

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2024 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2024 Summer Peak Case without Nelson Dewey		Facility Outage(s)	Project or Mitigation
		% of Facility Rating	% of Nominal bus voltage		
1	Berlin, River Run, Fountain Valley, Redgranite, ACEC Spring Lake, Silver Lake, Fox River 69-kV bus		93.9% - 95.4% 80.1% - 91.9%	Intact System Wautoma - Silver Lake Tap 69-kV line Sunset Point - Winneconne 69-kV line Ripon - Northwest Ripon Tap 69-kV line Silver Lake - ACEC Spring Lake 69-kV line	
1	Dartford, Northwest Ripon, Ripon Industrial Park, Ripon, Southwest Ripon 69-kV bus		92.6% - 95.9% 77.5% - 91.8%	Intact System Ripon - Northwest Ripon Tap 69-kV line Metomen - Ripon 69-kV line Sunset Point - Winneconne 69-kV line Wautoma - Silver Lake Tap 69-kV line	
1	Winneconne, Omro, Omro Industrial Park 69-kV bus		94.3% - 94.7% 75.4% - 91.9%	Intact System Sunset Point - Winneconne 69-kV line Winneconne - Omro Tap 69-kV line Ripon - Northwest Ripon Tap 69-kV line Metomen - Ripon 69-kV line	
1	Grand Marsh (PP&L), ACEC Brooks, Lincoln Pumping Station, ACEC Quincy 69-kV bus		87.5% - 91.7%	Necedah Tap - Big Pond 69-kV line Necedah Tap - Whistling Wings Tap 69-kV line Chaffee Creek - Coloma Tap 69-kV line Lincoln Pumping Station - Coloma Tap 69-kV line	
1	Sigel, Lakehead Pipeline, Vulcan, Port Edwards, Hollywood, Saratoga 138-kV bus		90.6% - 91.9%	Sigel - Arpin 138-kV line	No project needed at this time
1	Petenwell, Council Creek 138-kV bus		93.9% - 94.2% 91.1% - 91.9%	Intact System Saratoga - Petenwell 138-kV line Sigel - Arpin 138-kV line Council Creek - Council Creek DPC 69-kV line Baker - Coyne 115-kV line	Monroe County – Council Creek 161-kv line
1	Baker, Saratoga 115-kV bus		95.8% - 95.9% 90.1% - 91.2%	Intact System Baker - Coyne 115-kV line	No project needed at this time

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1	Necedah, Whistling Wings, ACEC Dellwood, Friendship, ACEC Friendship, Houghton Rock, McKenna 69-kV bus		78.8% - 91.9%	Necedah Tap - Big Pond 69-kV line Big Pond – Petenwell 69-kV line Necedah Tap - Whistling Wings Tap 69-kV line Whistling Wings Tap - Dellwood ACEC 69-kV line	McKenna Capacitor Expansion
1	Lakehead Pipeline, Endeavor, Roslin ACEC, Montello ACEC 69-kV bus		88.2% - 90.9%	Portage - Lakehead Pipeline 69-kV line Lakehead Pipeline - Endeavor 69-kV line Endeavor - Roslin ACEC - 69-kV line	
1	Sand Lake, Wautoma 138-kV bus		94.7% - 94.9% 91.4% - 91.7%	Intact System Sigel - Arpin 138-kV line Port Edwards - Sand Lake 138-kV line	
1	Green Lake , Roeder 138-kV bus		95.6% - 95.9%	Intact System	No project needed at this time
1	ACEC Winnebago, ACEC Glen, Neenah Creek, ACEC Chateau 69-kV bus		90.1% - 91.7%	Kilbourn - Winnebago ACEC 69-kV line	
1	Plainfield, Sand Lake, ACEC Hancock, Hancock, Coloma, Chaffee Creek, ACEC Coloma 69-kV bus		88.9% - 91.9%	Sand Lake 138/69-kV transformer Sand Lake Tap - Sand Lake 69-kV line Necedah Tap - Big Pond 69-kV line	
1	Castle Rock 69-kV bus		90.9%	Necedah Tap - Big Pond 69-kV line	No project needed at this time
1	Fairwater, Brandon, Metomen 69-kV bus		88.4% - 91.4%	Metomen 138/69-kV transformer Sunset Point - Winneconne 69-kV line	
1	Antigo, Aurora Street 115-kV bus		90.6% - 90.7%	Antigo - Black Brook 115-kV line	No project needed at this time

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		% of Facility Rating	% of Nominal bus voltage		
1	Harrison, Manawa 69-kV bus		91.8% - 91.9%	Harrison 138/69-kV transformer	No project needed at this time
1	Wittenburg 69-kV bus		91.3%	Whitcomb - Wittenberg CWEC 69-kV line	No project needed at this time
1	Arnott 69-kV bus		91.5%	Arnott 138/69-kV transformer	No project needed at this time
1	Metomen 138-kV bus		95.1% 91.6%	Intact System North Fond du Lac - Metomen 138-kV line	No project needed at this time
1	Turtle ACEC 69-kV bus		91.9%	Portage - Lakehead Pipeline Portage 69-kV line	No project needed at this time
1	Council Creek - Tunnel City Tap 69-kV line Petenwell 138/69-kV transformer	94.0% - 96.0%		Intact System	
1	North Randolph - Markesan - Mackford Prairie - Ripon 69-kV line	97.3% - 113.9%		Metomen - Ripon 69-kV line	
1	Arnott 138/69-kV transformer	107.1%		Harrison 138/69-kV transformer	
1	Berlin - Dartford 69-kV line	105.8% - 108.5%		Sunset Point - Winneconne 69-kV line Ripon - Northwest Ripon Tap 69-kV line	
1	Caroline 115/69-kV transformer	123.0%		Whitcomb 115/69-kV transformer	
1	Chaffee Creek - Coloma Tap 69-kV line	101.2%		Necedah Tap - Big Pond 69-kV line	
1	Council Creek - Tomah Industrial Park Tap 69-kV line	108.0%		Intact System	

