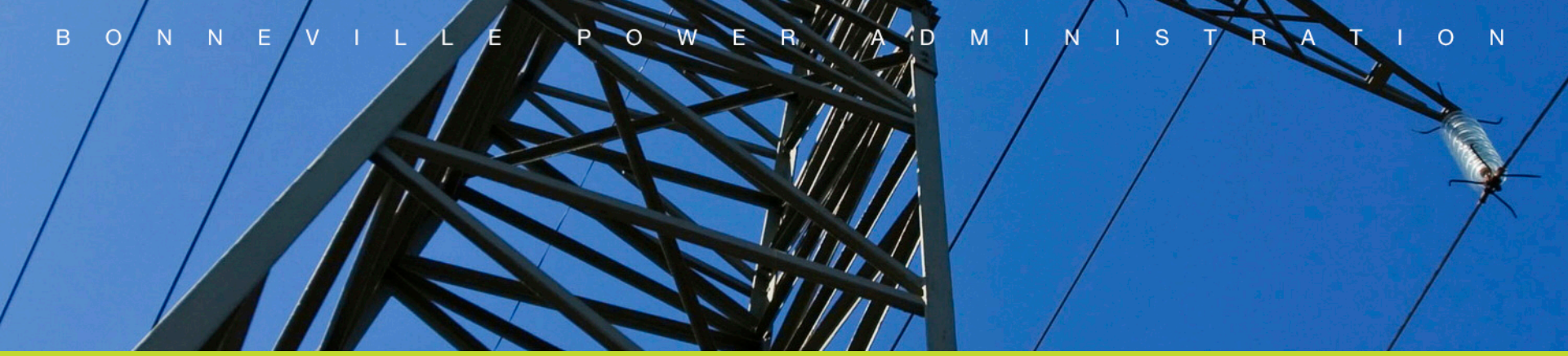
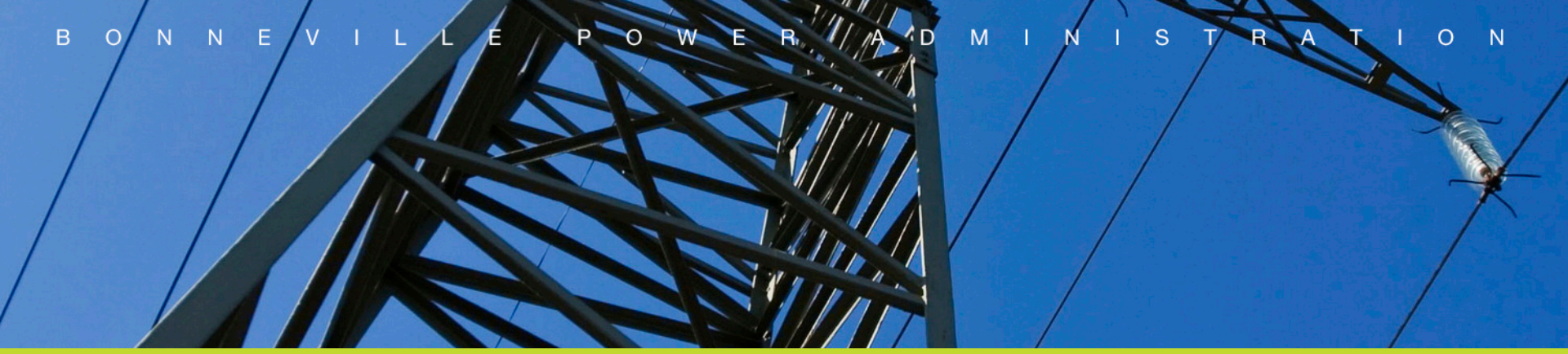


Contingency Sensitivity Analysis

Cory Rea



Purpose

- Allows user to investigate flow violations found in the contingency analysis tool
- Identifies key generators and loads that impact contingency overloads
- Identifies key transmission paths(interfaces) impacted by generators and loads

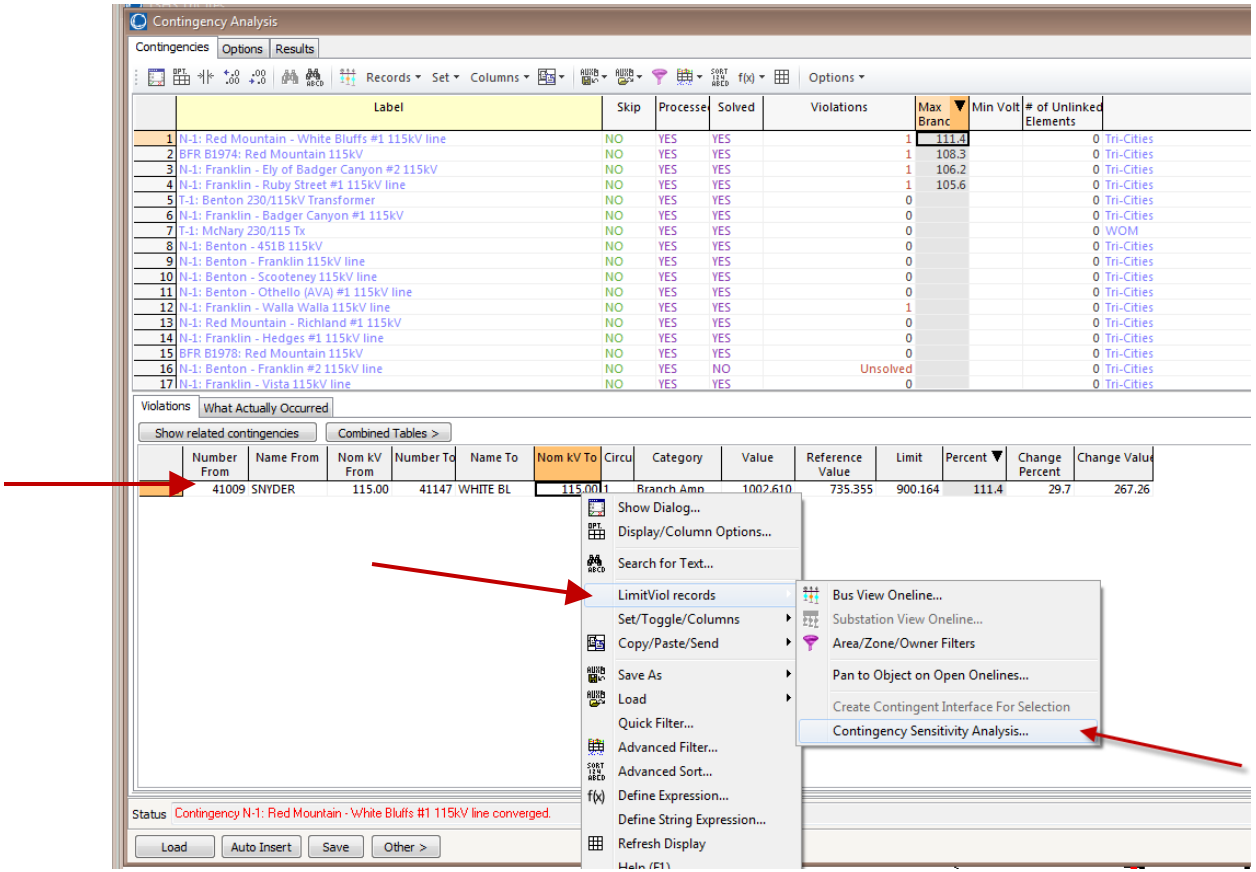
Background

- Idea of James Wong of BPA
- Validated by Daniel Kuraspediani, David Kleinschmidt and Chris Kulink of BPA
- Version 18 and 19

