

November 2017 ERCOT Monthly Operations Report

Reliability and Operations Subcommittee Meeting

January 11th, 2018

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# Report Highlights

* The unofficial ERCOT peak for November was 50,619 MW.
* There were four frequency events in November. PMU data indicates the ERCOT system transitioned well in each case.
* There were four instances where Responsive Reserves were deployed, all of which were the result of frequency events.
* There were four RUC commitments in November.
* The level of reportable SCED congestion decreased in November. This congestion was mostly due to planned outages as well as high wind output. There were 43 instances over 30 days on the Generic Transmission Constraints (GTCs) in November. There were two days on the North-Houston GTC, 25 days on the Panhandle GTC and 16 days on the East Texas GTC in November. There was no activity on the remaining GTCs during the Month.
* There were four DC Tie curtailments in November.

# Frequency Control

## Frequency Events

The ERCOT Interconnection experienced four frequency events in November, all of which resulted from Resource trips. The average event duration was approximately 0:05:59.

When analyzing frequency events, ERCOT evaluates PMU data according to industry standards. Events with an oscillating frequency of less than 1 Hz are considered to be inter-area, while higher frequencies indicate local events. Industry standards specify that damping ratio for inter-area oscillations should be 3.0% or greater. All events listed below indicate the ERCOT system met these standards and transitioned well after each disturbance.

Reported frequency events will include both frequency events where frequency was outside the range of 60±0.1 Hz as well as those determined to be Frequency Measurable Events (FME) as defined by BAL-001-TRE-1. Delta Frequency is defined as the difference between the pre-perturbation and post-perturbation frequency. The Duration of Event is defined as the time it takes for the frequency to recover to lesser/greater of the frequency at the time of the frequency event (t(0) or “A-point”) for low/high-frequency events, respectively. Further details on FMEs can be found in the MIS posted BAL-001-TRE-1 PDCWG Unit Performance reports. A summary of the frequency events is provided below:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Date and Time** | **Delta Frequency** | **Max/Min Frequency** | **Duration of Event** | **PMU Data** | **MW Loss** | **Load** | **Wind** | **Inertia** |
| **(Hz)** | **(Hz)** | **Oscillation Mode (Hz)** | **Damping Ratio** | **(MW)** | **%**  | **(GW-s)** |
| 11/6/2017 9:08 | 0.073 | 59.90 | 0:08:31 | No PMU Report Created | 550  |  40,614  | 7% |  256,218  |
| 11/13/2017 15:16 | 0.098 | 59.87 | 0:05:03 | 0.72 | 6% | 660  |  39,811  | 10% |  226,972  |
| 11/18/2017 2:30 | 0.074 | 59.88 | 0:04:43 | No PMU Report Created | 474  |  31,446  | 47% |  148,557  |
| 11/25/2017 20:24 | 0.121 | 59.74 | 0:05:38 | 0.70 | 18% | 1,219  |  34,960  | 24% |  186,409  |

 (Note: frequency events highlighted in blue have been identified as FMEs per BAL-001-TRE-1 and the Performance Disturbance Compliance Working group. PMU reports are typically generated when frequency drops below 59.9, but PMU data is available for other events.)

 Currently, the Critical Inertia Level for ERCOT is approximately 100,000 MW-s (Source: [link](http://www.ercot.com/content/wcm/key_documents_lists/77622/06.__Inertia_Background_for_ROS.pptx))



(Note: All data on this graph encompasses frequency event analysis based on BAL-001-TRE-1.)

## Responsive Reserve Events

There were four events where Responsive Reserve MWs were released to SCED in November. The events highlighted in blue were related to frequency events reported in Section 2.1 above.

|  |  |  |  |
| --- | --- | --- | --- |
| **Date and Time Released to SCED** | **Date and Time Recalled** | **Duration of Event** | **Maximum MWs Released** |
|
| 11/6/2017 9:08:22 | 11/6/2017 9:11:55 | 0:03:28 | 254.38 |
| 11/13/2017 15:16:13 | 11/13/2017 15:19:53 | 0:03:36 | 654.42 |
| 11/18/2017 2:30:36 | 11/18/2017 2:34:08 | 0:03:28 | 542.33 |
| 11/25/2017 20:24:34 | 11/25/2017 20:29:27 | 0:04:47 | 1657.33 |

## Load Resource Events

None.

# Reliability Unit Commitment

ERCOT reports on Reliability Unit Commitments (RUC) on a monthly basis. Commitments are reported grouped by operating day and weather zone. The total number of hours committed is the sum of the hours for all the units in the specified region. Additional information on RUC commitments can be found on the MIS secure site at Grid 🡪 Generation 🡪 Reliability Unit Commitment.

There were no DRUC commitments in November.

There were four HRUC commitments in November.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Resource Location** | **# of Resources** | **Operating Day** | **Total # of Hours Committed** | **Total MWhs** | **Reason for Commitment** |
| Coast | 1 | 11/15/2017 | 2 | 90 | Congestion |
| South Central | 1 | 11/17/2017 | 3 | 144 | Congestion |
| Southern | 1 | 11/29/2017 | 2 | 1,327 | Congestion |
| Southern | 1 | 11/30/2017 | 4 | 1,298 | Congestion |

# Wind Generation as a Percent of Load



# Congestion Analysis

The number of congestion events experienced by the ERCOT system decreased in November. There were 43 instances over 30 days on the Generic Transmission Constraints (GTCs) in November.

