

February 20, 2019

VIA ELECTRONIC FILING

Rachelle Verret Morphy
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Re: *North American Electric Reliability Corporation*

Dear Ms. Morphy:

The North American Electric Reliability Corporation hereby submits Notice of Filing of the North American Electric Reliability Corporation of Proposed Reliability Standard TPL-007-3. NERC requests, to the extent necessary, a waiver of any applicable filing requirements with respect to this filing.

Please contact the undersigned if you have any questions concerning this filing.

Respectfully submitted,

/s/ Lauren Perotti

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*Senior Counsel for the North American Electric
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Enclosure

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**BEFORE THE
CROWN INVESTMENT CORPORATION
OF THE PROVINCE OF SASKATCHEWAN**

**NORTH AMERICAN ELECTRIC)
RELIABILITY CORPORATION)**

**NOTICE OF FILING OF THE
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION
OF PROPOSED RELIABILITY STANDARD
TPL-007-3**

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**NOTICE OF FILING OF THE
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION
OF PROPOSED RELIABILITY STANDARD TPL-007-3**

The North American Electric Reliability Corporation (“NERC”) hereby provides notice of proposed Reliability Standard TPL-007-3 (*Transmission System Planned Performance for Geomagnetic Disturbance Events*) (Exhibit A), the associated implementation plan (Exhibit B), the Violation Risk Factors (“VRFs”) and Violation Severity Levels (“VSLs”), and the retirement of the currently-effective TPL-007 Reliability Standard. The NERC Board of Trustees adopted proposed Reliability Standard TPL-007-3 on February 7, 2019. NERC intends for proposed Reliability Standard TPL-007-3 to supersede proposed Reliability Standard TPL-007-2, which was filed with this authority on February 27, 2018.¹

Proposed Reliability Standard TPL-007-3 would require owners and operators of the Bulk Power System (“BPS”) to conduct initial and on-going vulnerability assessments of the potential impact of defined geomagnetic disturbance (“GMD”) events on BPS equipment and the BPS as a whole. The proposed standard carries forward modifications first reflected in TPL-007-2, including modifications to address United States Federal Energy Regulatory Commission (“U.S. FERC”) directives in Order No. 830.² These modifications are discussed in detail in

¹ *Petition of the North American Electric Reliability Corporation for Approval of Proposed Reliability Standard TPL-007-2* (“February 27, 2018 Filing”).

² Order No. 830, *Reliability Standard for Transmission System Planned Performance for Geomagnetic Disturbance Events*, 156 FERC ¶ 61,215 (2016), *reh’g denied*, Order No. 830-A, 158 FERC ¶ 61,041 (2017).

NERC's February 27, 2018 Filing to this authority. Proposed Reliability Standard TPL-007-3 further improves the TPL-007 standard by including a new Variance for Canadian registered entities. As discussed in further detail in this filing, this Variance provides an option by which Canadian registered entities may leverage operating experience, observed GMD effects, and ongoing research to define alternative benchmark GMD events or supplemental GMD planning event(s) for their GMD Vulnerability Assessments. This Variance also recognizes the unique regulatory frameworks specific to Canadian jurisdictions, particularly with respect to provincial processes for approving investments identified in Corrective Action Plans.

The proposed Reliability Standard and related elements are just, reasonable, not unduly discriminatory or preferential, and in the public interest. The proposed standard shall be effective in accordance with the proposed implementation plan (Exhibit B). As described in further detail in Section IV of this filing, the proposed implementation plan is intended to integrate those Requirements that would be made effective for the first time under proposed Reliability Standard TPL-007-3 with the GMD Vulnerability Assessment process that is currently being implemented through the currently effective version of the standard.

This filing presents the technical basis and purpose of proposed Reliability Standard TPL-007-3, a summary of the development history (Exhibit C), and a demonstration that the proposed Reliability Standard meets the Reliability Standards criteria (Exhibit D).

