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		Revision Number: 14.1 Revision Date: May 20, 2024
Owner: System Restoration Working Group (SRWG) Chair		Approved by: M/LCC Heads Review Due Date: May 20, 2025

## Attachment C - Charging of 345 kV Circuits in New England

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**Table 1 - Charging of 345 kV Circuits in New England**

**NOTE**

All MVar values are at nominal voltage.


A circuit # followed by an asterisk (\*) indicates a 345 kV cable that has one (1) or more reactors simultaneously switched upon cable energization; MVar charging values listed indicates gross/net charging to account for reactor compensation. These are calculated values only and they do **not** account for additional reactive Resources available to further compensate cable charging.

**NOTE**

All Lines that terminate in more than 1 Local Control Center (LCC) or Reliability Coordinator Area (RCA) jurisdiction are listed in each LCC and are **bolded**. The jurisdictional LCC or RC for the remote terminal is listed after the terminal name.


**NOTE\*\***

The 349 Line [Sections 4 and 5 with circuit #s followed by a double asterisk (\*\*)] overhead segment between Wakefield Junction and Golden Hills (NGRID) **cannot** be in-service without the Golden Hills - Mystic 349 XY (or 349X or 349Y) underground cable segment(s) (NGRID – NSTAR) also being in-service.


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## Section 1 - CONVEX


Circuit #	Terminals	Charging (MVar)
1X-Line	Northfield - Northfield 1X Transformer	10.6
3X-Line	Northfield - Northfield 3X Transformer	10.6
<b>301</b>	<b>Ludlow - Carpenter Hill (NGRID)</b>	<b>20.9</b>
310	Millstone - Manchester	41.3
312	Berkshire - Northfield Mountain	31.7
321	Long Mountain - Plumtree	15.8
329	Frost Bridge - Southington	8.6
330	Card - Lake Road	25.2
334	Ludlow - Stony Brook	3.8
<b>341</b>	<b>Lake Road - West Farnum (RIE)</b>	<b>22.0</b>
<b>347</b>	<b>Killingly - Sherman Road (RIE)</b>	<b>13.3</b>
348	Millstone - Haddam	23.1
352	Long Mountain - Frost Bridge	13.9
354	Ludlow - Northfield Mountain	25.1
362	Haddam Neck - Beseck	16.1
364	Haddam Neck - Montville	19.6

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Circuit #	Terminals	Charging (MVar)
368	Manchester - Card	14.1
371	Millstone - Montville	10.6
376	Haddam Neck - Scovill Rock	4.3
<b>381</b>	<b>Northfield Mountain - Vernon VT (VELCO)</b>	<b>17.1</b>
383	Millstone - Card	24.8
384	Laurel Energy - Scovill Rock	2.2
387	East Shore - Halvarsson - Scovill Rock	26.9
<b>393</b>	<b>Berkshire - Alps (NYISO)</b>	<b>20.0</b>
<b>398</b>	<b>Long Mountain - Cricket Valley (NYISO)</b>	<b>6.0</b>
3041	Scovill Rock - Southington	16.7
3165*	Singer - East Devon	102.6 / 2.6
3196	Ludlow - Agawam	15.6
3216	Agawam - North Bloomfield	17.2
3252	Beseck - Haddam	13.9
3271	Lake Road - Card	25.8
3280*	Singer - Norwalk	186.4 / 0.0
3348	Killingly - Lake Road	0.5


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Circuit #	Terminals	Charging (MVar)
3403*	Plumtree - Norwalk (one cable in service)	241.9 / 91.9
3419	Barbour Hill - Ludlow	17.1
3424	Manchester - Kleen	11.2
3533	Scovill Rock - Kleen	3.2
3557	Barbour Hill - Manchester	5.3
3619*	Singer - East Devon	102.5 / 2.5
3642	Manchester - North Bloomfield	14.4
3754	Beseck - Southington	10.4
3827	Beseck - East Devon	41.9
3921*	Singer - Norwalk	186.4 / 0.0