## Notable Constraints for November

Nodal protocol section 3.20 specifies that ERCOT shall identify transmission constraints that are active or binding three or more times within a calendar month. As part of this process, ERCOT reports congestion that meets this criterion to ROS. In addition ERCOT also highlights notable constraints that have an estimated congestion rent exceeding $1,000,000 for a calendar month. These constraints are detailed in the table below. Rows highlighted in blue indicate the congestion was affected by one or more outages. For a list of all constraints activated in SCED for the month of November, please see Appendix A at the end of this report.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Contingency Name** | **Overloaded Element** | **# of Days Constraint Active** | **Congestion Rent** | **Transmission Project** |
|
| Basecase | PNHNDL GTC | 25 | $22,591,443.12 | South Plains RPG Proposal & Panhandle Loop (5180, 5208) |
| Jewet-Sng 345kV | Btu\_Jack\_Creek - Twin Oak Switch 345kV | 16 | $5,047,625.31 | Houston Import Project (4458) |
| BROWNWOOD SWITCH to MERCERS GAP SW | Hasse 138/69kV | 12 | $2,983,208.70 |   |
| CRLNW-LWSSW 345kV | Ti Tnp - West Tnp 138kV | 3 | $2,669,477.92 |   |
| Apache Tnp to Caddo Sw Sta T | Choctaw Tap Tnp - Choctaw Tnp 69kV | 2 | $2,460,991.17 | Brackettville to Escondido (5206) |
| EMSES-SAGNA 138kV | Eagle Mountain Ses - Eagle Mountain Compressor 138kV | 3 | $2,119,129.79 |   |
| Basecase | EASTEX GTC | 16 | $1,916,162.50 |   |
| Lon\_Hill-Coleto 345kV&Warburtn 138 | Lon Hill - Pawnee Switching Station 345kV | 3 | $1,904,589.37 |   |
| Rns-Rtw & Sng-Tb 345kv | Singleton - Zenith 345kV | 3 | $1,783,938.95 | Houston Import Project (4458) |
| CRLNW-LWSSW 345kV | Carrollton Northwest - Lakepointe Tnp 138kV | 7 | $1,676,062.25 | Northwest Carrollton - LakePointe TNP 138 kV Line (5488) |
| Jewet-Sng 345kV | Gibbons Creek - Singleton 345kV | 5 | $1,386,507.62 | Houston Import Project (4458) |
| Fergus-Granmo&Wirtz-Starck 138kV | Burnet 138/69kV | 10 | $1,335,161.52 |   |
| MERCERS GAP SW to COMANCHE SWITCH | Hasse 138/69kV | 4 | $1,227,591.26 |   |
| Elmcreek-Sanmigl 345kV | Pawnee Switching Station - Calaveras 345kV | 6 | $1,182,057.74 |   |
| HCKSW-ALLNC&RNKSW 345kV | Wagley Robertson - Summerfield 138kV | 2 | $1,041,361.37 |   |
| Garfield-Stoney\_R&Hicross138 | Lytton Springs - Pilot Knob 138kV | 2 | $1,002,344.59 |   |
| Wirtz-Burnet&Starck 138kV | Granite Mountain - Marble Falls 138kV | 16 | $865,790.35 |   |
| COLETO CREEK GEN COLETOG1 | Blessing - Lolita 138kV | 7 | $858,811.25 |   |
| COLETO CREEK to VICTORIA LIN 1 | Coleto Creek - Victoria 138kV | 11 | $792,467.71 | Coleto Creek to Tuleta: New 138 kV Line (16TPIT0034) |
| TRADINGHOUSE SES to LAKE CREEK SES | Tradinghouse Ses - Sam Switch 345kV | 3 | $781,598.88 | Tradinghouse - Sam Switch 345 kV Line (4304) |
| Victoria-V\_Dupsw 138kV | Formosa - Lolita 138kV | 7 | $730,062.43 |   |
| ENNIS WEST SWITCH to WAXAHACHIE PU | Trumbull - Ennis Switch 138kV | 3 | $551,863.47 |   |
| Apache Tnp to Caddo Sw Sta T | Heights Tnp - Choctaw Tap Tnp 69kV | 3 | $551,744.36 |   |
| Asphalt Mines to Blewett (3) | Hamilton Road - Maverick 138kV | 10 | $473,959.30 | Brackettville to Escondido (5206) |
| JARDIN to DILLEY SWITCH AEP LIN 1 | Dilley Switch Aep - Cotulla Sub 69kV | 10 | $472,160.41 | Rebuild Dilley to Cotulla (5222) |
| PBSES-MOSSW&HLTSW 138KV | General Tire Switch - Southwestern Portland Tap 138kV | 8 | $404,201.58 |   |
| KLEBERG AEP to LOYOLA SUB LIN 1 | Loyola Sub 138/69kV | 7 | $362,734.75 | AEP\_Angstrom (15TPIT0069) |
