



March 1<sup>st</sup>, 2021

Mr. Steve Ruty  
Director, Grid Assets  
California ISO  
250 Outcropping Way  
Folsom, CA 95630

Dear Mr. Ruty,

In accordance with the Transmission Control Agreement (TCA) section 14.3, TCA Appendix C Section 4.0 and CAISO Tariff 4.8.3 Trans Bay Cable (TBC) submits the following **Public Access** Availability Report for CAISO review.

**Performance:**

TBC's summary performance for 2020 is:

Period	Scheduled Energy Unavailability	Forced Energy Unavailability	Availability (Combined)	MW Utilization
Q1	2.38%	0%	97.62%	51.36%
Q2	0.31%	1%	98.85%	50.09%
Q3	0.00%	0%	100.00%	50.59%
Q4	18.84%	0%	18.84%	47.29%
YEAR	5.40%	0.21%	94.38%	49.83%

The table above shows the performance data for each quarter during the year 2020, and for the whole year of 2020.

TBC completed all preventative maintenance for 2020, in accordance with CAISO approve Converter Station and Cable Maintenance Practices. Details are provided separately in the CAISO Standard Maintenance Reporting System TBC 2020 Review.

TBC operates a single DC transmission line and has accrued 10 years of operational data. TBC's ability to trend performance is limited to the data acquired since commercial operations. The Total Forced Outage duration in 2019 did not exceed our defined Upper Control Limit (UCL) for outage duration and was found to be within bounds and consistently less than the Center Control values as derived. In 2020, Total Forced Outage Duration was 1109 minutes, compared to 44 minutes of the previous year.

The following section provides details in TBC's derivation of UCL, as well as other values used to create the Control Charts.

### **Control Charts:**

TBC used CAISO's TCA, Appendix C, as a reference in creating TBC's control charts. Forced Outage data of the TBC Facility was used to create the charts. The following outage data were not included in the control charts:

- Scheduled Outages
- Outages classified as "Not a Forced Outage" in the Maintenance Procedures
- Forced Outages which:
  - Were caused by events outside TBC's Facility including outages which originate in other TO systems, other electric utility systems or customer equipment
  - Or outages which can be demonstrated to have been caused by earthquakes

The following variable and equations were extracted from the TCA and used to create TBC's control charts:

### **Annual Average Forced Outage Frequency for the TBC HVDC Facility**

$$F_{vc,k} = \frac{1}{N_k} \sum_{i=1}^{N_k} f_{ik}$$

$N_k$  = number of Transmission Line Circuits in Voltage Class in calendar year "k".  
See Appendix C, Note 2, Section 4.1.1 of the TCA.

*Because the TBC HVDC Facility is considered a single transmission line,  $N_k$  will equal one (1) for each calendar year "k".*

$f_{ik}$  = frequency of Forced Outages<sup>(IMS)</sup> for the "ith" Transmission Line Circuit as calculated in accordance with Appendix C, Section 4.1.1 of the TCA for calendar year "k".

*Because the TBC HVDC Facility is considered a single transmission line, "i" will equal one (1), and  $f_{ik}$  will simply be  $f_k$ .  $f_k$  will equal the number of Forced Outages that occurred on the TBC HVDC transmission line each for calendar year "k".*

$F_{vc,k}$  = frequency index for the Voltage Class,  $vc$ , (units = Forced Outages<sup>(IMS)</sup> /Transmission Line Circuit). The frequency index equals the average (mean) number of Forced Outages<sup>(IMS)</sup> for all Transmission Line Circuits within a Voltage Class for the calendar year "k".

*Because the TBC HVDC facility is considered its own voltage class and a single transmission line "vc" will equal one (1), and  $F_{vc,k}$  will simply be  $F_k$ .  $F_k$  will subsequently equal the number of Forced Outages that occurred on the TBC HVDC transmission line for each calendar year "k".*

$F_k = f_k$

### **Annual Average Accumulated Forced Outage Duration for the TBC HVDC Facility**

$$D_{vc,k} = \frac{1}{N_{o,k}} \sum_{i=1}^{N_{o,k}} d_{ik}$$

$N_{o,k}$  = number of Transmission Line Circuits in the Voltage Class for which the Forced Outage<sup>(IMS)</sup> frequency Availability Measure ( $f_{ik}$ ) as calculated in accordance with Section 4.1.1 of this Appendix C is greater than zero for the

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calendar year “k”. See Appendix C, Note 2, Section 4.1.1 of the TCA.

*Because the TBC HVDC Facility is considered a single transmission line,  $N_{o,k}$  will equal one (1) for each calendar year “k”.*

$d_{ik}$  = accumulated duration of Forced Outages<sup>(IMS)</sup> for the “i”th Transmission Line Circuit having a Forced Outage<sup>(IMS)</sup> frequency Availability Measure ( $f_{ik}$ ) greater than zero for calendar year “k” as calculated in accordance with Section 4.1.1 of this Appendix C.