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1	Harrison 138/69-kV transformer	116.0% 95.9% - 100.2%		Intact System Arnott 138/69-kV transformer Whitcomb - Rosholt Tap 69-kV line Iola - Iola CW Tap 69-kV line Wautoma 138/69-kV transformer	
1	McKenna - ACEC Quincy - Castle Rock 69-kV line	102.9% - 130.6%		Necedah Tap - Big Pond 69-kV line Necedah Tap - Whistling Wings Tap 69-kV line Dellwood ACEC - Whistling Wings Tap 69-kV line Petenwell - Big Pond 69-kV line Petenwell 138/69-kV transformer	Uprate Castle Rock - McKenna 69- kV line
1	Metomen - Ripon 69-kV line	112.1% 95.1% - 128.7%		Intact System Sunset Point - Winneconne 69-kV line North Randolph - Markesan Tap 69- kV line Winniconne - Omro Tap 69-kV line Mackford Praire - Markesan Tap 69- kV line	
1	Metomen 138/69-kV transformer	106.0% 101.6% - 125.4%		Intact System North Fond du Lac - Rosendale Tap 69-kV line Metomen - Rosendale Tap 69-kV line Sunset Point - Winneconne 69-kV line North Randolph - Markesan Tap 69- kV line	Metomen Transformer Replacement
1	Northwest Ripon - Ripon 69-kV line	96.1% - 138.5%		Sunset Point - Winneconne 69-kV line Winniconne - Omro Tap 69-kV line Omro - Omro Industrial Tap 69-kV line Wautoma - Silver Lake Tap 69-kV line Silver Lake - ACEC Spring Lake 69- kV line	
1	Northwest Ripon - Dartford 69-kV line	107.5%		Sunset Point - Winneconne 69-kV line	

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		% of Facility Rating	% of Nominal bus voltage		
1	Omro - Omro Industrial 69-kV line	101.1%		Ripon - Northwest Ripon Tap 69-kV line	
1	Omro - Winneconne 69-kV line Winneconne - Sunset Point 69-kV line	105.7% 96.8% - 134.5%		Intact System Ripon - Northwest Ripon Tap 69-kV line Metomen - Ripon 69-kV line Northwest Ripon Tap - Dartford Tap 69-kV line Wautoma - Silver Lake Tap 69-kV line	
1	Plover - Coyne 115-kV line	96.1%		Rocky Run - Coyne 115-kV line	No project needed at this time
1	Rocky Run 345/115-kV transformer T4	96.2% - 104.5%		Rocky Run 345/115 kV Transformer T2 Rocky Run 345/115 kV Transformer T1 Sigel - Arpin 138-kV line Werner West - White Lake 138-kV line Arpin 345/138-kV transformer	
1	Rosendale - North Fond du Lac 69-kV line	101.4%		Metomen 138/69-kV transformer	
1	Sand Lake - Sand Lake Tap 69-kV line	96.2% - 99.2%		Wautoma 138/69-kV transformer Necedah Tap - Big Pond 69-kV line	No project needed at this time
1	Wautoma 138/69-kV transformer	120.0% 96.0% - 110.5%		Intact System Sand Lake Tap - Sand Lake 69-kV line Sand Lake 138/69-kV transformer Portage - Lakehead Pipeline Portage 69-kV line Ripon - Northwest Ripon Tap 69-kV line	
1	Whitcomb 115/69-kV transformer	112.2% 101.4%		Intact System Caroline 115/69-kV transformer	
3	North Monroe 138/69-kV transformer	100%		System intact	Bass Creek transformer project

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		% of Facility Rating	% of Nominal bus voltage		
3	McCue-Harmony-Lamar 69-kV line	102%-99%		System Intact	Construct double-circuit line between McCue and Lamar substations
3	Hillman 138/69-kV transformer	111.4%-100.4%		DPC Galena-Pilot 69-kV line; Pilot-Terr TP 69-kV line; Terr Tap-LNGHLLW8 69-kV line; LNGHLLW8-Galna T8 69-kV line	Replace the existing 46 MVA Hillman 138/69-kV transformer with a 100 MVA transformer
3	McCue-Harmony-Lamar 69-kV line	119.8%-96.1%		Several single contingency outages	McCue-Lamar line uprate and construct double-circuit line between McCue and Lamar substations
3	North Monroe-Idle Hour 69-kV line	118.5%-95.8%		Paddock-Newark 69-kV line; Brodhead Switching-Spring Grove 69-kV; Spring Grove-Whistling Wind 69-kV line; Whistling Wind-Black Smith 69-kV line; North Monroe-Monticello 69-kV; Monticello-New Glarus 69-kV; Darlington- Gratiot 69-kV line; Darlington 138/69-kV transformer; Browntown-Jennings Road 69-kV line; South Monroe-Browntown 69-kV line; Gratiot-Wiota 69-kV line; Wiota-Jennings Rd 69-kV line; Brodhead-Newark 69-kV line; Paddock 138/69-kV transformer	Bass Creek transformer project
3	Stoughton South-Stoughton 69-kV line	103.3%		Oak Ridge-Verona 138-kV line; Verona 138/69-kV transformer	Potential Y-127 line uprate
3	Sun Valley-Oregon 69-kV line	100.9%		Stoughton South-Stoughton 69-kV line	Potential Oregon terminal uprate
3	North Monroe 138/69-kV transformer	97.1%-96.6%		Darlington 138/69-kV transformer; Paddock-Newark 69-kV line	Bass Creek transformer project
3	Paddock-Newark 69-kV line	96.8%		North Monroe-Idle Hour 69-kV line	Bass Creek transformer project
3	Dana – Sheepskin 69-kV line	144.2%-139.1%		McCue-Harmony 69-kV line; Harmony-Lamar 69-kV line	Sheepskin substation project which will uprate Y-61 Sheepskin-Dana 69-kV line to 95 MVA
3	Spring Green 138/69-kV transformer	96.3%		Gran Grae-Wauzeka 69-kV line	2 nd Spring Green transformer project

