# Posting 2

## Posting

This project was posted for comment from December 20, 2021, through January 19, 2022.

WECC distributed notice for the posting on December 16, 2021. A supplemental notice was dispatched on December 21, 2021, to correct inaccurate links. The drafting team (DT) asked stakeholders to provide feedback on the proposed document(s) through a standardized electronic template.

Four comments were received on the project.

## Location of Comments

Comments can be viewed in their original format on the WECC-0146 project page under the “Submit and Review Comments” accordion.

## Changes in Response to Comment

* Purpose statement was altered moving the “system remediation” sentence to the Rationale section under “General Application.”
* WR1/WM1 deleted “unless otherwise specified in accordance with Requirements WR2 and WR3.” WR1, WR2, and WR3 are default minimum thresholds. Deviation from the default is addressed in WR4.
* WR1.3 added a Rationale section explain BES Bus.
* WR1.4 deleted “for all P1 through P7 events” and added “for all P1 through P7 Single-Line to Ground fault events.”
* Footnote 3 was deleted to avoid ambiguity.
* WR2 deleted “An entity can use these criteria to identify instability due to Cascading or uncontrolled islanding if it does not impose it on others.” WR2 becomes the default criteria.
* WR2, and WR3 replaced minimum with “default.” WR1, WR2, and WR3 become the default criteria.
* WR3 added a Rationale section clarifying “BES Bus serving load.”
* WR4 are proposed in Posting 2 was completely replaced with a new WR4 to preserve an entity’s ability to use different study criteria than that required in WR1, WR2, and WR3.
* “Model” was replaced with “study” throughout.
* Rationale, General Application includes a line drawing for illustrative purposes.
* Rationale, WR1, deleted “[T]his is a planning criteria.” That point is self-evident.
* Rationale, WR1 was altered to reflect the new position that WR1, WR2, and WR3 are default minimum planning criteria.
* Rationale, WR1.1 added a narrative explaining how WR1.1 and WR1.2 are internally consistent.
* Rationale, WR2 deleted “[A]n entity can use these criteria for instability if they choose without imposing it on others.” With the addition of WR4 this statement is redundant.
* Rationale, WR3 deleted “[R]equirement WR3 addresses “what” must be achieved and does not address “how” to do it.” The statement is superfluous.
* Rationale WR4 deleted “[R]equirement WR4 ensures the free flow of information between entities” and added “WR4 does not change the WR1, WR2, and WR3 defaults; rather, WR4 allows for a different approach without changing the defaults.”

## Minority View

* None. Although the DT did not adopts all verbiage as proposed, the DT is confident that the proposed language addressed all substantive concerns.

## Proposed Effective Date

The proposed effective date is the first day of the second quarter following approval by the WECC Board of Directors (Board).

## Justification

Some entities may be using planning criteria other than the specified default of WR1. Setting the effective date as the first day of the second quarter should allow sufficient time to implement default criteria.

**Impact on Other WECC Criteria**

None.

## Action Plan

On February 17, 2022, the DT agreed by a majority vote to post Posting 3 for a 30-day comment period. Once the comment period opens, comments can be submitted by selecting the Submit and Review Comments accordion on the WECC-0146 homepage. Then, click **Submit Responses to Posting 3**.

The posting period will open February 22, 2022, and close March 24, 2022.

The DT will meet as follows to address comments received:

* March 31, 2022, 10:00 a.m. to 12:00 p.m. Webinar
* April 14, 2022, 10:00 a.m. to 12:00 p.m. Webinar
* April 28, 2022, 10:00 a.m. to 12:00 p.m. Webinar

## Contacts and Appeals

If you feel your comment has been omitted or overlooked, please contact [W. Shannon Black](mailto:sblack@wecc.org), WECC Consultant, at (503) 307-5782. In addition, there is a WECC Reliability Standards appeals process.