Accessing the Tool

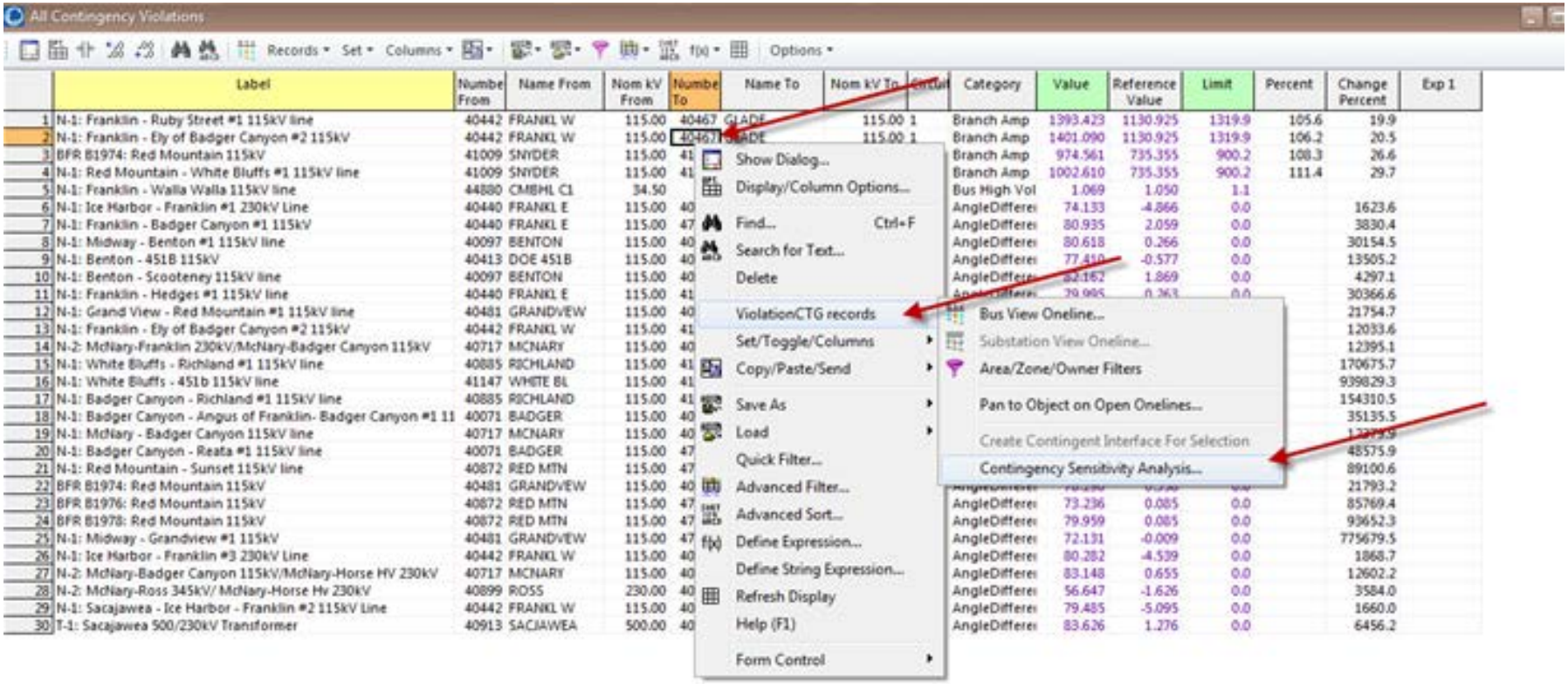
- Two ways to access the tool

LimitViol Records → Contingency Sensitivity Analysis



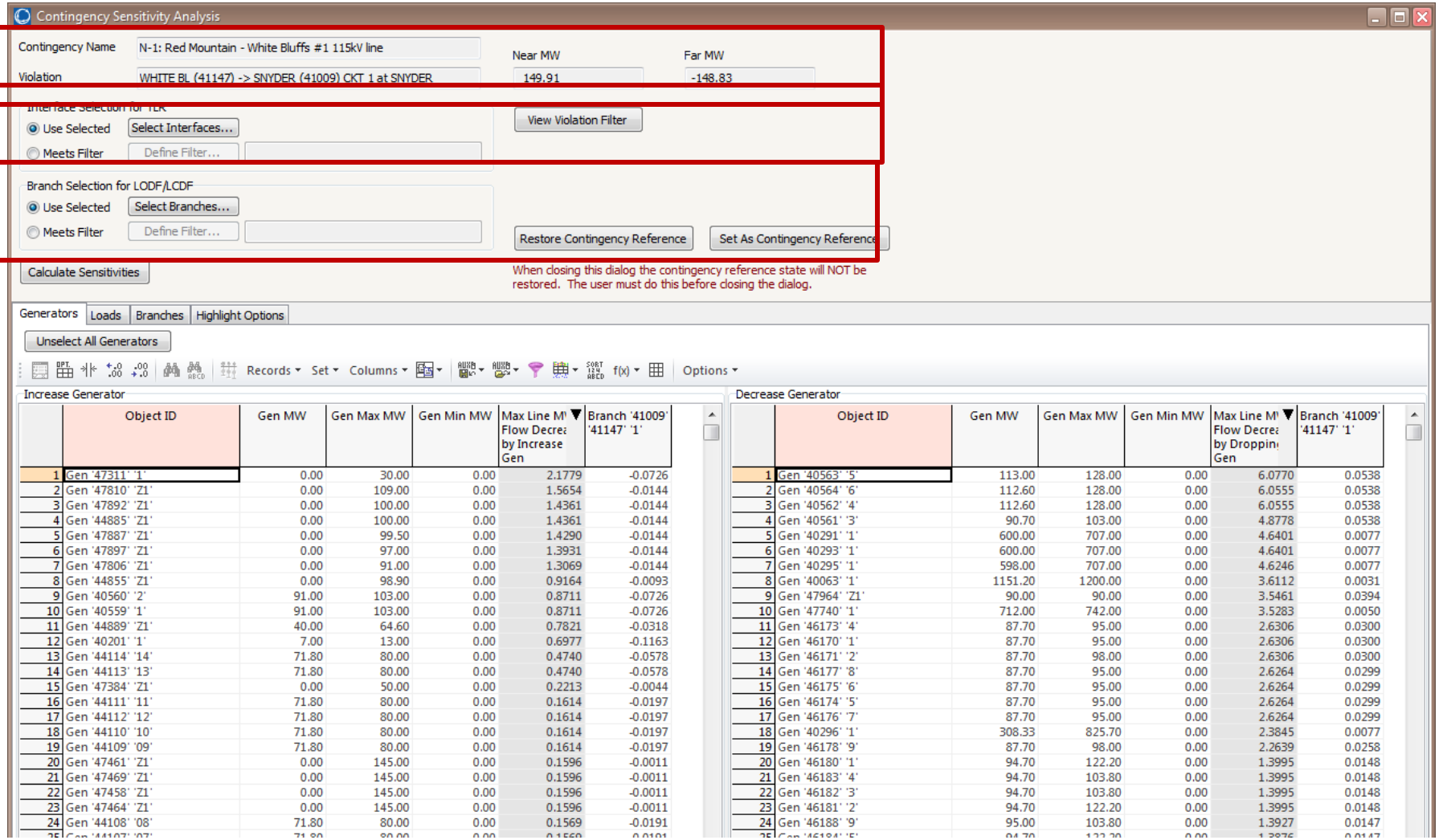
Accessing the Tool

Results Tab → ViolationCTG records → Contingency Sensitivity Analysis

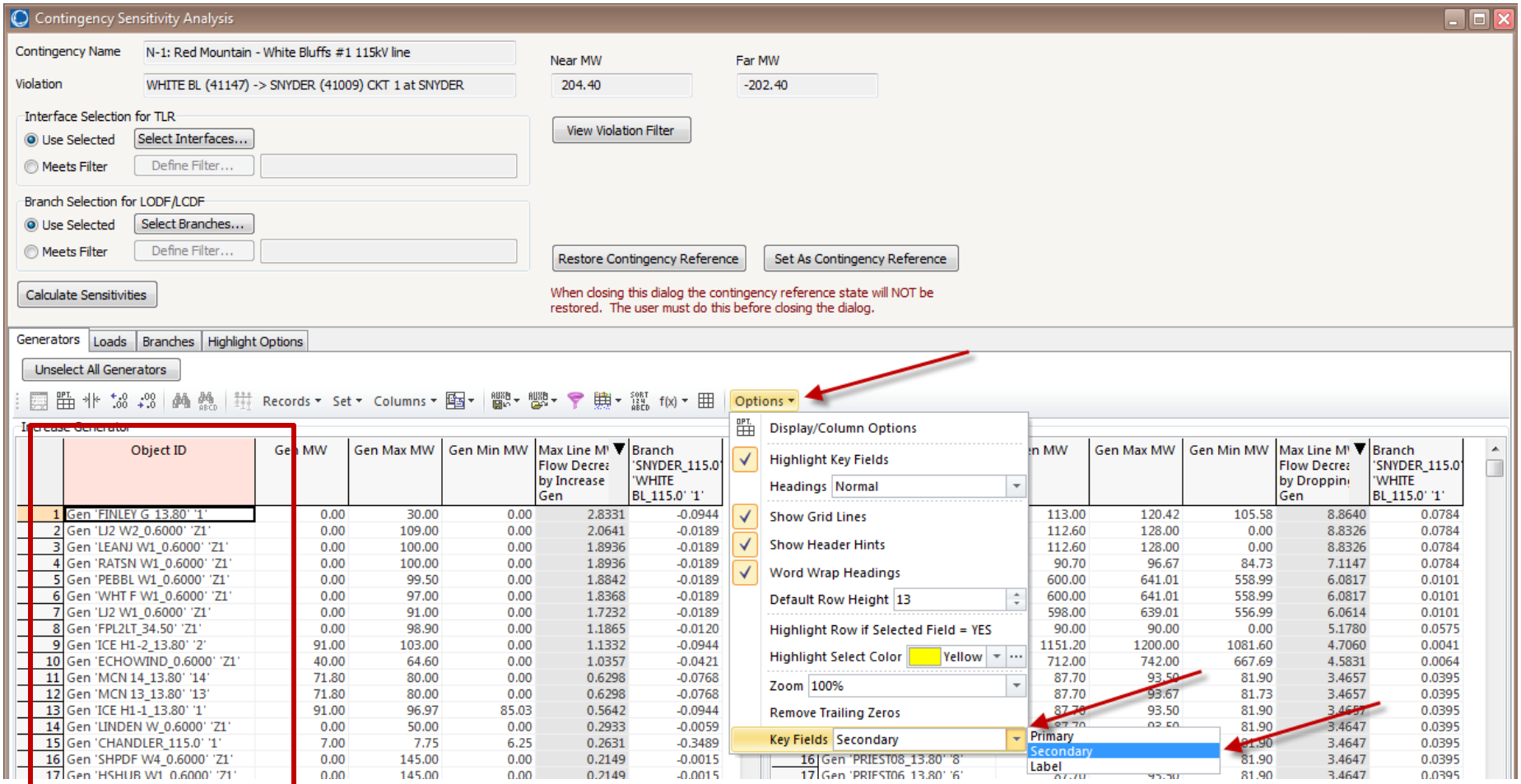


Note: Accessing the tool applies the contingency to the case

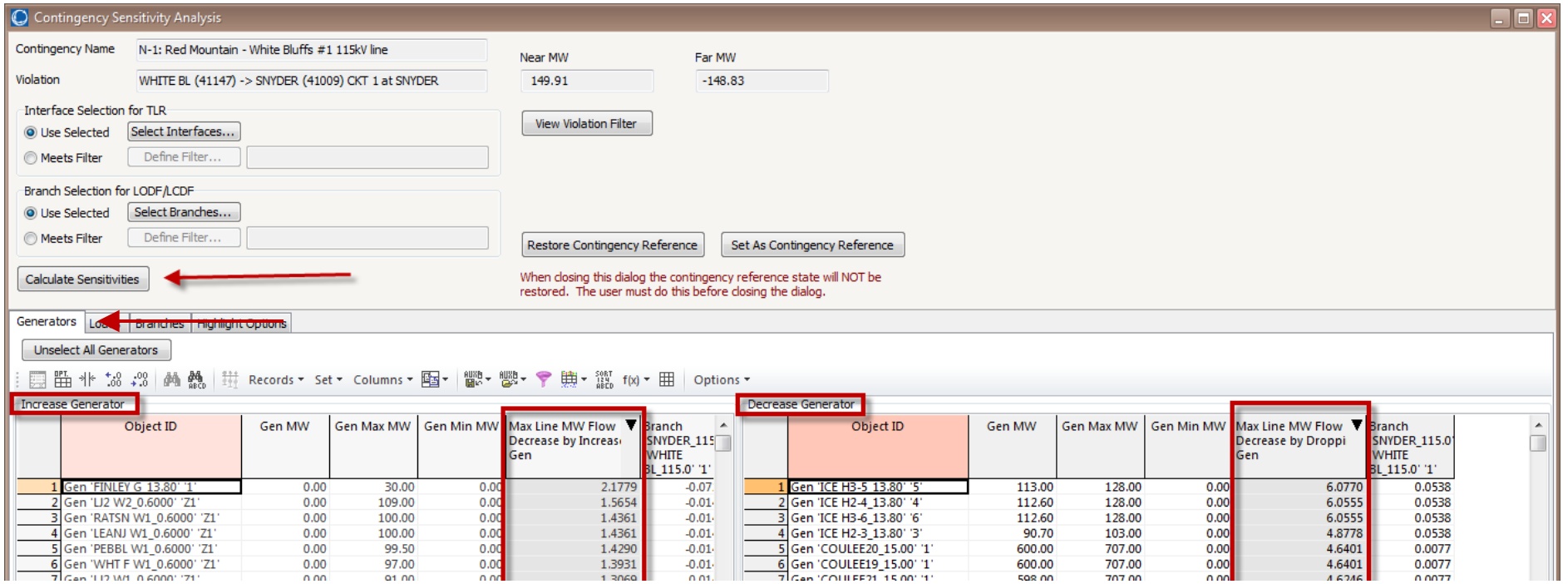
Fields


Contingency Sensitivity Analysis
Contingency Name
N-1: Red Mountain - White Bluffs #1 115kV line
Violation
WHITE BL (41147) -> SNYDER (41009) CKT 1 at SNYDER
Near MW
149.91
Far MW
-148.83
Use Selected
Select Interfaces...
Meets Filter
Define Filter...
View Violation Filter
Branch Selection for LODF/LCDF
Use Selected
Select Branches...
Meets Filter
Define Filter...
Restore Contingency Reference
Set As Contingency Reference
Calculate Sensitivities
When closing this dialog the contingency reference state will NOT be restored. The user must do this before closing the dialog.
Generators
Loads
Branches
Highlight Options
Unselect All Generators
Records
Set
Columns
Options
Increase Generator
Object ID
Gen MW
Gen Max MW
Gen Min MW
Max Line M' Flow Decrea by Increase Gen
Branch '41009' '41147' '1'
1 Gen '47311' '1' 0.00 30.00 0.00 2.1779 -0.0726
