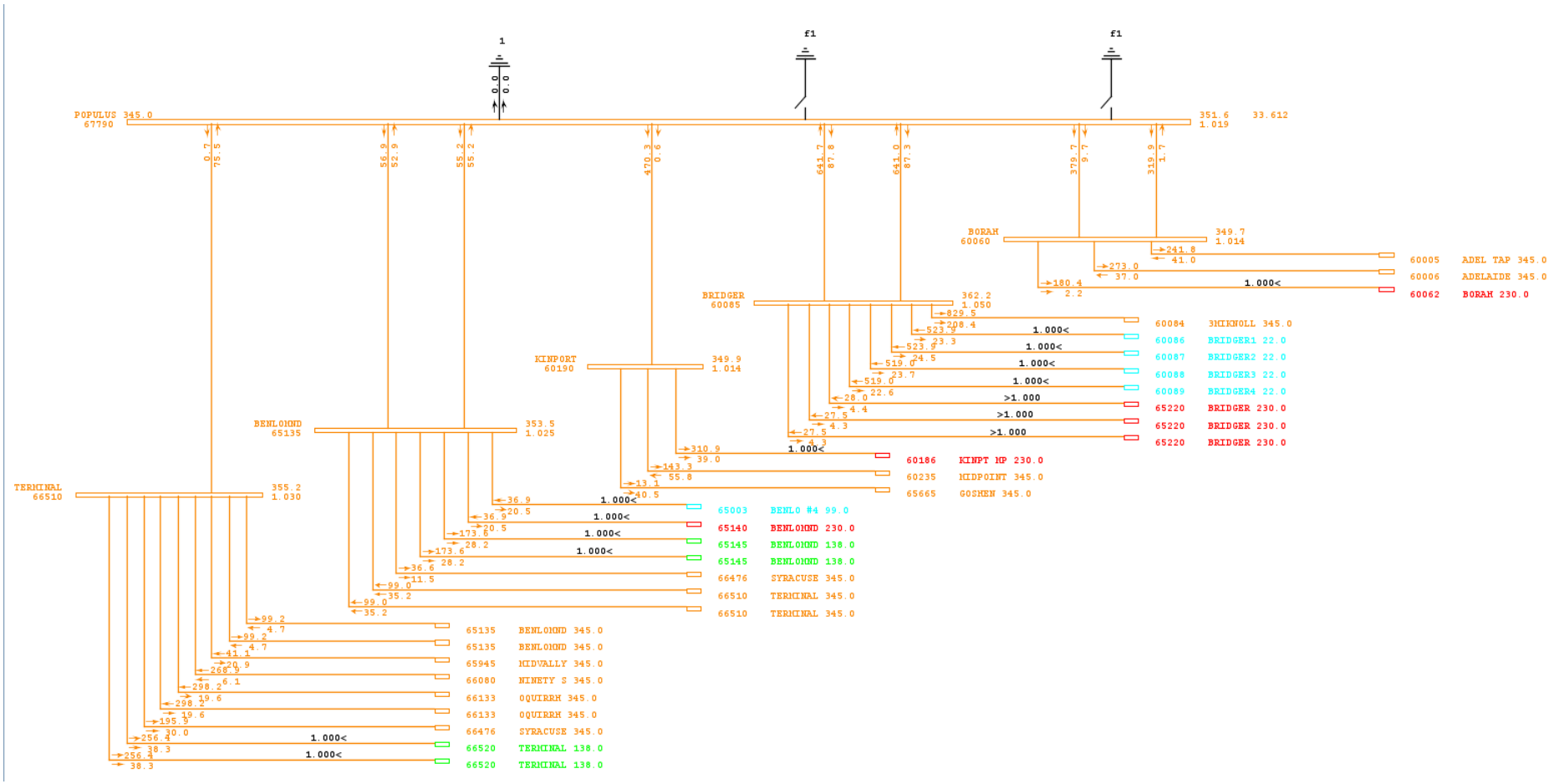
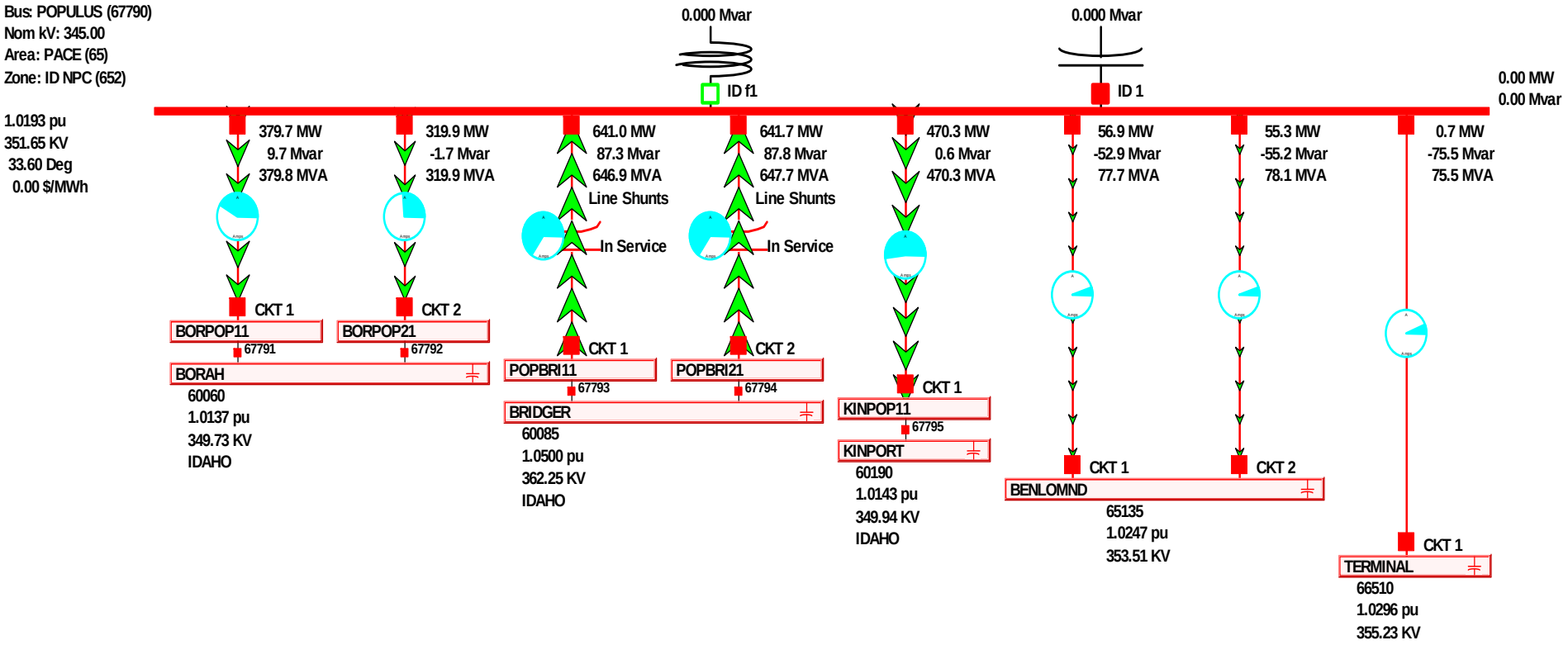
A Sample of Seldom Used Tools and other Power Flow Trivia

Tracy Rolstad
Avista System Planning
WECC PWSUG, 14 March 2012

GE Appears to Model One Shunt, but Displays Two

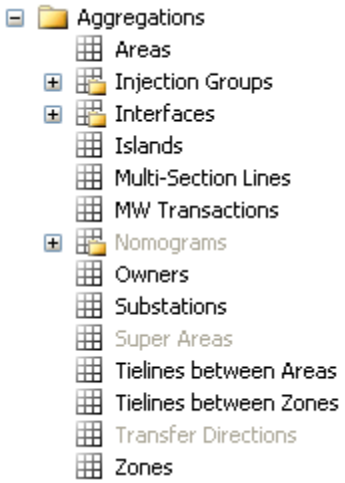


Carry Over from Case Read



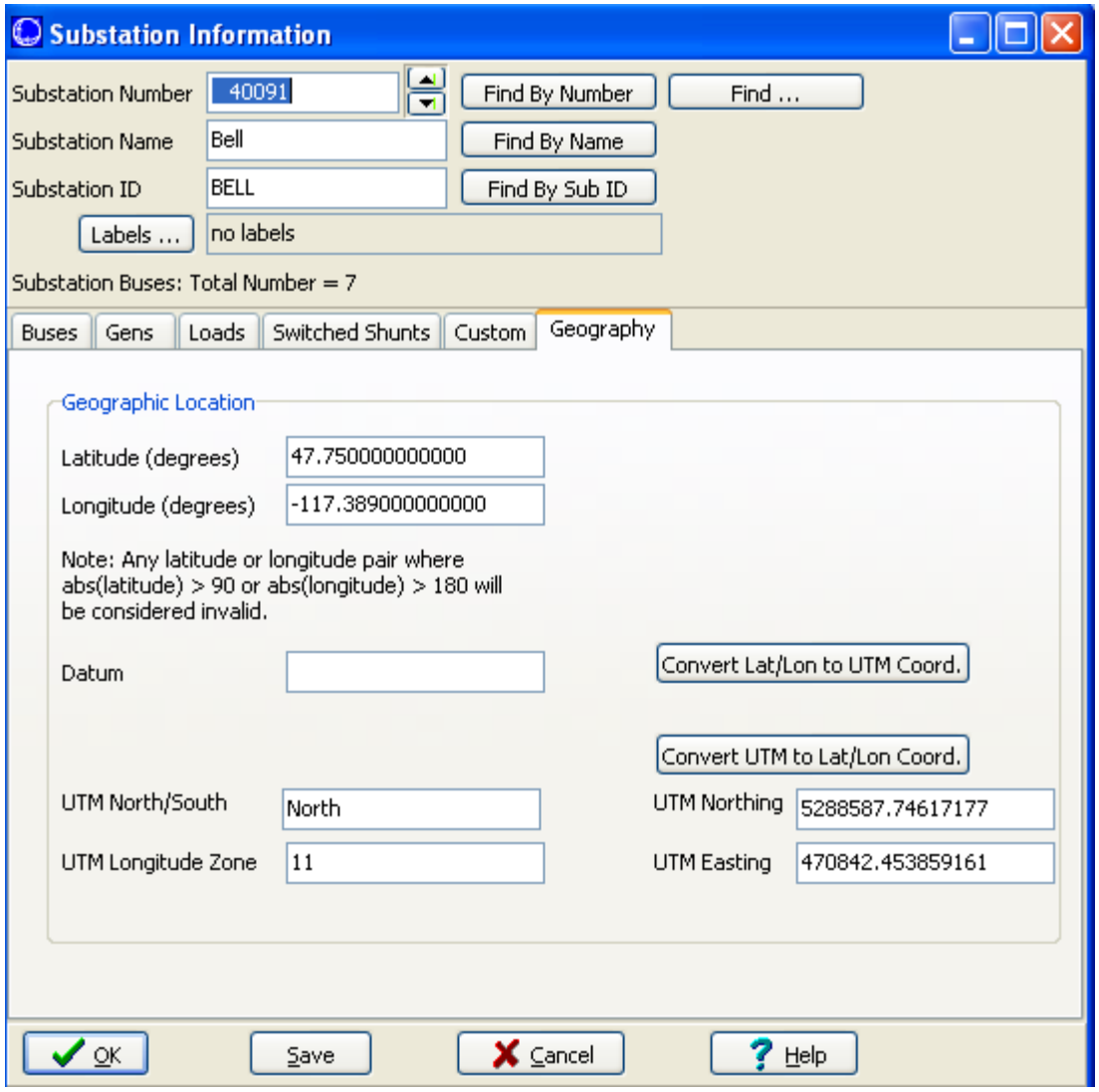
Unique Levels of Aggregation

- Injection Groups
  - Power plants, conforming load, etc
- Substations
  - Collection of buses, loads, generators, etc
    - Auto extractable with Lat/Long
- Interfaces
  - Path Rating catalog
    - Can contain numerous object elements



