APPENDIX M

UES-SEACOAST 2020-2024 DISTRIBUTION SYSTEM PLANNING STUDY

Unitil Energy Systems – Seacoast

Distribution System Planning Study 2020-2024

Prepared By:

Jake Dusling
Unitil Service Corp.
October 25, 2019

TABLE OF CONTENTS

1. Executive Summary

This study is an evaluation of the Unitil Energy Systems – Seacoast (UES–Seacoast) electric distribution system. The purpose of this study is to identify when system load growth is likely to cause main elements of the distribution system to reach their operating limits, and to prepare plans for the most cost-effective system improvements. The timeframe of this study is the summer peak load period over the next five years, from the summer of 2020 through the summer of 2024.

Projects currently under construction or that are expected to be completed in 2019 are assumed to be in service for the beginning year of this study.

The following items may require action within the 5-year study period. All cost estimates provided in this report are without general construction overheads.

Year	Project Description	Justification	Cost
2020	Timberlane S/S 13W2 Recloser – Replace Relay	Loading 93%	$17,500
2020	Circuit 23X1 – Install Regulator Wild Pasture Road	Voltage 115.5V	$30,000
2020	Circuit 23X1 – Install Regulator Amesbury Road	Voltage 115.9V	$30,000
2020	Circuit 13X3 – Install Regulators Old County Road	Voltage 115.9V	$70,000
2020	Circuit 22X1 – Install Regulator Colby Road	Voltage 116.5V	$30,000
2020	Circuit 19H1 – Transfer Load to 27X1	Voltage 116.6V Condition	$150,000
2020	Circuit 54X1 – Install Regulator Main Street	Voltage 116.9V	$30,000
2022	20T1 Transformer – Transfer Load to 28X1	Loading 91%	$225,000
2023	Circuit 19X3 – Replace cutouts with Switch	Loading 91%	$25,000
2024	Circuit 23X1 – Convert Portion of South Road	Loading 90%	$150,000
2024	Circuit 5X3 – Install Regulator Smith Corner Road	Voltage 116.9V	$30,000

2. System Configuration

The UES–Seacoast distribution system is comprised of 43 distribution circuits operating at primary voltages of 4.16, 13.8 and 34.5 kV. The majority of these circuits originate from 15 distribution substations supplied off the UES–Seacoast 34.5 kV subtransmission system, while 14 circuits are tapped directly off subtransmission lines. Additionally, there is one customer-owned subtransmission line tap supplied off the 34.5 kV subtransmission system and a few other distribution taps off the subtransmission lines to serve single customers.

The UES–Seacoast subtransmission system consist of 18 lines and is presently supplied from Eversource Energy's 345 kV and 115 kV transmission systems via three Eversource Energy substations, Timber Swamp, Peaslee, and Great Bay.

Timber Swamp substation, located in northwest Hampton, presently consists of a 345 kV high-side ring bus, two 345–34.5 kV, 75/100/125/140 MVA transformers, and two 34.5 kV low-side buses separated by a normally open bus tie breaker. Presently, one 34.5 kV bus supplies two line terminals feeding the UES-Seacoast 3360 and 3371 lines and second 34.5 kV bus supplies three line terminals feeding Eversource load. The 3360 and 3371 34.5 kV subtransmission lines transfer power from Timber Swamp substation to Guinea switching station serving loads in several UES-Seacoast service territory towns.

Peaslee substation, located in central Kingston is a 5 terminal 115 kV switching station with two outgoing 115 kV lines that supply the UES–Seacoast Kingston substation. Kingston substation consists of two 115-34.5 kV, 60 MVA transformers, supplying six UES–Seacoast 34.5 kV lines. Two of these lines supply five distribution substations to the southwest, two lines provide support to the northeast, and two line serves distribution load throughout Kingston and Danville.

Great Bay substation is located in southern Stratham. Great Bay consists of a 115 kV high-side bus, a single 115–34.5 kV, 24/32/40/44.8 MVA transformer, and a 34.5 kV low-side bus. Two 34.5 kV subtransmission lines exit Great Bay Substation and supply eight distribution substations and taps which serve loads in the Stratham and Exeter areas.

3. Study Focus

This study is primarily focused on the 34.5, 13.8 and 4.16 kV distribution substations and circuits. System modifications are based upon general distribution planning criteria. An evaluation of the 34.5 kV subtransmission system is made under a separate electric system planning study.

The first objective of this distribution planning study is to identify and propose solutions to correct specific conditions that do not meet design or operating criteria. The second objective is to develop and communicate a master plan for the development of a robust and efficient distribution system to accommodate long-term improvement and expansion throughout and beyond the study years. Recommendations are based on system adequacy, reliability and economy among available alternatives.

4. Load Projections

A five year history of summer and winter peak demands for each individual circuit were developed from monthly peak demand readings. A linear regression analysis was performed on the historical loads to forecast future peak demands for substation transformers, circuits and other major devices. Attempts were made to take into account known significant load additions, shifts in load between circuits, etc. In some instances, the peak loads did not present a confident trend over the historical period, so estimates were made using the best available information and knowledge of the circuit. In general, one standard deviation was added to these forecasts to account for differences from year to year in the severity of summer heat and other varying factors.

This methodology does not directly forecast future DG interconnections or other DER projects/initiatives such as energy efficiency programs. Rather the impact of DG and other DER programs are inherent in the historical regression analysis by offsetting most recent peak loads thereby reducing projected growth rates at the circuit level. It is recognized that the reduction in circuit growth rates will lag DG interconnections and other DER projects implemented in a given year. However, since load forecasts are completed annually, the timing of projects identified in the planning process is continually reviewed and updated.

Summer and winter peak load projections of all circuits and substation transformers for the five year study period are listed in Appendix A.

The following table shows the five circuits with the highest annual growth rates.

Ranking	Circuit	Average Annual Load Growth	Total Load Growth 2019-2023 (kVA)
1	19X3	3.0%	1,954
2	23X1	2.2%	327
3	19X2	2.1%	447
4	2X3	2.0%	470
5	2X2	1.7%	693

The projection analysis can be referenced in Appendix A.

5. Rating Analysis

A detailed review of the limiting factors associated with each circuit was completed. The limiting factors include current transformers (CT), switches, circuit exit conductors, regulators, power transformers and protective device settings. Overall circuit ratings are based upon the most restrictive of these limiting elements. The distribution system circuit limitations can be referenced in Appendix B. These circuit ratings were compared to summer and winter peak load projections found in Appendix A.

Projected loads reaching certain thresholds prompted a closer assessment of the conditions. Shading, as shown below, has been added to the projection analysis to provide a visual representation of potential problem areas. The analysis of circuits and transformers reaching 90% or higher of their normal ratings are described in the following section 6.

In the five-year period of this study, 16 of the 44 circuits studied and 9 of the 14 UES-Seacoast transformers are projected to be loaded over 50% of the normal limit. There is 1 distribution substation transformer and 1 distribution circuit projected to be loaded over 90% of the normal limit during the study period.

Legend
loading < 50% of Normal Limit
50% ≤ loading ≤ 90% of Normal Limit
90% < loading ≤ 100% of Normal Limit
100% of Normal Limit < loading

6. Transformer and Circuit Loading Analysis

Transformer and circuit loadings have been compared to the respective ratings. The monthly per phase transformer load readings are added together and then converted to kVA. In order to maintain some conservatism, those transformers and circuits which have reached 90% of the limiting factor have been highlighted and will be discussed later in the section. The threshold of 90% was taken to account for phase loading imbalance.

This section details the findings resulting from the analysis described in Section 5 as well as an analysis of stepdown transformer loadings and a review of circuit load phase imbalance. Individual project descriptions, justification, predicted benefits and associated cost estimates intended to address each of the identified issues are included in Section 8.

6.1. Distribution Substation Transformer Loadings

Distribution substation transformers where the projected load reaches 90% or more of their seasonal rating are listed here. Charts displaying the summer and winter loading of transformers, in per unit, are included in Appendix C.

Dow's Hill 4.16 kV Substation Transformer
Peak demand loading for the Dow's Hill 20T1 transformer is projected to reach as much as 1,689 kVA, 91% of its summer normal rating in 2022. It is projected to reach 1,726 kVA, 93% of its summer normal rating by the summer of 2024.

6.2. Distribution Substation Equipment Loadings

Circuit elements where the projected load will reach 90% or more of their normal rating are listed below. Summer and winter circuit loading graphs are included in Appendix D.

Timberlane – Circuit 13W2
Peak demand loading for Circuit 13W2 out of Timberlane S/S is projected to reach as much as 4,604 kVA (93% of phase overcurrent minimum pick-up flag) by the summer of 2020, and increase to as much as 4,896 kVA (99% of phase overcurrent minimum pick-up flag) by the summer of 2024.

6.3. Distribution Stepdown Transformer Loadings

The Summer Normal Limit used for distribution stepdown transformer loading analysis is 120% of the nameplate rating. This is based upon the "Normal Life Expectancy Curve" in ANSI/IEEE C57.91-latest. The ambient temperature assumed is 30°C (86°F).

The following table summarizes the distribution stepdown transformers that are projected to exceed their Summer Normal limit during the study period. Shading has been added to the projections to provide a visual representation of potential overloads.

Legend

loading < 90% of Limit
90% < loading ≤ 100% of Limit
100% of Limit < loading

CIRCUIT / LOCATION	TOWN	POLE #	Year Expected to Exceed 90%/100% of Rating	TRANSFORMER SIZE (kVA)			2020 Projected % Loading of Summer Limit			
				A	B	C	A	B	C	BANK
43X1 – South Road	Kensington	32/83	2021/2024	333			88%			88%

6.4. Phase Imbalances

All of the circuits within the UES-Seacoast service territory were reviewed for phase balance. The per phase loading for each circuit was averaged over a timeframe of January 2018 through December 2018. Circuits and substation transformers were ranked based upon the worst average phase imbalances (greatest deviation from the average).

In general, the goal for phase balancing is 10%. Circuits, where the imbalance is greater than 20% (which is considered severe) are reviewed in more detail to determine the severity of the problem. There are no circuits on the UES-Seacoast system that will require projects in 2020 to address phase imbalance.

7. Circuit Analysis Results

Detailed circuit analysis is completed for the UES-Seacoast distribution system on a three year rotating cycle, where each circuit is reviewed once every three years. Milsoft Windmil software is used to model the system impedances and loads to identify potential problems areas. The circuit analysis performed includes voltage drop, load flow, and protection analysis. All identified problems should be followed up with verification from field measurements. Solutions to the deficiencies noted below are detailed in Section 8.

The following is a list of the circuits analyzed in 2019. All other UES-Seacoast circuits not shown on this listing were reviewed for planning purposes. However, models for those circuits were not re-created and analyzed to the level of detail as the circuits listed.

Substation	Circuit	Substation	Circuit
Plaistow S/S	5X3	Kingston S/S	22X1
Timberlane S/S	13W1		22X2
	13W2	Winnicutt Road Tap	51X1
	13X3	New Boston Road Tap	54X1
Westville S/S	21W1		54X2
	21W2	Hunt Road Tap	56X1
Guinea Road Tap	47X1	Dorre Road Tap	56X2

Additionally, two UES-Seacoast circuits (19X3 and 13X3) met the threshold, more than 500KW or 15% of circuit peak load of aggregate DG, to analyze the circuits for unacceptable voltage conditions due to DG penetration. No violations were identified on these circuit due to existing DG.

