

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
1	Stone Lake 345-kV bus voltage		105.2%	Base Case	Place Stone Lake Inductor in-service
1	Rocky Run 345/115-kV transformer #3	95.8 – 97.4%		Rocky Run 345/115-kV transformer #2 Sigel – Arpin 115-kV line	No project needed yet
1	Wien – Stratford 115-kV line	108.2%		Glavin-Hume 115-kV line	Use recent valid circuit ratings
1	Stratford - McMillan 115-kV line	99.7%		Base Case	Use recent valid circuit ratings
1	Sigel, Lakehead Vesper, Vulcan and Port Edwards 138-kV bus voltages		86.6 – 91.0%	Arpin-Sigel 138-kV line Sigel-Lakehead Vesper 138-kV line	Publicly announced load curtailments
1	Port Edwards, Hollywood and Saratoga 138-kV bus voltages and Saratoga 115-kV bus voltage		88.0 – 91.9%	Arpin-Sigel 138-kV line Sigel-Lakehead Vesper 138-kV line	Publicly announced load curtailments
1	Castle Rock – Quincy 69-kV line	99.6%		Big Pond-Necedah tap 69-kV line	Uprate Castle Rock-Mckenna 69 kV circuit
1	Council Creek and Petenwell 138-kV bus voltages	–	89.2 – 95.0%	Base Case Arpin-Sigel 138-kV line	Monroe County – Council Creek 161 kV line
1	Petenwell, Necedah, Whistling Wings, Dellwood, Friendship, Houghton Rock and Mckenna 69-kV bus voltages	–	84.3 – 91.8%	Big Pond-Necedah Tap 69-kV line Necedah tap-Whistling Wings Tap 69-kV line Whistling Wings Tap-Dellwood 69-kV line	Mckenna capacitor bank expansion and conversion of Necedah substation to 138 kV
1	Metomen 138/69-kV transformer	96.5 – 112.5%		Metomen-Rosendale 69-kV line Rosendale-North Fond du Lac 69-kV line Winneconne-Sunset Point 69-kV line North Randolph-Markesan Tap 69-kV line Plus other less severe outages	Metomen transformer replacement
1	Lakehead Portage, Endeavor and Roslin 69-kV bus voltages		91.4 – 92.0%	Portage-Lakehead Portage 69-kV line	No project needed yet
1	Ripon, Ripon Industrial Park, NW Ripon, Dartford, SW Ripon 69-kV bus voltages		90.7 – 91.0%	Metomen-Ripon 69-kV line	No project needed yet
1	Winneconne, Omro and Omro Industrial 69-kV bus voltages		88.2 – 89.2%	Winneconne-Sunset Point 69-kV line	Ripon capacitor bank expansion, Metomen transformer replacement and Wautoma 2 nd transformer
1	Silver Lake Fountain Valley, Spring Lake, Red Granite and River Run 69-kV bus voltages		89.2 – 91.9%	Wautoma-Silver Lake 69-kV line Silver Lake-Spring Lake 69-kV line	Ripon capacitor bank expansion and Metomen transformer replacement
1	Sand Lake 138-kV bus voltage		90.7%	Arpin-Sigel 138-kV line	No project needed yet
2	Delta – Mead 69-kV line	100-161%	-	Base Case Chandler-Lakehead Tap 69-kV line Lakehead Tap-Masonville 69-kV line Masonville-Gladstone 69-kV line Gladstone-North Bluff 69-kV line North Bluff-Bay Tap 69-kV line Bay Tap-Mead 69-kV line	Uprate Delta-Mead-North Bluff 69 kV line, or dispatch local generation

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
2	Chandler – Delta 69-kV #1 line	114%	-	Chandler-Delta 69-kV #2 line	Uprate Chandler-Delta 69 kV line #1, or dispatch local generation
2	Chandler – Delta 69-kV #2 line	108%	-	Chandler-Delta 69-kV #1 line	Uprate Chandler-Delta 69 kV line #2, or dispatch local generation
2	Chandler 138/69-kV transformer	97-107%	-	Nordic-Mountain 69-kV line Mountain-Harris Tap 69-kV line Forsyth 138/69-kV transformer	Increased existing SE rating from SELD