Use of Aggregation Provides Enhanced Capability

- Substation Auto-extract
  - Quasi-GIS capability
    - Extract into ID, OR, WA borders
      - Or just ask Zach for his work!
- Bubble Diagram
  - Uses interfaces and areas to emulate GE diagram
    - Super Area used in this…
      - Will post needed *.aux files and *.pwd files
- Custom Case Information
  - Fills need for standard reporting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Substation Number
40091
Find By Number
Find ...
Substation Name
Bell
Find By Name
Substation ID
BELL
Find By Sub ID
Labels ...
no labels
Substation Buses: Total Number = 7
Buses
Gens
Loads
Switched Shunts
Custom
Geography
Geographic Location
Latitude (degrees)
47.750000000000
Longitude (degrees)
-117.389000000000
Note: Any latitude or longitude pair where
abs(latitude) > 90 or abs(longitude) > 180 will
be considered invalid.
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Convert Lat/Lon to UTM Coord.
Convert UTM to Lat/Lon Coord.
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North
UTM Northing
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UTM Longitude Zone
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UTM Easting
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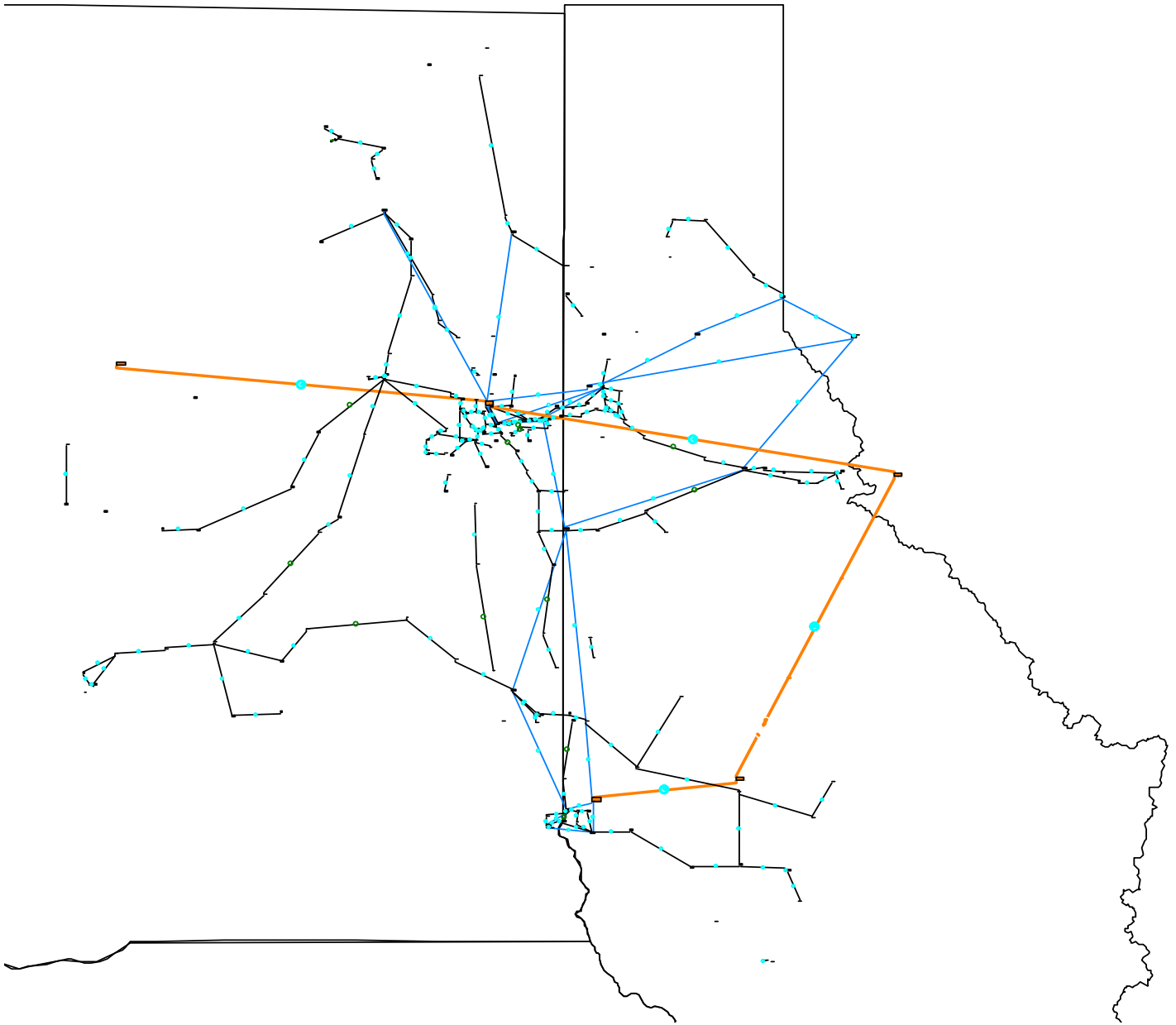
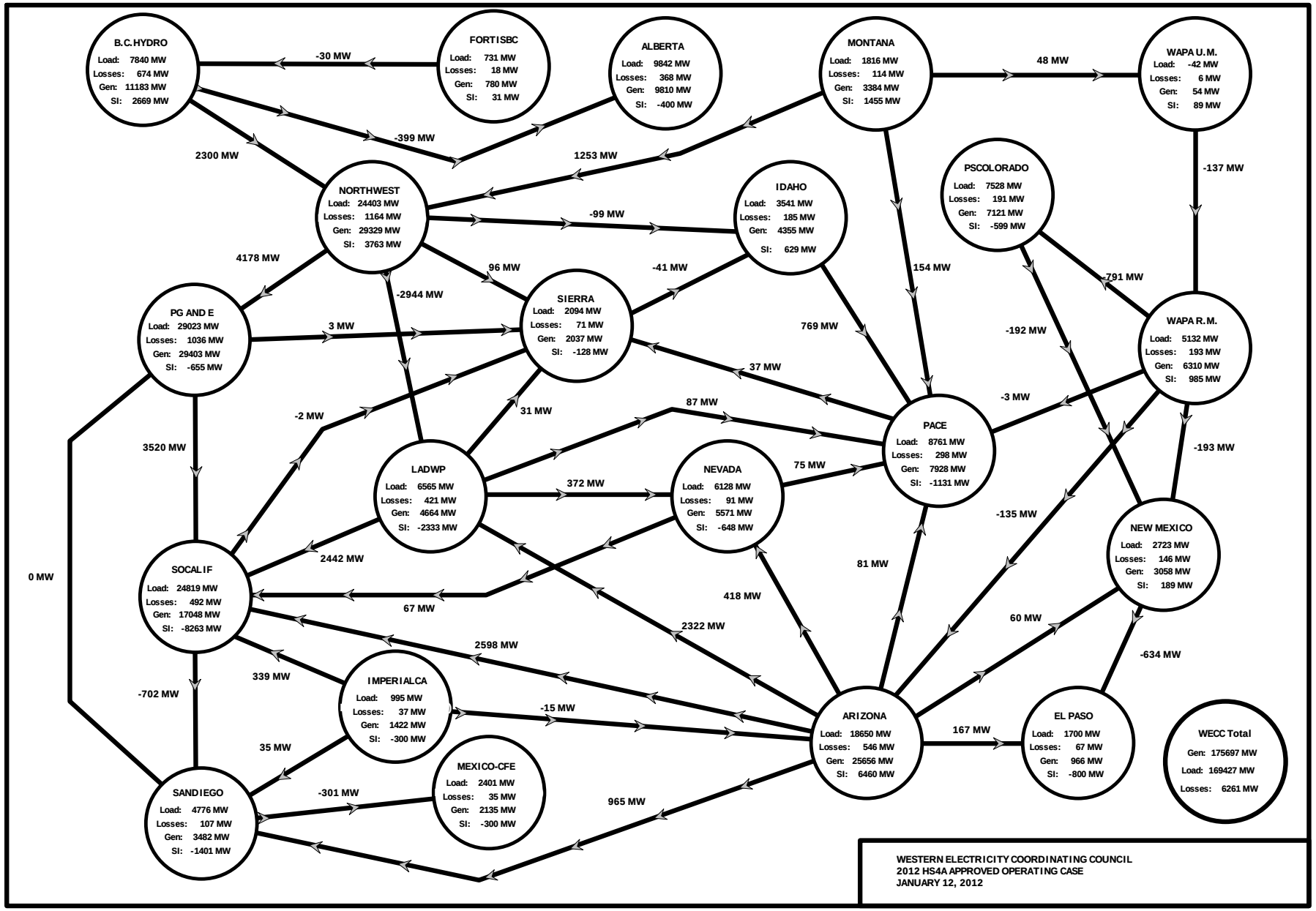
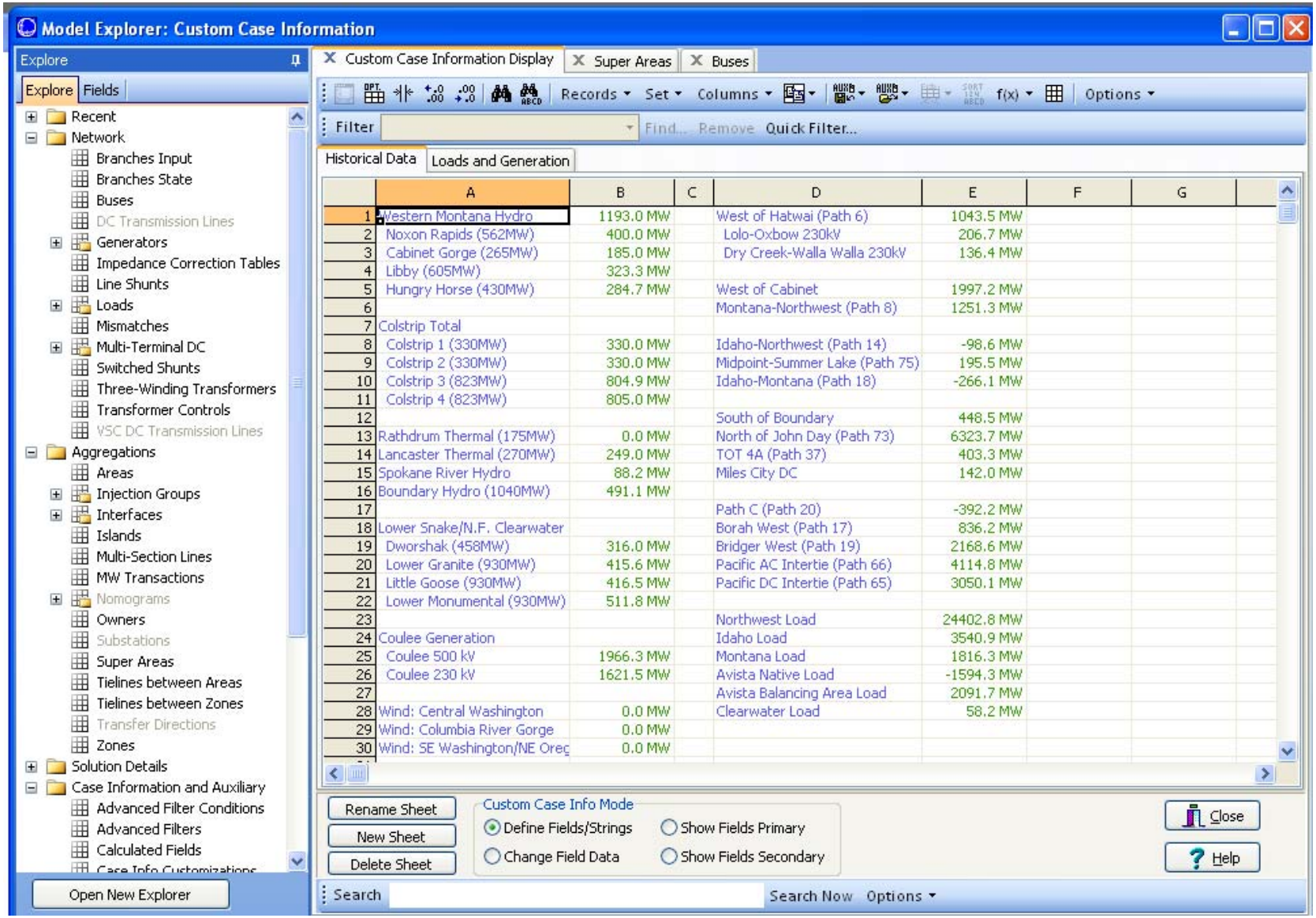
Help




B.C. HYDRO
Load: 7840 MW
Losses: 674 MW
Gen: 11183 MW
SI: 2669 MW
FORTISBC
Load: 731 MW
Losses: 18 MW
Gen: 780 MW
SI: 31 MW
ALBERTA
Load: 9842 MW
Losses: 368 MW
Gen: 9810 MW
SI: -400 MW
MONTANA
Load: 1816 MW
Losses: 114 MW
Gen: 3384 MW
SI: 1455 MW
WAPA U.M.
Load: -42 MW
Losses: 6 MW
Gen: 54 MW
SI: 89 MW
PSCOLORADO
Load: 7528 MW
Losses: 191 MW
Gen: 7121 MW
SI: -599 MW
NORTHWEST
Load: 24403 MW
Losses: 1164 MW
Gen: 29329 MW
SI: 3763 MW
IDAHO
Load: 3541 MW
Losses: 185 MW
Gen: 4355 MW
SI: 629 MW
PG AND E
Load: 29023 MW
Losses: 1036 MW
Gen: 29403 MW
SI: -655 MW
SIERRA
Load: 2094 MW
Losses: 71 MW
Gen: 2037 MW
SI: -128 MW
WAPA R.M.
Load: 5132 MW
Losses: 193 MW
Gen: 6310 MW
SI: 985 MW
PACE
Load: 8761 MW
Losses: 298 MW
Gen: 7928 MW
SI: -1131 MW
LADWP
Load: 6565 MW
Losses: 421 MW
Gen: 4664 MW
SI: -2333 MW
NEVADA
Load: 6128 MW
Losses: 91 MW
Gen: 5571 MW
SI: -648 MW
NEW MEXICO
Load: 2723 MW
Losses: 146 MW
Gen: 3058 MW
SI: 189 MW
SOCALIF
Load: 24819 MW
Losses: 492 MW
Gen: 17048 MW
SI: -8263 MW
IMPERIALCA
Load: 995 MW
Losses: 37 MW
Gen: 1422 MW
SI: -300 MW
ARIZONA
Load: 18650 MW
Losses: 546 MW
Gen: 25656 MW
SI: 6460 MW
EL PASO
Load: 1700 MW
Losses: 67 MW
Gen: 966 MW
SI: -800 MW
SANDIEGO
Load: 4776 MW
Losses: 107 MW
Gen: 3482 MW
SI: -1401 MW
MEXICO-CFE
Load: 2401 MW
Losses: 35 MW
Gen: 2135 MW
SI: -300 MW
WECC Total
Gen: 175697 MW
Load: 169427 MW
Losses: 6261 MW
-30 MW
-399 MW
2300 MW
1253 MW
48 MW
-137 MW
-99 MW
4178 MW
96 MW
-41 MW
154 MW
-791 MW
-2944 MW
3 MW
769 MW
-192 MW
37 MW
-3 MW
-2 MW
31 MW
87 MW
3520 MW
-193 MW
372 MW
75 MW
-135 MW
2442 MW
81 MW
0 MW
418 MW
67 MW
2322 MW
60 MW
2598 MW
-634 MW
339 MW
-702 MW
-15 MW
167 MW
35 MW
-301 MW
965 MW
WESTERN ELECTRICITY COORDINATING COUNCIL
2012 HS4A APPROVED OPERATING CASE
JANUARY 12, 2012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Branches State
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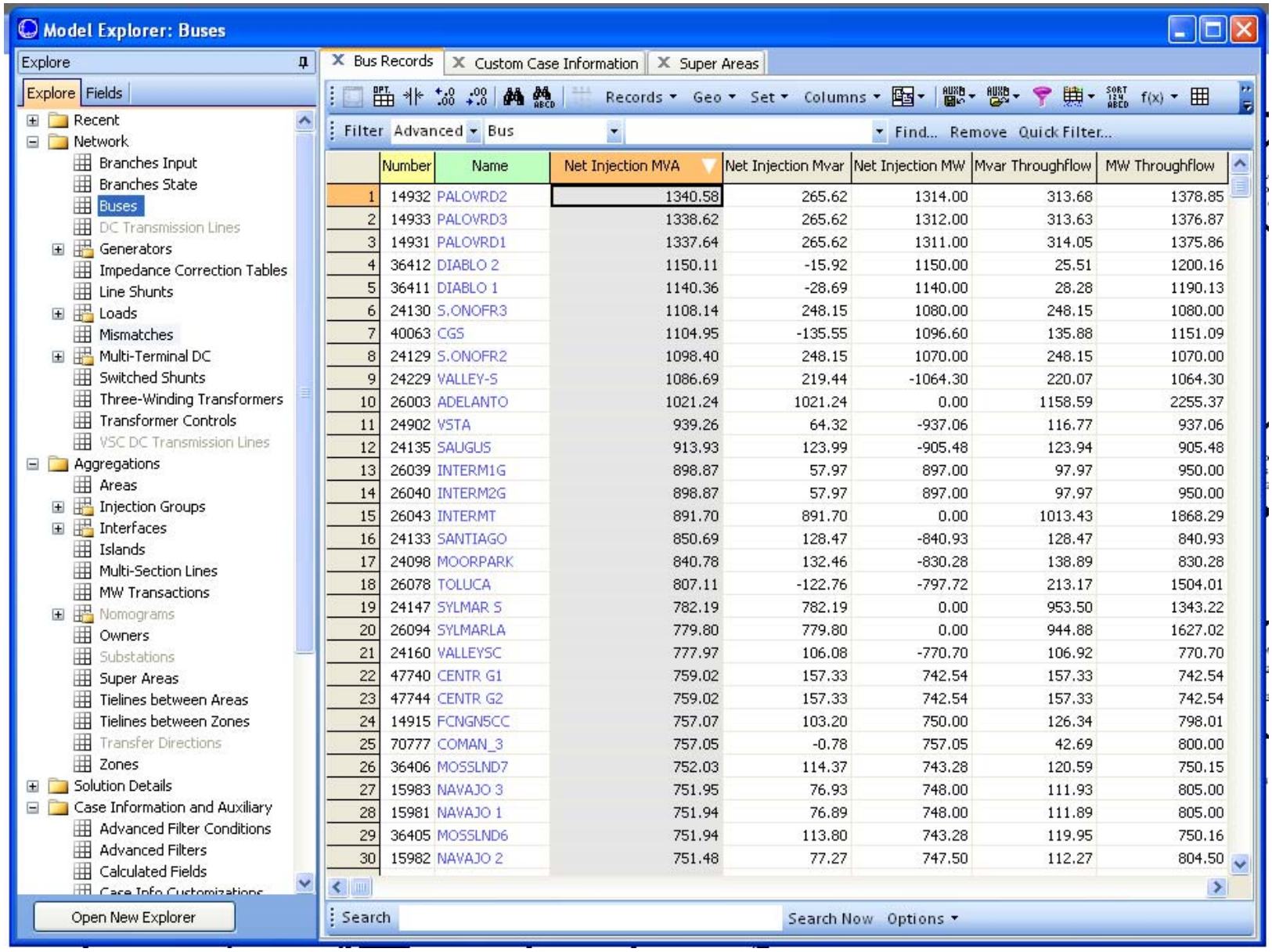
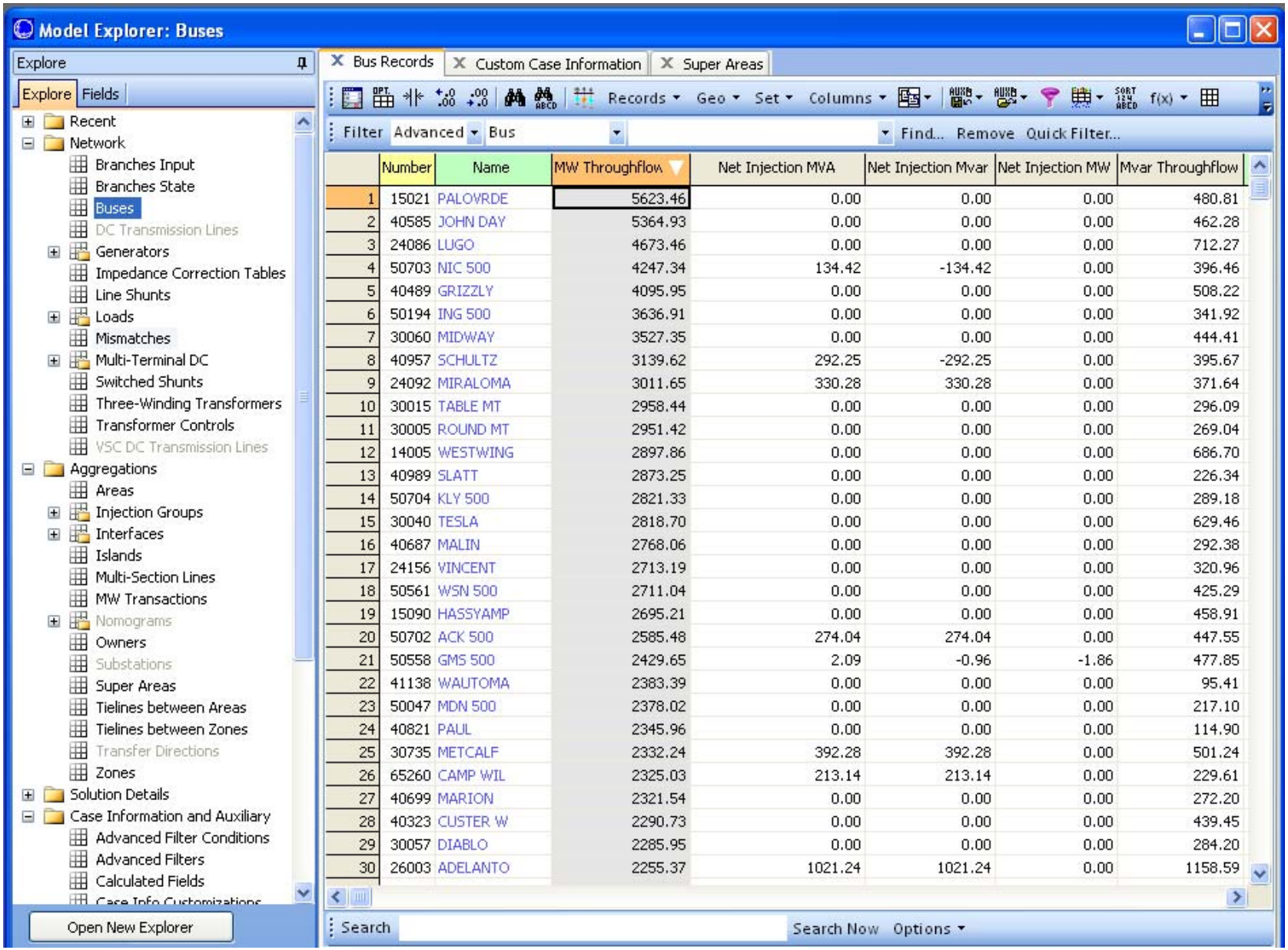
Generators
Impedance Correction Tables
Line Shunts
Loads
Mismatches
Multi-Terminal DC
Switched Shunts
Three-Winding Transformers
Transformer Controls
VSC DC Transmission Lines
Aggregations
Areas
Injection Groups
Interfaces
Islands
Multi-Section Lines
MW Transactions
Nomograms
Owners
Substations
Super Areas
Tielines between Areas
Tielines between Zones
Transfer Directions
Zones
Solution Details
Case Information and Auxiliary
Advanced Filter Conditions
Advanced Filters
Calculated Fields
Open New Explorer
Custom Case Information Display
Super Areas
Buses
Records
Set
Columns
f(x)
Options
Filter
Find...
Remove
Quick Filter...
Historical Data
Loads and Generation
A
B
C
D
E
F
G
1 Western Montana Hydro 1193.0 MW West of Hatwai (Path 6) 1043.5 MW
2 Noxon Rapids (562MW) 400.0 MW Lolo-Oxbow 230kV 206.7 MW
3 Cabinet Gorge (265MW) 185.0 MW Dry Creek-Walla Walla 230kV 136.4 MW
4 Libby (605MW) 323.3 MW
5 Hungry Horse (430MW) 284.7 MW West of Cabinet 1997.2 MW
6 Montana-Northwest (Path 8) 1251.3 MW
7 Colstrip Total
8 Colstrip 1 (330MW) 330.0 MW Idaho-Northwest (Path 14) -98.6 MW
9 Colstrip 2 (330MW) 330.0 MW Midpoint-Summer Lake (Path 75) 195.5 MW
10 Colstrip 3 (823MW) 804.9 MW Idaho-Montana (Path 18) -266.1 MW
11 Colstrip 4 (823MW) 805.0 MW
12 South of Boundary 448.5 MW
13 Rathdrum Thermal (175MW) 0.0 MW North of John Day (Path 73) 6323.7 MW
14 Lancaster Thermal (270MW) 249.0 MW TOT 4A (Path 37) 403.3 MW
15 Spokane River Hydro 88.2 MW Miles City DC 142.0 MW
16 Boundary Hydro (1040MW) 491.1 MW
17 Path C (Path 20) -392.2 MW
18 Lower Snake/N.F. Clearwater Borah West (Path 17) 836.2 MW
19 Dworshak (458MW) 316.0 MW Bridger West (Path 19) 2168.6 MW
20 Lower Granite (930MW) 415.6 MW Pacific AC Intertie (Path 66) 4114.8 MW
21 Little Goose (930MW) 416.5 MW Pacific DC Intertie (Path 65) 3050.1 MW
22 Lower Monumental (930MW) 511.8 MW
23 Northwest Load 24402.8 MW
24 Coulee Generation Idaho Load 3540.9 MW
25 Coulee 500 kV 1966.3 MW Montana Load 1816.3 MW
26 Coulee 230 kV 1621.5 MW Avista Native Load -1594.3 MW
27 Avista Balancing Area Load 2091.7 MW
28 Wind: Central Washington 0.0 MW Clearwater Load 58.2 MW
29 Wind: Columbia River Gorge 0.0 MW
30 Wind: SE Washington/NE Orec 0.0 MW
Rename Sheet
New Sheet
Delete Sheet
Custom Case Info Mode
Define Fields/Strings
Show Fields Primary
Change Field Data
Show Fields Secondary
Close
Help
Search
Search Now
Options