7.1. Voltage Concerns

Voltage drop analysis is performed to identify areas where the primary voltage on the circuit may be outside of a pre-determined acceptable range. The acceptable primary voltage range used for this analysis is 117-125 V on a 120 V base in order to maintain service voltage within the required ANSI range. This allows for a three-volt drop to the meter in the forward direction and a one-volt drop in the reverse direction to accommodate DG back feed. The following table summarize the areas where primary voltage is expected to be outside of this range. The table is sorted by circuit and year.

Circuit	Year	Voltage	Location
23X1	2020	115.5V	Wild Pasture Road, Kensington
	2020	115.9V	Old Amesbury Road, South Hampton
13X3	2020	115.9V	Old County Road, Plaistow
22X1	2020	116.5V	Cheney Lane, Danville
19H1	2020	116.6V	Oak Ridge Road, Exeter
54X1	2020	116.9V	Industrial Way, East Kingston
5X3	2024	116.9V	Kristie Lane, Plaistow

7.2. Overload Conditions

The following summarizes distribution equipment which is expected to be loaded above 90% of normal ratings during the five year study period. The table is sorted by circuit and year.

Circuit	Year	Percent Loading	Distribution Equipment (summer normal limit)	Location
19X3	2023	91%	Cutout with Solid Blades (300 Amps)	Pole 349/2, Pine Street, Exeter
23X1	2024	92% Continuous / 67% Minimum Melt	175QA (175 Amps Continuous / 240 Amps Minimum Melt)	Pole 32/84, South Road, Kensington (low-side stepdown fusing)

7.3. Protection Concerns

Analysis was performed on the circuits to identify protective devices that violate Unitil's distribution protection sensitivity and coordination criteria. This analysis resulted in the nine locations in the below table requiring protection modifications. EWRs will be issued in 2019 to address the concerns identified.

Circuit	Street	Pole	Old Fuse Size	New Fuse Size
20H1	E&H Trailer Park	2	20QA	50QA
13X3	Old County Road	11	175QA	200QA
22X2	Route 125	74	60QA	100QA
	Old Coach Road	1-A	100QA	150QA
6W2	North Shore Road	9	10QA	30QA
43X1	Washington Way	5	15QA	25QA
58X1	Chandler Avenue	14	30QA	60QA
	North Avenue	1	75QA	125QA
15X1	Pine Crest Shores	2	50QA	75QA

8. Detailed Recommendations

The following sections detail proposed system improvement projects to address the deficiencies listed in the previous sections. All cost estimates provided in this report are without general construction overheads.

All proposed traditional options were evaluated per Unitil's Project Evaluation Procedure and none of the proposed traditional options met the thresholds to require non-wires alternative projects to be reviewed.

8.1. Timberlane S/S 13W2 Recloser: Replace Relay and Increase Trip Setting – (2020)

Distribution load projections indicated that the trip setting of the 13W2 recloser at Timberlane substation is expected to exceed 93% of the phase overcurrent pick-up flag during summer conditions in 2020.

Increase the trip setting of circuit 13W2 to achieve a rating of at least 400 amps. This setting change will require the existing Form 3A recloser control to be replaced with a microprocessor based control.

Once this project is complete loading on 13W2 circuit position is expected to remain below planning criteria throughout the scope of this study.

Total Project Cost: $17,500

8.2. Circuit 23X1: Install Voltage Regulator Wild Pasture Road – (2020)

Circuit analysis has identified that the primary voltage along Wild Pasture Road in Kensington is expected to be as low as 115.5V in the summer of 2020 and as low as 114.5V in the summer of 2024.

An AMI voltage recording meter recorded an average minimum service voltage of 111V at customer along Wild Pasture Road during previous summer peak conditions.

Installing a voltage regulator along Wild Pasture Road is expected to resolve the identified voltage concern throughout the study period.

Total Project Cost: $30,000

8.3. Circuit 23X1: Install Voltage Regulator Amesbury Road – (2020)

Circuit analysis has identified that the primary voltage along Old Amesbury Road in South Hampton is expected to be as low as 115.9V in the summer of 2020 and as low as 115.3V in the summer of 2024.

An EWR has been issued to install an AMI voltage recording meter at a customer residences along Locust Street to verify model results.

Installing a voltage regulator along Amesbury Road is expected to resolve the identified voltage concern throughout the study period.

Total Project Cost: $30,000

8.4. Circuit 13X3: Install Voltage Regulators Old County Road – (2020)

Circuit analysis has identified that the primary voltage along Old County Road in Plaistow is expected to be as low as 115.9V in the summer of 2020 and as low as 115.3V in the summer of 2024.

An EWR has been issued to install an AMI voltage recording meter at a customer residences along Kingston Road to verify model results.

Installing a three voltage regulators along Old County Road is expected to resolve the identified voltage concern throughout the study period.

Total Project Cost: $70,000

8.5. Circuit 22X1: Install Regulator Colby Road – (2020)

Circuit analysis has identified that the primary voltage along Cheney Road in Danville is expected to be as low as 116.5V in the summer of 2020 and as low as 116.1V in the summer of 2024.

An AMI voltage recording meter recorded an average minimum service voltage of 112V at customer along Wild Pasture Road during previous summer peak conditions.

Installing a 2nd voltage regulator along Colby Road on phase C is expected to resolve the identified voltage concern throughout the study period.

Total Project Cost: $30,000

8.6. Circuit 19H1: Transfer Load to 27X1 – (2020)

Circuit analysis has identified that the primary voltage along Oak Ridge Road in Kensington is expected to be as low as 116.6V in the summer of 2020 and as low as 116.1V in the summer of 2024.

Additionally, the capacitor bank on 19H1 along Drinkwater Road creates AMI metering reading problems when it is switched into service and there are condition concerns associated with the aging 19H1 equipment at Gilman Lane substation.

Transfer circuit 19H1 to circuit 27X1 and decommission the 19H1 circuit position at Gilman Lane substation. A bank of 500 kVA stepdown transformers and three voltage regulators will be installed along Drinkwater Road to accommodate the load transfer.

This project is expected to address the identified voltage concern throughout the study period.

Total Project Cost: $150,000

8.7. Circuit 54X1: Install Voltage Regulator Main Street – (2020)

Circuit analysis has identified that the primary voltage along Industrial Way in East Kingston is expected to be as low as 116.9V in the summer of 2020 and as low as 116.7V in the summer of 2024.

An EWR has been issued to install an AMI voltage recording meter at a customer residences along Haverhill Road to verify model results.

Installing a voltage regulator along Main Street is expected to resolve the identified voltage concern throughout the study period.

Total Project Cost: $30,000

8.8. 20T1 Transformer: Transfer Load to 28X1 – (2022)

Distribution load projection indicate that the 20T1 transformer at Dow's Hill S/S is expected to be loaded to 91% of its normal ratings during summer conditions in 2022.

Rebuild Exeter Road from Pole 12/124 to pole 93/37 to 35 kV and convert to 34.5 kV operations. Pole 12/143 to Pole 93/37 will be reconductored with 336 spacer cable (Pole 12/124 to Pole 12/143 was previously rebuilt with 35kV spacer cable).

A bank of stepdown transformers will be installed in the vicinity of Ashbrook Road pole 8/21 and the new open point between 28X1 and 20H1 will be at Hampton Road pole 92/42.

This project is expected to address the identified transformer loading concern throughout the study period. Additionally, this projects works towards the master plan for the area.

Total Project Cost: $225,000

8.9. Circuit 19X3: Replace Cutouts with Switch – (2023)

Circuit analysis has identified that the cutouts with solid blades along Pine Street are expected to exceed 91% of their normal limits during summer conditions in 2023.

Replacing the existing cutouts with a gang-operated loadbreak switch will resolve this identified loading constraint throughout the study period.

Total Project Cost: $25,000

8.10. Circuit 23X1: Convert Portion of South Road – (2024)

Circuit analysis has identified that the 333 kVA stepdown transformer and 175QA low-side stepdown fuse is expected to exceed 90% of their normal limits during summer conditions in 2024.

Option 1 (Proposed):
Rebuild South Road from pole 32/84 to the vicinity of pole 32/59 to 35kV single-phase construction and convert to 34.5 kV operation. A new 333 kVA stepdown transformer will be installed in the vicinity of pole 32/59 South Road.

Total Project Cost: $150,000

Option 2:
Rebuild South Road from Amesbury Road pole 1/142 to South Road pole 32/59 to 35 kV spacer cable construction. Two additional 333 kVA stepdowns will be install at pole 32/83 South Road.

Total Project Cost: $250,000

Both options described above are expected to resolve the identified planning constraints through 2024 and beyond.

8.11. Circuit 5X3: Install Voltage Regulator Smith Corner Road – (2024)

Circuit analysis has identified that the primary voltage along Kristie Lane in Plaistow is expected to be as low as 116.9V in the summer of 2024.

An EWR has been issued to install an AMI voltage recording meter at a customer residences along Kristie Lane to verify model results.

Installing a voltage regulators along Smith Corner Road is expected to resolve the identified voltage concern throughout the study period.

Total Project Cost: $30,000

9. Circuit Tie Analysis

A detailed analysis was performed on all mainline distribution circuit ties in the UES-Seacoast system. The circuit ties were evaluated using 2020 projected summer peak loads and were assessed for loading and voltage violations. It is understood that marginal low voltage and protection coordination/sensitivity concerns may exist while circuits are tied. For the purposes of this review all elements were allowed to be operated up to their long term emergency ratings while circuits are tied.

Detail results of this analysis can be found in Appendix E.

10. Master Plan

This section describes a long range master plan for the UES–Seacoast system. The purpose of this plan is to provide strategic direction for the development of the electric distribution system as a whole. It does not, in and of itself, represent a cost-benefit justification for major system investments. Instead, it is intended to guide design decisions for various individual projects incrementally working towards broader system objectives. The concepts detailed below should be considered in all future designs of the system. It is expected that this Master Plan will be modified, adjusted, and refined as system challenges and opportunities evolve.

This master plan has been separated into two different parts. The first part of the plan consists of an overview map of the Seacoast distribution system. The second part of the master plan consists of more detailed future considerations. At this time some of these future considerations are not detailed.

10.1. Master Plan Map

The map in Appendix F identifies existing and future main line backbones at 34.5 kV, 13.8 kV and 4.16 kV as well as existing and future mainline equipment and a vision for self-healing". The map should be used as a tool when designing system improvement projects. Sections of conductor which have been identified as backbones will be constructed to 336.4 AA open wire conductor or equivalent and the appropriate insulation should be used, even if conditions do not require it at the time of construction.

10.1.1 Portsmouth Ave., Stratham

Portsmouth Ave. in its entirety will be converted to 34.5 kV three-phase main line construction creating ties to between circuits 47X1 and 51X1 and 11X1.

10.1.2 Kingston, East Kingston, Kensington, and Hampton Falls

The Shaw's Hill 34.5 kV distribution tap is comprised of 2 circuit positions (27X1 and 27X2). Portions of circuits 19X3, 23X1 and 19H1 will be transferred to these circuits over time. This will provide various circuit ties amongst circuits 27X1, 27X2, 23X1, 19X3, 19X2, 28X1 and 43X1.

Exeter Switching circuit 19H1 will be converted to 34.5 kV. This will involve the conversion of Drinkwater Road to the south and will a create tie between circuits 27X1, 19X2.

Dow's Hill S/S and circuit 20H1 will be converted to 34.5 kV. This will involve the conversion of Route 27 and Route 88 and will create ties with circuits 18X1, 47X1 and 28X1.