2 Gen '47810' 'Z1' 0.00 109.00 0.00 1.5654 -0.0144
3 Gen '47892' 'Z1' 0.00 100.00 0.00 1.4361 -0.0144
4 Gen '44885' 'Z1' 0.00 100.00 0.00 1.4361 -0.0144
5 Gen '47887' 'Z1' 0.00 99.50 0.00 1.4290 -0.0144
6 Gen '47897' 'Z1' 0.00 97.00 0.00 1.3931 -0.0144
7 Gen '47806' 'Z1' 0.00 91.00 0.00 1.3069 -0.0144
8 Gen '44855' 'Z1' 0.00 98.90 0.00 0.9164 -0.0093
9 Gen '40560' '2' 91.00 103.00 0.00 0.8711 -0.0726
10 Gen '40559' '1' 91.00 103.00 0.00 0.8711 -0.0726
11 Gen '44889' 'Z1' 40.00 64.60 0.00 0.7821 -0.0318
12 Gen '40201' '1' 7.00 13.00 0.00 0.6977 -0.1163
13 Gen '44114' '14' 71.80 80.00 0.00 0.4740 -0.0578
14 Gen '44113' '13' 71.80 80.00 0.00 0.4740 -0.0578
15 Gen '47384' 'Z1' 0.00 50.00 0.00 0.2213 -0.0044
16 Gen '44111' '11' 71.80 80.00 0.00 0.1614 -0.0197
17 Gen '44112' '12' 71.80 80.00 0.00 0.1614 -0.0197
18 Gen '44110' '10' 71.80 80.00 0.00 0.1614 -0.0197
19 Gen '44109' '09' 71.80 80.00 0.00 0.1614 -0.0197
20 Gen '47461' 'Z1' 0.00 145.00 0.00 0.1596 -0.0011
21 Gen '47469' 'Z1' 0.00 145.00 0.00 0.1596 -0.0011
22 Gen '47458' 'Z1' 0.00 145.00 0.00 0.1596 -0.0011
23 Gen '47464' 'Z1' 0.00 145.00 0.00 0.1596 -0.0011
24 Gen '44108' '08' 71.80 80.00 0.00 0.1569 -0.0191
Decrease Generator
Object ID
Gen MW
Gen Max MW
Gen Min MW