I. NOTICES AND COMMUNICATIONS

Notices and communications with respect to this filing may be addressed to:

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II. BACKGROUND

A. NERC Reliability Standards Development Procedure

The proposed Reliability Standard was developed in an open and fair manner and in accordance with the Reliability Standard development process. NERC develops Reliability Standards in accordance with Section 300 (Reliability Standards Development) of its Rules of Procedure (“NERC ROP”) and the NERC Standard Processes Manual.³

NERC’s rules provide for reasonable notice and opportunity for public comment, due process, openness, and a balance of interests in developing Reliability Standards, and thus satisfy certain of the criteria for approving Reliability Standards. The development process is open to any person or entity with a legitimate interest in the reliability of the BPS. NERC considers the comments of all stakeholders, and stakeholders must approve, and the NERC Board of Trustees must adopt, a Reliability Standard before NERC submits the Reliability Standard to the applicable governmental authorities.

³ The NERC Rules of Procedure is available at <http://www.nerc.com/AboutNERC/Pages/Rules-of-Procedure.aspx>. The NERC Standard Processes Manual is available at http://www.nerc.com/comm/SC/Documents/Appendix_3A_StandardsProcessesManual.pdf.

A Variance is a type of regional difference from a continent-wide Reliability Standard.

Under NERC's rules, a Variance is defined as follows:

“Variance” means an aspect or element of a Reliability Standard that applies only within a particular Regional Entity or group of Regional Entities, or to a particular entity or class of entities. A Variance allows an alternative approach to meeting the same reliability objective as the Reliability Standard, and is typically necessitated by a physical difference. A Variance is embodied within a Reliability Standard and as such, if adopted by NERC and approved by the Applicable Governmental Authority(ies), shall be enforced within the applicable Regional Entity or Regional Entities pursuant to delegated authorities or to procedures prescribed by the Applicable Governmental Authority.⁴

Under the Reliability Standards criteria, there must be some basis to justify a regional difference from a continent-wide Reliability Standard.

B. Procedural History of Proposed Reliability Standard TPL-007-3

This section provides an overview of the development of the TPL-007 standard, as well as the procedural history for proposed Reliability Standard TPL-007-3.

1. Reliability Standard TPL-007-1

On March 3, 2015, NERC submitted a filing to this authority regarding Reliability Standard TPL-007-1. Reliability Standard TPL-007-1 requires applicable entities to conduct initial and ongoing assessments of the potential impact of a 1-in-100 year benchmark GMD event on BPS equipment and the BPS as a whole.

The U.S. FERC approved Reliability Standard TPL-007-1 in Order No. 830, issued on September 22, 2016. In approving the standard, FERC stated that it “constitutes an important step in addressing the risks posed by GMD events to the Bulk-Power System.”⁵ The U.S. FERC

⁴ NERC ROP, Appendix 2 Definitions used in the NERC Rules of Procedure, available at <https://www.nerc.com/AboutNERC/Pages/Rules-of-Procedure.aspx>.

⁵ Order No. 830 at P 1.

also directed the following four revisions to the standard to address areas of concern noted in the order and underlying proceeding:

- revise the benchmark GMD event definition so that the reference peak geoelectric field amplitude component is not based solely on spatially-averaged data;⁶
- revise Requirement R6 “to require registered entities to apply spatially averaged and non-spatially averaged peak geoelectric field values, or some equally and efficient alternative, when conducting thermal impact assessments”⁷;
- revise the standard to require entities “to collect GIC monitoring and magnetometer data as necessary to enable model validation and situational awareness, including from any devices that must be added to meet this need”⁸; and
- revise requirements for Corrective Action Plans to include: (i) a one-year deadline for the development of any necessary Corrective Action Plans; (ii) a two-year deadline for the implementation of non-hardware mitigation; and (iii) a four-year deadline for the implementation of hardware mitigation.⁹

In addition to these standard modification directives, the U.S. FERC also directed NERC to undertake certain activities to improve understanding of GMDs and their potential impacts on power systems.¹⁰

2. Reliability Standard TPL-007-2

a) Development of TPL-007-2 and U.S. FERC Approval

In response to the U.S. FERC’s directives, NERC developed Reliability Standard TPL-007-2. As discussed in detail in NERC’s February 27, 2018 Filing to this authority, Reliability Standard TPL-007-2 added new Requirements for entities to assess their vulnerabilities to a second defined event, the supplemental GMD event. This supplemental GMD event was designed to account for the localized peak effects of severe GMD events on systems and

⁶ *Id.* at P 44.

⁷ *Id.* at P 65.

