ATTACHMENT 1 CONNECTION ENGINEERING STUDY REPORT

Connection Engineering Study Report for AUC Application

City of Medicine Hat AIES Interconnection

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Executive Summary

Project Overview

The City of Medicine Hat (COMH), in its capacity as a market participant, has submitted a System Access Service Request (SASR) to the Alberta Electric System Operator (AESO) requesting that the COMH's point of connection to the Alberta interconnected electric system (AIES) be relocated from the existing Medicine Hat 41S substation to a proposed new switching station, the Al Rothbauer 321S substation (the Connection Project).

This request was made to address the risk to electricity supply that presently exists from a flood event on the South Saskatchewan River. Currently the COMH generating station and the point of connection with the AIES are located on a common site adjacent to the South Saskatchewan River, with the potential for both to be impacted during a flood event. The proposed site of the Project connection will be outside the flood zone and directly adjacent and connected to a proposed COMH substation in the Medicine Hat area (AESO Planning Area 4).

In order to address the COMH SASR, a reconfiguration will be required to the approved Southern Alberta Transmission Reinforcement (SATR). The AESO and AltaLink Management Ltd. (AltaLink) are applying for the SATR Needs Identification Document Approval Amendment (SATR NID Approval Amendment) and a facility application amendment in separate applications. [1]

The scheduled in-service date (ISD) for the Connection Project is June 30, 2017. This report describes the results of the study conducted to analyze the impact of connecting the Connection Project to the AIES, including the SATR Reconfigurations.

Existing System

The Connection Project is located in the Medicine Hat area. The Study Area was defined to include all transmission system elements 138 kV and above within the Medicine Hat area and the tie lines connecting the Medicine Hat area to the rest of the AIES.

The Medicine Hat Transmission Development (MHTD) project, shown in Figure 1, forms part of the approved SATR, and is currently under construction in the area and was assumed to be in service for the pre-connection analysis.

Once the SATR MHTD is constructed, the transmission system in the Study Area will include:

- Two 240 kV transmission lines connecting Medicine Hat area to the Brooks area (AESO Planning Area 47) through the 240/138 kV Bowmanton 244S substation;
- A 138 kV looped system between Medicine Hat 41S, Bullshead 523S, and the new Bowmanton 244S substations.
- Three 138 kV tie lines to the Vauxhall, Brooks and Empress areas (AESO Planning Areas 52, 47, and 48).

[1] The *Southern Alberta Transmission Reinforcement* NID was originally approved by the Commission in Decision 2009-126 on September 8, 2009, and issued NID Approval No. U2009-340 on September 17, 2009.

Study Summary

Studies performed for the Project

Power flow, voltage stability, transient stability, and short-circuit analyses were performed to assess the system before the Project connection (pre-connection) and after the Project connection (post-connection). Normal conditions (Category A) and single contingency (Category B) analyses were performed. Because there was uncertainty about the ISD, several study scenarios were performed, as shown below: [2]

The following pre-connection analyses were performed:

- Power flow analysis (Category A and Category B for 2015 winter peak (WP))
- Short-circuit analysis (2015WP)

The following post-connection analyses were performed:

- Power flow analysis (Category A and Category B for 2015WP, 2016 summer light (SL), 2016 summer peak (SP), 2018SL, and 2018SP)
- Voltage stability analysis (Category A and Category B for 2016SL and 2016SP)
- Transient stability analysis (Category B for 2015WP and 2018SP)
- Short-circuit analysis (2015WP and 2023SP)

Results of the pre-connection studies

No Reliability Criteria violations were observed for the pre-connection analysis.

Connection alternative considered

The proposed Al Rothbauer 321S substation location will be close to the route of the approved 138 kV transmission line 675L, between the Bowmanton 244S and the Medicine Hat 41S substations. Because of the proximity to the 138 kV transmission line 675L, the only alternative considered involved connecting the Al Rothbauer 321S substation to the approved 138 kV transmission line 675L, shown in Figure 2.

This Connection Project alternative includes:

- Constructing a new 138 kV switching station, designated as the Al Rothbauer 321S substation with three 138 kV breakers.
- Connecting the proposed Al Rothbauer 321S substation to a proposed COMH substation, designated as the MHS-7 using a short 138 kV transmission line 882L.
- Connecting the Al Rothbauer 321S substation to the approved 138 kV transmission line 675L.
- Disconnecting the 138 kV transmission line 880L from the Medicine Hat 41S substation and terminating it at the proposed Al Rothbauer 321S substation by connecting it to the

[2] When the study was prepared, initial ISD of the Connection Project was 2015/2016. Therefore, 2015WP was selected for pre-connection assessment. The scheduled Connection Project ISD is currently June 30, 2017; there is no material change in the Study Area that would impact the analysis.

portion of 892L (previously the 892AL) between the Medicine Hat 41S substation and the Al Rothbauer 321S substation.

- Discontinuing use of the Medicine Hat 41S substation and the 138 kV transmission line 674AL for transmission purposes.

Required SATR Amendment

The Connection Project is dependent on amendments to the approved SATR. The AESO and AltaLink Management Ltd. (AltaLink) are applying for the SATR NID Approval Amendment and a facility application amendment in separate applications. The required amendments include:

- Terminating the approved 138 kV transmission line 675L at the site of the proposed Al Rothbauer 321S substation. If approved, the new higher capacity 138 kV transmission line 675L will be temporarily connected to the portion of the lower capacity 138 kV transmission line 674AL (previously a portion of the 674L) located between the Medicine Hat 41S substation and the site of the proposed Al Rothbauer 321S substation. .
- Retaining the 138 kV transmission line 892AL (previously a portion of the 892L). If the SATR NID Approval amendment is approved, the 138 kV transmission line 892AL will be decommissioned, and re-commissioned as the 880L as a part of the Connection Project.

The 138 kV transmission line 675L will need to be in service before the Connection Project is able to connect. The scheduled ISD for the 675L listed above is Q2 2016.

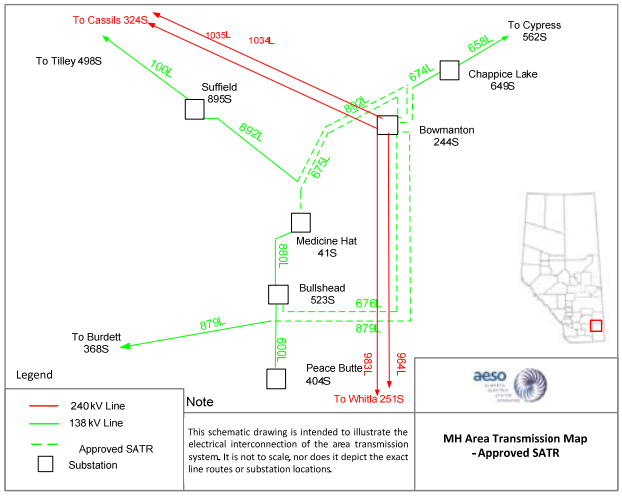

Figure 1: Approved SATR MHTD

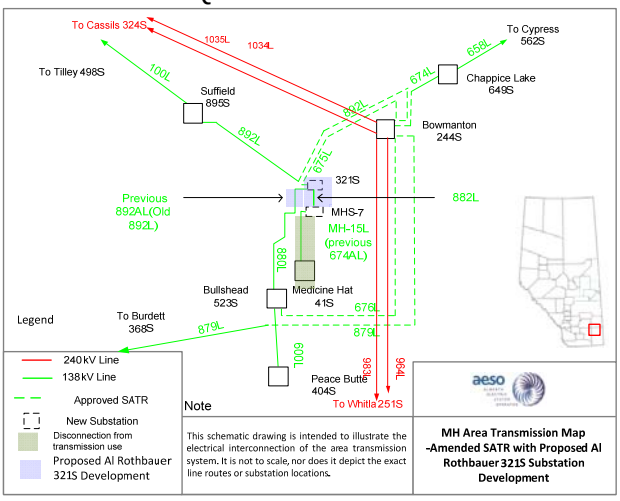

Figure 2: Proposed Connection Project showing the Amendments to SATR (to be applied for in a separate application)

Results of the post-connection studies

Post-connection analysis included both the required SATR NID Approval Amendment and the Connection Project. No criteria violations under N-0 and N-1 conditions were observed for the post-connection studies.

There could be as much as a year between the time the SATR NID Approval Amendment is in-service and the Connection Project is in service. In that time, the Peace Butte Wind Farm[3] may come into service in the area. A sensitivity analysis was performed to determine the impact of the Peace Butte Wind Farm connecting after the SATR NID Approval Amendment and prior to the Connection Project.

The sensitivity the 138 kV transmission line between the Medicine Hat 41S substation and the proposed Al Rothbauer 321S substation (674AL) site will be overloaded under the Category B contingency. Therefore, a Remedial Action Scheme (RAS) will be required to mitigate overloads under the Category B contingency. This RAS will not be required once the Connection Project is in place.

Conclusions and Recommendations

The study confirmed that connecting the Connection Project through the connection alternative considered is technically viable and will not adversely impact the AIES; the Reliability Criteria will continue to be met.

If the Peace Butte Wind Power Plant is in service prior to the completion of the Project, a temporary RAS will be required to mitigate overloads under a Category B contingency.

[3] Pteragen Canada Inc. (Pteragen), pursuant to Approval No. U2013-225 and Decision 2013-171, is the owner of the 120-megawatt wind power plant designated as the Peace Butte wind power plant. Pteragen filed Application No. 1610614 on May 27, 2014, with the AUC requesting approval of a time extension, from June 30, 2014 to December 31, 2016, in order to complete construction of the power plant. The time extension was approved on June 11, 2014 under Decision No. 2014-166.

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1. Introduction

1.1. Project

1.1.1. Project Overview

The COMH in its capacity as a market participant, has submitted a SASR to the AESO requesting that the COMH's point of connection to the AIES be relocated from the existing Medicine Hat 41S substation to a proposed new substation, the Al Rothbauer 321S substation (the Connection Project).

This request was made to address the risk to electricity supply that presently exists from a flood event on the South Saskatchewan River. Currently the COMH generating station and the point of connection with the AIES are located on a common site adjacent to the South Saskatchewan River, with the potential for both to be impacted during a flood event. The proposed site of the Connection Project connection will be directly adjacent and connected to a proposed COMH substation in the Medicine Hat area.

In order to connect the Connection Project, amendments will be required to the approved SATR project. The AESO and AltaLink are applying for the SATR NID Approval Amendment and a facility application amendment in separate applications.

The scheduled ISD for this project is June 30, 2017.

1.1.2. Load Component

A summary of the load data is as follows:

- Existing Medicine Hat 41S substation Demand Transmission Service (DTS): 26 MW
- Requested Al Rothbauer 321S substation DTS: 26 MW
- Future Expansion: no future change of DTS indicated in the SASR.
- Type of load: General distribution load

1.1.3. Generation Component

A summary of the generation data is as follows:

- Existing Medicine Hat 41S substation Supply Transmission Service (STS): 102 MW
- Requested Al Rothbauer 321S substation STS: 102 MW
- Future Expansion: no future change of STS indicated in the SASR.
- Type of generators: Single cycle gas turbines

1.2. Study Scope

1.2.1. Study Objectives

The objectives of this study are to:

- Assess the impact of the Connection Project on the AIES.

- Recommend any mitigation measures to address system performance concerns, if any, to reliably connect the Connection Project to the AIES.

1.2.2. Study Area

1.2.2.1. Study Area Description

The Connection Project is located in the Medicine Hat area. The Study Area was defined to include all transmission system elements 138 kV and above within the Medicine Hat area and the tie lines connecting the Medicine Hat area to the rest of the AIES.

From a transmission system perspective, the Study Area was served by three 138 kV transmission lines prior to approved SATR, as shown in Figure 1-1.

The SATR includes Medicine Hat area transmission developments. The SATR MHTD addresses forecasted transmission system capacity concerns in the Medicine Hat area, which are a result of both load and generation growth in the area. In order to serve the forecasted load and deliver the forecasted generation on a firm basis to the AIES, more capacity is needed in the area.

As shown in Figure 1-2 below, the SATR MHTD in the Study Area includes reconfiguring the 138 kV transmission system and adding a 240 kV transmission system. The facilities include:

- Add a new 240/138 kV Bowmanton 244S substation;
- Add a new 138 kV transmission line 675L between the Medicine Hat 41S substation and the new Bowmanton 244S substation of higher capacity than the 674L currently connected the COMH to the AIES from the north;
- Add a new 138 kV transmission line 676L between the Bullshead 523S substation and the new Bowmanton 244S substation;
- Add a new 138 kV transmission line 879L between the Burdett 368S substation and the new Bowmanton 244S substation;
- Add a new 138 kV line between the Bowmanton 244S substation and the existing line 892L north of the proposed Al Rothbauer 321S to connect Suffield 895S to Bowmanton 244S;
- Add two 240 kV transmission lines 1034L and 1035L between the Bowmanton 244S substation and the Cassils 324S substation; and
- Add two 240 kV transmission lines 964L and 983L between the Bowmanton 244S substation and the Whitla 251S substation.

Once SATR MHTD is constructed the transmission system in the Study Area will include:

- Two 240 kV transmission lines connecting Medicine Hat area to the Brooks area through the 240/138 kV Bowmanton 244S substation;
- A 138 kV looped system between Medicine Hat 41S, Bullshead 523S, and the Bowmanton 244S substations.
- Three 138 kV transmission lines to the Vauxhall area (via the Burdett 368S substation), Brooks area (via the Tilley 498S substation) and Empress area (via the Cypress 562S substation).

All transmission facilities within the Study Area were studied and were monitored for violations of the *Transmission Planning Criteria – Basis and Assumptions* (Reliability Criteria). The tie

lines connecting the Medicine Hat area to the rest of the AIES were also studied and were monitored for violations of the Reliability Criteria.

Figure 1-1: Medicine Hat Area Transmission System – Prior to the SATR

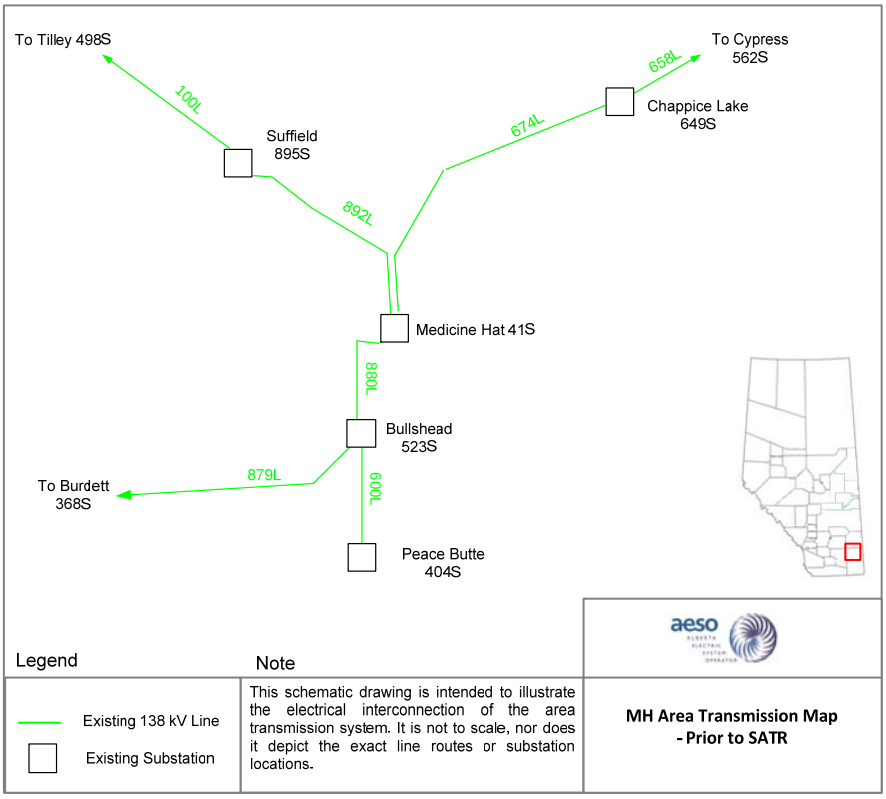
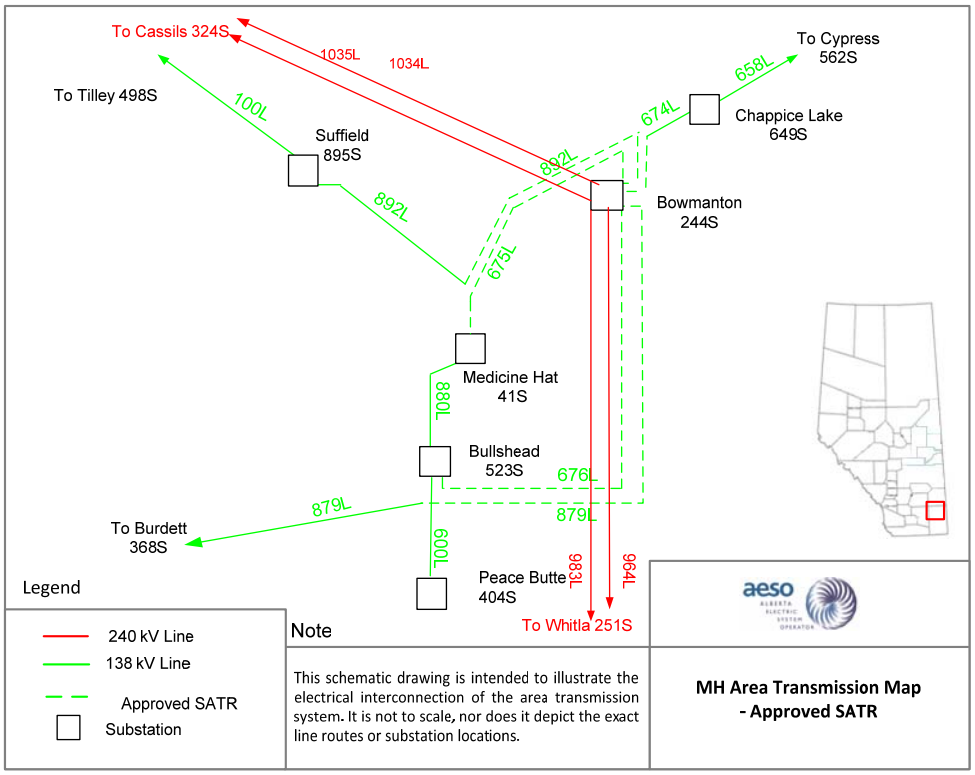


Figure 1-2: Medicine Hat Area Transmission System- After the SATR



1.2.2.2. Existing Constraints

There is an existing Remedial Action Scheme (RAS) in place to trip one of the two transformers at Tilley 498S substation under a Category B event. However this RAS will be removed once SATR MHTD is in service.

1.2.2.3. AESO Long-Term Plans

The AESO published the AESO 2015 Long Term Plan (2015 LTP) in November 2015. There are no transmission developments proposed for the Study Area until 2025.

1.2.3. Studies Performed

Power flow, voltage stability, transient stability, and short-circuit analyses were performed to assess the pre-connection and the post-connection system. Normal conditions (Category A) and single contingency (Category B) analyses were performed. Because there was uncertainty about the ISD, several study scenarios were performed, as shown below:

The following pre-connection analyses were performed:

- Power flow analysis (Category A and Category B for 2015WP)
- Short-circuit analysis (2015WP)

The following post-connection analyses were performed:

- Power flow analysis (Category A and Category B for 2015WP, 2016 SL, 2016 SP, 2018SL, and 2018SP)
- Voltage stability analysis (Category A and Category B for 2016SL and 2016SP)
- Transient stability analysis (Category B for 2015WP and 2018SP)
- Short-circuit analysis (2015WP and 2023SP)

1.3. Report Overview

The Executive Summary provides a high-level summary of the report and its conclusions. Section 1 provides an introduction of the Connection Project. Section 2 describes the Reliability Criteria, system data, and other study assumptions used in this study. Section 3 presents the study methodology used in this study. Section 4 discusses the pre-connection system assessment. Section 5 presents the connection alternative identified. Section 6 provides a technical analysis of the post-connection system assessment for the alternative selected for further study. Section 7 provides a short-circuit analysis for the pre- and post-connection. Section 8 discusses the connection project dependencies. Section 9 presents the conclusions and recommendations of this study.

2. Criteria, System Data, and Study Assumptions

2.1. Criteria, Standards, and Requirements

2.1.1. Transmission Planning Standards and Criteria

The Transmission Planning (TPL) Standards, which are included in the Alberta Reliability Standards, and the AESO's *Transmission Planning Criteria – Basis and Assumptions* (Reliability Criteria) [4] were applied to evaluate system performance under Category A system conditions (i.e., all elements in-service) and following Category B contingencies (i.e., single element outage), prior to and following the studied alternatives. Below is a summary of Category A and Category B system conditions.

Category A, often referred to as the N-0 condition, represents a normal system with no contingencies and all facilities in service. Under this condition, the system must be able to supply all firm load and firm transfers to other areas. All equipment must operate within its applicable rating, voltages must be within their applicable range, and the system must be stable with no cascading outages.

Category B events, often referred to as an N-1 or N-G-1 with the most critical generator out of service, result in the loss of any single specified system element under specified fault conditions with normal clearing. These elements are a generator, a transmission circuit, a transformer, or a single pole of a DC transmission line. The acceptable impact on the system is the same as Category A. Planned or controlled interruptions of electric supply to radial customers or some local network customers, connected to or supplied by the faulted element or by the affected area, may occur in certain areas without impacting the overall reliability of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted firm (non-recallable reserved) transmission service electric power transfers.

The TPL standards, TPL-001-AB-0 and TPL-002-AB-0 have referenced Applicable Rating when specifying the required system performance under Category A and Category B events. For the purpose of applying the TPL standards to the studies documented in this report Applicable Ratings are defined as follows:

- Applicable rating refers to the applicable normal and emergency facility thermal and voltage rating as applied by the facility owner or system voltage limit as determined and consistently applied by the ISO. Applicable ratings may include emergency ratings applicable for short durations as required to permit operating steps necessary to maintain system control. All ratings must be established by the applicable entity consistent with applicable ISO rules addressing facility ratings.
- For Category A conditions: Voltage range under normal operating condition per AESO Information Document ID# 2010-007RS, *General Operating Practice – Voltage Control*.
- For Category B conditions: The extreme voltage range as applicable from Table 2-1 in the *Transmission Planning Criteria – Basis and Assumptions*.
- Desired post-contingency voltage deviations for three defined post event timeframes as provided in Table 2-1 below.

[4] Filed under a separate cover

The post contingency voltage deviations following Category B events were compared with the guidelines in Table 2-1

Table 2-1 : Post-Contingency Voltage Deviation Guidelines for Low Voltage Busses

Parameter and Reference Point	Time Period		
	Post Transient (Up to 30s)	Post Auto Control (30s to 5min)	Post Transient (Up to 30s)
Voltage Deviation from Steady-State at Low-Voltage Bus	+/- 10%	+/-7%	+/-5%

2.1.2. AESO Rules

The AESO Voltage Control Practice ID # 2010-007RS, which relates to Section 304.4 of the ISO Rules, *Maintaining Network Voltage* will be applied to establish pre-contingency voltage profiles in the study region. Section 302.1 of the ISO Rules, *Real Time Transmission Constraint Management* (TCM Rule) will be followed in setting up the study scenarios and assessment of the connection impact. In addition, due regard will be given to the AESO Customer Connection Study Requirements Document and the Generation and Load Interconnection Standard.

The Reliability Criteria is the basis for planning the AIES. The transmission system will normally be designed to meet or exceed the Reliability Criteria under credible worst-case loading and generation conditions.

2.1.3. Load and Generation Assumptions

The load conditions and assumptions are shown in

Table 2-2 and include the system projects described in Table 2-4. The generation dispatch considered in the study was based on Section 2.1.5 below.

2.1.4. Load Assumptions

Table 2-2 presents the load conditions and assumptions to be used in the connection studies. The coincident load forecast is the AESO 2012 Long-term Outlook Update (2012 LTOU) at the peak Alberta internal load (AIL). As part of its planning responsibilities, the AESO updates its corporate forecasts routinely to ensure they reflect the latest economic projects, factors and timing. While the AESO has updated its regional forecasts since the connection studies were performed, the use of the current AESO load forecasts, found in the AESO 2014 Long-term Outlook, for the region would not materially alter the connection study results or affect its conclusions. In this study the active power to reactive power ratio in the AESO Base Cases will be maintained when modifying the loads.

Table 2-2: Forecast Load for Study Region (2012 LTOU)

Substation, Area or Region Name and Season	Forecast Peak Load (MW)		
	2015	2016	2018

Substation, Area or Region Name and Season		Forecast Peak Load (MW)		
		2015	2016	2018
Central	SP		1599	1684
	SL		1173	1237
	WP	1789		
South	SP		2839	2999
	SL		1896	2011
	WP	3057		
AIL w/o Losses	SP		10931	12247
	SL		7831	8892
	WP	11864		

2.1.5. Generation Assumptions

The existing and proposed generators and their dispatch levels in the Study Area are listed in Table 2-3.

In the high wind analysis, all existing and approved wind generation facilities in the Study Area were dispatched up to their contracted capacity level. This includes the approved Wild Rose 1, Wild Rose 2, and Peace Butte Wind Power Plants. The ISDs assumed for these wind facilities are listed in Table 2-3.

Table 2-3 Approved Wind Projects in the Study Area

Wind Projects (Past Gate 2)	Planned ISD	Total (MW)	2015 Dispatch (MW)	2016 Dispatch (MW)	2018 Dispatch (MW)
Pteragen Peace Butte Wind Farm	Q4 2016[5]	116	0	0	116
Naturener Wild Rose Wind Farm Phase 1& 2	Q4 2015/ Q1 2016[6]	420	400	400	400

2.1.6. Intertie Flow Assumptions

The COMH flow was tested under both 26 MW in flow (rate DTS, flow from the AIES into COMH) and 102 MW outflow (rate STS, flow from COMH into the AIES).

[5] Peace Butte wind farm is currently on hold and hasn't given an indication of when this project will proceed.

[6] NaturEner Wild Rose 1 Wind Energy Inc. has applied to the Commission to extend the construction completion date stipulated by the AUC in Power Plant Approval U2013-420 and Substation Permit and Licence U2013-421 for the Wild Rose 1 Wind Power Project from December 31, 2015, to July 17, 2017, under the *Hydro and Electric Energy Act*. The Wild Rose 1 Wind Power Project consists of a 210-megawatt wind power plant and a substation.

Alberta to British Columbia, Alberta to Montana, and Alberta to Saskatchewan intertie flows do not impact the Study Area.

2.2. System Projects

The approved transmission developments near the Study Area assumed the ISDs indicated in Table 2-4 are modelled in the study cases. Projects that are on hold were not included in the study cases.

Table 2-4: Summary of System Projects In and Around the Study Area

Project Name	Projected in-service date/ On Hold
SATR MHTD (Project 888)	January 2017
Picture Butte 120S to Journault 260S - 240 kV transmission line (Project 1035)	On Hold
Journault 260S to Whitla 251S - 240 kV transmission line (Project 1037)	On Hold

2.3. Customer Connection Projects

No additional connection projects were identified to include in this connection study.

2.4. Facility Ratings and Shunt Elements

The key transmission lines, transformers, and shunt elements in and around the Study Area and their ratings are listed in Table 2-5, Table 2-6 and Table 2-7, respectively.

Table 2-5: Summary of Transmission Line Ratings

Transmission Line	Nominal Voltage (kV)	From Bus		To Bus		Summer (MVA)	Winter (MVA)
1073L	240	477	ELKWATR1 240.00	669	MEDHAT2 240.00	1000	1200
1074L	240	477	ELKWATR1 240.00	669	MEDHAT2 240.00	1000	1200
964L	240	477	ELKWATR1 240.00	662	SUBD1 240.00	1000	1200
983L	240	477	ELKWATR1 240.00	662	SUBD1 240.00	1000	1200
1076L	240	477	ELKWATR1 240.00	462	WR2WF1 240.00	492	606
978L	240	477	ELKWATR1 240.00	531	WILDRO1 240.00	492	606
1034L	240	669	MEDHAT2 240.00	918	CASS01 240.00	1008	1275
1035L	240	669	MEDHAT2 240.00	918	CASS01 240.00	1008	1275

Transmission Line	Nominal Voltage (kV)	From Bus		To Bus		Summer (MVA)	Winter (MVA)
1009L	240	669	MEDHAT2 240.00	677	CYPRES2 240.00	638	788
892L[7]	138	270	SUFFIEL7 138.00	645	ESTMEDH2 138.00	67	96
600L	138	271	BULLS H7 138.00	839	600AL TA 138.00	121	149
880L	138	271	BULLS H7 138.00	660	MEDICI7B 138.00	123	150
879L	138	269	BURDETT7 138.00	645	ESTMEDH2 138.00	85	90
600L	138	284	BUTTE7 138.00	839	600AL TA 138.00	121	149
600AL	138	839	600AL TA 138.00	294	TOTHILL1 138.00	177	212
674L	138	320	CHAPPIC7 138.00	645	ESTMEDH2 138.00	81	100
675L	138	659	MEDICIN7 138.00	660	MEDICI7B 138.00	350	432
676L	138	271	BULLS H7 138.00	659	MEDICIN7 138.00	350	432
100L	138	275	Tilley 7 138.00	270	SUFFIEL7 138.00	69	115
658L	138	320	CHAPPIC7 138.00	674	CYPRES1 138.00	81	100

Table 2-6: Summary of Transformer Ratings

Substation Name and Number	Nominal Ratio	ID	MVA Rating
Bowmanton 244S	240/138	T1	200
Bowmanton 244S	240/138	T2	200
Suffield 895S	138/25	T3	42
Suffield 895S	138/25	T2	25
Bullshead 523S	138/25	T1	28
Peace Butte 404S	138/4.16	T1	18.7
Peace Butte 404S	138/25	T2	25
Chappice Lake 649S	138/25	T1	18.7
Medicine Hat 41S	138/69	T11	100
Medicine Hat 41S	138/13.8	T1	56

The shunt elements in the Medicine Hat Area are identified in Table 2-7 below.

[7] 892L capacity remains the same after SATR MHTD

Table 2-7: Summary of Shunt Elements in the Study Area

Substation Name and Number	Nominal Bus Voltage (kV)	Capacitors		Reactors	
		Number of Blocks	Total at Nominal Voltage (MVAr)	Number of Blocks	Total at Nominal Voltage (MVAr)
Bullshead 523S	138	1	18.3		
Bowmanton 244S	240	-	-	1	45
Medicine Hat 41S	13.8	2×7.2+1×9.0	23.4	-	-
Burdett 368S	138	1×24.46+1×24.50	48.9	-	-

2.5. Dynamic Data and Assumptions

Transient stability analysis was performed to determine whether the system remained stable under contingency conditions with the proposed development. The 2015WP and 2018SP load scenarios were used in the study. The dynamic data as modeled in the AESO 2012 planning base case suite was used in the study. Three-phase faults were tested at various locations in simulating the system disturbance. There is no new or additional generator component in this project.

2.6. Protection Fault Clearing Times

Actual fault clearing times were used for the existing transmission lines in the Medicine Hat area.

For new transmission lines, the generic fault clearing times specified in the *Transmission Planning Criteria - Basis and Assumptions* - Section 2.3 were applied in the transient stability analysis. Table 2-8 presents a set of maximum clearing times for each voltage level.

Table 2-8: Standard Fault Clearing Times

Nominal Voltage (kV)	Fast End Cycles	Slow End Cycles	Actual or Estimated
240	5	6 to 7	Estimated
138/144	6	7 to 8	Estimated

2.7. Voltage Profile Assumptions

The AESO ID#2010-007RS, was used to establish normal system (i.e., pre-contingency) voltage profiles for all key busses prior to commencing any studies. Voltage levels in Section 2.2 of the *Transmission Planning Criteria - Basis and Assumptions* apply for the bus nodes that ID# 2010-007RS does not specify voltage ranges. Bus voltages in the Study Area in all study cases were established toward the upper levels of the Normal Maximum voltage range as per Table 2-1 of the *Transmission Planning Criteria – Basis and Assumptions* prior to commencing any studies. All incidents where the bus voltages fell outside the desired operating range were noted in this report.

Table 2-9 below presents the summary of voltage at key nodes in the Study Area in the study cases based on ID# 2010-007RS.

Table 2-9: Summary of Voltage at Key Nodes in the Study Area

Substation	Nominal Voltage (kV)	Minimum Operating Limit (kV)	Desired Range (kV)	Maximum Operating Limit (kV)
Medicine Hat 41S	138	135	138 - 144	145
Bullshead 523S	138	135	138 - 144	145
West Brooks 28S	240	245	245 - 260	264
	138	138	138 - 144	145

3. Study Methodology

3.1. Study Scenarios

Table 3-1 below describes the study scenarios which were analyzed in this report.

Table 3-1: Study Scenarios

Scenario	Scenario Pre/Post-connection	COMH Outflow[8] (MW)	System Generation Dispatch Conditions
1	2015WP Pre-connection	102	High Wind
2	2015WP Post-connection	102	High wind
3	2015WP Pre-connection	-26	No Wind
4	2015WP Post-connection	-26	No Wind
5	2016SL Post-connection	102	High Wind
6	2016SP Post-connection	-26	No Wind
7	2018SL Post-connection	102	High Wind
8	2018SP Post-connection	-26	No Wind

3.2. Connection Studies Carried Out

Power flow, voltage stability, transient stability, and short-circuit analyses were undertaken.

The following pre-connection analyses were performed:

- Power flow analysis (Category A and Category B for 2015WP)
- Short-circuit analysis (2015WP)

The following post-connection analyses were performed:

- Power flow analysis (Category A and Category B for 2015WP, 2016SL, 2016SP, 2018SL, and 2018SP)
- Voltage stability analysis (Category A and Category B for 2016SL and 2016SP)
- Transient stability analysis (Category B for 2015WP and 2018SP)
- Short-circuit analysis (2015WP and 2023SP)

3.3. Power Flow Analysis

Pre-connection and post-connection power flow analyses were performed to assess the system performance for all Category A and Category B conditions.

[8] Inflow is shown as negative.

The contingencies considered for the power flow analyses included transmission elements rated at 138 kV and above in the Study Area and those that directly connect the Study Area to the AIES.

The elements that were monitored for any violations of the Reliability Criteria included all the elements rated at 138 kV and above in the Study Area and those that directly connect the Study Area to the AIES.

PSS/E 33 contingency power flow analysis was used as the study tool.

3.3.1. Contingencies Studied

The study included all Category B contingencies within the Study Area and the tie lines from the Study Area to the surrounding areas for all the study scenarios as shown in Table 3-1. Table 3-2 and Table 3-3 provide the lists of the transmission line and transformer contingencies that were considered in the study.

Table 3-2: Contingency List – Transmission Lines

Scenario	System Condition	Contingency	Nominal Voltage Rating (kV)	From Substation	To Substation
1-8	All transmission elements in service (N-0)	None		-	-
	N-1	675L	138	Bowmanton 244S	Medicine Hat 41S
	N-1	880L	138	Medicine Hat 41S	Bullshead 523S
	N-1	676L	138	Bullshead 523S	Bowmanton 244S
	N-1	1073L	240	Bowmanton 244S	Elkwater 264S
	N-1	1034L	240	Bowmanton 244S	Cassils 324S
	N-1	879L	138	Bowmanton 244S	Burdett 368S
	N-1	892L	138	Bowmanton 244S	Suffield 895S
	N-1	674L	138	Bowmanton 244S	Chappice Lake 649S
	N-1	100L	138	Tilley 498S	Suffield 895S
	N-1	658L	138	Cypress 562S	Chappice Lake 649S

Table 3-3: Contingency List – Generator/Transformer/SVC/etc.

Scenario	System Condition	Contingency	Substation
1-8	All transmission elements in service (N-0)	None	_
	N-1	240/138 kV Transformer (T1/T2)	Bowmanton 244S

3.4. Voltage Stability Analysis

The objective of the voltage stability analysis is to determine the ability of a power system to maintain sufficient reactive power margins at all the busses in the system under normal and abnormal steady-state operating conditions. In the study, voltage stability analysis was performed according to the Western Electricity Coordinating Council (WECC) Voltage Stability Assessment Methodology. The reference load level is the forecast peak load level.

Power-Voltage (P-V) curves were generated for Category A conditions and a selected set of critical Category B in the Study Area. The maximum operating load limits were determined to be:

- 5% below the load at the collapse point on the P-V curve for Category A
- 5% below the pre-contingency load corresponding to the collapse point on the P-V curve for Category B contingencies

PSS/E 33 PV analysis was used as the study tool.

3.4.1. Contingencies Studied

Table 3-4 below shows the contingency list of the five worst Category B events used in the voltage stability analysis for the post-connection system scenarios.

Table 3-4: Contingency List – Transmission Elements

Scenario	System Condition	Contingency	From Substation	To Substation
6 and 8	Post-connection	Medicine Hat 41S T1	-	-
		675L	Bowmanton 244S	321S
		MH-15	MHS-7	Medicine Hat 41S
		MHS-7 T1	-	-
		MH-20L	Medicine Hat 41S	MH69S-3

3.5. Short-Circuit Analysis

For the short-circuit analysis, all generators in and around the Study Area were switched on to evaluate the maximum fault current under three-phase faults and single-line-to-ground faults.

PSS/E 33 Automatic sequencing fault calculation (ASCC) function was used as the study tool.

3.6. Transient Stability Analysis

Transient stability analysis was performed to ensure that the system remained stable under contingency conditions after the Connection Project is connected. The 2015WP and 2018SP load scenario were analyzed. Three-phase faults were tested at various locations to simulate the system disturbance.

3.6.1. Contingencies Studied

Table 3-5 below shows the major contingencies used in the transient stability analysis after the Connection Project. Faults are applied at terminals of lines.

Table 3-5: Contingency List

Scenario	System Condition	Contingency	Fault Description
8	Post-connection	Bowmanton 244S 240/138 kV transformer T1	3-Phase fault on the 240kV bus; fault is cleared by removing the 240/138 transformer T1
		675L	3-Phase fault on the 138 kV transmission line 675L (between Bowmanton 244S and the proposed Al Rothbauer 321S); fault is cleared by removing the 138 kV transmission line 675L
		880L	3-Phase fault on the 138 kV transmission line 880L (between Medicine Hat 41S and Bullshead 523S); fault is cleared by removing the 138 kV transmission line 880L
		676L	3-Phase fault on the 138 kV transmission line 676L (between Bowmanton 244S and Bullshead 523S); fault is cleared by removing the 138 kV transmission line 676L

4. Pre-Connection System Assessment

4.1. Pre-Connection Power Flow Analysis

The pre-connection scenario includes the approved SATR MHTD developments shown in Figure 1-2. The post-connection scenario is described in Section 5. The steady-state performance of the pre-connection system was assessed under the 2015WP load scenarios. The power flow analysis was based on the Reliability Criteria, system data, and study assumptions as described in Section 2 and 3.

4.1.1. Scenario 1 - 2015WP Pre-connection (High Wind, 102 MW outflow from the COMH)

The Scenario 1 steady-state performance of the system under N-0 and N-1 was analyzed. The results of the power flow analysis are summarized in Table 4-1 and presented by the plots in Attachment A. No overloads or voltage violations were observed for Scenario 1.

(A) Category A (N-0) Results:

No overloads or voltage violations were observed for Scenario 1.

(B) Category B (N-1) Results:

No overloads or voltage violations were observed for Scenario 1.

Table 4-1: Summary of Pre-Connection System Performance – 2015WP Scenario 1

Contingency	Thermal Overloads	Voltage Performance
N-0: System Normal	None	Acceptable
N-1: Bowmanton 244S 240/138 kV Transformer	None	Acceptable
N-1: 675L (Bowmanton 244S to Medicine Hat 41S)	None	Acceptable
N-1: 880L (Medicine Hat 41S to Bullshead 523S)	None	Acceptable
N-1: 676L (Bowmanton 244S to Bullshead 523S)	None	Acceptable
N-1: 879L (Bowmanton 244S to Burdett 368S)	None	Acceptable
N-1: 892L (Bowmanton 244S to Suffield 895S)	None	Acceptable
N-1: 674L (Bowmanton 244S to Chappice Lake 649S)	None	Acceptable
N-1: 100L (Tilley 498S to Suffield 895S)	None	Acceptable
N-1: 658L (Cypress 562S to Chappice Lake 649S)	None	Acceptable

4.1.2. Scenario 3 - 2015 WP Pre-connection (No Wind, 26 MW inflow into Medicine Hat)

The steady state performance of the system under normal conditions (Category A) and single contingency (Category B) was assessed using Scenario 3. The results of the power flow

analysis are summarized in Table 4-2 and presented by the plots in Attachment A. No overloads or voltage violations were observed for the Scenario 3.

(A) Normal Conditions (Category A) Results:

No overloads or voltage violations were observed for the Scenario 3.

(B) Single Contingency (Category B) Results:

Table 4-2: Summary of Pre-Connection System Performance – 2015WP Scenario 3

Contingency	Thermal Overloads	Voltage Performance
N-0: System Normal	None	Acceptable
N-1: Bowmanton 244S 240/138 kV Transformer	None	Acceptable
N-1: 675L (Bowmanton 244S to Medicine Hat 41S)	None	Acceptable
N-1: 880L (Medicine Hat 41S to Bullshead 523S)	None	Acceptable
N-1: 676L (Bowmanton 244S to Bullshead 523S)	None	Acceptable
N-1: 879L (Bowmanton 244S to Burdett 368S)	None	Acceptable
N-1: 892L (Bowmanton 244S to Suffield 895S)	None	Acceptable
N-1: 674L (Bowmanton 244S to Chappice Lake 649S)	None	Acceptable
N-1: 100L (Tilley 498S to Suffield 895S)	None	Acceptable
N-1: 658L (Cypress 562S to Chappice Lake 649S)	None	Acceptable

5. Connection Alternatives

5.1. Connection Alternative

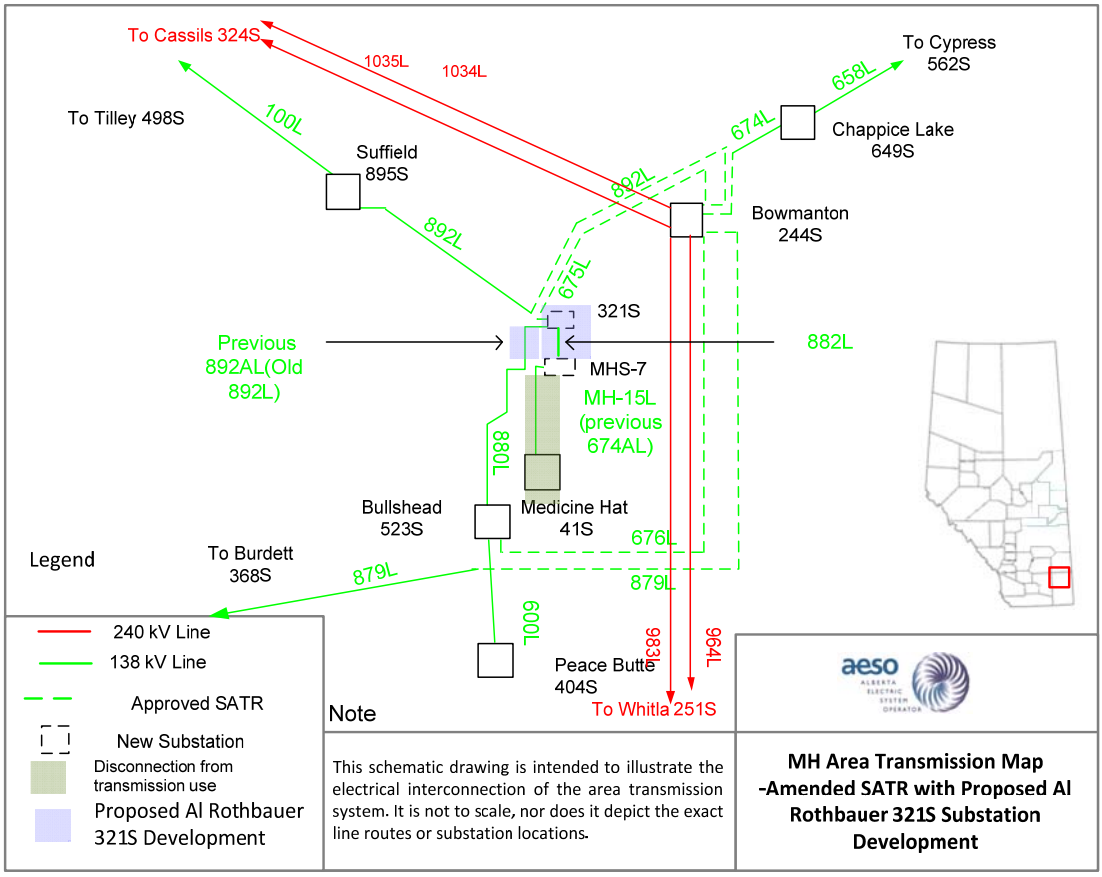
The proposed switching station, designated as the Al Rothbauer 321S substation location will be close to the route of the approved 138 kV transmission line 675L, between the Bowmanton 244S and the Medicine Hat 41S substations. Because of the proximity to the 138 kV transmission line 675L, the only alternative evaluated involved connecting the Al Rothbauer 321S substation to the AIES through the approved 138 kV transmission line 675L, shown in Figure 5-1.

This alternative involves:

- Constructing a new switching station, designated as the Al Rothbauer 321S substation with three 138 kV breakers.
- Connecting the approved 138 kV transmission line 675L into the proposed Al Rothbauer 321S substation.
- Disconnecting the 138 kV transmission line 880L from the Medicine Hat 41S substation and terminating it to the proposed Al Rothbauer 321S substation by connecting to the portion of 892L between Medicine Hat 41S substation and Al Rothbauer 321S substation (previously the 892AL).
- Discontinuing use of the Medicine Hat 41S substation and the 138 kV transmission line 674AL for transmission purposes.

After completion of this connection project, the COMH electrical system will be connected to the AIES through Al Rothbauer 321S substation.

Figure 5-1: Proposed Al Rothbauer 321S Substation Connection Project

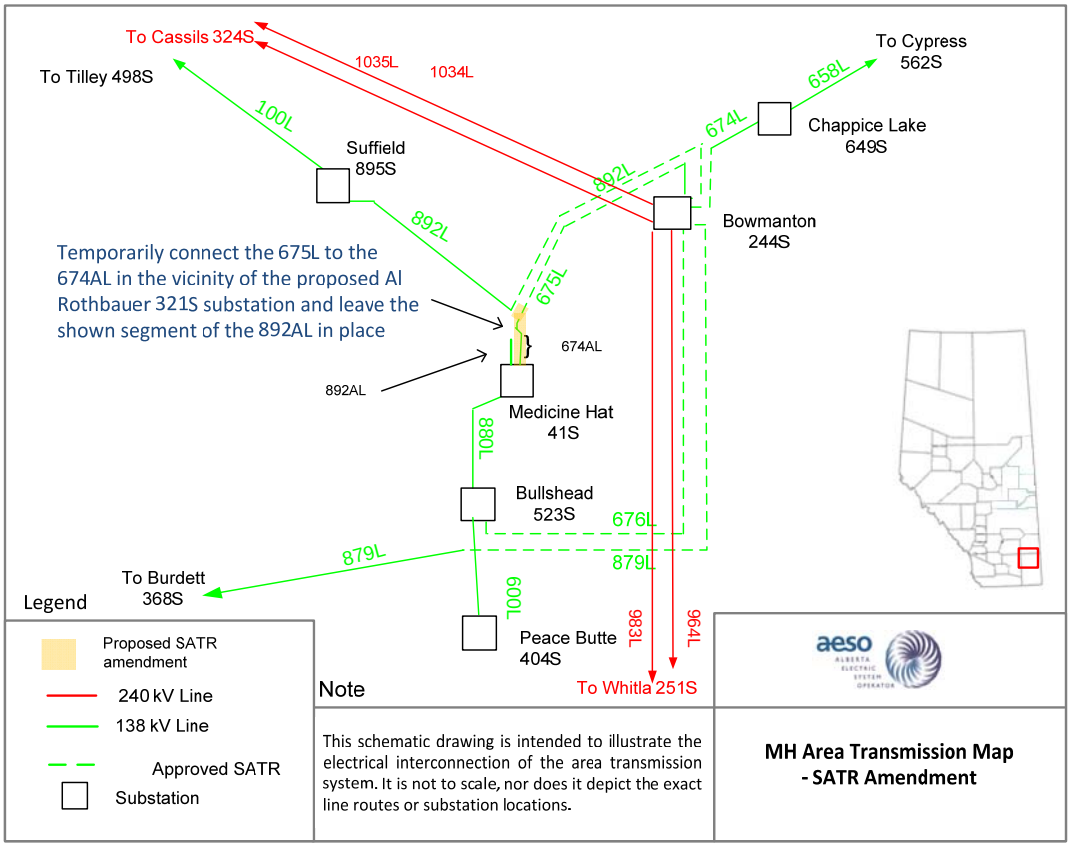


5.2. Connection Alternative Dependencies - SATR Amendment

The Connection Project is dependent on amendments to the approved SATR. The AESO and AltaLink Management Ltd. (AltaLink) are applying for the SATR NID Approval Amendment and a facility application amendment in separate applications. The required amendments include:

- Terminating the approved 138 kV transmission line 675L at the site of the proposed Al Rothbauer 321S substation. If approved, the new higher capacity 138 kV transmission line 675L will be temporarily connected to the portion of the lower capacity 138 kV transmission line 674AL (previously a portion of the 674L) located between the Medicine Hat 41S substation and the site of the proposed Al Rothbauer 321S substation.
- Retaining the 138 kV transmission line 892AL (previously a portion of the 892L). If the SATR NID Approval amendment is approved, the 138 kV transmission line 892AL will be decommissioned, and re-commissioned as the 880L as a part of the Connection Project.

Figure 5-2: SATR Amendment - Medicine Hat Transmission System



6. Technical Analysis of the Connection Alternative

The post-connection analysis included the Connection Project after the SATR amendment described in Section 5. The study results are summarized in the subsections that follow.

6.1. Alternative 1

6.1.1. Power Flow Analysis

The steady-state performance of the post-connection system was assessed under the near-term and long-term loading scenarios. The power flow analyses were based on the Reliability Criteria, system data, and study assumptions as described in Section 2 and Section 3.

The SATR MHTD will be in service before the Connection Project is in service. During this time, the Peace Butte Wind Farm is scheduled to come into service. A power flow sensitivity analysis was performed to determine the impact of the Peace Butte Wind Farm connecting after the amended SATR connection and prior to the Connection Project.

6.1.1.1. Scenario 2 - 2015WP Post-connection (High Wind,102 MW outflow from COMH)

The steady-state performance of the system under normal conditions (Category A) and single contingency (Category B) was assessed. The results of the power flow analysis are summarized in Table 6-1 and presented by the plots in Attachment B No overloads or voltage violations were observed for Scenario 2.

(A) Normal Conditions (Category A) Results:

No overloads or voltage violations were observed for Scenario 2.

(B) Single Contingency (Category B) Results:

No overloads or voltage violations were observed for Scenario 2.

Table 6-1: Summary of Post-Connection System Performance – 2015WP Scenario 2

Contingency	Thermal Overloads	Voltage Performance
N-0: System Normal	None	Acceptable
N-1: Bowmanton 244S 240/138 kV Transformer, T1	None	Acceptable
N-1: 675L (Bowmanton 244S to Medicine Hat 41S)	None	Acceptable
N-1: 880L (Medicine Hat 41S to Bullshead 523S)	None	Acceptable
N-1: 676L (Bowmanton 244S to Bullshead 523S)	None	Acceptable
N-1: 879L (Bowmanton 244S to Burdett 368S)	None	Acceptable
N-1: 892L (Bowmanton 244S to Suffield 895S)	None	Acceptable
N-1: 674L (Bowmanton 244S to Chappice Lake 649S)	None	Acceptable
N-1: 100L (Tilley 498S to Suffield 895S)	None	Acceptable

N-1: 658L (Cypress 562S to Chappice Lake 649S)	None	Acceptable

6.1.1.2. Scenario 4 - 2015WP Post-connection (No Wind,26 MW inflow from COMH)

The steady-state performance of the system under normal conditions (Category A) and single contingency (Category B) was assessed. The results of the power flow analysis are summarized in Table 6-2 and presented by the plots in Attachment B.

(A) Normal Conditions (Category A) Results:

No overloads or voltage violations were observed for Scenario 4.

(B) Single Contingency (Category B) Results:

No overloads or voltage violations were observed for Scenario 4.

Table 6-2: Summary of Post-Connection System Performance – 2015WP Scenario 4

Contingency	Thermal Overloads	Voltage Performance
N-0: System Normal	None	Acceptable
N-1: Bowmanton 244S 240/138 kV Transformer	None	Acceptable
N-1: 675L (Bowmanton 244S to Medicine Hat 41S)	None	Acceptable
N-1: 880L (Medicine Hat 41S to Bullshead 523S)	None	Acceptable
N-1: 676L (Bowmanton 244S to Bullshead 523S)	None	Acceptable
N-1: 879L (Bowmanton 244S to Burdett 368S)	None	Acceptable
N-1: 892L (Bowmanton 244S to Suffield 895S)	None	Acceptable
N-1: 674L (Bowmanton 244S to Chappice Lake 649S)	None	Acceptable
N-1: 100L (Tilley 498S to Suffield 895S)	None	Acceptable
N-1: 658L (Cypress 562S to Chappice Lake 649S)	None	Acceptable

6.1.1.3. Scenario 5 - 2016SL (High Wind, 102 MW outflow from COMH)

The steady-state performance of the system under normal conditions (Category A) and single contingency (Category B) was assessed. The results of the power flow analysis are summarized in Table 6-3 and presented by the plots in Attachment B.

(A) Normal Conditions (Category A) Results:

No overloads or voltage violations were observed for Scenario 5.

(B) Single Contingency (Category B) Results:

No overloads or voltage violations were observed for Scenario 5.

Table 6-3: Summary of Post-Connection System Performance – 2016SL Scenario 5

Contingency	Thermal Overloads	Voltage Performance
N-0: System Normal	None	Acceptable

N-1: Bowmanton 244S 240/138 kV Transformer	None	Acceptable
N-1: 675L (Bowmanton 244S to Medicine Hat 41S)	None	Acceptable
N-1: 880L (Medicine Hat 41S to Bullshead 523S)	None	Acceptable
N-1: 676L (Bowmanton 244S to Bullshead 523S)	None	Acceptable
N-1: 879L (Bowmanton 244S to Burdett 368S)	None	Acceptable
N-1: 892L (Bowmanton 244S to Suffield 895S)	None	Acceptable
N-1: 674L (Bowmanton 244S to Chappice Lake 649S)	None	Acceptable
N-1: 100L (Tilley 498S to Suffield 895S)	None	Acceptable
N-1: 658L (Cypress 562S to Chappice Lake 649S)	None	Acceptable

6.1.1.4. Scenario 6 - 2016SP (No Wind, 26 MW inflow to COMH)

The steady-state performance of the system under normal conditions (Category A) and single contingency (Category B) was assessed. The results of the power flow analysis are summarized in Table 6-4 and presented by the plots in Attachment B. No overloads or voltage violations were observed for Scenario 6.

(A) Normal Conditions (Category A) Results:

No overloads or voltage violations were observed for Scenario 6.

(B) Single Contingency (Category B) Results:

No overloads or voltage violations were observed for Scenario 6.

Table 6-4: Summary of Post-Connection System Performance – 2016SP Scenario 6

Contingency	Thermal Overloads	Voltage Performance
N-0: System Normal	None	Acceptable
N-1: Bowmanton 244S 240/138 kV Transformer	None	Acceptable
N-1: 675L (Bowmanton 244S to Medicine Hat 41S)	None	Acceptable
N-1: 880L (Medicine Hat 41S to Bullshead 523S)	None	Acceptable
N-1: 676L (Bowmanton 244S to Bullshead 523S)	None	Acceptable
N-1: 879L (Bowmanton 244S to Burdett 368S)	None	Acceptable
N-1: 892L (Bowmanton 244S to Suffield 895S)	None	Acceptable
N-1: 674L (Bowmanton 244S to Chappice Lake 649S)	None	Acceptable
N-1: 100L (Tilley 498S to Suffield 895S)	None	Acceptable
N-1: 658L (Cypress 562S to Chappice Lake 649S)	None	Acceptable

6.1.1.5. Scenario 7 - 2018SL (High Wind, 102 MW outflow from COMH)

The steady-state performance of the system under normal conditions (Category A) and single contingency (Category B) was assessed. The results of the power flow analysis are summarized in Table 6-5 and presented by the plots in Attachment B.

(A) Normal Conditions (Category A) Results:

No overloads or voltage violations were observed for Scenario 7.

(B) Single Contingency (Category B) Results:

No overloads or voltage violations were observed for Scenario 7.

Table 6-5: Summary of Post-Connection System Performance – 2018SL Scenario 7

Contingency	Thermal Overloads	Voltage Performance
N-0: System Normal	None	Acceptable
N-1: Bowmanton 244S 240/138 kV Transformer	None	Acceptable
N-1: 675L (Bowmanton 244S to Medicine Hat 41S)	None	Acceptable
N-1: 880L (Medicine Hat 41S to Bullshead 523S)	None	Acceptable
N-1: 676L (Bowmanton 244S to Bullshead 523S)	None	Acceptable
N-1: 879L (Bowmanton 244S to Burdett 368S)	None	Acceptable
N-1: 892L (Bowmanton 244S to Suffield 895S)	None	Acceptable
N-1: 674L (Bowmanton 244S to Chappice Lake 649S)	None	Acceptable
N-1: 100L (Tilley 498S to Suffield 895S)	None	Acceptable
N-1: 658L (Cypress 562S to Chappice Lake 649S)	None	Acceptable

6.1.1.6. Scenario 8 - 2018SP (No Wind, 26 MW inflow to COMH)

The steady-state performance of the system under normal conditions (Category A) and single contingency (Category B) was assessed. The results of the power flow analysis are summarized in Table 6-6 and presented by the plots in Attachment B.

(A) Normal Conditions (Category A) Results:

No overloads or voltage violations were observed for Scenario 8.

(B) Single Contingency (Category B) Results:

No overloads or voltage violations were observed for Scenario 8.

Table 6-6: Summary of Post-Connection System Performance – 2018SP Scenario 8

Contingency	Thermal Overloads	Voltage Performance
N-0: System Normal	None	Acceptable

N-1: Bowmanton 244S 240/138 kV Transformer	None	Acceptable
N-1: 675L (Bowmanton 244S to Medicine Hat 41S)	None	Acceptable
N-1: 880L (Medicine Hat 41S to Bullshead 523S)	None	Acceptable
N-1: 676L (Bowmanton 244S to Bullshead 523S)	None	Acceptable
N-1: 879L (Bowmanton 244S to Burdett 368S)	None	Acceptable
N-1: 892L (Bowmanton 244S to Suffield 895S)	None	Acceptable
N-1: 674L (Bowmanton 244S to Chappice Lake 649S)	None	Acceptable
N-1: 100L (Tilley 498S to Suffield 895S)	None	Acceptable
N-1: 658L (Cypress 562S to Chappice Lake 649S)	None	Acceptable

6.1.1.7. Sensitivity Analysis – Peace Butte Wind Farm Prior to the Connection Project (2018SL, High Wind, 102 MW outflow from COMH)

A sensitivity analysis was conducted with the Peace Butte Wind Farm in service following the amended SATR MHTD and prior to the Connection Project.

The results show that the 138 kV transmission line 674AL will be overloaded under the contingency of the 138 kV transmission line 676L. If this situation were to occur, a temporary RAS would be required to mitigate this overload. The results of the power flow analysis are summarized in Table 6-7 and presented by the plots in Attachment B.

Table 6-7: Summary of Pre-connection System Performance – 2018SL Sensitivity Scenario with Peace Butte Wind Farm and the Amended SATR MHTD connection

Contingency	Thermal Overloads	Voltage Performance
N-0: System Normal	None	Acceptable
N-1: Bowmanton 244S 240/138 kV Transformer	None	Acceptable
N-1: 675L (Bowmanton 244S to Medicine Hat 41S)	None	Acceptable
N-1: 880L (Medicine Hat 41S to Bullshead 523S)	None	Acceptable
N-1: 676L (Bowmanton 244S to Bullshead 523S)	674AL (170%)	Acceptable
N-1: 879L (Bowmanton 244S to Burdett 368S)	None	Acceptable
N-1: 892L (Bowmanton 244S to Suffield 895S)	None	Acceptable
N-1: 674L (Bowmanton 244S to Chappice Lake 649S)	None	Acceptable
N-1: 100L (Tilley 498S to Suffield 895S)	None	Acceptable
N-1: 658L (Cypress 562S to Chappice Lake 649S)	None	Acceptable

6.1.2. Voltage Stability Analysis

Post-connection voltage stability analysis was conducted for Scenario 5 and 6, to evaluate the system active margins under normal conditions (Category A) and single contingency (Category B).

6.1.2.1. Scenario 5 - 2016SL Post-Connection (High Wind, 102 MW outflow from COMH)

The COMH was considered as the source system for the outflow PV analysis while the rest of AIES was the sink. The PV analysis was carried out for normal conditions (Category A) and single contingency (Category B).

Table 6-8 shows the summary of the available Voltage Stability Margin under Category A and the worst outages under Category B conditions in the Study Area. The results show that after the Connection Project the transmission system has enough voltage stability margins for COMH to export power to AIES.

Table 6-8: Summary of Post-Connection Voltage Stability Results – 2016SL Scenario 5

Subsystem: COMH (generation:176.5 MW)			
System Condition	**Contigency**	**Incremental Subsystem Generation Increase before Collapse (MW)**	**Available Voltage Stability Margin for Subsystem (%)**
N-0	Normal Condition	280	158.6
N-1	MH-60L (MHS-7 to NECH)	280	158.6
N-1	Medicine Hat 41S 138/69 kV transformer	200	113.3
N-1	MHS-7 138/69 kV transformer	140	79.3
N-1	675L (Bowmanton 244S to MHS-7)	240	136.0

6.1.2.2. Scenario 6 - 2016SP Post-connection (No Wind, 26 MW inflow from COMH)

The COMH was the sink system for the inflow PV analysis while the source system was formed by the generation in Wabamun Area 40. The PV analysis was carried out for Category A, and Category B contingencies starting from the total Summer Peak load of 127 MW at COMH.

The results show that the transmission system has enough voltage stability margins for COMH to import power from AIES. The corresponding graph is presented in Attachment C.

Table 6-9: Summary of Post-Connection Voltage Stability Results – 2016SP Scenario 6

Subsystem: C0MH (load:126.8MW)			
System Condition	**Outage**	**Incremental Subsystem Load Increase before Collapse (MW)**	**Available Voltage Stability Margin for Subsystem (%)**
N-0	Normal Condition	130	102.5
N-1	MH-60L (MHS-7 to NECH)	50	39.4

Subsystem: C0MH (load:126.8MW)			
System Condition	Outage	Incremental Subsystem Load Increase before Collapse (MW)	Available Voltage Stability Margin for Subsystem (%)
N-1	Medicine Hat 41S 138/69 kV transformer	70	55.2
N-1	MHS-7 138/69 kV transformer	110	86.7
N-1	675L (Bowmanton 244S to MHS-7)	110	86.7

6.1.3. Transient Stability Analysis

A transient stability analysis was performed to ensure that the system remained stable under contingency conditions with the proposed development. The Scenario 2 and 7 were analyzed. Three-phase faults were tested at various locations to simulate the system disturbance.

Table 6-11 provides a list of dynamic contingencies performed in the study. A three-phase fault was simulated at the line end. The fault was then cleared in the specified time followed by the line tripping. Table 6-10 provides the fault clearing used in the study. Table 6-12 provides the monitored channels during the transient stability analysis.

Table 6-10: Fault Clearing Times

Transformer/ Transmission Line	Near End Cycles	Far End Cycles	Actual or Estimated
Bowmanton 240/138 kV transformer, T1	5	5	Estimated
675L	6	8	Estimated
880L	6	7	Actual
676L	6	8	Estimated
1034L	5	6	Estimated
1035L	5	6	Estimated
1073L	5	6	Estimated
1074L	5	6	Estimated

Table 6-11: Summary of Post-Connection Transient Stability – 2015WP SC2 and 2018SL SC7

Contingency	Description	From Bus	To Bus	CKT	Fault Location	Fault Type	Observation

Contingency	Description	From Bus	To Bus	CKT	Fault Location	Fault Type	Observation
Bowmanton 240/138 kV transformer, T1	3-Phase fault on 240kV bus; fault is cleared by removing the 240/138 transformer T1	669	659	T1	669	3-PH	Stable
675L	3-Phase fault on the 138 kV transmission line 675L (Bowmanton 244S to MHS-7) fault is cleared by trip 675L	659	744	75	744	3-PH	Stable
880L	3-Phase fault on the 138 kV transmission line 880L (Al Rothbauer 321S to Bullshead 523S); fault is cleared by trip 880L	660	271	80	271	3-PH	Stable
676L	3-Phase fault on the 138 kV transmission line 676L (Bowmanton 244S to Bullshead 523S); fault is cleared by trip 676L	659	271	76	659	3-PH	Stable

Table 6-12: Monitored Channels for the Transient Stability Analysis

Channel Identifier	Channel Category	Bus 1	Bus 2	ID
MHS-7 138	Bus-VOLTAGE	744	-	-
Suffield 138	Bus-VOLTAGE	270	-	-
Bullshead 138	Bus-VOLTAGE	271		
Bowmanton 138	Bus-VOLTAGE	659	-	-
Bowmanton 240	Bus-VOLTAGE	669	-	-
CMH14>	Machine-ANGLE	713	-	14
CMH11>	Machine-ANGLE	687	-	11
SHEER>	Machine-ANGLE	1482	-	1
TOTHILL2-P	Machine-PELEC	2294		G1
TOTHILL3-P	Machine-PELEC	4294		G2
CMH14-P	Machine-PELEC	713	-	14
CMH11-P	Machine-PELEC	687	-	11
SHEER-P	Machine-PELEC	1482	-	1
675L-FLOW	Branch-P	659	744	75
676L-FLOW	Branch-P	659	271	76
892L-FLOW	Branch-P	645	270	92
880L-FLOW	Branch-P	660	271	80

The transient stability results confirmed that the system remains stable for the selected Category B contingencies under normal fault clearing conditions in the Study Area. The transient stability plots are presented in Attachment D.

6.2. Conclusions of the Technical Analysis

The power flow results indicate that thermal overloads or voltage violations do not occur following the Connection Project with the SATR MHTD.

A sensitivity analysis was conducted with the Peace Butte Wind Farm in service following the SATR MHTD and prior to the Connection Project. The results show that the 138 kV transmission line 674AL will be overloaded under the contingency of the 138 kV transmission line 676L. If this situation were to occur, a temporary RAS would be required to mitigate this overload.

The voltage stability analysis results indicate that transmission system has sufficient voltage stability margins for the COMH to import from and export to the AIES when the Connection Project and the SATR MHTD are connected.

The transient stability results indicate that the system remains stable for the selected Category B contingencies under normal fault clearing conditions in the Study Area when the Connection Project and the SATR MHTD are connected.

7. Short-Circuit Analysis

7.1. Pre-Connection

Short-circuit analysis was performed using the 2015WP to determine the fault levels in the system before the proposed development. Three-phase and single-line-to-ground fault currents were calculated at the substation close to the proposed development. All generators in the Study Area were dispatched.

Table 7-1: Estimated Available Short-Circuit Current Levels, 2015WP Pre-connection

Substation	Voltage (Vbus, kV)	Pre-fault Voltage (kV)	3-ø Fault (kA)	Positive Sequence Impedance (R_1+jX_1) (pu)	L-G Fault (kA)	Zero Sequence Impedance (R_0+jX_0) (pu)
Bowmanton 244S	138	141	9.2758	0.004858+j0.045600	9.5653	0.005335+j0.041211
	240	245	6.3595	0.004547+j0.038310	6.7707	0.004751+j0.031015
Suffield 895S	138	141	3.1503	0.056139+j0.123806	1.9286	0.108012+j0.381225
Bullshead 523S	138	140	6.5216	0.010400+j0.064315	6.5617	0.010246+j0.063031
Burdett 368S	138	147	3.0647	0.066824+j0.129482	1.7986	0.137757+j0.434774
Medicine Hat 41S	138	141	7.0516	0.007428+j0.060013	6.8213	0.006360+j0.066250
Chappice Lake 649S	138	143	4.2138	0.035509+j0.097061	2.6828	0.052928+j0.277942

7.2. Post-Connection

Short-circuit analysis were performed using the 2015WP and 2023SP to determine the post-connection fault levels in the system. Three-phase and single-line-to-ground fault currents were calculated. No significant changes were observed on the short-circuit level after the Connection Project and STAR MHTD are connected.

Table 7-2: Estimated Available Short-Circuit Current Levels, 2015WP Post-connection

Substation	Voltage (Vbus, kV)	Pre-fault Voltage (kV)	3-ø Fault (kA)	Positive Sequence Impedance (R_1+jX_1) (pu)	L-G Fault (kA)	Zero Sequence Impedance (R_0+jX_0) (pu)
Bowmanton 244S	138	140	9.3382	0.005082+j0.045248	9.5664	0.005127+j0.041758
	240	245	6.376	0.004696+j0.038206	6.7662	0.004677+j0.031271
Suffield	138	140	3.1381	0.055882+j0.123389	1.9228	0.106989+j0.379461

Substation	Voltage (Vbus, kV)	Pre-fault Voltage (kV)	3-ø Fault (kA)	Positive Sequence Impedance (R_1+jX_1) (pu)	L-G Fault (kA)	Zero Sequence Impedance (R_0+jX_0) (pu)
895S						
Bullshead 523S	138	140	6.4533	0.011010+j0.064920	6.284	0.011386+j0.070045
Burdett 368S	138	143	3.0811	0.062844+j0.126100	1.8853	0.112407+j0.396352
Medicine Hat S	138	140	6.7734	0.009252+j0.062027	6.3205	0.009241+j0.075447
Chappice Lake 649S	138	142	4.2016	0.035197+j0.096676	2.6852	0.051554+j0.275037
Rothbauer 321S/MHS-7	138	140	7.2	0.007286+j0.058260	6.4	0.012135+j0.079333

Table 7-3: Estimated Available Short-Circuit Current Levels, 2023SP Post-connection

Substation	Voltage (Vbus, kV)	Pre-fault Voltage (kV)	3-ø Fault (kA)	Positive Sequence Impedance (R_1+jX_1)	L-G Fault (kA)	Zero Sequence Impedance (R_0+jX_0)
Bowmanton 244S	138	141	12.1544	0.003799+j0.034927	11.911	0.004965+j0.036320
	240	250	8.5433	0.003712+j0.029179	8.4632	0.004554+j0.029082
Suffield 895S	138	144	6.7992	0.013877+j0.062764	1.3374	0.199849+j0.827730
Bullshead 523S	138	141	8.6075	0.007750+j0.049186	8.3216	0.009573+j0.053622
Burdett 368S	138	145	3.4574	0.032004+j0.123117	1.3426	0.168978+j0.706205
Medicine Hat 41S	138	141	8.0668	0.008332+j0.052415	7.2451	0.009538+j0.070055
Chappice Lake 649S	138	142	4.1273	0.033642+j0.099316	2.1357	0.056410+j0.397554
Rothbauer 321S/MHS-7	138	141	8.8	0.006041+j0.048083	7.5	0.012223+j0.073151

8. Project Dependencies

The Connection Project is dependent on the completion of the SATR NID Approval Amendment, as described in Section 5.2. There are no other project dependencies

9. Conclusions and Recommendations

The COMH, in its capacity as a market participant, has submitted a SASR to the AESO requesting that the COMH's point of connection to the AIES be relocated from the existing Medicine Hat 41S substation to a proposed new switching station, the Al Rothbauer 321S substation (the Connection Project). The scheduled ISD for the Connection Project is June 30, 2017.

Project Alternative

The proposed Al Rothbauer 321S substation location will be close to the route of the approved 138 kV transmission line 675L between the Bowmanton 244S and the Medicine Hat 41S substations. Because of the proposed locations proximity to the 138 kV transmission line 675L, the only alternative evaluated involved connecting the Al Rothbauer 321S substation to the approved 138 kV transmission line 675L.