Max Line M' Flow Decrea by Droppin Gen
Branch '41009' '41147' '1'
1 Gen '40563' '5' 113.00 128.00 0.00 6.0770 0.0538
2 Gen '40564' '6' 112.60 128.00 0.00 6.0555 0.0538
3 Gen '40562' '4' 112.60 128.00 0.00 6.0555 0.0538
4 Gen '40561' '3' 90.70 103.00 0.00 4.8778 0.0538
5 Gen '40291' '1' 600.00 707.00 0.00 4.6401 0.0077
6 Gen '40293' '1' 600.00 707.00 0.00 4.6401 0.0077
7 Gen '40295' '1' 598.00 707.00 0.00 4.6246 0.0077
8 Gen '40063' '1' 1151.20 1200.00 0.00 3.6112 0.0031
9 Gen '47964' 'Z1' 90.00 90.00 0.00 3.5461 0.0394
10 Gen '47740' '1' 712.00 742.00 0.00 3.5283 0.0050
11 Gen '46173' '4' 87.70 95.00 0.00 2.6306 0.0300
12 Gen '46170' '1' 87.70 95.00 0.00 2.6306 0.0300
13 Gen '46171' '2' 87.70 98.00 0.00 2.6306 0.0300
14 Gen '46177' '8' 87.70 95.00 0.00 2.6264 0.0299
15 Gen '46175' '6' 87.70 95.00 0.00 2.6264 0.0299
16 Gen '46174' '5' 87.70 95.00 0.00 2.6264 0.0299
17 Gen '46176' '7' 87.70 95.00 0.00 2.6264 0.0299
18 Gen '40296' '1' 308.33 825.70 0.00 2.3845 0.0077
19 Gen '46178' '9' 87.70 98.00 0.00 2.2639 0.0258
20 Gen '46180' '1' 94.70 122.20 0.00 1.3995 0.0148
21 Gen '46183' '4' 94.70 103.80 0.00 1.3995 0.0148
22 Gen '46182' '3' 94.70 103.80 0.00 1.3995 0.0148
23 Gen '46181' '2' 94.70 122.20 0.00 1.3995 0.0148
24 Gen '46188' '9' 95.00 103.80 0.00 1.3927 0.0147