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## Section 2 - Maine

Circuit #	Terminals	Charging (MVar)
374	Buxton - Surowiec	22.7
375	Surowiec - Maine Yankee	25.5
377	Surowiec - Maine Yankee	25.6
378	Mason - Maine Yankee	3.0
<b>385</b>	<b>Buxton - Deerfield (New Hampshire)</b>	<b>42.1</b>
386	Buxton - South Gorham	5.9
388	Coopers Mills Road - Orrington	47.3
<b>390/3016</b>	<b>Orrington - Point Lepreau (NBPSO)</b>	<b>124.2</b>
<b>391</b>	<b>Buxton - Scobie Pond (New Hampshire)</b>	<b>58.0</b>
392	Maine Yankee - Coopers Mills Road	22.7
396	Orrington - Keene Road	43.0
<b>3001</b>	<b>Keene Road - Keswick (NBPSO)</b>	<b>83.2</b>
3015	Keene Road - Chester SVC	0.1
3020	Surowiec - Raven Farm	11.5
3021	Maguire Road - South Gorham	18.3
<b>3022</b>	<b>Maguire Road - Eliot (New Hampshire)</b>	<b>17.5</b>

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Circuit #	Terminals	Charging (MVar)
3023	Orrington - Albion Road	52.1
3024	Albion Rd - Coopers Mills Road	18.4
3025	Coopers Mills Road - Larrabee Road	31.3
3026	Larrabee Road - Surowiec	14.2
3038	Buxton - Surowiec	22.8
3039	Raven Farm - Yarmouth	5.7
3040	South Gorham - Raven Farm	15.6

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### Section 3 - New Hampshire

Circuit #	Terminals	Charging (MVar)
307	Deerfield - Eliot	16.7
361	Newington - Newington Energy	1.2
<b>326</b>	<b>Scobie Pond - Lawrence Road - Sandy Pond (NGRID)</b>	<b>25.8</b>
363	Seabrook - Scobie Pond	26.8
367	Fitzwilliam - Amherst	27.2
369	Seabrook - Timber Swamp Road	3.7
373	Scobie Pond - Deerfield	16.0
<b>379</b>	<b>Fitzwilliam - Vernon VT (VELCO)</b>	<b>17.4</b>
380	Eagle - Scobie Pond	8.3
<b>385</b>	<b>Deerfield - Buxton (Maine)</b>	<b>42.1</b>
<b>391</b>	<b>Scobie Pond - Buxton (Maine)</b>	<b>58.0</b>
<b>394</b>	<b>Seabrook - West Amesbury - Ward Hill (NGRID)</b>	<b>22.3</b>
<b>3022</b>	<b>Eliot - Maguire Road (Maine)</b>	<b>17.5</b>
<b>3124</b>	<b>Scobie Pond - Tewksbury (NGRID)</b>	<b>21.7</b>
3135	Newington - Timber Swamp Road	11.1
3176	Newington - Eliot	5.4




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Circuit #	Terminals	Charging (MVar)
3195	Amherst - Eagle	5.6


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## Section 4 - NGRID

Circuit #	Terminals	Charging (MVar)
<b>301</b>	<b>Carpenter Hill - Ludlow (CONVEX)</b>	<b>20.9</b>
302	Carpenter Hill - Millbury No. 3	13.1
303	Berry Street - ANP Bellingham	7.5
308	Millbury No. 3 - Wachusett	11.0
313	Millbury No. 3 - Wachusett	11.2
314	Wachusett - Sandy Pond	20.4
<b>315</b>	<b>Brayton Point - West Farnum (RIE)</b>	<b>33.6</b>
<b>323</b>	<b>Millbury No. 3 - West Medway (NSTAR)</b>	<b>13.4</b>
<b>326</b>	<b>Sandy Pond - Lawrence Road - Scobie Pond (New Hampshire)</b>	<b>25.8</b>
327	Brayton Point - Berry Street	21.0
<b>335</b>	<b>Holbrook - Auburn Street (NSTAR)</b>	<b>6.6</b>
337	Tewksbury - Sandy Pond	13.9
<b>338</b>	<b>Tewksbury - Woburn (NSTAR)</b>	<b>11.5</b>
339	Wakefield Junction - Tewksbury	13.6
<b>342</b>	<b>Auburn Street - Pilgrim - Canal (NSTAR)</b>	<b>41.8</b>
343	Wachusett - Sandy Pond	19.7