As shown in Figure 9-1, this Connection Project alternative includes:

- Constructing a new switching station, designated as the Al Rothbauer 321S substation, with three 138 kV breakers.
- Connecting the approved 138 kV transmission line 675L into the proposed Al Rothbauer 321S substation.
- Disconnecting the 138 kV transmission line 880L from the Medicine Hat 41S substation and terminating it to the proposed Al Rothbauer 321S substation by connecting it to the 892AL.
- Discontinuing use of the Medicine Hat 41S substation and the 138 kV transmission line 674AL for transmission purposes

SATR Amendment is Required

The Connection Project is dependent on amendments to the approved SATR. The AESO and AltaLink Management Ltd. (AltaLink) are applying for the SATR NID Approval Amendment and a facility application amendment in separate applications. The required amendments include:

- Terminating the approved 138 kV transmission line 675L at the site of the proposed Al Rothbauer 321S substation. If approved, the new higher capacity 138 kV transmission line 675L will be temporarily connected to the portion of the lower capacity 138 kV transmission line 674AL (previously a portion of the 674L) located between the Medicine Hat 41S substation and the site of the proposed Al Rothbauer 321S substation.
- Retaining the 138 kV transmission line 892AL (previously a portion of the 892L). If the SATR NID Approval amendment is approved, the 138 kV transmission line 892AL will be decommissioned, and re-commissioned as the 880L as a part of the Connection Project.

The 138 kV transmission line 675L will need to be in service before the Project is able to connect. The scheduled ISD for the 675L listed above is Q2 2016.

Technical Analysis indicate no Reliability Criteria violations

The power flow results indicate that thermal overloads or voltage violations do not occur following the Connection Project with the amended SATR MHTD connected.

The voltage stability analysis results indicate that transmission system has sufficient voltage stability margins for the COMH to import from and export to the AIES when the Connection Project and the amended SATR MHTD are connected.

The transient stability results indicate that the system remains stable for the selected Category B contingencies under normal fault clearing conditions in the Study Area when the Connection Project and the amended SATR MHTD are connected.

Temporary RAS may be required for Peace Butte Wind Farm

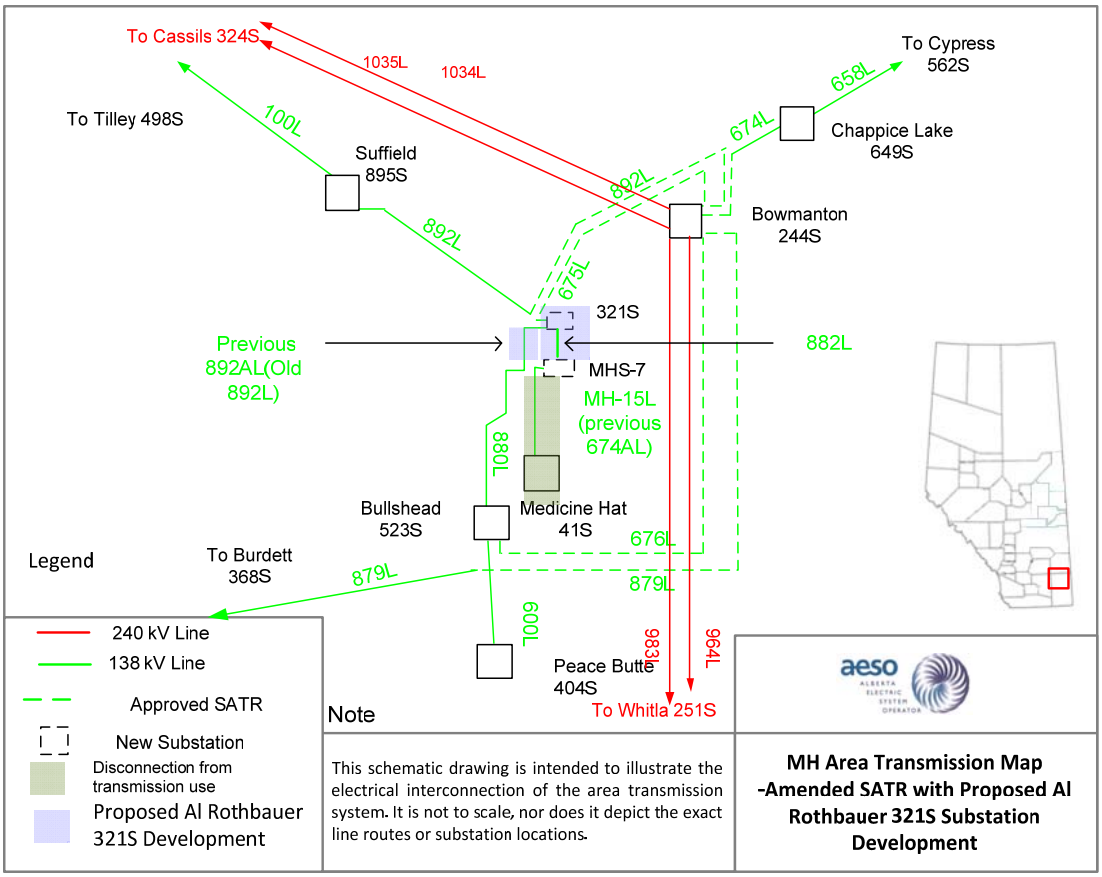
A sensitivity analysis was conducted with the Peace Butte Wind Farm in service following the amended SATR MHTD and prior to the Connection Project. The results show that the 138 kV transmission line 674AL will be overloaded under the contingency of the 138 kV transmission line 676L. If this situation were to occur, a temporary RAS would be required to mitigate this overload.

Recommendations

The study confirmed that the proposed Connection Project will not adversely impact the AIES.

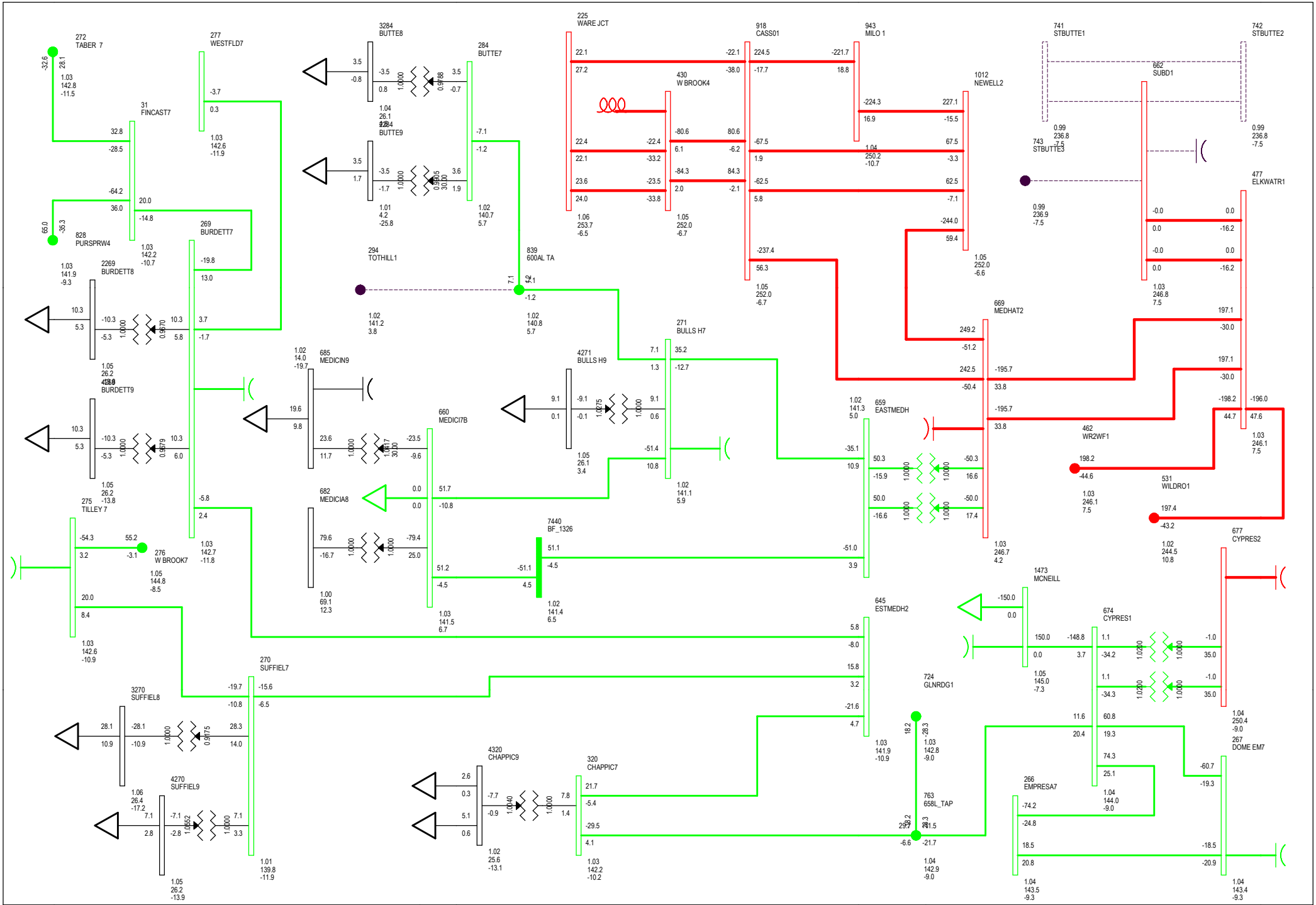
It is recommended that the proposed Connection Project be developed and energized following the SATR NID Approval Amendment. Further, a temporary RAS should be implemented if the Peace Butte Wind Farm connects prior to the energization of the Connection Project.

Figure 9-1: Proposed AI Rothbauer 321S Substation Connection Project



Attachment A

Pre-Connection Power Flow Analysis Results

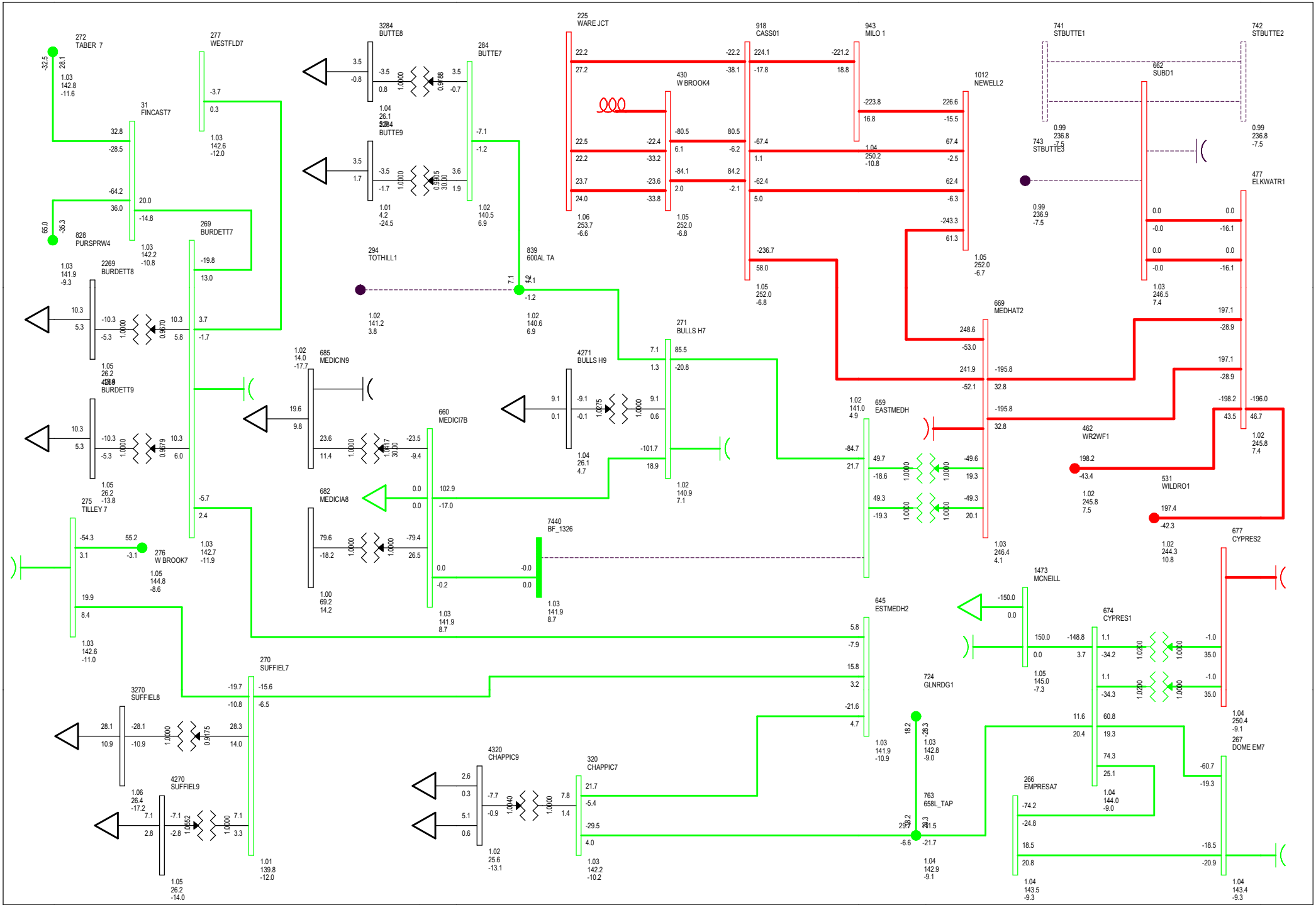


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 771.1 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-1: CATEGORY A - NO CONTINGENCY
FRI, NOV 27 2015 16:31

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

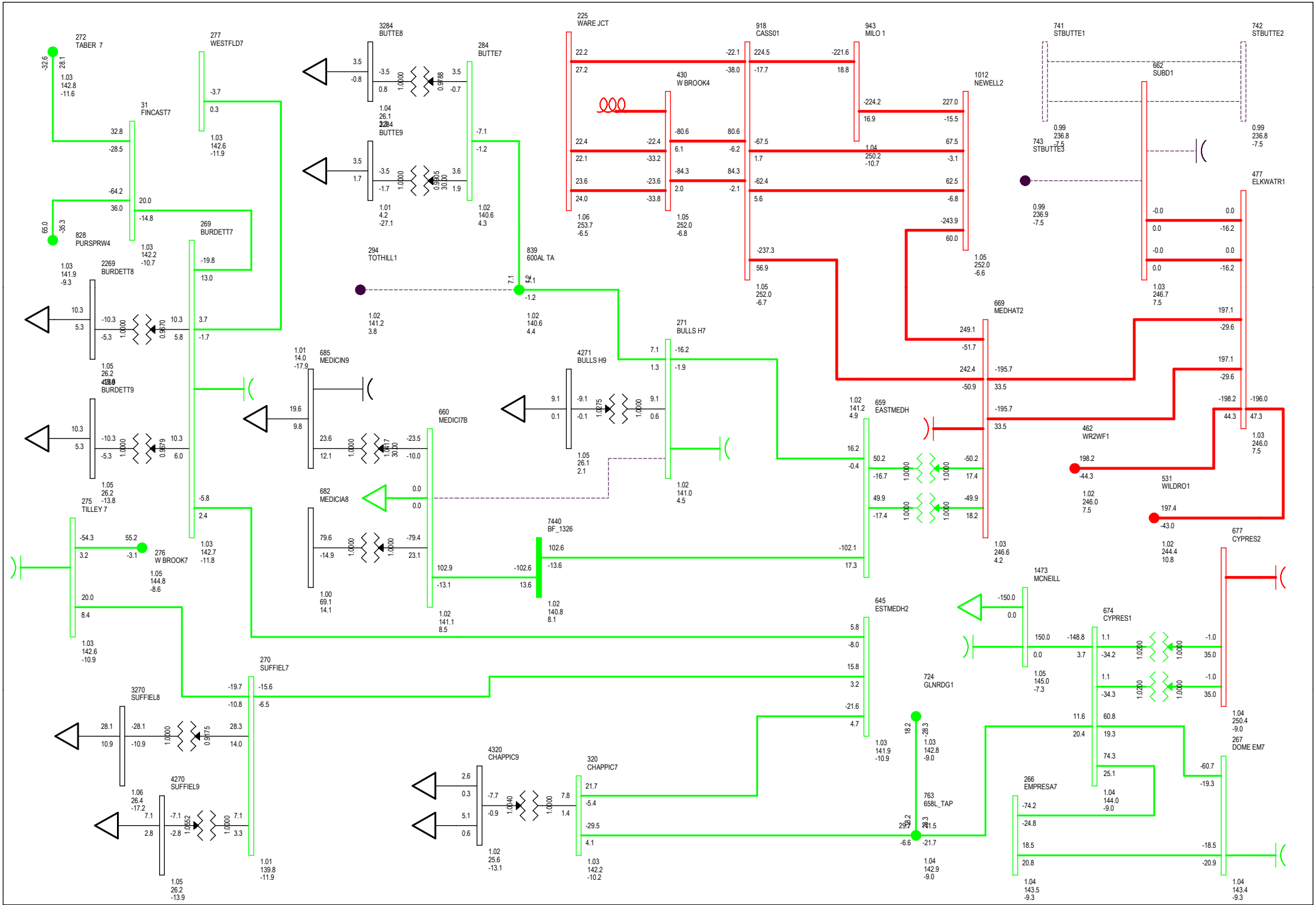


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 772.3 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-2: CATEGORY B - 675L (244S TO 41S)
FRI, NOV 27 2015 16:31

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

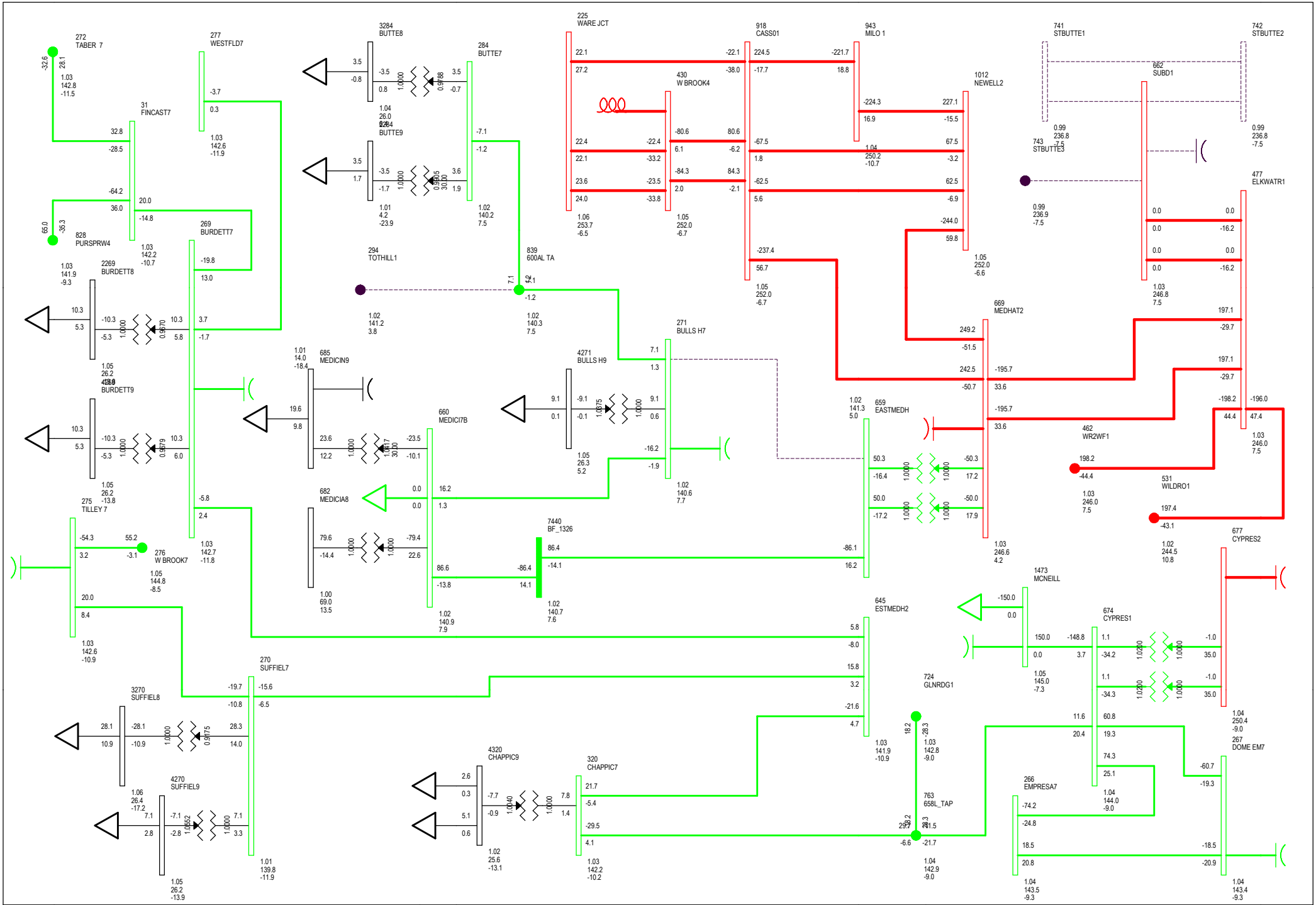


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 771.3 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-3: CATEGORY B - 880L (41S TO 523S)
FRI, NOV 27 2015 16:32

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

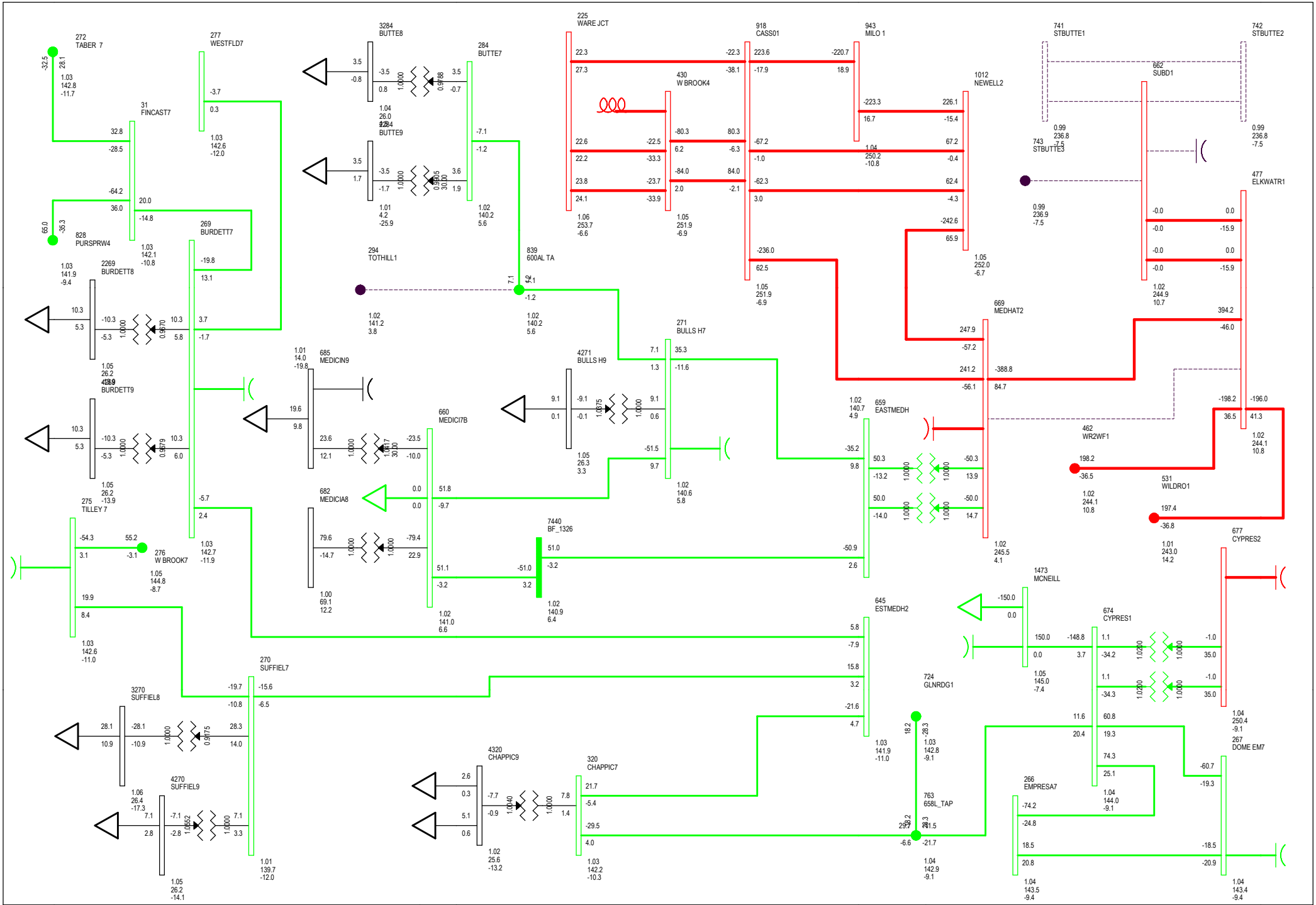


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 771.1 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-4: CATEGORY B - 676L (523S TO 244S)
FRI, NOV 27 2015 16:32

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

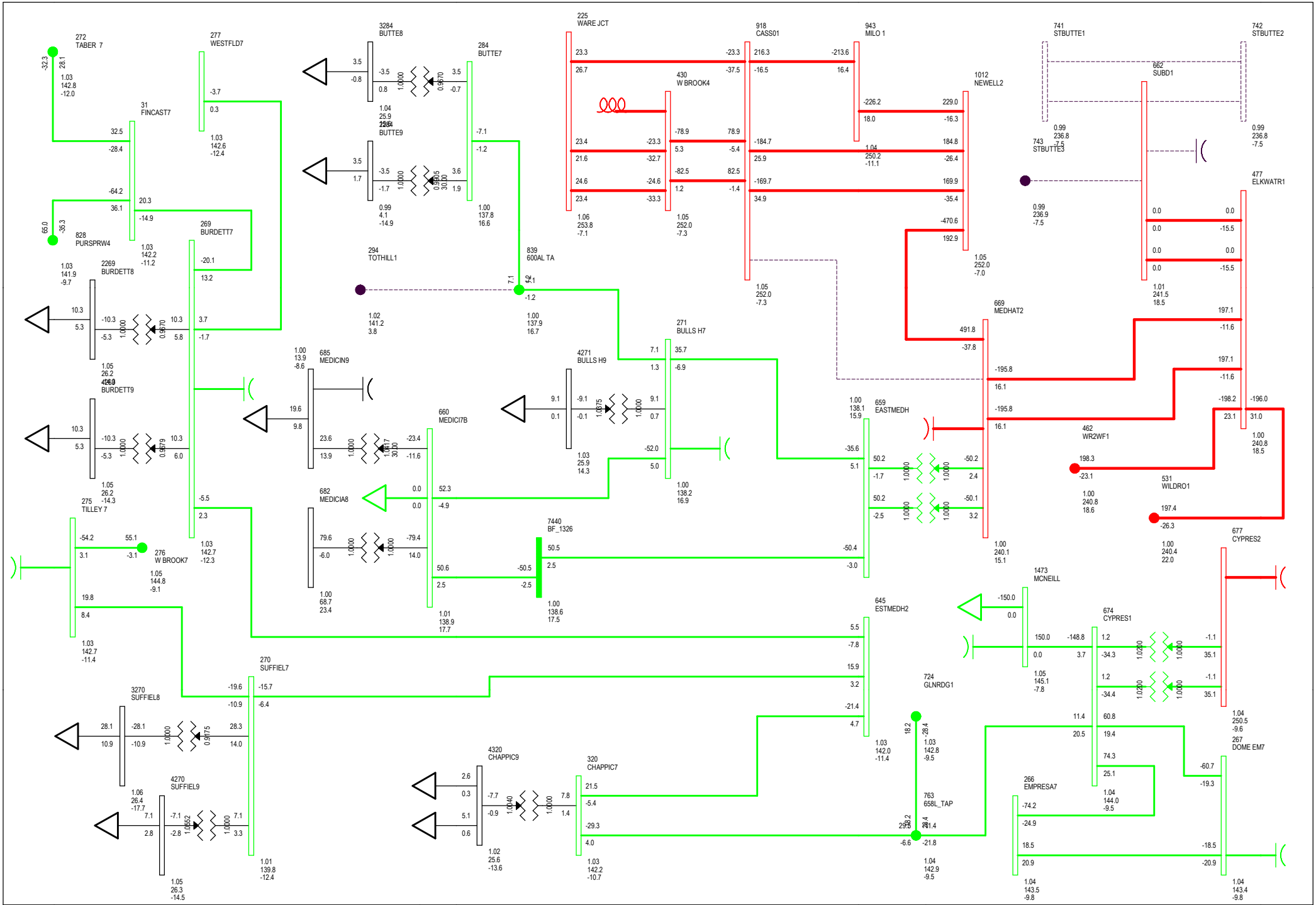


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 773.7 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-5: CATEGORY B - 1073L (244S TO 264S)
FRI, NOV 27 2015 16:32

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

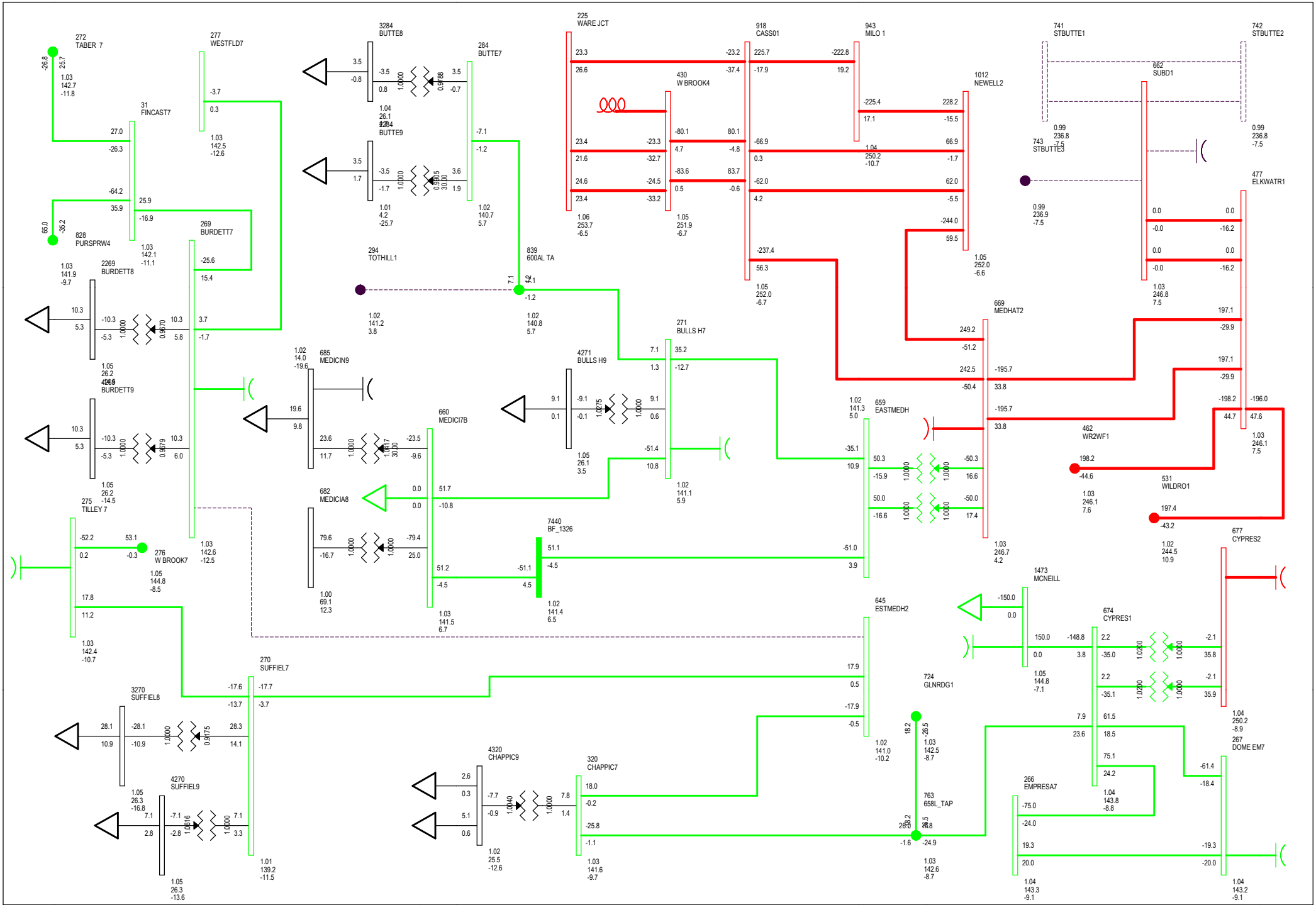


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 781.4 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-6: CATEGORY B - 1034L (244S TO 324S)
FRI, NOV 27 2015 16:33

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

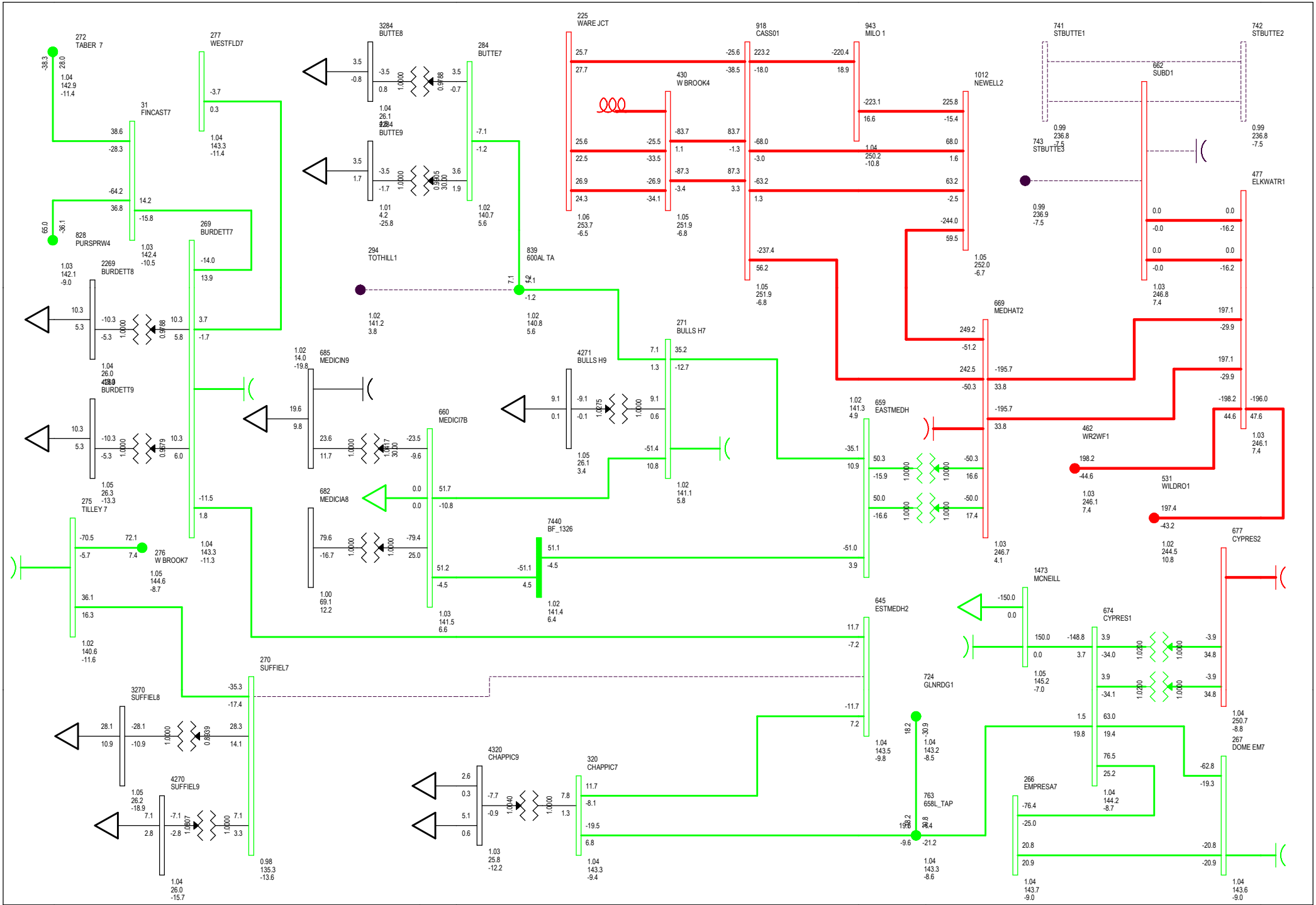


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 771.3 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-7: CATEGORY B - 879L (244S TO 368S)
FRI, NOV 27 2015 16:33

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

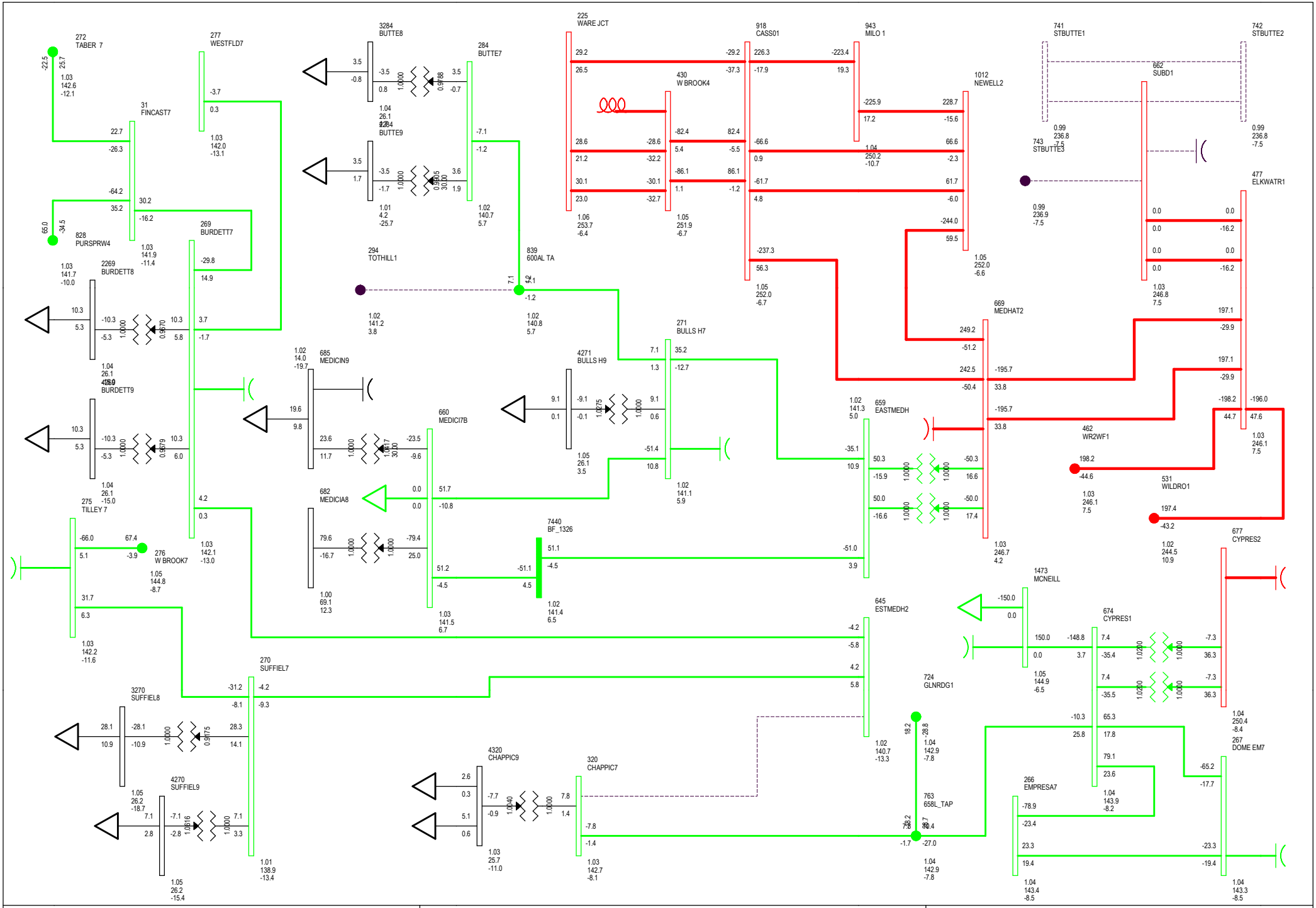


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 771.8 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-8: CATEGORY B - 892L (244S TO 368S)
FRI, NOV 27 2015 16:33

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

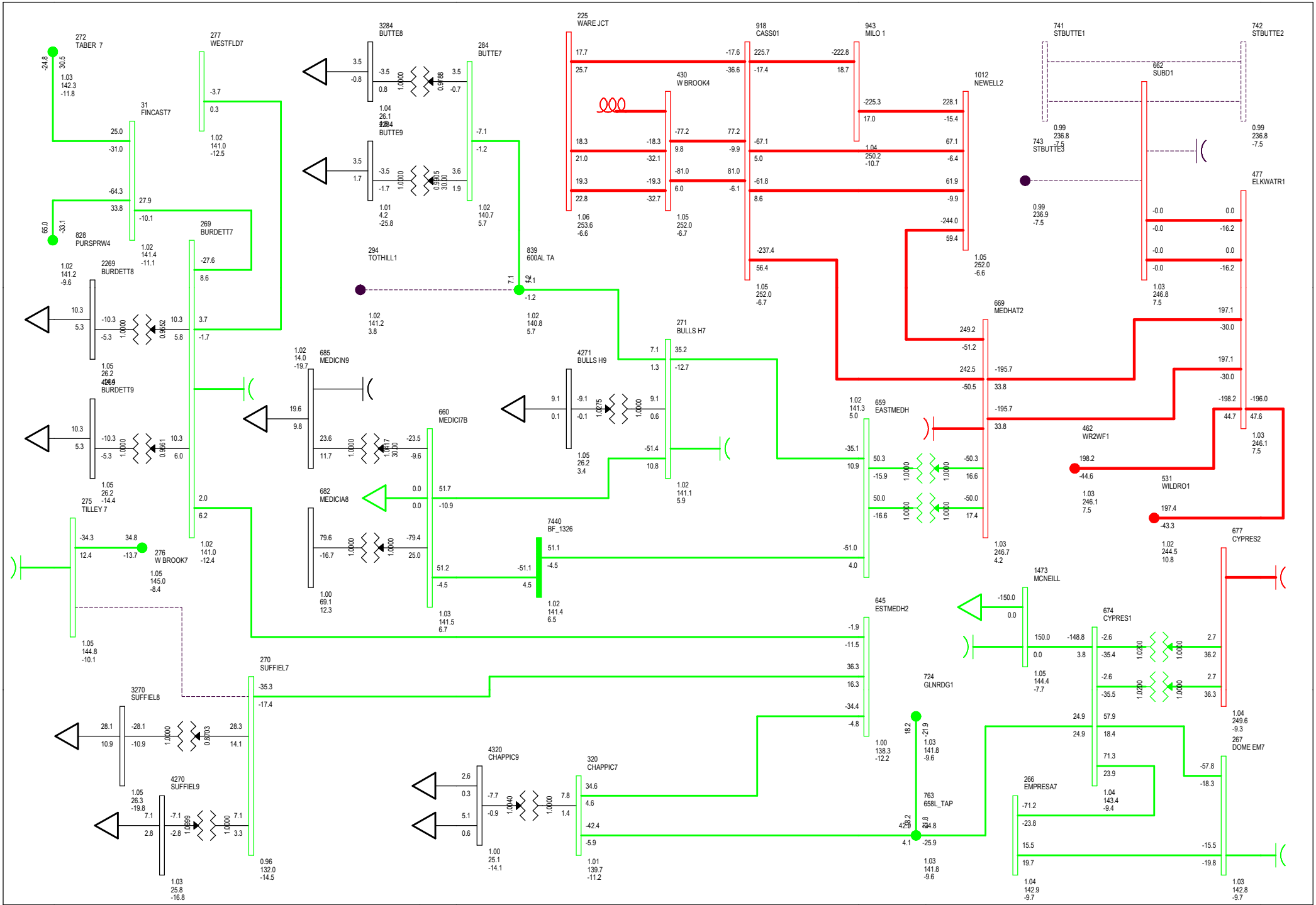


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 771.9 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-9: CATEGORY B - 674L (244S TO 649S)
FRI, NOV 27 2015 16:34

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

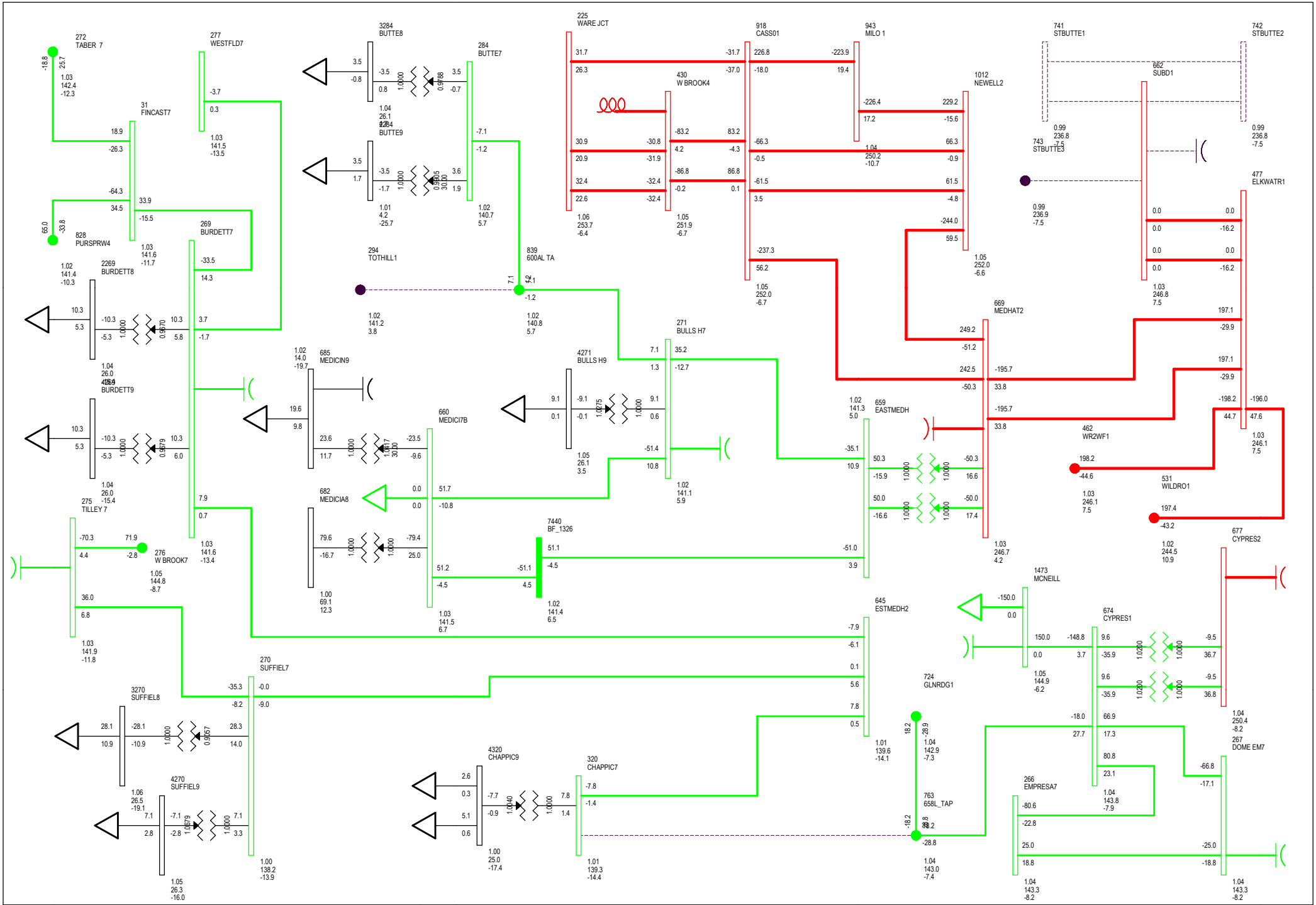


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 772.2 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-10: CATEGORY B - 100L (498S TO 895S)
FRI, NOV 27 2015 16:34

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

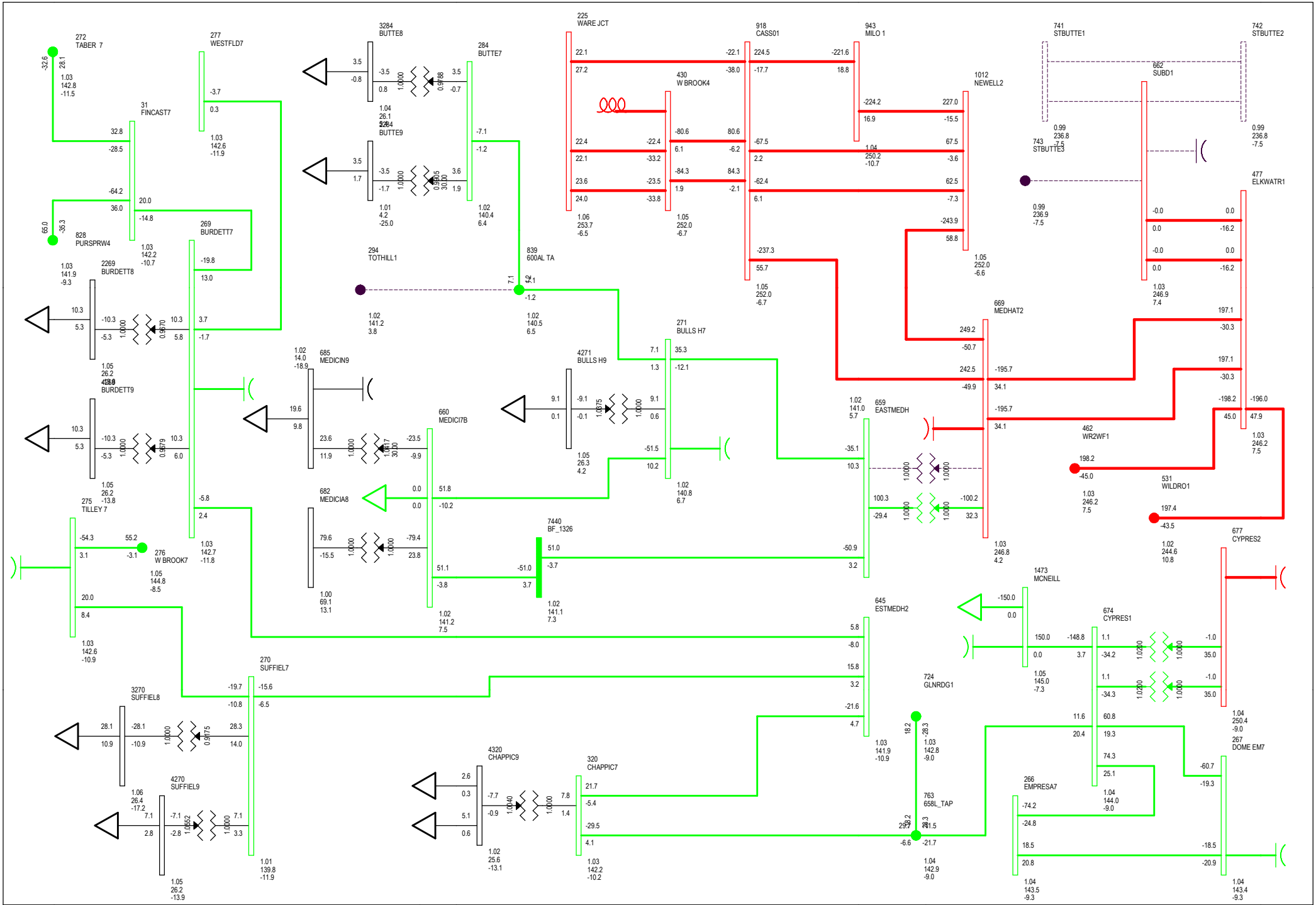


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 772.5 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-11: CATEGORY B - 658L (562S TO 649S)
FRI, NOV 27 2015 16:34

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

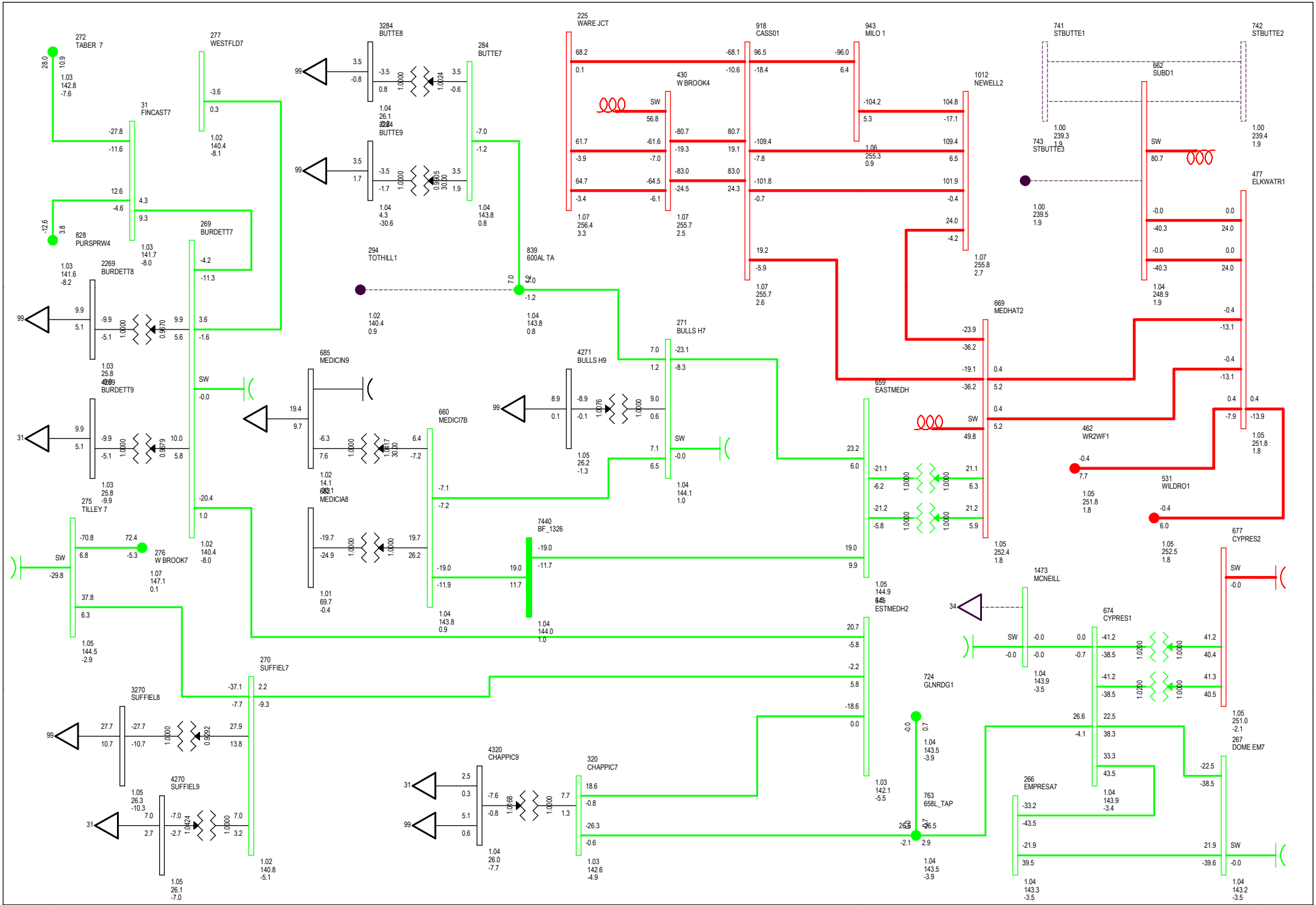


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 771.2 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 1
FIGURE A-12: CATEGORY B - TRANSFORMER T1 (244S)
FRI, NOV 27 2015 16:35

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

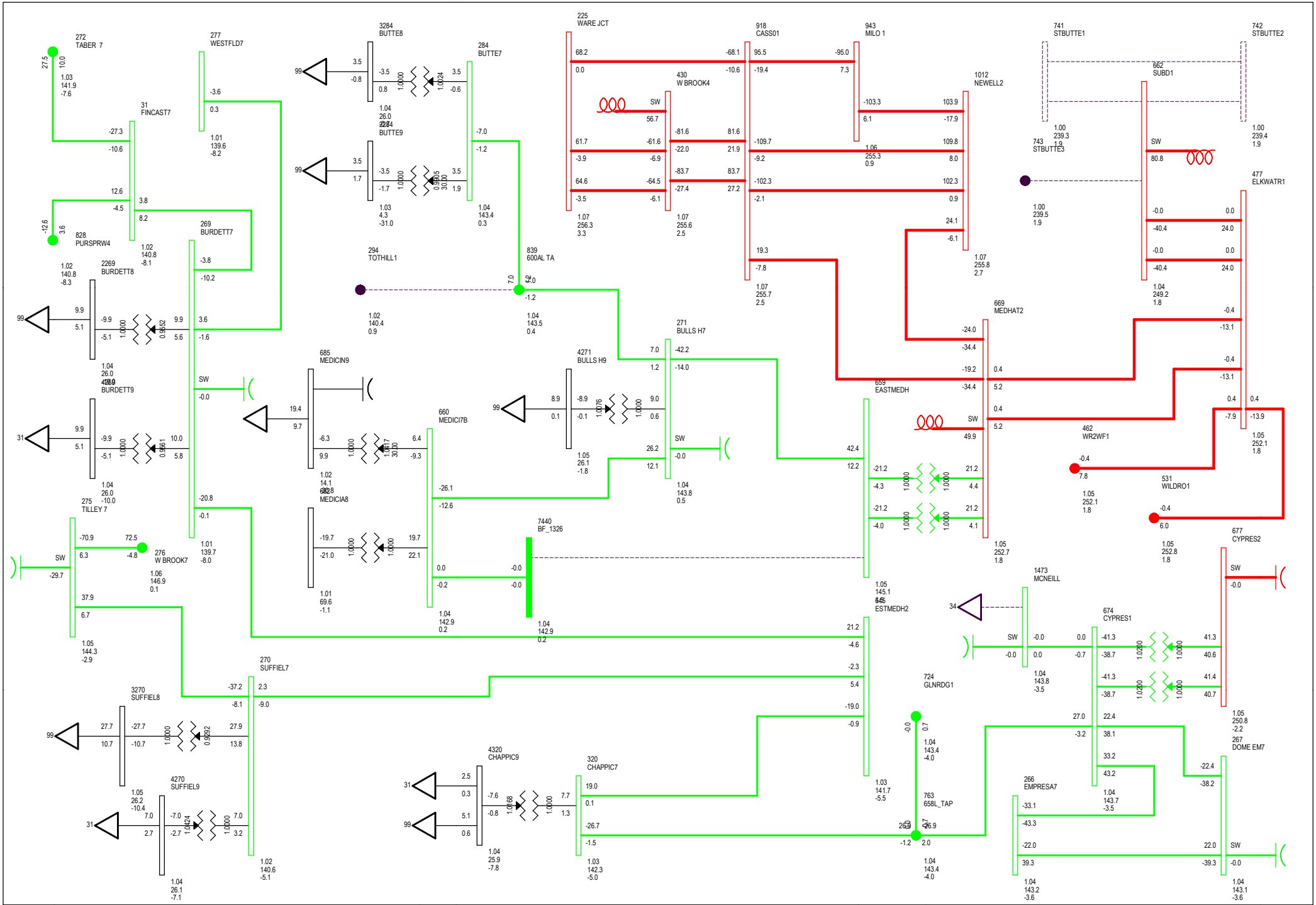


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.4 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-1: CATEGORY A - NO CONTINGENCY
THU, DEC 17 2015 7:25

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

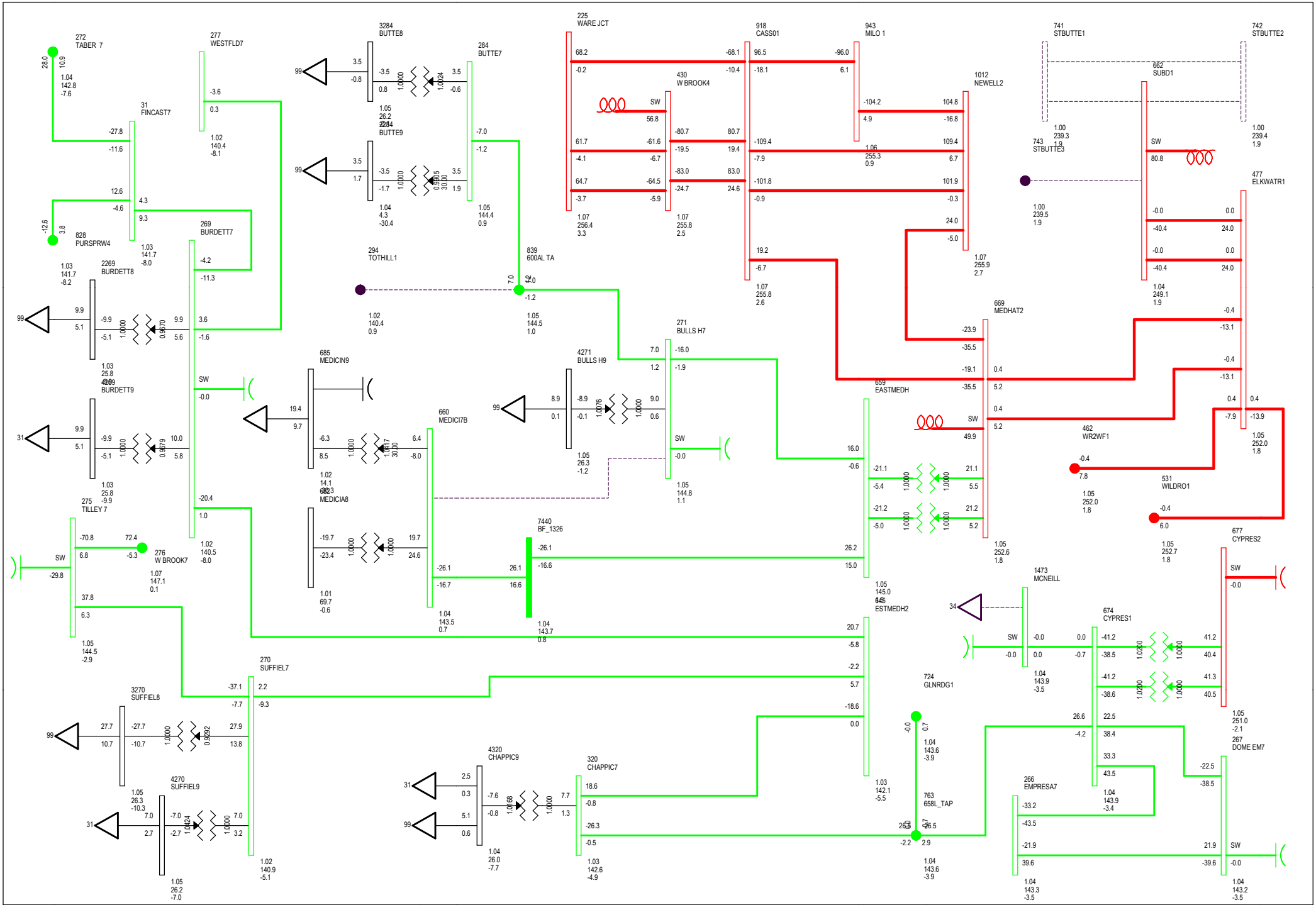


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.1 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-2: CATEGORY B - 675L (244S TO 41S)
THU, DEC 17 2015 7:26

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

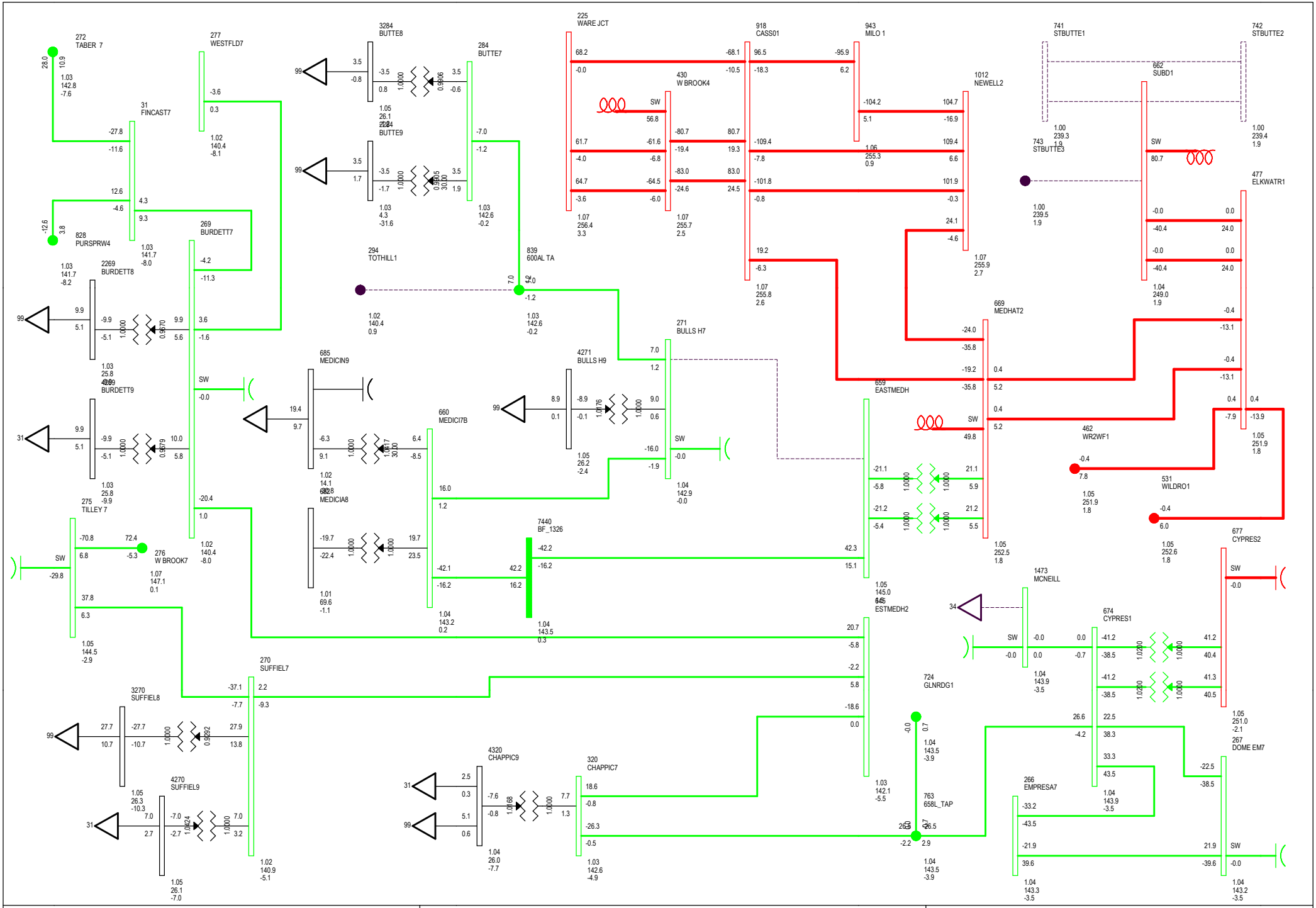


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.4 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-3: CATEGORY B - 880L (41S TO 523S)
THU, DEC 17 2015 7:26

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

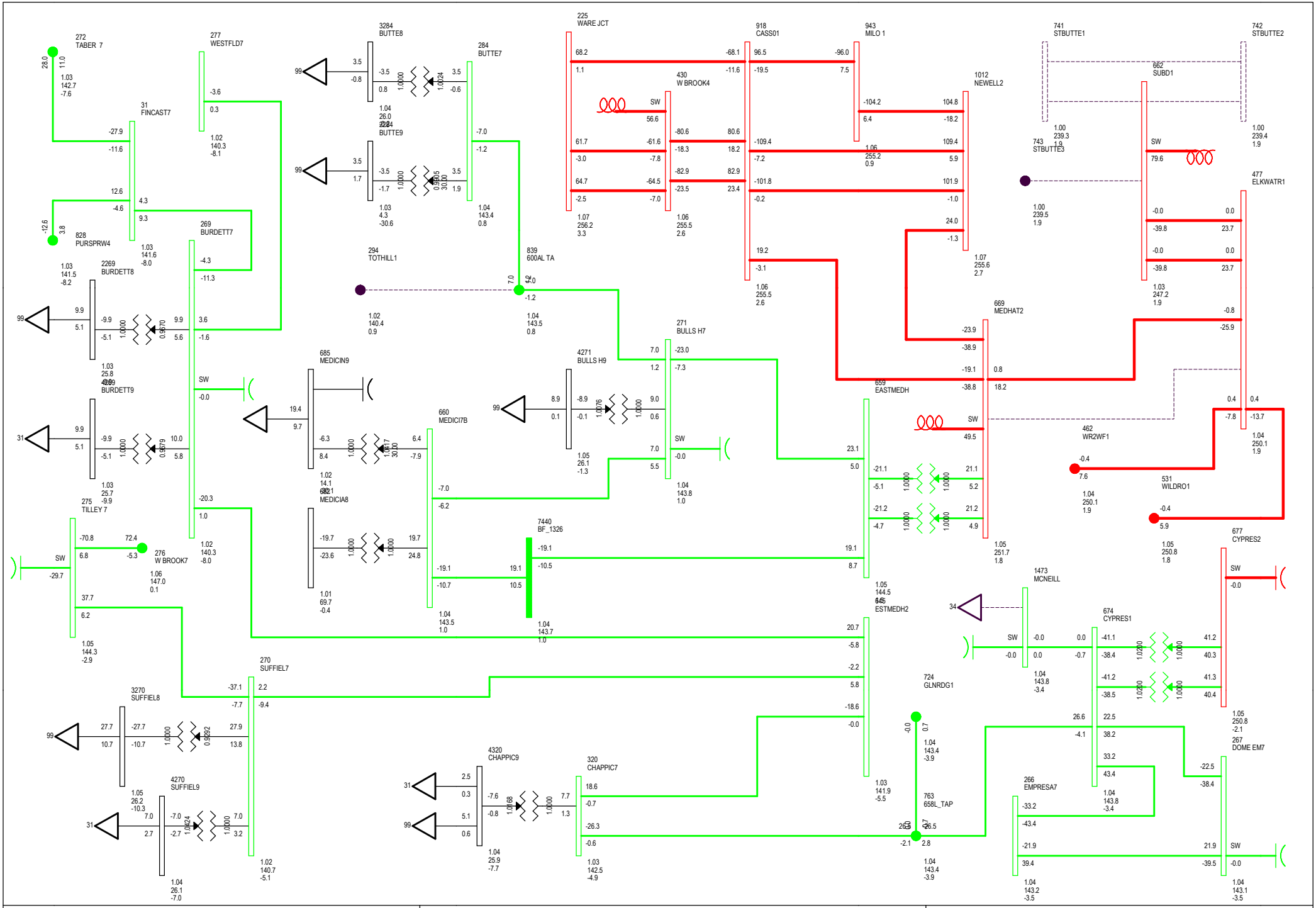


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.4 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-4: CATEGORY B - 676L (523S TO 244S)
THU, DEC 17 2015 7:26