Ranking Importance of Buses or Substations

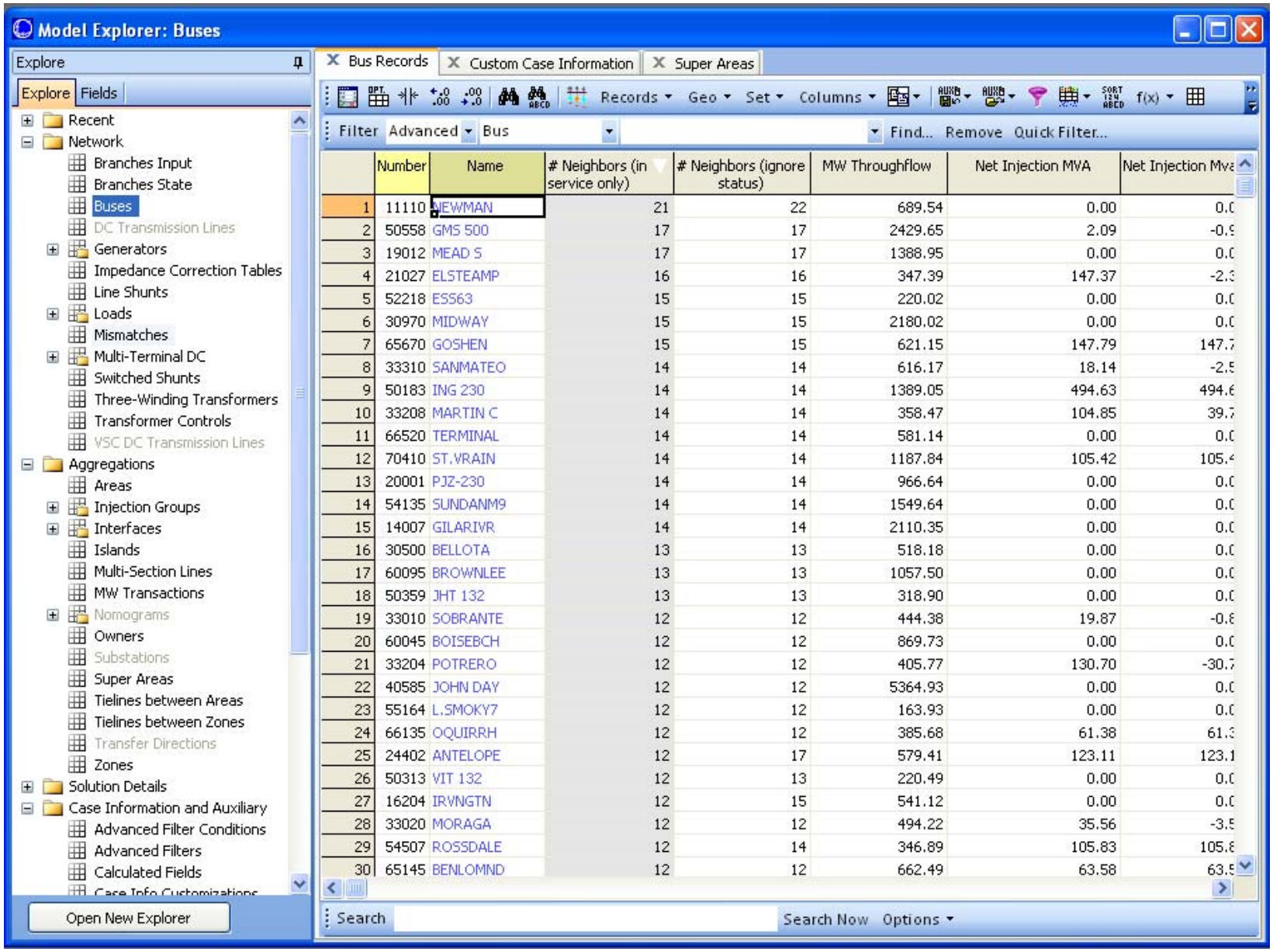
- All lines in service
  - Flow based: MW, MVAr, Net Injections
  - Equipment Count
- Contingency Based
  - Violation Count
  - RANK
  - Aggregate Overload
    - % or MVA
  - Gen or Load
  - Islands



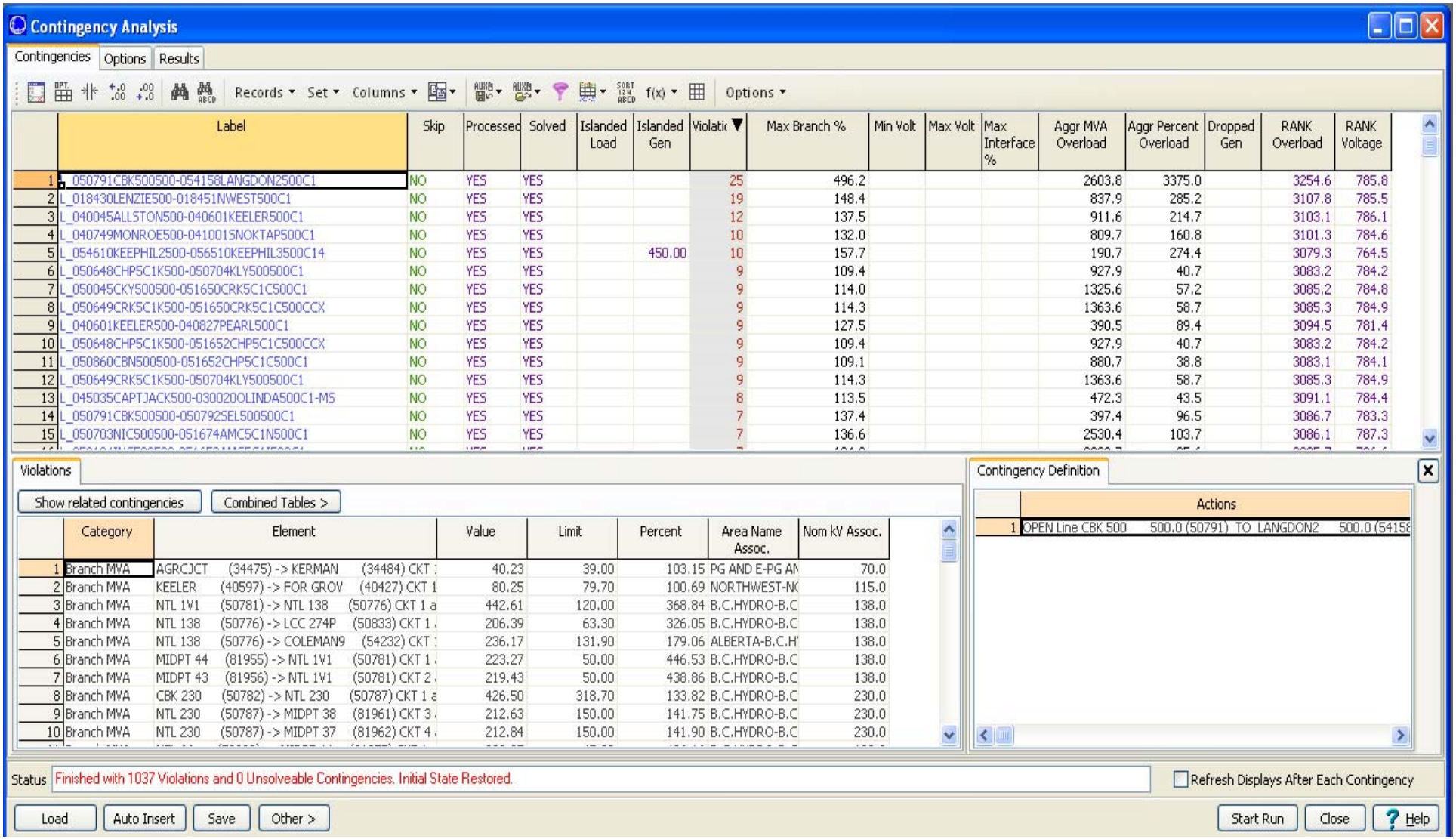
	Number	Name	Net Injection MVA	Net Injection Mvar	Net Injection MW	Mvar Throughflow	MW Throughflow
1	14932	PALOVRD2	1340.58	265.62	1314.00	313.68	1378.85
2	14933	PALOVRD3	1338.62	265.62	1312.00	313.63	1376.87
3	14931	PALOVRD1	1337.64	265.62	1311.00	314.05	1375.86
4	36412	DIABLO 2	1150.11	-15.92	1150.00	25.51	1200.16
5	36411	DIABLO 1	1140.36	-28.69	1140.00	28.28	1190.13
6	24130	S.ONOFR3	1108.14	248.15	1080.00	248.15	1080.00
7	40063	CGS	1104.95	-135.55	1096.60	135.88	1151.09
8	24129	S.ONOFR2	1098.40	248.15	1070.00	248.15	1070.00
9	24229	VALLEY-S	1086.69	219.44	-1064.30	220.07	1064.30
10	26003	ADELANTO	1021.24	1021.24	0.00	1158.59	2255.37
11	24902	VSTA	939.26	64.32	-937.06	116.77	937.06
12	24135	SAUGUS	913.93	123.99	-905.48	123.94	905.48
13	26039	INTERM1G	898.87	57.97	897.00	97.97	950.00
14	26040	INTERM2G	898.87	57.97	897.00	97.97	950.00
15	26043	INTERMT	891.70	891.70	0.00	1013.43	1868.29
16	24133	SANTIAGO	850.69	128.47	-840.93	128.47	840.93
17	24098	MOORPARK	840.78	132.46	-830.28	138.89	830.28
18	26078	TOLUCA	807.11	-122.76	-797.72	213.17	1504.01
19	24147	SYLMAR S	782.19	782.19	0.00	953.50	1343.22
20	26094	SYLMARLA	779.80	779.80	0.00	944.88	1627.02
21	24160	VALLEYSC	777.97	106.08	-770.70	106.92	770.70
22	47740	CENTR G1	759.02	157.33	742.54	157.33	742.54
23	47744	CENTR G2	759.02	157.33	742.54	157.33	742.54
24	14915	FCNGN5CC	757.07	103.20	750.00	126.34	798.01
25	70777	COMAN_3	757.05	-0.78	757.05	42.69	800.00
26	36406	MOSSLND7	752.03	114.37	743.28	120.59	750.15
27	15983	NAVAJO 3	751.95	76.93	748.00	111.93	805.00
28	15981	NAVAJO 1	751.94	76.89	748.00	111.89	805.00
29	36405	MOSSLND6	751.94	113.80	743.28	119.95	750.16
30	15982	NAVAJO 2	751.48	77.27	747.50	112.27	804.50