⁸ *Id.* at P 88 (The U.S. FERC stated, “Additional collection and disclosure of GIC monitoring and magnetometer data is necessary to improve our collective understanding of the threats posed by GMD events.”)

⁹ *Id.* at PP 101-102.

¹⁰ *Id.* at PP 89, 93.

equipment. The standard also contained new Requirements for the collection of GIC and magnetometer data. Lastly, the standard revised Requirement R7 to include deadlines for the development and completion of any necessary Corrective Action Plans.

On November 15, 2018, the U.S. FERC issued Order No. 851 approving Reliability Standard TPL-007-2 and issuing directives for further standard modifications.¹¹ In the order, the U.S. FERC also approved NERC's revised plan for conducting research into pertinent GMD-related topics.

3. On February 27, 2018, staff from the Independent Electricity System Operator (“IESO”) and Hydro One Networks Inc. (“Hydro One”) submitted a Standard Authorization Request to NERC seeking to develop a Canada-specific Variance to Reliability Standard TPL-007-2. Project 2018-01 Canadian-specific Revisions to TPL-007-2.

On February 27, 2018, staff from the Independent Electricity System Operator (“IESO”) and Hydro One Networks Inc. (“Hydro One”) submitted a Standard Authorization Request to NERC seeking to develop a Canada-specific Variance to Reliability Standard TPL-007-2. In early 2018, NERC initiated Project 2018-01 Canadian-specific Revisions to TPL-007-2. The purpose of this project was to consider revisions to Reliability Standard TPL-007-2 that would: (i) allow Canadian jurisdictions to define and implement alternative benchmark and supplemental GMD events for performing GMD Vulnerability Assessments; and (ii) account for regulatory approval processes in place in some Canadian jurisdictions to implement capital improvements identified in Corrective Action Plans.

¹¹ Order No. 851, *Geomagnetic Disturbance Reliability Standard; Reliability Standard for Transmission System Planned Performance for Geomagnetic Disturbance Events*, 165 FERC ¶ 61,124 (2018). In particular, the U.S. FERC directed NERC to revise TPL-007-2 to: (1) require the development and implementation of Corrective Action Plans to mitigate supplemental GMD event vulnerabilities; and (2) authorize extensions of time to implement Corrective Action Plans on a case-by-case basis. FERC directed NERC to submit these revisions within 12 months of the effective date of TPL-007-2 in the United States.

NERC appointed a standard drafting team consisting of subject matter experts from several Canadian provinces to develop a Variance to TPL-007-2.¹² The TPL-007-2 standard with the new Variance was assigned standard version number TPL-007-3 and was posted for comment and ballot. During the final ballot, proposed Reliability Standard TPL-007-3 achieved a 100 percent approval rating with 80.43 percent quorum. The associated implementation plan achieved a 100 percent approval rating with 82.09 percent quorum. The NERC Board of Trustees adopted the proposed standard on February 7, 2019. A complete summary of the development of the proposed standard is attached to this filing as Exhibit C.

III. JUSTIFICATION

As discussed below and in Exhibit D, proposed Reliability Standard TPL-007-3 satisfies the Reliability Standards criteria and is just, reasonable, not unduly discriminatory or preferential, and in the public interest. The proposed Reliability Standard builds upon the improvements reflected in the prior version of the TPL-007 standard and incorporates a new Variance option for Canadian registered entities. This Variance option maintains the rigor of the continent-wide Requirements by continuing to require entities to assess their vulnerabilities to GMD planning events of a 1-in-100 year severity. The Variance differs from the continent-wide approach in that it allows applicable Canadian entities to use regionally specific data to develop GMD planning events for their planning areas in lieu of the benchmark and supplemental GMD events defined in the standard. The Variance also recognizes some differences in Canadian jurisdictions relating to regulatory approvals for capital investments identified in Corrective Action Plans.

¹² This drafting team consisted of individuals from the provinces of Ontario, Quebec, and Saskatchewan, as well as a representative from Natural Resources Canada. Exhibit E contains a complete roster of the Project 2018-01 drafting team.