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| --- | --- |
| Commenter | Organization |
| Spencer Tacke | Auriga Corporation (AC) |
| Cain Braveheart | Bonneville Power Administration (BPA) |
| Gary Nolan | Arizona Public Service (AZPS) |
| Adrian Andreoiu | BC Hydro |
| Tyler Cooper | Black Hills Corporation |

**Index to Questions, Comments, and Responses**

**Question**

1. **The Drafting Team welcomes comments on all aspects of the document.**
2. **The Drafting Team welcomes comments on all aspects of the document.**

| Summary Consideration: | See summary in the preamble. | |
| --- | --- | --- |
| Commenter/Comment | | Response |
| AC | | Comments and Questions of current draft version of WECC-0146 TPL-001-WECC-CRT-3.2  1. WR1 1.1.2 states that steady-state voltages shall stay within plus or minus 10 % of the nominal voltage for P1 events, yet WR1 1.2 immediately below 1.1.2 states that the steady-state voltage deviation shall not exceed 8% for P1 events. These two requirements seem to be inconsistent with each other.  2. For requirements WR1 1.3, 1.4, 1.5, and WR2, were studies done to show that if any of these criteria are not met, then in general there will be system instability, Cascading or uncontrolled islanding?  As an example, I recall that a similar type of studies was done in the past (2009 & 2010-time frame) by the WECC Study group named the Bulk Electric System Definition Task Force (BESDTF), that ran over 100 base case stability studies to come up with an agreed to definition of definition of what constitutes a BES (Bulk Electric System) bus element, based on the available short circuit MVA available at the studied bus. After running all of these more than a 100 base cases of faulted system element transient stability studies, the BESDTF proposed a "hybrid" definition of the Bulk Electric System (BES) and the concept that a facility or transmission system element must have a material impact on the reliability of the bulk power system in order to require that it be included in the BES. That material impact, based on the results of evaluation of those over 100 base case faulted transient stability studies that were run, showed that in general BES elements were those whose available short circuit MVA exceeded 6000 MVA. |
| **WR1 Internal Consistency**  The following language was adopted for the Rationale section.  “WR1.1 describes the ceiling and floor of the magnitude of voltage allowed at any of the applicable BES buses both under normal operating conditions and after a P1 event (and other P events), whereas WR1.2 describes the change in voltage that is allowed between pre and post P1 events. Both criteria are independent of one another, and one doesn’t guarantee the other requiring 2 sets of criteria. For instance:   1. A BES bus at 0.95 p.u. pre-contingency voltage may encounter a contingency that drops the voltage to 0.88 p.u. => would violate WR1.1.2 (<0.9 p.u.) but not WR1.2 (<8% drop). 2. Another BES bus at 1.05 p.u. pre-contingency encounters a contingency that drops the voltage to 0.92 p.u. => would violate WR1.2 (> 8%) but not WR1.1.2 (>0.9 p.u.).”   **Studies**  The DT is in support of AC in that, where specific numeric thresholds have been used in the WECC Criterion, supporting technical studies should be made available. Many of the existing thresholds were imported from TPL – (001 thru 004) – WECC – 1 – CR ─ System Performance Criteria, April 18, 2008, and its 2006 predecessor WECC/NERC Planning Standards 1.D: Voltage Support and Reactive Power (VSRP). In turn, the 2006 studies stemmed from an earlier paper drafted in response to the July and August 1996 disturbances in the Western Interconnection. There is some indication from the Preface of the VSRP paper that the studies may date back as far as (circa) 1992-1995.  Because of the estimated 20-year gap between the studies and today’s task, the technical support studies that established the thresholds could not be found.  Because the foundational studies may now be outdated, the DT supports the position that new studies may be warranted. However, conducting the studies is outside of the means available to the DT. As such, the DT would support any effort/request by AC to have the studies refreshed by the appropriate planning/study entity. | | |
| BPA | | The following comments are submitted on behalf of BPA SMEs.  Regarding WR4: BPA recommends the following provision (originally in WR2) be added back to into the Criteria, “Each Transmission Planner and Planning Coordinator that uses a more stringent criterion than that stated in Requirement WR1, and applied that criterion to other systems, will have evidence of agreement from all other planning entities to which the more stringent criterion was applied.”  Without this, BPA is concerned that an adjacent transmission system would be responsible for meeting a criteria in another entities’ transmission system that is more stringent than the WECC base criteria, without the more stringent criteria being vetted and agreed to by impacted parties. |
| **More/Less Stringent**  Please see the response to BC Hydro that follows. Language proposed by BC Hydro negates the concerns raised in Posting 1 that the combined effect of WR1, WR2, and WR3 resulted in a suggestion rather than a requirement.  Because BPA’s issue has been raised in multiple iterations of this document, the following “General Application” has been added to the Rationale section of the document.  “Nothing in this document is to be interpreted as allowing third-party actions to impute liability on another. Each applicable entity is responsible for adherence to this WECC Criterion based solely on its own actions.” | | |