	Number	Name	MW Throughflow	Net Injection MVA	Net Injection Mvar	Net Injection MW	Mvar Throughflow
1	15021	PALOVRDE	5623.46	0.00	0.00	0.00	480.81
2	40585	JOHN DAY	5364.93	0.00	0.00	0.00	462.28
3	24086	LUGO	4673.46	0.00	0.00	0.00	712.27
4	50703	NIC 500	4247.34	134.42	-134.42	0.00	396.46
5	40489	GRIZZLY	4095.95	0.00	0.00	0.00	508.22
6	50194	ING 500	3636.91	0.00	0.00	0.00	341.92
7	30060	MIDWAY	3527.35	0.00	0.00	0.00	444.41
8	40957	SCHULTZ	3139.62	292.25	-292.25	0.00	395.67
9	24092	MIRALOMA	3011.65	330.28	330.28	0.00	371.64
10	30015	TABLE MT	2958.44	0.00	0.00	0.00	296.09
11	30005	ROUND MT	2951.42	0.00	0.00	0.00	269.04
12	14005	WESTWING	2897.86	0.00	0.00	0.00	686.70
13	40989	SLATT	2873.25	0.00	0.00	0.00	226.34
14	50704	KLY 500	2821.33	0.00	0.00	0.00	289.18
15	30040	TESLA	2818.70	0.00	0.00	0.00	629.46
16	40687	MALIN	2768.06	0.00	0.00	0.00	292.38
17	24156	VINCENT	2713.19	0.00	0.00	0.00	320.96
18	50561	WSN 500	2711.04	0.00	0.00	0.00	425.29
19	15090	HASSYAMP	2695.21	0.00	0.00	0.00	458.91
20	50702	ACK 500	2585.48	274.04	274.04	0.00	447.55
21	50558	GMS 500	2429.65	2.09	-0.96	-1.86	477.85
22	41138	WAUTOMA	2383.39	0.00	0.00	0.00	95.41
23	50047	MDN 500	2378.02	0.00	0.00	0.00	217.10
24	40821	PAUL	2345.96	0.00	0.00	0.00	114.90
25	30735	METCALF	2332.24	392.28	392.28	0.00	501.24
26	65260	CAMP WIL	2325.03	213.14	213.14	0.00	229.61
27	40699	MARION	2321.54	0.00	0.00	0.00	272.20
28	40323	CUSTER W	2290.73	0.00	0.00	0.00	439.45
29	30057	DIABLO	2285.95	0.00	0.00	0.00	284.20
30	26003	ADELANTO	2255.37	1021.24	1021.24	0.00	1158.59



	Number	Name	# Neighbors (in service only)	# Neighbors (ignore status)	MW Throughflow	Net Injection MVA	Net Injection Mva
1	11110	NEWMAN	21	22	689.54	0.00	0.0
2	50558	GMS 500	17	17	2429.65	2.09	-0.9
3	19012	MEAD S	17	17	1388.95	0.00	0.0
4	21027	ELSTEAMP	16	16	347.39	147.37	-2.3
5	52218	ESS63	15	15	220.02	0.00	0.0
6	30970	MIDWAY	15	15	2180.02	0.00	0.0
7	65670	GOSHEN	15	15	621.15	147.79	147.7
8	33310	SANMATEO	14	14	616.17	18.14	-2.5
9	50183	ING 230	14	14	1389.05	494.63	494.6
10	33208	MARTIN C	14	14	358.47	104.85	39.7
11	66520	TERMINAL	14	14	581.14	0.00	0.0
12	70410	ST.VRAIN	14	14	1187.84	105.42	105.4
13	20001	PJZ-230	14	14	966.64	0.00	0.0
14	54135	SUNDANM9	14	14	1549.64	0.00	0.0
15	14007	GILARIVR	14	14	2110.35	0.00	0.0
16	30500	BELLOTA	13	13	518.18	0.00	0.0
17	60095	BROWNLEE	13	13	1057.50	0.00	0.0
18	50359	JHT 132	13	13	318.90	0.00	0.0
19	33010	SOBRANTE	12	12	444.38	19.87	-0.8
20	60045	BOISEBCH	12	12	869.73	0.00	0.0
21	33204	POTRERO	12	12	405.77	130.70	-30.7
22	40585	JOHN DAY	12	12	5364.93	0.00	0.0
23	55164	L.SMOKY7	12	12	163.93	0.00	0.0
24	66135	OQUIRRH	12	12	385.68	61.38	61.3
25	24402	ANTELOPE	12	17	579.41	123.11	123.1
26	50313	VIT 132	12	13	220.49	0.00	0.0
27	16204	IRVNGTN	12	15	541.12	0.00	0.0
28	33020	MORAGA	12	12	494.22	35.56	-3.5
29	54507	ROSSDALE	12	14	346.89	105.83	105.8
30	65145	BENLOMND	12	12	662.49	63.58	63.5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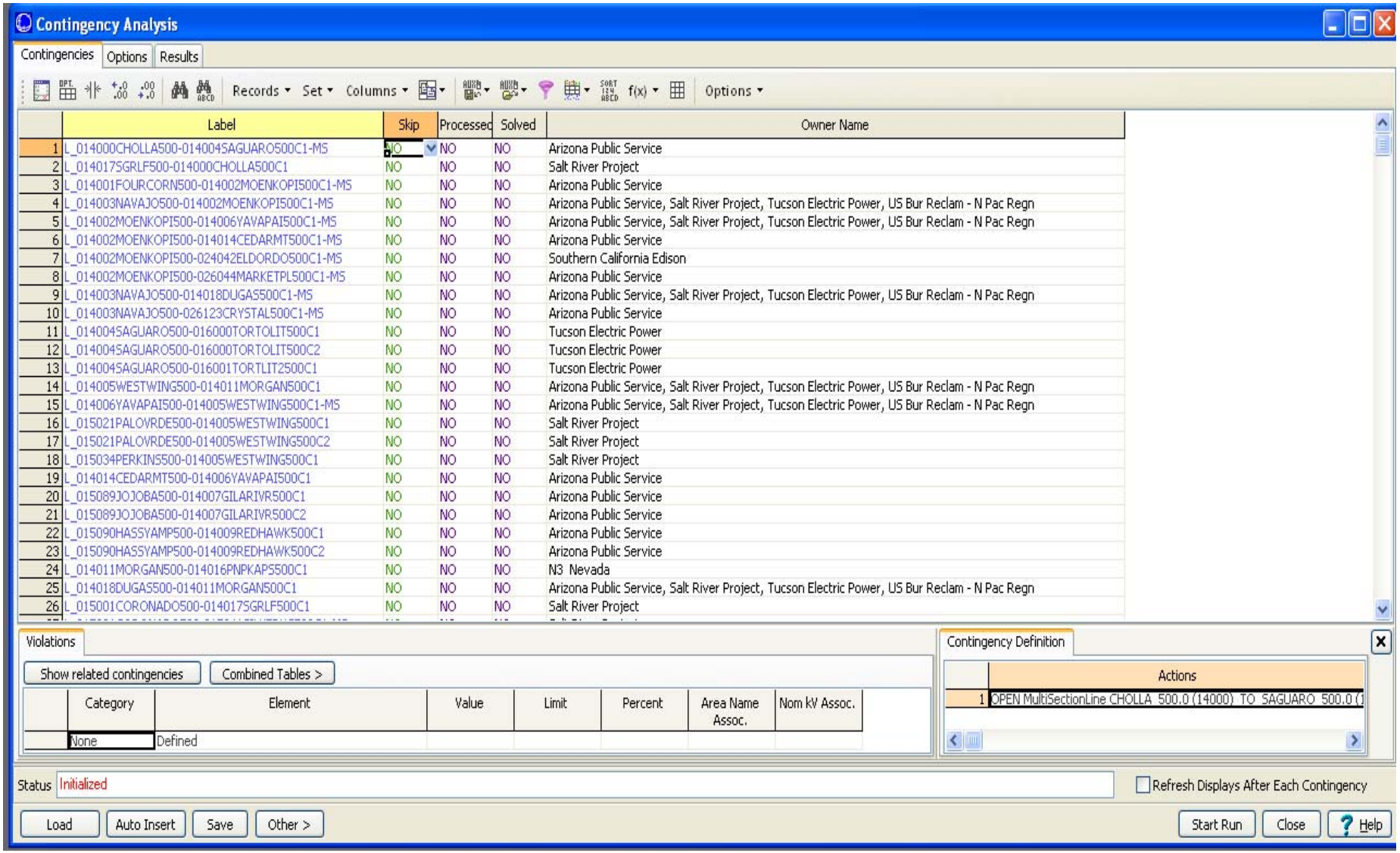
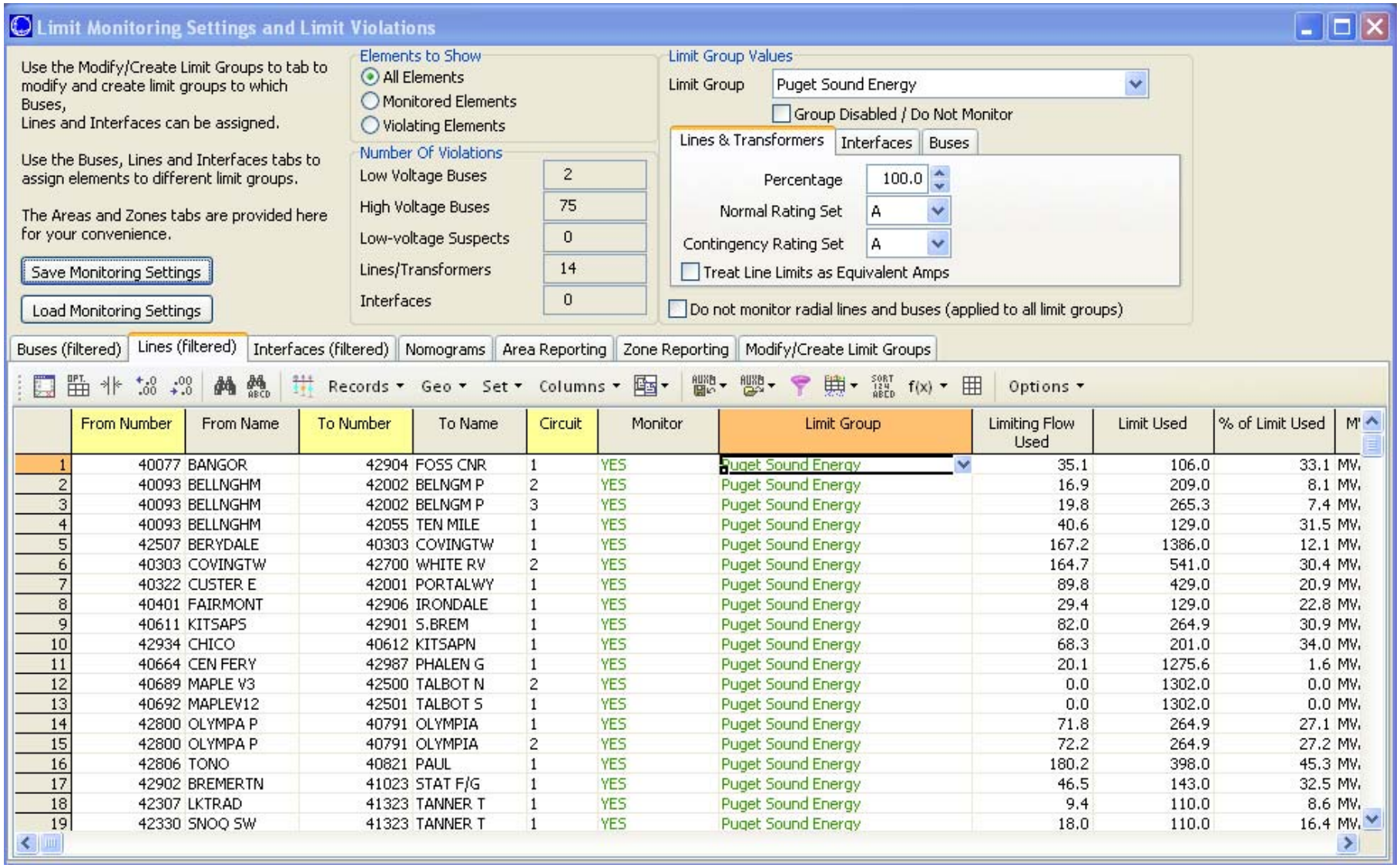
Options
Label
Skip
Processed
Solved
Islanded Load
Islanded Gen
Violatic
Max Branch %
Min Volt
Max Volt
Max Interface %
Aggr MVA Overload
Aggr Percent Overload
Dropped Gen
RANK Overload
RANK Voltage
1 050791CBK500500-054158LANGDON2500C1 NO YES YES 25 496.2 2603.8 3375.0 3254.6 785.8
2 L_018430LENZIE500-018451NWEST500C1 NO YES YES 19 148.4 837.9 285.2 3107.8 785.5
3 L_040045ALLSTON500-040601KEELER500C1 NO YES YES 12 137.5 911.6 214.7 3103.1 786.1
4 L_040749MONROE500-041001SNOKTAP500C1 NO YES YES 10 132.0 809.7 160.8 3101.3 784.6
5 L_054610KEEPHIL2500-056510KEEPHIL3500C14 NO YES YES 450.00 10 157.7 190.7 274.4 3079.3 764.5
6 L_050648CHP5C1K500-050704KLY500500C1 NO YES YES 9 109.4 927.9 40.7 3083.2 784.2
7 L_050045CKY500500-051650CRK5C1C500C1 NO YES YES 9 114.0 1325.6 57.2 3085.2 784.8
8 L_050649CRK5C1K500-051650CRK5C1C500CCX NO YES YES 9 114.3 1363.6 58.7 3085.3 784.9
9 L_040601KEELER500-040827PEARL500C1 NO YES YES 9 127.5 390.5 89.4 3094.5 781.4
10 L_050648CHP5C1K500-051652CHP5C1C500CCX NO YES YES 9 109.4 927.9 40.7 3083.2 784.2
11 L_050860CBN500500-051652CHP5C1C500C1 NO YES YES 9 109.1 880.7 38.8 3083.1 784.1
12 L_050649CRK5C1K500-050704KLY500500C1 NO YES YES 9 114.3 1363.6 58.7 3085.3 784.9
13 L_045035CAPTJACK500-030020OLINDA500C1-MS NO YES YES 8 113.5 472.3 43.5 3091.1 784.4
14 L_050791CBK500500-050792SEL500500C1 NO YES YES 7 137.4 397.4 96.5 3086.7 783.3
15 L_050703NIC500500-051674AMC5C1N500C1 NO YES YES 7 136.6 2530.4 103.7 3086.1 787.3
Violations
Show related contingencies
Combined Tables >
Category
Element
Value
Limit
Percent
Area Name Assoc.
Nom kV Assoc.
1 Branch MVA AGRCJCT (34475) -> KERMAN (34484) CKT 1 40.23 39.00 103.15 PG AND E-PG AN 70.0
2 Branch MVA KEELER (40597) -> FOR GROV (40427) CKT 1 80.25 79.70 100.69 NORTHWEST-NC 115.0
3 Branch MVA NTL 1V1 (50781) -> NTL 138 (50776) CKT 1 a 442.61 120.00 368.84 B.C.HYDRO-B.C 138.0
4 Branch MVA NTL 138 (50776) -> LCC 274P (50833) CKT 1 206.39 63.30 326.05 B.C.HYDRO-B.C 138.0
5 Branch MVA NTL 138 (50776) -> COLEMAN9 (54232) CKT 1 236.17 131.90 179.06 ALBERTA-B.C.H 138.0
6 Branch MVA MIDPT 44 (81955) -> NTL 1V1 (50781) CKT 1 223.27 50.00 446.53 B.C.HYDRO-B.C 138.0
7 Branch MVA MIDPT 43 (81956) -> NTL 1V1 (50781) CKT 2 219.43 50.00 438.86 B.C.HYDRO-B.C 138.0
8 Branch MVA CBK 230 (50782) -> NTL 230 (50787) CKT 1 a 426.50 318.70 133.82 B.C.HYDRO-B.C 230.0
9 Branch MVA NTL 230 (50787) -> MIDPT 38 (81961) CKT 3 212.63 150.00 141.75 B.C.HYDRO-B.C 230.0
10 Branch MVA NTL 230 (50787) -> MIDPT 37 (81962) CKT 4 212.84 150.00 141.90 B.C.HYDRO-B.C 230.0
Contingency Definition
Actions
1 OPEN Line CBK 500 500.0 (50791) TO LANGDON2 500.0 (5415
Status
Finished with 1037 Violations and 0 Unsolveable Contingencies. Initial State Restored.
Refresh Displays After Each Contingency
Load
Auto Insert
Save
Other >
Start Run
Close
Help