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3	Gran Grae-Wauzeka-Boscobel 69-kV line	107.3%-99.4%		Spring Green 138/69-kV transformer; Lone Rock-Spring Green 69-kV line; Nelson Dewey-Lancaster 138-kV line; Lancaster-Eden 138-kV line; Eden-Wyoming Valley 138-kV line; Spring Green-Wyoming Valley 138-kV line	Uprate Y-40 Gran Grae-Boscobel 69-kV line to achieve a 99 MVA summer emergency rating
3	West Middleton-Timberlane-Stage Coach 69-kV line	121.4%-96.2%		Spring Green 138/69-kV transformer; Nelson Dewey-Lancaster 138-kV line; Lancaster-Eden 138-kV line; Verona-Oak Ridge 138-kV line; Verona 138/69-kV transformer; Verona-SW Verona 69-kV line; Gran Grae-Wauzeka 69-kV line; Wauzeka-Boscobel 69-kV line; Trienda-Lake Delton 138-kV line	Short term: uprate the West Middleton-Timberlane section from 83 MVA to 106 MVA (need check the underground cable ratings) and uprate the Timberlane-Stage Coach section from 95 MVA to 115 MVA SE. Long term: potential 2 nd 69-kV line between West Middleton-Stage Coach (built for future 138 kV) ; Potential new 138-kV line from West Middleton-Stage Coach and install a 138/69-kV transformer at Stage Coach
3	Stage Coach-Black Earth 69-kV line	104.4%		Spring Green 138/69-kV transformer;	2 nd Spring Green transformer project
3	Waunakee Industrial Park-Huiskamp 69-kV line	108.7%-98.7%		North Madison 138/69-kV transformer ; West Middleton-Pheasant Branch 69-kV line	Potential Y132 line switch replacement project at Waunakee Industrial Park to achieve 170 MVA SE
3	West Middleton-Pheasant Branch 69-kV line	96.9%		Waunakee Switching Station-Waunakee 2 69-kV line	A potential new 69-kV line between West port and Huiskamp or a potential voltage conversion from West Middleton-Huiskamp or a new 138-kV line from West Middleton-Huiskamp and step down transformer at West Port or Pheasant Branch

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3	Waunakee Switching Station-Waunakee 2-West Port 69-kV line	113.9%-102.2%		West Middleton-Pheasant Branch 69-kV line	Short term: potential 2017 Waunakee Switching Station-Waunakee 2-West Port 69-kV 3.73 miles of line (Y-131) and terminal uprate to achieve 115 MVA SE Long term: A potential new 69-kV line between West port and Huiskamp or a potential voltage conversion from West Middleton-Huiskamp or a new 138-kV line from West Middleton-Huiskamp and step down transformer at West Port or Pheasant Branch
3	West Middleton 138/69-kV transformer	97%		2 nd West Middleton 138/69-kV transformer	Potential project to remove the CT, relay and RTU limitations for the transformer T3 to improve the SE rating from 191 MVA to 239 MVA
3	Fitchburg-Syene-Ninesprings 69-kV line	125.7%-102.3%		Royster-AGA tap 69-kV line; AGA tap-Pflaum 69-kV line	Loop Ninesprings-Pflaum line in and out of Femrite
3	Royster-AGA tap-Pflaum 69-kV line	122.7%-97.8%		Fitchburg-Syene 69-kV line; Ninesprings-Syene 69-kV line	Loop Ninesprings-Pflaum line in and out of Femrite
3	West Middleton-West Town 69-kV line	97.7%		West Middleton-Pleasant View 138-kV line	Potential ~2 mile line uprate from 83 MVA to 106 MVA
3	Royster-Sycamore 69-kV line	99.5%		Femrite 138/69-kV transformer	Uprate the 6986 Royster to Sycamore 69-kV line to 115 MVA or potential 2 nd Femrite transformer
3	Verona, Oak Ridge, Fitchburg, Pleasant View, McFarland, Sprecher, Kegonsa, Reiner, West Middleton, Femrite, Sycamore and Cross Country 138-kV buses, Gaston Rd 69-kV bus		92.5%-95.8%	System intact	Dane County voltage support project which potentially include capacitor banks at Verona, Oak Ridge, Femrite, Reiner Road
3	Eden, Wyoming, Spring Green, and Troy 138-kV buses		93.8%-94.4%	System intact	Eden capacitor banks; Mazomanie capacitor banks; Boscobel capacitor banks; or Potential 138-kV line from West Middleton-Spring Green substation
3	Miner, Benton and Shullsburg 69-kV buses		89.8%-91.9%	DPC Galena-Pilot 69-kV line; Pilot-Terr TP 69-kV line;	Need to discuss with DPC
3	Spring Green and Wyoming Valley 138-kV buses		91.7%	Gran Grae 138/69-kV transformer	Eden capacitor bank project
3	Harmony, Lamar, Fulton, Saunders Creek, Dana, Sheepskin, Bass Creek, Footville, Center, Union Townline, Orfordville and Evansville 69-kV buses		80.3%-91.8%	McCue-Harmony 69-kV line; Harmony-Lamar 69-kV line	Lamar 2-16.33 Mvar 69-kV capacitor banks;