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

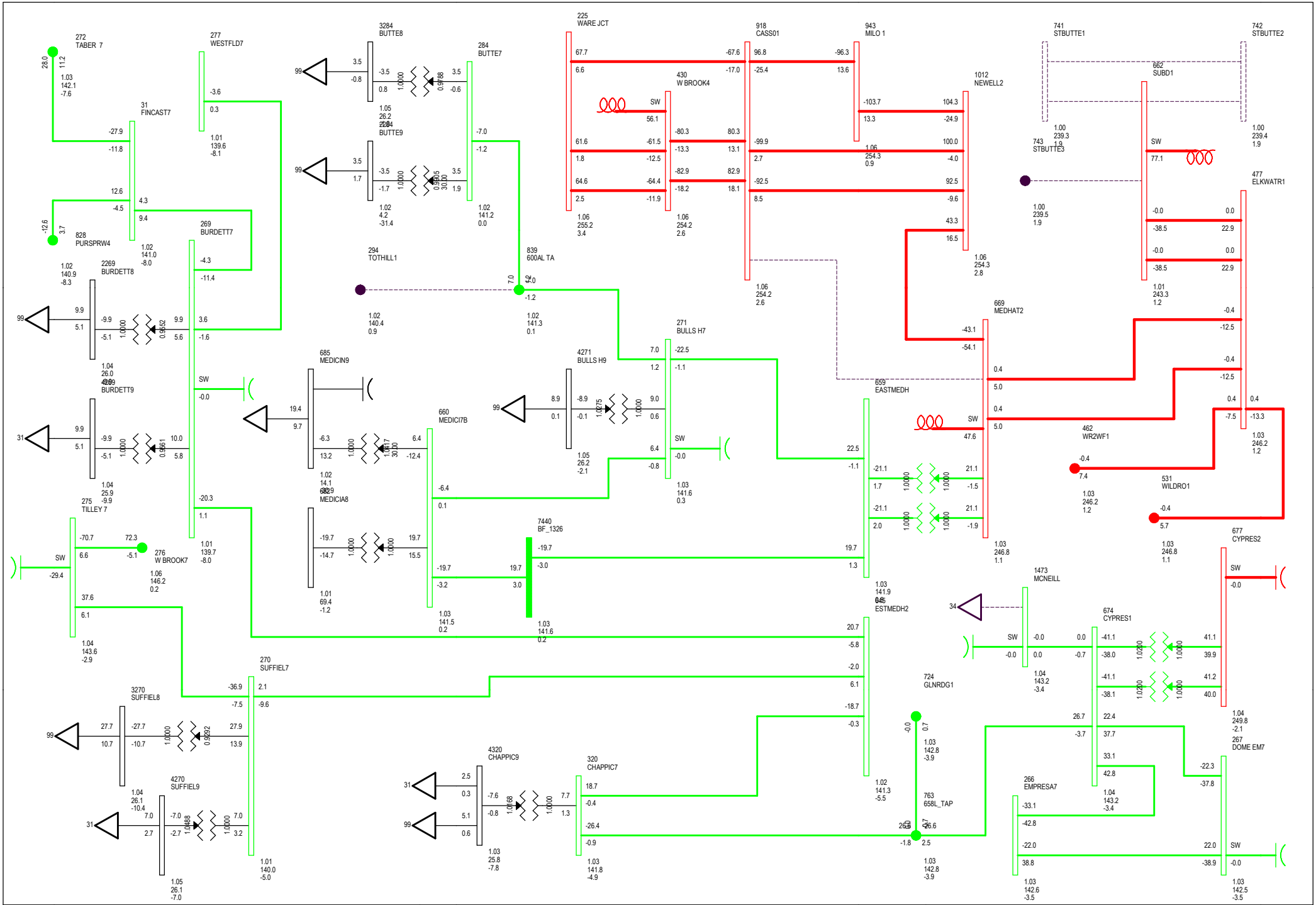


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.4 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-5: CATEGORY B - 1073L (244S TO 264S)
THU, DEC 17 2015 7:27

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

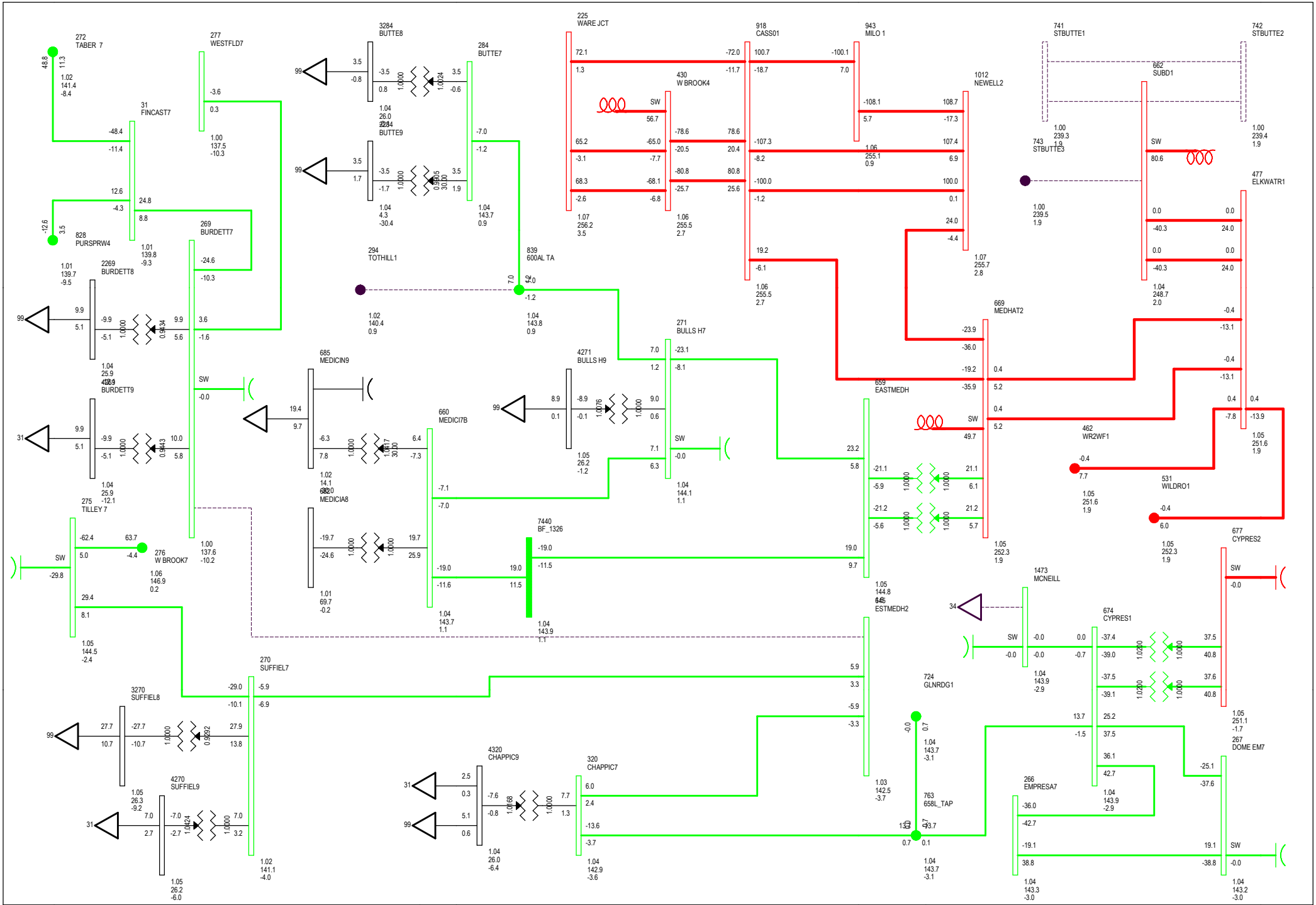


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.3 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-6: CATEGORY B - 1034L (244S TO 324S)
THU, DEC 17 2015 7:27

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

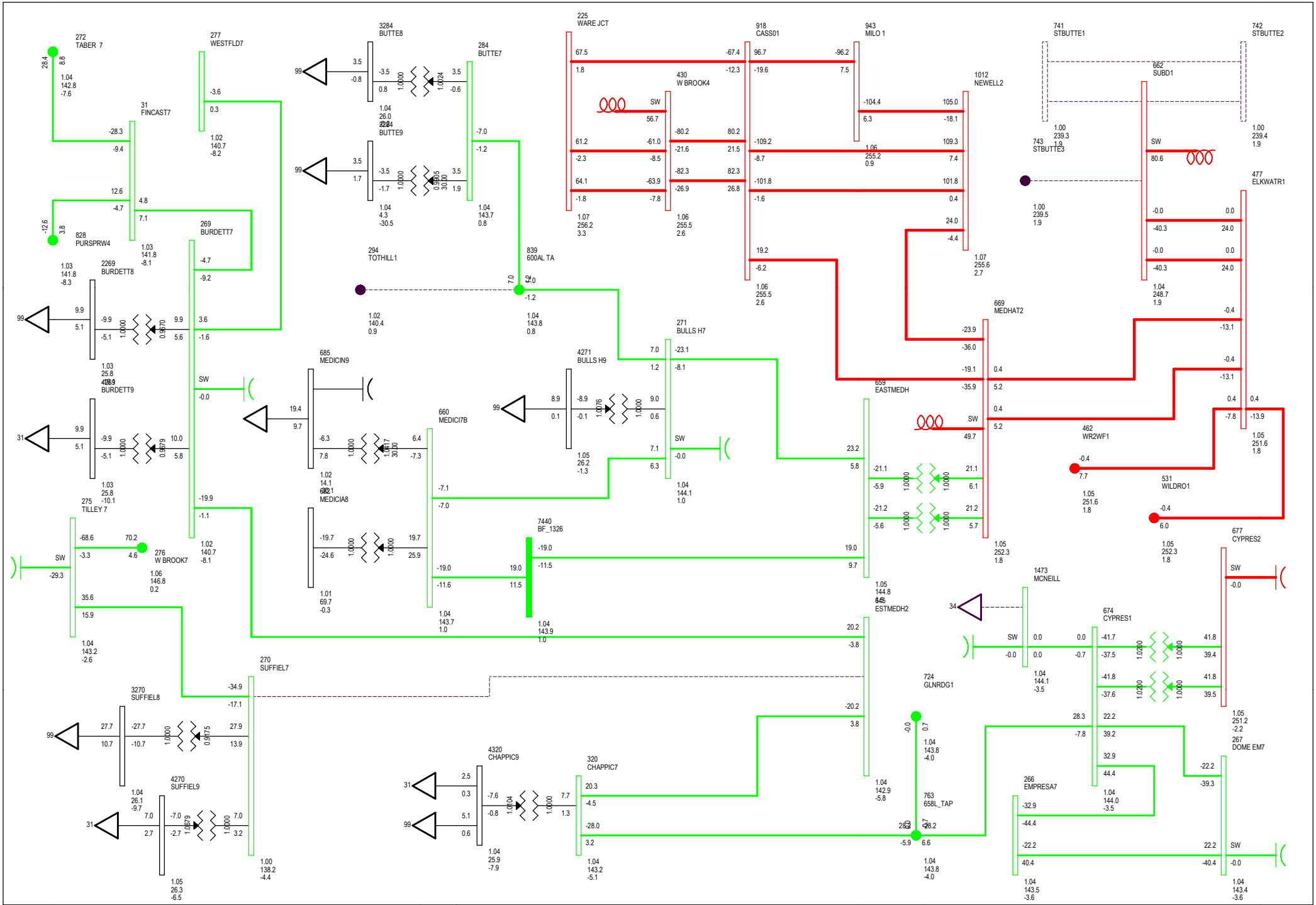


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -7.8 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-7: CATEGORY B - 879L (244S TO 368S)
THU, DEC 17 2015 7:27

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

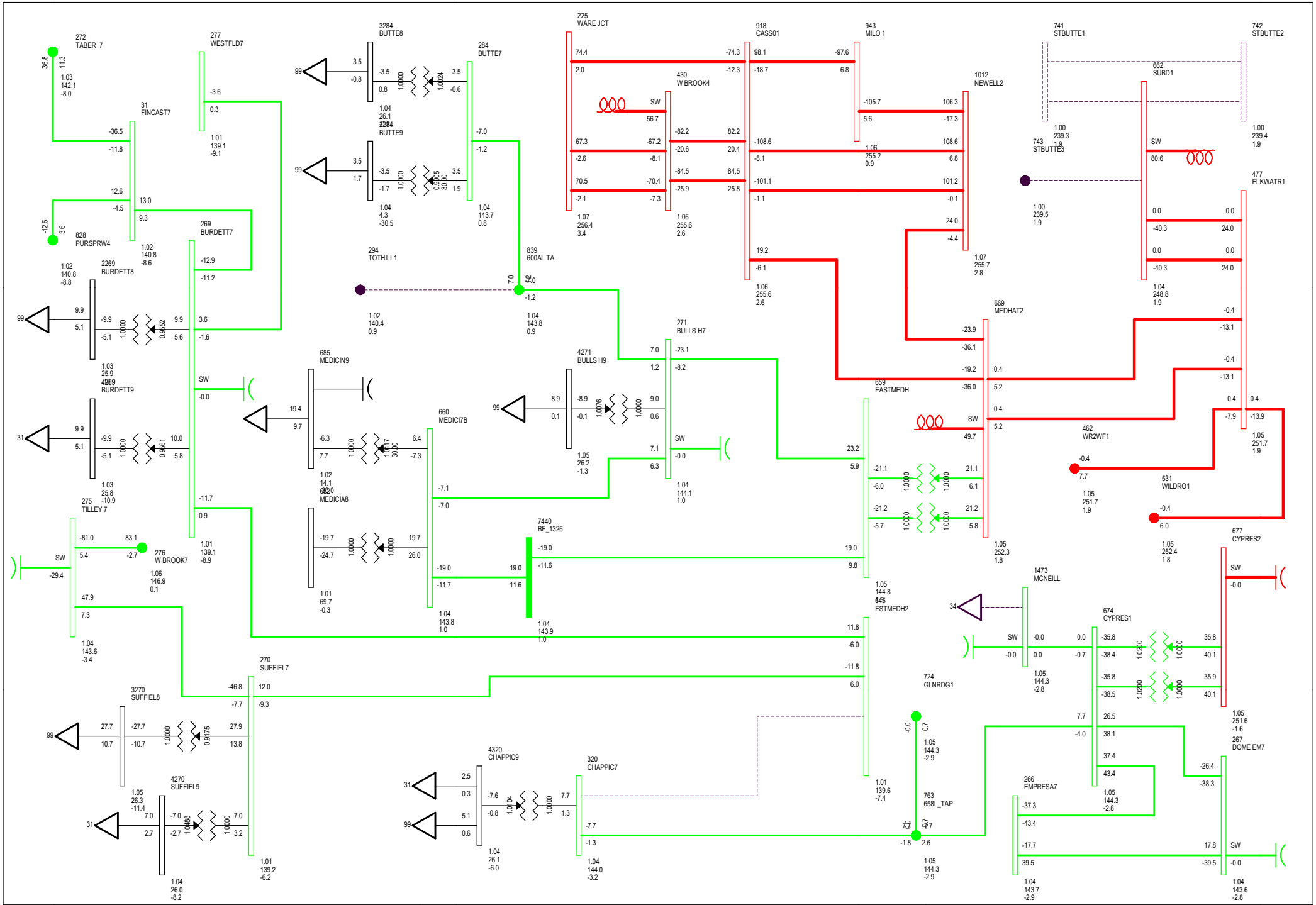


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 0.0 MW BC and MATL (Import): -8.3 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-8: CATEGORY B - 892L (244S TO 368S)
THU, DEC 17 2015 7:28

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

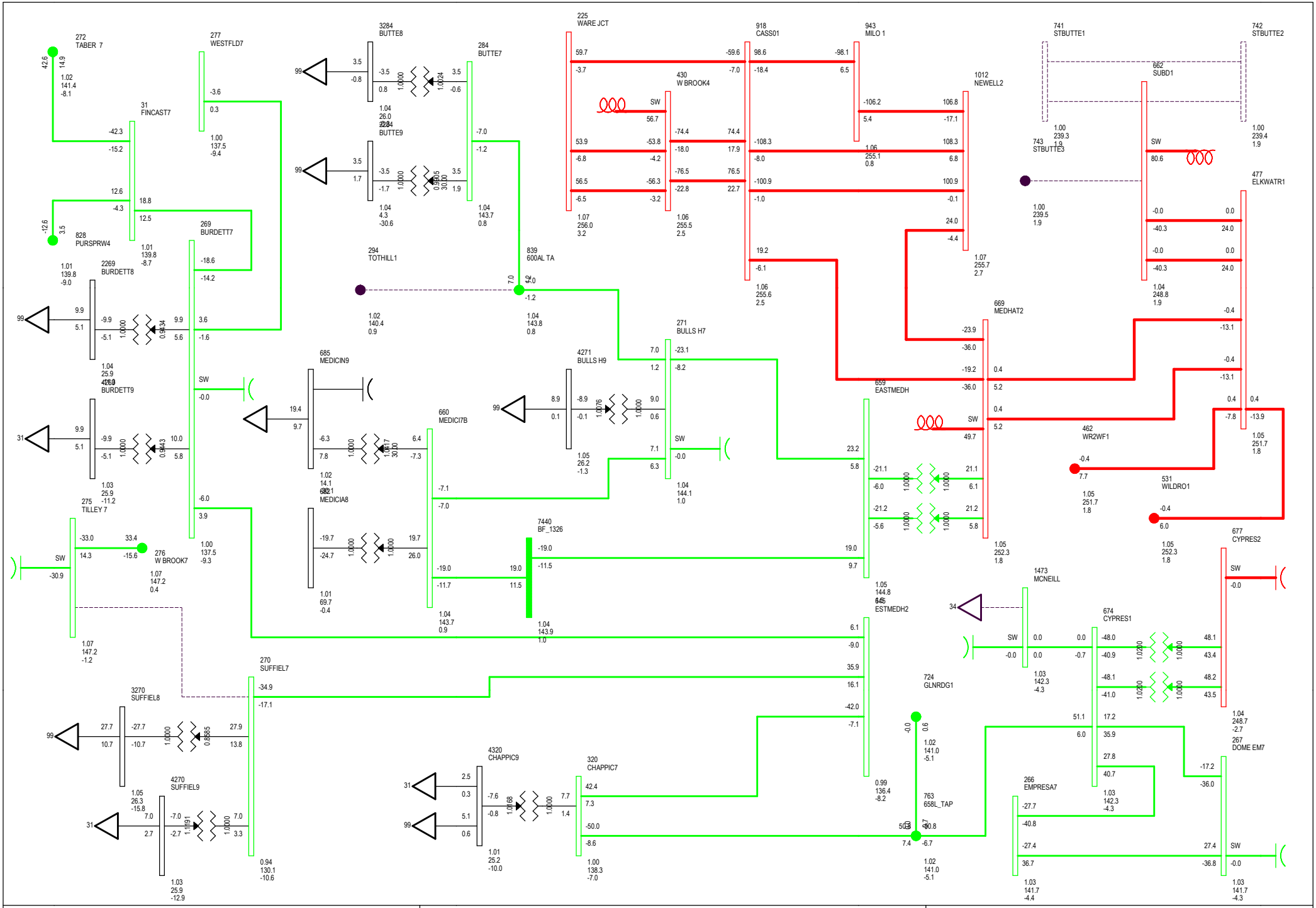


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -7.9 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-9: CATEGORY B - 674L (244S TO 649S)
THU, DEC 17 2015 7:28

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

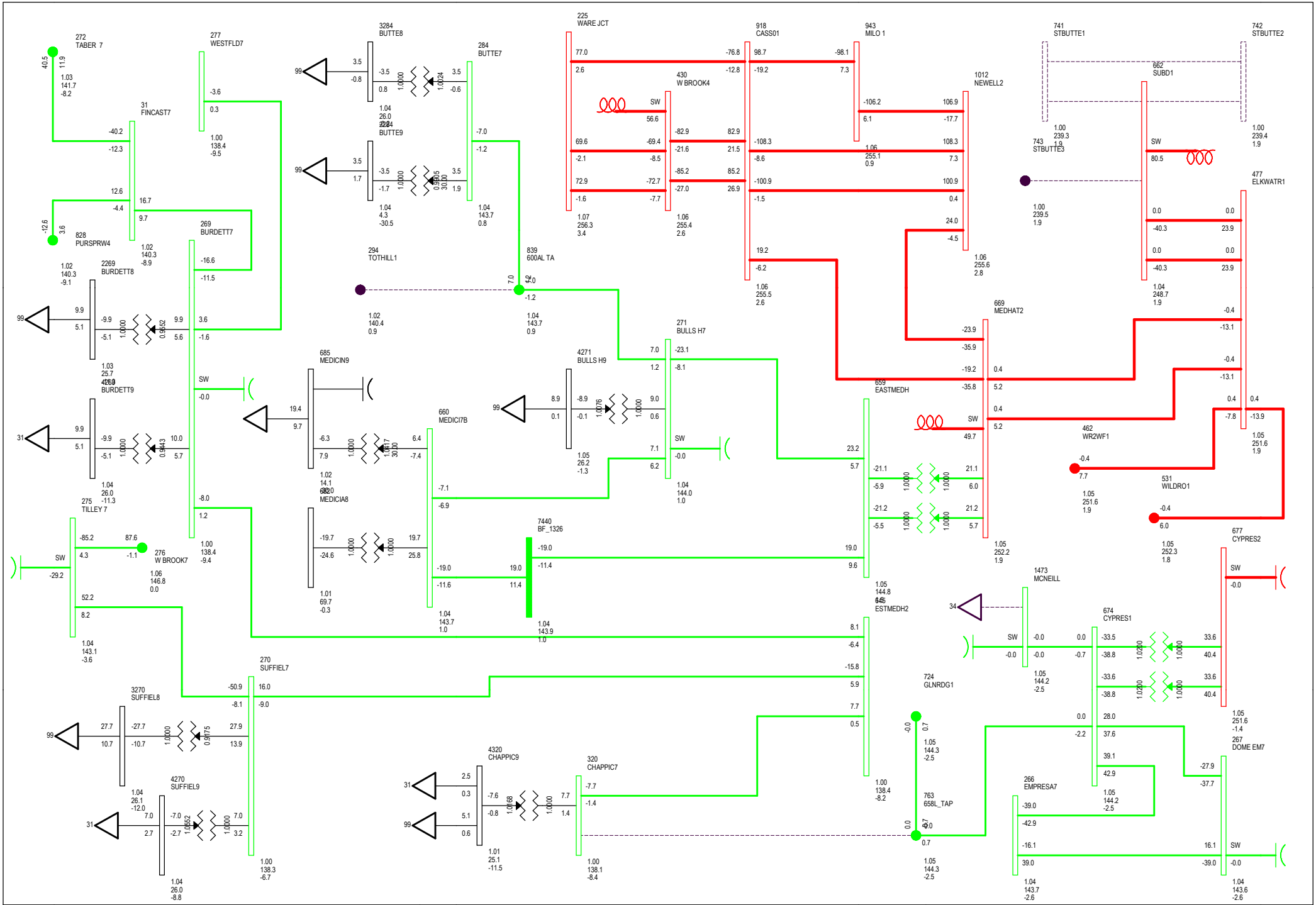


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 0.0 MW BC and MATL (Import): -5.7 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-10: CATEGORY B - 100L (498S TO 895S)
THU, DEC 17 2015 7:28

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

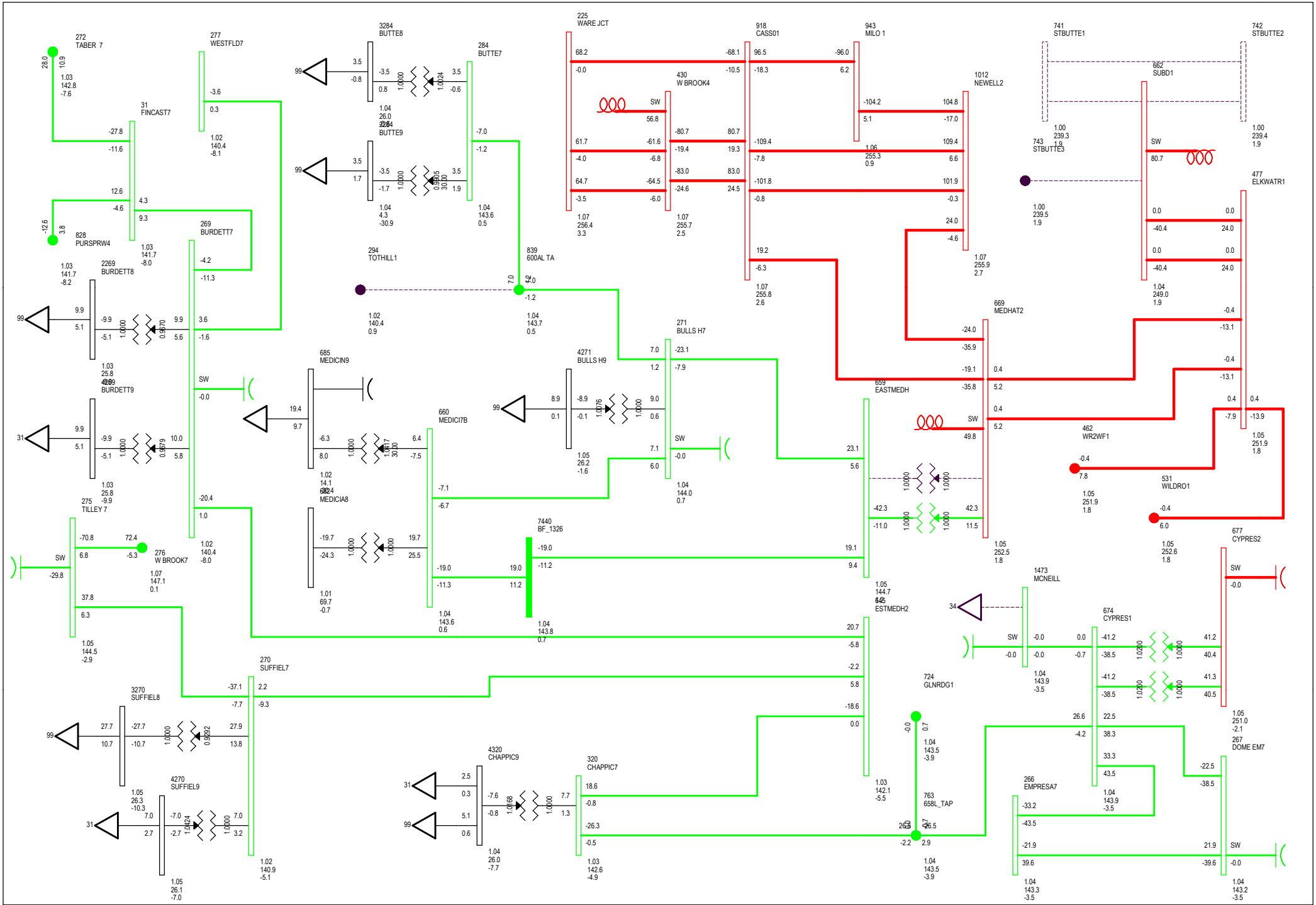


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -7.3 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-11: CATEGORY B - 658L (562S TO 649S)
THU, DEC 17 2015 7:29

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000



CITY OF MEDICINE HAT AIES INTERCONNECTION

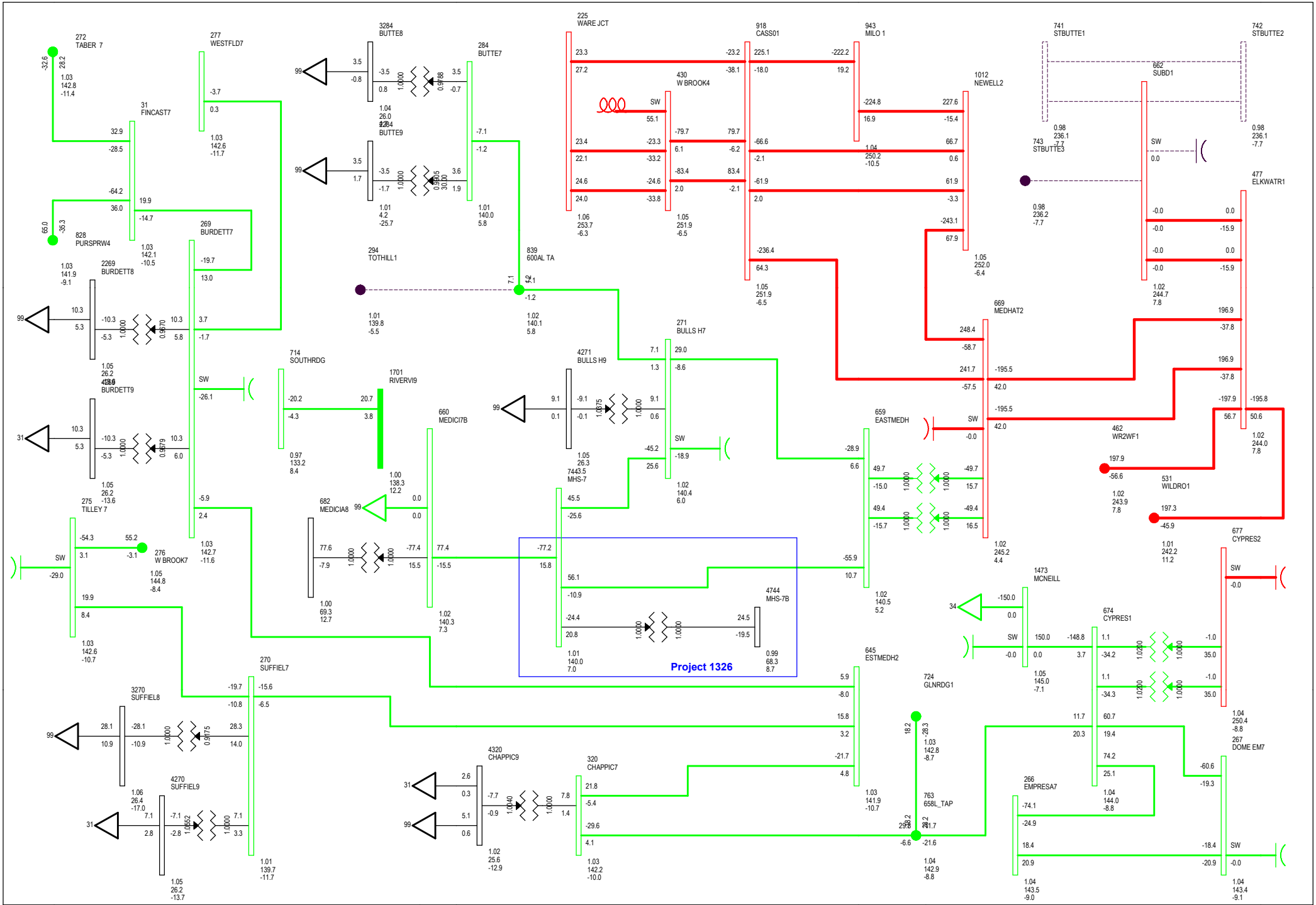
SK Tie (Import): -0.0 MW BC and MATL (Import): -8.4 MW

2015 WINTER PEAK (PRE_CONNECTION) SCENARIO 3
FIGURE B-12: CATEGORY B - TRANSFORMER T1 (244S)
THU, DEC 17 2015 7:29

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

Attachment B

Post-Connection Power Flow Analysis Results

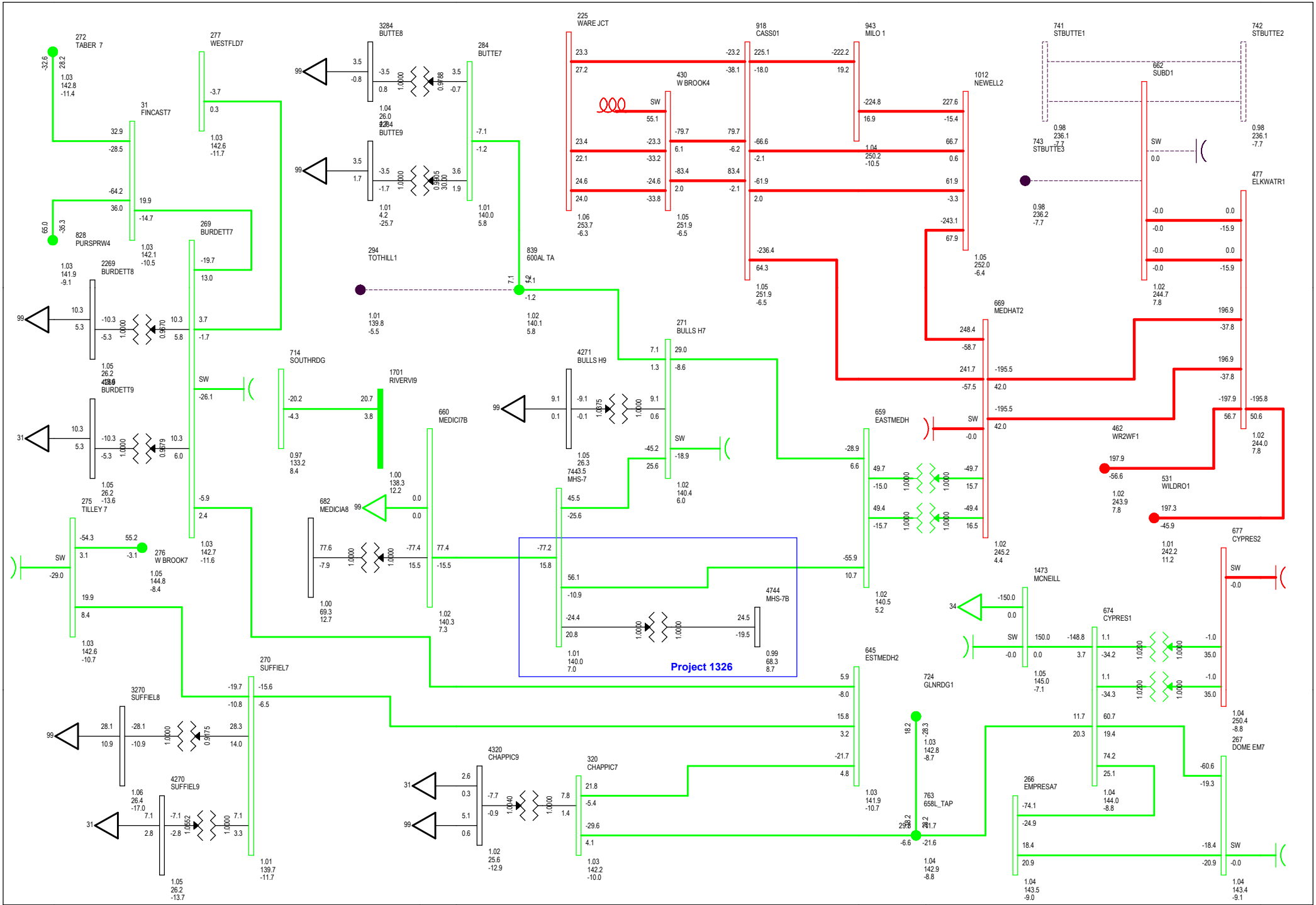


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 766.0 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-1: CATEGORY A - NO CONTINGENCY
FRI, NOV 27 2015 16:39

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

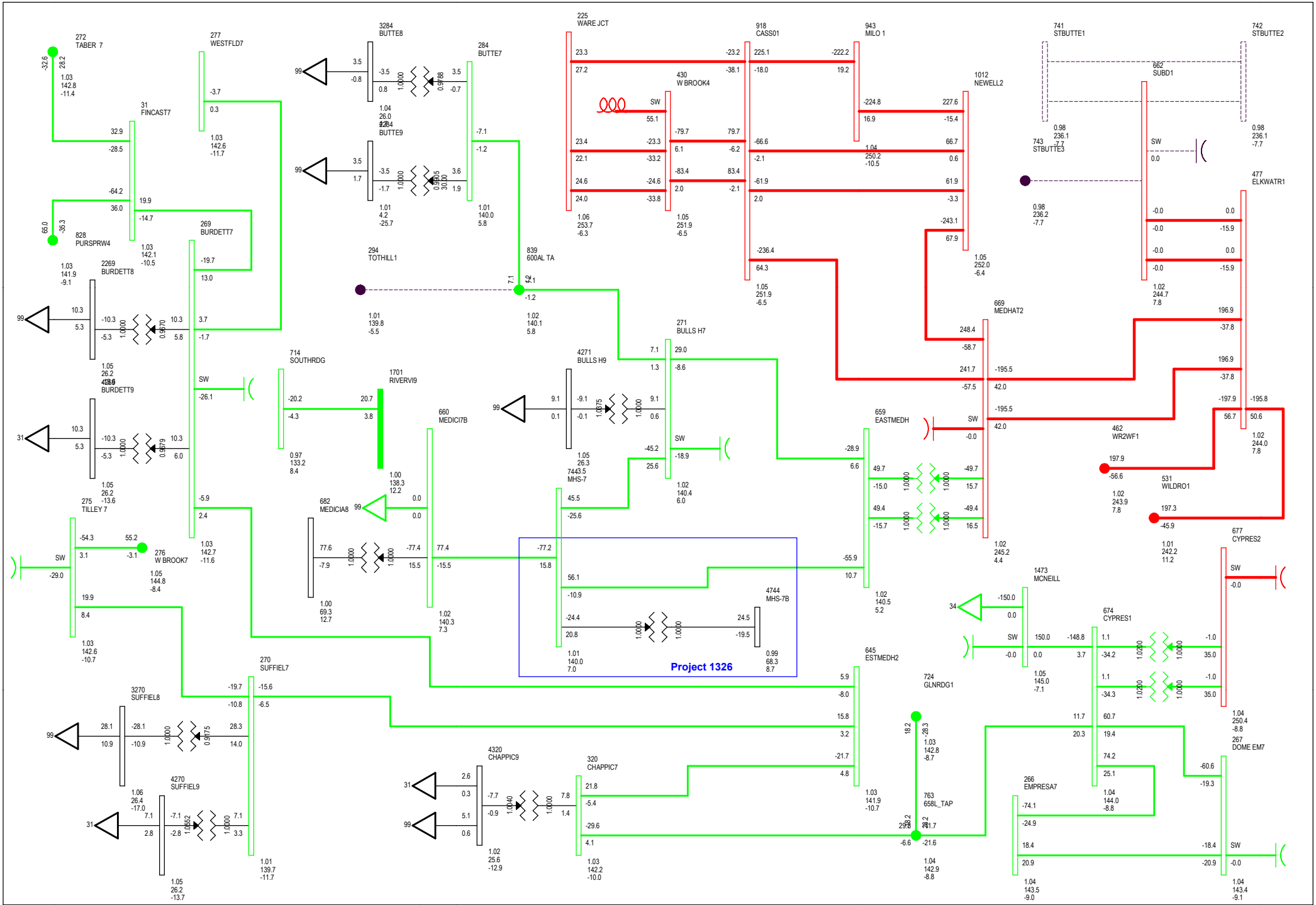


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 766.0 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-2: CATEGORY B - 675L (244S TO 41S)
FRI, NOV 27 2015 16:39

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

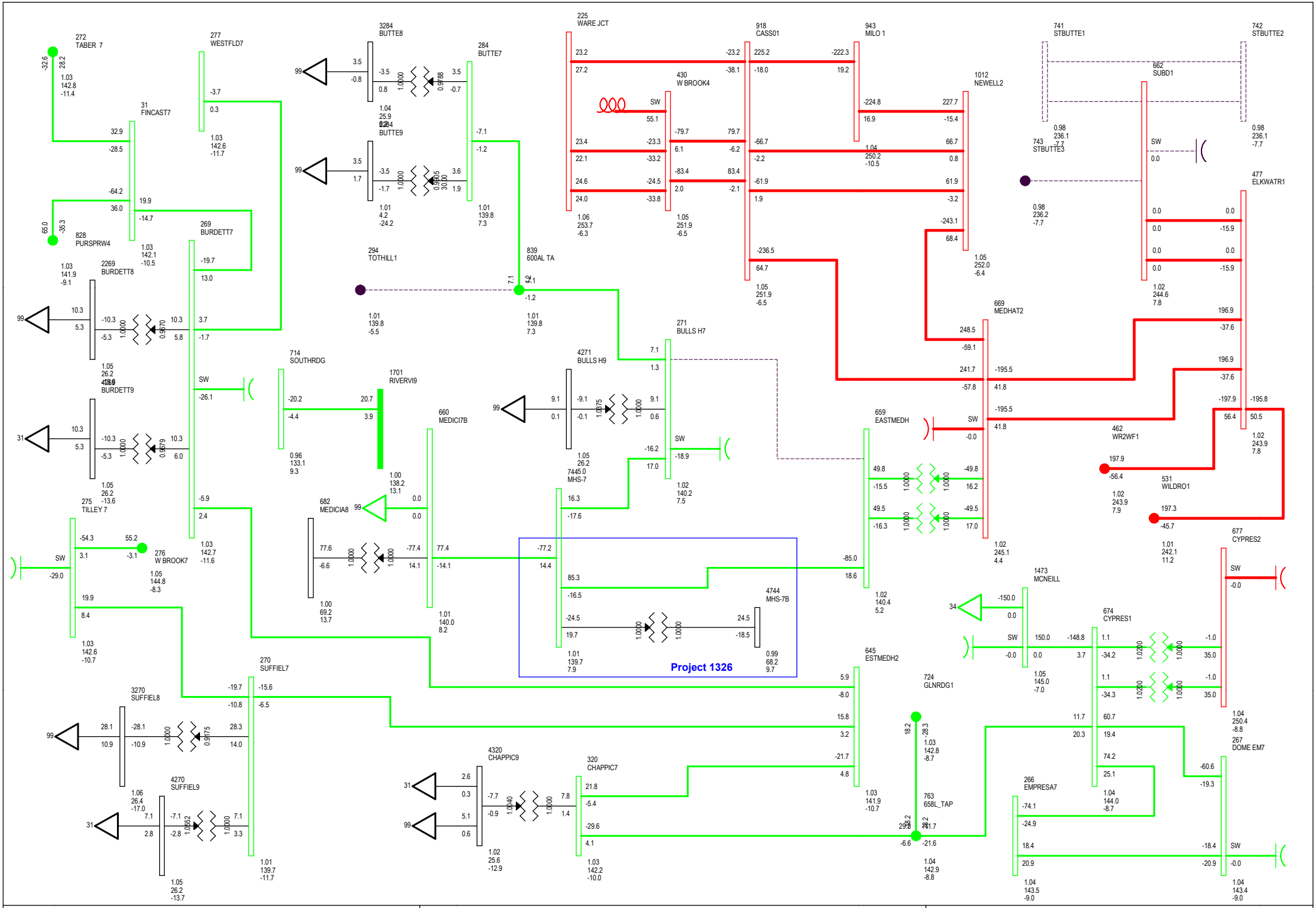


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 766.0 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-3: CATEGORY B - 880L (41S TO 523S)
FRI, NOV 27 2015 16:39

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

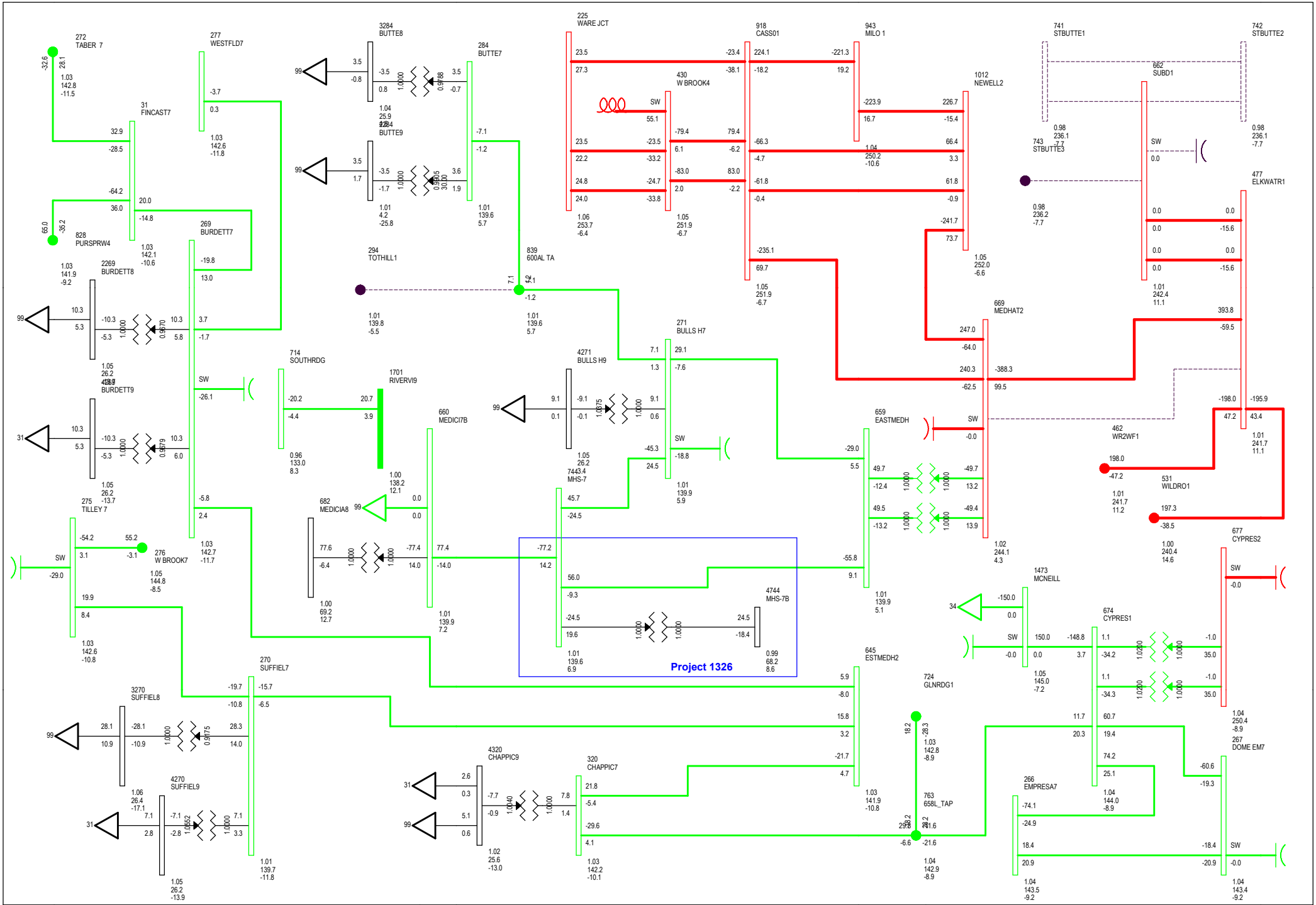


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 765.9 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-4: CATEGORY B - 676L (523S TO 244S)
FRI, NOV 27 2015 16:40

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

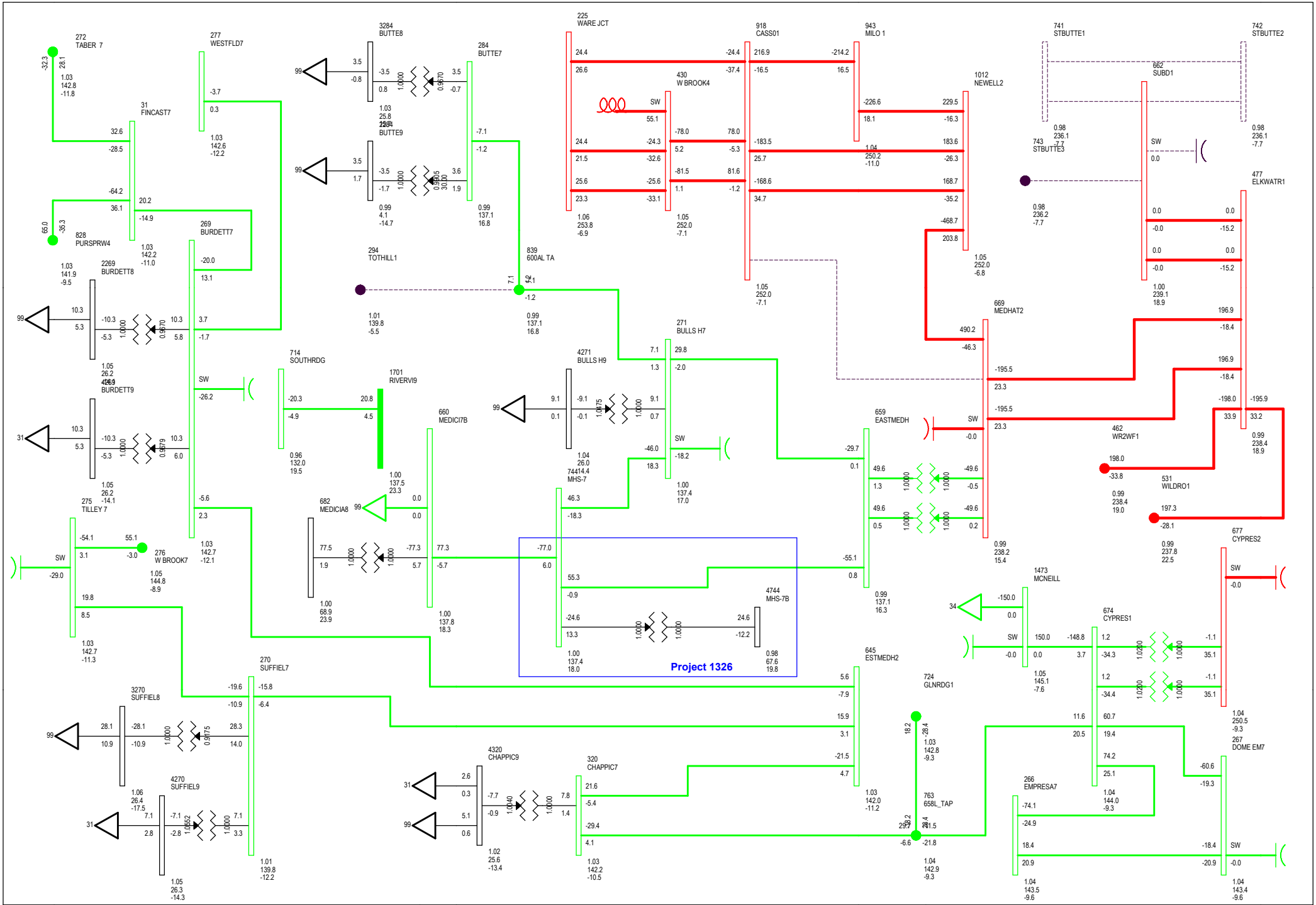


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 768.6 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-5: CATEGORY B - 1073L (244S TO 264S)
FRI, NOV 27 2015 16:40

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

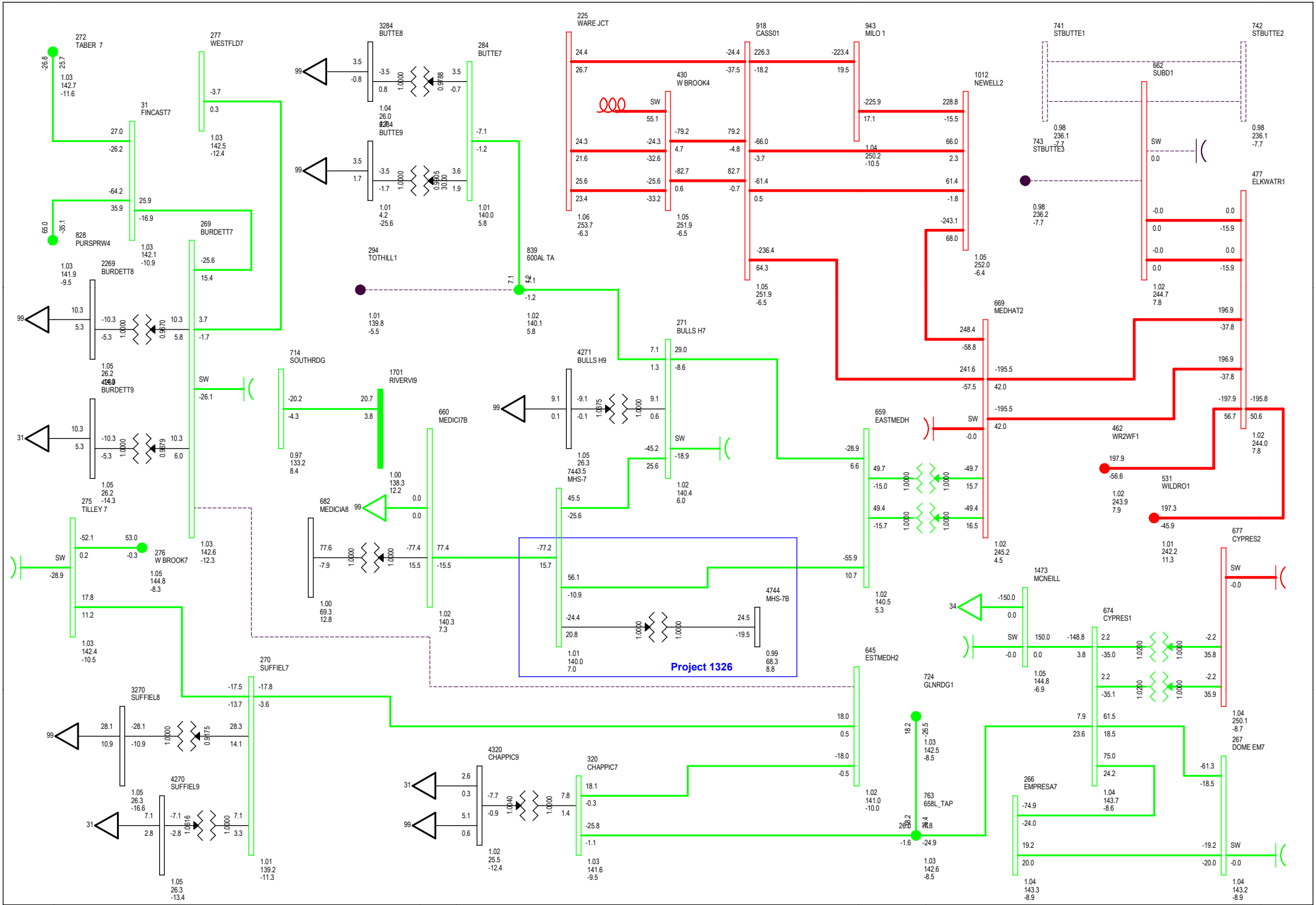


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 776.2 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-6: CATEGORY B - 1034L (244S TO 324S)
FRI, NOV 27 2015 16:40

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

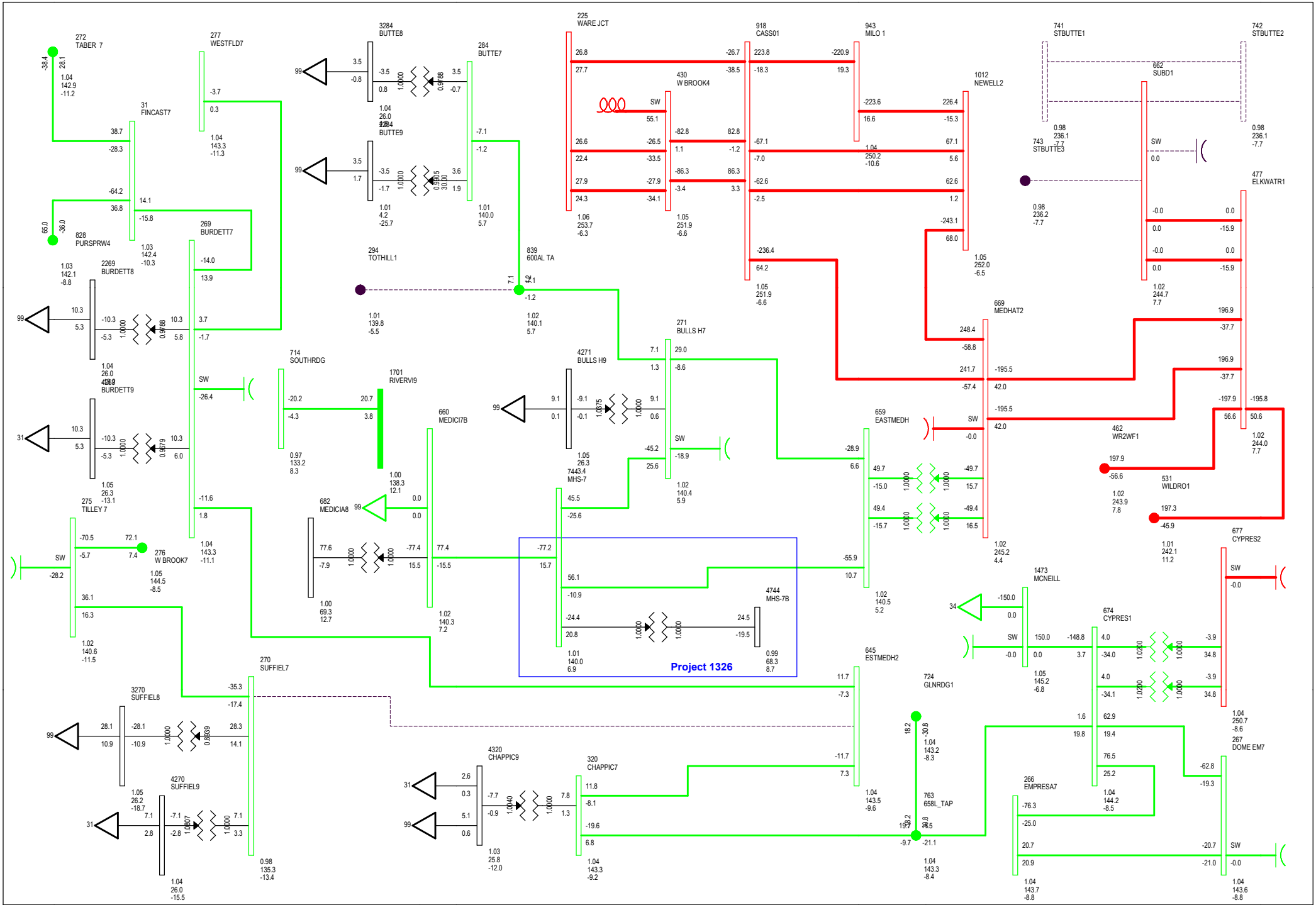


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 766.1 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-7: CATEGORY B - 879L (244S TO 368S)
FRI, NOV 27 2015 16:41

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

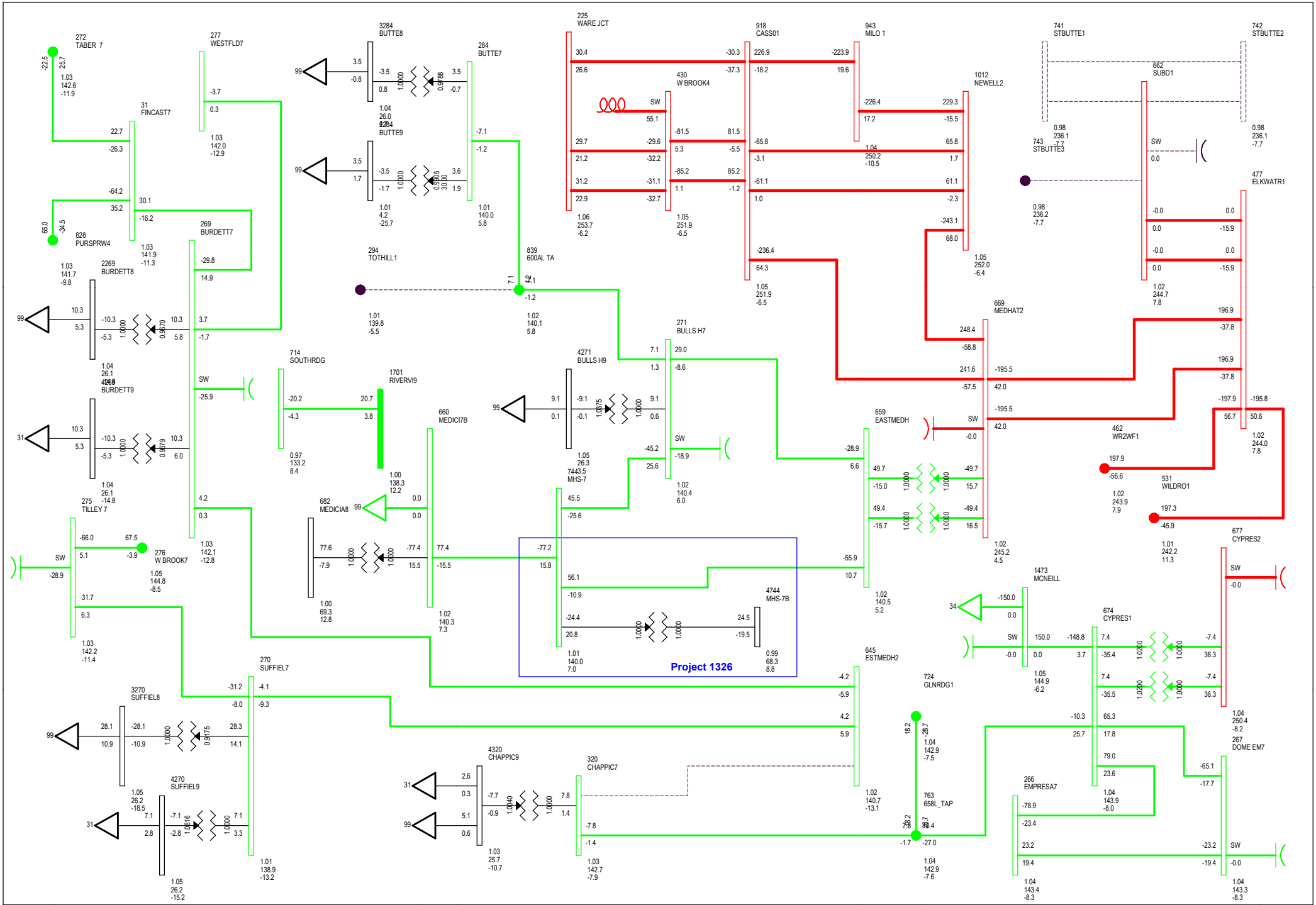


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 766.6 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-8: CATEGORY B - 892L (244S TO 368S)
FRI, NOV 27 2015 16:41

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

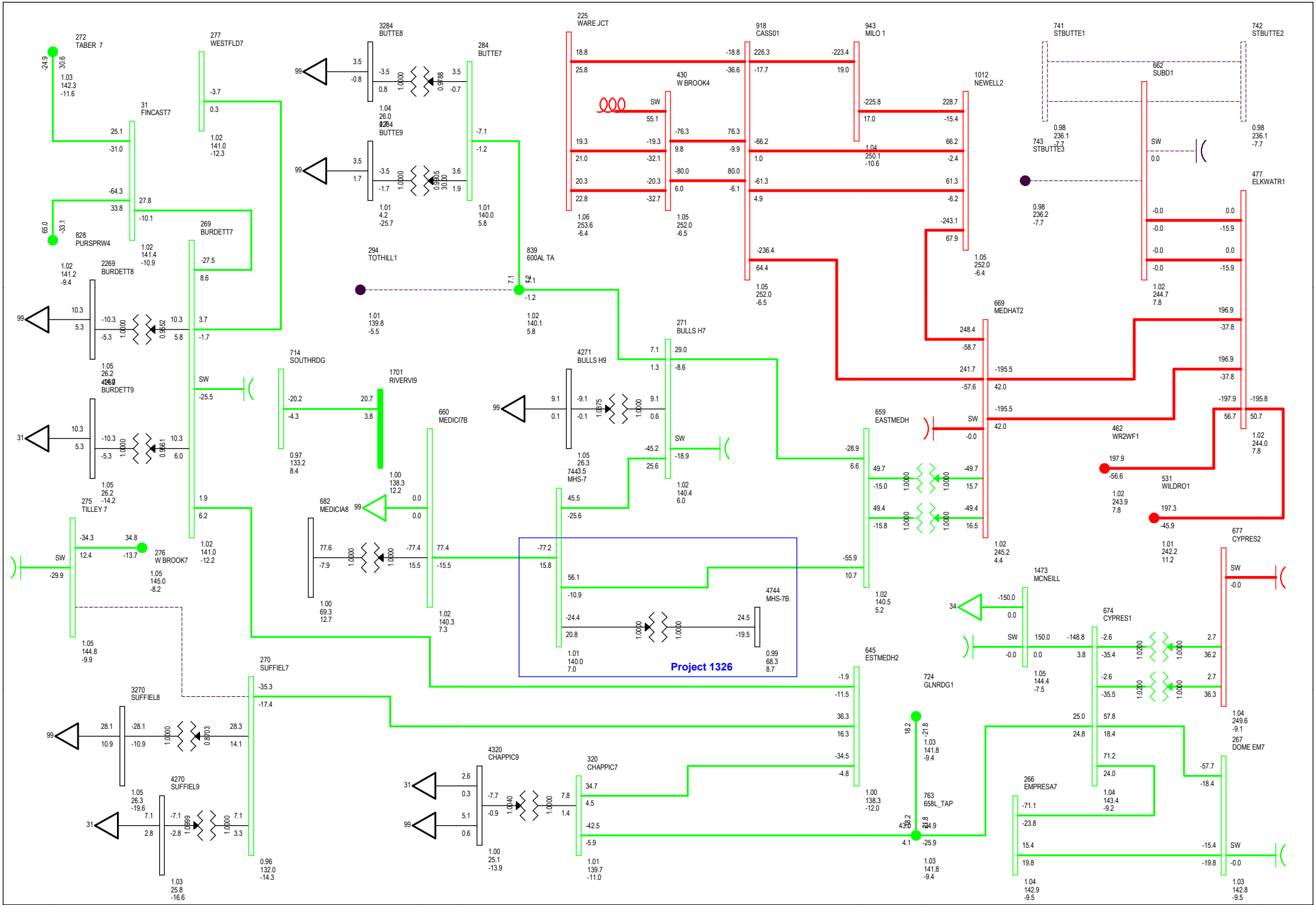


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 766.7 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-9: CATEGORY B - 674L (244S TO 649S)
FRI, NOV 27 2015 16:41

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

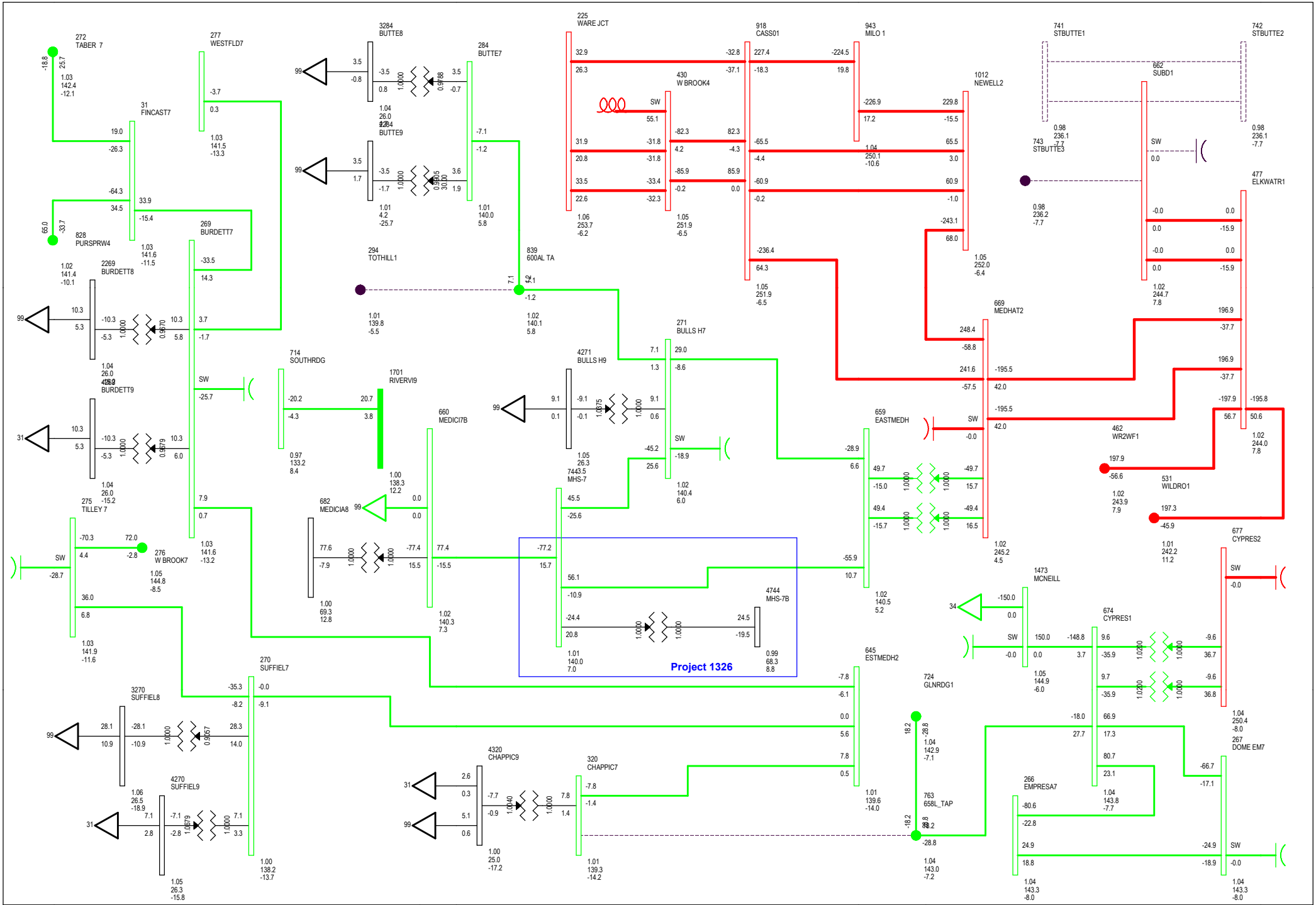


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 767.0 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-10: CATEGORY B - 100L (498S TO 895S)
FRI, NOV 27 2015 16:42

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

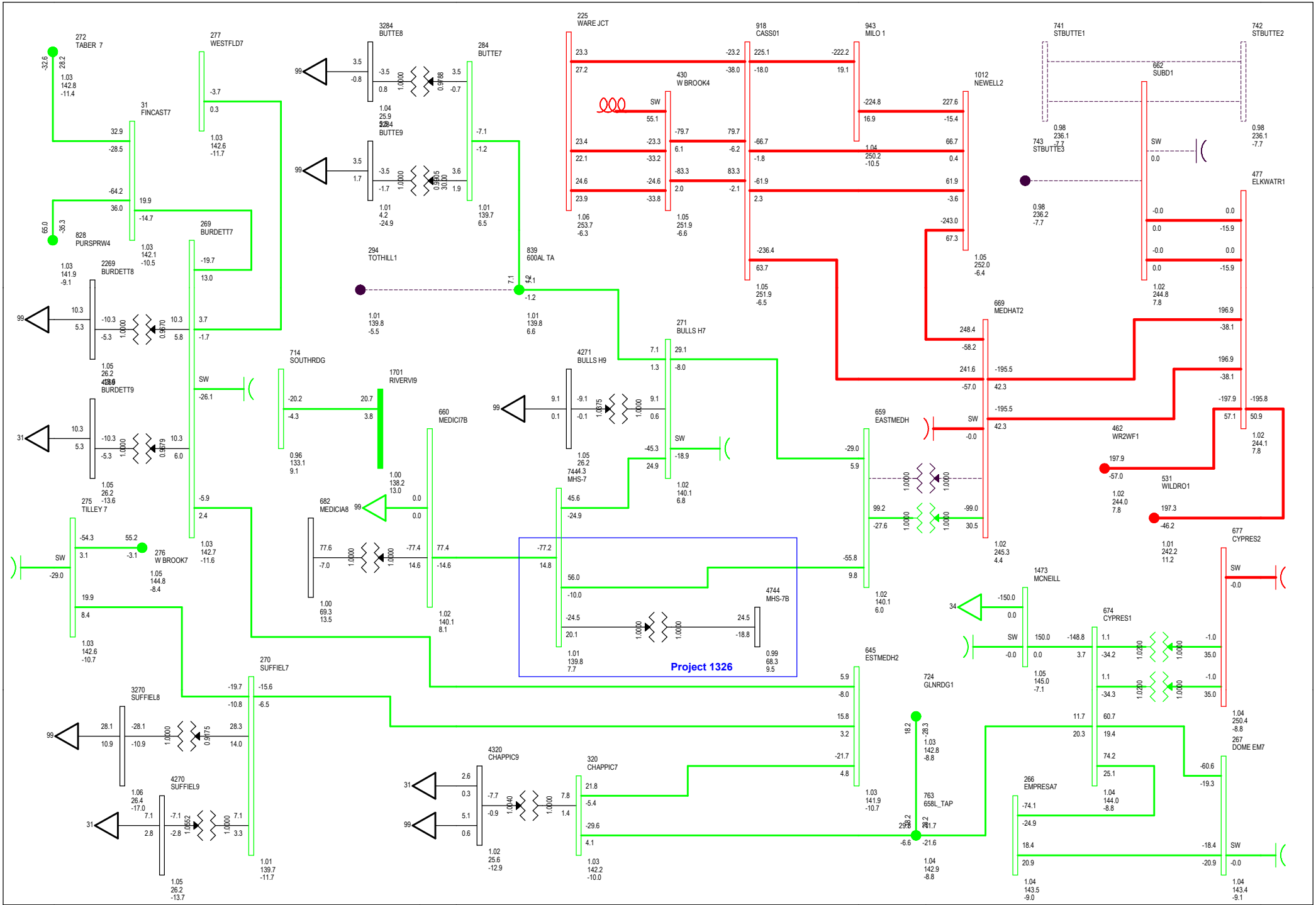


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 767.3 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-11: CATEGORY B - 658L (562S TO 649S)
FRI, NOV 27 2015 16:42