*Because the TBC HVDC Facility is considered a single transmission line, “i” will equal one (1), and  $d_{ik}$  will simply be  $d_k$ .  $d_k$  will equal the total accumulated duration of Forced Outages the TBC Facility experienced each calendar year “k”.*

$D_{vc,k}$  = duration index for the Voltage Class (units = minutes/Transmission Line Circuit). The duration index equals the average accumulated duration of Forced Outages<sup>(IMS)</sup> for all Transmission Line Circuits within a Voltage Class which experienced Forced Outages<sup>(IMS)</sup> during the calendar year “k”.

*Because the TBC HVDC facility is considered its own voltage class and a single transmission line “vc” will equal one (1),  $D_{vc,k}$  will simply be  $D_k$ .  $D_k$  will subsequently equal the number of Forced Outages that occurred on the TBC HVDC Facility for each calendar year “k”.*

$D_k = d_k$

### **CL for Annual Average Forced Outage Frequency for the TBC HVDC Facility**

$$CL_f = \frac{\sum_{k=1}^Y \sum_{i=1}^{N_k} f_{ik}}{\sum_{k=1}^Y N_k}$$

$Y$  = number of calendar years prior to the date a TO becomes a PTO for which the PTO has reliable, continuously recorded Forced Outage<sup>(IMS)</sup> data.

*TBC became a PTO from the beginning of commercial operation in November of 2010. Due to this the first calendar year used for the CL calculation will begin from the date of January 1<sup>st</sup>, 2011.*

$CL_f$  = center control line value for the Forced Outage<sup>(IMS)</sup> frequencies for each of the Transmission Line Circuits in the Voltage Class for “Y” calendar years prior to the date a TO becomes a PTO.

*Because the TBC Facility is considered a single voltage class and a single transmission line, this calculation essentially becomes the average number of Forced Outages since January 1<sup>st</sup>, 2011.*

### **CL for Annual Average Accumulated Forced Outage Duration for the TBC HVDC Facility**

$$CL_d = \frac{\sum_{k=1}^Y \sum_{i=1}^{N_{o,k}} d_{ik}}{\sum_{k=1}^Y N_{o,k}}$$

$CL_d$  = center control line value for accumulated Forced Outage<sup>(IMS)</sup> duration for each of the Transmission Line Circuits in the Voltage Class for “Y” calendar years prior to the date a TO becomes a PTO in which the Forced Outage<sup>(IMS)</sup> frequency ( $f_{ik}$ ) was greater than zero.

*Because of the assumptions made above, this calculation essentially becomes the average duration (in minutes) of Forced Outages since January 1<sup>st</sup>, 2011.*

### **Upper Control Limit (UCL) and Lower Control Limit (LCL) for Annual Average Forced Outage Frequency for the TBC HVDC Facility**

$UCL_f$  and  $LCL_f$  define a range of expected performance extending above and below the CL. The  $UCL_d$  and  $LCL_d$  were generated by multiplying the total number of Forced Outages of since January 1<sup>st</sup>, 2011 by 99.75% (0.9975) and .25% (0.0025), respectively.

### **UCL and LCL for Annual Average Accumulated Forced Outage Duration for the TBC HVDC Facility**

$UCL_d$  and  $LCL_d$  define a range of expected performance extending above and below the CL. The  $UCL_d$  and  $LCL_d$  were generated by multiplying the total number of the duration (in minutes) of Forced Outages since January 1<sup>st</sup>, 2011 by 99.75% (0.9975) and .25% (0.0025), respectively.

### **Upper Warning Limit (UWL) and Lower Warning Limit (LWL) for Annual Average Forced Outage Frequency for the TBC HVDC Facility**

$UWL_f$  and  $LWL_f$  define a range showing if the number of annual TBC Forced Outages is approaching the  $UCL_f$  and  $LCL_f$ . The  $UWL_f$  and  $LWL_f$  were generated from multiplying the total number of Forced Outages since January 1<sup>st</sup>, 2011 by 97.5% (0.975) and 2.5% (0.025), respectively.

### **UWL and LWL for Annual Average Accumulated Forced Outage Duration for the TBC HVDC Facility**

$UWL_d$  and  $LWL_d$  define a range showing if the annual accumulated duration of Forced Outages is approaching the  $UCL_d$  and  $LCL_d$ . This number was generated from multiplying the total duration of Forced Outages since January 1<sup>st</sup>, 2011 by 97.5% (0.975) and 2.5% (0.025), respectively.

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**Performance Monitoring:**

Based on the analysis of the control charts, TBC has identified that performance is accurately represented and in line with the calculated Center Control line values and should continue its preventative and predictive maintenance efforts in this manner. TBC's preventative and predictive maintenance routines resulted in a year with no forced outages.