Route 125 in Kingston will be converted to 34.5 kV. This will include converting portions of circuits 54X1, 22X1, 56X1 and 56X2 to allow the creation of circuit ties.

10.1.3 Hampton and Hampton Beach

Drinkwater road will be converted to 34.5 kV, creating a circuit tie between 2X3 and 28X1.

Winnacunnet Road Tap and the western portion of circuit 46X1 and the 2X2 portion of Winnacunnet Road will be convert to 34.5 kV operation, allowing portions of 2X2 to be transferred to 46X1.

10.1.4 Atkinson, Plaistow and Newton

The 34.5 kV circuit(s) emanating from Plaistow substation will be extended to create future circuit ties with circuits 58X1 and 56X1 and provide a future distribution backup to the radial 3358 line.

11. Conclusion

The projects identified in this study attempt to address all of the system constraints that have been identified. The future of the UES–Seacoast system will rely predominantly on where load enters the system and growth occurs. In the future, projects will continue to focus on improving system voltages, increasing capacity and creating additional distribution circuit ties that will improve overall system reliability. Implementation of the master plan will enable the system to grow towards one common vision in a direct and cost effective manner. It is recognized that this study is a living document and it will be continually updated as the system's needs change or new system deficiencies are identified.

Appendix A

Summer and Winter Load Forecasts

UES-Seacoast
5-Year Load Forecast
2020-2024

	Summer Peak Loads (three-phase kVA)				
	Projected				
Distribution Element	2020	2021	2022	2023	2024
Cemetery Lane 15X1	7,689	7,799	7,908	8,017	8,127
Dorre Road Tap 56X2	1,885	1,906	1,927	1,948	1,969
Dow's Hill 20T1	1,652	1,670	1,689	1,707	1,726
20H1	1,652	1,670	1,689	1,707	1,726
East Kingston 6T1	5,707	5,771	5,834	5,898	5,961
6W1	2,721	2,751	2,781	2,811	2,842
6W2	3,545	3,585	3,624	3,663	3,703
Exeter 1T1	2,991	3,024	3,057	3,090	3,124
Exeter 1T2	2,991	3,024	3,057	3,090	3,124
1H3	1,486	1,502	1,519	1,535	1,552
1H4	1,505	1,522	1,539	1,555	1,572
Gilman Lane 19T1	641	649	656	663	670
19H1	641	649	656	663	670
Gilman Lane 19X2	5,235	5,347	5,459	5,570	5,682
Gilman Lane 19X3	15,750	16,239	16,727	17,216	17,705
Guinea Road Tap 47X1	5,253	5,290	5,328	5,366	5,404
Guinea Switching 18X1	11,559	11,699	11,838	11,977	12,117
Hampton 2T1	1,193	1,206	1,219	1,233	1,246
2H1	1,193	1,206	1,219	1,233	1,246
Hampton 2X2	9,852	10,025	10,198	10,371	10,545
Hampton 2X3	5,819	5,936	6,054	6,171	6,289
Hampton Beach 3T3	9,444	9,552	9,659	9,767	9,874
3W1	4,710	4,768	4,826	4,883	4,941
3W4	4,734	4,784	4,834	4,883	4,933
High Street 17T1	6,041	6,115	6,189	6,263	6,337
17W1	4,088	4,136	4,184	4,232	4,280
17W2	1,953	1,979	2,005	2,031	2,057
Hunt Rd Tap 56X1	2,299	2,325	2,351	2,377	2,403
Kingston 22X1	3,791	3,834	3,876	3,918	3,960
Kingston 22X2	659	666	674	681	688
Mill Lane Tap 23X1	3,602	3,683	3,765	3,847	3,929
Munt Hill 28X1	1,604	1,624	1,644	1,664	1,684
New Boston Rd. Tap	5,812	5,876	5,941	6,006	6,070
54X1	2,927	2,959	2,992	3,024	3,057
54X2	2,885	2,917	2,949	2,981	3,014
Plaistow 5X3	4,347	4,360	4,372	4,385	4,397
Portsmouth Ave. Substation	12,895	13,193	13,492	13,790	14,089
11X1	4,904	4,947	4,989	5,032	5,075
11X2	7,294	7,375	7,456	7,538	7,619
Seabrook 7T1	4,294	4,342	4,390	4,437	4,485
7W1	4,294	4,342	4,390	4,437	4,485
Seabrook 7X2	6,079	6,146	6,214	6,281	6,349
Shaw's Hill Tap	3,420	3,458	3,496	3,534	3,572
27X1	2,123	2,084	2,107	2,129	2,152
27X2	1,072	1,083	1,095	1,107	1,119
Stard Road Tap 59X1	8,057	8,146	8,236	8,325	8,415
Timberlane 13T1	7,381	7,467	7,553	7,639	7,725
13W1	4,105	4,151	4,196	4,242	4,287
13W2	4,604	4,677	4,750	4,823	4,896

UES-Seacoast
5-Year Load Forecast
2020-2024

	Summer Peak Loads (three-phase kVA)				
	Projected				
Distribution Element	**2020**	**2021**	**2022**	**2023**	**2024**
Timberlane 13X3	1,393	1,416	1,440	1,463	1,486
Westville 21T1	6,249	6,332	6,415	6,498	6,581
21W1	6,249	6,332	6,415	6,498	6,581
Westville 21T2	5,097	5,169	5,241	5,312	5,384
21W2	5,097	5,169	5,241	5,312	5,384
Westville Tap 58X1	11,973	12,106	12,240	12,373	12,506
58X1E	5,276	5,335	5,393	5,452	5,511
58X1W	6,697	6,772	6,846	6,921	6,995
Willow Road Tap 43X1	6,407	6,478	6,549	6,620	6,692
Winnacunnet Road Tap 46X1	1,423	1,440	1,457	1,473	1,490
Winnicutt Road Tap 51X1	5,548	5,605	5,663	5,721	5,778

Legend

loading < 50% of Normal Limit
50% ≤ loading ≤ 90% of Normal Limit
90% < loading ≤ 100% of Normal Limit
100% of Normal Limit < loading

UES-Seacoast
5-Year Load Forecast
2019/20-2023/24

	Winter Peak Loads (three-phase kVA)				
	Projected				
Distribution Element	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**
Cemetery Lane 15X1	5,781	5,891	6,000	6,110	6,219
Dorre Road Tap 56X2	1,362	1,377	1,392	1,407	1,422
Dow's Hill 20T1	1,366	1,381	1,396	1,411	1,426
20H1	1,366	1,381	1,396	1,411	1,426
East Kingston 6T1	4,921	4,976	5,031	5,085	5,140
6W1	2,127	2,151	2,174	2,198	2,222
6W2	2,794	2,825	2,856	2,887	2,918
Exeter 1T1	1,252	1,266	1,280	1,294	1,308
Exeter 1T2	1,180	1,193	1,207	1,220	1,233
1H3	1,252	1,266	1,280	1,294	1,308
1H4	1,180	1,193	1,207	1,220	1,233
Gilman Lane 19T1	549	563	578	592	607
19H1	549	563	578	592	607
Gilman Lane	3,333	3,455	3,577	3,699	3,821
Gilman Lane 19X3	10,935	11,200	11,465	11,730	11,995
Guinea Road Tap 47X1	3,793	3,821	3,848	3,875	3,903
Guinea Switching 18X1	8,348	8,448	8,549	8,650	8,750
Hampton 2T1	993	1,004	1,015	1,026	1,037
2H1	993	1,004	1,015	1,026	1,037
Hampton 2X2	7,114	7,240	7,365	7,490	7,615
Hampton 2X3	4,501	4,576	4,652	4,728	4,803
Hampton Beach 3T3	6,820	6,898	6,975	7,053	7,131
3W1	3,401	3,443	3,485	3,527	3,568
3W4	3,419	3,455	3,491	3,527	3,562
High Street 17T1	4,750	4,821	4,891	4,962	5,032
17W1	3,050	3,084	3,118	3,151	3,185
17W2	1,700	1,737	1,774	1,810	1,847
Hunt Rd Tap 56X1	1,660	1,679	1,698	1,716	1,735
Kingston 22X1	2,803	2,834	2,865	2,896	2,927
Kingston 22X2	476	481	486	492	497
Mill Lane Tap 23X1	2,684	2,710	2,736	2,761	2,787
Munt Hill 28X1	1,158	1,173	1,187	1,201	1,216
New Boston Rd. 54X1	4,846	4,951	5,056	5,161	5,266
54X1	2,558	2,638	2,718	2,798	2,877
54X2	2,287	2,313	2,338	2,364	2,389
Plaistow 5X3	3,139	3,148	3,157	3,166	3,175
Portsmouth Ave. Substation	9,533	9,639	9,745	9,851	9,957
11X1	4,265	4,313	4,360	4,407	4,455
11X2	5,268	5,326	5,385	5,443	5,502
Seabrook 7T1	3,101	3,136	3,170	3,205	3,239
7W1	3,101	3,136	3,170	3,205	3,239
Seabrook 7X2	4,327	4,405	4,482	4,560	4,637
Shaw's Hill Tap	2,378	2,409	2,440	2,471	2,502
27X1	1,671	1,691	1,711	1,731	1,751
27X2	818	850	882	915	947
Stard Road Tap 59X1	5,818	5,883	5,948	6,012	6,077
Timberlane 13T1	6,399	6,574	6,749	6,924	7,099
13W1	2,754	2,818	2,883	2,948	3,012
13W2	3,646	3,756	3,866	3,976	4,087

UES-Seacoast
5-Year Load Forecast
2019/20-2023/24

	Winter Peak Loads (three-phase kVA)				
	Projected				
Distribution Element	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**
Timberlane 13X3	1,138	1,170	1,202	1,234	1,266
Westville 21T1	4,450	4,500	4,549	4,599	4,648
21W1	4,450	4,500	4,549	4,599	4,648
Westville 21T2	3,237	3,343	3,449	3,556	3,662
21W2	3,237	3,343	3,449	3,556	3,662
Westville Tap 58X1	7,997	8,063	8,129	8,194	8,260
58X1E	3,161	3,172	3,184	3,196	3,208
58X1W	4,837	4,890	4,944	4,998	5,052
Willow Road Tap 43X1	4,780	4,834	4,887	4,940	4,993
Winnacunnet Road Tap 46X1	1,028	1,040	1,052	1,064	1,076
Winnicutt Road Tap 51X1	4,007	4,048	4,090	4,131	4,173

Legend

loading < 50% of Normal Limit
50% ≤ loading ≤ 90% of Normal Limit
90% < loading ≤ 100% of Normal Limit
100% of Normal Limit < loading