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

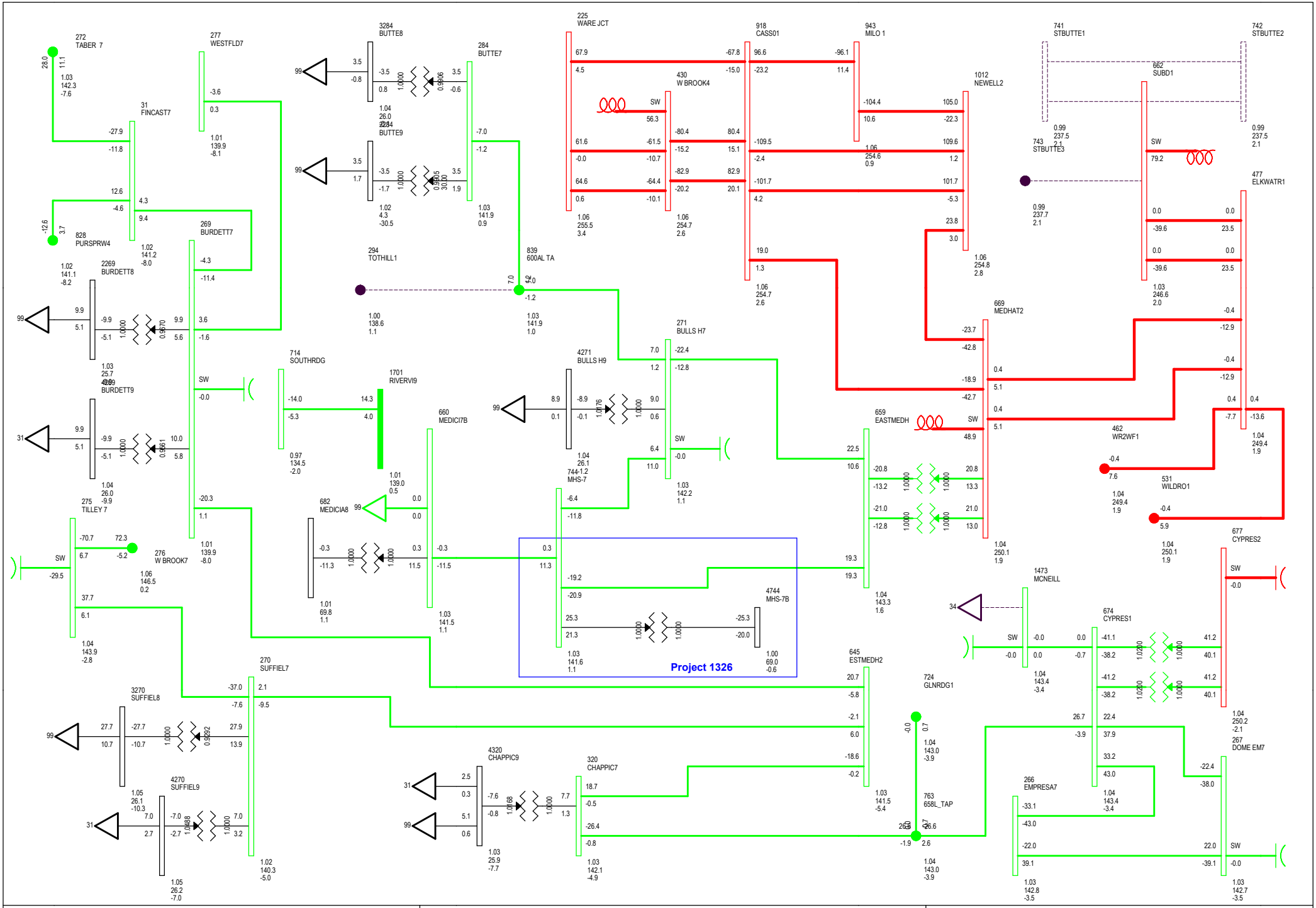


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 150.0 MW BC and MATL (Import): 766.0 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 2
FIGURE A-12: CATEGORY B - TRANSFORMER T1 (244S)
FRI, NOV 27 2015 16:42

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

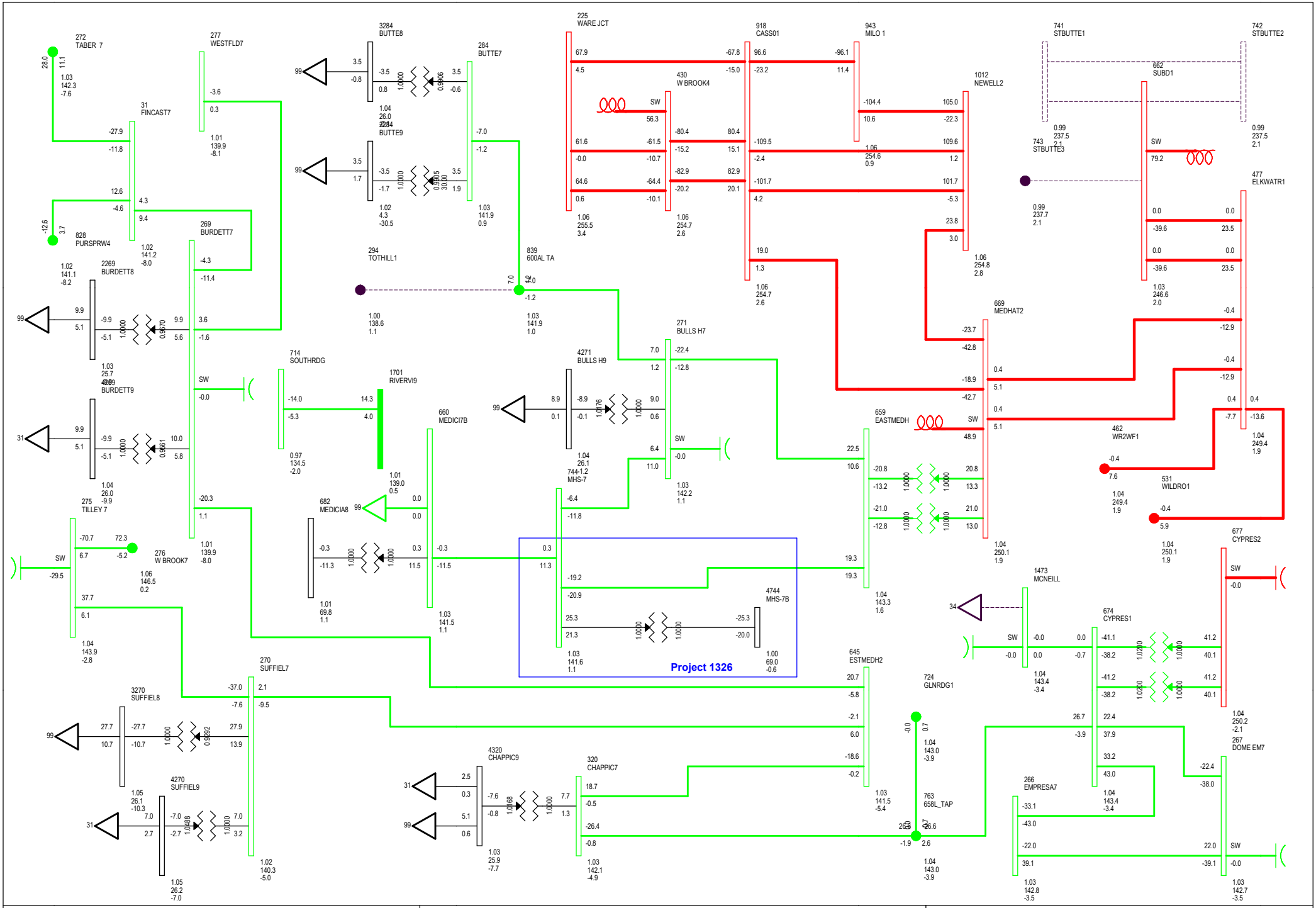


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.8 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-1: CATEGORY A - NO CONTINGENCY
THU, DEC 17 2015 7:31

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

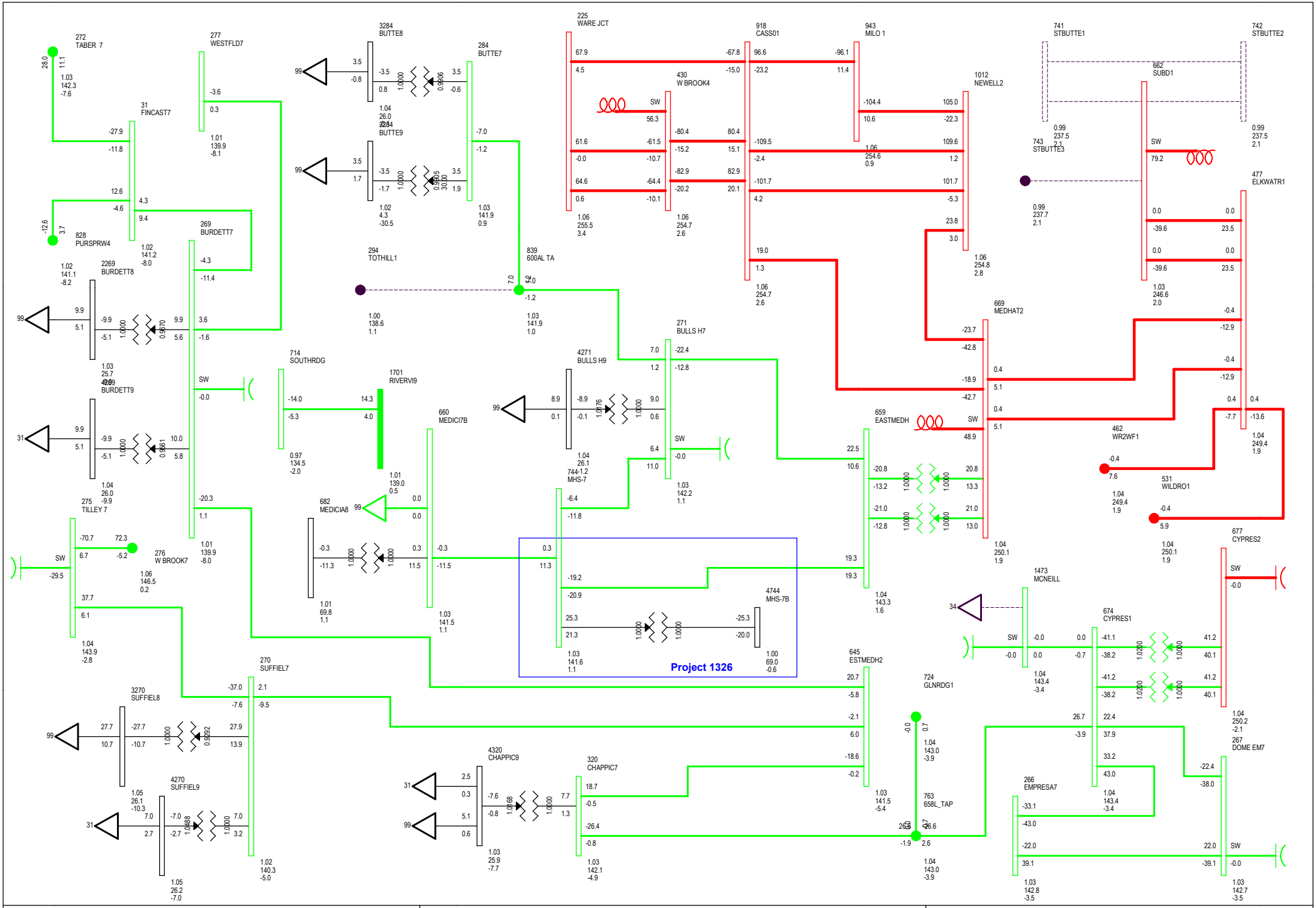


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.8 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-2: CATEGORY B - 675L (244S TO 41S)
THU, DEC 17 2015 7:31

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

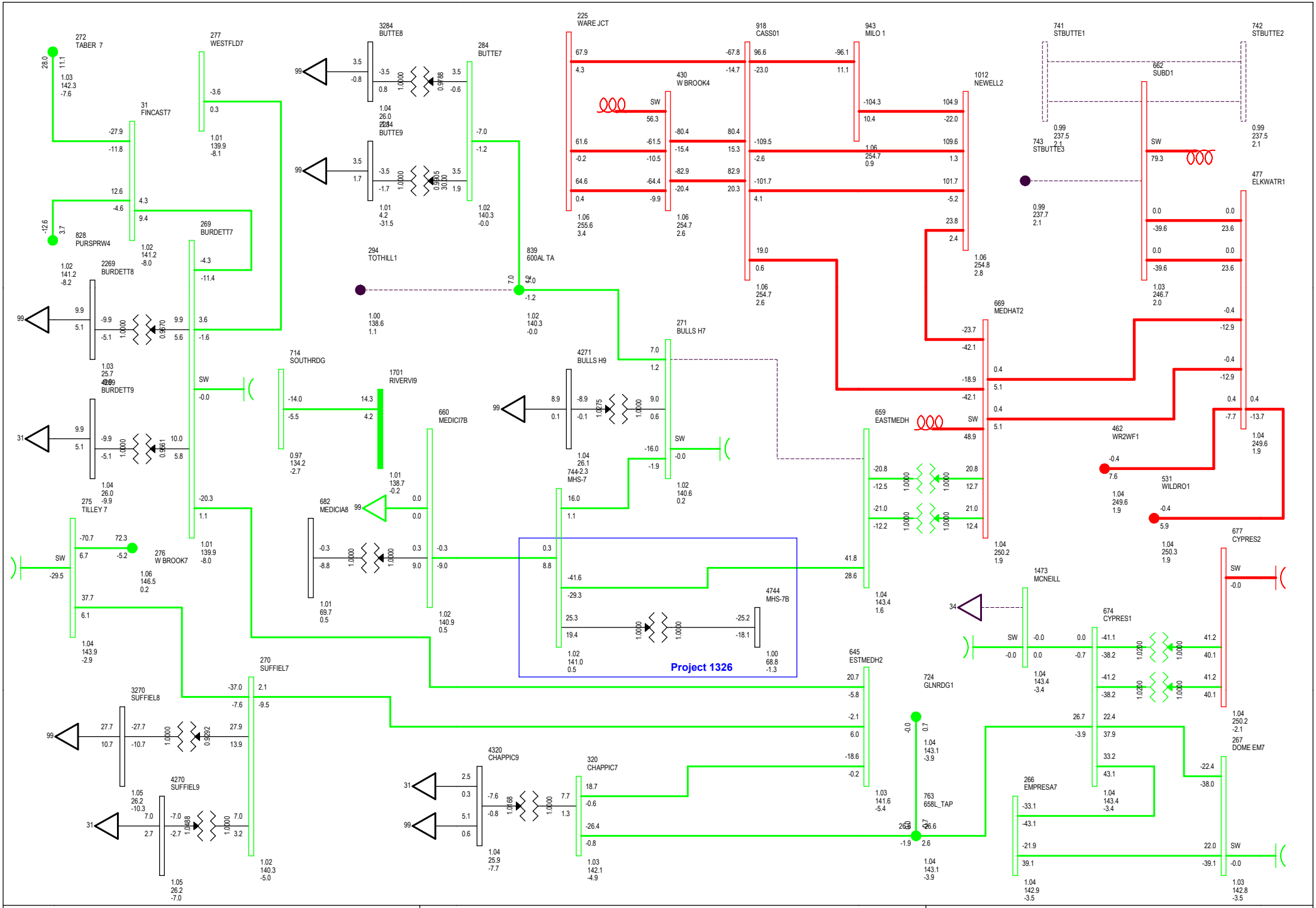


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.8 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-3: CATEGORY B - 880L (41S TO 523S)
THU, DEC 17 2015 7:31

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

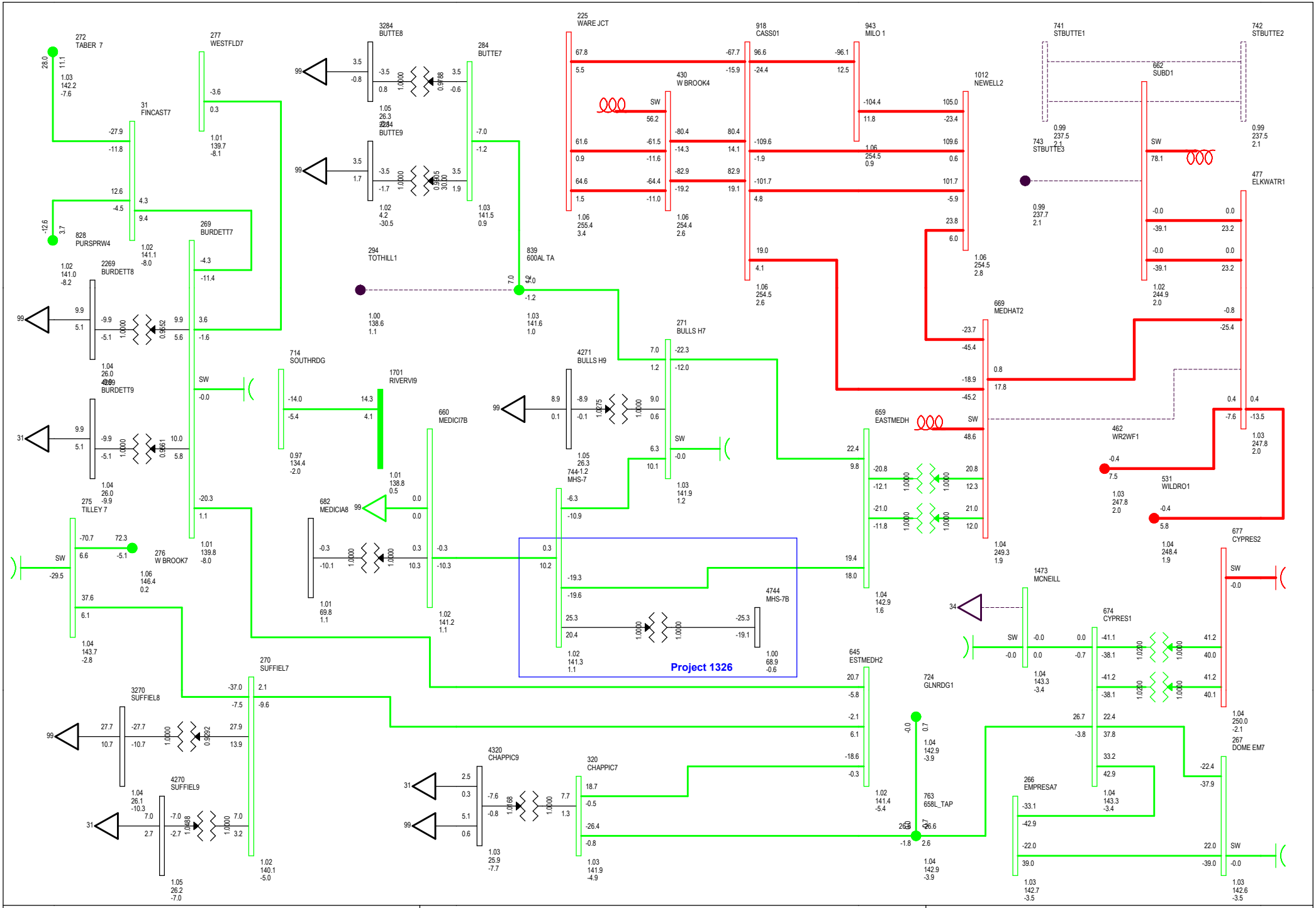


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.8 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-4: CATEGORY B - 676L (523S TO 244S)
THU, DEC 17 2015 7:32

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

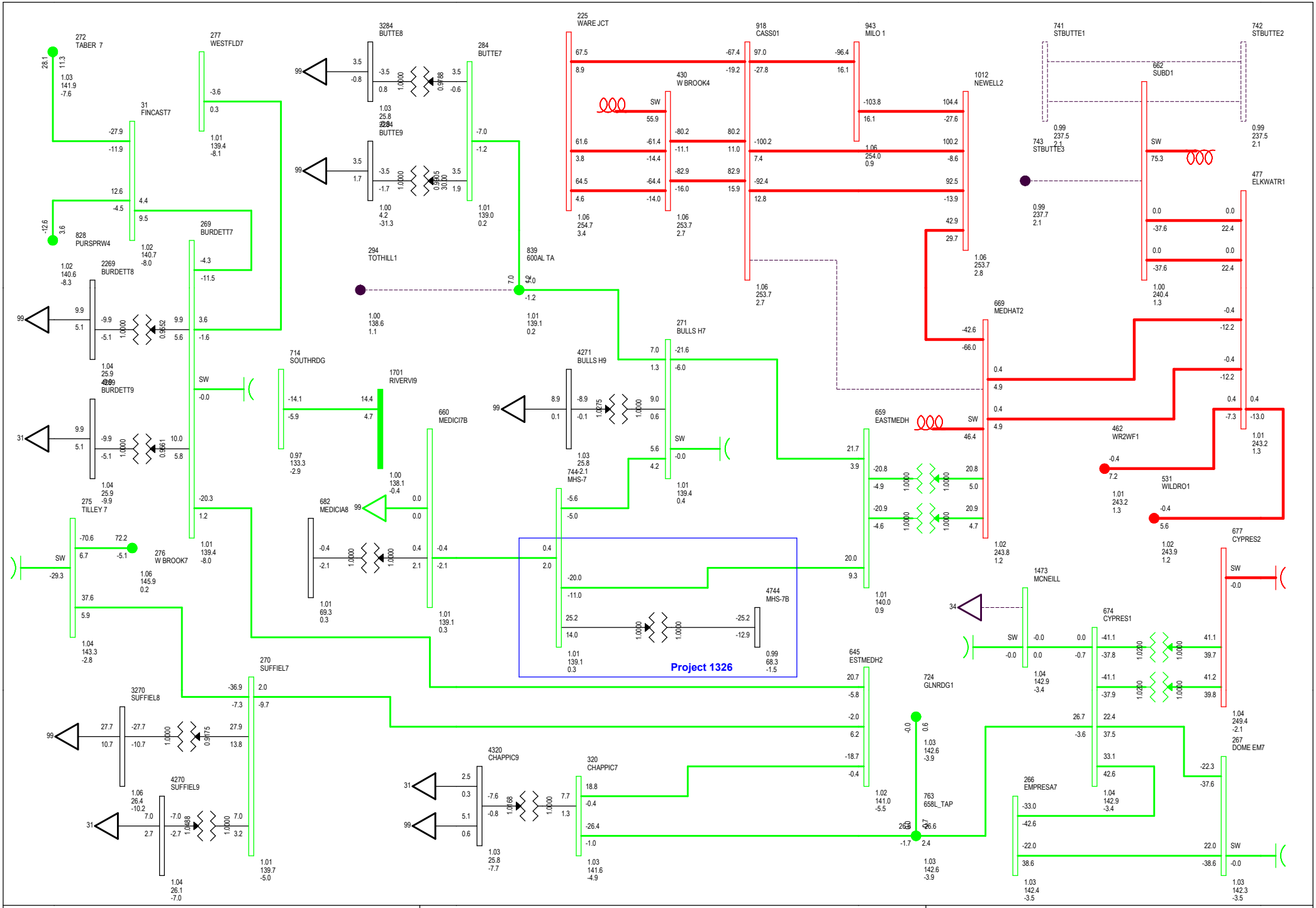


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.8 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-5: CATEGORY B - 1073L (244S TO 264S)
THU, DEC 17 2015 7:32

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

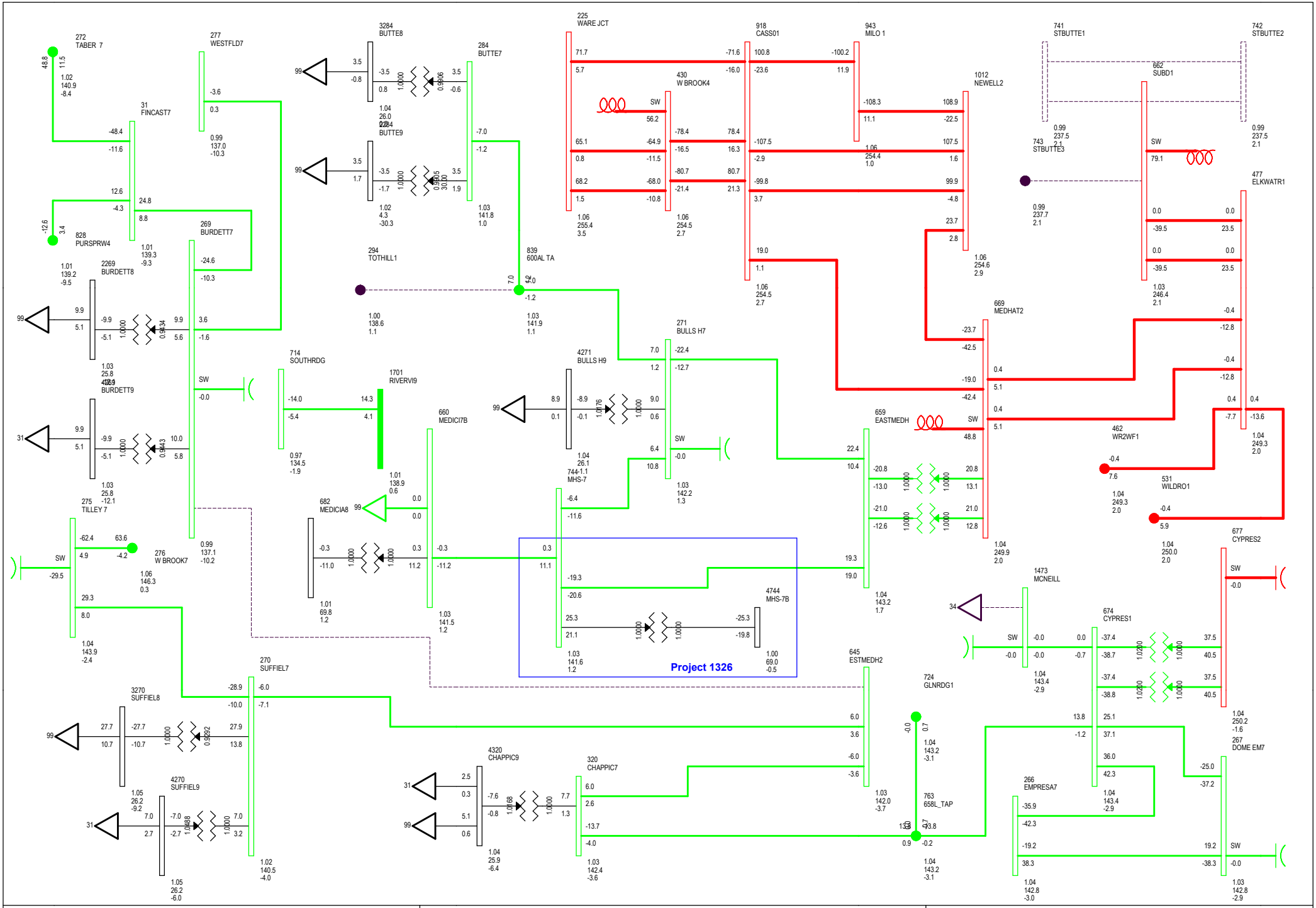


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.6 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-6: CATEGORY B - 1034L (244S TO 324S)
THU, DEC 17 2015 7:32

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

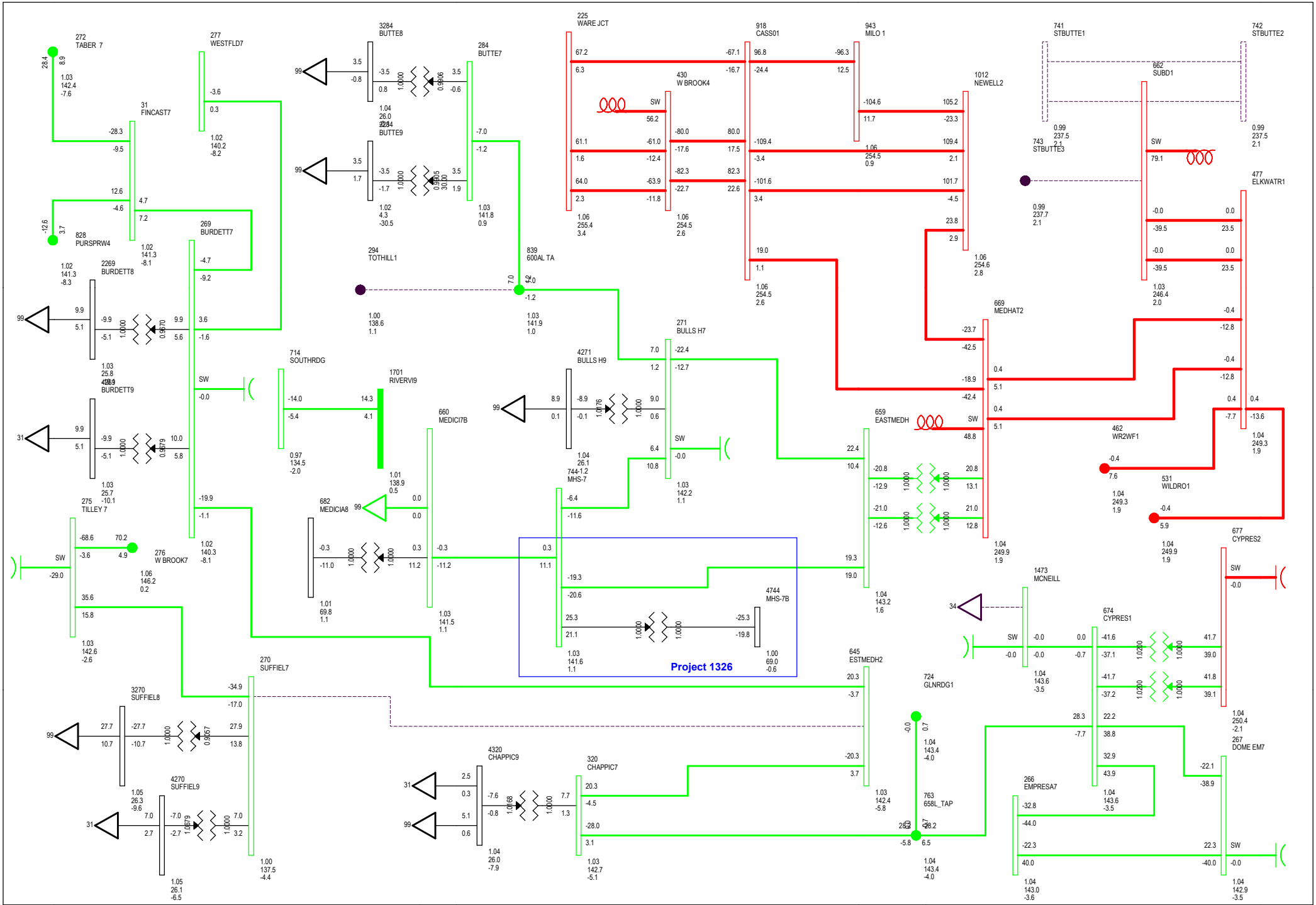


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.1 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-7: CATEGORY B - 879L (244S TO 368S)
THU, DEC 17 2015 7:33

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

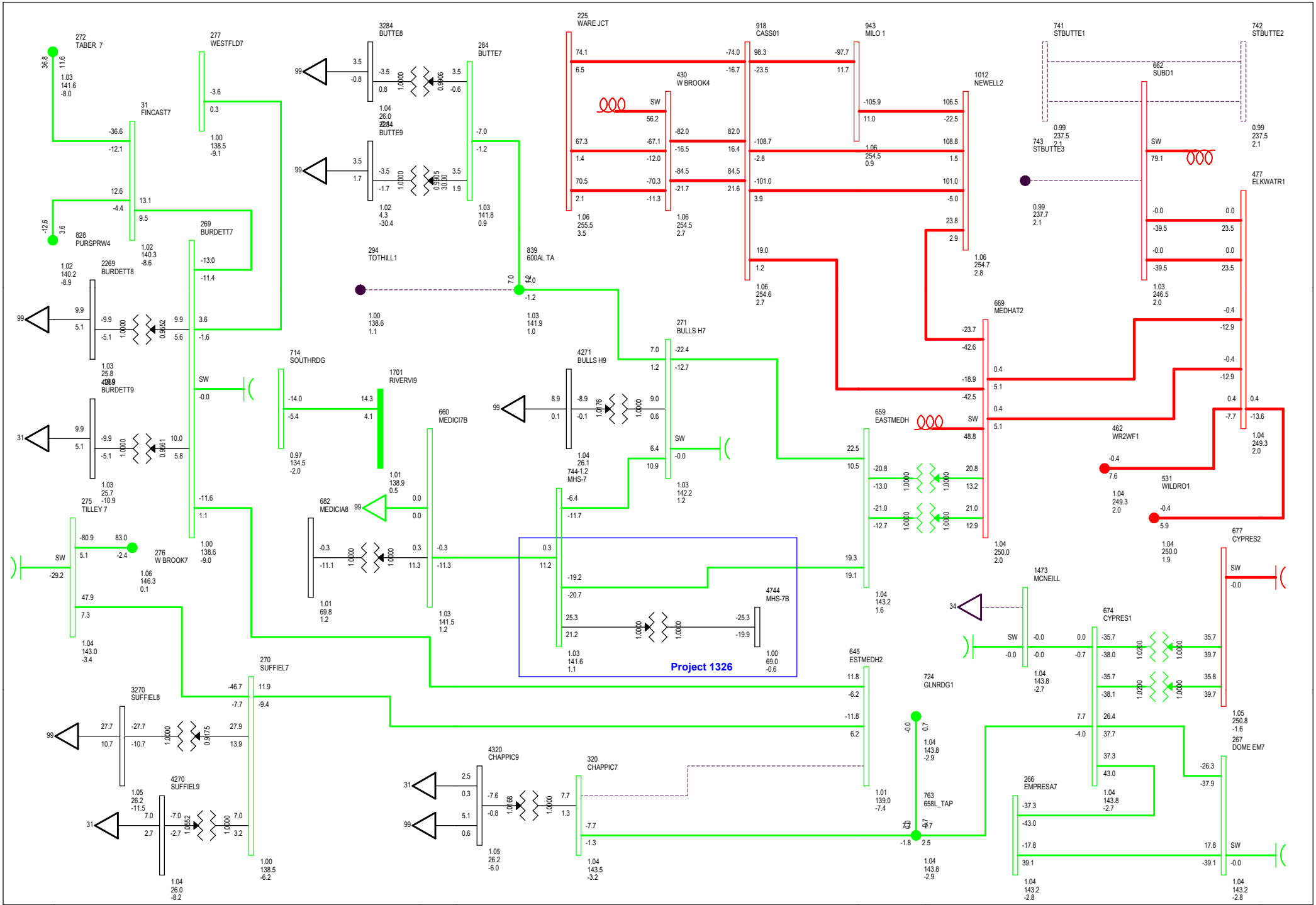


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.7 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-8: CATEGORY B - 892L (244S TO 368S)
THU, DEC 17 2015 7:33

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

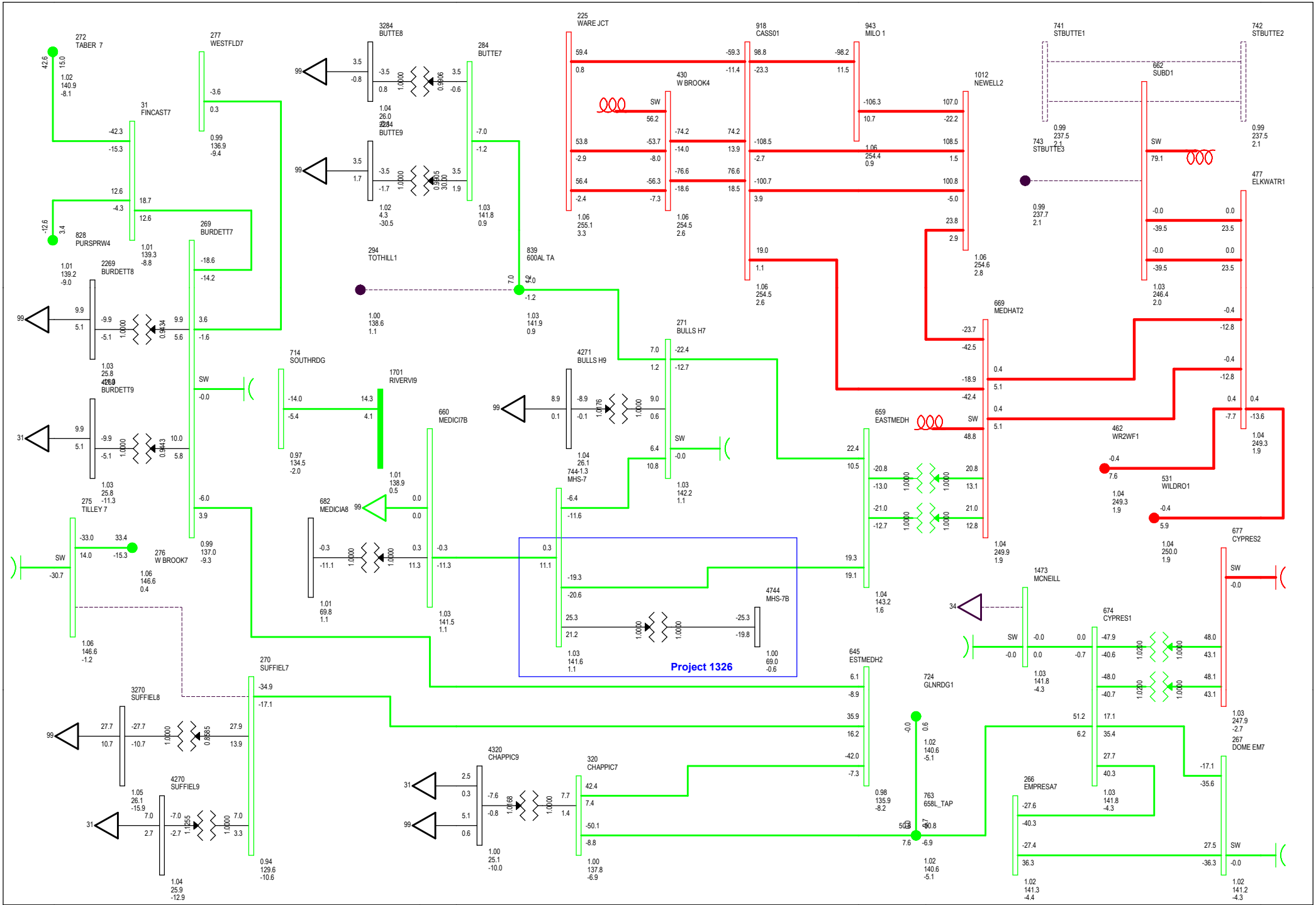


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.2 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-9: CATEGORY B - 674L (244S TO 649S)
THU, DEC 17 2015 7:33

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

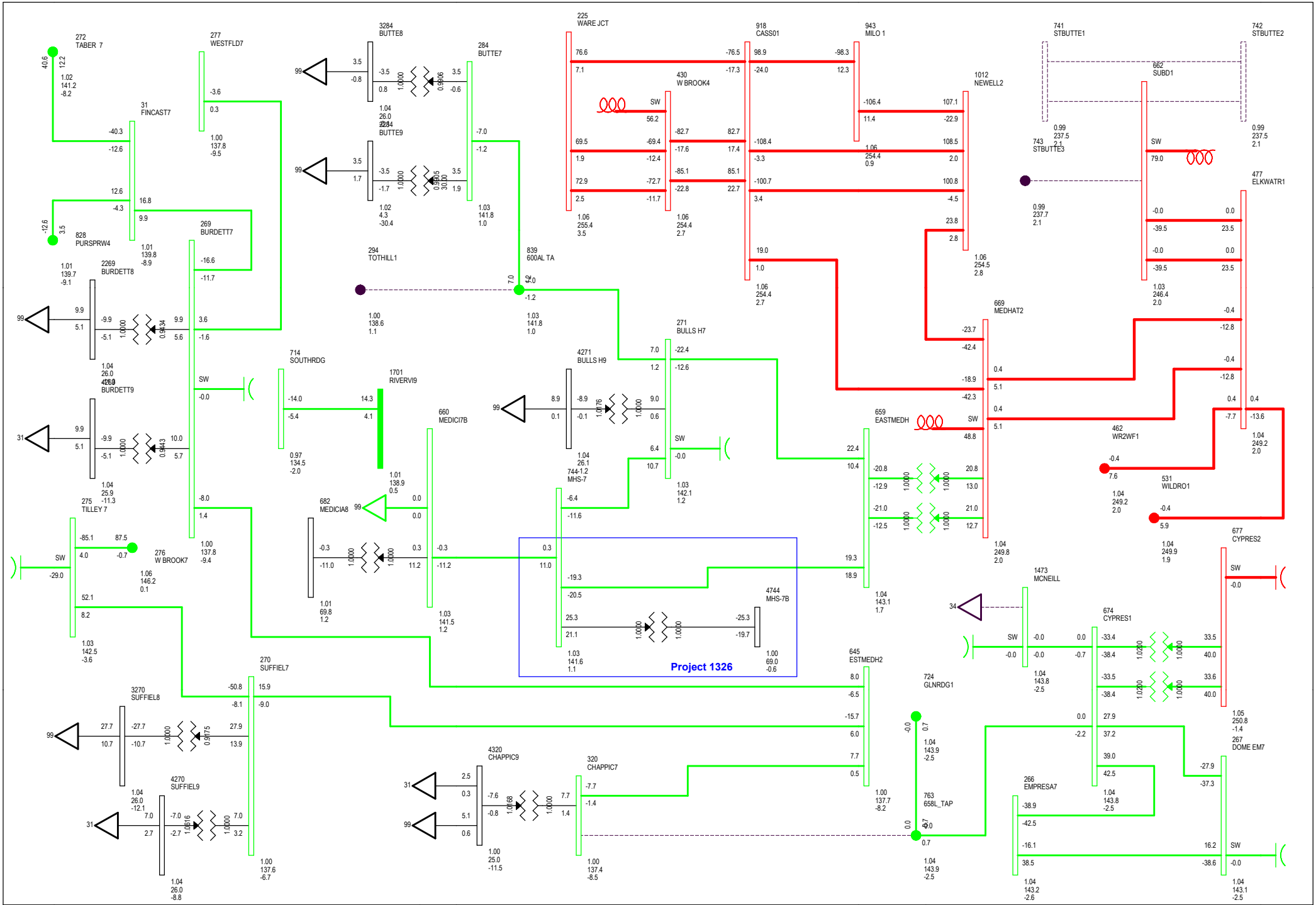


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -6.0 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-10: CATEGORY B - 100L (498S TO 895S)
THU, DEC 17 2015 7:34

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

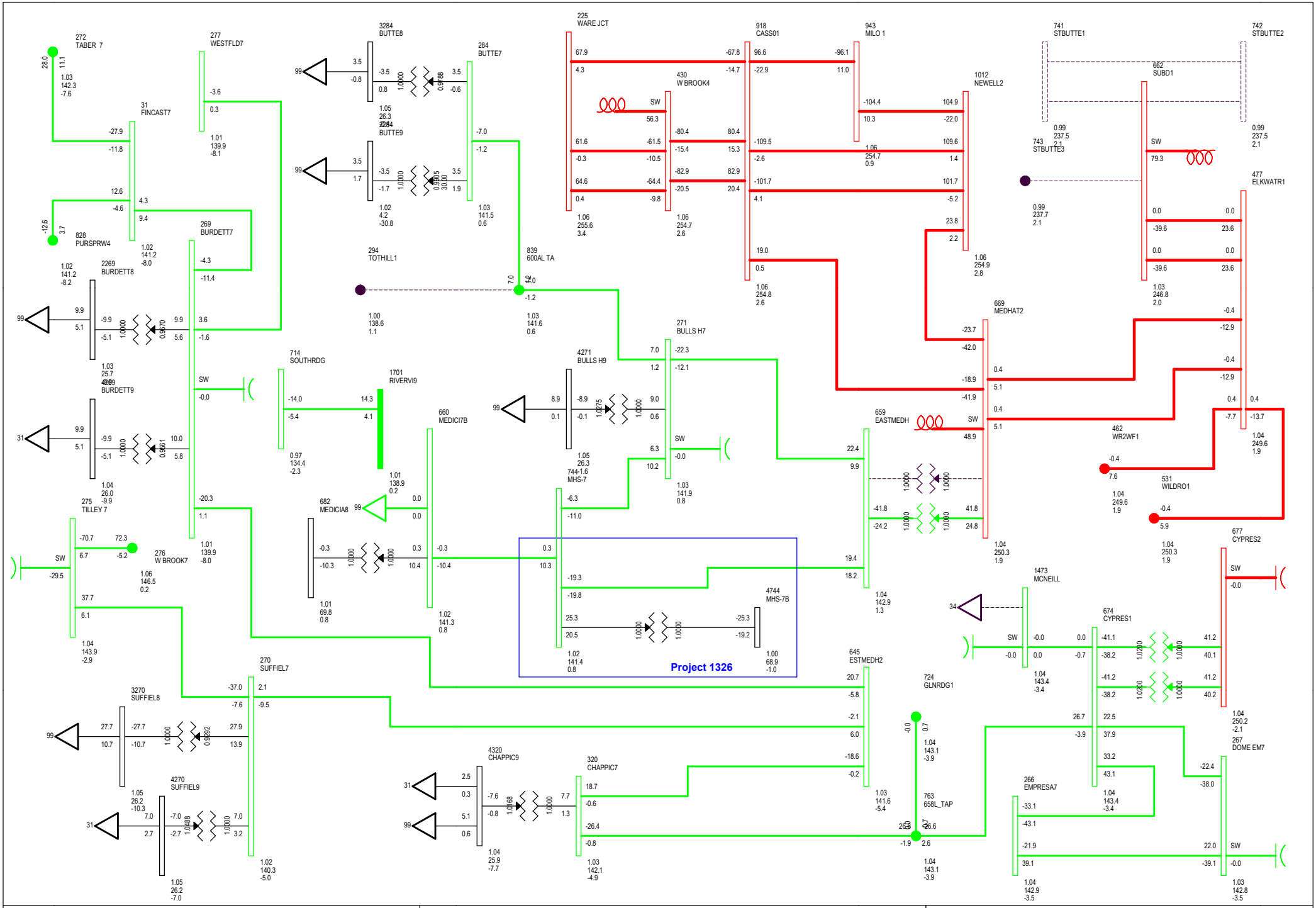


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -7.6 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-11: CATEGORY B - 658L (562S TO 649S)
THU, DEC 17 2015 7:34

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

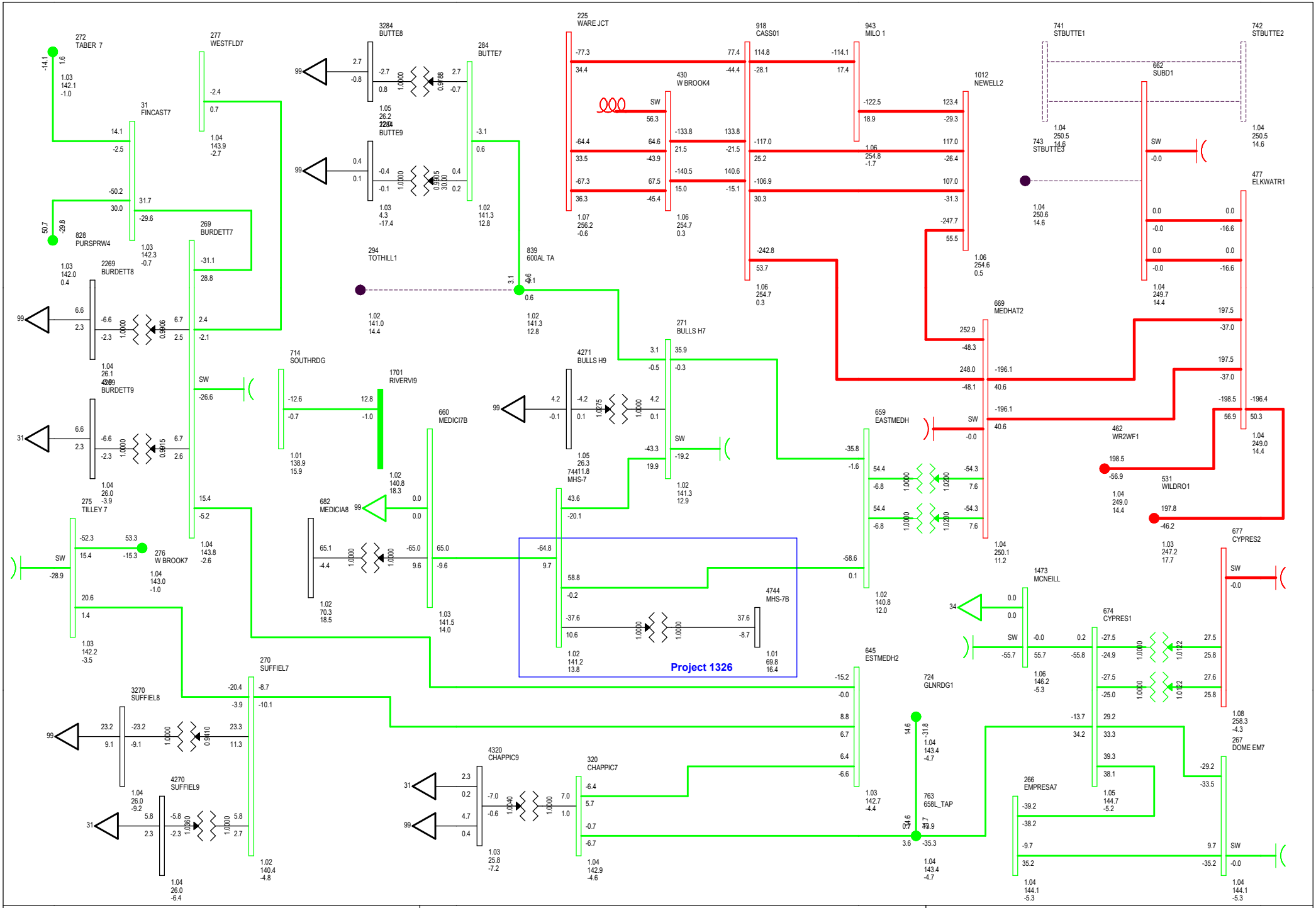


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -8.8 MW

2015 WINTER PEAK (POST_CONNECTION) SCENARIO 4
FIGURE B-12: CATEGORY B - TRANSFORMER T1 (244S)
THU, DEC 17 2015 7:34

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate B
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

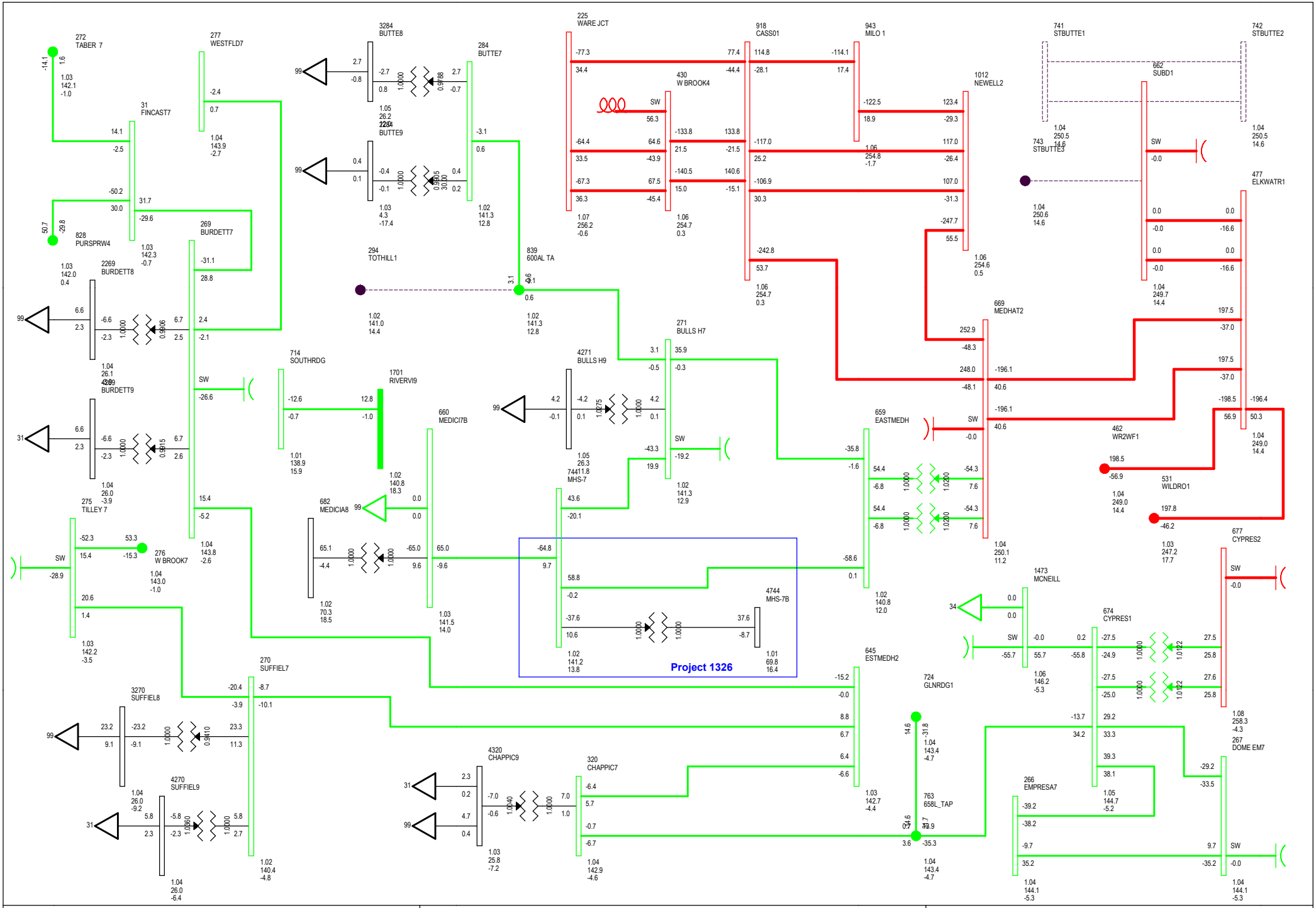


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 53.3 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-1: CATEGORY A - NO CONTINGENCY
THU, DEC 17 2015 7:35

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

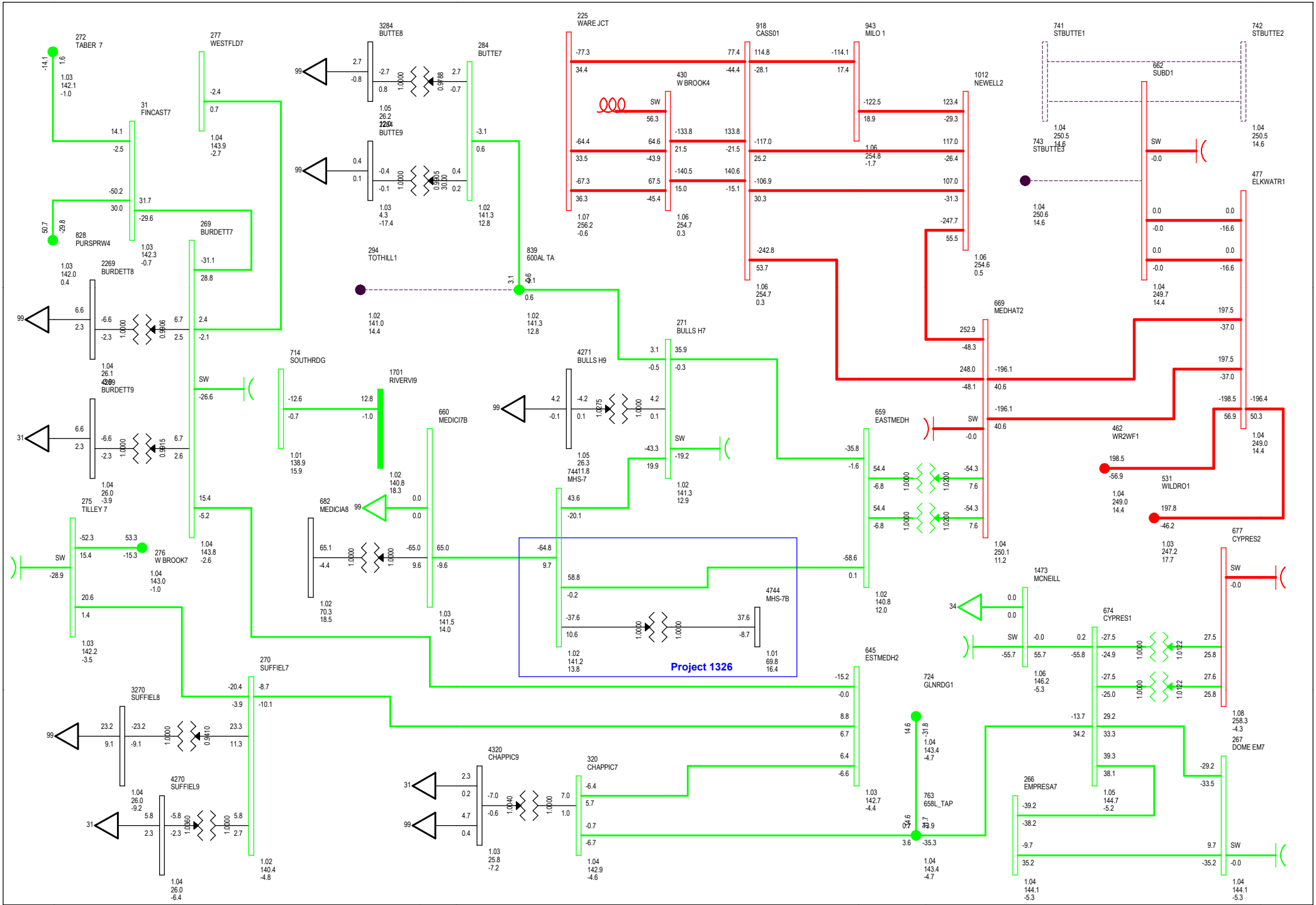


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 53.3 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-2: CATEGORY B - 675L (244S TO 41S)
THU, DEC 17 2015 7:36

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

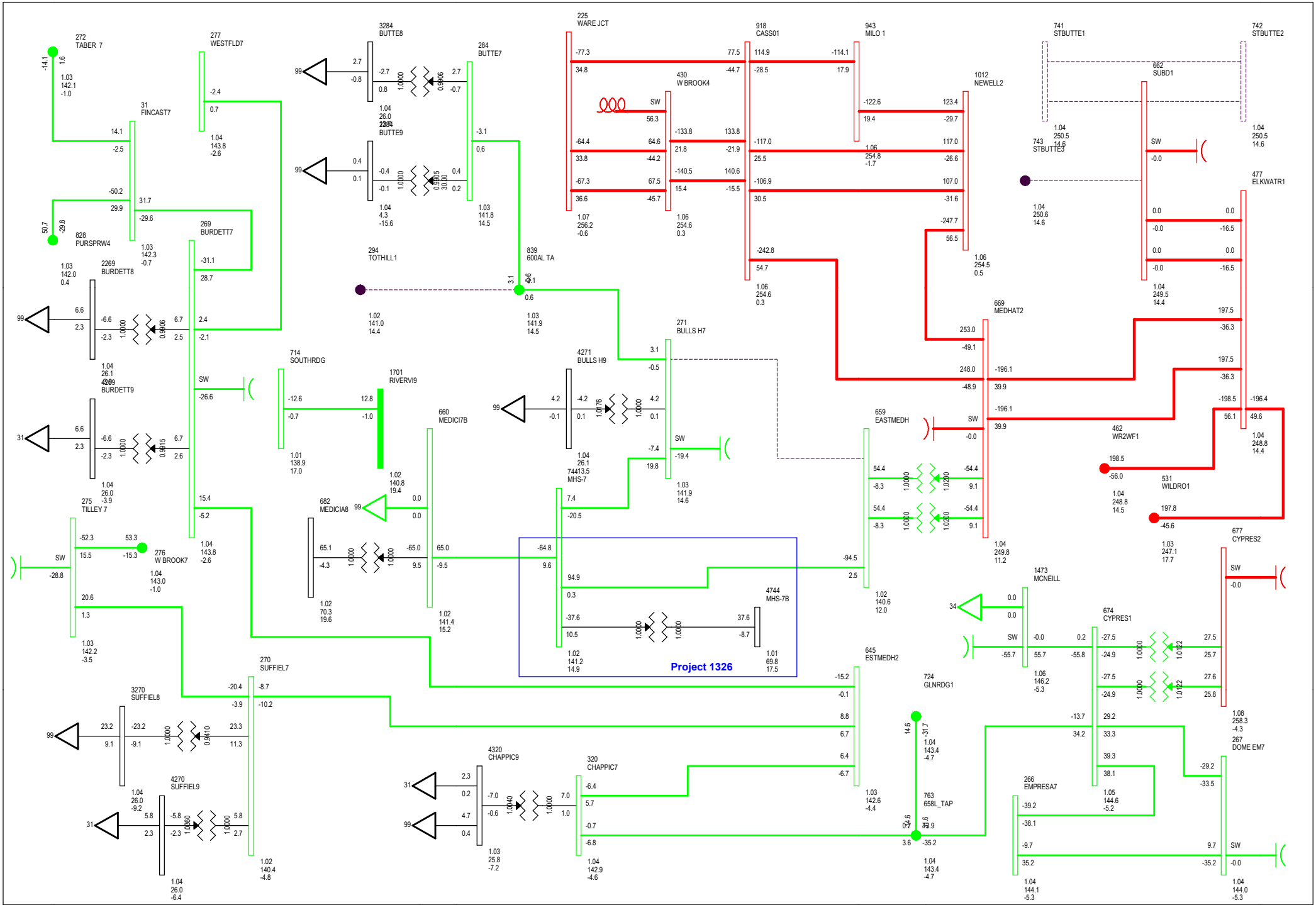


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 53.3 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-3: CATEGORY B - 880L (41S TO 523S)
THU, DEC 17 2015 7:36

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

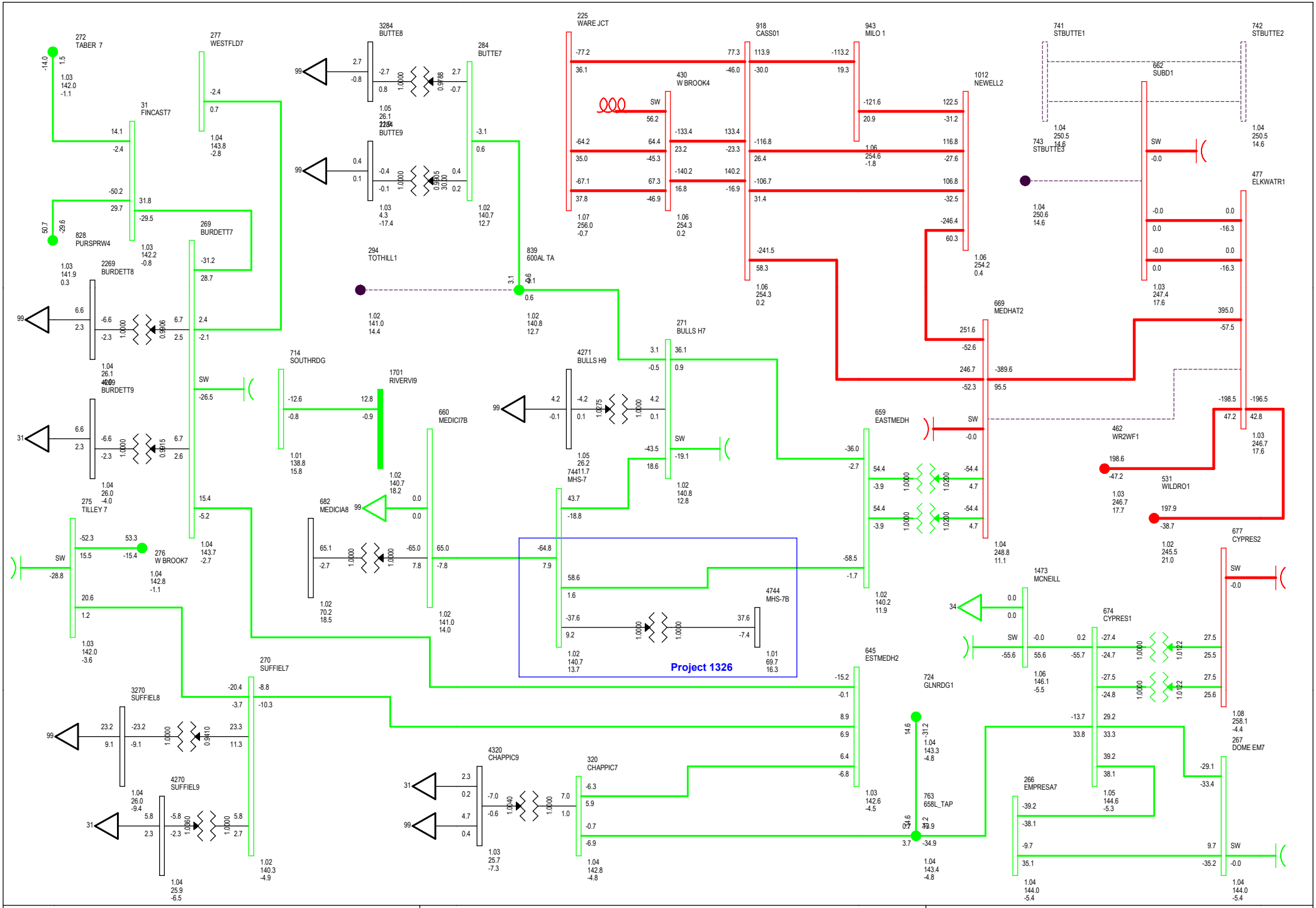


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 53.3 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-4: CATEGORY B - 676L (523S TO 244S)
THU, DEC 17 2015 7:36

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

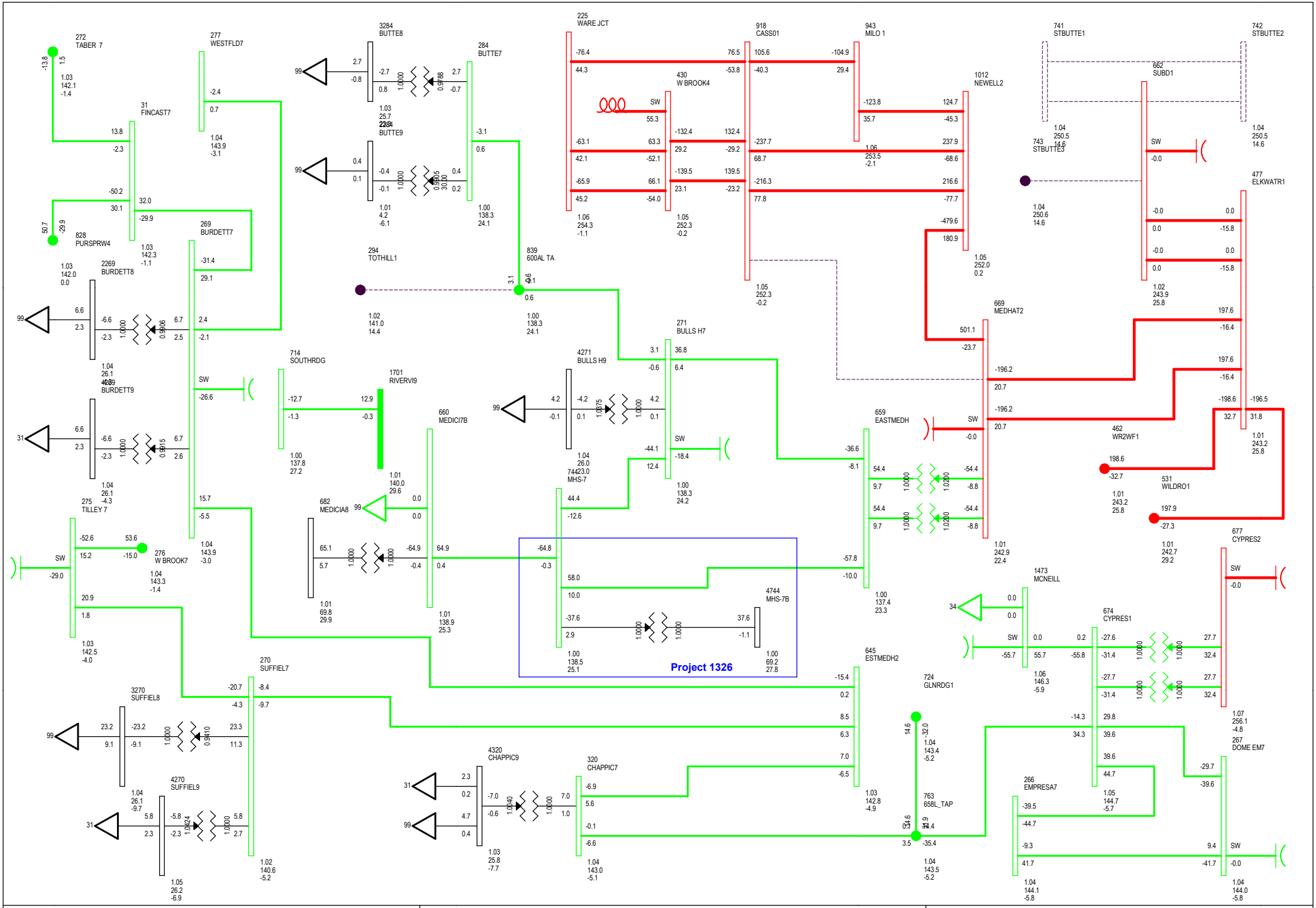


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 55.9 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-5: CATEGORY B - 1073L (244S TO 264S)
THU, DEC 17 2015 7:37

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

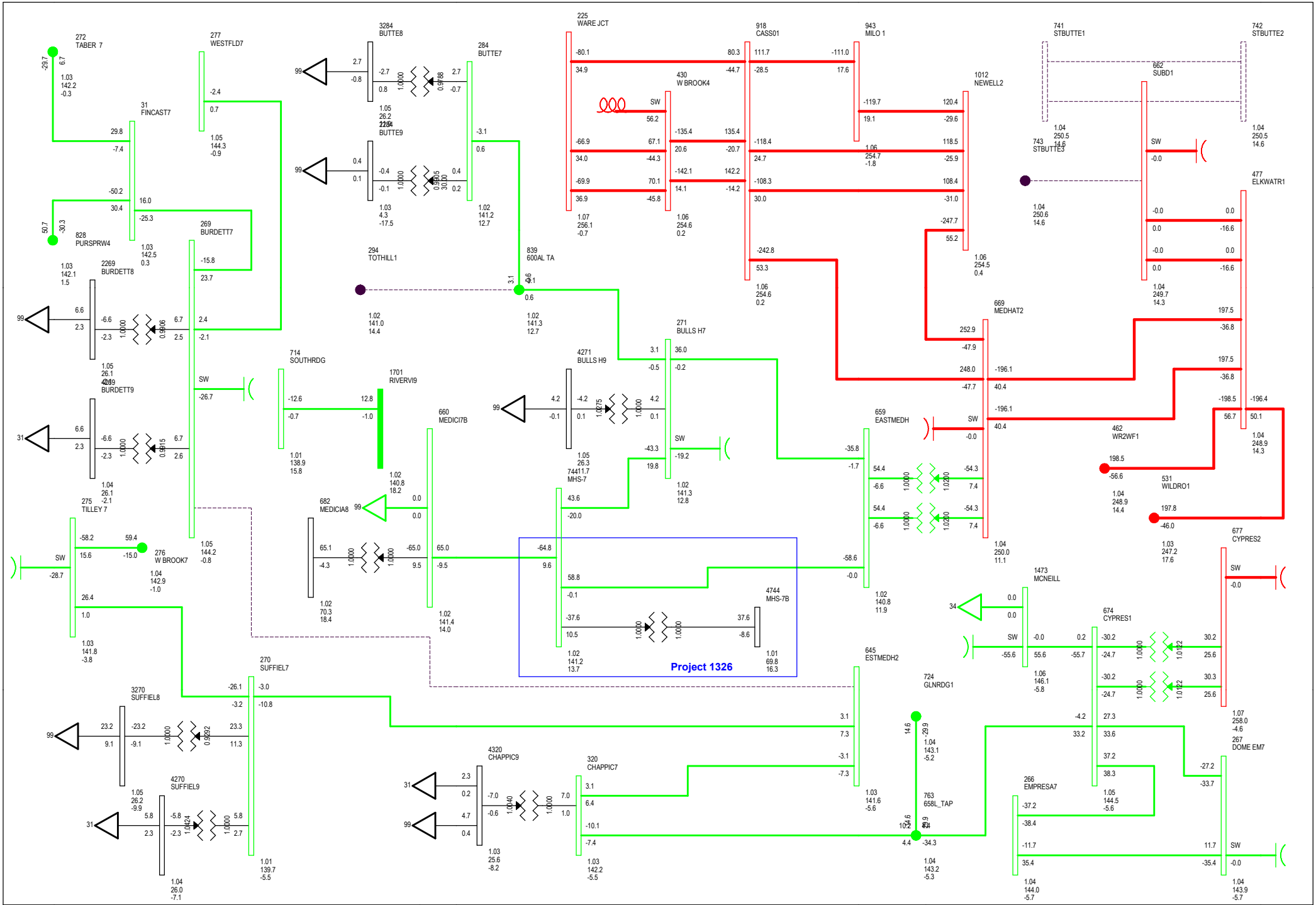


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 0.0 MW BC and MATL (Import): 64.5 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-6: CATEGORY B - 1034L (244S TO 324S)
THU, DEC 17 2015 7:37