2	Chandler – Lakehead Tap 69-kV line Masonville – Lakehead Tap 69-kV line Masonville – Gladstone 69-kV line Gladstone – North Bluff 69-kV line North Bluff – Bay Tap 69-kV line Mead – Bay Tap 69-kV line	123-162%	-	Delta-Mead 69-kV line	Uprate Chandler-Masonville, Masonville-Gladstone, Gladstone-North Bluff, Delta-Mead-North Bluff 69 kV lines; or dispatch local generation
2	Forsyth 138/69-kV transformer	102%	-	Chandler 138/69-kV transformer	Uprate the Forsyth 138/69 kV transformer
2	Atlantic-Henry St. Tap 69-kV line	97%	-	Base Case	
2	Atlantic-M38 69-kV line	101%	-	Atlantic-M38 138-kV line Atlantic 138/69-kV transformer	Uprate Atlantic-M38 69 kV line
2	Atlantic 138/69-kV transformer	100%	-	M38 138/69-kV transformer	Uprate Atlantic 138/69 kV transformer
2	Delta, West Side, Escanaba, Masonville, Mead, Gladstone, Bay View, North Bluff, Harris 69-kV bus voltages	-	90.4-92.0%	Chandler 138/69-kV transformer	North Bluff 69 kV capacitor bank, or dispatch local generation
2	Atlantic, Elevation St., Henry St., MTU, Osceola, Portage, Keweenaw 69 kV bus voltages	-	82.0-91.1%	Atlantic-M38 138-kV line Atlantic 138/69-kV transformer	M38/Osceola capacitor banks, or dispatch local generation
2	L'Anse, Baraga 69 kV-bus voltages	-	90.7-91.3%	M38 138/69-kV transformer	L'Anse capacitor bank
2	Winona, Atlantic, M38 138-kV bus voltages M38, L'Anse, Baraga 69-kV bus voltages	-	89.0-92.0%	M38-Perch Lake 138-kV line	M38/Osceola capacitor banks, or dispatch local generation
3	Fitchburg-Syene-Nine Springs 69-kV line	119.4%-102%		Royster-Pflaum Tap 69-kV line Pflaum-Pflaum Tap 69-kV line	Loop 6947 Nine Springs-Pflaum 69-kV line into Femrite Substation
3	Enzyme Bio Systems-RC3-Clinton-Sharon 69-kV line	118%-96.3%		Colley Road-Dickinson 138-kV line Dickinson-Global Renewable Energy 138-kV line Brick Church 138/69-kV transformer Global Renewable Energy-Brick Church 138-kV line	Rebuild Y-32 Colley Road-Brick Church 69-kV line
3	Royster-Pflaum Tap-Pflaum 69-kV line	115.9%-99.2%		Fitchburg-Syene 69-kV line Nine Springs-Syene 69-kV line	Loop 6947 Nine Springs-Pflaum 69-kV line into Femrite Substation
3	North Stoughton-Stoughton E – Stoughton 69-kV line	114.7%-112.2%		McCue-Harmony 69-kV line Harmony-Lamar 69-kV line	Rebuild Stoughton Substation bus
3	Sheepskin-Dana Tap 69-kV line	113.8%-109%		McCue-Harmony 69-kV line Harmony-Lamar 69-kV line	Sheepskin substation protection project in 2010

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
3	Stage Coach-Black Earth-Mazomanie 69-kV line	113.2%-102.1%		Spring Green 138/69-kV transformer	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating
3	Dane-Lodi Tap 69-kV line	110.1%-96.4%		Kirkwood-Island 69-kV line Island-Moore St 69-kV line Moore St-Baraboo 69-kV line	Rebuild part of the Y-8 Dane-Dam Heights 69-kV line
3	South Lake Geneva-Lake Geneva 69-kV line	109.7%		Brick Church-Cobble Stone 69-kV line	Construct new 138-kV line from North Lake Geneva to South Lake Geneva substation and Construct new 138-kV bus and install a 138/69-kV 100 MVA transformer at South Lake Geneva Substation
3	West Middleton-Timberland 69-kV line	107.7%		Spring Green 138/69-kV transformer	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating
3	Academy-Columbus Muni 2 Tap 69-kV line and Columbus Muni 2 Tap- Columbus 69-kV line	107.5%-97.6%		North Randolph-Fox Lake 138-kV line Fox Lake-N Beaver Dam 138-kV line	Construct a Horicon-East Beaver Dam 138-kV line
3	South Fond Du Lac-Waupun 69-kV line	107.4%-102.2%		North Randolph-Fox Lake 138-kV line Fox Lake-N Beaver Dam 138-kV line	Hubbard-North Beaver Dam project in 2014.