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3	Verona 138-kV bus		83.2%	Verona-Oak Ridge 138-kV line;	Verona 1-16.33 Mvar 69-kV capacitor bank / Adjust Verona 138/69-kV transformer setting
3	Verona, Sun Valley and SW Verona 69-kV buses		91.1%-91.7%	Verona-Oak Ridge 138-kV line; Verona 138/69-kV transformer	Verona capacitor bank project
3	Oak Ridge 138-kV bus		91.6%	Kegonsa-Oak Ridge 138-kV line	Dane County capacitor bank support project
3	SW Verona, Mount Horeb 69-kV buses		87.1%-91.1%	Verona-SW Verona 69-kV line	Potential Mount Horeb capacitor bank upgrade or addition
3	Hillman, Elmo, McGregor, Platteville and Cuba City 69-kV buses		91 %-91.7%	Hillman 138/69-kV transformer	Potential 2 nd Hillman transformer instead of the existing Hillman transformer replacement project
3	Hooterville 69-kV bus		91.8%	Eden 138/69-kV transformer	Eden capacitor bank project
3	Idle Hour, Monroe, South Monroe 69-kV buses		91.3%-91.8%	North Monroe-Idle Hour 69-kV line	Bass Creek transformer project
3	Brodhead Muni 3, Brodhead Muni 2, Brodhead Muni 1, Brodhead, RCEC Orfordville, Bass Creek, Footville, Center, Union Townline and Evansville 69-kV buses		88.6%-91.4%	Brodhead Switching Station- Brodhead Muni 3 69-kV line; Brodhead Muni 3-Brodhead Muni 2 69-kV line	Install a 138/69-kV transformer at Bass Creek Substation
3	Evansville and Union Townline 69-kV buses		91.1%-91.5%	Sheepskin-Evansville 69-kV line	Bass Creek transformer project
3	Wauzeka, Boscobel, Blue River, Muscoda 69-kV buses, Spring Green, Eden, Wyoming Valley and Troy 138-kV buses		88.8%-91.8%	Gran Grae-Wauzeka 69-kV line; Wauzeka-Boscobel 69-kV line	Boscobel capacitor bank project
3	Muscoda 69-kV bus		91.9%	Muscoda-Avoca 69-kV line	Boscobel capacitor bank project
3	Avoca, Muscoda 69-kV buses		90.4%-90.7%	Lone Rock-Avoca 69-kV line	Boscobel capacitor bank project
3	Muscoda, Lone Rock, Avoca, Boscobel, Blue River 69-kV buses		88.4%-91.8%	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
3	Muscoda, Lone Rock, Avoca, Boscobel, Blue River, Spring Green, Arena, Mazomanie, Black Earth 69-kV buses		87.3%-91.7%	Spring Green 138/69-kV transformer	2 nd Spring Green transformer
3	Arena 69-kV bus		91.7%	Spring Green-Arena 69-kV line	Mazomanie capacitor banks
3	Spring Green and Wyoming Valley 138-kV buses		91.6%	West Middleton-Timberlane 69-kV line	Eden capacitor banks; Mazomanie capacitor banks; Boscobel capacitor banks; or Potential 138-kV line from West Middleton-Spring Green substation
3	Gaston Road and Cottage Grove 69-kV buses		90.6%-91.4%	Kegonsa-Cottage Grove 69-kV line	Sun Prairie capacitor banks
3	McFarland, Femrite and Sprecher 138-kV buses		91%-91.9%	Kegonsa-McFarland 138-kV line; McFarland-Femrite 138-kV line	Femrite capacitor banks