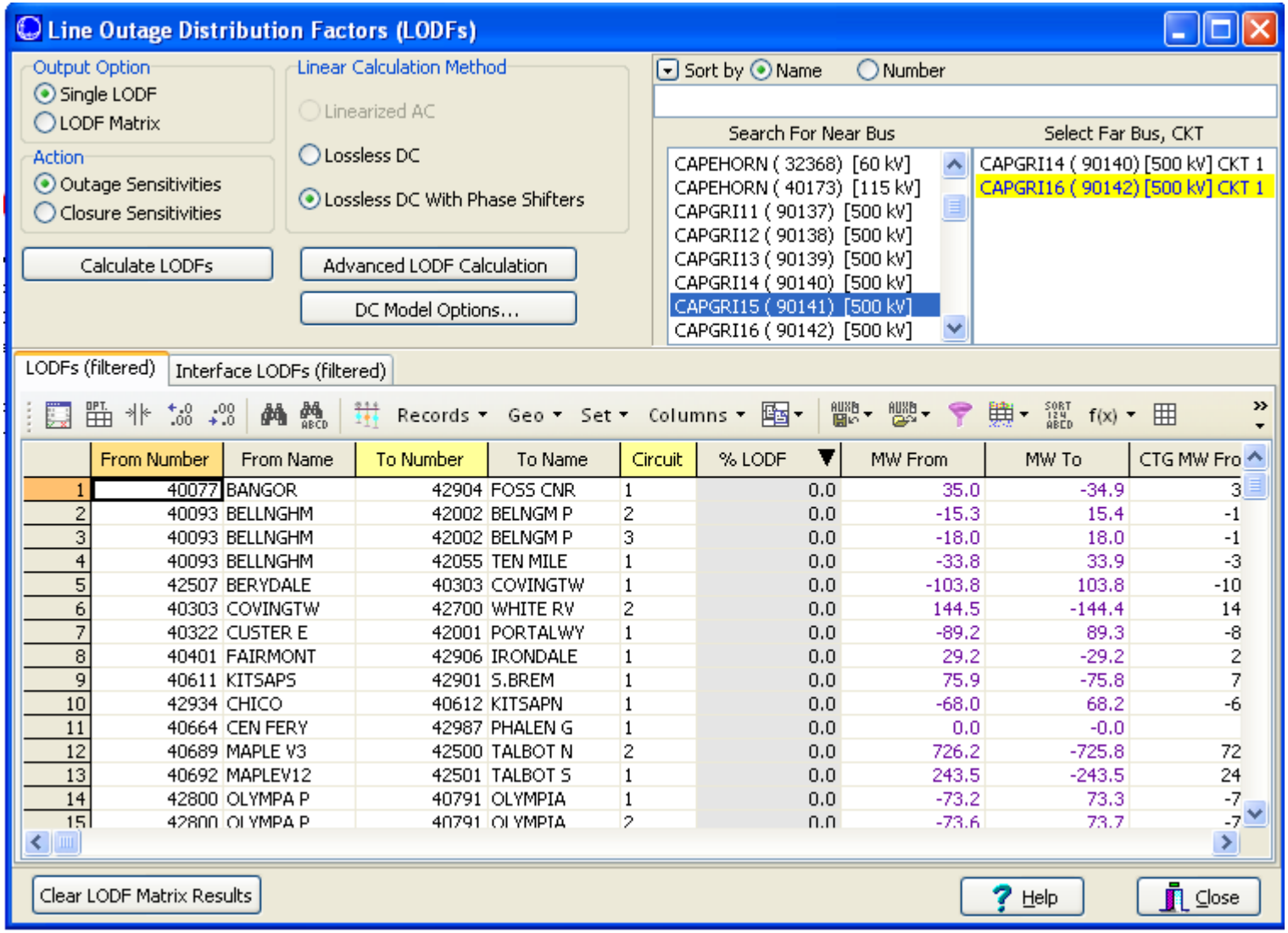
N-1-1 Contingencies

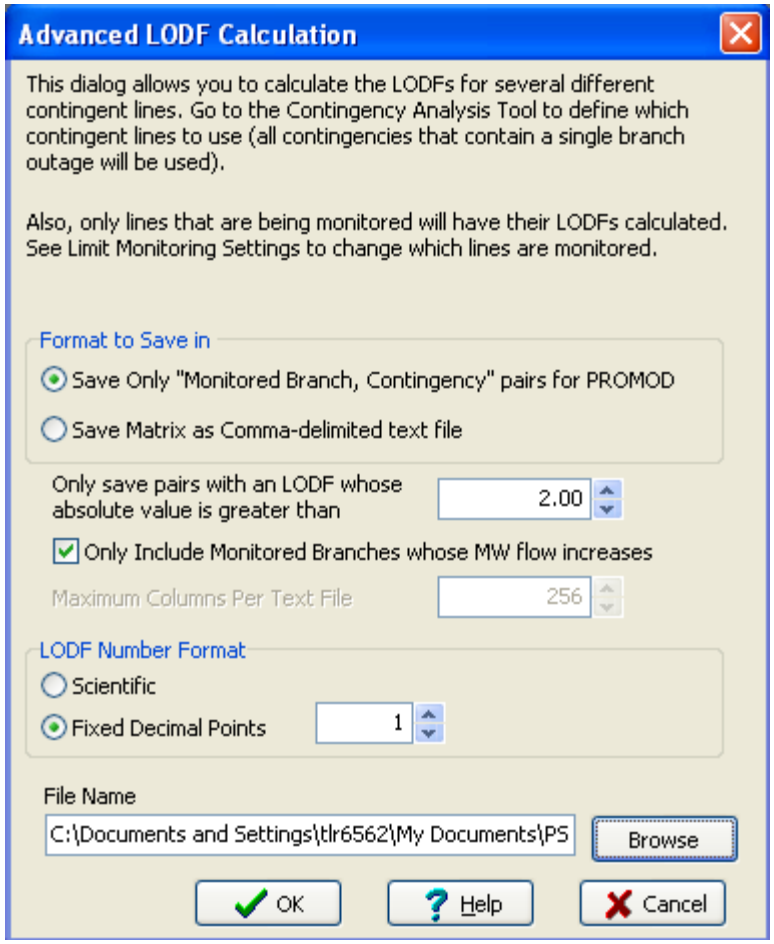
- How do you know what to simulate?
  - The numbers can be overwhelming
    - Or perhaps not?
- Use the Advanced LODF Tool
  - We will look at Puget's sensitivities to ALL WECC 500 kV ctgs
    - Auto insert WECC 500 kV ctgs
    - Create PSE Limit Monitoring Group
    - Run Advanced LODF
    - Examine Results

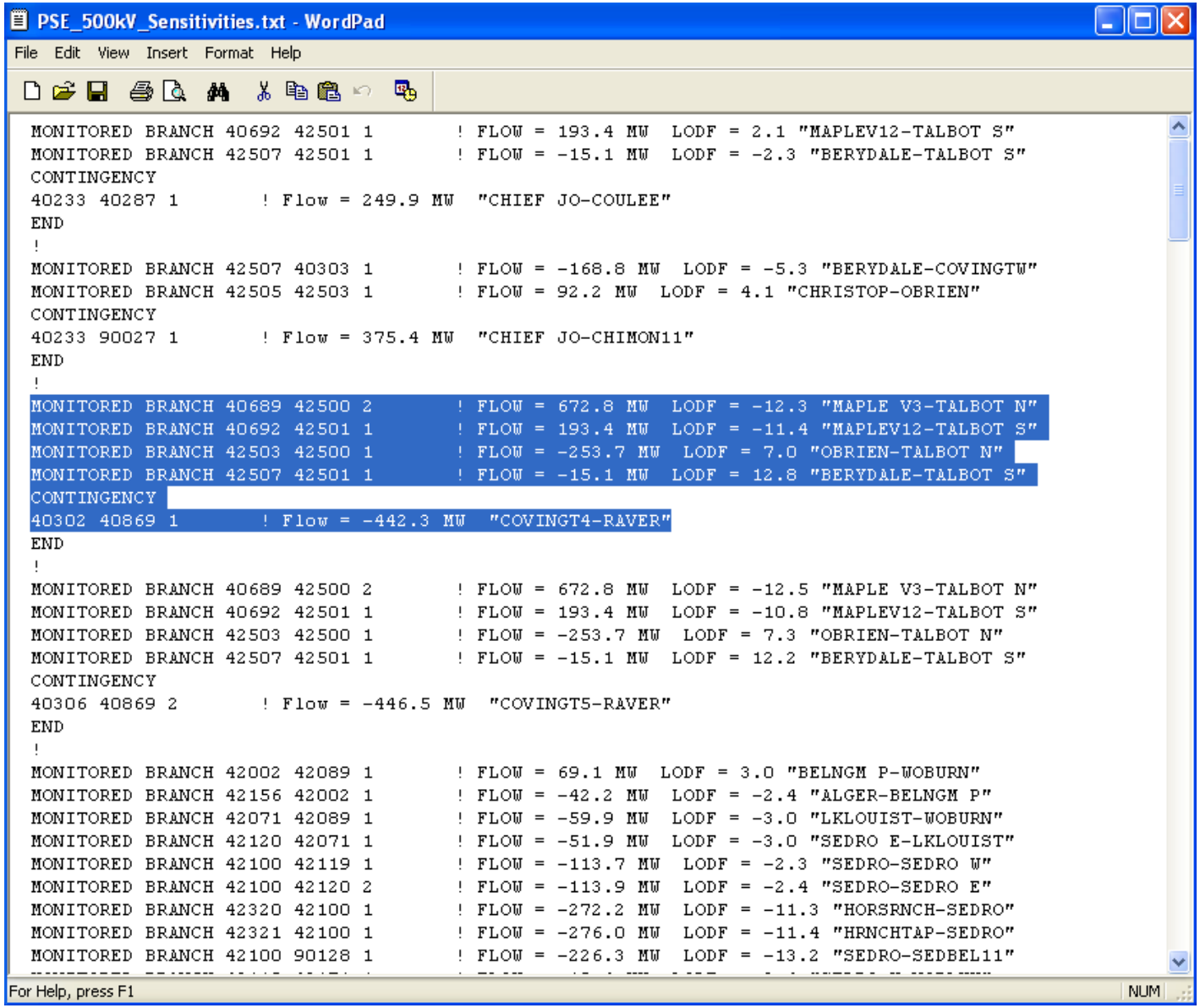

Contingency Analysis
Contingencies
Options
Results
Records
Set
Columns
f(x)
Options
Label
Skip
Processed
Solved
Owner Name
1 L_014000CHOLLA500-014004SAGUARO500C1-MS NO NO NO Arizona Public Service
2 L_014017SGRLF500-014000CHOLLA500C1 NO NO NO Salt River Project
3 L_014001FOURCORN500-014002MOENKOPI500C1-MS NO NO NO Arizona Public Service
4 L_014003NAVAJO500-014002MOENKOPI500C1-MS NO NO NO Arizona Public Service, Salt River Project, Tucson Electric Power, US Bur Reclam - N Pac Regn
5 L_014002MOENKOPI500-014006YAVAPAI500C1-MS NO NO NO Arizona Public Service, Salt River Project, Tucson Electric Power, US Bur Reclam - N Pac Regn
6 L_014002MOENKOPI500-014014CEDARMT500C1-MS NO NO NO Arizona Public Service
7 L_014002MOENKOPI500-024042ELDORDO500C1-MS NO NO NO Southern California Edison
8 L_014002MOENKOPI500-026044MARKETPL500C1-MS NO NO NO Arizona Public Service
9 L_014003NAVAJO500-014018DUGAS500C1-MS NO NO NO Arizona Public Service, Salt River Project, Tucson Electric Power, US Bur Reclam - N Pac Regn
10 L_014003NAVAJO500-026123CRYSTAL500C1-MS NO NO NO Arizona Public Service
11 L_014004SAGUARO500-016000TORTOLIT500C1 NO NO NO Tucson Electric Power
12 L_014004SAGUARO500-016000TORTOLIT500C2 NO NO NO Tucson Electric Power
13 L_014004SAGUARO500-016001TORTLIT2500C1 NO NO NO Tucson Electric Power
14 L_014005WESTWING500-014011MORGAN500C1 NO NO NO Arizona Public Service, Salt River Project, Tucson Electric Power, US Bur Reclam - N Pac Regn
15 L_014006YAVAPAI500-014005WESTWING500C1-MS NO NO NO Arizona Public Service, Salt River Project, Tucson Electric Power, US Bur Reclam - N Pac Regn
16 L_015021PALOVRDE500-014005WESTWING500C1 NO NO NO Salt River Project
17 L_015021PALOVRDE500-014005WESTWING500C2 NO NO NO Salt River Project
18 L_015034PERKINS500-014005WESTWING500C1 NO NO NO Salt River Project
19 L_014014CEDARMT500-014006YAVAPAI500C1 NO NO NO Arizona Public Service
20 L_015089JOJOBA500-014007GILARIVR500C1 NO NO NO Arizona Public Service
21 L_015089JOJOBA500-014007GILARIVR500C2 NO NO NO Arizona Public Service
22 L_015090HASSYAMP500-014009REDHAWK500C1 NO NO NO Arizona Public Service
23 L_015090HASSYAMP500-014009REDHAWK500C2 NO NO NO Arizona Public Service
24 L_014011MORGAN500-014016PNPKAPS500C1 NO NO NO N3 Nevada
25 L_014018DUGAS500-014011MORGAN500C1 NO NO NO Arizona Public Service, Salt River Project, Tucson Electric Power, US Bur Reclam - N Pac Regn
26 L_015001CORONADO500-014017SGRLF500C1 NO NO NO Salt River Project
Violations
Show related contingencies
Combined Tables >
Category
Element
Value
Limit
Percent
Area Name Assoc.
Nom kV Assoc.
None
Defined
Contingency Definition
Actions
1 OPEN MultiSectionLine CHOLLA 500.0 (14000) TO SAGUARO 500.0 (1
Status
Initialized
Refresh Displays After Each Contingency
Load
Auto Insert
Save
Other >
Start Run
Close
Help