Appendix B

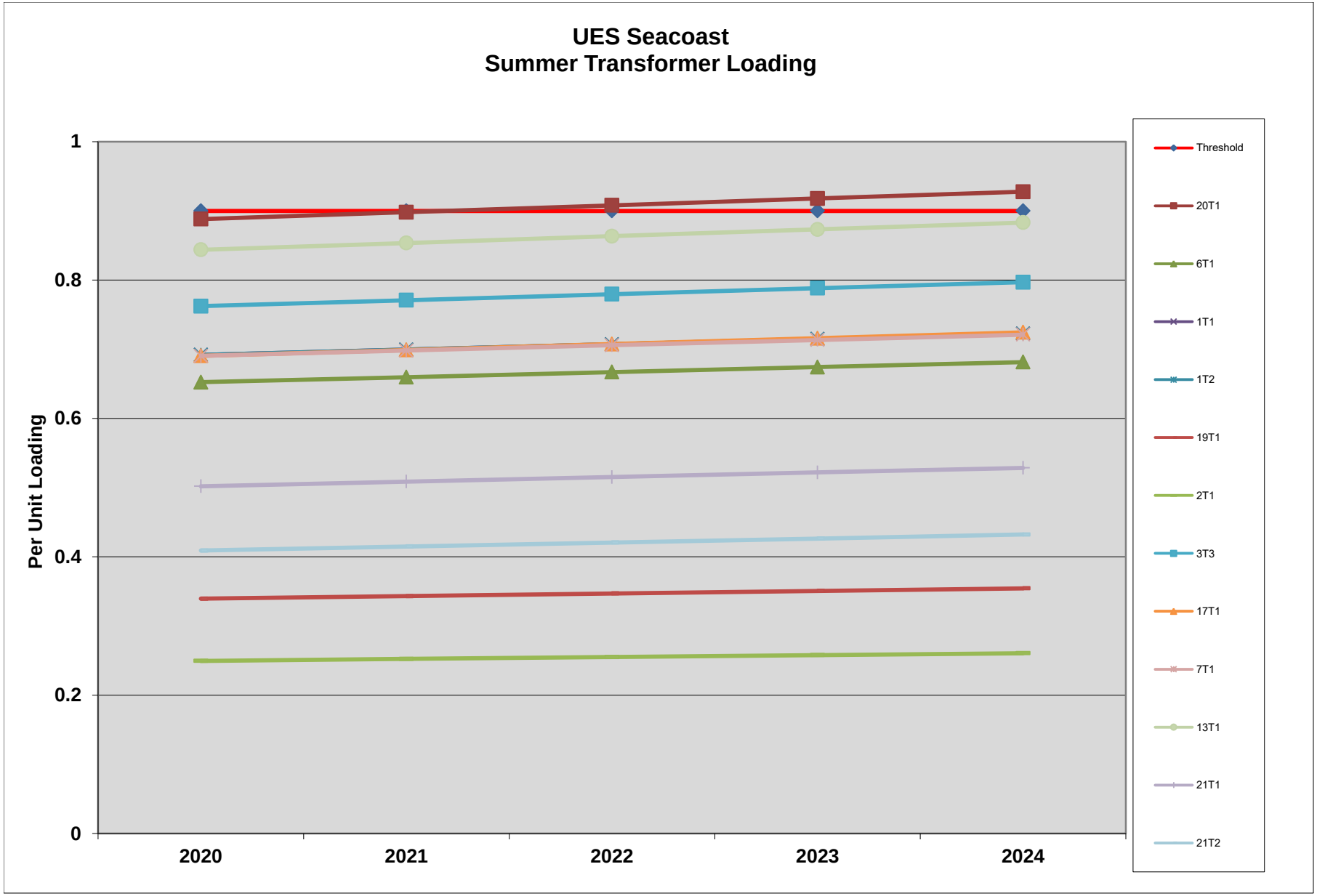
Distribution Circuit Ratings and Limitations

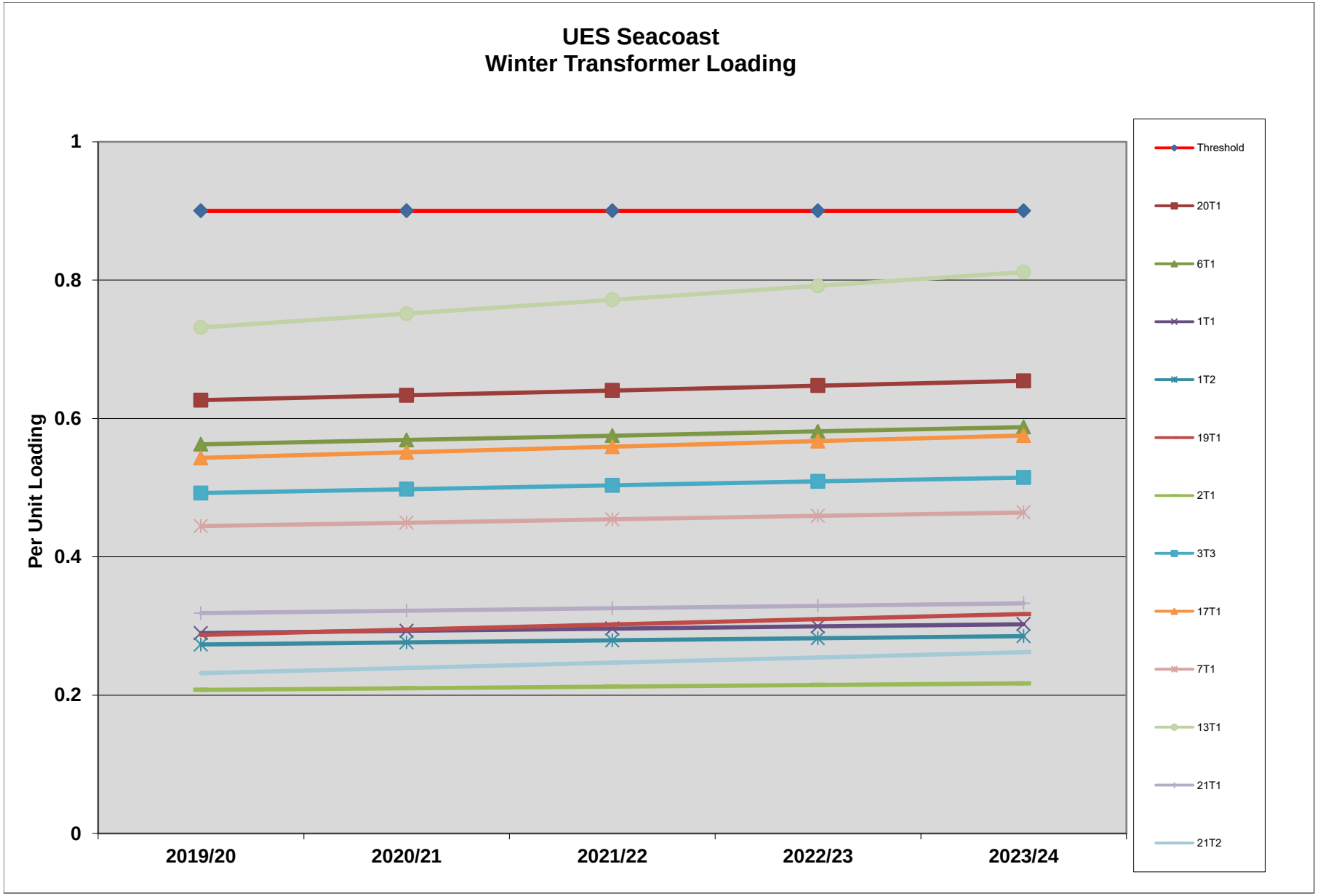
Distribution Element	Voltage Base	Breaker or Recloser Continuous Rating		Breaker or Recloser Trip Level		Breaker or Recloser Load Enchroachment		Current Transformer Present Tap Selection		Switch Continuous Rating		Fuse Limit		Regulator Limit		Conductor Rating		Transformer Rating		Overall Rating		Overall Rating		Limiting Element	
		Normal	LTE	Normal	LTE	Normal	LTE	Normal	LTE	Normal	LTE	Normal	LTE	Normal	LTE	Normal	LTE	Normal	LTE	Normal	LTE	Normal	LTE	Normal	LTE
	(kV)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(Amps)	(kVA)	(kVA)	(Amps)	(Amps)		
Cemetary Lane 15X1	34.5	800	800	333	360			600	600	900	900			450	525	531	645			19,899	21,512	333	360	Relay Set	Relay Set
Dorre Road Tap 56X2	34.5									600	600	113	113			247	294			6,723	6,723	113	113	Fuse	Fuse
Dow's Hill 20T1	4.16											597	597					258	268	1,860	1,930	258	268	Xfmr	Xfmr
20H1	4.16	600	600	355	384			600	600	600	600			480	560	531	645			2,559	2,767	355	384	Relay Set	Relay Set
East Kingston 6T1	13.8											412	412					521	530	9,842	9,842	412	412	Fuse	Fuse
6W1	13.8	800	800	296	320	468	468	600	600	600	600			589	687	531	645			11,186	11,186	468	468	Relay Set	Relay Set
6W2	13.8	800	800	296	320	468	468	600	600					589	687	531	645			11,186	11,186	468	468	Relay Set	Relay Set
Exeter 1T1	4.16							600	600	900	900	933	933					623	636	4,323	4,323	600	600	CT	CT
Exeter 1T2	4.16							600	600	900	900	933	933					623	636	4,323	4,323	600	600	CT	CT
1H3	4.16	800	800	414	448					900	900					500	620			2,986	3,228	414	448	Relay Set	Relay Set
1H4	4.16	800	800	414	448					900	900					500	620			2,986	3,228	414	448	Relay Set	Relay Set
Gilman Lane 19T1	4.16											299	299					262	271	1,890	1,950	262	271	Xfmr	Xfmr
19H1	4.16	560	560	296	320			600	600	400	400			480	560	340	411			2,133	2,306	296	320	Relay Set	Relay Set
Gilman Lane	34.5	400	400	444	480			600	600	600	600			450	525	500	620			23,902	23,902	400	400	Brkr/Rclsr	Brkr/Rclsr
Gilman Lane 19X3	34.5	800	800	370	400			600	600	600	600			450	525	531	645			22,110	23,902	370	400	Relay Set	Relay Set
Guinea Road Tap 47X1	34.5	560	560	414	448			200	200	300	300			240	280	531	645			11,951	11,951	200	200	CT	CT
Guinea Switching 18X1	34.5	600	600	414	448			600	600							531	645			24,763	26,771	414	448	Relay Set	Relay Set
Hampton 2T1	4.16	1200	1200									746	746					860	877	5,378	5,378	746	746	Fuse	Fuse
2H1	4.16	560	560	414	448			600	600	600	600			802	935	340	411			2,450	2,961	340	411	Wire	Wire
Hampton 2X2	34.5	800	800	311	336			600	600	400	400			450	525	531	645			18,572	20,078	311	336	Relay Set	Relay Set
Hampton 2X3	34.5	800	800	311	336			600	600	900	900			450	525	531	645			18,572	20,078	311	336	Relay Set	Relay Set
Hampton Beach 3T3	13.8	800	800					600	600									518	528	12,390	12,610	518	528	Xfmr	Xfmr
3W1	13.8	800	800					600	600	600	600			440	514	531	645			10,527	12,281	440	514	Reg	Reg
3W4	13.8	800	800	296	320			600	600	600	600			263	307	415	415			6,282	7,328	263	307	Reg	Reg
High Street 17T1	13.8											412	412					521	530	9,842	9,842	412	412	Fuse	Fuse
17W1	13.8	800	800	444	480			600	600	600	600			589	687	531	645			10,613	11,473	444	480	Relay Set	Relay Set
17W2	13.8	800	800	296	320			600	600	600	600			589	687	531	645			7,075	7,649	296	320	Relay Set	Relay Set
Hunt Rd Tap 56X1	34.5	800	800	278	300			600	600	600	600			270	315	531	645			16,134	17,927	270	300	Reg	Relay Set
Kingston 22X1	34.5	1200	1200	414	448			600	600	1200	1200					531	645			24,763	26,771	414	448	Relay Set	Relay Set
Kingston 22X2	34.5	1200	1200	414	448			600	600	1200	1200					531	645			24,763	26,771	414	448	Relay Set	Relay Set
Mill Lane Tap 23X1	34.5	400	400	296	320			200	200	600	600			240	280	531	645			11,951	11,951	200	200	CT	CT
Munt Hill Tap 28X1	34.5	800	800	192	208			600	600	600	600			450	525	531	645			11,497	12,429	192	208	Relay Set	Relay Set
New Boston Road	34.5	800	800	296	320			600	600	600	600			241	281	531	645			14,413	16,815	241	281	Reg	Reg
54X1	34.5	800	800	244	264			600	600	600	600					531	645			14,592	15,776	244	264	Relay Set	Relay Set
54X2	34.5	800	800	244	264			600	600	600	600					531	645			14,592	15,776	244	264	Relay Set	Relay Set
Plaistow 5X3	34.5	800	800	259	280					600	600			241	281	531	645			14,413	16,732	241	280	Reg	Relay Set
Portsmouth Ave Substation	34.5	800	800	348	376			400	400					450	525	531	645			20,783	22,468	348	376	Relay Set	Relay Set
Portsmouth Ave 11X1	34.5	800	800	237	256			600	600	600	600					531	645			14,150	15,297	237	256	Relay Set	Relay Set
Portsmouth Ave 11X2	34.5	800	800	237	256			600	600	600	600					531	645			14,150	15,297	237	256	Relay Set	Relay Set
Seabrook 7T1	13.8											1187	1187					260	265	6,220	6,330	260	265	Xfmr	Xfmr
7W1	13.8	800	800	592	640			600	600	900	900			263	307	531	645			6,282	7,328	263	307	Reg	Reg
Seabrook 7X2	34.5	800	800	192	208			600	600	900	900			200	234	531	645			11,497	12,429	192	208	Relay Set	Relay Set
Shaw's Hill Tap	34.5	800	800	266	288			600	600	600	600			450	525	531	645			15,919	17,210	266	288	Relay Set	Relay Set
27X1	34.5	800	800	237	256											531	645			14,150	15,297	237	256	Relay Set	Relay Set
27X2	34.5	800	800	237	256											531	645			14,150	15,297	237	256	Relay Set	Relay Set
Stard Road Tap 59X1	34.5	800	800	311	336					600	600			450	525	531	645			18,572	20,078	311	336	Relay Set	Relay Set
Timberlane 13T1	13.8							600	600			412	412					523	532	9,842	9,842	412	412	Fuse	Fuse
13W1	13.8	560	560	414	448			300	300	600	600			524	612	531	645			7,171	7,171	300	300	CT	CT
13W2	13.8	560	560	207	224			300	300	400	400			263	307	531	645			4,953	5,354	207	224	Relay Set	Relay Set
Timberlane 13X3	34.5	800	800	178	192					600	600			241	281	531	645			10,613	11,473	178	192	Relay Set	Relay Set
Westville 21T1	13.8							600	600									521	530	12,450	12,670	521	530	Xfmr	Xfmr
21W1	13.8	560	560	414	448			600	600	600	600			589	687	531	645			9,905	10,708	414	448	Relay Set	Relay Set
Westville 21T2	13.8							600	600									521	531	12,460	12,700	521	531	Xfmr	Xfmr
21W2	13.8	560	560	414	448			300	300	600	600			589	687	622	776			7,171	7,171	300	300	CT	CT
Westville Tap 58X1	34.5	560	560					400	400	300	300			241	281					14,413	16,815	241	281	Reg	Reg
58X1E	34.5	800	800	370	400											531	645			22,110	23,902	370	400	Relay Set	Relay Set
58X1W	34.5	800	800	148	160											663	808			8,844	9,561	148	160	Relay Set	Relay Set
Willow Road Tap 43X1	34.5	800	800	370	400									270	315	531	645			16,134	18,823	270	315	Reg	Reg
Winnacunnet Road Tap 46X1	34.5	560	560	67	72					72	72	135	135	270	315	531	645	60	60	3,600	3,600	60	60	Xfmr	Xfmr
Winnicutt Road Tap 51X1	34.5	800	800	414	448					900	900					531	645			24,763	26,771	414	448	Relay Set	Relay Set

