

**Table UP-5-HR: U.P. High Retirements Future –U.P. Preliminary Solutions Groups**

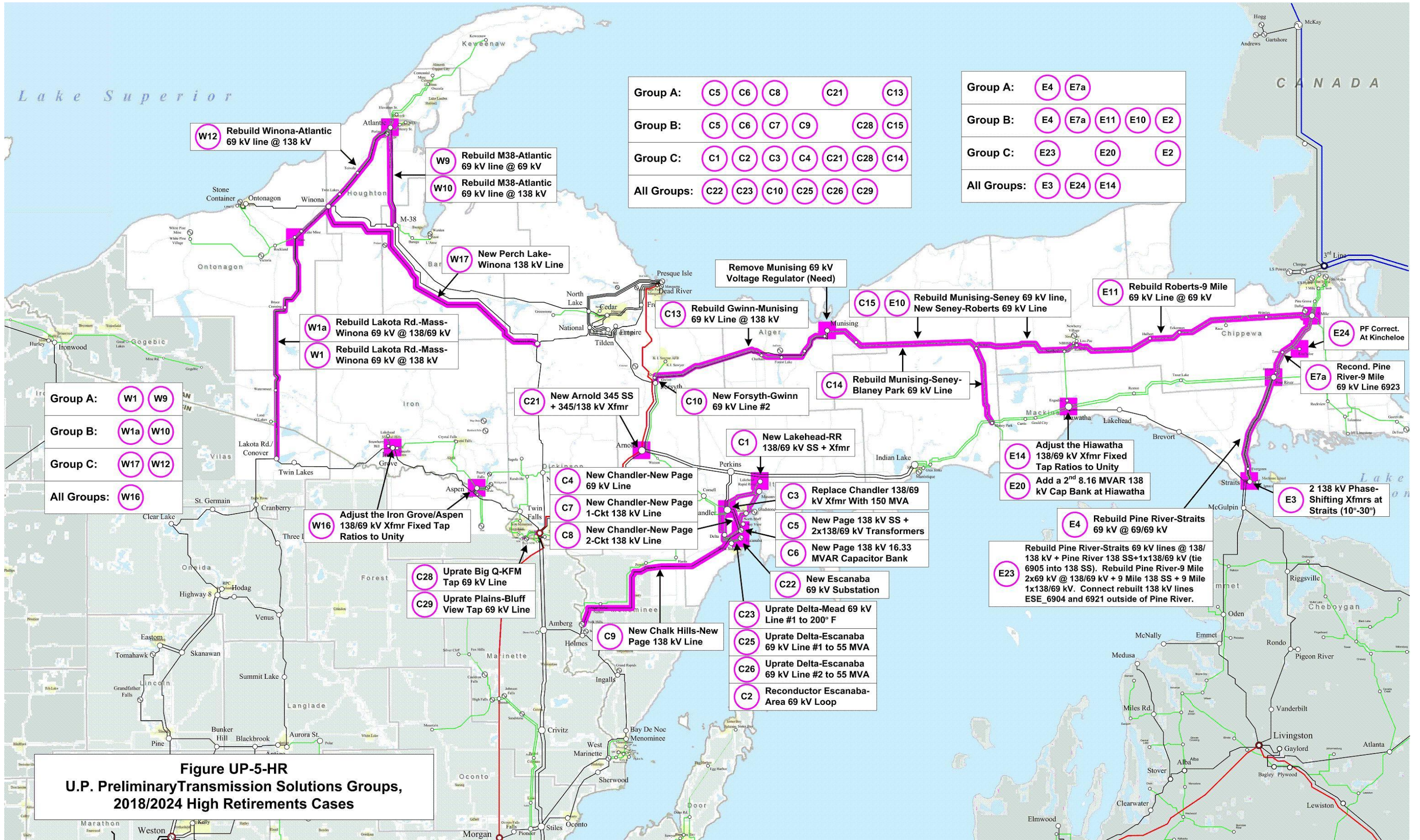
**Individual Solutions Not Common To All Solutions Groups**