| Coleto Creek to Lon Hill 345 | Warburton Road Switching Station - Victoria 138kV | 8 | $345,920.42 |   |
| WOLF SWITCHING STATION to Monahans | Moss Switch - Permian Basin Ses 138kV | 8 | $334,441.27 |   |
| NORTH EDINBURG TRX 1382 345/138 | Burns Sub - Rio Hondo 138kV | 3 | $303,933.61 |   |
| Lon\_Hill-Coleto 345kV&Warburtn 138 | Pettus - Normanna 69kV | 3 | $195,618.79 |   |
| Cheyenne to Cheyenne Tap (3) | Moss Switch - Permian Basin Ses 138kV | 9 | $188,379.06 | Far West Texas Project |
| COLETO CREEK to PAWNEE SWITCHING S | Pawnee Switching Station 345/138kV | 3 | $156,949.82 |   |
| LAQUINTA to LOBO LIN 1 | Bruni Sub 138/69kV | 9 | $149,676.31 |   |
| LAQUINTA to LOBO LIN 1 | Falfurrias - Premont 69kV | 5 | $126,919.69 |   |
| COLETO CREEK to PAWNEE SWITCHING S | Kenedy Switch - Coleto Creek 138kV | 3 | $123,587.15 | Coleto Creek to Tuleta: New 138 kV Line (16TPIT0034) |
| Lon\_Hill-Coleto 345kV&Warburtn 138 | Oconnor - Victoria 69kV | 4 | $109,715.29 |   |
| PBSES-MOSSW&HLTSW 138KV | Dollarhide - No Trees Switch 138kV | 3 | $109,245.36 |   |
| NORTH EDINBURG TRX NEDIN\_3\_1 345/1 | Burns Sub - Rio Hondo 138kV | 4 | $104,412.29 |   |
| Lon\_Hill-Coleto 345kV&Warburtn 138 | Beeville - Normanna 69kV | 4 | $103,308.24 |   |
| Basecase | Pig Creek - Solstice 138kV | 12 | $89,716.05 | Solstice to Permian Basin: Rebuild 138 kV line (5257) |
| BOSQUE SWITCH to ELM MOTT LIN 1 | Bosque Switch - Rogers Hill Bepc 138kV | 6 | $84,293.52 |   |
| ROCK ISLAND to GLIDDEN LCRA LIN 1 | Glidden Lcra 138/69kV | 5 | $83,598.06 |   |
| Victoria-V\_Dupsw 138kV | Greenlake - Weaver Road 69kV | 4 | $70,572.27 |   |
| CLEARFORK to TELEPHONE ROAD - Shar | Moss Switch - Permian Basin Ses 138kV | 5 | $63,214.25 |   |
| FRIEND RANCH to SONORA LIN 1 | Sonora 138/69kV | 5 | $60,712.45 |   |
| Alamito Creek to Barrilla (2 | Pig Creek - Solstice 138kV | 7 | $50,637.29 | Solstice to Permian Basin: Rebuild 138 kV line (5257) |
| COMANCHE SWITCH (Oncor) TRX CMNSW\_ | Hasse 138/69kV | 4 | $49,522.66 |   |
| Elmcreek-Sanmigl 345kV | Blessing - Lolita 138kV | 3 | $48,840.34 |   |
| Re Roserock Solar Plant to F | Barrilla - Fort Stockton Switch 69kV | 4 | $46,089.73 |   |
| PBSES-MOSSW&HLTSW 138KV | No Trees Switch - Cheyenne Tap 138kV | 7 | $39,597.16 |   |
| BRACKETTVILLE to HAMILTON ROAD LIN | Hamilton Road - Maverick 138kV | 3 | $38,219.48 | Brackettville to Escondido (5206) |
| Cenizo-Delsol(345)&Garza-Rom | Garza 138/69kV | 6 | $36,435.43 |   |
| Bronco to ALPINE REA LIN 1 | Alpine - Paisano 69kV | 9 | $29,789.64 |   |
| DANEVANG SWITCHING STATION to BLES | Blessing 138/69kV | 3 | $27,280.36 |   |
| SANDOW SWITCH to AUSTROP LIN \_A | Sandow Switch - Austrop 345kV | 3 | $24,178.94 |   |
| Colorado to Sheridan (2)138/ | Glidden Lcra 138/69kV | 4 | $16,185.52 |   |
| Elmcreek-Stp 345kv | Blessing - Lolita 138kV | 4 | $13,261.99 |   |
| FORT STOCKTON PLANT TRX 69T1 138/6 | Pig Creek - Solstice 138kV | 3 | $7,198.12 | Solstice to Permian Basin: Rebuild 138 kV line (5257) |
| Zorn-Marion & Cleasp 345kV | Henne - Zorn 138kV | 3 | $7,020.68 |   |
| Cottonwood Road Switch to Lo | Bowie 138/69kV | 4 | $6,527.87 |   |
| Lon\_Hill-Coleto 345kV&Warburtn 138 | Beeville - Normanna 69kV | 4 | $3,319.32 |   |
| Elmcreek-Sanmigl 345kV | Pawnee Switching Station - Calaveras 345kV | 6 | $1,197.23 |   |

## Generic Transmission Constraint Congestion

There were two days on the North-Houston GTC, 25 days on the Panhandle GTC and 16 days on the East Texas GTC in November. There was no activity on the remaining GTCs during the Month.