Fields

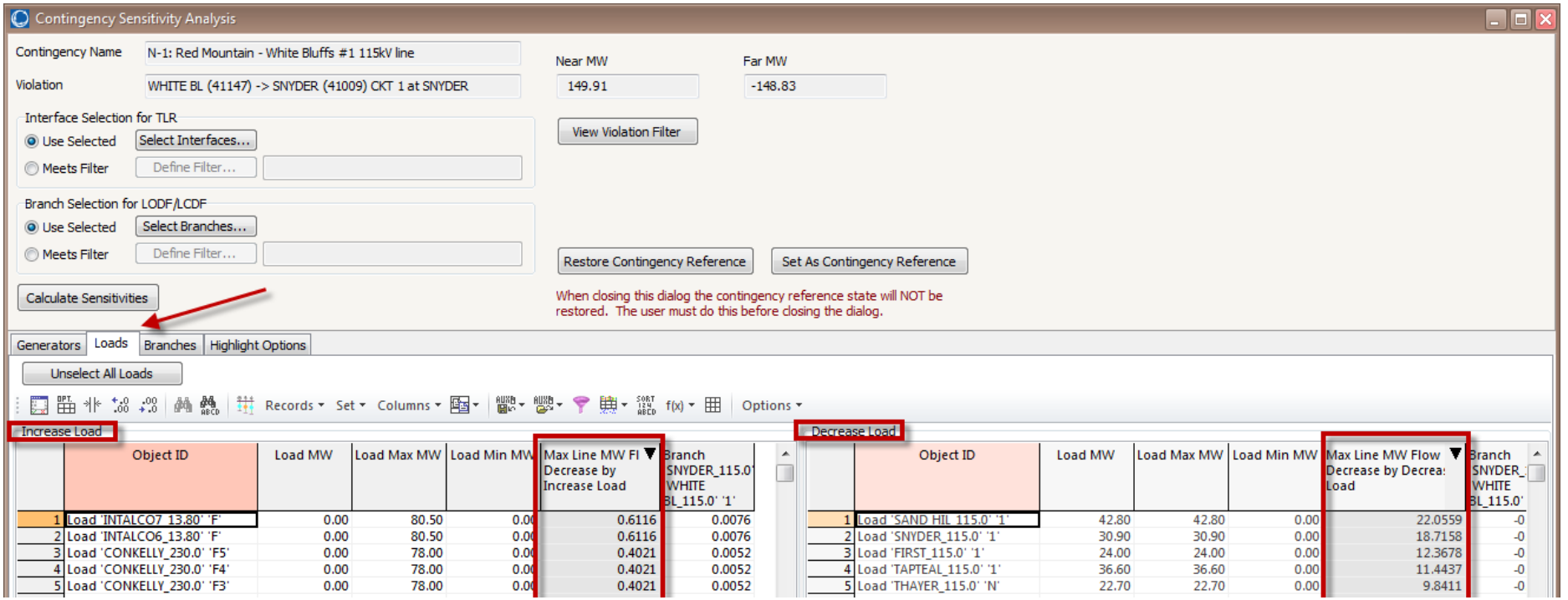

Contingency Sensitivity Analysis
Contingency Name
N-1: Red Mountain - White Bluffs #1 115kV line
Violation
WHITE BL (41147) -> SNYDER (41009) CKT 1 at SNYDER
Near MW
204.40
Far MW
-202.40
Interface Selection for TLR
Use Selected
Select Interfaces...
Meets Filter
Define Filter...
View Violation Filter
Branch Selection for LODF/LCDF
Use Selected
Select Branches...
Meets Filter
Define Filter...
Restore Contingency Reference
Set As Contingency Reference
Calculate Sensitivities
When closing this dialog the contingency reference state will NOT be restored. The user must do this before closing the dialog.
Generators
Loads
Branches
Highlight Options
Unselect All Generators
Records
Set
Columns
Options
Display/Column Options
Highlight Key Fields
Headings
Normal
Show Grid Lines
Show Header Hints
Word Wrap Headings
Default Row Height
13
Highlight Row if Selected Field = YES
Highlight Select Color
Yellow
Zoom
100%
Remove Trailing Zeros
Key Fields
Secondary
Primary
Secondary
Label
Object ID
Gen MW
Gen Max MW
Gen Min MW
Max Line MW Flow Decrea by Increase Gen
Branch 'SNYDER_115.0' 'WHITE BL_115.0' '1'
Gen Max MW
Gen Min MW
Max Line MW Flow Decrea by Droppin Gen
Branch 'SNYDER_115.0' 'WHITE BL_115.0' '1'
1 Gen 'FINLEY G 13.80' '1' 0.00 30.00 0.00 2.8331 -0.0944 113.00 120.42 105.58 8.8640 0.0784
2 Gen 'LJ2 W2_0.6000' 'Z1' 0.00 109.00 0.00 2.0641 -0.0189 112.60 128.00 0.00 8.8326 0.0784
3 Gen 'LEANJ W1_0.6000' 'Z1' 0.00 100.00 0.00 1.8936 -0.0189 112.60 128.00 0.00 8.8326 0.0784
4 Gen 'RATSN W1_0.6000' 'Z1' 0.00 100.00 0.00 1.8936 -0.0189 90.70 96.67 84.73 7.1147 0.0784
5 Gen 'PEBBL W1_0.6000' 'Z1' 0.00 99.50 0.00 1.8842 -0.0189 600.00 641.01 558.99 6.0817 0.0101
6 Gen 'WHT F W1_0.6000' 'Z1' 0.00 97.00 0.00 1.8368 -0.0189 600.00 641.01 558.99 6.0817 0.0101
7 Gen 'LJ2 W1_0.6000' 'Z1' 0.00 91.00 0.00 1.7232 -0.0189 598.00 639.01 556.99 6.0614 0.0101
8 Gen 'FPL2LT_34.50' 'Z1' 0.00 98.90 0.00 1.1865 -0.0120 90.00 90.00 0.00 5.1780 0.0575
9 Gen 'ICE H1-2_13.80' '2' 91.00 103.00 0.00 1.1332 -0.0944 1151.20 1200.00 1081.60 4.7060 0.0041
10 Gen 'ECHOWIND_0.6000' 'Z1' 40.00 64.60 0.00 1.0357 -0.0421 712.00 742.00 667.69 4.5831 0.0064
11 Gen 'MCN 14_13.80' '14' 71.80 80.00 0.00 0.6298 -0.0768 87.70 93.50 81.90 3.4657 0.0395
12 Gen 'MCN 13_13.80' '13' 71.80 80.00 0.00 0.6298 -0.0768 87.70 93.67 81.73 3.4657 0.0395
13 Gen 'ICE H1-1_13.80' '1' 91.00 96.97 85.03 0.5642 -0.0944 87.70 93.50 81.90 3.4657 0.0395
14 Gen 'LINDEN W_0.6000' 'Z1' 0.00 50.00 0.00 0.2933 -0.0059 81.90 3.4647 0.0395
15 Gen 'CHANDLER_115.0' '1' 7.00 7.75 6.25 0.2631 -0.3489 81.90 3.4647 0.0395
16 Gen 'SHPDF W4_0.6000' 'Z1' 0.00 145.00 0.00 0.2149 -0.0015 81.90 3.4647 0.0395
17 Gen 'HSHUB W1_0.6000' 'Z1' 0.00 145.00 0.00 0.2149 -0.0015 81.90 3.4647 0.0395
16 Gen 'PRIEST08_13.80' '8'
17 Gen 'PRIEST06_13.80' '6'

Calculate Sensitivities



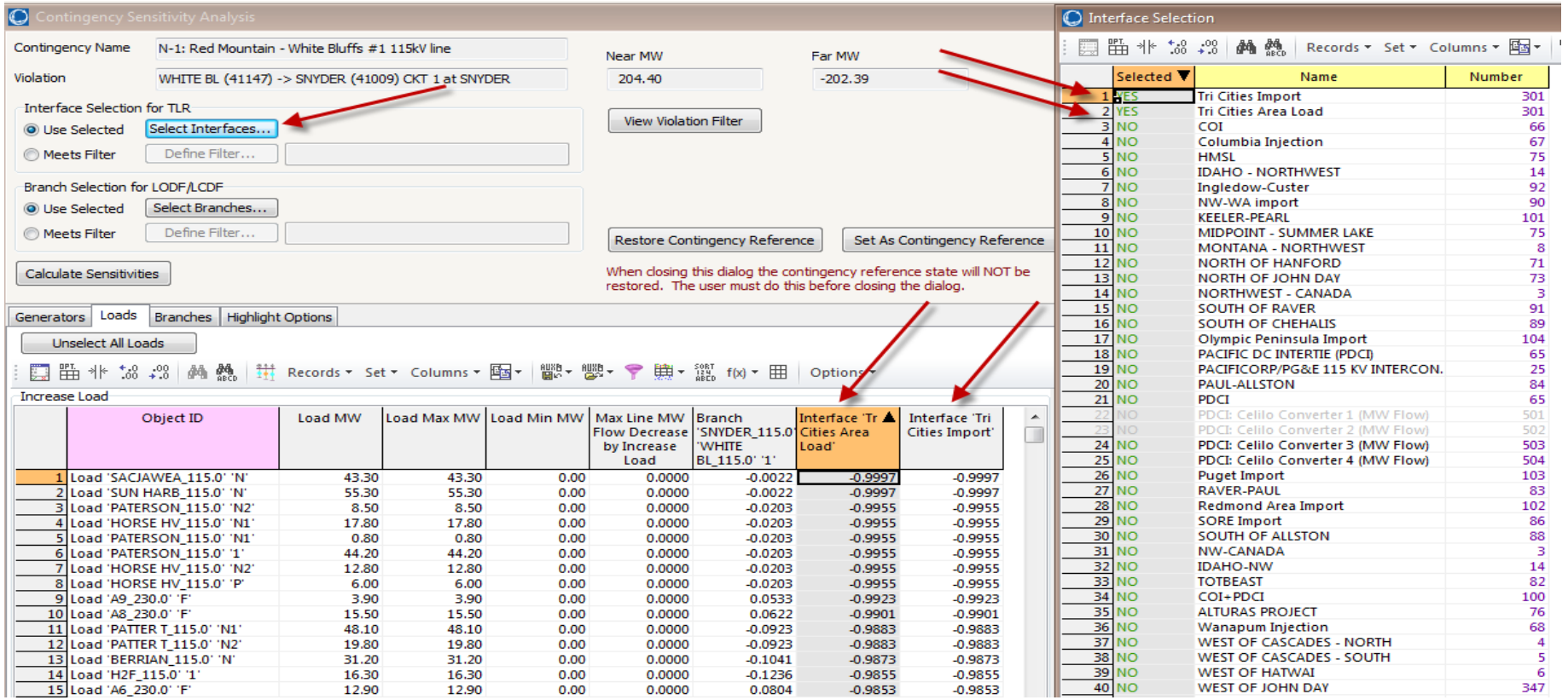
Please note that these values will **DECREASE** flow on the violating element so a positive number is what you would want for overload mitigation.