3	Colley Road 138/69-kV transformer	106.8%-96.4%		Paddock 138/69-kV transformer Paddock-Shirland Ave 69-kV line Shaw-Shirland 69-kV line	Install a 138/69-kV transformer at Bass Creek Substation and rebuild/reconductor X-12 Town Line Road-Bass Creek 138-kV line and Rebuild Y-33 Brodhead to South Monroe 69-kV line
3	Shaw-Shirland 69-kV line	106.6%		Colley Road 138/69-kV transformer	Rating increase after SELD validation
3	Cobblestone-Zenda Tap 69-kV line	106.5%		North Lake Geneva-Lake Geneva 69-kV line	Construct new 138-kV line from North Lake Geneva to South Lake Geneva substation and Construct new 138-kV bus and install a 138/69-kV 100 MVA transformer at South Lake Geneva Substation
3	N Monroe-Idle Hour 69-kV line	106.2%-98.7%		Darlington-Gratiot 69-kV line Gratiot-Wiota 69-kV line Wiota-Jennings Rd 69-kV line Darlington 138/69-kV transformer Paddock-Newark 69-kV line	Install a 138/69-kV transformer at Bass Creek Substation and rebuild/reconductor X-12 Town Line Road-Bass Creek 138-kV line and Rebuild Y-33 Brodhead to South Monroe 69-kV line

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
3	Gran Grae-Wauzeka-Boscobel 69-kV line	105.4%-97.6%		Spring Green 138/69-kV transformer Nelson Dewey-Lancaster 138-kV line Lancaster-Eden 138-kV line Eden-Wyoming Valley 138-kV line Spring Green-Lone Rock 69-kV line	Uprate Y-40 Gran Grae-Boscobel 69-kV line to achieve a 99 MVA summer emergency rating
3	Kirkwood-Rock Springs Tap – Artesian 138-kV line	103.2%-97.9%		Trienda-Lewiston 138-kV line East Dells-Kilbourn 138-kV line East Dells-Lewiston 138-kV line	Construct a Lake Delton-Birchwood 138-kV line
3	Spring Green 138/69-kV transformer	102.3%-101%		Gran Grae-Wauzeka 69-kV line Wauzeka-Boscobel 69-kV line	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating
3	Hillman 138/69-kV transformer	99.4%-96.9%		DPC Galena-Pilot 69-kV line Pilot-Terr TP 69-kV line	Replace the existing 46 MVA Hillman 138/69-kV transformer with a 100 MVA transformer
3	Paddock-Shirland Ave 69-kV line	98.6%		Colley Road 138/69-kV transformer	No project so far
3	McCue-Milton Lawn 69-kV line	96.7%		Janesville 138/69-kV transformer	Uprate terminal limitations at McCue for the Y-79 McCue-Milton Lawns 69-kV line
3	Eden 138/69-kV transformer	96.4%		Eden-Wyoming Valley 138-kV line	No project so far
3	McCue-Harmony 69-kV line	96.4%-95.6%		Kegonsa 138/69-kV transformer Kegonsa-N Stoughton 69-kV line	Uprate Y-61 McCue-Lamar 69-kV line to achieve 300 deg F line ratings and install 2-12.45 Mvar 69 kV capacitor banks at Lamar Substation
3	West Middleton 138/69 kV transformer	96.4%		West Middleton 138/69-kV transformer	Construct West Middleton-Blount 138-kV line
3	Colley Road-Dickinson 138-kV line	96%-95.1%		Rock River-La Prairie 138-kV line La Prairie-Bradford 138-kV line Bradford-West Darien 138-kV line	Colley Road protection project in 2010
3	Eden, Spring Green, Wyoming Valley and Troy 138-kV buses		92.9%-94.2%	Base Case	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating and Install 2-16.33 MVAR 69-kV capacitor banks at Eden Substation
3	Oakridge, Hawk, Pleasant View, McFarland, Sprecher, Kegonsa, Colloday Point, Reiner Road, Cross County, Fitchburg, Sycamore, Femrite and Blount 138-kV buses		93.7%-95.7%	Base Case	Install 2-16.33 MVAR 69-kV capacitor banks and 2-24.5 MVAR capacitor banks at Femrite substation
3	Hustisford, Hubbard, Concord, Rockvale, Fort Atkinson, Crawfish and Rubicon 138-kV buses		94.5%-95.8%	Base Case	Install 4-49 MVAR 138-kV capacitor banks at Concord Substation

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