Note: This is how many times a constraint has been activated to avoid exceeding a GTC limit, it does not imply an exceedance of the GTC occurred or that the GTC was binding.

## Manual Overrides for November

None.

## Congestion Costs for Calendar Year 2017

The following table represents the top twenty active constraints for the calendar year based on the estimated congestion rent attributed to the congestion. ERCOT updates this list on a monthly basis.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Contingency** | **Binding Element** | **# of 5-min SCED Intervals** | **Estimated Congestion Rent** | **Transmission Project** |
| Basecase | PNHNDL GTC | 31,517 | 127,186,275.86 | South Plains RPG Proposal & Panhandle Loop (5180, 5208) |
| HCKSW-ALLNC&RNKSW 345kV | Blue Mound - Wagley Robertson 138kV | 10,545 | 73,403,975.05 | Saginaw 345/138 kV auto (6273) |
| Rns-Rtw & Sng-Tb 345kv | Singleton - Zenith 345kV | 18,561 | 67,601,152.95 | Houston Import Project (4458) |
| Jewet-Sng 345kV | Btu\_Jack\_Creek - Twin Oak Switch 345kV | 21,657 | 65,523,866.96 | Houston Import Project (4458) |
| Rns-Rtw & Sng-Tb 345kv | Singleton - Zenith 345kV | 9,538 | 33,061,259.86 | Houston Import Project (4458) |
| NORTH PHARR to POLK AVENUE LIN 1 | North Mcallen - West Mcallen 138kV | 2,541 | 32,283,806.21 | Pharr 138 kV Loop (4493) |
| CRLNW-LWSSW 345kV | Carrollton Northwest - Lakepointe Tnp 138kV | 6,963 | 25,593,393.14 | Upgrade existing NW Carrollton - LakePointe 138 kV Line (5488) |
| White\_Pt-Mccampbe&Hecker 138 | Whitepoint - Rincon 138kV | 1,352 | 24,325,582.27 | Upgrade existing NW Carrollton - LakePointe 138 kV Line (5488) |
| HCKSW-ALLNC&RNKSW 345kV | Wagley Robertson - Summerfield 138kV | 1,632 | 22,995,433.32 | Saginaw 345/138 kV auto (6273) |
| Victoria-V\_Dupsw 138kV | Formosa - Lolita 138kV | 3,074 | 19,360,525.34 |  |
| NORTH PHARR to PHARR Magic Valley | North Mcallen - West Mcallen 138kV | 703 | 15,031,152.13 | Pharr 138 kV Loop (4493) |
| Hecker\_White\_Pt 138kv | Whitepoint - Rincon 138kV | 1,447 | 14,822,421.12 | Melon Creek: Build new (2979) |
| Nedin-Mv\_Wedn4&Mv\_Palm4 138k | Azteca Sub - Se Edinburg 138kV | 1,675 | 13,608,219.01 | Azteca Sub - SE Edinburg - Pharr and North Edinburg - McColl Road 138-kV terminal equipment upgrade. (2017 RTP S2) |
| Jewet-Sng 345kV | Gibbons Creek - Singleton 345kV | 2,429 | 12,177,961.20 | Houston Import Project (4458) |
| Jewet-Sng 345kV | Gibbons Creek - Twin Oak Switch 345kV | 318 | 10,861,578.84 | Houston Import Project (4458) |
| White\_Pt-Hecker&I\_Dupsw 138k | Whitepoint - Rincon 138kV | 761 | 9,477,211.29 | Melon Creek: Build new (2979) |
| Elmcreek-Sanmigl 345kV | Pawnee Switching Station - Calaveras 345kV | 688 | 8,839,716.78 |  |
| NORTH EDINBURG TRX 1382 345/138 | North Edinburg 345/1kV | 434 | 8,304,991.43 | Stewart Road: Construct 345 kV cut-in (5604) |
| Jewet-Sng 345kV | Singleton - Gibbons Creek 345kV | 2,887 | 7,620,579.90 | Houston Import Project (4458) |
| Re Roserock Solar Plant to F | Barrilla - Fort Stockton Switch 69kV | 2,269 | 6,989,876.38 | Far West Texas Project |

# System Events

## ERCOT Peak Load

The unofficial ERCOT peak load for the month was 50,619 MW and occurred on November 5th during hour ending 16:00.

## Load Shed Events

None.

## Stability Events

None.

## Notable PMU Events

ERCOT analyzes PMU data for any significant system disturbances that do not fall into the Frequency Events category reported in section 2.1. The results are summarized in this section once the analysis has been completed.

There were no reportable events in November.

## DC Tie Curtailment

There were two DC Tie curtailments in November.

|  |  |  |  |
| --- | --- | --- | --- |
| **Date**  | **Curtailing Period** | **# of Curtailments (Tags)** | **Curtailment Reason** |
|
| 11/6/2017 | HE18 – HE24 | 2 | Transmission Watch |
| 11/27/2017 | HE17 | 2 | Transmission Watch |

## TRE/DOE Reportable Events

None.

## New/Updated Constraint Management Plans

None.