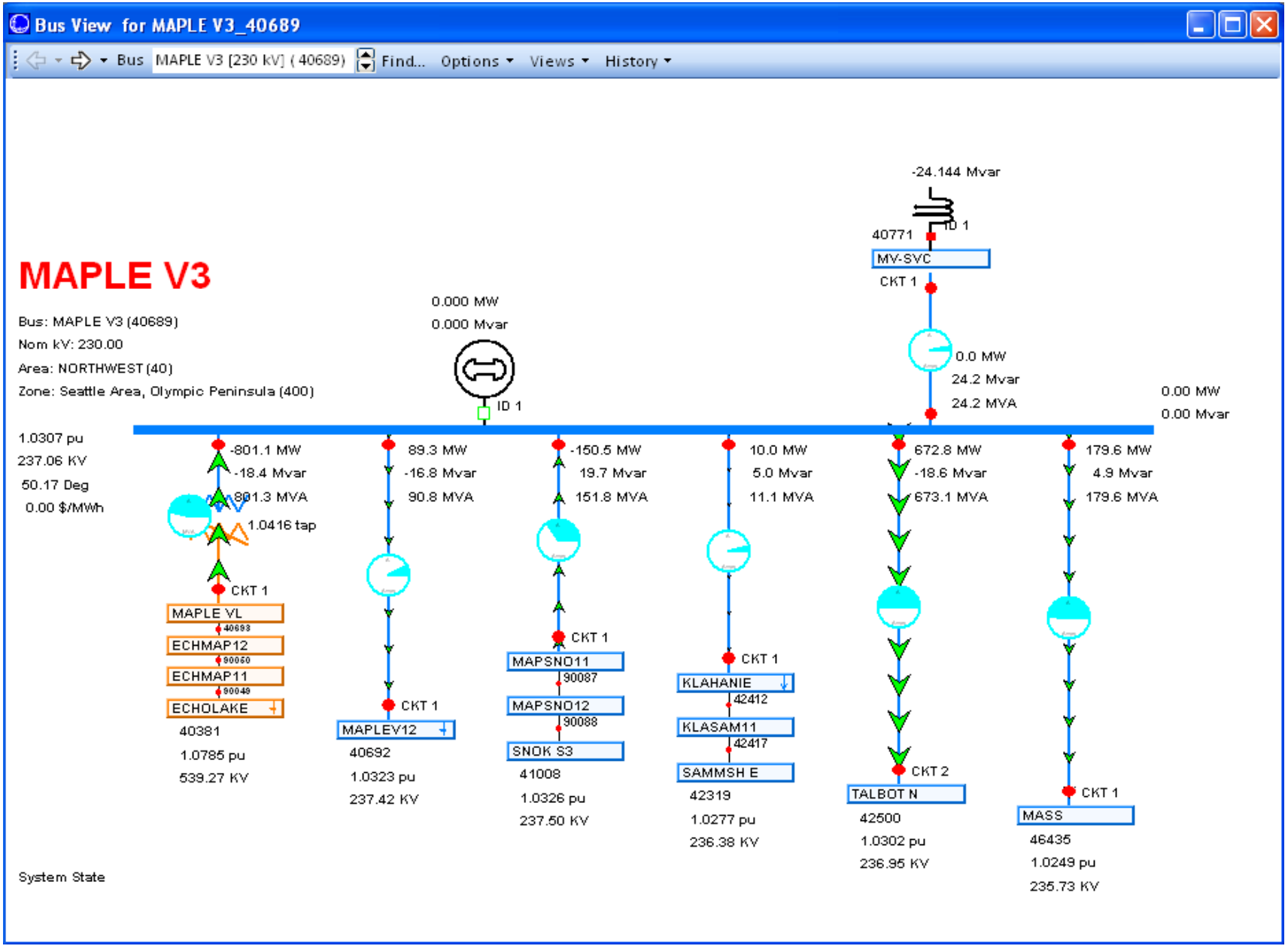


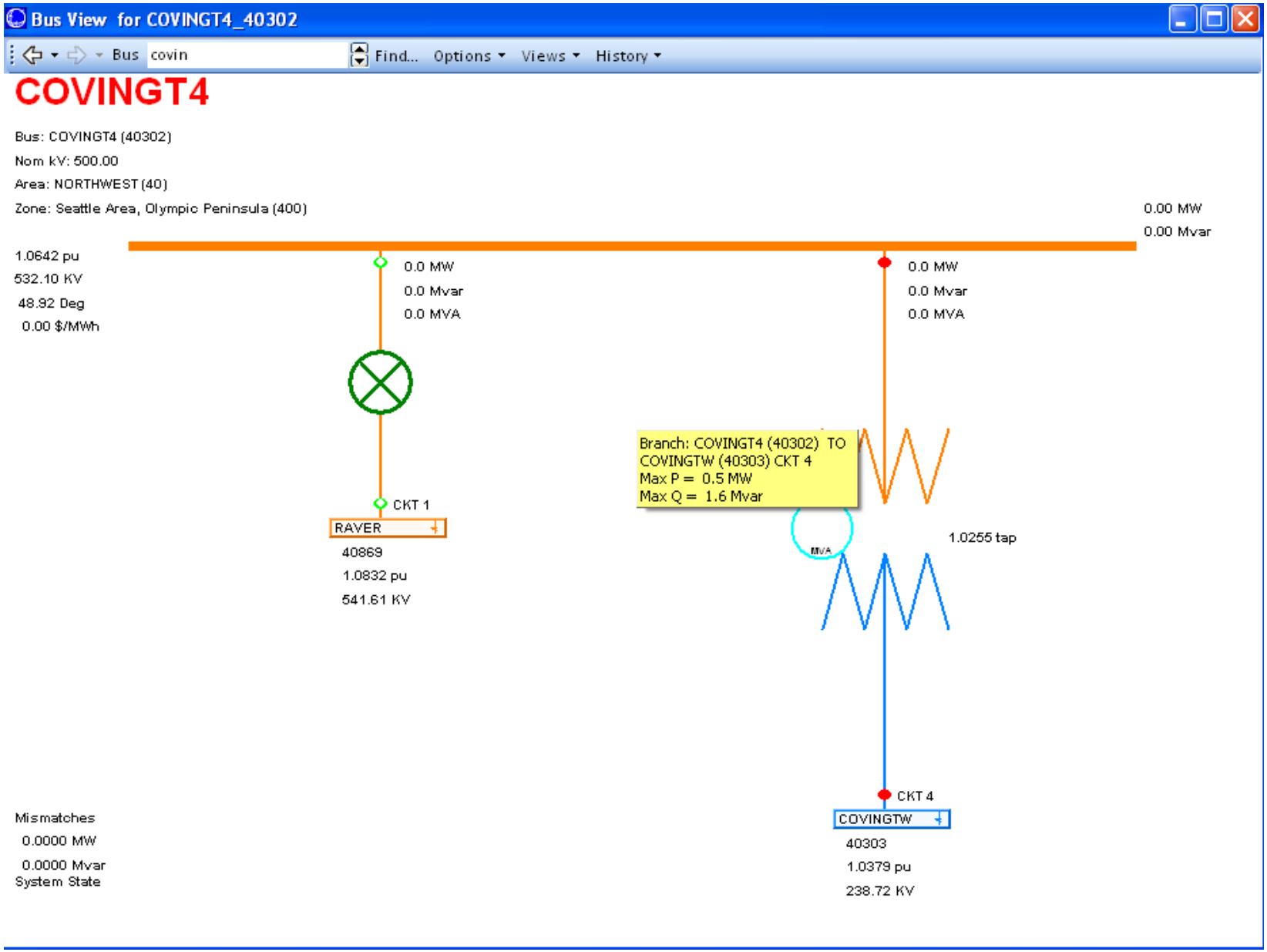
	From Number	From Name	To Number	To Name	Circuit	Monitor	Limit Group	Limiting Flow Used	Limit Used	% of Limit Used	M
1	40077	BANGOR	42904	FOSS CNR	1	YES	Puget Sound Energy	35.1	106.0	33.1	MV
2	40093	BELLNGHM	42002	BELNGM P	2	YES	Puget Sound Energy	16.9	209.0	8.1	MV
3	40093	BELLNGHM	42002	BELNGM P	3	YES	Puget Sound Energy	19.8	265.3	7.4	MV
4	40093	BELLNGHM	42055	TEN MILE	1	YES	Puget Sound Energy	40.6	129.0	31.5	MV
5	42507	BERYDALE	40303	COVINGTW	1	YES	Puget Sound Energy	167.2	1386.0	12.1	MV
6	40303	COVINGTW	42700	WHITE RV	2	YES	Puget Sound Energy	164.7	541.0	30.4	MV
7	40322	CUSTER E	42001	PORTALWY	1	YES	Puget Sound Energy	89.8	429.0	20.9	MV
8	40401	FAIRMONT	42906	IRONDALE	1	YES	Puget Sound Energy	29.4	129.0	22.8	MV
9	40611	KITSAPS	42901	S.BREM	1	YES	Puget Sound Energy	82.0	264.9	30.9	MV
10	42934	CHICO	40612	KITSAPN	1	YES	Puget Sound Energy	68.3	201.0	34.0	MV
11	40664	CEN FERY	42987	PHALEN G	1	YES	Puget Sound Energy	20.1	1275.6	1.6	MV
12	40689	MAPLE V3	42500	TALBOT N	2	YES	Puget Sound Energy	0.0	1302.0	0.0	MV
13	40692	MAPLEV12	42501	TALBOT S	1	YES	Puget Sound Energy	0.0	1302.0	0.0	MV
14	42800	OLYMPA P	40791	OLYMPIA	1	YES	Puget Sound Energy	71.8	264.9	27.1	MV
15	42800	OLYMPA P	40791	OLYMPIA	2	YES	Puget Sound Energy	72.2	264.9	27.2	MV
16	42806	TONO	40821	PAUL	1	YES	Puget Sound Energy	180.2	398.0	45.3	MV
17	42902	BREMERTN	41023	STAT F/G	1	YES	Puget Sound Energy	46.5	143.0	32.5	MV
18	42307	LKTRAD	41323	TANNER T	1	YES	Puget Sound Energy	9.4	110.0	8.6	MV
19	42330	SNOQ SW	41323	TANNER T	1	YES	Puget Sound Energy	18.0	110.0	16.4	MV


Line Outage Distribution Factors (LODFs)
Output Option
Single LODF
LODF Matrix
Action
Outage Sensitivities
Closure Sensitivities
Linear Calculation Method
Linearized AC
Lossless DC
Lossless DC With Phase Shifters
Calculate LODFs
Advanced LODF Calculation
DC Model Options...
Sort by Name Number
Search For Near Bus
Select Far Bus, CKT
CAPEHORN (32368) [60 kV]
CAPEHORN (40173) [115 kV]
CAPGRI11 (90137) [500 kV]
CAPGRI12 (90138) [500 kV]
CAPGRI13 (90139) [500 kV]
CAPGRI14 (90140) [500 kV]
CAPGRI15 (90141) [500 kV]
CAPGRI16 (90142) [500 kV]
CAPGRI14 (90140) [500 kV] CKT 1
CAPGRI16 (90142) [500 kV] CKT 1
LODFs (filtered)
Interface LODFs (filtered)
Records
Geo
Set
Columns
f(x)
From Number
From Name
To Number
To Name
Circuit
% LODF
MW From
MW To
CTG MW Fro
1 40077 BANGOR 42904 FOSS CNR 1 0.0 35.0 -34.9 3
2 40093 BELLNGHM 42002 BELNGM P 2 0.0 -15.3 15.4 -1
3 40093 BELLNGHM 42002 BELNGM P 3 0.0 -18.0 18.0 -1
4 40093 BELLNGHM 42055 TEN MILE 1 0.0 -33.8 33.9 -3
5 42507 BERYDALE 40303 COVINGTW 1 0.0 -103.8 103.8 -10
6 40303 COVINGTW 42700 WHITE RV 2 0.0 144.5 -144.4 14
7 40322 CUSTER E 42001 PORTALWY 1 0.0 -89.2 89.3 -8
8 40401 FAIRMONT 42906 IRONDALE 1 0.0 29.2 -29.2 2
9 40611 KITSAPS 42901 S.BREM 1 0.0 75.9 -75.8 7
10 42934 CHICO 40612 KITSAPN 1 0.0 -68.0 68.2 -6
11 40664 CEN FERY 42987 PHALEN G 1 0.0 0.0 -0.0
12 40689 MAPLE V3 42500 TALBOT N 2 0.0 726.2 -725.8 72
13 40692 MAPLEV12 42501 TALBOT S 1 0.0 243.5 -243.5 24
14 42800 OLYMPA P 40791 OLYMPIA 1 0.0 -73.2 73.3 -7
15 42800 OLYMPA P 40791 OLYMPIA 2 0.0 -73.6 73.7 -7
Clear LODF Matrix Results
Help
Close


Advanced LODF Calculation
This dialog allows you to calculate the LODFs for several different contingent lines. Go to the Contingency Analysis Tool to define which contingent lines to use (all contingencies that contain a single branch outage will be used).
Also, only lines that are being monitored will have their LODFs calculated. See Limit Monitoring Settings to change which lines are monitored.
Format to Save in
Save Only "Monitored Branch, Contingency" pairs for PROMOD
Save Matrix as Comma-delimited text file
Only save pairs with an LODF whose absolute value is greater than
2.00
Only Include Monitored Branches whose MW flow increases
Maximum Columns Per Text File
256
LODF Number Format
Scientific
Fixed Decimal Points
1
File Name
C:\Documents and Settings\tlr6562\My Documents\PS
Browse
OK
Help
Cancel


PSE_500kV_Sensitivities.txt - WordPad
File Edit View Insert Format Help
MONITORED BRANCH 40692 42501 1 ! FLOW = 193.4 MW LODF = 2.1 "MAPLEV12-TALBOT S"
MONITORED BRANCH 42507 42501 1 ! FLOW = -15.1 MW LODF = -2.3 "BERYDALE-TALBOT S"
CONTINGENCY
40233 40287 1 ! Flow = 249.9 MW "CHIEF JO-COULEE"
END
!
MONITORED BRANCH 42507 40303 1 ! FLOW = -168.8 MW LODF = -5.3 "BERYDALE-COVINGTW"
MONITORED BRANCH 42505 42503 1 ! FLOW = 92.2 MW LODF = 4.1 "CHRISTOP-OBRIEN"
CONTINGENCY
40233 90027 1 ! Flow = 375.4 MW "CHIEF JO-CHIMON11"
END
!
MONITORED BRANCH 40689 42500 2 ! FLOW = 672.8 MW LODF = -12.3 "MAPLE V3-TALBOT N"
MONITORED BRANCH 40692 42501 1 ! FLOW = 193.4 MW LODF = -11.4 "MAPLEV12-TALBOT S"
MONITORED BRANCH 42503 42500 1 ! FLOW = -253.7 MW LODF = 7.0 "OBRIEN-TALBOT N"
MONITORED BRANCH 42507 42501 1 ! FLOW = -15.1 MW LODF = 12.8 "BERYDALE-TALBOT S"
CONTINGENCY
40302 40869 1 ! Flow = -442.3 MW "COVINGT4-RAVER"
END
!
MONITORED BRANCH 40689 42500 2 ! FLOW = 672.8 MW LODF = -12.5 "MAPLE V3-TALBOT N"
MONITORED BRANCH 40692 42501 1 ! FLOW = 193.4 MW LODF = -10.8 "MAPLEV12-TALBOT S"
MONITORED BRANCH 42503 42500 1 ! FLOW = -253.7 MW LODF = 7.3 "OBRIEN-TALBOT N"
MONITORED BRANCH 42507 42501 1 ! FLOW = -15.1 MW LODF = 12.2 "BERYDALE-TALBOT S"
CONTINGENCY
40306 40869 2 ! Flow = -446.5 MW "COVINGT5-RAVER"
END
!
MONITORED BRANCH 42002 42089 1 ! FLOW = 69.1 MW LODF = 3.0 "BELNGM P-WOBURN"
MONITORED BRANCH 42156 42002 1 ! FLOW = -42.2 MW LODF = -2.4 "ALGER-BELNGM P"
MONITORED BRANCH 42071 42089 1 ! FLOW = -59.9 MW LODF = -3.0 "LKLOUIST-WOBURN"
MONITORED BRANCH 42120 42071 1 ! FLOW = -51.9 MW LODF = -3.0 "SEDRO E-LKLOUIST"
MONITORED BRANCH 42100 42119 1 ! FLOW = -113.7 MW LODF = -2.3 "SEDRO-SEDRO W"
MONITORED BRANCH 42100 42120 2 ! FLOW = -113.9 MW LODF = -2.4 "SEDRO-SEDRO E"
MONITORED BRANCH 42320 42100 1 ! FLOW = -272.2 MW LODF = -11.3 "HORSRNCH-SEDRO"
MONITORED BRANCH 42321 42100 1 ! FLOW = -276.0 MW LODF = -11.4 "HRNCHTAP-SEDRO"
MONITORED BRANCH 42100 90128 1 ! FLOW = -226.3 MW LODF = -13.2 "SEDRO-SEDBEL11"
For Help, press F1
NUM


Bus View for MAPLE V3_40689
Bus
MAPLE V3 [230 kV] (40689)
Find...
Options
Views
History
MAPLE V3
Bus: MAPLE V3 (40689)
Nom kV: 230.00
Area: NORTHWEST (40)
Zone: Seattle Area, Olympic Peninsula (400)
1.0307 pu
237.06 KV
50.17 Deg
0.00 $/MWh
0.000 MW
0.000 Mvar
ID 1
-24.144 Mvar
ID 1
40771
MV-SVC
CKT 1
0.0 MW
24.2 Mvar
24.2 MVA
0.00 MW
0.00 Mvar
-801.1 MW
-18.4 Mvar
801.3 MVA
1.0416 tap
CKT 1
MAPLE VL
40693
ECHMAP12
90050
ECHMAP11
90049
ECHOLAKE
40381
1.0785 pu
539.27 KV
89.3 MW
-16.8 Mvar
90.8 MVA
CKT 1
MAPLEV12
40692
1.0323 pu
237.42 KV
-150.5 MW
19.7 Mvar
151.8 MVA
CKT 1
MAPSNO11
90087
MAPSNO12
90088
SNOK S3
41008
1.0326 pu
237.50 KV
10.0 MW
5.0 Mvar
11.1 MVA
CKT 1
KLAHANIE
42412
KLASAM11
42417
SAMMSH E
42319
1.0277 pu
236.38 KV
672.8 MW
-18.6 Mvar
673.1 MVA
CKT 2
TALBOT N
42500
1.0302 pu
236.95 KV
179.6 MW
4.9 Mvar
179.6 MVA
CKT 1
MASS
46435
1.0249 pu
235.73 KV
System State


Bus View for COVINGT4_40302
Bus
covin
Find...
Options
Views
History
COVINGT4
Bus: COVINGT4 (40302)
Nom kV: 500.00
Area: NORTHWEST (40)
Zone: Seattle Area, Olympic Peninsula (400)
0.00 MW
0.00 Mvar
1.0642 pu
532.10 KV
48.92 Deg
0.00 $/MWh
0.0 MW
0.0 Mvar
0.0 MVA
0.0 MW
0.0 Mvar
0.0 MVA
Branch: COVINGT4 (40302) TO COVINGTW (40303) CKT 4
Max P = 0.5 MW
Max Q = 1.6 Mvar
1.0255 tap
MVA
CKT 1
RAVER
40869
1.0832 pu
541.61 KV
CKT 4
COVINGTW
40303
1.0379 pu
238.72 KV
Mismatches
0.0000 MW
0.0000 Mvar
System State

LODF Tool Prediction Is?