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

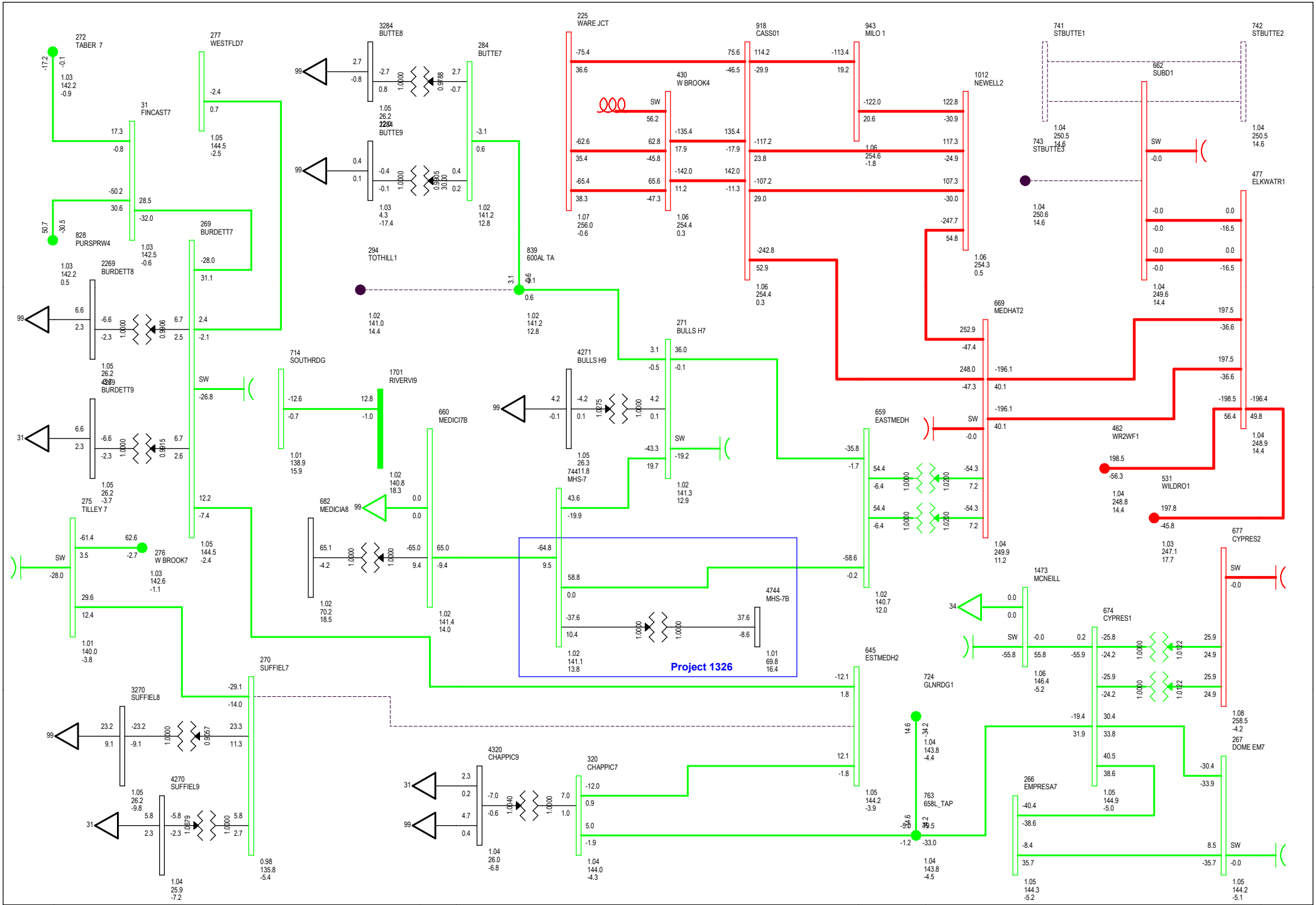


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 53.3 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-7: CATEGORY B - 879L (244S TO 368S)
THU, DEC 17 2015 7:37

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

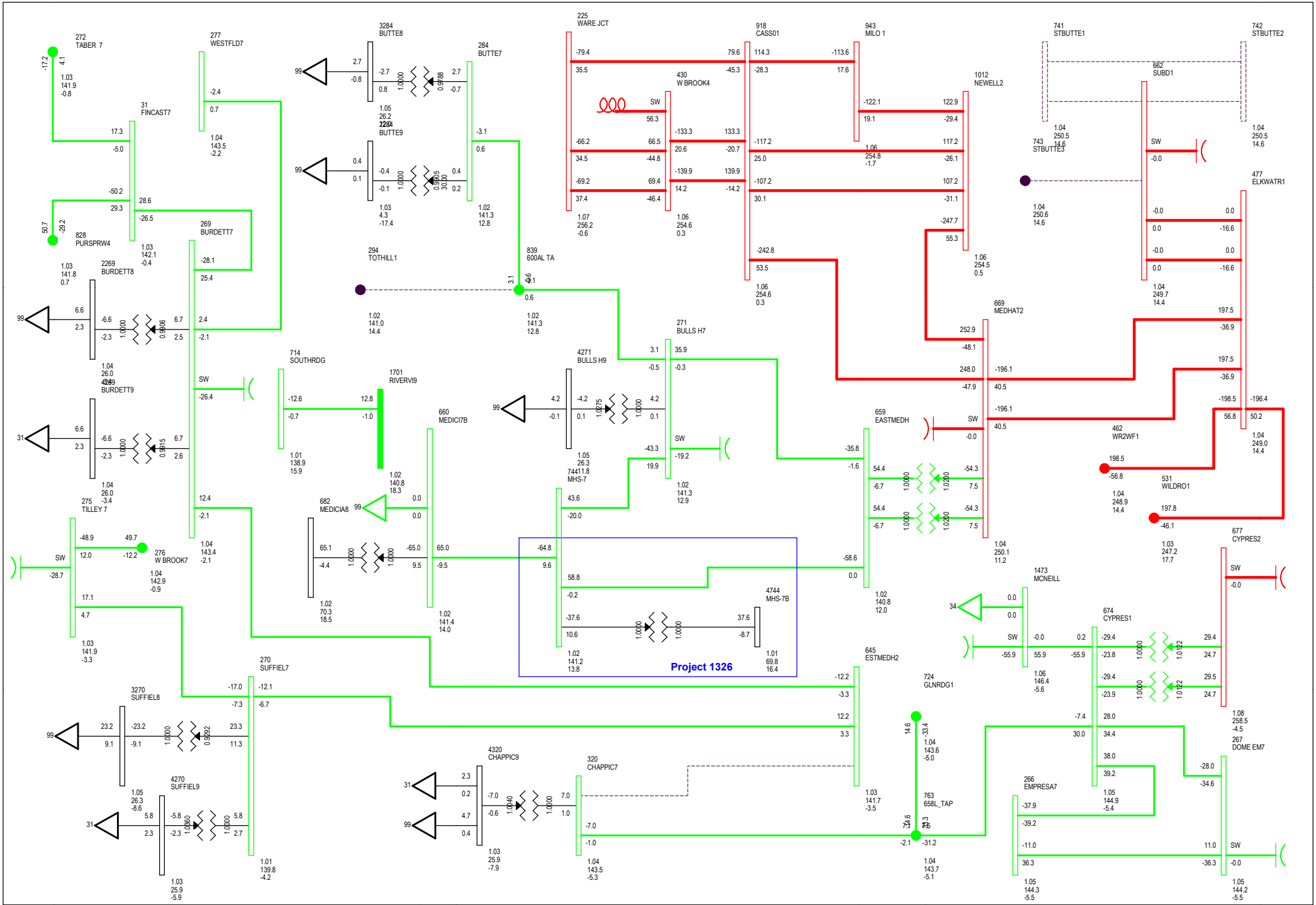


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 53.7 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-8: CATEGORY B - 892L (244S TO 368S)
THU, DEC 17 2015 7:38

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

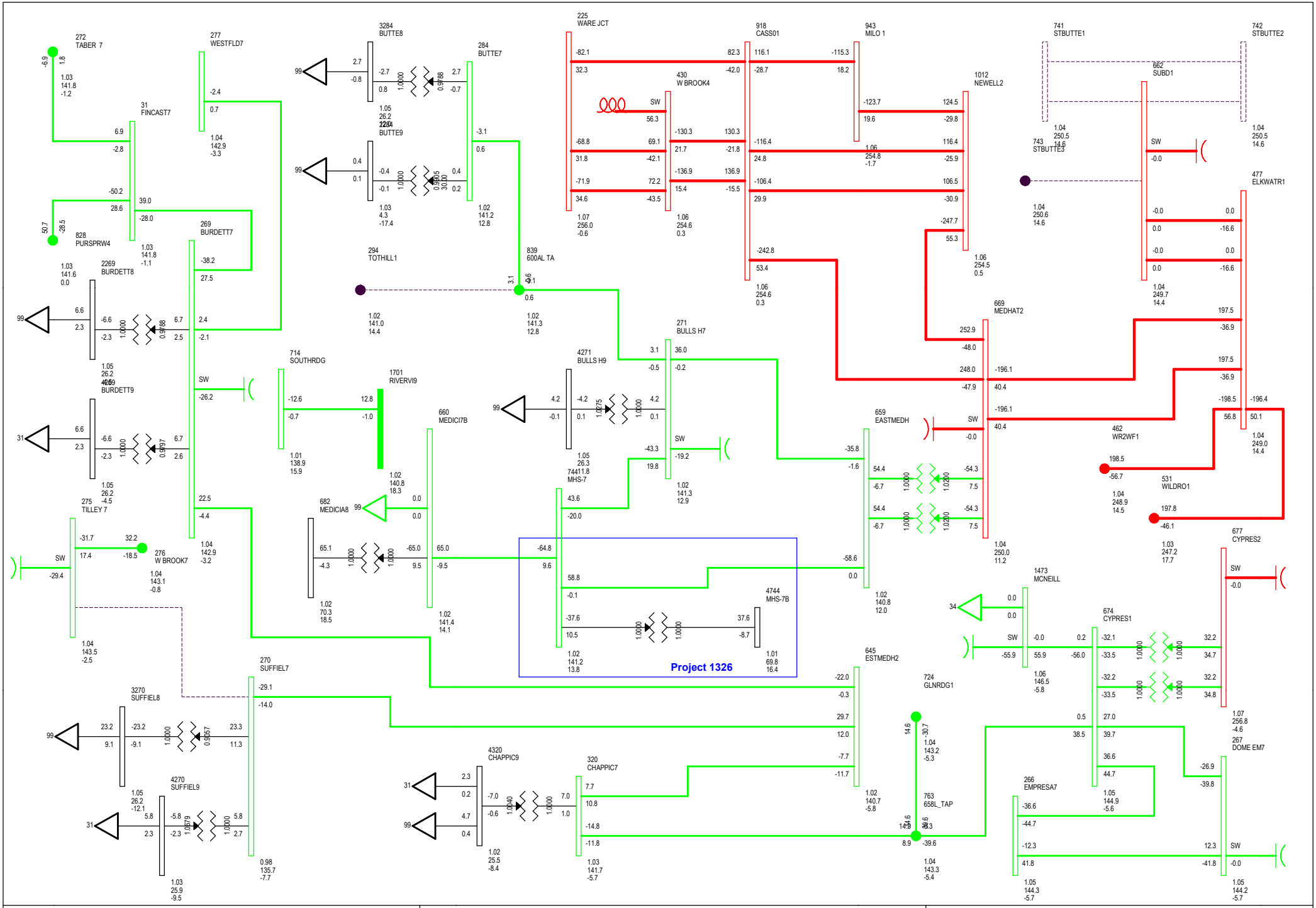


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 53.0 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-9: CATEGORY B - 674L (244S TO 649S)
THU, DEC 17 2015 7:38

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

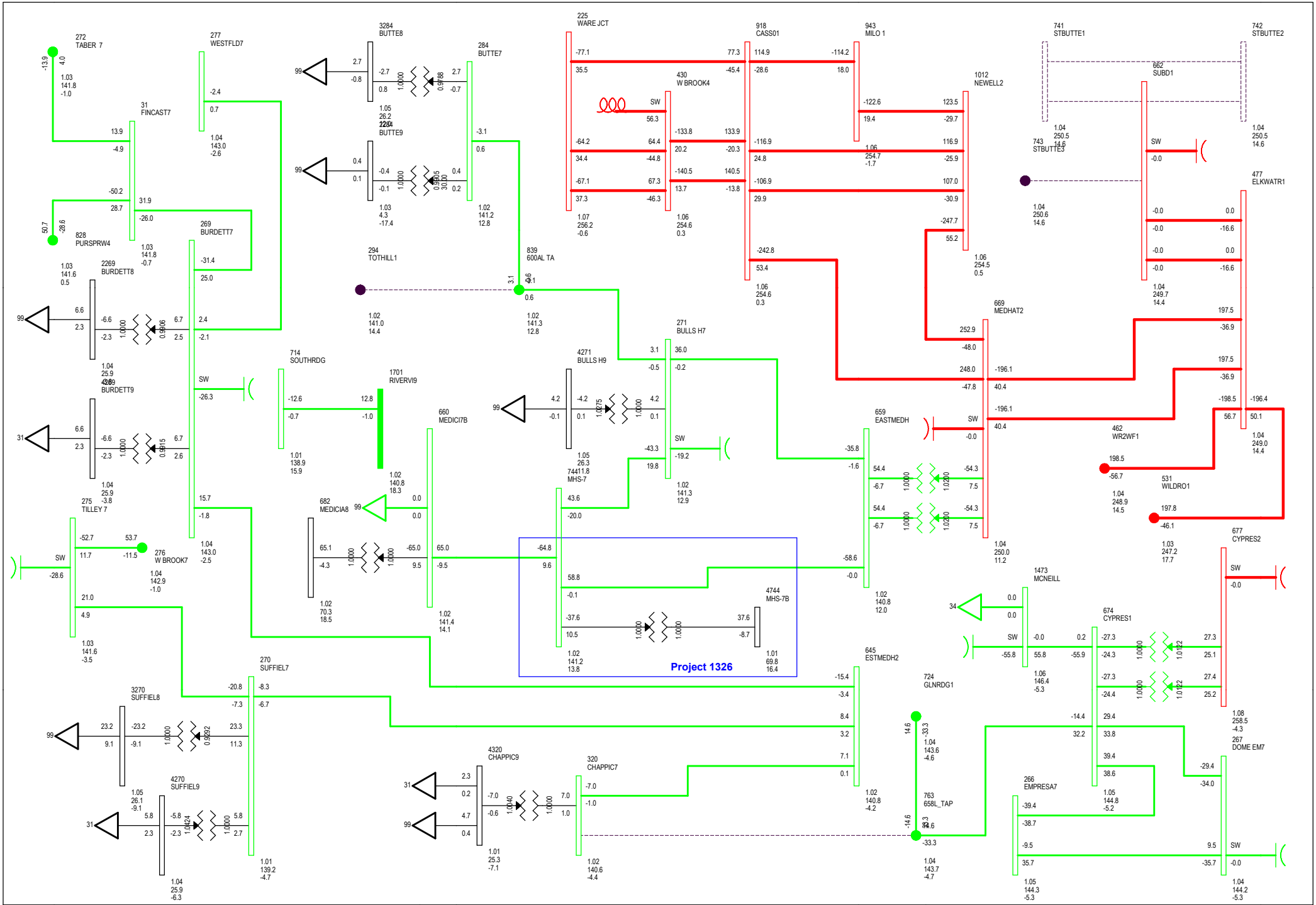


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 54.1 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-10: CATEGORY B - 100L (498S TO 895S)
THU, DEC 17 2015 7:38

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

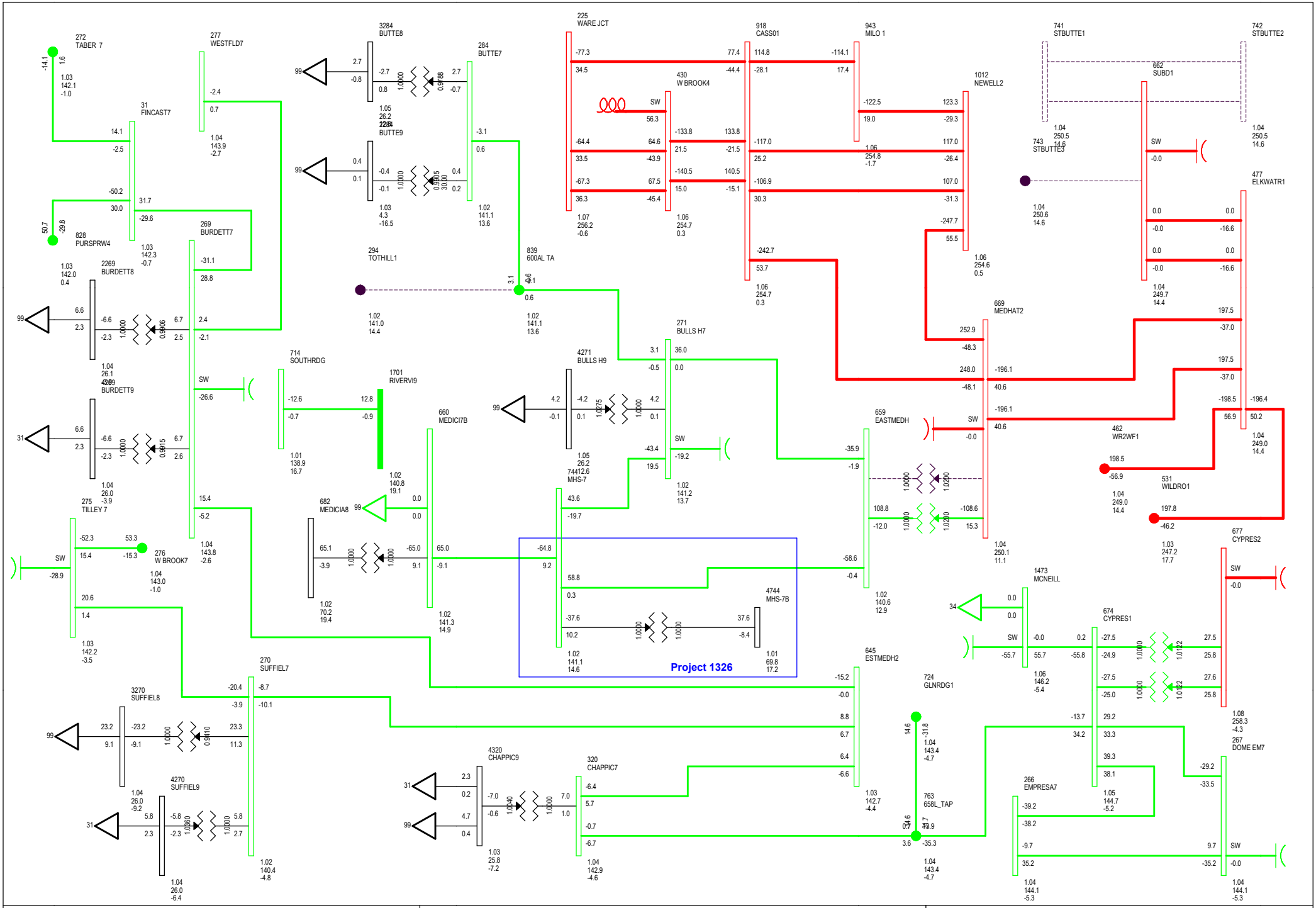


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 53.2 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-11: CATEGORY B - 658L (562S TO 649S)
THU, DEC 17 2015 7:39

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

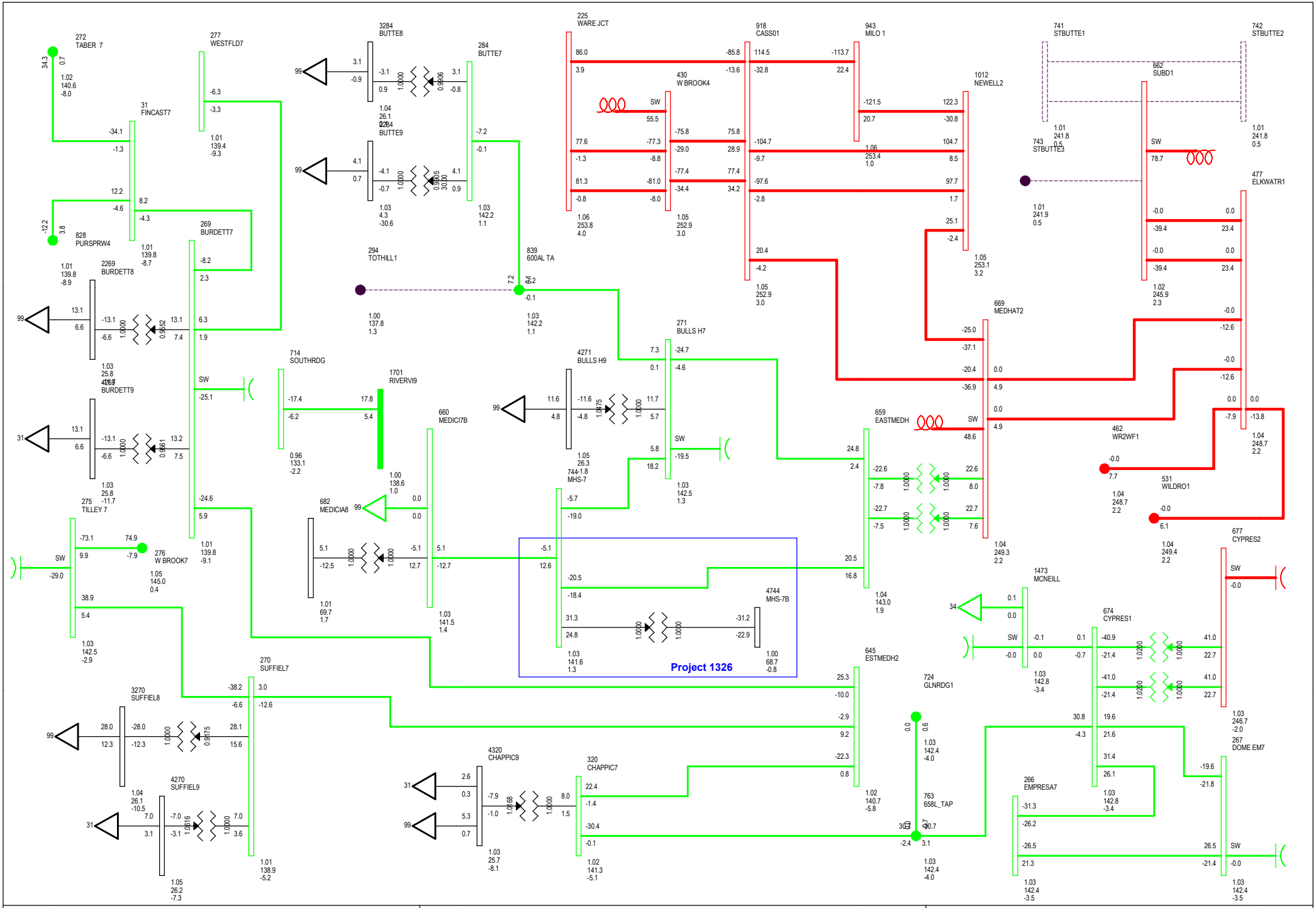


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): 53.4 MW

2016 SUMMER LIGHT (POST_CONNECTION) SCENARIO 5
FIGURE C-12: CATEGORY B - TRANSFORMER T1 (244S)
THU, DEC 17 2015 7:39

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

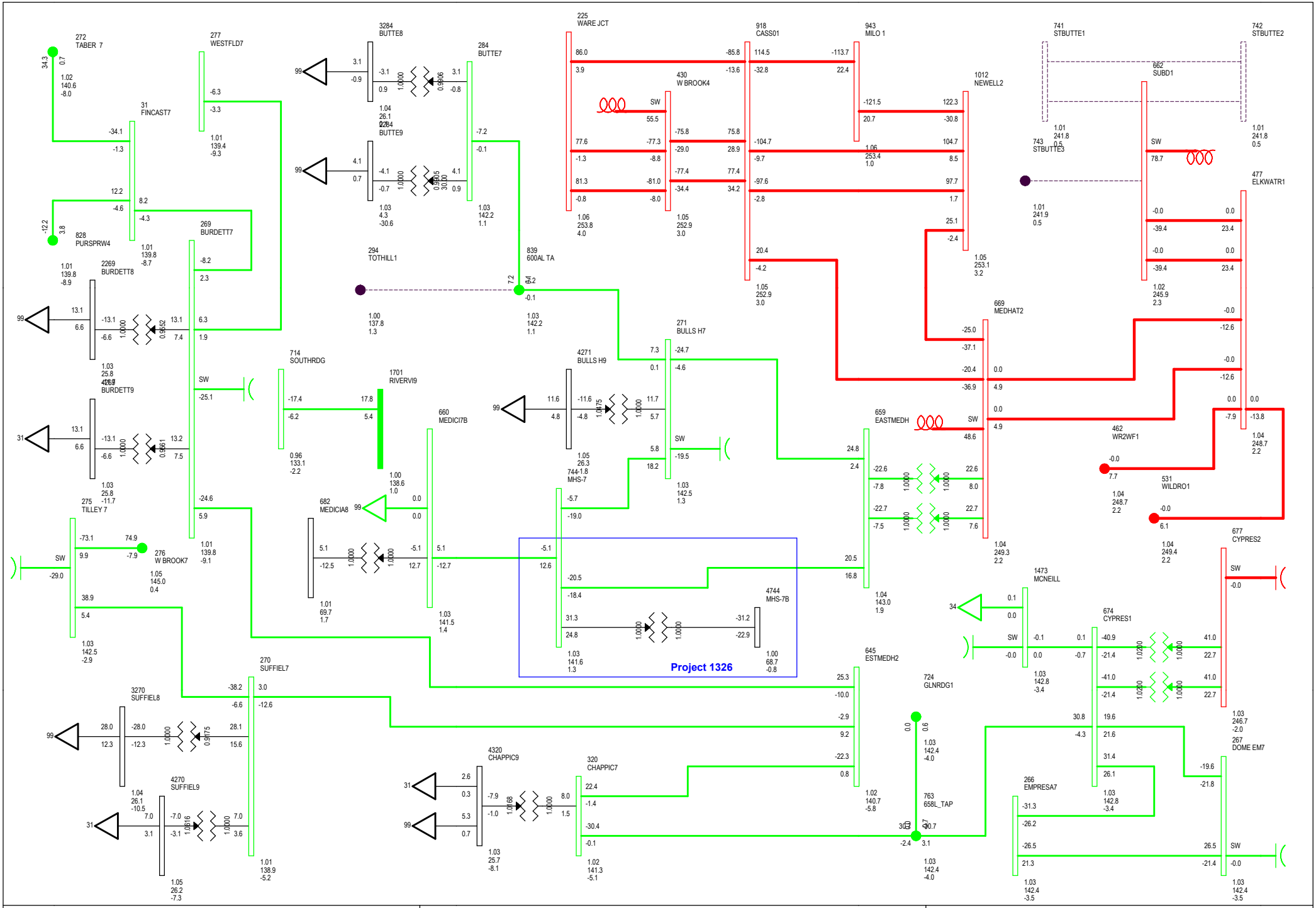


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): -0.7 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-1: CATEGORY A - NO CONTINGENCY
THU, DEC 17 2015 7:40

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

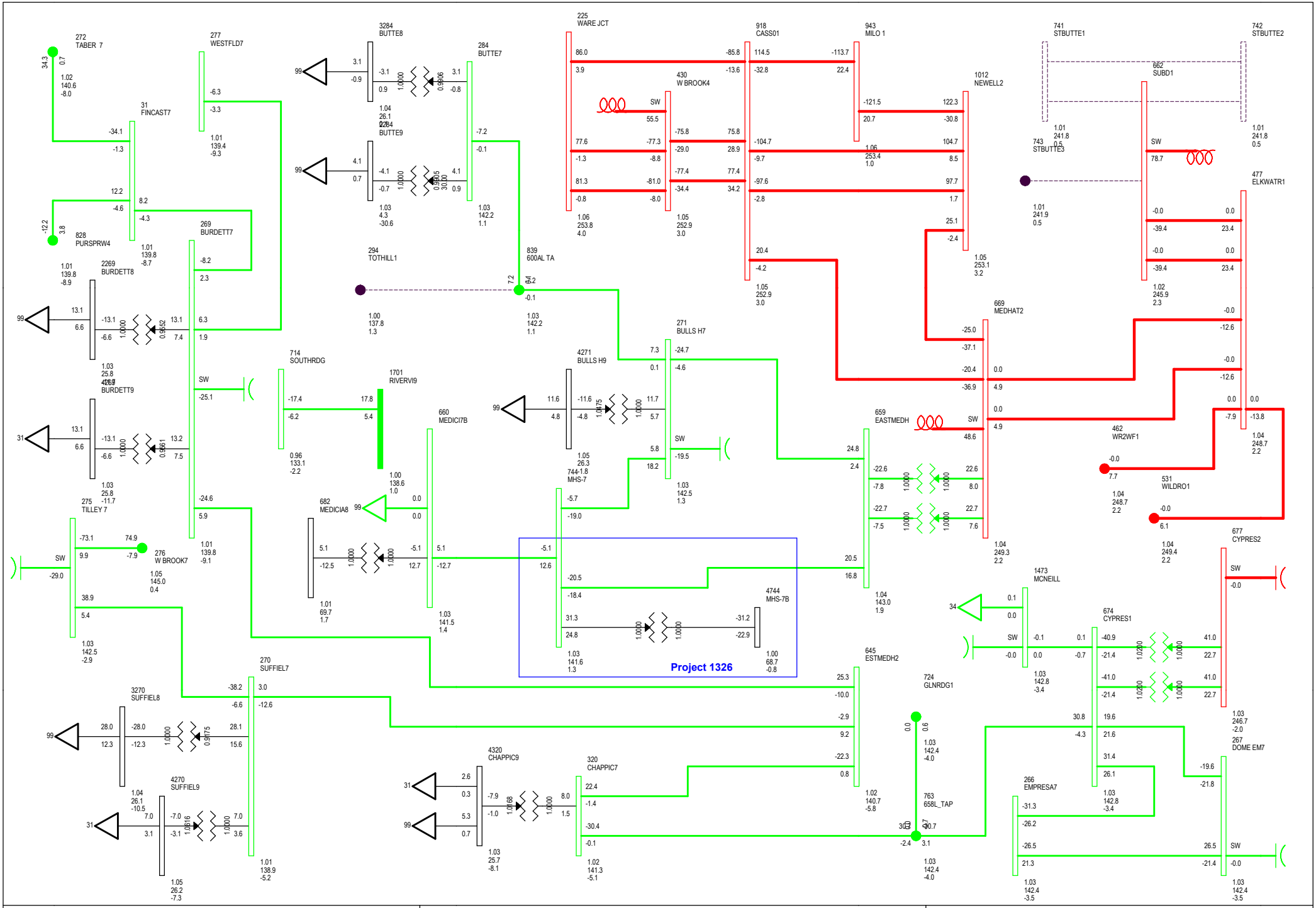


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): -0.7 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-2: CATEGORY B - 675L (244S TO 41S)
THU, DEC 17 2015 7:40

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

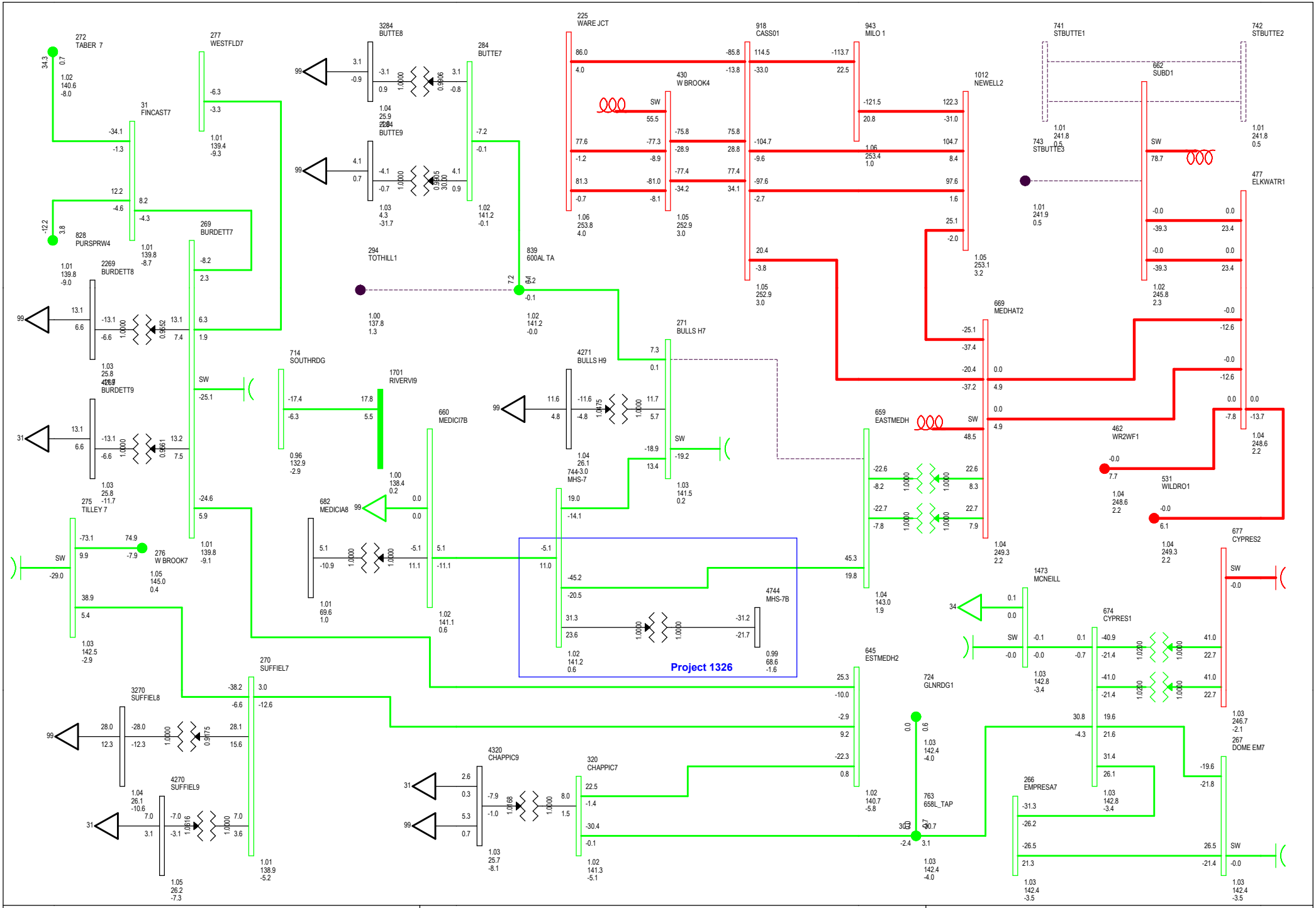


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): -0.7 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-3: CATEGORY B - 880L (41S TO 523S)
THU, DEC 17 2015 7:41

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

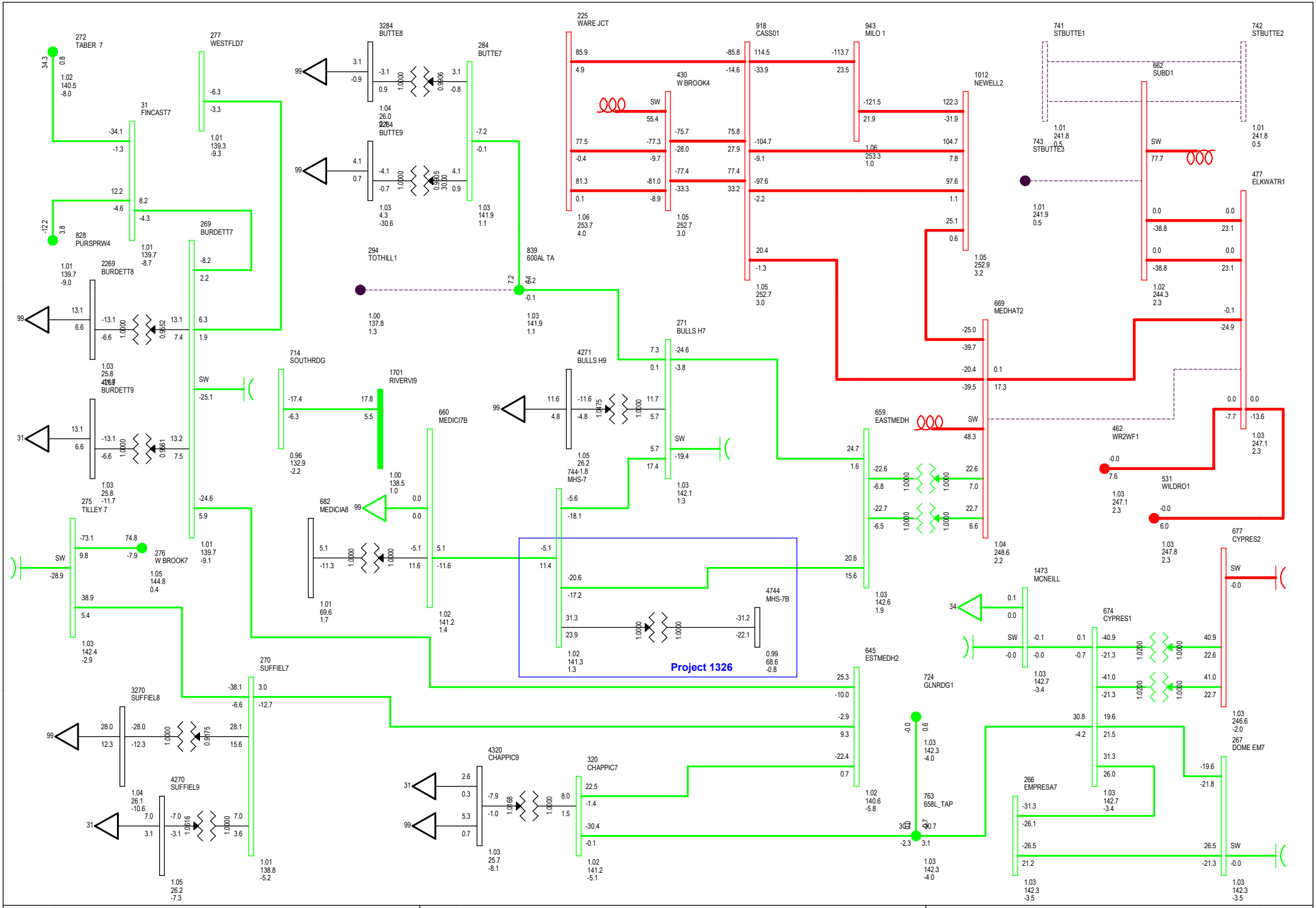


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): -0.7 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-4: CATEGORY B - 676L (523S TO 244S)
THU, DEC 17 2015 7:41

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

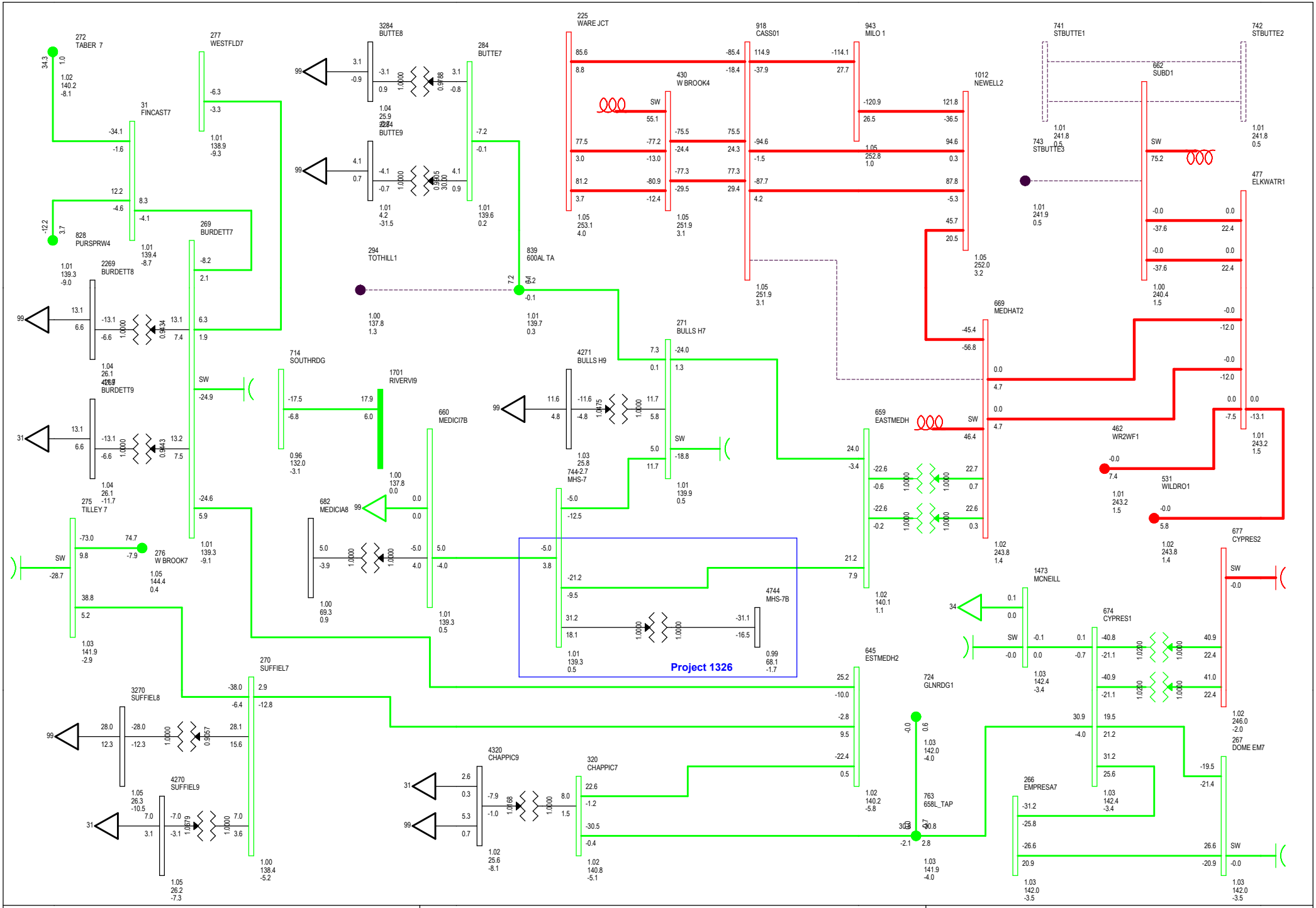


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): -0.7 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-5: CATEGORY B - 1073L (244S TO 264S)
THU, DEC 17 2015 7:41

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

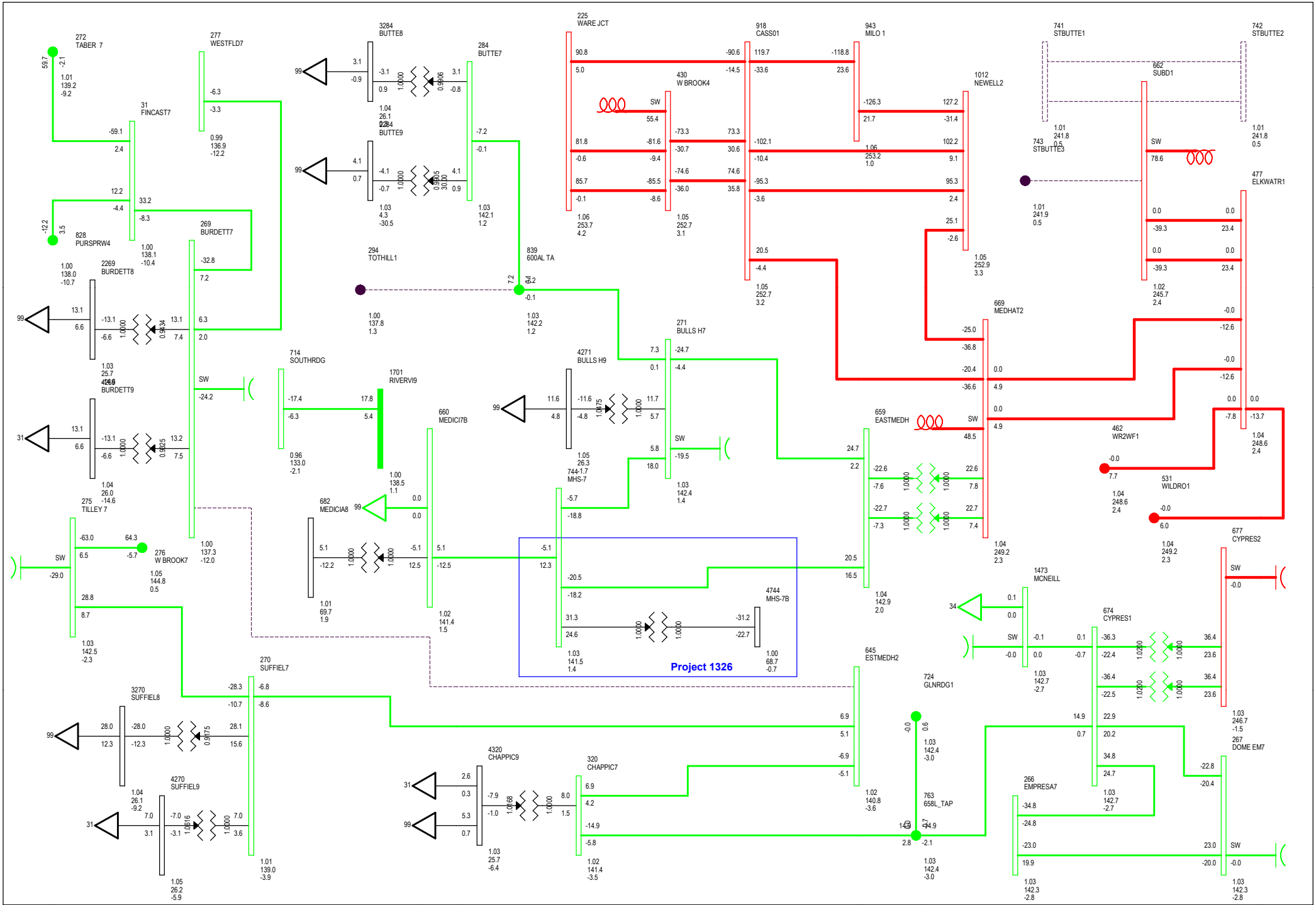


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): -0.4 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-6: CATEGORY B - 1034L (244S TO 324S)
THU, DEC 17 2015 7:42

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

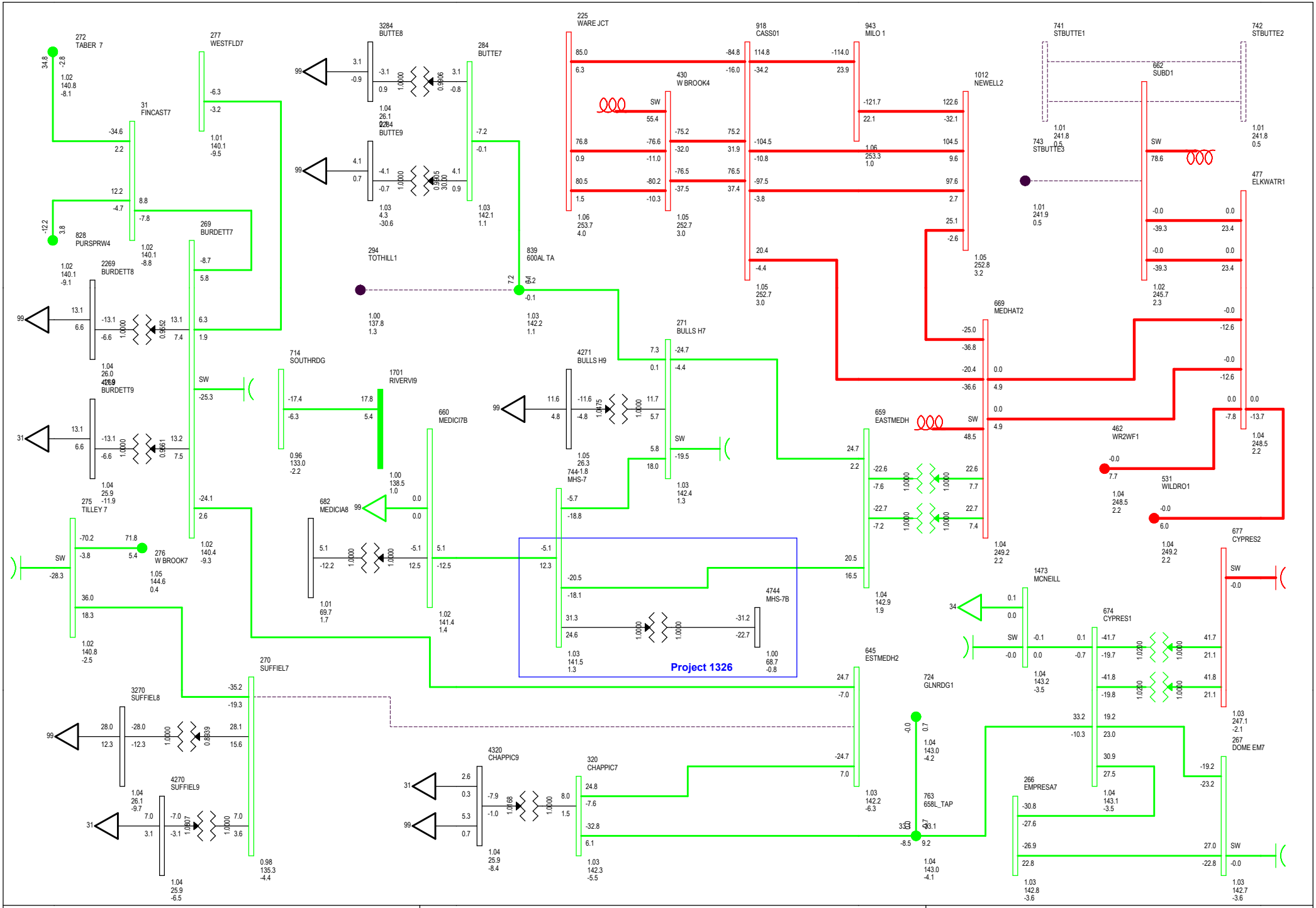


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 0.4 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-7: CATEGORY B - 879L (244S TO 368S)
THU, DEC 17 2015 7:42

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

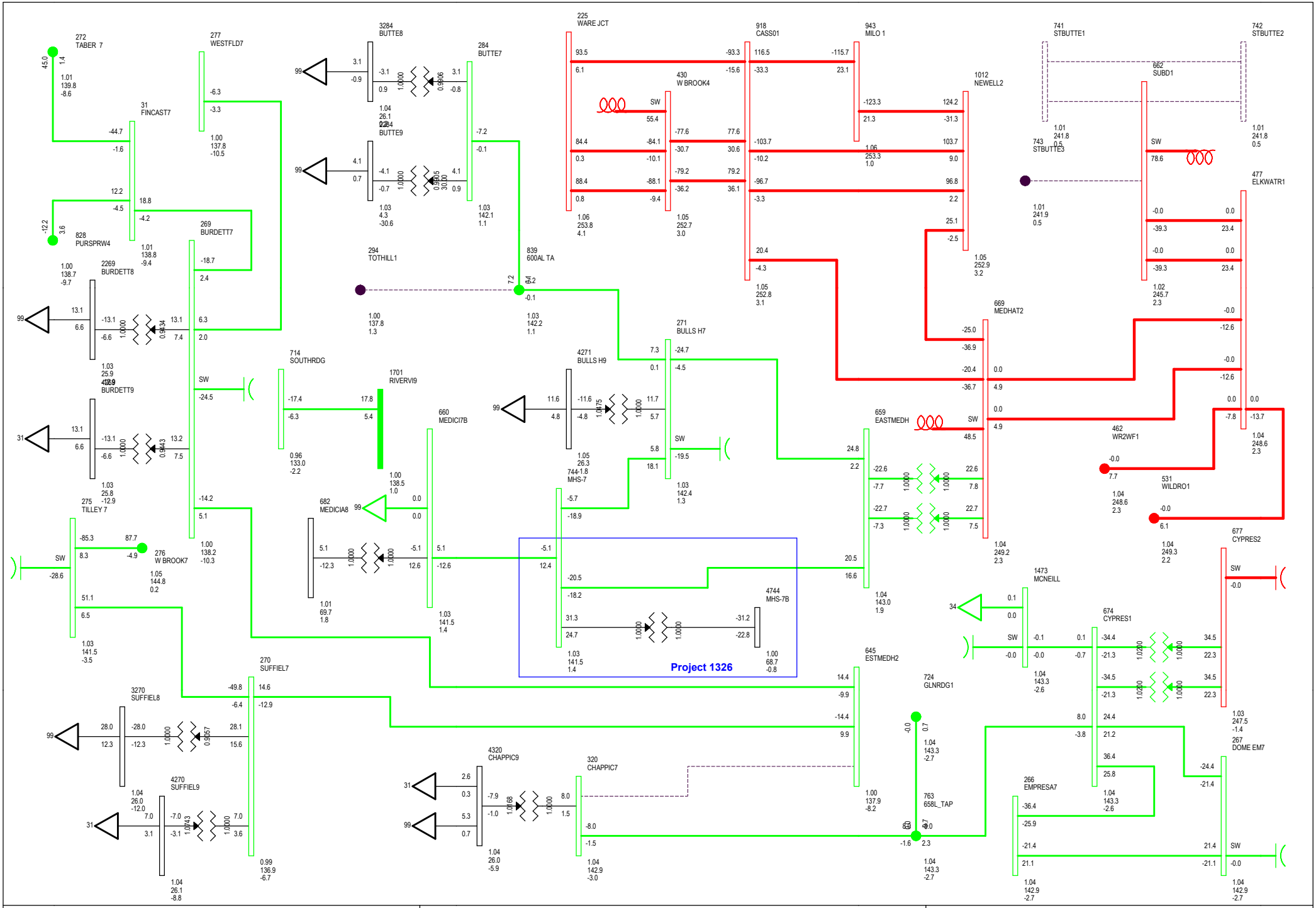


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): -0.5 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-8: CATEGORY B - 892L (244S TO 368S)
THU, DEC 17 2015 7:42

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

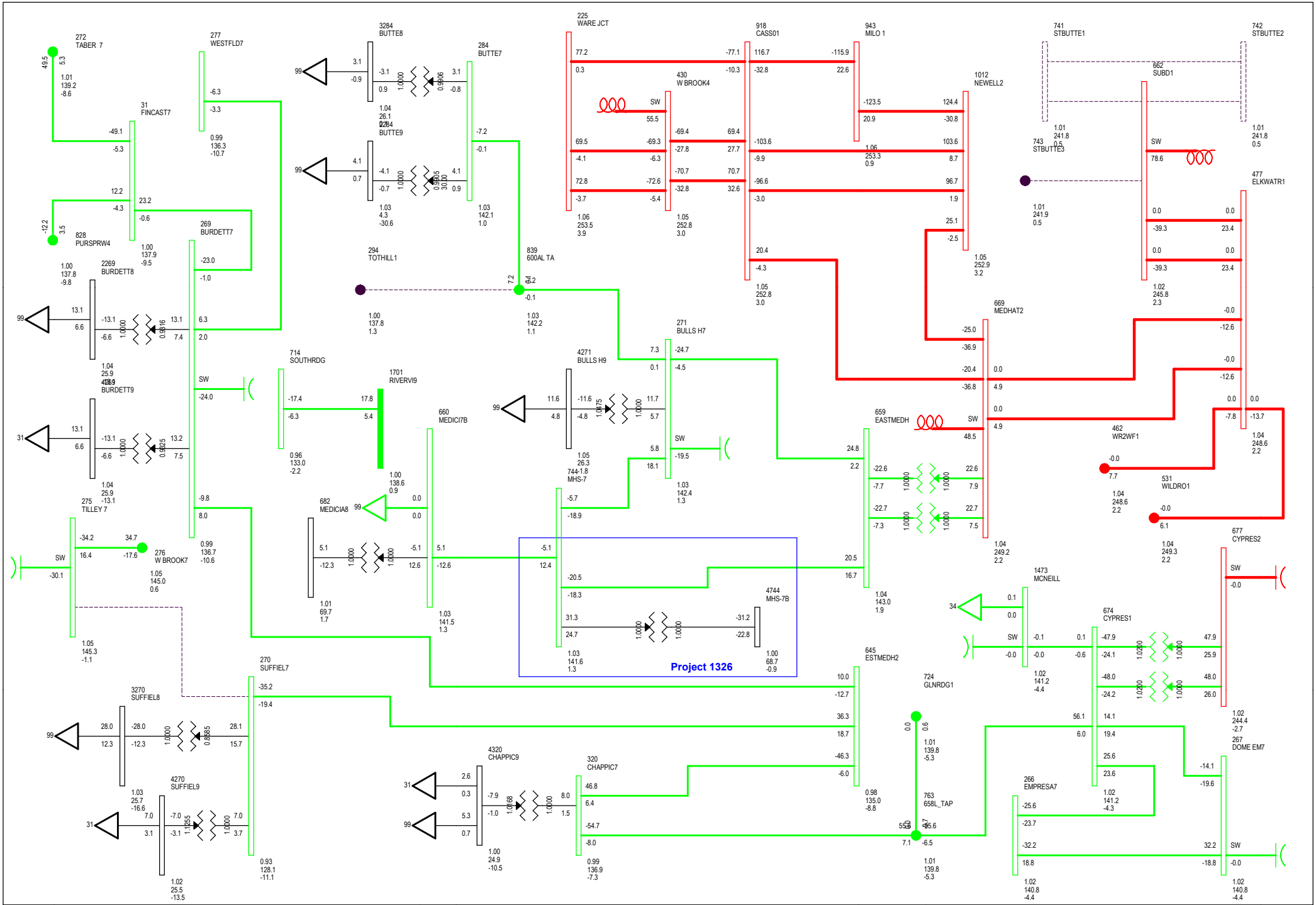


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 0.1 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-9: CATEGORY B - 674L (244S TO 649S)
THU, DEC 17 2015 7:42

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

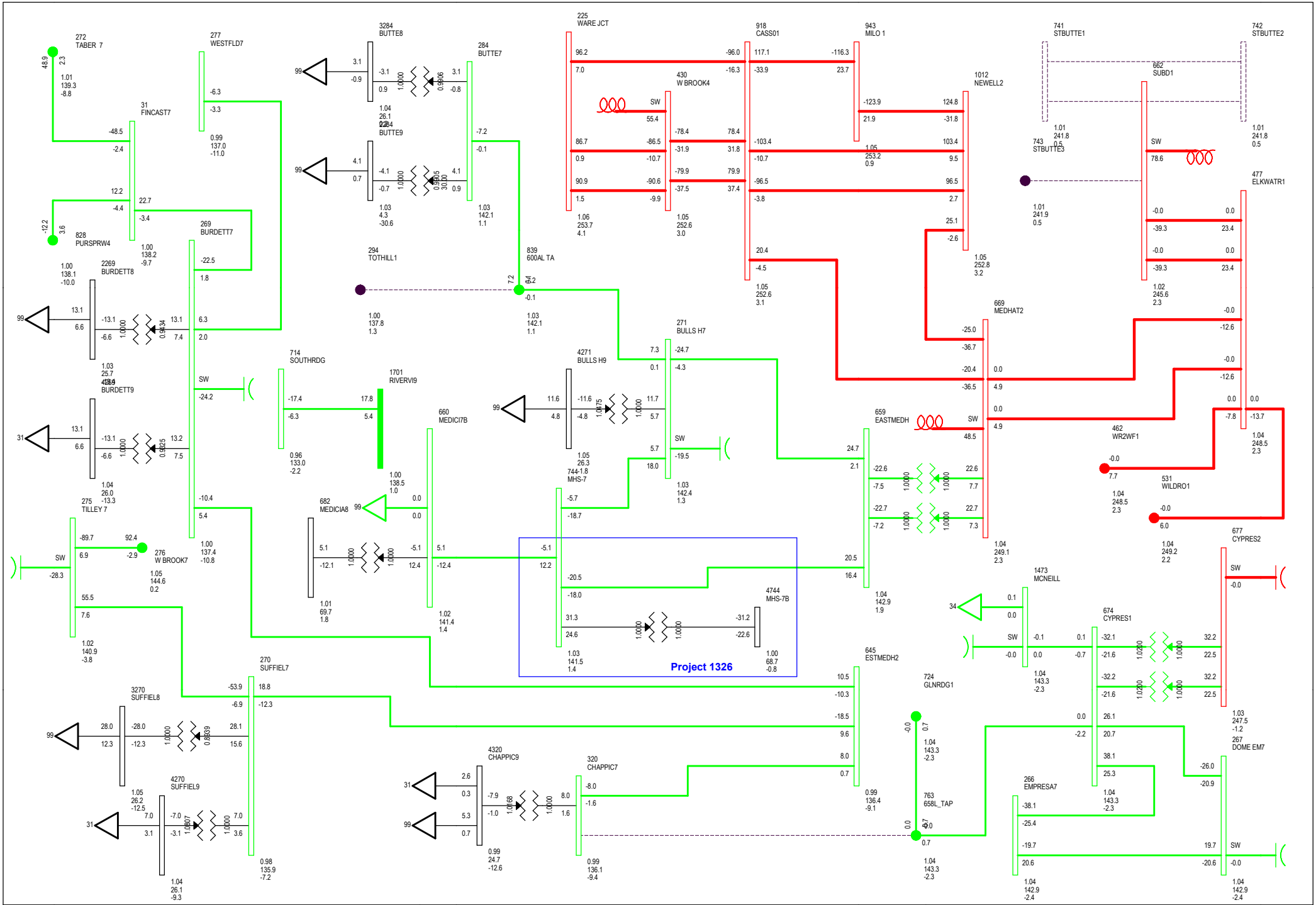


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 2.5 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-10: CATEGORY B - 100L (498S TO 895S)
THU, DEC 17 2015 7:43

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

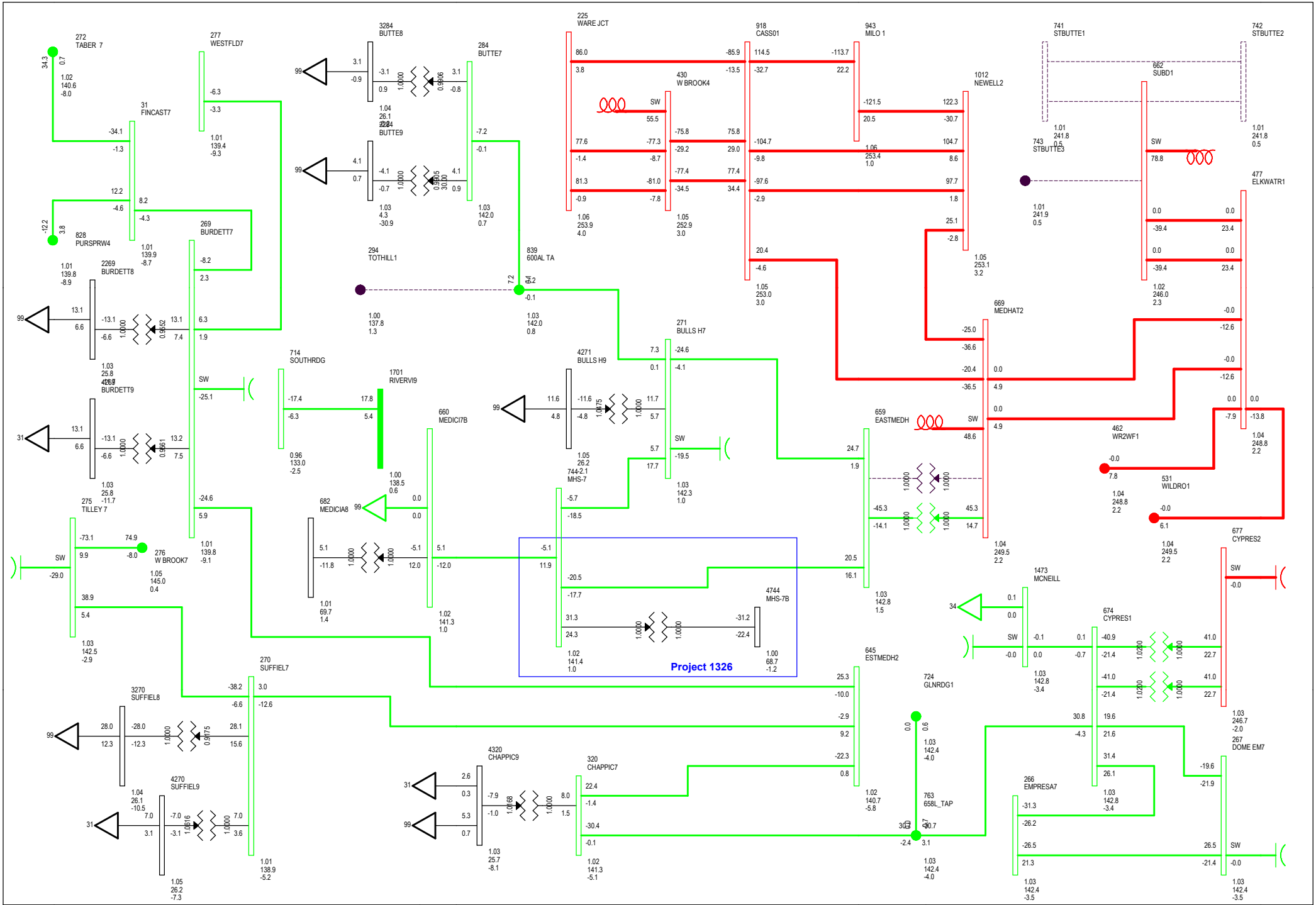


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 0.8 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-11: CATEGORY B - 658L (562S TO 649S)
THU, DEC 17 2015 7:43

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

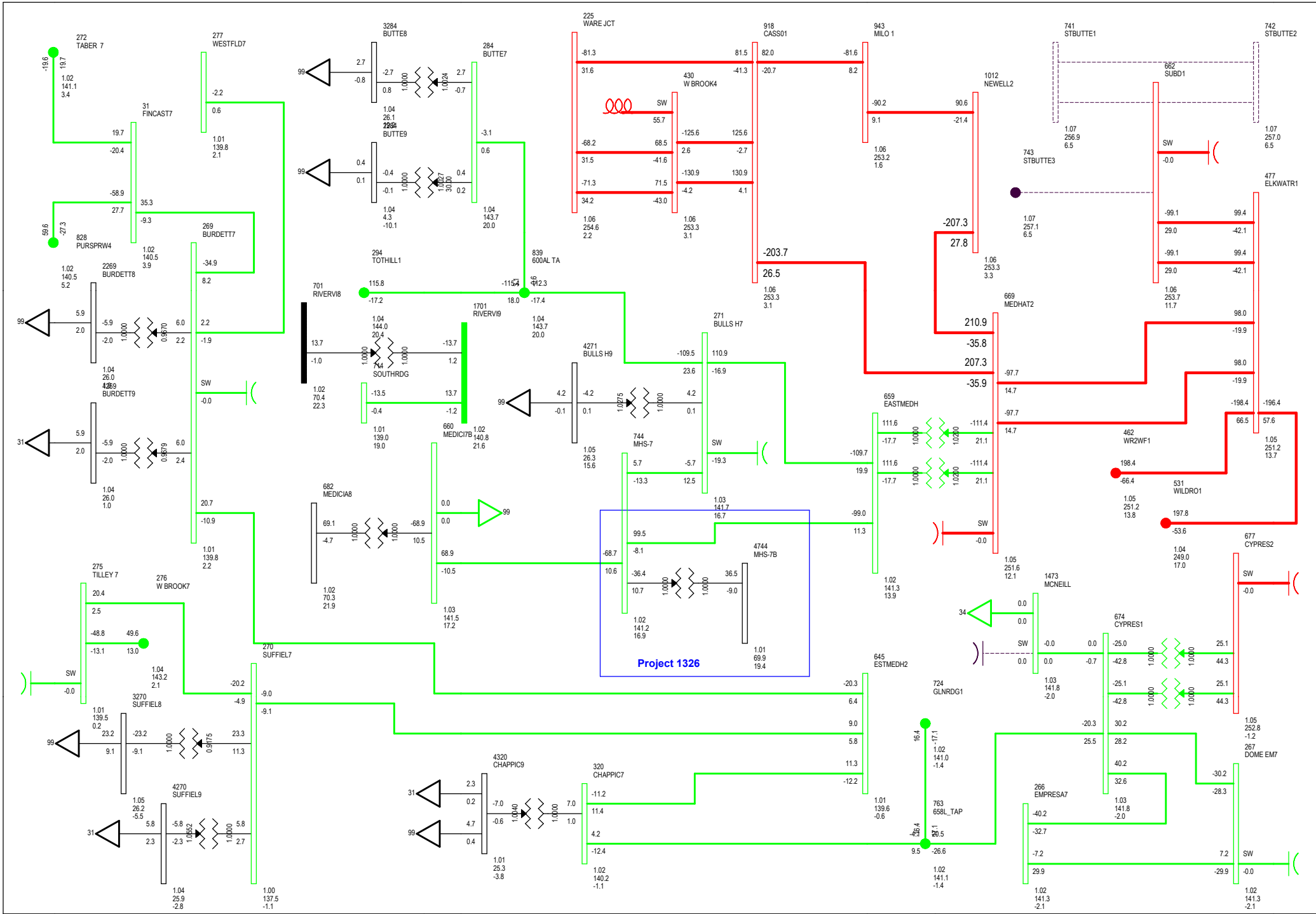


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): -0.7 MW

2016 SUMMER PEAK (POST_CONNECTION) SCENARIO 6
FIGURE D-12: CATEGORY B - TRANSFORMER T1 (244S)
THU, DEC 17 2015 7:43

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

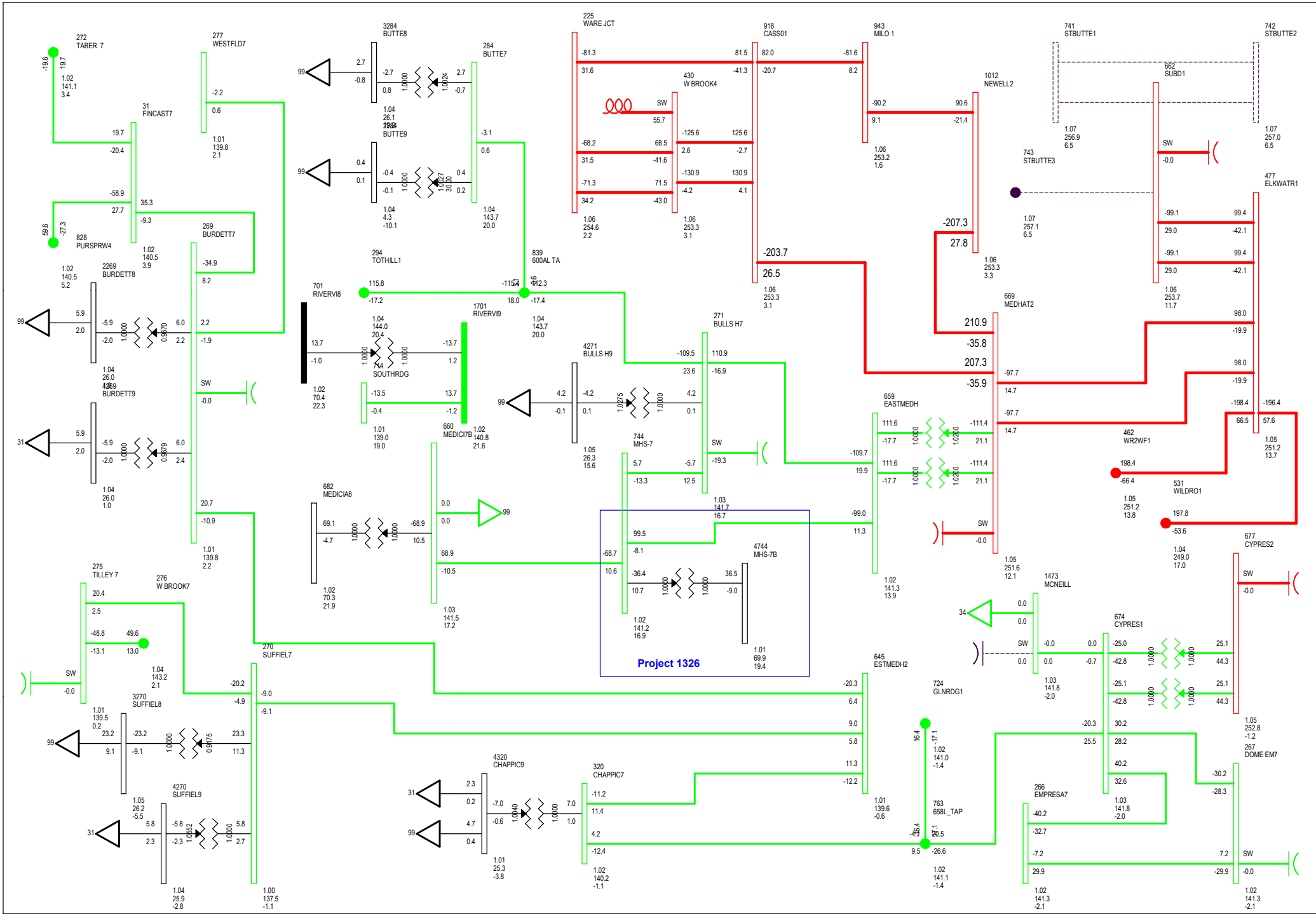


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.6 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-1: CATEGORY A - NO CONTINGENCY
THU, DEC 17 2015 7:48