Distribution Element	Voltage Base	Breaker or Recloser						Current Transformer		Switch		Fuse		Regulator		Conductor		Transformer		Overall		Overall		Limiting Element	
		Continuous Rating		Trip Level		Load Enchroachment		Present Tap Selection		Continuous Rating		Limit		Limit		Rating		Rating		Rating		Rating			
		Normal		Normal		Normal		Normal		Normal		Normal		Normal		Normal		Normal		Normal	LTE	Normal			
	(kV)	(Amps)	LTE (Amps)	(Amps)	LTE (Amps)	(Amps)	LTE (Amps)	(Amps)	LTE (Amps)	(Amps)	LTE (Amps)	(Amps)	LTE (Amps)	(Amps)	LTE (Amps)	(Amps)	LTE (Amps)	(Amps)	LTE (Amps)	(kVA)	(kVA)	(Amps)	LTE (Amps)	Normal	LTE
Cemetary Lane 15X1	34.5	800	800	333	360			600	600	900	900			536	536	694	777			19,899	21,512	333	360	Relay Set	Relay Set
Dorre Road Tap 56X2	34.5									600	600	113	113			322	354			6,723	6,723	113	113	Fuse	Fuse
Dow's Hill 20T1	4.16											597	597					303	321	2,180	2,310	303	321	Xfmr	Xfmr
20H1	4.16	600	600	355	384			600	600	600	600			580	580	694	777			2,559	2,767	355	384	Relay Set	Relay Set
East Kingston 6T1	13.8											412	412					580	603	9,842	9,842	412	412	Fuse	Fuse
6W1	13.8	800	800	296	320	468	468	600	600	600	600			712	712	694	777			11,186	11,186	468	468	Relay Set	Relay Set
6W2	13.8	800	800	296	320	468	468	600	600					712	712	694	777			11,186	11,186	468	468	Relay Set	Relay Set
Exeter 1T1	4.16							600	600	900	900	933	933					704	747	4,323	4,323	600	600	CT	CT
Exeter 1T2	4.16							600	600	900	900	933	933					704	747	4,323	4,323	600	600	CT	CT
1H3	4.16	800	800	414	448					900	900					696	778			2,986	3,228	414	448	Relay Set	Relay Set
1H4	4.16	800	800	414	448					900	900					696	778			2,986	3,228	414	448	Relay Set	Relay Set
Gilman Lane 19T1	4.16											299	299					304	321	2,151	2,151	299	299	Fuse	Fuse
19H1	4.16	560	560	296	320			600	600	400	400			580	580	443	495			2,133	2,306	296	320	Relay Set	Relay Set
Gilman Lane	34.5	400	400	444	480			600	600	600	600			536	536	696	778			23,902	23,902	400	400	Brkr/Rclsr	Brkr/Rclsr
Gilman Lane 19X3	34.5	800	800	370	400			600	600	600	600			536	536	694	777			22,110	23,902	370	400	Relay Set	Relay Set
Guinea Road Tap 47X1	34.5	560	560	414	448			200	200	300	300			290	290	694	777			11,951	11,951	200	200	CT	CT
Guinea Switching 18X1	34.5	600	600	414	448			600	600							694	777			24,763	26,771	414	448	Relay Set	Relay Set
Hampton 2T1	4.16	1200	1200									746	746					969	1008	5,378	5,378	746	746	Fuse	Fuse
2H1	4.16	560	560	414	448			600	600	600	600			969	969	443	495			2,986	3,228	414	448	Relay Set	Relay Set
Hampton 2X2	34.5	800	800	311	336			600	600	400	400			536	536	694	777			18,572	20,078	311	336	Relay Set	Relay Set
Hampton 2X3	34.5	800	800	311	336			600	600	900	900			536	536	694	777			18,572	20,078	311	336	Relay Set	Relay Set
Hampton Beach 3T3	13.8	800	800					600	600									580	603	13,860	14,341	580	600	Xfmr	CT
3W1	13.8	800	800					600	600	600	600			532	532	694	777			12,720	12,720	532	532	Reg	Reg
3W4	13.8	800	800	296	320			600	600	600	600			318	318	415	415			7,075	7,590	296	318	Relay Set	Reg
High Street 17T1	13.8											412	412					584	613	9,842	9,842	412	412	Fuse	Fuse
17W1	13.8	800	800	444	480			600	600	600	600			712	712	694	777			10,613	11,473	444	480	Relay Set	Relay Set
17W2	13.8	800	800	296	320			600	600	600	600			712	712	694	777			7,075	7,649	296	320	Relay Set	Relay Set
Hunt Rd Tap 56X1	34.5	800	800	278	300			600	600	600	600			326	326	694	777			16,582	17,927	278	300	Relay Set	Relay Set
Kingston 22X1	34.5	1200	1200	414	448			600	600	1200	1200					694	777			24,763	26,771	414	448	Relay Set	Relay Set
Kingston 22X2	34.5	1200	1200	414	448			600	600	1200	1200					694	777			24,763	26,771	414	448	Relay Set	Relay Set
Mill Lane Tap 23X1	34.5	400	400	296	320			200	200	600	600			290	290	694	777			11,951	11,951	200	200	CT	CT
Munt Hill Tap 28X1	34.5	800	800	192	208			600	600	600	600			536	536	694	777			11,497	12,429	192	208	Relay Set	Relay Set
New Boston Road	34.5	800	800	296	320			600	600	600	600			291	291	694	777			17,416	17,416	291	291	Reg	Reg
54X1	34.5	800	800	244	264			600	600	600	600					694	777			14,592	15,776	244	264	Relay Set	Relay Set
54X2	34.5	800	800	244	264			600	600	600	600					694	777			14,592	15,776	244	264	Relay Set	Relay Set
Plaistow 5X3	34.5	800	800	259	280					600	600			291	291	694	777			15,477	16,732	259	280	Relay Set	Relay Set
Portsmouth Ave Substation	34.5	800	800	348	376			400	400					536	536	694	777			20,783	22,468	348	376	Relay Set	Relay Set
Portsmouth Ave 11X1	34.5	800	800	237	256			600	600	600	600					694	777			14,150	15,297	237	256	Relay Set	Relay Set
Portsmouth Ave 11X2	34.5	800	800	237	256			600	600	600	600					694	777			14,150	15,297	237	256	Relay Set	Relay Set
Seabrook 7T1	13.8											1187	1187					292	307	6,980	7,330	292	307	Xfmr	Xfmr
7W1	13.8	800	800	592	640			600	600	900	900			318	318	694	777			7,590	7,590	318	318	Reg	Reg
Seabrook 7X2	34.5	800	800	192	208			600	600	900	900			242	242	694	777			11,497	12,429	192	208	Relay Set	Relay Set
Shaw's Hill Tap	34.5	800	800	266	288			600	600	600	600			536	536	694	777			15,919	17,210	266	288	Relay Set	Relay Set
27X1	34.5	800	800	237	256											694	777			14,150	15,297	237	256	Relay Set	Relay Set
27X2	34.5	800	800	237	256											694	777			14,150	15,297	237	256	Relay Set	Relay Set
Stard Road Tap 59X1	34.5	800	800	311	336					600	600			536	536	694	777			18,572	20,078	311	336	Relay Set	Relay Set
Timberlane 13T1	13.8							600	600			412	412					589	618	9,842	9,842	412	412	Fuse	Fuse
13W1	13.8	560	560	414	448			300	300	600	600			634	634	694	777			7,171	7,171	300	300	CT	CT
13W2	13.8	560	560	207	224			300	300	400	400			318	318	694	777			4,953	5,354	207	224	Relay Set	Relay Set
Timberlane 13X3	34.5	800	800	178	192					600	600			291	291	694	777			10,613	11,473	178	192	Relay Set	Relay Set
Westville 21T1	13.8							600	600									584	612	13,970	14,341	584	600	Xfmr	CT
21W1	13.8	560	560	414	448			600	600	600	600			712	712	694	777			9,905	10,708	414	448	Relay Set	Relay Set
Westville 21T2	13.8							600	600									584	613	13,970	14,341	584	600	Xfmr	CT
21W2	13.8	560	560	414	448			300	300	600	600			712	712	873	976			7,171	7,171	300	300	CT	CT
Westville Tap 58X1	34.5	560	560					400	400	300	300			291	291					17,416	17,416	291	291	Reg	Reg
58X1E	34.5	800	800	370	400											694	777			22,110	23,902	370	400	Relay Set	Relay Set
58X1W	34.5	800	800	148	160											868	974			8,844	9,561	148	160	Relay Set	Relay Set
Willow Road Tap 43X1	34.5	800	800	370	400									326	326	694	777			19,495	19,495	326	326	Reg	Reg
Winnacunnet Road Tap 46X1	34.5	560	560	67	72					72	72	135	135	326	326	694	777	60	60	3,600	3,600	60	60	Xfmr	Xfmr
Winnicutt Road Tap 51X1	34.5	800	800	414	448					900	900					694	777			24,763	26,771	414	448	Relay Set	Relay Set