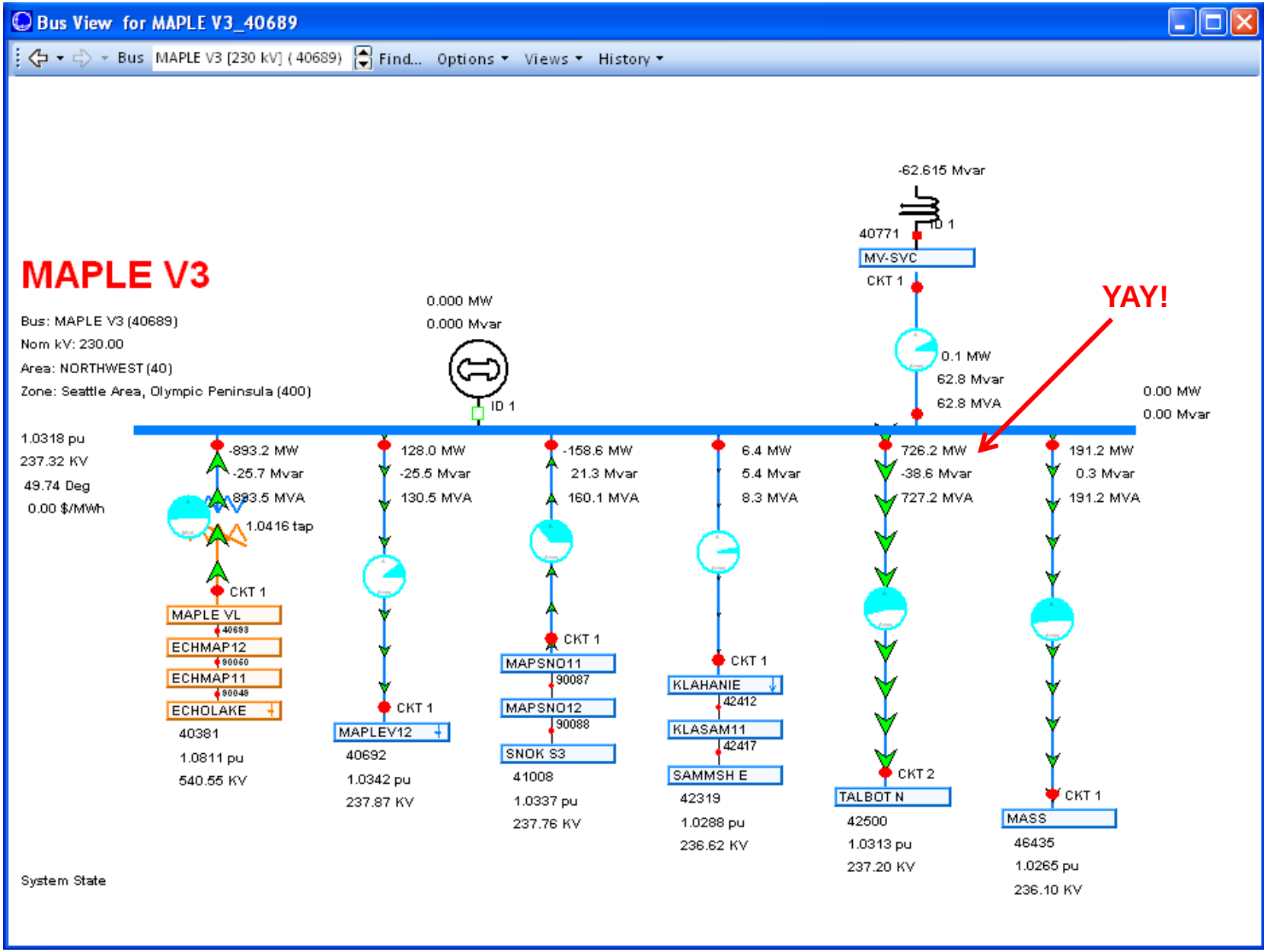
Flow = -442.3 MW "COVINGT4-RAVER“

And

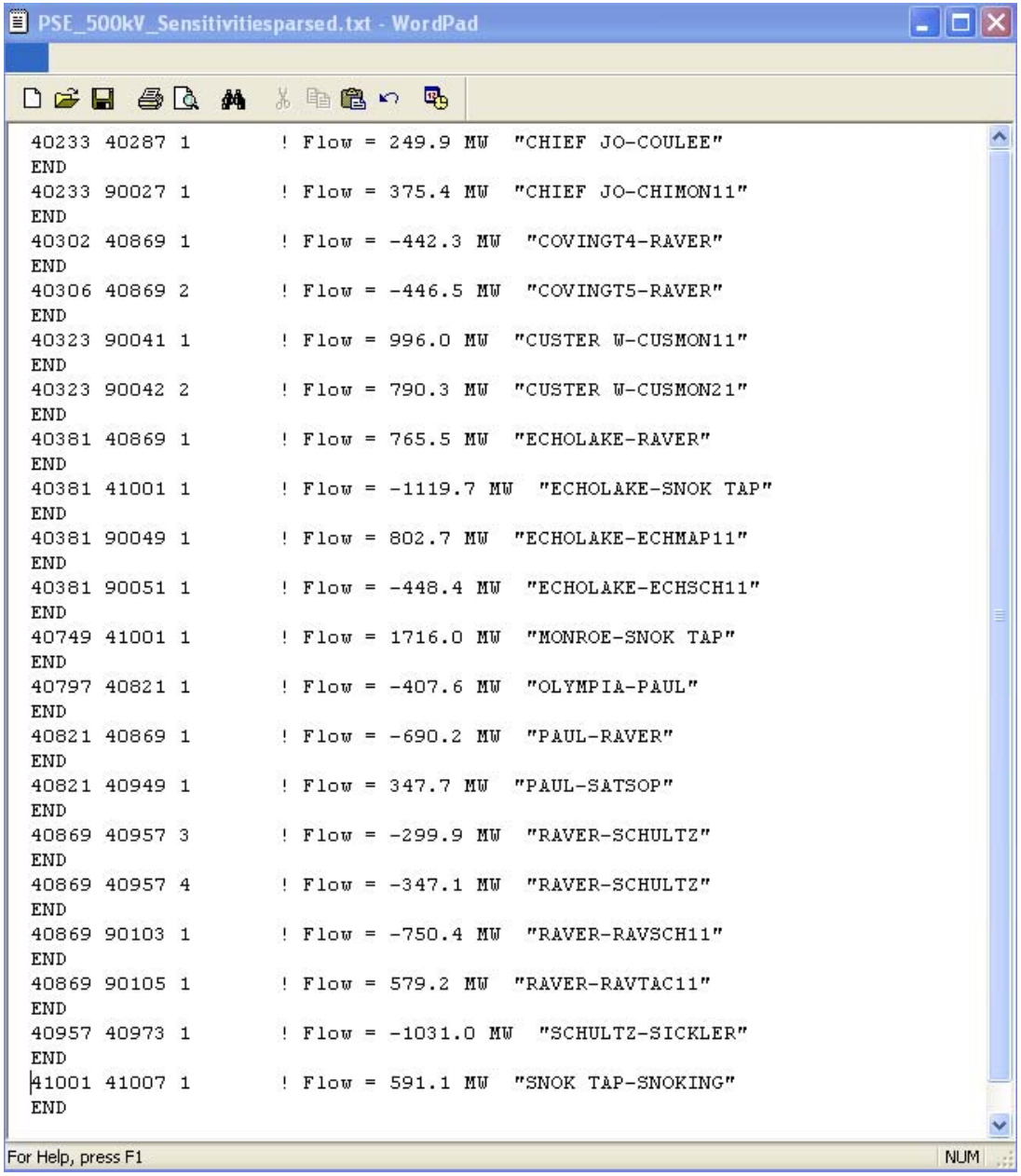
MONITORED BRANCH 40689 42500 2 !

FLOW = 672.8 MW LODF = -12.3 "MAPLE V3-TALBOT N"

So…. (-0.123) * (-442.3 MW) + 672.8 MW = 727.2 MW should show up on the MapleV3—Talbot N line. Ugh, signs… ☹


Bus View for MAPLE V3_40689
Bus
MAPLE V3 [230 kV] (40689)
Find...
Options
Views
History
MAPLE V3
Bus: MAPLE V3 (40689)
Nom kV: 230.00
Area: NORTHWEST (40)
Zone: Seattle Area, Olympic Peninsula (400)
1.0318 pu
237.32 KV
49.74 Deg
0.00 $/MWh
0.000 MW
0.000 Mvar
ID 1
-62.615 Mvar
ID 1
40771
MV-SVC
CKT 1
0.1 MW
62.8 Mvar
62.8 MVA
YAY!
0.00 MW
0.00 Mvar
-893.2 MW
-25.7 Mvar
893.5 MVA
1.0416 tap
CKT 1
MAPLE VL
40693
ECHMAP12
90050
ECHMAP11
90049
ECHOLAKE
40381
1.0811 pu
540.55 KV
128.0 MW
-25.5 Mvar
130.5 MVA
CKT 1
MAPLEV12
40692
1.0342 pu
237.87 KV
-158.6 MW
21.3 Mvar
160.1 MVA
CKT 1
MAPSNO11
90087
MAPSNO12
90088
SNOK S3
41008
1.0337 pu
237.76 KV
6.4 MW
5.4 Mvar
8.3 MVA
CKT 1
KLAHANIE
42412
KLASAM11
42417
SAMMSH E
42319
1.0288 pu
236.62 KV
726.2 MW
-38.6 Mvar
727.2 MVA
CKT 2
TALBOT N
42500
1.0313 pu
237.20 KV
191.2 MW
0.3 Mvar
191.2 MVA
CKT 1
MASS
46435
1.0265 pu
236.10 KV
System State

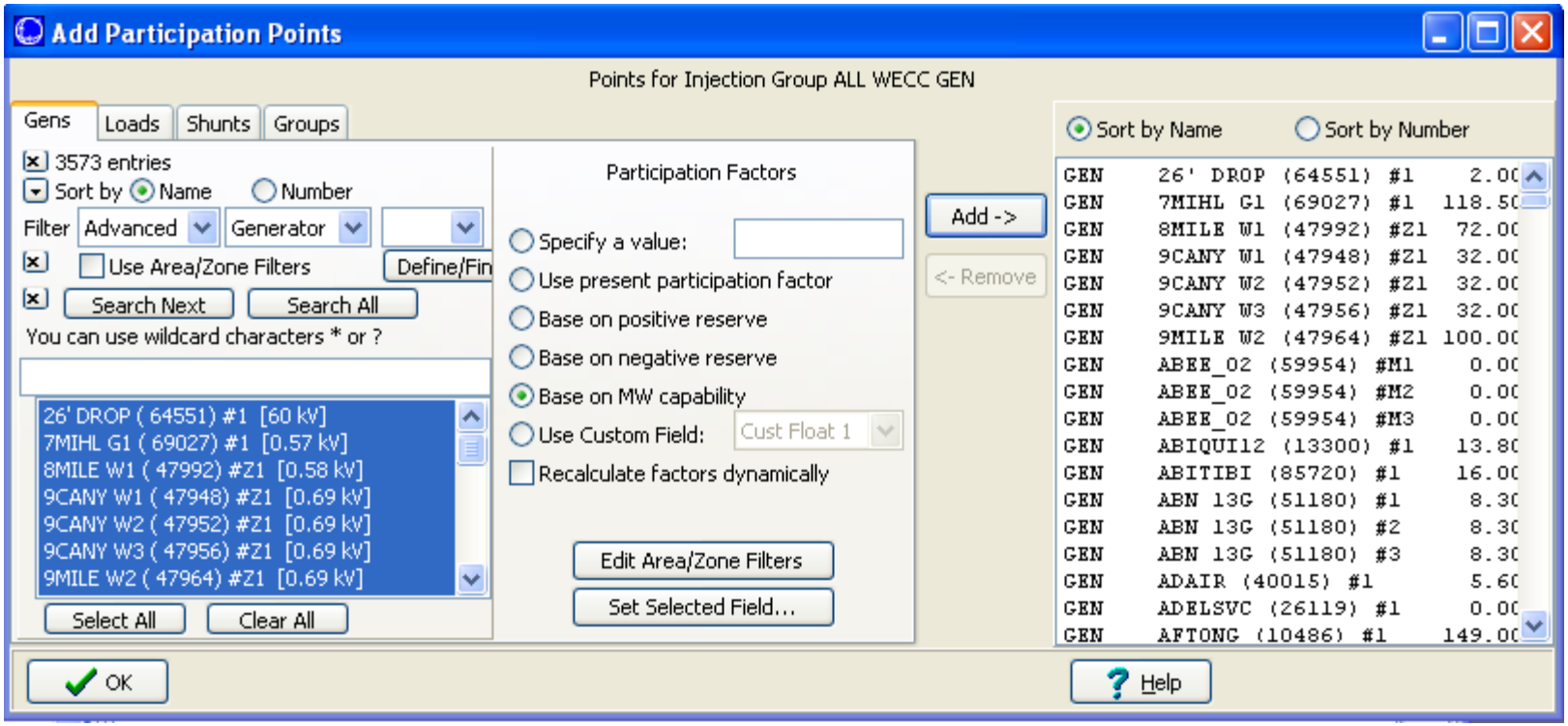
Well? PSE folks, will these outages load up the PSE system?