U.P. Zone	Solutions Group A		Solutions Group B		Solutions Group C	
	Map Item #	Solutions Description	Map Item #	Solutions Description	Map Item #	Solutions Description
Western	W1	Lakota Rd-Mass-Winona 138 kV rebuild (68 mi)	W1a	Lakota Rd-Mass-Winona 138/69 kV rebuild (68 mi), new Mass 138/69 kV transformer	W17	New Winona-Perch Lake 138 kV line (68 mi)
Western	W9	Rebuild M38-Atlantic 69 kV line at 69 kV (22 mi)	W10	Rebuild M38-Atlantic 69 kV line at 138 kV (22 mi), add 2 <sup>nd</sup> Atlantic 138/69 kV transformer	W12	Winona-Atlantic 138 kV rebuild (22 mi)
Central	C5	New Page 138 kV SS + 2 138/69 kV transformers	C5	New Page 138 kV SS + 2 138/69 kV transformers	C1	New Lakehead-Rapid River 138/69 kV 150 MVA + reconductor 69 kV line to Lakehead Tap
Central	C6	New Page 138 kV 16.33 MVAR capacitor bank	C6	New Page 138 kV 16.33 MVAR capacitor bank	C2	Reconductor Escanaba-area 69 kV loop (38 mi)
Central	C8	New Chandler-New Page 2-ckt 138 kV lines (6 mi)	C7	New Chandler-New Page 1-ckt 138 kV line (6 mi)	C3	Replace Chandler 138/69 kV with 150 MVA
Central			C9	New Chalk Hills-New Page 1-ckt 138 kV line (51 mi)	C4	New Chandler-New Page 69 kV line (6 mi)
Central	C21	Arnold 345 kV SS, 345/138 kV 500 MVA xfm			C21	Arnold 345 kV SS, 345/138 kV 500 MVA xfm
			C28	Uprate the Big Q-Kingsford Metals Tap 69 kV line to 84 MVA (SS limiters)	C28	Uprate the Big Q-Kingsford Metals Tap 69 kV line to 84 MVA (SS limiters)
Central	C13	Rebuild Gwinn-Munising 69 kV line @ 138 kV (45 mi)	C15	Rebuild Munising-Seney 69 kV line, new Seney-Roberts 69 kV line (59 mi)	C14	Rebuild Munising-Seney-Blaney Park 69 kV line (54 mi)
Eastern	E4	Pine River-Straits 2x69 kV rebuild at 69/69 kV (25 mi)	E4	Pine River-Straits 2x69 kV rebuild at 69/69 kV (25 mi)	E23	Rebuild Pine River-Straits 2x69 kV at 138/138 kV + Pine River 138 SS + 138/69 kV xfmr. Rebuild Pine River-9 Mile 2x69 kV @ 138/69 kV + 9 Mile 138 SS + 138/69 kV xfmr. Splice ESE 6904 & 6921 outside of Pine River (bypass) (45 mi)
Eastern	E7a	Reconductor Pine River-9 Mile 69 kV line 6923 with 336 ACSR conductors	E7a	Reconductor Pine River-9 Mile 69 kV line 6923 with 336 ACSR conductors		
Eastern			E11	Rebuild Roberts-9 Mile 69 kV at 69 kV (54 mi)	E20	Add a 2 <sup>nd</sup> 8.16 MVAR 138 kV capacitor bank at Hiawatha
Eastern			E10	Rebuild Munising-Seney 69 kV line, new Seney-Roberts 69 kV line (59 mi)		
Eastern			E2	Uprate the overhead portions of Straits-McGulpin 138 kV circuits #1 & #3 to 200° F	E2	Uprate the overhead portions of Straits-McGulpin 138 kV circuits #1 & #3 to 230° F

All solutions groups assume the retirement of the Munising 69 kV voltage regulator

**Solutions Common to All Solutions Groups**

U.P. Zone	Map Item #	Solutions Description	Differences Between Groups
Western	W16	Adjust the Iron Grove/Aspen 138/69 kV transformer no-load tap ratios to unity	
Central	C22	New Escanaba 69 kV substation	
Central	C23	Uprate Delta-Mead 69 kV line to 200° F	
Central	C10	New Forsyth-Gwinn 69 kV line #2	
Central	C25	Uprate the Escanaba #1 69 kV line (Delta-Escanaba) to 55 MVA	
Central	C26	Uprate the Escanaba #2 69 kV line (Delta-West Side Tap-Escanaba) to 55 MVA	
Central	C29	Uprate the Plains-Bluff View Tap 69 kV line to 46 MVA (SS limiters)	
Eastern	E3	Add two 138 kV phase-shifting transformers at Straits, 10°-30° phase shift	A - 30° phase shift, B - 20° phase shift, C - 10° phase shift
Eastern	E24	Add 99-100% distribution power factor correction to the Kincheloe point load addition	A, B – 100% pf correction, C – 99% pf correction
Eastern	E14	Adjust the Hiawatha 138/69 kV transformer no-load tap ratios to unity	



**Figure UP-5-HR**  
**U.P. Preliminary Transmission Solutions Groups,**  
**2018/2024 High Retirements Cases**