMPERIAL VALLEY – HIGHLINE & IMPERIAL VALLEY – N. GILA 500 KV LINES	HIGHLINE 500/230 KV TRANSFORMER	1329 MVA	124.1	Operational procedure for preventing the identified overload will be developed at Phase 2 study.
ELDORDO – LUGO & MOHAVE – LUGO 500 KV LINES	LUGO – VICTORVILLE 500 KV LINE	3000 A	130.0	Utilize the existing Nomogram for preventing this Category P6 outage thermal overload.
LUGO – MIRALOMA #2 & 3 500 KV LINES	MIRAGE – J. HINDS 230 KV LINE	896 A	102.0	Deploying Blythe CT1 RAS mitigates the identified overloads.
MCCULLOUGH – VICTORVILLE #1 &2 500 KV LINES			101.8	
DEVERS – VALLEYSC #1 & 2 500 KV LINES	DEVERS – VSTA #2 230 KV LINE	1240 A	101.0	Operational procedure for preventing the identified overload will be developed at Phase 2 study.

Table B-2: Path 46 versus Path 61 - Simultaneous Rating

Outage Element (s)	Overloaded Facility	Applicable Rating	Post-NGIV2 Loading (%)	Notes
Category P0—Normal Overloads				
ALL LINES IN SERVICE	NONE	N/A	N/A	None
Category P1 —Single Element Outage Overloads				
ELDORDO – LUGO 500 KV LINE	LUGO – VICTORVILLE 500 KV LINE	3000 A	117.4	Known simultaneous interaction between Path 46 and Path 61 persist following the addition of NGIV2. Nomogram for operating Path 46 and Path 61 will be developed in Phase 2.
MOHAVE – LUGO 500 KV LINE			106.7	
PALO VERDE – COLORADO RIVER 500 KV LINE			112.4	
	MIRAGE – J. HINDS 230 KV LINE	896 A	124.2	
LUGO – VICTORVILLE 500 KV LINE			101.5	
MIRAGE – J. HINDS 230 KV LINE	EAGLEMTN – J. HINDS 230 KV LINE	901 A	117.0	
EAGLEMTN – J. HINDS 230 KV LINE	MIRAGE – J. HINDS 230 KV LINE	896 A	114.2	
HASSYAMPA – HOODOO WASH 500 KV LINE	HASSYAMPA – N. GILA 500 KV LINE	2970 A	100.5	
HASSYAMPA – N. GILA 500 KV LINE	N. GILA – HOODOO WASH 500 KV LINE	2970 A	100.5	
Category P6 — Multiple Elements Outage Overloads				
IMPERIAL VALLEY – HIGHLINE & IMPERIAL VALLEY – N. GILA 500 KV LINES	HIGHLINE 500/230 KV TRANSFORMER	1329 MVA	124.7	Nomogram for operating Path 46 and Path 61 will be developed in Phase 2
ELDORDO – LUGO & MOHAVE – LUGO 500 KV LINES	LUGO – VICTORVILLE 500 KV LINE	3000 A	147.3	
	MIRAGE – J. HINDS 230 KV LINE	896 A	105.5	
MCCULLOUGH – VICTORVILLE #1 &2 500 KV LINES			103.7	
LUGO – MIRALOMA #2 & 3 500 KV LINES			104.5	
DEVERS – VALLEYSC #1 & 2 500 KV LINES	LUGO – VICTORVILLE 500 KV LINE	3000 A	102.8	
	DEVERS – SANBRDNO 230 KV LINE	796 A	102.0	
	DEVERS – VSTA 230 KV LINE	1240 A	103.4	

North Gila – Imperial Valley # 2 Transmission Project

WECC Path 46 Rating Increase

Comprehensive Progress Report

ATTACHMENT A

(AVAILABLE UP REQUEST)

Power Flow Contingency List

1/15/2016

North Gila – Imperial Valley # 2 Transmission Project

WECC Path 46 Rating Increase

Comprehensive Progress Report

ATTACHMENT B

(AVAILABLE UPON REQUEST)

Transient Stability Plots

1/15/2016