The purpose of proposed Reliability Standard TPL-007-3, which remains unchanged from prior versions of the TPL-007 standard, is to “[e]stablish requirements for Transmission system planned performance during geomagnetic disturbance (GMD) events.” The continent-wide Requirements remain unchanged from the prior version of the standard.¹³

This section provides a discussion of each of the elements included in the new Variance in proposed Reliability Standard TPL-007-3.

A. Applicability

The applicability of proposed Reliability Standard TPL-007-3 remains unchanged from prior versions of the TPL-007 standard. It would apply to: (1) Planning Coordinators and Transmission Planners whose planning areas have a Facility that includes a power transformer with a high side, wye-grounded winding with terminal voltage greater than 200 kV; and (2) Transmission Owners and Generator Owners that own a Facility that includes such equipment.

As provided in Section D.A of proposed Reliability Standard TPL-007-3 (Exhibit A), the Regional Variance for Canadian Jurisdictions shall apply only to entities in Canada. The applicability of this Variance reflects the substantial work that has been done in Canada to develop regionally specific data that may be used to develop alternative GMD planning events. Recognizing the role of the provincial authorities with respect to Reliability Standards, Section D.A further provides that the Variance shall apply “in those Canadian jurisdictions where the Variance has been approved for use by the applicable governmental authority or has otherwise become effective in the jurisdiction.”

¹³ Please refer to NERC’s February 27, 2018 Filing for additional information on the new and revised continent-wide TPL-007 standard Requirements first introduced in Reliability Standard TPL-007-2.

B. Attachment 1-CAN

Proposed Reliability Standard TPL-007-3 contains Requirements for entities to assess their vulnerabilities to two defined GMD events: (i) the benchmark GMD event, intended to assess vulnerabilities to the wide scale impacts of a severe, 1-in-100 year GMD event; and (ii) the supplemental GMD event, intended to account for the effects of localized peaks that could potentially affect reliable operations. These events are described in detail in Attachment 1 to the proposed Reliability Standard and are referenced in several TPL-007 standard Requirements relating to the different studies and obligations to be performed to develop benchmark and supplemental GMD Vulnerability Assessments.

Under the Variance, all references to “Attachment 1” in proposed Reliability Standard TPL-007-3 would be replaced with “Attachment 1 or Attachment 1-CAN”. Attachment 1-CAN describes an alternative approach that an entity may use to develop alternative benchmark or supplemental GMD event(s) to use in performing its GMD Vulnerability Assessment(s). An entity may use Attachment 1-CAN only where the Variance has been approved for use by the applicable governmental authority or where it has otherwise become effective in the jurisdiction. The alternative benchmark or supplemental GMD event(s) would achieve an equivalent level of reliability as established in the Attachment 1 to the proposed Reliability Standard; that is, entities would be required to assess their vulnerabilities to a 1-in-100 year GMD event, including the wide scale and localized impacts of such an event.

NERC has determined that adding an alternative option is appropriate for Canadian entities given the significant advancements in Canada in GMD data collection and research. Geomagnetic observatories have been operating in Canada since the 1840s. Digital data since the 1970s is available, providing a 40-year digital archive for analysis. Work is also underway to

digitize the earlier analog records, which would expand the digital archive further. Earth conductivity information has been collected during magnetotelluric studies, particularly as part of the Lithoprobe program.¹⁴ This information has been used to generate a set of earth 1-D conductivity models for the different geologic terrains within each province. In some places, these magnetotelluric studies provide information for producing 2-D and 3-D earth conductivity models.

An extreme value statistics study has been completed using the 1-minute geomagnetic observatory data and earth conductivity models that provides an initial assessment of the 1-in-100 year extreme geomagnetic and geoelectric field values in different parts of Canada.¹⁵ Work is now underway to use data with faster sampling rates (10-second, 5-second, and 1-second) to determine how the faster geomagnetic field variations captured in this data influence the 1-in-100 year results. Ongoing research also allows for more accurate characterization of regional parameters in planning models. For example, work has been conducted to use the growing Canadian data set in the evaluation of earth conductivity model effects to geomagnetically induced current modeling.¹⁶

The Variance would allow entities to take advantage of available data and ongoing research, such as the examples cited above, to develop customized, 1-in-100 year GMD planning event(s) specific to their planning area. When studied, these customized GMD planning events may provide a more representative depiction of the conditions an entity could expect to experience in its specific planning area during a severe, 1-in-100 year GMD event. The

¹⁴ Lithoprobe – Canada’s National Geoscience Project, <http://lithoprobe.eos.ubc.ca/>.