3	Boscobel, Muscoda and Blue River 69-kV buses		95.3%-95.6%	Base case	Install 1-8.16 MVAR capacitor bank at Boscobel 69-kV Substation and upgrade existing 5.4 MVAR bank with an 8.16 MVAR bank, Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating and Install 2-16.33 MVAR 69-kV capacitor banks at Eden Substation
3	Lodi and Okee 69-kV buses		95.4%-95.9%	Base case	Install 2-16.33 Mvar 69-kV capacitor banks at Dam Heights
3	Gaston Road, Cottage Grove and Bird Street 69-kV buses		95.7%-96%	Base case	Install 2-16.33 Mvar 69-kV capacitor banks at Sun Prairie
3	Spring Green, Arena, Mazomanie, Mazomanie Industrial, Lone Rock, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages		78.9%-90.1%	Spring Green 138/69-kV transformer	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating
3	Harmony, Lamar, Fulton, Saunders Creek, Dana Corp, Sheepskin and Evansville 69-kV buses		84.4%-91.7%	McCue-Harmony 69-kV line Harmony-Lamar 69-kV line Lamar-Fulton 69-kV line	Uprate Y-61 McCue-Lamar 69-kV line to achieve 300 deg F line ratings and install 2-12.45 Mvar 69 kV capacitor banks at Lamar Substation and construct double-circuit line between McCue and Lamar substations
3	Wauzeka, Spring Green, Lone Rock, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages, Spring Green and Wyoming Valley 138-kV bus voltages		85.9%-91.6%	Gran Grae-Wauzeka 69-kV line Wauzeka-Boscobel 69-kV line	Install 1-8.16 MVAR capacitor bank at Boscobel 69-kV Substation and upgrade existing 5.4 MVAR bank with an 8.16 MVAR bank ,
3	Lone Rock, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages		85.9%-88.5%	Lone Rock-Spring Green 69-kV line	Install 1-8.16 MVAR capacitor bank at Boscobel 69-kV Substation and upgrade existing 5.4 MVAR bank with an 8.16 MVAR bank, Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating
3	Hubbard and Hustisford 138-kV bus voltages		86.1%-86.8%	Rubicon-Hustisford 138-kV line Hubbard-Hustisford 138-kV line	Construct a Horicon-East Beaver Dam 138-kV line

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
3	Eden, Wyoming Valley, Spring Green, Troy and Lancaster 138-kV bus voltages, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages		86.2%-91.9%	Nelson Dewey-Lancaster 138-kV line Lancaster-Wyoming Valley 138-kV line Lancaster-Eden 138-kV line	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating and Install 2-16.33 MVAR 69-kV capacitor banks at Eden Substation
3	Dickinson, Global Renewable Energy, William Bay and Brick Church 138-kV buses		86.9%-91.6%	Colley Road – Dickinson 138-kV line Dickinson-Global Renewable Energy 138-kV line Global Renewable Energy-Brick Church 138-kV line	Install 2-24.5 Mvar 138-kV capacitor bank and 1-18 Mvar 69-kV capacitor bank at Brick Church substation
3	Idle Hour, Monroe, Black Smith, New Glarus, Monticello, Brown town and S Monroe 69-kV buses		87.4%-91.3%	North Monroe-Idle Hour 69-kV line North Monroe 138/69-kV transformer outage	Rebuild Y-33 Brodhead to South Monroe 69-kV line and Install a 138/69-kV transformer at Bass Creek Substation and rebuild/reconductor X-12 Town Line Road-Bass Creek 138-kV line
3	Concord ,Hubbard, Hustisford, Rubicon, Rockvale and Butler Ridge 138-kV bus voltages		87.7%-91.8%	Concord4-5 138-kV bus outage Hartford-St Lawrence 138-kV line	Install 4-49 MVAR 138-kV capacitor banks at Concord Substation
3	Avoca, Muscoda, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages		87.8%-91.6%	Lone Rock-Avoca 69-kV line Avoca-Muscoda 69-kV line	Install 1-8.16 MVAR capacitor bank at Boscobel 69-kV Substation and upgrade existing 5.4 MVAR bank with an 8.16 MVAR bank