## New/Modified/Removed RAS

None.

## New Procedures/Forms/Operating Bulletins

None.

# Emergency Conditions

## OCNs

None.

##  Advisories

None.

## Watches

|  |  |
| --- | --- |
| **Date and Time** | **Description** |
| 11/06/17 17:13 | ERCOT is issuing a Transmission Watch for the Eagle Pass DC Tie due to a force extension of a planned outage. |
| 11/27/17 15:58 | ERCOT is issuing a Transmission Watch for the Eagle Pass DC Tie due to a force extension of a planned outage. |

## Emergency Notices

None.

# Application Performance

## TSAT/VSAT Performance Issues

None.

## Communication Issues

None.

## Market System Issues

None.

# Model Updates

The Downstream Production Change (DPC) process allows ERCOT to make changes in the on-line Network Operations Model without loading a completely new model. The purpose of this process is to allow for reliable grid operations as system conditions change between designated Network Operations Model database loads. The DPC process is limited in scope to just those items listed below, with equipment ratings updates being the most common. ERCOT has seen a rise in the use of the DPC process to make on-line updates to the Network Operations Model in recent years, instead of through the standard Network Operations Model Change Request process.

* Static Line ratings (Interim Update)
* Dynamic Line ratings (non-Interim Update)
* Autotransformer ratings (non-Interim Update)
* Breaker and Switch Normal status (Interim Update)
* Contingency Definitions (Interim Update)
* RAP and RAS changes or additions (Interim Update)
* Net Dependable and Reactive Capability (NDCRC) values (Interim Update)
* Impedance Updates (non-Interim)