**Performance Outside Limits:**

Performance was inside the upper and lower limits, with the lower control limit specified at 2.5% of the sum of accumulated forced outage duration since 2011. Performance outside of this limit was 0 minutes force outage duration, which was less than 2.5% of the sum of all previous forced outages. This was reviewed and found to be accurate.

**Improving Performance:**

TBC continues to explore new preventative techniques and continue our use of industry best practices. These practices have provided a solid foundation for TBC over the past 10 years. TBC remains committed to the safe and reliable delivery of power to the city of San Francisco, and we strive to maintain this high level of performance while keeping our employees safe from COVID-19

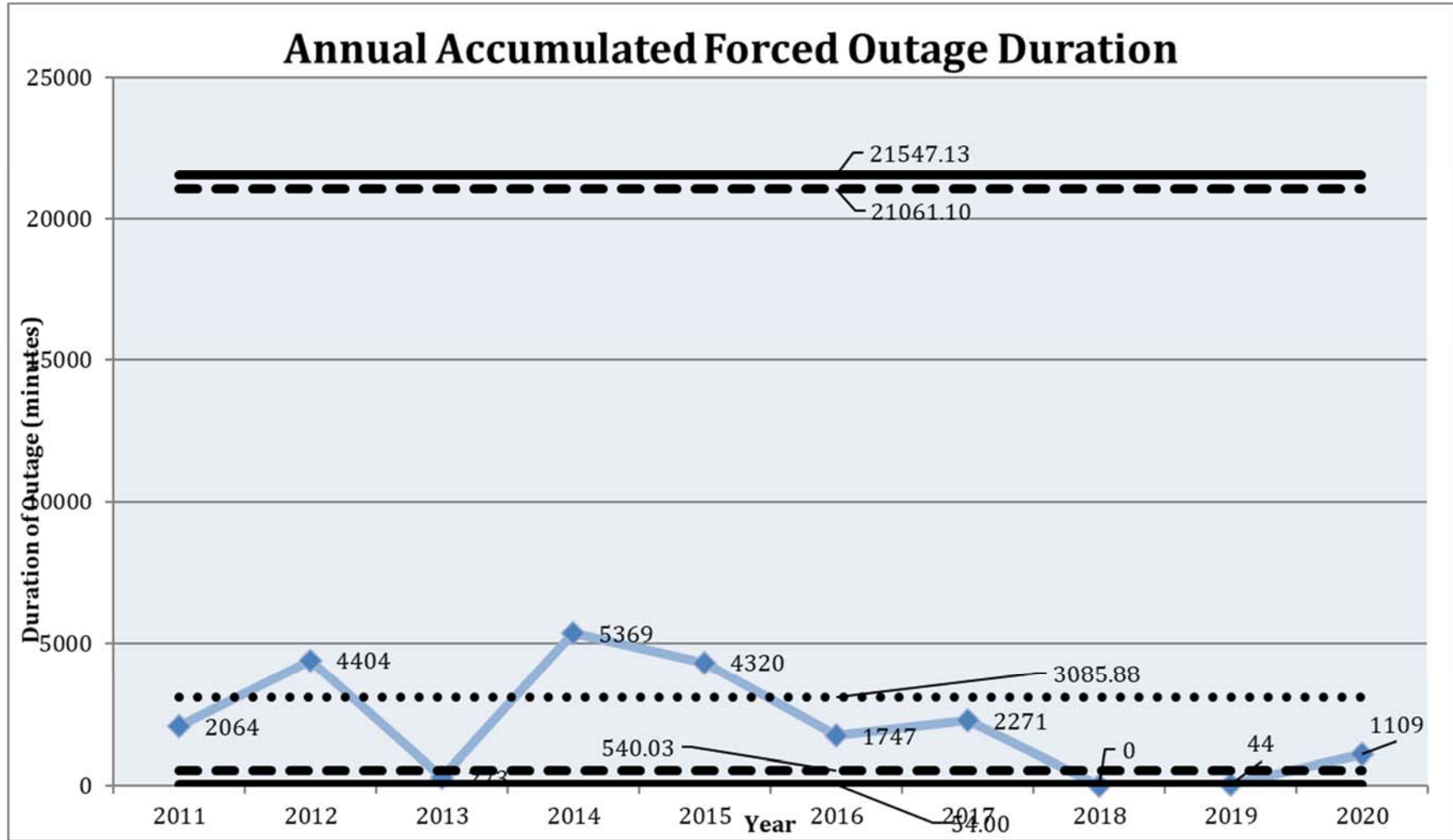
**2020 Summary Outage Data:**

Outage Type	Description	Duration (min)	Total (min)
Forced	Outage	1109	1118
Forced	Derate	9	
Scheduled	Scheduled	28486	24860
Total Outage Time (min)		25978	
Total Annual Availability (excluding Scheduled)		99.79%	

Respectfully,

Michael Blunt  
Director, Operations

Appendix 1. Control Charts



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