Appendix C

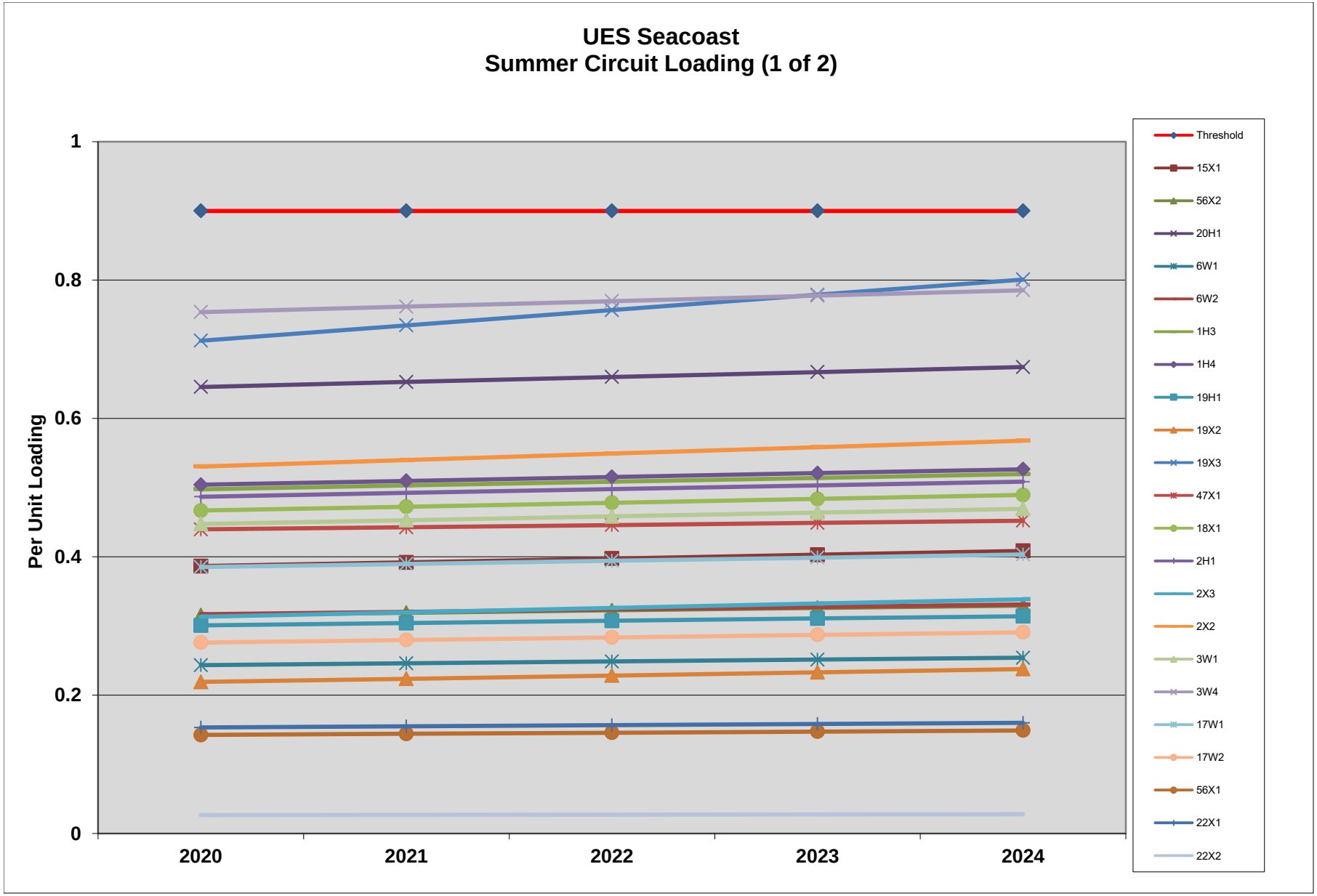
Transformer Loading Charts
(in Per Unit)

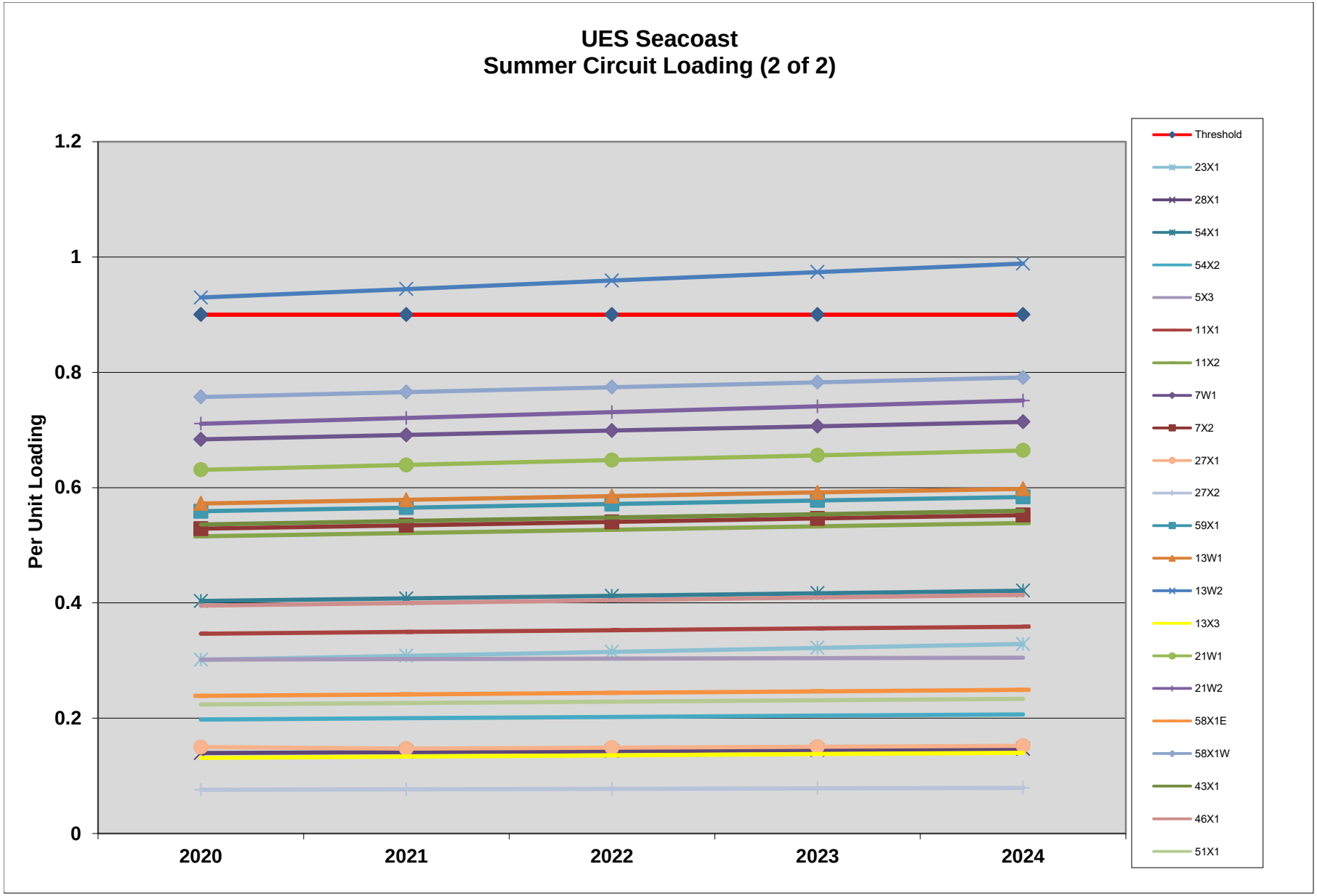

UES Seacoast
Summer Transformer Loading
Per Unit Loading
1
0.8
0.6
0.4
0.2
0
2020
2021
2022
2023
2024
Threshold
20T1
6T1
1T1
1T2
19T1
2T1
3T3
17T1
7T1
13T1
21T1
21T2