3	Brodhead Muni 3, Brodhead Muni 2, Brodhead, Brodhead Muni 1, RCEC Orfordville, Orfordville, Bass Creek, Footville, RCEC Center, Evansville 69-kV bus voltages		87.8%-91.9%	Brodhead Switching Station- Brodhead Muni 3 69-kV line Brodhead Muni 2 -Brodhead Muni 3 69-kV line Brodhead Muni 2-Brodhead 69-kV line	Install a 138/69-kV transformer at Bass Creek Substation and rebuild/reconductor X-12 Town Line Road-Bass Creek 138-kV line
3	Eden, Wyoming Valley, Spring Green, Troy, City view, Lake Delton and Lancaster 138-kV bus voltages,		88.2%-91.8%	Trienda-Lewiston 138-kV line Lake Delton-City View 138-kV line City View-Kirkwood 138-kV line Trienda-Lake Delton 138-kV line plus other less severe outages	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating and Install 2-16.33 MVAR 69-kV capacitor banks at Eden Substation
3	Cobblestone, Lake Shore, Twin Lakes, Richmond and Zenda 69-kV buses		88.4%-91.6%	Brick Church-Cobblestone 69-kV line	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
3	Lake Geneva, S Lake Geneva, Richmond, Katzenberg and Twin Lake 69-kV buses		88.4%-89.3%	North Lake Geneva-Lake Geneva 69-kV line	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating
3	Burke, Sun Prairie, Token Creek, South, Colorado, Bird St, Gaston RD and Reiner 69-kV buses		88.6%-91.9%	Reiner Road 138/69-kV transformer outage, Burke-Colorado 69-kV line and Reiner Road-Burke 69-kV line	Install 2-16.33 Mvar 69-kV capacitor banks at Sun Prairie
3	Evansville, Footville, Center and Bass Creek 69-kV bus voltages		88.7%-91.1%	Evansville-Sheepskin 69-kV line	Install a 138/69-kV transformer at Bass Creek Substation and rebuild/reconductor X-12 Town Line Road-Bass Creek 138-kV line
3	Arena, Mazomanie and Black Earth 69-kV bus voltages		88.7%-91.9%	Spring Green-Arena 69-kV line	Install 2-12.25 MVAR 69-kV capacitor banks at Mazomanie Substation
3	Eden, Wyoming Valley, Spring Green, Troy and Lancaster 138-kV bus voltages,		89%-91.8%	Spring Green-Troy 138-kV line Troy-Kirkwood 138-kV line	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating and Install 2-16.33 MVAR 69-kV capacitor banks at Eden Substation
3	Island, Moore St, Baraboo, Dam Heights, Tower St, Eagle View and Prairie Du Sac 69-kV bus voltages		89.3%-91.3%	Island-Kirkwood 69-kV line	Install 2-16.33 Mvar 69-kV capacitor banks at Dam Heights
3	Rockvale 138-kV bus voltage		90%	Concord-Rockvale 138-kV line	Install 4-49 MVAR 138-kV capacitor banks at Concord Substation
3	Potosi, Hillman, Darlington and Lafayette Wind 138-kV bus voltages		90.1%-90.9%	Nelson Dewey-Potosi 138-kV line Potosi-Hillman 138-kV line	Install 2-16.33 Mvar 69-kV cap banks at North Monroe
3	Albany and N Monroe 138-kV bus voltages		90.5%-90.6%	Townline-Albany 138-kV line	Install 2-16.33 Mvar 69-kV cap banks at North Monroe
3	Lone Rock, Muscoda, Avoca, Blue River, Boscobel, Boscobel Muni 69-kV bus voltages		90.7%-91.9%%	Spring Green-Wyoming Valley 138-kV line	Install 1-8.16 MVAR capacitor bank at Boscobel 69-kV Substation and upgrade existing 5.4 MVAR bank with an 8.16 MVAR bank, Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
3	Oakridge, Cross County, Fitchburg 138-kV buses		91.4%-91.9%	Rockdale-West Middleton 345-kV line West Middleton 345/138-kV transformer outage Pleasant View-West Middleton 138-kV line	Install 2-16.33 MVAR 69-kV capacitor banks and 2-24.5 MVAR capacitor banks at Femrite Substation
3	Fox Lake, N Beaver Dam and E Beaver Dam 138-kV bus voltages		90.2%-90.3%	North Randolph-Fox Lake 138-kV line	Construct a Horicon-East Beaver Dam 138-kV line