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3	Burke, Reiner, Sun Prairie, Bird St and Colorado 69-kV buses		89.1%-91.9%	Reiner 138/69-kV transformer; Reiner-Burke Tap 69-kV line; Colorado-Burke Tap 69-kV line	Sun Prairie capacitor banks
3	Spring Green and Wyoming Valley 138-kV buses		91.7%	Birchwood-Loch Mirror 138-kV line	Eden capacitor banks
3	Spring Green 138-kV bus		91.9%	Necedah Tap-Big Pond 69-kV line	Eden capacitor banks
3	Pheasant Branch 69-kV bus		90.8%	West Middleton-Pheasant Branch 69-kV line	Short term: potential capacitor banks at Pheasant Branch. Long term: A potential new 69-kV line between West port and Huiskamp or a potential voltage conversion from West Middleton-Huiskamp or a new 138-kV line from West Middleton-Huiskamp and step down transformer at West Port or Pheasant Branch
3	AGA tap, AGA, Pflaum, Ninesprings and Pflaum tap 69-kV buses		90%-91.9%	Royster-AGA tap 69-kV line; AGA tap-Pflaum 69-kV line	Loop Ninesprings-Pflaum line in and out of Femrite
3	Lancaster, Wyoming Valley, Spring Green, Troy and Eden 138-kV buses		86.4%-91.7%	Nelson Dewey-Lancaster 138-kV line; Lancaster-Eden 138-kV line; Eden-Wyoming Valley 138-kV line; Wyoming Valley-Spring Green 138-kV line	Eden capacitor banks
3	Potosi, Hillman, Lafayette Wind, Darlington, Eden, North Monroe 138-kV buses		87.5%-91.9%	Nelson Dewey-Potosi 138-kV line; Potosi-Hillman 138-kV line; Hillman-Lafayette Wind 138-kV line; Lafayette Wind-Darlington 138-kV line	North Monroe capacitor banks
3	Albany, North Monroe and Darlington 138-kV buses		87.9%-91.8%	Townline-Albany 138-kV line; North Monroe-Albany 138-kV line	North Monroe capacitor banks
3	Spring Green 138-kV bus		91.3%-91.7%	Spring Green-Troy 138-kV line; Spring Green-Wyoming Valley 138-kV line	Eden capacitor banks; Boscobel capacitor banks; Mazomanie capacitor banks
3	Troy, Spring Green, Eden and Wyoming Valley 138-kV buses		89.2%-91.5%	Troy-Kirkwood 138-kV line	Eden capacitor banks
3	Verona, Oak Ridge, Fitchburg, Hawk, Pleasant View, West Middleton and Cross Country, Spring Green, Troy and Wyoming Valley 138-kV buses, West Middleton 345-kV bus		90%-91.6%	Rockdale-West Middleton 345-kV line	Dane County voltage support project

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3	Lewiston, East Dells, Kilbourn, Loch Mirror, Birchwood, Zobel, Nishan, Artesian, Rock Springs, Kirkwood, City View , Kirkwood, Lake Delton, Spring Green, Wyoming Valley and Troy 138-kV bus voltages		86.0%-91.9%	Lake Delton-Kirkwood 138-kV line, Lake Delton-Trienda 138-kV line, Trienda-Lewiston 138-kV line, Lewiston-Kilbourn 138-kV line and Trienda-Kilbourn 138-kV line (ATC_B2_X-68 outage)	Potential Lake Delton-Birchwood 138-kV line or a new 138-kV line source into the Reedsburg loop
3	Spring Green and Wyoming Valley 138-kV buses		91.9%	Portage-Columbia 138-kV line	Eden capacitor banks
3	Spring Green and Wyoming Valley 138-kV buses		91.6%-91.7%	Columbia 345/138-kV transformer 2	Eden capacitor banks
3	Reiner 138-kV bus		91.8%	Reiner –Sycamore 138-kV line	Sun Prairie capacitor banks
3	Verona, Oak Ridge, Fitchburg, Hawk, Pleasant View, West Middleton and Cross Country 138-kV buses		88.8%-91.3%	West Middleton-Pleasant View 138-kV line	Dane County voltage support project
3	Verona, Oak Ridge, Fitchburg, Hawk, Pleasant View, West Middleton and Cross Country , Spring Green and Wyoming Valley 138-kV buses		90.2%-91.9%	West Middleton 345/138-kV transformer	Dane County voltage support project
3	Spring Green, Eden, Wyoming Valley and Troy 138-kV buses		89.5%-91.9%	Columbia Unit 1 outage; Columbia Unit 2 outage; King-Eau Claire-Arpin 345-kV line; King-Eau Claire-Arpin 345-kV Operating guide; Eau Claire-Arpin 345-kV line; Eau Claire-Arpin 345-kV Operating guide; Columbia 345/138-kV transformer 1 and 3 outage	Eden capacitor banks
3	Eden 138-kV bus		91.9%	Outage of DPC Genoa-Seneca 161-kV line plus Genoa-Lansing 136 kV line plus Genoa 161/69-kV transformer plus Genoa-Lac Tap 161-kV line	Eden capacitor banks
3	Colley Road 138/69-kV transformer	99.1% 97.5% 104.3% 117.9% 101.4% 99.4% 100.9%		Intact System Beloit Gateway-Dickinson 138-kV line Paddock-Shirland 69-kV line Paddock 138/69-kV transformer Shaw - Shirland 69-kV line Brick Church 138/69-kV transformer Colley Road - Dickinson 138-kV line	
3	Brick Church 138/69-kV transformer	111.8%		North Lake Geneva 138/69-kV transformer	

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2024 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2024 Summer Peak Case without Nelson Dewey		Facility Outage(s)	Project or Mitigation
		% of Facility Rating	% of Nominal bus voltage		
3	Enzyme Bio-RC3 69-kV line	98.5%		Beloit Gateway – Dickinson 138-kV line Brick Church 138/69-kV transformer Colley Road – Dickinson 138-kV line	Y-32 Line Rebuild
3	RC3-Clinton Tap 69-kV line	95.4%		Beloit Gateway – Dickinson 138-kV line Brick Church 138/69-kV transformer Colley Road – Dickinson 138-kV line	Y-32 Line Rebuild
3	North Lake Geneva – Lake Geneva 69-kV line	113.1%		Cobblestone – Brick Church 69-kV line Cobblestone – Zenda Tap 69-kV line	North Lake Geneva – South Lake Geneva 138kV line
3	Paddock 138/69-kV transformer	105.2%		Intact System Colley Road 138/69-kV transformer	Bass Creek transformer project
3	Lake Geneva - South Lake Geneva 69-kV line	156.0%		Cobblestone – Brick Church 69-kV line Cobblestone – Zenda Tap 69-kV line Brick Church 138/69-kV transformer Katzenberg-Zenda Tap 69-kV line	North Lake Geneva – South Lake Geneva 138kV line
3	Katzenberg-South Lake Geneva 69-kV line	117.4		Cobblestone – Brick Church 69-kV line	Uprate / Rebuild Brick Church – South Lake Geneva 69kV line
3	Shaw – East Rockton 69-kV line	108.7%		Paddock 138/69-kV transformer	
3	Colley Road – Park Street Tap 69-kV line	98.7%		Paddock 138/69-kV transformer	
3	Paddock - Shirland 69-kV line	102.1%		Colley Road 138/69-kV transformer	
3	North Lake Geneva 138/69-kV transformer	97.7%		Brick Church 138/69-kV transformer	
3	Brick Church - Walworth 69-kV line	113.8%		North Lake Geneva 138/69 transformer	
3	Cobblestone-Brick Church 69-kV line	106.5%		Lake Geneva - South Lake Geneva 69-kV line	Uprate / Rebuild Brick Church – South Lake Geneva 69kV line
3	Williams Bay 138-kV bus		89.0% 90.0% 91.6%	Colley Road - Dickinson 138-kV line Beloit Gateway – Dickinson 138-kV line Beloit Gateway – Brick Church 138-kV line	