Loads



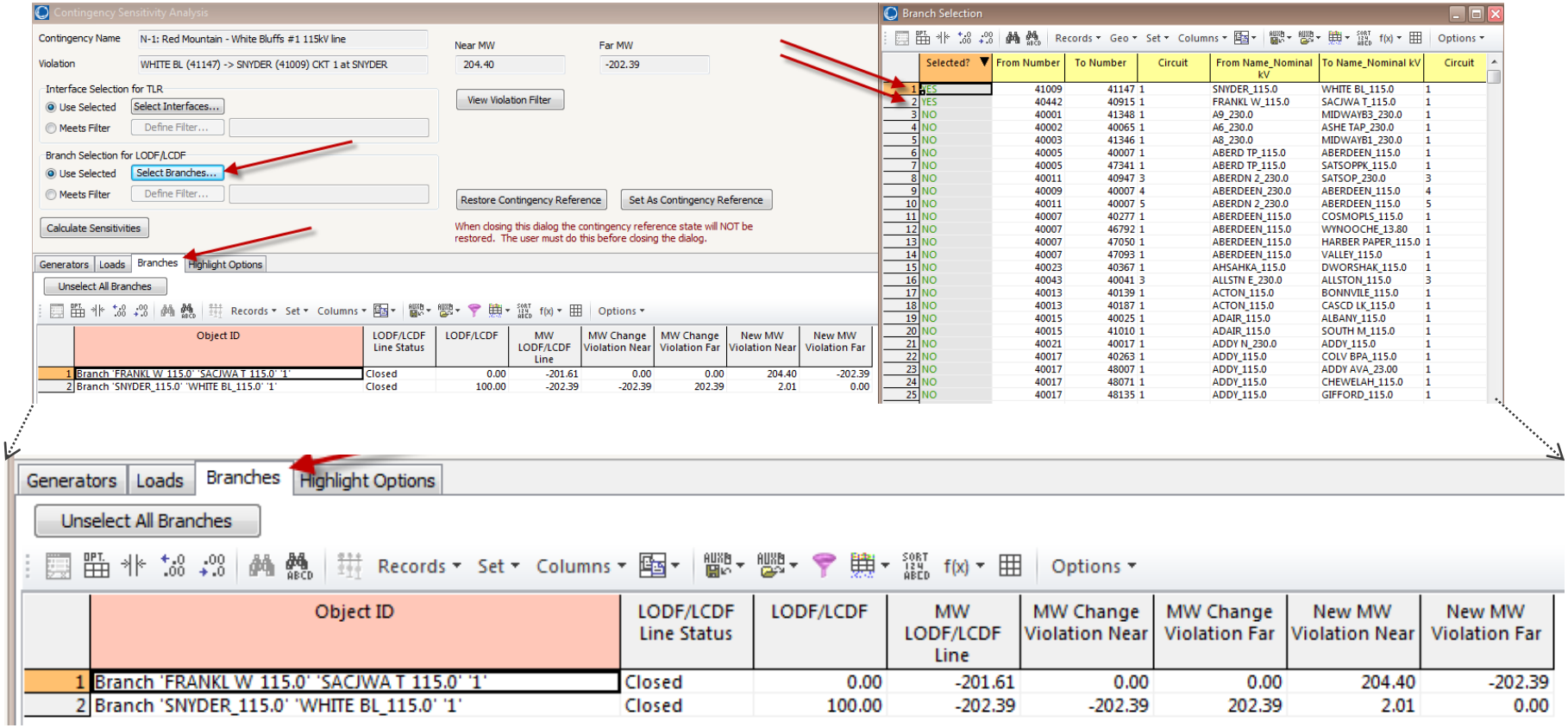
Please note that these values will **DECREASE** flow on the violating element so a positive number is what you would want for overload mitigation.

Sensitivities to Interfaces



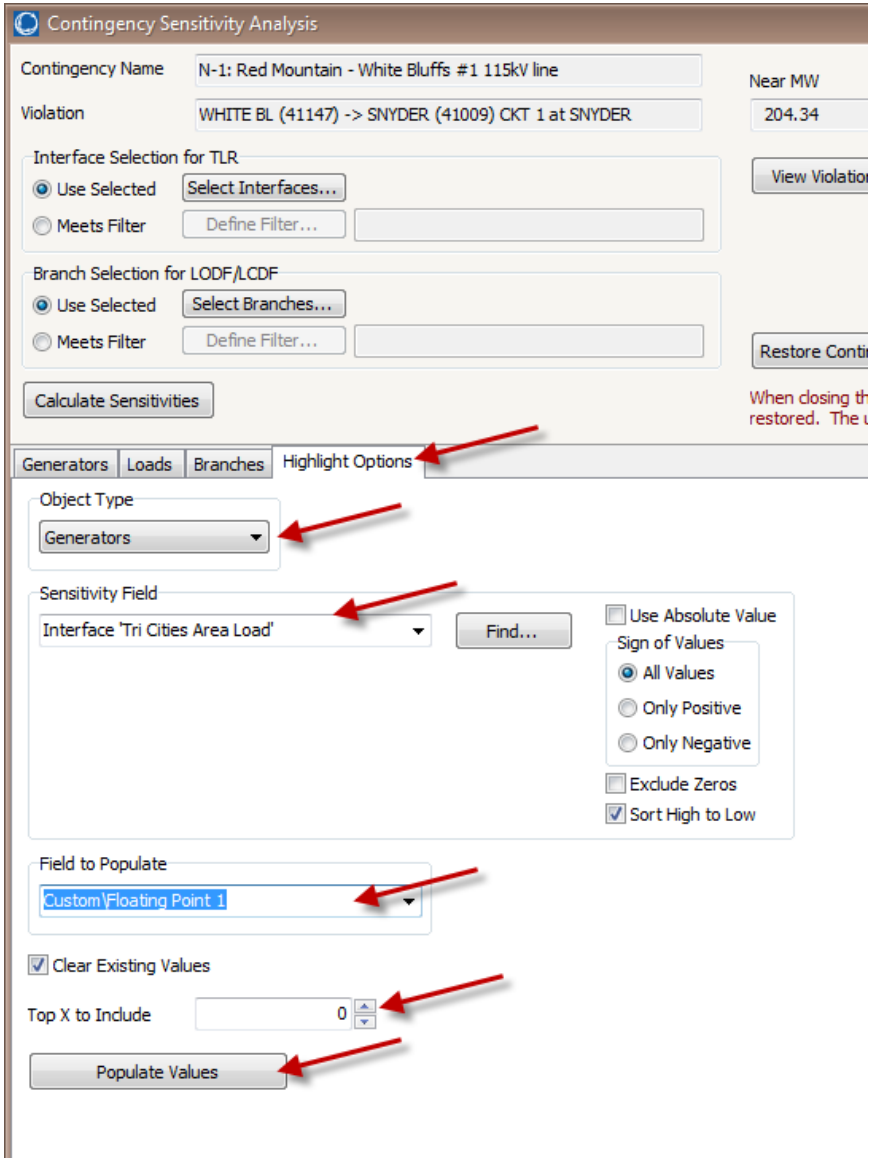
- Interface Sensitivity = $\frac{\Delta Value}{\Delta Flow}$ per 1 MW