|  |  |
| --- | --- |
| **Transmission Operator** | **Number of DPCs** |

|  |  |
| --- | --- |
| ERCOT | 5 |
| ONCOR | 4 |
| CENTERPOINT | 1 |

# Appendix A: Real-Time Constraints

The following is a complete list of constraints activated in SCED for the month of November. Full contingency descriptions can be found in the Standard Contingencies List located on the MIS secure site at Grid 🡪 Generation 🡪 Reliability Unit Commitment.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Contingency** | **Constrained Element** | **From Station** | **To Station** | **# of Days Constraint Active** |
| BASE CASE | PNHNDL | n/a | n/a | 25 |
| BASE CASE | EASTEX | n/a | n/a | 16 |
| DWIRSTA8 | 342T195\_1 | GRANMO | MARBFA | 16 |
| DWIRSTA8 | 342T195\_1 | MARBFA | GRANMO | 16 |
| DJEWSNG5 | JK\_TOKSW\_1 | TOKSW | JK\_CK | 16 |
| SMGPBRN8 | HAS\_XFM2 | HAS | HAS | 12 |
| BASE CASE | PIGCRE\_SOLSTI1\_1 | PIGCREEK | SOLSTICE | 12 |
| BASE CASE | PIGCRE\_SOLSTI1\_1 | SOLSTICE | PIGCREEK | 12 |
| SVICCO28 | COLETO\_VICTOR2\_1 | COLETO | VICTORIA | 11 |
| SJARDIL8 | DIL\_COTU\_1 | DILLEYSW | COTULAS | 10 |
| SBRAUVA8 | HAMILT\_MAVERI1\_1 | HAMILTON | MAVERICK | 10 |
| DFERSTA8 | BURNET\_AT3 | BURNET | BURNET | 10 |
| SLAQLOB8 | BRUNI\_69\_1 | BRUNI | BRUNI | 9 |
| SCHYWIN8 | 6485\_\_A | MOSSW | PBSES | 9 |
| SCOCBAR9 | ALPINE\_PAIS1\_1 | ALPINE | PAIS | 9 |
| SCOCBAR9 | ALPINE\_PAIS1\_1 | PAIS | ALPINE | 9 |
| SCOLLON5 | VICTO\_WARBU\_1A\_1 | VICTORIA | WARBURTN | 8 |
| SWLFMON8 | 6485\_\_A | MOSSW | PBSES | 8 |
| DPBSHLT8 | 6345\_\_B | GNTSW | SPRTP | 8 |
| UCOLCOL1 | BLESSI\_LOLITA1\_1 | BLESSING | LOLITA | 7 |
| SALMBA28 | PIGCRE\_SOLSTI1\_1 | SOLSTICE | PIGCREEK | 7 |
| DCRLLSW5 | 591\_\_A | LKPNT | CRLNW | 7 |
| DVICV\_D8 | FORMOS\_LOLITA1\_1 | LOLITA | FORMOSA | 7 |
| SALMBA28 | PIGCRE\_SOLSTI1\_1 | PIGCREEK | SOLSTICE | 7 |
| DPBSHLT8 | 6101\_\_A | NOTSW | CHEYT | 7 |
| SKLELOY8 | LOYOLA\_69\_1 | LOYOLA | LOYOLA | 7 |
| DELMSAN5 | PAWNEE\_SPRUCE\_1 | PAWNEE | CALAVERS | 6 |
| DCE\_GA58 | GARZA\_69A1 | GARZA | GARZA | 6 |
| DELMSAN5 | PAWNEE\_SPRUCE\_1 | CALAVERS | PAWNEE | 6 |
| SBOSELM5 | 1030\_\_B | BOSQUESW | RGH | 6 |
| DJEWSNG5 | SNGXGC99\_1 | GIBCRK | SNG | 5 |
| SLAQLOB8 | FALFUR\_PREMON1\_1 | FALFUR | PREMONT | 5 |
| SSONFRI8 | SONR\_69-1 | SONR | SONR | 5 |
| SCLETE25 | 6485\_\_A | MOSSW | PBSES | 5 |
| SROCGL28 | GLIDDE\_AT2 | GLIDDE | GLIDDE | 5 |
| DELMTEX5 | BLESSI\_LOLITA1\_1 | BLESSING | LOLITA | 4 |
| DHCKRNK5 | 6270\_\_C | WGROB | BLMND | 4 |
| SCRDLOF9 | BOW\_FMR1 | BOW | BOW | 4 |
| SWCSBOO8 | BARL\_FTSW1\_1 | FTSW | BARL | 4 |
| XNED358 | BURNS\_RIOHONDO\_1 | RIOHONDO | MV\_BURNS | 4 |
| SZEPCMN8 | HAS\_XFM2 | HAS | HAS | 4 |
| XCMN58 | HAS\_XFM2 | HAS | HAS | 4 |
| DLONWAR5 | BEEVIL\_NORMAN1\_1 | NORMANNA | BEEVILLE | 4 |
| DLONWAR5 | REFUG\_VICTO\_1C\_1 | VICTORIA | OCONNOR | 4 |
| SWCSBOO8 | BARL\_FTSW1\_1 | BARL | FTSW | 4 |
| SROCGL18 | GLIDDE\_AT2 | GLIDDE | GLIDDE | 4 |
| DVICV\_D8 | GREENL\_WEAVER1\_1 | WEAVERRD | GREENLK | 4 |
| DLONWAR5 | BEEVIL\_NORMAN1\_1 | BEEVILLE | NORMANNA | 4 |
| SBRAHAM8 | HAMILT\_MAVERI1\_1 | HAMILTON | MAVERICK | 3 |
| XFTS89 | PIGCRE\_SOLSTI1\_1 | SOLSTICE | PIGCREEK | 3 |
| DEMSSAG8 | 6260\_\_C | EMSES | EMMCP | 3 |