3	Bluff Creek and Sugar Creek 138-kV bus voltage		91%-91.3%	University-Bluff Creek 138-kV line	No project so far
3	Sun Valley 69-kV bus voltage		91.8%	Sun Valley-Verona 69-kV line	Uprate Y-61 McCue-Lamar 69-kV line to achieve 300 deg F line ratings and install 2-12.45 Mvar 69 kV capacitor banks at Lamar Substation, Install a 138/69-kV transformer at Bass Creek Substation and rebuild/reconductor X-12 Town Line Road-Bass Creek 138-kV line
3	La Prairie, Bradford, West Darien, SW Delavan and North Shore 138-kV buses		91.5%-91.9%	Rock River-La Prairie 138-kV line La Prairie-Bradford 138-kV line Bradford-West Darien 138-kV line	Install 2-24.5 Mvar 138-kV capacitor bank and 1-18 Mvar 69-kV capacitor bank at Brick Church Substation
3	Black Earth 69-kV bus voltage		92%	Stage Coach-Black Earth 69-kV line	Install 2-12.25 MVAR 69-kV capacitor banks at Mazomanie Substation
3	Cottage Grove and Gaston RD 69-kV bus voltage		90.5%-91.2%	Kegonsa-Cottage Grove 69-kV line	Install 2-16.33 Mvar 69-kV capacitor banks at Sun Prairie
3	McFarland, Femrite and Sprecher 138-kV bus voltages		90.8%-91.9%	Kegonsa-McFarland 138-kV line McFarland-Femrite 138-kV line	Install 2-16.33 MVAR 69-kV capacitor banks and 2-24.5 MVAR capacitor banks at Femrite Substation
3	Deforest, Burke, Sun Prairie, Token Creek, South, Colorado, Bird St, Gaston RD and Reiner 69-kV buses		91.2%-92%	Deforest-North Madison 69-kV line	Install 2-16.33 Mvar 69-kV capacitor banks at Sun Prairie
3	Lodi, Okee 69-kV bus voltages		90.6%-92%	Dane-Lodi Tap 69-kV line	Install 2-16.33 Mvar 69-kV capacitor banks at Dam Heights
3	Eagle View 69-kV bus voltage		92%	Eagle View-Dam Heights 69-kV line	No project so far
3	Randolph, Didion and Cambria 69-kV bus voltages		90.9%-91.8%	North Randolph-Randolph Tap 69-kV line Didion-Randolph Tap 69-kV line	Install 2-16.33 Mvar 69-kV cap banks at Rio
3	Boscobel 69-kV bus voltage		91.3%	Gran Grae 138/69-kV transformer	Install 1-8.16 MVAR capacitor bank at Boscobel 69-kV Substation and upgrade existing 5.4 MVAR bank with an 8.16 MVAR bank
3	Yahara, Vienna and American Center 138-kV bus voltages		91.3%-91.6%	North Madison-Yahara 138-kV line	No project so far
3	Miner and Shullsburg 69-kV bus voltages		91.8%-91.9%	DPC Galena-Pilot 69-kV line	No project so far

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
3	Fort Atkinson 138-kV bus voltage		91.6%-91.8%	Jefferson-Lakehead Cambridge 138-kV line Rockdale- Lakehead Cambridge 138-kV line	Install 4-49 MVAR 138-kV capacitor banks at Concord Substation
3	Horicon and Horicon Industry 69-kV bus voltage		91.2%-91.5%	Hubbard-Horicon 69-kV line	Construct a Horicon-East Beaver Dam 138-kV line
3	LCI and Pflaum 69-kV bus voltage		91.4%	Royster-Pflaum 69-kV line	Loop 6947 Nine Springs-Pflaum 69-kV line into Femrite Substation
3	N Lake Geneva Tap 138-kV bus voltage		91.9%	Burlington 138-kV bus 1-2	No project so far
3	Spring Green and Wyoming Valley 138-kV bus voltages		90.9%-91%	Columbia generation Unit 1 or Unit 2	Install 2-16.33 MVAR 69-kV capacitor banks at Spring Green Substation and Install a second 138/69-kV transformer at Spring Green with a 100 MVA summer normal rating and Install 2-16.33 MVAR 69-kV capacitor banks at Eden Substation
3	Wauzeka-Boscobel 69-kV line	99.2%		Columbia generation Unit 1 or Unit 2	Y-40 rebuild
3	North Monroe 138/69 kV transformer	95.3%		Columbia generation Unit 1 or Unit 2	Construct Verona-North Monroe 138-kV line