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

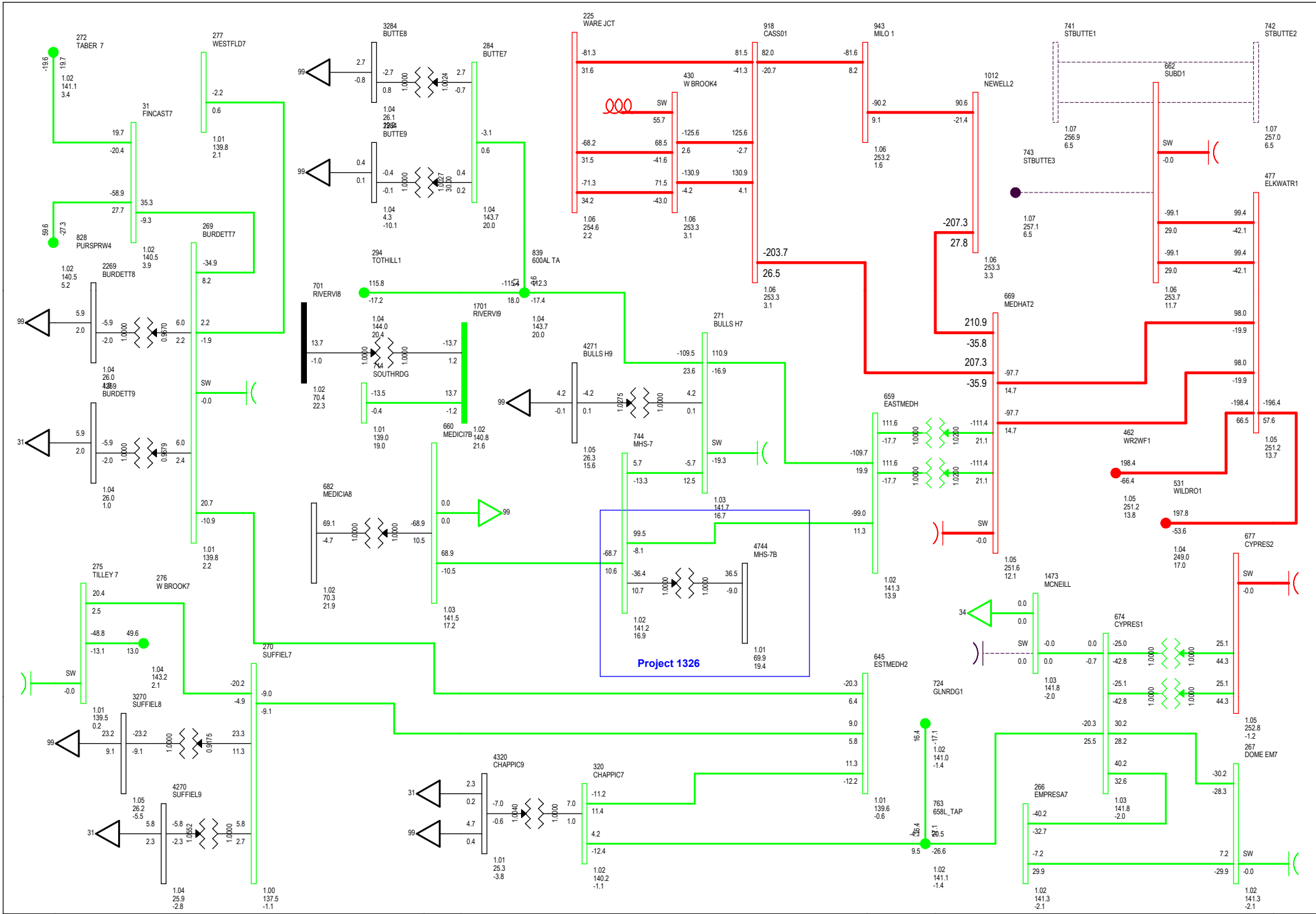


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.6 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-2: CATEGORY B - 675L (244S TO 41S)
THU, DEC 17 2015 7:48

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

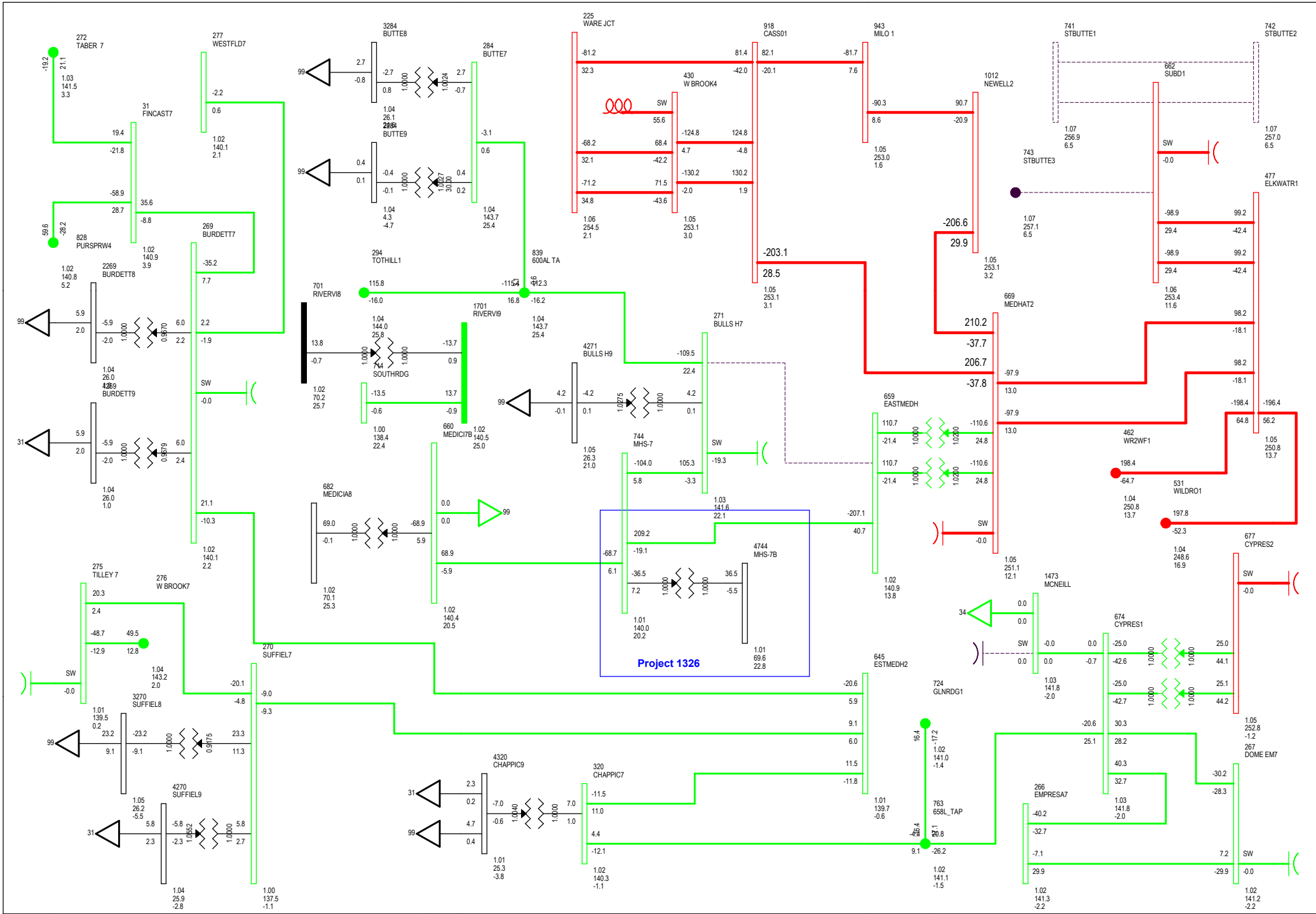


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.6 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-3: CATEGORY B - 880L (41S TO 523S)
THU, DEC 17 2015 7:48

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

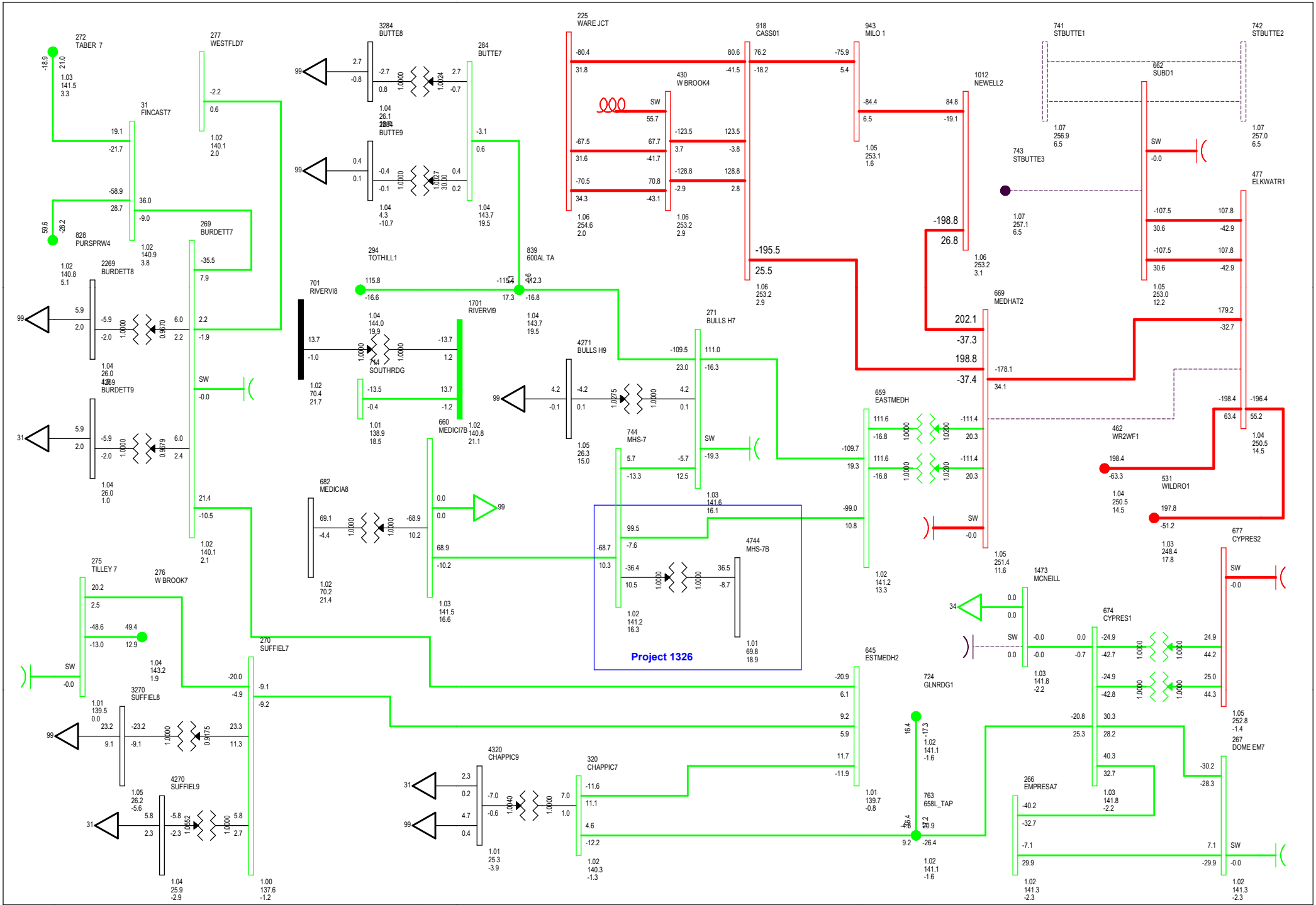


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -34.9 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-4: CATEGORY B - 676L (523S TO 244S)
THU, DEC 17 2015 7:49

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

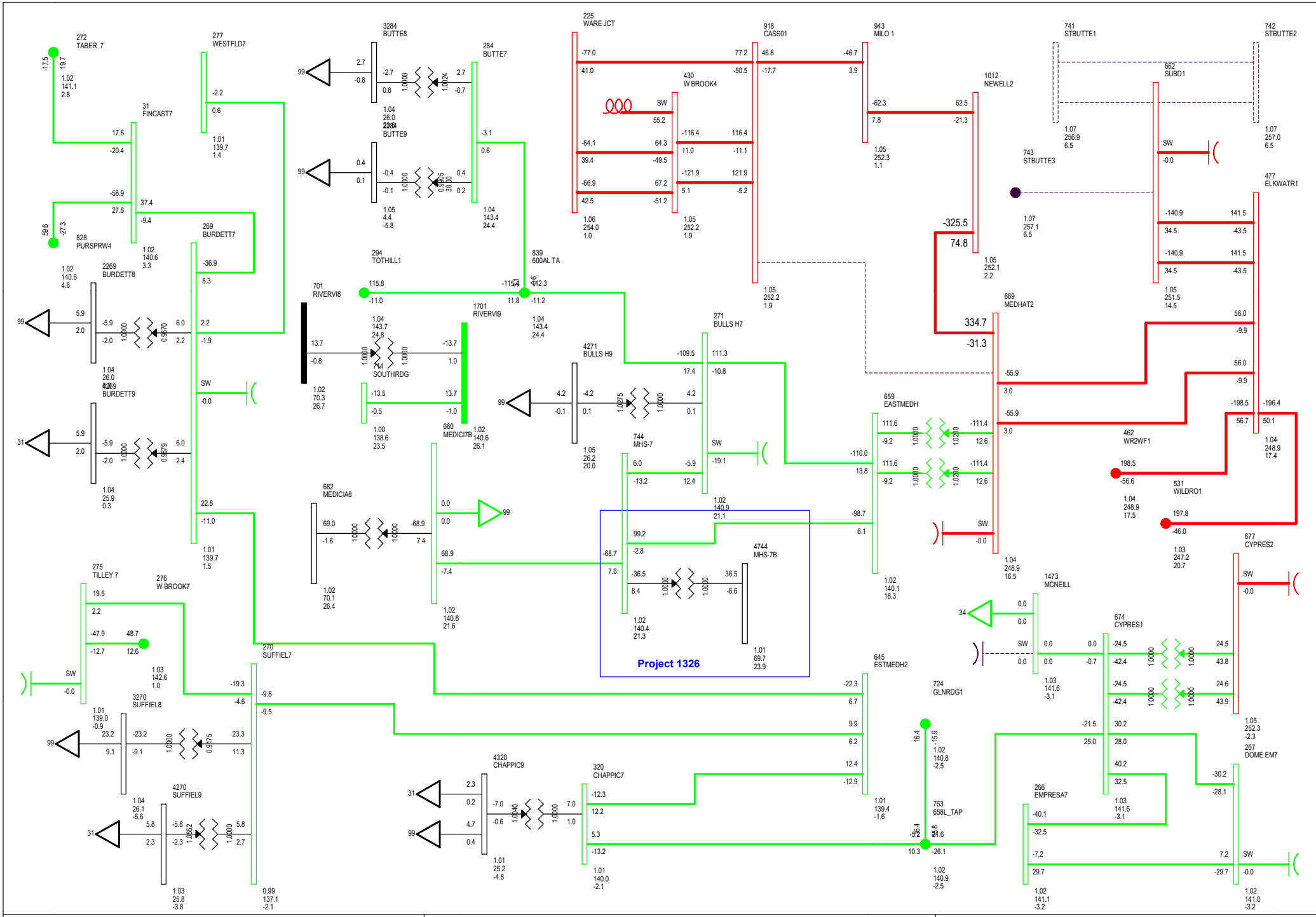


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.0 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-5: CATEGORY B - 1073L (244S TO 264S)
THU, DEC 17 2015 7:49

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

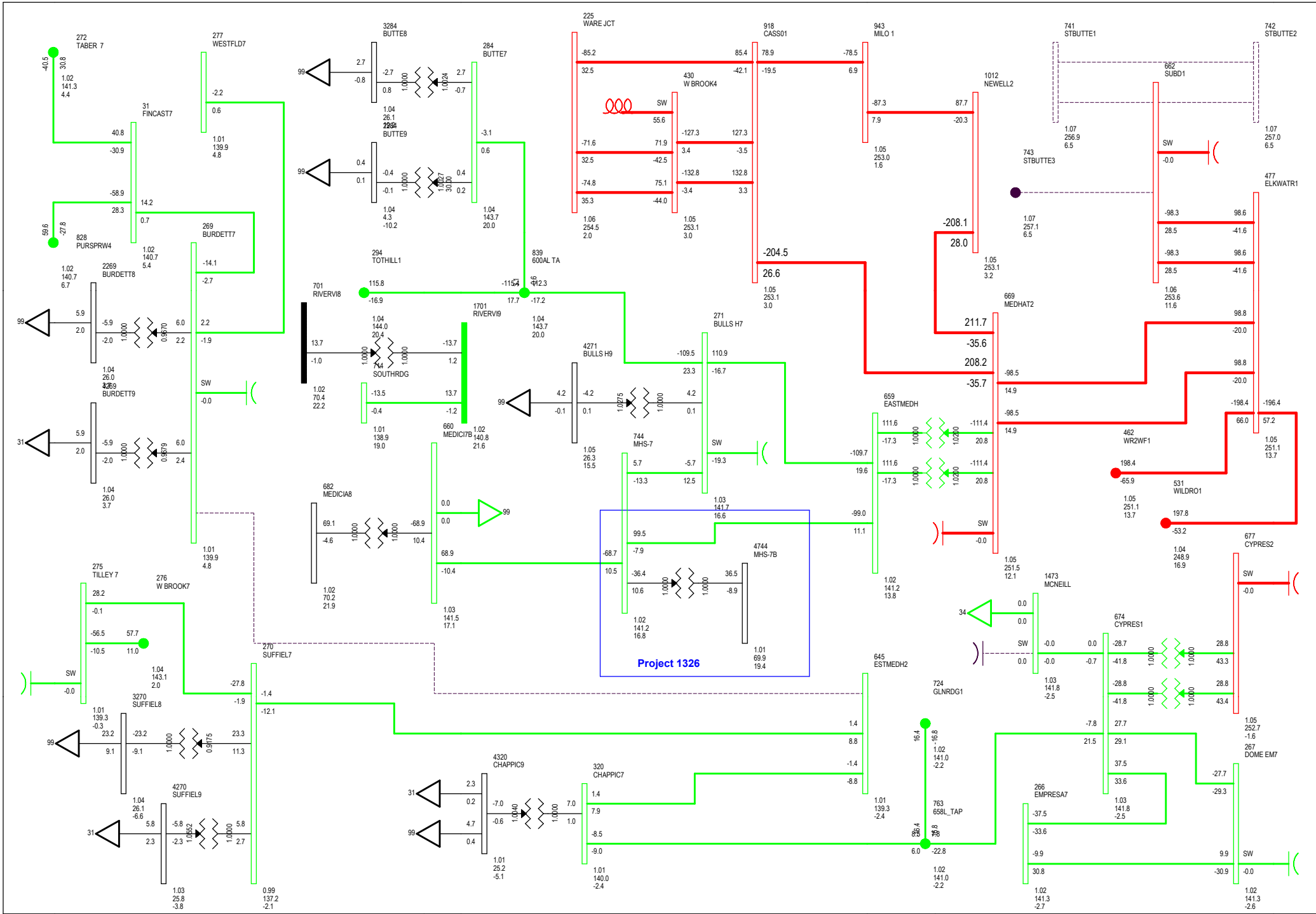


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 0.0 MW BC and MATL (Import): -30.7 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-6: CATEGORY B - 1034L (244S TO 324S)
THU, DEC 17 2015 7:49

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

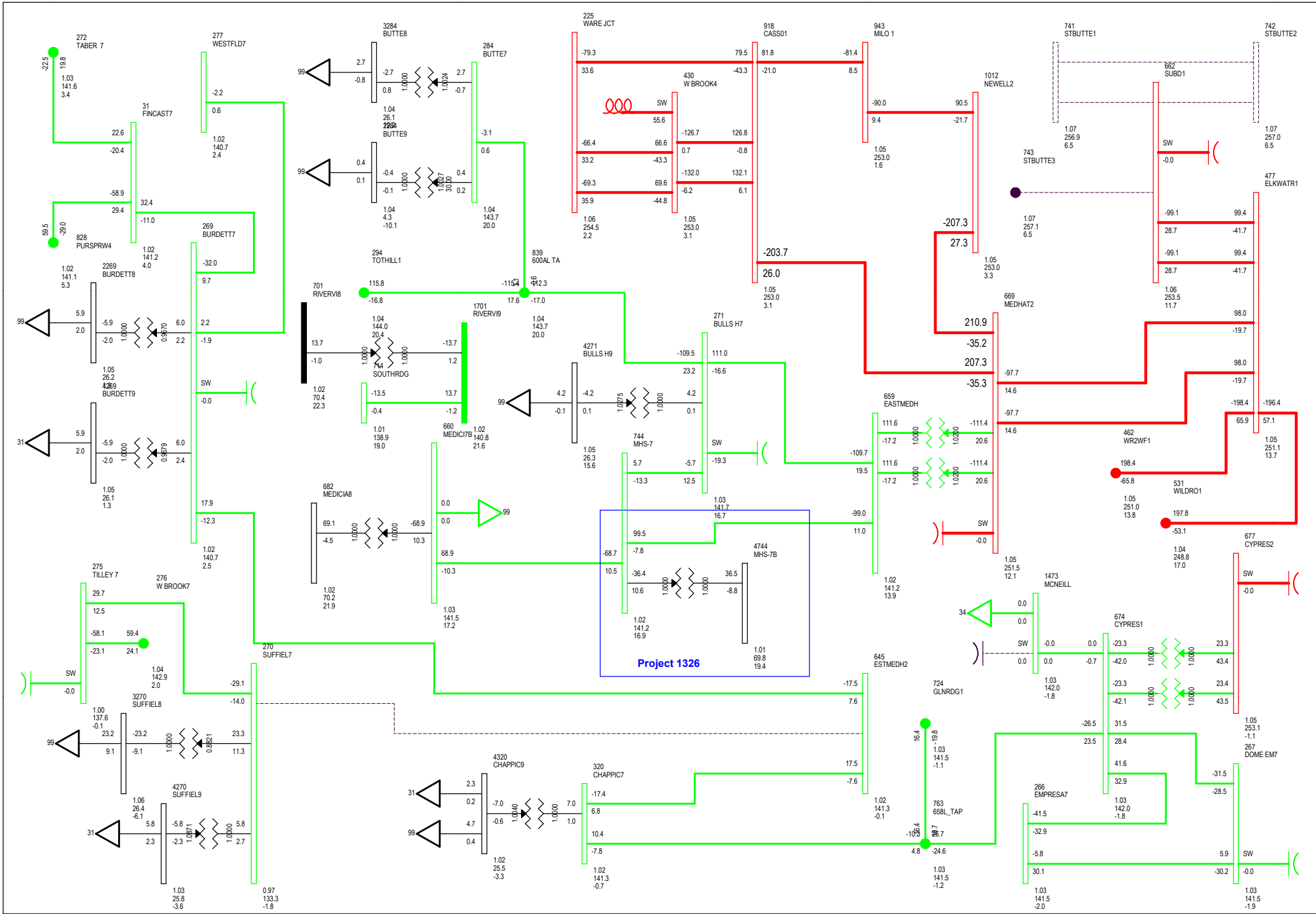


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.4 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-7: CATEGORY B - 879L (244S TO 368S)
THU, DEC 17 2015 7:50

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

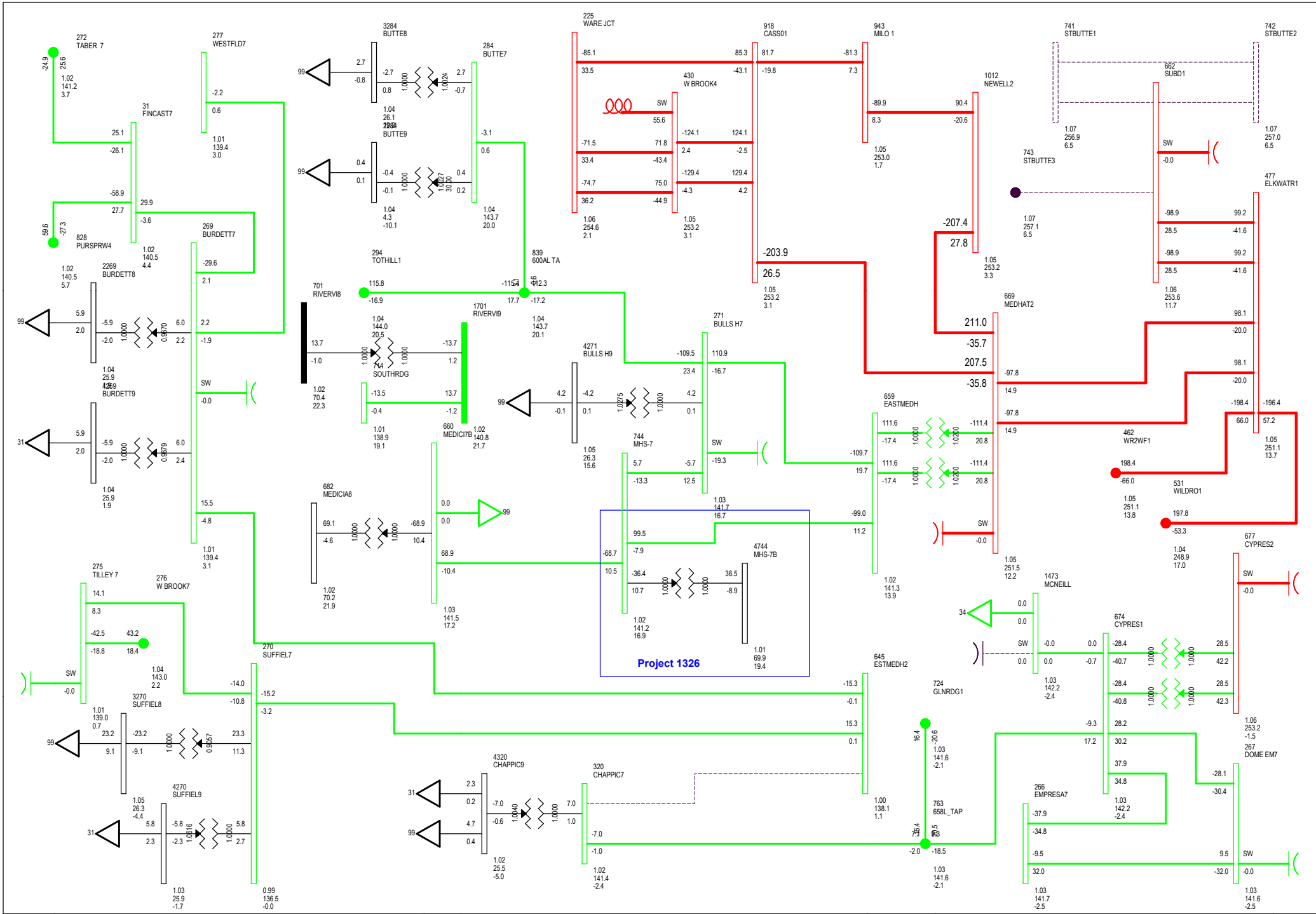


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.0 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-8: CATEGORY B - 892L (244S TO 368S)
THU, DEC 17 2015 7:50

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

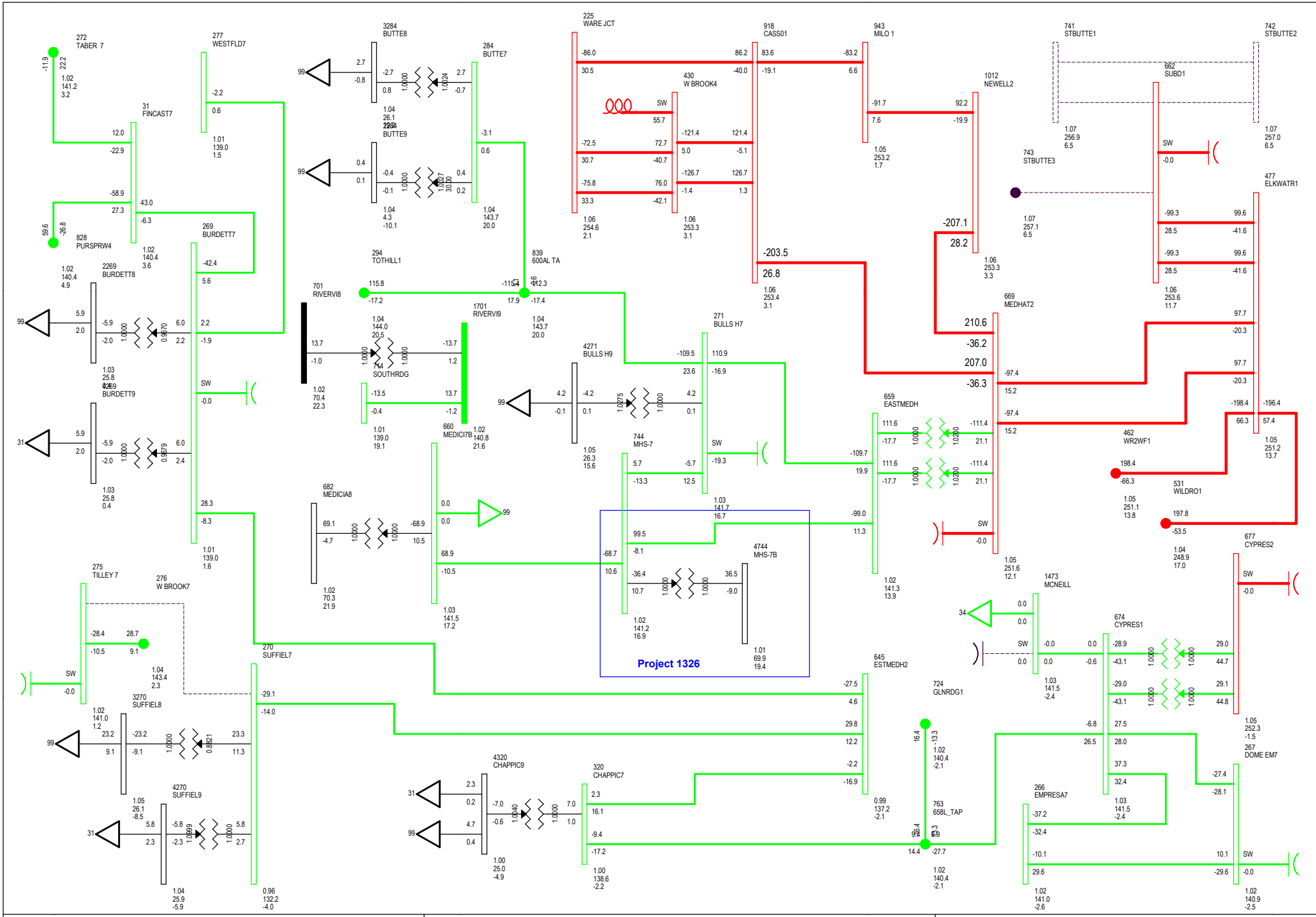


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.8 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-9: CATEGORY B - 674L (244S TO 649S)
THU, DEC 17 2015 7:50

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

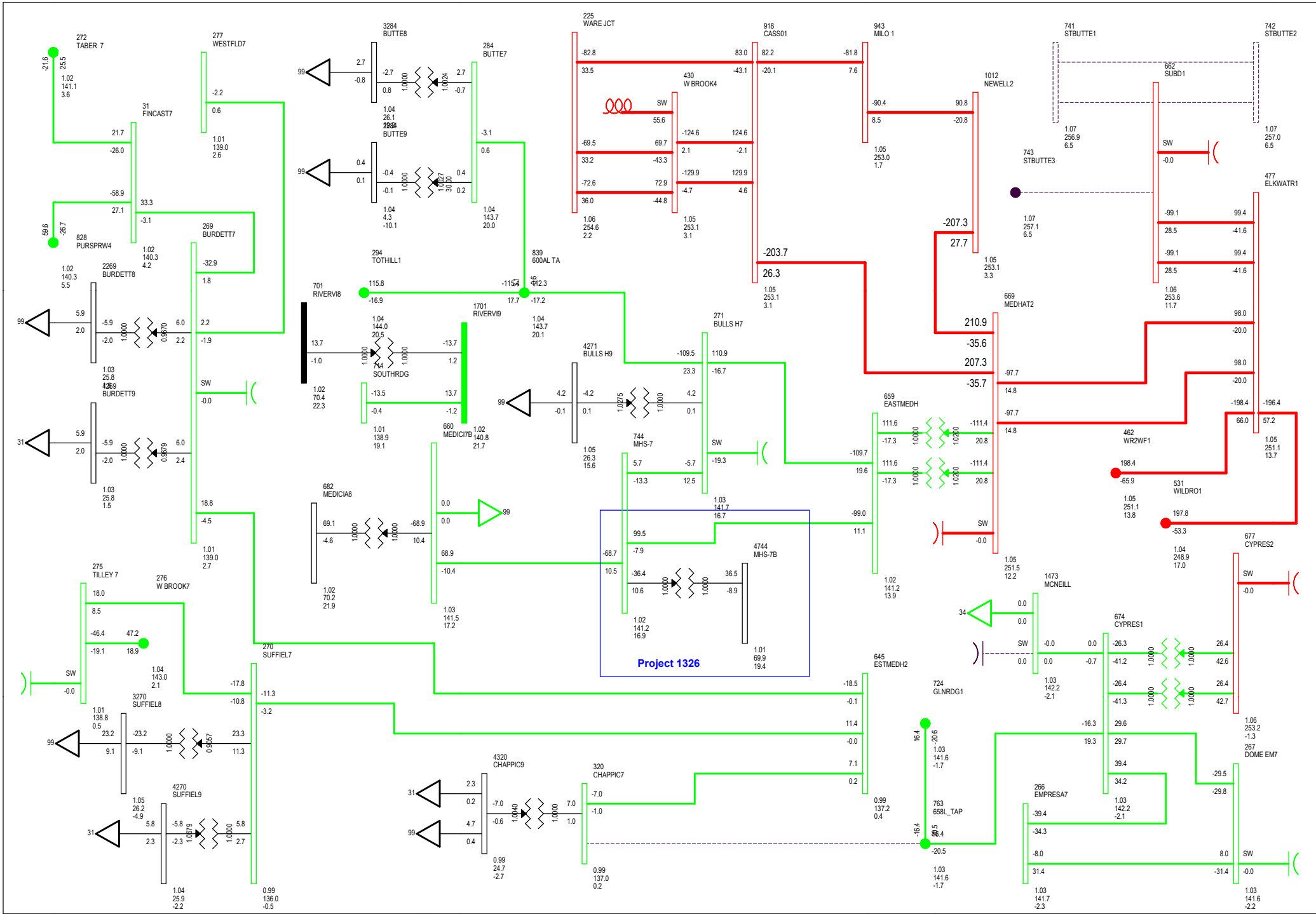


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -35.8 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-10: CATEGORY B - 100L (498S TO 895S)
THU, DEC 17 2015 7:50

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

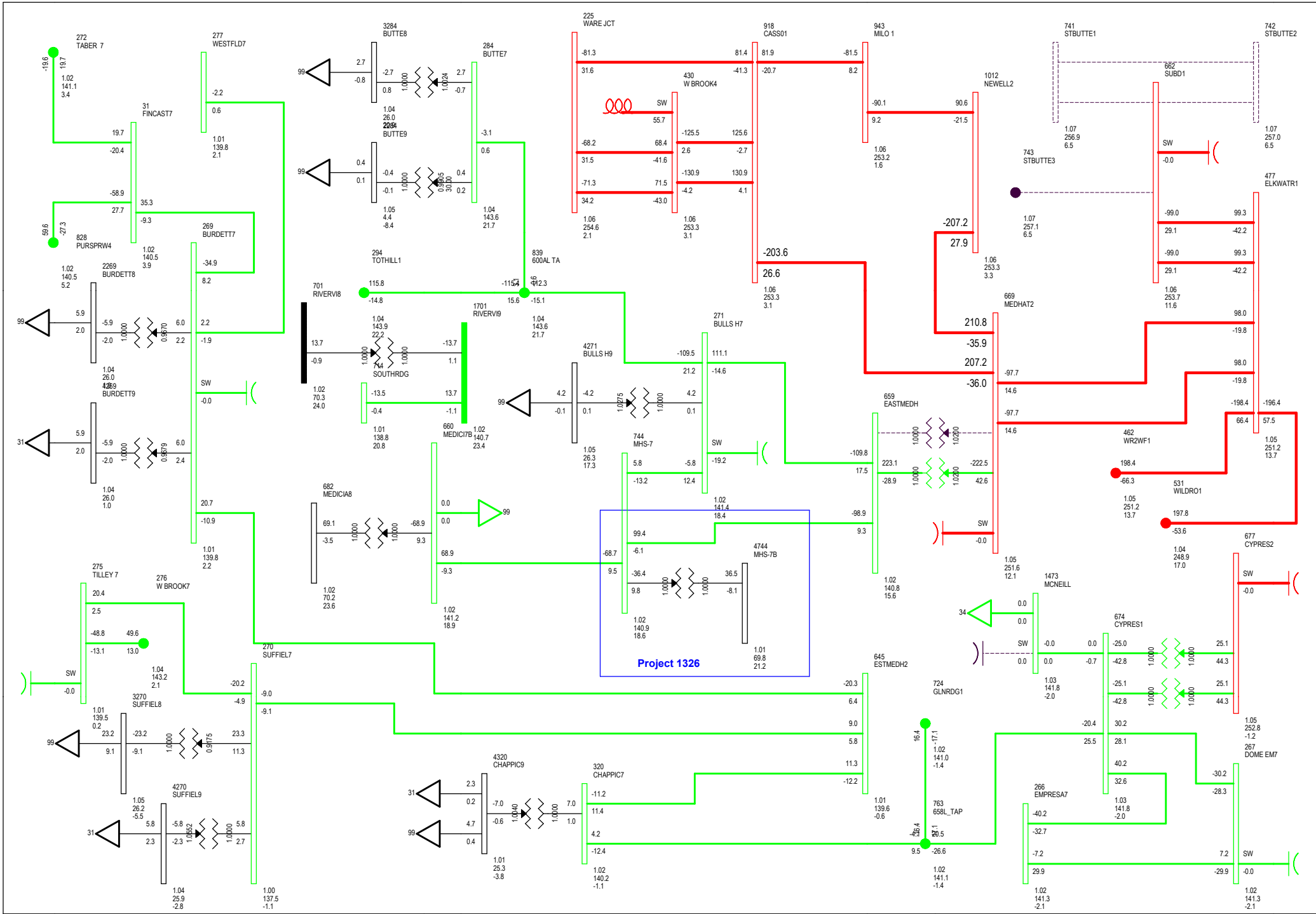


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.7 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-11: CATEGORY B - 658L (562S TO 649S)
THU, DEC 17 2015 7:51

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

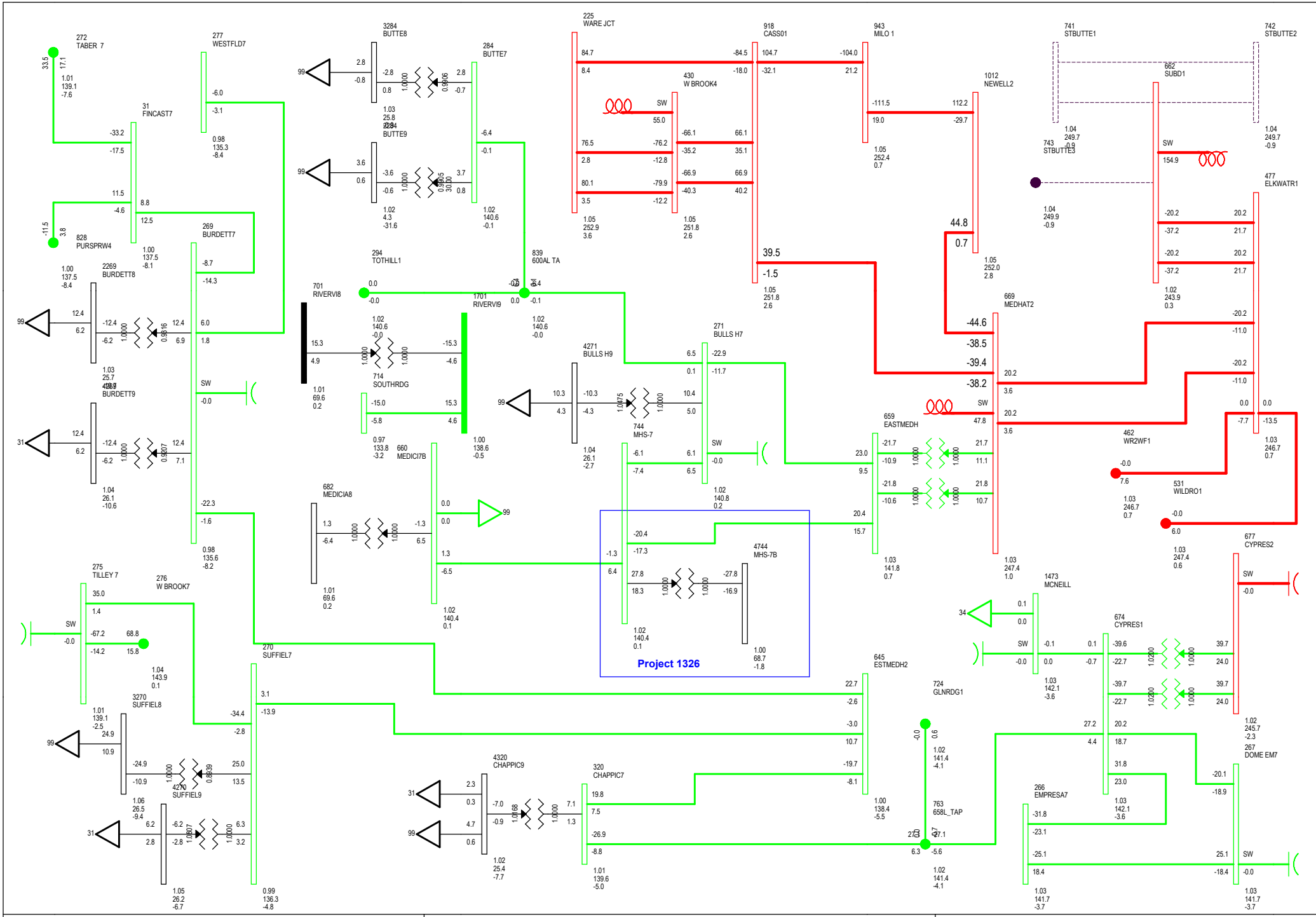


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.3 MW

2018 SUMMER LIGHT (POST_CONNECTION) SCENARIO 7
FIGURE E-12: CATEGORY B - TRANSFORMER T1 (244S)
THU, DEC 17 2015 7:51

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

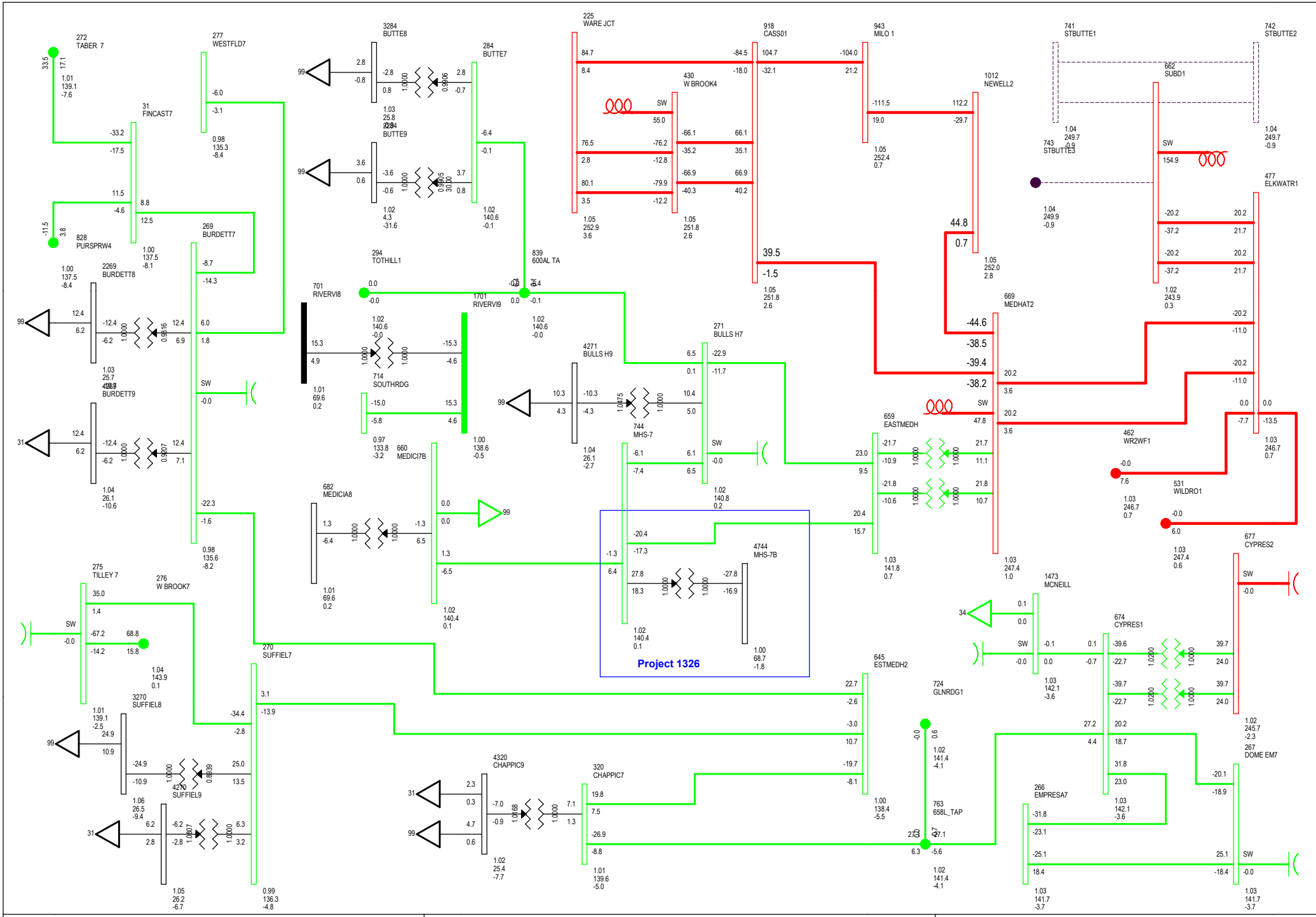


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 6.1 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-1: CATEGORY A - NO CONTINGENCY
THU, DEC 17 2015 7:52

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

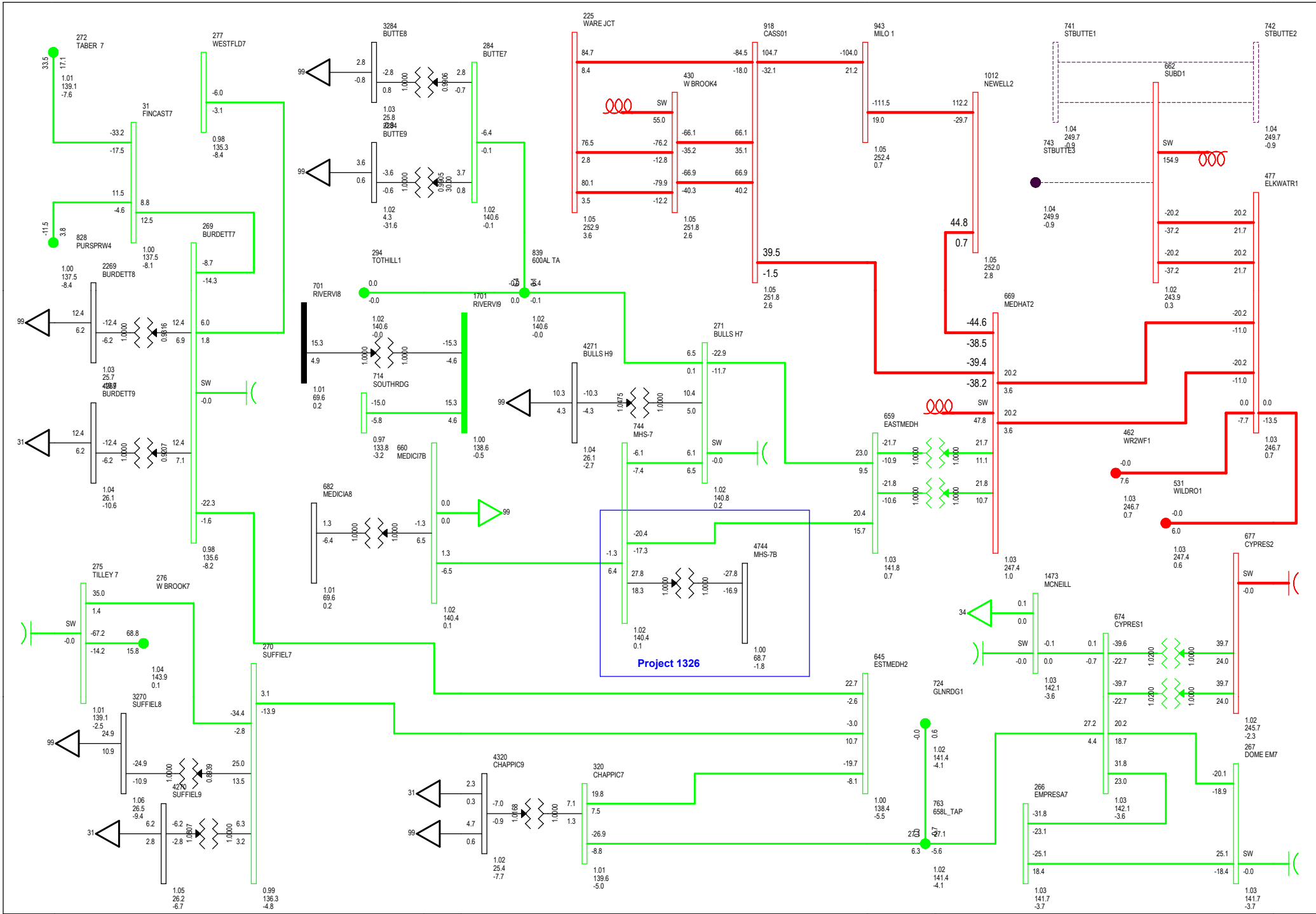


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 6.1 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-2: CATEGORY B - 675L (244S TO 41S)
THU, DEC 17 2015 7:52

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

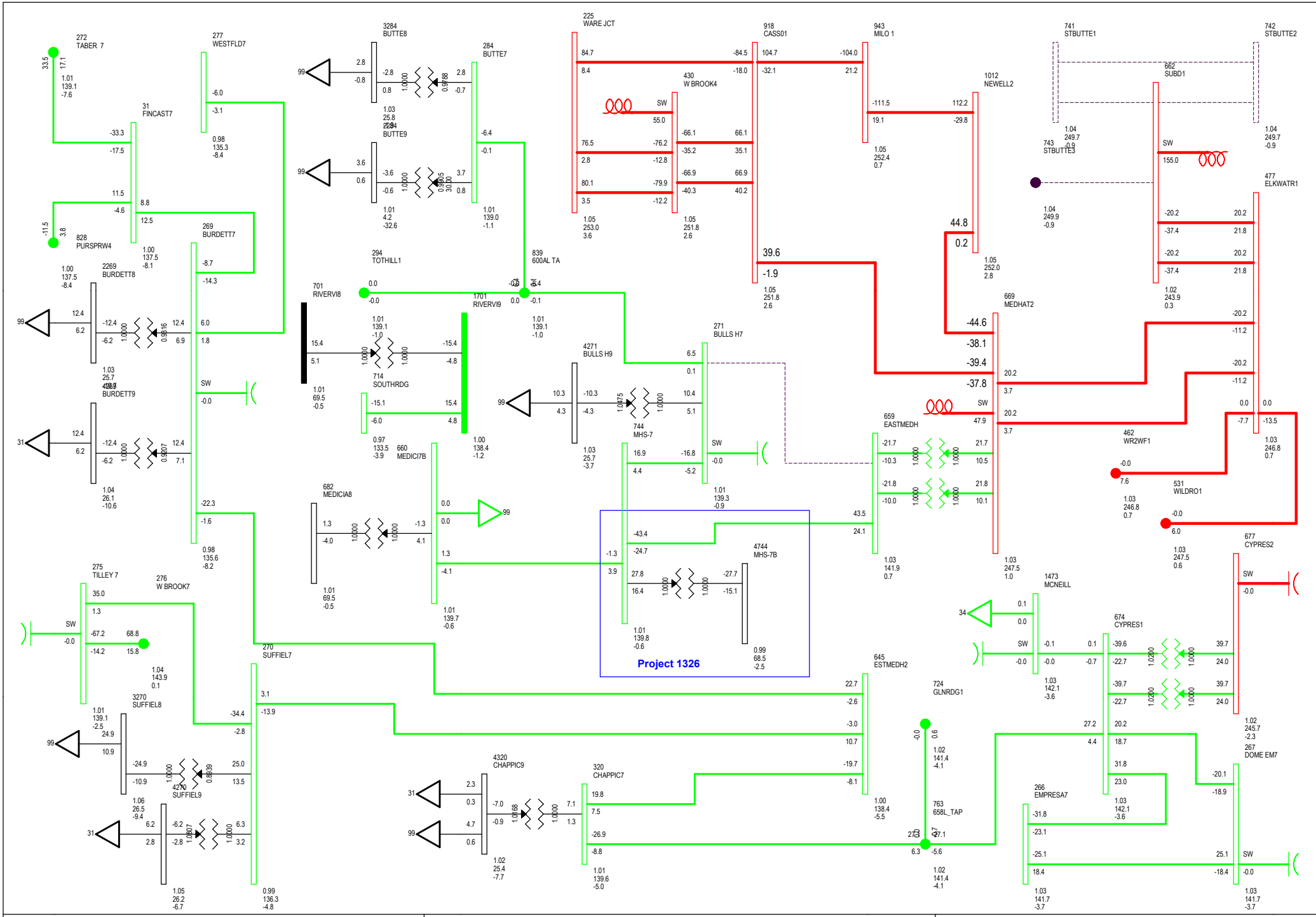


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 6.1 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-3: CATEGORY B - 880L (41S TO 523S)
THU, DEC 17 2015 7:53

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

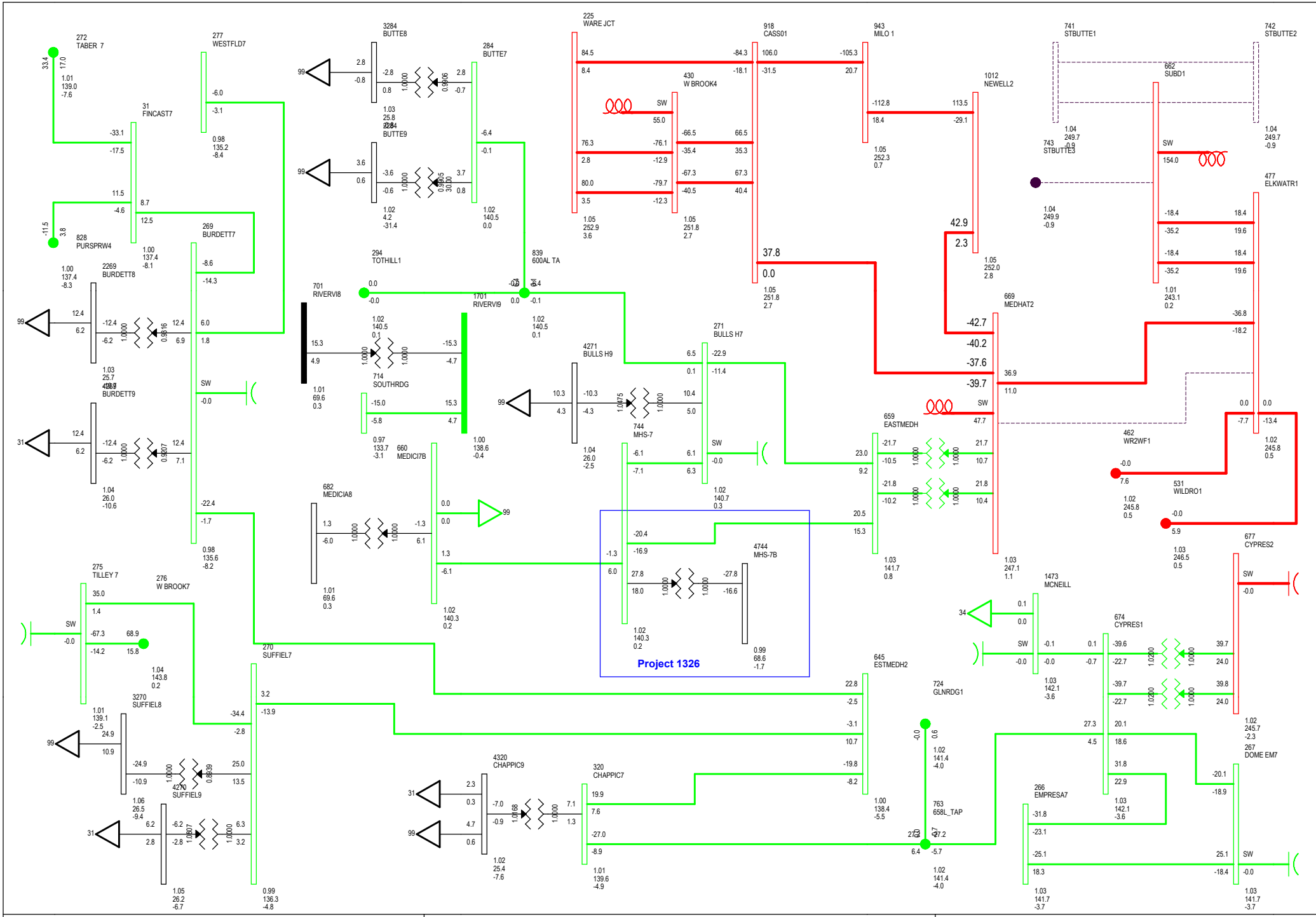


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 6.1 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-4: CATEGORY B - 676L (523S TO 244S)
THU, DEC 17 2015 7:53

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

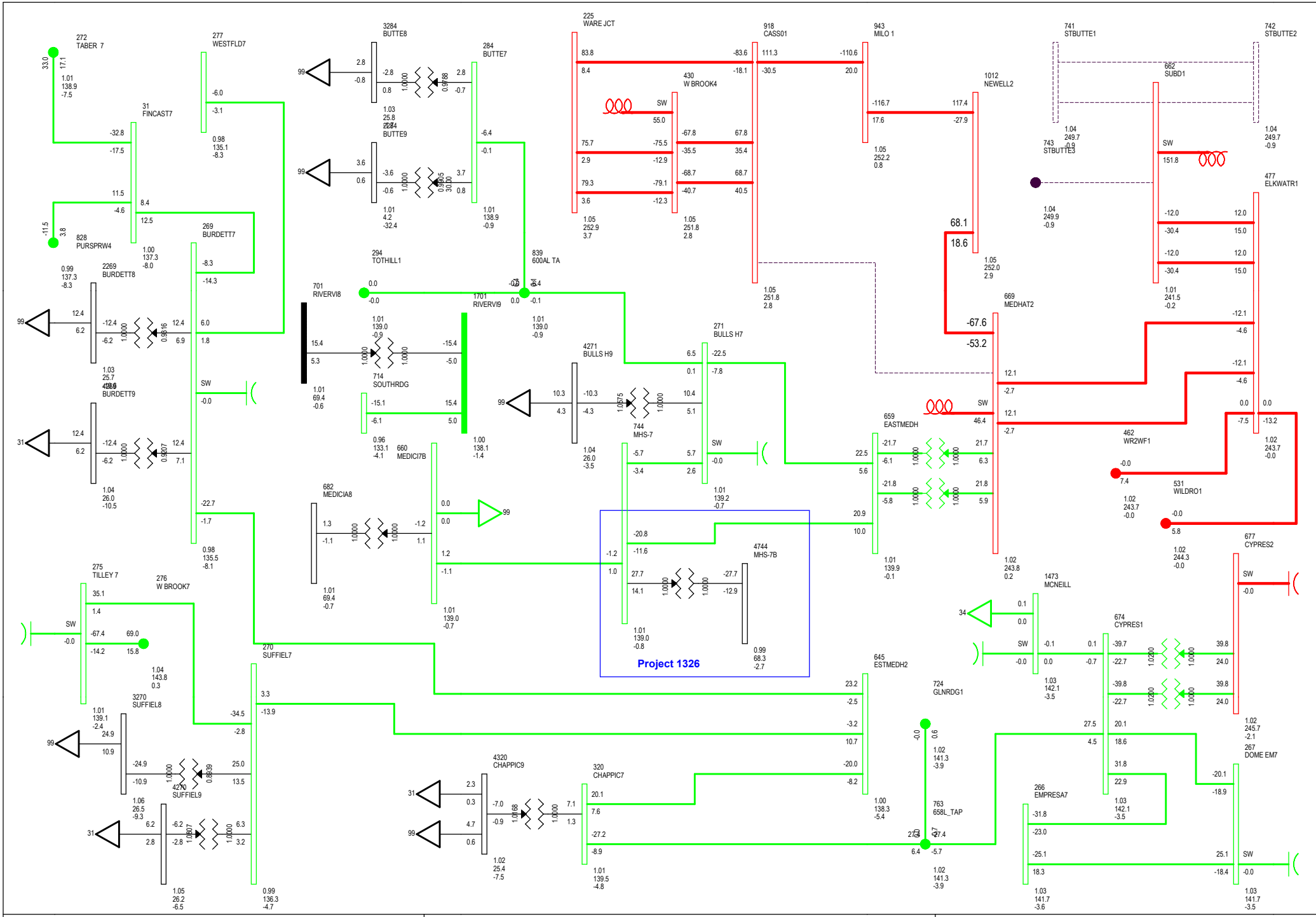


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 6.2 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-5: CATEGORY B - 1073L (244S TO 264S)
THU, DEC 17 2015 7:53

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

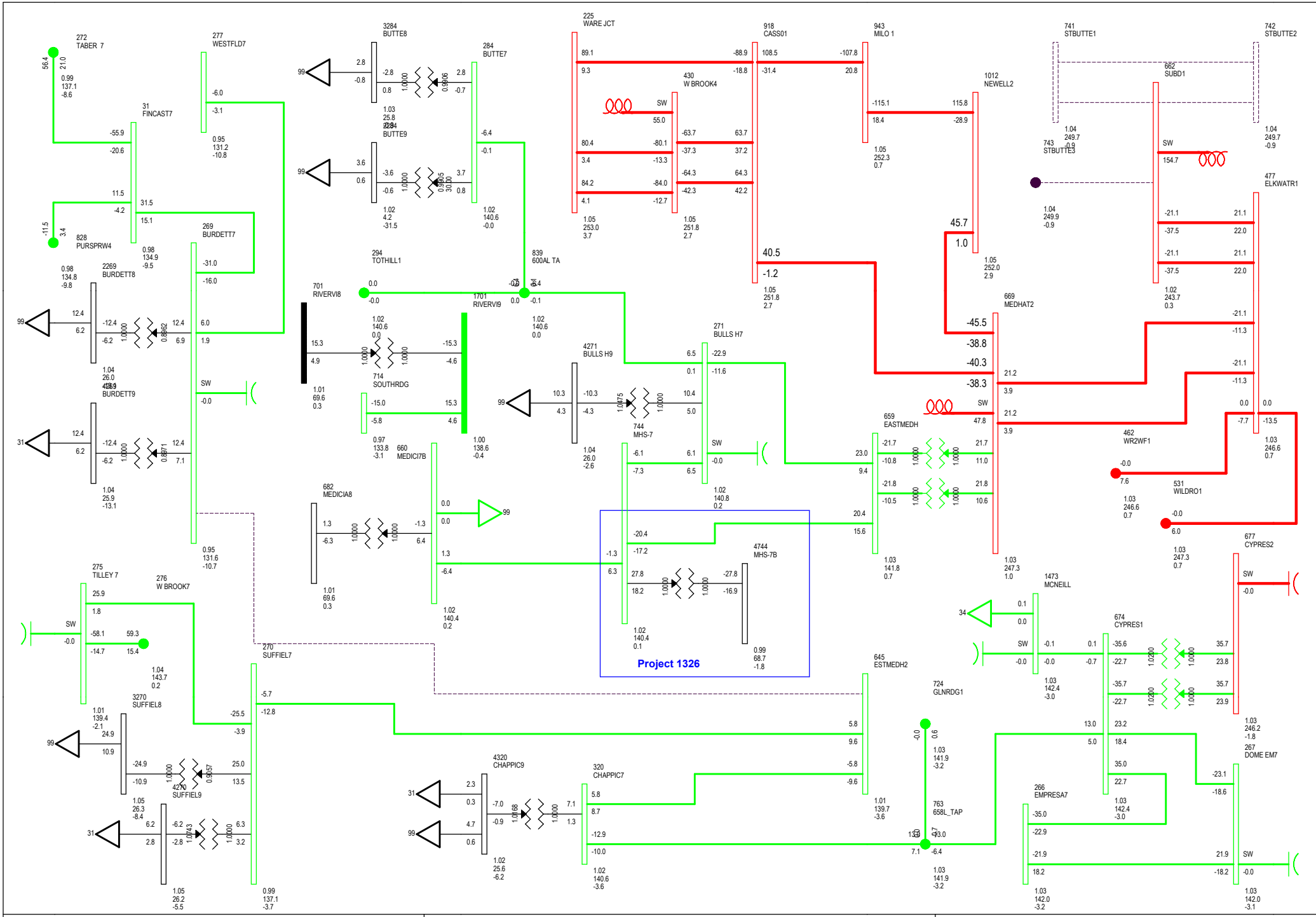


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 6.6 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-6: CATEGORY B - 1034L (244S TO 324S)
THU, DEC 17 2015 7:54

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

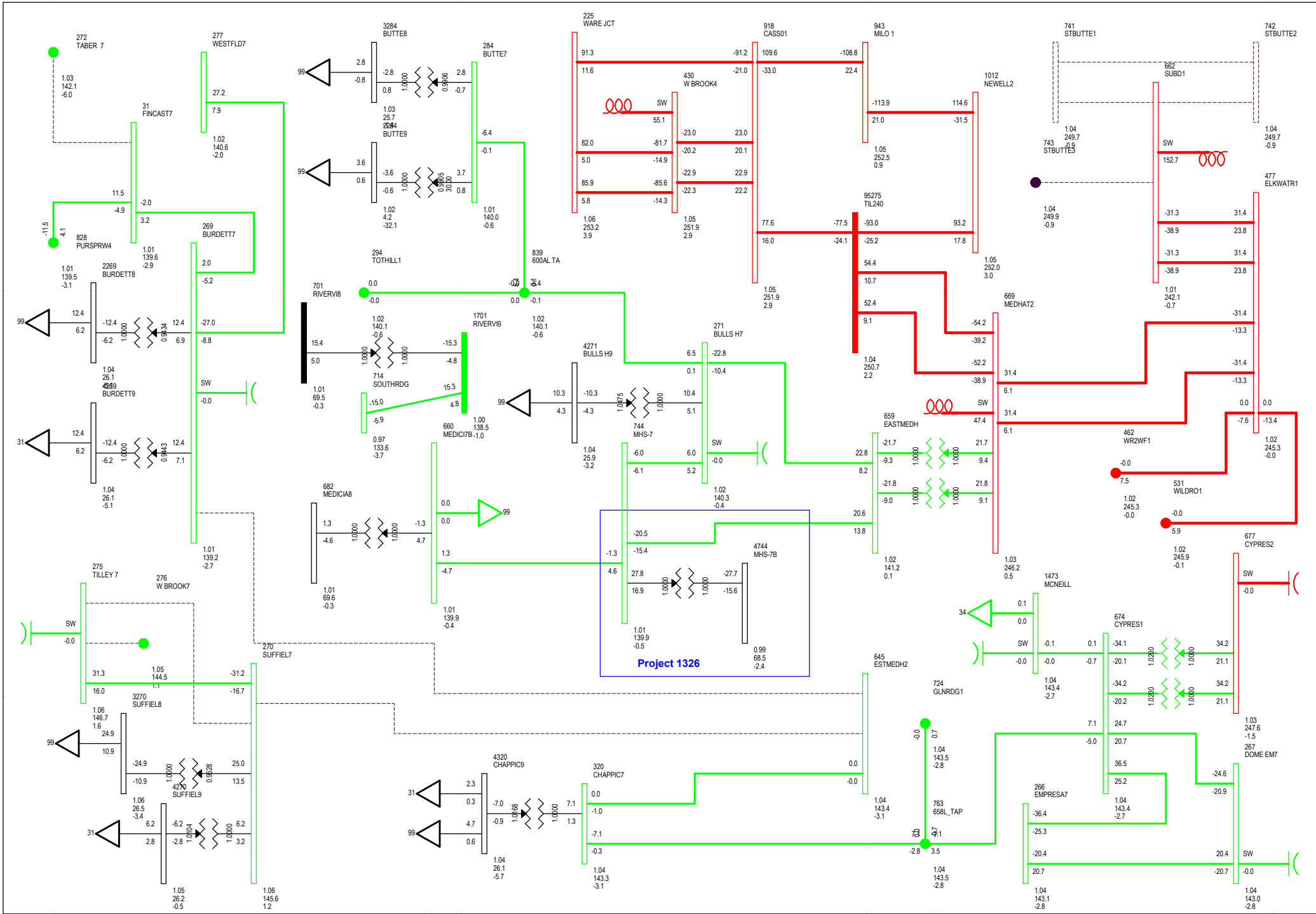


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 7.2 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-7: CATEGORY B - 879L (244S TO 368S)
THU, DEC 17 2015 7:54