| AZPS | | AZPS is generally supportive of the proposed revisions in Posting 2 with the exception of the following proposed change:  Comment on WR1.4:  AZPS proposes the addition of language (shown in bold) below:  Following fault clearing and voltage recovery above 80 percent, voltage at each applicable BES bus serving load shall neither dip below 70 percent of pre-contingency voltage for more than 30 cycles nor remain below 80 percent of pre-contingency voltage for more than two seconds,  *for all P1 through P7 Single-Line to Ground fault events.*  Rationale for the change:  AZPS proposes that WR1.4 should not apply to 3-phase to ground (3PG) faults as they are adequately addressed by WR1.3. As described in the rationale, the intent of WR1.4 is to identify severe undesirable power swings during normal system recovery rather than delayed voltage recovery. Multiple issues with applying WR1.4 were noted while performing simulations as presented to MVWG, WECC were seen only under simulated 3PG faults, and no historical/field evidence was noted that suggests such issues were noted in observed FIDVR events or was cause of concern for transient voltage stability. Thereby, AZPS suggests applying R1.4 only to Single line to Ground faults thereby adequately meeting the intent of the criteria without potentially picking up fictitious violations that would not detrimentally impact the system performance. AZPS recognizes that the above suggestion makes the criteria less stringent for a 3PG fault, and the lower burden appears to be a reasonable expectation given the nature and frequency of their occurrences. AZPS posits that with current improved modelling capabilities and ability to review rotor angle stability removes the need to utilize WR1.4 as a proxy to rotor angle stability and as such further allays concerns with the suggested less stringent criteria for 3PG faults. The presentation referenced above is posted on the WECC website at <https://www.wecc.org/Administrative/Green%20-%20Transient%20Voltage%20Recovery%20Criteria_August%202020.pdf> |
| **WR1.4 Clarification**  The following language was adopted by the team.  “WR1.4 Following fault clearing and voltage recovery above 80 percent, voltage at each applicable BES bus serving load shall neither dip below 70 percent of pre-contingency voltage for more than 30 cycles nor remain below 80 percent of pre-contingency voltage for more than two seconds, *for all P1 through P7 Single-Line to Ground fault events.” (Emphasis added.)* | | |
| BC Hydro | | BC Hydro welcomes the opportunity to comment and offers the following comments:  1. In the proposed TPL-001-WECC-CRT-4, the flexibility of allowing entities to have less stringent criteria (per Requirement WR3 of TPL-001-WECC-CRT-3.2 currently in effect) than the default criteria (per Requirement WR1 of TPL-001-WECC-CRT-3.2) was removed. The proposed TPL-001-WECC-CRT-4 WR1 sets default base planning criteria as the minimum performance threshold.  In some BES area transmission systems with long distance transmission connections to BC Hydro main system, in accordance with TPL-001-WECC-CRT-3.2 WR3, BC Hydro allowed some BES bus voltages higher than 1.05 p.u. (on system nominal voltage base) under system normal conditions, in special circumstances such as when local seasonal/intermittent generators are offline and under light local load conditions. The affected transmission facilities had been technically confirmed to have sufficient capability to be continuously operated at voltage levels above 1.05 p.u. while remaining within their continuous maximum voltage ratings.  As a result of the proposed removal of the TPL-001-WECC-CRT-3.2 WR3 language in the TPL-001-WECC-CRT-4 as currently drafted, BC Hydro may need extra efforts to manage the area system voltages under system normal conditions, such as proposing additional voltage control devices in System Planning time horizon and/or applying operational restrictions in Real-time Operations.  BC Hydro requests that the flexibility of allowing individual utilities [to] use less stringent performance criteria in remote areas of BES as long as there are no violations to facility ratings and no adverse reliability impacts to the BES (such as instability, uncontrolled separation or Cascading outages) or local customers and adjacent power systems.  As an alternative, BC Hydro suggests that WR1 Part 1.1.1 be revised to allow the high end of the voltage range to 1.1 p.u. (110 percent) of nominal under system normal conditions (P0 event).  This is expected to benefit rate payers while maintaining an adequate level or reliability. The application of less stringent criteria to remote systems should not adversely impact the reliability of BES as long as the steady-state operating parameters are within equipment ratings and system Stability is maintained with no uncontrolled separation or Cascading.  2. Requirement WR1 Parts WR1.2 through WR1.5 reference "applicable BES bus serving load". BC Hydro noted that in response to comments received to Posting 1, the drafting team modified the description of a "BES bus that is serving load" in the Rationale for WR1  from the existing TPL-001-WECC-CRT-3.2.  *FROM*  *"For purposes of this document, a BES bus that is serving load is the bus with direct transformation from BES-level voltage to distribution-level voltage that serves load."*  TO  *For purposes of this document, a BES bus that is serving load is any BES bus that serves downstream load connected to it (such downstream load may be radially connected to it or networked in with other BES buses) and would not include BES switching stations."* (As proposed TPL-001-WECC-CRT-4.)  BC Hydro requests that, in addition to the reference to the December 9, 2021 Drafting Team meeting discussions, a documented clarification for the change be provided; BC Hydro also suggests that examples such as single line diagrams would help elaborate the underlying concepts and allow for a consistent application.  