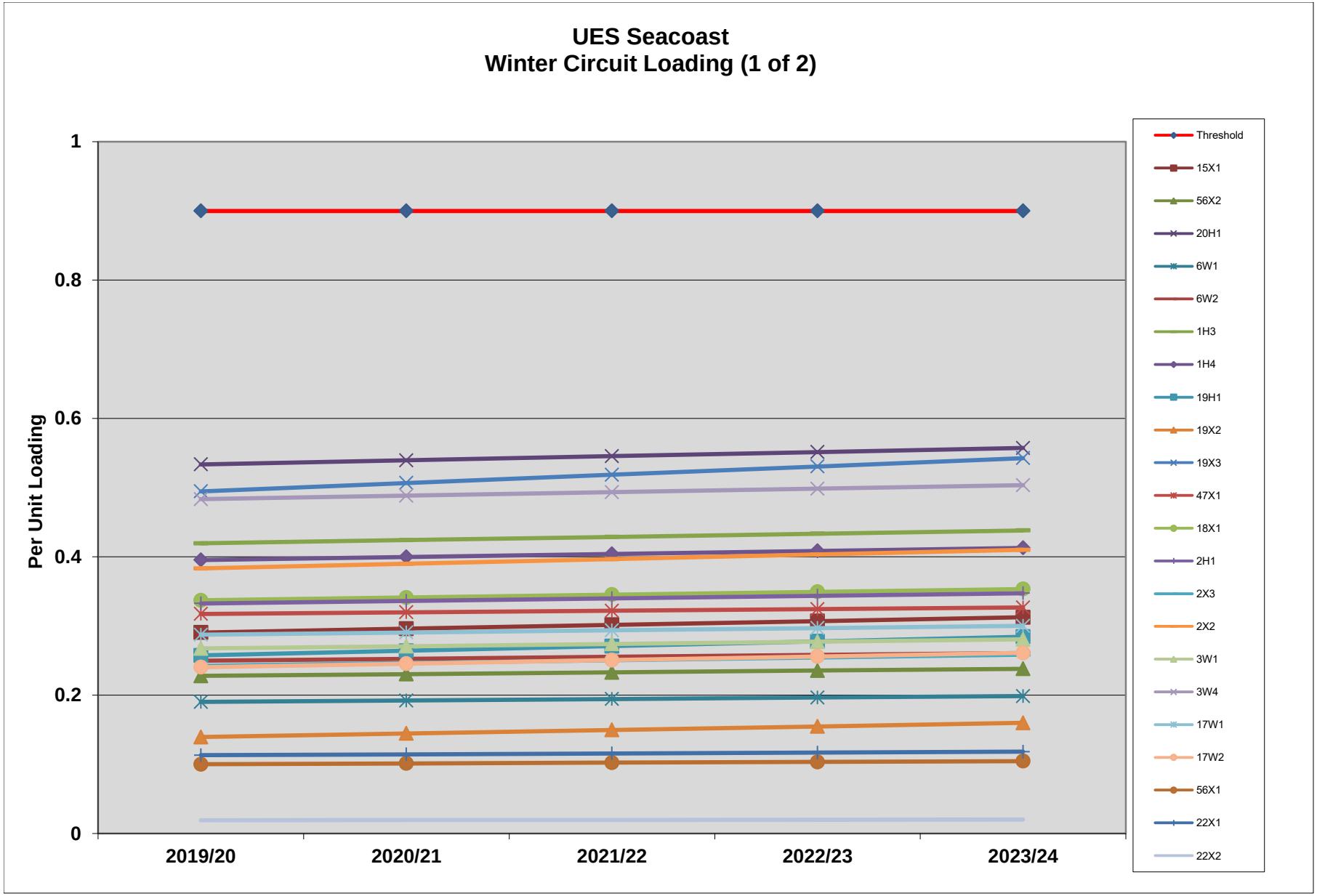

UES Seacoast
Winter Transformer Loading
Per Unit Loading
1
0.8
0.6
0.4
0.2
0
2019/20
2020/21
2021/22
2022/23
2023/24
Threshold
20T1
6T1
1T1
1T2
19T1
2T1
3T3
17T1
7T1
13T1
21T1
21T2

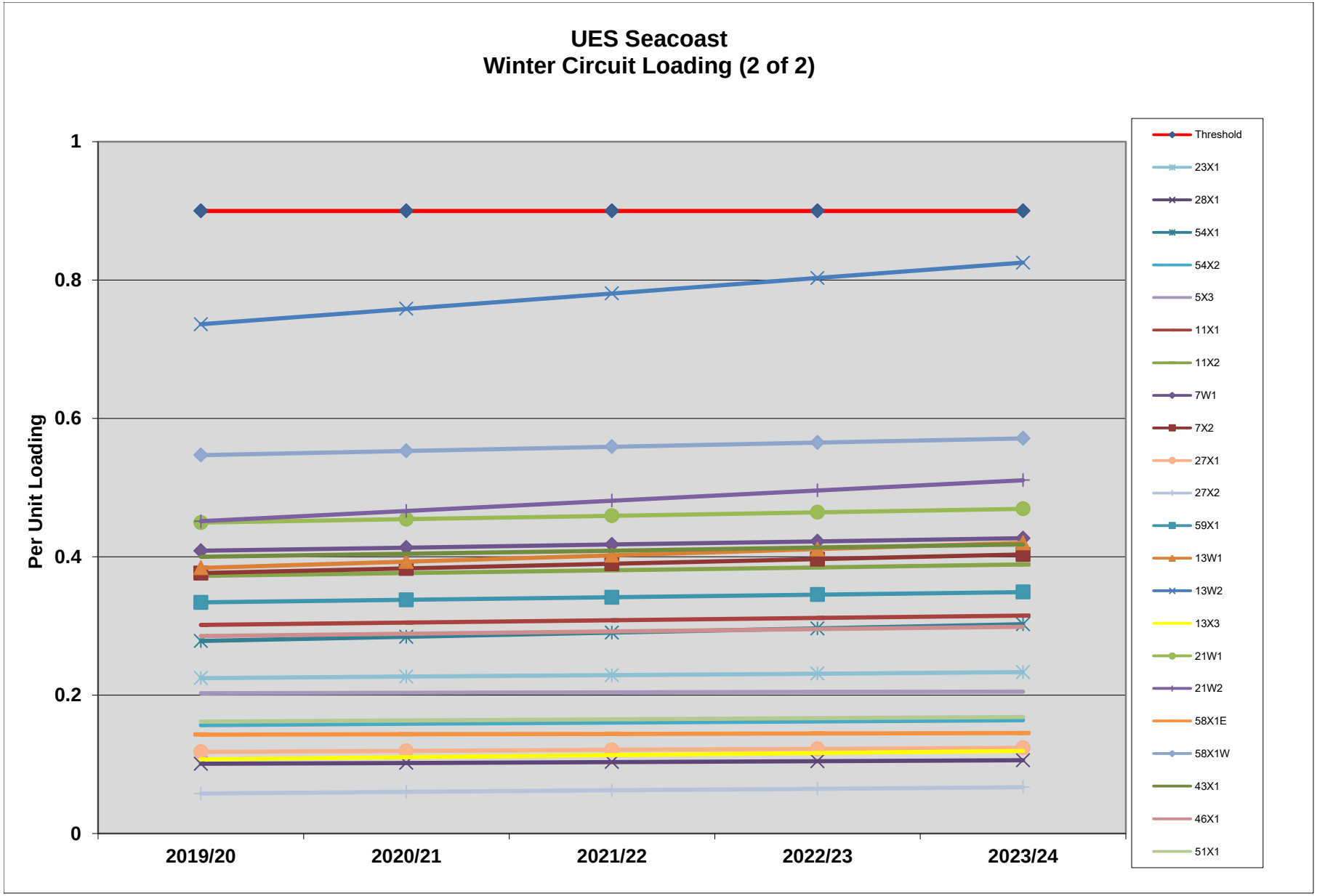
Appendix D

Circuit Loading Charts
(in Per Unit)


UES Seacoast
Summer Circuit Loading (1 of 2)
Per Unit Loading
1
0.8
0.6
0.4
0.2
0
2020
2021
2022
2023
2024
Threshold
15X1
56X2
20H1
6W1
6W2
1H3
1H4
19H1
19X2
19X3
47X1
18X1
2H1
2X3
2X2
3W1
3W4
17W1
17W2
56X1
22X1
22X2


UES Seacoast
Summer Circuit Loading (2 of 2)
Per Unit Loading
1.2
1
0.8
0.6
0.4
0.2
0
2020
2021
2022
2023
2024
Threshold
23X1
28X1
54X1
54X2
5X3
11X1
11X2
7W1
7X2
27X1
27X2
59X1
13W1
13W2
13X3
21W1
21W2
58X1E
58X1W
43X1
46X1
51X1


UES Seacoast
Winter Circuit Loading (1 of 2)
Per Unit Loading
1
0.8
0.6
0.4
0.2
0
2019/20
2020/21
2021/22
2022/23
2023/24
Threshold
15X1
56X2
20H1
6W1
6W2
1H3
1H4
19H1
19X2
19X3
47X1
18X1
2H1
2X3
2X2
3W1
3W4
17W1
17W2
56X1
22X1
22X2


UES Seacoast
Winter Circuit Loading (2 of 2)
Per Unit Loading
1
0.8
0.6
0.4
0.2
0
2019/20
2020/21
2021/22
2022/23
2023/24
Threshold
23X1
28X1
54X1
54X2
5X3
11X1
11X2
7W1
7X2
27X1
27X2
59X1
13W1
13W2
13X3
21W1
21W2
58X1E
58X1W
43X1
46X1
51X1

Appendix E

Circuit Tie Analysis Results

Circuit Tie	Restoring Circuit	Restored Circuit	Limit of Restoration during Summer Peak	Accepted Planning Violations	Limiting Element w/ Summer Normal Rating	% Peak Loading & Max Per-Phase Amps at S/S when Tie is Usable to Restore Entire Circuit	Accepted Planning Violations
1H3J1H4 River St	1H3	1H4	Entire Circuit	None	N/A	N/A	N/A
	1H4	1H3	Entire Circuit	None	N/A	N/A	N/A
1H3/1H4 Main St Pole 125/15	1H3	1H4	Up to Solids on Front Street Pole 70/27	None	300A Solids Main Street Pole 12/1	85% of Peak, 380A	114V on Primary
	1H4	1H3	Up to Solids on Main Street Pole 125/1	None	247A 1/0ACSR Lincoln Street	70% of peak, 320A	114V on Primary
6W1J6W2	6W1	6W2	Entire Circuit	None	N/A	N/A	N/A
	6W2	6W1	Entire Circuit	None	N/A	N/A	N/A
19X2J11X2	19X2	11X2	Entire Circuit	None	N/A	N/A	N/A
	19X2	11X2 and 11X1	Both Circuits	None	N/A	N/A	N/A
	11X2	19X2	Entire Circuit	None	N/A	N/A	N/A
19X2J19X3 River St	19X2	19X3	Entire Circuit	98% of 19X2 Recloser and Phase pickup	400A 19X2 Recloser	100% of peak, 392A	98% of 19X2 Recloser and Phase pickup
	19X3	19X2	Entire Circuit	90% of 19X3 Phase Pickup	500A 19X3 Phase Pickup 450A 19X3 Regulators	100% of Peak, 398A	90% of 19X3 Phase Pickup
19X3J43X1	19X3	43X1	Up to Solids on Kingston Road Pole 219/47	100% of Solids Pine Street Pole 149/2	300A Solids Pine Street Pole 149/2	75% of Peak, 350A	100% of Solids Pine Street Pole 149/2
	43X1	19X3	Up to Cutout Mounted Sectionalizer on Epping Road Pole 61/15 (need to replace 150QA Kingston Road Pole 219/39 with solids)	None	270A 43X1 Regulators (need to replace 150QA Kingston Road Pole 219/39 with solids)	70% of Peak, 305A	112% of 43X1 Regulators