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

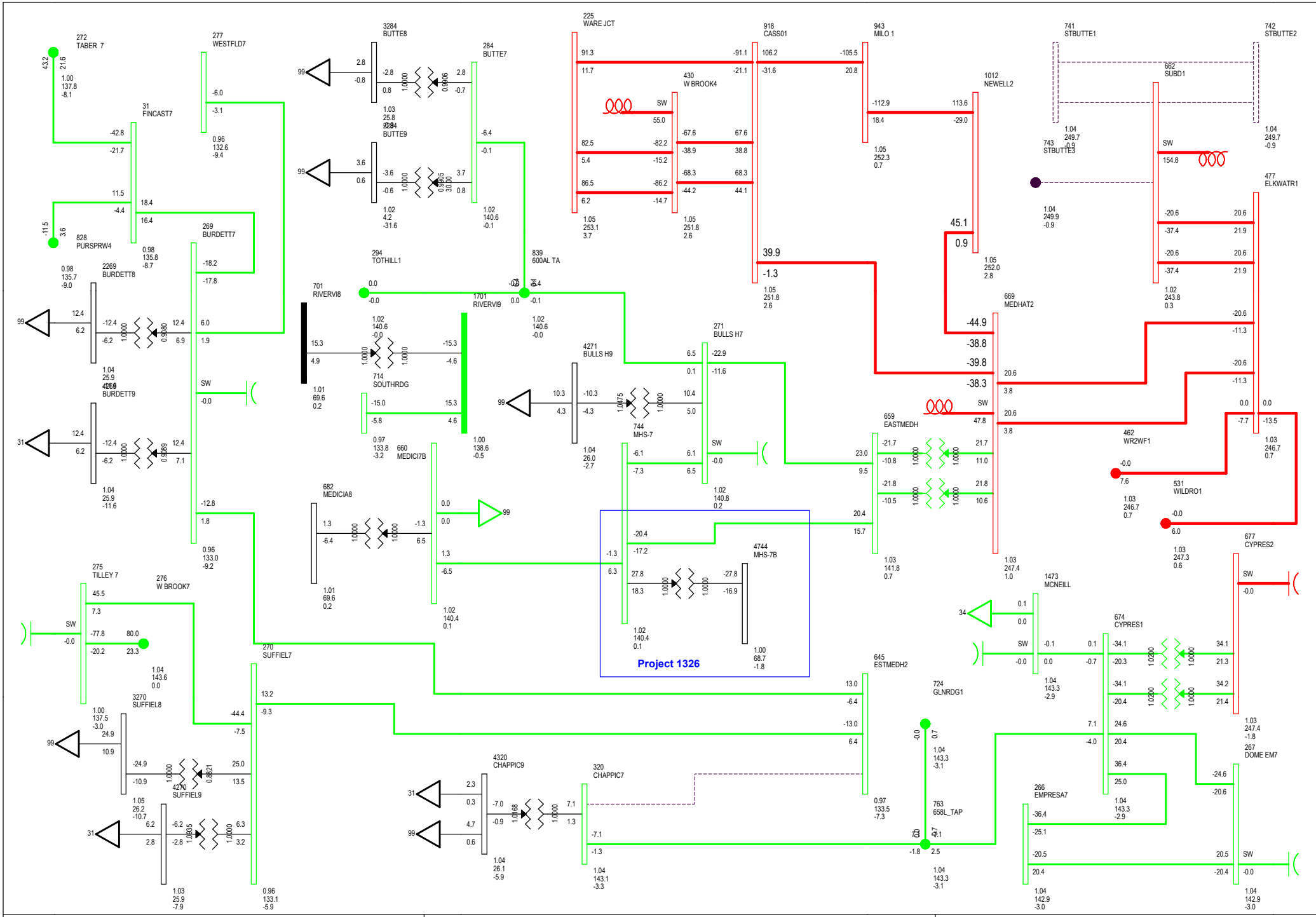


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 1.5 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE A-8: CATEGORY B - 892L (244S TO 368S)
MON, NOV 30 2015 7:45

Bus - Voltage (kV/pu)
Branch - MW/% Rate A
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=25.000 <=69.000 <=138.000 <=240.000 <=500.000 >500.000

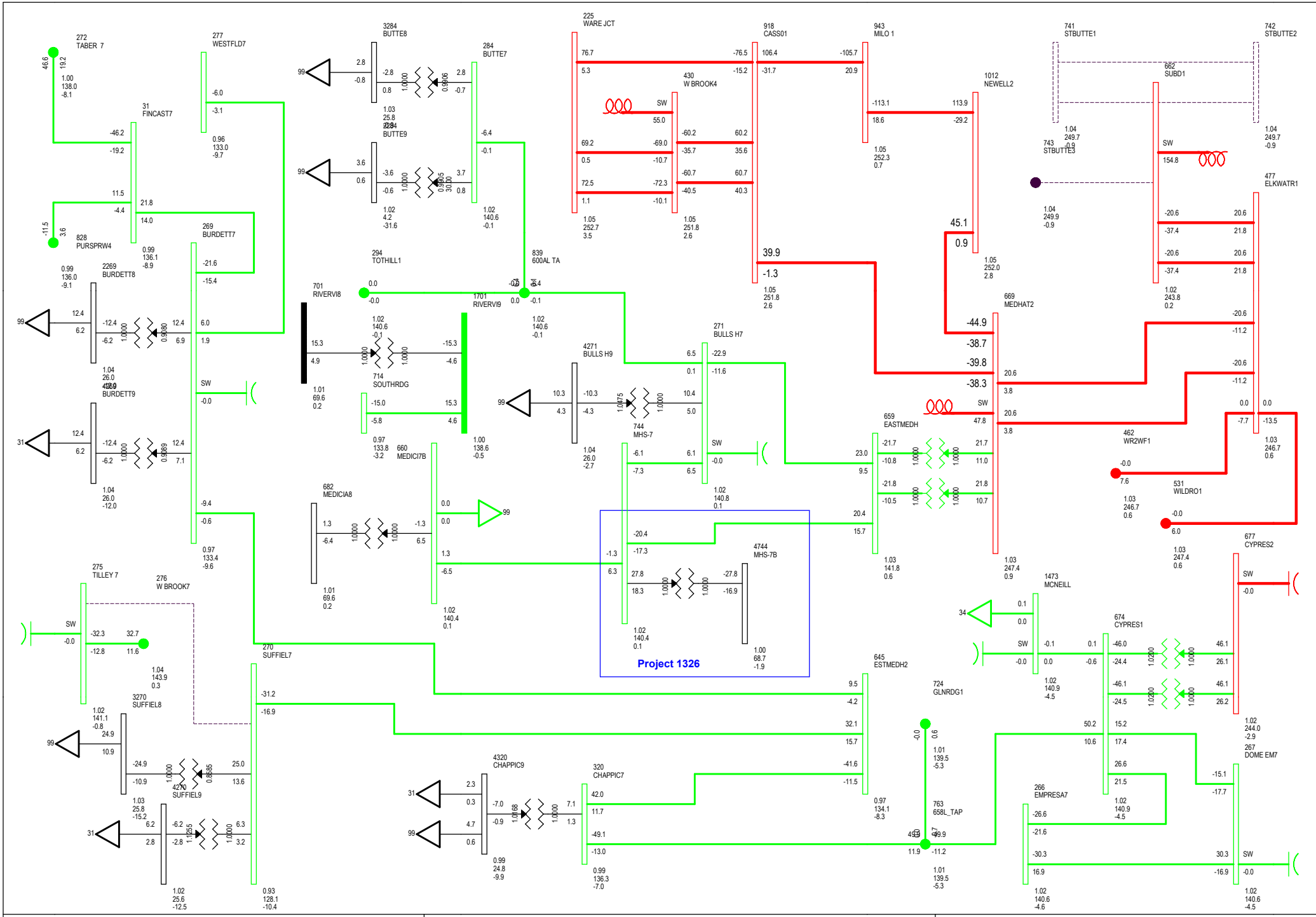


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 7.0 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-9: CATEGORY B - 674L (244S TO 649S)
THU, DEC 17 2015 7:54

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

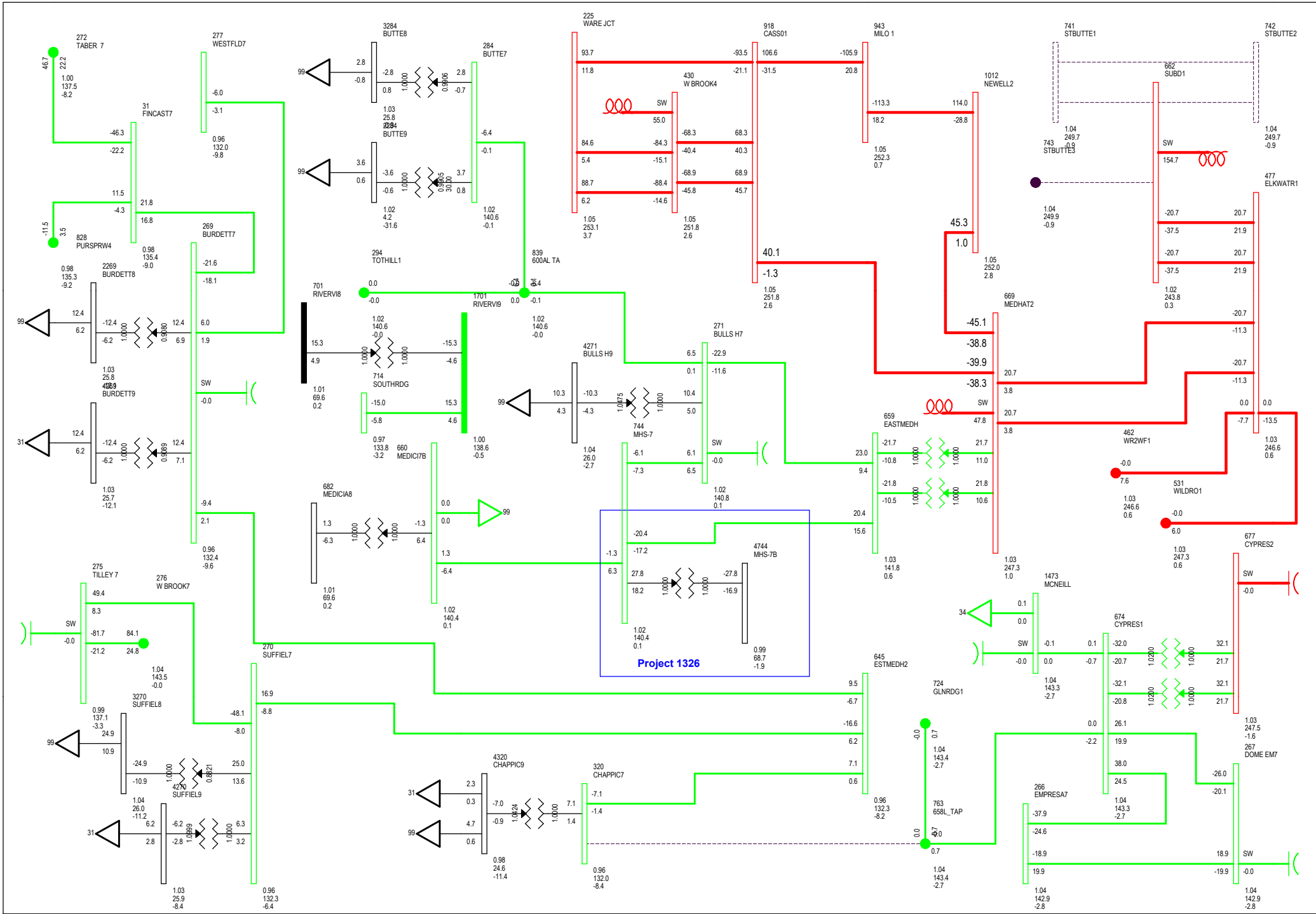


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 8.6 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-10: CATEGORY B - 100L (498S TO 895S)
THU, DEC 17 2015 7:55

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

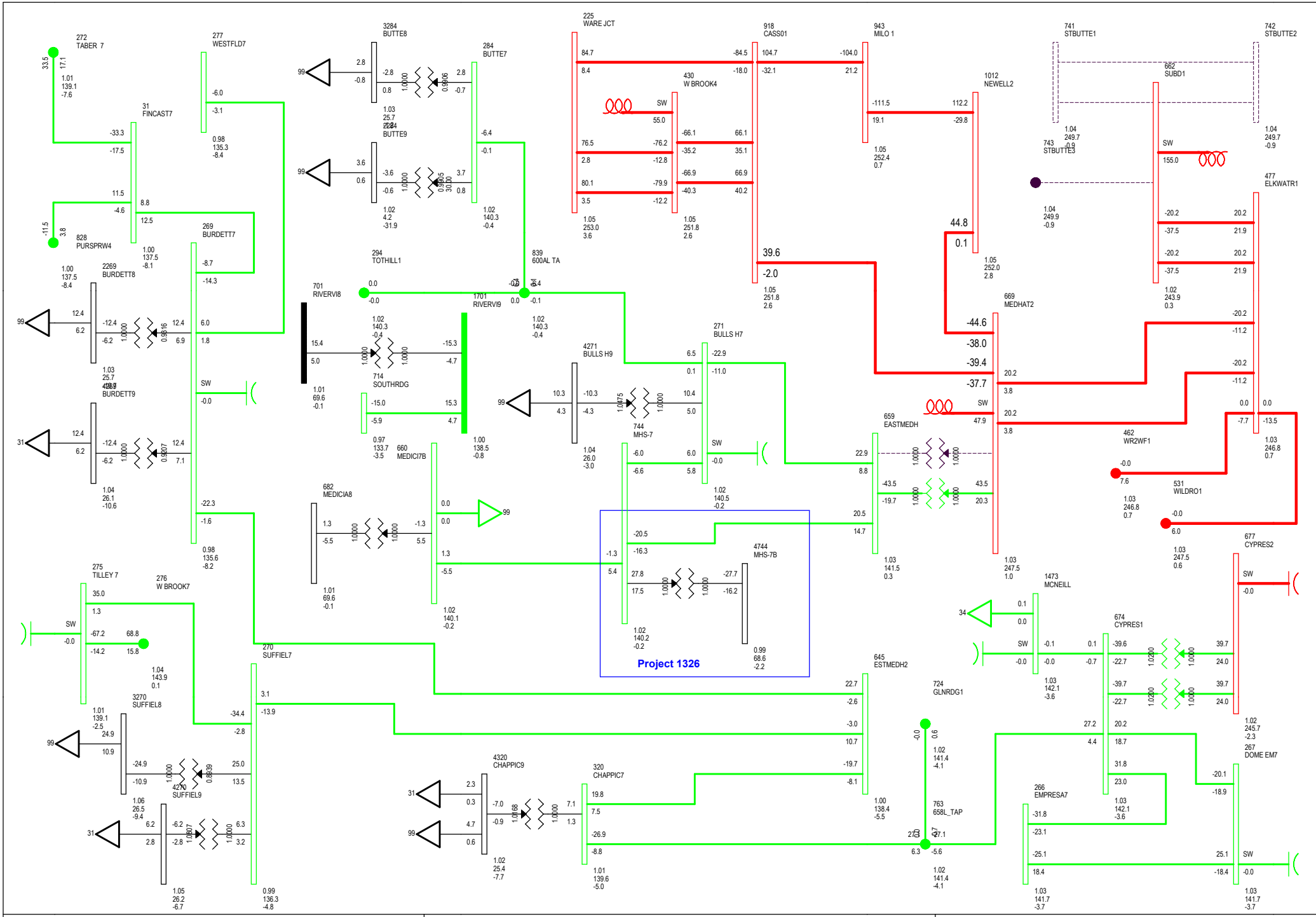


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 7.6 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-11: CATEGORY B - 658L (562S TO 649S)
THU, DEC 17 2015 7:55

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

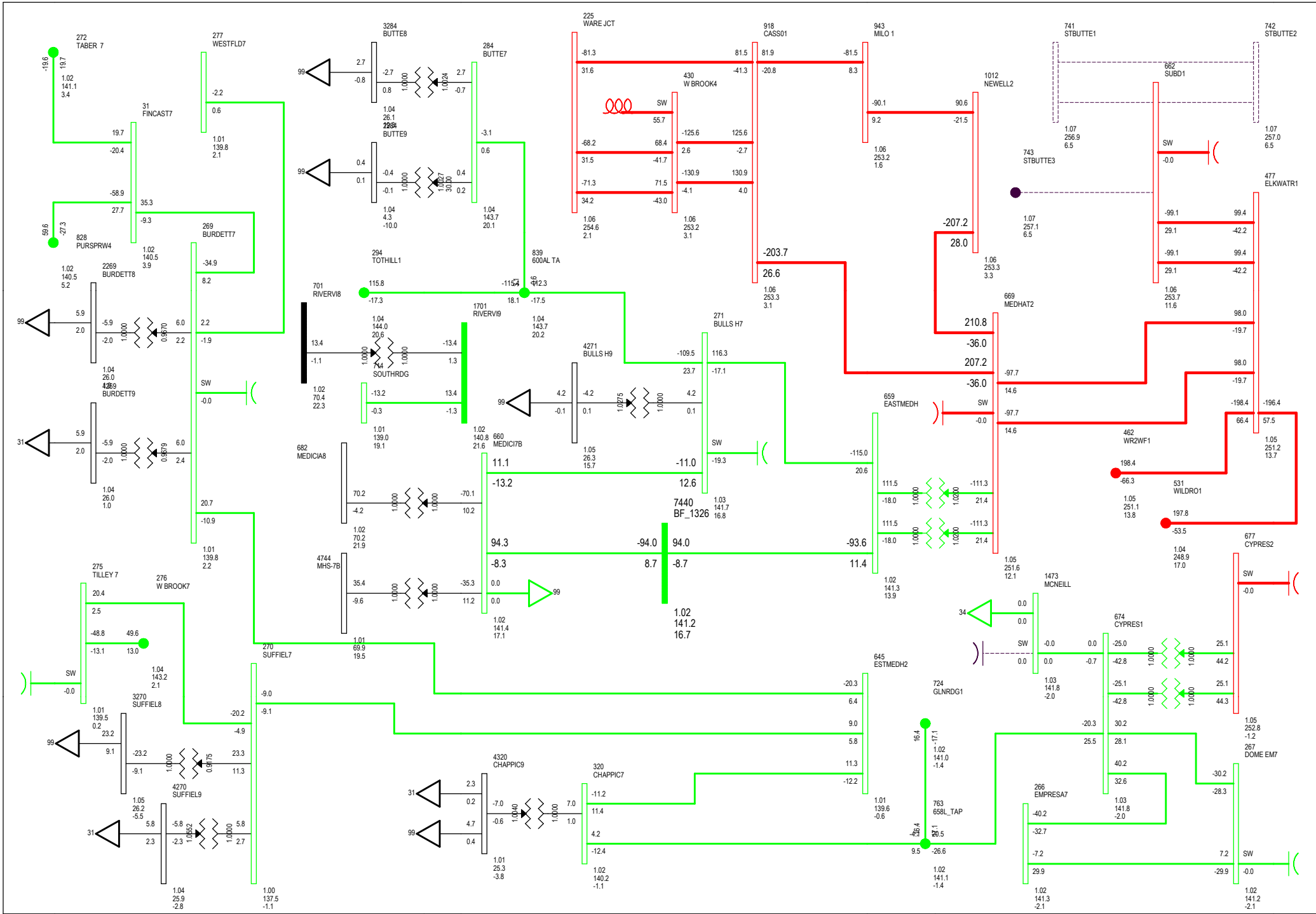


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.1 MW BC and MATL (Import): 6.1 MW

2018 SUMMER PEAK (POST_CONNECTION) SCENARIO 8
FIGURE F-12: CATEGORY B - TRANSFORMER T1 (244S)
THU, DEC 17 2015 7:55

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

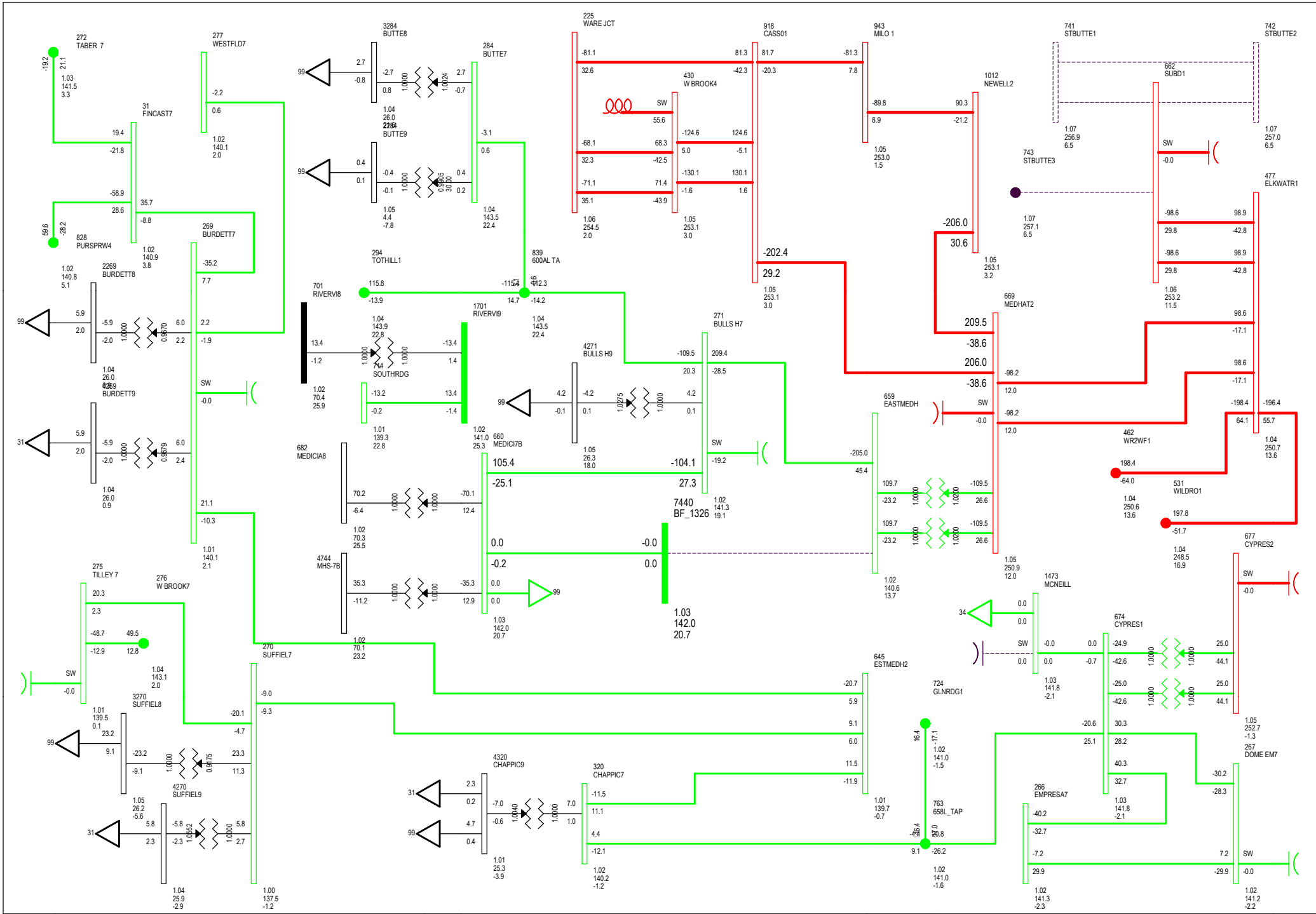


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.4 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-1: CATEGORY A - NO CONTINGENCY
THU, DEC 17 2015 7:56

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

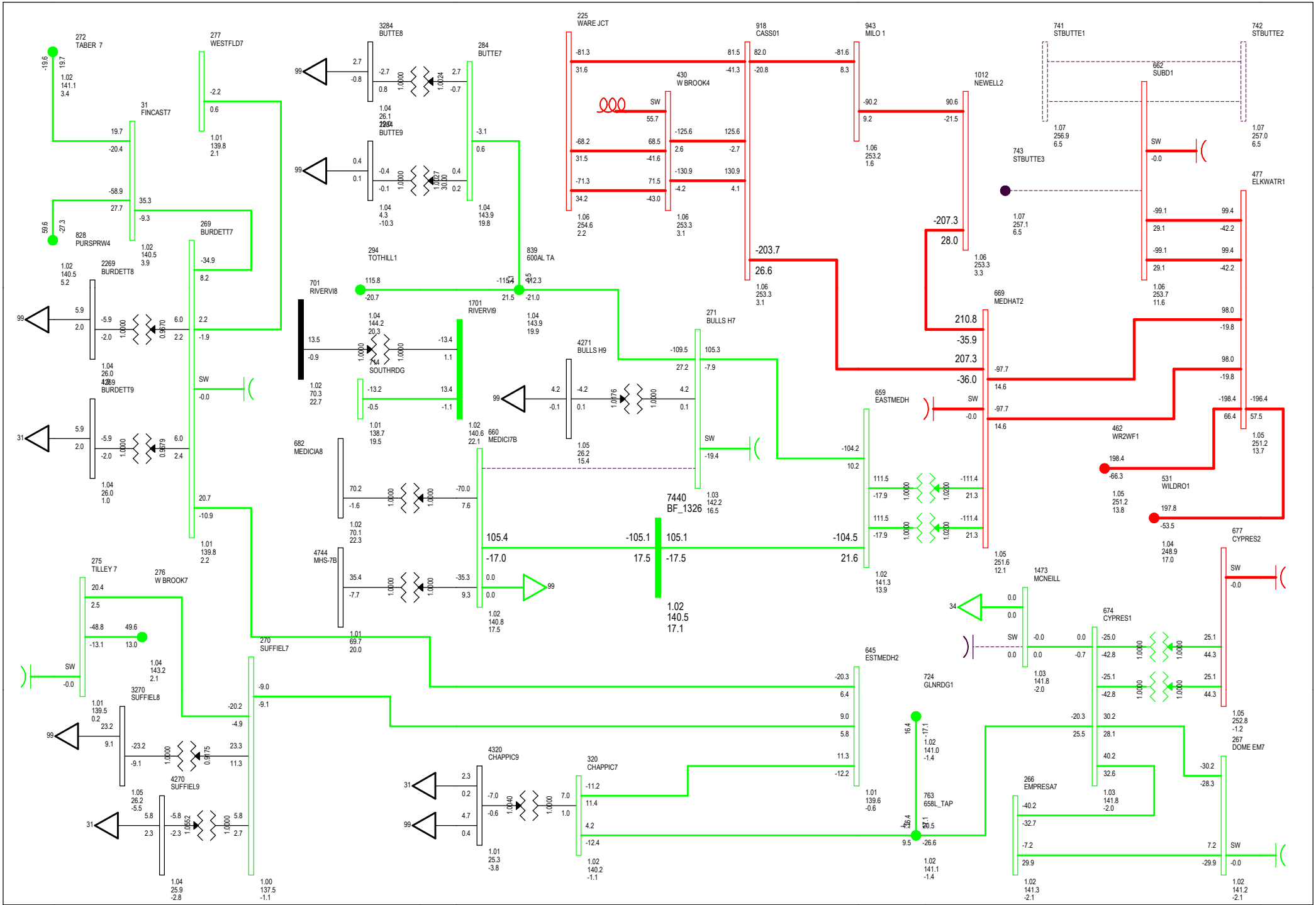


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -33.0 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-2: CATEGORY B - 675L (244S TO 41S)
THU, DEC 17 2015 7:57

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

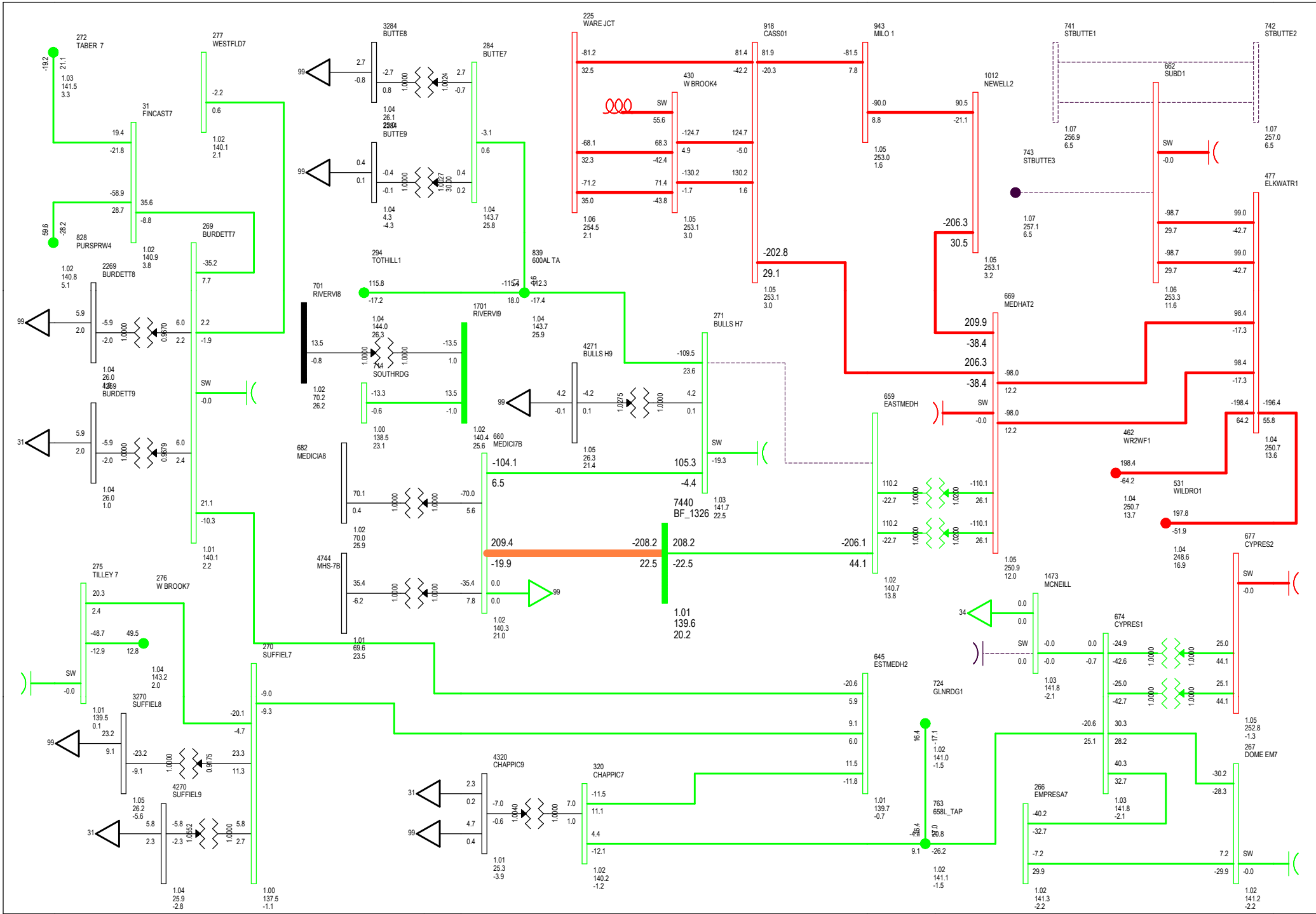


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.5 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-3: CATEGORY B - 880L (41S TO 523S)
THU, DEC 17 2015 7:57

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

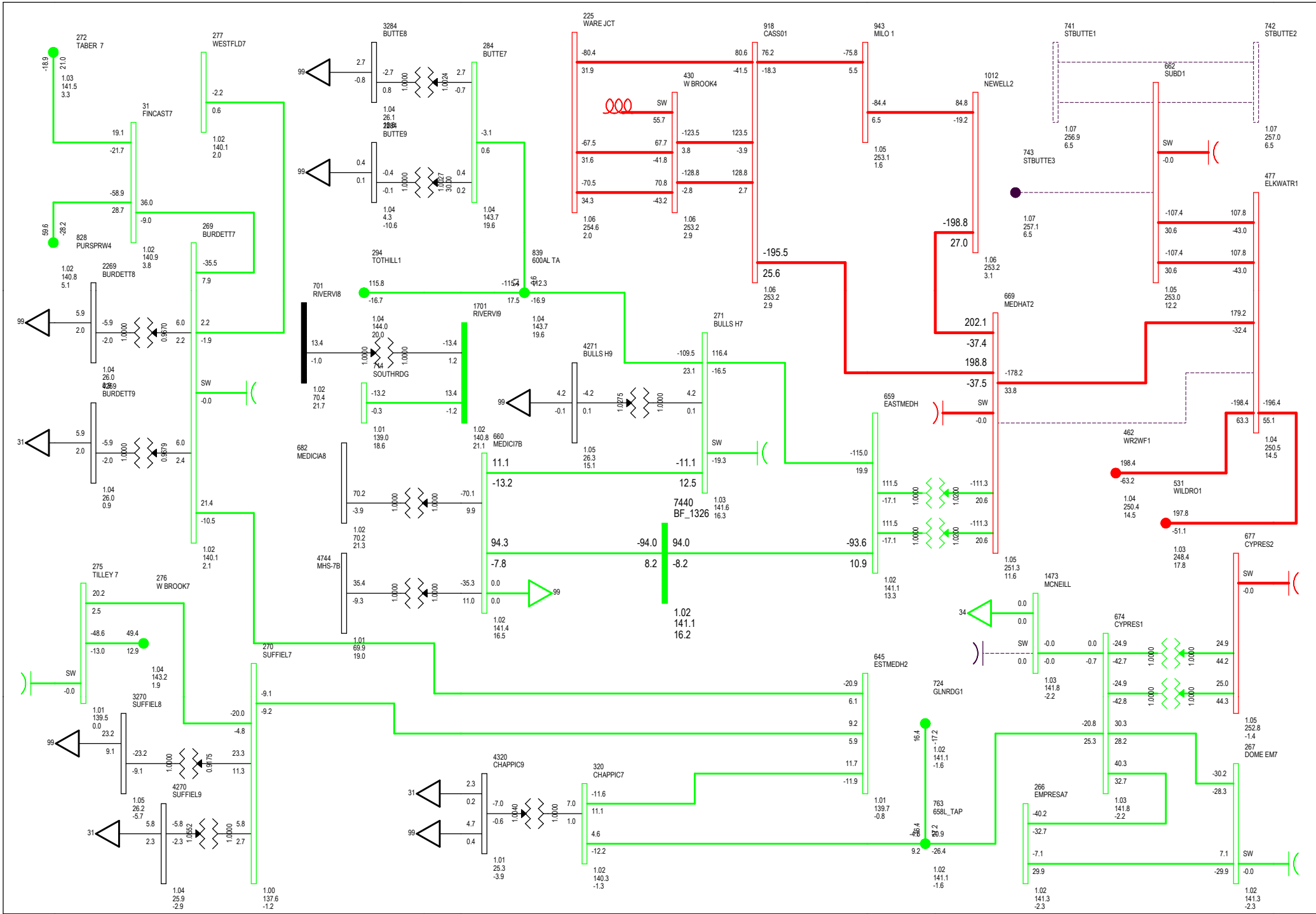


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -33.9 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-4: CATEGORY B - 676L (523S TO 244S)
THU, DEC 17 2015 7:57

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

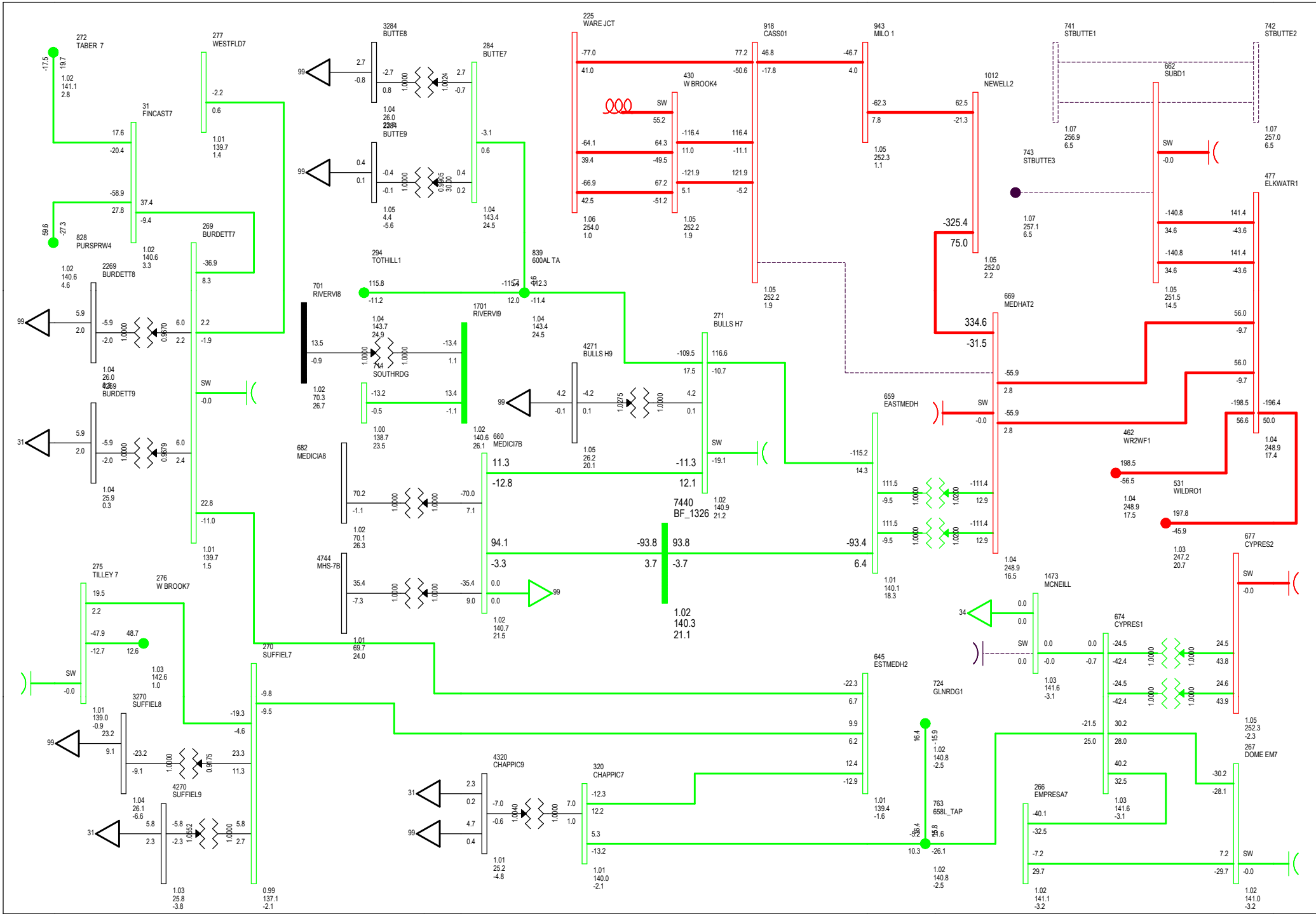


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -35.9 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-5: CATEGORY B - 1073L (244S TO 264S)
THU, DEC 17 2015 7:57

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

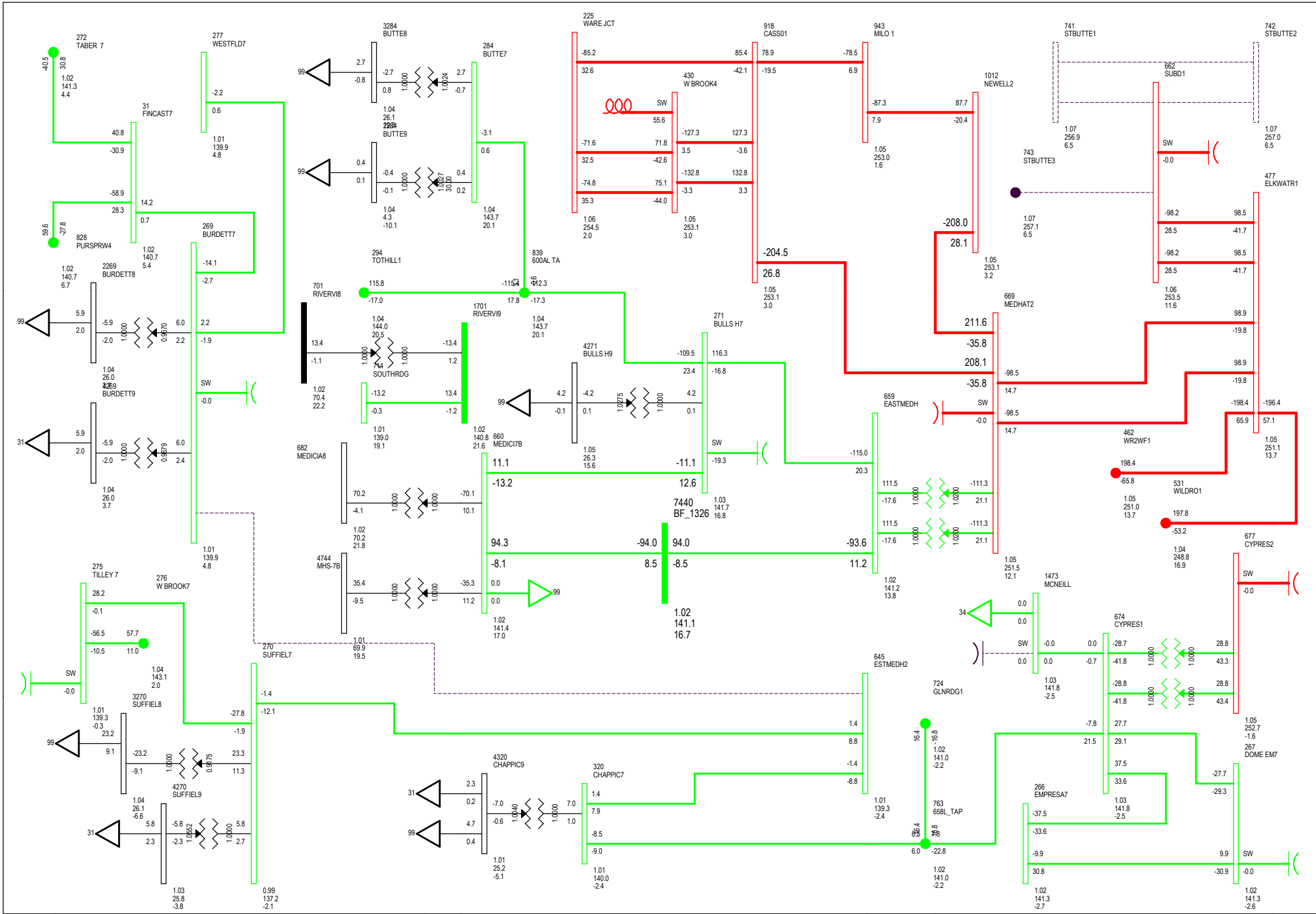


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): 0.0 MW BC and MATL (Import): -30.6 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-6: CATEGORY B - 1034L (244S TO 324S)
THU, DEC 17 2015 7:58

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

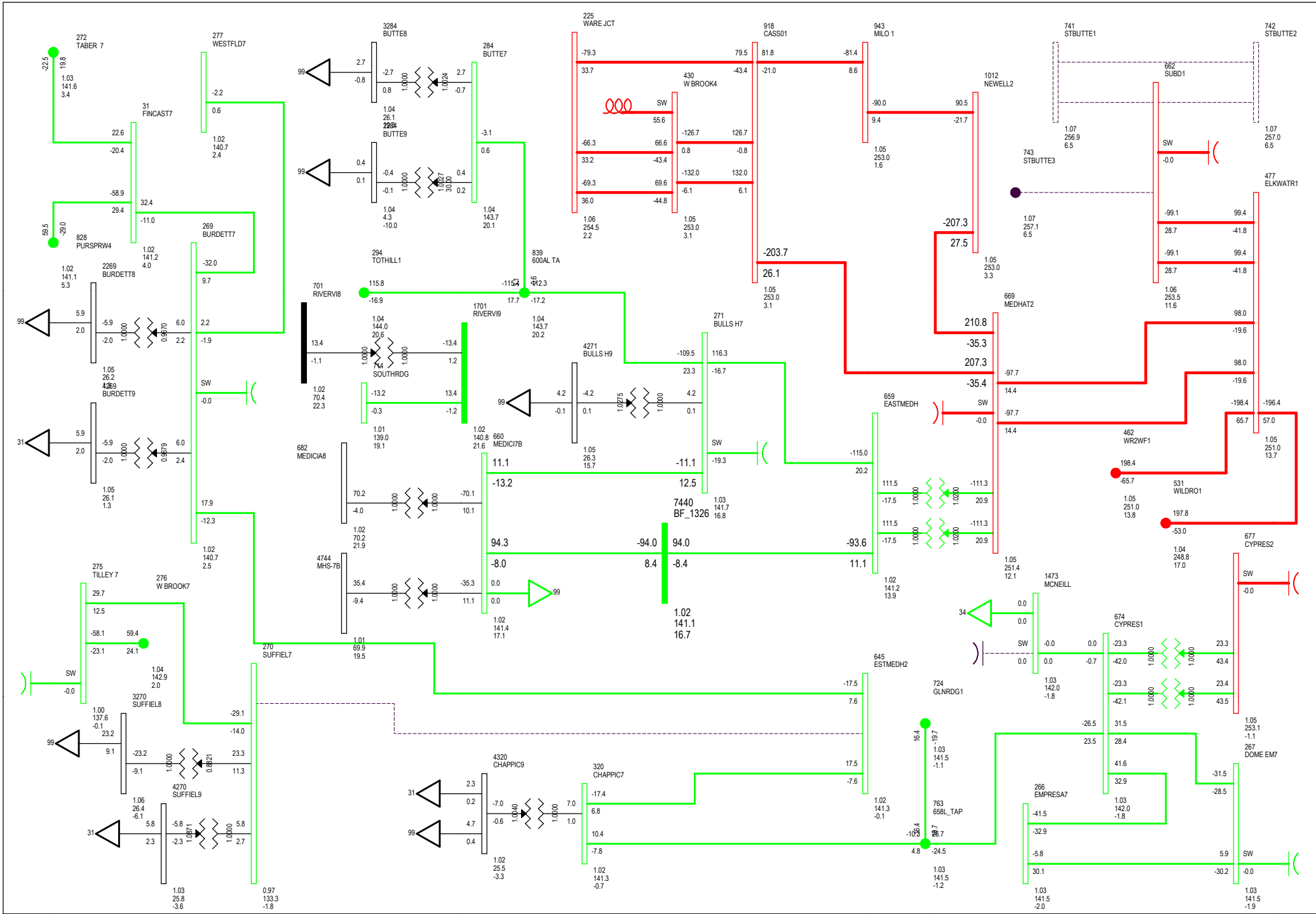


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.2 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-7: CATEGORY B - 879L (244S TO 368S)
THU, DEC 17 2015 7:58

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

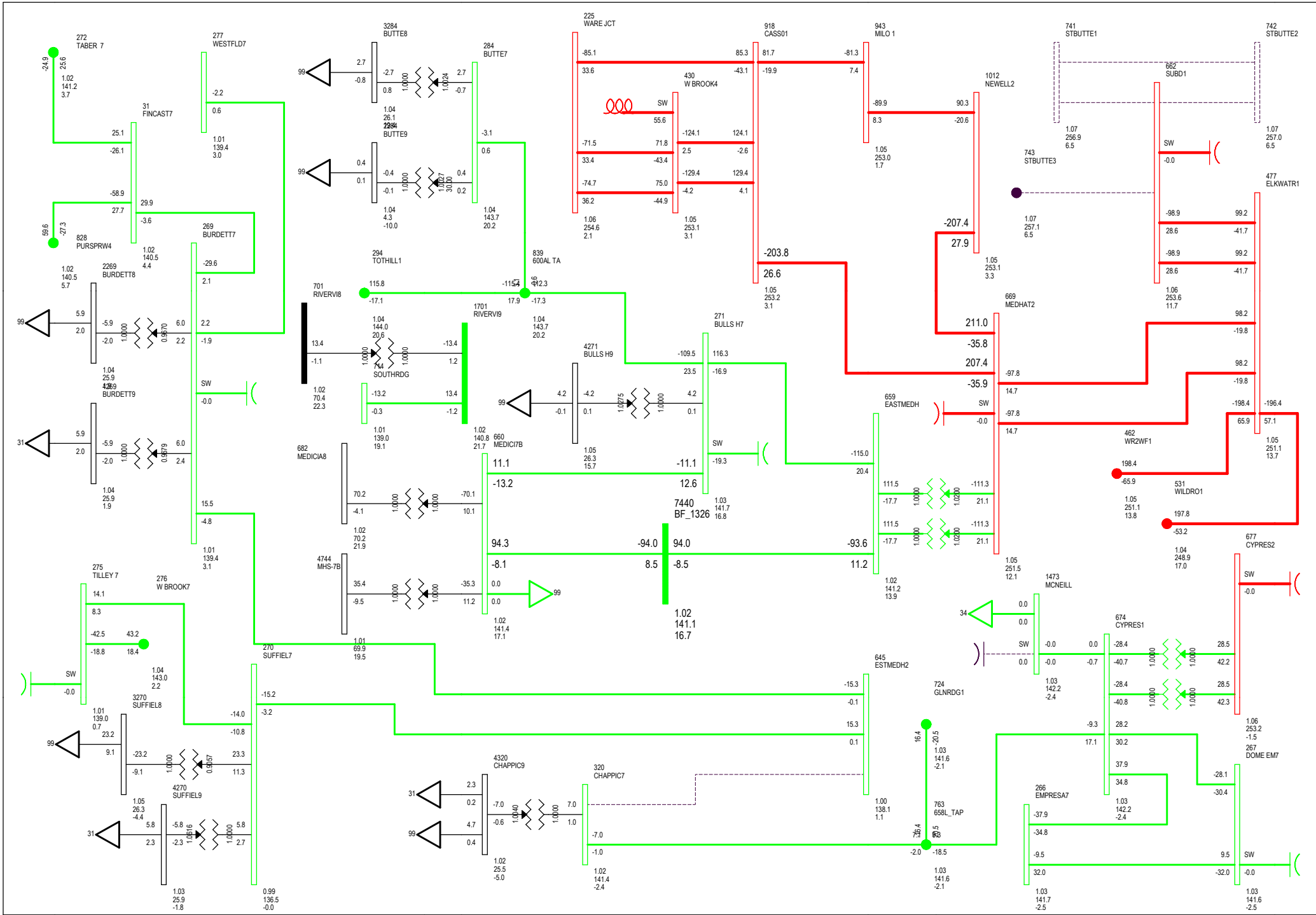


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -35.9 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-8: CATEGORY B - 892L (244S TO 368S)
THU, DEC 17 2015 7:58

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

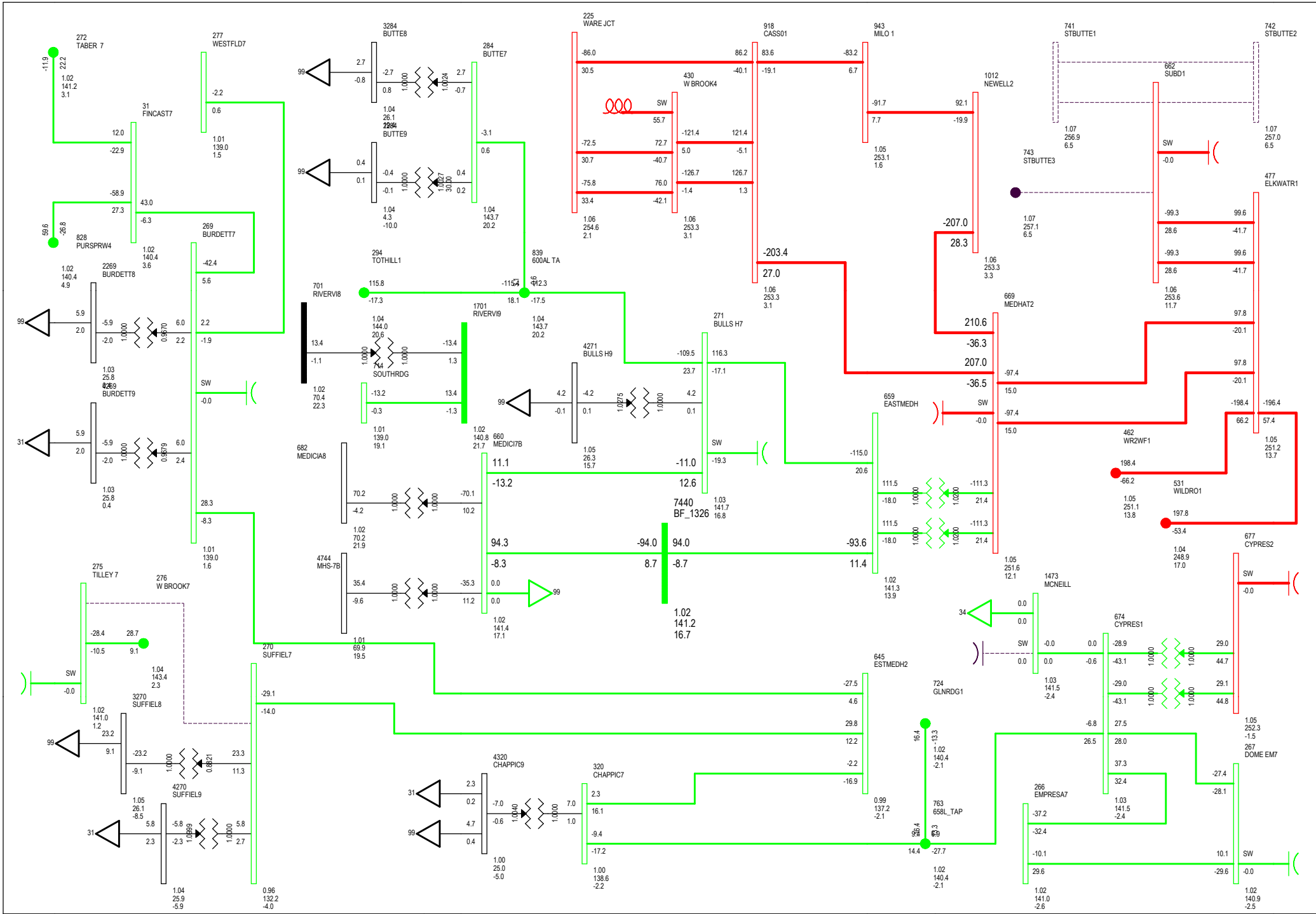


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.7 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-9: CATEGORY B - 674L (244S TO 649S)
THU, DEC 17 2015 7:59

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

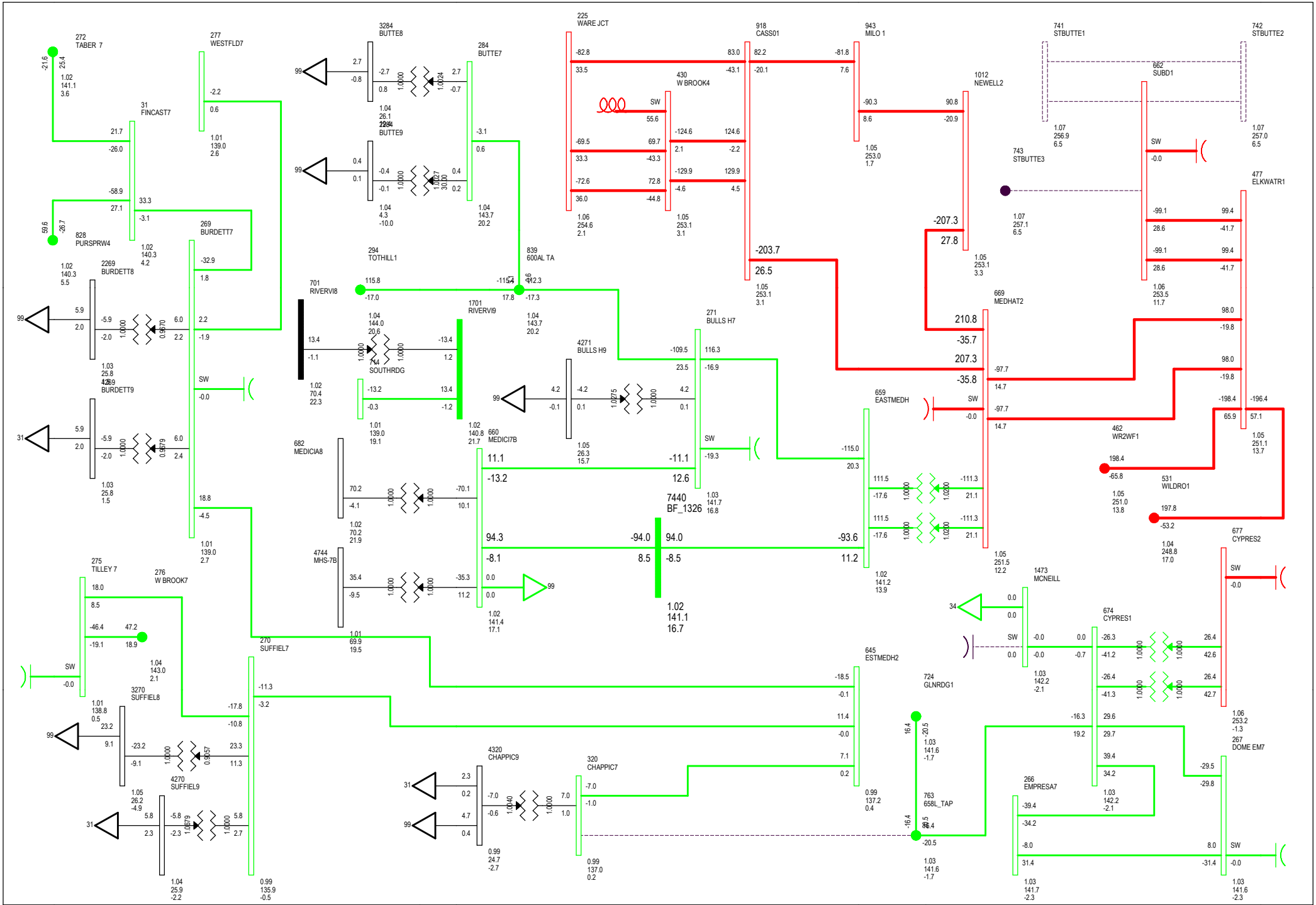


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -35.7 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-10: CATEGORY B - 100L (498S TO 895S)
THU, DEC 17 2015 7:59

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

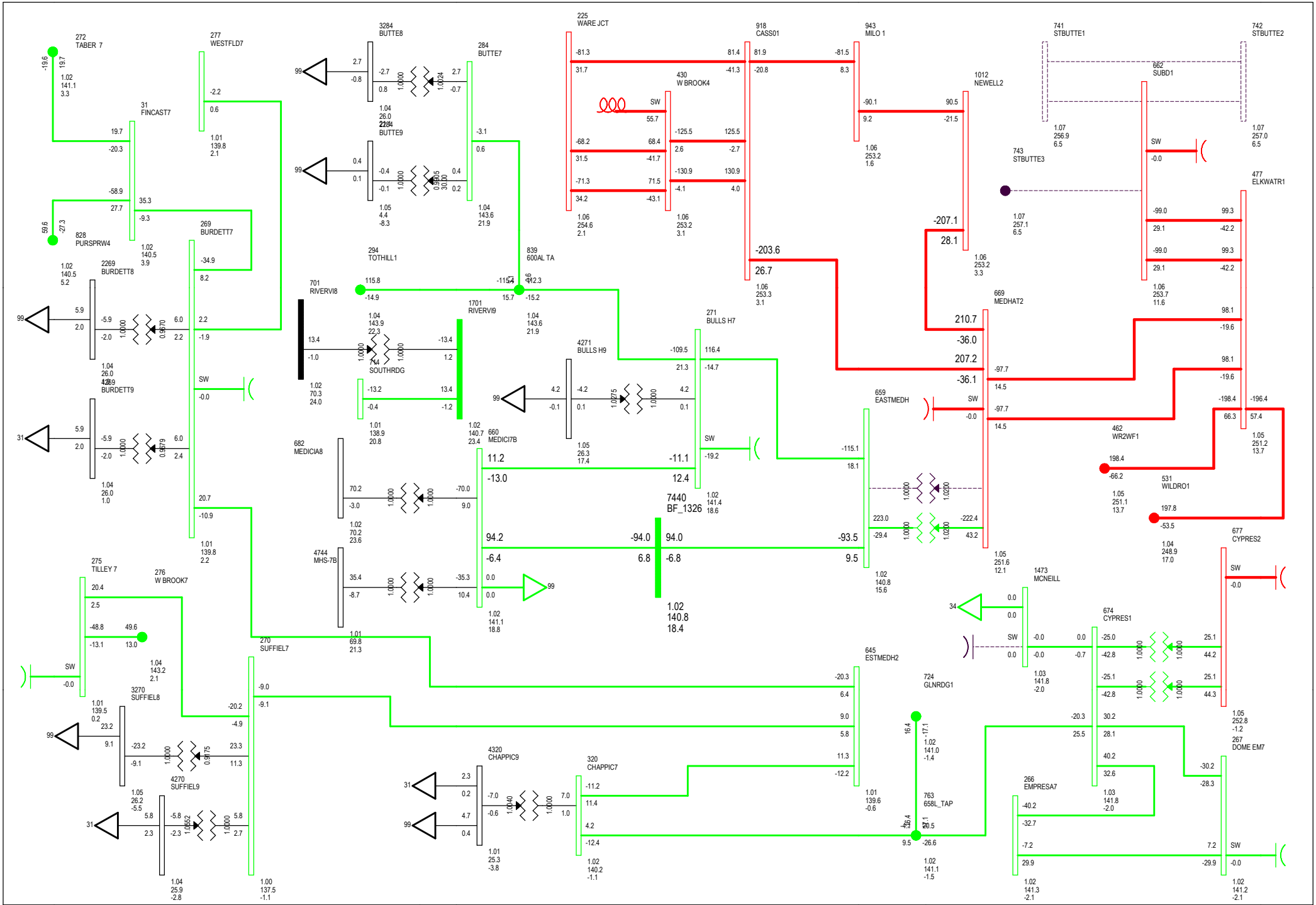


CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.6 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-11: CATEGORY B - 658L (562S TO 649S)
THU, DEC 17 2015 7:59

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000



CITY OF MEDICINE HAT AIES INTERCONNECTION

SK Tie (Import): -0.0 MW BC and MATL (Import): -36.2 MW

SENSITIVITY-PEACE BUTTE PRIOR TO THE PROJECT CONNECTION
FIGURE G-12: CATEGORY B - TRANSFORMER T1 (244S)
THU, DEC 17 2015 8:00

Bus - Voltage (kV/pu)/Angle
Branch - MW/Mvar
Equipment - MW/Mvar
100.0%Rate A
1.100OV 0.900UV
kV: <=69.000 <=138.000 <=240.000 >240.000

Attachment C

Post-Connection Voltage Stability Analysis Results

Figure C-1. MHS-7 138 kV Bus Voltage versus Incremental Transfer
2016SL-Case 5

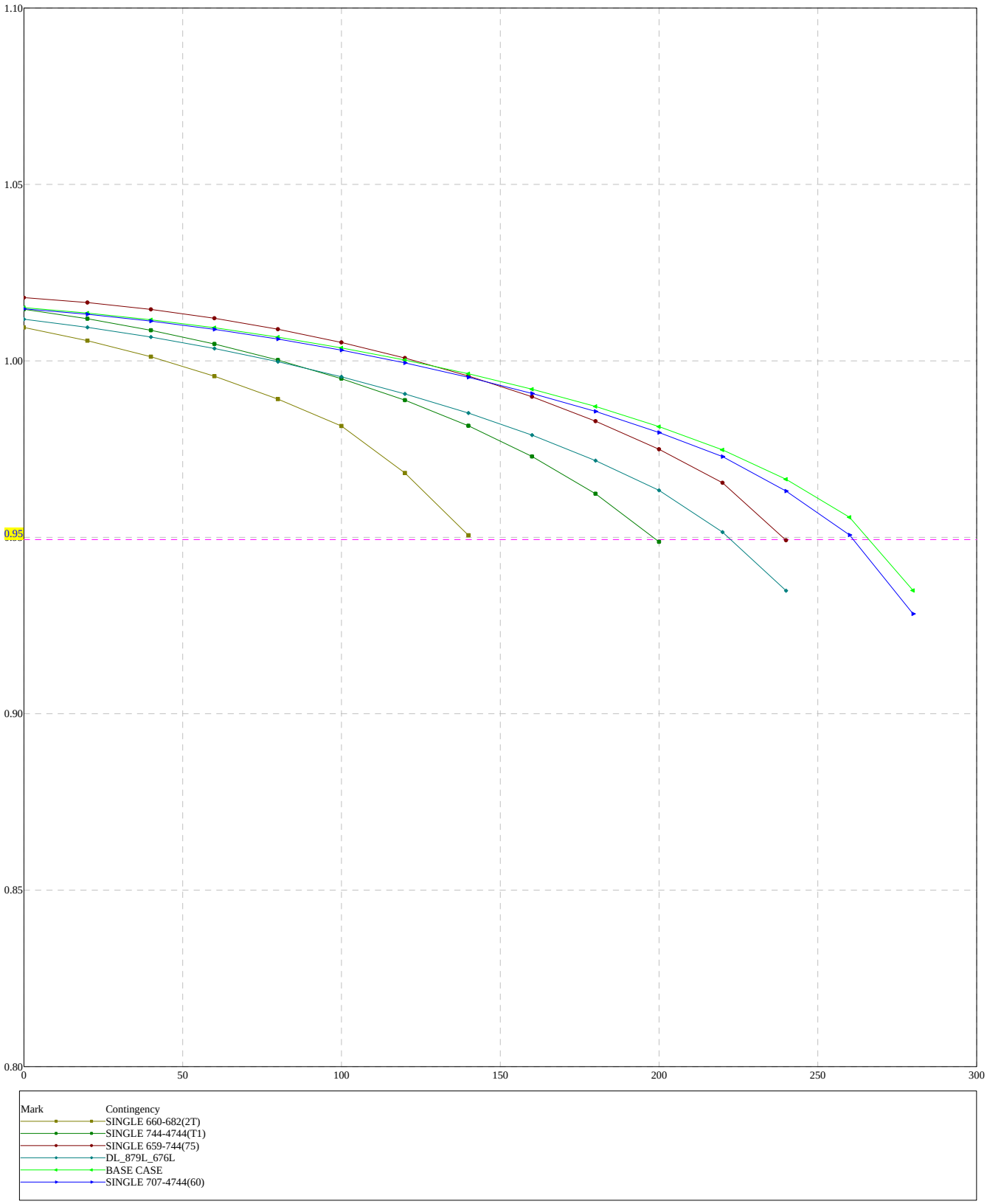


Figure C-2. Medicine Hat 41S 138 kV Bus Voltage versus Incremental Transfer
2016SL-Case 5

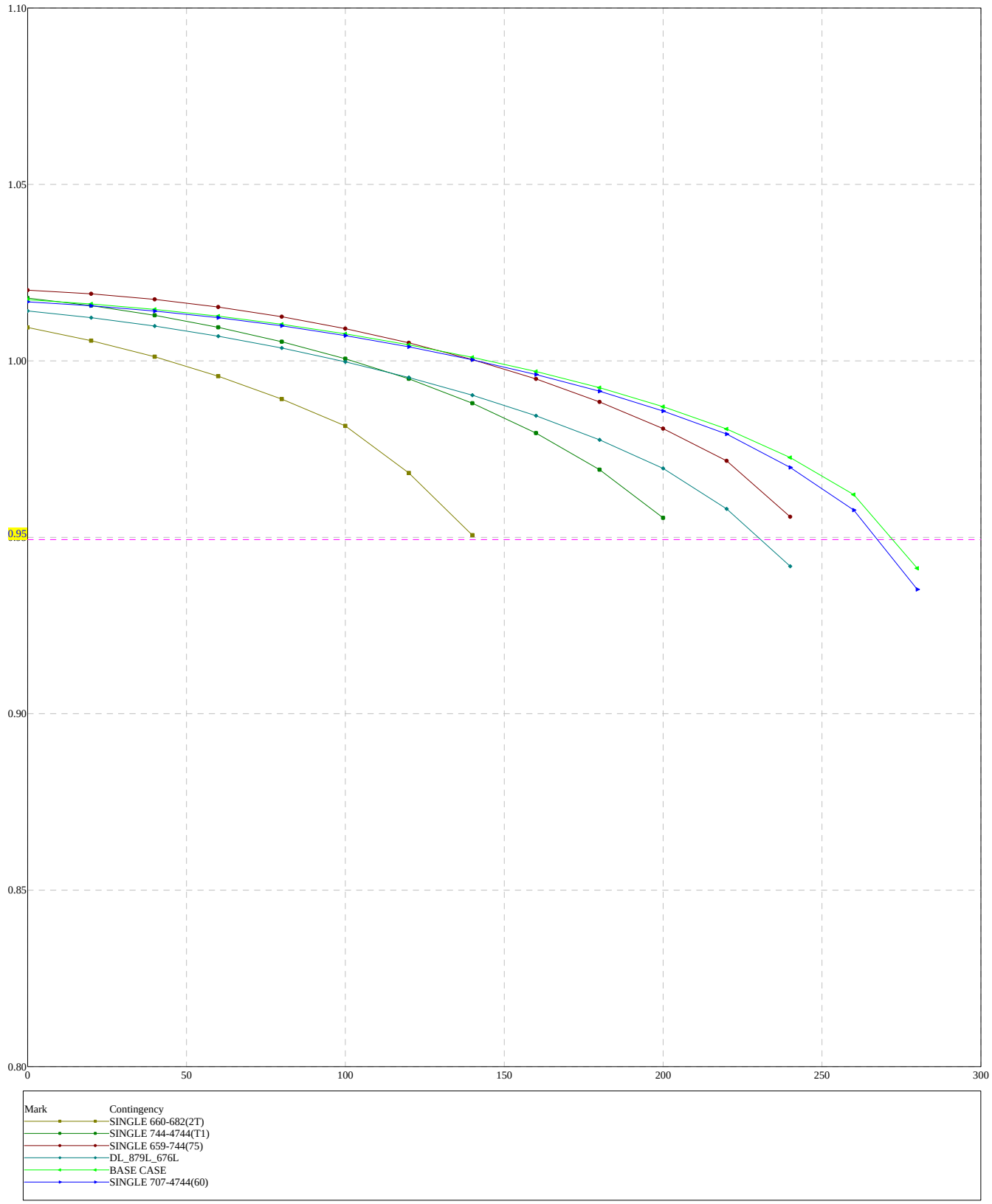


Figure C-3. Bowmanton 244S 138 kV Bus Voltage versus Incremental Transfer
2016SL-Case 5

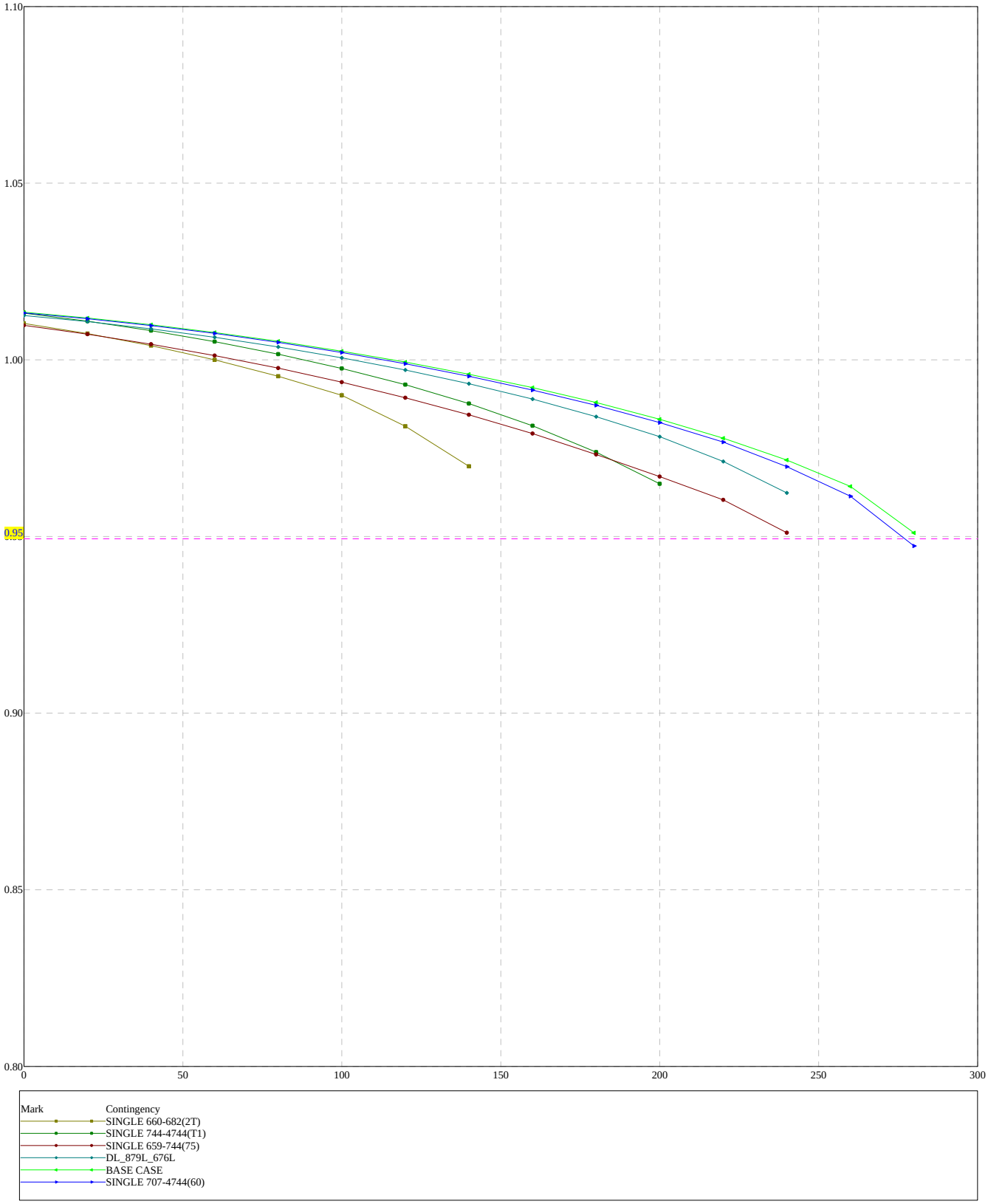


Figure C-4. Bullshead 523S 138 kV Bus Voltage versus Incremental Transfer
2016SL-Case 5