Sensitivities to LODF/LCDFs



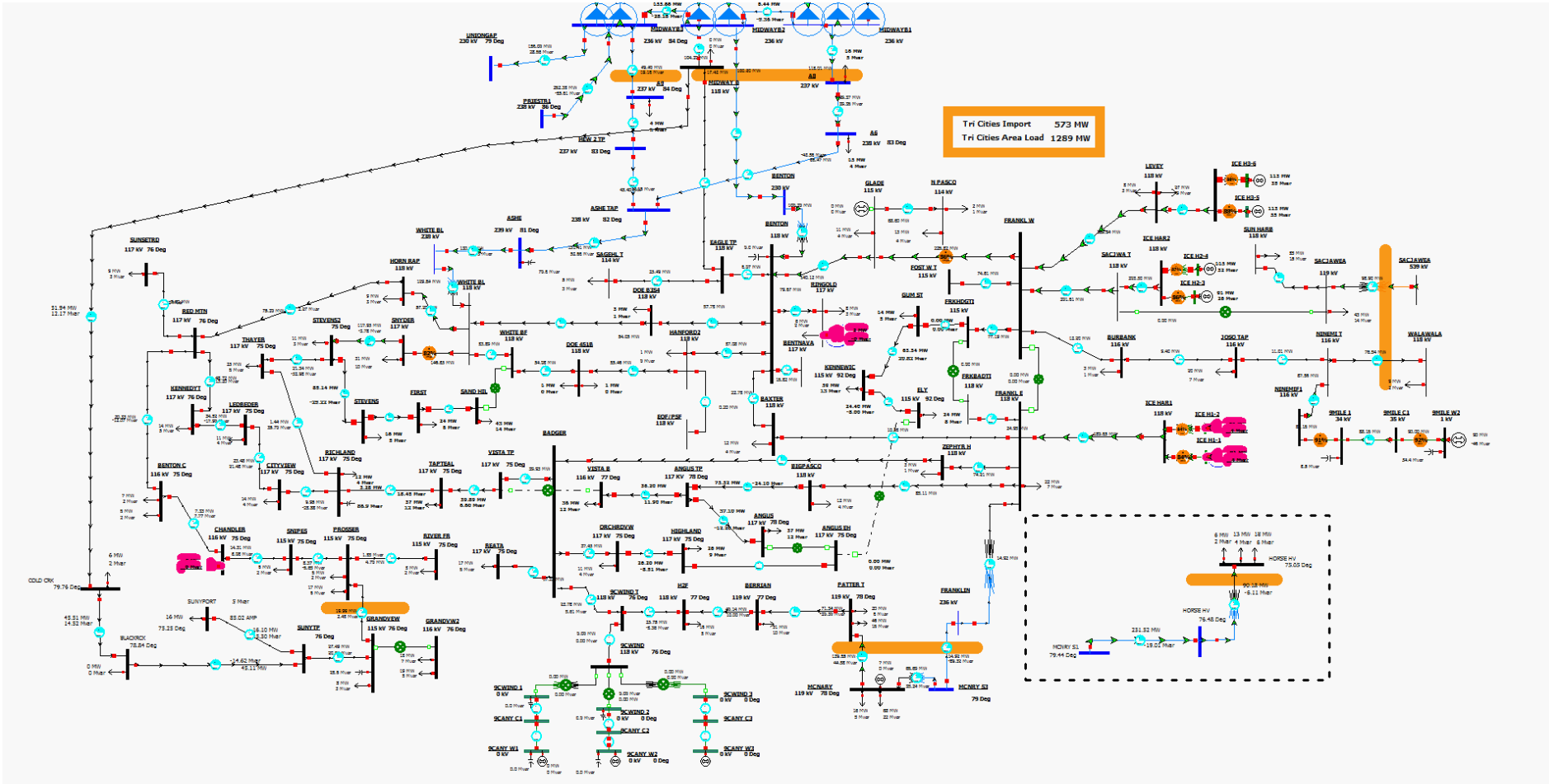
- Shows impact of opening or closing the selected branch on the violation element
- Calculations will not be shown for any outages/closures resulting in an island