3	McCue-Harmony-Lamar 69-kV line	100.1%-97.2%		Sheepskin generation Unit 1	Uprate Y-61 McCue-Lamar 69-kV line to achieve 300 deg F line ratings and install 2-12.45 Mvar 69 kV capacitor banks at Lamar Substation
3	West Middleton-Black Hawk 69-kV line	95.7%		West Campus generation ST	Construct West Middleton-Blount 138-kV line
3	Nelson Dewey-Gran Grae 161-kV line	96.1%		DPC Genoa generation Unit 3	No project so far
4	Pulliam-Suamico 69-kV line	117%	-	Base case	Rebuild/Convert Bayport-Suamico-Sobieski-Pioneer 69-kV line to 138 kV
4	West Marinette 138/69-kV transformer #1	99.8-98%	-	Wells St-Roosevelt 69-kV line outage Roosevelt 138/69-kV transformer outage	- Expand the Menominee 69-kV Substation and install 138 kV terminals. Loop the West Marinette-Bay De Noc 138-kV line into the Substation - Install 138/69-kV transformer at the expanded Menominee Substation
4	Pioneer-Sobieski 69-kV line	128%	-	Pulliam-Suamico 69-kV line outage followed by Sobieski-Pioneer 69-kV line close	Rebuild/Convert Bayport-Suamico-Sobieski-Pioneer 69-kV line to 138 kV
4	Sunset Point-Pearl Ave 69-kV line	106.1%	-	Ellinwood-Twelfth Avenue 69-kV line outage	Rebuild 2.37 miles of 69 kV from Sunset Point to Pearl Ave with 477 ACSR

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
4	Canal 138/69-kV transformer #1	95.1%	-	Canal 138/69-kV transformer #2 outage	- Construct Canal-Dunn Road 138-kV line - Install 60 MVA 138/69-kV transformer at Dunn Road
4	Glenview 138/69-kV transformer #1	96.1%	-	Glenview 138/69-kV transformer #2 outage	Replace two existing 138/69-kV transformers at Glenview Substation with 100 MVA transformers
4	Glenview 138/69-kV transformer #2	95.6%	-	Glenview 138/69-kV transformer #1 outage	Replace two existing 138/69-kV transformers at Glenview Substation with 100 MVA transformers
4	Finger Rd-Bluestone 69-kV line	96.5-113%	-	Wesmark-Kellnersville 69-kV line outage Kellnersville-Manrap 69-kV line outage Mishicot-Shoto 138-kV line outage Lakefront G9 outage	Construct a new 138-kV substation and loop Highway V-East Krok 138-kV line into the substation
4	Northeast-Mirro 69-kV line	95.9%	-	Lakefront G9 outage	Construct Shoto to Custer 138-kV line
4	City Limits 138-kV bus tie 1-2 City Limits-Combined Locks Tap 138-kV line	100.8-107.5%	-	North Appleton-Apple Hills 138-kV line outage	No provisional project. Additional study is being conducted.
4	Sobieski, Suamico 69-kV bus voltages	-	91-87.5%	Base case Pulliam G5 or G7 outage	Rebuild/Convert Bayport-Suamico-Sobieski-Pioneer 69-kV line to 138 kV
4	Bluestone, Wesmark 69-kV bus voltages	-	Diverged	Finger Rd-Bluestone 69-kV line outage	Construct a new 138-kV substation and loop Highway V-East Krok 138-kV line into the substation
4	East Krok, Beardsley St, Barnett, Booster 69-kV bus voltages	-	90.3-91.5%	East Krok 138/69-kV transformer outage	No provisional project. Additional study is being conducted.
4	Hickory, Forward Energy Center, Butternut 4, Butternut 5 138-kV bus voltages	-	91.3-91.5%	Hickory-South Fond du Lac 138-kV line outage	Install 28.8 MVAR capacitor bank at Butternut 138-kV Substation
4	Holland, Plymouth #4 138-kV bus voltage	-	90.1-91.8%	Charter Steel Industry-Holland 138-kV line outage	No provisional project. Additional study is being conducted.
4	Suamico, Sobieski 69-kV bus voltages	-	88.5-91.2%	Pulliam-Suamico 69-kV line outage followed by Sobieski-Pioneer 69-kV line close	Rebuild/Convert Bayport-Suamico-Sobieski-Pioneer 69-kV line to 138 kV
4	Holland 138-kV bus voltages	-	90.6%	Charter Steel 138-kV bus plus Charter Steel-Cedarsauk 138-kV line outage	No provisional project. Additional study is being conducted.