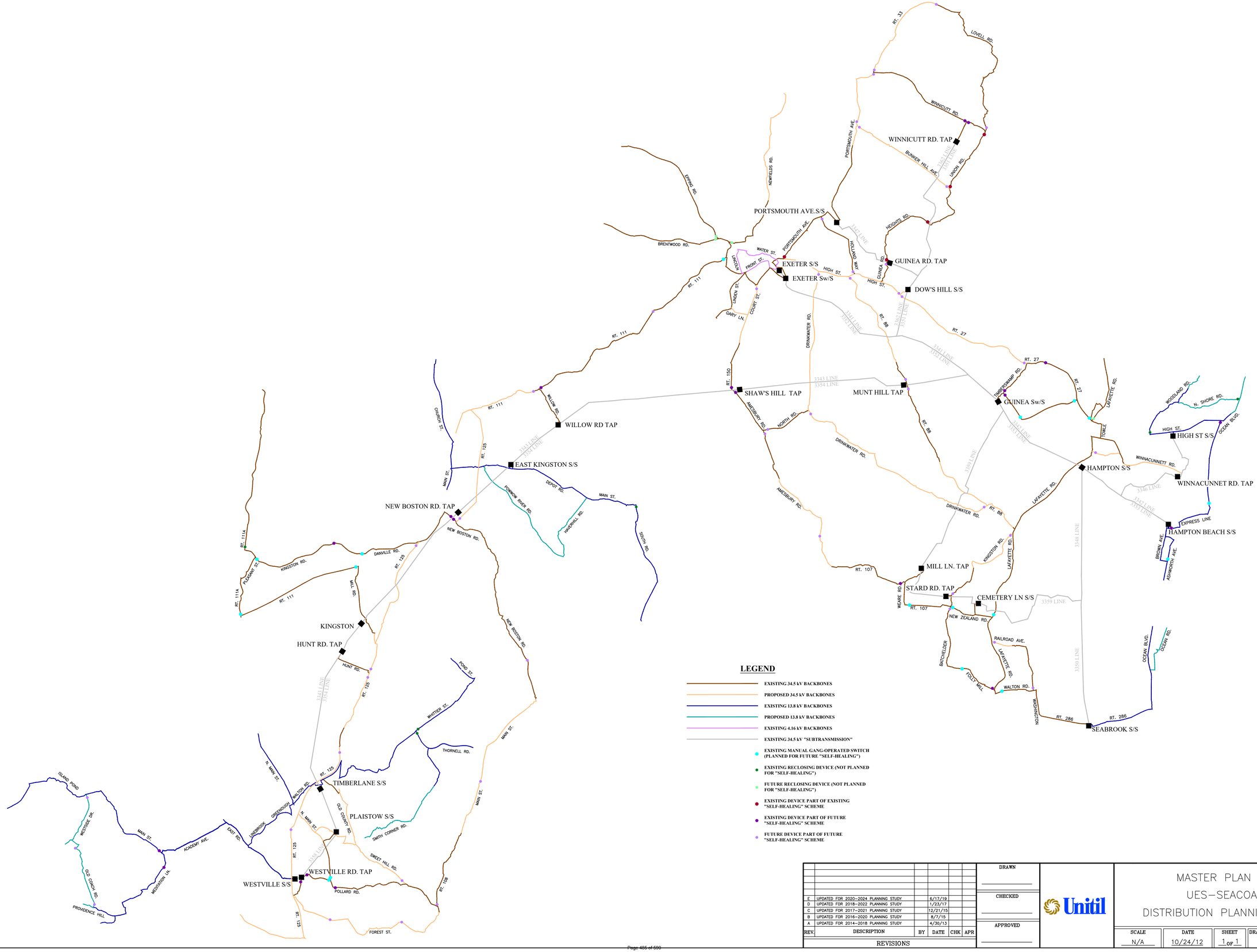
Circuit Tie	Restoring Circuit	Restored Circuit	Limit of Restoration during Summer Peak	Accepted Planning Violations	Limiting Element w/ Summer Normal Rating	% Peak Loading & Max Per-Phase Amps at S/S when Tie is Usable to Restore Entire Circuit	Accepted Planning Violations
5X3J58X1	5X3	58X1	Up to 58X1E Recloser	None	240A 5X3 Regulators	90% of Peak, 265A	110% of 5X3 Regulators
	58X1	5X3	Up to 5X3R1 Recloser	108% of 58X1 Regulators	240A 58X1 Regulators	90% of Peak, 270A	110% of 58X1 Regulators
13W1J13W2	13W1	13W2	Up to solids at Whittier Street Pole 35/1	100% on 13W1 300A CT Tap	300A 13W1 CT Tap	80% of Peak, 300A	100% on 13W1 300A CT Tap
	13W2	13W1	Up to Solids on Walton Road Pole 104/4	None	280A 13W2 Phase Pickup 262A 13W2 Regulators	65% of Peak, 240A	88% of 13W2 Pickup 92% of 13W2 Regulators
13W1J21W1	13W1	21W1	Up to Switch East Road Pole 21/16	93% of 13T1 Fuses Continuous Current Rating	457A 13T1 Fuses Continuous Current Rating 300A 13W1 CT Tap	65% of Peak, 295A	98% of 13W1 CT Tap 91% of 13T1 Fuses Continuous Current Rating
	21W1	13W1	Entire Circuit	82% of 21W1 Phase Pickup	520A 21T1 Transformer 560A 21W1 Phase Pickup 560A 21W1 Recloser	100% of Peak, 460A	82% of 21W1 Phase Pickup
21W1J21W2	21W1	21W2	Up to 21W2A Recloser	115V on Primary	331A 3/0 AA along Academy Ave	80% of Peak, 410A	115V on Primary
	21W2	21W1	Cannot be used under Peak	Cannot be used under Peak	300A 21W2 CT Tap	60% of Peak, 300A	100% of 21W2 CT Tap 114V on Primary
21W1/21W2 Solids at S/S	21W1	21W2	Entire Circuit	97% of 21T1 Transformer 90% of 21W1 Phase Pickup	520A 21T1 Transformer 560A 21W1 Phase Pickup 560A 21W1 Recloser	100% of Peak, 500A	97% of 21T1 Transformer 90% of 21W1 Phase Pickup
	21W2	21W1	Cannot be used under Peak	Cannot be used under Peak	300A 21W2 CT Tap	60% of Peak, 300A	100% of 21W2 CT Tap
22X1J22X2	22X1	22X2	Entire Circuit	None	N/A	N/A	N/A
	22X2	22X1	Entire Circuit	None	N/A	N/A	N/A
22X1J54X2	22X1	54X2	Entire Circuit	None	N/A	N/A	N/A
	54X2	22X1	Entire Circuit	None	N/A	N/A	N/A

Circuit Tie	Restoring Circuit	Restored Circuit	Limit of Restoration during Summer Peak	Accepted Planning Violations	Limiting Element w/ Summer Normal Rating	% Peak Loading & Max Per-Phase Amps at S/S when Tie is Usable to Restore Entire Circuit	Accepted Planning Violations
47X1J51X1	47X1	51X1	Entire Circuit	100% of 47X1 200A CT Tap	200A 47X1 TDA CT Tap	100% of Peak, 200A	100% of 47X1 200A CT Tap
	51X1	47X1	Entire Circuit	None	N/A	N/A	N/A
2X2J2X3	2X2	2X3	Entire Circuit	None	N/A	N/A	N/A
	2X3	2X2	Entire Circuit	None	N/A	N/A	N/A
2X2J18X1	2X2	18X1	Up to 18X1R1 with 18X1J3 Open	None	269A #1 Cu along Winnacunnet Road 300A Solids Pole 290/1 Winnacunnet Road	85% of Peak, 310A	110% of #1 Cu Winnacunnet Rd 98% of Solids Winnacunnet Pole 290/1
	18X1	2X2	Entire Circuit	None	N/A	N/A	116V on Primary
2X3J15X1	2X3	15X1	Entire Circuit	None	N/A	N/A	N/A
	15X1	2X3	Entire Circuit	None	N/A	N/A	N/A
18X1J3	18X1R3	18X1R2	Entire Circuit	None	N/A	N/A	N/A
	18X1R2	18X1R3	Entire Circuit	None	N/A	N/A	N/A
7X2J15X1	7X2	15X1	Cannot be used under Peak	Cannot be used under Peak	260A 7X2 Phase Pickup 200A 7X2 Regulators	85% of Peak, 225A	87% of 7X2 Pickup 112% of 7X2 Regulators
	15X1	7X2 and 7W1	Entire Circuits of 7X2 and 7W1	None	N/A	N/A	N/A
15X1J59X1-1	15X1	59X1	Entire Circuit	86% of Continuous and 63% of Minimum Melt of 175QA Old New Zealand Road Pole 61/13	175A (240A MM) 175QA Old New Zealand Road Pole 61/13	100% of Peak, 275A	86% of Continuous and 63% of Minimum Melt of 175QA Old New Zealand Road Pole 61/13
	59X1	15X1	Entire Circuit	None	N/A	N/A	N/A

Circuit Tie	Restoring Circuit	Restored Circuit	Limit of Restoration during Summer Peak	Accepted Planning Violations	Limiting Element w/ Summer Normal Rating	% Peak Loading & Max Per-Phase Amps at S/S when Tie is Usable to Restore Entire Circuit	Accepted Planning Violations
15X1J59X1-2	15X1	59X1	Entire Circuit	None	N/A	N/A	N/A
	59X1	15X1	Entire Circuit	None	N/A	N/A	N/A
23X1J59X1	23X1	59X1	Up to Solids on Amesbury Road Pole 1/140	100% of 23X1 200A CT Tap	200A 23X1 TDA CT Tap	90% of Peak, 195A	98% of 23X1 200A CT Tap
	59X1	23X1	Entire Circuit	None	N/A	N/A	N/A
17W1J17W2	17W1	17W2	Entire Circuit	None	N/A	N/A	N/A
	17W2	17W1	Entire Circuit	None	N/A	N/A	N/A
3W1J17W1	3W1	17W1	Up to 17W1R1 Recloser	92% of 3T3 Transformer	518A 3T3 Transformer	90% of Peak, 350A	99%of 3T3 Transformer
	17W1	3W1	Entire Circuit	90% of 3T3 Fuse Continuous Current Rating	457A 13T3 Fuses Continuous Current Rating	100% of Peak, 340A	90% of 3T3 Fuse Continuous Current Rating
3W1J3W4	3W1	3W4	Entire Circuit	None	N/A	N/A	N/A
	3W4	3W1	Up to 3W1R1	115% of 3W4 Regulators	263A 3W4 Regulators	100% of Peak, 300A	115% of 3W4 Regulators
3W1J3W5	3W1	3W4	Entire Circuit	None	N/A	N/A	N/A
	3W4	3W1	Up to 3W1R1	115% of 3W4 Regulators	263A 3W4 Regulators	100% of Peak, 300A	115% of 3W4 Regulators

Appendix F

Master Plan Map



LEGEND

- EXISTING 34.5 kV BACKBONES
- PROPOSED 34.5 kV BACKBONES
- EXISTING 13.8 kV BACKBONES
- PROPOSED 13.8 kV BACKBONES
- EXISTING 4.16 kV BACKBONES
- EXISTING 34.5 kV "SUBTRANSMISSION"
- EXISTING MANUAL GANG-OPERATED SWITCH (PLANNED FOR FUTURE "SELF-HEALING")
- EXISTING RECLOSING DEVICE (NOT PLANNED FOR "SELF-HEALING")
- FUTURE RECLOSING DEVICE (NOT PLANNED FOR "SELF-HEALING")
- EXISTING DEVICE PART OF EXISTING "SELF-HEALING" SCHEME
- EXISTING DEVICE PART OF FUTURE "SELF-HEALING" SCHEME
- FUTURE DEVICE PART OF FUTURE "SELF-HEALING" SCHEME

REV.	DESCRIPTION	BY	DATE	CHK	APR
E	UPDATED FOR 2020-2024 PLANNING STUDY		6/17/19		
D	UPDATED FOR 2018-2022 PLANNING STUDY		1/23/17		
C	UPDATED FOR 2017-2021 PLANNING STUDY		12/21/15		
B	UPDATED FOR 2016-2020 PLANNING STUDY		8/7/15		
A	UPDATED FOR 2014-2018 PLANNING STUDY		4/30/13		

REVISIONS

DRAWN

CHECKED

APPROVED

Unitil

MASTER PLAN MAP
UES-SEACOAST
DISTRIBUTION PLANNING STUDY

SCALE	DATE	SHEET	DRAWING NO.
N/A	10/24/12	1 OF 1	UES-S MP