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<b>Circuit #</b>	<b>Terminals</b>	<b>Charging (MVar)</b>
<b>344</b>	<b>Bridgewater - West Medway (NSTAR)</b>	<b>25.3</b>
<b>349**</b>	<b>Wakefield Junction - Golden Hills</b>	<b>2.2</b>
<b>349X**</b>	<b>Golden Hills - Mystic (NSTAR)</b>	<b>140.2</b>
<b>349Y**</b>	<b>Golden Hills - Mystic (NSTAR)</b>	<b>140.2</b>
<b>356</b>	<b>Bridgewater - Carver (NSTAR)</b>	<b>12.8</b>
<b>357</b>	<b>Millbury - West Medway (NSTAR)</b>	<b>13.6</b>
<b>366</b>	<b>West Farnum (RIE) - Millbury</b>	<b>18.1</b>
<b>394</b>	<b>Ward Hill - West Amesbury - Seabrook (New Hampshire)</b>	<b>22.3</b>
<b>397</b>	<b>Ward Hill - Tewksbury</b>	<b>13.7</b>
<b>3124</b>	<b>Tewksbury - Scobie Pond (New Hampshire)</b>	<b>21.7</b>
<b>3136</b>	<b>Wakefield Junction - Woburn (NSTAR)</b>	<b>130.9</b>
<b>3520</b>	<b>ANP Bellingham - West Medway (NSTAR)</b>	<b>1.8</b>


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## Section 5 - NSTAR

Circuit #	Terminals	Charging (MVar)
316	Holbrook - Stoughton	5.2
319	Woburn - Lexington	7.5
322	Canal - Carver	13.4
<b>323</b>	<b>West Medway - Millbury No. 3 (NGRID)</b>	<b>13.4</b>
324	Mystic - Kingston Street	87.5
325	West Medway - West Walpole	6.6
331	Carver - West Walpole	22.4
<b>335</b>	<b>Holbrook - Auburn Street (NGRID)</b>	<b>6.6</b>
336	West Medway - NEA Bellingham - ANP Blackstone	7.1
<b>338</b>	<b>Woburn - Tewksbury (NGRID)</b>	<b>11.5</b>
<b>342</b>	<b>Canal - Pilgrim -Auburn Street (NGRID)</b>	<b>41.8</b>
<b>344</b>	<b>West Medway - Bridgewater (NGRID)</b>	<b>25.3</b>
346	North Cambridge - Woburn	120.4
<b>349**</b>	<b>Golden Hills - Wakefield Junction (NGRID)</b>	<b>2.2</b>
<b>349X**</b>	<b>Golden Hills - Mystic (NGRID)</b>	<b>140.2</b>
<b>349Y**</b>	<b>Golden Hills - Mystic (NGRID)</b>	<b>140.2</b>


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Circuit #	Terminals	Charging (MVar)
351	Mystic - North Cambridge	103.4
355	Pilgrim - Carver	13.2
<b>356</b>	<b>Carver - Bridgewater (NGRID)</b>	<b>12.9</b>
<b>357</b>	<b>West Medway - Millbury (NGRID)</b>	<b>13.6</b>
358	Mystic - North Cambridge	91.4
365	North Cambridge - Woburn	120.4
372	Mystic - Kingston Street	77.2
389	West Medway - West Walpole	8.8
399	Carver - West Barnstable	27.4
<b>3136</b>	<b>Woburn - Wakefield Junction (NGRID)</b>	<b>130.9</b>
3161	Stoughton - West. Walpole	8.3
3162*	Stoughton - K Street	388.5 / 228.5
3163*	Stoughton - K Street	364.9 / 204.9
3164*	Stoughton - Hyde Park	248.6 / 88.6
<b>3361</b>	<b>ANP Blackstone - Sherman Road (RIE)</b>	<b>9.3</b>
<b>3520</b>	<b>West Medway - ANP Bellingham (NGRID)</b>	<b>1.8</b>

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## Section 6 - RIE

Circuit #	Terminals	Charging (MVar)
<b>315</b>	<b>Brayton Point (NGRID) - West Farnum</b>	<b>33.6</b>
328	West Farnum - Sherman Road	7.5
332	West Farnum - Kent County	17.7
333	Ocean State – Sherman Road	0.1
<b>341</b>	<b>West Farnum - Lake Road (CONVEX)</b>	<b>22.2</b>
<b>347</b>	<b>Sherman Road - Killingly (CONVEX)</b>	<b>12.9</b>
359	Kent County - West Farnum	18.7
<b>366</b>	<b>West Farnum – Millbury (NGRID)</b>	<b>18.1</b>
<b>3361</b>	<b>Sherman Road - ANP Blackstone (NSTAR)</b>	<b>12.1</b>