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
5	Bluemound 230-kV bus Concord 138-kV bus Walworth 138-kV bus Allerton 138-kV bus Bark River 138-kV bus Barton 138-kV bus Brookdale E 138-kV bus Brookdale W 138-kV bus Edgewood 138-kV bus Chinook 138-kV bus Cooney 138-kV bus Cottonwood 138-kV bus Germantown 138-kV bus Hartford 138-kV bus Merrill Hills 138-kV bus Mukwonago 138-kV bus Maple 138-kV bus Pleasant Valley 138-kV bus Duplainville 138-kV bus St. Lawrence 138-kV bus St. Martins 138-kV bus Summit 138-kV bus Sussex 138-kV bus 28 th St 138-kV bus Tamarack 138-kV bus Arthur Road 138-kV bus Westridge 138-kV bus Country Aire 138-kV bus Glacier 138-kV bus	--	95.3% 95.6% 95.8% 93.8% 93.7% 95.9% 94.6% 95.4% 94.4% 94.3% 93.7% 92.9% 94.3% 94.7% 94.0% 94.2% 94.5% 95.8% 95.9% 95.3% 95.8% 93.6% 95.5% 95.8% 95.7% 95.3% 95.0% 94.3% 95.4%	Intact system	Generation redispatch
5	Oak Creek – Pennsylvania 138-kV line	100.7 % 101.0% 102.3% 101.6% 102.1%	--	Intact system Kansas – Ramsey 138-kV line Nicholson – Oak Creek 138-kV line Nicholson – Ramsey 138-kV line Oak Creek – Ramsey 138-kV line Plus other less severe outages	Load shift
5	Cottonwood 138-kV bus voltage	--	88.9% 89.5%	Bark River – Cottonwood 138-kV line Bark River – Sussex 138-kV line	Generation redispatch
5	Bark River 138-kV bus voltage	--	89.5%	Bark River – Sussex 138-kV line	Generation redispatch
5	Germantown, Country Aire, Maple 138-kV buses	--	88.9 – 89.3%	Maple – Saukville 138-kV line	Generation redispatch
5	Bain 345/138-kV transformer T5	95.1% 159.7% 104.5%	--	Pleasant Prairie bus split between 2 and 3 Pleasant Prairie bus split between 3 and 4 Bain transformer #1	Generation redispatch

**TABLE ZS-3
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2018 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2018 Summer Peak Case		Facility Outage(s)	Project
		% of Facility Rating	% of Nominal bus voltage		
5	Bain 345/138-kV transformer T4	103.7%	--	Bain transformer T5	Generation redispatch
5	Albers – Bain 138-kV line	121.3%	--	Bain – Kenosha 138-kV line	Generation redispatch
5	Bain – Kenosha 138-kV line	98.7%	--	Albers – Bain 138-kV line	Generation redispatch
5	Arcadian6 – Waukesha3 138-kV line	99.3%	--	Arcadian4 – Waukesha1 138-kV line	Generation redispatch
5	Oak Creek 345/138-kV transformer #2	99.0%	--	Oak Creek 345/138-kV transformer #1	Generation redispatch
5	Branch – Kansas 138-kV line	108.2%	--	Oak Creek – Pennsylvania 138-kV line	Load shift
5	Nicholson – Ramsey 138-kV line	96.3%	--	Oak Creek – Pennsylvania 138-kV line	Load shift
5	Oak Creek – Ramsey 138-kV line	96.1%	--	Oak Creek – Pennsylvania 138-kV line	Load shift
5	Arcadian4 – Waukesha1 138-kV line	100.1%	--	Arcadian6 – Waukesha1 138-kV line	Generation redispatch
5	Tichigan , Burlington1 138-kV bus voltages	--	87.7-88.6%	Split Burlington 138-kV bus	Load shift
5	Arcadian 345/138-kV transformer #2	101.0%		Arcadian 345/138-kV transformer #1	Generation redispatch (temporary) Arcadian transformer (provisional permanent solution)
5	Arcadian 345/138-kV transformer #3	120.1%		Arcadian 345/138-kV transformer #1	Generation redispatch (temporary) Arcadian transformer (provisional permanent solution)