¹⁵ L. Nikitina et al., *Assessment of Extreme Values in Geomagnetic and Geoelectric Field Variation for Canada*, 14 SPACE WEATHER 481 (2016), available at <https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1002/2016SW001386>.

¹⁶ See L. Marti et al., *Simulation of Geomagnetically Induced Currents with Piecewise Layered Earth Models*, 29 IEEE TRANSACTIONS ON POWER DELIVERY 1886 (2014).

reliability benefit of such an approach is that it would allow an entity to develop a better understanding of the system impacts it is likely to experience during such an event and the types of corrective actions that would best address them.

The approach described in Attachment 1-CAN provides considerations for developing technically justified, alternative GMD planning events, including calculating geoelectric fields using geomagnetic field variations and earth transfer function(s) (i.e., the relationship between the electric fields and magnetic field variations at the surface of the earth). Reflecting the need to study both the potential wide scale and localized impacts of a severe GMD event, Attachment 1-CAN provides that the entity shall consider: (i) the large-scale spatial structure of the GMD event for the benchmark GMD Vulnerability Assessment (Requirement R4); and (ii) the small-scale (i.e. localized) spatial structure of the GMD event for the supplemental GMD Vulnerability Assessment (Requirement R8). Attachment 1-CAN also provides examples of information and data that may be used in developing these alternative GMD planning events.

Importantly, Attachment 1-CAN specifies that an entity may opt to use this alternative approach only where it has regionally specific information that provides a technically justified means to define 1-in-100 year GMD event(s) for its planning area. Entities that do not have sufficient information to develop alternative planning events using the approach described in Attachment 1-CAN must continue to use the benchmark and supplemental GMD events defined in Attachment 1 to perform their GMD Vulnerability Assessments. The benchmark and supplemental GMD events defined in Attachment 1 continue to provide a technically justified representation of a severe 1-in-100 year GMD event and remain appropriate for use in GMD Vulnerability Assessments.

C. Variance Requirements for Corrective Action Plans (Requirement R7)

Proposed Reliability Standard TPL-007-3 Requirement R7 would require entities to develop Corrective Action Plans to address system performance issues for GMD Vulnerability Assessments performed using the benchmark GMD event. Pursuant to U.S. FERC Order No. 830, certain revisions were made to this Requirement in the previous version of the standard, TPL-007-2.¹⁷ First, Requirement R7 Part 7.2 was revised to provide that the entity shall have one year from the completion of the GMD Vulnerability Assessment to complete the development of a Corrective Action Plan (Part 7.2). Second, Requirement R7 Part 7.3 was added to provide that each entity shall include an implementation timetable in its Corrective Action Plan. This timetable, which would be subject to revision under the process described in Part 7.4, shall: (i) specify implementation of non-hardware mitigation, if any, within two years of development of the Corrective Action Plan; and (ii) specify implementation of hardware mitigation, if any, within four years of development of the Corrective Action Plan.

The Variance in proposed Reliability Standard TPL-007-3 would replace Requirement R7 Part 7.3 in its entirety with Variance Requirement R7 Part D.A.7.3. The Variance would thus modify the continent-wide Requirement as follows:

R7. Each responsible entity, as determined in Requirement R1, that concludes through the benchmark GMD Vulnerability Assessment conducted in Requirement R4 that their System does not meet the performance requirements for the steady state planning benchmark GMD event contained in Table 1, shall develop a Corrective Action Plan (CAP) addressing how the performance requirements will be met. The CAP shall:

~~7.3. Include a timetable, subject to revision by the responsible entity in Part 7.4, for implementing the selected actions from Part 7.1. The timetable shall:~~

~~7.3.1. Specify implementation of non hardware mitigation, if any, within two years of development of the CAP; and~~

¹⁷ See February 27, 2018 Filing at 17-22 for additional information regarding the revisions to Requirement R7 introduced in Reliability Standard TPL-007-2.