3. The Rationale for Requirement WR3 states (on page 12 of 12):  *"WR3 acknowledges that the Transmission Planner and Planning Coordinator are in the best position to self-determine which transfer paths and load areas are most critical for****modeling****. (emphasis added) WR3 does not require the****modeling****(emphasis added) of each transfer path and load area, nor does it supersede NERC transmission system planning performance requirements addressing the criteria or methodology used to identify system instability."*  BC Hydro requests that the Drafting Team considers whether the term "studying" should be used instead of "modeling."  *4.* Requirement WR4 mandates that "*Each Transmission Planner and Planning Coordinator that uses planning criteria more stringent than the default base planning criteria in WR1 shall make its criteria available upon request within 30 days*."  BC Hydro recommends that the TP and PC that uses more stringent criteria be responsible for providing the information to their adjacent system TPs and PCs. |
| **Flexibility**  As the DT noted in Posting 1, the combination of as-approved WR1, WR2, and WR3 results in a contextual read that says, “Use WR1, except when you don’t.” This result stems largely from incomplete drafting in the as-approved requirements. BC Hydro raises a valid point that the applicable entities should be allowed to use their best judgment when deciding whether the default criteria best preserve reliability. To remedy the concerns, BC Hydro offers, and the DT accepts, the following proposal.  The previous WR4 was replaced with the following proposed language:  WR4. Each Transmission Planner and Planning Coordinator that uses planning criteria different than the default planning criteria in WR1, WR2, and WR3 shall:  4.1 Document the different criteria to include each of the following:  4.1.1 A narrative explaining why the different criteria was used.  4.1.2 A narrative explaining that the use of the different criteria will not result in violations of equipment ratings, instability, uncontrolled islanding, or Cascading on its own and adjacent systems.  4.2 Notify adjacent Transmission Planners and Planning Coordinators that criteria different from WR1 was used.  4.3 Make the different criteria available within 30 days of a request.  WM4. Each Transmission Planner and Planning Coordinator that uses planning criteria different than the default base planning criteria in WR1, WR2, and WR3 will have evidence documenting the different criteria, a narrative explaining why the different criteria was used, and evidence of public notice and availability of the criteria, as required in WR4.  This proposed language reinstates the flexibility of Version 3.2 but adds additional obligation to explain any deviation from the default criteria of WR1, WR2, and WR3. Since the above language was adopted for vetting in Posting 3, BPA’s proposed alternate language was not adopted.  **Explain the Change to “BES bus that is Serving Load”**  Clarifying narrative and line diagrams are appended to these responses. See Attachment A, Posting 2, Response to Comments provide by BC Hydro.  The following language was included in the Rationale section along with a line diagram:  “A BES bus that is serving load is the bus with direct transformation to a non-BES bus (the non-BES bus may be radial or networked) that serves customer load. Station-service and other substation loads are excluded. For example, this definition meets the intent of having the criteria apply to BES Buses 3, 8 and 12 but not to BES buses 1, 2, 9, 13, and 14.” (The line diagram follows this language in the proposed Rationale section.)  **WR3 Rationale: Study vs. Model**  Throughout, the word “study” was adopted over “model.”  **WR4 – Require Notice to Adjacent Systems**  This was addressed in the proposed remedial language for WR4. | | |
| Black Hills Corp. | | Subsequent Entry: These comments were received via email on January 27, 2022.   1. In WR3, the sub requirements refer to “transfer paths” and “load areas”, could some clarity be added here to better define these terms? **What is a “transfer path”**? Is it a WECC rated path, a TTC path used for ATC calculation, any BES Transmission line, or something else? **What is a load area**? 2. I think that the finger plot figures should be labeled “Illustration 1.3” and “Illustration 1.4” as referred to in the rational, but the actual figures only have reference to WR1.3 and WR1.4. I just want to make sure there is an absolute matching reference to connect the rationale to the example plots. |
| **Transfer Paths and Load Areas**  The following is paraphrased from the NERC Reliability Functional Model Technical Document — Version 5.1, pages 10 and 11:  Each Transmission Planner and Planning Coordinator individually determines the transfer paths and load area for inclusion in its studies. Per the 2021 WECC Path Rating Catalogue (Introduction) a “transfer path may be composed of transmission lines between Balancing Authorities, internal to a Balancing Authority, or a combination of both.”  Each TP and PC determines its transfer paths by the geographic location of the BES Facilities under its separate purview, i.e., those facilities for which the TP/PC develops reinforcement and Corrective Action Plans resulting from studies and analysis of system performance and interconnection of facilities and the loads served thereby. Load areas are determined electrically by the location of the load served by the Facilities under the separate purview of the TP and PC.  **References**  Once the document is finalized, the WECC technical editor will review and correct references. | | |