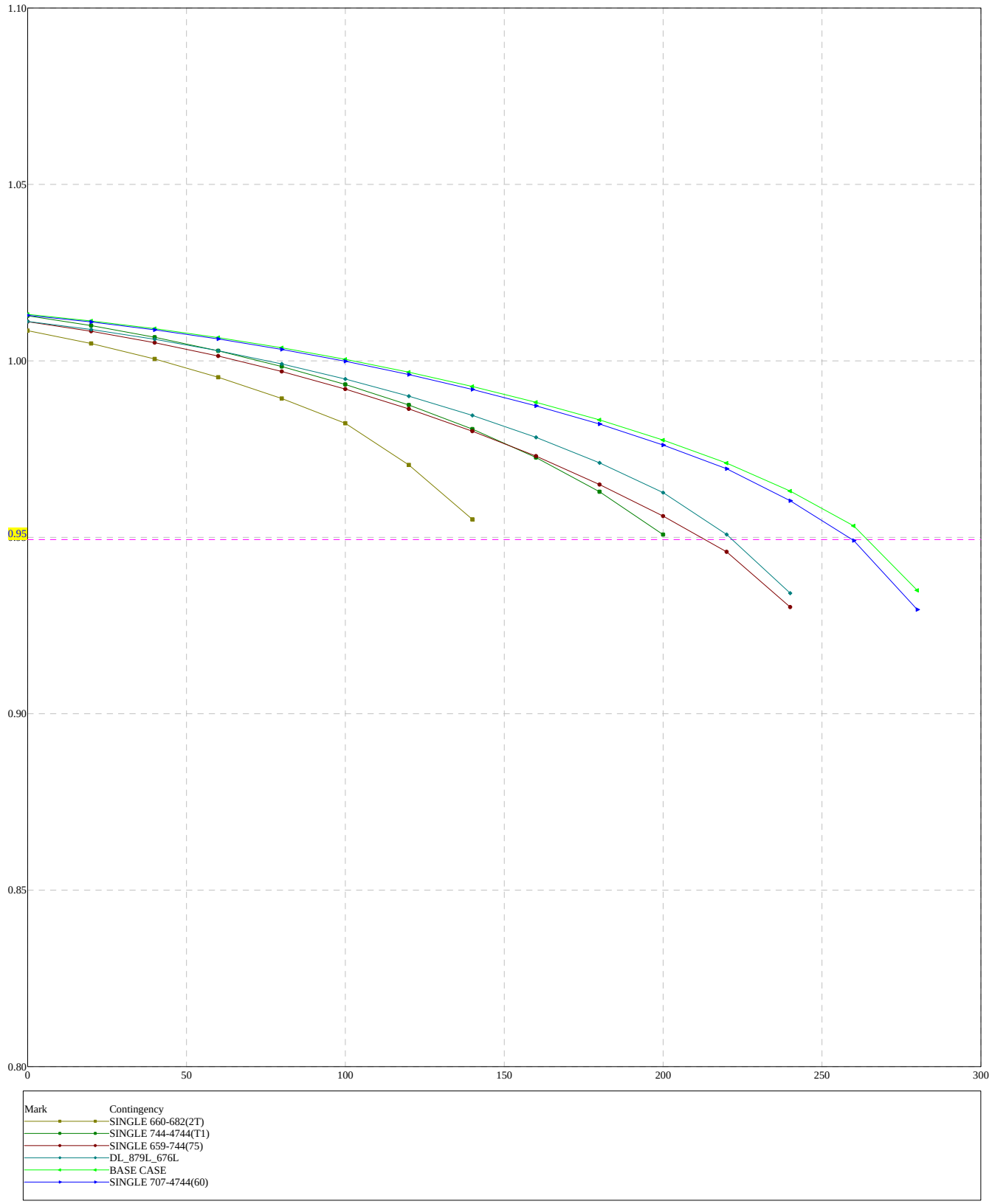


Figure C-5. MH69S-1 Powerplant Switchyard 69 kV Bus Voltage versus Incremental Transfer 2016SL-Case 5

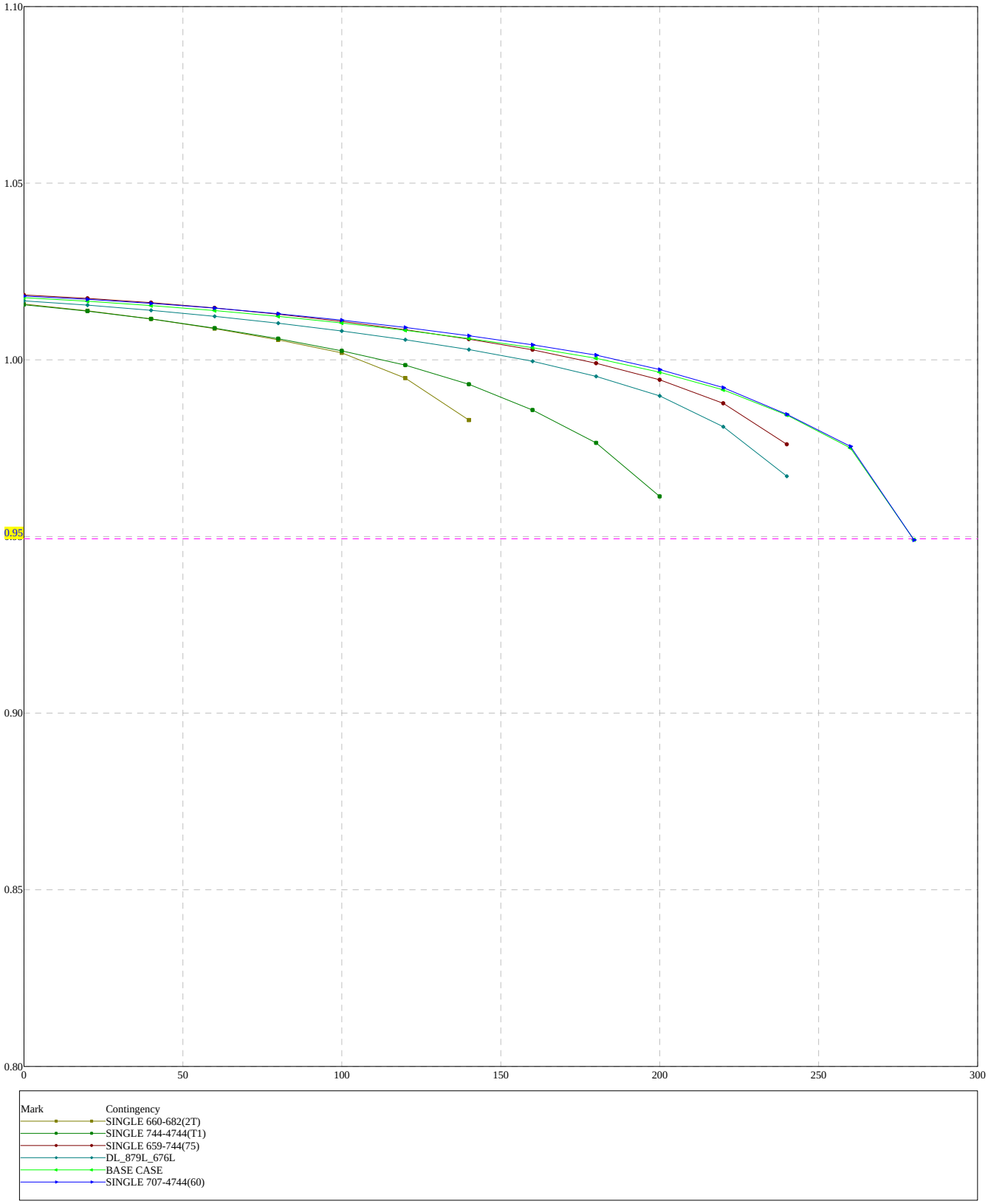


Figure C-6 MHS-7 138 kV Bus Voltage versus Incremental Transfer
2016SP-Case 6

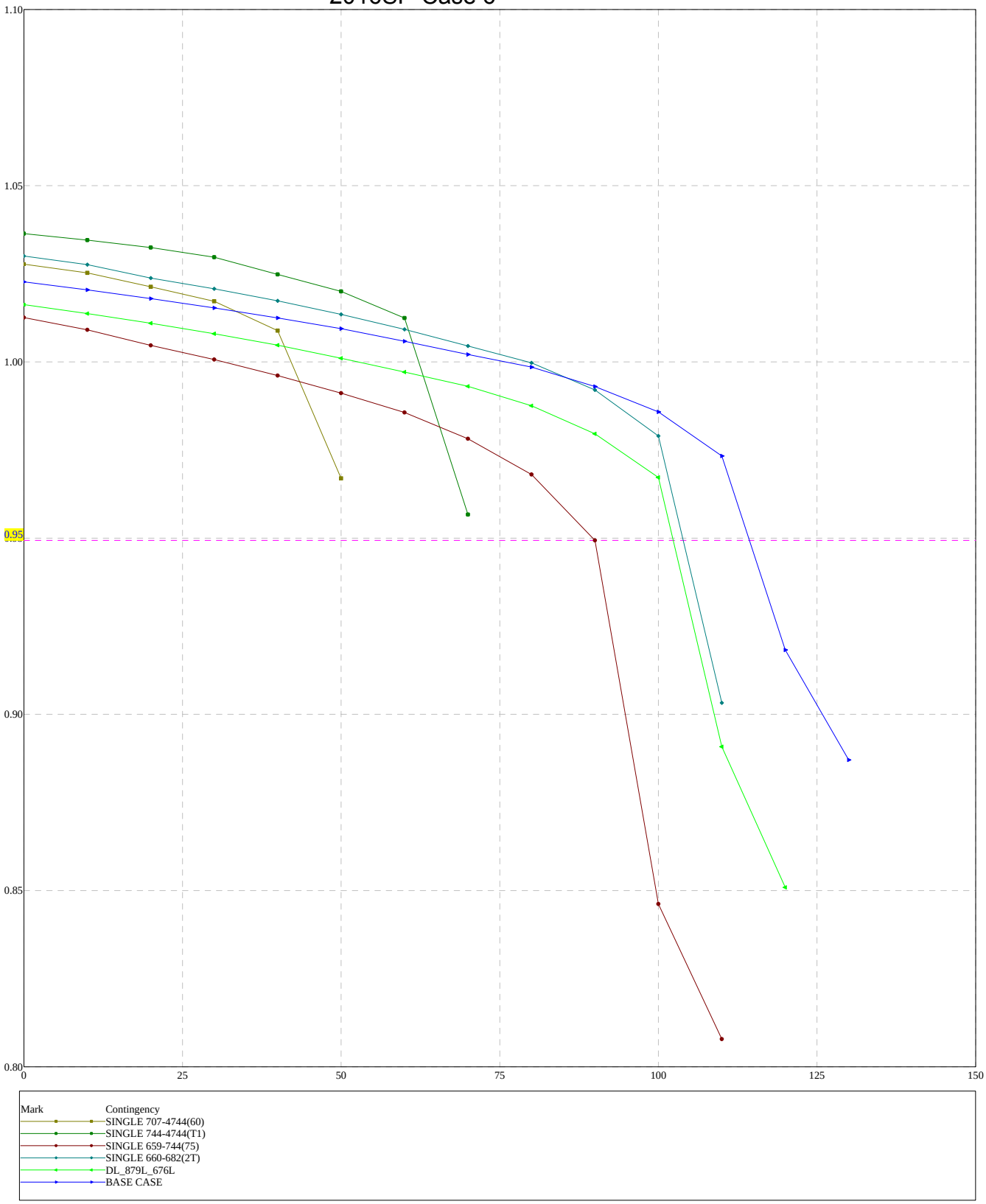


Figure C-7 Medicine Hat 41S 138 kV Bus Voltage versus Incremental Transfer
2016SP-Case 6

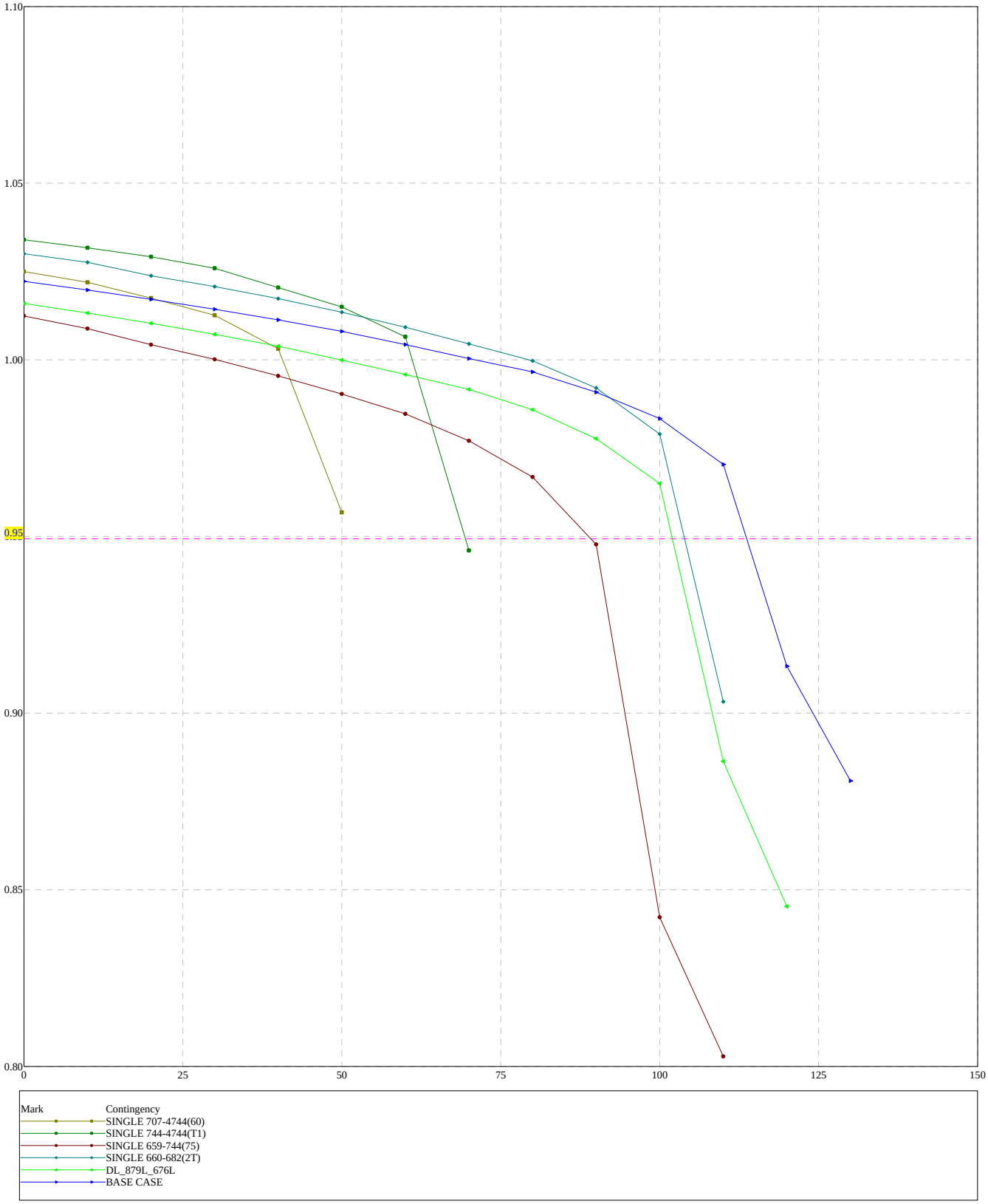


Figure C-8 Bowmanton 244S 138 kV Bus Voltage versus Incremental Transfer
2016SP-Case 6

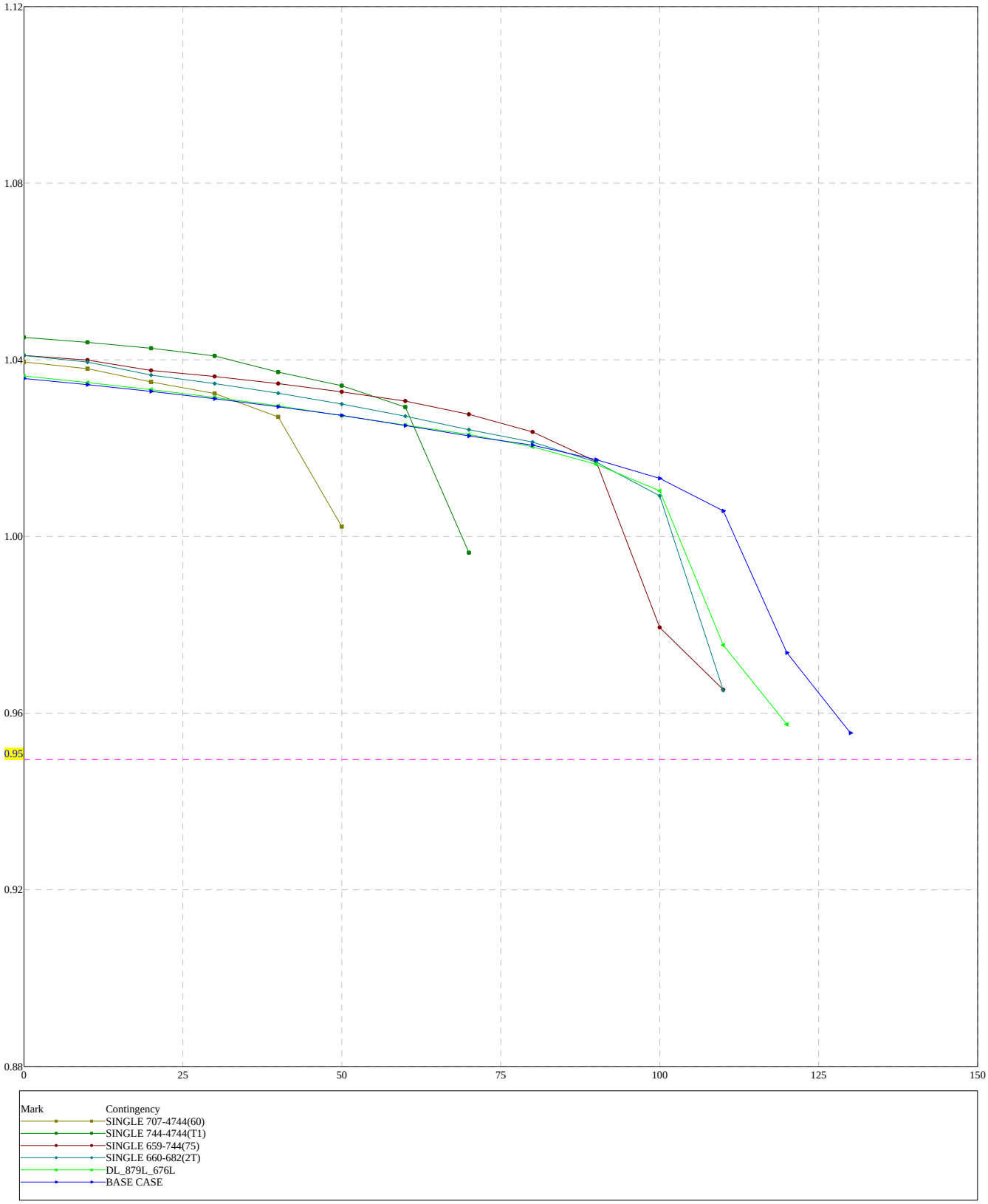


Figure C-9 Bullshead 523S 138 kV Bus Voltage versus Incremental Transfer
2016SP-Case 6

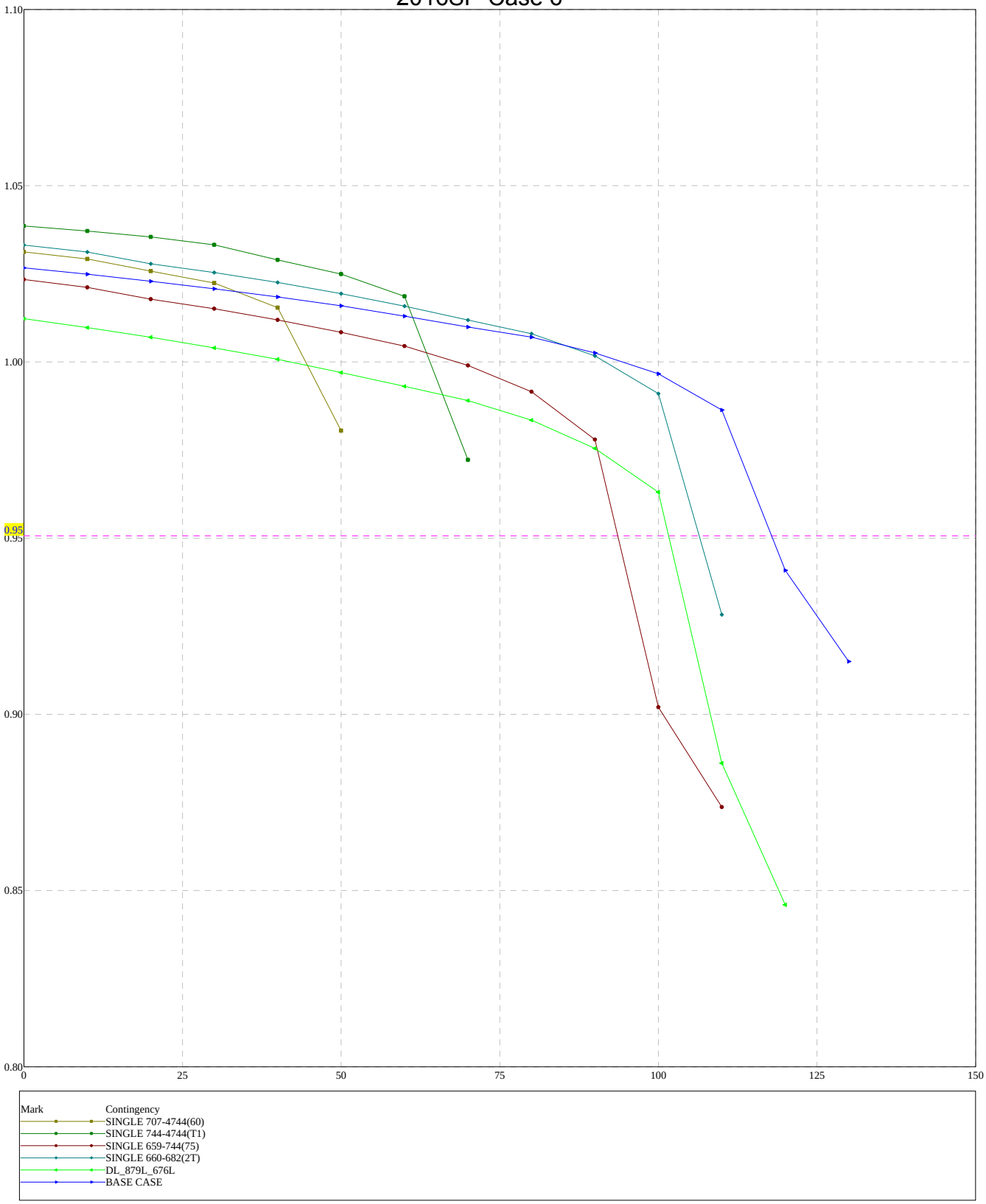
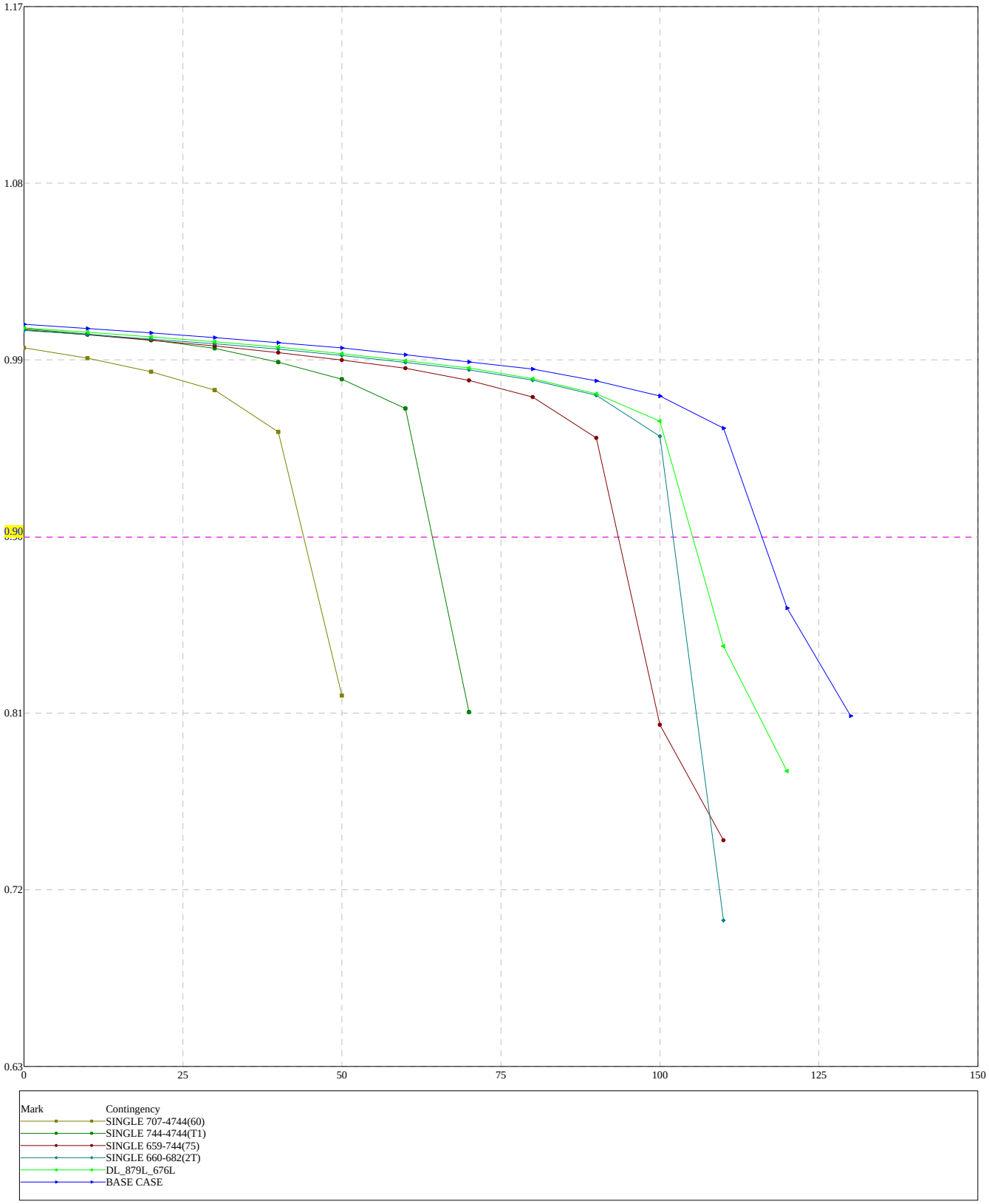


Figure C-10 MH69S-1 Powerplant Switchyard 69 kV Bus Voltage versus Incremental Transfer
2016SP-Case 6



Attachment D

Post-Connection Transient Stability Analysis Results

AESO MEDICINE HAT 2015 WP CASE1
CATB -B-BOWM

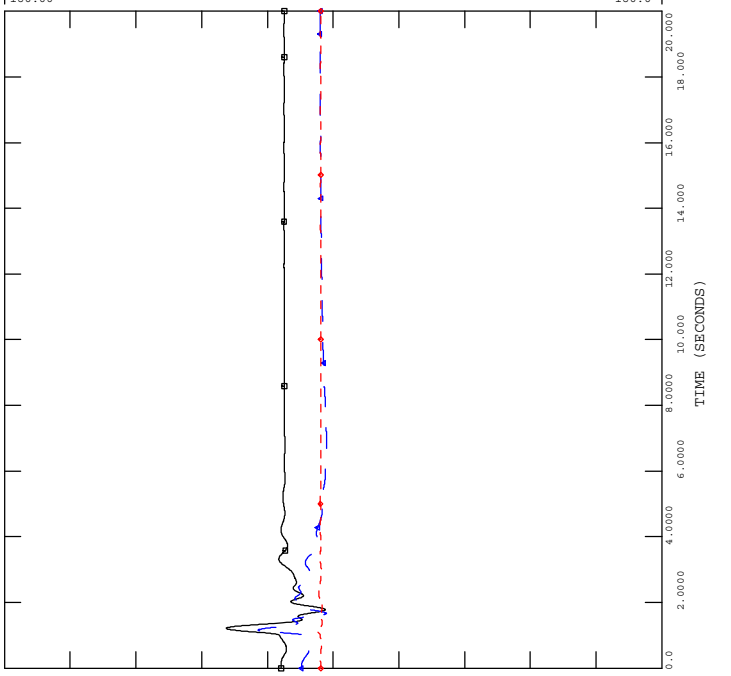
FILE: B-Bowm.out

WED, MAY 07 2014 14:19

ANGLE

CHNL# 8: [ANGL 1482[SHEER 1 19.000]1]
CHNL# 7: [ANGL 713[CMH 14 13.800]14]
CHNL# 6: [ANGL 687[CMH 11R9 13.800]11]

TIME (SECONDS)



AESO MEDICINE HAT 2015 WP CASE1
CATB -B-BOWM

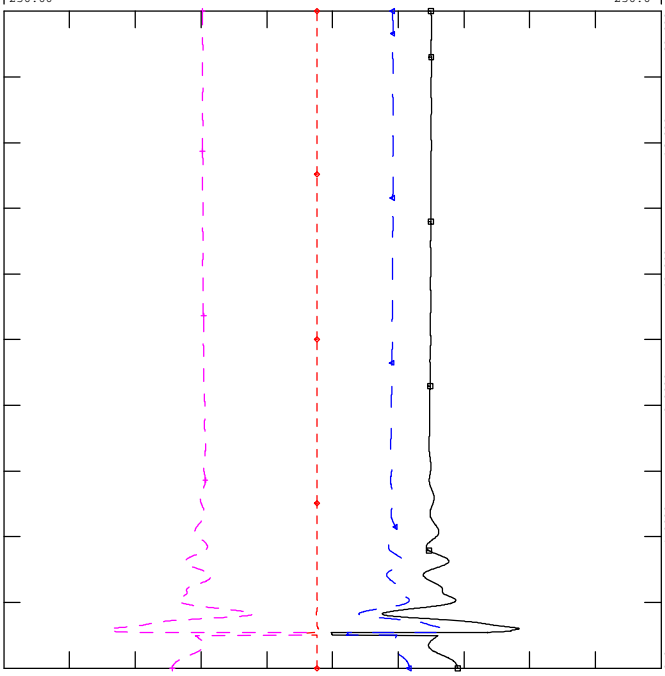
FILE: B-Bowm.out

WED, MAY 07 2014 14:19

BRANCH POWER

CHNL# 20: [POWR 660 TO 744 CKT '78']
CHNL# 17: [POWR 645 TO 270 CKT '92']
CHNL# 16: [POWR 271 TO 744 CKT '80']
CHNL# 19: [POWR 659 TO 744 CKT '75']

TIME (SECONDS)



AESO MEDICINE HAT 2015 WP CASE1
CATB -B-BOWM

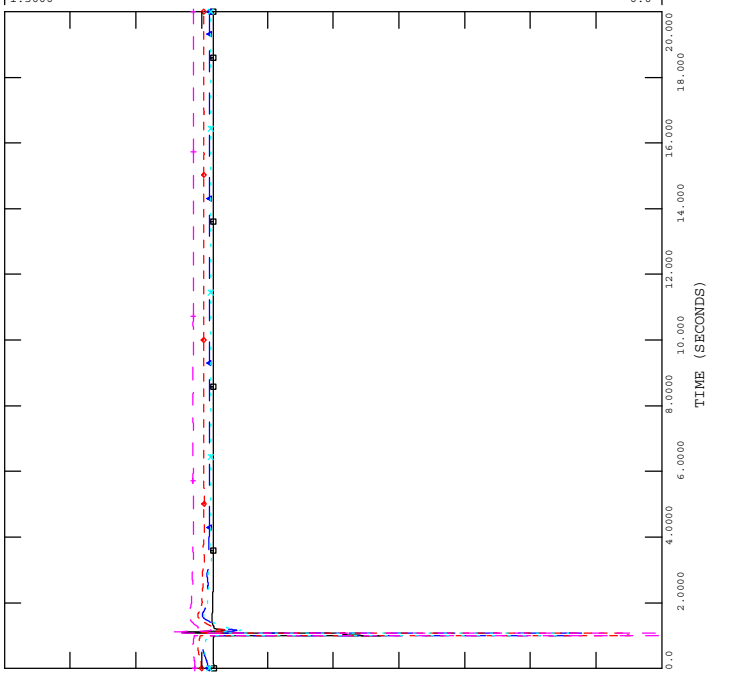
FILE: B-Bowm.out

WED, MAY 07 2014 14:19

VOLTAGE

CHNL# 5: [VOLT 744 [MHS-7 138.00]]
CHNL# 4: [VOLT 669 [MEDHAT2 240.00]]
CHNL# 3: [VOLT 659 [EASTMEDH 138.00]]
CHNL# 2: [VOLT 271 [BULLS H7 138.00]]
CHNL# 1: [VOLT 270 [SUFFIEL7 138.00]]

TIME (SECONDS)



AESO MEDICINE HAT 2015 WP CASE1
CATB -B-BOWM

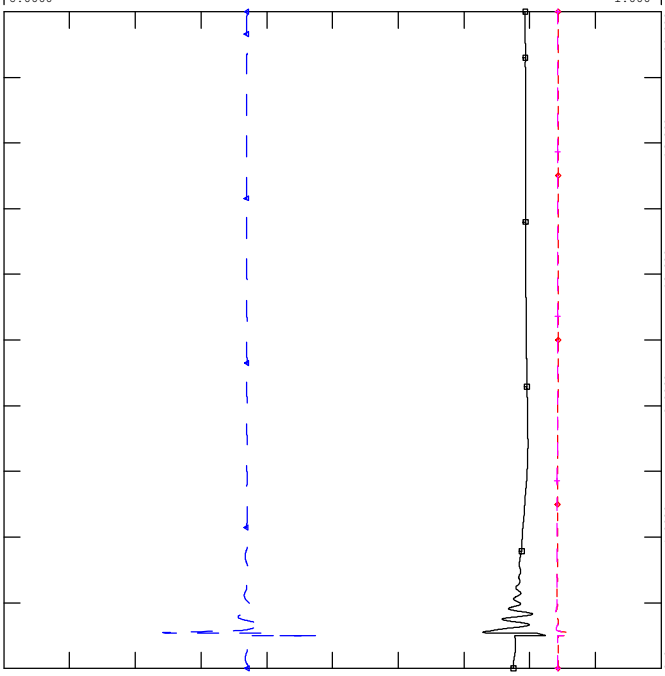
FILE: B-Bowm.out

WED, MAY 07 2014 14:19

ELECTRICAL POWER

CHNL# 13: [POWR 4294[TOTHILL3 34.500]G2]
CHNL# 12: [POWR 2294[TOTHILL2 34.500]G1]
CHNL# 11: [POWR 1482[SHEER 1 19.000]1]
CHNL# 10: [POWR 713[CMH 14 13.800]14]

TIME (SECONDS)

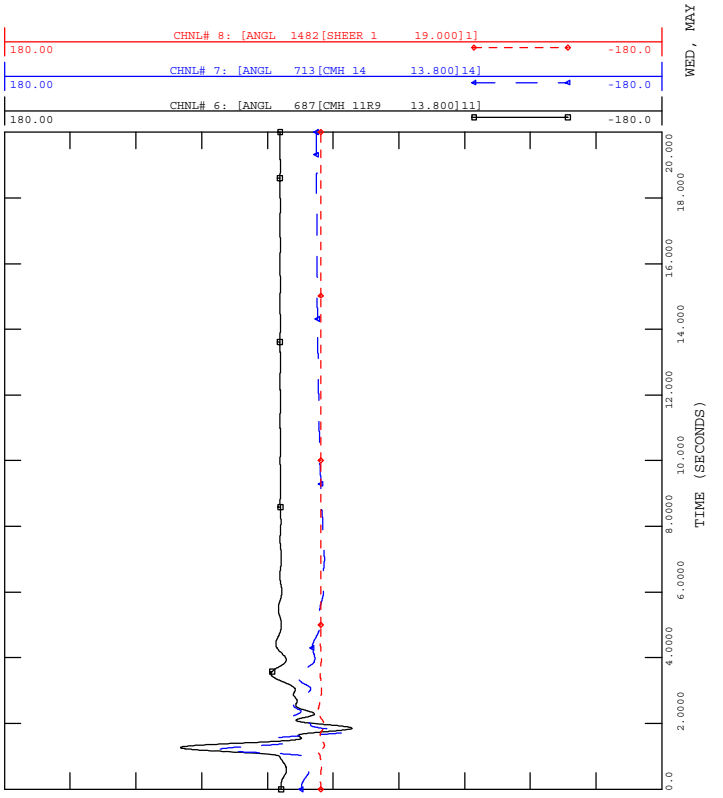


AESO MEDICINE HAT 2015 WP CASE1
CATB -B-675L

FILE: B-675L.out

WED, MAY 07 2014 14:19

ANGLE

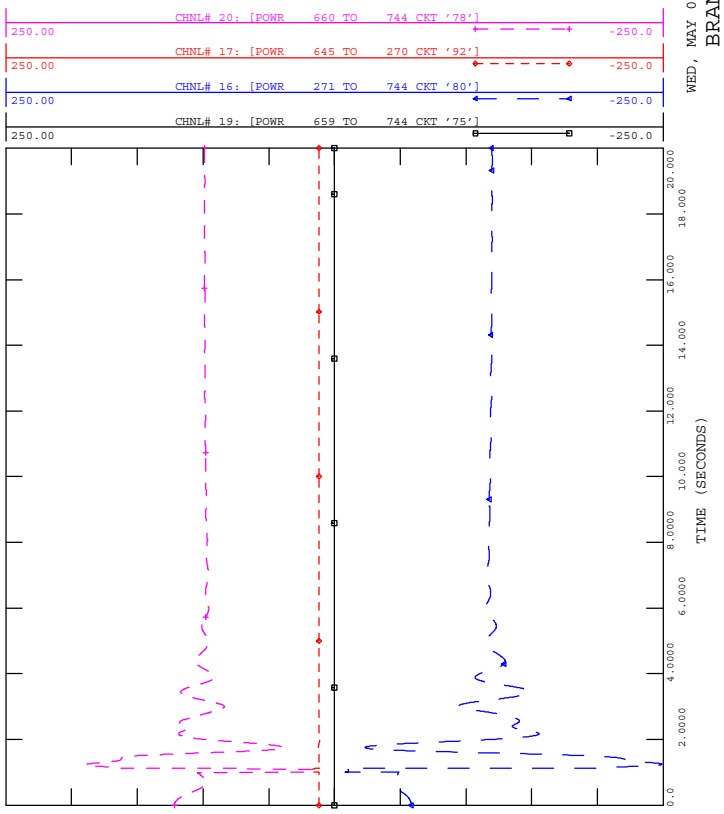


AESO MEDICINE HAT 2015 WP CASE1
CATB -B-675L

FILE: B-675L.out

WED, MAY 07 2014 14:19

BRANCH POWER

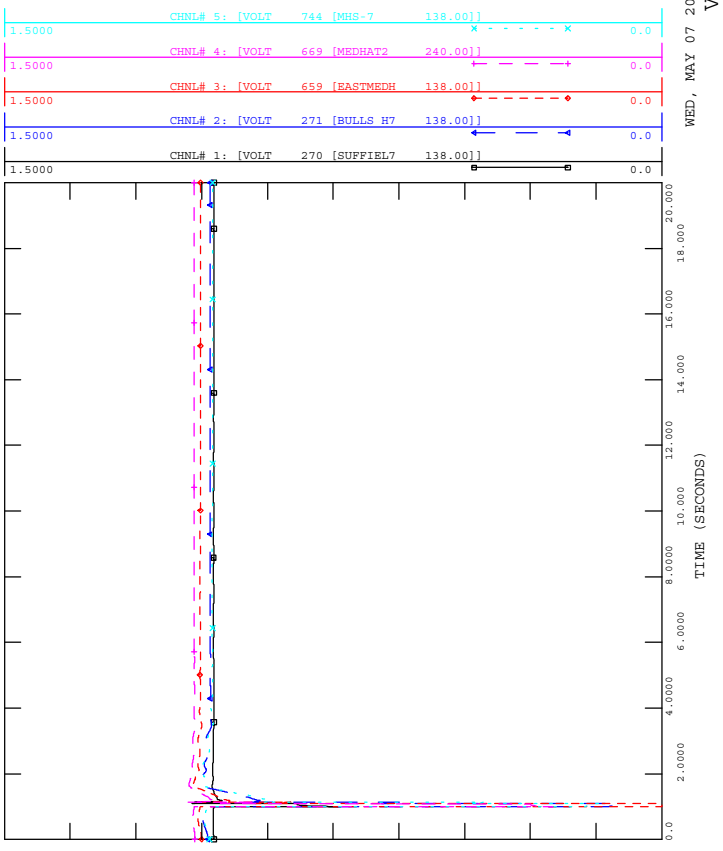


AESO MEDICINE HAT 2015 WP CASE1
CATB -B-675L

FILE: B-675L.out

WED, MAY 07 2014 14:19

VOLTAGE

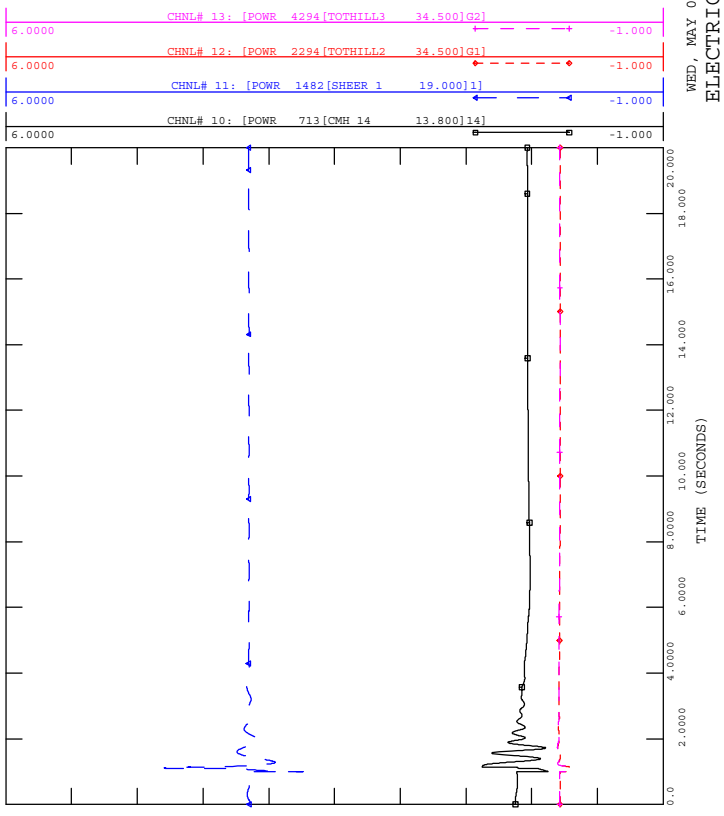


AESO MEDICINE HAT 2015 WP CASE1
CATB -B-675L

FILE: B-675L.out

WED, MAY 07 2014 14:19

ELECTRICAL POWER



AESO MEDICINE HAT 2015 WP CASE1
CATB -B-880L

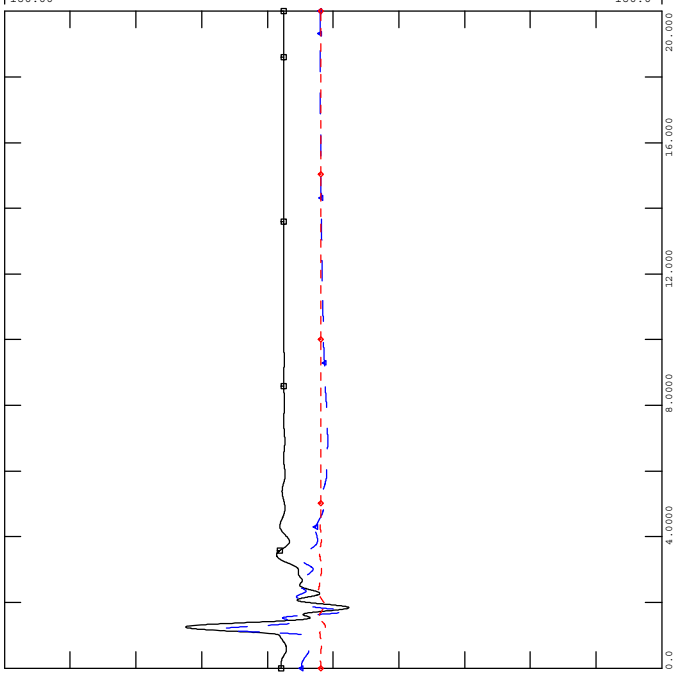
FILE: B-880L.out

WED, MAY 07 2014 14:19

ANGLE

CHNL# 8: [ANGL 1482[SHEER 1 19.000]1] 180.00 -180.0
CHNL# 7: [ANGL 713[CMH 14 13.800]14] 180.00 -180.0
CHNL# 6: [ANGL 687[CMH 11R9 13.800]11] 180.00 -180.0

TIME (SECONDS)



AESO MEDICINE HAT 2015 WP CASE1
CATB -B-880L

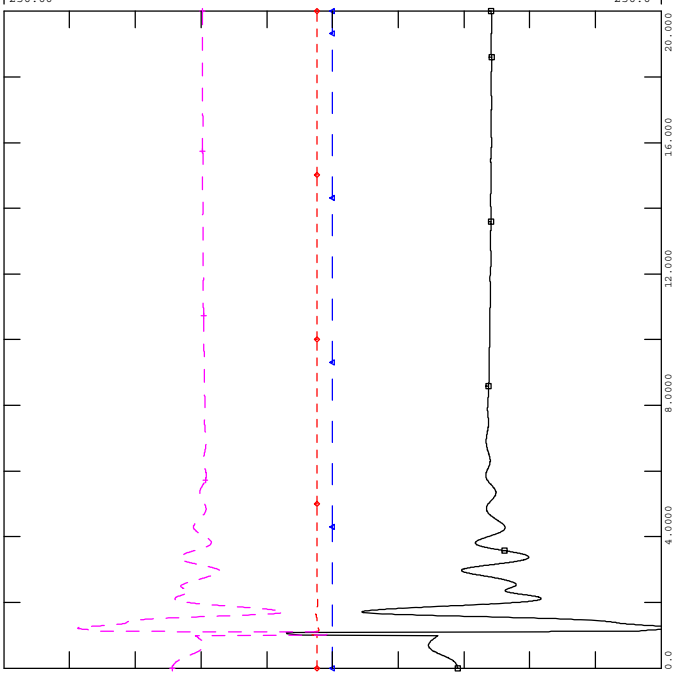
FILE: B-880L.out

WED, MAY 07 2014 14:19

BRANCH POWER

CHNL# 20: [POWR 660 TO 744 CKT '78'] 250.00 -250.0
CHNL# 17: [POWR 645 TO 270 CKT '92'] 250.00 -250.0
CHNL# 16: [POWR 271 TO 744 CKT '80'] 250.00 -250.0
CHNL# 19: [POWR 659 TO 744 CKT '75'] 250.00 -250.0

TIME (SECONDS)



AESO MEDICINE HAT 2015 WP CASE1
CATB -B-880L

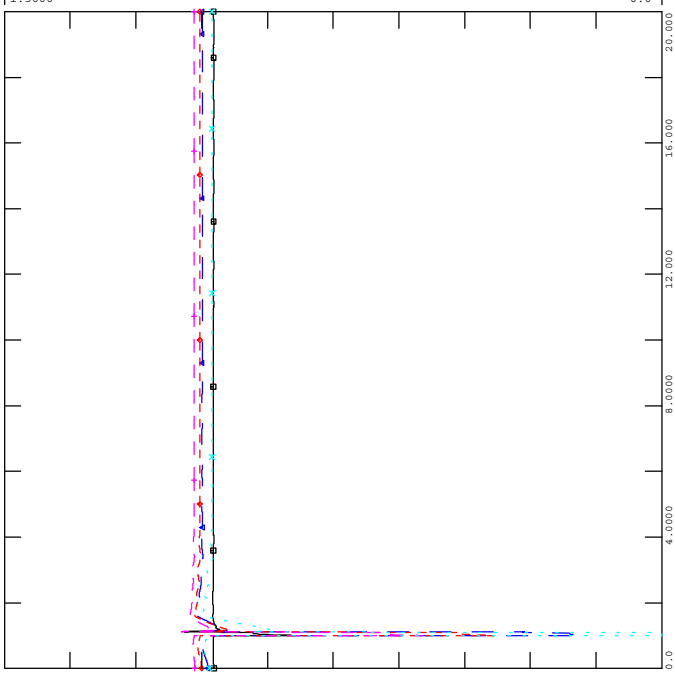
FILE: B-880L.out

WED, MAY 07 2014 14:19

VOLTAGE

CHNL# 5: [VOLT 744 [MHS-7 138.00]] 1.5000 0.0
CHNL# 4: [VOLT 669 [MEDHAT2 240.00]] 1.5000 0.0
CHNL# 3: [VOLT 659 [EASTMEDH 138.00]] 1.5000 0.0
CHNL# 2: [VOLT 271 [BULLS H7 138.00]] 1.5000 0.0
CHNL# 1: [VOLT 270 [SUFFIEL7 138.00]] 1.5000 0.0

TIME (SECONDS)



AESO MEDICINE HAT 2015 WP CASE1
CATB -B-880L

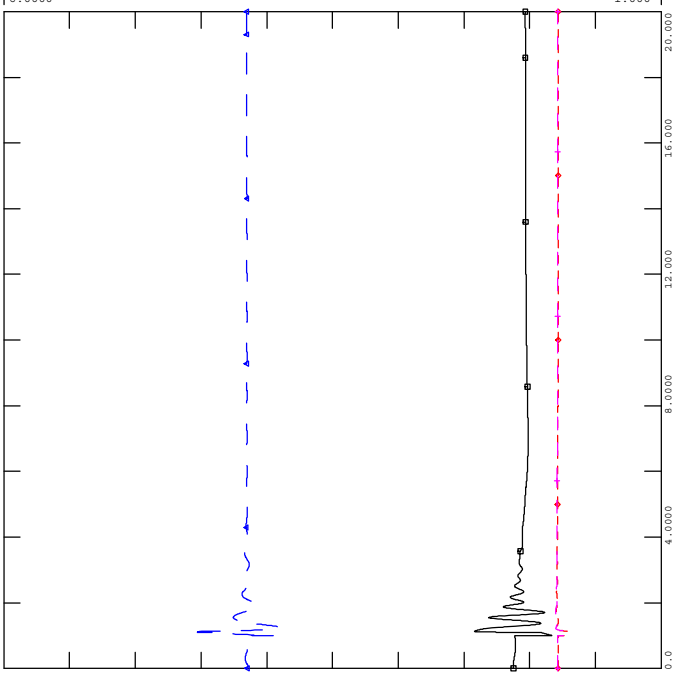
FILE: B-880L.out

WED, MAY 07 2014 14:19

ELECTRICAL POWER

CHNL# 13: [POWR 4294[TOTHILL3 34.500]G2] 6.0000 -1.000
CHNL# 12: [POWR 2294[TOTHILL2 34.500]G1] 6.0000 -1.000
CHNL# 11: [POWR 1482[SHEER 1 19.000]1] 6.0000 -1.000
CHNL# 10: [POWR 713[CMH 14 13.800]14] 6.0000 -1.000

TIME (SECONDS)



AESO MEDICINE HAT 2015 WP CASE1
CATB -B-676L

FILE: B-676L.out

WED, MAY 07 2014 14:19

ANGLE

CHNL# 8: [ANGL 1482[SHEER 1 19.000]1] 180.00 -180.0
CHNL# 7: [ANGL 713[CMH 14 13.800]14] 180.00 -180.0
CHNL# 6: [ANGL 687[CMH 11R9 13.800]11] 180.00 -180.0

TIME (SECONDS) 0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2015 WP CASE1
CATB -B-676L

FILE: B-676L.out

WED, MAY 07 2014 14:19

BRANCH POWER

CHNL# 20: [POWR 660 TO 744 CKT '78'] 250.00 -250.0
CHNL# 17: [POWR 645 TO 270 CKT '92'] 250.00 -250.0
CHNL# 16: [POWR 271 TO 744 CKT '80'] 250.00 -250.0
CHNL# 19: [POWR 659 TO 744 CKT '75'] 250.00 -250.0

TIME (SECONDS) 0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2015 WP CASE1
CATB -B-676L

FILE: B-676L.out

WED, MAY 07 2014 14:19

VOLTAGE

CHNL# 5: [VOLT 744 [MHS-7 138.00]] 1.5000 0.0
CHNL# 4: [VOLT 669 [MEDHAT2 240.00]] 1.5000 0.0
CHNL# 3: [VOLT 659 [EASTMEDH 138.00]] 1.5000 0.0
CHNL# 2: [VOLT 271 [BULLS H7 138.00]] 1.5000 0.0
CHNL# 1: [VOLT 270 [SUFFIEL7 138.00]] 1.5000 0.0

TIME (SECONDS) 0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2015 WP CASE1
CATB -B-676L

FILE: B-676L.out

WED, MAY 07 2014 14:19

ELECTRICAL POWER

CHNL# 13: [POWR 4294[TOTHILL3 34.500]G2] 6.0000 -1.000
CHNL# 12: [POWR 2294[TOTHILL2 34.500]G1] 6.0000 -1.000
CHNL# 11: [POWR 1482[SHEER 1 19.000]1] 6.0000 -1.000
CHNL# 10: [POWR 713[CMH 14 13.800]14] 6.0000 -1.000

TIME (SECONDS) 0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2018 SP CASE8
CATB -B-BOWM

FILE: B-Bowm.out

TUE, APR 15 2014 17:33

ANGLE

CHNL# 8: [ANGL 1482[SHEER 1 19.000]1]
CHNL# 7: [ANGL 713[CMH 14 13.800]14]
CHNL# 6: [ANGL 687[CMH 11R9 13.800]11]

180.00 -180.0

TIME (SECONDS)

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2018 SP CASE8
CATB -B-BOWM

FILE: B-Bowm.out

TUE, APR 15 2014 17:33

BRANCH POWER

CHNL# 20: [POWR 660 TO 744 CKT '78']
CHNL# 17: [POWR 645 TO 270 CKT '92']
CHNL# 16: [POWR 271 TO 744 CKT '80']
CHNL# 19: [POWR 659 TO 744 CKT '75']

150.00 -250.0

TIME (SECONDS)

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2018 SP CASE8
CATB -B-BOWM

FILE: B-Bowm.out

TUE, APR 15 2014 17:33

VOLTAGE

CHNL# 5: [VOLT 744 [MHS-7 138.00]]
CHNL# 4: [VOLT 669 [MEDHAT2 240.00]]
CHNL# 3: [VOLT 659 [EASTMEDH 138.00]]
CHNL# 2: [VOLT 271 [BULLS H7 138.00]]
CHNL# 1: [VOLT 270 [SUFFIEL7 138.00]]

1.5000 0.0

TIME (SECONDS)

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2018 SP CASE8
CATB -B-BOWM

FILE: B-Bowm.out

TUE, APR 15 2014 17:33

ELECTRICAL POWER

CHNL# 13: [POWR 4294[TOTHILL3 34.500]G2]
CHNL# 12: [POWR 2294[TOTHILL2 34.500]G1]
CHNL# 11: [POWR 1482[SHEER 1 19.000]1]
CHNL# 10: [POWR 713[CMH 14 13.800]14]

6.0000 -1.000

TIME (SECONDS)

0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2018 SP CASE8
CATB -B-675L

FILE: B-675L.out

TUE, APR 15 2014 17:33

ANGLE

CHNL# 8: [ANGL 1482[SHEER 1 19.000]1] 180.00 -180.0
CHNL# 7: [ANGL 713[CMH 14 13.800]14] 180.00 -180.0
CHNL# 6: [ANGL 687[CMH 11R9 13.800]11] 180.00 -180.0

TIME (SECONDS) 0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2018 SP CASE8
CATB -B-675L

FILE: B-675L.out

TUE, APR 15 2014 17:33

BRANCH POWER

CHNL# 20: [POWR 660 TO 744 CKT '78'] 150.00 -250.0
CHNL# 17: [POWR 645 TO 270 CKT '92'] 150.00 -250.0
CHNL# 16: [POWR 271 TO 744 CKT '80'] 150.00 -250.0
CHNL# 19: [POWR 659 TO 744 CKT '75'] 150.00 -250.0

TIME (SECONDS) 0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2018 SP CASE8
CATB -B-675L

FILE: B-675L.out

TUE, APR 15 2014 17:33

VOLTAGE

CHNL# 5: [VOLT 744 [MHS-7 138.00]] 1.5000 0.0
CHNL# 4: [VOLT 669 [MEDHAT2 240.00]] 1.5000 0.0
CHNL# 3: [VOLT 659 [EASTMEDH 138.00]] 1.5000 0.0
CHNL# 2: [VOLT 271 [BULLS H7 138.00]] 1.5000 0.0
CHNL# 1: [VOLT 270 [SUFFIEL7 138.00]] 1.5000 0.0

TIME (SECONDS) 0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2018 SP CASE8
CATB -B-675L

FILE: B-675L.out

TUE, APR 15 2014 17:33

ELECTRICAL POWER

CHNL# 13: [POWR 4294[TOTHILL3 34.500]G2] 6.0000 -1.000
CHNL# 12: [POWR 2294[TOTHILL2 34.500]G1] 6.0000 -1.000
CHNL# 11: [POWR 1482[SHEER 1 19.000]1] 6.0000 -1.000
CHNL# 10: [POWR 713[CMH 14 13.800]14] 6.0000 -1.000

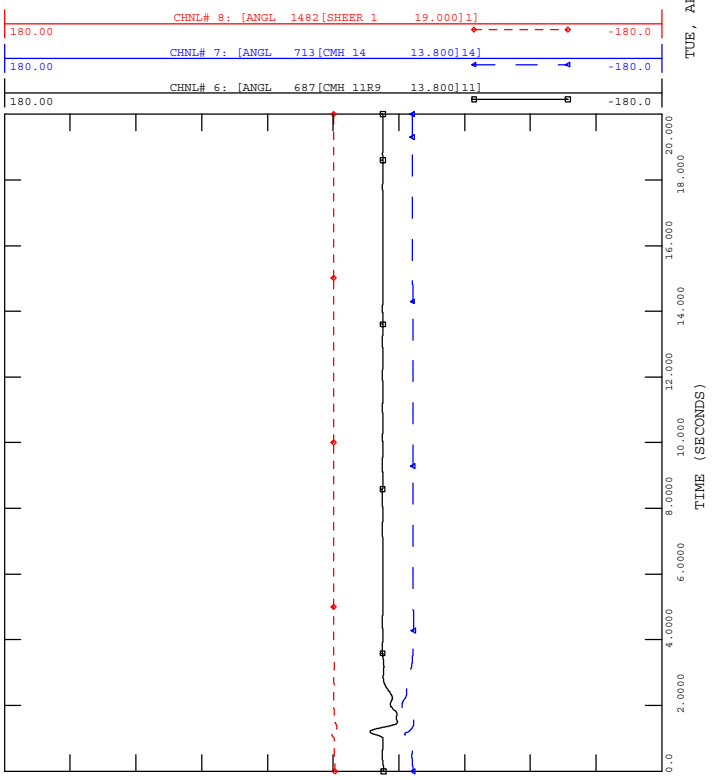
TIME (SECONDS) 0.0 2.0000 4.0000 6.0000 8.0000 10.000 12.000 14.000 16.000 18.000 20.000

AESO MEDICINE HAT 2018 SP CASE8
CATB -B-880L

FILE: B-880L.out

TUE, APR 15 2014 17:33

ANGLE

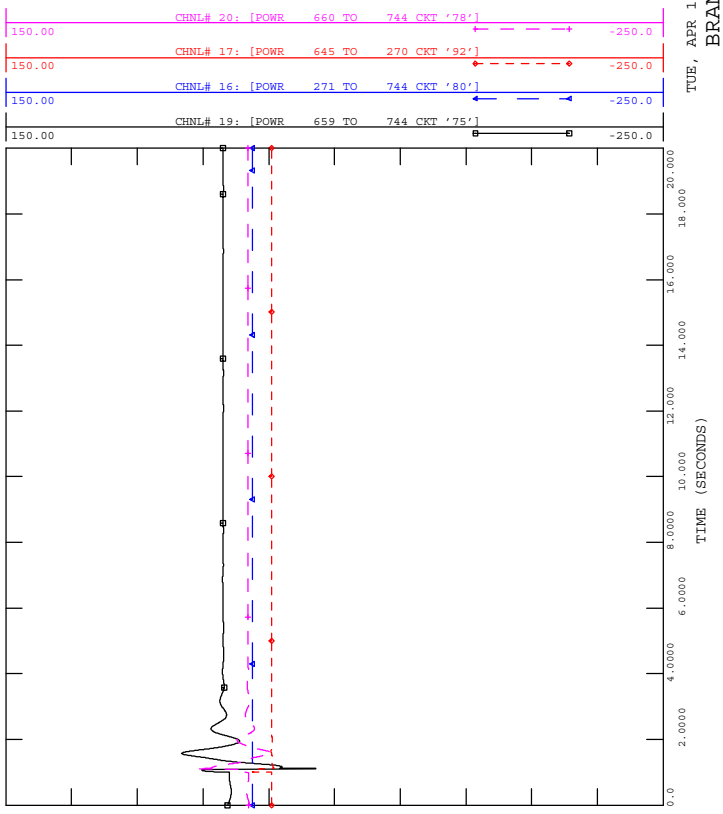


AESO MEDICINE HAT 2018 SP CASE8
CATB -B-880L

FILE: B-880L.out

TUE, APR 15 2014 17:33

BRANCH POWER

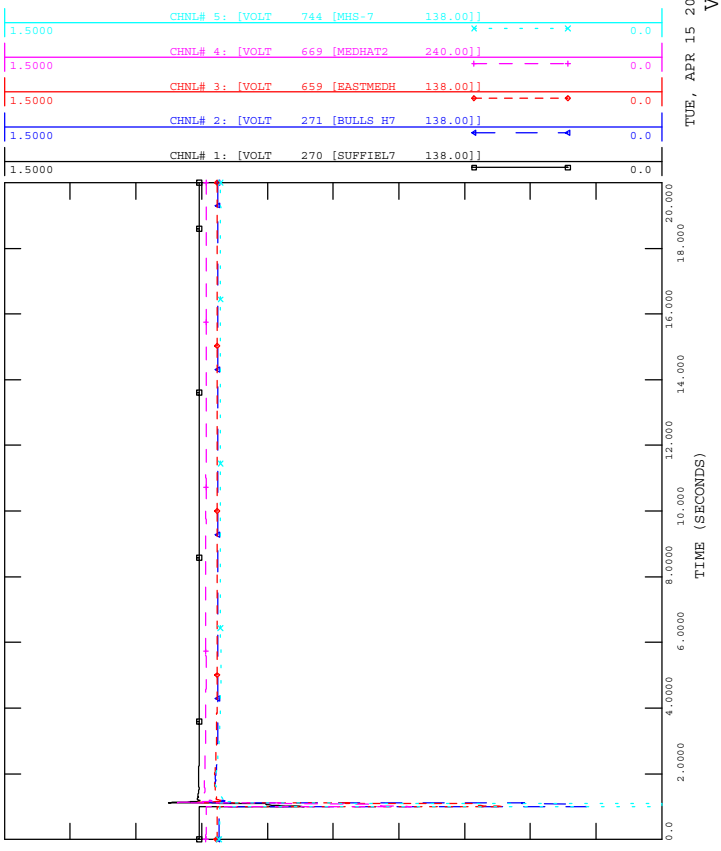


AESO MEDICINE HAT 2018 SP CASE8
CATB -B-880L

FILE: B-880L.out

TUE, APR 15 2014 17:33

VOLTAGE

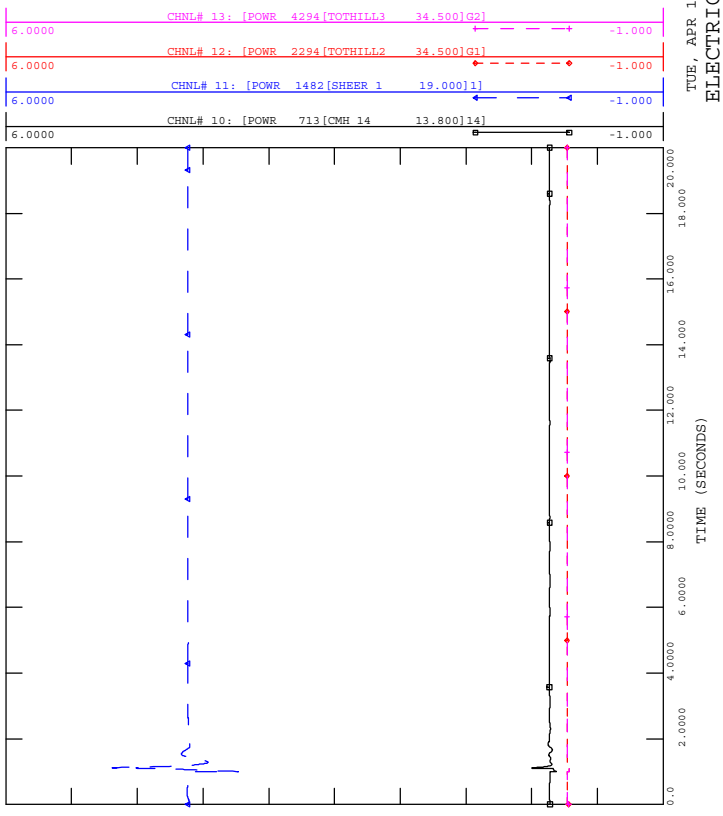


AESO MEDICINE HAT 2018 SP CASE8
CATB -B-880L

FILE: B-880L.out

TUE, APR 15 2014 17:33

ELECTRICAL POWER



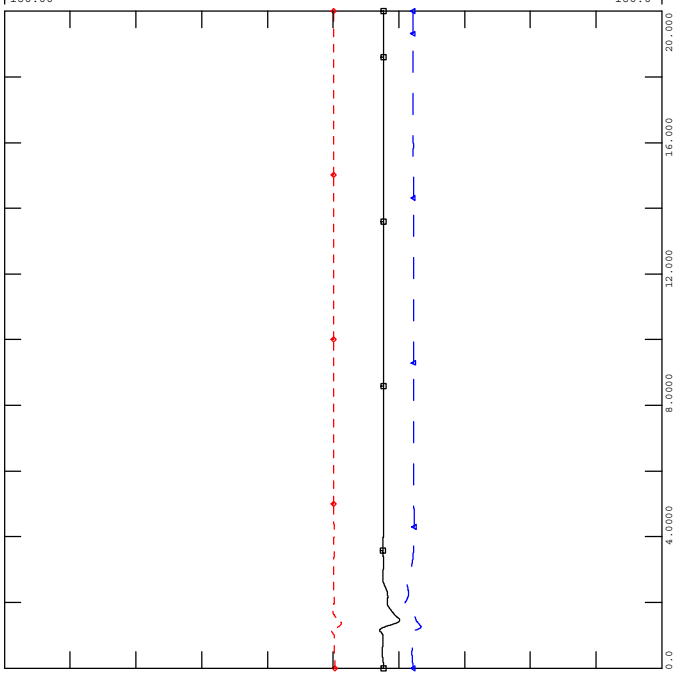
AESO MEDICINE HAT 2018 SP CASE8
CATB -B-676L

FILE: B-676L.out

TUE, APR 15 2014 17:33

ANGLE

CHNL# 8: [ANGL 1482[SHEER 1 19.000]1]
CHNL# 7: [ANGL 713[CMH 14 13.800]14]
CHNL# 6: [ANGL 687[CMH 11R9 13.800]11]



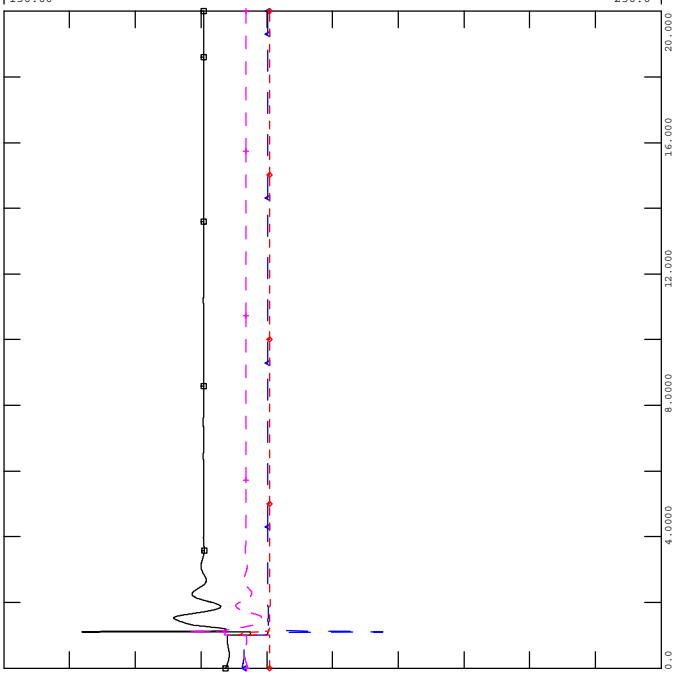
AESO MEDICINE HAT 2018 SP CASE8
CATB -B-676L

FILE: B-676L.out

TUE, APR 15 2014 17:33

BRANCH POWER

CHNL# 20: [POWR 660 TO 744 CKT '78']
CHNL# 17: [POWR 645 TO 270 CKT '92']
CHNL# 16: [POWR 271 TO 744 CKT '80']
CHNL# 19: [POWR 659 TO 744 CKT '75']



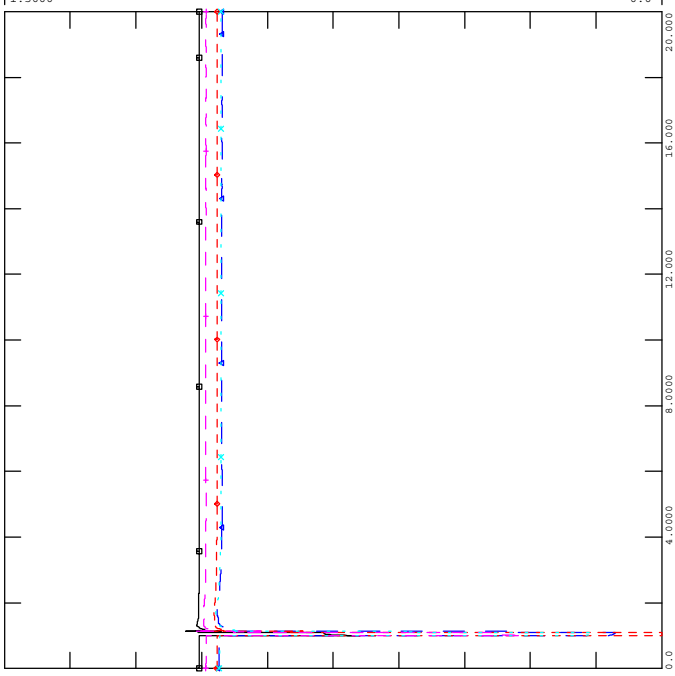
AESO MEDICINE HAT 2018 SP CASE8
CATB -B-676L

FILE: B-676L.out

TUE, APR 15 2014 17:33

VOLTAGE

CHNL# 5: [VOLT 744 [MHS-7 138.00]]
CHNL# 4: [VOLT 669 [MEDHAT2 240.00]]
CHNL# 3: [VOLT 659 [EASTMEDH 138.00]]
CHNL# 2: [VOLT 271 [BULLS H7 138.00]]
CHNL# 1: [VOLT 270 [SUFFIEL7 138.00]]



AESO MEDICINE HAT 2018 SP CASE8
CATB -B-676L

FILE: B-676L.out

TUE, APR 15 2014 17:33

ELECTRICAL POWER

CHNL# 13: [POWR 4294[TOTHILL3 34.500]G2]
CHNL# 12: [POWR 2294[TOTHILL2 34.500]G1]
CHNL# 11: [POWR 1482[SHEER 1 19.000]1]
CHNL# 10: [POWR 713[CMH 14 13.800]14]