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2024 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2024 Summer Peak Case without Nelson Dewey		Facility Outage(s)	Project or Mitigation
		% of Facility Rating	% of Nominal bus voltage		
3	Brick Church 138-kV bus		88.7% 90.5%	Beloit Gateway – Dickinson 138-kV line Beloit Gateway – Brick Church 138-kV line	
3	Fort Atkinson 138-kV bus		95.7% 91.9%	Intact System Split Concord 138-kV bus between buses G and 4	
3	Crawfish River 138-kV bus		91.9%	Split Concord 138-kV bus between buses G and 4	
3	Butler Ridge 138-kV bus		95.8% 89.3% 90.8%	Intact System Split Concord 138-kV bus between buses 4 and 5 Split Concord 138-kV bus between buses G and 4	
3	Katzenberg 69-kV bus		84.3% 90.8%	Lake Geneva - South Lake Geneva 69-kV line Cobblestone – Brick Church 69-kV line North Lake Geneva 138/69-kV transformer	
3	Twin Lakes 69-kV bus		83.4% 91.5% 89.9%	Lake Geneva - South Lake Geneva 69-kV line Katzenberg-South Lake Geneva 69-kV line North Lake Geneva 138/69-kV transformer Cobblestone – Brick Church 69-kV line	
3	Cobblestone - Zenda tap 69-kV line	126.6%		Lake Geneva - South Lake Geneva 69-kV line	
3	Katzenberg – Zenda tap 69-kV line	109.1%		Lake Geneva - South Lake Geneva 69-kV line	
3	Zenda 69-kV bus		90.5% 88.1%	Lake Geneva - South Lake Geneva 69-kV line Cobblestone – Brick Church 69-kV line	
3	South Lake Geneva 69-kV bus		83.7%	Lake Geneva - South Lake Geneva 69-kV line North Lake Geneva 138/69-kV transformer	
3	North Lake Geneva 138-kV bus		91.8% 91.6%	Split Burlington 138-kV bus Colley Road - Dickinson 138-kV line	

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2024 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2024 Summer Peak Case without Nelson Dewey		Facility Outage(s)	Project or Mitigation
		% of Facility Rating	% of Nominal bus voltage		
3	Concord 138-kV bus		86.8% 89.3%	Split Concord 138-kV bus between buses 4 and 5 Split Concord 138-kV bus between buses G and 4	
3	Rubicon 138-kV bus		88.9% 90.6%	Split Concord 138-kV bus between buses 4 and 5 Split Concord 138-kV bus between buses G and 4	
3	Bristol 138-kV bus		91.3%	Colley Road - Dickinson 138-kV line	
3	Delavan 138-kV bus		91.2%	Colley Road - Dickinson 138-kV line	
3	Dickinson 138-kV bus		86.2%	Colley Road - Dickinson 138-kV line	
3	Elkhorn 138-kV bus		90.6% 91.5%	Colley Road - Dickinson 138-kV line Beloit Gateway – Dickinson 138-kV line	
3	Cobblestone 69-kV bus		86.8%	Cobblestone – Brick Church 69-kV line	
3	West Darien 138-kV bus		91.9% 91.9%	REC LaPrairie – REC Bradford 138-kV line RCEC LaPrairie – Rock River 13-8kV line	
3	RC2 (RCEC Bradford) 138-kV bus		91.9% 91.9%	REC LaPrairie – REC Bradford 138kV line REC LaPrairie – Rock River 138-kV line	
3	RC9 (RCEC LaPrairie) 138-kV bus		91.9%	REC LaPrairie – Rock River 138-kV line	
3	Southwest Delavan 138-kV bus		91.9%	REC LaPrairie – Rock River 138-kV line	
3	Lake Geneva 69-kV bus		91.7%	North Lake Geneva 138/69-kV transformer	
3	Okee, Lodi Industrial Park, Lodi 69-kV bus		95.5% - 95.9% 90.3% - 91.5%	Intact System Dane - Lodi Tap 69-kV line	No project needed at this time