Highlight Options

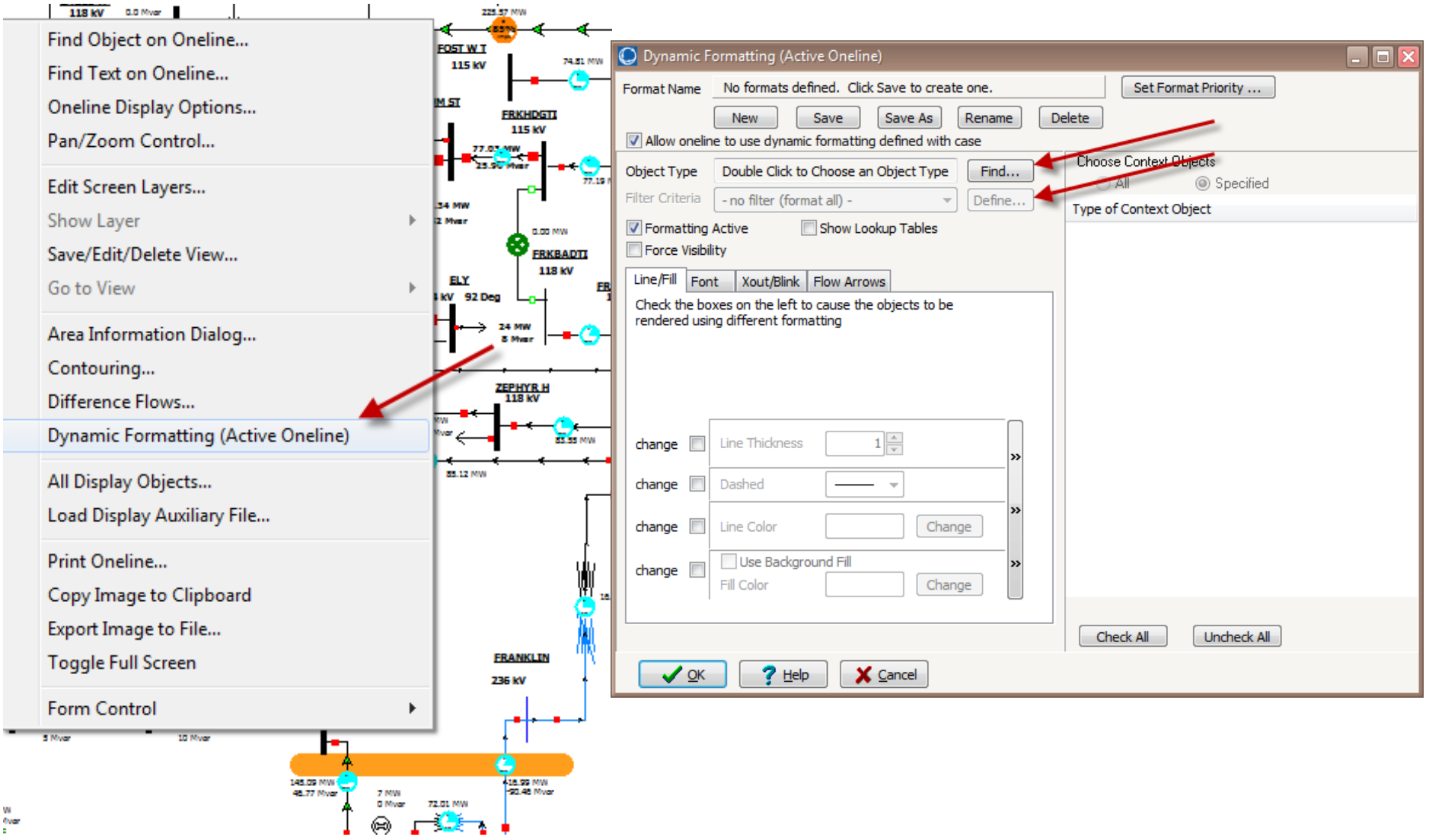


- **Object Type**
  What you would like to highlight
- **Sensitivity Field**
  What values to use
- **Field to Populate**
  Where the values go to use for dynamic one-lines
- **Top X to include**
  Top Values instead of filter
- **Populate Values**
  Clears when dialog is closed

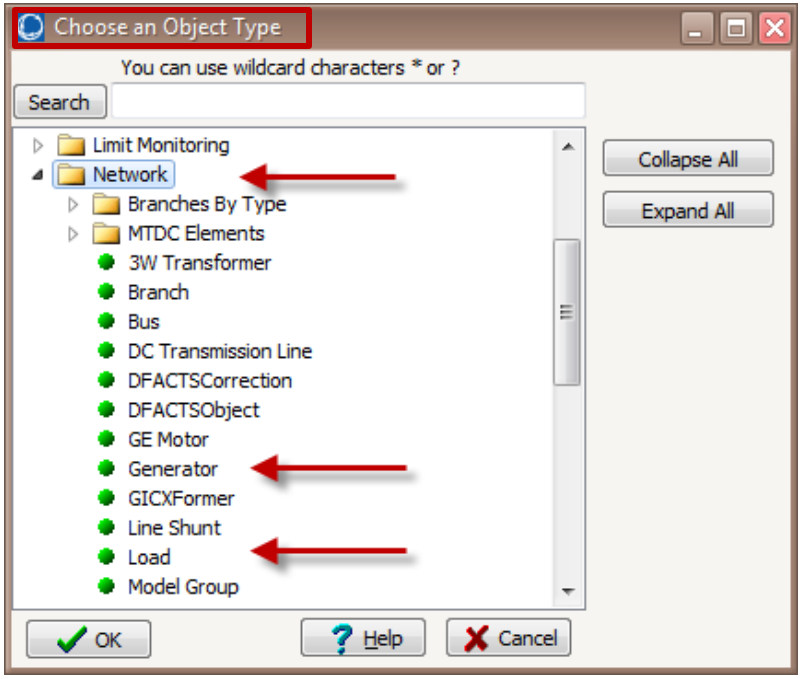
Dynamic Formatting

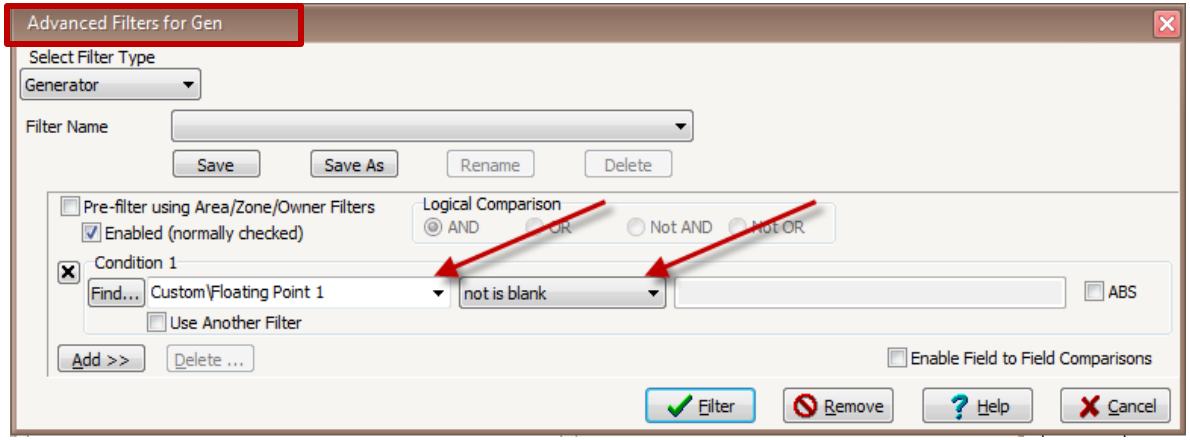


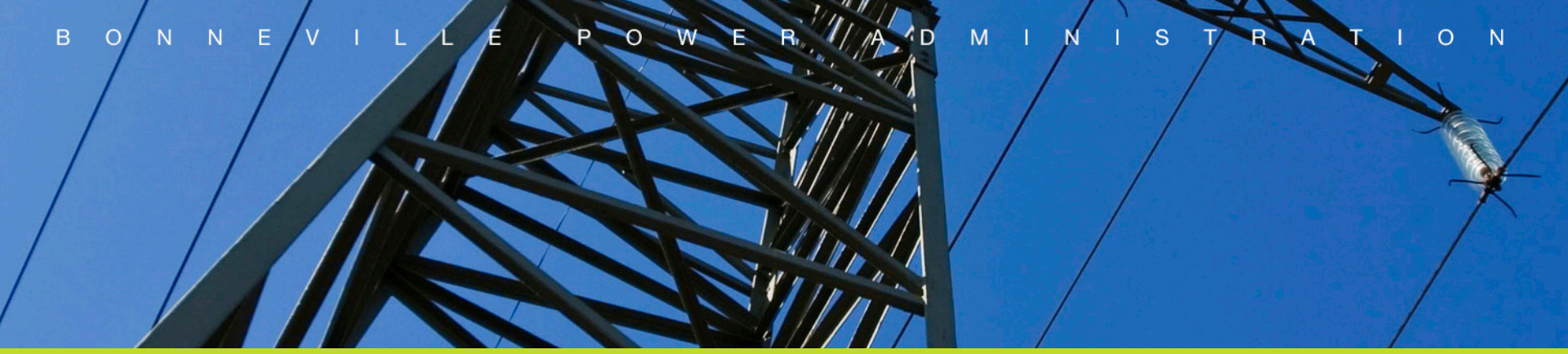
Dynamic Formatting Settings



Dynamic Formatting Settings







Questions?