| DLONWAR5 | NORMAN\_PETTUS1\_1 | PETTUS | NORMANNA | 3 |
| DLONWAR5 | LONHILL\_PAWNEE\_1 | PAWNEE | LON\_HILL | 3 |
| SSNDAU15 | 450\_\_A | SNDSW | AUSTRO | 3 |
| DPBSHLT8 | 6100\_\_F | DHIDE | NOTSW | 3 |
| XNED258 | BURNS\_RIOHONDO\_1 | RIOHONDO | MV\_BURNS | 3 |
| SAPACAD8 | G69\_FA\_1 | HEIGHTTN | CHOCTAP | 3 |
| DCRLLSW5 | 588\_A\_1 | LWSVW | LWVTI | 3 |
| SMGIENW8 | 921\_\_D | ENSSW | TRU | 3 |
| DRNS\_TB5 | SNGZEN99\_A | SNG | ZEN | 3 |
| SDANBLE8 | BLESSING\_69A1 | BLESSING | BLESSING | 3 |
| DELMSAN5 | BLESSI\_LOLITA1\_1 | BLESSING | LOLITA | 3 |
| XFTS89 | PIGCRE\_SOLSTI1\_1 | PIGCREEK | SOLSTICE | 3 |
| DCLEZOR5 | 89T204\_1 | ZORN | HENNE | 3 |
| SCOLPAW5 | COLETO\_KENEDS1\_1 | COLETO | KENEDSW | 3 |
| DLONWAR5 | NORMAN\_PETTUS1\_1 | NORMANNA | PETTUS | 3 |
| SCOLPAW5 | PAWNEE\_XF1 | PAWNEE | PAWNEE | 3 |
| SLCSTH25 | 505\_\_A | THSES | SAMSW | 3 |
| SCHYWIN8 | 6100\_\_F | NOTSW | DHIDE | 2 |
| SAPACAD8 | G69\_F2\_1 | CHOCTAP | CHOCTAW | 2 |
| DAUSDUN8 | CKT\_943\_1 | LYTTON\_S | PILOT | 2 |
| SPADPAD9 | ROTN\_WOLFGA1\_1 | WOLFGANG | ROTN | 2 |
| DBBSJEW5 | 1210\_\_C | NVARO | HAN1 | 2 |
| SRCHTR25 | 20\_\_A | BBSES | RCHBR | 2 |
| SODLBRA8 | HAMILT\_MAVERI1\_1 | HAMILTON | MAVERICK | 2 |
| DTRSRCH5 | 227\_\_A | LEG | NAVARRO | 2 |
| SBBSRC25 | 31\_\_A | RCHBR | TRSES | 2 |
| SKEYWLV8 | 6137\_\_A | GUNSW | BUZSW | 2 |
| SACSCLE5 | 6485\_\_A | MOSSW | PBSES | 2 |
| SFLAPIG8 | MUSQUI\_PIGCRE1\_1 | PIGCREEK | MUSQUIZ | 2 |
| DHKBCRL5 | 588\_A\_1 | LWSVW | LWVTI | 2 |
| DHCKRNK5 | 6271\_\_C | WGROB | SUMRFELD | 2 |
| XACS58 | 6485\_\_A | MOSSW | PBSES | 2 |
| DWAP\_JN5 | BI\_SMR98\_A | SMITHERS | BI | 2 |
| DLONWAR5 | BONIVI\_RINCON1\_1 | RINCON | BONIVIEW | 2 |
| BASE CASE | N\_TO\_H | n/a | n/a | 2 |
| DSAMTHS5 | 100027\_D\_1 | WHTNY | WND | 2 |
| SCAGKEN5 | 74T148\_1 | COMFOR | CICO | 2 |
| SCOLLON5 | BEEVIL\_NORMAN1\_1 | NORMANNA | BEEVILLE | 2 |
| DGARHIC8 | CKT\_943\_1 | LYTTON\_S | PILOT | 2 |
| SPADPAD9 | GIRA\_T\_SPUR1\_1 | SPUR | GIRA\_TAP | 2 |
| DSAMTHS5 | 228\_\_A | LEG | NAVARRO | 2 |
| SPAWLON5 | NORMAN\_PETTUS1\_1 | PETTUS | NORMANNA | 2 |
| DBBSJEW5 | 1480\_\_D | TRSES | GDLTP | 2 |
| DLONWAR5 | AIRCO4\_RINCON1\_1 | AIRCO4 | RINCON | 2 |
| DBWNKLN5 | HAS\_XFM2 | HAS | HAS | 2 |
| XSA2N58 | SANMIGL\_ATAH | SANMIGL | SANMIGL | 2 |
| DSNG\_TB5 | SNGZEN99\_A | SNG | ZEN | 2 |
| BASE CASE | SNYDER\_WKN\_BK1\_1 | ENAS | WKN\_BKR | 2 |
| DBBSJEW5 | 510\_\_A | TRSES | WTRML | 2 |
| DPBSHLT8 | 6100\_\_G | ACSSW | AMTBT | 2 |
| XFTS89 | 6332\_\_A | YUCSW | GASPAD | 2 |
| SBOMJC25 | 6560\_\_B | MRKLY | RICSW | 2 |
| SRDODES8 | 940\_\_C | ENWSW | WXHCH | 2 |
| DBBSJEW5 | 1750\_\_G | WILMR | WTRML | 1 |
| SSNDPB48 | 6485\_\_A | MOSSW | PBSES | 1 |
| DWTRTRC5 | 921\_\_D | ENSSW | TRU | 1 |
| DSC\_SL28 | CRNJFS94\_A | JFS | CRN | 1 |
| DDILCOT8 | DIL\_COTU\_1 | DILLEYSW | COTULAS | 1 |
| SLVOSON8 | ELDO\_LVOK1\_1 | LVOK | ELDO | 1 |
| SCOLNAD8 | GLIDDE\_AT2 | GLIDDE | GLIDDE | 1 |
| SWINPBS8 | IH20\_IHT1 | IH20 | IH20 | 1 |
| DCC3\_NED | NEDIN\_1382 | NEDIN | NEDIN | 1 |
| SSPUASP8 | ROTN\_WOLFGA1\_1 | WOLFGANG | ROTN | 1 |
| SCITHW8 | SA\_THW24\_A | THW | SA | 1 |
| DGIBSNG5 | 260\_A\_1 | JEWET | SNG | 1 |
| DZORHAY5 | 459T459\_1 | KENDAL | CAGNON | 1 |
| DCAGCI58 | 460T460\_1 | MEDILA | W1 | 1 |