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2024 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2024 Summer Peak Case without Nelson Dewey		Facility Outage(s)	Project or Mitigation
		% of Facility Rating	% of Nominal bus voltage		
3	Lake Delton, Kirkwood 138-kV bus		88.3% - 91.7%	Trienda - Lake Delton 138-kV line Lake Delton - Kirkwood 138-kV line Trienda - Lewiston ACEC 138-kV line Lewiston ACEC – Kilbourn 138-kV line	
3	Mackford Prairie, Markesan 69-kV bus		87.9% - 91.8%	North Randolph - Markesan Tap 69-kV line Markesan Tap - Mackford Prairie 69-kV line Metomen - Ripon 69-kV line	
3	Eagle View 69-kV bus		90.5%	Eagle View - Dam Height 69-kV line	No project needed at this time
3	Kilbourn, Loch Mirror, Birchwood, Dell Creek, Zobel, Nishan, Artesian, Rock Springs 138-kV bus		87.6% - 91.9%	Lake Delton - Trienda 138-kV line Trienda - Lewiston ACEC 138-kV line Lewiston ACEC - Kilbourn 138-kV line Kilbourn - Loch Mirror 138-kV line	Lake Delton – Birchwood 138-kV line
3	Lewiston 138-kV bus		87.6%	Trienda - Lewiston ACEC 138-kV line	
3	Artesian - Rock Springs - Kirkwood 138-kV line	95.9% - 115.2%		Trienda - Lewiston ACEC 138-kV line Trienda - Kilbourn 138-kV line Kilbourn - Lewiston ACEC 138-kV line Loch Mirror - Kilbourn 138-kV line	Lake Delton – Birchwood 138-kV line
3	Columbia 345/138-kV transformer T21	95.7%		Columbia 345/138-kV transformer T22	No project needed at this time
3	Columbia 345/138-kV transformer T23	95.7%		Columbia 345/138-kV transformer T22	No project needed at this time
3	Kilbourn - Lewiston 138-kV line	101.4%		Lake Delton - Trienda 138-kV line	
3	Kilbourn 138/69-kV transformer T32	96.3%		Kilbourn 139/69 kV transformer T31	No project needed at this time
3	Portage - Columbia 138-kV line	102.3%		Portage - Columbia 1 138-kV line Portage - Columbia 2 138-kV line	

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2024 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2024 Summer Peak Case without Nelson Dewey		Facility Outage(s)	Project or Mitigation
		% of Facility Rating	% of Nominal bus voltage		
3	Portage - Columbia 69-kV line	95.7%		Portage 138/69-kV transformer	No project needed at this time
3	Portage - Trienda 1 138-kV line	96.4%		Portage - Trienda 2 138-kV line	No project needed at this time
3	Portage - Trienda 2 138-kV line	107.8%		Portage - Trienda 1 138-kV line	Upgrade Portage to Trienda 2
3	Trienda - Lewiston 138-kV line	96.0% - 103.4%		Lake Delton - Trienda 138-kV line Rock Springs Tap - Kirkwood 138-kV line Lake Delton - Kirkwood 138-kV line	
3	Academy – Columbus Muni #3 tap 69-kV line	108.4 – 117.9%		N. Randolph – Fox Lake 138-kV line Fox Lake – N Beaver Dam 138-kV line	Horicon – East Beaver Dam 138-kV line project
3	Columbus Muni #3 tap – Columbus 69-kV line	106.5 – 116.1%		N. Randolph – Fox Lake 138-kV line Fox Lake – N Beaver Dam 138-kV line	Horicon – East Beaver Dam 138-kV line project
3	Acedemy 138/69-kV transformer	95.8%		N. Randolph – Fox Lake 138-kV line	Horicon – East Beaver Dam 138-kV line project
3	South Beaver Dam – Center Street 69-kV line	99.3 – 113.9%		N. Randolph – Fox Lake 138-kV line Fox Lake – N Beaver Dam 138-kV line	Horicon – East Beaver Dam 138-kV line project
3	South Fond du Lac – Koch Oil tap 69-kV line	110.9 – 117.9%		N. Randolph – Fox Lake 138-kV line Fox Lake – N Beaver Dam 138-kV line	Horicon – East Beaver Dam 138-kV line project
3	Koch Oil tap – Waupun 69-kV line	112.1 – 119.9%		N. Randolph – Fox Lake 138-kV line Fox Lake – N Beaver Dam 138-kV line	Horicon – East Beaver Dam 138-kV line project
3	Hubbard – Horicon Industrial Park 69-kV line	98.1 – 105.6%		N. Randolph – Fox Lake 138-kV line Fox Lake – N Beaver Dam 138-kV line	Horicon – East Beaver Dam 138-kV line project
3	Hubbard and Hustisford 138-kV buses		95.3 – 95.7% 84.2 – 90.6%	Base Case Rubicon – Hustisford 138-kV line Hustisford – Hubbard 138-kV line Concord 138 kV bus tie 4 – 5	Horicon – East Beaver Dam 138-kV line project
3	Dane - Lodi Tap 69-kV line	95.1% - 113.8%		Island Street - Kirkwood 69-kV line Lake Delton - Trienda 138-kV line Lake Delton - Kirkwood 138-kV line Baraboo Tap - Moore Street Tap 69-kV line Island Street - Moore Street Tap 69-kV line	Rebuild Dane-Dam Heights 69-kV line