~~7.3.2. Specify implementation of hardware mitigation, if any, within four years of development of the CAP.~~

D.A.7.3. Include a timetable, subject to revision by the responsible entity in Part 7.4, for implementing the selected actions from Part 7.1. The timetable shall:

D.A.7.3.1. Specify implementation of non-hardware mitigation, if any, within two years of the later of the development of the CAP or receipt of regulatory approvals, if required; and

D.A.7.3.2. Specify implementation of hardware mitigation, if any, within four years of the later of the development of the CAP or receipt of regulatory approvals, if required.

The only difference between Variance Requirement R7 Part D.A.7.3 and continent-wide Requirement R7 Part 7.3 is that the Variance would require entities to specify, in their Corrective Action Plans, that mitigation actions shall be implemented by “the later of the development of the [Corrective Action Plan] or receipt of regulatory approvals, if required.”¹⁸

The Variance would continue to require entities to take prompt action to address any GMD vulnerabilities they identify in their systems, but it recognizes that the timing for implementing corrective actions may ultimately depend on obtaining required regulatory approvals. In such cases, it would reduce the entity’s administrative burden to allow for such a contingency at the time the Corrective Action Plan is developed.

D. Enforceability of Proposed Reliability Standard TPL-007-3

Proposed Reliability Standard TPL-007-3 includes Measures in support of each Requirement to ensure that Requirements are enforced in a clear, consistent, non-preferential manner, without prejudice to any party. The proposed standard also includes VRFs and VSLs for each Requirement, which are used to help determine appropriate sanctions if an applicable entity

¹⁸ Proposed Reliability Standard TPL-007-3 Requirement R7 Part D.A.7.3 (emphasis added).

violates a Requirement. VRFs assess the impact to reliability of violating a specific Requirement, while VSLs provide guidance on the way that NERC will enforce Requirements. The Measures and VRFs and VSLs are unchanged from the prior version of the Reliability Standard, TPL-007-2.¹⁹

IV. EFFECTIVE DATE

NERC's proposed implementation plan is attached to this filing as Exhibit B. Under this plan, in those Canadian jurisdictions where approval by an applicable governmental authority is required, the standard shall become effective on the first day of the first calendar quarter that is three (3) months after the effective date of the applicable governmental authority's order approving the standard, or as otherwise provided for by the applicable governmental authority. Where approval by an applicable governmental authority is not required, the standard shall become effective the first day of the first calendar quarter that is three (3) months after the standard is adopted by the NERC Board of Trustees, or as otherwise provided for in that jurisdiction. Any prior versions of the TPL-007 standard, in effect or pending, would be retired immediately prior to the effective date of proposed Reliability Standard TPL-007-3.

The proposed Reliability Standard TPL-007-3 implementation plan recognizes that several Requirements in the currently-effective TPL-007 standard are or will soon become effective in many jurisdictions, and that entities may now be taking steps to complete the studies or assessments required by other Requirements that will become enforceable in the future. The proposed implementation plan thus contains two phased compliance timelines depending on whether proposed Reliability Standard TPL-007-3 becomes effective before January 1, 2021 or on/after January 1, 2021:

- If the proposed standard becomes effective before **January 1, 2021**, a new phased

¹⁹ See Exhibit C to NERC's February 27, 2018 Filing for more detailed analysis of the VRFs and VSLs.

compliance schedule would support entities completing Requirements for the supplemental GMD Vulnerability Assessment concurrently with Requirements for the benchmark GMD Vulnerability Assessment.²⁰

- If the standard becomes effective on or after **January 1, 2021**, entities would continue work on benchmark GMD Vulnerability Assessments and complete supplemental GMD Vulnerability Assessments during the next assessment cycle.

Under either timeline, entities would be required to comply with Requirements for the collection of GMD monitoring data within 24 months of the effective date of the standard. The phased-in compliance dates provided in the proposed implementation plan appropriately balance the reliability need to implement new and revised Requirements first made effective under proposed Reliability Standard TPL-007-3 while providing entities with sufficient time to meet their obligations.

²⁰ Depending on the date proposed Reliability Standard TPL-007-3 becomes effective, the phased compliance dates for completing steps for both benchmark and supplemental GMD Vulnerability Assessments may be slightly delayed from the dates set forth for benchmark GMD Vulnerability Assessments under the TPL-007-2 implementation plan.

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Date: February 20, 2019

EXHIBITS A — E