| SDHUACS8 | 6485\_\_A | MOSSW | PBSES | 1 |
| DBBSJEW5 | 920\_\_E | MTFSW | TLC | 1 |
| UFO2FOR1 | BLESSI\_LOLITA1\_1 | BLESSING | LOLITA | 1 |
| DTOKJK\_5 | HRN\_DANS\_1 | HRN | DANSBY | 1 |
| SSPJFS8 | JFSSC\_06\_A | JFS | SC | 1 |
| DCALHOT8 | N4\_X3\_1 | CALAVERS | X3 | 1 |
| SPADPAD9 | ROBY\_ROTN1\_1 | ROTN | ROBY | 1 |
| DBBSJEW5 | 1210\_\_B | HAN1 | HUBRD | 1 |
| DALNRYS5 | 1750\_\_B | SGOVL | KLBTP | 1 |
| DHILMAR5 | 293T304\_1 | CIBOLO | SCHERT | 1 |
| SCENLOB5 | BEEVIL\_NORMAN1\_1 | BEEVILLE | NORMANNA | 1 |
| SPAWCAL5 | BLESSI\_LOLITA1\_1 | BLESSING | LOLITA | 1 |
| DRIOHAR5 | BURNS\_RIOHONDO\_1 | RIOHONDO | MV\_BURNS | 1 |
| DCALBEC8 | D3\_G3\_1 | D3 | G3 | 1 |
| SBRAUVA8 | EAGLHY\_ESCOND1\_1 | EAGLHYTP | ESCONDID | 1 |
| SEAGHAM8 | UVALDE\_W\_BATE1\_1 | UVALDE | W\_BATESV | 1 |
| DBBSJEW5 | 1750\_\_B | SGOVL | KLBTP | 1 |
| DCRLLSW5 | 589\_C\_1 | LWSVS | CRLNW | 1 |
| SASPPAI8 | ASPM\_69T1 | ASPM | ASPM | 1 |
| DLONWAR5 | BONIVI\_WOODSB1\_1 | BONIVIEW | WOODSBOR | 1 |
| DBIGKEN5 | FRIR\_ROCKSP1\_1 | FRIR | ROCKSPRS | 1 |
| SGARROM8 | GARZA\_69A1 | GARZA | GARZA | 1 |
| XN\_S58 | N\_SHARPE\_PS3 | N\_SHARPE | N\_SHARPE | 1 |
| XBAR89 | PIGCRE\_SOLSTI1\_1 | SOLSTICE | PIGCREEK | 1 |
| STUNRIO8 | SANTIA\_SAPOWE1\_1 | SANTIAGO | SAPOWER | 1 |
| SDOWMOO8 | UVALDE\_W\_BATE1\_1 | UVALDE | W\_BATESV | 1 |
| DBBSJEW5 | 31\_\_A | RCHBR | TRSES | 1 |
| DBBSJEW5 | 975\_\_E | FGRSW | EUSSE | 1 |
| SN\_SLON5 | HOLLY4\_RODD\_F1\_1 | RODD\_FLD | HOLLY4 | 1 |
| SNADRIC8 | NAD\_ELCM\_1 | NADAS | ELCMPOS | 1 |
| SPOMNED5 | NLARSW\_PILONC1\_1 | NLARSW | PILONCIL | 1 |
| SRCHTRS5 | 31\_\_A | RCHBR | TRSES | 1 |
| DBBSJEW5 | 920\_\_A | ENPTP | CRISP | 1 |
| BASE CASE | BURNS\_RIOHONDO\_1 | RIOHONDO | MV\_BURNS | 1 |
| SCLETE25 | IH20\_IHT1 | IH20 | IH20 | 1 |
| SCENLOB5 | LON\_HI\_ORNGRO1\_1 | LON\_HILL | ORNGROV | 1 |
| SSIGSAN8 | NCA\_SMTP\_1 | SANMTAP | NCALHMS | 1 |
| SLOBSA25 | NORMAN\_PETTUS1\_1 | PETTUS | NORMANNA | 1 |
| DTOKJK\_5 | RBS\_HRN\_1 | RBS | HRN | 1 |
| DTRVPIR8 | SOLSRB21\_A | SRB | SOL | 1 |
| DJEWSNG5 | 256\_A\_1 | TOKSW | GIBCRK | 1 |
| SCLETE25 | 6095\_\_D | LMESA | JPPOI | 1 |
| DBBSJEW5 | 920\_\_D | TLC | ENPTP | 1 |
| DBBSJEW5 | 921\_\_D | ENSSW | TRU | 1 |
| DDUNLOS5 | AUSTRO\_AT2L | AUSTRO | AUSTRO | 1 |
| SLOSAU25 | AUSTRO\_AT2L | AUSTRO | AUSTRO | 1 |
| SVICCOL8 | COLETO\_VICTOR1\_1 | COLETO | VICTORIA | 1 |
| XACS58 | IH20\_IHT1 | IH20 | IH20 | 1 |
| BASE CASE | NWF\_NOTSW\_1 | NWF | NOTSW | 1 |
| DTOKJK\_5 | WAT\_HLK\_1 | WATSONCP | HLK | 1 |
| DTOKJK\_5 | 240\_\_A | JEWET | SNG | 1 |
| DCALHOT8 | C4\_L2\_1 | C4 | L2 | 1 |
| DCI\_SA\_8 | DH\_WO\_81\_A | DH | WO | 1 |
| SBRAUVA8 | EAGLHY\_MAVERI1\_1 | MAVERICK | EAGLHYTP | 1 |
| SN\_SAJO5 | FALFUR\_PREMON1\_1 | FALFUR | PREMONT | 1 |
| DLONWAR5 | FANNIN\_VICTOR1\_1 | VICTORIA | FANNINS | 1 |
| SBLESTP5 | GLIDDE\_AT2 | GLIDDE | GLIDDE | 1 |
| SMCEABS8 | MKLT\_TRNT1\_1 | TRNT | MKLT | 1 |
| DCALBEC8 | N3\_U2\_1 | CALAVERS | BRAUNIG | 1 |
| DNEDPAL8 | NEDIN\_N\_MCAL1\_1 | NEDIN | N\_MCALLN | 1 |
| DMCARIO8 | PIGCRE\_SOLSTI1\_1 | SOLSTICE | PIGCREEK | 1 |
| XYU189 | PIGCRE\_SOLSTI1\_1 | SOLSTICE | PIGCREEK | 1 |
| SRAYRI28 | RAYMND\_RAYMON1\_1 | RAYMND2 | RAYMOND1 | 1 |
| XLOB258 | UVALDE\_W\_BATE1\_1 | UVALDE | W\_BATESV | 1 |