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2024 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2024 Summer Peak Case without Nelson Dewey		Facility Outage(s)	Project or Mitigation
		% of Facility Rating	% of Nominal bus voltage		
4	Edgewater – Washington Street 69-kV line	95.2%		Edgewater – Nicolet 69-kV line	No project identified. Additional study needed.
4	Canal 138/69-kV transformer #1	97.7%		Canal 138/69-kV Transformer #2	No project identified. Additional study needed.
4	Canal 138/69-kV transformer #2	97.2%		Canal 138/69-kV Transformer #1	No project identified. Additional study needed.
4	Sunset Point 138/69-kV transformer #1	96.7%		Sunset Point 138/69-kV Transformer #2	No project identified. Additional study needed.
4	Bluestone 69-kV bus		91.1%	Finger Road – Bluestone 69-kV line	No project identified. Additional study needed.
4	Sister Bay 69-kV bus		94.8%	Base case	Canal – Dunn Road 138-kV line project
4	Egg Harbor 69-kV bus		95.6%	Base case	Canal – Dunn Road 138-kV line project
4	East Krok and Beardsley 69-kV bus		91.4 – 91.9%	East Krok 138/69-kV Transformer	No project identified. Additional study needed.
4	Holland 138-kV bus		90.0%	Charter–Holland–Cedersauk 138 kV Charter–Holland 138 kV	No project identified. Additional study needed.
5	Bain 345/138-kV transformer #5	159.7%		Splitting Pleasant Prairie 345-kV bus between buses 3 and 4.	Reduce Pleasant Prairie generation
5	Albers – Kenosha 138-kV line	101.3%		Bain – Kenosha 138-kV line	
5	Oak Creek-Elm Road 345/230-kV transformer	95.1%		Split Oak Creek 230-kV bus between 7&8	Reduce generator #8 output
5	Arcadian4- Waukesha1 138-kV line	116.3%		Arcadian 6 – Waukesha3 138-kV line	Arcadian – Waukesha line uprate. Run generation at Concord / Germantown
5	Arcadian Transformer #3	114.0%		Arcadian transformer #1	Replace Arcadian transformers. Run generation at Concord and Germantown
5	Arcadian Transformer #2	102.6%		Arcadian transformer #1	Replace Arcadian transformers. Run generation at Concord and Germantown
5	Branch – Kansas 138-kV line	119.0%		Oak Creek – Pennsylvania 138-kV line	
5	Arcadian6 – Waukesha3 138-kV line	115.3%		Arcadian 4- Waukesha1 138-kV line	Arcadian – Waukesha line uprate. Run generation at Concord / Germantown

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2024 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2024 Summer Peak Case without Nelson Dewey		Facility Outage(s)	Project or Mitigation
		% of Facility Rating	% of Nominal bus voltage		
5	Oak Creek - Pennsylvania 138-kV line	99.0% 100.4% 100.2% 99.5% 98.6% 98.3% 95.4%		Intact System Ok Creek-Nicholson 138-kV line Oak Creek-Ramsey 138-kV line Nicholson-Ramsey 138-kV line Kansas-Ramsey 138-kV line Norwich – Ramsey 138-kV line Bluemound3 – OC6 230-kV line Plus other less severe outages	Upgrade Oak Creek-Pennsylvania 138-kV line
5	Merrill Hills 138-kV bus		95.1%	Intact System	
5	Glacier 138-kV bus		95.9%	Intact System	
5	Fredonia 138-kV bus		91.9%	Cedarsauk-Fredonia 138-kV line	
5	Cooney 138-kV bus		94.9% 90.9% 89.9%	Intact System Concord-Cooney 138-kV line Split Concord 138-kV bus between buses 4 & 5	Install Summit capacitor banks
5	Cottonwood 138-kV bus		94.1% 91.6% 91.0% 90.6%	Intact System Concord-Cooney 138-kV line Split Concord 138-kV bus between buses 4 & 5 Bark River – Cottonwood 138-kV line	Install Summit capacitor banks
5	Summit 138-kV bus		94.6% 91.4% 90.6%	Intact System Concord-Cooney 138-kV line Split Concord 138-kV between bus 4 & the generator bus	Install Summit capacitor banks
5	Tichigan 138-kV bus		87.1% 90.8%	Split Burlington 138-kV bus Burlington-Air Liquide-Paris 138-kV line	
5	Burlington 138-kV bus		87.9% 91.7%	Split Burlington 138-kV bus Burlington-Air Liquide-Paris 138-kV line	
5	Hartford 138-kV bus		95.5% 89.7% 91.0%	Intact System Split Concord 138-kV bus between buses 4 & 5 Split Concord 138-kV bus between bus 4 & 5	Install Summit capacitor banks
5	St. Lawrence 138-kV bus		95.9% 91.6%	Intact System Split Concord 138-kV bus between buses 4 & 5	
5	Arthur Road 138-kV bus		95.8% 91.6%	Intact System Split Concord 138-kV bus between buses 4 & 5	

**TABLE ZS-4
PERFORMANCE CRITERIA LIMITS EXCEEDED AND OTHER CONSTRAINTS – 2024 Summer Peak Case**

Planning Zone	Criteria Exceeded/Need	2024 Summer Peak Case without Nelson Dewey		Facility Outage(s)	Project or Mitigation
		% of Facility Rating	% of Nominal bus voltage		
5	Bark River 138-kV bus		94.8%	Intact System	
5	Root River 138-kV bus		91.9%	Oak Creek-Root River 138-kV line	
5	Edgewood 138-kV bus		95.2% 90.1%	Intact System Edgewood – St. Martin 138-kV line	Install Mukwonago capacitor banks
5	Chinook 138-kV bus		95.2% 90.1%	Intact System Edgewood – St. Martin 138-kV line	
5	Mukwonago 138-kV bus		95.0% 91.6%	Intact System Edgewood – St. Martins 138-kV line	Install Mukwonago capacitor banks
5	Pleasant Valley 138-kV bus		91.5%	Pleasant Valley – Saukville 138-kV line	
5	Pennsylvania 138-kV bus		90.6%	Oak Creek – Pennsylvania 138-kV line	