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## Section 7 - VELCO

Circuit #	Terminals	Charging (MVar)
340	Vernon VT - Coolidge	43.7
350	Coolidge - West Rutland	23.6
370	West Rutland - New Haven	30.7
<b>379</b>	<b>Vernon VT - Fitzwilliam (New Hampshire)</b>	<b>17.4</b>
<b>381</b>	<b>Vernon VT - Northfield Mountain (CONVEX)</b>	<b>17.1</b>
3320	Newfane - Vernon VT	15.1
3321	Newfane - Coolidge	30.4
3340	Vermont Yankee - Vernon VT	0.2
3381	Vermont Yankee - Vernon VT	0.2


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## M/LCC 18 Attachment C Revision History

**Document History** (This document was created from the retired OP- 6 Appendix C)

Rev. No.	Date	Reason
- -	10/30/18	For previous revision history, refer to Rev 10.1 available through Ask ISO
Rev 11	10/30/18	Annual review by procedure owner; Globally, replaced "REMVEC/NGRID" with "NGRID" and re-ordered Tables 4 and 5 to remain alphabetical by LCC; Truncated the Revision History per SOP-RTMKTS.0210.0010 Section 5.6 This revision is not the result of a BES change and does not necessitate a change to the implementation of the Restoration Plan and does not result in changes to roles or tasks performed by identified entities in the Plan.
Rev 12	07/17/19	Annual review by procedure owner; identified new owner, Section 1, modified terminal and charging date for 398 Line; This revision is the result of a permanent planned or unplanned BES modification. This revision does not change the ability, through roles or specific tasks of one or more entities identified in the restoration plan, to implement the approved restoration plan. This revision does not impact the ability of ISO-NE to monitor and direct restoration efforts.
Rev 12.1	06/09/20	Annual review by procedure owner. No need for changes noted. This revision is <b>not</b> the result of any permanent planned or unplanned BES modification. This revision does <b>not</b> change the ability, through roles or specific tasks of one or more entities identified in the Plan, to implement the approved Plan. This revision does <b>not</b> impact the ability of ISO-NE to monitor and direct restoration efforts.
Rev 12.2	03/25/21	Annual review by procedure owner requiring no changes; This revision is <b>not</b> the result of a permanent planned or unplanned BES modification. This revision does <b>not</b> change the ability, through roles or specific tasks of one or more entities identified in the Plan, to implement the approved Plan. This revision does <b>not</b> impact the ability of ISO-NE to monitor and direct restoration efforts
Rev 13	03/03/22	Annual review by procedure owner; identified new owner, Sections 4 & 5, modified charging data for 349X and 349Y Lines; Section 5: modified charging data for 372 Line Re-titled main document; changed document owner. Edits for conforming nomenclature. This revision is <b>not</b> the result of any permanent planned or unplanned BES modification. This revision does <b>not</b> change the ability, through roles or specific tasks, of one or more entities identified in the Plan, to implement the approved Plan. This revision does <b>not</b> impact the ability of ISO-NE to monitor and direct system restoration efforts.
Rev 13.1	03/01/23	Annual review by procedure owner requiring no intent changes. Section 4: Removed NSTAR designation for Golden Hills substation in 349 row. This revision is <b>not</b> the result of any permanent planned or unplanned BES modification. This revision does <b>not</b> change the ability, through roles or specific tasks, of one or more entities identified in the Plan, to implement the approved Plan. This revision does <b>not</b> impact the ability of ISO-NE to monitor and direct system restoration efforts.



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Rev 14	02/28/24	Annual review by procedure owner; Updated MVAR charging values in all sections per NX9 database; Added 3136 Line entries to Sections 4 and 5; This revision is the result of a permanent planned BES modification; This revision does <b>not</b> change the ability, through roles or specific tasks, of one or more entities identified in the Plan, to implement the approved Plan; This revision does <b>not</b> impact the ability of ISO-NE to monitor and direct system restoration efforts.
Rev 14.1	05/20/24	Annual review by procedure owner; Added Table 6 for RIE inclusion; Moved items from Table 4 NGRID to Table 6 RIE as needed; This revision is <b>not</b> the result of any permanent planned or unplanned BES modification; This revision does <b>not</b> change the ability, through roles or specific tasks, of one or more entities identified in the Plan, to implement the approved Plan; This revision does <b>not</b> impact the ability of ISO-NE to monitor and direct system restoration efforts.