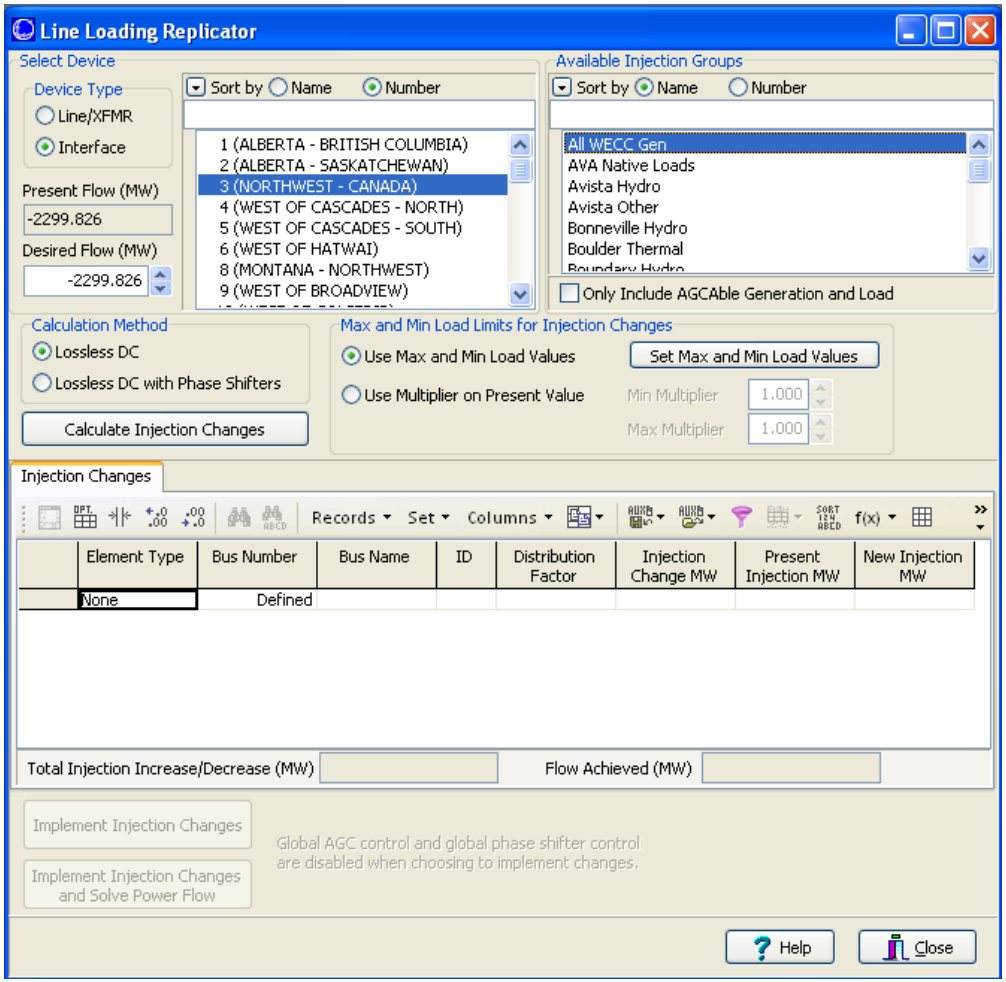
Setting Path Flows and Line Flows to Targets

- Tools Used
  - Injection Group(s)
    - For this example it is an uber-group that is all WECC generation regardless of type, size, etc.
  - Interfaces
  - Line Loading Replicator

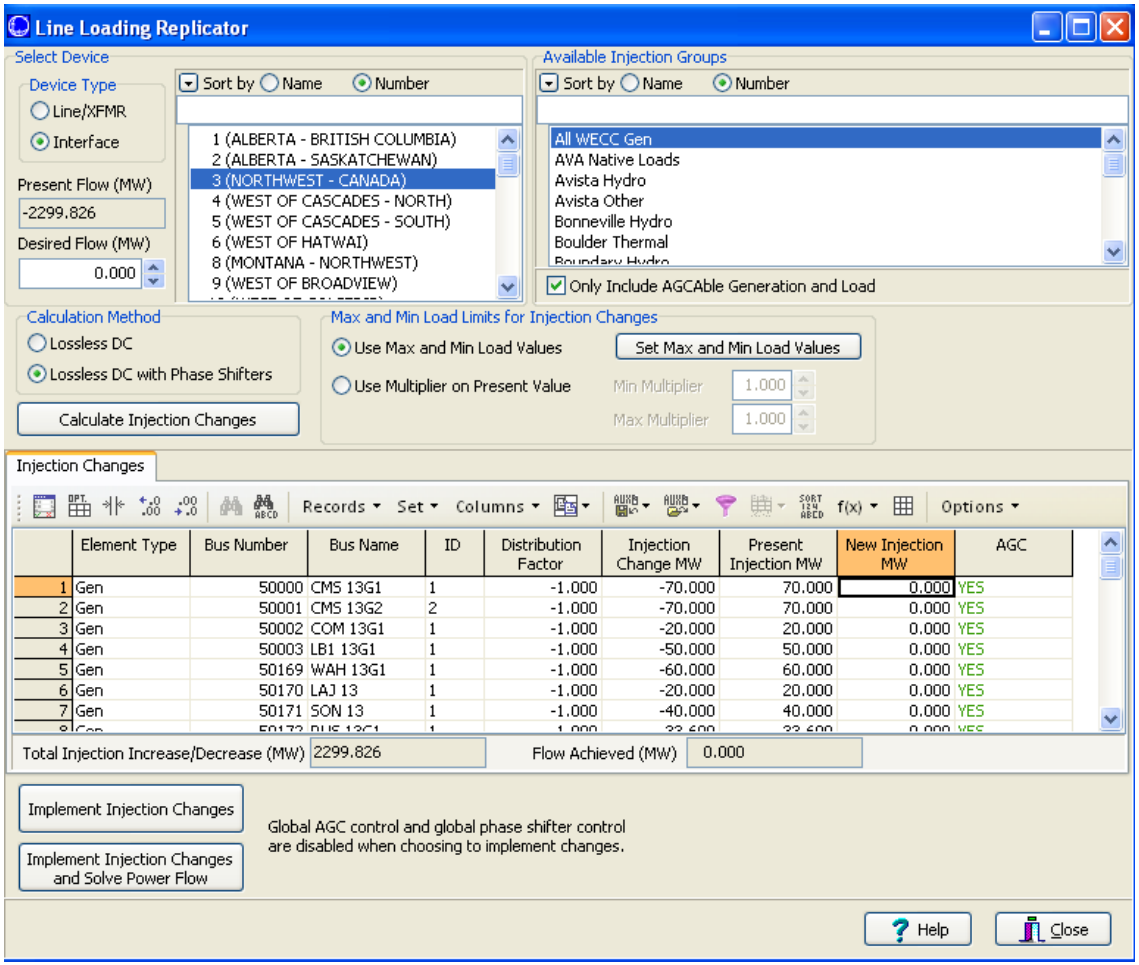
Creating All WECC Gen Group



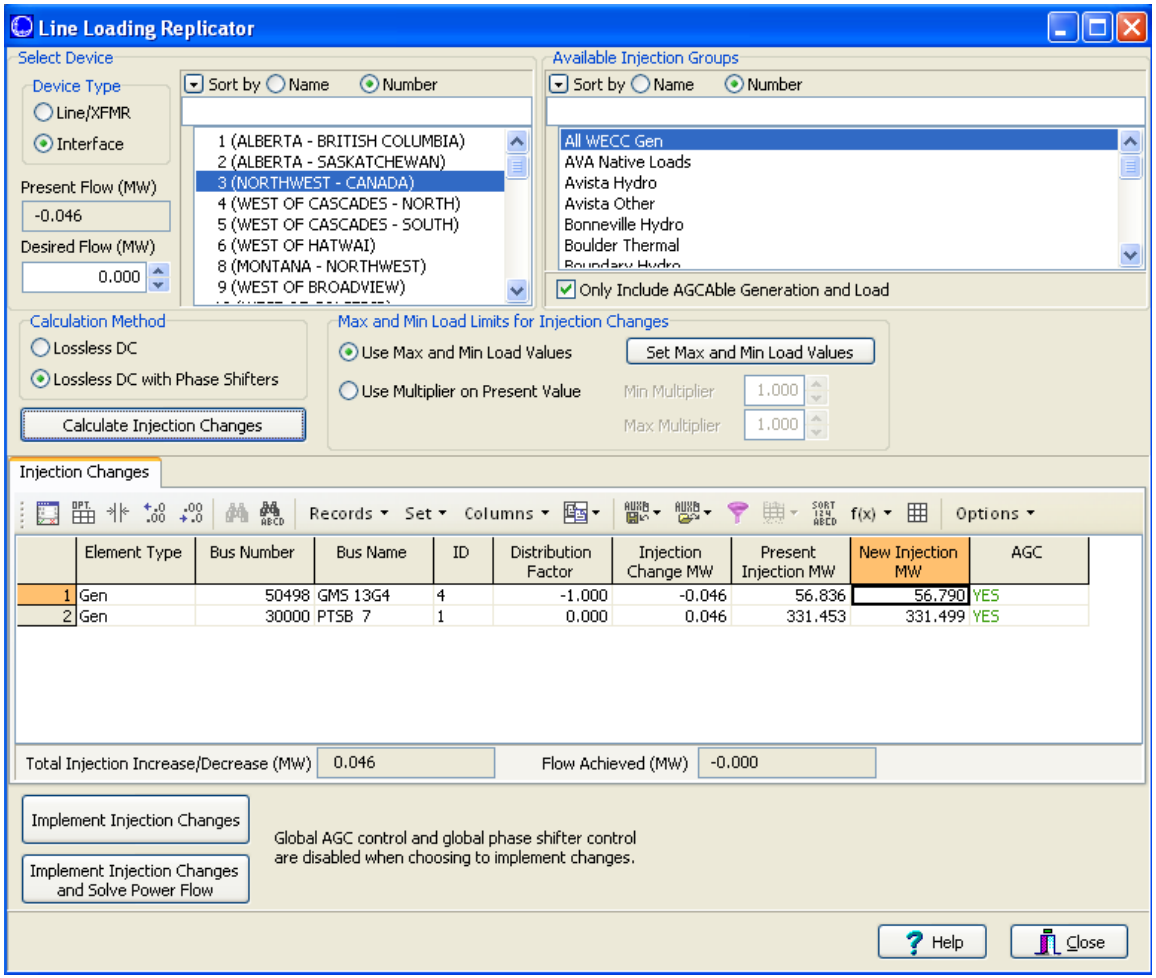
Line Loading Replicator on Northern Intertie



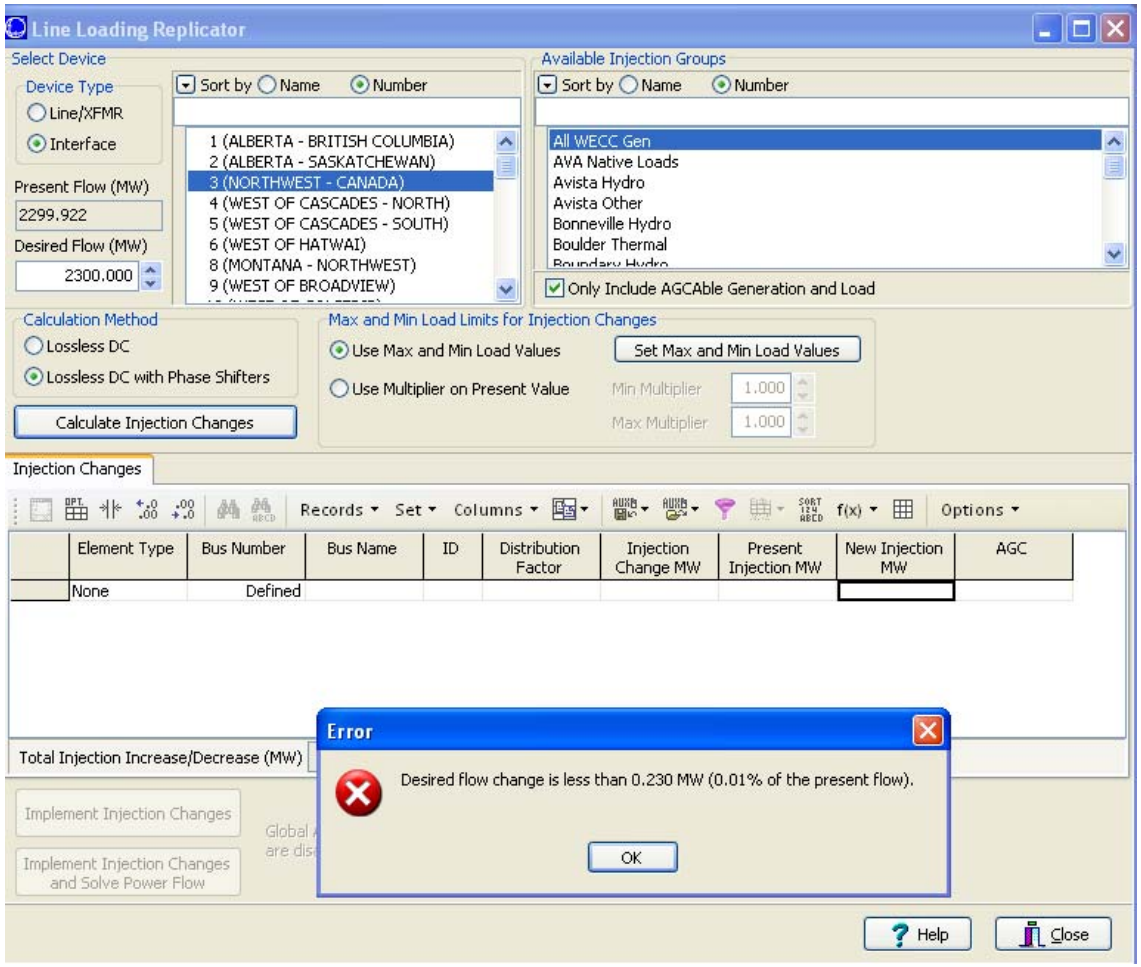
Set Northern Intertie to Zero in 15 seconds



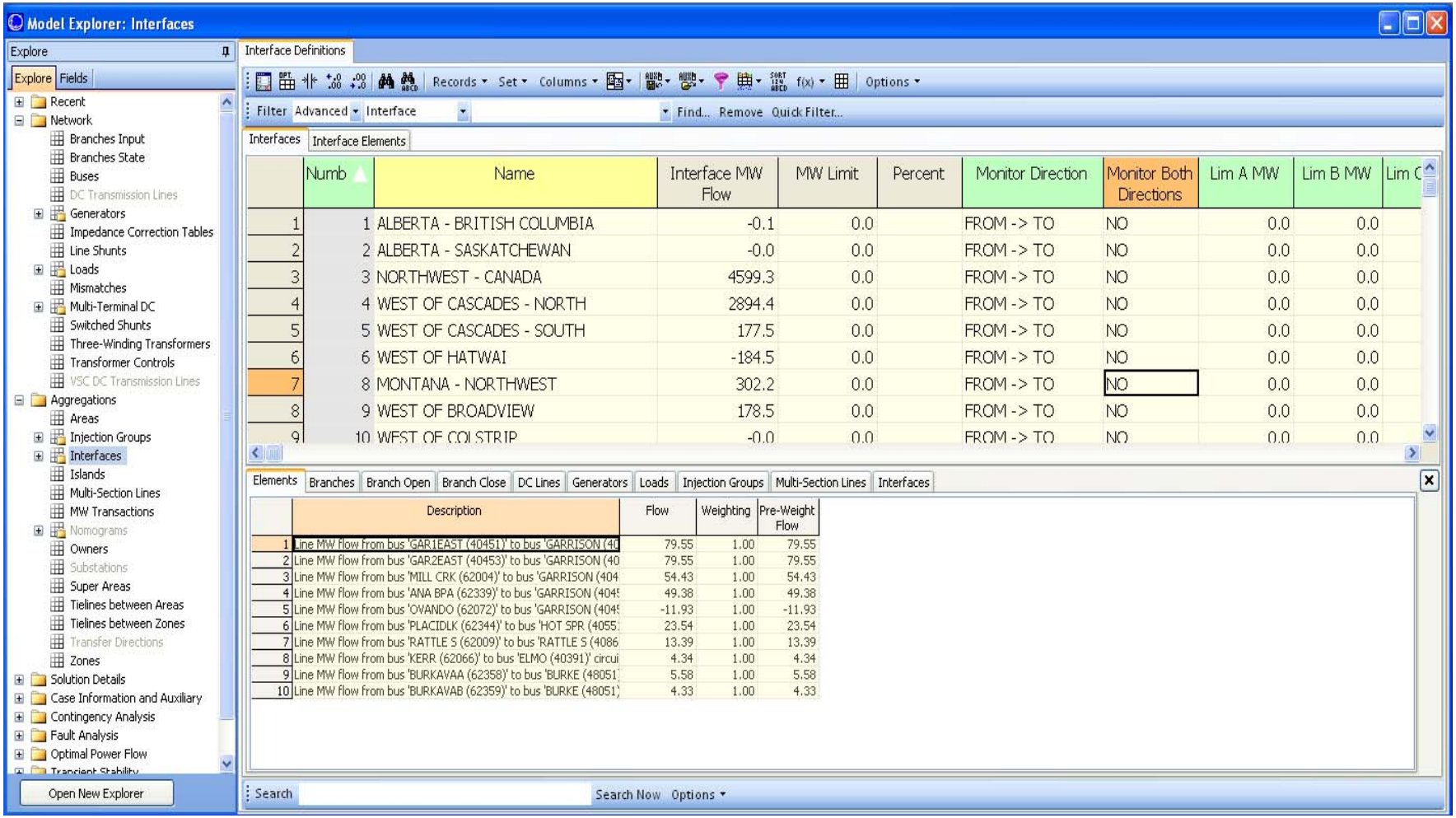
Results: Note Use of AGCable Flag



Going the other way by 2300 MW



Results from this: ~4600 MW Shift



Check Overloads and Generation Movement

- The line loading replicator is NOT an OPF…no constraints
- 15 overloads in base case (max =211%)
- 80 overloads in adjusted case (max=216%, same line as above)

Questions