# Attachment A—WECC-0146 Posting 2

## Response to Comments Response to BC Hydro

### Current Interpretation of “BES Bus-Serving Load”

Posting 2 states, “a BES bus that is serving load is the bus with direct transformation from BES-level voltage to distribution-level voltage that serves load” has led to multiple interpretations of which BES buses would qualify to apply criteria WR1.2, WR1.3 and WR1.4 across various entities.”

The two common interpretations encountered are as follows:

1. All BES buses that have radial load downstream of them are considered BES bus serving loads. Such loads need not have a distribution level voltage transformation as a direct transformation from the BES voltage level. As shown in Diagram 1, Bus 3 in addition to Bus 12 (with direct transformation to distribution level voltage) would qualify the intent of the definition as the BES even though at Bus 3 it steps down to a sub-transmission voltage level and eventually steps down to the distribution level at Buses 5 and 6 because it meets the intent of serving purely load downstream.
2. Some entities have expressed that Bus 3 would not meet their interpretation of the definition and only Bus 12 truly meets the definition as written.

G

kV

500

kV

230

AND

69

LOWER kV

BUS #1

BUS #2

BUS #3

BUS #4

BUS #5

BUS #6

BUS #7

LOAD &

U

-

DER

LOAD &

R

-

DER

Generator

and Battery

Storage

Systems

Interconnected BES System

LOAD &

U

-

DER

BES BUS

SERVING

LOAD

BES BUS

SERVING

LOAD

BUS #12

**Figure 1: Schematic of an illustrative transmission system to help identify   
"BES bus-serving load" definition as it currently stands**

### Proposed Clarification

The DT proposes the following changes for Posting 3 to address BES application.

A BES bus that is serving load is the bus with direct transformation to a non-BES bus (the non-BES bus may be radial or networked) that serves customer load. Station-service and other substation loads are excluded.

For example, this definition meets the intent of having the criteria apply to BES Buses 3, 8 and 12 but not to BES buses 1, 2, 9, 13, and 14. (In WECC-0146, Posting 3, a proposed line diagram is included in the Rationale section.)

The intent of this changed language is to reflect,

1. The existing buses as covered by both common interpretations described in the previous section (i.e., Buses 3 and 12 on Figures 1 and 2), but also additionally,
2. Importantly make sure that networked BES buses that serve load are also appropriate buses to apply these criteria. Since most of the BES buses are networked in—absence of applying these criteria might inadvertently miss the very intent of utilizing these criteria—to identify potential voltage instability and/or presence of wide-spread FIDVR in the load pocket. As shown in Figure 2, applying the current interpretation would disqualify Buses 3 and 8 from requiring the application of WR1.2, WR1.3 and WR1.4, while this new definition would accurately capture them. Note that Bus 9 as a switching station would not qualify based on the proposed definition.

G

500

kV

230

kV

AND

69

LOWER kV

BUS #1

BUS #2

BUS #4

BUS #5

BUS #6

BUS #7

LOAD &

U

-

DER

LOAD &

R

-

DER

Generator

and Battery

Storage

Systems

BES BUS

SERVING

Interconnected BES System

BUS #8

BUS #10

LOAD &

U

-

DER

BUS #9

BUS #11

BES BUS SERVING LOAD

Serving Load

NOT A BES BUS

SERVING LOAD

BUS #3

LOAD &

U

-

DER

BUS #12

BES BUS

SERVING

LOAD

BES BUS

SERVING LOAD

**Figure 2: Schematic of an illustrative transmission system to help identify "BES bus-serving load" definition as proposed**